Morven North Offshore Wind Array Project

Habitats Regulations Appraisal

Volume 2, Annex 3.1: Report to Inform Appropriate Assessment: Apportioning

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1 Introduction

1.1 Context

1.1.1.1 When assessing the impacts of a proposed offshore wind farm, it is crucial to determine the potential impacts that such a development will have on breeding seabird populations. Seabirds nest in colonies of variable sizes around the United Kingdom (UK) coastline (Burnell *et al*., 2023) and most species have large foraging ranges at sea (Woodward *et al*., 2019). Establishing potential connectivity between marine renewable sites and colonies, which are often designated as Special Protection Areas (SPAs), is a key element of the impact assessment. A theoretical approach has been developed by NatureScot (NatureScot, 2018) to determine the proportion of birds from SPA sites which use the Morven North Offshore Wind Array Project (hereafter Morven North) area in the breeding season. In non-breeding periods, for the majority of species, the standard approach to apportioning utilises the information presented in Furness (2015). These approaches allow the user to 'apportion' the potential impact of a marine renewable site to multiple SPAs and non-SPA colonies.

1.1.1.2 This technical report presents the methods used to apportion the potential impacts of Morven North on SPAs that support qualifying species for which connectivity has been identified as part of the screening exercise undertaken for Morven North Volume 1, Chapter 1: Morven Option Lease Agreement Site: HRA Stage 1 Screening Report (hereafter referred to as 'Morven Site HRA Screening Report') (Figure 1.1). The approach also includes non-SPA breeding colonies, and these results will be incorporated, where necessary, into Volume 2, Chapter 11: Offshore Ornithology of the EIA Report. The resulting apportioning values are presented for each site and will be used in Volume 2, Chapter 3: Report to Inform Appropriate Assessment Part 3: SPA and Ramsar Site Assessments (hereafter referred to as 'RIAA Part 3') to identify if an adverse effect may occur.

1.2 Purpose and scope

1.2.1.1 The purpose of this technical report is to calculate seasonal apportioning values for seabird species at breeding colonies. Apportioning takes into account colonies located within designated sites (i.e. SPAs, Sites of Special Scientific Interest (SSSIs), Marine Nature Reserves (MNRs), National Nature Reserves (NNRs), and Ramsar sites) as well as those that breed at non-designated sites. Note that screening only considers SPAs where the species is either a qualifying feature or an explicitly named component of an assemblage feature. If a species breeds within the geographic boundary of an SPA but is not designated as a feature of that site, it is not considered during the screening process. However, colony counts from such sites, including other designations such as SSSIs, NNRs, MNRs, and Ramsar sites, are included in the broader non-SPA colony totals used for apportionment.

1.2.1.2 These values will then be used to inform the assessment presented in RIAA Part 3 and, where necessary, the Volume 2, Chapter 11: Offshore Ornithology of the EIA Report.

1.2.1.3 Figure 1.1 identifies the SPAs that support qualifying species for which a Likely Significant Effect (LSE[2]) has been identified in Morven Site HRA Screening Report.

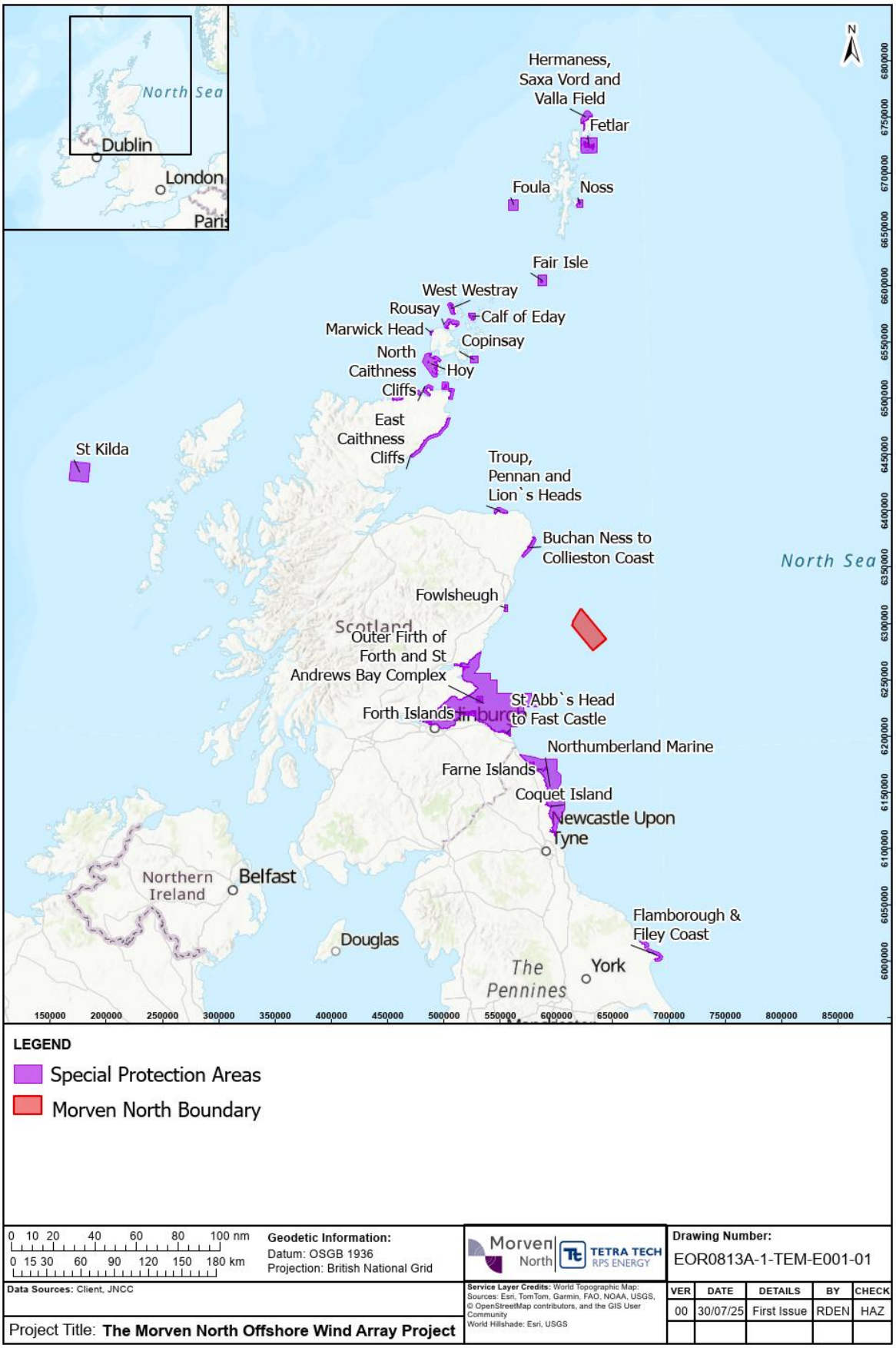

Figure 1.1: Designated sites that support qualifying species of breeding seabird for which Likely Significant Effect[2] has been identified in relation to potential impacts associated with Morven North

2 Methodology

2.1 Introduction

2.1.1.1 Apportioning undertaken for Morven North in the breeding season is based on the NatureScot 'theoretical approach' method for the breeding season (NatureScot, 2018). Apportioning during the non-breeding season (i.e. autumn and spring migration seasons and in winter) utilises the Biologically Defined Minimum Population Scales (BDMPS) approach developed by Furness (2015) for all species, except for herring gull (*Larus argentatus*), for which a different approach has been advised by NatureScot as part of previous offshore wind applications (NatureScot, 2021a; Marine Scotland Science, 2021) and guillemot (*Uria aalge*) for which a different approach has been agreed with NatureScot during pre-application consultation undertaken in October 2025.

2.1.1.2 To apportion impacts between SPA and non-SPA breeding colonies within mean-maximum foraging range plus one standard deviation of the wind farm, data from the Seabirds Count (Burnell *et al*., 2023) and Seabird Monitoring Programme (SMP) database; JNCC, 2025) have been used. Apportioning is calculated on the basis of the distance between count sector and Morven North, the available sea area from each sector within foraging range, and the numbers of breeding seabirds.

