THE PLANNING ACT 2008

THE INFRASTRUCTURE PLANNING (EXAMINATION PROCEDURE) RULES

2010

Natural England's End of Examination Position on Offshore Ornithology

For:

The construction and operation of Hornsea Project Four Offshore Wind Farm, located approximately 69 km from the East Riding of Yorkshire in the Southern North Sea, covering an area of approximately 468 km^2.

Planning Inspectorate Reference EN010098

10th August 2022

Introduction

This document provides an overview of Natural England's final position on the potential for significant adverse impacts (Environmental Impact Assessment (EIA)) and Adverse Effects on Integrity (AEoI; Habitats Regulations Assessments (HRA)) on key seabird species. An Executive Summary is provided here, followed by two technical appendices for the EIA and HRA assessments.

When compiling this document, we have mainly utilised the following submissions from the Applicant:

- G5.9 Revised Ornithological Baseline (tracked) [REP5a-010]
- G5.25 Ornithology EIA and HRA Annex (tracked) [REP6-029]
- G4.7 Ornithological Assessment Sensitivity Report [REP6-027]

Natural England have agreed the updated ornithological baseline abundance estimates for several key species, which was produced in line with our guidance following identification of several issues with the initial modelling approach. The G5.25 Ornithology EIA and HRA Annex (tracked) [REP6-029] provides updated assessments using the data presented in G5.9 Revised Ornithological Baseline (tracked) [REP5a-010] and is based on both the Applicant's preferred approach and Natural England's advised approach, which we welcome.

Outstanding issues and implications for the assessment

Natural England has identified several outstanding issues with G5.25 Ornithology EIA and HRA Annex (tracked) and G4.7 Ornithological Assessment Sensitivity Report that could influence this assessment and have attempted to address these as far as possible to provide our final positions. These outstanding issues and our approach to them within this document is summarised as follows:

EIA only issues

- We note that the Applicant has adjusted the BDMPS reference populations adopted for black-legged kittiwake *Rissa tridactyla* (kittiwake hereafter), Common guillemot (guillemot hereafter) *Uria aalge* and Atlantic puffin *Fratercula arctica* (puffin hereafter) in REP6-027 and REP6-029. Natural England have not agreed these changes and highlight that the larger numbers adopted by the Applicant will influence the interpretation of potential increases in baseline mortality resulting from predicted impacts for EIA. In the analysis presented within this document we have used the Natural England advised BDMPS values for these species in order to address this.
- The Population Viability Analysis (PVA) presented by the Applicant in REP6-027 has also made use of these unagreed BDMPS values. This has resulted in larger starting populations being subjected to the predicted impacts with potential consequences for interpretation of population level effects for EIA for kittiwake, guillemot and puffin. Natural England have advised the Applicant of this issue and are awaiting a response on the matter. It has not been addressed by the Applicant at Deadline 6 and we are therefore unable to comment on the BDMPS PVA outputs for these species. This severely limits our assessment of the potential effects of the predicted impacts on the relevant BDMPS populations.
- There appear to be summing errors in Table 51 (cumulative kittiwake collision estimates) of REP6-029, where the Applicant appears to have not adjusted for their own values for Hornsea 3. We have calculated the NE total for consented projects should be 3,979 and for all projects 4,014.

EIA and HRA issues

- Natural England identified that the densities used for Collision Risk Modelling (CRM) for northern gannet (gannet hereafter) *Morus bassanus* and kittiwake in G5.2 Ornithology EIA and HRA Annex (tracked) did not align with those presented in G5.9 Revised Ornithological Baseline (tracked). However, following communication with the Applicant it was confirmed there was a 'copy paste' issue and that the correct densities had been used for CRM for the central values. The standard deviations used to describe the variation around the density estimates within the stochastic CRM were however, found to be incorrect. The Applicant submitted a revised Ornithology EIA and HRA Annex [G5.25] at Deadline 6 which provided updated minimum and maximum collision risk estimates for gannet, kittiwake and great black-backed gull. Natural England have incorporated those revised values into this assessment.
- At Deadline 5a Natural England advised the Applicant of an issue relating to a newly identified problem with the NE/JNCC PVA tool that we advocate the use of [REP5a-029]. We identified that it would affect the Applicant's kittiwake PVA outputs for both EIA and HRA and provided suggested advice on measures to be taken to address the issue. The Applicant does not appear to have addressed this in their Deadline 6 submissions. This limits our ability to evaluate the potential effects of the predicted impacts on the relevant kittiwake populations, though we note it does not materially affect any of the conclusions drawn.
- We welcome that following consultation with NE, the Applicant has included consideration of macro-avoidance on gannet collision estimates for the project alone. However, we note that they have not applied corrections to cumulative or in-combination totals. Natural England have provided consideration of an indicative macro-avoidance correction applied across cumulative and in-combination CRM totals when forming our position.
- Based on the information provided up to and including Deadline 6, Natural England consider that we can provide our detailed EIA advice and HRA integrity judgements for the project alone, and cumulatively/in-combination. These positions may be subject to change following any modifications to the numbers provided by the Applicant.

HRA only issues

- The Applicant has provided updated adult apportioning values for gannet and kittiwake following Natural England's request and using additional data from the wider survey area. Natural England welcome this but have found that all months have been included in the calculations of the fractions of adults, or adult-type birds, rather than just the Natural England defined seasons. We have used the data they have provided to refine these estimates to the breeding season alone for gannet (87.2%) and kittiwake (96.8%) and have used these for apportioning within this assessment.
- The Applicant has incorrectly applied their preferred breeding season apportioning rate, rather than NE's advised values, to puffin in the NE approach presented in Table 105 of G5.2 Ornithology EIA and HRA Annex (tracked). Natural England have adjusted these values accordingly within this assessment.
- We note there are summing errors in Table 110 gannet in-combination estimates (Ornithology EIA and HRA Annex (tracked) [G5.25]) where the Applicant appears to have not adjusted for their own values for Hornsea Three. We have calculated that the NE total for consented projects should be 8,735 and for all projects 9,176.

As detailed above, where possible, Natural England have looked to address these issues within this assessment. The main outstanding issues are the PVA undertaken for EIA for

kittiwake, guillemot and puffin using the Applicant's BDMPS values which we do not agree with, and for kittiwake for HRA where there is a known issue with the standard deviations used. We therefore note that the estimates and positions presented in this document may be subject to revision following further analysis by Natural England or feedback from the Applicant prior to Deadline 8.

Natural England have also noted that the Applicant has included breeding season apportioning of impacts to FFC SPA for guillemot and razorbill from Hornsea Three. Our current position is that, given the distance from this project to the FFC SPA, and considering the mean-maximum +1SD foraging ranges of these species (Woodward et al. 2019), Hornsea Three is unlikely to be connected to FFC SPA in the breeding season. We have not currently recalculated the impacts excluding these Hornsea Three breeding season totals, but suggest that this would reduce the total in-combination impacts for these species considerably.

Approach to interpretation of predicted impacts based on PVA

Natural England advised that where there is a change of greater than 1% in the baseline mortality threshold of a relevant reference population, further investigation of the potential impacts should be carried out. This generally requires the use of PVA to assess how the predicted impacts of the development may influence the population relative to an unimpacted scenario. Cook & Robinson (2016) recommend using both the counterfactual of population growth rate (CPG) and the counterfactual of population size (CPS) metrics. Similarly, a further review by Jital et al. (2017), commissioned by Marine Scotland Science, also reinforce the utility of both metrics. Natural England therefore recommends that assessments should focus on the CPG and CPS metrics to quantify the relative changes in a population in response to anthropogenic impacts, as these are the two metrics that have been shown to be the least sensitive metrics to misspecification of the population trend and demographic rates used in the PVA model. However, **despite repeated requests from Natural England and the RSPB, the Applicant continues to only supply the CPG metric because of their assertion that it is inappropriate to base an assessment on CPS metrics**.

Natural England advises that a range of site, and project specific factors need to be considered when making integrity judgements. Population metrics need to be considered with reference to the site trend, population status and SPA conservation objectives for HRA, or to the relevant reference population trend and conservation status of the species for EIA. As it is not known what the growth rate of a specific feature of a colony will be over the next 35 years (lifespan of the project), this uncertainty should be considered when judging the significance of predicted impacts against the conservation objectives for the feature.

In interpreting the metrics from a PVA, the CPG and CPS metrics at the end of the impact (e.g. after 35 years) should be considered against a realistic assessment of the current and potential future population trend. Where a specific feature of a designated site has a conservation objective to restore the population size to a given level, as is the case for kittiwakes at FFC SPA, reductions in population growth rates and population size because of additional anthropogenic impacts may be counter to such conservation objectives. Whereas, if a specific feature has a conservation objective to maintain the population size at or above a given level, as is the case for gannet, guillemot and razorbill at the FFC SPA, then consideration will need to be given to a range of plausible growth rates for the colony and whether the PVA metrics suggest that the population will be maintained at or be able to grow above the current population size over the lifetime of the predicted additional impact.

Avian Influenza epidemic

The scale of the impact of the ongoing avian influenza epidemic on North Sea populations are presently unknown, though for some species populations there are likely to be significant reductions at a biogeographic level. This means that there is considerable uncertainty regarding the likely population sizes and trends in the future. This has made consideration of EIA-scale impacts challenging, though we have used best available evidence and used the broad approach adopted during the Norfolk Vanguard, Norfolk Boreas and East Anglia One North and Two projects.

Summary of Natural England's position based on our advised approach to the assessments

The following tables represent Natural England's current position on the potential for significant adverse impacts (Table 1) and AEoI (Table 2) for the project alone, cumulatively (EIA) or in-combination (HRA) with other plans and projects at Deadline 7. These tables should be considered in relation to the information provided above and in Appendix A (Detailed comments and conclusions on project alone and cumulative impacts for EIA) and Appendix B (Detailed comments and conclusions on project alone and in-combination impacts for HRA) below.

Table 1: Summary of EIA conclusions for assessments of project alone or cumulative impacts of Hornsea Project Four with other plans and projects. Findings based on information derived from EIA & HRA Annex [G5.25] and Ornithological Assessment Sensitivity Report [G4.7] presented within this document.

HRA Species & Site	Hornsea Project Four alone	Hornsea Project Four cumulatively with consented OWF projects	Hornsea Project Four cumulatively with consented OWF projects, SEP & DEP and Rampion 2
Gannet: collision + displacement	No significant adverse impact	Unable to rule out significant adverse impact	Unable to rule out significant adverse impact
Kittiwake: collision	No significant adverse impact	Unable to rule out significant adverse impact	Unable to rule out significant adverse impact
Guillemot: displacement	No significant adverse impact	Unable to rule out significant adverse impact	Unable to rule out significant adverse impact
Razorbill: displacement	No significant adverse impact	Unable to rule out significant adverse impact	Unable to rule out significant adverse impact
Puffin: displacement	No significant adverse impact	No significant adverse impact	Unable to rule out significant adverse impact
Great black-backed gull: collision	No significant adverse impact	Unable to rule out significant adverse impact	Unable to rule out significant adverse impact
Lesser black-backed gull: collision	No significant adverse impact	No significant adverse impact	Unable to rule out significant adverse impact
Herring gull: collision	No significant adverse impact	No significant adverse impact	Unable to rule out significant adverse impact

Table 2: Summary of HRA conclusions for assessments of project alone or in-combination impacts of Hornsea Project Four with other plans and projects.

HRA Species & Site	Hornsea Project Four alone	Hornsea Project Four in-combination with other consented OWF projects	Hornsea Project Four in-combination with consented OWF projects, SEP & DEP and Rampion 2
Gannet, Flamborough & Filey Coast SPA: collision + displacement	No AEoI	No AEoI	Unable to rule out AEoI
Kittiwake, Flamborough & Filey Coast SPA: collision	No AEoI	Unable to rule out AEoI	Unable to rule out AEoI
Guillemot, Flamborough & Filey Coast SPA: displacement	Unable to rule out AEoI	Unable to rule out AEoI	Unable to rule out AEoI
Razorbill, Flamborough & Filey Coast SPA: displacement	No AEoI	Unable to rule out AEoI	Unable to rule out AEoI
Breeding seabird assemblage, Flamborough & Filey Coast SPA	Unable to rule out AEoI	Unable to rule out AEoI	Unable to rule out AEoI
Red-throated diver, Greater Wash SPA: displacement (cable construction and O&M vessel movements)	No AEoI	No AEoI	Unable to rule out AEoI due to inclusion of SEP&DEP.
Common scoter, Greater Wash SPA: displacement	No AEoI	No AEoI	Unable to rule out AEoI due to inclusion of SEP&DEP.

Appendix A: Detailed comments and conclusions on project alone and cumulative impacts for EIA

This document is a technical document submitted into the Hornsea Project Four Examination to provide scientific justification for Natural England's advice provided on the significance of the potential for project alone and cumulative impacts at the Environmental Impact Assessment (EIA) scale. Our advice is based on best available evidence at the time of writing and is subject to change in the future should further evidence be presented.

Methods

For Natural England's displacement approach, we provide values as a range of displacement and mortality rates bounded by the upper and lower ranges for each species. For gannet this range is defined as 60% displacement and 1% mortality to 80% displacement and 10% mortality. For the auks, this is defined as 30% displacement and 1% mortality to 70% displacement and 10% mortality. For collision risk modelling impacts, we consider the range presented by the Applicant for the project alone based on the Natural England Approach and use the central value for the cumulative assessments.

We refer the reader to the 'Outstanding issues and implications' section in the Executive Summary that provides a summary of the outstanding issues that Natural England have identified with the Applicant's assessment and how they have been addressed within this assessment.

Collision impacts are provided for gannet excluding and including an indicative macro-avoidance rate of 70% (a central value between 60% and 80%), pending the outcomes of a Natural England commissioned project. Natural England have also included consideration of macro-avoidance within the cumulative total by considering a 70% macro-avoidance for collision risk. This was simply applied to estimates by multiplying the total collisions by 0.3 (70% macro-avoidance). Again, we consider this is only indicative of the potential changes in collision mortality estimates pending the finalisation of a Natural England commissioned report on the subject.

Two scenarios are also considered for guillemot for reference: Natural England bespoke approach (three seasons) and for illustrative purposes the SNCB standard approach (two seasons), the former being Natural England's advised option.

Summary of predicted impacts presented at Deadline 5a

Table A1 provides a summary of Natural England's current interpretation of the predicted impacts on key seabird species of conservation concern associated with Hornsea Four alone, cumulatively with consented projects and cumulatively including additional projects in the planning system for which a Preliminary Environmental Information Report is available (Sheringham Shoal and Dudgeon Extension Projects and Rampion 2). These values have been extracted, or re-calculated, from the Applicants G5.25 Ornithology EIA and HRA Annex (tracked). A breakdown of impacts at the biogeographic and BDMPS scale is provided in Table A1 which also serves to identify where a potential impact would lead to an increase in the relevant population baseline mortality rate of 1%.

The subsequent sections examine the potential for significant adverse effects for each key species, based on conservation status, ecology and sources of uncertainty. We provide a statement on Natural England's current position, given the available evidence, for each species.

Table A1. Summary of predicted operational impacts at biogeographic and Biologically Defined Minimum Population Scales and percentage of baseline mortality rates (based on the integrated age class mortality rates derived by the Applicant in their Environmental Statement A2.5). Impacts are provided for the Natural England approach to collision, displacement and combined assessments for relevant species. Cumulative estimates are based on the Applicant's numbers presented in G5.25 Ornithology EIA and HRA Annex (tracked) provided at Deadline 6, with the exception of the changes detailed in the 'Outstanding issues and implications' section in the main document. Values are also provided for impacts under different Macro-Avoidance (MA) rates for gannet and using different approaches to the assessment of displacement for guillemot. Impacts that would result in an increase in baseline mortality of >1% are highlighted in shaded cells.

Species	Assessment	Predicted impacts			Reference population		% Increase baseline mortality biogeographic			% Increase baseline mortality BDMPS		
		Project alone	Cumulative		Biogeographic popn. ind. (Furness 2015)	Largest BDMPS popn. ind. (Furness 2015)	Project alone	Cumulative		Project alone	Cumulative	
			Consented	All projects				Consented	All projects		Consented	All projects
NATURAL ENGLAND												
Gannet	Collision excl. MA	22 (3-125)	2,966	2,992	1,180,000	456,298	0.01 (0.00-0.06)	1.34	1.36	0.03 (0.00-0.15)	3.48	3.51
	Collision incl. MA @70%	7 (1-37)	890	897			0.00 (0.00-0.02)	0.40	0.41	0.01 (0.00-0.04)	1.04	1.05
	Displacement	13-173	289-3847	296-3952			0.01-0.08	0.13-1.74	0.13-1.79	0.02-0.20	0.34-4.51	0.35-4.63
	Combined excl. MA	16-298	3,254-6,813	3,288-6,943			0.01-0.14	1.47-3.09	1.49-3.15	0.02-0.35	3.81-7.98	3.85-8.14
	Combined incl. MA @70%	14-211	1,178-4,737	1,194-4,849			0.01-0.10	0.53-2.15	0.54-2.20	0.02-0.25	1.38-5.55	1.40-5.68
Kittiwake	NE Collision	93 (26-205)	3,979	4,010	5,100,000	839,456	0.01 (0.00-0.03)	0.50	0.50	0.07 (0.02-0.16)	3.04	3.06
Guillemot	Displacement NE bespoke	190-4,432	1,214-28,336	1,291-30,118	4,125,000	2,045,078	0.03-0.78	0.21-4.98	0.23-5.29	0.07-1.57	0.43-10.04	0.46-10.67
	Displacement SNCB standard	139-3,244	1,164-27149	1,240-28,931			0.02-0.57	0.20-4.77	0.22-5.08	0.05-1.15	0.41-9.62	0.44-10.25
Razorbill	Displacement	17-392	388-9,061	416-9,702	1,707,000	591,874	0.01-0.12	0.12-2.75	0.13-2.95	0.01-0.34	0.34-7.93	0.36-8.49
Puffin	Displacement	2-45	135-3,159	135-3,161	11,840,000	868,689	0.00-0.00	0.01-0.15	0.01-0.15	0.00-0.03	0.09-2.08	0.09-2.08
Great black-backed gull	Collision	10 (2-50)	974	986	235,000	91,399	0.03 (0.01-0.13)	2.59	2.62	0.07 (0.02-0.34)	6.66	6.74
Lesser black-backed gull*	Collision	1 (0-2)	531	533	864,000	209,007	0.00 (0.00-0.00)	0.53	0.54	0.00 (0.00-0.01)	2.21	2.22
Herring gull*	Collision	2 (0-5)	765	766	1,098,000	466,511	0.00 (0.00-0.00)	0.42	0.42	0.00 (0.00-0.01)	0.99	0.99

* Herring gull and lesser-black backed gull estimates are based upon the original collision risk estimates (Band Option 2) presented in Volume A5, Annex 5.3: Offshore Ornithology Collision Risk Modelling [A5.5.3].

