



Hornsea Offshore Wind Farm Project One

Updated In-combination Auk Displacement Note

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SMart Wind Limited

11th Floor

140 London Wall

London

EC2Y 5DN

Tel 02077765500

Email info@smartwind.co.uk

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Signed	Chris Jenner
For	SMart Wind Ltd on behalf of Heron Wind Limited, Njord Limited and Vi Aura Limited (together the 'Applicant')
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Position	Consents Manager

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1 UPDATED IN-COMBINATION AUK DISPLACEMENT NOTE

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 SMart Wind Ltd on behalf of Heron Wind Limited, Njord Limited and Vi Aura Limited (the 'Applicant') for the Hornsea Project One Offshore Wind Farm ('the Project').

1.1.2 The note has been drafted in response to comments from Natural England on the additional information provided by the Applicant on auk displacement at Deadline IV (Appendix W) and Deadline V (Appendix L), and following discussions with Natural England on 28th May 2014.

1.1.3 The Applicant's existing in-combination displacement assessment (see Appendix W of the Applicant's response to Deadline IV and Appendix L of the Applicant's response to Deadline V) is based, to the extent possible, on a quantitative approach. Where a quantitative assessment was undertaken, the results of that assessment were used in the in-combination assessment. Following standard practice the Applicant did not seek to undertake a quantitative displacement assessment for other projects where such an assessment was not provided by the Applicants for those projects. Whilst the Applicant recognises that those projects could contribute to an in-combination effect, the approach to the assessment of them was, of necessity, qualitative.

1.1.4 Nevertheless, Natural England noted that for some sites, for which displacement had not been quantified, that there are other data available (for example on abundance or density) which could be used to infer the likely magnitude of displacement. At Natural England's request, the Applicant has collated, to the extent possible, these relevant data and estimated the likely magnitude of displacement. The in-combination assessment has been revised accordingly and now includes quantitative information on the magnitude of the contribution of 12 sites that were previously only considered in qualitative terms.

1.1.5 In this note, the Applicant also provides further clarification for the offshore wind farm sites screened in to the assessment based on the Biological Defined Minimum Population Scales (BDMPS) during each season.

1.2 Approach

1.2.1 For those offshore wind farm sites where an existing assessment that has been completed using a quantitative approach, following the Natural England and JNCC guidance (Natural England and JNCC, 2013), is available, the data has been presented as outlined in Appendix W of the Applicant's response to Deadline IV and Appendix L of the Applicant's response to Deadline V. The Applicant has followed the same methodology outlined in Appendix W where for each project the seasonal proportions of guillemot applicable to Flamborough and Filey Coast (FFC) pSPA were taken from

application documentation associated with each project but where sites fall outside of the mean-maximum foraging from the FFC pSPA it was assumed that no breeding adult birds associated with the pSPA were present during the breeding season..

1.2.2 For the offshore wind farm sites where the displacement assessment did not follow a quantitative approach (see Volume 2, Chapter 5 of the ES and the HRA report, Doc Ref No 12.6), a review was undertaken to identify whether any potentially relevant data are available, from which it may be possible to infer the likely magnitude of displacement effects. In some cases data on the abundance or density of guillemot and / or razorbill are available. In these cases the likely populations potentially affected by displacement have been calculated using those data. In none of these cases are the proportions of adult birds associated with the breeding Flamborough and Filey Coast (FFC) pSPA defined, therefore, these have been calculated using the same assumptions as for Hornsea Project One (see Table 1). As stated this goes beyond the standard assessment practice. The Applicant has undertaken this work in the interests of trying to give further comfort to Natural England (and others) on this matter.

Sites included in the in combination assessment

1.2.3 Natural England guidance recommends assessing displacement using defined biological seasons (Natural England and JNCC, 2013). The Applicant presented an assessment of displacement effects during the breeding, post-breeding and non-breeding season in the HRA report (Doc Ref No 12.6) and subsequent assessment updates (Appendix W of the Applicant's response to Deadline IV and Appendix L of the Applicant's response to response to Deadline V). Appendix W identified the relevant BDMPS for each season, wind farm sites that fall geographically within the BDMPS in each season have been included in the in-combination assessment, this approach is described below for each species.

Guillemot

1.2.4 During the breeding season (May-June), the mean foraging range of breeding guillemots from the FFC pSPA colony is 37.8 km, while the mean-maximum range is 84.2 km and highest maximum reported 135 km (Thaxter et al., 2012). During the breeding season, for sites that fall within the mean-maximum foraging range of the pSPA 100% of birds have been apportioned to the pSPA as indicated in Table 1. Table 2 shows those sites that fall within the mean-maximum foraging range of the pSPA, for guillemot; Teesside, Triton Knoll, Humber Gateway and Westernmost Rough wind farms.

