Offshore Wind Power Limited

# West of Orkney Windfarm Offshore EIA Report

## Volume 1, Chapter 13 - Offshore and Intertidal Ornithology

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West of Orkney Windfarm

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# 13 OFFSHORE AND INTERTIDAL ORNITHOLOGY

CHAPTER SUMMARY

This chapter of the Offshore EIA report assesses the potential effects from the offshore Project on offshore and intertidal ornithological receptors. This includes direct, indirect, whole project assessment, cumulative, inter-related effects, inter-relationship, and transboundary effects. There has been ongoing consultation with naturescot throughout the EIA and associated HRA processes, to discuss the constraints analysis, environmental surveys, assessment scope and present early results of the assessments.

The baseline site-specific Digital Aerial Surveys (DAS) identified the following key species within the offshore Project area: kittiwake, great black-backed gull, Arctic tern, great skua, guillemot, razorbill, puffin, fulmar and gannet. Species recorded regularly in most months within the survey area and its vicinity were kittiwake, guillemot, razorbill, puffin and gannet. However for most species recorded at most times of year, abundance in the area potentially affected by the offshore Project was low or very low in the context of their population size. Great skuas and storm-petrels were generally absent from the Option Agreement Area (OAA) during the non-breeding season, storm petrels were recorded only in August and September. Key species present within the offshore Project area are considered to have a moderate sensitivity to disturbance. Four species (kittiwake, great black-backed gull, Arctic tern and gannet) have a moderate to high vulnerability to Wind Turbine Generation (WTG) collision risk.

The following impacts were identified as requiring assessment:

Construction and decommissioning:

- Direct distributional responses and displacement effects;
- Indirect effects as a result of disturbance and displacement of prey species;

Operation and maintenance:

- Direct distributional responses, displacement and barrier effects;
- Indirect effects due to habitat loss / change for key prey species;
- Direct collision risk; and
- Combined operational displacement and collision risk.

Overall, for the offshore Project alone, the assessment of potential effects of disturbance and displacement combined with collision risk showed that for all species at all times of year, effects would have a negligible or low impact on receptor populations. Disturbance and displacement during construction (including pre-construction) would be short-term, temporary and reversible and considered not significant. The assessment of the operation and maintenance stage was informed by Project-specific collision risk modelling, displacement assessment and Population Viability Analysis (PVA) to understand the potential effects on regional populations. Embedded mitigations will likely reduce impacts on birds, such as the minimum clearance between the lowest WTG blade tip and sea-level, set by the engineering requirements, is above the minimum required clearance, which reduces potential collision risk.

Collision risk, disturbance, displacement and barrier effects during the operation and maintenance stage were assessed as affecting very low proportions of breeding and non-breeding populations. Indirect effects from impacts to key prey species (e.g. sandeel and herring) were informed by the outcomes of other topic-specific assessments, such as fish and shellfish ecology and were assessed as not significant. No significant transboundary effects predicted.

For cumulative impacts with other projects, the potential for combined disturbance and collision effects on kittiwake, Arctic tern and gannet were identified. The cumulative impacts on the regional breeding and non-breeding populations were assessed to be minor and impacts assessed as not significant.

For cumulative impacts with other projects, the potential for disturbance, displacement and barrier effects only effects on guillemot, razorbill, puffin and fulmar were identified. The cumulative impacts on the regional breeding and non-breeding populations were assessed to be minor and impacts assessed as not significant.

For cumulative impacts with other projects, the potential for collision only effects on great black-backed gull and great skua were identified. The cumulative impacts on the regional breeding and non-breeding populations were assessed to be minor and impacts assessed as not significant.

It was also assessed that there was no potential for the effects during other stages of the offshore project to interact in a way that would result in combined effects of greater significance than the assessments for each individual stage. In addition, offshore and intertidal ornithology receptors are part of the wider ecosystem, and therefore, impacts on this receptor may affect other components of the ecosystem and *vice versa*. However, no significant effects were predicted on any key prey species and no significant change in the distribution or abundance of seabirds as predators in the offshore project area is anticipated. Therefore, no ecosystem effects were anticipated to occur in relation to ornithology receptors, either as direct impacts to them as predators or through indirect effects to their prey species.

The whole project assessment concluded no overlap between the effects of the onshore and offshore Project on offshore and intertidal ornithology receptors.

An assessment of effects on Special Protection Areas (SPAs), as required by the HRA process, is reported within the Offshore Report to Inform Appropriate Assessment (RIAA). The Offshore RIAA concluded that when considering the "best scientific knowledge in the field" and using available evidence from operational offshore windfarms, no adverse effects on site integrity can be concluded for all SPAs.

Details of any required monitoring will be determined post-consent and discussed and agreed via a regional advisory group (or equivalent). Monitoring details will be subject to approval as part of the discharge of consent conditions.

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## 13.1 Introduction

This chapter of the Offshore EIA Report presents the offshore and intertidal ornithology receptors of relevance to the offshore Project and assesses the potential impacts from the construction (including pre-construction), operation and maintenance and decommissioning of the offshore Project on these receptors. Where required, mitigation is proposed, and the residual impacts and their significance are assessed. Potential cumulative and transboundary impacts are also considered.

There has been ongoing consultation with NatureScot throughout the Offshore EIA and associated HRA processes, to discuss the constraints analysis, environmental surveys, assessment scope and present early results of the assessments. OWPL are confident that all the information required by the regulator and NatureScot to understand potential impacts, prepare the Appropriate Assessment and determine the consent application has been provided.

This chapter has been prepared by MacArthur Green using Digital Aerial Survey (DAS) data collected by HiDef Aerial Surveying Limited (HiDef). Full details of the baseline data acquired through the DAS specifically carried out within the Option Agreement Area (OAA) and a 4 km buffer can be found in the Offshore EIA Report, Supporting Study (SS) 12: Offshore ornithology technical supporting study.

Table 13-1 below provides a list of all the supporting studies which relate to, and should be read in conjunction with, the offshore and intertidal ornithology impact assessment. All supporting studies are appended to this Offshore EIA Report and issued on the accompanying universal serial bus (USB).

The assessment within this EIA chapter has been based on density and abundance peak mean estimates, which are provided in Supporting Study 12 (SS12): Offshore ornithology technical supporting study, Annex 12.4. The density/abundance for each calendar month was calculated as the mean of estimates for each calendar month and the mean seasonal peak was taken as the highest from within the months within each season. This approach was taken as it makes full use of the available DAS data. Further data and analysis has been provided based on an ***Alternative Approach*** which follows NatureScot guidance but does not make use of all available DAS data. The numbers based on the ***Alternative Approach*** are provided within SS12: Offshore ornithology technical supporting study, Annex 12.13 and signposted throughout the EIA chapter in bold italics where relevant. Annex 12.13 also provides further information on the subsequent changes in the predicted impacts for the displacement assessment, annual adult survival rate and Population Viability Analysis (PVA) modelling. The difference between these approaches was very small, with some predicted impacts being smaller using the ***Alternative Approach***, while others were greater. This was also reflected in the predicted change in adult survival and PVA results. However, the ***Alternative Approach*** did not change the conclusions of the assessment.

*Table 13-1 Supporting studies*

| DETAILS OF STUDY | LOCATIONS OF SUPPORTING STUDY |
|---|---|
| **Offshore Ornithology Technical Supporting Study:**<br>• **Annex 12.1: Mean design based estimates of density and abundance per month** | Offshore EIA Report, Supporting Study (SS) 12: Offshore ornithology technical supporting study |

| DETAILS OF STUDY | LOCATIONS OF SUPPORTING STUDY |
|---|---|
| • Annex 12.2: Design based estimates of density and abundance per survey<br>• Annex 12.3: Matrix displacement tables<br>• Annex 12.4: All design-based estimates of density and abundance of birds in flight and on the sea<br>• Annex 12.5: Collision risk input parameters<br>• Annex 12.6: Summary of collision risk results<br>• Annex 12.7: Survey dates and times<br>• Annex 12.8: Highly Pathogenic Avian Influenza Virus epidemic<br>• Annex 12.9: Density surface models (DSMs) for key species<br>• Annex 12.10: PVA methods, inputs and results<br>• Annex 12.11: Digital aerial survey raw count data<br>• Annex 12.12: Regional population estimates<br>• Annex 12.13: Alternative peak mean estimate displacement matrices and analyses | |
| Digital Video Aerial Survey Methodology and Marine Mammal Survey Results (HiDef) | Offshore EIA Report, Supporting Study (SS) 8: Digital Video Aerial Survey Methodology and Marine Mammal Survey Results |

The impact assessment presented herein draws upon information presented within other impact assessments within this Offshore EIA Report, including, chapter 10: Benthic subtidal and intertidal ecology and chapter 11: Fish and shellfish ecology. This interaction between the impacts assessed within different topic-specific chapters on a receptor is defined as an 'inter-relationship'. The chapters and impacts related to the assessment of potential effects on fish and shellfish ecology are provided in Table 13-2.

*Table 13-2 Offshore and intertidal ornithology inter-relationships*

| CHAPTER | IMPACT | DESCRIPTION |
|---|---|---|
| Benthic subtidal and intertidal ecology (chapter 10, Offshore EIA Report)<br>Fish and shellfish ecology (chapter 11, Offshore EIA Report) | Indirect impacts through effects on habitats and prey during construction. | Potential impacts on benthic ecology and fish and shellfish during construction could affect the prey resource for birds. |
| | Indirect impacts through effects on habitats and prey during operation. | Potential impacts on benthic ecology and fish and shellfish during operation could affect the prey resource for birds. |
| | Indirect impacts through effects on habitats and prey during decommissioning. | Potential impacts on benthic ecology and fish and shellfish during decommissioning could affect the prey resource for birds. |

The following specialists have contributed to the assessment:

- HiDef Aerial Surveying Limited (HiDef) – DAS, video footage analysis, ornithology survey reporting;
- DMP Statistical Solutions Limited – Density Surface Modelling (DSM); and
- MacArthur Green – baseline description, data analysis, impact assessment and Offshore EIA Report chapter write up.

Effects on Special Protected Areas (SPAs) have been considered under the Habitats Regulation Appraisal (HRA) process which has been undertaken alongside this Offshore EIA Report. The Offshore RIAA provides the assessment of the offshore Project on SPAs.

## 13.2 Legislation, policy and guidance

Over and above the legislation presented in chapter 3: Planning policy and legislative context, the following legislation, policy and guidance are relevant to the assessment of impacts from the offshore Project on offshore and intertidal ornithology:

- Legislation:
    - Directive 2009/147/EC on the Conservation of Wild Birds ('Birds Directive');
    - Directive 92/43/EEC on Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) ('Habitats Directive');
    - The Conservation (Natural Habitats and c.) Regulations 1994 (as amended); Environmental Impact Assessment Directive 2014/52/EU (the EIA Directive[1]);
    - The Conservation of Offshore Marine Habitats and Species Regulations 2017;
    - The Conservation of Habitats and Species Regulations 2017;
    - The Nature Conservation (Scotland) Act 2004 (as amended); and
    - The Wildlife and Countryside Act 1981 (as amended).
- Policy:
    - Scotland's National Marine Plan policy GEN 9 Natural heritage: Development and use of the marine environment must: (a) Comply with legal requirements for protected areas and protected species; (b) Not result in significant impact on the national status of Priority Marine Features (PMFs); and (c) Protect and, where appropriate, enhance the health of the marine area;
    - National Island's Plan; and
    - UK Post-2010 Biodiversity Framework.
- Guidance:
    - Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2022);
    - Advice on marine renewables development (NatureScot, 2023):
        - Guidance Note 1: Guidance to support Offshore Wind Applications: Marine Ornithology – Overview;

[1] *The EU Directives have been included as a reference, but it is noted that following the UK withdrawal from the EU these Directives are not legally binding, although the EU Withdrawal Act (2018) maintains the requirements of the EU Directives into domestic law as retained EU Law.*

  - Guidance Note 2: Guidance to support Offshore Wind Applications: Advice for Marine Ornithology Baseline Characterisation Surveys and Reporting;
  - Guidance Note 3: Guidance to support Offshore Wind Applications: Ornithology – Identifying Theoretical Connectivity with Breeding Site Special Protection Areas using Breeding Season Foraging Ranges;
  - Guidance Note 4: Guidance to support Offshore Wind Applications: Determining connectivity of Marine Birds with Marine Special Protection Areas and Breeding Seabirds from Colony SPAs in the Non-Breeding Season;
  - Guidance Note 5: Guidance to support Offshore Wind Applications: Recommendations for Marine Bird Population Estimates
  - Guidance Note 6: Guidance to support Offshore Wind Applications: Marine Ornithology Impact Pathways for Offshore Wind Developments
  - Guidance Note 7: Guidance to support Offshore Wind Applications: Marine Ornithology – Advice for Assessing Collision Risk of Marine Birds;
  - Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the Distributional Responses, Displacement and Barrier Effects of Marine Birds;
  - Guidance Note 9: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for Seasonal Definitions for Birds in the Scottish Marine Environment;
  - Guidance Note 10: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for Apportioning Impacts to Breeding Colonies[2];
  - Guidance Note 11: Guidance to support Offshore Wind Applications: Recommendations for Seabird Population Viability Analysis (PVA).
- Seasonal Definitions for Birds in the Scottish Marine Environment (NatureScot, 2020);
- A handbook on environmental impact assessment: Guidance for competent authorities, consultees and others involved in the Environmental Impact Assessment process in Scotland (SNH, 2018a);
- Interim guidance on apportioning impacts from marine renewable developments to breeding seabird populations in SPAs (SNH, 2018b);
- Recommendations for the presentation and content of interim marine bird, mammal and basking shark survey reports for marine renewable energy developments (SNH, 2014);
- Reports and presentations from the NatureScot "Bird impact assessment guidance workshop for offshore wind"[3] [4] (2022);
- Joint Statutory Nature Conservation Bodies (SNCB) Interim Displacement Advice Note (SNCB, 2022);
- SNCB Position Note on avoidance rates for use in collision risk modelling (SNCB, 2014);
- Gull foraging offshore and onshore: developing apportioning approaches to casework (Quinn, 2019); and
- Scottish Marine Energy Research (ScotMER) Programme - Offshore wind developments - collision and displacement in petrels and shearwaters: literature review.

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[2] *Guidance Note 10 is part of the package of advice but is currently not available.*

[3] *https://www.webarchive.org.uk/wayback/archive/20221013130442/https://www.nature.scot/doc/bird-impact-assessment-guidance-workshop-offshore-wind-report-and-presentations*

[4] *https://www.nature.scot/doc/bird-impact-assessment-guidance-workshop-offshore-wind-report-and-presentations*

## 13.3 Scoping and consultation

Stakeholder consultation has been ongoing throughout the EIA and has played an important part in ensuring the scope of the baseline characterisation and impact assessment are appropriate with respect to the Project and the requirements of the regulators and their advisors.

The Scoping Report, which covered the onshore and offshore Project, was submitted to Scottish Ministers (via Marine Scotland - Licensing Operations Team (MS-LOT[5])) and The Highland Council (THC) on 1st March 2022[6]. MS-LOT circulated the Scoping Report to consultees relevant to the offshore Project and a Scoping Opinion was received from MS-LOT on 29th June 2022. Relevant comments from the Scoping Opinion and other consultation specific to offshore and intertidal ornithology are provided in Table 13-4 below, which provides a response on how these comments have been addressed within the Offshore EIA Report.

Further consultation has been undertaken throughout the pre-application stage. Table 13-3 summarises the consultation activities carried out relevant to offshore and intertidal ornithology.

*Table 13-3 Consultation activities for offshore and intertidal ornithology*

| CONSULTEE AND TYPE OF CONSULTATION | DATE | SUMMARY |
|---|---|---|
| **Consultation meetings** | | |
| NatureScot | November 2018 | DAS programme for the OAA was discussed and agreed with NatureScot (then Scottish Natural Heritage (SNH)) prior to July 2020). Additional meetings were held in November 2020 to confirm the surveys were underway in accordance with the agreed strategy. |
| **Offshore Ornithology Consultee Online Meeting - OWPL, Xodus, MacArthur Green, NatureScot and RSPB** | 12th July 2022 | Discussion on the following topics: Project overview, DAS key findings from the first breeding season, Habitats Regulations Appraisal (HRA) screening, scoping feedback, displacement analysis, collision analysis and PVA. |

*[5] MS-LOT have since been renamed Marine Directorate Licensing Operations Team (MD-LOT).*

*[6] The Scoping Report was also submitted to Orkney Islands Council (OIC), as the scoping exercise included consideration of power export to the Flotta Hydrogen Hub, however, this scope is not covered in this Offshore EIA Report and will be subject to a separate Marine Licence and onshore planning applications.*

| CONSULTEE AND TYPE OF CONSULTATION | DATE | SUMMARY |
|---|---|---|
| Offshore Ornithology Consultee Online Meeting - OWPL, Xodus, MacArthur Green and NatureScot | 9th September 2022 | Discussion about PVA metrics to include in the assessment including the difference between Counterfactual of Population Size (CPS) and the Counterfactual of Growth Rate (CGR). Discussion also included the level of change in the CGR required to demonstrate that mitigation measures are likely to be beneficial. |
| Offshore Ornithology Consultee – written letter | 16th November 2022 | Letter (Ref. WO1-WOW-HSE-CN-LT-0002) to NatureScot from OWPL regarding the avoidance rate guidance for seabirds to be used in collision risk modelling. NatureScot email response received 5th December 2022 |
| Offshore Ornithology Consultee Online Meeting - OWPL, Xodus, MacArthur Green and NatureScot | 8th February 2023 | Discussion about the final baseline outputs, initial EIA assessment results and HRA approach. Approach to cumulative assessment presented and discussed. Breeding season based on Pentland Firth Offshore Wind Farm (PFOWF), Moray, West, Moray East, Beatrice. Non-breeding season based on both Biologically Defined Minimum Population Scales (BDMPS) North Sea ("east") and Western Waters ("west") due to the Project being near the boundary between BDMPS regions. |
| Offshore Ornithology Consultee – written letter | 2nd March 2023 | Letter (Ref. WO1-WOW-HSE-EV-LT-0007). Letter to NatureScot from OWPL regarding follow up actions from meeting 8th February 2023 and clarifications regarding changes to NatureScot guidance. NatureScot letter response (Ref. CNS REN OSWF-ScotWind-N1 OWPL West of Orkney Pre App) received 5th April 2023. |
| Offshore Ornithology Consultee Online Meeting - OWPL, Xodus and NatureScot | 18th April 2023 | Presentation of changes to DAS area that took place during programme and reflected the awarded OAA area. |
| Offshore Ornithology Online Meeting - OWPL, Xodus, MacArthur Green, NatureScot and MS-LOT | 25th April 2023 | Discussed updates to the EIA results following feedback from NatureScot and initial HRA outputs. |
| Offshore Ornithology Consultee – written letter | 18th May 2023 | Letter (Ref. WO1-WOW-HSE-EV-LT-0020). Letter to NatureScot from OWPL regarding follow up actions from meeting 25th April 2023. Letter outlined the concerns identified with using SeabORD to assess displacement and barrier effects and why the matrix |

| CONSULTEE AND TYPE OF CONSULTATION | DATE | SUMMARY |
| --- | --- | --- |
| | | approach should be utilised for the Offshore RIAA. NatureScot email response received 31st May 2023. |
| **Offshore Ornithology Consultee – written letter** | 18th May 2023 | Letter (Ref. WO1-WOW-HSE-EV-LT-00017). Letter to NatureScot, clarifying the change made to the DAS area. |
| **Offshore Ornithology Consultee - email** | 19th May 2023 | Letter to NatureScot from MacArthur Green regarding clarification on PVA projections. NatureScot email response received 31st May 2023. |
| **Offshore Ornithology Online Meeting - OWPL, Xodus, MacArthur Green, MS-LOT, and NatureScot** | 24th May 2023 | Initial discussion of Derogation Strategy. |

