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HORNSEA OFFSHORE WIND FARM PROJECT TWO

**WRITTEN SUBMISSION FOR DEADLINE 3:
APPENDIX 5**

24th September 2015

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

This note sets out natural England's position on the collision risk posed to razorbill at the Flamborough and Filey coast (FFC) pSPA. Our analysis draws on data provided by the applicant on razorbill 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.

RAZORBILL PROJECT ALONE

Table 1. Natural England summary of range of potential displacement impacts on FFC pSPA razorbill 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
Razorbill	Breeding	48.2	4	85
	Post-breeding	3.4	0	10
	Non-breeding	2.7	0	1
	Pre-breeding	3.4	0	4
	Annual		4	100

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

RA mortality figures		% Mortality			
FFC adults mean of pop ests		1	2	5	10
% Displacement	30	4	9	21	43
	40	6	11	29	57
	50	7	14	36	72
	60	9	17	43	86
	70	10	20	50	100

Table 3. Predicted reductions in population growth rate¹ for the Project Alone. (Using density independent PVA model with demographic rate set 1 and mean estimates of birds in project area. Shaded cells are those where the reduction in growth rate exceeds 0.5%).

RA GR figures		% Mortality			
FFC adults mean of pop ests		1	2	5	10
% Displacement	30	0.251	0.251	0.251	0.251

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.

	40	0.251	0.251	0.251	0.501
	50	0.251	0.251	0.251	0.501
	60	0.251	0.251	0.251	0.501
	70	0.251	0.251	0.251	0.501

Table 4. Predicted annual displacement mortality for razorbill 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).

RA mortality figures		% Mortality			
FFC adults UCL of pop ests		1	2	5	10
% Displacement	30	9	18	46	92
	40	12	25	61	123
	50	15	31	77	153
	60	18	37	92	184
	70	21	43	107	215

Table 5. Predicted reductions in population growth rate² for Project Alone. (Using density independent PVA model with demographic rate set 1 and upper 95% confidence limits of species population estimates. Shaded cells are those where the reduction in growth rate exceeds 0.5%, or 1%).

RA GR figures		% Mortality			
FFC adults UCL of pop ests		1	2	5	10
% Displacement	30	0.251	0.251	0.251	0.501
	40	0.251	0.251	0.501	0.757
	50	0.251	0.251	0.501	1.02
	60	0.251	0.251	0.501	1.02
	70	0.251	0.251	0.767	1.24

Table 6. Predicted annual displacement mortality for razorbill 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).

RA mortality figures		% Mortality			
FFC adults LCL of pop ests		1	2	5	10

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.

% Displacement	30	2	4	10	21
	40	3	6	14	28
	50	3	7	17	35
	60	4	8	21	42
	70	5	10	24	48

Table 7. Predicted reductions in population growth rate³ for Project Alone. (Using density independent PVA model with demographic rate set 1 and lower 95% confidence limits of species population estimates).

RA GR figures		% Mortality			
FFC adults LCL of pop ests		1	2	5	10
% Displacement	30	0.251	0.251	0.251	0.251
	40	0.251	0.251	0.251	0.251
	50	0.251	0.251	0.251	0.251
	60	0.251	0.251	0.251	0.251
	70	0.251	0.251	0.251	0.251

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.

Table 8. Natural England position on displacement impacts from Hornsea P2 for razorbill population of FFC pSPA.

<p>Likely impact considered by Natural England</p>	<p>For the purposes of assessing colony impacts against the outputs of the population models Natural England has focussed our assessment on the range 4-100 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. Considering the variability in the baseline population estimates, Natural England consider that displacement impacts are unlikely to exceed 215 adults per annum (based on the upper 95% confidence limits of the population estimates and 70% displacement and 10% mortality).</p>
<p>Conclusions on AEOsI for FFC pSPA for Project alone impacts</p>	<p>A density independent PVA model using the demographic rate set 1 from the Applicant's PVA assessment⁴ predicts that with an additional annual adult mortality of 100 birds the population growth rate would fall by 0.5% and the population size at 25 years would be 10.8% lower than an un-impacted population size. Considering an impact of 215 adults per annum the growth rate would fall by ~1% and the final population size would be 21% 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 supports high densities of razorbill during the breeding or non-breeding season⁵ 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 0.5% 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>

⁴ Natural England have considered outputs from the Applicant's PVA model using the Demographic rate set 1 (rather than the updated rate set 2) as for razorbill the Rate Set 1 provides a better fit to the current population trend for the colony.