Potential for significant adverse impacts on key species of conservation concern

Background information

For reference, Table A2 provides a summary of the current conservation status of the key seabird species taken through EIA. Additional considerations that are specific to HRA, namely factors affecting apportioning, are outlined in Annex I of our Deadline 6 response to G4.7 Ornithological Assessment Sensitivity Report [REP6-059]. Within the following sections, we discuss the potential for significant adverse effects arising from Hornsea Four alone, cumulatively with other consented projects or cumulatively with consented projects, SEP & DEP and Rampion 2 where applicable.

Table A2. Summary of the IUCN global conservation status (BirdLife International 2021), IUCN2 conservation status in Great Britain (Stanbury et al. 2021) and recent UK population trends (JNCC 2021) for species considered of key relevance to the EIA level assessment.

Species	Conservation status BoCC5	Conservation status IUCN and IUCN2	Recent UK population trend SB2000-2019 (JNCC 2021*)
Northern gannet	Amber	Globally and Great Britain - Least concern	34
Black-legged kittiwake	Red	*Globally - Vulnerable *Great Britain - Critically endangered	-29
Common guillemot	Amber	Globally and Great Britain - Least concern	60
Razorbill	Amber	Globally and Great Britain - Least concern	37
Atlantic puffin	Red	*Globally - vulnerable *Great Britain - Least concern	n/a
Great black-backed gull	Amber	* Globally – Least concern * Great Britain - Endangered	-23
Lesser black-backed gull	Amber	* Globally - Least concern, * Great Britain - Data deficient	n/a
Herring gull	Red	* Globally – Least concern * Great Britain - Endangered	n/a

*SMP Report 1986–2019 | JNCC - Adviser to Government on Nature Conservation

Gannet project alone and cumulative combined collision and displacement impacts

Background

The EIA assessment for gannet has been based on the revised baseline characterisation data presented by the Applicant in Revised Ornithology Baseline (tracked) [G5.9] and, unless specified, outcomes of the assessments reported in Ornithology EIA and HRA Annex (tracked) [G5.25]. We note that the Applicant has provided updated collision estimates within the latter document and we have been assured that these values are correct.

Natural England broadly agree (excepting slight rounding errors) with the cumulative totals presented by the Applicant.

Predicted Impacts

Based on Natural England advice, the combined collision and displacement estimates (Table A1), with or without the 70% reduction in collision estimates associated with potential macro-avoidance, had the potential to exceed the 1% change in baseline mortality threshold for either the biogeographic or BDMPS population based on the cumulative impacts. This was irrespective of whether SEP & DEP and Rampion 2 were included. The predicted project alone impacts do not exceed the threshold. We note that the Applicant's approach results in cumulative estimates which do not exceed the threshold for the biogeographic population when macro-avoidance is factored in, but do for the BDMPS population. Thus, the potential for significant cumulative adverse effects should be investigated. We agree with the PVA undertaken for gannet in Ornithological Assessment Sensitivity Report [G4.7] and have used the Counterfactuals of Population Growth (CPG) rates provided by the Applicant. These provide the best available evidence on which to base the assessment, though this should not be taken as an endorsement or 'acceptance' of the model outputs. **We note the Applicant refuses to provide the Counterfactuals of Final Population Size metrics for all PVA**.

Based on the range of predicted impacts provided in Tables A3 and A4 (applying macro-avoidance at 70% and considering a best-case scenario of 60% displacement and 1% mortality and a worst-case scenario of 80% displacement and 10% mortality) we conclude the following when examining the range in predicted impacts and potential changes in population growth rates:

Project alone

- No predicted impacts exceed the 1% increase in baseline mortality threshold and the associated reductions in growth rate (<0.03%) are unlikely to affect the population at either biogeographic or BDMPS level.

Cumulative (consented)

- A wide range of impacts have been considered between 3,000 and 5,000 additional mortalities per annum when macro-avoidance is factored in. This would result in a 0.3-0.5% reduction in colony growth rate per annum based on the biogeographic population and 0.86-1.30% reduction in growth rate based on the BDMPS population.
- Only at an estimated impact of around 5,000 additional mortalities (factoring macro-avoidance), is the population predicted to decline over the lifespan of the wind farm for a BDMPS population growth rate scenario of around 1% per annum. The biogeographic population is not predicted to decline over the life of the project given the same impact for a growth rate scenario of >1%.

Cumulative (consented + SEP & DEP and Rampion 2)

- The same range of potential impacts has been considered as for the cumulative consented projects above and therefore we reach the same conclusions when SEP & DEP and Rampion 2 are included in the totals.

Table A3. Predicted combined collision and displacement impacts on the gannet biogeographic population for the range of revised mortality impacts in Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and cumulative impacts, with and without correction for macro-avoidance. Counterfactuals of growth rate have been derived from the nearest representative values from the range of impacts considered by the Applicant within their Ornithological Assessment Sensitivity Report [G4.7]. Counterfactuals of final population size have not been supplied. Shaded cells are those where the reduction in growth rate could exceed 0.5%.

Gannet: Biogeographic						
Assessment description	**Additional mortality**	**% Baseline mortality using biogeographic population***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
Project alone, no macro-avoidance	16-298	0.01-0.14	15-125**	1.00-1.00	0.00-0.01%	
Project alone, 70% macro-avoidance	14-211	0.01-0.10	15-125**	1.00-1.00	0.00-0.01%	
Consented projects, no macro-avoidance	3,254-6,813	1.47-3.09	3,300-7,000	0.997	0.33%	
Consented projects, 70% macro-avoidance	1,178-4,737	0.53-2.15	3,000-5,000	0.997-0.995	0.30-0.50%	
Consented + SEP & DEP and Rampion 2, no macro-avoidance	3,288-6,943	1.49-3.15	3,300-7,000	0.997	0.33%	
Consented + SEP & DEP and Rampion 2, 70% macro-avoidance	1,194-4,849	0.54-2.20	3,000-5,000	0.997-0.995	0.30-0.50%	

* 1,180,000 total population (Furness 2015)

** next available increment is 3,000 additional mortalities.

Table A4. Predicted combined collision and displacement impacts on the gannet BDMPS population for the range of revised mortality impacts in Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and cumulative impacts, with and without correction for macro-avoidance. Counterfactuals of growth rate have been derived from the nearest representative values from the range of impacts considered by the Applicant within their Ornithological Assessment Sensitivity Report [G4.7]. Counterfactuals of final population size have not been supplied. Shaded cells are those where the reduction in growth rate could exceed 0.5%.

Gannet: BDMPS						
Assessment description	**Additional mortality**	**% Baseline mortality using largest BDMPS population***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
Project alone, no macro-avoidance	16-298	0.02-0.35	15-125**	1.00-1.00	0.00-0.03%	
Project alone, 70% macro-avoidance	14-211	0.02-0.25	15-125**	1.00-1.00	0.00-0.03%	

Consented projects, no macro-avoidance	3,254-6,813	1.47-3.09	3,300-7,000	0.991-0.982	0.86-1.82%	
Consented projects, 70% macro-avoidance	1,178-4,737	0.53-2.15	3,000-5,000	0.991-0.987	0.86-1.30%	
Consented + SEP & DEP and Rampion 2, no macro-avoidance	3,288-6,943	1.49-3.15	3,300-7,000	0.991-0.982	0.86-1.82%	
Consented + SEP & DEP and Rampion 2, 70% macro-avoidance	1,194-4,849	0.54-2.20	3,000-5,000	0.991-0.987	0.86-1.30%	

* 456,298 total population (Furness 2015)

** next available increment is 3,000 additional mortalities.

We consider the addition of 5,000 additional mortalities (factoring macro-avoidance) to be a worst-case scenario here and gannet displacement impacts, combined with the central collision estimates, are likely to be toward the lower end of the matrix considered. Using a displacement rate of 70% and a mortality rate of 1% as illustrative, this would result in a predicted cumulative total for consented projects based on Natural England advice of around 1,225 additional mortalities, including correction for macro-avoidance at 70%. This would result in a 1.44% increase in the baseline mortality rate of the BDMPS population. Extrapolating between PVA outputs for the impact scenarios visited (i.e. a linear regression (r^2=1) applied to the impacts and predicted reductions in growth rate reported by the Applicant) this would result in a reduction in BDMPS population growth rate of around 0.4% per annum and would be unlikely to cause a decline in the population for a growth scenario of 1% per annum or above.

Conservation Status

The northern gannet is classified as 'Least Concern' with respect to the potential for global extinction (BirdLife International 2021). However, at the UK scale the species is Amber listed in Birds of Conservation Concern (BoCC) 5 (Stanbury et al. 2021) due to localisation of breeding populations within Important Bird Areas/SPAs and international importance of UK population. It has been estimated that the UK holds 55.6% of the global population (JNCC 2021).

The UK gannet population has risen by 34% between surveys carried out in 1969/70 and in 2013-15 during the latest census for which data is available (JNCC 2021). This increase is generally attributed to the cessation of hunting and persecution dating from the end of the 19th century (Nelson 1978).

Based on current UK gannet population growth rates of around 2-3% per annum and using the PVA model outputs, then the level of additional cumulative mortality from collisions from the offshore wind farms would still allow the population to grow. However, it unclear whether this continued growth is sustainable for the next 35 years (lifespan of the project) and UK breeding productivity has shown a declining trend over the last decade or so (JNCC Seabird Monitoring Programme 'SMP' data, see: Northern gannet (Morus bassanus) | JNCC - Adviser to Government on Nature Conservation). All these aspects should be considered when judging whether a reduction in population growth rate of around 0.4% would be significant.

Future Pressures

The North Sea is likely to be significantly modified by anthropogenic impacts in the coming decades, most notably warming of sea temperatures due to climate change and the associated shifts in gannet prey distribution and availability. Furthermore, the delivery of

fisheries management changes, such as the ending of 'discarding' practices, may also affect gannet, this species being known to take advantage of discarded fish (Le Bot et al. 2018). It may also be that habitat becomes a limiting factor for breeding birds, though it has been suggested that when colonies reach capacity, they may begin to recolonise historic sites (Nelson 1978). Gannet is considered an adaptable species with a large foraging range, however these combined factors have significant potential to affect gannet productivity and survival and therefore the potential for population growth.

We also note that gannetries have been significantly impacted by avian influenza, with mass mortalities reported at large colonies such at Hermaness and Noss in Shetland, and Bass Rock in the Firth of Forth.

EIA conclusions

In this context, and given the uncertainty around the level of cumulative collisions and their influence on the population, it is plausible that the UK gannet population may well not continue to grow at current rates. Natural England considers it is likely that the level of predicted cumulative impact would not be significant for a population growing at 2-3% per annum. However, if the population does not grow at that level for the next 35 years (say if the growth rate was around 1% per annum), we consider that it is uncertain whether a 0.4% reduction in growth rate would result in a significant effect.

Based on consideration of the PVA metrics as currently presented, the above conservation assessment, consideration of future growth of the population, potential for increased prevalence of Avian Influenza, and given the UK's particular responsibility for gannet because of supporting over half of the global population, we consider that the predicted impacts at the North Sea population scale have the potential to give rise to significant effects. Therefore, **Natural England remain unable to rule out a significant adverse impact on gannet from combined cumulative collision and displacement mortality at an EIA scale. This is irrespective of whether SEP & DEP and Rampion 2 are included in the cumulative totals or not.** However, we note that the incorporation of macro-avoidance rates results in a reduction of the predicted impacts and therefore the likely level of risk compared to previous OWF EIA impact assessments.

Kittiwake project alone and cumulative collision impacts

Background

The EIA assessment for kittiwake has been based on the revised baseline characterisation data presented by the Applicant in Revised Ornithology Baseline (tracked) [G5.9] and, unless specified, outcomes of the assessments reported in and Ornithology EIA and HRA Annex (tracked) [G5.25]. As with gannet, we note that the Applicant has assured Natural England that the new collision mortality estimates are now correct for kittiwake.

Natural England broadly agree (slight rounding errors) with the cumulative totals presented by the Applicant. However, we did discover what appears to be a summing error in Table 51 (cumulative kittiwake collision estimates) in Ornithology EIA and HRA Annex (tracked) [G5.2], where the Applicant appears to have not adjusted for their own values for Hornsea Three. We have used the corrected values within this assessment.

Natural England have noted that the Applicant has based their assessment on a BDMPS population estimate that was not agreed by Natural England. We have advised the Applicant on this matter [REP5a-029] and note that, within this document we have used the BDMPS populations currently advised by Natural England.

Predicted Impacts

Based on Natural England advice, the collision estimates (Table A1) only had the potential to exceed the 1% change in baseline mortality threshold for the BDMPS population based on the cumulative (consented or consented + SEP & DEP) impacts. The predicted project alone impacts do not exceed the BDMPS population threshold. Thus, the potential for significant adverse effects should be investigated in relation to cumulative impact. We note that the Applicant's approach results in the same interpretation of these data.

Natural England highlight that the Applicant's PVAs for kittiwake have also used a BDMPS population estimate that was not agreed with Natural England. Again, we have advised the Applicant on this matter and suggest PVAs should be rerun using our advised BDMPS values and associated impact values (change in adult survival rates for the relevant population). Furthermore, we note that the Applicant's PVA outputs for kittiwake in Ornithological Assessment Sensitivity Report [G4.7] are currently likely to produce erroneous outputs. This is a result of an issue with the NE/JNCC PVA tool that has recently been identified. This coding issue (bug) results in incorrect outputs where a standard deviation of 'exactly zero' is specified for the baseline vital rates. Natural England and the developers of the tool are working to rectify this issue as quickly as possible. We identified the issue was relevant to the Applicant's models and Natural England have advised them of this [REP5a-029]. However, this has not yet been addressed by the Applicant and we therefore cannot comment on the PVA results provided by the Applicant at this stage. This severely limits interpretation of the population level effects of the predicted impacts, and we anticipate we may need to review our position if updated PVAs are provided prior to Deadline 8.

Based on the predicted collision impacts provided in Table A5 and A6 we provide the following observations when examining the range of potential impacts and associated change in population growth rates:

Project alone

- The estimated additional 93 project alone mortalities resulting from collisions do not exceed the 1% increase in baseline mortality for the biogeographic or BDMPS populations.

- We cannot comment further on the potential for population level impacts due to a lack of confidence in the available PVA outputs.

Cumulative (consented excluding Rampion as it is outside the North Sea BDMPS for kittiwake)

- Nearly 4,000 additional kittiwake mortalities are now predicted cumulatively with other consented projects (3,979). This level of additional impact only exceeded the 1% increase in baseline mortality threshold for the BDMPS population.
- We cannot currently comment further on the potential for population level impacts due to a lack of confidence in the available PVA outputs.

Cumulative (consented + SEP & DEP)

- The cumulative impact estimate increases slightly to 4,010 when including SEP & DEP.
- We cannot currently comment further on the potential for population level impacts due to a lack of confidence in the available PVA outputs.

Table A5. Predicted Population impacts on the kittiwake biogeographic population for the range of revised mortality impacts in Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and cumulative collision impacts. Natural England do not agree the PVA modelling that has been undertaken by the Applicant and therefore do not present the results here. Note that for kittiwake it has been assumed that all projects from Hornsea Three onwards will fully compensate their associated impacts.

Kittiwake: Biogeographic						
Assessment description	**Additional mortality**	**% Baseline mortality using 2017 census data***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
Project alone	93 (26-205)	0.01 (0.00-0.03)	50-200			
Consented projects	3,979	0.50	4,000			
Consented + SEP & DEP	4,010	0.50	4,000			

*5,100,000 total population (Furness 2015)

Table A6. Predicted Population impacts on the kittiwake BDMPS population for the range of revised mortality impacts in Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and cumulative collision impacts. Natural England do not agree the PVA modelling that has been undertaken by the Applicant and therefore do not present the results here. Note that for kittiwake it has been assumed that all projects from Hornsea Three onwards will fully compensate their associated impacts.

Kittiwake: BDMPS						
Assessment description	**Additional mortality**	**% Baseline mortality using 2017 census data***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
Project alone	93 (26-205)	0.07 (0.02-0.16)	50-200			
Consented projects	3,979	3.07	4,000			
Consented + SEP & DEP	4,010	3.10	4,000			

*839,456 total population (Furness 2015)

Conservation Status

Kittiwake are listed as 'Vulnerable' to global extinction on the IUCN Red List (raised from 'Least Concern' to 'Vulnerable' in 2017) because of breeding population declines in Europe of >40% over 39 years (Birdlife International 2018). Stanbury et al. (2021) also include Kittiwake as a 'Critically endangered' species on the IUCN2 Regional Red List assessment of extinction risk for Great Britain. Kittiwake is also listed as Red on BoCC5 (Stanbury et al. 2021) because of severe population declines in the UK.

Different colonies have declined at different rates, with the more northerly colonies in Scotland suffering the greatest declines within the UK. Almost all the sites designated for breeding Kittiwake in Great Britain have Unfavourable conservation status. By contrast, urban colonies have shown significant increases in some instances.

Future Pressures

There is very strong evidence for links between prey availability and the success of Kittiwake. For example, following their review of JNCC breeding success in Britain and Ireland (1986-2006), Furness et al. (2013) suggest that, in 68% of the cases, food shortage was a likely cause of reduced breeding success. Carroll et al. (2017), provide evidence for kittiwake breeding success being strongly linked with prior sandeel fishing mortality in the southern North Sea, discussing the vital importance of these resources and potential sensitivity to climate change. The EU funded SEANSE project assessed the impact of climate change on key bird species (Rijkwaterstaat Zee & Delta 2020). The results suggested that changes in prey availability, due to climate change, is probably the largest pressure on kittiwake at the wider North Sea level. Furthermore, overwinter survival in kittiwake, at a time when adult mortality is already high, may also be affected by increasingly unpredictable and extreme weather conditions. There is also the potential for Avian Influenza to have a significant impact on large seabird colonies that adds an additional pressure. These combined pressures could continue to weaken the resilience of a population already in decline and any additional sources of mortality are expected to exacerbate this.

