NORTH FALLS

Offshore Wind Farm

HABITATS REGULATIONS ASSESSMENT

Shadow Appropriate Assessment for Guillemot at the Farne Islands SPA

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Glossary of Acronyms

Acronym	Definition
AEOI	Adverse Effect on Integrity
BDMPS	Biologically Defined Minimum Population Scale
CL	Confidence Limit
CPGR	Counterfactual of the Population Growth Rate
CPS	Counterfactual of Population Size
DCO	Development Consent Order
ES	Environmental Statement
FFC	Flamborough and Filey Coast
FI	Farne Islands
HP4	Hornsea Project Four
HPAI	Highly Pathogenic Avian Influenza
HRA	Habitats Regulations Assessment
LCL	Lower Confidence Limit
MMFR	Mean Maximum Foraging Range
NE	Natural England
OWF	Offshore Wind Farm
PINs	Planning Inspectorate
PVA	Population Viability Analysis
RIAA	Report to Inform Appropriate Assessment
SACO	Supplementary Advice on the Conservation Objectives
SADEP	Sheringham and Dudgeon Extension Projects
SD	Standard Deviation
SMP	Seabird Monitoring Programme
SNCB	Statutory Nature Conservation Body
SPA	Special Protection Area
UCL	Upper Confidence Limit

1 Introduction

1. This technical note updates the shadow appropriate assessment for guillemot at the Farne Islands Special Protection Area (SPA), provided in section 4.6.4.2 of the North Falls Report to Inform Appropriate Assessment (RIAA) Part 4 Offshore Ornithology [**APP-178**].

2. The update is provided in response to comments provided by Natural England in their relevant representation [RR-243]. Specifically Natural England comments P22, F3 and F26, reproduced below:

   - (P22) *No in-combination assessment for guillemot for the Farne Islands SPA. There is the potential for effects from North Falls to combine with those from Berwick Bank and other North Sea projects. The Applicant should carry out a full in-combination assessment of impacts for guillemot at the Farne Islands SPA, to allow Natural England to advise further regarding the risks of adverse effects in-combination.*

   - (F3) *The Applicant has not carried out an in-combination assessment for guillemot for the Farne Islands SPA. Natural England has advised Marine Scotland that adverse effects on the Farne Islands SPA could not be ruled out at Berwick Bank OWF due to impacts on guillemot from that project alone, and other consented/proposed projects could also impact the site. Therefore, there is the potential for effects from North Falls to combine with those from Berwick Bank and other North Sea projects. This should be properly considered, rather than assuming the contribution is not material. The Applicant should carry out a full in-combination assessment of impacts for guillemot at the Farne Islands SPA, to allow Natural England to advise further regarding the risks of adverse effects in-combination.*

   - (F26) *The Applicant has ruled out the potential for in-combination displacement effects for Guillemot at the Farne Islands SPA on the basis that at displacement rates of 50% and mortality rates of 1%, increases in baseline mortality are less than 0.1%. Impacts at 70% displacement and 10% mortality are also presented. Natural England consider that, in the absence of a full displacement matrix, presentation of 2% rather than 10% mortality at 70% displacement as the worst-case scenario would be more useful. For in-combination assessments, this would be consistent with recent advice given to SADEP OWF (ref PINS EN010109) where we advised 70%/2% for all projects other than Hornsea 4 where we advised 70%/5%. It also recognises that SoS will likely base their conclusions on this scenario across all projects and so it would be advantageous to present in both the project alone and in-combination assessments... A full in-combination assessment of impacts should be presented for guillemot for the Farne Islands SPA. Natural England should be consulted on the results of this assessment, at which point we can advise on whether AEOI can be excluded. We advise that Nature Scot, as the relevant SNCB, are consulted on predicted impacts to Scottish SPAs and the potential for contribution to existing impacts in light of AEOI judgements.*

3. Responses to Natural England's relevant representations are provided in the Applicant's Response to Relevant Representations from Natural England (Document reference [**9.1**]).

2 Shadow Appropriate Assessment for guillemot at the Farne Islands SPA

2.1 SPA overview and conservation objectives

4. The Farne Islands are a group of low-lying islands 2-6 km off the coast of Northumberland in north-east England. They are important as nesting areas for seabirds, especially terns, gulls and auks.

5. Guillemot is one of the qualifying features of the SPA screened in for appropriate assessment in relation to North Falls (see RIAA Part 4 [**APP-178**]) Table 4.5, and HRA Screening Report (RIAA Appendix 1.1, [**APP-174**]). A shadow appropriate assessment for this species at the Farne Islands SPA is included in the RIAA Part 4, Section 4.6.4. As above, in their Relevant Representations [**RR-243**], Natural England has requested a more detailed in combination assessment, which is presented here.

6. The SPA's conservation objectives are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to the integrity of the National Sites Network, by maintaining or restoring:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The populations of each of the qualifying features; and
- The distribution of qualifying features within the site.

2.2 Status

7. At classification in 1983, the SPA's breeding population of common guillemot was cited as 6,000 pairs. The population subsequently increased to 32,875 breeding pairs (5-year peak mean 2010 -14) (Natural England 2023), an increase of 548% over a period of approximately 30 years. Between 2015 and 2019, the mean count was 52,949 individuals (data from Seabird Monitoring Programme (SMP) database, accessed 17 January 2025), equivalent to 35,476 breeding pairs (based on a multiplier of 0.67, used to convert individuals counted on land to breeding pairs; Walsh *et al*., 1995), an overall increase of 7.9%.

8. The mean count over the most recent 5-year period, 2020-2024, is 54,948 individuals (SMP database, accessed 17 January 2025), equivalent to 36,815 pairs. Although the most recent five year mean is equivalent to a 3.8% increase on that for 2015-2019, during this time the guillemot population declined by 32% from 63,413 individuals counted in 2020, to 42,892 in 2024. This is likely to be

at least in part due to outbreaks of HPAI at the Farne Islands in 2022 and 2023, which affected a number of seabird species including guillemot. The SPA seabird colonies were apparently free of HPAI in 2024 (National Trust 2024).