*Table 13-4 Comments from the Scoping Opinion response relevant to Offshore and intertidal*

| CONSULTEE | COMMENT | RESPONSE |
|---|---|---|
| **Scoping Opinion** | | |
| Scottish Ministers (via MD-LOT) | In regards to the study area, section 2.5.2 of the Scoping Report does not clearly set out the specific areas covered by the survey campaign which commenced in July 2020, nor does it make clear the extent to which cable search areas have been included. The Scottish Ministers advise the Developer that the study area must be clearly defined within the EIA Report and include maps to show the project footprint in line with the NatureScot representation and MSS advice. In addition, ornithological impacts in the intertidal area must be fully addressed in the EIA Report. | A description of the study area covered for the site-specific baseline surveys is provided in section 13.4.1 and section 13.4.3.<br><br>Potential impacts to birds in the intertidal area has been assessed in section 13.6.1.1.4. In addition, impacts to ornithology features using the exposed substrate below Mean High Water Springs (MHWS) during low tides were assessed in chapter 11: Terrestrial ornithology of the Onshore EIA. Waders identified within the study area, four species; curlew, lapwing, oyster catcher and snipe, were confirmed to breed and breeding wigeon and teal territories were identified (chapter 11: Terrestrial ornithology, Onshore EIA Report). Therefore, it has been assumed that the same birds use the intertidal substrate below MHWS and low tides as use the intertidal substrate between MHWS and high tides. |
| Scottish Ministers (via MD-LOT) | In relation to baseline characterisation, the Scottish Ministers advise that the Developer must also include the Waggitt *et al.*, (2020) and the Bradbury *et al.*, (2017) report as advised by NatureScot in its representation in the baseline characterisation. | Waggitt *et al.* 2020 and Bradbury *et al.* 2017 are listed as baseline data sources in Table 13-5, and has been used to inform the impacts assessment as appropriate. |

| CONSULTEE | COMMENT | RESPONSE |
|---|---|---|
| Scottish Ministers (via MD-LOT) | In relation to baseline characterisation the Scottish Ministers advise that the digital area surveys which commenced in July 2020 have not been undertaken in line with the NatureScot guidance which requires that baseline surveys should commence at the start of either the breeding or non-breeding seasons. Although NatureScot advise that this should be acceptable, consideration should be given to extending the data collection until the end of the 2022 breeding season, in line with the RSPB representation.<br><br>No detail of survey design, methodology or summary data from the DAS has been provided in the Scoping Report on which to provide any further comment or inform advice. Therefore, in line with the RSPB representation and MSS advice, in the absence of any survey data, all species identified in the DAS and all qualifying species of the Special Protected Areas ("SPAs") in foraging range must be scoped in for further assessment in the EIA Report. The Developer must also provide evidence of robustness of methods deployed within the EIA Report in line with the representations from NatureScot and RSPB. The Scottish Ministers advise that the NatureScot and RSPB representations and the MSS advice in relation to the detection of smaller bird species, for example storm petrels, and crepuscular species are addressed in full. Finally, in relation to baseline characterisation of cable routes and landfall, The Scottish Ministers advise that the Developer must address the NatureScot representation and MSS advice in full. | DAS data collection was carried out between July 2020 to September 2022. A full breeding season of DAS data was not available at the time of Scoping. Full details of the baseline DAS surveys are provided in supporting study 12 (SS12): Offshore Ornithology Technical Supporting Study. The DAS programme of the OAA was discussed and agreed with NatureScot (Erika Knott) prior to July 2020 (initial meeting in November 2018 and further meeting in November 2020 to confirm the surveys were underway in accordance with the agreed strategy).<br><br>The EIA assessment (chapter 13: Offshore and intertidal ornithology) presents the 'Matrix Approach' as advised by SNCB (2022) and makes best use of 27 months of DAS data. The *Alternative Approach* SNCB (2022) guidance (using full breeding season data only) followed for the assessment of disturbance and displacement is presented in Annex 12.13 details the alternative peak mean estimate displacement matrices and analyses. Details of the respective methods used are provided in SS12: Offshore ornithology technical supporting study and the results of the *Alternative Approach* are sign-posted throughout the chapter.<br><br>Storm petrels were detected from multiple surveys. These species have been detected from HiDef footage from surveys of other locations. This demonstrates that these species can be, and are, detected.<br><br>Survey frequency followed existing guidance and best practice. Note that "crepuscular" species have been assigned to this category due to their behaviour at breeding colonies, not their behaviour at sea. |

| CONSULTEE | COMMENT | RESPONSE |
|---|---|---|
| | | All species recorded in the DAS baseline surveys and all SPA species within foraging range of the Project were scoped into the assessment. |
| **Scottish Ministers (via MD-LOT)** | In Table 2-34 of section 2.5.6 of the Scoping Report, the Developer summarises the potential impacts to offshore ornithology. The large scope of the offshore assessment results in a lack of clarity in regards to which pathways have been identified as most relevant in the different project areas and phases. However, the Scottish Ministers broadly agree with all of the proposed impacts scoped into the EIA report, however in addition, impacts of disturbance should be extended to the operational and maintenance phases due to impacts from vessel activity, in line with the NatureScot representation and MSS advice. | The impact assessment methodology is provided in Section 13.5. Impacts of disturbance are assessed for the operational and maintenance stage, refer to section 13.6.2. |
| **Scottish Ministers (via MD-LOT)** | The Scottish Ministers advise that the Scoping Report does not adequately capture impacts of wet storage on ornithological interests. The Scottish Ministers advise that the NatureScot representation and the MSS advice in this regard must be fully addressed by the Developer in the EIA Report.<br><br>With regards to impacts of artificial light sources, the Scottish Ministers advise that current proposed qualitative approach, as detailed in paragraph 5, section 2.5.9.1.3 of the Scoping Report, may be insufficient. Further consultation with NatureScot is necessary to determine appropriate assessment methods, and to ensure embedded mitigation to reduce the risk to birds is included in the EIA Report. | The assessment is for fixed foundations only, wet storage areas not required.<br><br>A consultation meeting with NatureScot took place on the 8th February 2023 regarding the assessment. There is currently a lack of empirical evidence on which to judge the impact of artificial light attraction (Deakin *et al.*, 2022). A qualitative approach on the impact of lighting is considered as part of the disturbance and displacement assessment during the construction stage, refer to section 13.6.1.1, this includes the potential effects of lighting on European storm petrel as requested by NatureScot during pre-application consultation (letter from NatureScot ref. CNS REN OSWF-ScotWind-N1 OWPL West of Orkney Pre App). Embedded mitigations on lighting are included see section 13.5.4. |
| **Scottish Ministers (via MD-LOT)** | In regards to indirect impact pathways, the Scottish Ministers advise that the proposed approach to assess indirect impacts on seabird prey should be scoped into the EIA Report in line with representations from NatureScot, RSPB and OIC. The Scottish Ministers highlight the concerns raised by both NatureScot and RSPB | Indirect impacts on seabird prey species have been assessed separately for the construction/decommissioning stage |

| CONSULTEE | COMMENT | RESPONSE |
|---|---|---|
| | in their representation that this will be insufficiently captured in the wider assessment of displacement. In addition, further consideration of impacts of ghost fishing must be included in the EIA Report for floating WTGs. The Scottish Ministers advise that the NatureScot, RSPB and OIC representations and MSS advice in relation to indirect impact pathways must be addressed in full in the EIA Report. | (section 13.6.1.2) and the operation and maintenance stage (section 13.6.2.2).<br><br>Consultation with NatureScot (letter from NatureScot ref. CNS REN OSWF-ScotWind-N1 OWPL West of Orkney Pre App received 5th April) advised the use of displacement values of 30-50% and mortality rate of 3% for the assessment of Arctic tern, these rates have been used in the assessment. In the same letter, NatureScot confirmed that great skua and European storm-petrel would not require displacement assessment.<br><br>The assessment is for fixed foundations only. Ghost fishing was discussed at the offshore ornithology consultee online meeting in July 2022 and agreed that due to the current application being for fixed foundations only, it would be scoped out of the assessment. |
| Scottish Ministers (via MD-LOT)<br><br>Scottish Ministers (via MD-LOT) | Key species are identified in section 2.5.4.1.1 of the Scoping Report. The Scottish Ministers broadly agree with those key species identified in the Scoping Report but advise that in addition great skua should also be included. Depending on the results of the baseline surveys, additional species such as fulmar, European storm petrel and Leach's petrel may also require to be considered as a key species in future assessments. In addition, when considering the export cable through Scapa Flow, the Developer must include all qualifying species of the Scapa Flow SPA. This is a view supported by NatureScot and RSPB.<br><br>Further advice in respect of European protected sites will be provided if a Habitats Regulations Appraisal ("HRA") screening request is submitted. The Scottish Ministers advise that the Developer must fully implement the advice in the NatureScot representation regarding bespoke survey considerations but suggest further discussion with NatureScot on this point is required. | Kittiwake, Arctic tern, great black-backed gull, guillemot, razorbill, puffin, fulmar, gannet, great skua and storm-petrel have all been included as key species in the assessment, refer to section 13.6. Leach's petrel was not recorded during baseline surveys and therefore screened out of the assessment. Species considered in the assessment were agreed in consultation with NatureScot.<br><br>The offshore Export Cable Corridor (ECC) in this assessment does not pass though Scapa Flow. The offshore export cables to the Flotta Hydrogen Hub are not part of this consent application and are not considered within this Offshore EIA Report. As a result, there is no connectivity of the offshore |

| CONSULTEE | COMMENT | RESPONSE |
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| | | study area to the Scapa Flow SPA. The Scapa Flow SPA has been screened out of the Offshore RIAA.<br><br>An HRA screening report was submitted in August 2022 and HRA Screening Response received November 2022. |
| Scottish Ministers (via MD-LOT) | In relation to page 163 of the Scoping Report whereby a pers comms from Francis Daunt is quoted regarding puffin tracking, The Scottish Ministers would like to note that this is confirmed to be a misrepresentation. The Scottish Ministers refer to the RSPB representation and advise that tracking data can be useful however caution should be exercised in using the data to determine where birds from colonies do not visit. The Developer is directed to the puffin tracking study undertaken by Ellie Owen of RSPB. In addition, and in line with the NatureScot representation, the Developer is advised to review the survey undertaken by the Sule Skerry Ringing Group in 2018 with a view to considering the requirement for a further bespoke survey. Given the recent surge in avian flu, any additional surveys which are being considered should be in line with the guidance in place at the time and discussed further with NatureScot. | Comments relating to Francis Daunt on puffin tracking have been withdrawn.<br><br>Consultation meetings with NatureScot took place on the 12th July 2022 and 8th February 2023 regarding the baseline data collection. It was concluded from the consultation meetings that further data collection beyond the 27 months of DAS was not required. Therefore, for the assessment, site specific DAS results were utilised. |
| Scottish Ministers (via MD-LOT) | In regards to the impact assessment, The Scottish Ministers are broadly content with the assessment methods and tools proposed, in table 2-34 (Section 2.5.6) of the Scoping Report, however further discussion with NatureScot will be required when the project design is refined, and baseline information is provided. | Consultation with NatureScot has taken place throughout, refer to list of meetings listed in section 13.3, and will continue through the detailed design stage of the Project. |
| Scottish Ministers (via MD-LOT) | In line with the NatureScot and RSPB representations and the MSS advice, the Scottish Ministers advise that MRSea is the preferred method for modelling densities should the data allow. If an alternative approach is proposed, this must be discussed and agreed in advance of the EIA Report with NatureScot. | Details of DSM methodology using the MRSea package are provided in the SS12: Offshore ornithology technical supporting study. Maps produced from the models are provided in Annex 12.9. |
| Scottish Ministers (via MD-LOT) | The Scottish Ministers advise that displacement effects should be assessed using the SNCB (2022) matrix methods for auks in the breeding and non-breeding seasons and the SeabORD tool for species with tracking data in the breeding season. Further input options for SeabORD may become available through the Cumulative Effects Framework ("CEF") project within the timescales relevant to the project. The Scottish Ministers advise that the displacement and mortality rates provided by NatureScot in its representation are | SNCB (2022) guidance followed for assessment of disturbance and displacement.<br><br>As confirmed with NatureScot during consultation (letter to NatureScot ref.: WO1-WOW-HSE-EV-LT-0007; response |

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| | adopted. The Scottish Ministers advise that the NatureScot and RSPB representations and the MSS advice in relation to displacement effects must be addressed in full in the EIA Report. | letter from NatureScot ref CNS REN OSWF-ScotWind-N1 OWPL West of Orkney Pre App), the SeabORD model has been used run for guillemot and puffin. The results of this modelling are provided in the Offshore RIAA, Appendix F.<br><br>The displacement and mortality rates used for the disturbance and displacement assessment (section 13.6.2.1) follow NatureScot and RSPB advised rates for kittiwake, guillemot, razorbill, puffin, fulmar and gannet.<br><br>Consultation with NatureScot (letter from NatureScot ref. CNS REN OSWF-ScotWind-N1 OWPL West of Orkney Pre App received 5th April) advised the use of displacement values of 30-50% and mortality rate of 3% for the assessment of Arctic tern, these rates have been used in the assessment. In the same letter, NatureScot confirmed that great skua and European storm-petrel would not require displacement assessment.<br><br>Direct distributional responses and displacement effects has been considered for the construction and operation and maintenance stages in sections 13.6.1 and 13.6.2 of chapter 13: Offshore and intertidal ornithology, Offshore EIA Report. Further information is also included in SS12: Offshore ornithology technical supporting study. |
| **Scottish Ministers (via MD-LOT)** | In regards to CRM, the Scottish Ministers advise that the basic and extended Band (2012) models are used primarily with option 2 and 3 for the worst case and most likely scenarios, using Johnston *et al.*, (2014) corrigendum flight height data. Outputs should be provided using the stochastic CRM tool. The Scottish Ministers in line with the NatureScot and RSPB representations and the MSS advice do not support the use of Bowgen & Cook (2018) avoidance rates and flight speeds in CRM for kittiwake and large gulls. The Scottish Ministers advise that the SNCB (2014) guidance on avoidance rates should be used although highlight the | Stochastic Collision Risk Modelling (sCRM) tool was used for the assessment (section 13.6.2.3). Refer to SS12: Offshore ornithology technical supporting study for details of sCRM.<br><br>Flight speeds used in sCRM for kittiwake, great black-backed gull and gannet are those published in the NatureScot Guidance Note 7, Table 2 |

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| | NatureScot advice that further review of avoidance rates, specifically for application in the sCRM is ongoing and NatureScot will advise of any revised SNCB position once this process is complete. | (https://www.nature.scot/doc/guidance-note-7-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing). Flight speed for Arctic tern was obtained from Alerstam *et al.*, (2007) and flight speed for great skua was taken from Pennycuick. (1997). Bowgen & Cook (2018) has not been used.<br><br>Avoidance rates used in sCRM for all species are those published in the NatureScot Guidance Note 7, Table 2. In addition, sCRM was also carried out using avoidance rates set out in the recently published JNCC review (Ozsanlav-Harris *et al.*, 2022), although Ozsanlav-Harris *et al.*, 2022 did not present avoidance rates for gannet.<br><br>Flight height proportions for Option 2 and Option 3 modelling were taken from Johnston *et al.*, (2014). |
| **Scottish Ministers (via MD-LOT)** | With regard to Population Viability Analysis ("PVA"), the Scottish Ministers advise the use of the Natural England PVA tool in line with the representations made by RSPB and NatureScot. The Scottish Ministers highlight the representation of RSPB and the NatureScot together with the MSS advice in this regard and advise that it is fully considered within the EIA Report. | In line with representations by MSS, NatureScot and the RSBP, the NE PVA tool has been used for the PVA assessment. The CPS and CGR values from years 10 to 35 (as discussed and agreed with NatureScot at the offshore ornithology consultee online meetings 9th September 2022 and 8th February 2023), in five-year increments, are provided for all species requiring a PVA (i.e. species with change to the adult annual survival rate of ≥0.02%) during the breeding and non-breeding seasons.<br><br>Refer to the SS12: Offshore ornithology technical supporting study, Annex 12.10 for details. |

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| Scottish Ministers (via MD-LOT) | With regards to cumulative assessment, the Scottish Ministers advise that the Developer consider the impacts of consented onshore developments in Orkney, particular consideration should be given to the impact to red-throated divers in line with the representation from RSPB. The Scottish Ministers draw further attention to representation from both RSPB and NatureScot in relation to Scapa Flow and advise that the cumulative effects from other types of development, aquaculture and port and harbour construction are also considered in the EIA Report. | A full cumulative assessment in section 13.7.3 assesses potential cumulative impacts from a range of development categories.<br><br>The cable corridor in this assessment does not pass though the Scapa Flow SPA. The offshore export cables to the Flotta Hydrogen Hub are not part of this consent application and are not considered within this Offshore EIA Report.<br><br>Onshore WTGs have not been considered within the cumulative assessment. There are not considered to be shared receptors between onshore WTGs and the offshore Project. |
| Scottish Ministers (via MD-LOT) | In relation to transboundary impacts, consideration should be given to potential impact on seabird populations that breed out with Scotland as well as to wintering water birds as highlighted in the representation made by NatureScot. Further discussion on these impacts will be required on receipt of the HRA screening report. Further to this the Scottish Ministers draw the Developers attention to the data source provided by OIC in their representation. | The cumulative assessment (section 13.7.3) includes developments throughout the UK.<br><br>Transboundary effects have been considered in section 13.11.<br><br>Migratory species have been considered in section 13.6.2.1.1-presence of WTG and infrastructure in the OAA.<br><br>Migratory species have been considered within the Offshore RIAA, which concludes that there is no additional risk of being unable to conclude no adverse effect on site integrity to any of these SPAs, see the Offshore RIAA.<br><br>Assessment of impacts to wintering waterbirds that originate outside the UK are assessed in the Offshore RIAA. |

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| Marine Scotland Science (MSS) | Echoing NatureScot, MSS have concerns about the lack of detail contained in the Scoping Report. As NS point out, the range of potential scenarios of design, and lack of inclusion of key components of assessment methodology inhibit understanding of the potential effects that may occur. Overall the paucity of information, and vagueness surrounding the potential development design serve to limit the capacity in which MSS can offer advice to LOT beyond general (already widely available via guidance) comments. This lack of information increases uncertainty around potential project impacts. | The Project description is provided in chapter 5: Project description.<br><br>The assessment methodology for offshore ornithology is provided in section 13.5.<br><br>NatureScot have been consulted on the DAS methodology prior to the undertaking of the surveys (initial meeting held with SNH (now NatureScot) in 2018 and further meeting in November 2020 to confirm the surveys were underway in accordance with the agreed strategy) and throughout the EIA to discuss data inputs to assessments, assessment methodologies and draft analysis results. |
| MSS | OWPL have undertaken surveys from July 2020 but the specific area covered and to what extent cables search areas have been considered is not provided. The recommendation from NS regarding the standing advice that full seabird breeding seasons and non-breeding seasons are surveyed does not appear to have been followed. No summary data are provided on which to provide any further comment or inform advice. With surveys initiated almost two years ago, it would be reasonable to have expected some data from some of those surveys to have informed the Scoping Report. | The DAS programme of the OAA was discussed and agreed with NatureScot (Erika Knott) prior to July 2020 (initial meeting with SNH in November 2018 and further meeting in November 2020 to confirm the surveys were underway in accordance with the agreed strategy). Due to the fact the export of power to the Flotta Hydrogen Hub, is not part of the current application, bird data for Scapa Flow has not been required to inform the current EIA.<br><br>A full breeding season of DAS data was not available at the time of Scoping. For the baseline assessment, DAS were carried out over a total of 27 months including two full breeding seasons. An *Alternative Approach* using a full breeding season covering 24 months as requested by NatureScot has also been undertaken (presented in SS12: Offshore ornithology technical supporting study, annex 12.13). |