EIA Conclusions

Given the current limitations associated with the PVA outputs, Natural England cannot currently provide further detailed comment on the significance of the levels of additional mortality at the BDMPS scale (where the 1% threshold has been triggered for cumulative impacts). However, we note that within recent Examinations (Norfolk Boreas, Norfolk Vanguard, EA1N and EA2) the potential for significant cumulative effects at the North Sea population scale has been identified. **Therefore, we are unable to rule out a significant adverse impact on kittiwake from cumulative collision mortality at an EIA scale irrespective of whether SEP & DEP are included in the cumulative totals or not**. We do not anticipate updated PVA models are likely to alter this position. However, Natural England will endeavour to reassess the available information if new model outputs are presented prior to Deadline 8.

Guillemot project alone and cumulative displacement impacts

Background

Revised baseline characterisation data has been used for the EIA assessment (Revised Ornithology Baseline (tracked) [G5.9]) and the impact estimates presented in Ornithology EIA and HRA Annex (tracked) [G5.25] have been used unless specified. However, Natural England note that the Applicant has only applied the standard season (breeding and non-breeding) for the Natural England approach to EIA. Natural England have instead led with our bespoke approach to assessing guillemot displacement based on the inclusion of a chick rearing/breeding season (August-September) for the Hornsea Four assessment alone. We present results based on the standard SNCB Natural England approach for comparison.

As with kittiwake above, Natural England found that the Applicant has based their assessment on a BDMPS population estimate that was not agreed with us. We have provided further advice on this matter to the Applicant [REP5a-029] and note that within this document we have used the BDMPS populations currently advised by ourselves. However, this issue also affects the PVA outputs because we do not agree the starting population used by the Applicant. We have informed the Applicant of our concerns in this regard and have suggested the PVAs should be rerun using our advised BDMPS values. We will review our position when/if updated PVAs are provided prior to Deadline 8.

Predicted Impacts

The predicted project alone impacts did not exceed a 1% increase in baseline mortality for both the biogeographic or BDMPS populations (Table A1). However, the predicted cumulative impacts do have the potential to exceed a 1% increase at both population scales using either the standard or bespoke Natural England approaches to displacement. Thus, the effects of these impacts require further investigation.

Based on the predicted displacement impacts provided in Table A7 and A8 we provide the following observations when examining the range of potential impacts and associated change in population growth rates:

Project alone

- Using Natural England's bespoke advice, the project alone impacts would range between 190-4,432 (at 30% displacement & 1% mortality and 70% displacement & 10% mortality). This would only exceed the 1% change in baseline mortality threshold for the BDMPS population toward the top end of the range.
- Based on the standard SNCB displacement assessment approach, the same conclusions apply.
- We cannot comment further on the potential for population level impacts as we currently do not agree with the PVA carried out by the Applicant.

Cumulative (consented)

- Using Natural England's bespoke advice for Hornsea project Four, the cumulative (consented) impacts would range between 1,214-28,336 (at 30% displacement & 1% mortality and 70% displacement & 10% mortality). This has the potential to exceed the 1% change in baseline mortality threshold for both the biogeographic and BDMPS populations. We note that if a displacement rate of 70% and mortality rate of 5% were applied to the Hornsea Project Four data (given the sensitivity of the site) and 70% and 2% for all other consented projects, the combined impact

would be 6,997 (1.23% and 2.48% increase in baseline mortality of the biogeographic and BDMPS populations respectively).

- Based on the standard SNCB Natural England approach, the cumulative (consented) impacts would range between 1,164-27,149 (at 30% displacement & 1% mortality and 70% displacement & 10% mortality). This has the potential to exceed the 1% change in baseline mortality threshold for both the biogeographic and BDMPS populations. If a displacement rate of 70% and mortality rate of 5% were applied to the Hornsea Project Four data (given the sensitivity of the site) and 70% and 2% for all other consented projects, the combined impact would be 6,403 (1.12% and 2.27% increase in baseline mortality of the biogeographic and BDMPS populations respectively).
- We cannot comment further on the potential for population level impacts as we do not agree with the PVA carried out by the Applicant.

Cumulative (consented + SEP & DEP and Rampion 2)

- Using Natural England's bespoke advice, the cumulative totals including SEP & DEP and Rampion 2 were predicted to be 1,291-30,118 (at 30% displacement & 1% mortality and 70% displacement & 10% mortality). This has the potential to exceed the 1% change in baseline mortality threshold for both the biogeographic and BDMPS populations. If a displacement rate of 70% and mortality rate of 5% were applied to the Hornsea Project Four data (given the sensitivity of the site) and 70% and 2% for all other consented projects, the combined impact would be 7,353 (1.29% and 2.61% increase in baseline mortality of the biogeographic and BDMPS populations respectively).
- Based on the standard SNCB displacement assessment approach, the cumulative totals including SEP & DEP and Rampion 2 were predicted to be 1,291-30,118 (at 30% displacement & 1% mortality and 70% displacement & 10% mortality). This has the potential to exceed the 1% change in baseline mortality threshold for both the biogeographic and BDMPS populations. We note that if a displacement rate of 70% and mortality rate of 5% were applied to the Hornsea Project Four data (given the sensitivity of the site) and 70% and 2% for all other consented projects, the combined impact would be 6,759 (1.19% and 2.39% increase in baseline mortality of the biogeographic and BDMPS populations respectively).
- We cannot comment further on the potential for population level impacts due to a disagreement with the starting populations used by the Applicant.

Table A7. Predicted Population impacts on the guillemot biogeographic population for the range of revised mortality impacts in Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and cumulative displacement impacts. The range of displacement impacts represents the lower (30% displacement and 1% mortality) and upper (70% displacement and 10% mortality) bounds of our advice. Both the standard SNCB guillemot assessment method and the approach following our advice for Hornsea Project Four (introduction of a third season) are provided for comparison. Natural England do not agree the PVA modelling that has been undertaken by the Applicant and therefore do not present the results here.

Guillemot: Biogeographic						
Assessment description	**Additional mortality**	**% Baseline mortality using biogeographic population***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
NE bespoke: Project alone	190-4,432	0.03-0.78	200-4,500			
NE bespoke: Consented projects	1,214-28,336	0.21-4.98	1,000-30,000			
NE bespoke: Consented + SEP & DEP and Rampion 2	1,291-30,118	0.23-5.29	1,000-30,000			
Standard SNCB: Project alone	139-3,244	0.02-0.57	150-3,000			
Standard SNCB: Consented projects	1,164-27,149	0.20-4.77	1,000-30,000			
Standard SNCB: Consented + SEP & DEP and Rampion 2	1,240-28,931	0.22-5.08	1,000-30,000			

*4,125,000 total population (Furness 2015)

Table A8. Predicted Population impacts on the guillemot BDMPS population for the range of revised mortality impacts in Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and cumulative displacement impacts. The range of displacement impacts represents the lower (30% displacement and 1% mortality) and upper (70% displacement and 10% mortality) bounds of our advice. Both the standard guillemot assessment method and the approach following our advice for Hornsea Project Four (introduction of a third season) are provided for comparison. Natural England do not agree the PVA modelling that has been undertaken by the Applicant and therefore do not present the results here.

Guillemot: BDMPS						
Assessment description	**Additional mortality**	**% Baseline mortality using largest BDMPS population***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
NE bespoke: Project alone	190-4,432	0.07-1.57	200-4,500			
NE bespoke: Consented projects	1,214-28,336	0.43-10.04	1,000-30,000			
NE bespoke: Consented + SEP & DEP and Rampion 2	1,291-30,118	0.46-10.67	1,000-30,000			
Standard SNCB:	139-3,244	0.05-1.15	150-3,000			

Project alone						
Standard SNCB: Consented projects	1,164-27,149	0.41-9.62	1,000-30,000			
Standard SNCB: Consented + SEP & DEP and Rampion 2	1,240-28,931	0.44-10.25	1,000-30,000			

*2,045,078 total population (Furness 2015)

Conservation Status

Guillemot are listed as 'Least concern' on the IUCN Red List (Birdlife International 2021). However, it is listed as Amber on BoCC 5 (Stanbury et al. 2021) due to:

- Localisation of breeding population within Important Bird Areas (IBAs)/Special Protection Areas (SPAs) – more than 50% of the UK population found at ten or fewer sites (SPAs/IBAs) in the breeding season (Stanbury et al. 2021).
- International importance of UK population – threshold of 20% of European population (Stanbury et al. 2021)

Guillemots are one of the most commonly encountered seabirds in UK waters, with an estimated population of around 1,41 million individuals; representing some 13% of the world population (Mitchell et al. 2004). The most recent data 2000-2019, although based on a limited dataset, suggests the UK guillemot population may have increased by around 60% (JNCC 2021), though many of the Scottish colonies have experienced significant declines in recent years. Changes in sandeel abundance, and the need for individuals to switch to lower quality prey resources, have been suggested to be a key driver of observed productivity trends which in turn is likely to be affected by commercial fisheries and climate change (Rindorf et al. 2000).

Future Pressures

As noted above, prey availability is likely to be a significant driver in the future. Extreme weather could also impact breeding birds on nests, during moult or over winter when adult mortality is already highest. Wrecks (large numbers of birds on the shore) of auks, generally in the autumn and winter, have been recorded which suggest weather, possibly inhibiting feeding, or a lack of prey, are responsible for starvation. Extreme weather conditions are forecast to become more frequent and, if occurring regularly year-on-year, breeding populations are likely to suffer. The potential impacts of an increasing prevalence of Avian Influenza may also continue to add to the pressures facing guillemot along with mortality from commercial fisheries as bycatch.

There is obviously uncertainty in relation to how birds will respond to individual offshore wind farm projects, and how other pressures will affect the populations over the next 35 years or so. However, pressures relating to offshore wind development and climate change on habitat, prey availability and individual survival, are likely to continue to increase in the foreseeable future.

EIA Conclusions

Even at lower displacement and mortality rates of 50% and 2% respectively, and regardless of whether the standard SNCB or bespoke Natural England approach is adopted (or whether SEP & DEP and Rampion 2 were included), a 1% increase in baseline mortality threshold for the BDMPS population would be exceeded by the cumulative (consented) impacts. Whilst we are currently unable to provide comment on PVA results, and thus contextualise what this might mean for the population, we note that this level of impact could have significant effects

at the North Sea scale. Should new PVA outputs become available Natural England would reassess this position prior to Deadline 8.

Therefore, we advise a significant adverse impact to guillemot from cumulative displacement cannot be ruled out at an EIA scale irrespective of whether SEP & DEP and Rampion 2 are included in the cumulative totals or not. Please note that this also follows advice we have previously provided to OWF submissions such as Norfolk Vanguard, Norfolk Boreas, East Anglia 1N and East Anglia 2.

Razorbill project alone and cumulative displacement impacts

Background

Revised baseline characterisation data has been used for the EIA assessment (Revised Ornithology Baseline (tracked) [G5.9]) and the impact estimates presented in Ornithology EIA and HRA Annex (tracked) [G5.25] have been used unless specified. Natural England agree these values and the cumulative values presented by the Applicant. The Applicant has provided the assessment in line with Natural England advice and have also provided their preferred approach to the assessment.

Predicted Impacts

The predicted project alone impacts did not exceed a 1% increase in baseline mortality for both the biogeographic or BDMPS populations (Table A1). However, the predicted cumulative impacts did have the potential to exceed a 1% increase at both population scales. Therefore, the effects of these impacts warrant further investigation.

PVA undertaken by the Applicant for razorbill has been carried out following Natural England advice (Ornithological Assessment Sensitivity Report [G4.7]). We consider the outputs of these models to provide the best available evidence on which to base the assessment, though this should not be taken as an endorsement or 'acceptance' of the model outputs. Again, we note the Applicant refuses to provide the Counterfactuals of Final Population Size metrics for all PVA).

Based on the predicted displacement impacts provided in Table A9 and A10 we provide the following observations when examining the range of potential impacts and associated change in population growth rates:

Project alone

- Between 17 and 392 additional razorbill mortalities per annum were estimated for the project alone using the Natural England approach (displacement and mortality rate range of 30% and 1% to 70% and 10%. At this level of impact, the 1% increase in baseline mortality threshold was not exceeded.

Cumulative (consented)

- Including consented projects, the predicted cumulative impacts ranged between 388 and 9,061 additional mortalities per annum.
- This resulted in a predicted increase in baseline mortality of the biogeographic population of 0.12-2.75% and the BDMPS population of 0.34-7.93.
- The CPG metrics associated with the PVA runs for the closest impact levels inferred a reduction in population growth rate of less than 0.7% for the biogeographic population and up to 1.8% for the BDMPS population could occur as a result of the worst-case scenario.
- If a displacement rate of 70% and mortality rate of 2% is applied for other projects and a mortality rate of 5% is applied for Hornsea Project four alone (given the potential sensitivity of the site), a cumulative displacement mortality of approximately 1,850 birds per annum is predicted. This equates to a 0.56% or 1.62% increase in baseline mortality rates for the biogeographic and BDMPS populations respectively. The nearest impact assessed within the range of outputs provided by the Applicant is 1,750 and, at this level of additional mortality, there could be a 0.12% or 0.35% reduction in population growth rate of the biogeographic and BDMPS populations respectively.

Cumulative (consented + SEP & DEP and Rampion 2)

- Including consented projects, SEP & DEP and Rampion 2, the predicted cumulative impacts ranged between 416 and 9,702 additional mortalities per annum.
- This resulted in a predicted increase in baseline mortality of the biogeographic population of 0.13-2.95% and the BDMPS population of 0.36-8.49.
- The CPG metrics associated with the PVA runs for the closest impact levels inferred a reduction in population growth rate of almost 0.7% for the biogeographic population, and up to 2% for the BDMPS population, could occur as a result of the worst-case scenario.
- Examining a scenario where a displacement rate of 70% and mortality rate of 2% is applied for other projects and a mortality rate of 5% is applied for Hornsea Project four (given the potential sensitivity of the site), results in a cumulative displacement mortality estimate of approximately 1,975 per annum, which would equate to an 0.60% and 1.73% increase in baseline mortality rates for the biogeographic and BDMPS populations respectively. The nearest impact assessed within the range of outputs provided by the Applicant is 2,000 and, at this level of additional mortality, there could be a 0.14% or 0.40% reduction in population growth rate of the biogeographic and BDMPS populations respectively.

Table A9. Predicted Population impacts on the razorbill biogeographic population for the range of revised mortality impacts in Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and cumulative displacement impacts. The range of displacement impacts represents the lower (30% displacement and 1% mortality) and upper (70% displacement and 10% mortality) bounds of our advice. Counterfactuals of growth rate have been derived from the nearest representative values from the range of impacts considered by the Applicant within their Ornithological Assessment Sensitivity Report [G4.7]. Counterfactuals of final population size have not been supplied. Shaded cells are those where the reduction in growth rate could exceed 0.5%.

Razorbill: Biogeographic						
Assessment description	**Additional mortality**	**% Baseline mortality using biogeographic population***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
Project alone	17-392	0.01-0.12	25-400	1.00-1.00	0.00-0.03%	
Consented projects	388-9,061	0.12-2.75	400-9,000	1.00-0.994	0.03-0.62%	
Consented + SEP & DEP and Rampion 2	416-9,702	0.13-2.95	400-10,000	1.00-0.993	0.03-0.69%	

*1,707,000 total population (Furness 2015)

Table A10. Predicted Population impacts on the razorbill BDMPS population for the range of revised mortality impacts in Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and cumulative displacement impacts. The range of displacement impacts represents the lower (30% displacement and 1% mortality) and upper (70% displacement and 10% mortality) bounds of our advice. Counterfactuals of growth rate have been derived from the nearest representative values from the range of impacts considered by the Applicant within their Ornithological Assessment Sensitivity Report [G4.7]. Counterfactuals of final population size have not been supplied. Shaded cells are those where the reduction in growth rate could exceed 0.5%.

Razorbill: BDMPS						
Assessment description	**Additional mortality**	**% Baseline mortality using largest BDMPS population***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
Project alone	17-392	0.01-0.34	25-400	1.00-0.999	0.00-0.08%	
Consented projects	388-9,061	0.34-7.93	400-9,000	0.999-0.982	0.08-1.80%	
Consented + SEP & DEP and Rampion 2	416-9,702	0.36-8.49	400-10,000	0.999-0.980	0.08-2.00%	

*591,874 total population (Furness 2015)

Conservation Status

Razorbill are listed as 'near threatened' on the IUCN Red List (Birdlife International 2021). They are listed as Amber on BoCC 5 (Stanbury et al. 2021) due to:

- Localisation of breeding population within Important Bird Areas (IBAs)/Special Protection Areas (SPAs) – more than 50% of the UK population found at ten or fewer sites (SPAs/IBAs) in the breeding season (Stanbury et al. 2021).
- International importance of UK population – threshold of 20% of European population (Stanbury et al. 2021).

The UK population of 187,100 individuals comprises 20.2% of the world population, while the Scottish population comprises around 75% of this (Mitchell et al. 2004). The most recent data, although based on a limited dataset, suggests the UK razorbill population may have increased by around 37% between 2000 and 2019, although individual colonies have had varied success with strong increases in some and declines in others (JNCC 2021).

Future Pressures

Though there are differences between the species, razorbill are likely to be sensitive to the same additional pressures as guillemot (see above). Climate change, extreme weather events, reductions in prey availability, fishing pressure (mortality through bycatch) and Avian Influenza outbreaks are all likely to have negative impacts on populations.

Conclusions

Predicted cumulative (consented alone or including SEP & DEP and Rampion 2) mortality predictions exceeded the 1% increase in baseline mortality threshold of the largest BDMPS at between 40 and 50% displacement and 2% mortality. However, based on the PVA outputs this is unlikely to result in a decline in the population if a growth scenario of ≥1% per annum is maintained. Nevertheless, it remains unclear whether the current net growth of the UK razorbill population is sustainable in the face of the numerous pressures, including offshore wind development, facing them. Taking this into account, **we advise that a significant adverse impact to razorbill from cumulative operational displacement cannot be ruled out at an EIA scale irrespective of whether SEP & DEP and Rampion 2 are included in the cumulative totals or not. This is in line with the advice we have previously provided to OWF submissions such as Norfolk Vanguard, Norfolk Boreas, East Anglia 1N and East Anglia 2.**

Puffin project alone and cumulative displacement impacts

Background

Revised baseline characterisation data has been used for the EIA assessment (Revised Ornithology Baseline (tracked) [G5.9]) and the impact estimates presented in Ornithology EIA and HRA Annex (tracked) [G5.25] have been used unless specified.

