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# West of Orkney Windfarm

## Offshore Ornithology Additional Information

### Appendix 7 - EIA: Cumulative mortalities at regional population scales

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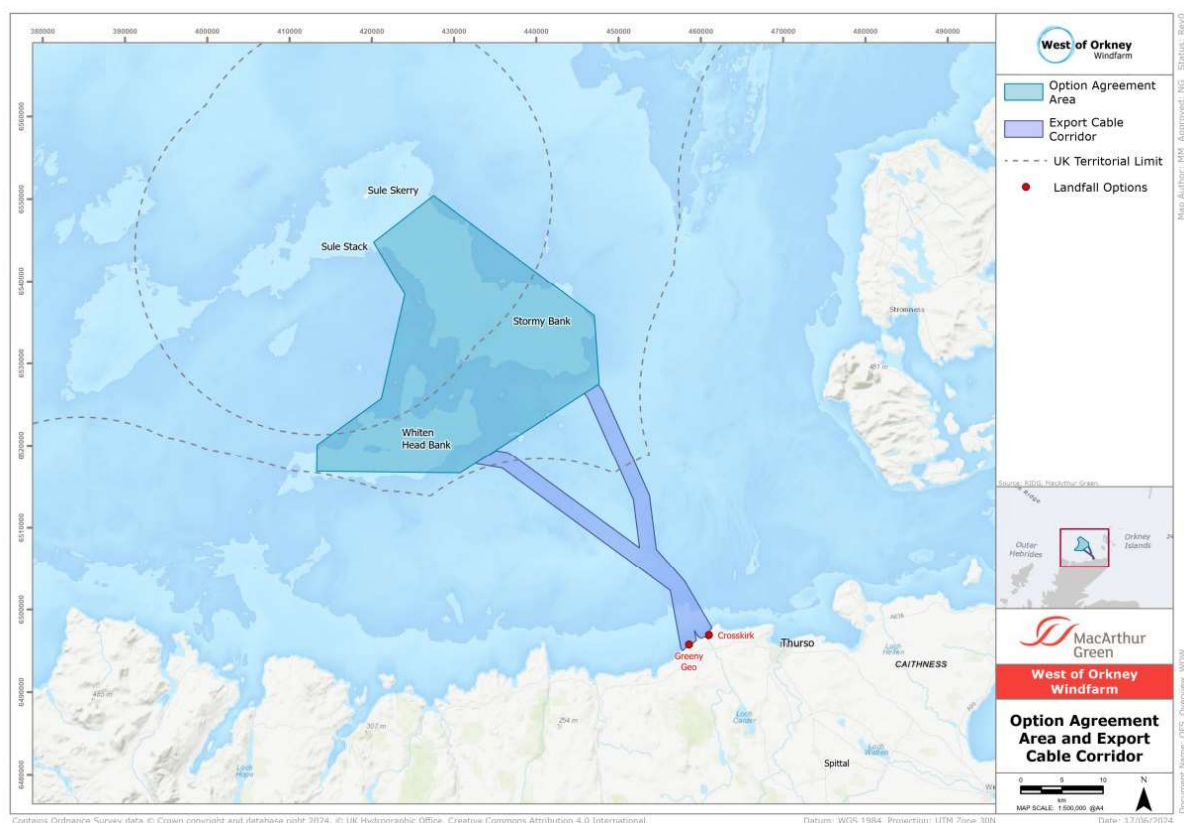
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## 1 INTRODUCTION

### 1.1 Project summary

1. Offshore Wind Power Limited (OWPL) ('the Applicant') is proposing the development of the West of Orkney Windfarm ('the Project'), an Offshore Wind Farm (OWF), located at least 23 kilometres (km) from the north coast of Scotland and 28 km from the west coast of Hoy, Orkney (**Figure 1-1**).



**Figure 1-1. Map showing location of the West of Orkney Windfarm Option Agreement Area (OAA) and Export Cable Corridor (ECC) which together, comprise the Offshore Project Area.**

2. The Offshore Project will comprise up to 125 wind turbine generators (WTGs) with fixed-bottom foundations and up to five Offshore Substation Platforms (OSPs). The area within which the WTGs, OSPs and associated infrastructure will be located is the Option Agreement Area (OAA). The OAA covers an area of 657 km<sup>2</sup>. The export cables will be located within the Export Cable Corridor (ECC), with landfall options at Greeny Geo and/or Crosskirk in Caithness (**Figure 1-1**). The OAA and ECC together comprise the offshore Project area.
3. The Applicant submitted an application for consent under Section 36 of the Electricity Act 1989 and Marine Licences under Part 4 of the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 to Scottish Ministers in September 2023 for the offshore components of the Project seaward of Mean High Water Springs (MHWS).

4. In accordance with relevant EIA Regulations<sup>1</sup>, an Offshore Environmental Impact Assessment (EIA) Report was submitted to Marine Directorate – Licensing Operations Team (MD-LOT) as part of the Applicant’s consent application (the ‘Offshore EIA Report’). A Report to Information Appropriate Assessment (RIAA) was also submitted as part of the Offshore Application to provide the Competent Authority (MD-LOT) with the information required to assist them in undertaking an Appropriate Assessment (AA) for the offshore Project as required under the Conservation (Natural Habitats & c.) Regulations 1994 (as amended), the Conservation of Marine Habitats and Species Regulations 2017 and The Conservation of Habitats and Species Regulations 2017 (as amended) (hereafter referred to as the ‘Habitats Regulations’).
5. Following the review of the Applicant’s application, and upon receipt of representations from consultees, MD-LOT issued a request for Additional Information on offshore ornithology. This report is part of the Ornithology Additional Information (OAI).

## 1.2 Relationship between the original application and the OAI

6. The Ornithology Additional Information (OAI) (see **Introduction to the Additional Ornithology Information** for structure of OAI and list of all reports) includes:
  - an **Addendum to the Offshore EIA Report** in the form of a revised EIA chapter for Offshore and Intertidal Ornithology. All ornithology information in this report should be read in place of information in the original EIA chapter;
  - an **Addendum to the RIAA**. All ornithology information in this report should be read in place of information in the original RIAA (with the exception of information on pre-application consultation);
  - a set of nine technical appendices. This **Appendix 7: EIA Cumulative mortalities at regional population scales** is one of the nine technical appendices. These reports entirely replace the original Supporting Study 12: Offshore Ornithology Technical Supporting Study.
7. NatureScot’s pre- and post-application Project-specific advice and online guidance notes<sup>2</sup> were followed throughout the OAI. To demonstrate this, reference to NatureScot’s guidance and advice is made throughout the OAI, either in the text or in separate text boxes.

## 1.1 Purpose of the Report

8. This report provides information on the cumulative impacts from other OWFs included in the EIA assessment in **Addendum to the Offshore EIA Report**. This report describes the methods

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<sup>1</sup> The relevant EIA Regulations include the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017, and the Marine Works (Environmental Impact Assessment) Regulations 2007.

<sup>2</sup> [Guidance Note 1: Guidance to support Offshore Wind Applications: Marine Ornithology - Overview | NatureScot](#)

used to collate information on cumulative impacts and provides quantitative information on cumulative impacts to inform the EIA assessment.

9. NatureScot and MD-LOT advice and guidance were followed at all stages. The relevant advice or guidance (e.g. published online guidance, Project-specific advice) is referred to throughout the report, where relevant.

### 1.3 Terminology

10. The following terminology is used in this report:

- Option Agreement Area (OAA): this is the area within which WTGs and other offshore Project infrastructure will be installed;
- Export Cable Corridor (ECC) is the area from the OAA to the landfall site in which the export cable will be placed;
- Offshore Project area comprises the OAA and ECC;
- OAA plus 2 km buffer: This includes a 2 km wide ‘zone of influence’ around the OAA, allowing for changes in bird behaviour (e.g. disturbance/displacement) in the vicinity of the OAA;
- OAA plus 4 km buffer: the OAA plus 4 km buffer was the area used for characterising baseline seabird numbers and distribution for the Project (see **Appendix 1 - EIA and HRA: Baseline Site Characterisation Technical Report**);
- WTG: Wind Turbine Generator.

## 2 METHODS

11. A list of OWFs to be considered for the cumulative assessment was derived from The Crown Estate<sup>3</sup> and Crown Estate Scotland<sup>4</sup> websites. The original Project application was submitted on 26 September 2023. As this Ornithology Additional Information is additional to the original application, initially no OWF projects that had submitted applications since the original assessment were added to the list for cumulative assessment. However, some projects had submitted an application since the Project application submission. Consequently, any project that had submitted an application prior to 31 December 2023 was included in the cumulative assessment. Advice was then sought from both NatureScot and MD-LOT on whether the proposed list was complete.

