

Hornsea Offshore Wind Farm

Project Two

Clarification Note – Apportioning of predicted guillemot mortality to the Flamborough and Filey Coast pSPA population

Appendix O to the Response submitted for Deadline IIA

Application Reference: EN010053

25 August 2015

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Document title	Apportioning and assessment of predicted guillemot mortality to the Flamborough and Filey Coast pSPA population
Document Reference	
Status	FINAL
Version	V1.2
Date	August 2015
Project name	Hornsea Offshore Wind Farm, Project Two
Client	SMart Wind Ltd on behalf of Optimus Wind Limited and Breesea Limited (together the 'Applicant')

Authorisation	
Signed	
For	SMart Wind Ltd on behalf of Optimus Wind Limited and Breesea Limited (together the 'Applicant')
Date/Print Name	
Position	

1 Apportioning and assessment of predicted guillemot mortality to the Flamborough and Filey Coast pSPA population

1.1 Introduction

1.1.1 The note provides details of the applicants considered position and deemed implications for the FFC pSPA in addition to the position of Natural England. Where differences between the Applicant and Natural England occur, these are explored to provide appropriate clarity.

1.1.2 This clarification note has been prepared in respect of the application for a development consent order (DCO) to the Secretary of State under the Planning Act 2008 ('the Application') by SMartWind Ltd on behalf of Optimus Wind Ltd and Breesea Ltd (the 'Applicant') for the Hornsea Project Two Offshore Wind Farm (the 'Project').

1.1.3 This note has been prepared in response to queries raised by Natural England in their Relevant and Written Representations regarding the apportioning of guillemots present within the Project site to the Flamborough and Filey Coast (FFC) pSPA during the breeding season. Specifically, this note explores the assumptions made regarding the spatial and numerical distribution of non-breeding (including immature) birds during the breeding season and the foraging range used to identify colonies from which birds may interact with the Project site.

1.1.4 Natural England have not raised any queries about the methodologies used to apportion birds in any other seasons defined for guillemot (i.e. the non-breeding season) and therefore this note does not provide any exploration of alternative apportioning approaches during this season.

1.1.5 The apportioning methodology for guillemot that informed the assessment was presented in Appendix D of the HRA Report (Doc ref No. 12.6). This clarification note builds on the guillemot apportioning and assessment that is presented in the HRA Report (Doc ref No. 12.6).

1.1.6 The note provides details of the applicants considered position and deemed implications for the Flamborough and Filey Coast pSPA (FFC pSPA) in addition to the position of Natural England. Where differences between the Applicant and Natural England occur, these are explored to provide appropriate clarity.

1.1.7 The report is structured to include the following sections:

- A description of consultation with Natural England from the Section 42 submission through to final submission and consultation that has taken place as part of the examination process (Section **Error! Reference source not found.**);
- Guillemot phenology – definition of seasonal extents (Section **Error! Reference source not found.**);
- Breeding season apportioning – Project Two alone (Section **Error! Reference source not found.**);

- Assessment of predicted guillemot mortality from Project Two alone (Section 1.5);
- Assessment of predicted guillemot mortality from Project Two in-combination with other plans or project (Section 1.6); and
- Conclusions – implications for FFC pSPA (Section 1.7).

1.2 Consultation with Natural England

1.2.1 This section outlines the assessment evolution of the breeding guillemot feature of the FFC pSPA, including; consultation and development of the Biologically Defined Minimum Population Scale (BDMPS) approach, and finally the apportioning methodologies incorporated into assessment for guillemot from the Section 42 submission to Deadline II of the Project examination. During this period there have been ongoing discussions with Natural England that have informed the BDMPS and apportioning methodologies presented in the submitted application and subsequently within this clarification note.

1.2.2 The remaining text in Section 1.2 of this note details queries raised by Natural England at various stages of the application and which are clarified within this note.

Section 42 and application submission

1.2.3 In the Section 42 submission, guillemot was screened out of further assessment during the breeding season as the Project site falls beyond the mean-maximum foraging range of the species (Thaxter *et al.*, 2012). This foraging range has previously been used to identify connectivity with protected sites for many previously consented offshore wind projects. Natural England did not however agree with the exclusion of guillemot and stated that as FFC pSPA was the nearest SPA colony to the Project site designated for this species it should be screened into the assessment regardless of any published foraging range. Natural England also referenced a recent example from the Dogger Bank Creyke Beck project where guillemot had been screened into the assessment despite lying beyond the mean-maximum foraging range and a BDMPS was defined for the species in the North Sea in order to calculate the proportion of birds originating from different SPA sites.

1.2.4 This resulted in an extended (and extremely precautionary) foraging range of 200 km being applied during the application. Following Section 42 consultation with Natural England, the Applicant incorporated the BDMPS and seasonal definitions from Furness (2015).

Natural England's Relevant Representation

1.2.5 Natural England raised a number of queries within their Relevant Representation in relation to the apportioning methodology applied to auk species (paragraphs 59-71) and specifically to guillemot in paragraphs 62-64.