As discussed in relation to kittiwake and guillemot above, we found that the Applicant has used an alternate BDMPS population estimate to that advised by Natural England. We have used the BDMPS populations currently advised by ourselves when calculating the increase in baseline mortality rate that would arise from predicted impacts. This issue also affects the Applicant's PVA outputs which use the BDMPS population as an input (Ornithological Assessment Sensitivity Report [G4.7]). We will review our position when/if updated PVAs are provided prior to Deadline 8.

Predicted Impacts

The predicted project alone impacts did not exceed a 1% increase in baseline mortality for both the biogeographic or BDMPS populations (Table A1). However, the predicted cumulative impacts do have the potential to exceed a 1% increase at the BDMPS level alone. Thus, the effects of these impacts require further investigation.

Based on the predicted displacement impacts provided in Table A11 and A12 we provide the following observations when examining the range of potential impacts and associated change in population growth rates:

Project alone

- The project alone impacts are predicted to range between 2-45 (at 30% displacement & 1% mortality and 70% displacement & 10% mortality). This did not exceed the 1% change in baseline mortality threshold for either biogeographic or BDMPS population.

Cumulative (consented)

- The cumulative (consented) impacts would range between 135-3,159 (at 30% displacement & 1% mortality and 70% displacement & 10% mortality). This has the potential to exceed the 1% change in baseline mortality threshold for the BDMPS population alone.
- We note that if a displacement rate of 70% and mortality rate of 2% were applied instead, the combined impact would be 632 (0.03% and 0.42% increase in baseline mortality of the biogeographic and BDMPS populations respectively).
- We cannot comment further on the potential for population level impacts due to a disagreement with the starting populations used by the Applicant.

Cumulative (consented + SEP & DEP and Rampion 2)

- Due to the very small numbers added to the cumulative total from SEP & DEP and Rampion 2 there is effectively no difference in the assessment including these projects.
- We cannot comment further on the potential for population level impacts due to a disagreement with the starting populations used by the Applicant.

Natural England note that the 1% increase in baseline mortality for the BDMPS population would not be exceeded until a displacement rate of 70% and mortality rate of 5% is reached in the displacement matrix (Ornithology EIA and HRA Annex (tracked) [G5.2]). We highlight that puffin is also not considered as susceptible to disturbance as guillemot and razorbill, as noted in the SNCB displacement guidance.

Table A11. Predicted Population impacts on the puffin biogeographic population for the range of revised mortality impacts in Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and cumulative displacement impacts. The range of displacement impacts represents the lower (30% displacement and 1% mortality) and upper (70% displacement and 10% mortality) bounds of our advice. Natural England do not agree the PVA modelling that has been undertaken by the Applicant and therefore do not present the results here.

Puffin: Biogeographic						
Assessment description	**Additional mortality**	**% Baseline mortality using biogeographic population***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
Project alone	2-45	0.00 (0.00-0.00)	5-20			
Consented projects	135-3,159	0.05 (0.01-0.15)	125-3,000			
Consented + SEP & DEP and Rampion 2	135-3,161	0.05 (0.01-0.15)	125-3,000			

*11,840,000 total population (Furness 2015)

Table A12. Predicted Population impacts on the puffin BDMPS population for the range of revised mortality impacts in Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and cumulative displacement impacts. The range of displacement impacts represents the lower (30% displacement and 1% mortality) and upper (70% displacement and 10% mortality) bounds of our advice. Natural England do not agree the PVA modelling that has been undertaken by the Applicant and therefore do not present the results here.

Puffin: BDMPS						
Assessment description	**Additional mortality**	**% Baseline mortality using largest BDMPS population***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
Project alone	2-45	0.01 (0.00-0.03)	5-20			
Consented projects	135-3,159	0.74 (0.09-2.08)	125-3,000			
Consented + SEP & DEP and Rampion 2	135-3,161	0.74 (0.09-2.08)	125-3,000			

*868,689 total population (Furness 2015)

Conservation Status

Puffins are the second most abundant breeding seabird in the UK, but they have strongholds in Iceland and Norway (JNCC 2021). The species is classed as globally 'Vulnerable' on the IUCN Red List, but it has been classified as a species of 'Least-concern' in Great Britain (Stanbury et al. 2021). It has an 'Amber' conservation status (BoCC 5).

Puffin populations are notoriously difficult to survey as they nest in burrows however, the UK population of 580,700 apparently occupied burrows constitutes 9.6% of the biogeographic population (Mitchell et al. 2004). Around 85% of the UK breeding population is thought to be in Scotland. Estimates from the three major seabird censuses suggest there was an increase in the UK population of 19% between Operation Seafarer (1969-70) and Seabird 2000 (JNCC 2021). Breeding productivity in the UK, despite being variable and mainly reflecting productivity in Scotland, has shown a generally increasing trend since around 2007 at which time it had reached a historic low. However, significant declines in important east coast

colonies (Isle of May and Farne Islands) were recorded between 2003 and 2008/09 and it is unclear what was responsible for this or whether it has translated to the wider UK population (JNCC 2021).

Future Pressures

Sandeels form a large proportion of the diet of puffins and they therefore may also be expected to be sensitive to fluctuations in prey availability and there is some suggestion that reduced prey quality may contributed to reduced productivity in some years (JNCC 2021). Moreover, as with guillemots and razorbills, puffins are also likely to be susceptible to extreme weather events which may increase in frequency and magnitude due to climate change. Avian Influenza outbreaks could also severely impact puffin populations, adding to the pressures facing the species.

Based on the available information, and notwithstanding the lack of PVA outputs with which Natural England agree, **we consider the current levels of predicted cumulative displacement for puffin (excluding SEP & DEP and Rampion 2) are unlikely to lead to significant effects on the BDMPS population under current conditions.** However, given the significant amount of uncertainty associated with the potential impacts of climate change and other pressures that could reduce the resilience of the population over the next 35 years or so**,** this conclusion is made with reduced confidence. **Furthermore, due to the uncertainty associated with the figures for SEP and DEP and Rampion 2, Natural England advise that significant adverse impacts cannot be ruled out when these projects are included in the cumulative totals.**

Great black-backed gull cumulative project alone and cumulative collision impacts

Background

Revised baseline characterisation data has been used for the EIA assessment (Revised Ornithology Baseline (tracked) [G5.9]) and the impact estimates presented in Ornithology EIA and HRA Annex (tracked) [G5.25] have been used unless specified. We acknowledge that the Applicant has updated the minimum and maximum collision estimates for great black-backed gull in their latest submission and we have updated our values accordingly. Natural England agree these values and the cumulative values presented by the Applicant. The Applicant has provided the assessment in line with Natural England advice and have also provided their preferred approach to the assessment.

Predicted Impacts

The predicted project alone impacts did not exceed a 1% increase in baseline mortality for both the biogeographic or BDMPS populations (Table A1). However, the predicted cumulative impacts did have the potential to exceed a 1% increase for the BDMPS population. Therefore, the effects of these impacts require further investigation.

PVA undertaken by the Applicant for great black-backed gull (Ornithological Assessment Sensitivity Report [G4.7]) has been carried out following Natural England. The outputs of these models provide the best available evidence on which to base the assessment, though this should not be taken as an endorsement or 'acceptance' of the model outputs. Again, we note the Applicant refuses to provide the Counterfactuals of Final Population Size metrics for all PVA).

Based on the predicted displacement impacts provided in Table A13 and A14 we provide the following observations when examining the range of potential impacts and associated change in population growth rates:

Project alone

- Annual collision mortality rates were estimated at between 2 and 50 individuals per annum for the project alone using the Natural England approach. At this level of impact, the 1% increase in baseline mortality threshold was not exceeded for either the biogeographic or BDMPS populations.

Cumulative (consented excluding Rampion)

- Including consented projects, the predicted cumulative impact was estimated at 974 great black-backed gull per annum using the central values.
- This resulted in a predicted increase in baseline mortality of the biogeographic population 2.59% and the BDMPS population of 6.66%.
- The CPG metrics associated with the PVA runs, for the closest impact levels assessed by the Applicant, suggested population growth rates could be reduced by 0.5% for the biogeographic population and 1.29% for the BDMPS population.
- The BDMPS population would be predicted to decline for a population growth rate scenario of 1% per annum, but would be expected to increase for a growth rate scenario of ≥2% per annum.

Cumulative (consented + SEP & DEP and Rampion 2)

- Including consented projects, SEP & DEP and Rampion 2, increased the predicted cumulative impacts to 986 additional mortalities per annum and slightly increased the predicted reductions in population growth rate accordingly.

Table A13. Predicted Population impacts on the great black-backed gull biogeographic population for the range of revised mortality impacts in Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and cumulative collision impacts. Counterfactuals of growth rate have been derived from the nearest representative values from the range of impacts considered by the Applicant within their Ornithological Assessment Sensitivity Report [G4.7]. Counterfactuals of final population size have not been supplied. Shaded cells are those where the reduction in growth rate could exceed 0.5%.

Great black-backed gull: Biogeographic						
Assessment description	**Additional mortality**	**% Baseline mortality using biogeographic population***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
Project alone	10 (2-50)	0.03 (0.01-0.013)	5-50	1.00-1.00	0.00-0.03%	
Consented projects	974	2.59	975	0.995	0.50%	
Consented + SEP & DEP and Rampion 2	986	2.62	1000	0.995	0.51%	

*235,000 total population (Furness 2015)

Table A14. Predicted Population impacts on the great black-backed gull BDMPS population for the range of revised mortality impacts in Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and cumulative collision impacts. Counterfactuals of growth rate have been derived from the nearest representative values from the range of impacts considered by the Applicant within their Ornithological Assessment Sensitivity Report [G4.7]. Counterfactuals of final population size have not been supplied. Shaded cells are those where the reduction in growth rate could exceed 0.5%.

Great black-backed gull: BDMPS						
Assessment description	**Additional mortality**	**% Baseline mortality using largest BDMPS population***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
Project alone	10 (2-50)	0.07 (0.02-0.34)	5-50	1.000-0.999	0.01-0.07%	
Consented projects	974	6.66	975	0.987	1.29%	
Consented + SEP & DEP and Rampion 2	986	6.74	1000	0.987	1.32%	

*91,399 total population (Furness 2015)

Conservation Status

Great black-backed gull is classed as 'Least Concern' of global extinction by IUCN (Birdlife International 2018). The overall population trend across its range is stable, although at a UK level the species is Amber listed in BoCC 5 due to moderate declines in both the breeding and non-breeding populations. It has also been assigned an 'Endangered' classification on the IUCN2 for Great Britain (Stanbury et al. 2021).

The UK population has been estimated at 16,800 apparently occupied nests, comprising some 10% of the world population (Mitchell et al. 2004). The most recent information suggests that

the UK population may have declined by around 23% between 2000 and 2019 (JNCC 2021). These declines are driven mainly by the reductions within Scottish colonies. However, the reasons for these declines are unclear. Any additional mortality predicted to arise from offshore wind farms should be considered in addition to ongoing population declines.

EIA Conclusions

Based on consideration of the PVA outputs presented here, the conservation assessment and particularly that the great black-backed gull population appears to be in a period of long-term decline, the predicted impacts at the North Sea population scale have the potential to give rise to significant effects. **Therefore, Natural England remain unable to rule out a significant adverse impact on great black-backed gull from cumulative collision mortality at an EIA scale (irrespective of whether SEP & DEP and Rampion 2 are included in the cumulative totals or not.)** This is in line with the advice we have previously provided to OWF submissions such as Norfolk Vanguard, Norfolk Boreas, East Anglia 1N and East Anglia 2.

Lesser black-backed gull project alone and cumulative collision impacts

Background

The Applicant has not been required to update their assessment of collision risk impacts on lesser black-backed gull (Volume A2, Chapter 5: Offshore & Intertidal Ornithology [A2.5] & Volume A5, Annex 5.3: Offshore Ornithology Collision Risk Modelling [A5.5.3]). However, we note that the Applicant had not previously taken this species through a cumulative assessment. Thus, Natural England have used cumulative project totals held by us for this assessment. We refer the reader to Table A1 which provides the project alone and cumulative numbers for the assessment.

Predicted Impacts

Natural England note that the cumulative totals including the consented projects (531 additional mortalities) and including the consented projects and SEP & DEP (Rampion 2 has not been added at this stage) exceed the 1% increase in baseline mortality for the BDMPS population (2.21-2.22%). We therefore consider this requires further investigation.

Without PVA outputs to provide an indication of how the impacts may influence the population growth rates it remains difficult to determine whether these levels of additional mortality could lead to a decline in the population of the lifespan of Hornsea Project Four. However, the recent advice provided by Natural England on EA1N and EA2 examined available PVAs and found that similar levels of additional cumulative mortality from collisions from the offshore wind farms, resulting in a 0.3% reduction in annual growth rate, would still allow the population to increase (EN010077-009608-Natural England EA1N Appendix 1 NE Updated Offshore Ornithology Cumulative EIA Advice Jan 2022.pdf (planninginspectorate.gov.uk)). It is considered likely that the level of predicted cumulative impact would not be significant for a population should it be able to grow at 1-2% per annum.

Conservation Status

Lesser black-backed gull are classified as 'Least Concern' on the global IUCN red list (BirdLife International 2018). The overall population trend across its range is increasing, although it has experienced recent declines at a UK level (Balmer et al. 2013). The species is Amber listed in BoCC 5 (Stanbury et al. 2021) due to:

- Localisation of breeding population within Important Bird Areas (IBAs)/Special Protection Areas (SPAs) – more than 50% of the UK population found at ten or fewer sites (SPAs/IBAs) in the breeding season (Stanbury et al. 2021).
- International importance of UK population – threshold of 20% of European population (Stanbury et al. 2021).

We note that quite a high proportion of birds in the largest BDMPS of 209,007 will be UK breeding birds (Furness 2015). Indeed, the UK population of lesser black-backed gull is estimated at 139,000 apparently occupied nests; this constitutes some 12% of the world population (JNCC 2021). Between the 1969-70 and 1998-2002 censuses the UK lesser black-backed gull population increased by 81% (only UK wide estimates considered reliable; JNCC 2021). This suggests a compound growth rate of approximately 1.8% per annum. However, Natural England note that since 2002 the trend excluding urban nesting gulls, has been that of significant decline (JNCC 2021). There are significant uncertainties with these data and whether the productivity of urban nesting gulls offsets the observed declines in natural nesting birds too. It therefore remains difficult to know how the UK lesser black-backed gull population is currently faring. Nevertheless, significant declines have been noted in specific colonies of up to 91%. The cause of these declines remains unclear but may be linked to a decrease

domestic refuse, reduced fisheries discards, predation, cannibalism and human disturbance (JBCC 2021).

EIA Conclusions

It is unclear whether the current lesser black-backed gull population growth rates will persist over the next 35 years, and this needs consideration in relation to whether a 0.3% reduction in annual growth rate would result in significant effects. Based on trends seen at several colonies and the considerable uncertainty surrounding the success of natural and urban nesting gulls, it remains difficult to entirely rule out the population going into decline during the life of the wind farm. However, we consider the current level of cumulative mortality from OWF is unlikely to be detectable against background mortality.

Based on consideration of the above, we therefore advise a conclusion of no significant adverse impact from cumulative collision for lesser black backed gull at an EIA scale if only consented projects are included in the cumulative total. However, due to the uncertainty associated with the figures for SEP and DEP and Rampion 2, Natural England advise that significant adverse impacts cannot be ruled out when these projects are included in the cumulative totals.

Herring gull (LBBG) project alone and cumulative collision impacts

Background

As with lesser black-backed gull, the Applicant has not been required to update their assessment of collision risk impacts on lesser black-backed gull (Volume A2, Chapter 5: Offshore & Intertidal Ornithology [A2.5] & Volume A5, Annex 5.3: Offshore Ornithology Collision Risk Modelling [A5.5.3]). However, we note that the Applicant had not previously taken this species through the cumulative assessment. Thus, Natural England have used cumulative project totals held by us for this assessment. We refer the reader to Table A1 which provides the project alone and cumulative numbers for the assessment.

Predicted Impacts

Natural England note that the cumulative totals including the consented projects (765 additional mortalities) and including the consented projects, SEP & DEP (Rampion 2 has not been added at this stage) fall just below the 1% threshold for the BDMPS population (0.99-0.99%). We therefore consider this requires further investigation. However, the Hornsea Project Four Applicant has not undertaken PVA for herring gull - and no PVA was undertaken for EA1N and EA2 as the threshold level was not exceeded.

As with EA1N and EA2 , we note that the cumulative total has now almost reached 1% of baseline mortality of the largest BDMPS, reinforcing the need for herring gull CRM to have been carried out, and the need for all future offshore wind farm projects in the North Sea to do similar (EN010077-009608-Natural England EA1N Appendix 1 NE Updated Offshore Ornithology Cumulative EIA Advice Jan 2022.pdf (planninginspectorate.gov.uk)).

Conservation Status

Herring gull are classified as 'Least Concern' on the global IUCN red list (BirdLife International 2018) and as 'Endangered' on the IUCN2 list for Great Britain. The overall population trend across its range is increasing, although it has experienced recent declines at a UK level (Balmer et al. 2013). The species is Red listed in BoCC 5 (Stanbury et al. 2021) because of population declines in the UK. Botulism is thought to have played a major role in the decline between the first two censuses and has possibly continued to be an issue. Further, as with lesser black-backed gull, a decrease in domestic refuse and reduced fisheries discards may have put pressure on populations.

EIA Conclusions

Whilst it is likely that the BDMPS herring gull population has, or still is, experiencing significant declines, we consider it unlikely that the cumulative collision mortality would be detectable against background mortality (being less than 1%). **We therefore advise that significant adverse impact from cumulative collision to herring gull at an EIA scale can be ruled out when including consented projects alone. However, due to the uncertainty associated with the figures for SEP and DEP and Rampion 2, Natural England advise that significant adverse impacts on herring gull cannot be ruled out when these projects are included in the cumulative totals.**

Appendix B: Detailed comments and conclusions on project alone and in-combination impacts for HRA

This Appendix is a technical document submitted into the Hornsea Project Four Examination to provide scientific justification for Natural England's advice provided on the significance of the potential for project alone and in-combination impacts in relation to Habitats Regulation Assessment (HRA). Our advice is based on best available evidence at the time of writing and is subject to change in the future should further evidence be presented.

Methods

Our method broadly follows that adopted for the EIA assessment in Appendix A but with impacts apportioned to Flamborough and Filey Coast Special Protection Area (FFC SPA).