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| | | The results of the *Alternative Approach* are sign-posted throughout the Offshore EIA Report chapter.<br><br>Full details of the baseline DAS surveys are provided in SS12: Offshore ornithology technical supporting study. |
| MSS | With respect to the digital aerial surveys, MSS advise that information should be provided on the ability of digital aerial surveys to detect smaller species such as storm petrels and if not, how the applicant expects to determine baseline characterisation for these species, presenting justification of their approach. A similar point is raised by RSPB regarding survey frequency and adequate representation of crepuscular species, and MSS support consideration of this. | Storm petrels were detected from multiple surveys. These species have been detected from HiDef footage from surveys of other locations. This demonstrates that these species can be, and are, detected.<br><br>Survey frequency followed existing guidance and best practice. Note that "crepuscular" species have been assigned to this category due to their behaviour at breeding colonies, not their behaviour at sea. |
| MSS | MSS advise that the applicant should consider how to characterise baseline seabird occurrence in relation to cable routes and landfall. We are limited in further advice due to the large cable search area and the 16 potential landfall sites, some of which may have greater sensitivity than others. A consultant technical expert would assist the applicant to understand ornithological concerns at each of their potential cable options and MSS agree with NS that further surveys may be necessary in this respect. | Baseline conditions beyond the study area was based on published information.<br><br>Since issue of the Scoping Report, the potential landfall locations have since been reduced to two off the north Caithness coast. The landfalls associated with the Flotta Hydrogen Hub are not part of this current consent application and are not considered within this Offshore EIA Report.<br><br>An intertidal standard Wetland Bird Survey (WeBS) has been undertaken at the landfall locations, recording all waders and wildfowl species using the shore as described in 13.4.4.6. Potential impacts to birds in the intertidal area has been assessed in section 13.6.1.1.4. |

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| | | In addition a number of bird surveys have been undertaken and are described further in Section 11.4 of chapter 11: Terrestrial ornithology, Onshore EIA Report. |
| MSS | MSS support the inclusion of great skua as a key species. As highlighted by RSPB, until further information is provided, all species should be considered of relevance. Regarding RSPB comments on puffin tracking, MSS wish to add that Francis Daunt has confirmed to MS that the comments attributed to him (page 163 Table 2-28) are incorrect. MSS consider it relevant to highlight this as the original 'pers. Comm.' In the Scoping Report contradicts current rationale and progress towards effective puffin tagging. | Kittiwake, guillemot, razorbill, puffin, fulmar, gannet, great skua and storm-petrel have all been included as key species in the assessment, refer to section 13.6.<br><br>Comments relating to Francis Daunt on puffin tracking have been withdrawn. |
| MSS | MSS highlight again the lack of detail and large scope of the offshore assessment area as limiting in identification of key impact pathways, however MSS support NatureScot suggestion that disturbance should be included in operation and maintenance. | Disturbance and displacement have been considered for the operation and maintenance stage, refer to section 13.6.2.1.<br><br>Since issue of the Scoping Report, the potential landfall locations have reduced from 16 to 2 and potential intertidal impacts have been assessed for the two remaining landfall options on the north Caithness coast. |
| MSS | We support both NatureScot and RSPB comments that wet storage needs to be considered as a potential impact pathway. MSS also consider lighting to be a potential impact of concern and agree with NS reference should be made to the report forthcoming from MS1. MSS support NS suggestion that, where appropriate, embedded mitigation to reduce risk to birds should be considered with respect to lighting. | The assessment is for fixed foundations only, wet storage areas not required.<br><br>Lighting is considered as part of the disturbance and displacement assessment during the construction stage, refer to section 13.6.1.1 and during operation and maintenance in section 13.6.2.1<br><br>Lighting specification has been included as an embedded mitigation measure to reduce the risk to birds as discussed in section 13.5.4. |

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| MSS | MSS highlight comments from RSPB and support the response that an air-gap of over 22 m is welcomed and could provide reduced risk of collision. | The collision risk assessment is based on an air gap of 24.7m above HAT (29.52 m above LAT).<br><br>Input parameters into sCRM are provided in SS12: Offshore ornithology technical supporting study, Annex 12.5, outputs are provided in Annex 12.6. |
| MSS | Regarding indirect pathways, MSS support comments made by both NS and RSPB regarding the impacts to prey from the development and associated infrastructure. MSS consider the approach set out in the scoping report to be insufficient, supporting both NS and RSPB in their request for a clear and informed assessment that characterises the ecology of the ecosystem in the Option Agreement Area (OAA) and Export Cable Corridors (ECC) relative to supporting habitats, fish ecology and trophic connectivity to seabirds. MSS support NS suggestion that beyond this minimum requirement there may be greater need to further assess linkages and potential consequences of impacts. | Indirect impacts on seabird prey species have been assessed separately for the construction/decommissioning stage (section 13.6.1.2) and the operation and maintenance stage (section 13.6.2.2). An assessment of ecosystem effects is provided in section 13.10. |
| MSS | MSS support comments made by NatureScot regarding prey and ghost fishing, requiring further consideration of these impacts as appropriate e.g., if floating turbines are selected. | Ghost fishing was discussed at the offshore ornithology consultee online meeting in July 2022 and agreed that the risk was negligible as floating WTGs are no longer included in the current consent application. |
| MSS | MSS agree with NS and RSPB that MRSea is the preferred method for modelling densities should data allow. | Details of DSM methodology using the MRSea package are provided in the SS12: Offshore ornithology technical supporting study. Maps produced from the models are provided in Annex 12.9. |
| MSS | MSS support the use of the SNCB method to assess displacement effects, however SeabORD should be utilised where appropriate. Regarding displacement mortality, MSS support the suggested range of impacts provided by NS, noting there is an ORJIP project on mortality rates currently underway, that on completion would need to have any changes in rates adopted by the SNCB. In agreement with NS and RSPB, further clarification on | The displacement assessment followed the 'Matrix Approach' as advised by SNCB (2022) and makes best use of 27 months of DAS data. |

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| | the mortality rates for fulmar, red throated diver, Arctic tern (and potentially other sensitive species) may be required as the project advances. | The ***Alternative approach,*** using SNCB (2022) guidance followed for the assessment of disturbance and displacement (presented in Annex 12.13) details the alternative peak mean estimate displacement matrices and analyses. Results of this *Alternative Approach* are signposted throughout the Offshore EIA chapter.<br><br>Details of the respective methods used are detailed in SS12: Offshore ornithology technical supporting study, Offshore EIA Report. The Offshore RIAA followed the SNCB (2022) approach, in order to inform the appropriate assessment using the advice from statutory consultees.<br><br>As confirmed with NatureScot during consultation (letter to NatureScot ref.: WO1-WOW-HSE-EV-LT-0007; response letter from NatureScot ref CNS REN OSWF-ScotWind-N1 OWPL West of Orkney Pre App), the SeabORD model has been used run for guillemot and puffin. The results of this modelling are provided in the Offshore RIAA, Appendix F. |
| MSS | MSS note the question regarding gannet avoidance, and whether gannet should be only considered for displacement. MSS support both NS and RSPB on the current evidence and theory involving gannet and collision/displacement. We agree with NS that both should be assessed and should be additive. For gannet, MSS note RSPB suggest an avoidance rate of 98%, based on evidence of behavioural changes in the birds depending on the season. MSS support the assessment of this project to follow the SNCB guidance as provided by NS, however the 98% value could be provided for additional context. MSS support NS request on clarification of the area covered by the digital aerial surveys which commenced in July 2020 | Gannet is assessed for both displacement and collision effects; combined effects are presented in section 13.6.2.4<br><br>NatureScot's interim avoidance rates set out in Table 2 of their recently published Guidance Note 7 (https://www.nature.scot/doc/guidance-note-7-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing) were used for sCRM. In addition, sCRM was also carried out using avoidance rates set out in the recently published JNCC review (Ozsanlav-Harris *et al.*, 2022), although Ozsanlav-Harris *et al.*, 2022 did not present avoidance rates for gannet. |

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| | | Input parameters into sCRM are provided in SS12: Offshore Ornithology Technical Supporting Study, Annex 12.5.<br><br>The study area covered by DAS commencing in July 2020 is presented in Figure 13-1, details are presented in section 13.4.3 and in SS12: Offshore Ornithology Technical Supporting Study. |
| MSS | MSS support the use of the stochastic CRM tool to provide full outputs, using Johnston *et al.* (2014) corrigendum height data3. MSS, together with NS and RSPB, do not support the use of Bowgen and Cook 2018. NS provide guidance in their response on current avoidance rates for consideration but note a revised position from the SNCB is likely. MSS support NS guidance on flight speeds, and highlight (as per RSPB response) that any data presented alongside the suggested guidance is clearly evidence-based, with a strong justification. | Stochastic Collision Risk Modelling (sCRM) tool was used for the assessment (section 13.6.2.3). Refer to the SS12: Offshore ornithology technical supporting study for details of sCRM.<br><br>Flight speeds used in sCRM for kittiwake, great black-backed gull and gannet are those published in the NatureScot Guidance Note 7, Table 2 (https://www.nature.scot/doc/guidance-note-7-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing). Flight speed for Arctic tern was obtained from Alerstam *et al.*, (2007) and flight speed for great skua was taken from Pennycuick, C.J. (1997). Bowgen & Cook (2018) has not been used.<br><br>Avoidance rates used in sCRM for all species are those published in the NatureScot Guidance Note 7, Table 2. In addition, sCRM was also carried out using avoidance rates set out in the recently published JNCC review (Ozsanlav-Harris *et al.*, 2022), although Ozsanlav-Harris *et al.*, 2022 did not present avoidance rates for gannet.<br><br>Flight height proportions for Option 2 and Option 3 modelling were taken from Johnston *et al.*, (2014). |

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| MSS | For migratory species, a tool is in development from MS and Crown Estate Scotland to assess migratory collision risk. An assessment will be carried out by MS and their contractors using this tool to establish the need for individual projects to undertake bespoke analysis. Further detail can be provided to LOT on this as the project develops. | Migratory species CRM tool not available for assessment at the time of writing, so following current (2023) NatureScot guidance, the 2014 report by WWT Consulting and Macarthur Green (2014) was used to assess migratory species. |
| MSS | Regarding monitoring results, both NS and RSPB provide further comment here that MSS agree with, and therefore we add no further comment on this query. | Noted. |
| MSS | MSS support the use of the NE PVA for population viability analysis, including age apportioning and sabbaticals considered where feasible, agreeing with NS that two time periods would be beneficial in interpretation of outputs. MSS agree with NS and RSPB that ratios (referred to in NS advice as 'counterfactuals') of both population size and growth rate are presented. Comparison of predicted and empirical growth rates is supported as model validation, in common with NS and RSPB, noting the limitation may be the availability of appropriate and relevant data. MSS support model tuning, however we do stress it must be reflective of biology with clear justification for each population and species. | The NE PVA shiny tool has been used for the PVA assessment. The CPS and CGR values from years 10 to 35, in five-year increments, are provided for all species requiring a PVA (i.e. species with change to the adult annual survival rate of ≥0.02%) during the breeding and non-breeding seasons.<br><br>Refer to SS12: Offshore ornithology technical supporting study, Annex 12.10 for details.<br><br>PVA model tuning was not used, as only counterfactual metrics were presented. |
| MSS | MSS agree with NS and RSPB that potential cumulative impacts with developments on inshore waters such as harbour expansions needs consideration. MSS also support RSPB's comment that consideration may also be required, cumulatively, with onshore windfarms, depending on those species affected by the ultimate project design. | A full cumulative assessment in section 13.7.3, including harbour expansions assesses potential cumulative impacts from a range of development categories.<br><br>Onshore WTGs have not been considered within the cumulative assessment. There are not considered to be shared receptors between onshore WTGs and the offshore Project. |

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| NatureScot | The intertidal area, between Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS), is covered under both relevant onshore and offshore legislation. However, the intertidal area only appears to be mentioned in relation to benthic ecology and the marine historic environment. Consideration is required for other receptors, including seals and birds. | Consideration of potential impacts on the intertidal area has been given with respect to a wider range of receptors than was indicated in the Scoping Report, including marine physical and coastal processes; fish and shellfish ecology; marine mammals and megafauna and ornithology (Offshore EIA Report) as well as chapter 11: Terrestrial ornithology (Onshore EIA Report).<br><br>An intertidal survey has been undertaken as described in section 13.4.4.6. Potential impacts to birds in the intertidal area has been assessed in section 13.6.1.1.4. |
| NatureScot | The study area is defined in Section 2.5.2 as comprising a number of elements including; the project footprint plus a suitable buffer, the Zone of Influence of the potential impacts from the project and the region containing reference bird populations. It is noted in Section 2.5.3.1.1 that Digital Aerial Surveys (DAS) of 'the Project plus a 4km buffer commenced in July 2020', It would be useful to have clarification on what comprises the Project footprint. Does this include the Export Cable Corridors (ECC) as well as the Option Agreement Area (OAA)? | The offshore Project area comprises of the OAA and the offshore ECC as illustrated in Figure 13-1 in section 13.4.1. This area reflects the entire offshore Project within which all of the offshore components seaward of MHWS will be located.<br><br>The study area for ornithological receptors comprises of the OAA plus a 4 km buffer (which is the area covered by aerial surveys) as well as the ECC. This is also shown on Figure 13-1 in Section 13.4.1. |
| NatureScot | As noted above there is no mention of ornithological interests of the intertidal area within the Scoping Report. Given the Marine Licence is relevant up to MHWS, information on potential impacts to ornithological interests in the intertidal area will need to be detailed in the EIA Report. Depending on the final landfall locations selected, survey work may be required to inform impact assessments. | An intertidal survey has been undertaken as described in section 13.4.4.6. Potential impacts to birds in the intertidal area has been assessed in section 13.6.1.1.4.<br><br>Potential impacts on all seabird species recorded during baseline surveys are considered in the assessment. Impacts to ornithology features using the exposed substrate below MHWS during low tides were assessed in chapter 11: Terrestrial ornithology of the Onshore EIA Report. These were |

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| | | assessed in the onshore ornithology EIA to be not significant. While the assumption made here was that the impacts were identical, in reality the intertidal substrate between MHWS and low tides is available to waterbirds and waders for less time than between MHWS and high tides, as the tide exposes this substrate for less time. Therefore this assumption is likely precautionary. |
| NatureScot | The data sources provided in Table 2-26, Section 2.5.3 are relevant to inform the evidence base around distributions of marine birds at sea but some are limited in either species or areas covered. Therefore, NatureScot recommend including two additional relevant sources that would provide a broad scale indication of potential ornithological interest across and within the offshore marine area; Waggitt *et al.* (2020) and the Bradbury *et al.* (2017) report. | Waggitt *et al.*, 2020 and Bradbury *et al.*, 2017 have been used as baseline data sources in Table 13-5. |
| NatureScot | It would have been helpful to our assessment of the relevance of the information sources, as summarised in Section 2.5.4.1.1, if the boundaries of the OAA and ECCs had been superimposed onto relevant figures (e.g. 2-16, 2-18) and if in Section 2.5.4.1.1.1, maps had been included showing locations both of the Project boundaries and of the areas covered by the aerial surveys conducted for Dounreay Tri and those commissioned by HIE. | Figure 13-1 in section 13.4.1 (of chapter 13: Offshore and intertidal ornithology, Offshore EIA Report) shows the boundaries of the OAA and offshore ECC compared to the DAS survey area. The map presented in section 13.4 includes both the OAA and ECC area with the buffer areas covered by the DAS surveys. Maps illustrating the transect lines are included in SS12: Offshore ornithology technical supporting study.<br><br>Although no project-specific aerial surveys were undertaken within the majority of the offshore ECC, sufficient data are considered to be available from other sources, in particular the most recent aerial surveys conducted for the PFOWF, which has been included in this assessment. |

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| NatureScot | In addition, we note as mentioned above that DAS of the Project plus buffer commenced in July 2020. We would therefore have anticipated seeing at least preliminary, if not fully analysed, data from the initial 12 months of these surveys (i.e. up to and including June 2021) being presented in this Scoping Report to support baseline characterisation, with published sources being used to provide wider context for the area surveyed; and to indicate potential ornithological interest across the remainder of the offshore marine area, including the offshore ECCs. | A full breeding season of DAS data were not available at the time of Scoping. For the baseline assessment, DAS were carried out over a total of 27 months including two full breeding seasons.<br><br>Full details of the baseline DAS surveys are provided in SS12: Offshore ornithology technical supporting study.<br><br>Baseline characterisation data sources used to inform the assessment are provided in Table 13-5. |
| NatureScot | The DAS commenced in July 2020, which is in the middle of the breeding season and not in line with our guidance that baseline surveys should commence at the start of either breeding or non-breeding season. However, provided there is a full 24 months of survey, the duration and frequency should be acceptable. | Baseline surveys began prior to guidance being published but the DAS programme for the OAA was discussed and agreed with NatureScot (SNH) prior to July 2020 (refer to section 13.3). The DAS were carried out over 27 months to include two full breeding seasons. Survey timings provided in section 13.4.3. |
| NatureScot | No details have been provided in the Scoping Report of survey design or methods. We will require evidence that the digital aerial survey design and methods are robust, including with respect to detection and identification of storm petrels. | Survey methods were agreed with NatureScot before surveys commenced (initial meeting with SNH in November 2018 and subsequent meeting in November 2020 to confirm the surveys were underway in accordance with the agreed strategy) and therefore were considered acceptable to survey the species likely to be present, including storm petrels.<br><br>Storm petrels were detected from multiple surveys. These species have been detected from HiDef footage from surveys of other locations. This demonstrates that these species can be, and are, detected.<br><br>Details of the DAS survey is detailed in SS8: Digital video aerial survey methodology and marine mammal survey results. Raw |

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| | | count data is provided in SS12: Offshore ornithology technical supporting study. |
| NatureScot | Key seabird species are identified within Section 2.5.4.1.1 of the Scoping Report and on the basis of the OAA location and information presented we would agree with inclusion, as a minimum, of kittiwake, guillemot, razorbill, puffin and gannet. We note that great skua is also identified as a key species (on the basis of the 2015 Dounreay Tri surveys) but is excluded from the key species list in Table 2-32, Section 2.5.4.3. In light of current identified potential additional pressures on great skua populations associated with avian flu we consider that it should also be identified as a key species. Furthermore, depending on baseline survey findings, we anticipate that some of the additional species currently identified as of potential interest, in particular fulmar and European storm petrel, may also require to be considered as key species' in future assessments. Further discussion and agreement with NatureScot and Marine Scotland is required once the DAS results have been analysed. | Kittiwake, guillemot, razorbill, puffin, fulmar, gannet, great skua and storm-petrel have all been included as key species in the assessment, refer to section 13.6. |
| NatureScot | Pending full publication of the Seabird Count census results in the Seabird Monitoring Programme database (anticipated second half of 2023) Daisy Burnell (JNCC) can advise on any gaps in either coverage, method/quality, or data input that might require consideration of bespoke surveys. We would request further discussions on requirements for additional bespoke surveys to support this EIA, but offer the following preliminary comments:<br><br>Great skua<br><br>There was significant mortality at colonies in Shetland and elsewhere in late summer 2021 arising from the highly pathogenic H5N18 and sick and dead great skuas (as well as gannets) have been found in spring 2022 in Shetland. Samples have recently been sent for analysis, following confirmation of H5N1 in eider found dead in April 2022. The potential impacts of this highly pathogenic flu on great skua populations are of considerable concern; the global population at Seabird 2000 was just 16,000 pairs of which 60% were in Scotland, the vast majority in the Northern Isles. The ongoing avian flu outbreak in wild birds may impact great skua numbers and render Seabirds Count data unreliable. We advise the need to consult with NatureScot, RSPB and other | Consultation meetings with NatureScot took place on the 12th July 2022 and 8th February 2023 regarding the baseline data collection.  It was concluded from the consultation meetings that further data collection beyond the 27 months of DAS was not required.<br><br>Puffin colony size estimates were obtained from the SMP Database for the Sule Skerry & Sule Stack SPA and incorporated into the EIA Regional Population Size estimate. The estimate from the SMP Databased in 2018 matches the reported estimate from the Sule Skerry Ringing Group. |