2.2 Identification of species

2.2.1.1 Table 2.1 identifies the designated sites and associated features for which potential LSE[2] has been identified and therefore where apportioning values are required, in order to apportion potential impacts from Morven North to each relevant designated site. Although Table 2.1 focuses on SPA populations, consideration has been given to all breeding colonies within the relevant foraging range of a species. Apportioning values for non-SPA colonies (including SSSIs, MNRs, NNRs and Ramsar sites) are provided in Appendix A.

Table 2.1: Special Protection Areas and associated qualifying features for which apportioning is required

SPA	Qualifying feature	Season of relevance
Buchan Ness to Collieston Coast	Kittiwake (*Rissa tridactyla*)	All
	Herring gull	All
	Guillemot	All
Calf of Eday	Kittiwake	All
Copinsay	Kittiwake	All
Coquet Island	Kittiwake	All
	Puffin (*Fratercula arctica*)	All
	Fulmar (*Fulmarus glacialis*)	All
East Caithness Cliffs	Kittiwake	All
	Razorbill (*Alca torda*)	Non-breeding seasons only
	Fulmar	All
Fair Isle	Kittiwake	All
	Gannet (*Morus bassanus*)	Non-breeding seasons only
	Puffin	Non-breeding seasons only
	Fulmar	All

SPA	Qualifying feature	Season of relevance
Farne Islands	Kittiwake	All
	Puffin	All
Fetlar	Fulmar	All
Flamborough and Filey Coast	Kittiwake	All
	Puffin	All
	Gannet	Non-breeding seasons only
	Razorbill	Non-breeding seasons only
	Guillemot[1]	Non-breeding seasons only
	Fulmar	All
Forth Islands	Kittiwake	All
	Guillemot	Non-breeding seasons only
	Razorbill	All
	Puffin	All
	Gannet	All
Foula	Puffin	Non-breeding seasons only
	Fulmar	All
Fowlsheugh	Kittiwake	All
	Herring gull	All
	Guillemot	All
	Razorbill	All
Hermaness, Saxa Vord and Valla Field	Gannet	Non-breeding seasons only
	Puffin	Non-breeding seasons only
	Fulmar	All
Hoy	Kittiwake	All
	Puffin	All
	Fulmar	All
Marwick Head	Kittiwake	All
North Caithness Cliffs	Kittiwake	All
	Puffin	All
	Fulmar	All
Northumberland Marine	Kittiwake	All
	Puffin	All

[1] An LSE[2] for guillemot at the Flamborough and Filey Coast SPA was not identified based on the approach applied. However, following pre-application consultation with Natural England it has been included in the Report to Inform Appropriate Assessment (RIAA).

SPA	Qualifying feature	Season of relevance
	Razorbill	All
	Fulmar	All
Noss	Gannet	Non-breeding seasons only
	Fulmar	All
Outer Firth of Forth and St Andrews Complex	Herring gull	Non-breeding
Rousay	Kittiwake	All
St Abb's Head to Fast Castle	Kittiwake	All
	Guillemot	Non-breeding seasons only
	Razorbill	All
St Kilda	Gannet	Non-breeding seasons only
Troup, Pennan and Lion's Heads	Kittiwake	All
	Guillemot	Non-breeding seasons only
	Razorbill	All
West Westray	Kittiwake	All

2.3 Apportioning of potential impacts during the breeding season

2.3.1.1 In the breeding season, a population of birds in a given sea area is likely to comprise breeding adult birds from breeding colonies, immature birds (i.e. birds that have not yet reached breeding age), and non-breeding birds (i.e. birds that have reached breeding age but have not yet started breeding or are skipping a breeding season (sabbatical birds)).

2.3.1.2 The proportion of each component must be estimated to allow the proportion of breeding birds to be calculated, as it is this component that is relevant for Habitat Regulations Appraisal (HRA).

2.3.1.3 The apportioning values calculated here will be used within RIAA Part 3 to inform the assessments presented. In addition, consideration will be given to available site-specific information and information on the distribution and population structure of birds present in relevant sea areas.

2.4 Breeding adults

2.4.1.1 Following NatureScot guidance (NatureScot, 2018), potential impacts were apportioned between SPA and non-SPA breeding colonies within each species' mean-maximum foraging range (plus one standard deviation (SD)) (Woodward *et al*., 2019) and Morven North using the 'theoretical approach'. The method utilises the weighting factors described in Table 2.2.

Table 2.2: Colony-specific weighting factors used for the apportioning approach

Weighting factor	Methodology
Colony size (with consistent count unit used between colonies for a species e.g. individuals, breeding pairs, or apparently occupied sites).	Large colonies will contribute more individuals to the number of seabirds found in a given sea area, all other factors being equal. To account for this, a weighting factor based on colony size has been derived. For all colonies considered, colony size has been calculated from Seabirds Count data, with this providing a common reference point as all count data is contemporaneous. Seabirds Count data is comprised of separate count sections, with long stretches of coastline such as Flamborough and Filey Cliffs SPA made up of several count sections. For the purposes of this analysis, each count section has been treated as a separate colony. If a single designated site is made up of several count sections, the combined designated site impact has been reconstructed after the weighting for each count section has been completed.
Distance of colony from Morven North (using the geometric centre of both).	Weighting by distance from the colony has been calculated using the measured sea-route distance between the geometric centre of Morven North to the geometric centre of the colony as advised by NatureScot (As detailed in RIAA Part 3). The sea-route distance represents the distance between a colony and Morven North based on the movement of birds across the sea only, excluding any significant movements over land. For the purposes of this apportioning approach it is assumed that, as birds radiate out from a colony, density will decrease by a factor proportional to 1/distance^2 as area increases proportionally by $\pi.r^2$. For the purposes of this assessment, a weighting factor based on 1/distance2 has therefore been used, as advised by NatureScot (2018).
Sea area (the area of the open sea within the foraging range of the relevant species).	The available sea area for foraging has been measured by plotting a circle defined by the species-specific foraging range around the colony in ArcGIS and calculating the area of sea available to each seabird species. The fraction of the disc centred on the colony that is occupied by sea surface is then expressed as a decimal. As the density of birds will increase as the area of available foraging area decreases, this is used in the formula as 1/estimated area.

2.4.1.2 This process uses the Seabirds Count colony counts (Burnell *et al*., 2023). Using the centroid for Morven North, a buffer zone was created which equated to the species' mean-maximum foraging range plus one SD. The NatureScot (2018) guidance recommends that the mean-maximum foraging range is used; however, more recent guidance provided as part of project-specific consultation by UK Statutory Nature Conservation Bodies (SNCBs) recommends that the mean-maximum plus one SD is used (ERM, 2024). Further discussion on this is provided in Section 4.

2.4.1.3 The distance between the Morven North centroid and each SPA and non-SPA colony within each species' foraging range at sea was then calculated assuming an at-sea route.

2.4.1.4 The equation used for apportioning in Step 1 is:

$$\textbf{Colony Weight} = \frac{\textbf{Colony Population}}{\textbf{Sum of Populations}} \times \frac{\textbf{Sum of Distance}^2}{\textbf{Colony Distance}^2} \times \frac{{}^{1}/_{\textbf{Colony Sea Proportion}}}{\textbf{Sum of } ({}^{1}/_{\textbf{Colony Sea Proportion}})}$$

2.4.2 NatureScot approach

2.4.2.1 Following pre-application consultation with NatureScot in October 2025, it was agreed that the Applicant would apply an alternative apportioning approach in the breeding season for herring gull. This approach applies a different distance measurement method to the second weighting factor (Distance of colony from Morven North) described in Table 2.2. Using the current apportioning approach as described in Table 2.2 which measures distances from the centre of Morven North to each colony, would mean that the Buchan Ness to Collieston Coast SPA is outside of foraging range and therefore receives a 0% apportioning value. In October 2025, NatureScot requested that distances instead be calculated from the edge of Morven North to each colony. This therefore means that Morven North is within foraging range of herring gull from the Buchan Ness to Collieston Coast SPA.