For Natural England's approach to displacement, we provide values as a range of displacement and mortality rates bounded by the upper and lower ranges for each species. For gannet this range is defined as 60% displacement and 1% mortality to 80% displacement and 10% mortality. For the three auk species (guillemot, razorbill and puffin), this is defined as 30% displacement and 1% mortality to 70% displacement and 10% mortality.

For collision risk modelling impacts, we consider the range presented by the Applicant for the project alone based on the Natural England Approach and use the central value from that range for the in-combination assessments. We acknowledge that the Applicant has now provided updated collision estimates (minimum and maximum) for gannet and kittiwake within Ornithology EIA and HRA Annex (tracked) [G5.25] and we have used these in this assessment.

We refer the reader to the 'Outstanding issues and implications' section within the Executive Summary that provides a summary of the outstanding issues that Natural England have identified with the Applicant's assessment, and how they have been addressed within the assessment that follows.

Collision impacts are provided for gannet excluding and including an indicative macro-avoidance rate of 70% (a central value between 60% and 80%), pending the outcomes of a Natural England commissioned project. Natural England have also included consideration of macro-avoidance within the cumulative total by considering a 70% macro-avoidance for collision risk. This was simply applied to estimates by multiplying the total collisions by 0.3 (70% macro-avoidance). Again, we consider this is only indicative of the potential changes in collision mortality estimates, pending the finalisation of a Natural England commissioned report on the subject. Two scenarios are also considered for guillemot for reference: Natural England bespoke (three seasons) and the Statutory Nature Conservation Body (SNCB) standard approach (two seasons with Natural England apportioning values).

The impact apportioning rates to FFC SPA we have used are as described by the Applicant in Ornithology EIA and HRA Annex (tracked) [G5.2], except where we have identified a disagreement with the Natural England approach or an error in the numbers provided (please refer to the 'Outstanding issues and implications' section within the Executive Summary).

Dealing with Uncertainty in HRA

Avian Influenza epidemic

We must highlight that the scale of the impact of the ongoing avian influenza epidemic on the FFC SPA populations are presently unknown. This means that there is considerable uncertainty regarding the likely population sizes and growth rates in the future. The future population size will have implications for the numbers of birds using the Hornsea Four array

area and the likely levels of impact from Hornsea Four, and also the robustness of the population and therefore its resilience to impacts. It is highly challenging to provide advice on PVA outputs in the absence of even an initial qualification of the impacts of this event. This does inevitably reduce the level of confidence in our integrity judgements, though we have used best available evidence and used the broad approach adopted during the Norfolk Vanguard, Norfolk Boreas and East Anglia One North and Two projects.

Additional Sources of Uncertainty for HRA

Natural England set out the broad uncertainties regarding seabird impacts assessments in Appendix I of EN010098 H4 Appendix B6.2 - NE comments on G4.7 Ornithological Assessment Sensitivity Report. These remain relevant to the consideration of adverse effects on seabird SPAs, but there are other uncertainties that arise in the context of HRA. Table B1 below details potential sources of uncertainty associated with the apportioning of impacts to FFC SPA. Combined with the myriad of uncertainties associated with sampling seabird populations (at-sea and at colonies), methods for processing data and assumptions applied during different assessment steps, these factors can lead to a large variation in predicted impacts. Whilst this complicates assessments, it is necessary to quantify this uncertainty where possible so that the accuracy and precision of predicted impacts is taken into consideration. This underlies the range-based approach adopted by SNCBs and supports the requirement for appropriate precaution in assessments.

Table B1. Sources of uncertainty associated with apportioning impacts to FFC SPA for HRA

Assessment element	Detail of source of uncertainty	Species influenced	Implications
Apportioning impacts to FFC SPA	**Seasonal definitions.** Definitions of species-specific seasons has the potential to influence the magnitude of seasonal mean peak abundance estimates and the total annual mean peak abundance estimate considered for displacement.	Species subject to displacement assessment (particularly guillemot)	Total annual displacement impacts could be under or overestimated depending on the definitions of seasons in relation to peaks and adequate characterisation of periods relating to different behaviours and vulnerability.
	Connectivity during different seasons. There is uncertainty in methods used for determining the proportions of birds using an offshore wind farm project area, which have connectivity to specific colonies during different season. This is often dependent on the availability of colony specific tracking data or generic foraging ranges combined with some form of distance decay function or, in the case of periods outside of the breeding season, the BDMPS method which examines the contributions of colonies to a mixed population.	All species assessed	There are different methods for estimating the connectivity between the birds present within and area and specific SPA colonies. However, there is uncertainty in such methods, particularly outside the breeding season when seabirds are no longer central-place foragers. Thus, impacts assigned to SPAs could be under- or over-estimated.
	Proportions of adults using a project area. There is likely to be variability in the use of a site between seasons and years. The quality of site- and species-specific ageing data may be highly variable.	All species assessed	There is significant uncertainty around the proportions of adults using a project area and this may lead to under- or over-estimation of impacts on adults assigned to FFC SPA.
	Proportions of sabbatical (skipped breeding) birds. A proportion of an adult breeding population may take a period of time out from breeding at a colony and it has been suggested that impacts on these birds may not be attributed to a specific colony.	All species assessed	There is uncertainty in the proportions of sabbatical birds present within project area during different seasons and between years. Selected values could under or overestimate the impacts assigned to an SPA.

Summary of predicted impacts presented at Deadlines 5a-6

Table B2 provides a summary of Natural England's current interpretation of the predicted impacts on key seabird species of conservation concern associated with Hornsea Project Four alone, in-combination with consented projects and cumulatively including additional projects in the planning system but not yet submitted (Sheringham Shoal and Dudgeon Extension Projects and Rampion 2). These values have been extracted, or re-calculated, from the Applicant's Ornithology EIA and HRA Annex (tracked) [G5.25]. A breakdown of impacts on the latest FFC SPA population counts and estimates populations at citation are provided in Table B2 which also serves to identify where a potential impact would lead to an increase in the relevant population baseline mortality rate of 1%.

The subsequent sections examine the potential for Adverse Effects on Integrity (AEoI) for each species considered, based on conservation objectives, ecology and sources of uncertainty. We provide a statement on Natural England's current position, given the available evidence, for each species.

Table B2. Summary of predicted operational impacts on the baseline mortality rates (based on survival rates from Horswill & Robinson 2015) of relevant designated seabird features of the Flamborough and Filey Coast Special Protection Area. Impacts are considered against the latest adult population estimates and the population estimates at citation. Impacts are provided for the Natural England approaches to collision, Natural England's bespoke approaches to guillemot and razorbill displacement (as well as SNCB standard approaches for these species and combined assessments for relevant species. In-combinations estimates are based on the Applicant's numbers presented in the Ornithology EIA and HRA Annex (tracked) [G5.25] provided at Deadline 6, with the exception of the changes detailed in the 'Outstanding issues and implications' section in the main document. Values are also provided for impacts under different Macro-Avoidance (MA) rates for gannet. Impacts that would result in an increase in baseline mortality of >1% are highlighted in shaded cells.

Species	Assessment type	Predicted impacts			Reference population		% Increase baseline mortality latest estimate			% Increase baseline mortality citation count		
		Project alone	In-combination		Latest estimate popn. ind.	Citation popn. ind.	Project alone	In-combination		Project alone	In-combination	
			Consented	All projects				Consented	All projects		Consented	All projects
NATURAL ENGLAND												
Gannet	Collision excl. MA	14 (2-59)	308	338	26,784	16,938	0.65 (0.09-2.72)	14.21	15.58	1.03 (0.15-4.30)	22.48	24.64
	Collision incl. MA @70%	4 (1-18)	93	101			0.19 (0.03-0.82)	4.26	4.67	0.31 (0.00-1.56	6.74	7.39
	Displacement	6-76	52-699	55-734			0.26-3.49	2.42-32.20	2.54-33.83	0.42-5.52	3.82-50.93	4.01-53.51
	Combined excl. MA	6-147	361-1,007	393-1,072			0.27-6.78	6.63-46.41	8.12-49.41	0.43-10.72	26.30-73.71	8.66-78.15
	Combined incl. MA @70%	6-97	145-791	156-836			0.26-4.48	6.68-36.47	7.21-38.50	0.42-7.08	10.56-57.68	11.41-60.90
Kittiwake	NE Collision	71	393*	393*	103,070	167,400	0.47	2.61	2.61	0.29	1.61	1.61
Guillemot	Displacement NE bespoke approach	97-2,262	197-4,605	200-4,672	121,754	83,124	1.31-30.46	2.66-62.00	2.70-62.90	1.91-44.56	3.89-90.72	3.94-92.04
	Displacement SNCB standard	33-771	133-3,114	136-3,181			0.44-10.38	1.80-41.93	1.84-42.83	0.6-15.19	2.63-61.35	2.69-62.67
Razorbill	Displacement NE bespoke apportioning	10-228	30-700	31-713	40,506	21,140	0.23-5.36	0.70-16.45	0.72-16.77	0.44-10.27	1.35-31.51	1.38-32.13
	Displacement SNCB standard	2-39	22-511	22-524			0.05-0.92	0.51-12.00	0.53-12.33	0.09-1.76	0.99-23.00	1.01-23.62
Assemblage (puffin)	Displacement SNCB standard	1-14	31	4-86	3,579		0.18-4.26	1.10-25.60	1.10-25.60			
Assemblage (herring gull)	NE collision	<2										

* Note that the kittiwake in-combination assessment assumes all consented and future projects from Hornsea Three onwards have impacts compensated in full.

Potential for Adverse Effects on Integrity of designated seabird features of Flamborough and Filey Special Protection Area

Gannet – alone and in-combination with other plans and projects

Background

Natural England note that the Applicant revised the modelling approach used for deriving abundance estimates for gannet in accordance with our advice and guidance from the Centre for Research into Ecological and Environmental Modelling (CREEM). This advice has resulted in the Applicant providing revised modelled abundance estimates for birds in flight within the array for collision risk assessment and using design-based estimates for the array and a 2 km buffer (all behaviours) for the assessment of displacement (Revised Ornithology Baseline (tracked) [G5.9]). We note that the Applicant has provided updated collision estimates, including minimum and maximum values, within Ornithology EIA and HRA Annex (tracked) [G5.25].

For the in-combination assessment, we agree with the values presented by the Applicant. However, we have noted that there were summing errors in Table 110 of Ornithology EIA and HRA Annex (tracked) [G5.25]. We have calculated the Natural England EIA total for consented projects should be 8,735 and for all projects 9,176. These corrected values have been used in this assessment.

Predicted Impacts

In all cases (project alone and in-combination), the predicted combined displacement and collision impacts based on the Natural England advice vary greatly due to the range in displacement and mortality rates assessed. However, in all cases, the range of predicted impacts for FFC SPA gannet have the potential to exceed a 1% increase in the baseline mortality (based on the latest SPA count), though we note the predicted impacts are reduced considerably when macro-avoidance corrections are applied (Tables B2 and B4). Thus, further consideration of the potential population level impacts for FFC SPA is required.

We agree the PVA undertaken for gannet in Ornithological Assessment Sensitivity Report [G4.7] and have used the Counterfactuals of Population Growth (CPG) rates provided by the Applicant. These provide the best available evidence on which to base the assessment, though this should not be taken as an endorsement or 'acceptance' of the model outputs. However, we continue to advise that the Applicant should provide the Counterfactuals of Final Population Size metrics for all PVAs for FFC SPA qualifying species.

We consider it is appropriate to assess the combined impacts including the indicative 70% macro-avoidance correction, though we note that this level of macro-avoidance is expected to be refined following the publication of a Natural England commissioned project report.

We note that the gannet population of FFC SPA increased (compound growth rate) at 9.9% per annum (between 2003/4 and 2015, JNCC Seabird Monitoring Programme 'SMP' data). Using FFC SPA data for 2000-2017 the growth rate was 10.2% per annum. However, it is not known what the growth rate of the colony will be over the next 35 years, and this should therefore be considered when judging the significance of predicted impacts against the conservation objectives for the feature.

As was undertaken during the Norfolk Vanguard and Norfolk Boreas examinations, Natural England has reviewed growth rates for the 22 gannet colonies across Britain, Channel Islands and Ireland with repeated census data (Cramp et al. 1974, Lloyd et al. 1991, Mitchell et al. 2004, plus more recent count data from the SMP). The Flamborough/Bempton gannet colony

was founded in the late 1930s (Cramp et al. 1974) and so has been in existence now for about 80 years. Thus, by the end of the lifespan of the Hornsea Project Four it will be about 115 years in age. Given the analysis of trends in gannet colony growth rates amongst a suite of long-established colonies, it is highly likely that its annual growth rate averaged over the whole period since founding will drop from its current average of approximately 11% over the first 80 years. The highest annual colony growth rate calculated over a period of >100 years is 4.5% at Grassholm. The Flamborough colony is unlikely to achieve a higher annual growth rate than this.

The average annual growth rate calculated over a period of >90 years across the 8 gannet colonies with records exceeding 90 years is 1.8%. Amongst these colonies the mean annual growth rate over the most recent years of their records (80+ years) has been just 1.2% per annum (or 1.3% excluding Sula Sgeir, as the growth rate here may be influenced adversely by an annual licenced harvest of young birds) compared to an average rate of 2.0% per annum during the first 80 or so years of their existence. Further, the productivity of the colony has shown a decreasing trend since 2009, when monitoring began, which may be indicative of some form of density dependent regulation within the colony (Lloyd et al. 2020). The growth rate of the colony also appears to have slowed between 2008 and 2017 to 8.6% per annum.

Following the analysis above, Natural England has considered the CPG for the predicted levels of additional mortality for a range of plausible future growth rate scenarios for FFC of 1-5% per annum.

Table B3. Predicted combined collision and displacement impacts on the gannet FFC SPA population for the range of revised mortality impacts presented in/estimated from the Applicant's Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and in-combination combined collision and displacement impacts, with and without correction for macro-avoidance. Counterfactuals of growth rate have been derived from the nearest representative values from the range of impacts considered by the Applicant within their Ornithological Assessment Sensitivity Report [G4.7]. Counterfactuals of final population size have not been supplied. Shaded cells are those where the reduction in growth rate could exceed 0.5%.

Gannet: FFC SPA						
Assessment description	**Additional mortality**	**% Baseline mortality using 2017 census data***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
Project alone, no macro-avoidance	8-135	0.36-6.21	5-125	1.00-0.994	0.02-0.55%	
Project alone, 70% macro-avoidance	6-93	0.29-4.30	5-100	1.00-0.996	0.02-0.44%	
Consented projects, no macro-avoidance	361-1,007	16.63-46.41	350-1000	0.985-0.956	1.55-4.41%	
Consented projects, 70% macro-avoidance	145-791	6.68-36.47	150-800	0.993-0.965	0.66-3.53%	
Consented + SEP & DEP and Rampion 2, no macro-avoidance	393-1,072	18.12-49.41	400-1000	0.982-0.956	1.77-4.41%	
Consented + SEP & DEP and Rampion 2, 70% macro-avoidance	156-836	7.21-38.50	150-800	0.993-0.965	0.66-3.53%	

* 26,784 adults

Integrity judgement

The Conservation Objective for the gannet population of the FFC SPA is to maintain the size of the breeding population at a level which is above 8,469 pairs (16,938 adults), whilst avoiding deterioration from its current level, as indicated by the latest mean peak count or equivalent. The latest mean count available is 24,594 adults based on the mean of the 2012, 2015 and 2017 counts.

Based on the range of predicted impacts provided in Table B3 (applying macro-avoidance at 70% and considering a best-case scenario of 60% displacement and 1% mortality and a worst-case scenario of 80% displacement and 10% mortality) we conclude the following when examining the potential change in population growth rates and range in background colony growth rates:

Project alone

- We have considered a range of impacts from 5-100 breeding adults. The predicted reduction in population growth rates range from 0.02 to 0.44%.
- Given these values, the colony would be predicted to continue to increase from its current size of 24,594 adults for a growth rate of ≥1%.

In-combination (consented)

- We have considered a range of impacts from 150-800 breeding adults. The predicted reduction in population growth rates range from 0.66 to 3.53%.
- At the extreme worst case predicted impact level (800 individuals) the colony is predicted to be decreasing if the growth rate is ≤2%. The colony would increase, and the current population size (mean 2012, 15 and 17) would be predicted for growth rate scenarios of >4% per annum.
- Natural England consider that the impacts are more likely to reflect mortality levels towards the lower end of the range. By way of illustration, at a displacement rate of 80% and mortality rate of 2%, the predicted impacts would be ~225 breeding adults. At this impact level, the colony would be predicted to be maintained at its current size of 24,594 adults, or increase, for a growth rate scenario of ≥1% per annum.

In-combination (consented + SEP & DEP and Rampion 2)

- We have considered a range of impacts from 150-800 breeding adults.
- The resultant predicted reductions in population growth rates are 0.66 to 3.53%.
- We draw the same conclusion as for the in-combination (consented) assessment above but note that there is uncertainty in the scale of the predicted impacts of the additional projects considered until they are submitted and Examined.

We conclude that if the colony were to experience an annual growth rate of 2% or more per annum over the next 35 or so years, then the integrity of the site for this feature is high, with high rates of self-renewal under dynamic conditions with minimal external management. Therefore, in such circumstances the FFC SPA gannet population is believed to be robust enough to allow the conservation objective to maintain the population at (or above) designation levels and sustain additional alone and in-combination mortalities from the offshore wind farms.

We consider it to be unlikely that the FFC annual growth rate would be as low as 1%, as from the analysis of gannet colony growth rates we have conducted, the current annual growth rate of approximately 9.9% (2003/04 census to 2017) appears to be relatively high for a colony of this age. This indicates that, on balance, the colony is likely to maintain more than the historical

1.3% mean annual growth rate for UK gannet colonies into the foreseeable future. As highlighted above, the AI epidemic inevitably reduces the level of confidence we can have in our growth rate predictions.

Nevertheless, the incorporation of macro-avoidance responses into the collision risk assessments and the corresponding reduction in impacts means that **Natural England can advise that an adverse effect on integrity (AEoI) of the gannet feature of the FFC SPA can be ruled out for project alone and in-combination including currently consented projects.**

As in other recent assessments (Norfolk Boreas and EA1N & EA2), due to Natural England's concerns regarding the uncertainty in predicted impacts for projects in planning (SEP & DEP and Rampion 2), that have not been consented, we are not able to advise that an AEoI can be ruled out for the gannet feature of the FFC SPA for in-combination combined impacts of collision and displacement when these projects are included.