1.2.5 During the post breeding season (July-September) the BDMPS is identified as colonies between the Firth of Forth and Humberside (see Figure 3 of Appendix W of the Applicant's response to Deadline IV) and wind farm sites from the Firth of Forth south to the Thames Estuary have been included in the assessment (see Table 2). During this period it has been assumed that 36% of birds are likely to originate from the FFC pSPA (this is the contribution the pSPA population makes to the overall BDMPS as described in Appendix W of the Applicant's response to Deadline IV).

1.2.6 During the non-breeding season (October-April) the BDMPS is identified as colonies from the Firth of Forth to Humberside (see Figure 3 of Appendix W) and wind farm sites from the Firth of Forth south to the Thames Estuary have been included in the assessment (see Table 2). During this period it has been assumed that 36% of birds are likely to originate from the FFC pSPA (this is the contribution the pSPA population makes to the overall BDMPS as described in Appendix W).

Razorbill

1.2.7 During the breeding season, the mean foraging range of breeding razorbills from the FFC pSPA colony is 23.7 km, while the mean-maximum range is 48.5 km and highest maximum reported 95 km (Thaxter et al., 2012). During the breeding season, for sites that fall within the mean-maximum foraging range of the pSPA, 100% of the birds have been apportioned to the pSPA as indicated in Table 1. Table 2 shows those sites that fall within the mean-maximum foraging range of the pSPA, for razorbill only Westernmost Rough wind farm falls within the mean maximum foraging range.

1.2.8 During the post-breeding season the BDMPS is defined as colonies between the Firth of Forth and Humberside, during this period birds will be distributed throughout the southern North Sea, therefore wind farm sites from the Firth of Forth down to the Thames Estuary have been included in the assessment (see Table 2). During this period 61% of birds are likely to originate from the FFC pSPA (this is the contribution the pSPA population makes to the overall BDMPS as described in Appendix W of the Applicant's response to Deadline IV).

1.2.9 During the non-breeding season the BDMPS is defined as colonies between Shetland and Humberside (see Figure 4 of Appendix W). During this period birds will be distributed throughout the southern North Sea, therefore wind farm sites from the Firth of Forth down to the Thames Estuary have been included in the assessment (see Table 2). During this period 24% of birds are likely to originate from the FFC pSPA (this is the contribution the pSPA population makes to the overall BDMPS as described in Appendix W of the Applicant's response to Deadline IV).

Table 1: Assumptions about the proportion of adults in the population and the proportion of these that can be apportioned to the pSPA for each species and period

	Guillemot			Razorbill		
	Breeding	Post-breeding	Non-breeding	Breeding	Post-breeding	Non-breeding
Proportion of adults in the total population	0.57	0.57	0.57	0.57	0.57	0.57
Proportion apportioned to the pSPA	1	0.36	0.36	1	0.61	0.24

Table 2: Offshore wind farm sites included in the in combination assessment for each species and each season (projects up to and including Hornsea Project One) are included in the “building block” approach to in combination assessment (shaded blue). The status of applications in the Firth of Forth (shaded green) is uncertain, the projects shaded white are reasonably foreseeable.

Offshore wind farm site	Natural England Tier	Guillemot			Razorbill		
		Breeding	Post-breeding	Non-breeding	Breeding	Post breeding	Non-breeding
Beatrice Demonstrator	1						✓
Blyth Demonstration Site	1		✓	✓		✓	✓
Greater Gabbard	1		✓	✓		✓	✓
Gunfleet Sands I, II and III	1		✓	✓		✓	✓
Humber Gateway	1	✓	✓	✓		✓	✓
Kentish Flats	1		✓	✓		✓	✓
Kentish Flats Extension	1		✓	✓		✓	✓
Lincs	1		✓	✓		✓	✓
London Array Phase I	1		✓	✓		✓	✓
Lynn and Inner Dowsing	1		✓	✓		✓	✓
Sheringham Shoal	1		✓	✓		✓	✓
Thanet	1		✓	✓		✓	✓
Teesside	1	✓	✓	✓		✓	✓
Westermost Rough	2	✓	✓	✓	✓	✓	✓
Aberdeen offshore wind farm development	3						✓
Beatrice Offshore Wind Farm (BOWL)	3						✓
Dudgeon	3		✓	✓		✓	✓