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### MD-LOT (email dated 10 June 2024):

*Having considered the list provided, we identify that consented projects Green Volt and Seagreen Phase 1A, have not been included on the list. Projects which have been consented must be assessed quantitatively. This includes projects which have been consented elsewhere in the UK which may impact on the same protected sites/species as West of Orkney.*

*The established MD-LOT position is that projects which are reasonably foreseeable should be included in the in-combination assessment. This includes projects which have received a scoping opinion. MD-LOT therefore advises that other offshore wind projects in Scotland where a scoping opinion has been adopted to date must be included in the in-combination assessment – this may be a qualitative assessment.*

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12. Following this advice, GreenVolt and Seagreen Phase 1A were added to the list of OWFs (i.e. additional to those identified for Offshore EIA Report and RIAA) for cumulative impact assessments. Additionally, Salamander was also added to the list as another Scottish OWF for which an application had recently been submitted.
  13. A dual approach to the cumulative assessment was developed, where (a) consented projects and projects for which an application had been submitted were assessed quantitatively and, (b) projects for which a Scoping Opinion had been adopted (as of 19 June 2024) were assessed qualitatively. Details of each approach are given below. Although there is a theoretical potential for projects other than OWFs could to contribute to cumulative effects, these are typically of much smaller scale, not found in offshore locations and are not assessed using the same methods (e.g. Collision Risk Mortality). Therefore, only OWFs have been assessed here.
  14. The first step was to list all OWFs which had been consented and those OWFs for which a Scoping Opinion had been adopted. Additionally, other OWFs that were earlier in the

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<sup>3</sup> <https://opendata-thecrownestate.opendata.arcgis.com/datasets/thecrownestate::wind-site-agreements-england-wales-ni-the-crown-estate/about>.

<sup>4</sup> [https://crown-estate-scotland-spatial-hub-coregis.hub.arcgis.com/datasets/b9c7d514362f40ceb3fe299b47aeb8b3\\_o/explore?location=56.656616%2C-2.570552%2C7.55](https://crown-estate-scotland-spatial-hub-coregis.hub.arcgis.com/datasets/b9c7d514362f40ceb3fe299b47aeb8b3_o/explore?location=56.656616%2C-2.570552%2C7.55).



planning process, and had not yet had a Scoping Opinion adopted, were also listed. Therefore, the list comprised OWFs that:

- Have a seabed option agreement;
- Have submitted a Scoping Report;
- Have a Scoping Opinion;
- Have submitted an application;
- Have been consented;
- Are under construction; or
- Are operational.

15. In assessment of cumulative impacts, a three-tiered system has been used, in relation to the certainty associated with project impacts and whether or not the project will actually be consented and built. This three-tiered system has been adapted from advice on cumulative effects assessment for nationally significant infrastructure projects from the Planning Inspectorate<sup>5</sup>.

16. The definition of each of the three tiers is explained below:

<p><b>Tier 1</b></p> <p>Tier 1 projects include those OWFs:</p> <ul style="list-style-type: none"><li>• which are operational;</li><li>• which are under construction;</li><li>• which are consented;</li><li>• for which an application has been submitted.</li></ul>
<p><b>Tier 2</b></p> <p>Tier 2 projects include those OWFs:</p> <ul style="list-style-type: none"><li>• for which a Scoping Opinion has been adopted.</li></ul>
<p><b>Tier 3</b></p> <p>Tier 3 projects include those OWFs:</p> <ul style="list-style-type: none"><li>• for which a Scoping Report has been submitted;</li><li>• for which a seabed option agreement is in place (e.g ScotWind and INTOG projects that have yet to submit a Scoping Report).</li></ul>

<sup>5</sup> [Nationally Significant Infrastructure Projects - Advice Note Seventeen: cumulative effects assessment relevant to nationally significant infrastructure projects - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/612222/Nationally_Significant_Infrastructure_Projects_-_Advice_Note_Seventeen_-_cumulative_effects_assessment_relevant_to_nationally_significant_infrastructure_projects_-_GOV.UK.pdf).

17. **Table 2-1** lists all OWFs included in the cumulative impact assessments, under each of the three tiers, according to the stage of the planning process/development the project is at.

**Table 2-1. List of OWFs included in cumulative impact assessments with the Project**

OWF	Current project status
<b>Tier 1 – application submitted, consented, under construction, operational</b>	
Berwick Bank	Application submitted
Blyth Demo	Operational
Beatrice Offshore Wind Farm	Operational
Dudgeon Extension Project and Sheringham Extension Project	Consented
Dogger Bank Creyke Beck A and B	Under Construction
Dogger Bank Teesside A and Sofia (formerly Dogger Bank Teesside B)	Under Construction/consented
Dudgeon	Operational
East Anglia One	Operational
East Anglia ONE North	Consented
East Anglia Three	Under Construction
East Anglia TWO	Consented
EOWDC	Operational
Forthwind	Consented
Galloper	Operational
Greater Gabbard	Operational
Greenvolt	Consented
Gunfleet Sands (I and II)	Operational
Hornsea Project Four	Consented
Hornsea Project One	Operational
Hornsea Project Three	Under Construction
Hornsea Project Two	Operational
Humber Gateway	Operational
Hywind	Operational
Inchcape	Under construction
Kentish Flats & Extension	Operational
Kincardine	Operational
Lincs, Lynn & Inner Dowsing	Operational
London Array	Operational
Methil	Operational
Moray East	Operational

OWF	Current project status
Moray West	Under construction
Neart na Gaoithe	Under construction
Norfolk Boreas	Consented
Norfolk Vanguard	Consented
PFOWF	Consented
Race Bank	Operational
Rampion	Operational
Salamander	Application submitted
Seagreen Alpha & Bravo (including Phase 1A)	Operational (Phase 1A consented)
Sheringham Shoal	Operational
Teesside	Operational
Thanet	Operational
Triton Knoll	Operational
Westermost Rough	Operational
<b>Tier 2 – Scoping Opinion adopted</b>	
Broadshore Hub, including Scaraben and Sinclair	Scoping Opinion
Buchan	Scoping Opinion
Caledonia	Scoping Opinion
Cenos	Scoping Opinion
Culzean	Scoping Opinion
Marramwind	Scoping Opinion
Morven	Scoping Opinion
Muir Mhor	Scoping Opinion
Ossian	Scoping Opinion
Spiorad na Mara Limited	Scoping Opinion
Stromar	Scoping Opinion
<b>Tier 3 – Scoping Report submitted or Seabed Option Agreement</b>	
Arven	Scoping Report submitted
Aspen	Seabed Option Agreement
Avalon	Seabed Option Agreement
Ayre	Seabed Option Agreement
Beech	Seabed Option Agreement
Bellrock	Scoping Report submitted
Bowdun	Seabed Option Agreement
CampionWind	Seabed Option Agreement

OWF	Current project status
Cedar	Seabed Option Agreement
Flora	Seabed Option Agreement
Havbredaey	Seabed Option Agreement
Judy	Seabed Option Agreement
MachairWind	Seabed Option Agreement
Stoura	Seabed Option Agreement
Talisk	Seabed Option Agreement

18. Quantitative information on potential collision and displacement mortalities was available for OWFs listed under Tier 1. This information was obtained from project applications and Appropriate Assessments. As advised by MD-LOT (email dated 10 June 2024), a quantitative assessment was undertaken for OWFs listed under Tier 1, cumulatively with Project impacts. See **section 2.1** below for more details.
19. OWFs listed under Tier 2 have the potential to add to cumulative impacts along with potential impacts by the Project. A qualitative approach to assessing cumulative impacts for these Tier 2 OWFs was used (see **section 2.2** below for more details).
20. If constructed, the OWFs listed under Tier 3 would be expected to add cumulative impacts to those potentially impacted by the Project. However, there is limited or no information on which seabird populations could be impacted by these OWFs. There is a high degree of uncertainty about project designs and even whether these projects will reach determination. Consequently, it is not possible to use the very limited available information for Tier 3 projects in a quantitative or qualitative assessment.

## 2.1 Cumulative Impact Assessment Methods

21. Cumulative impacts from the Project and other OWFs need to be assessed against a reference population. NatureScot advised, in a consultation meeting on 11<sup>th</sup> June 2024, that a regional population was the appropriate reference population against which to assess impacts for EIA. A regional population was defined as the sum of all birds (adults and immature bird) from all colonies (both SPA and non-SPA) within mean max foraging range of the Project (Woodward *et al.* 2019).
22. As a first step, the breeding season regional population for each species was estimated from the sum of all colonies, Special Protection Area (SPA) and non-SPA (obtained from the Seabird Monitoring Programme (SMP) database<sup>6</sup>), within the NatureScot advised species-specific foraging ranges of the Project. Since wind farm impacts are expected to affect all age classes, the colony population size estimates (which are of breeding adults only) were divided by the estimate of the proportion of adult birds in the wider population. This proportion of adult birds was taken from the stable age structure, as used in the

<sup>6</sup> <https://app.bto.org/seabirds/public/index.jsp>

BDMPS report (Furness, 2015). By dividing colony counts by the assumed proportion of adult birds (e.g. 0.53 for kittiwake), an estimate of the whole population associated with that colony, including immatures, can be calculated. These whole (i.e. all age) population estimates for each colony were then summed to give an all-age regional population.

