



FIVE ESTUARIES OFFSHORE WIND FARM

APPENDIX 2 TO THE FIVE ESTUARIES
DRAFT REPORT TO INFORM
APPROPRIATE ASSESSMENT:
APPORTIONING METHODOLOGY
(ORNITHOLOGY)

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DEFINITION OF ACRONYMS

Term	Definition
ECC	Export Cable Corridor
HRA	Habitat Regulations Assessment
JNCC	Joint Nature Conservation Committee
LSE	Likely Significant Effect
O&M	Operation and Maintenance
OWF	Offshore Wind Farm
PEIR	Preliminary Environmental Information Report
RIAA	Report to Inform Appropriate Assessment



Term	Definition
RIS	Ramsar Information Sheet
SNCB	Statutory Nature Conservation Bodies
SPA	Special Protection Areas
VE	Five Estuaries



1 INTRODUCTION

- 1.1.1 This appendix supplements the Report to Inform Appropriate Assessment (RIAA), with the aim of outlining the methodology and approach to the apportioning of impacts from the Five Estuaries (hereafter “VE”) offshore wind farm (OWF) to ornithological receptors at designated sites screened in for assessment (see updated screening report). The direct impact of VE OWF has been assessed and presented in the corresponding Offshore Ornithology Preliminary Environmental Information Report (PEIR) chapter (Volume 2, Chapter 4: Offshore Ornithology) and Collision Risk Modelling (CRM) Annex (Volume 4, Annex 4.8: Collision Risk Modelling Inputs and Outputs). The approach by which collision and displacement induced mortalities are apportioned to relevant sites is detailed within this report.



2 METHODOLOGY

BIO-SEASONS

- 2.1.1 It is important to consider seasonality within the assessments because seabird behaviour and distributions change throughout the year. For example, species are present at different times of year depending on their migration patterns and during the breeding season birds attending their nests are restricted by the distance over which they can forage. Therefore, we assign species biologically defined seasons (bio-seasons) over which there are distinct differences in population sizes or distributions to more accurately assess the impact of OWFs over these periods. The bio-seasons used throughout the assessments underpinning the results presented within the RIAA were defined from Furness (2015) for all screened in species (see VE PEIR Volume 2, Chapter 4: Offshore Ornithology and Volume 4, Annex 4.8: Collision Risk Modelling Inputs and Outputs). Consequently, the impacts were apportioned to SPAs within each of these bio-seasons.
- 2.1.2 As can be seen in Table 1 some species have a different number of non-breeding bio-seasons to account for periods during which substantial migration of the species occurs through UK waters. Notably, in all cases the full breeding seasons (as opposed to migration-free breeding) were used, which incorporate the modal return to the colony through to the modal departure from the colony at the end of breeding (Furness, 2015). Using the full breeding season is generally considered a more precautionary approach because the impacts are apportioned to fewer colonies during the breeding season compared with the non-breeding season.
- 2.1.3 Furness (2015) defines the post-breeding (autumn) migration, and pre-breeding (spring) migration periods, based on the periods during which substantial migration of the species occurs through UK waters. As a result, the migration periods overlap somewhat with the UK breeding season and with the non-breeding season, since timing of migrations of birds from high latitude regions can differ from that of UK birds.

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

Species	Bio-season					
	Migration free breeding	Post-breeding migration	Return migration	Migration-free winter	Breeding	Non-breeding
Kittiwake	-	Aug - Dec	Jan - Apr	-	-	-
LBBG	-	Aug - Oct	Mar - Apr	Nov - Feb	Apr - Aug	-
Guillemot	-	-	-	-	Mar - Jul	Aug - Feb
Razorbill	-	Aug - Oct	Jan - Mar	Nov - Dec	Apr - Jul	-
Red-throated diver	-	Sep - Nov	Feb - Apr	Dec - Jan	-	-
Gannet	-	Sep - Nov	Dec - Mar	-	Mar - Sep	-