Offshore wind farm site	Natural England Tier	Guillemot			Razorbill		
Galloper	3		✓	✓		✓	✓
Moray Firth Project One (MORL)	3						✓
Race Bank	3		✓	✓		✓	✓
Triton Knoll	3	✓	✓	✓		✓	✓
East Anglia One	4		✓	✓		✓	✓
Hornsea Project One	4		✓	✓		✓	✓
Inch Cape	4		✓	✓		✓	✓
Near na Gaoithe	4		✓	✓		✓	✓
Seagreen Alpha	4		✓	✓		✓	✓
Seagreen Bravo	4		✓	✓		✓	✓
Dogger Bank Creyke Beck	4		✓	✓		✓	✓
Dogger Bank Teesside A & B	4		✓	✓		✓	✓
Hornsea Project Two	5		✓	✓		✓	✓

1.3 Results

Table 3: Updated in combination displacement analysis for guillemot (X's mark projects that are included in the building block approach, (X) mark projects in the Firth of Forth, greyed out cells show where projects are screened out of the assessment in a particular season). Data shown relate to adult birds apportioned to the Flamborough and Filey Coast pSPA, the source data for these calculations are shown in Appendix A.

Site	Tier	Building block	Breeding	Post-breeding	Non-breeding
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	Site	Tier	Building block	Breeding	Post-breeding	Non-breeding
Existing assessments	Aberdeen Bay	3	X			
	Dogger Bank Creyke Beck	4			1173	1173
	Dogger Bank Teesside	4			529	529
	East Anglia ONE	4	X		23	559
	Hornsea Project One	4	X		4764	3849
	Hornsea Project Two	5			2586	1974
	Seagreen Alpha	4	(X)		2221	2221
	Seagreen Bravo	4	(X)		2171	2171
Inferred from available data	Beatrice Offshore Wind Farm (BOWL)	3	X			
	Galloper	3	X		131	910
	Greater Gabbard	1	X		123	123
	Humber Gateway	1	X	91	33	33
	Inch Cape	4	(X)		326	181
	Kentish Flats	1	X		0	3
	Kentish Flats Extension	1	X		3	3
	London Array Phase I	1	X		0	121


	Site	Tier	Building block	Breeding	Post-breeding	Non-breeding
	Moray Firth Project One (MORL)	3	X			
	Neart na Gaoithe	4	(X)		1168	1702
	Thanet	1	X		3	24
	Triton Knoll	3	X	95	297	315
No data available	Beatrice Demonstrator	1	X			
	Blyth Demonstration Site	1	X		-	-
	Dudgeon	3	X		-	-
	Gunfleet Sands I, II and III	1	X		-	-
	Lincs	1	X		-	-
	Lynn and Inner Dowsing	1	X		-	-
	Race Bank	3	X		-	-
	Sheringham Shoal	1	X		-	-
	Teesside	1	X		-	-
	Westermost Rough	2	X		-	-

Table 4: Updated in combination displacement analysis for razorbill (X's mark projects that are included in the building block approach, (X) mark projects in the Firth of Forth, greyed out cells show where projects are screened out of the assessment in a particular season). Data shown relate to adult birds apportioned to the Flamborough and Filey Coast pSPA, the source data for these calculations are shown in Appendix A.

	Site	Tier	Building block	Breeding	Post-breeding	Non-breeding
Existing assessments	Aberdeen Bay	3	X			35
	Dogger Bank Creyke Beck	4			489	489
	Dogger Bank Teesside	4			261	261
	East Anglia ONE	4	X		21	88
	Hornsea Project One	4	X		3122	1082
	Hornsea Project Two	5			1768	556
	Seagreen Alpha	4	(X)		284	284
	Seagreen Bravo	4	(X)		79	79
Inferred from available data	Beatrice Offshore Wind Farm (BOWL)	3	X			120
	Galloper	3	X		2	190
	Greater Gabbard	1	X		162	64
	Humber Gateway	1	X		nd ¹	nd

¹ No data available for this species at this site

	Site	Tier	Building block	Breeding	Post-breeding	Non-breeding
	Inch Cape	4	(X)		499	45
	Kentish Flats	1	X		0	0
	Kentish Flats Extension	1	X		0	0
	London Array Phase I	1	X		0	10
	Moray Firth Project One (MORL)	3	X			245
	Neart na Gaoithe	4	(X)		647	558
	Thanet	1	X		0	7
	Triton Knoll	3	X		87	279
No data available	Beatrice Demonstrator	1	X			
	Blyth Demonstration Site	1	X		-	-
	Dudgeon	3	X		-	-
	Gunfleet Sands I, II and III	1	X		-	-
	Lincs	1	X		-	-
	Lynn and Inner Dowsing	1	X		-	-
	Race Bank	3	X		-	-
	Sheringham Shoal	1	X		-	-
	Teesside	1	X		-	-



	Site	Tier	Building block	Breeding	Post-breeding	Non-breeding
	Westermost Rough	2	X	-	-	-

Table 5: Qualitative assessment of sites for which relevant data are unavailable.