9. Supplementary advice on the conservation objectives (SACOs) for guillemots, includes a target to maintain the size of the breeding population at a level which is above 32,875 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent (Natural England 2023).

10. Based on a breeding population of 73,630 adult guillemots (36,815 x 2), and an adult mortality rate of 6.1% (1-93.9% survival rate, Horswill and Robinson 2015, Environmental Statement (ES) Chapter 13 **[APP-027]**), Table 13.11), a total of 4,491 adults from the Farne Islands SPA breeding population would suffer mortality each year. This is the baseline mortality rate against which the predicted additional mortality from OWF effects is assessed.

2.3 Connectivity

11. The breeding and non-breeding seasons are as defined in ES Chapter 13 [**APP-027]**, Table 13.10.

2.3.1 Breeding season

12. North Falls is 485.6km from the Farne Islands SPA (nearest distance from array boundary to SPA boundary). There is no connectivity between North Falls and the Farne Islands SPA during the breeding season, as North Falls is beyond the Mean Maximum Foraging Range (MMFR) + one Standard Deviation (SD) from the SPA (55.7+39.7=95.4km) (see RIAA Part 4 [**APP-178**]) paragraph 417 for more background on MMFR for guillemot).

2.3.2 Non-breeding season

13. There is potential connectivity as North Falls and the Farne Islands SPA are within the UK North Sea and Channel Biologically Defined Minimum Population Scale (BDMPS), as identified by Furness (2015), with an estimated total population of 1,617,306 individuals during the non-breeding season (Furness, 2015). Assuming that guillemot breeding populations from all SPAs within this area mix widely within the BDMPS area, then there is potential for breeding adults of the Farne Islands SPA to be subject to displacement effects at North Falls during the non-breeding season.

14. The Farne Islands SPA population of breeding adult guillemots is estimated as 3.73% of the overall BDMPS population of this species (Furness 2015 (Appendix A, Table 62)).

2.4 Effect: displacement/barrier effect during operation

15. The breeding population of guillemot at the Farne Islands SPA has been screened in for appropriate assessment due to the potential operational displacement/barrier effect during the non-breeding season.

16. As stated in ES Chapter 13, Section 13.6.2.1 [**APP-027**], for the purposes of assessment of birds at an offshore wind farm (OWF) array area (and buffer) during a given season, it is usually not possible to distinguish between displacement and barrier effects (i.e. to define whether individual birds that are displaced may have intended to travel to, or beyond an OWF site) even when tracking data are available. Therefore, in this assessment displacement and barrier effects on guillemot are considered together (as is standard practice within the industry).

17. The assessment assumes that a proportion of the guillemots present in the North Falls array area and 2km buffer would be displaced during the operation of the OWF, and that a proportion of displaced birds would die as a result of displacement. For guillemot, SNCBs (2017) advise that displacement rates of 30% to 70% are considered, along with a range of mortality rates from 1% to 10% of displaced birds. In this assessment, the focus is on two scenarios: 70% displacement and 2% mortality of displaced birds, and 50% displacement and 1% mortality of displaced birds. The first scenario is based on the HRA for Hornsea Project Four (HP4), where the Secretary of State is understood to have based the consent decision on displacement and mortality rates of 70% and 2% for guillemot and razorbill (DESNZ, 2023). The second scenario, which represents the Applicant's approach, is based on a detailed review of the evidence in relation to displacement of auks from OWFs, included in ES Chapter 13 [**APP-027**], Section 13.6.2.1.1.

2.5 Project alone assessment

18. An estimated 200 individuals of the 6,231 guillemots predicted to be present at the North Falls array area and 2km buffer annually is apportioned to the Farne Islands SPA (Table 2.1).

Table 2.1 Seasonal (mean peak) and annual population estimates of Guillemot at North Falls (array area and 2km buffer) and numbers apportioned to the Farne Islands SPA

BREEDING SEASON		NON-BREEDING SEASON		ANNUAL	
Mean Peak (95% CLs)	Apportioned to Farnes	Mean Peak (95% CLs)	Apportioned to Farnes	Total (95% CLs)	Apportioned to Farnes
866 (242-2346)	0	5365 (868-14674)	200 (32-547)	6,231 (1110-17020)	200 (32-547)

1. See ES Appendix 13.2 [**APP-103**] Section 4 for details of how seasonal mean peaks and upper and lower 95% CLs (values in parentheses) were calculated.
2. Apportioning to the Farne Islands SPA as per section 2.3 above.

19. Displacement matrices showing the number of guillemots from the Farne Islands SPA breeding population predicted to die annually due to displacement from North Falls, and the equivalent increases in baseline population mortality rate, are shown in Table 2.2 and Table 2.3.

20. At 50% displacement and 1% mortality of displaced birds, 1 (95% CLs 0-3) adult guillemot is predicted to die per year due to displacement at North Falls. This is

equivalent to a 0.0% (95% CLs 0.0-0.1%) increase in the baseline mortality of the SPA population.

21. At 70% displacement and 2% mortality of displaced birds, 3 (95% CLs 0-8) adult guillemots are predicted to die per year due to displacement at North Falls. This is equivalent to a 0.1% (95% CLs 0.0-0.2%) increase in the baseline mortality of the SPA population.

22. Under both scenarios of displacement and mortality the predicted increases in the baseline mortality rate are less than 1% and unlikely to be detectable against natural variation. It is concluded that predicted guillemot mortality due to operational phase displacement at North Falls alone would not adversely affect the integrity of the Farne Islands SPA.

Table 2.2 Guillemot annual displacement matrix for the Farne Islands SPA The cells show the number of predicted bird mortalities (to the nearest integer) at a given rate of displacement and mortality (LCL and UCL = upper and lower 95% CLs). Grey cells identify the range of displacement and mortality rates for consideration as recommended by SNCBs. Values in red identify scenarios where the baseline mortality rate would increase by >1%.