⁵ NE/MMO Seabird Sensitivity Mapping Tool. http://www.gis.naturalengland.org.uk/pubs/gis/GIS_register.asp

The density independent PVA model using the demographic rate set 1 predicted a population growth rate of 6.89% 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 21,140 breeding adults. It is not clear whether the FFC pSPA colony will continue to grow at this rate for the next 25 years. However, colony productivity is higher than the national average⁶ and has shown an increasing trend in recent years (Figure 2) which suggests that the colony does have the potential to continue to grow. When the conservation objectives are set for the FFC SPA there is likely to be a maintain objective for the razorbill feature.

Based on the current population trend and productivity levels for the colony and on the basis of predicted displacement mortality for the project alone resulting in a decline in growth rate of no more than 0.5%, taking account of uncertainty in the baseline data, Natural England consider that there would be **No AEOI**.

⁶ Horswill, C & Robinson, R.A. (2015), Review of Seabird Demographic Rates and Density Dependence, JNCC Report 552, ISSN 0963-8901

RAZORBILL IN-COMBINATION.

Table 9. Natural England summary of range of potential displacement impacts on FFC pSPA razorbill 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 (Westermost Rough), 48.2% for Hornsea P1 and P2; 30% for Dogger Bank Creyke Beck and Dogger Bank Teesside (as per examination for these projects). Apportioning for non-breeding season months for all projects in North Sea BDMPS follows percentages given in Table 1 (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
Razorbill	Breeding	10	229
	Post-breeding	3	63
	Non-breeding	1	25
	Pre-breeding	2	48
	Annual	16	364

Table 10. Predicted annual displacement mortality for razorbill 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.

RA mortality figures		% Mortality			
FFC adults In-combination		1	2	5	10
% Displacement	30	16	31	78	156
	40	21	42	104	208

	50	26	52	130	260
	60	31	62	156	312
	70	36	73	182	364

Table 11. Predicted reductions in population growth rate⁷ for Project in-combination with other plans and projects. (Using density independent PVA model with demographic rate set 1. Shaded cells are those where the reduction in growth rate exceeds 0.5%, 1% or 2%).

RA GR figures		% Mortality			
FFC adults In-combination		1	2	5	10
% Displacement	30	0.251	0.251	0.501	1.02
	40	0.251	0.251	0.757	1.24
	50	0.251	0.501	0.757	1.50
	60	0.251	0.501	1.02	1.78
	70	0.251	0.501	1.02	2.02

⁷ 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.

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

<p>Likely impact considered by Natural England</p>	<p>Natural England has based our assessment of impacts on the range 16-364 adults per annum based on a range of displacement 30-70% and mortality 1-10%.</p>
<p>Conclusions on AEoSI for FFC pSPA for Project in-combination impacts</p>	<p>A density independent PVA model predicts that with an additional annual adult mortality of 400 birds (closest modelled output above predicted 364 adults impact) the population growth rate would fall by 2% 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 razorbill density during the breeding (where relevant) and non-breeding seasons we do not expect mortality rates to be at the top of the range considered⁸. Therefore we do not expect the mortality to exceed a level where the population growth rate would decline by more than ~0.5% 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 with demographic rate set 1 predicted a population growth rate of 6.89% per annum over the next 25 years. The FFC pSPA colony increased by 3% per annum 1987-2008 and the current population size is 21,140 breeding adults. It is not clear whether the FFC pSPA colony will</p>

⁸ NE/MMO Seabird Sensitivity Mapping Tool. http://www.gis.naturalengland.org.uk/pubs/gis/GIS_register.asp

continue to grow at this rate for the next 25 years. However, colony productivity is higher than the national average⁹ and has shown an increasing trend in recent years (Figure 1 and 2) which suggests that the colony does have the potential to continue to grow. When the conservation objectives are set for the FFC SPA there is likely to be a maintain objective for the razorbill feature.

Based on the current population trend (Figure 1) and productivity levels (Figure 2) 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 less than 0.5% per annum, Natural England consider that on balance there would be **No AEOI**.