23. Hence, the steps for estimating the regional populations were as follows:

- For each species included in the assessment, all breeding colonies (both SPA and non-SPA) within the recommended foraging range defined by Woodward et al. (2019) and presented in NatureScot Guidance Note 3 (also presented in **Table 2-2**) from the OAA plus a 2 km buffer were extracted from the JNCC Seabirds Count spreadsheet;
- Bird counts for the composition of colony sites forming each ‘master’ colony were summed to produce one value for each ‘master’ site;
- For species recorded in count units of Apparently Occupied Nests (AON; kittiwake and great black-backed gull), Apparently Occupied Sites (AOS; gannet) or Apparently Occupied Burrows (AOB; puffin), the ‘master’ site count total was multiplied by 2 to calculate the total number of adult individuals (**Table 2-3**); and
- For guillemot and razorbill which were recorded in count units of individuals (IND), the ‘master’ site count total was first multiplied by 0.67 to calculate the number of adult pairs and then multiplied by 2 to calculate the total number of adult individuals (**Table 2-3**).

**Table 2-2. Mean-maximum (MM) foraging range distance + standard deviation (SD) used for identifying which seabird colonies to include in the regional population size.**

Species	NatureScot recommended Foraging Range (km)	Metric
Northern gannet	509.4	MM+SD
Northern gannet (Forth Islands SPA)	590.0	Max
Northern gannet (Grassholm SPA)	516.7	Max
Northern gannet (St Kilda SPA)	709.0	Max
Black-legged kittiwake	300.6	MM+SD
Great black-backed gull	73.0	Max/MM
Common guillemot (for all colonies except those in the Northern Isles)	95.2	MM+SD
Common guillemot (all Northern Isles colonies)	153.7	MM+SD
Razorbill (all colonies except those in the Northern Isles)	122.2	MM+SD
Razorbill (all Northern Isles colonies)	164.6	MM+SD
Atlantic Puffin	265.4	MM+SD

**Table 2-3. Regional population estimates taken from SMP database information**

Species	Breeding season regional population size (Individual adults) <sup>1</sup>	Proportion of adults	Breeding season regional population size (all individuals) <sup>2</sup>
Kittiwake	219,608	0.53	414,355
Great black-backed gull	1,497	0.44	3,402
Guillemot	558,694	0.57	980,165
Razorbill	80,198	0.57	140,698
Puffin	629,864	0.55	1,145,207
Gannet	509,546	0.55	926,447

1. Breeding season individual adult population size is from Seabirds Count database available at:

<https://jncc.gov.uk/our-work/seabirds-count/>.

2. Breeding season all individuals population is calculated by dividing the total number of individual adults by the proportion of adults within the whole population. The proportion of populations assumed to be adults was taken from the stable age structures presented in the BDMPS report (Furness, 2015).

24. During the non-breeding period(s), individuals from outside of the regional population may be present within the OAA plus 2 km buffer, and so an appropriate amount of the total predicted annual mortality associated with each impact assessed quantitatively (displacement and collisions) needs to be apportioned to the regional population.
25. The Project sits on the northern boundary of many species' east coast and west coast BDMPS regions. This means that birds impacted by the Project could be from colonies along the west coast of the UK or the east coast of the UK (North Sea). NatureScot advised (consultation meeting of 28 May 2024) that to simplify the HRA assessment process, a worst-case scenario could be adopted of assuming that the Project mortalities were to breeding adults from SPAs along the North Sea coast of the UK and not to SPAs along the west coast of the UK. This assumption is precautionary due to in-combination impacts to east coast SPAs being larger than on west coast SPAs, as there are currently many more OWFs in planning, consented or operational in the North Sea, than in the Irish Sea, the Celtic Sea and the west coast of Scotland.
26. Therefore, it follows that within an EIA context, the relevant reference population for all birds present during the non-breeding season is also the species-specific UK North Sea (and Channel where appropriate for the species being assessed) (eastern region) BDMPS, taken from Furness, (2015), as shown in (Table 2-4).

**Table 2-4. Non-breeding season eastern region BDMPS population sizes taken from Furness (2015).**

Species	Non-breeding BDMPS (all individuals) <sup>1</sup>			
	Non-breeding	Spring migration	Autumn migration	Winter
Kittiwake	N/A	627,816	829,937	N/A
Great black-backed gull	91,399	N/A	N/A	N/A
Guillemot <sup>2</sup>	980,165	N/A	N/A	N/A

Non-breeding BDMPS (all individuals) <sup>1</sup>				
Species	Non-breeding	Spring migration	Autumn migration	Winter
Razorbill	N/A	591,874	591,874	218,622
Puffin	231,957	N/A	N/A	N/A
Gannet	N/A	248,385	456,298	N/A

1. Non-breeding BDMPS populations are from Furness (2015).

2. Guillemot non-breeding population is considered to be the same as the breeding season, as advised by NatureScot.

27. The proportion of estimated non-breeding season(s) mortality attributable to the regional population for each development was then calculated using the ratio of birds from the regional population compared to the appropriate BDMPS non-breeding season(s) population. Thus the breeding season regional populations (**Table 2-3**) were divided by the non-breeding BDMPS (**Table 2-4**) to obtain the proportion of non-breeding impacts apportioned to the regional population (**Table 2-5**).

**Table 2-5. Non-breeding proportions apportioned to the regional populations.**

Proportion of non-breeding impacts apportioned to regional populations				
Species	Non-breeding	Spring migration	Autumn migration	Winter
Kittiwake	N/A	0.66	0.5	N/A
Great black-backed gull	0.04	N/A	N/A	N/A
Guillemot <sup>2</sup>	1.0	N/A	N/A	N/A
Razorbill	N/A	0.24	0.24	0.64
Puffin	1.0	N/A	N/A	N/A
Gannet	N/A	1.0	1.0	N/A

28. For example, in the case of kittiwake, 0.66 (= 414,355 / 627,816) of all cumulative collision and displacement mortality in spring and 0.50 (= 414,355 / 829,937) in autumn was attributable to the regional population. Note that for gannet and puffin it was assumed that all cumulative collision and/or displacement was attributable to the regional population.
29. The all-age regional populations (hereafter just ‘regional populations’) were used as the basis for Project alone and cumulative assessment. Details of the calculation of the regional populations are provided in the **Addendum to the Offshore EIA Report**. The colony counts used to inform regional population size are presented in **Appendix 1 - EIA and HRA: Baseline Site Characterisation Technical Report: Annex 1S: SPA and regional population sizes**.
30. NatureScot advice on methods for estimating regional populations was followed:

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NatureScot Consultation Meeting 11 June 2024:

EIA Regional populations

We have accepted the approach outlined by Salamander and provide below how we see this being done:

1. Breeding season regional populations are based on foraging ranges (Woodward et al., 2019).
2. Non-breeding season regional populations are based on BDMPS (Furness, 2015).
3. Breeding season population contributes only some of the birds subject to impact in the non-breeding season. (BDMPS population is bigger).
4. So, the number of mortalities during the non-breeding season will include impacts to birds that aren't part of the breeding season regional population.
5. To account for this, the mortality in the non-breeding season needs to be multiplied by the ratio of birds from the regional breeding population compared to the BDMPS non-breeding population.
6. Then add the proportion of non-breeding season mortality applied to the regional breeding population should then be added to the breeding season mortality estimate to calculate an annual mortality. This annual impact on adult survival rate should be used in a regional PVA (based on the regional breeding population).

As an example using fictitious numbers:

- Breeding season population = 200,000
- Non-breeding season population = 600,000
- Breeding season mortality = 12
- Non-breeding season mortality = 20
- $200,000/600,000 = 0.33$  (i.e. breeding seabird population makes up 33% of BDMPS population)
- $20 \times 0.33 = 6.6$  (mortalities from regional breeding population in non-breeding season)
- Annual mortality for PVA purposes = 18.6

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2.1.1 Breeding Season

31. Other OWFs which could contribute to cumulative impacts in the breeding season were those within the species-specific foraging ranges of the Project. Collision mortality and/or displacement mortality from each OWF within foraging range of the Project were summed to give total cumulative breeding season collision and displacement mortality.

