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THE INFRASTRUCTURE PLANNING (ENVIRONMENTAL PROCEDURE RULES)
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HORNSEA OFFSHORE WIND FARM PROJECT TWO

**WRITTEN SUBMISSION FOR DEADLINE 3:
APPENDIX 4**

24th September 2015

HRA Guillemot Displacement Impacts on Flamborough and Filey Coast pSPA (FFC pSPA).

This note sets out Natural England’s position on the collision risk posed to guillemot at the Flamborough and Filey coast (FFC) pSPA. Our analysis draws on data provided by the applicant on guillemot in support of their submissions for Hornsea project 2. The paper sets out a summary of the range of impacts for different displacement scenarios for the project alone (Table 1 and 2) and then demonstrates what each of these scenarios means in terms of population growth rate (Table 3, 5 and 7) and mortality (Table 4 and 6) based on the outputs of PVA modelling carried out by the Applicant.

GUILLEMOT PROJECT ALONE

Table 1. Natural England summary of range of potential displacement impacts on FFC pSPA guillemot for Project alone. Figures are adult mortalities. Lower displacement mortality represents 30% displacement and 1% mortality; upper displacement mortality represents 70% displacement and 10% mortality. (see Table 2 for complete annual matrix).

Species	Season	Apportioning % to FFC pSPA	FFC pSPA (no. of adult mortalities). Lower displacement mortality	FFC pSPA (no. of adult mortalities). Upper displacement mortality
Guillemot	Breeding	46.3	11	251
	Non-breeding	4.4	2	41
	Annual		12	291

Table 2. Predicted annual displacement mortality for guillemot adults apportioned to FFC pSPA. (Based on mean population estimates across the range of displacement and mortality levels considered by Natural England).

GU mortality figures	% Mortality
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FFC adults mean of pop ests		1	2	5	10
% Displacement	30	12	25	62	125
	40	17	33	83	166
	50	21	42	104	208
	60	25	50	125	250
	70	29	58	146	291

Table 3. Predicted reductions in population growth rate¹ from Project Alone. (Using density independent PVA model, demographic rate set 2 and mean densities of birds in Project area).

GU mortality figures		% Mortality			
FFC adults mean of pop ests		1	2	5	10
% Displacement	30	0.074	0.074	0.132	0.191
	40	0.074	0.074	0.132	0.256
	50	0.074	0.074	0.191	0.314
	60	0.074	0.074	0.191	0.314

¹ Reductions in population growth rate relate to the nearest mortality level output from the PVA model that lies above the predicted displacement mortality, so for example, if the predicted displacement is 110 birds and PVA outputs are given in 50 bird increments, the reduction in growth rate in the matrix is that for the 150 birds mortality level.

	70	0.074	0.132	0.191	0.381
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Table 4. Predicted annual displacement mortality for guillemot adults apportioned to FFC pSPA. (Based on upper 95% confidence limits of population estimates across the range of displacement and mortality levels considered by Natural England).

GU mortality figures		% Mortality			
FFC adults UCL of pop ests		1	2	5	10
% Displacement	30	21	43	107	214
	40	29	57	143	286
	50	36	71	178	357
	60	43	86	214	428
	70	50	100	250	500

Table 5. Predicted reductions in population growth rate² from Project Alone. (Using density independent PVA model, demographic rate set 2 and upper 95% confidence limits of species densities. Shaded cells are those where the reduction in growth rate exceeds 0.5%).

² Reductions in population growth rate relate to the nearest mortality level output from the PVA model that lies above the predicted displacement mortality, so for example, if the predicted displacement is 110 birds and PVA outputs are given in 50 bird increments, the reduction in growth rate in the matrix is that for the 150 birds mortality level.

GU mortality figures		% Mortality			
FFC adults UCL of pop ests		1	2	5	10
% Displacement	30	0.074	0.074	0.191	0.314
	40	0.074	0.132	0.191	0.381
	50	0.074	0.132	0.256	0.508
	60	0.074	0.132	0.314	0.574
	70	0.074	0.132	0.314	0.632

Table 6. Predicted annual displacement mortality for guillemot adults apportioned to FFC pSPA. (Based on lower 95% confidence limits of population estimates across the range of displacement and mortality levels considered by Natural England).

GU mortality figures		% Mortality			
FFC adults LCL of pop ests		1	2	5	10
% Displacement	30	8	15	38	75
	40	10	20	50	101
	50	13	25	63	126
	60	15	30	75	151
	70	18	35	88	176

Table 7. Predicted reductions in population growth rate³ from Project Alone. (Using density independent PVA model, demographic rate set 2 and lower 95% confidence limits of species densities in project area).

GU mortality figures		% Mortality			
FFC adults LCL of pop ests		1	2	5	10
% Displacement	30	0.074	0.074	0.074	0.132
	40	0.074	0.074	0.074	0.191
	50	0.074	0.074	0.132	0.191
	60	0.074	0.074	0.132	0.256
	70	0.074	0.074	0.132	0.256

Table 8. Natural England position on displacement impacts from Hornsea P2 for guillemot population of FFC pSPA for the project alone.