Mean		Mortality										
		1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
Displacement	10%	0	0	1	1	1	2	4	6	10	16	20
	20%	0	1	1	2	2	4	8	12	20	32	40
	30%	1	1	2	2	3	6	12	18	30	48	60
	40%	1	2	2	3	4	8	16	24	40	64	80
	50%	1	2	3	4	5	10	20	30	50	80	100
	60%	1	2	4	5	6	12	24	36	60	96	120
	70%	1	3	4	6	7	14	28	42	70	112	140
	80%	2	3	5	6	8	16	32	48	80	128	160
	90%	2	4	5	7	9	18	36	54	90	144	180
	100%	2	4	6	8	10	20	40	60	100	160	200
LCL		Mortality										
		1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
Displacement	10%	0	0	0	0	0	0	1	1	2	3	3
	20%	0	0	0	0	0	1	1	2	3	5	6
	30%	0	0	0	0	0	1	2	3	5	8	10
	40%	0	0	0	1	1	1	3	4	6	10	13
	50%	0	0	0	1	1	2	3	5	8	13	16
	60%	0	0	1	1	1	2	4	6	10	16	19
	70%	0	0	1	1	1	2	5	7	11	18	23
	80%	0	1	1	1	1	3	5	8	13	21	26
	90%	0	1	1	1	1	3	6	9	15	23	29
	100%	0	1	1	1	2	3	6	10	16	26	32
UCL		Mortality										
		1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
Displacement	10%	1	1	2	2	3	5	11	16	27	44	55
	20%	1	2	3	4	5	11	22	33	55	88	109
	30%	2	3	5	7	8	16	33	49	82	131	164
	40%	2	4	7	9	11	22	44	66	109	175	219
	50%	3	5	8	11	14	27	55	82	137	219	274
	60%	3	7	10	13	16	33	66	99	164	263	328
	70%	4	8	11	15	19	38	77	115	192	307	383
	80%	4	9	13	18	22	44	88	131	219	350	438
	90%	5	10	15	20	25	49	99	148	246	394	493
	100%	5	11	16	22	27	55	109	164	274	438	547

Table 2.3 Guillemot annual displacement matrix for the Farne Islands SPA The cells show the predicted increase in baseline mortality rate at a given rate of displacement and mortality (LCL and UCL = upper and lower 95% CLs). Grey cells identify the range of displacement and mortality rates for consideration as recommended by SNCBs. Values in red identify scenarios where the baseline mortality rate would increase by >1%.

Mean		Mortality										
		1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
Displacement	10%	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.4
	20%	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.4	0.7	0.9
	30%	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.4	0.7	1.1	1.3
	40%	0.0	0.0	0.1	0.1	0.1	0.2	0.4	0.5	0.9	1.4	1.8
	50%	0.0	0.0	0.1	0.1	0.1	0.2	0.4	0.7	1.1	1.8	2.2
	60%	0.0	0.1	0.1	0.1	0.1	0.3	0.5	0.8	1.3	2.1	2.7
	70%	0.0	0.1	0.1	0.1	0.2	0.3	0.6	0.9	1.6	2.5	3.1
	80%	0.0	0.1	0.1	0.1	0.2	0.4	0.7	1.1	1.8	2.9	3.6
	90%	0.0	0.1	0.1	0.2	0.2	0.4	0.8	1.2	2.0	3.2	4.0
	100%	0.0	0.1	0.1	0.2	0.2	0.4	0.9	1.3	2.2	3.6	4.5
LCL		Mortality										
		1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
Displacement	10%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
	20%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
	30%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2
	40%	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.3
	50%	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.4
	60%	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.4
	70%	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.4	0.5
	80%	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.5	0.6
	90%	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.5	0.6
	100%	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.6	0.7
UCL		Mortality										
		1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
Displacement	10%	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.6	1.0	1.2
	20%	0.0	0.0	0.1	0.1	0.1	0.2	0.5	0.7	1.2	1.9	2.4
	30%	0.0	0.1	0.1	0.1	0.2	0.4	0.7	1.1	1.8	2.9	3.7
	40%	0.0	0.1	0.1	0.2	0.2	0.5	1.0	1.5	2.4	3.9	4.9
	50%	0.1	0.1	0.2	0.2	0.3	0.6	1.2	1.8	3.0	4.9	6.1
	60%	0.1	0.1	0.2	0.3	0.4	0.7	1.5	2.2	3.7	5.8	7.3
	70%	0.1	0.2	0.3	0.3	0.4	0.9	1.7	2.6	4.3	6.8	8.5
	80%	0.1	0.2	0.3	0.4	0.5	1.0	1.9	2.9	4.9	7.8	9.7
	90%	0.1	0.2	0.3	0.4	0.5	1.1	2.2	3.3	5.5	8.8	11.0
	100%	0.1	0.2	0.4	0.5	0.6	1.2	2.4	3.7	6.1	9.7	12.2

2.6 In combination assessment

23. The Project alone assessment found a very small predicted guillemot mortality, a mean of between 1 and 3 birds per year, and <0.1% increase in baseline mortality, assuming a realistic, evidence-based precautionary scenario of 50% displacement/1% mortality and a more precautionary scenario of 70% displacement/2% mortality. On this basis, it is concluded that there would be no material contribution of North Falls to any in-combination effects of OWFs on the Farne Islands SPA. Accordingly, no in-combination assessment is required for this feature.

24. The conclusion of the assessment is therefore that predicted guillemot mortality due to displacement and barrier effects at North Falls would not adversely affect the integrity of the Farne Islands SPA, either for the project alone or in-combination.

25. Notwithstanding this conclusion, the estimated in-combination mortality, together with a Population Viability Analysis (PVA), is provided below as context to the Project alone assessment. This information is presented without prejudice to the conclusion above.