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| | potential data holders, and potentially to assist with further surveys of colonies with connectivity to the proposal.<br><br>Puffins<br><br>The last survey of the SPA population on Sule Skerry was in 2018, with the estimate recorded on the SMP being a maximum of 47,742 Apparently Occupied Burrows. The timing of this survey, in July, is sub-optimal for this species and details for the methods used are unknown. The survey was undertaken by the Sule Skerry Ringing Group (led by Jez Blackburn) and was part-funded by The Seabird Group. We advise a copy of the survey report is obtained to consider whether a further bespoke survey of puffins might be advisable.<br><br>Gannets<br><br>At Sule Skerry and Sule Stack SPA, there has been relatively recent (since 2003) colonisation of Sule Skerry with very rapid growth in population, estimated at over 4,500 pairs in 2018 and now roughly equalling numbers at Sule Stack. Please also note the possibility of avian flu spread to gannet. | |
| NatureScot | The inclusion of the OAA and offshore ECCs into a single 'offshore assessment area' means that there is lack of clarity in regards to which pathways have been identified as most relevant in the different project areas/phases. Despite this, in general, the key impact pathways of collision risk, displacement, disturbance and barrier effects that are of relevance to marine birds have been captured in Table 2-24, Section 2.5.6. However, we advise that consideration of disturbance should not be confined to construction/decommissioning but also considered in the operational and maintenance phase. Depending on locations of ports/harbours used as a base for vessels accessing the windfarm and/or for maintenance of floating wind turbines and levels of associated vessel activity there is the potential for significant disturbance, including of SPA waterfowl species. Therefore, this pathway should be scoped in for assessment. | The impact of disturbance and displacement during the operation and maintenance stage is assessed in section 13.6.2.1.<br><br>Vessel movement disturbance during construction is considered within section 13.6.1.<br><br>Consultation with NatureScot (letter from NatureScot ref. CNS REN OSWF-ScotWind-N1 OWPL West of Orkney Pre App received 5th April) advised the use of displacement values of 30-50% and mortality rate of 3% for the assessment of Arctic tern, these rates have been used in the assessment. In the same letter, NatureScot confirmed that great skua and European storm-petrel would not require displacement assessment. |

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| NatureScot | Given the location, we consider that there may be particular risks associated with this development for species such as storm petrels and shearwaters that may be attracted to and/or disorientated by artificial light sources. As well as turbine lighting, these include lighting on servicing or construction vessels, noting in particular that construction will be a 24/7 operation. Such effects could impact assessment of collision and/or displacement and as such the proposed qualitative approach (detailed in paragraph 5, Section 2.5.9.1.3) to assess lighting impacts may be insufficient. We recommend further consultation with NatureScot and Marine Scotland with respect to this aspect of the assessment considering findings from current Marine Scotland commissioned review to inform the assessment of the risk of collision and displacement in petrels and shearwaters from offshore wind developments in Scotland, which is due for completion soon, as well as from baseline ornithological surveys of the OAA. We also note that the embedded mitigation identified around lighting (Tables 2-33, 2-49 and 2-64) relates solely to compliance with requirements around navigational and aircraft safety; there are no proposals for embedded mitigation to reduce risk to birds. | Lighting is considered as part of the disturbance and displacement assessment during the construction stage, refer to section 13.6.1.1.<br><br>Embedded mitigations on lighting to reduce the impact on birds are included see section 13.5.4.<br><br>Findings from current Marine Scotland commissioned review to inform the assessment of the risk of collision and displacement in petrels and shearwaters from offshore wind developments in Scotland (Deakin et al., 2022) has been considered within section 13.4.4.4 for the relevant species. |
| NatureScot | As described in Section 2.5.4.1, the OAA is located across two shallow sandy banks (Stormy Bank and Whitten Head Bank) which are likely to be important to fish, such as sandeels that are in turn important prey resources for many species of breeding seabirds. Given this, we feel the proposed approach in the scoping report of assuming that indirect impacts to marine birds associated with any impacts on prey resources and/or their supporting habitats will be captured in wider assessment of displacement is insufficient. Clear linkages should be made in the EIA Report to assessments relating to benthic habitats and fish ecology, but more focussed assessment of these indirect pathways may also be required given their potential significance. Similarly, it should be noted with respect to the Scapa Flow ECC that Conservation Objectives for the Scapa Flow SPA include 'The supporting habitats and processes relevant to qualifying features and their prey/food resources are maintained'. | Indirect impacts on seabird prey species have been assessed separately for the construction/decommissioning stage refer to section 13.6.1.2) and the operation and maintenance stage section 13.6.2.2). An assessment of ecosystem effects is provided in Section 13.10.<br><br>The cable corridor does not pass though the Scapa Flow SPA. The offshore export cables to the Flotta Hydrogen Hub are not part of this current consent application and are not considered within this Offshore EIA Report. A separate, future application for the export cables to the Flotta Hydrogen Hub will be made. |

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| NatureScot | We note that underwater noise has not been scoped in as a potential impact pathway. However, we acknowledge there is limited evidence available to indicate that significant disturbance from underwater noise is likely. Mitigation measures necessary to reduce impacts to marine mammal species will help reduce any potential impacts to diving seabird species in the absence of such evidence. | Underwater noise is considered as part of the disturbance and displacement assessment during the construction stage, refer to section 13.6.1.1. |
| NatureScot | We are broadly content with the assessment methods and tools proposed, as summarised in Table 2-34 (Section 2.5.6). However, we advise the need for further discussion and agreement with NatureScot and Marine Scotland around details as the project envelope is refined, as baseline information emerges, and as further progress is made on development of relevant tools (in particular the Cumulative Effects Framework (CEF)). Particular aspects that will require further discussion include:<br><br>The key principles set out in MacKenzie *et al.* 2013 for modelling seabird and cetacean data should apply and we support use of MRSea (where sufficient data points are available). Details of any proposals to use alternative or additional approaches should be discussed and agreed in advance. | As the Project progressed, consultation meetings have been held with NatureScot regarding the refinement of the Project envelope, assessment input data and methods in addition to the presentation of draft assessment results (see Table 13-3).<br><br>MacKenzie *et al.*, 2013 is listed as a baseline data source in Table 13-5.<br><br>Key principals set out in MacKenzie *et al.*, 2013 are used for the baseline data analysis. Details of Density Surface Model (DSM) methodology using the MRSea package are provided in the SS12: Offshore ornithology technical supporting study. Maps produced from the models are provided in Annex 12.9. |
| NatureScot | For the displacement assessment, we currently advise use of SNCB (2017) matrix methods for auks in breeding and non-breeding seasons and the SeabORD tool (Searle *et al.*, 2018) for species with tracking data in the breeding season. However, as identified in the Scoping Report, further input options for SeabORD may become available through the CEF project within the timescales relevant to this assessment. | A matrix method has been used for the displacement assessment in the Offshore EIA Report, refer to section 13.6.2.1 and makes best use of 27 months of DAS data.<br><br>Using SNCB (2022) guidance followed for the assessment of disturbance and displacement is presented in Annex 12.13 details the alternative peak mean estimate displacement matrices and analyses (SS12: Offshore Ornithology technical supporting study). Results of the *Alternative Approach* are signposted throughout the EIA chapter. |

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| | | Details of the respective methods used are provided in SS12: Offshore Ornithology technical supporting study.<br>The seasonal peak mean was taken as the highest from within the months within each season as discussed during pre-application consultation with NatureScot (meeting dated 8th February 2023).<br>As confirmed with NatureScot during consultation (letter to NatureScot ref.: WO1-WOW-HSE-EV-LT-0007; response letter from NatureScot ref CNS REN OSWF-ScotWind-N1 OWPL West of Orkney Pre App), the SeabORD model has been run for guillemot and puffin. The results of this modelling are provided in the Offshore RIAA, Appendix F. |
| NatureScot | For displacement assessments we advocate adoption of a range of mortality figures, including consideration of potential seasonal differences and we advise the following values for auks (guillemots, razorbills and puffins), gannet and kittiwake as per Table 1 below:<br>[Table 1 below]<br>We have not previously required quantitative displacement and mortality assessment for fulmar and Arctic tern. Should this be required, given the location of the proposed development, we would wish to see the rationale for the proposed displacement and mortality rates before agreeing values to be used, noting in particular that the displacement rate suggested here may be insufficiently precautionary. | The displacement and mortality rates used for the disturbance and displacement assessment (section 13.6.2.1) follow NatureScot advised rates. The developer preferred approach is based on the mid-point mortality advice, while an ***Alternative Approach***, using the SNCB advice, is based on a range of mortality rates from displacement.<br>Consultation with NatureScot (letter from NatureScot ref. CNS REN OSWF-ScotWind-N1 OWPL West of Orkney Pre App received 5th April) advised the use of displacement values of 30-50% and mortality rate of 3% for the assessment of Arctic tern, these rates have been used in the assessment. NatureScot also confirmed that great skua and European storm-petrel would not require displacement assessment.<br>Displacement and mortality rates, and their rationale, used for kittiwake, Arctic tern, guillemot, razorbill, puffin, fulmar and gannet are presented in SS12: Offshore Ornithology Technical |

| Table 1 | Displacement rate | Mortality rate (breeding season) | Mortality rate (non-breeding season) |
|---|---|---|---|
| Auks – guillemot, razorbill and puffin | 60% | 3% and 5% | 1% and 3% |
| Gannet | 70% | 1% and 3% | 1% and 3% |
| Kittiwake | 30% | 1% and 3% | 1% and 3% |

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| | | Supporting Study, Annex 12.3 (developer preferred approach) and Annex 12.13 (*Alternative Approach*). |
| NatureScot | In relation to what buffer should be used in gannet displacement we would recommend further discussion on this, noting that our presumption is that the baseline DAS, which commenced in July 2020 extend only to 4km beyond the OAA. However, the wording in Section 2.5.3.1.1 refers to the wider 'Project' which would also include the ECCs, as above clarification on the aerial survey area is required. | For the Offshore EIA Report, the offshore Project area comprises of the OAA and the offshore ECC. This area reflects the entire offshore Project within which all of the offshore components seaward of MHWS will be located.<br><br>The study area for ornithological receptors comprises of the OAA plus a 4 km buffer (which is the area covered by aerial surveys) as well as the ECC. These areas are shown on Figure 13-1 in Section 13.4.1.<br><br>A 2 km buffer has been used for the gannet displacement assessment as presented to NatureScot at the offshore ornithology consultee online meeting 8th February 2023 and following NatureScot Guidance Note 8[7]. Details are provided in SS12: Offshore ornithology technical supporting study, Annex 12.3. |
| NatureScot | We expect the basic and extended Band (2012) models to be used, primarily with option 2 and 3 for the worst case and most likely scenarios using Johnston *et al.* (2014) corrigendum flight height data. The scenarios should be agreed in advance with NatureScot and Marine Scotland. | Stochastic Collision Risk Modelling was used for the assessment. Basic and extended models were both run. Avoidance rates used were those provided by SNCB (2014), flight height proportions for Band Option 2 modelling were taken from Johnston *et al.* (2014). |

[7] https://www.nature.scot/doc/guidance-note-8-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing

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| | | Input parameters, including all WTG scenarios, into sCRM are provided in the Offshore ornithology technical supporting study, Annex 12.5. |
| NatureScot | For stochastic Collision Risk Modelling (sCRM) appropriate inputs (maximum or mean) for monthly aerial densities and any associated variability estimates will require further discussion and agreement. Additional external factors including 2021 auk wrecks and the ongoing avian flu situation may influence advice on this aspect. | sCRM inputs were discussed with NatureScot at the offshore ornithology consultee online meeting 8th February 2023. NatureScot confirmed the sCRM requirements in a letter (Ref. CNS REN OSWF-ScotWind-N1 OWPL West of Orkney Pre App) dated 5th April 2023.<br><br>Calendar month mean densities (and their standard deviation) were used for sCRM.<br><br>Input parameters into sCRM are provided in the Offshore ornithology technical supporting study, Annex 12.5.<br><br>The Project has had a review undertaken by Bob Furness (SS12: Offshore ornithology technical supporting study, Annex 12.8) which has been shared with NatureScot and confirms that as survey data were mostly collected prior to the avian flu outbreak, the predicted magnitudes of impact on seabird populations should remain consistent with current populations (see section 13.4.5.1.1). |
| NatureScot | We would not support application of the avoidance rates or flight speeds in Bowgen & Cook (2018) in CRM for kittiwakes and large gulls. Our current advice is use of SNCB (2014) guidance with SD of ±2 and adoption of 98% as default for species with no agreed avoidance rate, or terrestrial avoidance rates if available. Further review of avoidance rates, specifically for application in the sCRM is ongoing and we will advise of any revised SNCB position once this process is complete. In the interim, any proposed use of alternative rates to those in the SNCB (2014) guidance must be supported by robust evidence and rationale, and would require prior discussion and agreement with NatureScot and Marine Scotland. | Flight speeds used in the sCRM are those published in Alerstam *et al.* (2007) and Pennycuick, C.J. (1997). Bowgen & Cook (2018) values were not used. |

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| | | Avoidance rates followed NatureScot Guidance Note 7[8].<br><br>Input parameters into sCRM are provided in SS12: Offshore ornithology technical supporting study 13.1, Annex 12.5. |
| NatureScot | Similarly, we would not support use of the flight speeds in Bowgen & Cook (2018) for kittiwakes and large gulls. We recommend use of those published in Pennycuick 1997 and Alerstam *et al*. 2007. Our current advice is use of SNCB (2014) guidance with SD of ±2 and adoption of 98% as default for species with no agreed avoidance rate, or terrestrial avoidance rates if available. Further review of avoidance rates, specifically for application in the sCRM is ongoing and we will advise of any revised SNCB position once this process is complete. In the interim, any proposed use of alternative rates to those in the SNCB (2014) guidance must be supported by robust evidence and rationale, and would require prior discussion and agreement with NatureScot and Marine Scotland. | Flight speeds used in the sCRM are those published in Alerstam *et al.* (2007) and Pennycuick, C.J. (1997). Bowgen & Cook (2018) values were not used.<br><br>Avoidance rates followed NatureScot Guidance Note 7[9].<br><br>Input parameters into sCRM are provided in SS12: Offshore ornithology technical supporting study, Annex 12.5. |
| NatureScot | Several questions have been posed at the end of the ornithology section with regards to monitoring results from offshore windfarms in Scottish Waters. We would anticipate consultants maintaining awareness of emerging information from relevant studies and discussing any associated proposed amendments in assessment approach with NatureScot and Marine Scotland at the earliest opportunity. | The available monitoring information from the Moray Firth Ornithology Regional Advisory Group (MFRAG) ornithology sub-group and the Forth and Tay Regional Advisory Group (FTRAG) ornithology sub-group has been reviewed. The results from these studies show no displacement from the Beatrice Offshore Wind Limited (BOWL) project for kittiwake, guillemot, razorbill and puffin, but a clear displacement effect on gannet. Tracking and observational studies show a low likelihood of connectivity between breeding great black-backed gull colonies and the windfarms. |

[8] https://www.nature.scot/doc/guidance-note-7-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing

[9] https://www.nature.scot/doc/guidance-note-7-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing

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| NatureScot | In instances where proposed monitoring approaches are at variance with current guidance and/or specific scoping advice, we would anticipate that the evidence presented should be derived from relevant studies at multiple comparable developments and have been subject to peer review and/or formal ratification. With reference to the specific study cited (Vallejo *et al.*, 2017), we note that this was in relation to the Robin Rigg windfarm in the Solway Firth, which is very different in both scale and location to the proposed West of Orkney development. In addition, as acknowledged by the authors, there were some limitations to the study and approaches to marine ornithology survey and analyses have evolved substantially in the interim; as such we would not consider this study in isolation as applying more generally to potential displacement of common guillemots by offshore windfarms. | Studies presenting the best scientific evidence in the field have been given due consideration. |
| NatureScot | Regarding gannet macro avoidance rates, whilst a number of studies have suggested high displacement rates for gannets, there is also evidence of considerable variation among individual birds with consequent seasonal, age or sex specific and locational variation (Lane *et al.*, 2020 and Peschoko *et al.*, 2021). In addition, while displacement rates may be relatively high, modelling suggests that associated energetic costs and impacts on survival or productivity may be insignificant. Consequently we do not consider that current evidence supports displacement, rather than collision, as being the primary impact source for this species. However, given the evidence from post consent monitoring indicating gannets may displace over larger distances and increased number of windfarms being proposed, and therefore larger cumulative effect, we agree that displacement impacts should be included within impact assessments for gannet. We advise collision and displacement be considered as additive, with no adjustment for densities, as we are currently unable to disentangle macro avoidance from other aspects of the species avoidance rate. | Impacts of disturbance and displacement have been assessed for gannet, refer to section 13.6.2.1.11.<br><br>Combined collision and displacement have been considered as additive; for gannet combined impacts refer to section 13.6.2.4.3.<br><br>The cumulative effect of combined operational collision risk and displacement has been assessed for gannets. See section 13.7.3.1.6. As requested, no adjustments for densities were made. |
| NatureScot | Regarding Population viability analysis (PVA), the impacts of collision and displacement will need to be considered in the context of relevant SPA breeding colonies particularly where the assessed effects exceed a change to the adult annual survival rate of 0.02%. Where apportioned impacts are large and/or the SPA populations are small, it is likely that population models will be required to establish whether or not there could be long-term impacts on population viability. | PVAs have been run for species where the assessed effects exceed a change to the adult annual survival rate of 0.02% points. PVA outputs for the project alone assessment are provided in the SS12: Offshore ornithology technical supporting study, Annex 12.10 and the results summarised in Section 13.5.3.4.2 in this chapter. |

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| | | The impacts for each species during the breeding season have been considered in the context of breeding colonies within relevant foraging range of the offshore Project. Regional breeding season populations used in the assessment are provided in Table 13-8. |
| NatureScot | We recommended the NE PVA tool is used. We request that the modelling of impacts is undertaken over two time periods; 25 years and 50 years due to increased uncertainty in interpreting outputs from model predictions further than 25 years ahead which necessitates a more cautious approach to their interpretation. No recovery period should be applied to either model run. Impacts should be applied to all ages in agreement with the age apportioning approach, and sabbatical rates of adult birds should be taken into account. | The NE PVA tool has been used for the PVA assessment. The CPS and CGR values from years 10 to 35 in five year increments (as discussed and agreed with NatureScot at the offshore ornithology consultee online meeting 9th September 2022 and 8th February 2023), are provided for all species requiring a PVA (i.e. species with change to the adult annual survival rate of ≥0.02%) during the breeding and non-breeding seasons.<br><br>Refer to SS12: offshore ornithology technical supporting study, Annex 12.10 for details. |
| NatureScot | We advise that as proposed, counterfactual ratios of both final population size and population growth rate should be presented for PVAs. No recovery period should be applied to either model run. Impacts should be applied to all ages in agreement with the age apportioning approach, and sabbatical rates of adult birds should be taken into account. | CPS and CGR values are presented for all PVAs in SS12: Offshore ornithology technical supporting study, Annex 12.10. No recovery period was applied and impacts to all age classes were included. Sabbatical rates were applied where data allows, following NatureScot guidance, to estimate impacts on adult birds separately to impacts on other age classes. |
| NatureScot | Regarding PVA, we support comparison of empirical and predicted growth rates over appropriate time frames (typically several decades) to be used in model validation – but details of approach in specific cases will be dependent on availability of relevant empirical data. Further technical discussions on this aspect may be required once requirements for PVA models for individual species and populations become clear. | The predicted impact from the Project on population growth rate was assessed using the CGR metric, thus the difference in growth rate was carefully considered in the assessment . Details are presented in SS12: Offshore ornithology technical supporting study, Annex 12.10. |

