Hornsea Offshore Wind Farm

Project Two

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

Appendix Q to the Response submitted for Deadline IIA

Application Reference: EN010053

25 August 2015

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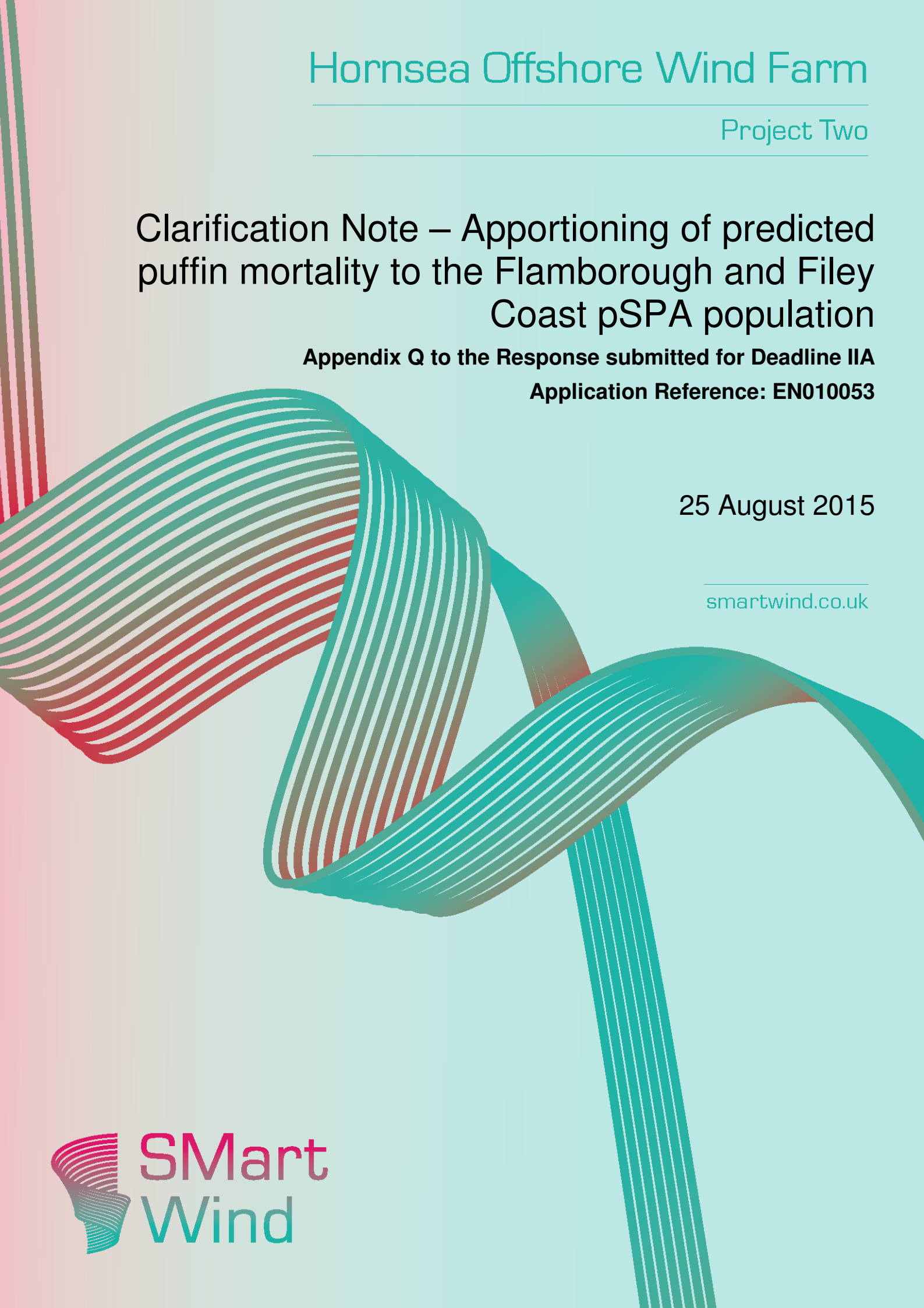

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Position	

1 Apportioning and Assessment of predicted puffin mortality to the Flamborough and Filey Coast pSPA population

1.1 Introduction

1.1.1 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').