2.1.2 Non-breeding Season

32. With the exception of guillemot, all wind farms within the North Sea Biologically Defined Minimum Population Scales (BDMPS) were considered to have the potential to contribute to non-breeding season cumulative impacts. The contribution from each OWF was calculated as their mortality in a particular BDMPS season, multiplied by the proportion of the seasonal BDMPS population which comprised the breeding season regional population. For example, if the regional population was estimated to be 100,000 individuals (of all ages) and the BDMPS population was 500,000 (all ages), the proportional contribution from all OWFs within the BDMPS to impacts on the regional population would be 20%. Thus, the impact from



each OWF was multiplied by 0.2 and the result summed to obtain the cumulative total for that season. Thus, the impacts are assigned to the regional (breeding season) population in proportion.

33. For guillemot, the non-breeding season is treated the same as the breeding season, so only non-breeding season impacts from OWFs within foraging range of the Project were included.

### 2.1.3 Annual Cumulative Total

34. The breeding and non-breeding seasonal totals were summed to obtain the annual total impact on the regional population for each species.

## 2.2 Qualitative Cumulative Assessment Methods

35. MD-LOT advised (by email, dated 10 June 2024) that a qualitative cumulative assessment was required for all OWF projects for which a Scoping Opinion had been adopted but that had not yet submitted an application. 11 OWFs had an adopted Scoping Opinion but had not submitted an application (as of 19 June 2024).

36. Scoping Reports for these 11 OWFs were reviewed for information presented therein about species occurring more frequently and in higher abundance in the offshore project development area.

37. All but one (Caledonia) presented summaries of the most abundant seabird species recorded during digital aerial surveys. A summary of information in the Scoping Report for each of the 11 OWFs considered under Tier 2 is given below.

### 2.2.1 Summary of Scoping Reports for Tier 2 OWF

#### 2.2.1.1 Broadshore, Scaraben and Sinclair

38. The Broadshore, Scaraben and Sinclair Scoping Report (RHDHV, 2024<sup>7</sup>) identified six species as the most abundant, presented in decreasing order of abundance: guillemot, kittiwake, fulmar, puffin, gannet and razorbill.

#### 2.2.1.2 Buchan

39. The Buchan Offshore Wind Scoping Report (Natural Power, 2023<sup>8</sup>) found guillemot to be the most abundant species in the project area, followed by fulmar, herring gull, razorbill and puffin.

#### 2.2.1.3 Caledonia

40. The Caledonia Offshore Wind Farm Scoping Report (GoBe, 2022<sup>9</sup>) did not present any digital aerial survey information but identified species of seabird that had been recorded in high abundance on surveys of other OWFs in the vicinity of the Caledonia project area.

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<sup>7</sup> [240108 - broadshore\\_scaraben\\_and\\_sinclair - eia\\_scoping - scoping\\_report.pdf \(marine.gov.scot\)](#).

<sup>8</sup> [230928-Buchan\\_Offshore\\_Wind-Scoping-Offshore\\_Scoping\\_Report.pdf \(marine.gov.scot\)](#).

<sup>9</sup> [pre-application - offshore\\_scoping\\_report\\_redacted.pdf \(marine.gov.scot\)](#).

#### 2.2.1.4 Cenos

41. The Cenos Offshore Windfarm Scoping Report (Flotation Energy, 2023<sup>10</sup>) identified the following species as being the most abundant in the project area: guillemot, fulmar, kittiwake, gannet and puffin.

#### 2.2.1.5 Culzean

42. The Culzean Floating Wind Pilot EIA Scoping Report (Xodus, 2023<sup>11</sup>) noted guillemot, razorbill, great black-backed gull, herring gull and fulmar being recorded in the project area in autumn and winter. Breeding season numbers were low due to the distance of the project from the coast.

#### 2.2.1.6 MarramWind

43. The MarramWind Offshore Wind Farm Environmental Impact Assessment Scoping Report (MarramWind, 2023<sup>12</sup>) identified guillemot as the most abundant species in the project area, followed by kittiwake, fulmar and gannet.

#### 2.2.1.7 Morven

44. The Morven Offshore Wind Array Project Environmental Impact Assessment Scoping Report (RPS, 2023<sup>13</sup>) notes the following species recorded in higher abundances: kittiwake, guillemot, razorbill, puffin, fulmar, gannet.

#### 2.2.1.8 Muir Mhor

45. The Muir Mhòr Offshore Wind Farm Offshore EIA Scoping Report (GoBe, 2023<sup>14</sup>) identified the following species as being recorded in high abundance in the project area: fulmar, guillemot, gannet, kittiwake, puffin, razorbill.

#### 2.2.1.9 Ossian

46. The Ossian Array EIA Scoping Report (RPS, 2023<sup>15</sup>) identified the following species as the most abundant in the project area: guillemot, kittiwake, gannet, puffin, fulmar and razorbill.

#### 2.2.1.10 Spiorad na Mara

47. The Spiorad na Mara Offshore Wind Farm Scoping Report (Spiorad na Mara, 2023<sup>16</sup>) identified the following species as being present in higher abundance in the project area: fulmar, puffin, guillemot, razorbill, gannet, European shag, kittiwake.

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<sup>10</sup> [flo-cen-rep-0010\\_cenos\\_scoping\\_report\\_document\\_-\\_redacted.pdf \(marine.gov.scot\)](#)

<sup>11</sup> [Scoping Report \(marine.gov.scot\)](#).

<sup>12</sup> [MarramWind Offshore Wind Farm Scoping Report \(marine.gov.scot\)](#)

<sup>13</sup> [Project Moven \(marine.gov.scot\)](#).

<sup>14</sup> [Microsoft Word - Muir Mhòr Offshore Wind Farm Offshore Environmental Impact Assessment \(EIA\) Scoping Report CLEAN.docx \(marine.gov.scot\)](#).

<sup>15</sup> [ossian\\_wind\\_-\\_array\\_eia\\_scoping\\_report\\_-\\_eoro811a.pdf \(marine.gov.scot\)](#)

<sup>16</sup> [Spiorad na Mara - Scoping Report \(marine.gov.scot\)](#).

### 2.2.1.11 Stromar

48. The Stromar Offshore Wind Farm EIA Offshore Scoping Report (GoBe, 2024<sup>17</sup>) identified the following species as being recorded in high abundance in the project area: kittiwake, great black-backed gull, guillemot, razorbill, fulmar and gannet.

### 2.2.2 Summary of Qualitative Cumulative Impacts

49. The information derived from each of the 11 Scoping Reports was summarised by species, and these are indicated (**Table 2-6**).

**Table 2-6. OWFs included in the qualitative cumulative assessment and the species identified in their Scoping Reports.**

Species	OWF					
	Broadshare Hub	Buchan	Culzean	Muir Mhor	Ossian	Stromar
Black-legged kittiwake	Y			Y	Y	Y
Common guillemot	Y	Y	Y	Y	Y	Y
Herring gull		Y	Y			
Northern fulmar	Y	Y		Y		Y
Great black-backed gull						Y
Northern fulmar	Y	Y	Y	Y	Y	Y
Razorbill	Y	Y	Y	Y	Y	Y
Northern gannet				Y	Y	Y
Atlantic puffin	Y			Y	Y	

### 2.3 Quantitative Cumulative Assessment Methods

50. The 44 OWF listed under Tier 1 (**Table 2-1**) were included in a quantitative assessment of cumulative impacts. Information on OWF impacts were collated and then summed for the cumulative impact assessment.
51. NatureScot requested (consultation meeting, 11 June 2024) that two cumulative scenarios were considered: with Berwick Bank Wind Farm impacts included and excluded. Thus cumulative mortalities including and excluding Berwick Wind Farm impacts were assessed against the regional population size.
52. Previously, neither NatureScot nor Natural England have required a displacement and barrier impact assessment for fulmar. However, NatureScot advised that this impact pathway required assessment for fulmar due to the location of the Project and the proximity to fulmar breeding colonies. During a consultation meeting with NatureScot on 11 June 2024, NatureScot advised that no cumulative assessment was required for fulmar, as no other OWFs have assessed displacement for this species. Consequently, only Project alone impacts are considered for fulmar.

<sup>17</sup> [240110 - scotwind\\_ne3 - stromar - scoping - scoping\\_opinion - scoping\\_report.pdf \(marine.gov.scot\)](#).

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NatureScot Consultation Meeting 18 June 2024:

Presentation of Worst Case and Most Likely Scenarios

NatureScot confirmed that for the collision assessment, the presentation of the Worst-Case Scenario (WCS) and the Most-Likely Scenario (MLS) is a Project decision. If the Project is willing to take the risk, NatureScot confirmed that basing the assessment on WCS is fine.

NatureScot Consultation Meeting 25 June 2024:

NatureScot confirmed that if the MLS were presented, they would use this for context, but NatureScot advice would be based on the WCS. Given that the MLS and WCS impacts are similar, including the MLS scenario is unlikely to substantially change NatureScot advice.