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| | | Discussion about PVA metrics to include in the assessment including the difference between CPS and the CGR as well as the level of change in the CGR required to demonstrate that mitigation measures are likely to be beneficial were discussed with NatureScot on the 9th September 2022. |
| **NatureScot** | PVA Model tuning is an accepted aspect of modelling, but this must be biologically meaningful and justified (i.e. parameters should not be adjusted simply to make the model 'fit'). Note that we request that the modelling of impacts is undertaken over two time periods, namely 25 and 50 years; this recognises the increased uncertainty in interpreting outputs from model predictions over longer time intervals. | PVA model tuning was not used. However, productivity rates were based on local evidence as these were known to be lower than the recommended values in Horswill & Robinson (2014). Additionally, as counterfactual metrics were presented the need to tune models to improve absolute model projections was not necessary. |
| **NatureScot** | Further discussion will be required regarding transboundary impacts on receipt of both the HRA screening report and the bird baseline report. It is likely that impacts will occur to seabird populations that breed outside Scotland as well as to wintering water birds that originate outside of the UK. | Transboundary effects are assessed in section 13.11.<br><br>Assessment of impacts to wintering waterbirds that originate outside the UK are assessed in the Offshore RIAA. |
| **NatureScot** | Approach to assessment: Consideration should also be given to indirect impacts on birds, fish and marine mammals, where appropriate. | Indirect effects as a result of disturbance and displacement of prey species is assessed in Section 13.6.1.2.<br><br>An assessment of ecosystem effects is provided in section 13.10. |
| **Orkney Islands Council (OIC)** | The Orkney onshore export cable corridor search area includes many sites that are designated for their natural heritage interest – internationally, nationally, and locally. The environmental effects of the project on the interests of these sites should therefore be assessed and the findings presented in the Environmental Statement. The assessment should address both direct and indirect effects, e.g., disturbance, displacement, and loss of breeding / foraging habitat, as well as effects that may result in accumulation with other | Noted, effects on designated sites will be assessed in the HRA Offshore RIAA. |

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| | development that affects these sites. Careful consideration should also be given to the timing of each stage of the project. | |
| OIC | The search area includes the following national and internationally designated sites:<br>• Hoy SAC/SPA/SSSI<br>• Scapa Flow SPA<br>• Muckle Head and Selwick SSSI<br>These sites are designated on account of their ornithological, botanical and geological/geomorphological interest. Further information on the qualifying interests and sensitivities of these sites, as well as maps showing their location and boundaries, is available online from NatureScot's Sitelink facility at https://sitelink.nature.scot/home | Noted, all relevant sites within foraging range to the Project are included in the assessment. |
| OIC | The Scoping Report confirms that "if the export cable corridor search area and substation search area are further refined in line with the survey programme, then an ornithological desk top study and subsequent field surveys will be focused around the export cable corridor and onshore substation footprints including survey specific buffers following the standard survey methodology outlined in Table 4-25." I recommend that advice should be sought from NatureScot on the frequency and duration of the ornithological surveys, as well as guidance on locations for any vantage point surveys that are deemed necessary. | NatureScot was consulted on the DAS programme for the Offshore Ornithology baseline characterisation (initial meeting with SNH in November 2018 and subsequent meeting in November 2020 to confirm the surveys were underway in accordance with the agreed strategy).<br>An intertidal standard Wetland Bird Survey (WeBS) has been undertaken at the landfall locations, recording all waders and wildfowl species using the shore as described in section 13.4.4.6. Potential impacts to birds in the intertidal area has been assessed in section 13.6.1.1.4. |
| OIC | The EIAR should ensure that impacts on benthic species that form a key food supply for key bird species (including those that are qualifying features of the SPAs) should be included; it is acknowledged that reference is made to use of benthic and fish population data. | An assessment of ecosystem impacts is provided in Section 13.10. |

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| **OIC** | 2.5.4.2 Scapa Flow (Offshore Ornithology)<br><br>NatureScot has commissioned digital aerial surveys of the Scapa Flow and North Orkney SPAs for the winter of 2021/22 and 2022/23. Vantage point surveys have also been commissioned as part of this survey work. | The DAS programme of the OAA was discussed and agreed with NatureScot (Erika Knott) prior to July 2020 (initial meeting with (SNH) now NatureScot November 2018 and subsequent meeting in November 2020 to confirm the surveys were underway in accordance with the agreed strategy). Due to the fact the export of power to the Flotta Hydrogen Hub, is not part of the current application, bird data for Scapa Flow has not been required to inform the current EIA |
| **OIC** | Table 2-34 EIA Scoping Assessment for Offshore Ornithology<br><br>Include assessment of impacts on benthic foraging habitats for pSPA bird features. | Indirect impacts on seabird prey species have been assessed separately for the construction/decommissioning stage (section 13.6.1.2) and the operation and maintenance stage (section 13.6.2.2). |
| **OIC** | 2.5 Offshore Ornithology – data source<br><br>Short-Term Behavioural Responses of Wintering Waterbirds to Marine Activity Quantifying the Sensitivity of Waterbird Species during the Non-Breeding Season to Marine Activities in Orkney and the Western Isles (Scottish Marine and Freshwater Science Vol 9 No 7) | This paper is listed in the data sources section 13.4.2 and has been considered throughout the assessment, where relevant. |
| **OIC** | Table 2-53 Summary of Key Datasets and Reports<br><br>Include Orkney Islands Marine Region: State of the Environment Assessment 2020 | The Orkney Islands Marine Region: State of the Environment Assessment 2020 has been included and referenced as a baseline data source as appropriate for the different receptor assessments |
| **Royal Society for the** | Do you agree that the data sources identified are sufficient to characterise the offshore ornithology baseline in the Offshore EIA? | i) Space Hub Sutherland project is listed in the cumulative developments in Table 13-38. The Dounreay Tri information was used to inform the wider context as part of the scoping |

| CONSULTEE | COMMENT | RESPONSE |
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| Protection of Birds (RSPB) | i) We are broadly satisfied with the data sources identified to ascertain the offshore ornithology baseline in the turbine array area. Due to its age, we support the use data collected to support Dounreay Tri for wider context only. We are pleased to see the cumulative impacts with the Space Hub Sutherland have been scoped in.<br><br>ii) We do not agree that the statement in Table 2.28 re puffin tracking as a pers comms from Francis Daunt as it is contrary to the position that he has discussed with us in our role in FTRAG. We therefore request sight of this pers comms. This section also omits the RSPB puffin tracking carried out by Ellie Owen.<br><br>iii) We caution against potential over-use and over interpretation of tracking data due to the small number of birds tagged. Tracking data is extremely useful in indicating foraging ranges and the area birds from colonies are known to visit. However, it should not be used to determine where birds from a colony do not visit.<br><br>iv) Related to the above, and of relevance for the HRA, we welcome the use of foraging ranges to derive connectivity with SPA colonies. We would recommend that site-specific data alongside that published in Woodward *et al*. (2019) are examined and where the maximum foraging range from the colony exceeds the Woodward *et al* value, the site-specific value is used. The exceptions to this are for common guillemot and razorbill. Tracking on Fair Isle showed foraging for both common guillemot and razorbill distances are greater than those of all other colonies. This may relate to poor prey availability during the study. However, trends for seabirds in the Northern Isles indicate this may be becoming a more frequent occurrence. For all designated sites south of the Pentland Firth (i.e., excluding the Northern Isles), we advise use of mean max +1SD discounting Fair Isle values.<br><br>All Northern Isle SPAs<br><br>All sites south of Pentland Firth<br><br>Common guillemot<br><br>153.7 mm +SD<br><br>95.2 mm +SD<br><br>Razorbill<br><br>164.6 mm +SD | report, however, in support of the Offshore EIA Report, site-specific DAS survey data has been used.<br><br>ii) This is withdrawn.<br><br>iii) Tracking data (section 13.4.4.4) has been used to support baseline site specific DAS data.<br><br>iv) Foraging ranges used to assess connectivity were based on Woodward et al. (2019) and are presented in Table 13-8. The displacement and mortality rates used for the disturbance and displacement assessment (section 13.6.2.1) follow RSPB and NatureScot advised rates. |

| CONSULTEE | COMMENT | RESPONSE |
|---|---|---|
| | 122.2 mm +SD | |
| **RSPB** | 2) Do you agree that all potential impacts have been identified for offshore ornithology receptors?<br><br>i) As required by the EIA Regulations, as well as the individual impacts, the cumulative impacts of other existing and/or approved development should also be considered. We consider this includes onshore windfarm developments on Orkney, several which are predicted to have impacts to red-throated diver.<br><br>ii) We are concerned that limited information has been provided in relation to the inshore ornithology baseline (i.e., the cabling corridor across Scapa Flow). This was excluded from the terrestrial ornithology sections. The cumulative impacts of disturbance from developments to the inshore waters, including that from aquaculture and quay/harbour expansions, should not be overlooked.<br><br>iii) The secondary and cumulative impact (to seabirds) from disturbance to sandeel and other forage fish supporting habitats from the turbines and/or cabling should be scoped in. We suggest this take the form of a qualitative assessment using the results of the work to understand the suitability of the seabed habitat for sandeel and herring spawning (see section 2.3.4.1 of the Scoping Report) and ecosystem level effects, such as changes in stratification downstream of turbines.<br><br>iv) The scoping opinion indicates that both fixed and floating foundations are being considered. It is our understanding that some types of the floating windfarms need to be towed into position rather than being erected is-situ. We are also unsure whether any ongoing maintenance would be done in situ or require the turbines to be taken to a wet-storage area for repair. Ornithological impacts associated within these elements should be scoped in. | (i) A full cumulative assessment in section 13.7.3 assesses potential cumulative impacts from a range of development categories. As the current consent application does not include a cable corridor to the Flotta Hydrogen Hub, there were no predicted impacts from the Project on red-throated divers.<br><br>ii) The offshore ECC in this assessment does not pass though the Scapa Flow SPA. The offshore export cables to the Flotta Hydrogen Hub are not part of this current consent application and are not considered within this Offshore EIA Report. A separate, future application for the export cables to Flotta Hydrogen Hub will be made.<br><br>iii) Indirect impacts to seabird prey species have been assessed in section 13.6.1.2 and section 13.6.2.2.<br><br>iv) The assessment is for fixed foundations only. Floating foundations are not part of the Project Design Envelope for the current application.<br><br>An assessment of ecosystem effects has been provided in Section 13.10, chapter 13: Offshore and intertidal ornithology, Offshore EIA Report.<br><br>Onshore WTGs have not been considered within the cumulative assessment. There are not considered to be shared receptors between onshore WTGs and the offshore Project. |

| CONSULTEE | COMMENT | RESPONSE |
| --- | --- | --- |
| RSPB | 3) Do you agree that relevant species have been scoped in?<br><br>i) No Digital Aerial Surveys (DAS) data has been provided. All species identified in the DAS and all qualifying species of the SPAs in foraging range should therefore be scoped in.<br><br>ii) When considering cabling across the Scapa Flow SPA, impacts to all the qualifying species should be scoped in.<br><br>iii) Notwithstanding the above comments, we agree that the key species for the turbine array area are likely to include Kittiwake, Guillemot, Razorbill, Puffin and Gannet. Given the proximity of Sule Stack and Sule Skerry SPA, and the large number of unknowns in terms of behaviour, in particular flight behaviour and disorientation in the vicinity of lights, we consider both Storm Petrel and Leach's Petrel will also be key species of interest. | i) A full breeding season of DAS data was not available at the time of scoping. Full details of the 27 month baseline DAS surveys are provided in SS12: Offshore Ornithology Technical Supporting Study. All species recorded in the DAS baseline surveys were scoped into the assessment.<br><br>ii) The cable corridor in this assessment does not pass though the Scapa Flow SPA. The offshore export cables to the Flotta Hydrogen Hub are not part of this current consent application and are not considered within this Offshore EIA Report. A separate, future application for the export cables to Flotta Hydrogen Hub will be made. As a result, there is no connectivity of the offshore study area to the Scapa Flow SPA. The Scapa Flow SPA has been screened out of the Offshore RIAA.<br><br>iii) Kittiwake, guillemot, razorbill, puffin, gannet and storm-petrel are all included as key species in the assessment, refer to section 13.6.2.1 of chapter 13: Offshore and intertidal ornithology of the Offshore EIA Report. Leach's petrel was not recorded during baseline surveys and therefore screened out of the assessment. Species considered in the assessment were agreed in consultation with NatureScot. |
| RSPB | 4) For those impacts scoped in, do you agree that the methods described are sufficient to inform a robust impact assessment?<br><br>i) We are broadly satisfied with the DAS method set out in 2.4.3.11 and site-specific survey information in 2.6.3.1. Images across 21 parallel transects 2 km apart are being collected across the windfarm array project area plus a 4 km buffer. This is using digital video techniques and the methods employed by HiDef. We note the surveys commenced in July 2020 and 17 have been completed at the time of scoping. DAS should cover | i) DAS data collection was carried out between July 2020 to September 2022. A total of 27 months of data were used for the assessment including two full breeding seasons and one partial breeding season (refer to section 13.4.3). Full details of the DAS data are provided in the SS12: Offshore ornithology technical supporting study |

| CONSULTEE | COMMENT | RESPONSE |
| --- | --- | --- |
| | a 24 months period and include two full breeding seasons. We therefore recommend data collection continues until the end of the breeding seasons in 2022.<br><br>ii) Information on the timings of flights needs to be provided due to the potential for missing activity peaks out with survey times, particularly for crepuscular species.<br><br>iii) Information on the proportion of the area being analysed does not appear to have been provided. We recommend comparing data from four cameras and two cameras for two-month period to capture variability and demonstrate data robustness.<br><br>iv) We agree with the use of Density Surface Modelling (DMS) to predict the abundance of birds in flight and birds in the water using MRSea (Scott-Hayward *et al.*, 2013). However clear details of all the modelling procedures carried out needs to be provided, including a comparison with design based density estimates and diagnostics in relation to model validation. | ii) Full details of the DAS data are provided in the S12: Offshore ornithology technical supporting study. Flight dates and timings are provided in Annex 12.7.<br><br>iii) A summary of the study area is provided in section 13.4.3, survey coverage was 12.5%. Current NatureScot guidance (Guidance Note 2) does not advise on a specific level of survey coverage nor analyses across a range of survey coverage levels. For full details, refer to SS12: Offshore ornithology technical supporting study.<br><br>iv) Details of DSM methodology using the MRSea package are provided in the SS12: Offshore ornithology technical supporting study. Maps produced from the models are provided in Annex 12.9. |
| RSPB | 5) Since no flight height data will be available from digital aerial surveys, is Option 2 and Option 3 using Johnston *et al.* (2014) only data an acceptable approach?<br><br>i) If no flight heights are available, the distributions presented in the Johnson *et al.* (2014) (corrigendum) paper should be used.<br><br>ii) We note that a minimum lower blade tip clearance of 22 metres is proposed. In section 1.3.4.1.1 of the Scoping Report, it is stated that 22 metres does not represent the minimum air gap and that the minimum air gap will be determined through specific ornithological collision risk modelling. A minimum air gap of more than 22 metres is welcomed as 22 meters is relatively close to the sea level and within potential collision height for many seabirds. Unfortunately, the lack of commitment to a larger airgap at this time means that collision risk impacts associated the 22 meter lower blade tip clearance cannot be ruled out and must therefore be scoped in. | Stochastic Collision Risk Modelling (section 13.6.2.3) was used for the assessment. avoidance rates used were those provided in NatureScot Guidance Note 7, flight height proportions for Band Option 2 modelling were taken from Johnston *et al.* (2014).<br><br>Input parameters for collision risk modelling are provided in SS12: Ornithology technical supporting study, Annex 12.5. The CRM was based on an air gap of 24.7 m HAT, providing embedded mitigation that will reduce predicted impacts compared to a minimum air gap of 22 m. |
| RSPB | 6) Are the flight speed data in Bowgen and Cook (2018) suitable to use for kittiwake and large gulls? | Stochastic Collision Risk Modelling was used for the assessment following SNCB (2014) guidance and NatureScot |

| CONSULTEE | COMMENT | RESPONSE |
|---|---|---|
| | i) These can be presented but alongside current SNCB recommended default values. If these data are used, details as to whether "straight line speed" or "true speed" are used should be given, alongside a justification. | Guidance Note 7. Flight speeds for Band Option 2 modelling were taken from Table 1, Appendix 1 of NatureScot Guidance Note 7.<br><br>Input parameters into sCRM are provided in SS12: Offshore ornithology technical supporting study, Annex 12.5. |
| RSPB | 7) Are the avoidance rates in Bowgen and Cook (2018) suitable to use for kittiwake and large gulls?<br><br>i) We do not endorse use of the avoidance rates in Bowgen and Cook (2018)3 as they rely on data from just one site. We consider avoidance rates recommended by NatureScot for kittiwake and large gulls are more suitable.<br><br>ii) We note that for all other species it is proposed to use the avoidance rates recommended by NatureScot. We agree with the published avoidance rates within the "Joint Response from the Statutory Nature Conservation Bodies to the Marine Scotland Science Avoidance Rate Review 25th November 2014", except for gannet during the breeding season. For this species we advocate that the default avoidance rate of 98% should be used. This is because gannet change their flight behaviour during the breeding season (Lane *et al.*, 2020) which is likely to alter their avoidance behaviour. The review on which the SNCB based their guidance is almost entirely drawn from studies on non-breeding gannet (Cook *et al.*, 2014)5.<br><br>iii) For collision risk modelling, we recommend the use of the stochastic CRM shiny app developed by Marine Scotland Science, and that the full output reports are provided. We welcome further discussion on the model options used and parameterisation of them. | Avoidance rates used for sCRM were those advised by NatureScot (NatureScot letter reference: CNS REN OSWF-ScotWind-N1 OWPL West of Orkney Pre App, dated 5th April 2023) sCRM used NatureScot's interim avoidance rates set out in Table 2 of their recently published Guidance Note 7 (https://www.nature.scot/doc/guidance-note-7-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing). In addition, sCRM was also carried out using avoidance rates set out in the recently published JNCC review (Ozsanlav-Harris *et al.*, 2022).<br><br>The stochastic CRM shiny app was used for collision risk modelling following the recommended input values from NatureScot Guidance Note 7.<br><br>Input parameters into sCRM are provided in SS12: Offshore ornithology technical supporting study, Annex 12.5. |
| RSPB | Are the proposed displacement and mortality rates acceptable for the EIA (Table 2-35)?<br><br>i) We suggest use of the displacement and mortality rates outlined in the table below.<br><br>Displacement / Mortality – Breeding Season / Mortality – Non-Breeding Season<br><br>Razorbill: 40-60% / 3 -5% / 1-3% | i) The displacement and mortality rates used for the disturbance and displacement assessment (section 13.6.2.1) follow NatureScot and RSPB advised rates for kittiwake, guillemot, razorbill, puffin, fulmar and gannet.<br><br>Consultation with NatureScot (letter from NatureScot ref. CNS REN OSWF-ScotWind-N1 OWPL West of Orkney Pre App |

| CONSULTEE | COMMENT | RESPONSE |
|---|---|---|
| | Guillemot: 40-60% / 3-5% / 1- 3%<br><br>Puffin: 30-60% / 3- 5% / 1 -3%<br><br>Gannet: 60-80% / 1- 3% / 1- 3%<br><br>Kittiwake: 30% / 1-% / 1- 3%<br><br>Fulmar: 10-30% / 1-3% / 1-3%<br><br>ii) We support the use of the method in the Joint SNCB Interim Displacement Advice Note (updated January 2022) to estimate displacement mortality. However, we would also want to see SeaBORD included, where possible, in the displacement assessment. | received 5th April) advised the use of displacement values of 30-50% and mortality rate of 3% for the assessment of Arctic tern, these rates have been used in the assessment. In the same letter, NatureScot confirmed that great skua and European storm-petrel would not require displacement assessment.<br><br>Displacement and mortality rates are presented in SS12: Offshore ornithology technical supporting study, Annex 12.3.<br><br>ii) The displacement assessment followed the 'Matrix Approach' as advised by SNCB (2022) and makes best use of 27 months of DAS data.<br><br>SNCB (2022) guidance followed for the assessment of disturbance and displacement is presented in SS12: Offshore ornithology technical supporting study, Annex 12.13 details the alternative peak mean estimate displacement matrices and analyses. Results of this *Alternative Approach* are signposted throughout the Offshore EIA Report chapter.<br><br>Details of the respective methods used are detailed in SS12: Offshore ornithology technical supporting study, Offshore EIA Report.<br><br>As confirmed with NatureScot during consultation (letter to NatureScot ref.: WO1-WOW-HSE-EV-LT-0007; response letter from NatureScot ref CNS REN OSWF-ScotWind-N1 OWPL West of Orkney Pre App), the SeabORD model has been run for guillemot and puffin. The results of this modelling are provided in the Offshore RIAA, Appendix F. |