1.1.2 This note has been prepared in response to queries raised by Natural England in their Relevant and Written Representations regarding the apportioning of puffin present within the Project site to the Flamborough and Filey Coast (FFC) pSPA during the breeding season.

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

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

1.1.5 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.

1.1.6 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.**);
- Puffin phenology – definition of seasonal extents (Section **Error! Reference source not found.**);
- Breeding season apportioning – Project Two alone (Section **Error! Reference source not found.**);
- Annual predicted mortality apportioning to FFC pSPA – Project Two alone (Section1.5);
- Assessment of predicted puffin mortality from Project Two in combination with other plans or project (Section 1.6); and
- Conclusions – implications for FFC pSPA (Section1.7).

1.2 Consultation with Natural England

1.2.1 This section outlines the assessment evolution of the breeding puffin 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 puffin 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

1.2.3 In the Section 42 submission, it was determined that there was no potential for Likely Significant Effect (LSE) on puffin during the breeding season as the mean-maximum foraging range as stated in Thaxter *et al.* (2012) indicates there would be limited no connectivity between FFC pSPA and the Project site. The Project lies 99.7 km from the pSPA while mean-maximum foraging for puffin is 105.4 km. Natural England did not agree with the exclusion of puffin from the assessment based on the mean-maximum foraging range and stated that as the FFC pSPA was the nearest SPA colony to the Project site designated for puffin that it should be screened into the assessment. Within application documents the Applicant therefore applied an extended and heavily precautionary foraging range of 200 km to the assessment for puffin.

Natural England Relevant Representation

1.2.4 Natural England's Relevant Representation includes a number of queries (paragraphs 68-71) in relation to the methodology used to apportion impacts to FFC pSPA puffin population.

1.2.5 Natural England state that as part of the Project site is within mean-maximum foraging range for puffin, all birds present in the Project area during the breeding season should be apportioned to the pSPA.

1.2.6 Natural England also raised concerns regarding the assumptions about the distribution of immature birds in the breeding season. They do not consider that there is evidence to support the use of the population distribution and scales derived by Furness (2015) for the non-breeding period and apply this to the breeding season.

1.2.7 Natural England did 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."*

1.2.8 At a consultation meeting on the 3rd June 2015, the apportioning of impacts to the FFC pSPA puffin 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 Puffin phenology – seasonal definitions

1.3.1 Following Section 42 consultation with Natural England, four seasons were defined for puffin based on information presented in Furness (2015), these are presented in Table 1.1.

Table 1.1: Seasonal extents used for puffin 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 Table 1.1 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 As detailed above, the HRA Report (Doc. Ref. 12.6) applied a precautionary assumption that puffin from FFC pSPA could forage out to a distance of 200 km.

1.4.2 It is considered highly unlikely that adult breeding birds will be evenly distributed throughout their defined foraging range, with the density of foraging birds likely to be highest closest to the colony as birds attempt to reduce energetic costs associated with provisioning young (MacArthur Green, 2014). Detailed cumulative foraging range data for puffin indicates that 95% of foraging trips occur within 65 km of the colony. This infers that only 5% of foraging trips would occur beyond this distance with this percentage decreasing as distance from the colony increases (Figure 1.1). Figure 1.1 suggests that it is likely that only 1-2% of foraging trips from FFC pSPA will occur at a distance likely to interact with the Project site.