26. Seasonal and annual population estimates of breeding guillemot at all OWFs included in the in-combination assessment are presented in Table 2.4 along with the numbers apportioned to the Farne Islands SPA. These are the total number of birds at risk of displacement from all OWFs within the BDMPS area. Seasonal totals for OWFs are taken from Appendix 13.3 of the North Falls Environmental Statement [**APP-104**] where these are still current (with references to source material included in Appendix 13.3). For some OWFs where quantitative information on guillemot numbers has become available in the public domain since Appendix 13.3 was prepared[1], the numbers have been updated (see notes to Table 2.4). The cut-off date for the information presented in this assessment was the end of January 2025.

27. The potential for breeding season connectivity between an OWF and the Farne Islands SPA was identified for four projects within MMFR + 1SD (95.4km, Section 2.3.1): Blyth (44.6km from the Farne Islands), Berwick Bank (55.7km), Neart na Gaoithe (71.4km) and Inch Cape (93.7km). However, no breeding season connectivity was concluded for the latter two consented projects which are furthest from the SPA, as the respective HRAs (Marine Scotland 2018, 2019) did not identify breeding season connectivity with the Farne Islands. At 55.6 km from the Farne Islands, Berwick Bank is within MMFR + 1SD (and just within MMFR of 55.7km, Section 2.3.1). The Report to Inform Appropriate Assessment for Berwick Bank (Royal HaskoningDHV, 2022) identifies breeding season connectivity with the Farne Islands SPA, and identifies an apportioning rate of 0.08 for adult guillemots present at Berwick Bank during the breeding season. Blyth OWF (44.6km from the Farne Islands SPA) is slightly closer than

[1] A cut-off of March 2024 was used for the DCO submission to enable submission documents to be finalised.

2828Berwick Bank, and a nominal apportioning rate of 0.10 has been applied during the breeding season (Table 2.4), with reference to the Berwick Bank rate.

28. For a small number of OWFs within the UK North Sea and Channel BDMPS, Natural England has advised that an additional post-breeding/moult season should be adopted for guillemot, during August and September. The post-breeding/moult season includes a period where guillemot chicks jump from nests before they can fly and disperse out to sea accompanied by the male parent, and also covers the annual moult period for guillemots during which they become flightless for a time. This is considered a period of particular sensitivity for the species. Use of this additional season was first advised by Natural England for Hornsea Project Four (HP4), where guillemot were present in the array area and 2km buffer in large numbers in August and September and it was considered by Natural England that, given the proximity of the array area to the Flamborough and Filey Coast (FFC) SPA, the vast majority of the individuals present were likely to be from the SPA breeding colonies. The Examining Authority for HPA agreed that Natural England's bespoke approach to the definition of guillemot seasons for the FFC SPA should be used. In consenting Hornsea Project Four, the Secretary of State referred to the Natural England advice on seasons for guillemot at the FFC but didn't specifically comment on this in the conclusion of the appropriate assessment (DESNZ 2023). Subsequently Natural England has advised that a post-breeding/moult season should also be identified for Dogger Bank South and Outer Dowsing, OWFs, also in relation to guillemot at the FFC SPA. Thus Table 2.4 includes population estimates for the post-breeding moult period for Hornsea Project Four and Dogger Bank South (but not Outer Dowsing where no estimate was found in the Development Consent Order (DCO) documentation). As the extra season was identified in relation to the FFC SPA, no guillemots have been apportioned to the Farne Islands SPA during this season.

29. During the non-breeding season, 3.73% of the relevant OWF population of guillemots has been apportioned to the Farne Islands SPA (see Section 2.3.2).

30. The estimated annual total of breeding adult guillemots from Farne Islands SPA present and at risk of displacement from all OWFs within the UK North Sea BDMPS combined is 17,171 individuals (Table 2.4). Of this total, North Falls contributes only 200 birds, representing only 1.2% of the in-combination total. This total includes Berwick Bank OWF. It is understood that for Scotwind Projects, NatureScot requests that cumulative and in combination displacement numbers are presented with and without Berwick Bank, which has the largest total number of guillemots at risk of displacement of all OWFs within the UK North Sea and channel BDMPS. The same approach has been taken here. Thus, without Berwick Bank, the estimated annual total of breeding adult guillemots from Farne Islands SPA at risk of displacement from all OWFs within the UK North Sea BDMPS combined is 12,230 individuals, of which North Falls contributes 1.6% of the in-combination total.

31. It is noted that two of the OWFs included in the in combination assessment, HP4 and SADEP, have been consented subject to compensation measures for guillemot at the FFC SPA. The aim of these measures is to offset the predicted displacement mortality of guillemots from these OWFs at the FFC SPA. While they are not targeted at the Farne Islands SPA, the measures will reduce the

overall predicted displacement effect of OWFs within the UK North Sea and Channel BDMPS on guillemot. However, no account of the proposed compensation has been taken in the in combination assessment presented here.

32. A displacement matrix for the in-combination totals of guillemots from the Farne Islands at risk of displacement, including Berwick Bank, is presented in Table 2.5. The corresponding predicted increases in the mortality rate of the SPA population are given in Table 2.6 Displacement matrices without Berwick Bank area included in Table 2.7 and Table 2.8.