Offshore wind farm site	Tier	Comments
Beatrice Demonstrator	1	Comprises 2 WTG, maximum count of 1 razorbill, effects considered negligible
Blyth Demonstration Site	1	No information, however this is a small site (c. 4 km ²) and located inshore which implies a negligible risk of displacement
Dudgeon	3	No information (species not assessed)
Gunfleet Sands I, II and III	1	No information, however this is a small site (c. 20.5 km ²) and effects are likely to be negligible
Lincs	1	No information (species not assessed)
Lynn and Inner Dowsing	1	No information, however this is a small site (c. 20 km ²) and effects are likely to be negligible
Race Bank	3	No information
Sheringham Shoal	1	No information (displacement impact considered to be minor)
Teesside	1	No information, however this is a small site (c. 10 km ²) and located inshore which implies a negligible risk of displacement
Westermost Rough	2	No information (displacement impact considered to be minor)

1.3.1 The results of the in combination displacement analysis are indicated for guillemot (Table 6) and razorbill (Table 7). Note that the total indicated is the maximum number of birds potentially exposed to displacement. The magnitude of the mortality effect is then indicated for a range of assumptions about the level of displacement and the proportion of those birds predicted to die as a consequence.

1.3.2 The apportioned SPA numbers can be found in Table A1 in Appendix A. These have been apportioned using the assumptions in Table 1.

Table 6: Summary of predicted magnitude of in combination guillemot mortality due to displacement using a) a building block approach which excludes the potential effects of sites in the Firth of Forth, b) building block approach which includes the Firth of Forth sites and c) all sites. The total number of birds exposed to displacement is shown and then the proportions of those birds that are predicted to die based on varying levels of displacement and consequent mortality.

Displacement assumptions	Breeding	Post-breeding	Non-breeding
<i>Building block (excl Firth of Forth sites) total</i>	187	5377	5940
Predicted mortality (30% and 2%)	1	32	36
Predicted mortality (50% and 10%)	9	269	297
Predicted mortality (70% and 10%)	13	376	416
<i>Building block (incl Firth of Forth sites) total</i>	187	11263	12190
Predicted mortality (30% and 2%)	1	68	73
Predicted mortality (50% and 10%)	9	563	611
Predicted mortality (70% and 10%)	13	788	855
<i>All sites total</i>	187	15551	15891
Predicted mortality (30% and 2%)	1	93	95
Predicted mortality (50% and 10%)	9	778	795
Predicted mortality (70% and 10%)	13	1089	1112

Table 7: Summary of predicted magnitude of in combination razorbill mortality due to displacement using a) a building block approach which excludes the potential effects of sites in the Firth of Forth, b) building block approach which includes the Firth of Forth sites and c) all sites. The total number of birds exposed to displacement is shown and then the proportions of those birds that are predicted to die based on varying levels of displacement and consequent mortality.

Displacement assumptions	Breeding	Post-breeding	Non-breeding
<i>Building block (excl Firth of Forth sites) total</i>	0	3395	2119
Predicted mortality (30% and 2%)	0	27	17
Predicted mortality (50% and 10%)	0	170	106
Predicted mortality (70% and 10%)	0	238	148
<i>Building block (incl Firth of Forth sites) total</i>	0	4903	3085
Predicted mortality (30% and 2%)	0	39	25
Predicted mortality (50% and 10%)	0	245	154
Predicted mortality (70% and 10%)	0	343	216
<i>All sites total</i>	0	7421	4391
Predicted mortality (30% and 2%)	0	59	35
Predicted mortality (50% and 10%)	0	371	220
Predicted mortality (70% and 10%)	0	519	307

1.4 Conclusions

1.4.1 This updated assessment has taken account, to the extent possible, the information available for other wind farms that are likely to affect the guillemot and razorbill populations of the FFC pSPA through displacement.

1.4.2 In this assessment the greatest confidence is placed on the information obtained from those other wind farms where a detailed, quantitative analysis and assessment of displacement effects has been undertaken.