Kittiwake – alone and in-combination with other plans and projects

Background

Natural England note that the Applicant revised the modelling approach used for deriving abundance estimates for kittiwake in accordance with our advice and guidance from CREEM. This advice has resulted in the Applicant providing revised modelled abundance estimates for birds in flight within the array for collision risk assessment and using design-based estimates for the array and a 2 km buffer (all behaviours) for the assessment of displacement. The Applicant has also recently (Deadline 6) provided updated collision risk estimates, including minimum and maximum estimates, within Ornithology EIA and HRA Annex (tracked) [G5.25].

In the case of the in-combination assessment, we agree with the values presented by the Applicant. However, we have noted that the Applicant has also considered impacts on kittiwake associated with projects in planning (SEP & DEP and Rampion 2). Natural England assume that all impacts from consented and future projects will be wholly compensated for. However, we note that there is currently uncertainty in relation to the potential for compensation measures to fulfil requirements over the lifespan of the respective wind farm projects.

Predicted Impacts

In all cases (project alone and in-combination), the predicted collision impacts based on the Natural England advice were approximately three times those predicted by the Applicant (Ornithology EIA and HRA Annex (tracked) [G5.25]). For the Natural England approach, the predicted impact alone only just exceeded a 1% increase in the baseline mortality (latest count) for the maximum collision prediction (Tables B2 and B4). However, the 1% threshold is clearly exceeded for in-combination impacts using the central values. The predicted impacts also exceed a 1% increase in the baseline mortality for the in-combination totals under the Applicant's preferred approach (Ornithology EIA and HRA Annex (tracked) [G5.25]). **We note that based on Natural England's approach, the estimated collision mortality for Hornsea Project Four is 71 adult kittiwake per annum. This would contribute 18% to the in-combination total for the consented projects where compensation has not been agreed.** Thus, further consideration of the potential population level impacts for FFC SPA is required.

Natural England have noted that there is still an outstanding issue relating to the PVA modelling. Natural England advised the Applicant of an issue with the JNCC/NE PVA tool at Deadline 5a [REP5a-029]. This issue is known to affect the outcomes of the PVA where a standard deviation of 'exactly zero' is applied to any of the baseline vital rates. This was the case in the PVA undertaken by the Applicant for kittiwake at FFC SPA, and we have advised on an interim solution whilst the issue is being fixed. We have not received any further PVA results at Deadline 6 and therefore, due to outstanding issues, we cannot comment on the PVA currently presented by the Applicant. However, given the nature of the assessment for kittiwake, we do not believe this will have a material effect on our position on the potential for AEoI of the Kittiwake breeding bird feature of FFC SPA. We will review our position when/if updated PVAs are provided prior to Deadline 8.

Table B4. Predicted impacts on the kittiwake FFC SPA population for the range of revised mortality impacts presented in/estimated from the Applicant's Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and in-combination collision impacts. Natural England do not agree with the PVA modelling that has been undertaken by the Applicant and therefore do not present the results here. Note that for kittiwake all projects, from Hornsea Three onwards, have totals reduced to 0 in light of the Secretary of State requiring compensatory measures to be put in place.

Kittiwake: FFC SPA						
Assessment description	**Additional mortality**	**% Baseline mortality using 2017 census data***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
Project alone	71 (22-152)	0.49 (0.14-1.02)	20-150			
Consented projects	393	2.61	400			
Consented + SEP & DEP and Rampion 2	393	2.61	400			

*103,070

Integrity judgement

Natural England's advice regarding in-combination collision impacts to FFC SPA kittiwakes remains the same as that set out in our Deadline 12 [REP12-090] response during the EA1N and EA2 examinations. Namely that, as this feature has a restore conservation objective requiring the population to be returned to previous levels, and because there are indications that the predicted level of mortality would mean the population could decline from current levels should it currently be stable, **it is not possible to rule out AEoI of the kittiwake feature of the FFC SPA for collision impacts from in-combination with other plans and projects.**

We note that SoS has drawn similar conclusions for all OWF projects from Hornsea Three onwards. This conclusion is drawn irrespective of whether SEP and DEP are included in the totals or not.

Guillemot – alone and in-combination with other plans and projects

Background

Natural England note that the Applicant revised the modelling approach used for deriving abundance estimates for guillemot in accordance with advice from Natural England and CREEM. This advice has resulted in the Applicant providing revised modelled abundance estimates for all birds (all behaviours) within the array and 2 km buffer for the assessment of displacement.

Natural England agree that the Applicant has provided an apportioning approach that follows our guidance and note that they have also adopted their own approach to the assessment using i) a weighted approach to the calculation of total annual mean peak abundance estimates and ii) a weighted approach to apportioning birds in the non-breeding season. These results are presented in the Applicant's Ornithology EIA and HRA Annex (tracked) [G5.25] and are summarised in Table B1 above.

Natural England do not agree with the Applicant's 'double-weighted' approach and their rebuttal of our additional advice regarding an appropriate approach to take. We have responded to the Applicant's comments and provided further justification of our approach for consideration at Deadline 6 [REP6-056]. For illustrative purposes, we have also included consideration of the standard SNCB approach to deriving displacement impacts for guillemot using 100% apportioning to FFC SPA in the breeding season and the BDMPS (4.41%) approach for the non-breeding season. However Natural England maintain the view that Natural England's bespoke approach is the most appropriate treatment of the data, for the reasons set out in REP5-115 and REP6-056.

We agree with the values presented by the Applicant for the in-combination assessments using Natural England's advised approach. However, we note that the Applicant has included breeding season impacts for Hornsea Three for guillemot. Natural England consider that, given the distance from FFC SPA, breeding season impacts from Hornsea Three could be excluded from the in-combination totals. This would result in a significant reduction in the in-combination impacts presented by the Applicant.

Predicted Impacts

In all cases (project alone and in-combination), the predicted displacement impacts based on the Natural England advice vary greatly due to the range in displacement and mortality rates assessed. However, in all cases the range of predicted impacts have the potential to exceed a 1% increase in the baseline (latest count) mortality. This is also the case under the SNCB standard displacement assessment approach. Thus, further consideration of the potential population level impacts for FFC SPA is required.

We support the PVA undertaken for guillemot in Ornithological Assessment Sensitivity Report [G4.7] and have used the Counterfactuals of Population Growth (CPG) rates provided by the Applicant. These provide the best available evidence on which to base the assessment though this should not be taken as an endorsement or 'acceptance' of the model outputs. We again note the Applicant refuses to provide the Counterfactuals of Final Population Size metrics for all PVA.

The FFC SPA guillemot colony has been increasing steadily (numbers from Lloyd et al. [2020]), with an overall increase (compound growth rate) of 3.2% per annum between SMP colony counts over 30 years between 1987 (32,578 uncorrected ind.) and 2017 (84,647 uncorrected ind.). Going back further, the overall growth rate between 1969 and 2017, incorporating a period of higher growth of the colony between 1969 and 1987, has been

around 4.1% per annum over the 48 years. However, we note that annual growth rates between counts since 1987 have fluctuated between 2.9% (1987-2000) and 3.9% (2008-2017) per annum.

It is also important to recognise that guillemot productivity has been declining at the SPA since 2009, indicating that recent population increase may be driven, at least in part, by immigration from elsewhere. It is unclear how the population size will change over the next 35 years in the face of other pressures including climate change. The potential for a reduction in colony growth rate should therefore be considered when judging the significance of predicted impacts against the conservation objectives for the feature.

The other major English North Sea colony (Farne Islands SPA) has also experienced good growth of 3.8% per annum between 2000 (31,497 adults) and 2019 (64,042 adults). Colonies in the Irish Sea have experienced variable rates of growth and decline, with Skomer and Skokholm representing the most successful colony with a growth rate of 4.2% per annum (2000-2019) and Ailsa Craig a decline of 2.3% per annum (2001-2019). Moreover, many colonies in Scotland have experienced significant declines in guillemot populations of around 4% per annum between Seabird 2000 and 2015-17 (JNCC Seabird Monitoring Programme 'SMP' data, see: Guillemot (Uria aalge) | JNCC - Adviser to Government on Nature Conservation). However, based on trends at other colonies outside of Scotland, Natural England has considered the counterfactuals CPG for the predicted levels of additional mortality for a range of plausible future growth rate scenarios for FFC of between 1 and 5% per annum. This is to allow us to contextualise the predicted impacts and potential resilience of the colony to them.

Table B5. Predicted impacts on the guillemot FFC SPA population for the range of revised mortality impacts presented in/estimated from the Applicant's Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and in-combination displacement impacts. The range of displacement impacts represents the lower (30% displacement and 1% mortality) and upper (70% displacement and 10% mortality) bounds of our advice. Both the standard guillemot assessment method (using standard seasons and apportioning rates of 100% in the breeding and 4.41% in the non-breeding season) and the approach following our advice for Hornsea Project Four (introduction of a third season and specific apportioning rate) are provided for comparison. Counterfactuals of growth rate have been derived from the nearest representative values from the range of impacts considered by the Applicant within their Ornithological Assessment Sensitivity Report [G4.7]. Counterfactuals of final population size have not been supplied. Shaded cells are those where the reduction in growth rate could exceed 0.5%.

Guillemot: FFC SPA						
Assessment description	**Additional mortality**	**% Baseline mortality using 2017 census data***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
NE bespoke: Project alone	97-2,262	1.31-30.46	100-2,250	0.999-0.979	0.09-2.07%	
NE bespoke: Consented projects	197-4,605	2.66-62.00	200-4,500	0.998-0.959	0.18-4.14%	
NE bespoke: Consented + SEP & DEP and Rampion 2	200-4,672	2.70-62.90	200-4,500	0.998-0.959	0.18-4.14%	
SNCB standard: Project alone	33-771	0.44-10.38	30-750	1-0.993	0.03-0.69	
SNCB standard: Consented projects	133-3,114	1.80-41.93	125-3,000	0.999-0.972	0.11-2.76%	

SNCB standard: Consented + SEP & DEP and Rampion 2	136-3,181	1.84-42.83	125-3,250	0.999-0.970	0.11-2.99%	

*121,754 (after applied corrections)

Integrity judgement

The Conservation Objective for the guillemot population of the FFC SPA is to maintain the size of the breeding population at a level which is above 83,124 breeding adults, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent (121,754 breeding adults in 2017).

Initial assessment of impacts on FFC SPA guillemot using a range-based approach

Based on the range of predicted impacts provided in Table B5, considering a best-case scenario of 30% displacement and 1% mortality and an extreme worst-case scenario of 70% displacement and 10% mortality, we conclude the following when examining the potential change in population growth rates and range in background colony growth rates:

Project alone

- We have considered a range of impacts from 100-2,250 breeding adults using our preferred approach for Hornsea Project Four, as well as 30-750 breeding adults based on the standard SNCB approach.
- The predicted reduction in population growth rates range from 0.09 to 2.07% for the NE bespoke approach and 0.03 to 0.69% for the standard SNCB approach.
- For the worst-case Natural England bespoke approach (2,250 additional mortalities), the colony would reduce significantly from its current level under a growth rate of 1%. At a growth rate of 2%, the population would also decline from its current level. At a growth rate of 3% per annum, the colony would be predicted to be increasing beyond its current level.
- For the worst-case standard SNCB approach (750 additional mortalities), the colony would be predicted to continue to grow from its current size of 121,754 adults under a growth rate scenario of ≥1% per annum.
- Assuming a more realistic mortality rate of 5% (displacement rate of 70%) for the bespoke approach, the 'project alone' impact would be estimated to be 1,131. At this level of impact, the nearest PVA outputs (at an impact of 1,250) suggest that the population would decline at a growth rate of 1% per annum. The population would increase at a growth rate of ≥2% per annum.

In-combination (consented)

- We have considered a range of impacts from 200-4,500 based on our preferred bespoke approach, and also considered 125-3,000 breeding adults based on the standard SNCB approach.
- The predicted reduction in population growth rates ranges from 0.18-4.14% for the bespoke approach and 0.11 to 2.76% for the standard SNCB approach.
- Based on the maximum predicted impacts using the bespoke approach (4,500 adults), it is suggested that the colony would only be able to sustain the current population if the growth rate was greater than 4%. Otherwise, the population would decline. Nb. this level of impact represents the worst-case scenario across all in-combination projects, and we consider where this sits in relation to the sensitivity of the species and importance of the project area later.

- Assuming a more realistic mortality rate of 5% (displacement rate of 70%) for the bespoke approach, the 'in-combination (consented)' impact would be estimated to be around 2,300 birds. At this level of impact, the nearest PVA outputs (at an impact of 2,250) suggest that the population would decline at a growth rate of ≤2% per annum but would increase at a growth rate of ≥3% per annum.
- At the maximum predicted impact level derived from the standard SNCB approach (3,000 adults), the colony population would be in decline for a growth rate scenario of ≤2% per annum. The population would increase from its current (2017) population level at a sustained growth rate of 3% per annum.

In-combination (consented + SEP & DEP and Rampion 2)

- We have considered a range of impacts from 200-4,500 for the NE bespoke approach, and 125-3,250 breeding adults for the standard SNCB approach.
- The resultant predicted reductions in population growth rates are 0.18-4.14% for the bespoke approach and 0.11 to 2.99% for the standard approach and.
- We draw the same conclusion as for the in-combination (consented) assessment above but note that there is uncertainty in the scale of the predicted impacts of the additional projects considered until they are submitted and Examined.

Risk assessment taking into account the sensitivity of the Hornsea Four array area and displacement buffer

The range of impacts in our initial consideration include an extreme worst-case of assuming a displacement rate of 70% and mortality rate of 10% across all in-combination projects. To be clear, Natural England does not propose that these rates are used for decision-making. Nevertheless, the overall range considered identifies that the impact levels within this range could result in adverse effects. Therefore, it is necessary to investigate at what points in the displacement matrix do impact levels of concern start to arise. Table B6 provides further context for how the displacement impacts and associated changes in growth rate vary across the range of displacement and mortality rates applied to the annual total mean-peak abundance estimates. We note that a reduction in population growth rate of >0.5% per annum are reached at mortality rates of 2% for our preferred bespoke approach. The equivalent figure for the standard SNCB approach is 5%.

Given Natural England's concerns about the sensitivity of the Hornsea Four area during the chick rearing/moult stage, we consider the displacement and mortality rates should reflect this, though we note that conservation objectives other than population abundance are relevant here. For illustrative purposes, we have utilised a displacement rate of 70% and a mortality rate of up to 5% for Hornsea Four alone to reflect the heightened sensitivity of the area. For other projects in the in-combination assessment we have considered a 70% displacement and 2% mortality, under the assumption that the majority of them occupy less important sea areas. This approach is broadly in line with previous advice provided on Norfolk Boreas in EN010087-002883-SoS Deadline - Natural England.pdf (planninginspectorate.gov.uk)). As noted above, the 'project alone' impact would be estimated to be 1,131 adults per annum at 70% displacement and 5% mortality.

Using this method, an in-combination (consented) estimate of approximately 1,600 adult mortalities per annum can be calculated based on the bespoke Natural England approach. Taking the PVA outputs for the nearest available impacts considered by the Applicant in Ornithological Assessment Sensitivity Report [G4.7] (1,500 or 1,750 adults), it is predicted that in both cases the population would decline were it to have a growth rate scenario of ≤1% per annum. The colony is only predicted to continue to increase over the 35-year lifetime of the

project for a scenario of ≥2% per annum. Please note that Natural England is not providing a position on specific levels of displacement and mortality that should be adopted for the assessment here, but illustrating the levels of impact that have a greater likelihood of resulting in adverse effects.

Natural England also note that the Applicant's in-combination totals have included a large number of predicted impacts from Hornsea Three for the breeding season. Natural England considers these impacts should not be included in the total for FFC SPA. If these were to be removed from the consented projects total, it would reduce the in-combination total (as described in the preceding paragraph to approximately 1,500 birds. This would not alter the assessment presented in the above paragraph.

Natural England note that the predicted impacts on the guillemot FFC SPA feature alone, based on the project alone (bespoke approach at 70% displacement and 5% mortality), are predicted to be more than three-times the in-combination impacts from the other consented projects (at 70% displacement and 2% mortality and excluding Hornsea Three during breeding season). Further, for the project alone, this predicted level of impact could lead to a reduction in colony population over the 35 years at a growth rate of 2% per annum or less.

If the colony were to experience a reduction in annual growth rate to less than 2% per annum over the next 35 or so years, then the integrity of the site will be likely to be adversely affected. The current long-term annual growth rate is around 3.2% (1987-2017), with the most recent growth rate suggesting some improvement (3.9% between 2008 and 2017). However as noted above, despite this continued growth at FFC SPA, the productivity rates for guillemot have shown a decreasing trend since 2009 (Lloyd et al, 2020), when the monitoring began. This may be indicative of density dependence mechanisms beginning to operate and the population reaching carrying capacity, though this can only be speculated.

In the context of other colonies around the UK, the English colonies on the east coast have generally been more successful, though there have been signs that some of the Scottish colonies may have been beginning to experience increased productivity and return rates. Overall, we cannot conclude with confidence that the population growth rate will be maintained over the lifespan (35 years) of the project and will therefore provide the required resilience to maintain the population at current levels or above.

Table B6. Predicted impacts and associated % reductions in guillemot population growth rates (in parentheses) at FFC SPA from Hornsea project 4 alone, in-combination with consented projects, and in-combination with all consented projects + SEP & DEP and Rampion 2. Pink shaded cells are those where the reduction in growth rate exceeds 0.5%, 1% or 2%.