2.4.2.2 Whilst there are colonies for other species that, despite LSE[2] being identified in Morven Site HRA Screening Report which utilises an edge to edge measurement approach, receive a 0% apportioning value, these SPAs are located a significant distance from Morven North. This means that, if apportioning were to be undertaken for these species using distances measured from the edge of Morven North, the resulting apportioning value would be negligible and therefore any apportioned impact from Morven North would also be negligible. It was therefore agreed that the approach requested by NatureScot in October 2025 would be applied to herring gull only in the context of Morven North.

2.5 Immature birds

2.5.1.1 There are a number of methods that can be applied to account for the presence of immature birds at Morven North. These include the use of site specific data or the use of stable age proportions derived from population models, or both. This section presents the adult proportions derived when applying both these methods. Please see Section 4.3 for discussion on the differences between each approach with this taken into account in the assessments in RIAA Part 3.

2.5.2 Site specific data

2.5.2.1 A major part of any seabird population comprises immature birds. This is especially relevant for many of the species considered in this report, with some species not breeding until they reach nine years of age. A proportion of immature birds return to natal waters during the breeding season, with the proportion of each immature age class increasing as individuals get closer to breeding age.

2.5.2.2 To determine the proportion of immature birds present within the Morven North Offshore Ornithology Baseline Characterisation Study Area (as defined in Volume 3, Chapter 11.1: Offshore Ornithology Baseline Characterisation Report of the EIA Report), data from the site specific digital aerial surveys have been analysed (Table 2.3). This approach can only be used for gannet, kittiwake, and large gull species, as it is not possible to identify the age class of birds of other species from aerial surveys. Only those birds assigned to an age class have been included in the calculation in Table 2.3; however, the number of birds for which an age class was not assigned is also provided.

Table 2.3: Number of birds assigned to different age class categories during site specific surveys of the Morven North survey area

Species	Breeding season (Months)	Birds for which age was not identified (number of animals)	Total bird for which age was identified (number of animals)	Number of adult-type birds identified	Number of immature birds identified	Proportion of immature birds (%)[2]
Kittiwake	April to August	761	546	519	27	4.9
Herring gull	April to August	1	36	35	1	2.8
Gannet	March to September	139	465	446	19	4.1

2.5.2.3 The identification of kittiwake age classes at sea is difficult and in most cases impossible (with exception of birds that are in either juvenile, first winter or first summer plumage). Whilst one year old kittiwakes can be easily identified due to differences in plumage, two and three year old birds, which have not yet reached the age of first breeding (which is typically at four years old), cannot be easily identified (Coulson, 2011; Olsen and Larsson, 2003). Therefore, data on age class collected during digital aerial surveys will potentially represent a considerable overestimate of the proportion of breeding adults present at Morven North.

2.5.2.4 It is certain that an unknown proportion of the cohort of unaged 'adult type' kittiwakes at Morven North will include two and three year old birds. However, Coulson (2011) provides evidence that shows that immature kittiwake visit natal waters, with increasing numbers of older immatures visiting breeding colonies. This is concurrent with mortality reducing the absolute number of birds from each successive year class of kittiwake in the species wider population. Therefore, to calculate an apportioning value for the breeding season in respect to the number of two and three year old kittiwakes at Morven North an approach developed during the examination for Hornsea Offshore Wind Farm Project Two (SMart Wind, 2015a) and since applied in several other offshore wind farm assessments which have been consented (Ørsted, 2018; The Crown Estate, 2022; The Crown Estate, 2024), has been adopted. The approach makes use of age-specific survival rates from Horswill and Robinson (2015) to calculate the proportion of different age classes likely to be present:

- 0.790 for the survival rate of juveniles to one year olds;
- 0.854 for one to two year olds;
- 0.854 for two to three year olds.

2.5.2.5 The apportioned values will likely remain an under-estimate for the second and third year immatures, as, proportionately, those cohorts show a much greater affinity for natal waters than first year birds.

2.5.2.6 These survival rates along with the proportion of adult and immature kittiwake recorded during site specific surveys are presented in Table 2.4 to calculate the proportion of all immature age classes present at Morven North.

[2] Rounded to one decimal place

Table 2.4: Estimated breeding season contribution of immature kittiwakes predicted to be present at Morven North

Analysis step	Formula (using the parameters identified as part of each analysis step)	Value
(a) Survival rate of immature age classes	-	0.854
(b) % of kittiwake at Morven North assigned to one year old birds	-	4.95
% of kittiwake at Morven North assigned to other immature age classes		
(c) Two year old birds	c = b x a	4.22
(d) Three year old birds	d = b x a x a	3.61
(e) % of kittiwakes at Morven North assigned to adults	e = 100% - (c + d + b)	87.22

2.5.3 Furness (2015) approach

2.5.3.1 The age class proportions presented above provide site specific context. However, in addition to the species considered above there are additional species that also need consideration in the assessments for Morven North for which the age composition of the population of the species at Morven North cannot be derived from site specific baseline surveys. As part of pre-application consultation, the Applicant requested NatureScot's advice on how to account for the presence of immature birds at Morven North during the breeding season as part of the apportioning process. As detailed in RIAA Part 3, NatureScot confirmed that immature birds should be removed and recommended the use of stable age proportions from Furness (2015) for all species. For species of relevance to this report the following adult proportions are therefore used:

- kittiwake = 53.2%;
- herring gull = 47.8%;
- guillemot = 57.5%;
- razorbill = 57.1%;
- puffin = 49.0%;
- fulmar = 62.0%;
- gannet = 55.2%.

2.6 Sabbaticals

2.6.1.1 Every breeding season, a proportion of adults do not breed and take a 'sabbatical'. To include any impacts occurring on sabbatical birds within the impacts apportioned to breeding individuals at a colony would likely mean overestimating the effects to these species/populations (Marine Scotland 2017a, b). This is because breeding colony population size estimates, which are used within the Environmental Impact Assessment (EIA) and Report to Inform Appropriate Assessment (RIAA) (Volume 3, Chapter 11.1: Offshore Ornithology Baseline Characterisation Report of the EIA Report and RIAA Part 3) to inform the derivation of the significance of impacts, do not include sabbatical birds.

2.6.1.2 It is not possible to separate non-breeding adult birds from those that are breeding in a given sea area; therefore, published estimates of sabbatical behaviour have been obtained (Table 2.5). Consideration will be given in relevant assessments to the sabbatical values presented in Table 2.5 for each species.

Table 2.5: Proportion of sabbatical birds to be considered in Chapter 2.2: Report to Inform Appropriate Assessment Part 3: Special Protection Areas and Ramsar Site Assessments

Species	Incidence of missed breeding			
	Horswill and Robinson (2015)			Marine Scotland (2017a, b) (%)
	Value (%)	Data quality	Data representation	
Kittiwake	18.0-20.8	Intermediate	Poor	10
Gannet	N/A	-	-	10
Herring gull	35.0	Intermediate	Good	35
Guillemot	7.9	Good	Good	7
Razorbill	3.0	Intermediate	Good	7
Puffin	7.8	Intermediate	Good	7

2.6.1.3 In December 2024, the Applicant asked NatureScot for their position in relation to the application of sabbatical rates. In January 2025, NatureScot responded, stating that they agree with the Marine Scotland (2017) rates and therefore these have been applied as follows:

- large gulls = 35%;
- kittiwake = 10%;
- auk species = 7%;
- gannet = 10%.

2.6.1.4 These rates are also those recommended by Marine Scotland as part of the Scoping opinions for the Revised Inch Cape Offshore Wind Farm and the Moray East offshore wind farms (Marine Scotland, 2017a, 2017b).