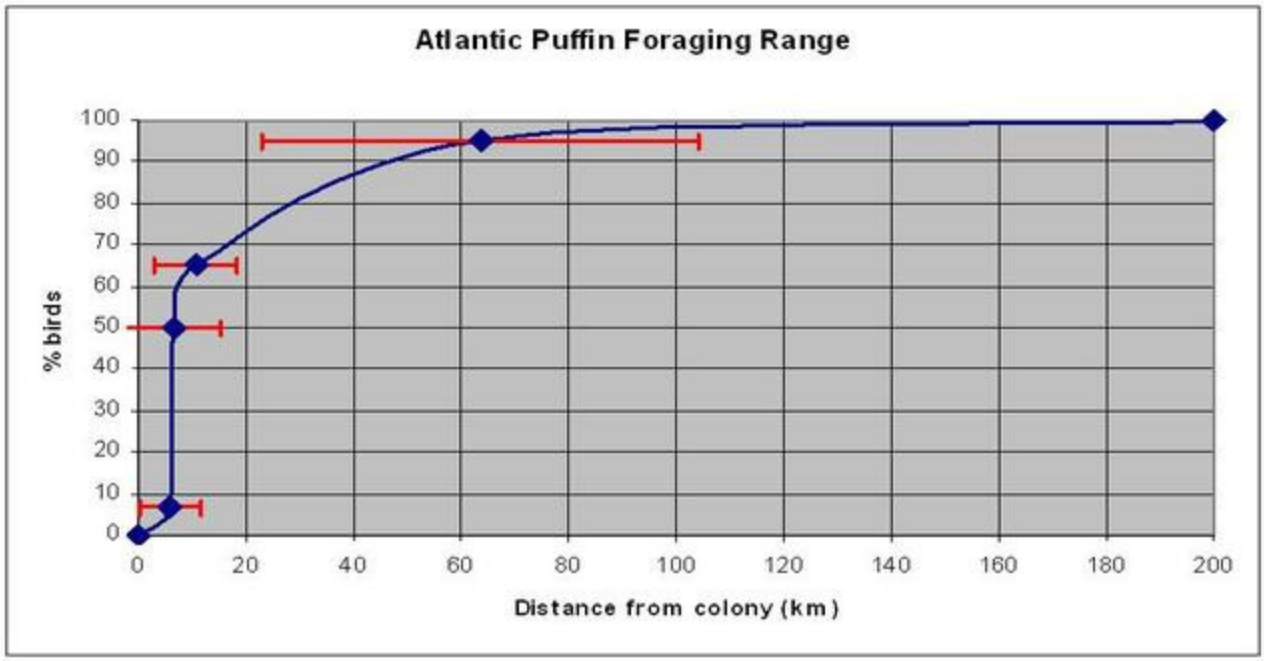

Figure 1.1: Cumulative frequency and proportion of birds found foraging at different distances from colony (BirdLife International, 2014[1]).

1.4.3 Colonies on the east coast of England generally show high breeding success and have not been affected by dramatic food shortages experienced by populations in Shetland and Orkney. 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.

1.4.4 Based on the information presented above for the relationship between foraging range and breeding productivity it is therefore considered by the Applicant that it is unlikely that breeding adults from the FFC pSPA would be present at the Project site during the breeding season. The Applicant and Natural England do however agree that the mean-maximum foraging range of 105.4 km (Thaxter *et al.,* 2012) is a suitably precautionary measure with which to frame the assessment of Project Two.

Population age structure

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

1. The total number of immature birds associated with colonies in the North Sea during the non-breeding season was estimated. 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;

[1] Seabirdwikispaces.com

3. The estimated number of breeding birds within the 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 were totalled to provide the total number of birds with potential connectivity to Subzone 2 in the breeding season; and
5. The FFC 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 puffin with predicted connectivity to the Project site was calculated as 33,945 birds. The contribution of breeding adults from the FFC pSPA to this population is 5.77% (Table 1.2).

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	9,625
2	No. of immatures in the North Sea from foreign colonies	Individuals	22,360
3	Breeding birds within extended foraging range of Subzone 2	Breeding adults	0
	Flamborough and Filey Coast pSPA population	Breeding adults	1,960
4	Total number of birds in region	Individuals	33,945
5	Proportion of total population represented by Flamborough and Filey Coast pSPA	%	5.77

1.4.7 As part of their Relevant Representations, Natural England stated that they do not agree with the application of non-breeding proportions from Furness (2015) to the breeding season.

1.4.8 The application of non-breeding season proportions is considered by the Applicant to be precautionary. Puffin is a migratory species exhibiting movements to wintering areas between central Norway south to the Canary Islands and into the North Atlantic (Wernham *et al.,* 2002). These movements are more pronounced in younger age groups, but after the first summer many second and third year birds will return to areas around colonies in order to prospect for nesting opportunities during the breeding season.

1.4.9 Puffin are less faithful to their natal colony than other auk species, suggesting that immature birds from various colonies may be present in the sea areas adjacent to breeding colonies (Mead, 1974; Harris, 1983). Immature birds of all age classes can be observed at colonies during the breeding season, with younger age classes present at colonies as the season progresses (Harris, 1983; Sandvik *et al.* 2008).