PROPORTION OF ADULTS IN THE POPULATION

- 2.1.4 To then calculate the proportion of impact consequent mortalities that would be attributed to each SPA, the NatureScot (2018) apportioning tool requires the number of breeding adults that are impacted by the OWF (as opposed to individuals which are calculated by CRM and displacement). For this assessment, the proportion of adults in the population during the breeding season was derived from the tables in Appendix A of Furness (2015) and is presented in Table 2 below.
- 2.1.5 The data presented in Furness (2015) are considered to provide a more accurate representation of population age structure than site-based data, since only a small proportion of individuals for each species could be positively aged within the latter, especially due to the low number of recorded birds during the non-breeding season within the site-specific surveys. During the full breeding bio-season the proportion of adult birds within the array was derived from Appendix A: Table 16 of Furness (2015) for the FFC SPA.

Table 2: The proportion of adults in the population during the breeding season, derived from Furness (2015).

Species	Proportion of adults during the breeding season
Kittiwake	0.532
LBBG	0.595
Guillemot	0.575
Razorbill	0.571
RTD	-
Gannet	0.552

- 2.1.6 This provides a resultant proportion of adult mortalities attributed to each colony. Where an SPA consists of more than one colony, the total number of birds apportioned to that SPA is the sum of birds apportioned to each constituent colony.



2.2 BREEDING SEASON APPORTIONING

2.2.1 Apportioning impacts from VE to specific designated (breeding) seabird populations during the breeding season was undertaken using the interim guidance from NatureScot, (2018)¹. Breeding adults are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, therefore it can be expected that a high proportion of adult birds potentially affected by offshore wind farm impacts can be attributed to colonies within foraging range. The NatureScot (2018) guidance provides an evidence led approach which uses this principle and thus calculates which colonies estimated collision and displacement induced mortalities are likely to be attributed to during the breeding bio-season. This guidance was deemed the most appropriate to use for assessing the impact from VE. Additionally, this approach has been widely used and well established for use throughout the UK. The methodology calculates an estimated proportion of breeding adults associated with each colony based on the following parameters:

- The population size of each colony;
- The distance from each colony (geometric centre) to Project arrays (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).

2.2.2 NatureScot (2018) guidance states using the following equation for apportioning calculations:

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

2.2.3 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 +1SD presented in Woodward *et al.* (2019). On this basis, all designated Special Protection Areas (SPAs) and Ramsar sites within MMF range +1SD were included.

¹ <https://www.nature.scot/doc/interim-guidance-apportioning-impacts-marine-renewable-developments-breeding-seabird-populations>



DISTANCE FROM COLONY TO PROJECTS

2.2.4 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 for 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 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.

PROPORTION OF SEA WITHIN FORAGING RANGE

- 2.2.5 The area of suitable foraging habitat within the sea for each species from each colony was calculated as follows: using GIS, a buffer around each colony was drawn for each species which equals 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 land, estuaries or freshwater bodies of water were 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.
- 2.2.6 Using the calculation and parameters described above, a resultant weighting for each colony within foraging range was calculated.
- 2.2.7 An overview of the input values and resulting apportionment to the FFC SPA for gannet and Alde-Ore Estuary SPA for lesser-black backed gull is presented in Table 3 and Table 4 respectively as per NatureScot (2018) methodology.



Table 3: Gannet calculation values following the NatureScot Apportionment methodology (NatureScot 2018).

Colony Name	Distance from VE (km)	Count	Percentage sea	1/P(Sea)	Distance^2	Resulting Weight for colony	Proportional Weight of colony
FFC	276	26,784	52.4	0.019	76176.000	0.709	0.606
Alderney West Coast & Burhour Islands Ramsar	380.7	11,900	51.1	0.020	144932.490	0.170	0.145
Chausey	401	0	50.0	0.020	160801.000	0.000	0.000
Cote de Granit Rose-Sept Iles	487	39,052	59.9	0.017	237169.000	0.291	0.248



Table 4: Lesser black-backed gull calculation values following the NatureScot Apportionment methodology (NatureScot 2018), with colonies forming the Alde-Ore Estuary SPA in bold.