| CONSULTEE | COMMENT | RESPONSE |
|---|---|---|
| RSPB | 9) What displacement and mortality rates should be used to assess impacts for gannet and Arctic tern?<br><br>i) Gannet are included in the table above. RSPB will need further discussion on the displacement and consequent mortality rates of Arctic tern. | Consultation with NatureScot (letter from NatureScot ref. CNS REN OSWF-ScotWind-N1 OWPL West of Orkney Pre App received 5th April) advised the use of displacement values of 30-50% and mortality rate of 3% for the assessment of Arctic tern, these rates have been used in the assessment. In the same letter. |
| RSPB | 10) Ornithology monitoring results from offshore windfarms in Scottish Waters have been completed (Vallejo *et al.*, 2017), are underway or will be reposting results during the assessment period for this Project. How can the results of these monitoring studies be applied to the assessment of this Project?<br><br>i) We do not understand this question – all methods and advice are under constant review and incorporated into statutory advice. | The available monitoring information from the MFRAG ornithology sub-group and the FTRAG ornithology sub-group has been reviewed. The results from these studies show no displacement from the BOWL project for kittiwake, guillemot, razorbill and puffin, but a clear displacement effect on gannet. These recently published monitoring results have been used to inform the impact assessment as appropriate. |
| RSPB | 11-13) Several sites have reported that gannet macro avoidance rates are almost 100% (e.g. Skov *et al.*, 2018, MFRAG-O meeting minutes 9th July 2020, Rehfisch *et al.*, 2014). Given that these results appear to be universal to date, the assessment of gannets being at risk from collision but not displacement appears to be incorrect. Should the impact assessment for gannet now be to consider displacement as the primary impact source?<br><br>i) The evidence of macro-avoidance of gannets is not as clear cut as this question implies, and only the Beatrice study (cited in the question as MFRAG-O) and Peschko *et al.*, (2021) report during the breeding season. Both show different levels of macro-avoidance There is also preliminary evidence of habituation to the presence of windfarms and consequent lower macro-avoidance (Vanerman *et al.*, 2021) | Gannets have been included in the displacement assessment (section 13.6.2.1.11) as well as collision assessment. |
| RSPB | 14) Counterfactual metrics are recommended where there is misspecification of demographic parameters. If parameters are not mis-specified should other metrics be used? | The NE PVA shiny tool has been used for the PVA assessment. The CPS and CGR values from years 10 to 35, in five year increments, are provided for all species requiring a PVA (i.e. |

| CONSULTEE | COMMENT | RESPONSE |
|---|---|---|
| | i) Counterfactual metrics are not only recommended where there is misspecification of demographic parameters but are considered the most robust PVA metrics for the assessment of offshore windfarms. As such, we advise the two metrics 'Counterfactual of final population size' and 'Counterfactual of population growth-rate' should be presented<br><br>ii) Where apportioned impacts are large and / or the SPA populations are small, it is likely that population models will be required to establish whether or not there could be long-term impacts on population viability.<br><br>iii) We recommend that the NE PVA shiny tool is used to assess population scale impacts for both projects alone and in-combination assessments, where relevant. | species with change to the adult annual survival rate of ≥0.02%) during the breeding and non-breeding seasons.<br><br>Refer to SS12: Offshore ornithology technical supporting study 13.1, Annex 12.10 for details. |
| RSPB | 15) Is a comparison of empirical and predicted growth rates sufficient for model validation?<br><br>i) Yes | Model validation was not completed as the PVA used counterfactual metrics, which are less sensitive to model mis-parameterisation (Cook & Robinson 2016). |
| RSPB | 16) Is model tuning an acceptable approach to population modelling where models do not validate well<br><br>i) Yes | PVA model tuning was not used, as only counterfactual metrics were presented. |

## 13.4 Baseline characterisation

This section outlines the current baseline for offshore and intertidal ornithology within the offshore and intertidal ornithology offshore study area. The baseline characterisation and impact assessment were based on data collected for the Project-specific DAS plus relevant desk-based surveys (section 13.4.2).

### 13.4.1 Study area

The offshore and intertidal ornithology study area is defined as an area relevant at a biologically meaningful scale for the consideration of potential impacts on offshore ornithological features. The suitability of the study area for the purpose of environmental impact assessment was agreed with NatureScot prior to DAS commencing in July 2020 (at the time SNH) (section 13.3). This study area comprises the OAA plus a 4 km buffer around it (Figure 13-1).

During the Project site-specific DAS, the survey area was altered in the south east corner. This has been discussed with NatureScot and agreed that it caused no issue (see section 13.3).

OWPL commenced DAS ahead of the ScotWind leasing round which meant that the survey area was defined as the expected development area within the N1 Plan Option, rather than a refined OAA. Therefore, between July 2020 and January 2021 the survey area was 1,290km$^2$ comprising the expected development area and a 4km buffer. From February 2021 to September 2022, the survey area was modified slightly to reflect the refinement of the preferred OAA (ahead of the ScotWind bid application). This increased the survey area to 1,321 km$^2$ (offshore Project area + 4 km buffer) due to a revision of the boundary in the south-east corner (see Figure 13-2). This change in area was both absolutely small (31.1 km$^2$) as well as being a relatively very small part of the overall survey area (2.4%) or the OAA + 4 km buffer (4%).

In addition to the OAA plus a 4 km buffer covered by DAS, the study area over which potential impacts on offshore bird species are considered includes the offshore ECC (within which the offshore export cables would be installed) beyond the OAA up to and including the intertidal zone at Greeny Geo and/or Crosskirk, ending at the MHWS (Figure 13-1). Refer to the Onshore EIA Report, chapter 11: Terrestrial ornithology for assessment of impacts on birds above the MHWS.

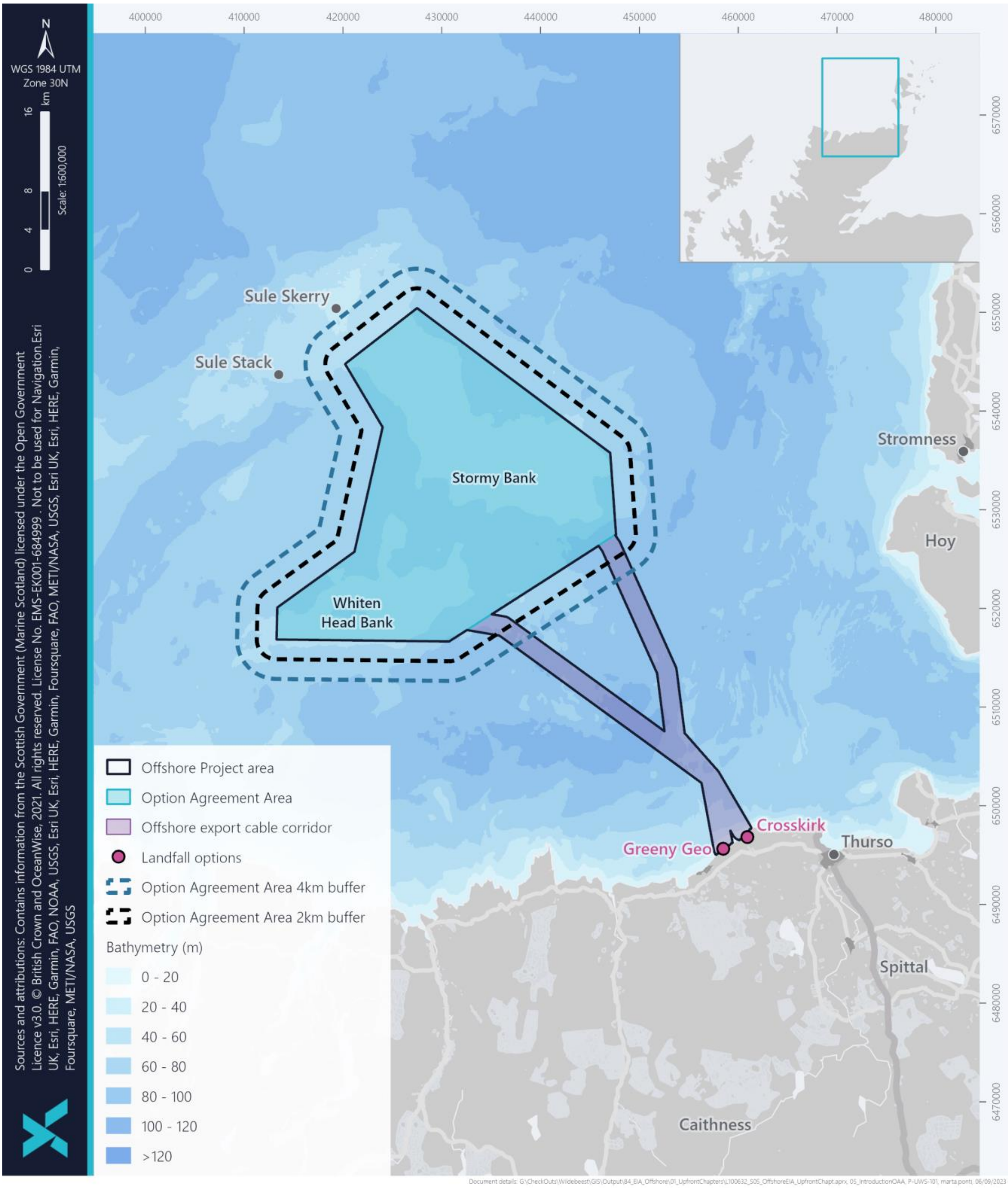



*Figure 13-1 Ornithology offshore study area*

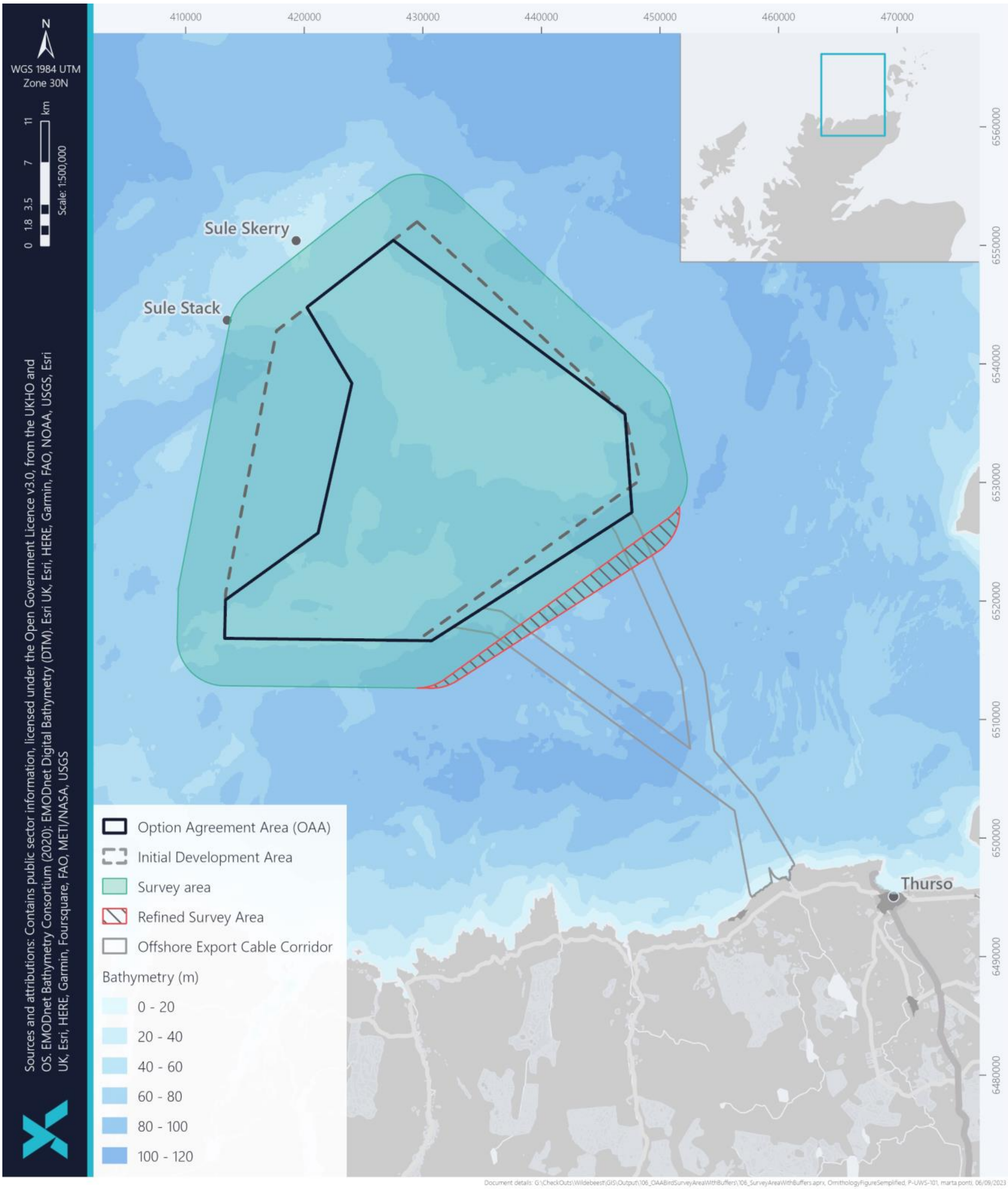



*Figure 13-2 Refined offshore survey area*

## 13.4.2 Data sources

The existing data sets (including project-specific and desk-based) and literature with relevant coverage to the offshore Project, which have been used to inform the baseline characterisation for offshore and intertidal ornithology are outlined in Table 13-5.

Desk-based data sources to describe the baseline environment include both peer-reviewed scientific literature and 'grey literature' such as other OWF project submissions and reports. Published literature on seabird ecology and distribution, and on the potential impacts of windfarms have also been considered.

*Table 13-5 Summary of key datasets and reports*

| TITLE | SOURCE | YEAR | AUTHOR | LOCATION IN REPORT WHERE REFERENCE IS USED |
|---|---|---|---|---|
| **Key seabird species data sources** | | | | |
| **Project-specific DAS data** | HiDef DAS data recorded in the study area (OAA plus a 4 km buffer). Data available in the SS12: Offshore ornithology technical supporting study (Refer to section 13.4.3). | 2020 to 2022 | HiDef | Data used to calculate bird density and abundance estimates within the project specific study area in impact assessment (section 13.6). |
| **PFOWF Environmental Impact Assessment Report** | DAS data recorded between May 2015 to April 2016 for the PFOWF. EIAR available at: https://marine.gov.scot/node/22753. | 2020 | Highland Wind Limited | Data on displacement mortality and collision risk mortality used in the cumulative assessment (section 13.7). |
| **Scientific paper entitled 'Distribution maps of cetacean and seabird populations in the North-East Atlantic'** | Species Distribution Model (SDM) maps showing predicted densities of seabirds (including key species kittiwake, puffin, guillemot, fulmar, storm-petrel, great skua, gannet and razorbill) around the British Isles available at: https://besjournals.onlinelibrary.wiley.com/doi/epdf/10.1111/1365-2664.13525. | 2020 | Waggitt *et al.*, 2020 | Information used to assess importance of wider area surrounding the offshore Project for key species in impact assessment (section 13.6). |

| TITLE | SOURCE | YEAR | AUTHOR | LOCATION IN REPORT WHERE REFERENCE IS USED |
|---|---|---|---|---|
| Orkney Islands Council report entitled 'State of the Environment Assessment: A baseline assessment of the Orkney Islands Marine Region' | Report available here: https://www.orkney.gov.uk/Files/Planning/Development-and-Marine-Planning/20210107-OIC-Report-V9-screen%20v2.pdf. | 2020 | Orkney Islands Council | Information used to assess importance of wider area surrounding the offshore Project for key species in impact assessment (section 13.6). |
| Seabird Monitoring Programme (SMP) database | Colony data to determine seabird sites with potential connectivity. Data available at: https://app.bto.org/seabirds/public/data.jsp. | 2000 – 2021 | Coordinated by JNCC | Data used to assess regional population estimates (section 13.4.4.2). |
| RSPB webpage entitled 'Tracking the elusive Leach's storm petrel on St Kilda' | Track of a Leach's storm petrel from St Kilda available at: https://community.rspb.org.uk/ourwork/b/science/posts/tracking-the-elusive-leach-s-storm-petrel-on-st-kilda. | 2021 | Coordinated by RSPB | Data used in the Offshore RIAA to assess connectivity. |
| Scientific paper entitled 'GPS tracking reveals highly consistent use of restricted foraging areas by European Storm-petrels *Hydrobates pelagicus* breeding at the largest UK colony: implications for conservation management' | Tracks of storm-petrels from Shetland, available at: BCI 2000037 35.52 (cambridge.org). | 2021 | Bolton 2021 | Data used in the Offshore RIAA to assess connectivity. |
| BirdLife International Seabird Tracking Database | Tracking data to determine seabird sites with potential connectivity. Data available at: http://www.seabirdtracking.org/. | 2006-2014 | Coordinated by BirdLife International | Data used in the Offshore RIAA to assess connectivity. |
| Scottish Marine and Freshwater Science report entitled 'Short-term behavioural responses of wintering waterbirds to marine activity in Orkney and Western Isles' | Data available at: https://data.marine.gov.scot/sites/default/files//SMFS%200907.pdf. | 2018 | Jarrett *et al.*, 2018 | Assessment of red-throated divers to vessel movement disturbance (section 13.6.1.1.2). |

| TITLE | SOURCE | YEAR | AUTHOR | LOCATION IN REPORT WHERE REFERENCE IS USED |
|---|---|---|---|---|
| Scientific paper entitled 'Breeding density, fine-scale tracking, and large-scale modelling reveal the regional distribution of four seabird species' | Models showing distribution of four breeding seabird species (shag, kittiwake, guillemot and razorbill) around the British Isles. Paper available at: Ecological Applications, 27(7), pp.2074-2091 https://esajournals.onlinelibrary.wiley.com/doi/10.1002/eap.1591. | 2017 | Wakefield *et al.*, 2017 | Information used to assess importance of wider area surrounding the offshore Project for key species in impact assessment (section 13.6). |
| Mapping Seabird Sensitivity to Offshore Wind Farms. | https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0106366 | 2014 (corrected in 2017) | Bradbury et al., 2017 | Information used to assess importance of wider area surrounding the offshore Project for key species in impact assessment (section 13.6). |
| Combining habitat modelling and hotspot analysis to reveal the location of high density seabird areas across the UK. Technical Report | Model predictions of seabird hotspot distributions around the UK. RSPB Research Report no. 63 available at: https://www.rspb.org.uk/globalassets/downloads/documents/conservation-science/cleasby_owen_wilson_bolton_2018.pdf. | 2018 | Cleasby *et al.*, 2018 | Information used to assess importance of wider area surrounding the offshore Project for key species in impact assessment (section 13.6). |
| Marine Scotland Science Report 04/14: Statistical Modelling of Seabird and Cetacean data: Guidance Document | Guidance document focusing on statistical issues related to improving wildlife surveys in the measurement of distribution of animals in areas of near-shore and off-shore renewable energy development. Available at: https://tethys.pnnl.gov/sites/default/files/publications/Mackenzie-et-al-2014.pdf. | 2013 | Mackenzie *et al.*, 2013 | In line with guidance, DSM for key bird species recorded during site-specific DAS were produced, details are presented in the SS12: Offshore ornithology technical supporting study Annex 12.9. |
| An Atlas of Seabird Distribution in north-west European Waters. Technical Report | Analysis of European Seabirds at Sea (ESAS) data to predict the spatial density of birds around the UK and Ireland. JNCC report available at: https://hub.jncc.gov.uk/assets/c132752f-827c-41fc-b617-e681db21eaf5. | 1995 | Stone *et al.*, 1995 | Information used to assess importance of wider area surrounding the offshore Project for key species in impact assessment (section 13.6). |

### 13.4.3 Project site-specific surveys

A series of project-specific aerial surveys using digital video techniques were undertaken between July 2020 to September 2022 by HiDef Aerial Surveying Limited (HiDef). The data collected during the DASs have been used to identify the bird species present and their seasonal abundance.

Full methodology details of the DAS data collection (Supporting Study 8 (SS8): Digital video aerial survey methodology and marine mammal survey results) and subsequent data analysis (Annex 12.1; Annex 12.2) are provided in the SS12: Offshore ornithology technical supporting study.