1.4.10 Rafts of birds beneath colonies are known to contain first year birds with these birds representing 15% of all birds present. It is also known that about 23% of puffin from an individual colony do not exhibit natal philopatry with regular movement of birds

occurring between colonies in east Scotland and north-east England (Harris, 1983). This precautionary value of 77% immatures assumed to have the potential to interact with the Project site (with the remaining 23% distributed elsewhere in the North Sea) is taken forward for further analysis. If it is also assumed that all adult breeding birds from the SPA potentially interact with the Project site it would lead to the conclusion that FFC pSPA would provide 2.61% to this wider population. On this basis, the 'non-breeding' proportion of FFC pSPA breeding adult puffins of 5.77% calculated within the HRA Report (Doc ref. No. 12.6) is considered to be precautionary and maintained as the Applicant's view in this assessment.

1.4.11 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 38.0%. However, whilst one year old puffins can be easily identified during boat-based surveys, older immature birds, which have not yet reached the age of first breeding, cannot be easily 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.

1.4.12 In the breeding season, breeding adult birds associated with the FFC pSPA are restricted in terms of foraging range due to the necessity to provision young. Immature/non-breeding adult birds may not be as restricted and may therefore be distributed over a larger area than breeding adult birds. These factors will therefore result again, in a significant over-estimation of the proportion of adult breeding birds present at the Project site.

1.4.13 Harris (1983) indicates that immature birds are frequently observed at colonies with many birds visiting colonies other than that at which they fledged. Immature birds arrive progressively earlier at breeding colonies as they age, with all age classes remaining at a colony until the end of the breeding season (Harris, 1983; Sandvik *et al.,* 2008). Although it is suggested that younger immatures may be distributed in areas away from colonies in the breeding season, first year birds are thought to represent 15% of birds present in rafts beneath colonies (Harris, 1983).

Summary of the Applicant and Natural England positions

1.4.14 Notwithstanding the Applicants consideration that it is likely that few breeding adult puffin from FFC pSPA, if any, reach the Project site in the breeding season, they agree in the application of 105.4 km foraging range for the purposes of this assessment. With regards to population age structure, Natural England's position is the use of a 38.0% 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 a immatures present.

1.4.15 The step-wise calculation of likely proportions of immature and non-breeding adult birds likely present in the North Sea based on Furness (2015) and applied within the HRA Report (Doc ref. No. 12.6) was found to be precautionary and maintained as the Applicant's position in this Note. This suggests that a proportion of 5.77%

attributable to breeding adult puffins from the pSPA is appropriate to apply to the breeding season apportioning exercise.

1.4.16 Apportioned predicted displacement mortality to FFC pSPA is shown in Table 1.3. Under the Applicant's favoured displacement and mortality rates (40 and 10% respectively) and applying a breeding adults proportion from the pSPA of 5.77% the mortality of 1 puffin is predicted. Under Natural England's maximum favoured displacement and mortality rates (70 and 10% respectively) and applying a breeding adults proportion from the pSPA of 38.0% the mortality of 12 puffin is predicted.

Table 1.3: Predicted puffin displacement mortality from Project Two alone in the breeding season apportioned to FFC pSPA.

Position	Displacement mortality (No. birds)		Percentage of breeding adults	Apportioned mortality to pSPA (No. birds)	
	40% displacement / 10% mortality	70% displacement; 10% mortality		40% displacement / 10% mortality	70% displacement; 10% mortality
Applicant	19	33	5.77	1	2
Natural England	19	33	38.0	7	12

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 in Table 3.3 ofthe Statement of Common Ground submitted by the Applicant in their Deadline II 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 puffin was calculated as 231,980 individuals. The contribution of the pSPA to this population is 0.42%.

1.5.3 . This represents non-breeding season displacement mortality apportioned to the pSPA of 0 birds in the under the Applicants favoured rates and 1 bird when applying the maximum of Natural England's favoured rates (70% displacement; 10% mortality).

1.5.4 Natural England therefore consider that annual displacement mortality would represent 13 birds apportioned to FFC pSPA according to their favoured maximum

displacement and mortality rates (Table 1.4). The Applicant considers an assessment on a seasonal basis to be appropriate with the season with the worst case scenario appropriate to assess against the FFC pSPA (mortality of 1 bird in the breeding season).

Table 1.4: Apportioned puffin displacement mortality to FFC pSPA for each defined biological season.