1.2.6 Two main issues applicable to the apportioning exercise undertaken for guillemot in the breeding season were:

- “Natural England do not agree that the estimates of numbers of immatures from UK, Faeroes and Norwegian colonies predicted to be in the North Sea in winter can be used in the breeding season...”
- “Natural England does not agree with the 200km foraging range that has been applied to scope in adults from breeding colonies...”

1.2.7 Natural England do however note that:

- “adult birds recorded in the project area in the breeding season period are not necessarily birds that are provisioning young.”
- “later in the breeding season some adults could be failed breeders...”
- “immature birds show natal philopatry and for several species are likely to start prospecting for sites within the colony during the breeding season.”

Pre-examination and examination consultation

1.2.8 At a consultation meeting on the 3rd June 2015, the apportioning of impacts to the FFC pSPA guillemot population was discussed. The implications of these discussions (including revision to foraging range applied) are detailed with respect to the positions of both the Applicant and Natural England in the remainder of this Note.

1.3 Guillemot phenology – seasonal definitions

1.3.1 Subsequent to Section 42 consultation with Natural England, two seasons were defined for guillemot based on information presented in Furness (2015); these are presented in Table 1.1.

Table 1.1: Seasonal extents used for guillemot throughout the assessment of Hornsea Project Two.

Season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Non-breeding												
Breeding												

1.3.2 Natural England have not raised any disagreements with the seasonal definitions presented in **Error! Reference source not found.** within their Relevant and Written Representations. Therefore, the Applicant and Natural England are aligned in their application for all assessment purposes.

1.4 Breeding season apportioning – Project Two alone

Foraging range

- 1.4.1 In Appendix D of the HRA Report (Doc ref No. 12.6), the Applicant presented evidence that indicated it was unlikely that guillemot present at the Project site during the breeding season originated from the FFC pSPA. This evidence incorporated information on foraging range and breeding productivity of guillemot at the FFC pSPA. However, Natural England advised that they did not agree there were no breeding season impacts on the guillemot population at the FFC pSPA. Therefore the maximum number of guillemot present at the Project site that could be attributed to the FFC pSPA was calculated based on the highly precautionary assumption that guillemot from the FFC pSPA could forage out to a distance of 200 km.
- 1.4.2 However, as part of their Relevant Representations, Natural England suggest the use of a 135 km foraging range based on information presented in Thaxter *et al.* (2012).
- 1.4.3 The application of a 135 km foraging range for guillemot is however, still considered by the Applicant to be precautionary. Few birds from the FFC pSPA bring back fish from areas 30 km beyond the colony (Brown and Grice, 2005) and detailed cumulative frequency foraging range data for guillemot indicates that less than 5% of foraging trips from the FFC pSPA will occur at a distance likely to interact with Subzone 2 (**Error! Reference source not found.**). If birds were to consistently forage over such a large distance this would negatively impact the productivity of the colony to such an extent as to reduce overall productivity to zero. This has previously been documented at colonies in Shetland and on Fair Isle where, in years where food supply was poor, extended foraging trips were undertaken by breeding birds (Heubeck and Parnaby, 2012).
- 1.4.4 If a foraging range of 135 km is applied, the Project site is still within range of all colonies considered previously and as such there are no changes to the proportion of birds attributable to the FFC pSPA as a result of this change.