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### 2.3.1 Collision and Displacement Scenarios

53. **Appendix 3 - EIA and HRA: Collision Risk Modelling Technical Report** presents estimated Project collisions for both the Worst Case Scenario (WCS) and the Most Likely Scenario (MLS). Annual collision mortalities were not substantially smaller under the MLS, compared to the WCS (**Table 2-7**). Therefore, only the WCS was considered for both the Project alone and cumulative impact assessments (this was agreed with NatureScot in a consultation meeting on 18 June 2024).

**Table 2-7. Estimated annual collision mortalities for the Project under the Most Likely Scenario (MLS) and Worst Case Scenario (WCS). See Appendix 3 - EIA and HRA: Collision Risk Modelling Technical Report for more details.**

Species	MLS	WCS
Gannet	42.69	45.06
Great black-backed gull	11.44	11.94
Great skua	0.36	0.38
Kittiwake	52.7	56.04

**Appendix 4 - EIA and HRA: Displacement Technical Report** presents estimated Project displacement mortalities for both high and low impact scenarios. These high and low impact scenarios are derived from assumptions about the proportion of displaced birds that die. These assumptions follow NatureScot advice (see NatureScot Guidance Note 8<sup>18</sup>). **Table 2-8** presents displacement mortalities for the high and low impact scenarios, as well as assumed displacement rates and mortality of displaced birds. NatureScot advised that both high and low impact scenarios should be considered in the impact assessment (consultation meeting, 11 June 2024).

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<sup>18</sup> [Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects of Marine birds | NatureScot.](#)

**Table 2-8. Annual displacement mortalities for the Project alone high and low displacement impacts. See Appendix 4 - EIA and HRA: Displacement Technical Report for more details.**

Species	Low impact scenario			High impact scenario		
	Displacement rate	Mortality rate for displaced birds	Mortality	Displacement rate	Mortality rate for displaced birds	Mortality
Kittiwake	30%	1%	7.0	30%	3%	21.0
Guillemot	60%	3% breeding season; 1% non-breeding season	169.9	60%	5% breeding season; 3% non-breeding season	318.3
Razorbill	60%	3% breeding season; 1% non-breeding season	3.3	60%	5% breeding season; 3% non-breeding season	6.6
Puffin	60%	3% breeding season; 1% non-breeding season	107.7	60%	5% breeding season; 3% non-breeding season	196.6
Fulmar	20%	1%	8.8	20%	3%	26.4
Gannet	70%	1%	14.2	70%	3%	42.5

### 2.3.2 Obtaining Impacts for Other OWFs

54. As is common practice, the collision and abundance estimates for other OWFs were primarily obtained from recent submissions made by other offshore wind farms. For the West of Orkney Windfarm cumulative assessment, these were Outer Dowsing<sup>19</sup> and Berwick Bank<sup>20</sup>. For more recent projects (Greenvolt and Salamander), which were not included in the cumulative tables presented elsewhere, the figures were taken from the project applications.
55. For displacement, the total abundance of each species in each season within the OWF boundary plus its 2 km buffer were tabulated. These abundance rates were then multiplied by the NatureScot advised species- and season-specific displacement and mortality rates to ensure that, as far as possible, a consistent approach was followed to estimating displacement impacts was applied to all OWFs.
56. NatureScot advise that kittiwakes should be assessed for both displacement and collision impacts (see NatureScot Guidance Note 7<sup>21</sup> and Guidance Note 8<sup>22</sup>). However, Natural England advise that displacement does not need to be assessed for this species (Parker *et al.*, 2022). Consequently, kittiwake displacement mortality was calculated for OWFs in Scotland but not for those in England (as agreed with NatureScot in a consultation meeting on 4 June 2024).
57. Section 3 presents collision mortalities and abundance estimates for each OWF. Displacement mortality is calculated from abundance estimates, using consistent displacement and mortality rates, as provided in NatureScot Guidance Note 8. Estimates for each season (NatureScot breeding and non-breeding season, BDMPS seasons: spring migration, autumn migration and winter), by OWF, are provided.

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<sup>19</sup> <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010130/EN010130-000354-6.1.12%20Chapter%2012%20Offshore%20and%20Intertidal%20Ornithology.pdf>.

<sup>20</sup> <https://berwickbank-eia.com/offshore-eia/vol2-ch11-ornithology/>.

<sup>21</sup> [Guidance Note 7: Guidance to support Offshore Wind Applications: Marine Ornithology - Advice for assessing collision risk of marine birds | NatureScot](#)

<sup>22</sup> [Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects of Marine birds | NatureScot.](#)

### 3 RESULTS

#### 3.1 Kittiwake

##### Impacts Assessed: Collision and Displacement

58. **Table 3-1** presents the estimated kittiwake collision and displacement mortalities for the Project and all other OWFs included in the cumulative assessment. NatureScot advise that displacement impacts should be considered for kittiwake (NatureScot Guidance Note 8) whereas Natural England advise that kittiwake displacement do not need to be included in impact assessments (Parker *et al.*, 2022). Therefore, displacement was only considered for OWFs in Scotland, as agreed with NatureScot at a consultation meeting on 4 June 2024. A displacement rate of 30% and mortality rates for displaced birds of 1% (low impact scenario) and 3% (high impact scenario) have been applied.
59. Kittiwake collision mortalities were generally higher than displacement mortalities for Scottish OWFs (**Table 3-1**). Total cumulative annual collision mortality from all OWFs was estimated to be 3,188 collisions per annum and cumulative annual displacement mortality was estimated to be 268 and 799 mortalities per annum, for low and high impact scenarios, respectively.

**Table 3-1. Kittiwake cumulative collisions, abundance and estimated displacement mortality. Displacement calculated using 30% displacement and 1% or 3% mortality. Note that projects in English waters have not been assessed for kittiwake displacement. Empty cells indicate no data available (WoW = the Project).**

Project	Collisions				Abundance				Displacement (30% x 1%)				Displacement (30% x 3%)			
	Breeding	Autumn	Spring	Summer	Breeding	Autumn	Spring	Summer	Breeding	Autumn	Spring	Summer	Breeding	Autumn	Spring	Summer
WoW	17.86	16.31	21.87	1112.7	798.7	1216.8	3	2	4	10	7	11				
PFOWF	4	1	0	546	118	41	2	0	0	5	1	0				
BOWL	69	8	29	1,430	1,112	1,112	4	3	3	13	10	10				
Moray East	32	2	14	1,963	0	0	6	0	0	18	0	0				
Moray West	57	17	5	6,902	1,470	1,074	21	4	3	62	13	10				
Blyth Demonstration Site	1	2	1	591	740	740	0	0	0	0	0	0				
Dogger Bank A & B	210	98	215	7,898	3,450	15,482	0	0	0	0	0	0				
Dogger Bank C & Sofia	100	66	158	4,395	2,181	11,805	0	0	0	0	0	0				
Dudgeon	0	0	0				0	0	0	0	0	0				
Dudgeon & Sheringham Extension Project	7	4	1				0	0	0	0	0	0				
East Anglia ONE	1	117	34	171	1,158	758	0	0	0	0	0	0				
East Anglia ONE North	29	6	2	231	159	435	0	0	0	0	0	0				
East Anglia THREE	4	50	27	345	3,419	1,309	0	0	0	0	0	0				
East Anglia TWO	21	4	5	241	127	301	0	0	0	0	0	0				
EOWDC	9	4	1	663	14	23	2	0	0	6	0	0				
Galloper	5	20	23				0	0	0	0	0	0				
Greater Gabbard	1	11	8				0	0	0	0	0	0				
Gunfleet Sands	0	0	0				0	0	0	0	0	0				
Hornsea Project Four	54	10	3	3,771	3,608	2,626	0	0	0	0	0	0				
Hornsea Project One	32	41	15	2,946	31,481	767	0	0	0	0	0	0				
Hornsea Project Two	12	6	2	2,903	1,449	1,975	0	0	0	0	0	0				
Hornsea Project Three	56	28	6	5,320	2,550	3,795	0	0	0	0	0	0				
Humber Gateway	1	2	1				0	0	0	0	0	0				