1.4.3 Less confidence can be placed on the displacement impacts that have been inferred from data or information available for those sites where displacement impacts have not been quantified. In those cases it is necessary to take what data are presented

on abundance or density and apply similar assumptions to those made at Hornsea Project One.

1.4.4 There remain a sub-set of sites for which no data or information on the relevant species could be located. For these sites a qualitative assessment has been undertaken. Many of the sites are small, the total area of all the sites is also relatively small compared to both the area of the offshore wind farms that have been included in the quantitative part of the assessment and in relation to the geographical extent of the breeding and non-breeding populations. Furthermore, in each case no significant effects on either guillemot or razorbill were identified in EIA's carried out for those projects. On this basis, whilst these sites could contribute to an in combination displacement effect, their combined additional contribution would not be expected to significantly alter the conclusions of this assessment.

1.4.5 The Applicant maintains that appropriate assumptions for the in combination analysis are:

- Displacement levels of 30% and 40% for guillemot and razorbill respectively and mortality of displaced birds of 2%. Nevertheless the magnitude of displacement for other assumptions is also presented, including 50% displacement together with 10% mortality and Natural England's upper limit for each parameter, 70% displacement together with 10% mortality.
- To assume that the maximum rate of mortality in any one season is the rate that applies for the whole year. Summing seasons does not make logical or biological sense as there is no evidence that mortality arising from displacement will be cumulative throughout the year, in the way that, for example, collision mortality operates. Rather, it is considered that displacement operates as a reduction in the functional capacity of affected habitats. Those affected habitats can no longer support the same population of auks as they could prior to the construction and operation of the wind farm. The metric of interest, therefore, is the maximum number of birds that are no longer capable of being supported by those habitats. The Applicant's approach is to identify in which season the numbers of auks are at their maximum and to assume that the level of displacement that occurs during that season indicates the maximum number of birds that are no longer supported by those habitats.

1.4.6 It is the applicant's position that the predicted in combination mortality, under any of the assumptions in Table 6 or 7, does not exceed the thresholds indicated by appropriately parameterised PBR which are (see Annex J of the HRA report, Doc Ref No 12.6):

- Guillemot ($f = 0.4$): 1,293
- Razorbill ($f = 0.5$): 607

1.4.7 At Deadline V, Natural England presented in-combination displacement figures using the calculations from Appendix W of the Applicant's response to Deadline IV. These figures were based on a different set of assumptions than those advocated by the Applicant, namely summing seasonal mortality, using higher displacement and mortality rates and advocating a lower PBR threshold than those presented by the Applicant.

1.4.8 Using Natural England's assumptions (summing seasonal mortality) and Natural England's PBR threshold of 970 birds ($f = 0.3$) no adverse effect can be concluded for **guillemot** under the following scenarios:

- Building block (excl Firth of Forth sites)
 - When applying a displacement rate of 50% and mortality rate of 10% a mortality of 575 individuals is predicted, this does not exceed Natural England's advocated PBR value ($f = 0.3$)
- Building block (incl Firth of Forth sites)
 - When applying a 40% displacement rate and 10% mortality rate a mortality of 947 is predicted, this does not exceed Natural England advocated PBR value ($f = 0.3$)
 - When applying a displacement rate of 50% and mortality rate of 8% a mortality of 947 is predicted. This does not exceed Natural England advocated PBR value of 972 ($f = 0.3$)
- All sites
 - When applying a displacement rate of 30% and mortality rate of 10% a mortality of 949 is predicted. This does not exceed Natural England's advocated PBR value of 972 ($f = 0.3$)
 - When applying a displacement rate of 50% and a mortality rate of 6% a mortality of 949 is predicted. This does not exceed Natural England's advocated PBR value of 972 ($f = 0.3$)

1.4.9 Using Natural England's assumptions (summing seasonal mortality) and Natural England's PBR threshold of 365 birds ($f = 0.3$) no adverse effect can be concluded for **razorbill** under the following scenarios:

- Building block (excl Firth of Forth sites)
 - When applying a displacement rate of 50% and a mortality rate of 10% a mortality of 276 individuals is predicted.
- Building block (incl Firth of Forth sites)
 - When applying a displacement rate of 45% and a mortality rate of 10% a mortality of 359 individuals is predicted.
 - When applying a displacement rate of 50% and mortality rate of 9.1% mortality of 363 individuals is predicted
- All sites
 - When applying a displacement rate of 30% and mortality rate of 10% a mortality of 354 individuals is predicted.
 - When applying a displacement rate of 50% and a mortality rate of 6.1% a mortality of 360 individuals is predicted.