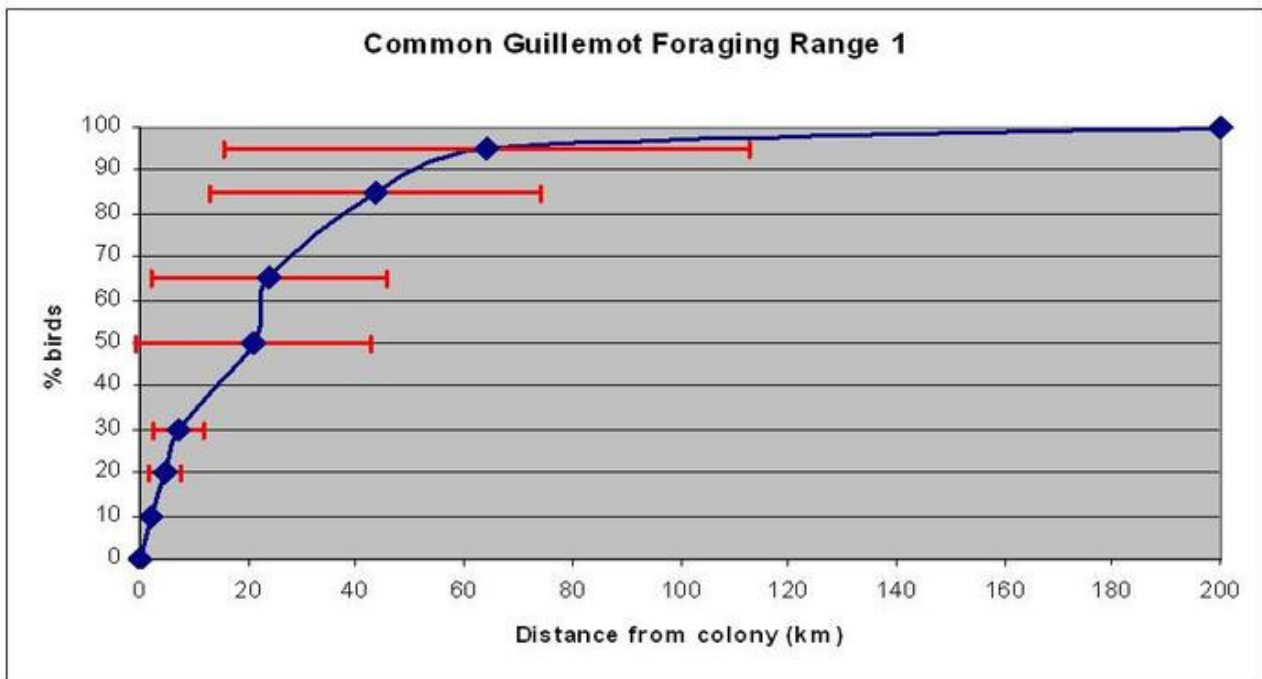


Figure 1-1: Cumulative frequency and proportion of birds found foraging at different distances from colony (Birdlife International, 2014¹).

Population age structure

1.4.5 The proportion of breeding adult guillemots present at the Project site originating from the FFC pSPA during the breeding season was derived in the HRA Report (Doc. ref. 12.6) with the following steps (and reference to Furness 2015):

1. The total number of immature birds associated with colonies in the North Sea during the non-breeding season was calculated. It was assumed that these immatures remain in the North Sea during the breeding season;
2. The total number of immature birds from foreign colonies that overwinter in the North Sea was calculated. It was again assumed that these birds remain in the North Sea during the breeding season;
3. The estimated number of breeding birds within the extended 200 km foraging range was calculated using data from the JNCC's Seabird Monitoring Programme database;
4. The resulting immature population from Step 1, a precautionary 25% of the immature population from Step 2 and the breeding adult population calculated in Step 3 was totalled to provide the total number of birds with potential connectivity to Subzone 2 in the breeding season; and
5. The Flamborough and Filey Coast pSPA population was then compared to the total population calculated in Step 4 to determine the proportion of the total population represented by birds from the pSPA colony.

1.4.6 By applying the five steps outlined above, the total population of guillemot with predicted connectivity to the Project site was calculated as 702,832 birds. The contribution of breeding adults from the FFC pSPA to this population was 11.84%

¹ Seabirdwikispaces.com

(**Error! Reference source not found.**). This approach was considered to be highly precautionary by the Applicant when cross-referencing against known mean-maximum foraging range data and the high breeding productivity of the species.

Table 1.2: Calculation of the regional breeding population and proportion attributable to Flamborough and Filey Coast pSPA.

Step	Component	Metric	Number
1	No. of immatures in the North Sea during the breeding season	Individuals	604,573
2	No. of immatures in the North Sea from foreign colonies	Individuals	59,200
3	Breeding birds within extended foraging range of Subzone 2	Breeding adults	245
	Flamborough and Filey Coast pSPA population	Breeding adults	83,214
4	Total number of birds in region	Individuals	702,832
5	Proportion of total population represented by Flamborough and Filey Coast pSPA	%	11.84

1.4.7 Natural England query the validity of incorporating immature birds from Norwegian and Faroese colonies into the non-breeding population of birds in the North Sea. Guillemot are most accurately described as a dispersive species rather than migratory (Wernham *et al.*, 2002; BWPi, 2009) with many adults even from northern colonies present in neighbouring seas throughout the year (Wernham *et al.*, 2002). Therefore it is likely that many birds associated with North Sea colonies remain in the North Sea throughout the year. However, guillemots are known to disperse over large distances, with this especially true for first year birds (BWPi, 2009).

1.4.8 Baillie *et al.* (1994) presents recovery data for different immature age classes from seven different regions around Scotland. There are recoveries in the breeding season of immature birds from all regions in the North Sea area in which the Project site is located. Halley and Harris (1993) have also recorded immature birds from colonies around Britain and Ireland visiting the breeding colony at the Isle of May. Mead (1974) also presents recoveries of guillemot from colonies around the UK. There is evidence that immature birds from around the UK can be found in the North Sea during the breeding season and these birds may therefore be visiting the FFC pSPA colony. Mead (1974) also suggest that first year birds do not normally return to the vicinity of the colony during the breeding season although many older immatures do so.

1.4.9 Small numbers of guillemots from Scandinavian and Faeroese colonies are known to reach northern Britain with some entering the North Sea (Wernham *et al.*, 2002) and there is evidence to suggest that birds from colonies in northern Norway and Russia are present in the North Sea during the non-breeding season (BWPi, 2009). It is not however known if these birds remain in the North Sea during the breeding season. On this basis, if the birds in Step 2 of Table 1.2 are removed from the analysis the proportion of total population represented by FFC pSPA breeding adults is 12.1%. This forms the basis of the Applicant's position in this Note.