Season	Percentage of breeding adults apportioned to pSPA	Displacement (no. of birds)	
		Applicant favoured rates	Natural England (70% displacement; 10% mortality
Breeding	5.77	1	n/a
	38.0	n/a	12
Non-breeding	0.42	0	1

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 105.4 km foraging range is applied to the in-combination assessment in order to identify the breeding colonies from which breeding adult puffin 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. This revision (from 200 km applied in the HRA Report (Doc. Ref., No. 12.6)) results in changes to the suite of projects considered in the in-combination assessment during the breeding season. As a result of the change, puffin from the pSPA are no longer considered to interact with the Dogger Bank projects during the breeding season

1.6.2 Table 1.5 presents the following information for each project considered in-combination:

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

1.6.3 The Applicant has applied an apportioning value of 5.77% in the breeding season for Project Two. For projects considered in-combination that fall within the mean-maximum foraging range of the pSPA, 100% of birds have been apportioned to the pSPA.

1.6.4 Table 1.6 and Table 1.7 present displacement matrices using the apportioned populations in the breeding and non-breeding seasons respectively as advocated by the Applicant.

Table 1.5 Puffin seasonal mean peak populations and apportioning values for project within the in-combination assessment (Applicant's position).

Project	Mean peak population in the breeding season	Breeding season apportioning (%)	Mean peak apportioned to the pSPA	Mean peak population in the non-breeding season	Non-breeding season apportioning (%)	Mean peak apportioned to the pSPA
Aberdeen	42	0.00	0.00	81.65	0.42	0.34
Beatrice	2858	0.00	0.00	2434.76	0.42	10.29
Blyth Demonstration	235	0.00	0.00	122.82	0.42	0.52
Dogger Bank Creyke Beck A	37	0.00	0.00	295.23	0.42	1.25
Dogger Bank Creyke Beck B	102	0.00	0.00	742.94	0.42	3.14
Dogger Bank Teesside A	34	0.00	0.00	272.96	0.42	1.15
Dogger Bank Teesside B	35	0.00	0.00	328.66	0.42	1.39
Dudgeon	1	0.00	0.00	3.18	0.42	0.01
East Anglia ONE	16	0.00	0.00	32.00	0.42	0.14
Galloper	0	0.00	0.00	0.75	0.42	0.00
Greater Gabbard	0	0.00	0.00	0.86	0.42	0.00
Hornsea Project One	1070	5.77	61.74	1257.00	0.42	5.31
Hornsea Project Two	468	5.77	26.97	2039.00	0.42	8.61
Humber Gateway	15	100.00	14.81	9.56	0.42	0.04
Inch Cape	2956	0.00	0.00	2688.00	0.42	11.36
Lincs and LID6	3	0.00	0.00	5.95	0.42	0.03
London Array I & II	0	0.00	0.00	0.55	0.42	0.00
Moray	2795	0.00	0.00	656.41	0.42	2.77
Neart na Gaoithe	2562	0.00	0.00	2103.38	0.42	8.89
Race Bank	1	0.00	0.00	9.62	0.42	0.04
Seagreen A	4254	0.00	0.00	N/A	0.42	N/A
Seagreen B	8262	0.00	0.00	N/A	0.42	N/A
Sheringham Shoal	4	0.00	0.00	25.75	0.42	0.11

Project	Mean peak population in the breeding season	Breeding season apportioning (%)	Mean peak apportioned to the pSPA	Mean peak population in the non-breeding season	Non-breeding season apportioning (%)	Mean peak apportioned to the pSPA
Teesside	35	100.00	35.04	17.96	0.42	0.08
Thanet	0	0.00	0.00	0.06	0.42	0.00
Triton Knoll	23	100.00	23.14	70.71	0.42	0.30
Westermost Rough	61	100.00	61.24	35.04	0.42	0.15
TOTAL			**222.95**			**55.91**

Table 1.6 In-combination displacement matrix for puffin in the breeding season apportioned to the pSPA (Applicant's position).