Colony Name	Distance from VE (km)	Count	Percentage sea	1/P(Sea)	Distance^2	Resulting Weight for colony	Proportional Weight of colony
Arc Pit RSPB	119.6	12	51.0	0.020	14308.010	0.000	0.000
Ashford (urban)	98.6	8	49.6	0.020	9728.700	0.000	0.000
Berney Marshes	73.8	40	68.5	0.015	5439.992	0.001	0.001
Birchington (urban)	66.3	80	49.4	0.020	4398.058	0.002	0.004
Breydon Water	75.3	0	70.7	0.014	5675.124	0.000	0.000
Burntwick Island	103.0	6	40.6	0.025	10608.012	0.000	0.000
Burrowes Pit RSPB	120.8	0	51.0	0.020	14593.922	0.000	0.000
Canterbury	84.9	6	48.2	0.021	7212.726	0.000	0.000
Chelmsford Town	109.6	4	28.0	0.036	12019.929	0.000	0.000
Clacton Railway Station	61.7	6	44.5	0.022	3808.318	0.000	0.000
Cobmarsh Island	79.5	0	37.8	0.026	6314.431	0.000	0.000
Elmley RSPB Reserve	95.5	0	43.8	0.023	9128.634	0.000	0.000
Faversham (buildings)	86.5	10	47.3	0.021	7476.142	0.000	0.000
Felixstowe Docks	52.3	0	51.1	0.020	2733.250	0.000	0.000
Flanders Mare	93.2	0	44.5	0.022	8691.445	0.000	0.000
Folkestone Rooftops	95.0	6	50.5	0.020	9019.143	0.000	0.000
Fox's Marina / Ipswich Docks	65.5	18	47.5	0.021	4293.074	0.000	0.001



Colony Name	Distance from VE (km)	Count	Percentage sea	1/P(Sea)	Distance^2	Resulting Weight for colony	Proportional Weight of colony
Gillingham Business Park (urban)	110.8	0	40.9	0.024	12284.743	0.000	0.000
Great Cob Island	81.2	0	37.3	0.027	6589.278	0.000	0.000
Greenborough	103.0	112	41.3	0.024	10601.722	0.001	0.003
Hamford Water	55.5	1200	48.0	0.021	3076.578	0.041	0.088
Havergate Island	42.4	3340	58.1	0.017	1793.806	0.163	0.347
Hollesley Marsh	44.7	38	56.7	0.018	1996.692	0.002	0.004
Lowestoft	59.8	1500	70.5	0.014	3573.579	0.030	0.064
Maidstone (buildings)	118.3	16	43.0	0.023	13987.324	0.000	0.000
Maplin Bank	86.3	2	41.6	0.024	7452.652	0.000	0.000
Marden	125.6	2	45.7	0.022	15785.067	0.000	0.000
Margate, Kingsgate, Ramsgate & Broadstairs (urban)	60.0	40	50.1	0.020	3598.660	0.001	0.002
Medway City Estate (urban)	113.3	12	39.3	0.025	12825.771	0.000	0.000
Minsmere RSPB (Scrape & Beach)	43.3	4	64.2	0.016	1872.195	0.000	0.000
Mocketts Saltmarsh	90.2	4	45.2	0.022	8130.081	0.000	0.000
Nor Marsh RSPB	107.9	4	40.2	0.025	11643.642	0.000	0.000
North Point Pit	126.8	12	51.2	0.020	16084.105	0.000	0.000
Orfordness Beach (Orford Ness 1)	40.8	194	58.8	0.017	1667.933	0.010	0.021