- 1.4.10 Natural England's position is that the application of Project Two site specific data is suitable to calculate the proportion of breeding adults present. During the breeding season the proportion of adult breeding birds present at the Project site was 46.3%. However, the Applicant considers that whilst one year old guillemots can be identified during boat-based surveys, older immature birds, which have not yet reached the age of first breeding, cannot be separated from adult birds. Therefore data on age class collected during boat-based surveys will potentially represent a considerable underestimate of the proportion of immatures present at the Project site.
- 1.4.11 Detailed cumulative foraging range data indicates that 95% of foraging trips occur within 70km of a colony (Figure 1-1). This infers that only 5% of foraging trips would occur beyond this distance with the percentage decreasing as distance from colony increases. It is likely that foraging at such a large distance would negatively impact the productivity of the colony to such an extent as to reduce overall productivity to zero. Burke and Montevecchi (2009) compared breeding guillemot in two consecutive years that had differing food availability. In the first year the mean-maximum foraging range of guillemot was 60 km whereas in the second year this increased to 81 km due to changes in food availability. In this second year Burke and Montevecchi (2009) suggested that birds were close to an energetic limit meaning that foraging effort could not be increased further without a decrease in the survival rates of chicks.
- 1.4.12 In recent decades breeding success has been good at colonies between Humberside and south-east Scotland. This is in contrast to colonies further north where breeding success has been comparatively low (Heubeck and Parnaby, 2012; MacArthur Green, 2014). High breeding success at colonies between Humberside and south-east Scotland implies that food supply, and as such foraging opportunities, are good. This would result in foraging breeding adults having to travel shorter distances than those cited in the literature in order to acquire food. This information indicates that foraging trips of guillemot from the FFC pSPA are more likely to occur closer to the colony with less than 5% of foraging trips interacting with the Project site.

Summary of the Applicant and Natural England positions

- 1.4.13 The Applicant and Natural England agree on the application of a revised 135 km foraging range from FFC pSPA in the breeding season. With regards to age structure, Natural England's position is the use of a 46.3% proportion of breeding adult birds derived from Project Two specific data. The Applicant considers that this data was not designed for use in this manner and cannot provide a true indication of the number of immatures present. A step-wise calculation of likely proportions of immature and non-breeding adult birds likely present in the North Sea suggests a proportion of 12.1% attributable to the pSPA as being appropriate.
- 1.4.14 Apportioned predicted displacement mortality to FFC pSPA is shown in **Error! Reference source not found.**

Table 1.3: Apportioning approaches applied in the HRA Report and resultant displacement results for the Project alone.

Position	Displacement mortality (No. birds)		Percentage of breeding adults	Apportioned mortality to pSPA	
	30% displacement / 10% mortality	70% displacement; 10% mortality		30% displacement / 10% mortality	70% displacement; 10% mortality
Applicant	232	541	12.1	28	65
Natural England	232	541	46.3	107	251

1.4.15 The Applicant and Natural England disagree on the application of species specific displacement and mortality rates within the analysis, as detailed in the HRA Report (Doc. ref. 12.6) and within the Statement of Common Ground as submitted by the Applicant in their second response (Appendix R). When applying the maximum favoured rates (70% displacement; 10% mortality) subscribed to by Natural England, 251 guillemot are apportioned to the FFC pSPA (with a breeding adult proportion of 46.3%).

1.4.16 When rates favoured by the Applicant (30% displacement; 10% mortality), 65 guillemot are apportioned to the pSPA (with a breeding adult proportion of 12.1%).

1.5 Annual predicted mortality apportioning to FFC pSPA – Project Two alone

1.5.1 Natural England have noted in their Relevant and Written representations that the displacement mortality estimated for each season should be summed to provide an annual level of risk. The Applicant considers that displacement represents a different mechanism to collision and that seasonal estimates should not be summed due to the clear potential for ‘double-counting’ of effects. It is highly unlikely that seasonal mortality is additive in this way and in any case, this approach takes no account of the relative duration of the displacement effect in each season. This disagreement is captured Table 3.3 of the Statement of Common Ground as submitted by the Applicant in their second response (Appendix R).

1.5.2 In the non-breeding season, population data from Furness (2015) were used to calculate the contribution of birds from FFC pSPA to a wider non-breeding population present within the North Sea. Based on the proportion of birds from UK and foreign colonies considered to be present in the North Sea during the non-breeding season as presented in Furness (2015), the North Sea population of guillemot was calculated as 1,623,172 individuals. The contribution of the pSPA to this population is 4.61%. This represents displacement mortality apportioned to the pSPA of 2 birds, using the Applicants favoured rates (30% displacement; 1% mortality), and 43 at the maximum end of Natural England’s advocated range of rates (70% displacement; 10% mortality).