The study area where DAS were conducted encompassed the OAA plus a 4 km buffer (Figure 13-1); the DAS transect lines were each separated by 2 km across the 1,290 km$^2$ and 1,321 km$^2$ study area in July 2020 to January 2021 and February 2021 to September 2022, respectively (see section 13.4.1 for description of modification to survey area). The DAS programme carried out a total of 27 DASs, generally one per month (with the exception of none in January 2022 and two surveys in February 2022), to provide distribution and density/abundance data for all observed species with a 12.5%. coverage.

The assessment considers up to MHWS. In addition, impacts to ornithology features using the exposed substrate area landward of MLWS are assessed in the Onshore EIA Report, Chapter 11: Terrestrial Ornithology.

The baseline DAS provided information on species (or species-groups if species identification is not possible), abundance, distribution, behaviour, location, numbers, sex and age (where possible) and direction (although it should be noted that flight height estimation from DAS is subject to a large degree of uncertainty and these data are not currently supported for use in assessment of collision risk). The assessment identified the nature of the use of the site by birds recorded – i.e., seasonal differences and activities (foraging, overwintering, migrating or other) in order to determine the importance of the site relative to the wider area for seabird populations throughout the year.

#### 13.4.3.1 The Offshore ECC and Landfall

Owing to the short-term nature and small spatial scale of potential impacts on birds from installation of the offshore export cables, no DASs in the offshore ECC were conducted (outside of the 4 km study area defined in section 13.4.1), and therefore other data sources (Table 13-5), which are considered to provide an appropriate level of detail for impact assessment purposes, are used to inform the impact assessment for the offshore ECC.

The two, relatively small, areas selected for the landfall at Greeny Geo and/or Crosskirk were surveyed using the standard Wetland Bird Survey (WeBS) Core Counts method (Gilbert *et al*., 1998). All waders and wildfowl species using the shore within the onshore Project area and 500 m buffer were recorded. Counts were made using telescopes from vantage points, to avoid disturbance to birds. When birds moved during the count, this was recorded to avoid double counting. All counts were completed within a seven-hour period commencing 3.5 hours before the advertised time of low water and finishing 3.5 hours after low water. Further details are provided in the Onshore EIA Report, Chapter 11: Terrestrial ornithology.

## 13.4.4 Existing baseline

A review of literature and available data sources, augmented by consultation and Project site-specific surveys has been undertaken to describe the current baseline environment for offshore and intertidal ornithology.

### 13.4.4.1 Designated sites

The impact assessment considers potential connectivity of the OAA and the offshore ECC with statutory designated sites, which have birds listed as qualifying features. Two classes of statutory designated sites are considered: Special Protection Areas (SPAs) and Ramsar sites.

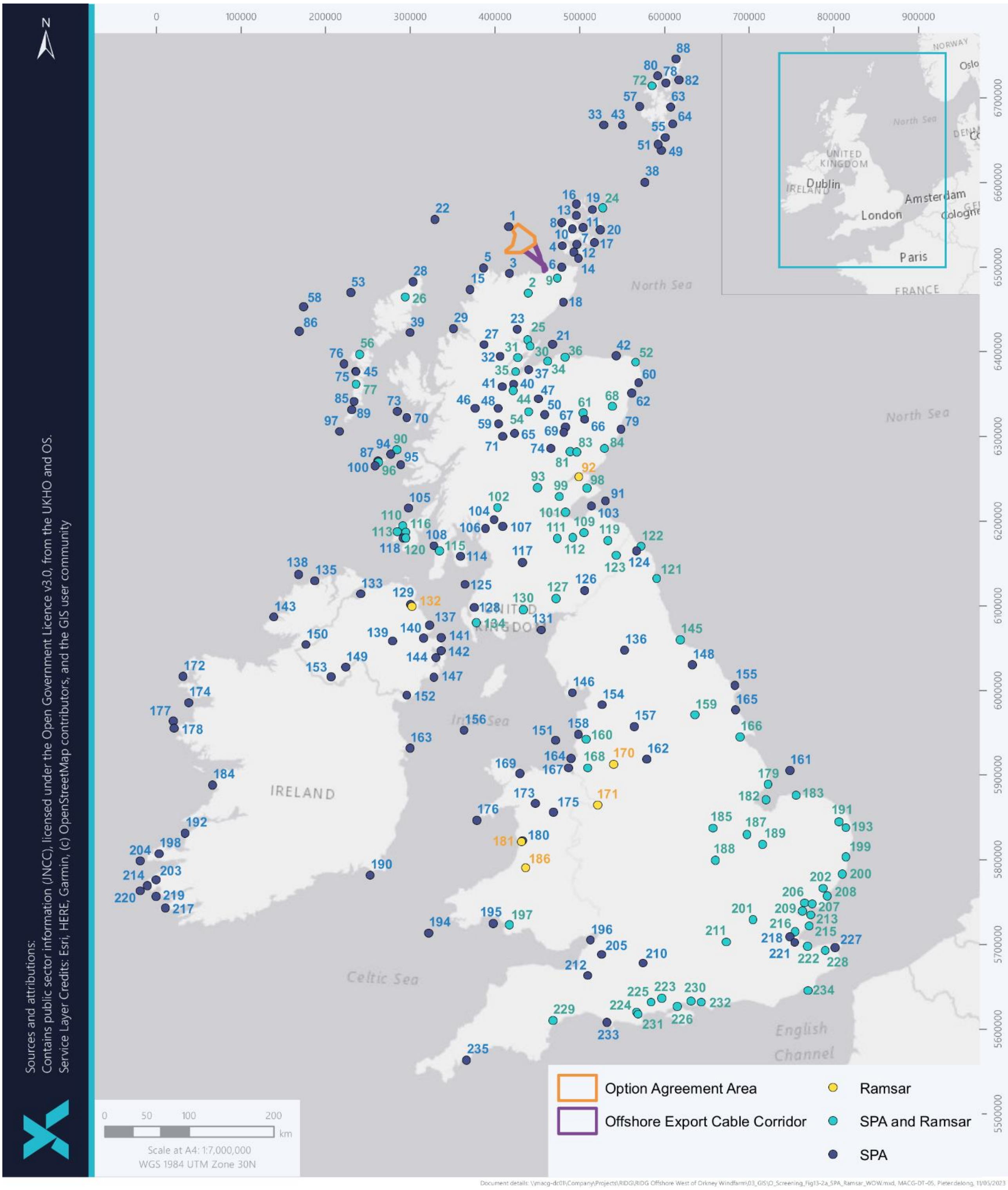
Designated sites which may have connectivity to the OAA and/or offshore ECC include those designated for breeding and non-breeding seabirds and those for terrestrial, coastal or marine bird interests (typically overwintering aggregations). Seabird breeding sites may be connected during the breeding season (e.g. the OAA is within foraging range of breeding birds) or during the non-breeding season (e.g. birds pass through during spring and autumn migration or are present overwinter), or during both periods. Terrestrial / coastal sites designated for migrant species outside the breeding season may be connected on the grounds of passage movements through the windfarm.

The offshore Project does not overlap with any SPA or Ramsar site, although the OAA is close to the Sule Skerry and Sule Stack SPA (Figure 13-3) and is within foraging range from other SPAs (refer to Offshore RIAA). As seabirds can travel long distances it is necessary to give consideration to designated sites beyond the OAA and offshore ECC boundaries.

Statutory designated sites that have been identified for potential connectivity are listed in Figure 13-3. As advised by consultees (Table 13-4), qualifying features of SPAs and Ramsar sites were considered to have potential connectivity with the offshore Project if the mean of the maximum foraging range (km) plus one SD of the mean (+1SD hereafter; Woodward *et al.*, 2019) overlap with the OAA and/or the offshore ECC.

Full consideration of connectivity of SPAs and Ramsar sites is provided in a separate HRA screening report (OWPL, 2022) and subsequent Report to Inform Appropriate Assessment (Offshore RIAA). This covers in more detail matters associated with statutory site designations and has been subject to consultation with NatureScot and RSPB as part of the application process. The HRA screening report and subsequent HRA screening Response (MS-LOT, 2022) identified 235 designated sites (SPAs and Ramsar sites) requiring further consideration in relation to potential effects. Remaining sites were not considered to be within range or to have a pathway for a potential effect in relation to the offshore Project.

Although the HRA process is separate from the EIA, the screening carried out is also considered to be appropriate in terms of classifying bird sensitivity for the ornithological impact assessment, so the same sites are summarised in Figure 13-3.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Ramsar
SPA and Ramsar
SPA

| ID | Name | ID | Name | ID | Name | ID | Name |
|---|---|---|---|---|---|---|---|
| 1 | Sule Skerry and Sule Stack | 60 | Buchan Ness to Collieston Coast | 119 | Greenlaw Moor | 178 | Cruagh Island SPA |
| 2 | Caithness and Sutherland Peatlands | 61 | Muir of Dinnet | 120 | Eilean na Muice Duibhe (Duich Moss) | 179 | Gibraltar Point |
| 3 | North Sutherland Coastal Islands | 62 | Ythan Estuary, Sands of Forvie and Meikle Loch | 121 | Northumbria Coast | 180 | Dyfi Estuary / Aber Dyfi |
| 4 | Hoy | 63 | East Mainland Coast, Shetland | 122 | Lindisfarne | 181 | Cors Fochno and Dyfi |
| 5 | Cape Wrath | 64 | Noss | 123 | Din Moss - Hoselaw Loch | 182 | The Wash |
| 6 | North Caithness Cliffs | 65 | Drumochter Hills | 124 | Holburn Lake and Moss | 183 | North Norfolk Coast |
| 7 | Scapa Flow | 66 | Glen Tanar | 125 | Ailsa Craig | 184 | Cliffs of Moher SPA |
| 8 | Marwick Head | 67 | Lochnagar | 126 | Langholm - Newcastleton Hills | 185 | Rutland Water |
| 9 | Caithness Lochs | 68 | Loch of Skene | 127 | Castle Loch, Lochmaben | 186 | Cors Caron |
| 10 | Orkney Mainland Moors | 69 | Caenlochan | 128 | Glen App and Galloway Moors | 187 | Nene Washes |
| 11 | North Orkney | 70 | Rum | 129 | Antrim Hills | 188 | Upper Nene Valley Gravel Pits |
| 12 | Switha | 71 | Ben Alder | 130 | Loch Ken and River Dee Marshes | 189 | Ouse Washes |
| 13 | Rousay | 72 | Ronas Hill - North Roe and Tingon | 131 | Solway Firth | 190 | Saltee Islands SPA |
| 14 | Pentland Firth Islands | 73 | Canna and Sanday | 132 | Garron Plateau | 191 | Broadland |
| 15 | Handa | 74 | Forest of Clunie | 133 | Lough Foyle | 192 | Kerry Head SPA |
| 16 | West Westray | 75 | Aird and Borve, Benbecula | 134 | Loch of Inch and Torrs Warren | 193 | Breydon Water |
| 17 | Copinsay | 76 | Monach Islands | 135 | Horn Head to Fanad Head SPA | 194 | Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro |
| 18 | East Caithness Cliffs | 77 | South Uist Machair and Lochs | 136 | North Pennine Moors | 195 | Bae Caerfyrddin/ Carmarthen Bay |
| 19 | Calf of Eday | 78 | Otterswick and Graveland | 137 | Larne Lough | 196 | Severn Estuary |
| 20 | Auskerry | 79 | Fowlsheugh | 138 | Tory Island SPA | 197 | Burry Inlet |
| 21 | Moray Firth | 80 | Ramna Stacks and Gruney | 139 | Lough Neagh and Lough Beg | 198 | Dingle Peninsula SPA |
| 22 | North Rona and Sula Sgeir | 81 | Loch of Lintrathen | 140 | Belfast Lough | 199 | Minsmere-Walberswick |
| 23 | Strath Carnaig and Strath Fleet Moors | 82 | Fetlar | 141 | Copeland Islands | 200 | Alde-Ore Estuary |
| 24 | East Sanday Coast | 83 | Loch of Kinnordy | 142 | Outer Ards | 201 | Lee Valley |
| 25 | Dornoch Firth and Loch Fleet | 84 | Montrose Basin | 143 | West Donegal Coast SPA | 202 | Stour and Orwell Estuaries |
| 26 | Lewis Peatlands | 85 | Kilpheder and Smerclate, South Uist | 144 | Strangford Lough | 203 | Iveragh Peninsula SPA |
| 27 | Beinn Dearg | 86 | St Kilda | 145 | Teesmouth and Cleveland Coast | 204 | Blasket Islands SPA |
| 28 | Ness and Barvas, Lewis | 87 | Coll and Tiree | 146 | Morecambe Bay and Duddon Estuary | 205 | Chew Valley Lake |
| 29 | Priest Island (Summer Isles) | 88 | Hermaness, Saxa Vord and Valla Field | 147 | Killough Bay | 206 | Abberton Reservoir |
| 30 | Loch Eye | 89 | Eoligarry, Barra | 148 | North York Moors | 207 | Colne Estuary (Mid-Essex Coast Phase 2) |
| 31 | Cromarty Firth | 90 | Coll | 149 | Slieve Beagh - Mullaghfad - Lisnaskea | 208 | Hamford Water |
| 32 | Ben Wyvis | 91 | Outer Firth of Forth and St Andrews Bay Complex | 150 | Pettigoe Plateau | 209 | Blackwater Estuary (Mid-Essex Coast Phase 4) |
| 33 | Seas off Foula | 92 | Firth of Tay and Eden Estuary | 151 | Liverpool Bay / Bae Lerpwl | 210 | Salisbury Plain |
| 34 | Moray and Nairn Coast | 93 | South Tayside Goose Roosts | 152 | Carlingford Lough | 211 | South West London Waterbodies |
| 35 | Inner Moray Firth | 94 | Coll (corncrake) | 153 | Upper Lough Erne | 212 | Somerset Levels and Moors |
| 36 | Loch Spynie | 95 | Treshnish Isles | 154 | Bowland Fells | 213 | Dengie (Mid-Essex Coast Phase 1) |
| 37 | Loch Flemington | 96 | Sléibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast) | 155 | Flamborough and Filey Coast | 214 | Puffin Island SPA |
| 38 | Fair Isle | 97 | Mingulay and Berneray | 156 | Irish Sea Front | 215 | Foulness (Mid-Essex Coast Phase 5) |
| 39 | The Shiant Isles | 98 | Cameron Reservoir | 157 | South Pennine Moors Phase 2 | 216 | Benfleet and Southend Marshes |
| 40 | Loch Ashie | 99 | Loch Leven | 158 | Ribble and Alt Estuaries | 217 | Beara Peninsula SPA |
| 41 | North Inverness Lochs | 100 | Tiree (corncrake) | 159 | Lower Derwent Valley | 218 | Thames Estuary and Marshes |
| 42 | Troup, Pennan and Lion's Heads | 101 | Firth of Forth | 160 | Martin Mere | 219 | Deenish Island and Scariff Island SPA |
| 43 | Foula | 102 | Loch Lomond | 161 | Greater Wash | 220 | Skelligs SPA |
| 44 | Loch Ruthven | 103 | Forth Islands | 162 | Peak District Moors (South Pennine Moors Phase 1) | 221 | Medway Estuary and Marshes |
| 45 | West Coast of the Outer Hebrides | 104 | Inner Clyde Estuary | 163 | Lambay Island SPA | 222 | The Swale |
| 46 | West Inverness-shire Lochs | 105 | Oronsay and South Colonsay | 164 | Mersey Narrows and North Wirral Foreshore | 223 | New Forest |
| 47 | Loch Vaa | 106 | Renfrewshire Heights | 165 | Hornsea Mere | 224 | Dorset Heathlands |
| 48 | Loch Knockie and Nearby Lochs | 107 | Black Cart | 166 | Humber Estuary | 225 | Avon Valley |
| 49 | Sumburgh Head | 108 | Sound of Gigha | 167 | The Dee Estuary | 226 | Solent and Southampton Water |
| 50 | Cairngorms | 109 | Fala Flow | 168 | Mersey Estuary | 227 | Thanet Coast and Sandwich Bay |
| 51 | Lochs of Spiggie and Brow | 110 | Gruinart Flats, Islay | 169 | Traeth Lafan/ Lavan Sands, Conway Bay | 228 | Stodmarsh |
| 52 | Loch of Strathbeg | 111 | Westwater | 170 | Rostherne Mere | 229 | Exe Estuary |
| 53 | Flannan Isles | 112 | Gladhouse Reservoir | 171 | Midland Meres and Mosses Phase 2 | 230 | Portsmouth Harbour |
| 54 | River Spey - Insh Marshes | 113 | Rinns of Islay | 172 | Duvillaun Islands SPA | 231 | Poole Harbour |
| 55 | Mousa | 114 | Arran Moors | 173 | Migneint-Arenig-Dduallt | 232 | Chichester and Langstone Harbours |
| 56 | North Uist Machair and Islands | 115 | Kintyre Goose Roosts | 174 | Clare Island SPA | 233 | Chesil Beach and The Fleet |
| 57 | Papa Stour | 116 | Bridgend Flats, Islay | 175 | Berwyn | 234 | Dungeness, Romney Marsh and Rye Bay |
| 58 | Seas off St Kilda | 117 | Muirkirk and North Lowther Uplands | 176 | Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island | 235 | Falmouth Bay to St Austell Bay |
| 59 | Creag Meagaidh | 118 | Laggan, Islay | 177 | High Island, Inishshark and Davillaun SPA | | |

Document details: S:\Projects\RIDG\RIDG Offshore West of Orkney Windfarm\03_GIS\O_Screening_Fig13-2b_SPA_Ramsar_WOW.mxd, MACG-DT-01, Lindsay Fergusson, 11/05/2023

*Figure 13-3 Location of SPAs and Ramsar sites designated for qualifying features with potential connectivity with the offshore Project*

### 13.4.4.2 Counts of seabird colonies

Through the SMP, annual monitoring of 25 species of seabird that breed regularly in Britain and Ireland has been undertaken since 1986 to the present time. In addition to the annual counts at a sample of colonies provided through the SMP, periodic breeding seabird censuses have taken place to help identify where and why changes might be happening. The last complete count was in 2000 (Mitchell *et al.*, 2004), with a new count having started in 2015. The completion of this count was delayed due to the COVID-19 pandemic and was eventually completed at the end of the 2022 breeding season. At the time of writing, data were available for individual colonies up to 2022, but the results of the last complete count have not yet been published.

### 13.4.4.3 Regional distribution of seabirds

Aerial and vessel survey data have been presented in a range of studies to show spatial and temporal distributions of seabirds, including the key seabird species assessed in this report, around the UK (Waggitt *et al.*, 2020; Cleasby *et al.*, 2018; Bradbury *et al.*, 2017; Wakefield *et al.*, 2017; Stone *et al.*, 1995). These data have been used to predict densities of seabirds in the north-east Atlantic (Waggitt *et al.*, 2020), predict hotspots of distribution around Orkney and Caithness (Cleasby *et al.*, 2018), map seabird sensitivity to offshore windfarms in English territorial waters (Bradbury *et al.*, 2017) and identify possible SPAs in the marine environment (Kober *et al.*, 2018). These studies have provided background information on how seabirds utilise the area surrounding the offshore Project (Table 13-5).

### 13.4.4.4 GPS tracking of seabirds

Tracking studies for key seabird species within foraging range (mean maximum +1SD) to the offshore Project are available from the BirdLife International Seabird Tracking Database (Table 13-5); these data have been used to investigate the baseline use of the offshore Project and which colonies, including designated sites, that seabirds may originate from.

#### 13.4.4.4.1 Kittiwake

On the western side of Orkney, a total of four kittiwakes have been tracked using GPS from the seabird colonies on Sule Skerry in 2011 and five birds from Cape Wrath in 2014. On the eastern side of Orkney, a total of 54 birds have been tracked from the island of Muckle Skerry, 20 birds from the island of Copinsay plus an additional 12 tracks from Copinsay, 13 tracks from Fair Isle, five tracks from Bullers of Buchan, 20 tracks from Whinnyfold, 15 tracks from Fowlsheugh and 50 tracks from the Isle of May.