Method			% Mortality			
	FFC adults mean of population		1	2	5	10
NE bespoke approach to displacement and apportioning	Project alone					
	% Displacement	30	96.9 (0.09%)	193.9 (0.18%)	484.6 (0.46%)	969.3 (0.92%)
		40	129.2 (0.11%)	258.5 (0.23%)	646.2 (0.69%)	1292.4 (1.15%)
		50	161.5 (0.14%)	323.1 (0.3%)	807.7 (0.69%)	1615.5 (1.38%)
		60	193.9 (0.18%)	387.7 (0.37%)	969.3 (0.92%)	1938.5 (1.84%)
		70	226.2 (0.21%)	452.3 (0.46%)	1130.8 (0.92%)	2261.6 (2.07%)
	In-combination with consented projects					
	% Displacement	30	197.4 (0.18%)	394.7 (0.37%)	986.8 (0.92%)	1973.6 (1.84%)
		40	263.1 (0.25%)	526.3 (0.46%)	1315.7 (1.15%)	2631.4 (2.53%)
		50	328.9 (0.3%)	657.9 (0.69%)	1644.6 (1.61%)	3289.3 (2.99%)
		60	394.7 (0.37%)	789.4 (0.69%)	1973.6 (1.84%)	3947.1 (3.68%)
		70	460.5 (0.41%)	921 (0.92%)	2302.5 (2.07%)	4605 (4.14%)
	In-combination with consented projects + SEP & DEP and Rampion 2					

Method			% Mortality			
	FFC adults mean of population		1	2	5	10
	% Displacement	30	200.2 (0.18%)	400.4 (0.37%)	1001.1 (0.92%)	2002.2 (1.84%)
		40	267 (0.25%)	533.9 (0.46%)	1334.8 (1.15%)	2669.6 (2.53%)
		50	333.7 (0.3%)	667.4 (0.69%)	1668.5 (1.61%)	3337.1 (2.99%)
		60	400.4 (0.37%)	800.9 (0.69%)	2002.2 (1.84%)	4004.5 (3.68%)
		70	467.2 (0.44%)	934.4 (0.92%)	2335.9 (2.07%)	4671.9 (4.14%)
Standard SNCB approach to displacement and apportioning	Project alone					
	% Displacement	30	33 (0.03%)	66.1 (0.07%)	165.2 (0.16%)	330.4 (0.3%)
		40	44 (0.04%)	88.1 (0.09%)	220.2 (0.21%)	440.5 (0.41%)
		50	55.1 (0.05%)	110.1 (0.09%)	275.3 (0.25%)	550.6 (0.46%)
		60	66.1 (0.07%)	132.1 (0.07%)	330.4 (0.3%)	660.7 (0.46%)
		70	77.1 (0.07%)	154.2 (0.14%)	385.4 (0.37%)	770.8 (0.69%)
	In-combination with consented projects					
	% Displacement	30	133.5 (0.11%)	266.9 (0.25%)	667.3 (0.69%)	1334.7 (1.15%)
		40	178 (0.16%)	355.9 (0.32%)	889.8 (0.92%)	1779.5 (1.61%)
		50	222.4 (0.21%)	444.9 (0.41%)	1112.2 (0.92%)	2224.4 (2.07%)
		60	266.9 (0.25%)	533.9 (0.46%)	1334.7 (1.15%)	2669.3 (2.53%)
		70	311.4 (0.28%)	622.8 (0.46%)	1557.1 (1.38%)	3114.2 (2.76%)
	In-combination with consented projects + SEP & DEP and Rampion 2					
	% Displacement	30	136.3 (0.11%)	272.7 (0.25%)	681.7 (0.69%)	1363.3 (1.15%)
		40	181.8 (0.16%)	363.6 (0.32%)	908.9 (0.92%)	1817.8 (1.61%)
		50	227.2 (0.21%)	454.4 (0.46%)	1136.1 (1.15%)	2272.2 (2.07%)
		60	272.7 (0.25%)	545.3 (0.46%)	1363.3 (1.15%)	2726.6 (2.53%)
		70	318.1 (0.3%)	636.2 (0.69%)	1590.5 (1.38%)	3181.1 (2.99%)

Further context and considerations

There are also other important factors and sources of uncertainty which need to be taken into account when considering whether Hornsea Four will lead to AEoI of the guillemot breeding feature, namely:

- **How important the area is for guillemot during the chick rearing moult stage as key supporting habitat.** Natural England note that the Developable Area Approach (DAA) has significantly reduced the impacts that could have arisen from the project. This reflects the fact that some of the areas immediately adjacent to the site hold higher densities of guillemot at this time of year. Inter-annual variability in the location of the most important areas cannot be ruled based on two survey years, and it may be the case that the hotspots of use encroach on the Array and 2 km buffer to different degrees in different years. In any event, it remains the case that large numbers of auks use the project area in August and September, as set out in Table B2. Furthermore, whilst this period of importance of the Hornsea Project Four area is relatively short-lived (though still several weeks), it is likely to represent a critical time for flightless birds that may be attending dependent chicks. These chicks need to develop rapidly and learn to forage, and moulting adults will also have higher energetic demands and will need to build condition prior to the winter. Achieving good body condition prior to the winter, will likely be a key factor determining survival and could also carry over to the condition at the start of the following breeding season, which in turn could affect breeding productivity. We also note that displaced birds will be forced to compete with others in the more important adjacent sea areas, again potentially influencing condition prior to the winter.
- **How other nearby consented projects will influence the importance and use of the Hornsea Four area.** It is possible that displacement of guillemot from other nearby projects (namely Hornsea One and Two) could increase the importance of the Hornsea

Project Four area and surrounding seas. This again could lead to increased competition and potential reductions in condition impacting over-winter survival and subsequent productivity.

- **Uncertainty surrounding how birds will respond to the wind farm.** Flightless birds with chicks may either be less or more risk averse depending upon how they perceive the wind farm and given the need to forage and build condition/grow following the breeding season. There is further uncertainty as to whether the wind farm will be perceived as a barrier to birds looking to move further offshore to other important foraging areas and over-wintering habitat. The potential for changes to normal post-breeding migration routes cannot be ruled out and there may be associated energetic costs at a time of year when birds may be more vulnerable to additional demands.
- **How indirect effects will influence prey resources during the chick rearing moult period.** It remains unclear how the project will affect the productivity of the immediate and wider surrounding seas. However, Natural England consider that impacts on the form and function of the Flamborough Front cannot be ruled out and this may influence prey resource abundance and distribution relative to FFC SPA and areas used by guillemot during the chick rearing/moult period. Indirect effects associated with changes in biodiversity within the wind farm also have the potential to negatively, or positively, influence the abundance and availability of prey, and consequently either compound or reduce displacement rates.
- **Climate change**. This could lead to changes in prey resource abundance and distribution relative to FFC SPA and areas used by guillemot during the chick rearing/moult period. It could also result in increases in extreme weather conditions which may result in wrecks of auks occurring immediately after the breeding season.
- **The potential implications of Avian Influenza**. As noted in the overview, the ongoing Avian Influenza crisis has the potential to impact guillemot colonies including FFC SPA. This could lead to significant mortality events which would further reduce the resilience of the colony to anthropogenic impacts.

Conservation objectives and attributes

The high-level Conservation Objectives for all features of the site can be found at: [redacted]. These need to be considered in the light of the Supplementary Advice on Conservation Objectives document [redacted]), which provides more detailed advice and information to enable the application and achievement of the Objectives. This advice contains generic 'attributes' of the site as well as site-specific targets and site-specific explanatory advice. We consider the following attributes in our conservation advice are relevant:

- **Breeding population: abundance** - Maintain the size of the breeding population at a level which is above 41,607 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.
- **Disturbance caused by human activity** - Restrict the frequency, duration and/or intensity of disturbance affecting roosting, nesting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed.
- **Supporting habitat: extent and distribution of supporting habitat for the breeding season**: Maintain the extent, distribution and availability of suitable breeding habitat which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding).

- **Supporting habitat: food availability (bird):** Maintain the distribution, abundance and availability of key food and prey items (eg. Sandeel, herring, sprat) at preferred sizes.
- **Connectivity with supporting habitats**: Maintain safe passage of birds moving between nesting and feeding areas.

We advise that the ExA consider the potential impacts on guillemot (and razorbill) in the light of this full set of attributes, not just population abundance, drawing on the supporting notes in the attribute descriptions, which contain site-specific detail. As noted in our Relevant Representations [REP-029], Natural England has concerns that Hornsea Four falls within an area of 'functional importance' for the FFC SPA guillemot colony, in particular due to its usage of large numbers of guillemot in August and September during a sensitive life-cycle stage. Such functional importance cannot be straight-forwardly expressed in a numeric assessment, though we have endeavoured to factor this into the displacement/mortality rates used.

Conclusions

Given the uncertainties discussed above, considering the colony's current and likely future growth rates, and evidence of declines in productivity at the colony, and the potential functional importance of the Hornsea 4 array area**, Natural England cannot rule out that the FFC SPA annual growth rate will be sustained at a level over the next 35 years to prevent it from being susceptible to the displacement impacts of Hornsea Project Four. Accordingly, we cannot rule out beyond reasonable scientific doubt that, given the predicted impacts associated with Hornsea Project Four, the conservation objectives for the feature will be met.**

Based on the above information, Natural England advise that an AEoI on the guillemot feature of the FFC SPA cannot be ruled out for the project alone or in-combination with other consented plans and projects (either excluding or including SEP & DEP and Rampion 2).

FFC SPA Razorbill – alone and in-combination with other plans and projects

Background

Natural England note that the Applicant revised their approach used for deriving abundance estimates for razorbill in accordance with advice from Natural England and CREEM regarding the modelling undertaken. This advice has resulted in the Applicant being unable to provide updated modelled individual survey abundance estimates for razorbill. Natural England have therefore agreed the use of design-based abundance estimates for all birds (all behaviours) within the array and 2 km buffer for the assessment of displacement instead.

Natural England agree that the Applicant has provided an apportioning approach that follows Natural England's additional guidance (including a bespoke approach to apportioning in the post-breeding season). These results are presented in the Applicant's Ornithology EIA and HRA Annex (tracked) [G5.25] and are summarised in Table B2 above. For illustrative purposes, as with guillemot Natural England have also considered the standard SNCB approach to apportioning for comparison using our breeding season apportioning and the BDMPS for the remaining three seasons.

We agree with the values presented by the Applicant for the in-combination assessments. However, we note that the Applicant has included breeding season impacts for Hornsea Three for razorbill. Natural England consider that, given the distance from FFC SPA, breeding season impacts from Hornsea Three could be excluded from the in-combination totals. This would result in a significant reduction in the in-combination impacts presented by the Applicant.

Predicted Impacts

In all cases, the predicted displacement impacts based on the Natural England advice (standard and bespoke apportioning), vary greatly due to the range in displacement and mortality rates assessed. However, in all cases except the standard SNCB approach for the project alone, the range of predicted impacts have the potential to exceed a 1% increase in the baseline (latest count) mortality (Tables B2 and B7). Thus, further consideration of the potential population level impacts for FFC SPA is required.

We support the PVA undertaken for razorbill in Ornithological Assessment Sensitivity Report [G4.7] and have used the CPG rates provided by the Applicant. However, we note that the Applicant has considered two different survival rates, one based on razorbill data and an alternative based on guillemot data due to a poor fit between the PVA derived population trend at FFC SPA and the underlying colony trend. This is presented in a validation exercise within the Applicant's Ornithological Assessment Sensitivity Report [G4.7]. We acknowledge that the model using the razorbill survival rate represents a relatively poor fit to the underlying colony counts and that using the guillemot survival rates provides a considerably better one. This is likely due to razorbill survival rates being poorly quantified relative to those for guillemot, and suggests that razorbill survival rates are likely to be higher than currently estimated. Natural England welcome this type of analysis by the Applicant and highlight that it illustrates the difficulties associated with estimating vital rates and ensuring appropriate values are used within PVA.

We have provided counterfactuals based on both model runs for reference in Table B7. We note that, although there is a large difference in the predicted population trends, the counterfactuals of population growth rate derived from the two approaches do not differ substantially (Table B7). Natural England consider the outputs of these models to provide the best available evidence on which to base the assessment though this should not be taken as

an endorsement or 'acceptance' of the model outputs. Again, we note the Applicant refuses to provide the Counterfactuals of Final Population Size metrics for all PVA.

Table B7. Predicted impacts on the razorbill FFC SPA population for the range of revised mortality impacts presented in/estimated from the Applicant's Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and in-combination displacement impacts. The range of displacement impacts represents the lower (30% displacement and 1% mortality) and upper (70% displacement and 10% mortality) bounds of our advice. Counterfactuals of growth rate have been derived from the nearest representative values from the range of impacts considered by the Applicant within their Ornithological Assessment Sensitivity Report [G4.7]. Values in parentheses represent the outputs of the Applicant's PVA model adopting the guillemot survival rate used in the Applicant's model validation. Counterfactuals of final population size have not been supplied. Shaded cells are those where the reduction in growth rate could exceed 0.5%.

Razorbill: FFC SPA						
Assessment description	**Additional mortality**	**% Baseline mortality using 2017 census data***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
NE bespoke apportioning: Project alone	10-228	0.23-5.36	10-225	1-0.993 (1-0.994)	0.03-0.66% (0.03-0.62%)	
NE bespoke apportioning: Consented projects	30-700	0.70-16.45	30-700	0.999-0.980 (0.999-0.982)	0.09-2.04% (0.08-1.94%)	
NE bespoke apportioning: Consented + SEP & DEP and Rampion 2	31-713	0.72-16.77	30-700	0.999-0.980 (0.999-0.981)	0.09-2.04% (0.08-1.94%)	
Standard SNCB apportioning: Project alone	2-39	0.05-0.92	5-40	1.00-0.999 (1.00-0.999)	0.01-0.12% (0.01-0.11%)	
Standard SNCB apportioning: Consented projects	22-511	0.51-12.00	20-500	0.999-0.985 (0.999-0.986)	0.06-1.46% (0.05-1.39%)	
Standard SNCB apportioning: Consented + SEP & DEP and Rampion 2	22-524	0.53-12.33	20-500	0.999-0.985 (0.999-0.986)	0.06-1.46% (0.05-1.39%)	

*40,506 (after applied corrections)

The FFC SPA razorbill colony has exhibited strong growth in recent years (numbers from Lloyd et al. (2020)). There has been an overall increase (compound growth rate) of 4.4% per annum between SMP colony counts over 30 years between 1987 (7,688 uncorrected ind.) and 2017 (27,967 uncorrected ind.). Going back further, the overall growth rate between 1969 and 2017 has been equivalent to around 6% per annum over the 48 years. However, annual growth rates between counts since 1987 have fluctuated between 0.7% (1987-2000) and 7.2% (2008-2017) per annum. The colony growth rates suggest that the razorbill colony is currently very productive, and we note that, compared to guillemot, there has been no indication of a reduction in productivity rates that might provide an indication of density-dependence in operation. However, it is unclear how this will change over the next 35 years in the face of other pressures including climate change. The potential for a reduction in colony growth rate should therefore be considered when judging the significance of predicted impacts against the conservation objectives for the feature, particularly given the growth rate observed between 1987 - 2000.

Farne Islands SPA only supports a comparatively small colony (427 ind. in 2019). This colony has an estimated growth rate of around 2.6% per annum between 2000 and 2019 (SMP database), although a gradual decline in numbers has been reported since 2014 (The Natural History Society of Northumbria, 2021). Colonies in the Irish Sea have also experienced lower growth rates than FFC SPA, with Skomer and Skokholm representing the most successful colony with a growth rate of 3.7% per annum (2000-2018) and Rathlin Island showing a 0.8% per annum decline of 2.5% per annum (1999-2011). Moreover, as with guillemot, many colonies in Scotland have experienced significantly lower growth rates or declines in razorbill numbers of up to around 5% per annum (West Westray Cliffs 1999-2017) though some have fared better, with Fowlsheugh experiencing a growth rate of 4.3% per annum between 1999 and 2018 (JNCC Seabird Monitoring Programme 'SMP' data, see: Razorbill (Alca torda) | JNCC - Adviser to Government on Nature Conservation. We highlight that, compared to say gannet, there is considerable variation in razorbill colony growth rates around the UK. The growth rates at FFC SPA appear exceptional.

Based on trends at other colonies outside of Scotland, Natural England has considered the counterfactuals CPG for the predicted levels of additional mortality for a range of plausible future growth rate scenarios for FFC of between 1 and 8% per annum. This is to allow us to contextualise the predicted impacts and potential resilience of the colony to them.

Integrity Judgement

The Conservation Objective for the razorbill population of the FFC SPA is to maintain the size of the breeding population at a level which is above 21,140 breeding adults, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent (40,506 in 2017).

Initial assessment of impacts on FFC SPA razorbill using a range-based approach

Based on the range of predicted impacts provided in Table B8, considering a best-case scenario of 30% displacement and 1% mortality and a worst-case scenario of 70% displacement and 10% mortality, we conclude the following when examining the potential change in population growth rates and range in background colony growth rates.

Project alone

- We have considered a range of impacts from 10-225 breeding adults using our preferred bespoke approach to apportioning for Hornsea Project Four, as well as 5-40 breeding adults based on the standard SNCB approach.
- The predicted reduction in population growth rates range from 0.03 to 0.66% for the Natural England bespoke approach (using razorbill survival rate values) to 0.01 to 0.12% for the standard approach.
- For the worst-case bespoke apportioning approach (225 additional mortalities), the colony would also be predicted to continue to increase from its current size of 40,506 adults for a growth rate scenario of ≥1% per annum.
- For the worst-case standard SNCB approach (40 additional mortalities), the colony would be predicted to continue to increase from its current size of 40,506 adults for a growth rate scenario of ≥1% per annum.
- We note that when guillemot survival rates are used in the PVA, the reductions in population growth rates are slightly smaller for both the bespoke and standard approaches and the conclusions for the project alone would remain the same.

In-combination (consented)

- We have considered a range of impacts from 30-700 based on our preferred bespoke approach and 20-500 breeding adults based on the SNCB standard approach.
- The predicted reduction in population growth rates range from 0.09-1.89% for the bespoke apportioning approach (using razorbill productivity values) and 0.06 to 1.46% for the standard SNCB approach.
- Based on the maximum predicted impacts using the bespoke approach (700 adults), it is predicted that the colony would be in decline at a growth rate of 1%. At growth rate scenarios of >2% per annum the population would increase from its current population level (40,506 adults).
- At the maximum predicted impact level derived from the standard SNCB approach (500 adults), the colony population would be in decline at a growth rate of 1%. At growth rate scenarios of 2% or greater per annum the population would increase from its current population level (40,506).
- Using the guillemot survival rates within the razorbill PVA results in relatively small changes to the reductions in growth rates and CPG that do not alter the conclusions provided above.

In-combination (consented + SEP & DEP and Rampion 2)

- We have considered a range of impacts from 30-700 for the bespoke apportioning approach and 20-500 breeding adults for the standard SNCB approach.
- The predicted reduction in population growth rates range from 0.09-2.04% for the bespoke apportioning approach (using razorbill productivity values) and 0.06 to 1.46% for the standard SNCB approach.
- As these impacts are broadly the same as for the in-combination consented projects, we draw the same conclusion as above but note that there is uncertainty in the scale of the predicted impacts of the additional projects considered until they are submitted then Examined.
- Again, we consider the results of the PVA using guillemot survival rates suggest slightly smaller reductions in growth rates could occur but do not alter these conclusions.