1.5.3 Natural England therefore consider that annual displacement mortality would represent 294 birds apportioned to FFC pSPA according to their upper range of displacement and mortality rates (70% and 10% respectively). The Applicant considers an assessment on a seasonal rather than annual basis to be appropriate, of which maximum risk is of 65 birds in the breeding season.

1.6 Assessment of impacts attributable to the FFC pSPA – In-combination

Projects considered in-combination

1.6.1 As described for Project Two alone, a 135 km foraging range is applied to the in-combination assessment in order to identify the breeding colonies from which breeding adult guillemots may forage within the Project site. This foraging range is also applied within the in-combination assessment to identify other offshore wind farm projects to be considered (see Figure 1-2).

1.6.2 The revised foraging range (from 200 km applied in the HRA Report) results in changes to the suite of projects considered in-combination during the breeding season. As a result of this change, guillemots from the pSPA are no longer considered to interact with the Dogger Bank Teesside A & B projects during the breeding season.

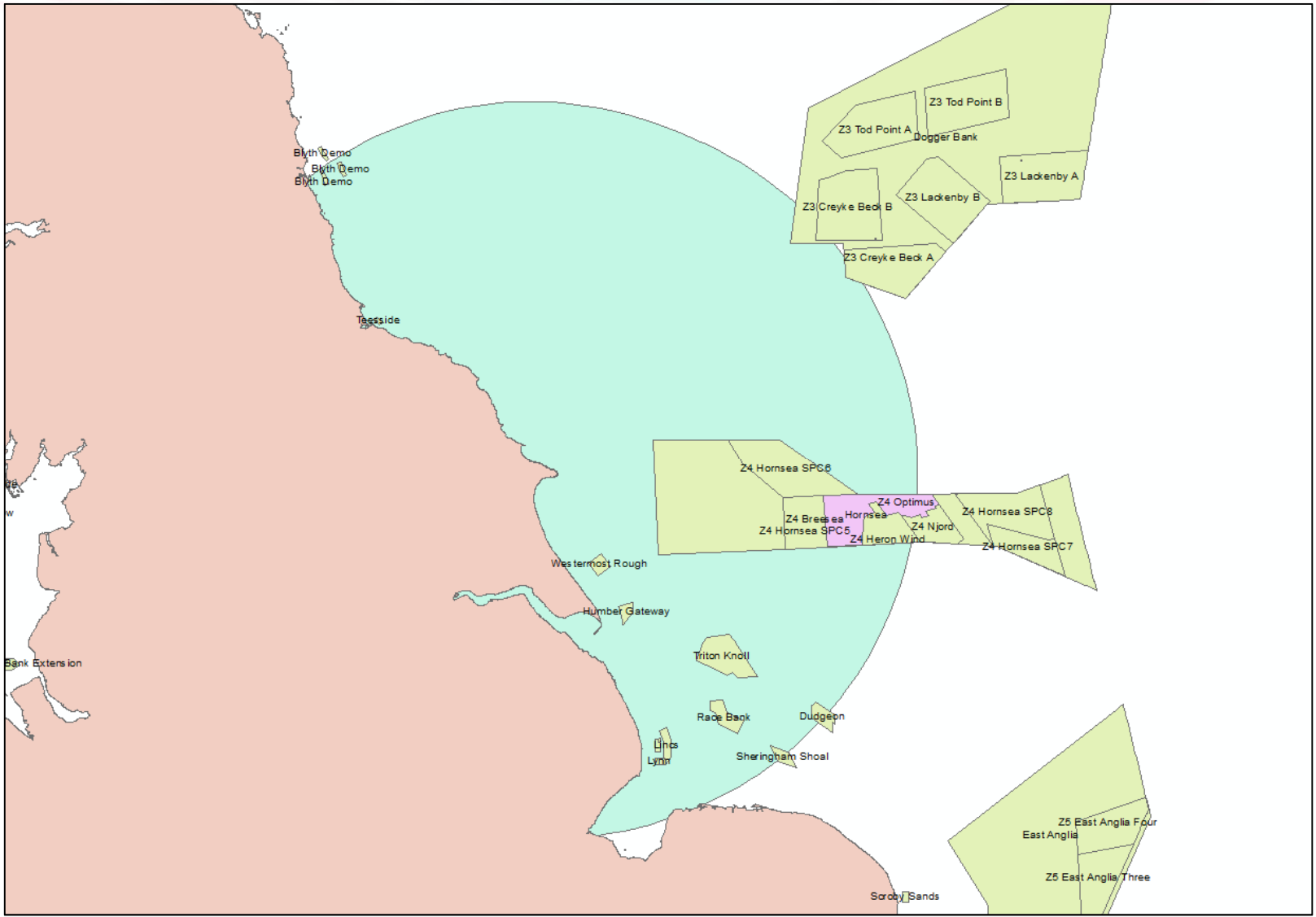


Figure 1-2 Guillemot foraging range (135km) from FFC pSPA indicating projects included within the in-combination assessment.