2.7 Apportioning of potential impacts during the non-breeding period

2.7.1 Approach for all species excluding guillemot at Scottish Special Protection Areas and herring gull

2.7.1.1 The calculation of apportioning values for non-breeding seasons (post-breeding, non-breeding, and pre-breeding) has followed the approach used previously in the application and examination documentation for multiple offshore wind farms (e.g. East Anglia THREE Ltd., 2015; Forewind, 2013; SMart Wind, 2015b) and is advised for use by NatureScot, as detailed in RIAA Part 3. For apportionment, the contribution of adult birds from an individual designated site, as estimated by Furness (2015), to the relevant BDMPS population for each species/season combination is divided by the total BDMPS population. The calculated value is the proportion of the BDMPS population represented by adult birds from the designated site under consideration. It should be noted that no updates have been made to the population data presented in Furness (2015), as any updates will not be contemporaneous with the data that have not been updated. For any designated site not named in Furness (2015), the proportion of birds present in the relevant BDMPS areas in each season has been taken from the nearest named designated site.

2.7.1.2 This approach has been used for all species at Scottish SPAs except guillemot and herring gull (see Section 2.7.2). Where LSE^2 has been identified for guillemot at breeding colonies outside of Scotland, the Furness (2015) approach has been applied. This therefore applies to the Flamborough and Filey Coast SPA, at which guillemot is a qualifying feature. LSE^2 was not identified for any English SPAs at which herring gull is a qualifying feature.

2.7.2 Foraging range approach for guillemot at Scottish Special Protection Areas and herring gull

2.7.2.1 For herring gull, NatureScot recommend a different approach to apportioning in the non-breeding season (Marine Scotland Science, 2021). This approach is similar to the Furness (2015) approach described above, but instead of using the BDMPS areas defined in Furness (2015), the area of the BDMPS is defined as the mean-maximum foraging range of the species plus one SD (Woodward *et al*., 2019). The breeding adult population within this area plus the associated immature population (calculated using the stable age proportions from Furness (2015)) are then totalled to provide the BDMPS population. The population of the relevant SPA is then divided by the BDMPS population to provide the apportioning value. The calculation of the BDMPS population for herring gull is presented in Table 2.6.

Table 2.6: Calculation of non-breeding season apportioning values for herring gull

Species	Mean-maximum foraging range plus 1SD (km)	Breeding adult population in foraging range (No. of breeding adults)	Immature population (No. of birds)	Total BDMPS population (No. of birds)
Herring gull	58.8+26.8	5,436	5,925	11,361

2.7.2.2 For guillemot, a different approach has been agreed between the Applicant and NatureScot during pre-application consultation undertaken in October 2025. Due to the increased populations recorded at Morven North in surveys undertaken in July and August it is considered that guillemots from a wider range of colonies than would usually be identified following the approach normally recommended by NatureScot (the application of the mean-maximum foraging range plus one SD) may be contributing to the population present at Morven North. The approach for guillemot therefore utilises tracking data collected by Buckingham *et al*. (2023) to identify the colonies that may contribute birds to the population present at Morven North. These data suggest that guillemot from colonies between the Troup, Pennan and Lion's Heads SPA and the St Abb's Head to Fast Castle SPA may occur at Morven North during the post-breeding and non-breeding seasons. The total population of guillemot at colonies in this area has been calculated to provide the total breeding population. This population has been multiplied by the immature ratio presented in Furness (2015) to calculate the number of immatures associated with this population. These two populations have then been combined to provide the total population from which birds at Morven North may originate. The population of each SPA has then been divided by the total population to calculate apportioning values which are then applied to post-breeding and non-breeding season impacts.

3 Results

3.1.1.1 Based upon calculations undertaken using the approaches described in Section 2, the apportioning values for each SPA feature with potential connectivity to Morven North are presented in Sections 3.2 to 3.8 below.

3.1.1.2 In all tables in the following sections, dashes denote where Morven North is beyond the recommended foraging range (Burnell *et al.*, 2023) of the relevant species when following the approach described in Section 2.4 as recommended by NatureScot in pre-application consultation (RIAA Part 3). As such, these colonies would not form part of the regional population but have been provided within the tables below for completion purposes.

3.2 Kittiwake

3.2.1 Breeding season

3.2.1.1 The calculation of apportioning values in the breeding season for all colonies for which an LSE[2] was identified in Morven Site HRA Screening Report is presented in Table 3.1. A breakdown of apportioning values for non-SPA colonies is presented in Appendix A.

Table 3.1: Calculation of apportioning values for kittiwake in the breeding season for Special Protection Areas for which Likely Significant Effects[2] were identified

SPA	Population (No. of breeding adults)	Distance to Morven North[3] (km)[4]	Proportion of foraging range at Sea[3]	Resulting weight for colony	Proportional weight of colony
Buchan Ness to Collieston Coast	22,590	94	0.734	0.341	0.146
Calf of Eday	672	297	0.862	0.001	<0.001
Copinsay	1,910	260	0.837	0.003	0.001
Coquet Island	932	160	0.599	0.006	0.003
East Caithness Cliffs	48,958	229	0.779	0.113	0.048
Fair Isle	896	314	0.913	-	-
Farne Islands	8,804	129	0.617	0.084	0.036
Flamborough and Filey Coast	103,070	282	0.587	0.196	0.084
Forth Islands	9,084	114	0.604	0.102	0.044
Fowlsheugh	28,078	76	0.679	0.703	0.301
Hoy	532	278	0.825	0.001	<0.001
Marwick Head	1,812	311	0.843	-	-

[3] Where a colony consists of multiple subsites average values are provided for distance to Morven North and proportion of foraging range at sea.
[4] The mean-maximum foraging range plus one standard deviation for kittiwake is 156.1 + 144.5km (Woodward *et al.*, 2019).

SPA	Population (No. of breeding adults)	Distance to Morven North[3] (km)[4]	Proportion of foraging range at Sea[3]	Resulting weight for colony	Proportional weight of colony
North Caithness Cliffs	11,142	249	0.808	0.010	0.004
Rousay	660	308	0.852	-	-
St Abb's Head to Fast Castle	10,300	117	0.608	0.122	0.052
Troup, Pennan and Lion's Heads	21,232	142	0.740	0.132	0.056
West Westray	5,510	309	0.863	-	-
Non-SPA colonies	49,808	-	-	0.522	0.223

3.2.2 Non-breeding seasons

3.2.2.1 Calculation of apportioning values for use in non-breeding seasons are presented in Table 3.2.

Table 3.2: Calculation of non-breeding season apportioning values for kittiwake

SPA	Apportioning values					
	Autumn migration (August to December)			Spring migration (January to April)		
	BDMPS population (No. of Individuals)	Number of breeding adults in BDMPS population from SPA	Apportioning value	BDMPS population (No. of individuals)	Number of breeding adults in BDMPS population from SPA	Apportioning value
Buchan Ness to Collieston Coast	829,937	15,050	0.018	627,816	15,050	0.024
Calf of Eday		896	0.001		896	0.001
Copinsay		799	0.001		799	0.001
Coquet Island		222	<0.001		222	<0.001
East Caithness Cliffs		48,492	0.058		48,492	0.077
Fair Isle		925	0.001		925	0.001
Farne Islands		4132	0.005		4,132	0.007
Flamborough and Filey Coast		45,140	0.054		45,140	0.072
Forth Islands		3,720	0.004		3,720	0.006
Fowlsheugh		11,204	0.013		11,204	0.018
Hoy		476	0.001		476	0.001
Marwick Head		631	0.001		631	0.001

SPA	Apportioning values					
	Autumn migration (August to December)			Spring migration (January to April)		
	BDMPS population (No. of Individuals)	Number of breeding adults in BDMPS population from SPA	Apportioning value	BDMPS population (No. of individuals)	Number of breeding adults in BDMPS population from SPA	Apportioning value
North Caithness Cliffs		12,180	0.015		12,180	0.019
Rousay		2,117	0.003		2,117	0.003
St Abb's Head to Fast Castle		4,084	0.005		4,084	0.007
Troup, Pennan and Lion's Heads		17,875	0.022		17,875	0.028
West Westray		14,466	0.017		14,466	0.023

3.3 Herring gull

3.3.1 Breeding season

Applicant approach (distances measured from the centre of Morven North)

3.3.1.1 The calculation of apportioning values in the breeding season for all colonies for which an LSE[2] was identified in Morven Site HRA Screening Report using distances measured from the centre of Morven North is presented in Table 3.3. A breakdown of apportioning values for non-SPA colonies is presented in Appendix A.