Appendix A

Table A1: Sources of data for each wind farm included in the in-combination assessment

	Site	Comments
Existing assessments	Aberdeen Bay	Appendix W and Appendix L, note excluded for GU due to revised BDMPS
	Dogger Bank Creyke Beck	Appendix W and Appendix L, note assume no effects during the breeding season as site beyond mean-maximum foraging range for both guillemot and razorbill
	Dogger Bank Teesside	Appendix W and Appendix L, note assume no effects during the breeding season as site beyond mean-maximum foraging range for both guillemot and razorbill
	East Anglia ONE	Appendix W and Appendix L, note assume no effects during the breeding season as site beyond mean-maximum foraging range for both guillemot and razorbill
	Hornsea Project One	Appendix W and Appendix L, note assume no effects during the breeding season as site beyond mean-maximum foraging range for both guillemot and razorbill
	Hornsea Project Two	Appendix W and Appendix L, note assume no effects during the breeding season as site beyond mean-maximum foraging range for both guillemot and razorbill
	Seagreen Alpha	Appendix W and Appendix L
	Seagreen Bravo	Appendix W and Appendix L
Inferred from available data	Beatrice Offshore Wind Farm (BOWL)	Section 7.6.2.5 of ES addendum (BOWL 2013) indicates that up to 880 razorbills are potentially at risk of displacement. It is not known whether this represents a count obtained during the breeding, post-breeding or non-breeding season. This value has, however, been used as the peak population estimate for razorbill in the non-breeding season in this in-combination assessment.
	Galloper	The data used in the displacement analysis for Galloper Offshore Wind Farm has been extracted from Tables A.60 and A.61 of the Project Environmental Statement (GWFL 2011). Tables A.60 and A.61 provide the population estimates for both guillemot and razorbill respectively for the GWF

	<p>survey area, per survey undertaken between 2008-2010.</p> <p>In order to calculate each season's mean peak population values for Galloper, the 'Total Estimate' values provided in Tables A.60 and A.61 were used as an indication of the total monthly population estimates for both guillemot and razorbill within both of the two identified survey years. Year 1 of the surveys included those in June 2008 – May 2009, whilst Year 2 included the surveys in June 2009 – May 2010. Averages of the peak seasonal population estimates for Years 1 and 2 for both Guillemot and Razorbill were calculated to establish the mean peak values for each season.</p>
Greater Gabbard	<p>The data used in the displacement analysis for Greater Gabbard Offshore Wind Farm has been derived from Sections 4.2.5 and 4.2.10 of Greater Gabbard Offshore Wind Ltd (2009) pre-construction monitoring report, which provided peak estimates of winter (individuals) for guillemot and razorbill respectively for the Grater Gabbard wind farm area for the winter period of 2008/2009. Separate estimates were provided for the wind farm and buffer areas and these were summed.</p>
Humber Gateway	<p>Limited data are available for this offshore wind farm. The record of the Appropriate Assessment undertaken by the Department of Energy and Climate Change (DECC 2009) indicates (p. 10):</p> <p><i>“Guillemot was the most common auk species with at least 50 birds recorded in the survey area during the boat-based surveys and a peak of nearly 160 birds in March 2004. However, the wind farm site and immediate surrounds did not support any notable concentrations. The main concentrations of rafting guillemots were recorded further to the east and north of the site, especially towards the Flamborough Head and Bempton Cliffs breeding colonies.”</i></p> <p>On this basis it is assumed that no more than 160 guillemots are at risk of displacement and that, whilst not quantified the effects on razorbill will be less than this (as guillemot was the most common auk recorded and razorbill was not present in sufficient numbers to indicate a Likely Significant Effect).</p>
Inch Cape	<p>The Environmental Statement for Inch Cape (Inch Cape Offshore Limited, 2013) provides information on the number of birds that are likely to be displaced from the proposed wind farm. The data used in the displacement analysis has been taken from Tables</p>