1.6.3 Table 1.4 presents the following information for each project considered in combination:

- Mean-peak guillemot population calculated for each season;
- The percentage used to apportion birds present to the pSPA; and
- The resultant population at the projects considered to be associated with the pSPA.

1.6.4 For projects that fall within the mean-maximum foraging range, 100% of birds are apportioned to the pSPA. For those projects that fall on the edge of the mean-maximum foraging range 12.1% of birds have been apportioned to the pSPA using the same methodology derived in Section 1.4 for Project Two. Like Project Two these projects lie on the outer limit of the foraging range and it is considered highly unlikely all birds within the sites are breeding adult birds originating from the pSPA. The exception to this is Dogger Bank Creyke Beck A and B where the apportioning figures presented within the final examination material have been used as the project was consented on this basis.

1.6.5 Table 1.5 and Table 1.6 present displacement matrices using the apportioned populations in the breeding and non-breeding seasons respectively, as advocated by the Applicant.

Table 1.4: Guillemot seasonal mean peak populations and apportioning values for project within the in-combination assessment (Applicant's position).

Project	Mean peak population in breeding season	Mean peak population in non-breeding season	Breeding season apportioning (%)	Non-breeding apportioning (%)	Mean peak population attributable to FFC pSPA in breeding season	Mean peak population attributable to FFC pSPA in non- breeding season
Aberdeen	547	225	0.00	4.61	0.00	10.40
Beatrice	13610	2755	0.00	4.61	0.00	127.09
Blyth Demonstration	1220	1321	12.10	4.61	147.67	60.96
Dogger Bank Creyke Beck A	5407	6142	35.00	4.61	1892.45	283.38
Dogger Bank Creyke Beck B	9479	10621	35.00	4.61	3317.51	490.04
Dogger Bank Teesside A	3283	2268	0.00	4.61	0.00	104.63
Dogger Bank Teesside B	5211	3701	0.00	4.61	0.00	170.78
Dudgeon	334	542	12.10	4.61	40.41	25.01
East Anglia ONE	274	640	0.00	4.61	0.00	29.54
Galloper	305	593	0.00	4.61	0.00	27.37
Greater Gabbard	345	548	0.00	4.61	0.00	25.29
Hornsea Project One	9836	8097	12.10	4.61	1190.11	373.61
Hornsea Project Two	7735	13164	12.10	4.61	935.94	607.38
Humber Gateway	99	138	100.00	4.61	98.82	6.38
Inch Cape	4371	3177	0.00	4.61	0.00	146.59
Lincs and LID6	582	814	100.00	4.61	581.67	37.57
London Array I & II	192	377	0.00	4.61	0.00	17.38
Moray	9820	547	0.00	4.61	0.00	25.24
Neart na Gaoithe	1755	3761	0.00	4.61	0.00	173.54
Race Bank	361	708	100.00	4.61	361.45	32.69
Seagreen A	16500	n/a	0.00	4.61	0.00	0.00
Seagreen B	16054	n/a	0.00	4.61	0.00	0.00
Sheringham Shoal	390	715	12.10	4.61	47.14	33.01

Project	Mean peak population in breeding season	Mean peak population in non-breeding season	Breeding season apportioning (%)	Non-breeding apportioning (%)	Mean peak population attributable to FFC pSPA in breeding season	Mean peak population attributable to FFC pSPA in non-breeding season
Teesside	267	901	100.00	4.61	267.29	41.56
Thanet	18	124	0.00	4.61	0.00	5.73
Triton Knoll	425	746	100.00	4.61	424.60	34.42
Westermost Rough	347	486	100.00	4.61	347.50	22.45
Total					9652.55	2912.04

Table 1.5 In-combination displacement matrix for guillemot in the breeding season apportioned to FFC pSPA (Applicant's position).

Guillemot (Breeding)	Mortality (%)													
		0	1	2	10	20	30	40	50	60	70	80	90	100
Displacement level (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10	0	10	19	97	193	290	386	483	579	676	772	869	965
	20	0	19	39	193	386	579	772	965	1158	1351	1544	1737	1930
	30	0	29	58	290	579	869	1158	1448	1737	2027	2316	2606	2896
	40	0	39	77	386	772	1158	1544	1930	2316	2703	3089	3475	3861
	50	0	48	97	483	965	1448	1930	2413	2896	3378	3861	4343	4826
	60	0	58	116	579	1158	1737	2316	2896	3475	4054	4633	5212	5791
	70	0	68	135	676	1351	2027	2703	3378	4054	4729	5405	6081	6756
	80	0	77	154	772	1544	2316	3089	3861	4633	5405	6177	6949	7722
	90	0	87	174	869	1737	2606	3475	4343	5212	6081	6949	7818	8687
	100	0	97	193	965	1930	2896	3861	4826	5791	6756	7722	8687	9652

Table 1.6 In-combination displacement matrix for guillemot in the non-breeding season apportioned to FFC pSPA (Applicant’s position).