Table 2.4 Seasonal and annual population estimates of guillemots at risk of displacement at North Falls and other OWFs included in the in-combination assessment; and numbers apportioned to the breeding population of the Farne Islands (FI) SPA

Tier	OWF	Distance From FI (km)	Number of guillemots at risk of displacement[1]								Consented with compen-sation for guillemot at FFC[3]
			Breeding		Chick rearing / moult[2]		Non-breeding		Annual		
			Total	FI	Total	FI	Total	FI	Total	FI	
Operational, in construction and consented											
1	Beatrice	292.7	13,610	0	n/a	n/a	2,755	103	16,365	103	-
1	Beatrice Demonstrator	286.4	n/a	0	n/a	n/a	n/a	n/a	n/a	n/a	-
1	Blyth Demonstration[4]	44.6	1,220	122	n/a	n/a	1,321	49	2,541	171	-
1	Dudgeon	320.1	334	0	n/a	n/a	542	20	876	20	-
1	East Anglia ONE	455.1	274	0	n/a	n/a	640	24	914	24	-
1	EOWDC (Aberdeen)	174.8	547	0	n/a	n/a	225	8	772	8	-
1	Galloper	467.7	305	0	n/a	n/a	593	22	898	22	-
1	Greater Gabbard	467.8	345	0	n/a	n/a	548	20	893	20	-
1	Gunfleet Sands	470.1	0	0	n/a	n/a	363	14	363	14	-
1	Hornsea Project One	280.7	9,836	0	n/a	n/a	8,097	302	17,933	302	-
1	Hornsea Project Two	265.5	7,735	0	n/a	n/a	13,164	491	20,899	491	-
1	Humber Gateway	249.1	99	0	n/a	n/a	138	5	237	5	-
1	Hywind	202.0	249	0	n/a	n/a	2,136	80	2,385	80	-
1	Kentish Flats and Extension	494.4	0	0	n/a	n/a	7	0	7	0	-
1	Kincardine	148.1	632	0	n/a	n/a	0	0	632	0	-

Tier	OWF	Distance From FI (km)	Number of guillemots at risk of displacement[1]								Consented with compen-sation for guillemot at FFC[3]
			Breeding		Chick rearing / moult[2]		Non-breeding		Annual		
			Total	FI	Total	FI	Total	FI	Total	FI	
1	Lincs and Lynn and Inner Dowsing	297.0	582	0	n/a	n/a	814	30	1,396	30	-
1	London Array	482.3	192	0	n/a	n/a	377	14	569	14	-
1	Methil	103.5	25	0	n/a	n/a	0	0	25	0	-
1	Moray Firth East	283.8	9,820	0	n/a	n/a	547	20	10,367	20	-
1	Race Bank	297.7	361	0	n/a	n/a	708	26	1,069	26	-
1	Rampion	554.3	10,887	0	n/a	n/a	15,536	579	26,423	579	-
1	Scroby Sands	396.6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
1	Sheringham Shoal	323.5	390	0	n/a	n/a	715	27	1,105	27	-
1	Teeside	112.1	267	0	n/a	n/a	901	34	1,168	34	-
1	Thanet	509.6	18	0	n/a	n/a	124	5	142	5	-
1	Triton Knoll	277.3	425	0	n/a	n/a	746	28	1,171	28	-
1	Westermost Rough	228.5	347	0	n/a	n/a	486	18	833	18	-
2	Dogger Bank (formerly Creyke Beck) A and B	206.1	14,886	0	n/a	n/a	16,763	625	31,649	625	-
2	Dogger Bank C (formerly Teeside A) and Sofia (Teeside B)	235.6	8,494	0	n/a	n/a	5,969	223	14,463	223	-
2	Moray West	282.2	24,426	0	n/a	n/a	38,174	1,424	62,600	1,424	-

Tier	OWF	Distance From FI (km)	Number of guillemots at risk of displacement[1]								Consented with compen-sation for guillemot at FFC[3]
			Breeding		Chick rearing / moult[2]		Non-breeding		Annual		
			Total	FI	Total	FI	Total	FI	Total	FI	
2	Neart na Gaoithe[5]	71.4	1,755	0	n/a	n/a	3,761	140	5,516	140	-
2	Seagreen (Forth) Alpha and Bravo	97.5	24,724	0	n/a	n/a	8,800	328	33,524	328	-
3	East Anglia ONE North	438.2	4,183	0	n/a	n/a	1,888	70	6,071	70	-
3	East Anglia THREE	427.8	1,744	0	n/a	n/a	2,859	107	4,603	107	-
3	East Anglia TWO	442.3	2,077	0	n/a	n/a	1,675	62	3,752	62	-
3	Green Volt	246.1	4,429	0	n/a	n/a	16,105	601	20,534	601	-
3	Hornsea Project Four (NE apportioning approach)[6]	304.4	9,382	0	36,965	0	16,962	2,011	63,309	2,011	**Y**
3	Hornsea Project Three	234.7	13,374	0	n/a	n/a	17,772	663	31,146	663	-
3	Inch Cape[8]	93.7	4,371	0	n/a	n/a	3,177	119	7,548	119	-
3	Norfolk Boreas	398.0	7,767	0	n/a	n/a	13,777	514	21,544	514	-
3	Norfolk Vanguard	392.9	4,320	0	n/a	n/a	4,776	178	9,096	178	-
3	SADEP	310.2	4,934	0	n/a	n/a	15,972	596	20,906	596	**Y**
Application submitted for determination											
4	Berwick Bank[8]	55.6	74,154	3,171	n/a	n/a	44,171	1,648	118,325	8,173	-
4	Dogger Bank South[9]	209.6	17,184	0	20,176	0	22,447	1,590	60,437	1,590	-

Tier	OWF	Distance From FI (km)	Number of guillemots at risk of displacement[1]								Consented with compen-sation for guillemot at FFC[3]
			Breeding		Chick rearing / moult[2]		Non-breeding		Annual		
			Total	FI	Total	FI	Total	FI	Total	FI	
4	Five Estuaries[10]	472.5	1,201	0	n/a	n/a	3,698	138	4,899	138	-
4	Outer Dowsing[11]	284.2	14,371	0	n/a	n/a	9,215	344	23,586	344	-
4	Rampion 2	555.1	134	0	n/a	n/a	5,723	213	5,857	213	-
4	West of Orkney[12]	386.6	7,973	0	n/a	n/a	4,393	164	12,365	164	-
4	North Falls	485.6	866	0	n/a	n/a	5,365	200	6,231	200	-
Total including Berwick Bank			**305,878**	**3,293**	**57,141**	**0**	**314,924**	**13,878**	**677,944**	**17,171**	
Total, excluding Berwick Bank			**231,724**	**122**	**57,141**	**0**	**270,753**	**12,230**	**559,619**	**12,352**	

1. In most cases based on the mean peak populations for the OWF plus a 2km buffer (SNCBs 2017), however the buffer zones for OWFs included in the assessment varied between 0-4km depending on the data available. OWF seasonal and annual totals of guillemots at risk of displacement follow those in ES Appendix 13.3, [**APP-104**], except where footnotes indicate updates have been made.