Colony Name	Distance from VE (km)	Count	Percentage sea	1/P(Sea)	Distance^2	Resulting Weight for colony	Proportional Weight of colony
Packingshed Island	79.6	4	37.8	0.026	6338.028	0.000	0.000
Pewet Island	80.8	13	37.8	0.026	6529.766	0.000	0.001
Quarry Wood Industrial Estate (urban)	120.8	8	42.0	0.024	14597.193	0.000	0.000
Ransomes and Rapiar (Industrial Site)	65.2	30	47.9	0.021	4248.703	0.001	0.002
Ransomes Euro Park (urban)	61.4	100	49.3	0.020	3771.156	0.003	0.006
Rat Island	74.1	16	39.9	0.025	5485.952	0.000	0.001
Reavels (Industrial Site)	67.2	28	47.1	0.021	4509.621	0.001	0.001
Shell Ness (Isle of Sheppey)	92.2	0	44.0	0.023	8493.441	0.000	0.000
Sunken Island	80.6	4	37.4	0.027	6494.505	0.000	0.000
Whitstable (urban)	83.2	14	46.5	0.022	6914.241	0.000	0.000
Waddenzee	197.7	36,268	50.0	0.020	39085.290	0.094	0.201
Veerse Meer	101.5	528	50.0	0.020	10302.250	0.005	0.011
Duinen en Lage Land Texel	200.5	36802	50.0	0.020	40200.250	0.093	0.198
Duinen Vlieland	227.9	9884	50.0	0.020	51938.410	0.019	0.041
Alde-Ore Estuary SPA Total	-	3534.0	-	-	-	-	0.368



2.3 NON-BREEDING SEASON APPORTIONING

2.3.1 Outside of the breeding bio-season, the population of birds contains a mix of individuals from UK breeding colonies and from further away, therefore, a much lower percentage of birds can be attributed to any particular breeding colony population. Apportionment for VE 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 (Nature Scot, 2018). This approach used the following data:

- Defined bio-seasons taken from 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 for colonies 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.

2.3.2 Proportions of mortality impacts attributed for each relevant designated site was then calculated using the following equation:

$$\frac{\textit{Designated site population size}}{\textit{Regional population size}} \times \textit{Proportion of population that remain during season}$$

2.3.3 The resulting apportionment is presented in Table 5 below.



Table 5: Species bio-season apportionment of BDMPS population to SPAs as derived from Furness (2015) during the non-breeding season.

Species	Bio-season	SPA	% Apportioned to SPA
Kittiwake	Return migration	FFC	7.19
	Post-breeding migration		5.44
Lesser black-backed gull	Return migration	AOE	3.33
	Full breeding		36.8
	Post-breeding migration		3.33
	Migration-free winter		4.92
Guillemot	Non-breeding	Farne Islands	3.73
		FFC	4.41
Razorbill	Return migration	Farne Islands	0.07
	Post-breeding migration		0.02
	Migration-free winter		0.07
	Return migration	FFC	3.38
	Post-breeding migration		3.38
	Migration-free winter		0.91
Gannet	Return migration	FFC	6.23
	Full breeding		60.6
	Post-breeding migration		4.85



2.4 COLONY POPULATION SIZES

2.4.1 Once apportioned, the impacts from VE on relevant designated sites, were assessed against both citation counts and more recent counts provided in Table 6. Citation counts were based on the citation documents provided for relevant sites (Natural England, 2021). More recent colony sizes were based on data provided in the Seabird Monitoring Programme Database (JNCC, 2020) 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. Counts used in the assessment for screened in sites are presented in Table 6 below.

Table 6: Population abundance data used in assessment for screened in sites and features, with citation and most recent counts and year

Site	Species	Citation count (individuals) (year)	Updated Count (year)
Outer Thames Estuary SPA	Red-throated divers	6,466 (1989-2006/07)	22,280 (2019)
Flamborough and Filey SPA	Gannet	16,938 (2008-2012)	26,784 (2017)
	Guillemot	83,214 (2008-2011)	121,754 (2017)
	Razorbill	21,140 (2008-2012)	40,506 (2017)
	Kittiwake	167,400 (1987)	103,040 (2017)
Farne Islands SPA	Guillemot	65,751 (2010-2014)	64,042 (2019)
	Razorbill	572 (2001)	427 (2019)
Alde-Ore Estuary SPA and Ramsar	Lesser black-backed gull	28,140 (1994/97)	3,534 (2018/19)



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