Likely impact considered by Natural England	For the purposes of assessing colony impacts against the outputs of the population models Natural England has focussed our assessment on the range 12-291 adults per annum generated using the mean population estimates for the Project area and 2km buffer and a range of displacement 30-70% and mortality 1-10% rates. However, considering the variability in the baseline population estimates, Natural England consider that displacement impacts are unlikely to exceed 500 adults per annum (based on the upper 95% confidence
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³ Reductions in population growth rate relate to the nearest mortality level output from the PVA model that lies above the predicted displacement mortality so for example if the predicted displacement is 110 birds and PVA outputs are given in 50 bird increments, the reduction in growth rate in the matrix is that for the 150 birds mortality level.

	limits of the population estimates and 70% displacement and 10% mortality in Table 4).
Conclusions on AEOSI for FFC pSPA for Project alone impacts	<p>A density independent PVA model predicts that with an additional annual adult mortality of 300 birds (closest modelled output to predicted 291 adults impact) the population growth rate would fall by 0.38% and the population size at 25 years would be 8.4% lower than an un-impacted population size. Considering an impact of 500 adults per annum the growth rate would fall by 0.63% and the final population size would be 13.5% lower than the un-impacted population size at 25 years.</p> <p>While there is some empirical evidence to support the displacement levels for auks we do not know what the likely mortality impacts of displacement are. We therefore consider it appropriate to consider a range of mortalities from 1-10%, but on the basis that Hornsea P2 does not lie in an area of the North Sea that has high levels of guillemot density during the breeding or non-breeding season⁴ we do not expect mortality rates to be at the top of the range considered. Therefore, even accounting for variability in the baseline population estimates we do not expect the mortality from displacement to exceed a level where the population growth rate would decline by more than 0.3% per annum.</p> <p>A density dependent model would predict smaller declines in growth rate, however, there is no evidence to support application of any particular form or magnitude of density dependence in the model.</p> <p>The density independent PVA model predicted a population growth rate of 4.42% per annum over the next 25 years. The FFC pSPA colony increased by 2.8% per annum between 1987-2008 and the current population size is 83,214 breeding adults. When the conservation objectives are set for the FFC SPA there is likely to be a maintain objective for the guillemot feature.</p> <p>Based on the current population trend for the colony (Figure 1) and on the basis of predicted displacement</p>

⁴ NE/MMO Seabird Sensitivity Mapping Tool. http://www.gis.naturalengland.org.uk/pubs/gis/GIS_register.asp

mortality for the project alone resulting in a decline in growth rate of no more than 0.3%, Natural England consider that there would be **No AEO SI**.

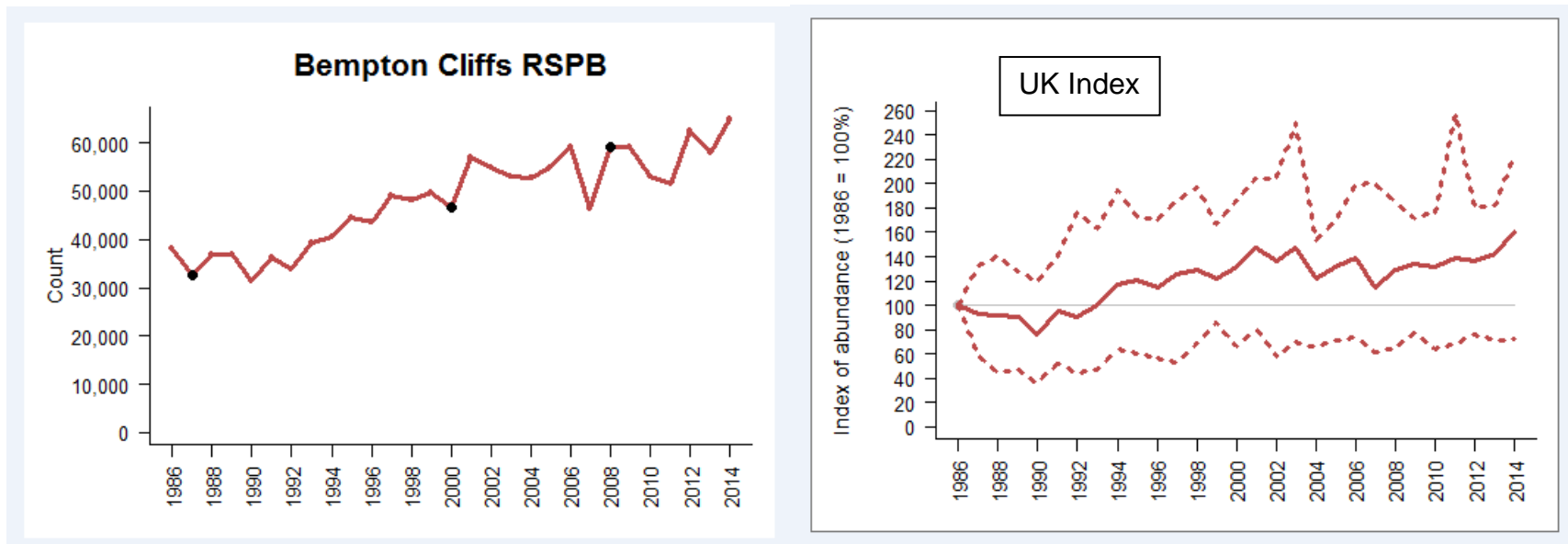


Figure 1. Population index for Bempton Cliffs count unit (FFC pSPA), compared to UK population index 1986-2014. Data supplied by R.Mavor, JNCC.