⁹ Horswill, C & Robinson, R.A. (2015), Review of Seabird Demographic Rates and Density Dependence, JNCC Report 552, ISSN 0963-8901

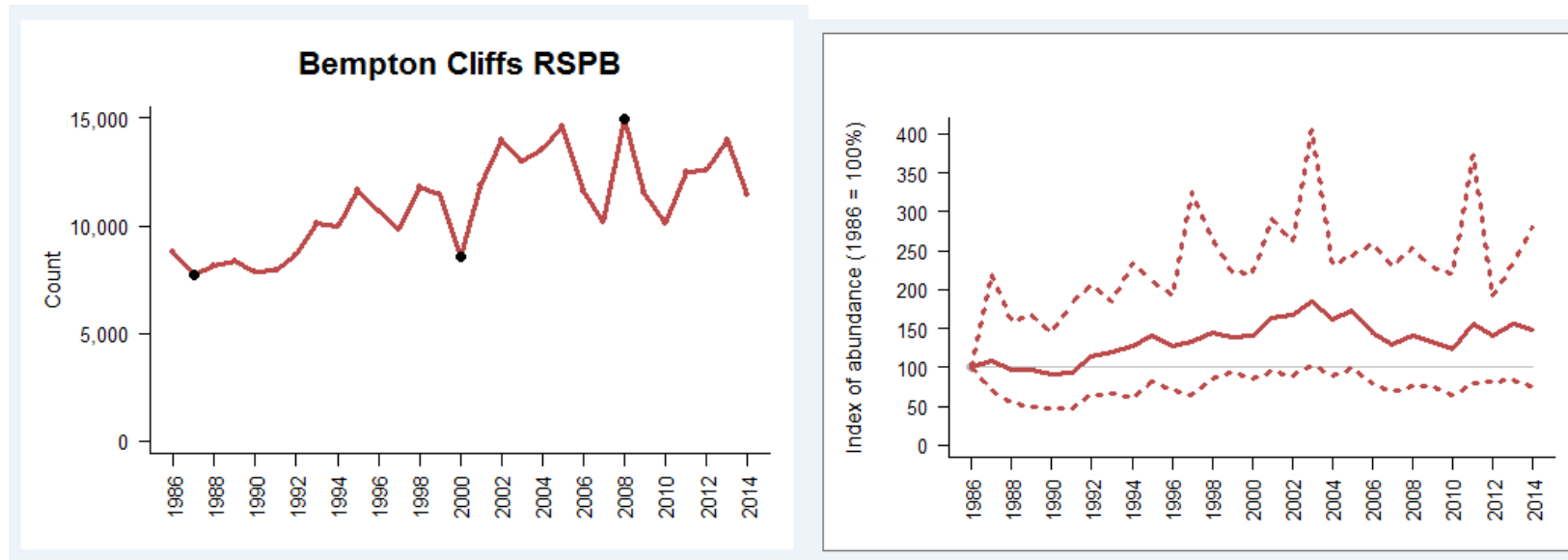


Figure 1. Razorbill population index for 1986-2014 for Bempton Cliffs (part of FFC pSPA) and the UK index with 95% confidence intervals). Data provided by R. Mavor, JNCC.

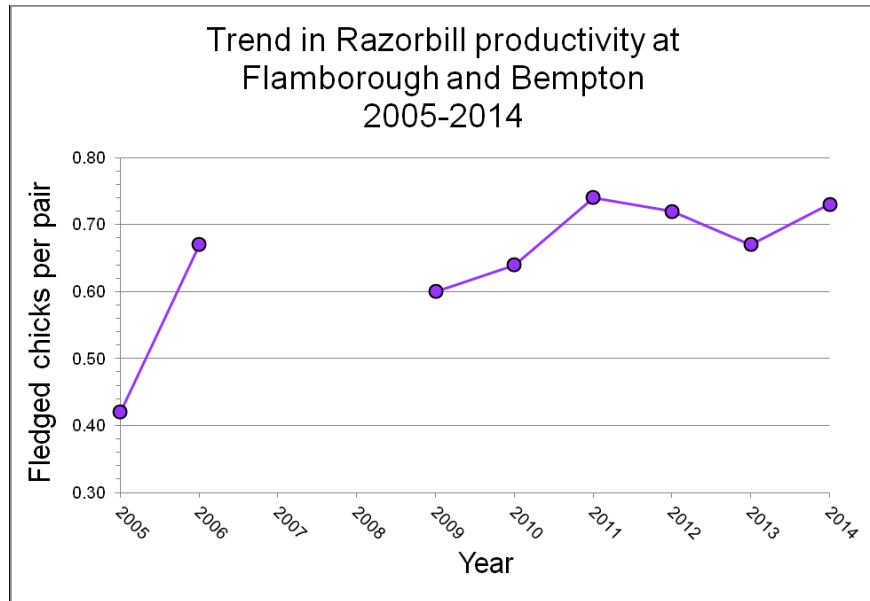


Figure 2. Trend in Razorbill productivity 2005-2014. Aitken et al 2015.¹⁰

¹⁰ David Aitken, Michael Babcock, Keith Clarkson, Ruth Jeavons. 2015. Flamborough Head and Bempton Cliffs SPA Seabird Monitoring Programme 2014 Report