Puffin (Breeding)	Mortality (%)													
Displacement level (%)		**0**	**1**	**2**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10	0	0	0	2	4	7	9	11	13	16	18	20	22
	20	0	0	1	4	9	13	18	22	27	31	36	40	45
	30	0	1	1	7	13	20	27	33	40	47	54	60	67
	40	0	1	2	9	18	27	36	45	54	62	71	80	89
	50	0	1	2	11	22	33	45	56	67	78	89	100	111
	60	0	1	3	13	27	40	54	67	80	94	107	120	134
	70	0	2	3	16	31	47	62	78	94	109	125	140	156
	80	0	2	4	18	36	54	71	89	107	125	143	161	178
	90	0	2	4	20	40	60	80	100	120	140	161	181	201
	100	0	2	4	22	45	67	89	111	134	156	178	201	223

Table 1.7 In-combination displacement matrix for puffin in the non- breeding season apportioned to the pSPA (Applicant's position).

Puffin (Non-breeding)	Mortality (%)													
Displacement level (%)		**0**	**1**	**2**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10	0	0	0	1	1	2	2	3	3	4	4	5	6
	20	0	0	0	1	2	3	4	6	7	8	9	10	11
	30	0	0	0	2	3	5	7	8	10	12	13	15	17
	40	0	0	0	2	4	7	9	11	13	15	18	20	22
	50	0	0	1	3	6	8	11	14	17	19	22	25	28
	60	0	0	1	3	7	10	13	17	20	23	26	30	33
	70	0	0	1	4	8	12	15	19	23	27	31	35	39
	80	0	0	1	4	9	13	18	22	26	31	35	40	44
	90	0	0	1	5	10	15	20	25	30	35	40	45	50
	100	0	1	1	6	11	17	22	28	33	39	44	50	55

1.6.5 Table 1.8 presents identical information as given in Table 1.5 and updated to provide Natural England's view on apportioning. Natural England advocate an apportioning value of 37.99% during the breeding season, this has been applied to Project Two and Hornsea Project One. For those projects that fall within the mean-maximum foraging range 100% birds are apportioned to the pSPA.

1.6.6 Table 1.9 and Table 1.10 present displacement matrices using the apportioned populations in the breeding and non-breeding seasons respectively as advocated by Natural England.

Table 1.8 Puffin seasonal mean peak populations and apportioning values for project within the in-combination assessment (Natural England's position).

Project	Mean peak population in the breeding season	Breeding season apportioning (%)	Mean peak apportioned to the pSPA	Mean peak population in the non-breeding season	Non-breeding season apportioning (%)	Mean peak apportioned to the pSPA
Aberdeen	42	0.00	0.00	81.65	0.42	0.34
Beatrice	2858	0.00	0.00	2434.76	0.42	10.29
Blyth Demonstration	235	0.00	0.00	122.82	0.42	0.52
Dogger Bank Creyke Beck A	37	0.00	0.00	295.23	0.42	1.25
Dogger Bank Creyke Beck B	102	0.00	0.00	742.94	0.42	3.14
Dogger Bank Teesside A	34	0.00	0.00	272.96	0.42	1.15
Dogger Bank Teesside B	35	0.00	0.00	328.66	0.42	1.39
Dudgeon	1	0.00	0.00	3.18	0.42	0.01
East Anglia ONE	16	0.00	0.00	32.00	0.42	0.14
Galloper	0	0.00	0.00	0.75	0.42	0.00
Greater Gabbard	0	0.00	0.00	0.86	0.42	0.00
Hornsea Project One	1070	37.99	406.48	1257.00	0.42	5.31
Hornsea Project Two	468	37.99	177.60	2039.00	0.42	8.61
Humber Gateway	15	100.00	14.81	9.56	0.42	0.04
Inch Cape	2956	0.00	0.00	2688.00	0.42	11.36
Lincs and LID6	3	0.00	0.00	5.95	0.42	0.03
London Array I & II	0	0.00	0.00	0.55	0.42	0.00
Moray	2795	0.00	0.00	656.41	0.42	2.77
Neart na Gaoithe	2562	0.00	0.00	2103.38	0.42	8.89
Race Bank	1	0.00	0.00	9.62	0.42	0.04
Seagreen A	4254	0.00	0.00	N/A	0.42	N/A
Seagreen B	8262	0.00	0.00	N/A	0.42	N/A