Guillemot (Non-breeding)	Mortality (%)													
		0	1	2	10	20	30	40	50	60	70	80	90	100
Displacement level (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10	0	3	6	29	58	87	116	146	175	204	233	262	291
	20	0	6	12	58	116	175	233	291	349	408	466	524	582
	30	0	9	17	87	175	262	349	437	524	612	699	786	874
	40	0	12	23	116	233	349	466	582	699	815	932	1048	1165
	50	0	15	29	146	291	437	582	728	874	1019	1165	1310	1456
	60	0	17	35	175	349	524	699	874	1048	1223	1398	1572	1747
	70	0	20	41	204	408	612	815	1019	1223	1427	1631	1835	2038
	80	0	23	47	233	466	699	932	1165	1398	1631	1864	2097	2330
	90	0	26	52	262	524	786	1048	1310	1572	1835	2097	2359	2621
	100	0	29	58	291	582	874	1165	1456	1747	2038	2330	2621	2912


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- 1.6.6 Table 1.7 presents identical information as given in Table 1.4 and updated to provide Natural England's view on apportioning. Natural England advocate an apportioning value of 46.29% during the breeding season, this has been applied to the Project and Hornsea Project One. For those projects that fall within the mean-maximum foraging range 100% birds are apportioned to the pSPA.
- 1.6.7 For those projects that fall on the edge of the mean-maximum foraging range, in the absence of appropriate site-specific data on population age structure, the Project Two specific value 46.29% of breeding adult guillemot has been applied to apportion birds e to the pSPA. As discussed for Project Two, these projects lie on the outer limit of the foraging range and it is considered highly unlikely that all birds within the project sites are breeding adult birds originating from the pSPA. However, the application of an apportioning value of 46.29% for these sites (Dudgeon, Sheringham Shoal and Blyth Demonstration Project) has not been agreed with Natural England and therefore may not be a true representation of their position.
- 1.6.8 For Dogger Bank Creyke Beck A and B the apportioning percentages presented within the final examination material have been applied as these were figures upon which the project was granted consent.
- 1.6.9 Table 1.8 and Table 1.9 present displacement matrices using the apportioned populations (as advocated by Natural England) in the breeding and non-breeding seasons respectively.

Table 1.7 Guillemot seasonal mean peak populations and apportioning values for project within the in-combination assessment (Natural England's position).

Project	Mean peak population in breeding season	Mean peak population in non-breeding season	Breeding season apportioning (%)	Non-breeding apportioning (%)	Mean peak population apportioned to the FFC pSPA in the breeding season	Mean peak population apportioned to the FFC pSPA in the non-breeding season
Aberdeen	547	225	0.00	4.61	0.00	10.40
Beatrice	13610	2755	0.00	4.61	0.00	127.09
Blyth Demonstration	1220	1321	46.29	4.61	564.98	60.96
Dogger Bank Creyke Beck A	5407	6142	35.00	4.61	1892.45	283.38
Dogger Bank Creyke Beck B	9479	10621	35.00	4.61	3317.51	490.04
Dogger Bank Teesside A	3283	2268	0.00	4.61	0.00	104.63
Dogger Bank Teesside B	5211	3701	0.00	4.61	0.00	170.78
Dudgeon	334	542	46.29	4.61	154.62	25.01
East Anglia ONE	274	640	0.00	4.61	0.00	29.54
Galloper	305	593	0.00	4.61	0.00	27.37
Greater Gabbard	345	548	0.00	4.61	0.00	25.29
Hornsea Project One	9836	8097	46.29	4.61	4553.38	373.61
Hornsea Project Two	7735	13164	46.29	4.61	3580.91	607.38
Humber Gateway	99	138	100.00	4.61	98.82	6.38
Inch Cape	4371	3177	0.00	4.61	0.00	146.59
Lincs and LID6	582	814	100.00	4.61	581.67	37.57
London Array I & II	192	377	0.00	4.61	0.00	17.38
Moray	9820	547	0.00	4.61	0.00	25.24
Near na Gaoithe	1755	3761	0.00	4.61	0.00	173.54
Race Bank	361	708	100.00	4.61	361.45	32.69
Seagreen A	16500	n/a	0.00	4.61	0.00	0.00
Seagreen B	16054	n/a	0.00	4.61	0.00	0.00
Sheringham Shoal	390	715	46.29	4.61	180.36	33.01

Project	Mean peak population in breeding season	Mean peak population in non-breeding season	Breeding season apportioning (%)	Non-breeding apportioning (%)	Mean peak population apportioned to the FFC pSPA in the breeding season	Mean peak population apportioned to the FFC pSPA in the non-breeding season
Teesside	267	901	100.00	4.61	267.29	41.56
Thanet	18	124	0.00	4.61	0.00	5.73
Triton Knoll	425	746	100.00	4.61	424.60	34.42
Westermost Rough	347	486	100.00	4.61	347.50	22.45
Total					16325.55	2912.04

Table 1.8 In-combination displacement matrix for guillemot in the breeding season apportioned to the pSPA (Natural England's position).