Table 3.3: Calculation of apportioning values for herring gull in the breeding season for Special Protection Areas for which Likely Significant Effects[2] were identified (Applicant approach)

SPA	Population (No. of Breeding Adults)	Distance to Morven North3 (km)[5]	Proportion of foraging range at sea[3]	Resulting weight for colony	Proportional weight of colony
Buchan Ness to Collieston Coast	4,154	94	0.735	-	-
Fowlsheugh	2,070	76	0.542	0.396	0.387
Non-SPA colonies	3,366	-	-	0.627	0.613

[5] The mean-maximum foraging range plus one standard deviation for herring gull is 58.8 + 26.8km (Woodward *et al.*, 2019)

NatureScot approach (distances measured from the edge of Morven North)

3.3.1.2 The calculation of apportioning values in the breeding season for all colonies for which an LSE[2] was identified in Chapter 1: Morven Option Lease Agreement Site: HRA Stage 1 Screening Report using distances measured from the edge of Morven North is presented in Table 3.3. A breakdown of apportioning values for non-SPA colonies is presented in Appendix A.

Table 3.4: Calculation of apportioning values for herring gull in the breeding season for Special Protection Areas for which Likely Significant Effects[2] were identified using NatureScot's advocated approach

SPA	Population (No. of Breeding Adults)	Distance to Morven North (km)[5]	Proportion of foraging range at sea[3]	Resulting weight for colony	Proportional weight of colony
Buchan Ness to Collieston Coast	4,154	76	0.735	0.220	0.258
Fowlsheugh	2,070	63	0.542	0.231	0.271
Non-SPA colonies	3,820	-	-	0.401	0.470

3.3.2 Non-breeding seasons

3.3.2.1 Calculation of apportioning values for use in non-breeding seasons are presented in Table 3.5. The total breeding population of herring gull in foraging range of Morven North is 5,436 birds. This has been multiplied by the immature ratio from Furness (2015) to provide a total BDMPS population of 11,361 birds. The breeding adult populations for each SPA have then been divided by the BDMPS population to provide the apportioning values presented in Table 3.5.

Table 3.5: Calculation of non-breeding season apportioning values for herring gull

SPA	Apportioning values		
	Non-breeding season (September to February)		
	BDMPS population (no. of Individuals)	Number of breeding adults in BDMPS population from SPA	Apportioning value
Buchan Ness to Collieston Coast	11,361	-	-
Fowlsheugh		2,070	0.182

3.4 Guillemot

3.4.1 Breeding season

3.4.1.1 The calculation of apportioning values in the breeding season for all colonies for which an LSE[2] was identified in Morven Site HRA Screening Report, and is presented in Table 3.6. A breakdown of apportioning values for non-SPA colonies is presented in Appendix A.

Table 3.6: Calculation of apportioning values for guillemot in the breeding season for Special Protection Areas for which Likely Significant Effects[2] were identified

SPA	Population (No. of individuals)	Distance to Morven North[3] (km)[6]	Proportion of foraging range at sea[3]	Resulting weight for colony	Proportional weight of colony
Buchan Ness to Collieston Coast	29,433	94	0.742	0.154	0.158
Fowlsheugh	69,828	76	0.557	0.748	0.766
Non-SPA colonies	7,314	-	-	0.074	0.076

3.4.2 Non-breeding seasons

Approach for English Special Protection Areas

3.4.2.1 The methodology for calculating apportioning values for guillemot in the non-breeding season at English SPAs follows that described in Section 2.7.1. Calculation of apportioning values for use in non-breeding seasons when following the Furness (2015) approach are presented in Table 3.7.

Table 3.7: Calculation of non-breeding season apportioning values for guillemot (England)

SPA	Apportioning values		
	Non-breeding season (August to February)		
	BDMPS population (No. of individuals)	No. of breeding adults in BDMPS population from SPA	Apportioning value
Flamborough and Filey Coast	1,617,306	71,354	0.044

Foraging range approach for Scottish Special Protection Areas

3.4.2.2 The methodology for calculating apportioning values for guillemot in the non-breeding season at Scottish SPAs follows that described in Section 2.7.2. Calculation of apportioning values for Scottish SPAs for use in non-breeding seasons are presented in Table 3.8. The total breeding population of guillemot that may contribute to the population present at Morven North is 272,886 birds. This has been multiplied by the immature ratio from Furness (2015) to provide a total BDMPS population of 474,821 birds. The breeding adult populations for each SPA have then been divided by the BDMPS population to provide the apportioning values presented in Table 3.8.

[6] The mean-maximum foraging range plus one standard deviation for guillemot is 55.5 + 39.7km (Woodward et al., 2019).

Table 3.8: Calculation of non-breeding season apportioning values for guillemot (Scotland)

SPA	Apportioning values		
	Non-breeding (August to February)		
	Number of breeding adults in BDMPS population from SPA	No. of breeding adults in BDMPS Population from SPA	Apportioning value
Buchan Ness to Collieston Coast	474,821	39,440	0.083
Fowlsheugh		93,570	0.197
Forth Islands		35,523	0.075
St Abb's Head to Fast Castle		61,408	0.129
Troup, Pennan and Lion's Heads		31,893	0.067

3.5 Razorbill

3.5.1 Breeding season

3.5.1.1 The calculation of apportioning values in the breeding season for all colonies for which an LSE[2] was identified in Morven Site HRA Screening Report, and is presented in Table 3.9. A breakdown of apportioning values for non-SPA colonies is presented in Appendix A.

Table 3.9: Calculation of apportioning values for razorbill in the breeding season for Special Protection Areas for which Likely Significant Effects[2] were identified

SPA	Population (No. of individuals)	Distance to Morven North[3] (km)[7]	Proportion of foraging range at sea[3]	Resulting weight for colony	Proportional weight of colony
Forth Islands	5,695	114	0.405	0.130	0.117
Fowlsheugh	14,063	76	0.593	0.581	0.522
St Abb's Head to Fast Castle	2,931	117	0.493	0.060	0.054
Troup, Pennan and Lion's Heads	4,518	142	0.658	-	-
Non-SPA colonies	14,448	-	-	0.340	0.306

[7] The mean-maximum foraging range plus one standard deviation for razorbill is 73.8 + 48.4km (Woodward *et al.*, 2019)

3.5.2 Non-breeding seasons

3.5.2.1 Calculation of apportioning values for use in non-breeding seasons are presented in Table 3.10.

Table 3.10: Calculation of non-breeding season apportioning values for razorbill

SPA	Apportioning values					
	Migration seasons (August to October and January to March)			Winter (November and December)		
	BDMPS population (No. of Individuals)	Number of breeding adults in BDMPS population from SPA	Apportioning value	BDMPS Population (no. of Individuals)	Number of breeding adults in BDMPS population from SPA	Apportioning value
East Caithness Cliffs	591,874	25,000	0.042	218,622	7,500	0.034
Flamborough and Filey Coast		20,002	0.034		6,001	0.027
Forth Islands		5,250	0.009		1,575	0.007
Fowlsheugh		7,048	0.012		2,114	0.010
St Abb's Head to Fast Castle		2,438	0.004		731	0.003
Troup, Pennan and Lion's Heads		3,486	0.006		1,046	0.005

3.6 Puffin

3.6.1 Breeding season

3.6.1.1 The calculation of apportioning values in the breeding season for all colonies for which an LSE[2] was identified in Morven Site HRA Screening Report and is presented in Table 3.11. A breakdown of apportioning values for non-SPA colonies is presented in Appendix A.