GUILLEMOT IN-COMBINATION.

Table 9. Natural England summary of range of potential displacement impacts on FFC pSPA guillemot for Project in-combination with other plans and projects. Figures are adult mortalities. Figures calculated using 100% apportioning for projects within mean maximum foraging range (Teeside, Westernmost Rough, Humber Gateway, Triton Knoll), 46.3% for Hornsea P1 and P2; 35% for Dogger Bank Creyke Beck and Dogger Bank Teesside. Non-breeding season apportioning rate of 4.4% for all projects in North Sea BDMPS (Furness 2015). Lower displacement mortality represents 30% displacement and 1% mortality; upper displacement mortality represents 70% displacement and 10% mortality. (see Table 10 for complete annual matrix).

Species	Season	FFC pSPA (no. of adult mortalities). Lower displacement level	FFC pSPA (no. of adult mortalities). Upper displacement level
Guillemot	Breeding	52	1222
	Non-breeding	8	194
	Annual	61	1416

Table 10. Predicted annual displacement mortality for guillemot adults apportioned to FFC pSPA for all plans and projects in the North Sea BDMPS scale, across the range of displacement and mortality levels considered by Natural England.

GU mortality figures		% Mortality			
FFC adults In-combination		1	2	5	10
% Displacement	30	61	121	303	607
	40	81	162	405	809
	50	101	202	506	1012

	60	121	243	607	1214
	70	142	283	708	1416

Table 11. Predicted reductions in population growth rate⁵ from Project in-combination with other plans and projects. (Using density independent PVA model and demographic rate set 2. Shaded cells are those where the reduction in growth rate exceeds 0.5%, or 1%).

GU GR figures		% Mortality			
FFC adults In-combination		1	2	5	10
% Displacement	30	0.132	0.191	0.441	0.822
	40	0.132	0.256	0.574	1.07
	50	0.191	0.314	0.693	1.33
	60	0.191	0.314	0.822	1.57
	70	0.191	0.381	0.949	1.83

Table 12. Natural England position on displacement impacts from Hornsea P2 in-combination with other plans and projects for guillemot population of FFC pSPA.

⁵ Reductions in population growth rate relate to the nearest mortality level output from the PVA model that lies above the predicted displacement mortality so for example if the predicted displacement is 110 birds and PVA outputs are given in 50 bird increments, the reduction in growth rate in the matrix is that for the 150 birds mortality level.

<p>Likely impact considered by Natural England</p>	<p>Natural England has based our assessment of impacts on the range 61-1416 adults per annum based on a range of displacement 30-70% and mortality 1-10%.</p>
<p>Conclusions on AEO SI for FFC pSPA for Project in-combination impacts</p>	<p>A density independent PVA model predicts that with an additional annual adult mortality of 1400-1450 birds (closest modelled outputs to predicted 1416 adults impact) the population growth rate would fall by 1.8% and the population size at 25 years would be ~33% lower than an un-impacted population size. This level of impact would be considered significant in the context of the current colony population trend.</p> <p>However, while there is some empirical evidence to support the displacement levels for auks we do not know what the likely mortality impacts of displacement are. We therefore consider it appropriate to consider a range of mortalities from 1-10%, but on the basis that the projects that have been scoped into the assessment lie in areas of the North Sea that represent low to medium levels of guillemot density during both the breeding (where relevant) and non-breeding seasons we do not expect mortality rates to be at the top of the range considered⁶. Therefore we do not expect the mortality to exceed a level where the population growth rate would decline by more than ~0.4% per annum.</p> <p>A density dependent model would predict smaller declines in growth rate however there is no evidence to support application of any particular form or magnitude of density dependence in the model.</p> <p>The density independent PVA model predicted a population growth rate of 4.42% per annum over the next 25 years. The FFC pSPA colony increased by 2.8% per annum 1987-2008 and the current population size is 83,214 breeding adults. When the conservation objectives are set for the FFC SPA there is likely to be a maintain objective for the guillemot feature.</p> <p>Based on the current population trend for the colony, and on the basis of predicted displacement mortality for the project in-combination with other plans and projects resulting in a decline in growth rate of no more than</p>

⁶ NE/MMO Seabird Sensitivity Mapping Tool. http://www.gis.naturalengland.org.uk/pubs/gis/GIS_register.asp

	0.4%, Natural England consider that there would be No AEOs .
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