Overall, we consider the use of guillemot survival rates in the razorbill PVA may provide a closer representation of the actual situation at FFC SPA, but that the resultant CPGs and predicted reductions in growth rates do not materially affect the outcome of the assessment.

<u>Risk assessment taking into account the sensitivity of the Hornsea Four array area and displacement buffer</u>

The range of impacts in our initial consideration include an extreme worst-case of assuming a displacement rate of 70% and mortality rate of 10% across all in-combination projects. To be clear, Natural England does not propose that these rates are used for decision-making. Nevertheless, the overall range considered identifies that the impact levels within this range could result in adverse effects. Therefore, it is necessary to investigate at what points in the displacement matrix do impact levels of concern start to arise.

Table B9 provides further context for how the displacement impacts and associated changes in growth rate vary across the range of displacement and mortality rates applied to the annual total mean-peak abundance estimates. We note that a reduction in population growth rate of >0.5% per annum as a result of in-combination impacts is not reached until mortality rates of 5% are considered for both the NE bespoke apportioning and standard SNCB approaches. A

1% reduction in growth rate is just reached at 70% displacement and 5% mortality for our preferred bespoke approach.

As with guillemot, given Natural England's concerns about the sensitivity of the Hornsea Project Four area during the chick rearing/moult stage we consider the displacement and mortality rates should reflect this. For illustrative purposes, as with guillemot, we have assumed a displacement rate of 70% and a mortality rate of up to 5% for the Hornsea Project alone, and applied a 70% displacement and 2% mortality rate for other projects (broadly in line with previous advice in EN010087-002883-SoS Deadline - Natural England.pdf (planninginspectorate.gov.uk)), under the assumption that the majority of them occupy less important sea areas [REP6-056]. Based on the bespoke apportioning approach for razorbill, an in-combination (consented) estimate of approximately 208 adults can be calculated. Taking the available PVA impacts assessed by the Applicant (200 or 225 adults), it is predicted that the colony would continue to increase for growth rate scenarios of ≥1% per annum. Please note that Natural England is not providing a position on the specific levels of displacement and mortality that should be adopted for the assessment here, but illustrating the levels of impact that have a greater likelihood of resulting in adverse effects.

Table B8. Predicted % reductions in razorbill population growth rates at FFC SPA from Hornsea project 4 alone, in-combination with consented projects, and in-combination with all consented projects + SEP & DEP and Rampion 2. Pink shaded cells are those where the reduction in growth rate exceeds 0.5%, 1% or 2%.

Method			% Mortality			
	FFC adults mean of population		1	2	5	10
NE bespoke approach to displacement and apportioning	Project alone					
	% Displacement	30	9.8 (0.03%)	19.6 (0.06%)	48.9 (0.15%)	97.8 (0.29%)
		40	13 (0.04%)	26.1 (0.09%)	65.2 (0.22%)	130.4 (0.37%)
		50	16.3 (0.04%)	32.6 (0.09%)	81.5 (0.22%)	163 (0.51%)
		60	19.6 (0.06%)	39.1 (0.12%)	97.8 (0.29%)	195.5 (0.58%)
		70	22.8 (0.06%)	45.6 (0.15%)	114.1 (0.37%)	228.1 (0.66%)
	In-combination with consented projects					
	% Displacement	30	30 (0.09%)	60 (0.15%)	149.9 (0.44%)	299.8 (0.87%)
		40	40 (0.12%)	79.9 (0.22%)	199.9 (0.58%)	399.7 (1.17%)
		50	50 (0.15%)	99.9 (0.29%)	249.8 (0.73%)	499.7 (1.46%)
		60	60 (0.15%)	119.9 (0.37%)	299.8 (0.87%)	599.6 (1.75%)
		70	70 (0.22%)	139.9 (0.44%)	349.8 (1.02%)	699.6 (2.04%)
	In-combination with consented projects + SEP & DEP and Rampion 2					
	% Displacement	30	30.6 (0.09%)	61.1 (0.15%)	152.8 (0.44%)	305.7 (0.87%)
		40	40.8 (0.12%)	81.5 (0.22%)	203.8 (0.58%)	407.6 (1.17%)
		50	50.9 (0.15%)	101.9 (0.29%)	254.7 (0.73%)	509.5 (1.46%)
		60	61.1 (0.22%)	122.3 (0.37%)	305.7 (0.87%)	611.4 (1.75%)
		70	71.3 (0.22%)	142.7 (0.44%)	356.6 (1.02%)	713.3 (2.04%)

Method			% Mortality			
	FFC adults mean of population		1	2	5	10
SNCB standard approach to displacement and apportioning	Project alone					
	% Displacement	30	1.7 (0.01%)	3.4 (0.01%)	8.4 (0.03%)	16.8 (0.06%)
		40	2.2 (0.01%)	4.5 (0.01%)	11.2 (0.03%)	22.4 (0.06%)
		50	2.8 (0.01%)	5.6 (0.01%)	14 (0.04%)	28 (0.09%)
		60	3.4 (0.01%)	6.7 (0.01%)	16.8 (0.04%)	33.5 (0.09%)
		70	3.9 (0.01%)	7.8 (0.03%)	19.6 (0.06%)	39.1 (0.12%)
	In-combination with consented projects					
	% Displacement	30	21.9 (0.06%)	43.8 (0.12%)	109.4 (0.29%)	218.8 (0.66%)
		40	29.2 (0.09%)	58.3 (0.15%)	145.9 (0.44%)	291.7 (0.87%)
		50	36.5 (0.12%)	72.9 (0.22%)	182.3 (0.51%)	364.7 (1.09%)
		60	43.8 (0.12%)	87.5 (0.29%)	218.8 (0.66%)	437.6 (1.31%)
		70	51.1 (0.15%)	102.1 (0.29%)	255.3 (0.73%)	510.6 (1.46%)
	In-combination with consented projects + SEP & DEP and Rampion 2					
	% Displacement	30	22.5 (0.06%)	44.9 (0.15%)	112.3 (0.29%)	224.7 (0.66%)
		40	30 (0.09%)	59.9 (0.15%)	149.8 (0.44%)	299.6 (0.87%)
		50	37.4 (0.12%)	74.9 (0.22%)	187.2 (0.51%)	374.5 (1.09%)
		60	44.9 (0.15%)	89.9 (0.29%)	224.7 (0.66%)	449.4 (1.31%)
		70	52.4 (0.15%)	104.9 (0.29%)	262.1 (0.73%)	524.3 (1.46%)

As with guillemot, Natural England also note that the Applicant's in-combination totals have included a large number of predicted impacts from Hornsea Project Three for the breeding season. Natural England considers these impacts should not be included in the total for FFC SPA. If these were to be removed from our bespoke approach in-combination totals for the consented projects, it would reduce the predicted impacts at 70% displacement and 2% mortality by approximately 7 adults. We do not consider that this would make any material difference to the outcome of the assessment but advise that this should be taken into account in any future assessments.

The predicted impacts on the razorbill feature of FFC SPA, based on the project alone (bespoke approach at 70% displacement and 5% mortality), are predicted to be around 20% greater than the in-combination impacts (at 70% displacement and 2% mortality) from the other consented projects to date. However, we note that the impacts from the project alone, using either the NE bespoke or standard SNCB apportioning approach, would not result in a decline in the population provided that the growth rate is maintained at 0.5% or more per annum over the lifetime of the project.

If the colony were to experience a reduction in annual growth rate to 2-3% per annum over the next 35 or so years, then the integrity of the site for this feature is still likely to remain high, with good potential for self-renewal under dynamic conditions with minimal external management. The current long-term annual growth rate is around 4.4% (1987-2017), with

better growth rates between 2000 and 2017 of 7.3% per annum. FFC SPA is currently one of the most productive razorbill colonies in the UK and, despite significant inter-annual variability, there does not appear to be any sign of a declining trend in productivity rates (Lloyd et al., 2020). In contrast, some of the Scottish and Welsh colonies have had very poor productivity in recent years relative to England. This has generally been associated with prey shortages or quality reductions, emphasising the susceptibility of seabird colonies in the face of localised changes to prey availability.

Given the current success of the FFC SPA colony relative to others, in comparison to the FFC SPA guillemot population, it seems less likely that growth of the FFC SPA razorbill population would drop to below 1% per annum. However, we note that there is inherent uncertainty in this conclusion given the 35-year lifespan of the project and the other pressures facing seabird colonies, as set out in the other species accounts above.

Conclusions

Based on the information provided above, the FFC SPA razorbill colony appears to be robust enough to maintain the population at its current level, and sustain additional mortalities from Hornsea Four project's alone impacts, which we do not predict to exceed a 0.5% reduction in growth rate.

Natural England advises that an AEOI on the razorbill feature of the FFC SPA can be ruled out based on the project alone.

We do not consider it is likely that the population growth rate will fall much below around 1-2% per annum over the lifetime of the project based on current data, though there is inherent uncertainty in this assumption, particularly given the growth rate observed between 1987-2000 was below 1%. We highlight that, based on our preferred approach to apportioning, and given a displacement rate of 70% and mortality rate of 5%, Hornsea Project Four alone would now contribute more to the in-combination then all other consented projects, resulting in a substantial increase in the in-combination total. With this in mind, and also taking into account the other key factors and uncertainties discussed in relation to guillemot, which are also relevant to razorbill, it remains difficult for Natural England to rule out the potential for AEoI in-combination on the razorbill feature of FFC SPA over the lifespan of the project, as a growth rate of under 1% would potentially make the population susceptible to displacement impacts.

We are also conscious that the above analysis has been hindered by the refusal of the Applicant to prevent the Counterfactuals of Population Size (CPS), which provides an additional perspective on potential impacts. We do note that RSPB have calculated CPS for their preferred impact levels and note that their in-combination CPS values are for a 11-1 – 21.9% relative reduction in the final population size. This reinforces our concern that the razorbill population may not be sufficiently robust in the face of the predicted impacts to prevent a decline from its current level.

It is fair to say that the risk of adverse effects is less pronounced than for guillemot when solely considering population abundance. However, there are also other factors and uncertainties which need to be taken into account when considering whether Hornsea Project Four will lead to AEoI on the razorbill breeding feature. These have been discussed in relation to our position on guillemot and we refer the reader to that section [REP6-56]. In particular, we are concerned that the Hornsea Four array area, as well as surrounding waters, has functional importance for razorbill in the sensitive chick-rearing and moult phase. Also, as per guillemot, we highlight that the assessment of impacts needs to consider conservation objectives beyond just population abundance, using the equivalent SACOs for razorbill.

Based on the above considerations, Natural England advise that an AEoI on the razorbill feature of the FFC SPA cannot be ruled out for the project in-combination with other consented plans and projects (both including and excluding SEP & DEP and Rampion 2).

Breeding seabird assemblage – alone and in-combination with other plans and projects

Here, we consider the potential for impacts leading to AEoI of the breeding seabird assemblage of FFC SPA. As qualifying species of the SPA, the four species discussed above are principal components of the assemblage. The assemblage also includes fulmar (as a named component), puffin, herring gull, shag and cormorant. Therefore, the impacts on other assemblage species need consideration where they might be significant, as set out below. We then go on to consider the key conservation objectives for the assemblage as a whole.

Fulmar

Natural England note that fulmar have been screened-out for HRA for FFC SPA (OFF-ORN-2.10; APP-130). This was due to a lack of any evidence suggesting fulmar are sensitive to displacement or collision impact pathways.

Puffin

The Applicant undertook an assessment for puffin in line with the approach to an assemblage component, the results of this are provided in Table B2 above Table B9 below. Natural England agree the results provided in Ornithology EIA and HRA Annex (tracked) [G5.2], which are based on design-based abundance estimates and Natural England advice on apportioning. We noted one outstanding issue with the values presented by the Applicant based on the Natural England approach where an incorrect apportioning rate had been applied in Table 105 of Ornithology EIA and HRA Annex (tracked) [G5.2].

Given the range of displacement and mortality rates considered by Natural England for puffin, the impacts are estimated to be between 1 and 14 additional mortalities per annum for the project alone. Using a more realistic displacement rate of 70% and mortality rate of 2% for puffin results in an estimate of 3 additional mortalities.

When in-combination impacts are considered, the estimated potential additional mortalities could increase to 86 (25.6% increase in baseline mortality) based on the Natural England approach and the worst-case of 70% displacement and 10% mortality for the project alone. The predicted in-combination impacts (both consented and including SEP & DEP and Rampion 2), using a more plausible 70% displacement and 2% mortality, would be around 17 adult breeding birds (5% increase in the baseline natural mortality rate). This level of impact suggests that further investigation is required.

There is very little robust data on trends in puffin colony growth rates at FFC SPA due to the inherent difficulties surveying the species at FFC SPA, where the bird nests in cracks in the cliffs. Understanding of the population trend at FFC SPA is therefore poor. The English population trend between the seabird colony register and seabird 2000 suggested a compound growth rate of around 5% was possible (JNCC Seabird Monitoring Programme 'SMP' data, see: Atlantic puffin (Fratercula arctica) | JNCC - Adviser to Government on Nature Conservation). More detailed trends in breeding abundance at Coquet Island and the Farne Islands also suggest that, despite fluctuations, there has been a strong growth trend for puffin population on the east coast of England between 1986 and 2019.

The mean at-sea population count for puffin was 3,579 individuals between 2017 and 2018 and this was used as a starting population by the Applicant in their PVAs presented in Ornithological Assessment Sensitivity Report [G4.7].

For the worst-case scenario considered here (85 additional adult mortalities per annum), the colony would need to sustain a growth rate of 3% or more to maintain or grow the current

population. However, for a more plausible predicted impact of 15 additional adult mortalities (nearest PVA value for in-combination total at 70% displacement and 2% mortality), the population is predicted to increase for a growth rate of 1% or more.

We conclude that in-combination displacement effects will exert a degree of pressure on the puffin population. However, we do not consider this would be sufficient to trigger an adverse effect on the seabird assemblage solely due to puffin impacts, given the fairly modest level of the in-combination impact on growth rates, and recognising that the species is not a qualifying feature or a named component of the assemblage. However, there is significant uncertainty in this conclusion due to the difficulties monitoring the colony and therefore the ability to predict future trends, and the potential for extrinsic pressures (as described above for guillemot and razorbill) to reduce the resilience of the colony.

Table B9. Predicted impacts on the puffin FFC SPA population for the range of revised mortality impacts presented in/estimated from the Applicant's Ornithology EIA and HRA Annex (tracked) [G5.2] predicted for project alone and in-combination displacement impacts. The range of displacement impacts represents the lower (30% displacement and 1% mortality) and upper (70% displacement and 10% mortality) bounds of our advice. Counterfactuals of growth rate have been derived from the nearest representative values from the range of impacts considered by the Applicant within their Ornithological Assessment Sensitivity Report [G4.7]. Counterfactuals of final population size have not been supplied. Shaded cells are those where the reduction in growth rate exceeds 0.5%.

Puffin: FFC SPA						
Assessment description	**Additional mortality**	**% Baseline mortality using 2017 census data***	**Closest Applicant assessed impact scenario**	**Counterfactual of Growth Rate (CGR) after 35 years**	**Reduction in growth rate per annum**	**Counterfactual of Final Population Size (CPS) after 35 years**
Project alone	1-4	0.18-4.26	1-5	1-0.998	0.03-0.17%	
Consented projects	4-86	1.10-25.60	5-85	0.998-0.972	0.17-2.80%	
Consented + SEP & DEP and Rampion 2	4-86	1.10-25.60	5-85	0.998-0.972	0.17-2.80%	

*3,579 (mean at-sea count from 2017 and 2018)

Herring gull

As part of the breeding seabird assemblage, herring gull was screened into the assessment of the operation and maintenance phase on a precautionary basis. The Applicant has estimated that less than a single additional adult herring gull mortality could be attributed to FFC SPA. Natural England advise that this level of impact would not significantly influence the FFC SPA herring gull population and thus the seabird assemblage. However, we suggest that a running total of minor potential impacts on herring gull from FFC SPA is maintained for future assessments.

Seabird assemblage integrity advice

The seabird assemblage at FFC SPA is the single largest mainland seabird colony in the UK and the largest in England. At classification the site supported 216,730 individuals. This reflects extensive tall cliffs providing nesting opportunities with good access to productive foraging areas, including those associated with the major frontal system of the Flamborough Front.

As noted above, Natural England is unable to rule out adverse effects on FFC SPA guillemot (alone and in-combination), razorbill and kittiwake (in-combination). There will also be additional impacts on other assemblage species below a level that would result in adverse effects, namely gannet, puffin and (to a much lesser extent) herring gull.

Direct impacts arise due to collision risk and displacement effects. In addition, there is the potential for indirect impacts, due to the potential for the array to disrupt marine processes, affecting primary productivity and thereby forage fish availability for those SPA species. There is considerable uncertainty regarding the extent and nature of the marine process impacts.

Key attributes within the Supplementary Advice on Conservation Objectives for FFC SPA follow, together with a short analysis:

Assemblage of species: abundance

In 2017, the FFC SPA assemblage feature totalled 298,544 individual seabirds, a substantial increase on the citation population, though broadly similar to the notional assemblage population of 305,784 reported in the 2001 SPA Review (Stroud et al, 2001). Due to the predicted impact on the more numerous species comprising the assemblage, particularly guillemot, and the uncertainty regarding the impacts of the proposal on marine processes, it cannot be concluded that the overall abundance of the assemblage will be maintained.

Assemblage of species: diversity

There are 9 seabird species in the assemblage, those mentioned above plus cormorant and shag, which are not relevant here. It is not expected that Hornsea Four will result in any one species being lost to the assemblage, and so the diversity of the seabird assemblage will be maintained.

Supporting habitat: extent and distribution of supporting habitat for the breeding season; and Supporting habitat: quality of supporting breeding habitat

The Hornsea 4 proposal has the potential to exclude significant numbers of assemblage birds, particularly guillemot, from the array area, reducing the extent and distribution of supporting habitat. In addition, the array may through disrupting marine processes affect the Flamborough Front and therefore seabird prey availability, also reducing the quality of supporting habitat. It cannot be concluded that the extent, distribution and quality of supporting breeding habitat will be maintained.

Conclusion

Accordingly Natural England cannot rule out adverse effects on the assemblage feature, due to potentially significant levels of impact on the assemblage abundance, and on the extent and quality of supporting habitat used by SPA seabirds in the breeding season and, for guillemot and razorbill, the chick-rearing and moult phase. The risk increases when the impacts of Hornsea Four are considered in-combination with other plans and projects.

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