Table 3.11: Calculation of apportioning values for puffin in the breeding season for Special Protection Areas for which Likely Significant Effects[2] were identified

SPA	Population (No. of breeding adults)	Distance to Morven North[3] (km)[8]	Proportion of foraging range at Sea[3]	Resulting weight for colony	Proportional weight of colony
Coquet Island	50,058	160	0.580	0.343	0.139
Farne Islands	87,504	129	0.591	0.903	0.365
Flamborough and Filey Coast	8,558	298	0.571	-	-
Forth Islands	85,846	114	0.560	1.144	0.463
Hoy	860	271	0.808	-	-
North Caithness Cliffs	6,078	250	0.792	<0.001	<0.001
Non-SPA colonies	17,602	-	-	0.083	0.032

3.6.2 Non-breeding seasons

3.6.2.1 Calculation of apportioning values for use in non-breeding seasons are presented in Table 3.12.

Table 3.12: Calculation of non-breeding season apportioning values for puffin

SPA	Apportioning values		
	Non-breeding season (August to March)		
	BDMPS population (No. of individuals)	Number of breeding adults in BDMPS population from SPA	Apportioning value
Coquet Island	231,957	12,344	0.053
Fair Isle		3,212	0.014
Farne Islands		39,962	0.172
Flamborough and Filey Coast		958	0.004
Forth Islands		62,231	0.268
Foula		6,750	0.029
Hermaness, Saxa Vord and Valla Field		7,098	0.030
Hoy		1,050	0.005
North Caithness Cliffs		293	0.001

[8] The mean-maximum foraging range plus one standard deviation for puffin is 119.6 + 131.2km (Woodward *et al.*, 2019)

3.7 Fulmar

3.7.1 Breeding season

3.7.1.1 The calculation of apportioning values in the breeding season for all colonies for which an LSE[2] was identified in Morven Site HRA Screening Report and is presented in Table 3.13. A breakdown of apportioning values for non-SPA colonies is presented in Appendix A.

Table 3.13: Calculation of apportioning values for fulmar in the breeding season for Special Protection Areas for which Likely Significant Effects[2] were identified

SPA	Population (No. of breeding adults)	Distance to Morven North3 (km)[9]	Proportion of Foraging Range at Sea[3]	Resulting Weight for Colony	Proportional Weight of Colony
Coquet Island	106	160	0.688	0.003	0.001
East Caithness Cliffs	27,928	228	0.774	0.288	0.080
Fair Isle	64,982	314	0.796	0.360	0.101
Fetlar	18,354	426	0.817	0.052	0.015
Flamborough and Filey Coast	2,514	282	0.666	0.019	0.005
Foula	20,506	384	0.814	0.074	0.021
Hermaness, Saxa Vord and Valla Field	26,416	468	0.822	0.062	0.017
Hoy	41,082	237	0.791	0.275	0.077
North Caithness Cliffs	30,740	247	0.785	0.242	0.068
Noss	10,184	380	0.807	0.038	0.011
Non-SPA colonies	463,178	-	-	2.141	0.579

3.7.2 Non-breeding seasons

3.7.2.1 Calculation of apportioning values for use in non-breeding seasons are presented in Table 3.14. The data required to calculate apportioning values in the non-breeding season for Coquet Island SPA are not included in Furness (2015). Data for this SPA have therefore been sourced from BTO *et al*., (2025) representing counts from 2015, which are temporally comparable with the data used in Furness (2015). This population has been multiplied by the relevant proportions from nearby colonies in

[9] The mean-maximum foraging range plus one standard deviation for gannet is 315.2 + 194.2km (Woodward *et al.,* 2019)

Furness (2015) to estimate the number of fulmars from Coquet Island SPA that would be present in each seasonal BDMPS.

Table 3.14: Calculation of non-breeding season apportioning values for fulmar

SPA	Apportioning values					
	Migration seasons (October and December to March)			Winter (November)		
	BDMPS population (No. of Individuals)	Number of breeding adults in BDMPS population from SPA	Apportioning value	BDMPS population (No. of Individuals)	Number of breeding adults in BDMPS population from SPA	Apportioning value
Coquet Island	957,702	108	<0.001	568,736	76	<0.001
East Caithness Cliffs		28,404	0.030		19,883	0.035
Fair Isle		53,368	0.056		41,509	0.073
Fetlar		16,042	0.017		12,477	0.022
Flamborough and Filey Coast		1,756	0.002		1,229	0.002
Foula		35,564	0.037		27,661	0.049
Hermaness, Saxa Vord and Valla Field		12,600	0.013		9,800	0.017
Hoy		35,255	0.037		27,420	0.048
North Caithness Cliffs		25,650	0.027		19,950	0.035
Noss		9,446	0.010		7,347	0.013

3.8 Gannet

3.8.1 Breeding season

3.8.1.1 The calculation of apportioning values in the breeding season for all colonies for which an LSE[2] was identified in Morven Site HRA Screening Report and is presented in Table 3.15. A breakdown of apportioning values for non-SPA colonies is presented in Appendix A.

Table 3.15: Calculation of apportioning values for gannet in the breeding season for Special Protection Areas for which Likely Significant Effects[2] were identified

SPA	Population (No. of breeding adults)	Distance to Morven North3 (km)[10]	Proportion of foraging range at sea[3]	Resulting weight for colony	Proportional weight of colony
Forth Islands	150,518	126	0.702	3.508	0.868
Non-SPA colonies	183,396	-	-	0.536	0.132

3.8.2 Non-breeding seasons

3.8.2.1 Calculation of apportioning values for use in non-breeding seasons are presented in Table 3.16.

Table 3.16: Calculation of non-breeding season apportioning values for gannet

SPA	Apportioning values					
	Autumn (September to November)			Spring (December to March)		
	BDMPS population (No. of Individuals)	Number of breeding adults in BDMPS population from SPA	Apportioning value	BDMPS population (No. of Individuals)	Number of breeding adults in BDMPS population from SPA	Apportioning value
Fair Isle	456,299	6,278	0.014	248,385	5,494	0.022
Flamborough and Filey Coast		22,122	0.048		15,485	0.062
Forth Islands		110,964	0.243		77,675	0.313
Hermaness, Saxa Vord and Valla Field		38,965	0.085		34,094	0.137
Noss		15,627	0.034		13,674	0.055
St Kilda		11,924	0.026		0	0

[10] The mean-maximum foraging range plus one standard deviation for gannet is 315.2 + 194.2km (Woodward *et al.*, 2019)

4 Discussion

4.1 Overview

4.1.1.1 The approaches set out in this report to calculate apportioning values follow best practice methodologies (NatureScot, 2018; Natural England, 2021) and have been used to inform multiple previous offshore wind farm assessments. However, as with any methodology, it is important to understand where the approaches applied incorporate certain assumptions and/or limitations that may lead to under or over-estimates of the proportion of breeding adult birds present in a given area. These assumptions and/or limitations pertain to the following:

4.1.1.2 For breeding adult birds:

- that birds are evenly distributed at sea (this is in reality extremely unlikely due to the known patchy distribution of prey species and information gained from tracking studies);
- that seabird colonies are independent of one another;
- that birds have larger foraging ranges at larger breeding colonies due to competition and prey depletion closer to the colony (Storer-Ashmole's Halo; Elliot *et al*., 2009);
- the use of mean-maximum plus one SD foraging range for each species.

4.1.1.3 For immature birds:

- Limited information is available on the proportion of immature birds that return to natal waters and the distribution of immature birds within natal waters.

4.1.1.4 Consideration has been given in RIAA Part 3 to these assumptions and/or limitations. This includes, where available, discussion on site specific tracking studies and what effect the assumptions may have on the overall magnitude of any potential impacts. Further information on some of the assumptions identified above is provided below.

4.2 Foraging range

4.2.1.1 NatureScot (2018) recommends the use of the mean-maximum foraging range for each species. However, recent project-specific guidance from all SNCBs (e.g. NatureScot, 2021b) in relation to LSE[2] screening recommends the use of the mean-maximum foraging range plus one SD for LSE[2] screening and, as a consequence, for apportioning.