		<p>15A.57 and 15A.59 within Appendix 15A of the ES. These tables present the estimated displaced number of birds for the breeding, post-breeding and non-breeding seasons for both guillemot and razorbill respectively within the wind farm area and a buffer.</p>
	Kentish Flats	<p>The data used in the displacement analysis for Kentish Flats Offshore Wind Farm has been derived from Table 19 within Section 4.1.3.3 of the Kentish Flats fifth ornithological monitoring report (Environmentally Sustainable Systems Ltd, 2008), which provided monthly population estimates for guillemot for the Wind Farm and Buffer. The peak population estimate was used within the displacement analysis for the Kentish Flats Offshore Wind Farm.</p> <p>No data for razorbill are provided in this report and it is, therefore, assumed that none were recorded during the surveys.</p>
	Kentish Flats Extension	<p>The data used in the displacement analysis for Kentish Flats Extension Offshore Wind Farm has been derived from Table 9.8 within Section 9 of the project ES (Vattenfall, 2011). This table provided the peak population estimate for Guillemot (14 birds) within the wind farm area and associated buffer area during the 2005-2007 post-construction monitoring surveys for Kentish Flats.</p>
	London Array Phase I	<p>The data used in the displacement analysis for London Array Phase 1 Offshore Wind Farm has been extracted from Figures 6.113 and 6.117 of the Project ES (London Array Ltd, 2005). Figures 6.113 and 6.117 indicate population estimates for guillemot and razorbill respectively, based upon the project boat surveys.</p> <p>In order to calculate each season's mean peak population values for London Array Phase 1, the population estimates provided in Figures 6.113 and 6.117 for the wind farm area and buffer were used as an indication of the total monthly population sizes for both guillemot and razorbill within survey years.</p> <p>Due to the presentation of the population estimate data as bar charts within the project ES, the population estimates that have been included within the displacement analysis have been interpreted from the chart as accurately as possible. The population estimates used within the displacement analyses were interpreted from the measurement of the bar features in each chart, using these measurements to infer an approximate total</p>

	<p>population estimate. For guillemot, population estimates were interpreted to the nearest 10 birds, whilst razorbill population estimates were interpreted to the nearest single bird.</p> <p>Three survey years were identified: 2002-2003 (Year 1), 2003-2004 (Year 2) and 2004-2005 (Year 3). Averages of the peak seasonal population estimates for Years 1, 2 and 3 for both Guillemot and Razorbill were calculated to establish the mean peak values for the displacement analysis of London Array Phase 1. These values were then multiplied by 0.63 to account for a reduction in the wind farm area from the planned 1000 MW site to the 630 MW site which was constructed. It is understood that Phase II of this development will not now proceed.</p>
Moray Firth Project One (MORL)	<p>The data used in the displacement analysis for Moray Firth Project One Offshore Wind Farm has been derived from Table 27 within Technical Appendix 4.5 A of the project ES (Moray Offshore Renewables Ltd., 2012). Table 27 provided abundance estimate for razorbill during the breeding season and non-breeding season, using 2010-2012 boat-based survey data for both the wind farm site and the buffer area respectively.</p> <p>The abundance estimate for razorbill during the non-breeding season for the wind farm area (892) and buffer (899) were summed giving 1,791 as the peak count for the non-breeding season.</p>
Neart na Gaoithe	<p>The data used in the displacement analysis for Neart na Gaoithe Offshore Wind Farm has been extracted from Sections 5.12 and 5.13, Appendix 12.2 of the project ES (Mainstream Renewable Power, 2012). Sections 5.12 and 5.13 provide monthly population estimates for the Development Area and associated buffers for the period November 2009 to October 2011. These monthly data were used to calculate mean peak populations for each season for each species.</p>
Thanet	<p>The data used in the displacement analysis for Thanet Offshore Wind Farm has been extracted from Table 4.1.1.3 within Appendix 8.1 of the project ES (Warwick Energy Ltd., 2005). Table 4.1.1.3 provides the density estimates for guillemot and razorbill, both within the wind farm area and within the buffer area during the period November 2004 to September 2005.</p> <p>The area of the wind farm and its buffer are known (approximately 35km² and 31km² respectively) and so it was possible to convert the monthly density</p>