Project	Collisions		Abundance				Displacement (30% x 1%)		Displacement (30% x 3%)			
	Breeding	Autumn	Spring	Breeding	Autumn	Spring	Breeding	Autumn	Spring	Breeding	Autumn	Spring
Hywind Scotland	12	1	1	112			0	0	0	1	0	0
Inch Cape	25	16	4	3,866	1,069	1,069	12	3	3	35	10	10
Kentish Flats Extension	0	0	3				0	0	0	0	0	0
Kincardine	16	6	1	229			1	0	0	2	0	0
Lincs, Lynn & Inner Dowsing	1	1	0				0	0	0	0	0	0
London Array	1	2	1				0	0	0	0	0	0
Levenmouth Demonstration Turbine	0	0	0	184			1	0	0	2	0	0
Near na Gaoithe	11	5	1	2,164	2,016	139	6	6	0	19	18	1
Norfolk Boreas	10	23	9	575	2,576	949	0	0	0	0	0	0
Norfolk Vanguard	16	12	14	519	916	1,294	0	0	0	0	0	0
Race Bank	1	17	4				0	0	0	0	0	0
Rampion	40	27	22				0	0	0	0	0	0
Seagreen (Phase 1)	71	95	55	3,235	2,286	2,286	10	7	7	29	21	21
Sheringham Shoal	0	0	0				0	0	0	0	0	0
Teesside	28	17	2				0	0	0	0	0	0
Thanet	0	1	0				0	0	0	0	0	0
Triton Knoll	18	101	33	290	332	226	0	0	0	0	0	0
Westermost Rough	0	0	0				0	0	0	0	0	0
Forthwind	0	0	0				0	0	0	0	0	0
Berwick Bank	393	121	114	21,141	11,190	13,766	63	34	41	190	101	124
Greenvolt	5-2	5-4	3-3	183	149	83	1	0	0	2	1	1
Salamander	14	0	0	3,718	220	0	11	1	0	33	2	0
<b>Total</b>	<b>1385-1</b>	<b>963-7</b>	<b>839-2</b>	<b>25042-0</b>	<b>11559-0</b>	<b>13849-0</b>	<b>143-0</b>	<b>60-0</b>	<b>61-0</b>	<b>427-0</b>	<b>184-0</b>	<b>188-0</b>

### 3.2 Gannet

#### Impacts Assessed: Collision and Displacement

60. **Table 3-2** presents the estimated gannet collision and displacement mortalities for the Project and all other OWFs included in the cumulative assessment. A displacement rate of 70% and mortality rates for displaced birds of 1% (low impact scenario) and 3% (high impact scenario) have been applied.
61. Gannet collision mortalities were generally higher than displacement mortalities, although not for all OWFs (**Table 3-2**). Total annual collision mortality from all OWFs was estimated to be 2,068 collisions per annum. Total annual displacement mortality was estimated to be 256 and 1,246 mortalities per annum, for low and high impact scenarios, respectively.

**Table 3-2. Gannet cumulative collisions, abundance and estimated displacement mortality. Displacement calculated using 70% displaced and 1% or 3% mortality. Empty cells indicate no data available (WoW = the Project).**

Project	Collisions				Abundance				Displacement (70% x 1%)				Displacement (70% x 3%)			
	Breeding	Autumn	Spring	Breeding	Autumn	Spring	Breeding	Autumn	Spring	Breeding	Autumn	Spring	Breeding	Autumn	Spring	
WoW	35-29	8	1,76	851.7	1368	139.5	6.0	9.6	1.0	17.9	28.7	2.9				
PFOWF	2	0	0	-	-	-	1.0	0.0	0.0	1.0	0.0	0.0				
BOWL	37	49	10	151	0	0	1.1	0.0	0.0	3.2	0.0	0.0				
Moray East	81	35	9	564	292	27	3.9	2.0	0.2	11.8	6.1	0.6				
Moray West	10	2	1	2,827	439	144	19.8	3.1	1.0	59.4	9.2	3.0				
Blyth Demonstration Site	4	2	3	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0				
Dogger Bank A & B	81	84	54	1,155	2,048	394	8.1	14.3	2.8	24.3	43.0	8.3				
Dogger Bank C & Sofia	15	10	11	2,250	887	464	15.8	6.2	3.2	47.3	18.6	9.7				
Dudgeon	22	39	19	53	25	11	0.4	0.2	0.1	1.1	0.5	0.2				
Dudgeon & Sheringham Extension Project	0	1	0	440	638	58	3.1	4.5	0.4	9.2	13.4	1.2				
East Anglia ONE	3	131	6	161	3,638	76	1.1	25.5	0.5	3.4	76.4	1.6				
East Anglia ONE North	5	29	8	412	1,269	524	2.9	8.9	3.7	8.7	26.6	11.0				
East Anglia THREE	12	11	1	149	468	44	1.0	3.3	0.3	3.1	9.8	0.9				
East Anglia TWO	13	23	4	192	891	192	1.3	6.2	1.3	4.0	18.7	4.0				
EOWDC	4	5	0	35	5	0	0.2	0.0	0.0	0.7	0.1	0.0				
Galloper	18	31	13	360	907	276	2.5	6.3	1.9	7.6	19.0	5.8				
Greater Gabbard	14	9	5	252	69	105	1.8	0.5	0.7	5.3	1.4	2.2				
Gunfleet Sands	0	0	0	0	12	9	0.0	0.1	0.1	0.0	0.3	0.2				
Hornsea Project Four	19	5	2	976	790	401	6.8	5.5	2.8	20.5	16.6	8.4				
Hornsea Project One	3	7	5	671	694	250	4.7	4.9	1.8	14.1	14.6	5.3				
Hornsea Project Two	7	14	6	457	1,140	124	3.2	8.0	0.9	9.6	23.9	2.6				
Hornsea Project Three	10	5	5	1,333	984	524	9.3	6.9	3.7	28.0	20.7	11.0				
Humber Gateway	2	1	2	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0				

Project	Collisions		Abundance				Displacement (70% x 1%)				Displacement (70% x 3%)				
	Breeding		Spring		Autumn		Spring		Autumn		Spring		Autumn		
	Breeding	Autumn	Spring	Breeding	Autumn	Spring	Breeding	Autumn	Spring	Breeding	Autumn	Spring	Breeding	Autumn	
Hywind Scotland	6	1	1	10	0	4	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1
Inch Cape	108	5	4	2,398	703	212	16.8	4.9	1.5	50.4	14.8	4.5			
Kentish Flats Extension	3	0	0	120	0	0	0.8	0.0	0.0	2.5	0.0	0.0			
Kincardine	1	1	1	0	13	0	0.0	0.1	0.0	0.0	0.3	0.0			
Lincs, Lynn & Inner Dowsing	2	1	2	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0			
London Array	2	1	2	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0			
Levenmouth Demonstration Turbine	6	0	0	23	0	0	0.2	0.0	0.0	0.5	0.0	0.0			
Near na Gaoithe	89	7	7	1,987	552	281	13.9	3.9	2.0	41.7	11.6	5.9			
Norfolk Boreas	14	13	4	1,229	1,723	526	8.6	12.1	3.7	25.8	36.2	11.0			
Norfolk Vanguard	8	19	5	271	2,453	437	1.9	17.2	3.1	5.7	51.5	9.2			
Race Bank	34	12	4	92	32	29	0.6	0.2	0.2	1.9	0.7	0.6			
Rampion	36	64	2	0	590	0	0.0	4.1	0.0	0.0	12.4	0.0			
Seagreen (Phase 1)	159	8	9	2,956	664	332	20.7	4.6	2.3	62.1	13.9	7.0			
Sheringham Shoal	14	4	0	47	31	2	0.3	0.2	0.0	1.0	0.7	0.0			
Teesside	5	2	0	1	0	0	0.0	0.0	0.0	0.0	0.0	0.0			
Thanet	1	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0			
Triton Knoll	27	64	30	211	15	24	1.5	0.1	0.2	4.4	0.3	0.5			
Westermost Rough	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0			
Forthwind	1	0	0	64	26	44	0.4	0.2	0.3	1.3	0.5	0.9			
Berwick Bank	170	18	3	4,735	1,500	269	33.1	10.5	1.9	99.4	31.5	5.6			
Greenvolt	15	1	2	198	24	102	1.4	0.2	0.7	4.2	0.5	2.1			
Salamander	4	1	1	442	369	0	3.1	2.6	0.0	9.3	7.7	0.0			
<b>Total</b>	<b>1102.3</b>	<b>723.0</b>	<b>242.8</b>	<b>27222.0</b>	<b>23891.0</b>	<b>5885.0</b>	<b>197.4</b>	<b>176.9</b>	<b>42.3</b>	<b>590.6</b>	<b>530.2</b>	<b>126.3</b>			

### 3.3 Great Black-backed Gull

#### Impacts Assessed: Collision Only

62. **Table 3-3** presents the estimated great black-backed gull collision mortalities for the Project and all other OWFs included in the cumulative assessment.
63. Great black-backed gull collision mortalities, for all OWFs included in the assessment, were estimated to be 1,003 collisions per annum (**Table 3-3**). 82% of collisions occurred in the non-breeding season. Berwick Bank reported zero collisions.