2. For some OWFs Natural England (NE) has advised that an extra post-breeding/moult season is identified (August and September), due to the likely presence during this time of large numbers of chicks which have left the nest (jumplings) accompanied by adults within the array area and 2km buffer. In all cases these birds are assumed to be from the FFC SPA (see paragraph 28). No OWFs have been identified where jumplings and accompanying adults from the Farne Islands may be present. Column shows “n/a” for all OWFs to which this additional season does not apply. For this additional season, no guillemots have been apportioned to the Farne Islands SPA.

3. Two OWFs have now been consented subject to compensation for guillemot in relation to predicted effects at the FFC. No other OWFs have been consented subject to compensation for guillemot or any other SPA.

4. Within MMFR for guillemot (55.7km (excluding Fair Isle); Woodward *et al.* 2019) A nominal breeding season proportion of 0.1 has been applied, based on the value for Berwick Bank (see below), and on the basis that Blyth OWF is closer to the FI SPA than Berwick Bank.

5. Within MMFR plus 1SD for guillemot (95.4km (excluding Fair Isle); Woodward *et al*. 2019). However, no guillemots apportioned to FI SPA during the breeding season, as the HRA for the Project (Marine Scotland, 2018) did not identify breeding season connectivity for this SPA.

7. With reference to Hornsea Project Four HRA (DESNZ 2023) applying the NE bespoke approach to seasons, including an additional post-breeding/moult season (August and September), as well as breeding (March to July) and non-breeding (October to February).

Tier	OWF	Distance From FI (km)	Number of guillemots at risk of displacement[1]								Consented with compen-sation for guillemot at FFC[3]
			Breeding		Chick rearing / moult[2]		Non-breeding		Annual		
			Total	FI	Total	FI	Total	FI	Total	FI	
7. Within MMFR plus 1SD for guillemot (95.4km (excluding Fair Isle); Woodward *et al.* 2019). However, no guillemots apportioned to FI SPA during the breeding season, as the HRA for the Project (Marine Scotland, 2019) did not identify breeding season connectivity for this SPA.											
8. Within MMFR for guillemot at FI SPA. For the breeding season, based on applicant approach: adult proportion of 0.486 and apportionment of 0.088 adults to the Farne Islands SPA; Royal HaskoningDHV (2022). During the non-breeding season, SPA apportionment based on Furness (2015).											
9. Seasonal totals from Royal HaskoningDHV (2024).											
10. Seasonal totals from MacArthur Green (2024a).											
11. Seasonal totals for array area minus Offshore Restricted Build Area, plus 2km buffer GoBe (2024a). It is understood that NE has advised the application of a post-breeding/moult season for Outer Dowsing, in relation to the FFC SPA (GoBe, 2024b). Seasonal totals of the number of guillemots at risk of displacement incorporating this additional season do not appear to be presented in the DCO documents, so the NE approach has not been included here.											
12. Seasonal totals from MacArthur Green (2024)..											

Table 2.5 In combination displacement matrix for guillemot at the Farne Islands SPA including Berwick Bank. The cells show the number of predicted bird mortalities (to the nearest integer) per annum at given rates of displacement and mortality. Grey cells identify the range of displacement and mortality rates for consideration as recommended by SNCBs. Red text indicates predicted mortality values where the baseline mortality rate would increase by >1%.

Mean		Mortality										
		1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
Displacement	10%	17	34	52	69	86	172	343	515	859	1374	1717
	20%	34	69	103	137	172	343	687	1030	1717	2747	3434
	30%	52	103	155	206	258	515	1030	1545	2576	4121	5151
	40%	69	137	206	275	343	687	1374	2061	3434	5495	6869
	50%	86	172	258	343	429	859	1717	2576	4293	6869	8586
	60%	103	206	309	412	515	1030	2061	3091	5151	8242	10303
	70%	120	240	361	481	601	1202	2404	3606	6010	9616	12020
	80%	137	275	412	549	687	1374	2747	4121	6869	10990	13737
	90%	155	309	464	618	773	1545	3091	4636	7727	12363	15454
	100%	172	343	515	687	859	1717	3434	5151	8586	13737	17171

Table 2.6 Guillemot in combination annual displacement matrix for the Farne Islands SPA, including Berwick Bank. The cells show the predicted increase in baseline mortality rate at a given rate of displacement and mortality. Grey cells identify the range of displacement and mortality rates for consideration as recommended by SNCBs. Values in red identify scenarios where the baseline mortality rate would increase by >1%.

Mean		Mortality										
		1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
Displacement	10%	0.4	0.8	1.1	1.5	1.9	3.8	7.6	11.5	19.1	30.6	38.2
	20%	0.8	1.5	2.3	3.1	3.8	7.6	15.3	22.9	38.2	61.2	76.5
	30%	1.1	2.3	3.4	4.6	5.7	11.5	22.9	34.4	57.3	91.8	114.7
	40%	1.5	3.1	4.6	6.1	7.6	15.3	30.6	45.9	76.5	122.3	152.9
	50%	1.9	3.8	5.7	7.6	9.6	19.1	38.2	57.3	95.6	152.9	191.2
	60%	2.3	4.6	6.9	9.2	11.5	22.9	45.9	68.8	114.7	183.5	229.4
	70%	2.7	5.4	8.0	10.7	13.4	26.8	53.5	80.3	133.8	214.1	267.6
	80%	3.1	6.1	9.2	12.2	15.3	30.6	61.2	91.8	152.9	244.7	305.9
	90%	3.4	6.9	10.3	13.8	17.2	34.4	68.8	103.2	172.0	275.3	344.1
	100%	3.8	7.6	11.5	15.3	19.1	38.2	76.5	114.7	191.2	305.9	382.3

Table 2.7 In combination displacement matrix for guillemot at the Farne Islands SPA excluding Berwick Bank. The cells show the number of predicted bird mortalities (to the nearest integer) per annum at given rates of displacement and mortality. Grey cells identify the range of displacement and mortality rates for consideration as recommended by SNCBs. Red text indicates predicted mortality values where the baseline mortality rate would increase by >1%.