		estimates into population estimates for both species. The average density for the wind farm and the buffer area was calculated and multiplied by the total area of the wind farm and the buffer. Where there was more than one count in any one month, the average of these were taken. From these data a peak population estimate for each season was obtained.
	Triton Knoll	<p>The data used in the displacement analysis for Triton Knoll Offshore Wind Farm has been extracted from the respective tables for guillemot and razorbill within the project ES (Triton Knoll Offshore Wind Farm Ltd., 2012), Annex H1, Appendix II. These tables present the population size estimates for the wind farm site and a buffer derived from boat-based surveys undertaken between January 2008 and December 2009. Two methods are used to calculate the population for each month, the data based on a population estimate using correction factors for birds on the water have been used (rather than the extrapolation method also shown).</p> <p>These monthly data were used to calculate mean peak populations for each season for each species.</p>
No data available	Beatrice Demonstrator	Comprises 2 WTG, maximum count of 1 razorbill, effects considered negligible
	Blyth Demonstration Site	No information, however this is a small site (c. 4 km ²) and located inshore which implies a negligible risk of displacement
	Dudgeon	No information (species not assessed)
	Gunfleet Sands I, II and III	No information, however this is a small site (c. 20.5 km ²) and effects are likely to be negligible
	Lincs	No information (species not assessed)
	Lynn and Inner Dowsing	No information, however this is a small site (c. 20 km ²) and effects are likely to be negligible
	Race Bank	No information
	Sheringham Shoal	No information (displacement impact considered to be minor)
	Teesside	No information, however this is a small site (c. 10 km ²) and located inshore which implies a negligible risk of displacement
	Westermost Rough	No information (displacement impact considered to be minor)

References

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- Vattenfall. (2011). Kentish Flats Offshore Wind Farm Extension Environmental Statement. Section 9: Offshore Ornithology. IPC Document Ref 4.2.9. Vattenfall, October 2011.
- Warwick Energy Ltd. (2005). Thanet Offshore Wind Farm Environmental Statement. Warwick Energy Ltd, November 2005.

Table A2: Population estimates for guillemot obtained for wind farms where there is no quantitative analysis of displacement impacts. The population estimates (sub-table a) for populations comprising all birds (adults and non-adults and pSPA birds and non-pSPA birds) have been apportioned using the same assumptions as for Hornsea P1 (sub-table b) to obtain a population of adult birds that can be attributed to the Flamborough and Filey Coast pSPA (sub-table c).

	Wind Farm Site	Breeding	Post-breeding	Non-breeding
a) Populations (all ages) potentially affected by displacement	Beatrice Offshore Wind Farm (BOWL)			
	Galloper		637	4434
	Greater Gabbard		600	600
	Humber Gateway	160	160	160
	Inch Cape		1588	880
	Kentish Flats		0	17
	Kentish Flats Extension		14	14
	London Array Phase I		2	590
	Moray Firth Project One (MORL)			
	Neart na Gaoithe		5694	8296
	Thanet		16	116
	Triton Knoll	167	1446	1534
b) Apportioning assumptions applied	Proportion of adults in population	0.57	0.57	0.57
	Proportion attributed to pSPA	1	0.36	0.36
c) Adult pSPA birds potentially affected by displacement	Beatrice Offshore Wind Farm (BOWL)			
	Galloper		131	910
	Greater Gabbard		123	123
	Humber Gateway	91	33	33
	Inch Cape		326	181
	Kentish Flats		0	3
	Kentish Flats Extension		3	3
	London Array Phase I		0	121
	Moray Firth Project One (MORL)			
	Neart na Gaoithe		1168	1702
	Thanet		3	24
	Triton Knoll	95	297	315

Table A3: Population estimates for razorbill obtained for wind farms where there is no quantitative analysis of displacement impacts. The population estimates (sub-table a) for populations comprising all birds (adults and non-adults and pSPA birds and non-pSPA birds) have been apportioned using the same assumptions as for Hornsea P1 (sub-table b) to obtain a population of adult birds that can be attributed to the Flamborough and Filey Coast pSPA (sub-table c).

	Wind Farm Site	Breeding	Post-breeding	Non-breeding
a) Populations (all ages) potentially affected by displacement	Beatrice Offshore Wind Farm (BOWL)			880
	Galloper		6	1387
	Greater Gabbard		466	466
	Humber Gateway			
	Inch Cape		1435	326
	Kentish Flats		0	0
	Kentish Flats Extension		0	0
	London Array Phase I		0	72
	Moray Firth Project One (MORL)			1791
	Near na Gaoithe		1860	4082
	Thanet		0	48
	Triton Knoll		252	2040
b) Apportioning assumptions applied	Proportion of adults in population	0.57	0.57	0.57
	Proportion attributed to pSPA	1	0.61	0.24
c) Adult pSPA birds potentially affected by displacement	Beatrice Offshore Wind Farm (BOWL)			120
	Galloper		2	190
	Greater Gabbard		162	64
	Humber Gateway			
	Inch Cape		499	45
	Kentish Flats		0	0
	Kentish Flats Extension		0	0
	London Array Phase I		0	10
	Moray Firth Project One (MORL)			245
	Near na Gaoithe		647	558
	Thanet		0	7
	Triton Knoll		87	279