**Table 3-3. Great black-backed gull cumulative collisions (WoW = the Project).**

Project	Collisions	
	Breeding	Non-breeding
WoW	0.81	11
PFOWF	0	0
BOWL	14	31
Moray East	23	12
Moray West	4	5
Blyth Demonstration Site	3	5
Dogger Bank A & B	5	28
Dogger Bank C & Sofia	8	29
Dudgeon	0	0
Dudgeon & Sheringham Extension Project	6	0
East Anglia ONE	2	122
East Anglia ONE North	5	37
East Anglia THREE	4	1
East Anglia TWO	4	3
EOWDC	1	2
Galloper	1	21
Greater Gabbard	15	60
Gunfleet Sands	0	0
Hornsea Project Four	15	71
Hornsea Project One	5	18
Hornsea Project Two	8	28
Hornsea Project Three	1	5
Humber Gateway	2	4
Hywind Scotland	0	5
Inch Cape	0	37
Kentish Flats Extension	0	0
Kincardine	0	0
Lincs, Lynn & Inner Dowsing	0	0
London Array	0	0
Levenmouth Demonstration Turbine	1	1
Neart na Gaoithe	1	7

Project	Collisions	
	Breeding	Non-breeding
Norfolk Boreas	7	29
Norfolk Vanguard	5	21
Race Bank	0	0
Rampion	5	21
Seagreen (Phase 1)	13	54
Sheringham Shoal	0	0
Teesside	9	35
Thanet	0	0
Triton Knoll	16	106
Westermost Rough	0	0
Forthwind	0	0
Berwick Bank	0	0
Greenvolt	0.1	7
Salamander	0	3
<b>Total</b>	<b>183.9</b>	<b>819.0</b>

### 3.4 Guillemot

#### Impacts Assessed: Displacement Only

64. **Table 3-4** presents the estimated guillemot displacement mortalities for the Project and all other OWFs included in the cumulative assessment. A displacement rate of 60% with mortality rates for displaced birds of 3% (low impact scenario) and 5% (high impact scenario) for the breeding season and 1% (low impact scenario) and 3% (high impact scenario) for the non-breeding season, were applied.
65. Guillemot displacement mortalities from the Project alone were 170-318 per annum, under the low and high displacement impact scenarios, respectively (**Table 3-4**). For all OWFs included in the assessment, annual displacement mortality was 7,020 – 14,314 guillemots per annum, under the low and high displacement impact scenarios, respectively. Generally, breeding season mortality was higher than non-breeding season.

**Table 3-4. Guillemot cumulative abundance and estimated displacement mortality. Displacement calculated using 60% displaced and 5%/3% (breeding season) and 3%/1% (non-breeding season) mortality. Empty cells indicate no data available (WoW = the Project).**

Project	Abundance		Low Displacement Scenario (60% x 3%/1%)		High Displacement Scenario (60% x 5%/3%)	
	Breeding	Non-breeding	Breeding	Non-breeding	Breeding	Non-breeding
WoW	7972.5	4392.9	143.5	26.4	239.2	79.1
PFOWF	1146	650	20.6	3.9	34.4	11.7
BOWL	13610	2755	245.0	16.5	408.3	49.6
Moray East	9820	547	176.8	3.3	294.6	9.8
Moray West	24426	38174	439.7	229.0	732.8	687.1
Blyth Demonstration Site	1220	1321	22.0	7.9	36.6	23.8
Dogger Bank A & B	14886	16763	267.9	100.6	446.6	301.7
Dogger Bank C & Sofia	8494	5969	152.9	35.8	254.8	107.4
Dudgeon	334	542	6.0	3.3	10.0	9.8
Dudgeon & Sheringham Extension Project	3576	8671	64.4	52.0	107.3	156.1
East Anglia ONE	274	640	4.9	3.8	8.2	11.5
East Anglia ONE North	4183	1888	75.3	11.3	125.5	34.0
East Anglia THREE	1744	2859	31.4	17.2	52.3	51.5
East Anglia TWO	2077	1675	37.4	10.1	62.3	30.2
EOWDC	547	225	9.8	1.4	16.4	4.1
Galloper	305	593	5.5	3.6	9.2	10.7
Greater Gabbard	345	548	6.2	3.3	10.4	9.9
Gunfleet Sands	0	363	0.0	2.2	0.0	6.5
Hornsea Project Four	15245	69555	274.4	417.3	457.4	1252.0
Hornsea Project One	9836	8097	177.0	48.6	295.1	145.7
Hornsea Project Two	7735	13164	139.2	79.0	232.1	237.0
Hornsea Project Three	13374	17772	240.7	106.6	401.2	319.9



Project	Abundance		Low Displacement Scenario (60% x 3%/1%)		High Displacement Scenario (60% x 5%/3%)	
	Breeding	Non-breeding	Breeding	Non-breeding	Breeding	Non-breeding
Humber Gateway	99	138	1.8	0.8	3.0	2.5
Hywind Scotland	249	2136	4.5	12.8	7.5	38.4
Inch Cape	4371	3177	78.7	19.1	131.1	57.2
Kentish Flats Extension	0	7	0.0	0.0	0.0	0.1
Kincardine	632	0	11.4	0.0	19.0	0.0
Lincs, Lynn & Inner Dowsing	582	814	10.5	4.9	17.5	14.7
London Array	192	377	3.5	2.3	5.8	6.8
Levenmouth Demonstration Turbine	25	0	0.5	0.0	0.8	0.0
Neart na Gaoithe	1755	3761	31.6	22.6	52.7	67.7
Norfolk Boreas	7764	13777	139.8	82.7	232.9	248.0
Norfolk Vanguard	4320	4776	77.8	28.7	129.6	86.0
Race Bank	361	708	6.5	4.2	10.8	12.7
Rampion	10887	15536	196.0	93.2	326.6	279.6
Seagreen (Phase 1)	24724	8800	445.0	52.8	741.7	158.4
Sheringham Shoal	390	715	7.0	4.3	11.7	12.9
Teesside	267	901	4.8	5.4	8.0	16.2
Thanet	18	124	0.3	0.7	0.5	2.2
Triton Knoll	425	746	7.7	4.5	12.8	13.4
Westernmost Rough	347	486	6.2	2.9	10.4	8.7
Forthwind	417	401	7.5	2.4	12.5	7.2
Berwick Bank	74154	44171	1334.8	265.0	2224.6	795.1
Greenvolt	4429	16105	79.7	96.6	132.9	289.9
Salamander	3616	11779	65.1	70.7	108.5	212.0
<b>Total</b>	<b>281173.5</b>	<b>326598.9</b>	<b>5061.3</b>	<b>1959.7</b>	<b>8435.6</b>	<b>5878.8</b>

### 3.5 Razorbill

#### Impacts Assessed: Displacement Only

66. **Table 3-5** presents the estimated razorbill displacement mortalities for the Project and all other OWFs included in the cumulative assessment. A displacement rate of 60% with mortality rates for displaced birds of 3% (low impact scenario) and 5% (high impact scenario) for the breeding season and 1% (low impact scenario) and 3% (high impact scenario) for the non-breeding season, were applied.
67. Razorbill displacement mortalities from the Project were low, at 5-9 birds per annum for the low and high displacement impact scenarios, respectively (**Table 3-5**). Total annual displacement mortality was estimated to be 1,428 and 3,362 mortalities per annum, for low and high impact scenarios, respectively.

**Table 3-5. Razorbill cumulative abundance and estimated displacement mortality. Displacement calculated using 60% displaced and 5%/3% (breeding season) and 3%/1% (non-breeding season) mortality. Empty cells indicate no data available (WoW = the Project).**

Project	Abundance				Displacement (60% x 3%/1%)				Displacement (60% x 5%/3%)			
	Breeding	Autumn	Winter	Spring	Breeding	Autumn	Winter	Spring	Breeding	Autumn	Winter	Spring
WoW	141	112	19	132	3	1	0	1	4	2	0	2
PFOWF	134	16	17	14	2	0	0	0	4	0	0	0
BOWL	873	833	555	833	16	5	3	5	26	15	10	15
Moray East	2423	1103	30	168	44	7	0	1	73	20	1	3
Moray West	2808	3544	184	3585	51	21	1	22	84	64	3	65
Blyth Demonstration Site	121	91	61	91	2	1	0	1	4	2	1	2
Dogger Bank A & B	2788	3673	3871	9268	50	22	23	56	84	66	70	167
Dogger Bank C & Sofia	1987	902	2385	4872	36	5	14	29	60	16	43	88
Dudgeon	256	346	745	346	5	2	4	2	8	6	13	6
Dudgeon & Sheringham Extension Project	1239	4500	1531	464	22	27	9	3	37	81	28	8
East Anglia ONE	16	26	155	336	0	0	1	2	0	0	3	6
East Anglia ONE North	403	85	54	207	7	1	0	1	12	2	1	4
East Anglia THREE	1807	1122	1499	1524	33	7	9	9	54	20	27	27
East Anglia TWO	281	44	136	230	5	0	1	1	8	1	2	4
EOWDC	161	64	7	26	3	0	0	0	5	1	0	0
Galloper	44	43	106	394	1	0	1	2	1	1	2	7
Greater Gabbard	0	0	387	84	0	0	2	1	0	0	7	2
Gunfleet Sands	0	0	30	0	0	0	0	0	0	0	1	0
Hornsea Project Four	386	4311	455	449	7	26	3	3	12	78	8	8
Hornsea Project One	1109	4812	1518	1803	20	29	9	11	33	87	27	32
Hornsea Project Two	2511	4221	720	1668	45	25	4	10	75	76	13	30
Hornsea Project Three	630	2020	3649	2105	11	12	22	13	19	36	66	38
Humber Gateway	27	20	13	20	0	0	0	0	1	0	0	0