Mean		Mortality										
		1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
Displacement	10%	12	25	37	49	62	124	247	371	618	988	1235
	20%	25	49	74	99	124	247	494	741	1235	1976	2470
	30%	37	74	111	148	185	371	741	1112	1853	2965	3706
	40%	49	99	148	198	247	494	988	1482	2470	3953	4941
	50%	62	124	185	247	309	618	1235	1853	3088	4941	6176
	60%	74	148	222	296	371	741	1482	2223	3706	5929	7411
	70%	86	173	259	346	432	865	1729	2594	4323	6917	8647
	80%	99	198	296	395	494	988	1976	2965	4941	7906	9882
	90%	111	222	334	445	556	1112	2223	3335	5559	8894	11117
	100%	124	247	371	494	618	1235	2470	3706	6176	9882	12352

Table 2.8 Guillemot in combination annual displacement matrix for the Farne Islands SPA, excluding Berwick Bank. The cells show the predicted increase in baseline mortality rate at a given rate of displacement and mortality. Grey cells identify the range of displacement and mortality rates for consideration as recommended by SNCBs. Values in red identify scenarios where the baseline mortality rate would increase by >1%.

Mean		Mortality										
		1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
Displacement	10%	0.3	0.6	0.8	1.1	1.4	2.8	5.5	8.3	13.8	22.0	27.5
	20%	0.6	1.1	1.7	2.2	2.8	5.5	11.0	16.5	27.5	44.0	55.0
	30%	0.8	1.7	2.5	3.3	4.1	8.3	16.5	24.8	41.3	66.0	82.5
	40%	1.1	2.2	3.3	4.4	5.5	11.0	22.0	33.0	55.0	88.0	110.0
	50%	1.4	2.8	4.1	5.5	6.9	13.8	27.5	41.3	68.8	110.0	137.5
	60%	1.7	3.3	5.0	6.6	8.3	16.5	33.0	49.5	82.5	132.0	165.0
	70%	1.9	3.9	5.8	7.7	9.6	19.3	38.5	57.8	96.3	154.0	192.5
	80%	2.2	4.4	6.6	8.8	11.0	22.0	44.0	66.0	110.0	176.0	220.0
	90%	2.5	5.0	7.4	9.9	12.4	24.8	49.5	74.3	123.8	198.0	247.5
	100%	2.8	5.5	8.3	11.0	13.8	27.5	55.0	82.5	137.5	220.0	275.0

33. The predicted in combination annual mortality of guillemots to displacement at OWFS within the UK North Sea and Channel BDMPS at 50% / 1% and 70% / 2%, including and excluding Berwick Bank, are shown in Table 2.9**Error! Not a valid bookmark self-reference.**. In all cases the predicted increases in the baseline mortality rate are >1% and could be detectable against natural variation. Thus, PVA has been run for each in-combination scenario to assess the potential population level impact.

Table 2.9 Predicted number of mortalities of adult guillemots that breed at the Farne Islands (FI) SPA and % increases in baseline mortality rate for different in-combination scenarios

Scenario / Displacement and mortality rates	Annual predicted mortality, no. guillemots	% increase in baseline mortality rate of FI breeding adult population*
Including Berwick Bank		
50% displacement, 1% mortality	86	1.9 %
70% displacement, 2% mortality	240	5.4 %
Excluding Berwick Bank		
50% displacement, 1% mortality	62	1.4 %
70% displacement, 2% mortality	173	3.9 %
*Based on a population of 73,630 breeding adults (Section 2.2) and a baseline annual mortality rate of 6.1% (Horswill and Robinson 2015)		

34. PVA has been run with the NE PVA Tool (Searle *et al*. 2019) using a density independent population model, as recommended by Natural England (2022), with the demographic rates for the baseline scenario taken from Horswill and Robinson (2015). Models were run for a 30-year period, with the population projections under baseline conditions (i.e. without any OWF effects) compared with those incorporating the additional mortality predicted from the in-combination displacement effects. The modelling approach is as set out in RIAA Appendix 4.2 [**APP-180**], except for some amendments (including the use of a burn-in period of 5 years, rather than 4), based on advice from Natural England in their Relevant Representations (RR-243, NE Ref F27[2]). The modelling input parameters are given in Appendix A, which highlights parameters which have been updated.

[2] Responses to Natural England's relevant representation are provided in the Applicant's Response to Relevant Representations from Natural England (Document reference [**9.1**]).

35. Density independent models incorporate no feedback between population size and demographic rates, such that a population can either increase to infinity (which is biologically implausible) or decrease to extinction. Consequently, the PVA used to assess the population-level impacts assumes that the predicted mortality associated with displacement is entirely additive to the baseline mortality that would occur in the absence of these impacts. This is likely to cause overestimation of the resulting population-level impacts. Density dependent models, which incorporate a mechanism for population regulation, are likely to be more realistic (e.g. reproductive rates may be expected to decline as population size increases if an expanding population resulted in competition for food resources and/or suitable nesting sites). Although there is considerable evidence for density dependence operating in seabird populations (e.g. Horswill *et al.* 2016), NE (2022a) advises against the use of density dependent population models due to the lack of empirical evidence of the underpinning mechanisms of density dependent regulation within seabird populations. As a consequence, the resulting PVA is likely to give overly precautionary outputs because it does not allow for the operation of compensatory density dependence to offset (to some degree at least) the additional mortality from displacement (e.g. Horswill *et al*. 2016).