4.2.1.2 The use of the mean-maximum foraging range plus one SD is recommended by SNCBs as a precautionary approach, intended to ensure that any colonies with potential connectivity to a development are considered. However, while this method increases the number of SPAs included in the assessment, it also results in the total potential impact being distributed across a larger number of colonies. This has the effect of reducing (or "diluting") the predicted level of impact apportioned to colonies closer to the development, reducing the apportioned impact to colonies closer to Morven North. For example, Morven North is within the mean-maximum foraging range of six SPAs at which kittiwake is a qualifying feature compared to 13 when applying the mean-maximum foraging range plus one SD.

4.2.1.3 The use of a mean-maximum foraging range plus one SD represents a highly precautionary approach regardless of its application, as although it ensures from a HRA screening perspective that no SPAs are erroneously omitted from the RIAA, the likelihood of an LSE[2] occurring on any project beyond mean-maximum foraging range is highly unlikely. A mean-maximum foraging range already represents the average of the maximum foraging ranges exhibited by birds across multiple studies. A SD of a mean value represents the amount by which individual values differ from the mean value. It is an expression of confidence in the mean value and should not be applied as an absolute value, as in the application of foraging ranges for screening. This is particularly the case when the average value is already an average of maximum values from multiple studies which may not reflect the true foraging behaviour of all individuals from a colony.

4.2.1.4 However, despite the limitations of the application of a mean-maximum foraging range plus one SD for apportioning purposes, its application is necessary to ensure that potential impacts can be apportioned to all SPAs for which potential connectivity has been identified. The use of a mean-maximum foraging range would result in a 0% apportioning value being applied to all colonies between the mean-maximum foraging range and mean-maximum foraging range plus one SD. However, given the precaution involved in identifying connectivity, the application of a 0% apportioning value is likely to be correct.

4.2.1.5 The apportioning approach presented in this report applies the mean-maximum foraging range plus one SD.

4.3 Immature proportions

4.3.1.1 A number of approaches to quantifying the presence of immature birds at Morven North in the breeding season are presented in Section 2.4.2. The first approach utilises data from site specific surveys and the second is based on stable age population models from Furness (2015). In addition, the use of site specific data for kittiwake is combined with a population model to account for the inability to separate between older immature age classes and adult kittiwake during surveys. Whilst there are limitations associated with each of these approaches, it is important that immatures are accounted for in the apportioning approach applied in the breeding season, as an assumption that all birds present at Morven North are breeding adult birds is certainly incorrect. Table 4.1 summarises the data available for each species relevant to this technical report.

Table 4.1: Methods for determining the proportion of immature birds of different species present at Morven North in the breeding season

Species	Migratory behaviour	Site specific data	Furness (2015) data
Kittiwake	Adult birds: Many leave UK waters after the breeding season, although some, especially those on the east coast, remain in the North Sea. They return in Spring (Furness, 2015). Immature birds: Majority leave UK waters after the breeding season. A proportion of each immature age class returns to UK waters as the breeding season progresses with this proportion increasing as age increases. In addition, older immatures return to UK waters earlier in the breeding season than younger age classes (Coulson, 2011).	Can be used: to identify first year birds. Unable to distinguish between adults and older age groups.	Can be used.
Herring gull	All birds: Birds disperse after the breeding season and, following NatureScot advice, are assumed to be within foraging range of breeding colonies. It is assumed that this distribution persists throughout the year.	Can be used: All age groups readily identifiable.	Can be used.
Guillemot	All birds: Disperse following the breeding season, largely remaining in UK waters.	Cannot be used: immature age classes (with the exception of fledged birds) are not identifiable from adult birds.	Can be used.
Razorbill	All birds: Disperse more widely than guillemot, with a proportion leaving UK waters (Furness, 2015).	Cannot be used: immature age classes (with the	Can be used.

Species	Migratory behaviour	Site specific data	Furness (2015) data
		exception of fledged birds) are not identifiable from adult birds.	
Puffin	All birds: Migrate following the breeding season (Furness, 2015). Immature birds: Leave UK waters after the breeding season. A proportion of each immature age class returns to UK waters as the breeding season progresses with this proportion increasing as age increases. In addition, older immatures return to UK waters earlier in the breeding season than younger age classes.	Cannot be used: distinguishing features cannot be seen in digital aerial surveys.	Can be used.
Fulmar	Adult birds: Disperse after the breeding season to complete moult. Re-occupy breeding areas following moult but large foraging ranges means attendance is sporadic (Furness, 2015). Immature birds: Majority leave UK waters after the breeding season. A proportion of each immature age class returns to UK waters as the breeding season progresses with this proportion increasing as age increases (Furness, 2015).	Cannot be used	Can be used
Gannet	Adult birds: Majority leave UK waters after the breeding season. They return in spring (Furness, 2015). Immature birds: Majority leave UK waters after the breeding season. A proportion of each immature age class returns to UK waters as the breeding season progresses with this proportion increasing as age increases. In addition, older immatures return to UK waters earlier in the breeding season than younger age classes (Lane *et al*., 2021).	Can be used: All age groups readily identifiable.	Can be used.

4.3.1.2 Although any population of breeding seabirds has an immature component associated with it (as indicated in Table 4.1), the spatial distribution of that component is often very different to the breeding adult component, especially in the breeding season (Black and Ruffino, 2019; Potiek *et al*., 2019). For many seabird species, immature birds gradually begin to return to natal waters in the breeding season as they get nearer to breeding age. The proportion of older immature age classes in natal waters is therefore higher than the proportion of younger immature age classes, with many younger immatures remaining in wintering areas during the breeding season. These wintering areas are outside of UK waters for some species. In addition, the distribution of immature birds in natal waters may be dictated by proximity to breeding colonies, either because birds are prospecting for breeding sites or due to competition with breeding adult birds. Where all immature classes of a species can be reliably identified during baseline surveys, this is less of an issue. However, for species where only some age classes can be identified during baseline surveys, resulting immature proportions represent an under-estimate. Conversely, the use of stable age proportions fails to account for the distribution of immature birds and may therefore over-estimate the proportion of immatures present in a given sea area.

4.3.1.3 The immature proportions derived from Furness (2015) are calculated using stable age population models. These models quantify the proportion of different age groups within a hypothetical

population. Whilst this process identifies proportions of each age group, it does not take into account the spatial distribution of the different immature age cohorts. It is known that immature birds visit natal waters in the breeding season, with the proportion of each immature age cohort visiting natal waters increasing as birds get nearer to their age of first breeding (e.g. Coulson, 2011). However, younger immatures will often remain in wintering areas and may therefore not contribute to the population present at Morven North. To include these birds in the immature proportions applied in the assessment has the potential to under-estimate the proportion of adults present.

4.3.1.4 The proportion of immatures derived from site specific data is further influenced by the ability to separate between different age classes during surveys. In the context of this technical report, this is particularly relevant to kittiwake. Whilst one year old kittiwakes can be easily identified due to differences in plumage, two and three year old birds, which have not yet reached the age of first breeding, cannot be easily identified (Coulson, 2011; Olsen and Larsson, 2003). Therefore, data on age class collected during surveys will potentially represent a considerable overestimate of the proportion of breeding adults present in a given sea area.

4.3.1.5 It is certain that an unknown proportion of the cohort of unaged 'adult type' kittiwakes at Morven North will include two and three year old birds. Coulson (2011) provides evidence that shows that immature kittiwake visit natal waters with increasing numbers of older immatures visiting breeding colonies. This therefore supports the conclusion that the approach proposed to calculate an apportioning value for the breeding season will under-estimate the proportion of second and third year immatures. This is because second and third year immatures show a much greater affinity for natal waters than first year birds.

4.3.1.6 As detailed in Section 2.3, an approach has been applied that aims to address the underestimation. Mortality reduces the absolute number of birds present from each successive year class of kittiwake, whilst maintaining the proportion of each year class of immatures represented at Morven North. In calculating the number of two and three year old kittiwakes at Morven North, the analysis uses survival rates of each immature age class of kittiwake that follows the rate provided in Horswill and Robinson (2015). This approach is considered precautionary for the following reasons:

- it is known that older immature age classes that are not identifiable during baseline surveys will be present at Morven North;
- a smaller proportion of one year old birds are likely to be present in natal waters, with a much greater proportion of older age classes of immature birds showing affinity with natal waters. Therefore, the proportion of older age classes is likely underestimated when applying the approach.