Project	Abundance				Displacement (60% x 3%/1%)				Displacement (60% x 5%/3%)			
	Breeding	Autumn	Winter	Spring	Breeding	Autumn	Winter	Spring	Breeding	Autumn	Winter	Spring
Hywind Scotland	30	719	10	0	1	4	0	0	1	13	0	0
Inch Cape	1436	2870	651	0	26	17	4	0	43	52	12	0
Kentish Flats Extension	0	0	0	0	0	0	0	0	0	0	0	0
Kincardine	22	0	0	0	0	0	0	0	1	0	0	0
Lincs, Lynn & Inner Dowsing	45	34	22	34	1	0	0	0	1	1	0	1
London Array	14	20	14	20	0	0	0	0	0	0	0	0
Levenmouth Demonstration Turbine	4	0	0	0	0	0	0	0	0	0	0	0
Near na Gaoithe	331	5492	508	0	6	33	3	0	10	99	9	0
Norfolk Boreas	630	263	1065	345	11	2	6	2	19	5	19	6
Norfolk Vanguard	879	866	839	924	16	5	5	6	26	16	15	17
Race Bank	28	42	28	42	1	0	0	0	1	1	1	1
Rampion	630	66	1244	3327	11	0	7	20	19	1	22	60
Seagreen (Phase 1)	9574	0	2375	0	172	0	14	0	287	0	43	0
Sheringham Shoal	106	1343	211	30	2	8	1	0	3	24	4	1
Teesside	16	61	2	20	0	0	0	0	0	1	0	0
Thanet	3	0	14	21	0	0	0	0	0	0	0	0
Triton Knoll	40	254	855	117	1	2	5	1	1	5	15	2
Westermost Rough	91	121	152	91	2	1	1	1	3	2	3	2
Forthwind	57	81	58	81	1	0	0	0	2	1	1	1
Berwick Bank	4040	8849	1399	7480	73	53	8	45	121	159	25	135
Greenvolt	457	0	58	0	8	0	0	0	14	0	1	0
Salamander	334	0	484	0	6	0	3	0	10	0	9	0
<b>Total</b>	<b>38912</b>	<b>52969</b>	<b>28116.0</b>	<b>41151.0</b>	<b>701.0</b>	<b>316.0</b>	<b>163</b>	<b>248</b>	<b>1166</b>	<b>954</b>	<b>505.0</b>	<b>740.0</b>

### 3.6 Puffin

#### Impacts Assessed: Displacement Only

68. **Table 3-6** presents the estimated puffin displacement mortalities for the Project and all other OWFs included in the cumulative assessment. A displacement rate of 60% with mortality rates for displaced birds of 3% (low impact scenario) and 5% (high impact scenario) for the breeding season and 1% (low impact scenario) and 3% (high impact scenario) for the non-breeding season, were applied.
69. Puffin displacement mortalities from the Project alone were 107.7 to 196.6 per annum, under the low and high displacement impact scenarios, respectively (**Table 3-6**). For all OWFs included in the assessment, annual displacement mortality was 804 to 1,618 puffins per annum, under the low and high displacement impact scenarios, respectively.

**Table 3-6. Puffin cumulative abundance and estimated displacement mortality. Displacement calculated using 60% displaced and 5%/3% (breeding season) and 3%/1% (non-breeding season) mortality. Empty cells indicate no data available (WoW = the Project).**

Project	Abundance		Displacement (60% x 3%/1%)		Displacement (60% x 5%/3%)	
	Breeding	Autumn	Breeding	Autumn	Breeding	Autumn
WoW	5272	2136	94.9	12.8	158.2	38.4
PFOWF	1211	2	21.8	0.0	36.3	0.0
BOWL	2858	2435	51.4	14.6	85.7	43.8
Moray East	2795	656	50.3	3.9	83.9	11.8
Moray West	1115	3966	20.1	23.8	33.5	71.4
Blyth Demonstration Site	235	123	4.2	0.7	7.1	2.2
Dogger Bank A & B	139	1038	2.5	6.2	4.2	18.7
Dogger Bank C & Sofia	69	602	1.2	3.6	2.1	10.8
Dudgeon	1	3	0.0	0.0	0.0	0.1
Dudgeon & Sheringham Extension Project	0	28	0.0	0.2	0.0	0.5
East Anglia ONE	16	32	0.3	0.2	0.5	0.6
East Anglia ONE North	0	0	0.0	0.0	0.0	0.0
East Anglia THREE	181	307	3.3	1.8	5.4	5.5
East Anglia TWO	15	0	0.3	0.0	0.5	0.0
EOWDC	42	82	0.8	0.5	1.3	1.5
Galloper	0	1	0.0	0.0	0.0	0.0
Greater Gabbard	0	1	0.0	0.0	0.0	0.0
Gunfleet Sands	0	0	0.0	0.0	0.0	0.0
Hornsea Project Four	203	1257	3.7	7.5	6.1	22.6
Hornsea Project One	1070	2039	19.3	12.2	32.1	36.7
Hornsea Project Two	468	67	8.4	0.4	14.0	1.2
Hornsea Project Three	253	442	4.6	2.7	7.6	8.0
Humber Gateway	15	10	0.3	0.1	0.5	0.2
Hywind Scotland	119	85	2.1	0.5	3.6	1.5

Project	Abundance		Displacement (60% x 3%/1%)		Displacement (60% x 5%/3%)	
	Breeding	Autumn	Breeding	Autumn	Breeding	Autumn
Inch Cape	2956	2688	53.2	16.1	88.7	48.4
Kentish Flats Extension	3	6	0.1	0.0	0.1	0.1
Kincardine	19	0	0.3	0.0	0.6	0.0
Lincs, Lynn & Inner Dowsing	3	6	0.1	0.0	0.1	0.1
London Array	0	1	0.0	0.0	0.0	0.0
Levenmouth Demonstration Turbine	8	0	0.1	0.0	0.2	0.0
Near na Gaoithe	2562	2103	46.1	12.6	76.9	37.9
Norfolk Boreas	0	23	0.0	0.1	0.0	0.4
Norfolk Vanguard	67	112	1.2	0.7	2.0	2.0
Race Bank	1	10	0.0	0.1	0.0	0.2
Rampion	7	0	0.1	0.0	0.2	0.0
Seagreen (Phase 1)	6154	5389	110.8	32.3	184.6	97.0
Sheringham Shoal	4	26	0.1	0.2	0.1	0.5
Teesside	35	18	0.6	0.1	1.1	0.3
Thanet	0	0	0.0	0.0	0.0	0.0
Triton Knoll	23	71	0.4	0.4	0.7	1.3
Westermost Rough	61	35	1.1	0.2	1.8	0.6
Forthwind	0	0	0.0	0.0	0.0	0.0
Berwick Bank	4513	8892	81.2	53.4	135.4	160.1
Greenvolt	250	41	4.5	0.2	7.5	0.7
Salamander	357	0	6.4	0.0	10.7	0.0
<b>Total</b>	<b>33100</b>	<b>34733</b>	<b>595.8</b>	<b>208.1</b>	<b>993.3</b>	<b>625.1</b>

## **4 SUMMARY**

### **4.1 Brief Summary of Key Points of this Report**

70. This report provides collision and displacement impacts for the Project and OWFs considered in the cumulative assessment. The Addendum to the Offshore EIA Report uses these figures to estimate the impacts on the regional populations for each species and presents assessment as necessary. This includes the use of PVA for Project alone impacts if the Project alone increase in mortality rate exceed 0.02%, and cumulatively if the cumulative increase in mortality rate exceeds 0.02% and the Project alone impact exceeds 0.2. The PVA results are reported in Appendix 9 - EIA: PVA at regional population scales for Project alone and cumulative impacts and discussed in the Addendum to the Offshore EIA Report



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