Project	Mean peak population in the breeding season	Breeding season apportioning (%)	Mean peak apportioned to the pSPA	Mean peak population in the non-breeding season	Non-breeding season apportioning (%)	Mean peak apportioned to the pSPA
Sheringham Shoal	4	0.00	0.00	25.75	0.42	0.11
Teesside	35	100.00	35.04	17.96	0.42	0.08
Thanet	0	0.00	0.00	0.06	0.42	0.00
Triton Knoll	23	100.00	23.14	70.71	0.42	0.30
Westermost Rough	61	100.00	61.24	35.04	0.42	0.15
Total			**718.31**			**55.91**

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

Puffin (Breeding)	Mortality (%)													
Displacement level (%)		**0**	**1**	**2**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10	0	1	1	7	14	22	29	36	43	50	57	65	72
	20	0	1	3	14	29	43	57	72	86	101	115	129	144
	30	0	2	4	22	43	65	86	108	129	151	172	194	215
	40	0	3	6	29	57	86	115	144	172	201	230	259	287
	50	0	4	7	36	72	108	144	180	215	251	287	323	359
	60	0	4	9	43	86	129	172	215	259	302	345	388	431
	70	0	5	10	50	101	151	201	251	302	352	402	453	503
	80	0	6	11	57	115	172	230	287	345	402	460	517	575
	90	0	6	13	65	129	194	259	323	388	453	517	582	646
	100	0	7	14	72	144	215	287	359	431	503	575	646	718

Table 1.10 In-combination displacement matrix for puffin in the non-breeding season apportioned to the pSPA (Natural England's position).

Puffin (Non-breeding)	Mortality (%)													
Displacement level (%)		0	1	2	10	20	30	40	50	60	70	80	90	100
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10	0	0	0	1	1	2	2	3	3	4	4	5	6
	20	0	0	0	1	2	3	4	6	7	8	9	10	11
	30	0	0	0	2	3	5	7	8	10	12	13	15	17
	40	0	0	0	2	4	7	9	11	13	15	18	20	22
	50	0	0	1	3	6	8	11	14	17	19	22	25	28
	60	0	0	1	3	7	10	13	17	20	23	26	30	33
	70	0	0	1	4	8	12	15	19	23	27	31	35	39
	80	0	0	1	4	9	13	18	22	26	31	35	40	44
	90	0	0	1	5	10	15	20	25	30	35	40	45	50
	100	0	1	1	6	11	17	22	28	33	39	44	50	55

1.7 Summary and conclusions

Summary

1.7.1 At the Applicants favoured rates (40% displacement, 10% mortality) mortality of 8.9 puffin are 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 50.2 puffin 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 3.8 birds resulting in an annual total of 54 birds.

1.7.3 In line with previous similar assessments for offshore wind farms, the Applicant has not sought to combine seasonal displacement 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 seasonal mortality cannot be summed. The Applicant considers that displacement has the potential to result in mortality of 9 birds apportioned to FFC pSPA during the breeding season only (negligible 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 is estimated to have declined from 2,615 individuals to 1,960 between 2000 and 2008, representing an average annual rate of decline of 3.4%. However, puffin colonies are very difficult to survey reliably, therefore this decline should be treated with caution.

1.7.6 PVA modelling (MacArthur Green 2015) predicts a continued slight negative growth rate of -0.77% (density independent and excluding any immigration). If additional mortality of 10 birds annum is assumed (the Applicant predicts that this will be no more than 9 in-combination) then the model predicts a very slight further reduction of 0.5%. Under this scenario, the predicted median impacted population size after 25 years would be approximately 88% of that which the model predicts would occur in the absence of any additional impact from the Project in-combination with other plans and projects.

1.7.7 A density dependent model was also run. This model predicts a lesser change in growth rate, approximately 0.16 – 0.37% and consequently a higher ratio of impacted to unimpacted median population size after 25 years (approximately 91 - 95%).

1.7.8 Puffin is a non-listed component of the breeding seabird assemblage of the FFC pSPA. This assemblage comprises 215,750 individuals. It is unclear whether previous counts of puffin have accurately recorded colony size and hence may have underestimated the population size perhaps incorrectly indicating or exaggerating any decline in the population.

1.7.9 Nevertheless, PVA modelling based on these past trends has been undertaken and indicates that further decline is likely. The additional mortality predicted to arise from the Project will very slightly increase the rate of decline, but there is no indication that this decline, over a period of 25 years, would substantially reduce the puffin population to an extent that would mean that breeding seabird assemblage of the FFC pSPA would no longer be considered to be in favourable condition.

1.8 References

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