Guillemot (Breeding)	Mortality (%)													
		0	1	2	10	20	30	40	50	60	70	80	90	100
Displacement level (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10	0	16	33	163	327	490	653	816	980	1143	1306	1469	1633
	20	0	33	65	327	653	980	1306	1633	1959	2286	2612	2939	3265
	30	0	49	98	490	980	1469	1959	2449	2939	3428	3918	4408	4898
	40	0	65	131	653	1306	1959	2612	3265	3918	4571	5224	5877	6530
	50	0	82	163	816	1633	2449	3265	4082	4898	5714	6530	7347	8163
	60	0	98	196	980	1959	2939	3918	4898	5877	6857	7836	8816	9796
	70	0	114	229	1143	2286	3428	4571	5714	6857	8000	9143	10285	11428
	80	0	131	261	1306	2612	3918	5224	6530	7836	9143	10449	11755	13061
	90	0	147	294	1469	2939	4408	5877	7347	8816	10285	11755	13224	14693
	100	0	163	327	1633	3265	4898	6530	8163	9796	11428	13061	14693	16326

Table 1.9 In-combination displacement matrix for guillemot in the non-breeding season apportioned to the pSPA (Natural England's position).

Guillemot (Non-breeding)	Mortality (%)													
	0	1	2	10	20	30	40	50	60	70	80	90	100	
Displacement level (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	
	10	0	3	6	29	58	87	116	146	175	204	233	262	291
	20	0	6	12	58	116	175	233	291	349	408	466	524	582
	30	0	9	17	87	175	262	349	437	524	612	699	786	874
	40	0	12	23	116	233	349	466	582	699	815	932	1048	1165
	50	0	15	29	146	291	437	582	728	874	1019	1165	1310	1456
	60	0	17	35	175	349	524	699	874	1048	1223	1398	1572	1747
	70	0	20	41	204	408	612	815	1019	1223	1427	1631	1835	2038
	80	0	23	47	233	466	699	932	1165	1398	1631	1864	2097	2330
	90	0	26	52	262	524	786	1048	1310	1572	1835	2097	2359	2621
	100	0	29	58	291	582	874	1165	1456	1747	2038	2330	2621	2912


1.7 Summary and conclusions

Summary

- 1.7.1 At the Applicants favoured rates (30% displacement, 10% mortality) mortality of 290 guillemot is apportioned to FFC pSPA in the breeding season from Project Two and other projects considered in-combination.
- 1.7.2 At the maximum of Natural England's advocated range of rates (70% displacement, 10% mortality) mortality of 1143 guillemot is apportioned to FFC pSPA in the breeding season from Project Two and other projects considered in-combination. Natural England consider it appropriate to sum seasonal estimates of displacement risk. Non-breeding season displacement apportioned to FFC pSPA is 203 birds resulting in an annual total of 1345 birds.
- 1.7.3 In line with previous similar assessments for offshore wind farms, the Applicant has not sought to combine displacement and collision effects. Doing so would inevitably result in an element of double counting as the effects are unlikely to be additive in the way that simply summing the respective effects would imply. The Applicant assesses displacement on a seasonal rather than annual basis and therefore predicted mortality cannot be summed with annual collision estimates. The Applicant considers that displacement has the potential to result in mortality of 290 birds apportioned to FFC pSPA during the breeding season only (lower mortality is predicted for the non-breeding season).
- 1.7.4 Nevertheless, either under the Applicants or Natural England's position, 1% of baseline mortality of FFC pSPA is surpassed. Therefore Population Viability Analysis (PVA) has been undertaken.

Conclusion

- 1.7.5 The population of guillemots at the FFC pSPA has grown at an average rate of 3% since 2000. The maximum predicted growth rate for this species of 7.1%, calculated using the method proposed by Niel & Lebreton (2005).
- 1.7.6 PVA modelling (MacArthur Green 2015) predicts a conservative growth rate of 4.4 % (density independent and excluding any immigration). If additional mortality of 300 birds annum is assumed (the Applicant predicts that this will be no more than 290 in-combination) then the model predicts a very slight reduction of 0.38%. Under this scenario, the predicted median impacted population size after 25 years would be approximately 92% of that which the model predicts would occur in the absence of any additional impact from the Project. This is a relative reduction in population size (compared to that which might otherwise have arisen). The model predicts a positive growth rate, and so the impacted population after 25 years would still be larger than that which was assumed for the initiation of the modelling exercise.
- 1.7.7 A density dependent model was also run. This model predicts a lesser change in growth rate, approximately 0.17 – 0.19% and consequently a higher ratio of



impacted to unimpacted median population size after 25 years (approximately 95%).

1.7.8 On this basis, there is no indication that, at the level of mortality predicted to arise from the Project, that the population is likely to decline, over a period of 25 years, to an extent that would mean that the breeding guillemot population of the FFC pSPA would no longer be considered to be in favourable condition.

1.7.9 PVA modelling indicates that the resulting levels of mortality predicted by the Applicant to arise when applying these approaches to apportioning would not be sufficient for the population to decline below the FFC pSPA citation for this species.

1.8 References

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