36. The population models on which the PVA is based also assumed that the guillemot breeding population at the Farne Islands SPA is a closed population. In reality, this will not be the case as there will be immigration and emigration resulting in exchange of birds with other breeding colony populations (e.g. Reynolds *et al*., 2009); this, again, is likely to result in overestimation of impacts at the scale of the colony population (Miller *et al*. 2019).

37. The potential impact of the predicted displacement mortality on the SPA guillemot population was assessed on the basis of Counterfactual of Population Size (CPS) and Counterfactual of the Population Growth Rate (CPGR), as derived from the PVA. The CPS is the median of the ratio of the end-point size of the impacted to un-impacted (or baseline) population, expressed as a proportion, and CPGR is the median of the ratio of the annual growth rate of the impacted to un-impacted population, expressed as a proportion. These two metrics have been demonstrated to be relatively insensitive to mis-specification of demographic rates and variation in population trend (Cook and Robinson 2016, Jitlal *et al*. 2017).

38. Due to the intrinsic structure of the population modelling approach, increases in mortality rates will always have some effect on population size and growth rate, such that the counterfactuals of impacted to unimpacted populations will never be greater than 1 and will almost always be less, thus always suggesting a negative effect. What is undefined is the level at which such negative effects could cause adverse effects on a population.

39. PVA outputs are presented in Table 2.10.

Table 2.10 PVA outputs for the Farne Islands SPA guillemot population for the predicted in-combination mortality due to displacement from OWFs.

Scenario		Additional adult mortalities	Growth Rate (median)	Counter-factual		Reduction in growth rate	Reduction in population size
				CPGR[1]	CPS[2]		
Baseline		0	1.089	1.000	1.000	N/A	N/A
With Berwick Bank	50% / 1%	86	1.088	0.999	0.962	0.1%	3.8%
	70% / 2%	240	1.085	0.997	0.898	0.3%	10.2%
Without Berwick Bank	50% / 1%	62	1.088	0.999	0.972	0.1%	2.8%
	70% / 2%	173	1.086	0.998	0.925	0.2%	7.5%

1. Counterfactual of Population Growth Rate (after 30 years).
2. Counterfactual of Population Size (after 30 years).

40. With reference to Section 2.2 above, the context for the PVA is a population that underwent a 548% increase over the period 1983 to 2014, and further overall increases (based on 5 year mean counts) of respectively 7.9% between 2015 and 2019, and 3.8% between 2020 and 2024. Despite the increase in the most recent 5 year mean breeding population compared with 2015-2019, the colony underwent a year-on-year decline between 2020 and 2024, and was affected by HPAI in 2022 and 2023.

41. At 50% displacement and 1% mortality, considered the most realistic precautionary scenario based on a review of evidence relating to the effects of displacement on guillemot mortality (see above), the predicted reduction in population growth rate for the scenario excluding Berwick Bank is 0.1%, and the reduction in population size of the impacted compared to unimpacted population over 30 years is 2.8%. Including Berwick Bank, the predicted reduction in population growth rate is also 0.1%, and the predicted population in population size after 30 years is 3.8% (Table 2.10). Based on these very small, predicted changes, and considering sources of precaution, notably the use of a density independent model, it is considered that these scenarios do not indicate a change in population size that would be significant in the context of the conservation objective to maintain or restore population size (Section 2.2 above).

42. Under the more precautionary scenario of 70% displacement and 2% mortality, the predicted reduction in population growth rate without Berwick Bank is 0.2%, and the reduction in population size of the impacted compared to unimpacted population over 30 years is 7.5%. Including Berwick Bank, the predicted reduction in population growth rate is 0.3%, and the predicted population in population size after 30 years is 10.2%. These higher rates of displacement and mortality result in greater levels of predicted impacts, although it is considered that, given sources of precaution in the PVA, these also are unlikely to represent a change in population size that would be significant in the context of the conservation objective to maintain or restore population size.

43. As stated above, the information on estimated in-combination displacement mortality and PVA is provided as context for the assessment. Given the conclusion that the Project would make no material contribution to the in-combination mortality, there would be no contribution to any adverse effect on integrity to the FFC SPA.

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Appendix A. Population Viability Analysis Input Parameters

Table A 1. input parameters for the in-combination displacement impacts on guillemot at the Farne Islands SPA (Parameters highlighted in red text are those that have been updated in response to Relevant Representations from Natural England, (RR-243, NE Ref F27, see Applicants Response to Natural England relevant representations, Document Reference [9.1]

PARAMETER	VALUE
PVA model run type	simplescenarios
Model to use for environmental stochasticity	betagamma
Model for density dependence	Nod.
Include demographic stochasticity in the model?	Yes
Number of simulations	5000
Random seed	10
Years for burn-in	5
Case study selected	None
Species chosen to set initial values	Guillemot
Age at first breeding	6
Upper constraint on productivity in the model?	Yes, constrained to 1 per pair
Number of sub-populations	1
Are demographic rates applied separately to each subpopulation?	No
Units for initial population size	Breeding Adults
Are baseline demographic rates specified separately for immatures?	No
Initial population values	73630 in 2024
Productivity rate per pair	Mean 0.672, SD 0.147

PARAMETER	VALUE			
Adult survival rate	Mean 0.939, SD 0.015			
Number of impact scenarios	4			
Are impacts applied separately to each subpopulation?	No			
Are impacts of scenarios specified separately for immatures?	No			
Are standard errors of impacts available?	No			
Should random seeds be matched for impact scenarios?	No			
Are impacts specified as a relative value or absolute harvest?	Relative			
Years in which impacts are assumed to begin and end	2028 - 2058			
Impact on productivity rate	0			
Impact on adult survival rate[1]	With Berwick Bank 50% displacement, 1% mortality	With Berwick Bank 70% displacement, 2% mortality	Without Berwick Bank 50% displacement, 1% mortality	Without Berwick Bank 70% displacement, 2% mortality
	0.0011680	0.0032595	0.0008420	0.0023496
[1] Impact on adult survival calculated as predicted adult mortality from displacement / adult population				

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