4.3.1.7 The identification of immature age classes of large gulls and gannets during baseline surveys is easier than for kittiwake, and the immature proportions calculated for these species are therefore considered to be more representative. The identification of immature age classes of auk species is not possible from baseline surveys (with the exception of juvenile birds in the post-breeding season) and, where necessary, other sources will be relied upon within RIAA Part 3.

5 References

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Appendix A Apportioning values for non-SPA colonies (including SSSIs, MNRs, NNRs and Ramsar sites)

A.1 Kittiwake

Table A. 1: Apportioning values for kittiwake at non-Special Protection Area colonies

Master site	Count (No. birds)	Apportioning value
Boulby Cliffs	2,520	0.003
Burn of Daff	2,186	0.023
Caithness - Wick Bay to Freshwick Bay	90	0.000
Carr Craig, Eyebroughy and Haystack	1,114	0.003
Catterline to Inverbervie	4,094	0.043
Deerness	10	0.000
Eyemouth to Burnmouth	1,418	0.007
Findon Ness - Hare Ness	2,354	0.024
Fraserburgh	162	0.001
Girdle Ness to Hare Ness	4,186	0.043
Green Holms	64	0.000
Hall Bay to Craigeven Bay	158	0.002
Hartlepool	48	0.000
Hartlepool Fish Quay	322	0.000
Holm	28	0.000
Hopeman Bay	1,120	0.001
Horse of Copinsay	144	0.000
Howick - Cullornose Point - Dunstanburgh Castle Point	2,136	0.007

Master site	Count (No. birds)	Apportioning value
Hoy and Southwalls	66	0.000
Lunan Bay to Arbroath	1,076	0.007
Marsden Bay	6,688	0.013
Montrose to Lunan Bay	740	0.006
Newton Hill	4	0.000
Newtonhill - Hall Bay	596	0.006
North Sutor to Shandwick	558	0.001
Pentland Firth Islands SPA	262	0.000
Peterhead	66	0.000
Portknockie	618	0.001
Portsoy to Cullen	1,032	0.002
Rerwick Head to Mirkady Point	6	0.000
River Tees Mouth	754	0.001
River Tyne to Seaton Sluice	2,514	0.004
Rosehearty to Bay of Cullen	56	0.000
Saltburn Coast	2,220	0.003
Sanday - Stove to Kettletoft	102	0.000
Scalby to Rocky Point	90	0.000
Scapa Bay to St. Marys	46	0.000
Scarborough to Osgodby Point	5,462	0.005
Seahouses	412	0.002
Shapinsay (Coastal)	34	0.000
South Ronaldsay	102	0.000
South Sutor	238	0.000

Master site	Count (No. birds)	Apportioning value
Staithes to Sandsend	1,538	0.002
Stonehaven to Wine Cove	560	0.006
Stronsay	294	0.000
Whitby to Robin Hood's Bay	734	0.001
Yesnaby - Ness Point, Stromness	12	0.000
Ythan Estuary, Sands of Forvie and Meikle Loch SPA	774	0.006
Total	49,808	-

A.2 Herring gull

Table A. 2: Apportioning values for herring gull at non-Special Protection Area colonies

Master site	Count (No. birds)	Apportioning value (Applicant approach)	Apportioning value (NatureScot approach)
Burn of Daff	326	0.057	0.040
Catterline to Inverbervie	1,946	0.361	0.249
Findon Ness - Hare Ness	250	0.044	0.030
Girdle Ness to Hare Ness	134	0.023	0.015
Hall Bay to Craigeven Bay	30	0.005	0.004
Inverbervie to St Cyrus	46	0.008	0.006
Lunan Bay to Arbroath	224	N/A	0.022
Montrose to Lunan Bay	154	N/A	0.016
Newton Hill	136	0.024	0.017
Newtonhill - Hall Bay	102	0.018	0.013
St Cyrus NNR	2	N/A	0.000
Stonehaven to Wine Cove	396	0.073	0.052
Ythan Estuary, Sands of Fovie and Meikle Loch SPA	74	N/A	0.006
Total	3,366 (Applicant) 3,820 (NatureScot)	-	-

A.3 Guillemot

Table A. 3: Apportioning values for guillemot non-Special Protection Area colonies

Master site	Count (No. birds)	Apportioning value
Burn of Daff	347	0.004
Catterline to Inverbervie	4,505	0.049
Findon Ness - Hare Ness	1,177	0.012
Girdle Ness to Hare Ness	222	0.002
Lunan Bay to Arbroath	670	0.006
Montrose to Lunan Bay	20	0.000
Newton Hill	3	0.000
Newtonhill - Hall Bay	311	0.003
Ythan Estuary, Sands of Forvie and Meikle Loch SPA	59	0.000
Total	7,314	-

A.4 Razorbill

Table A. 4: Apportioning values for razorbill at non-Special Protection Area colonies

Master site	Count (No. birds)	Apportioning value
Buchan Ness to Collieston Coast SPA	5,826	0.110
Burn of Daff	148	0.005
Catterline to Inverbervie	2,785	0.104
Eyemouth to Burnmouth	224	0.004
Findon Ness - Hare Ness	929	0.031
Girdle Ness to Hare Ness	297	0.010
Hall Bay to Craigeven Bay	5	0.000
Lunan Bay to Arbroath	517	0.017
Montrose to Lunan Bay	57	0.002
Newton Hill	140	0.005
Newtonhill - Hall Bay	161	0.005
St Abb's Head to Fast Castle SPA	2,931	0.054
Stonehaven to Wine Cove	280	0.010
Ythan Estuary, Sands of Forvie and Meikle Loch SPA	148	0.003
Total	14,448	-

A.5 Puffin

Table A. 5: Apportioning values for puffin at non-Special Protection Area colonies

Master site	Count (No. birds)	Apportioning value
Buchan Ness to Collieston Coast SPA	352	0.002
Burn of Daff	14	0.000
Caithness - Wick Bay to Freshwick Bay	6	0.000
Carr Craig, Eyebroughy and Haystack	5,282	0.017
Catterline to Inverbervie	20	0.000
Copinsay SPA	1,756	0.001
East Caithness Cliffs SPA	368	0.000
Findon Ness - Hare Ness	38	0.000
Flotta & Calf of Flotta	12	0.000
Fowlsheugh SPA	318	0.003
Horse of Copinsay	16	0.000
Lunan Bay to Arbroath	40	0.000
Melvich to Duncansby Stacks SSSI	10	0.000
Newton Hill	4	0.000
Newtonhill - Hall Bay	6	0.000
Pentland Firth Islands SPA	9,140	0.008
Portsoy to Cullen	32	0.000
South Ronaldsay	14	0.000
Stonehaven to Wine Cove	2	0.000
Switha	112	0.000
Troup, Pennan and Lion's Heads SPA	60	0.000
Total	17,602	-

A.6 Fulmar

5.1.1.1 Data for fulmar is available on request (not presented here due to volume – 1,998 rows of data).

A.7 Gannet

Table A. 6: Apportioning values for gannet at non-Special Protection Area colonies

Master site	Count (No. birds)	Apportioning value
Fair Isle SPA	9,942	0.008
Flamborough and Filey Coast SPA	26,784	0.032
Foula SPA	4,886	0.002
Hermaness, Saxa Vord and Valla Field SPA	59,124	0.020
Marwick Head SPA	18	0.000
North Rona and Sula Sgeir SPA	24,542	0.009
Noss SPA	27,530	0.014
St Abb's Head to Fast Castle SPA	22	0.000
Sule Skerry and Sule Stack SPA	18,130	0.011
Troup, Pennan and Lion's Heads SPA	9,650	0.034
West Westray SPA	2,768	0.002
Total	183,396	-