The tracks from Sule Skerry indicate some overlap with the offshore Project, but there was no overlap from other tracked colonies. The sample size from Copinsay and the Pentland Firth islands on the eastern side of Orkney appear to be sufficient to understand where these birds are foraging and for apportioning impacts to these colonies.

#### 13.4.4.4.2 Arctic tern

There are no published tracking studies of Arctic terns in the region of the offshore Project. This species has been tracked using geolocators from the Farne Islands (Redfern and Bevan, 2020) and other studies in England have used boats to track Arctic terns (e.g. Perrow *et al.*, 2011). Key Arctic tern colonies with potential connectivity to the offshore

Project are those on Sule Skerry and Hoy the largest colonies in the region are on North Ronaldsay, Papa Westray, Swona and Stroma, but as Arctic terns generally forage in coastal locations within 3 to 10 km from the colony, although there are exceptions (Eglington and Perrow, (2014)), it is unlikely to be a key species in the breeding season.

#### 13.4.4.4.3 Great skua

Wade *et al.* (2014) tracked seven great skuas from Hoy in 2011. There was minimal overlap between the core area used by breeding birds and the offshore Project, although following breeding failure, the core area used by this species expanded and overlapped with the offshore Project. Wade *et al.* (2014) also tracked 10 great skuas from Foula in 2011; neither breeding birds nor birds that failed to breed overlapped with the offshore Project.

#### 13.4.4.4.4 Guillemot

A total of nine birds were tracked with GPS from the colonies on the island of Copinsay between 2012 and 2014 by the RSPB. However, there has been no tracking of guillemots from Sule Skerry and Sule Stack, Cape Wrath, west coast of Orkney and the north Caithness coast which are likely to be key colonies with potential connectivity to the offshore Project. The tracks from Copinsay showed no overlap with the offshore Project.

#### 13.4.4.4.5 Razorbill

The RSPB tracked a total of 33 razorbills from the island of Muckle Skerry and 14 birds from Copinsay between 2010 and 2014. Key razorbill colonies with potential connectivity to the offshore Project include those from Cape Wrath and along the north coast of Caithness. The tracks from Muckle Skerry and Copinsay showed no overlap with the offshore Project.

#### 13.4.4.4.6 Puffin

While tracking data exists from the Isle of May, there are no published tracks available for this dataset. However, the RSPB has undertaken tracking of puffins on the Shiant Islands and Hermaness, Shetland[10]. None of the tracked birds were recorded near the offshore Project.

#### 13.4.4.4.7 Gannet

A total of 15 gannets were tracked from Sule Skerry in 2011. Due to the close proximity of Sule Skerry to the OAA, gannets from Sule Skerry are likely to be the main source of birds using the offshore Project. Wakefield *et al.* (2013) showed that there was space partitioning between gannet colonies, which strongly indicated that the vast majority of birds within the offshore Project during the breeding season are likely to be from Sule Skerry and Sule Stack. Tracking from other colonies strongly indicates no, or little, connectivity in the breeding season with other gannet colonies (see Wakefield *et al.*, 2013).

[10] *https://rspb.maps.arcgis.com/apps/Cascade/index.html?appid=2733e23a70fe460fa8f4ecf9ce7af0c6*

#### 13.4.4.4.8 European storm petrel

Bolton (2021) tracked breeding European storm-petrels from the largest UK colony on Mousa, Shetland, during incubation and chick rearing between 2014 and 2017 using GPS tags; birds used an area to the south of Shetland and did not overlap with the offshore Project. A further nine chick-rearing birds GPS-tracked from Mousa in 2018 travelled in a similar direction but remained closer to the colony than birds tracked in previous years (Deakin *et al*., 2022). The RSPB tracked 19 breeding European Storm-petrels from Lunga, Treshnish Isles, in 2021; all birds remained on the continental shelf, moving through the Sea of the Hebrides, with one bird travelling 198 km from the colony to the shelf edge (Deakin *et al*., 2022), suggesting there was no overlap with the offshore Project. A further 20 GPS tags were deployed on European Storm-petrels breeding on Lunga, Treshnish Isles in 2021 for retrieval in 2022 (RSPB unpublished data).

#### 13.4.4.4.9 Leach's petrel

The first Leach's petrels were tracked during the breeding season in 2021 on the island of St Kilda by the RSPB (RSPB unpublished data); this tracking data confirmed this species use of deep waters (>1,000 m) around the Rosemary Bank seamount that were identified as hotspots by at-sea surveys (Deakin *et al*., 2022).

#### 13.4.4.4.10 Fulmar

In northern Orkney, a total of 72 fulmars have been tracked with geolocators from the island of Eynhallow between 2006 and 2013. On the eastern side of Orkney, fulmars have been tracked with GPS tags from the island of Muckle Skerry in the Pentland Firth including 10 birds from between 2011 and 2014 and one bird from the island of Swona in 2012; 13 birds have also been tracked from the island of Copinsay between 2010 and 2013. The tracks from these colonies show little overlap with the offshore Project. The sample size from Pentland Firth Islands and Copinsay appears to be sufficient to understand where these birds are foraging and for apportioning impact to these colonies in the northern and eastern side of Orkney.

### 13.4.4.5 The OAA

Impacts have been assessed for the offshore Project for bird species recorded within the study area during site-specific DAS (section 13.4.4.5.1) in relevant biological seasons (section 13.4.4.5.2) which were considered to be at potential risk either due to their abundance, potential sensitivity to windfarm impacts or due to biological characteristics which make them potentially susceptible (e.g. commonly fly at rotor heights).

#### 13.4.4.5.1 Baseline Digital Aerial Surveys

A total of 27 site-specific baseline DASs were carried out within the study area (OAA plus a 4 km buffer; section 13.4.1) between July 2020 and September 2022.

A total of 26 seabird species were recorded within the study area during DAS.

Full details of the baseline DASs are provided in the SS12: Offshore ornithology technical supporting study and supporting annexes including: design based estimates of mean density and abundance of birds in each calendar month (including all birds in flight and on the water, Annex 12.1), design based estimates of density and abundance of birds in each DAS (including all birds in flight and on the water, Annex 12.2), density and abundance estimates separated for birds recorded in flight and birds on the water (Annex 12.4), DSM for key bird species in line with guidance by MacKenzie *et al.*, 2013 (Annex 12.9) and raw count data of all bird species recorded within the study area (Annex 12.11).

#### 13.4.4.5.2 Biological seasons

Impacts on bird species recorded during the site-specific DAS have been assessed in this chapter in relation to relevant breeding and non-breeding biological seasons, as advised by NatureScot using NatureScot (2023) guidance (Table 13-6).

*Table 13-6 Species specific seasonal definitions taken from NatureScot (2023)*

| SPECIES | BREEDING SEASON | NON-BREEDING SEASON |
|---|---|---|
| Kittiwake | mid-April to August | September to mid-April |
| Black-headed gull | April to August | September to March |
| Little gull | mid-April to July[1] | August to mid-April |
| Common gull | April to August | September to March |
| Great black-backed gull | April to August | September to March |
| Herring gull | April to August | September to March |
| Lesser black-backed gull | mid-March to August | September to mid-March[1] |
| Common tern | May to mid-September | mid-September to April[1] |
| Arctic tern | May to August | September to April[1] |
| Great skua | mid-April to mid-September | mid-September to mid-April[1] |
| Arctic skua | May to August | September to April[1] |
| Little auk[2] | Not a breeding species in the UK | Not present in significant numbers |
| Guillemot | April to mid-August | mid-August to March |

| SPECIES | BREEDING SEASON | NON-BREEDING SEASON |
|---|---|---|
| Razorbill | April to mid-August | mid-August to March |
| Black guillemot | April to August | September to March |
| Puffin | April to mid-August | mid-August to March |
| Red-throated diver | May to mid-September | mid-September to April |
| Great northern diver | mid May to September[1] | October to mid-May |
| European storm-petrel | mid-May to October | November to mid-May[1] |
| Fulmar | April to mid-September | mid-September to March |
| Cory's shearwater[2] | Not a breeding species in the UK | Not present in significant numbers |
| Sooty shearwater[2] | Not a breeding species in the UK | Not present in significant numbers |
| Great shearwater[2] | Not a breeding species in the UK | Not present in significant numbers |
| Manx shearwater | April to mid-October | mid-Oct to March[1] |
| Gannet | mid-March to September | October to mid-March |
| Shag | March to September | October to February |

**Notes:**

**1: Not present in significant numbers in Scottish marine areas**

**2: Breeding and non-breeding season date range not provided in NatureScot (2023) guidance**

#### 13.4.4.5.3 Density and abundance estimates

Details of all seabird species that were recorded during baseline site-specific DAS as well as an explanation of how the density and abundance estimates were estimated are presented in detail in the SS12: Offshore ornithology technical supporting study.

In summary, for each species, the peak mean in any given season was calculated as follows:

- The population density/abundance for each DAS was calculated using design-based estimation methods, with 95% bootstrap confidence intervals (CI) calculated using non-parametric bootstrapping;
- The density/abundance for each calendar month was calculated as the mean of estimates for each calendar month (e.g. mean of three values for the month of July, mean of two values for the month of October, etc.); and
- The mean seasonal peak was taken as the highest from within the months within each season as discussed during consultation with NatureScot (meeting dated 8th February 2023).

The peak mean abundance estimates of birds (recorded in flight and on the water) within species-specific seasons (following NatureScot 2023 guidance) recorded within the OAA plus a 2 km buffer (all species except divers) or the OAA plus a 4 km buffer (divers only) used to inform the offshore ornithology displacement impact assessment (section 13.6) are provided in Table 13-7. *Density and abundance estimates for the Alternative Approach are presented in SS12, Annex 12.13.*

Densities of birds in flight only within the OAA used to inform the offshore ornithology collision risk impact assessment (section 13.6) are provided in the SS12: Offshore ornithology technical supporting study, Annex 12.5.

*Table 13-7 Mean seasonal peak population estimates, SD and 95% bootstrap CI by biological seasons for all birds on the water and in flight within the OAA plus 2 km[1] buffer*

| SPECIES | MEAN SEASONAL PEAK ABUNDANCE (NUMBER OF INDIVIDUALS WITHIN OAA + 2 KM[1] BUFFER) | | | | | |
|---|---|---|---|---|---|---|
| | BREEDING SEASON | | | NON-BREEDING SEASON | | |
| | PEAK MONTH | ESTIMATE (SD) | 95% CI | PEAK MONTH | ESTIMATE (SD) | 95% CI |
| Kittiwake | July | 690.15 (254.95) | 251.01-1251.17 | March | 1216.78 (201.34) | 840.8-1627.65 |
| Black-headed gull | April | 3.87 (3.83) | 0-11.7 | N/A | 0 (0) | N/A |
| Little gull | N/A | 0 (0) | N/A | September | 2.58 (2.57) | 0-7.75 |
| Common gull | April | 3.88 (3.51) | 0-11.63 | N/A | 0 (0) | N/A |
| Great black-backed gull | June | 7.75 (7.23) | 0-23.25 | December | 220.86 (43.52) | 143.37-317.83 |
| Herring gull | May | 7.75 (7.23) | 0-23.25 | November | 15.5 (9.49) | 0-34.88 |

| SPECIES | MEAN SEASONAL PEAK ABUNDANCE (NUMBER OF INDIVIDUALS WITHIN OAA + 2 KM[1] BUFFER) | | | | | |
|---|---|---|---|---|---|---|
| | BREEDING SEASON | | | NON-BREEDING SEASON | | |
| | PEAK MONTH | ESTIMATE (SD) | 95% CI | PEAK MONTH | ESTIMATE (SD) | 95% CI |
| Lesser black-backed gull | August | 2.58 (2.39) | 0-7.74 | N/A | 0 (0) | N/A |
| Common tern | August | 2.65 (2.17) | 0-7.96 | N/A | 0 (0) | N/A |
| Arctic tern | June | 89.14 (56.79) | 0-205.42 | N/A | 0 (0) | N/A |
| Great skua | August | 113.79 (84.83) | 2.65-317.55 | October & November | 3.88 (3.58) | 0-11.63 |
| Arctic skua | July | 10.58 (5.44) | 0-21.15 | N/A | 0 (0) | N/A |
| Little auk | N/A | 0 (0) | N/A | November | 11.61 (5.85) | 0-23.22 |
| Guillemot[2] | July | 4860.91 (707.08) | 3519.54-6286.13 | September | 4275.05 (471.93) | 3394.89-5231.14 |
| Razorbill[2] | April | 69.8 (18.68) | 34.9-109.69 | September | 143.87 (66.31) | 36.62-286.99 |
| Black guillemot | July | 2.58 (2.39) | 0-7.75 | October | 3.88 (3.48) | 0-11.63 |
| Puffin[2] | June | 5271.86 (788.04) | 3909.96-6905.42 | August | 2663.37 (446.26) | 1840.37-3557.68 |
| Red-throated diver[1] | May | 3.88 (3.34) | 0-11.65 | October | 3.88 (3.58) | 0-11.63 |
| Great northern diver[1] | May | 7.76 (7.32) | 0-23.27 | October | 3.88 (3.51) | 0-11.63 |
| European storm-petrel | August | 74.85 (25.27) | 30.97-131.64 | N/A | 0 (0) | N/A |
| Fulmar | September | 1917.82 (541.06) | 1042.9-3100.78 | December | 2774.25 (662.37) | 1592.39-4099.57 |

| SPECIES | MEAN SEASONAL PEAK ABUNDANCE (NUMBER OF INDIVIDUALS WITHIN OAA + 2 KM[1] BUFFER) | | | | | |
|---|---|---|---|---|---|---|
| | BREEDING SEASON | | | NON-BREEDING SEASON | | |
| | PEAK MONTH | ESTIMATE (SD) | 95% CI | PEAK MONTH | ESTIMATE (SD) | 95% CI |
| Cory's shearwater | August | 2.58 (2.45) | 0-7.74 | N/A | 0 (0) | N/A |
| Sooty shearwater | August | 5.16 (3.29) | 0-12.91 | N/A | 0 (0) | N/A |
| Great shearwater | N/A | 0 (0) | N/A | N/A | 0 (0) | N/A |
| Manx shearwater | June | 7.75 (5.15) | 0-19.38 | N/A | 0 (0) | N/A |
| Gannet | August | 958.12 (477.89) | 318.11-2070.05 | October | 1170.85 (146.55) | 891.52-1461.73 |
| Shag | April | 7.76 (5.13) | 0-19.39 | N/A | 0 (0) | N/A |

Note:

1: Estimates for diver species are presented for the OAA plus a 4 km buffer.

2: Including unidentified auks apportioned using identified auk ratios and accounting for availability bias

Further analyses using the *Alternative Approach* as described in NatureScot Guidance Note 8[11] and SNCB (2022)[12] is provided in SS12: Offshore ornithology technical supporting study, Annex 12.13. The *Alternative Approach* uses only complete seasonal data to ensure that the peak in each season is accurately identified and applied. The approach used for the assessment in this chapter makes use of all of the available DAS data (SS12: Offshore ornithology technical supporting study, Annex 12.3). All months are used to identify the peak month in each season across the survey period. This is a more defensible approach from both a biological perspective and a statistical perspective. From a biological perspective the approach used will be more likely to choose the point in the season which represents a true biological peak. It is more statistically meaningful as it is not simply using the mid-point of the two largest numbers, which by definition will represent a statistical tail of the distribution, and therefore, by definition has a low probability of occurring in each year over the duration of the operational windfarm. A complete analysis of the

[11] *https://www.nature.scot/doc/guidance-note-8-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing*

[12] *https://data.jncc.gov.uk/data/9aecb87c-80c5-4cfb-9102-39f0228dcc9a/joint-sncb-interim-displacement-advice-note-2022.pdf*

*Alternative Approach*, including PVA's for species in seasons where the predicted change in adult survival exceeded 0.02% points is provided in SS12: Offshore ornithology technical supporting study, Annex 12.13.

#### 13.4.4.5.4 Adult regional population sizes

Impacts on each species' population size have been assessed in relation to relevant adult breeding and non-breeding seasons (Table 13-6) reference populations (Table 13-8).

For the breeding season, adult regional populations used for the impact assessment have been based on the best available colony count data obtained from the SMP database (for a list of SMP colony data, refer to the SS12: Offshore ornithology technical supporting study, Annex 12.12). The breeding season regional populations were calculated as follows:

- For each species included in the assessment, colonies within the mean of the maximum foraging range (km) +1SD (Woodward *et al.*, 2019) surrounding the offshore Project (OAA plus offshore ECC) were extracted from the SMP database;
- Bird counts for each 'master' colony (a composition of colony sites) were extracted for one year which appeared to have the most complete count; and
- Bird counts recorded for each master colony in one year were summed to produce a regional population estimate.

For guillemot and razorbill foraging ranges, it was agreed during consultation with NatureScot (meeting dated 8th February 2023) to use the mean max+1SD for all Northern Isle SPAs including Fair Isle values, following NatureScot (2023) Guidance Note 3. As advised by NatureScot, guillemot non-breeding season populations were considered to be the same as the breeding season population, NatureScot (2023) Guidance Note 4.

For the non-breeding period, the reference populations used for the impact assessment are the relevant BDMPS taken from Appendix A in Furness (2015). As the offshore Project is located close to the boundary of the East and West BDMPS regions, both regions are assessed for non-breeding birds.

*Table 13-8 Regional breeding season population estimates summed from the SMP database and minimum non-breeding population sizes taken from Appendix A of Furness (2015)*

| SPECIES | MEAN MAXIMUM FORAGING RANGE +1SD. | BREEDING SEASON REGIONAL POPULATION SIZE (INDIVIDUAL ADULTS) | NON-BREEDING BDMPS (INDIVIDUAL ADULTS) | |
|---|---|---|---|---|
| | | | EAST COAST REGION BDMPS | WEST COAST REGION BDMPS |
| **Kittiwake** | 300.6 | 256,327 | Autumn migration: 480,815<br>Spring migration: 375,815 | Autumn migration: 498,970<br>Spring migration: 375,711 |

| SPECIES | MEAN MAXIMUM FORAGING RANGE +1SD. | BREEDING SEASON REGIONAL POPULATION SIZE (INDIVIDUAL ADULTS) | NON-BREEDING BDMPS (INDIVIDUAL ADULTS) | |
|---|---|---|---|---|
| | | | EAST COAST REGION BDMPS | WEST COAST REGION BDMPS |
| Great black-backed gull | 73 | 2,524 | Winter: 32,070 | Winter: 14,238 |
| Arctic tern[4] | 40.5 | 1,724 | N/A | N/A |
| Great skua | 931.2 | 21,124 | Autumn migration: 11,436<br>Spring migration: 5,718 | Autumn migration: 10,154<br>Spring migration: 16,498 |
| Guillemot[2] | 153.7[1] | 612,608 | 612,608 | 612,608 |
| Razorbill | 164.6[1] | 95,725 | Winter: 106,183<br>Migration: 302,314 | Winter: 179,183<br>Migration: 316,928 |
| Puffin | 265.4 | 333,421 | Winter: 199,974 | Winter: 249,896 |
| Fulmar | 1,200.2 | 647,236 | Winter: 408,808<br>Migration: 573,641 | Winter: 363,383<br>Migration: 490,041 |
| Gannet[3] | 509.4 | 404,008 | Autumn migration: 242,340<br>Spring migration: 163,701 | Autumn migration: 318,001<br>Spring migration: 391,540 |

Note:

1. Mean max+1SD for all Northern Isle SPAs including Fair Isle values, NatureScot (2023) Guidance Note 3

2. Guillemot non-breeding season populations are considered to be the same as the breeding season population, NatureScot (2023) Guidance Note 4.

3. Exceptions apply for three SPAs designated for breeding gannet. Recommended foraging range for Forth Islands SPA = 590 km, Grassholm SPA = 516.7 km and St Kilda SPA = 709 km.

4. Arctic tern was not present in the Project area in the non-breeding season.

#### 13.4.4.5.5 Adult baseline mortality rate

The effect of additional mortality due to impacts resulting from development of the offshore Project is assessed in terms of the percentage point change in the adult baseline mortality which was predicted to result. For each Important Ornithological Feature (IOF) (refer to section 13.5.3) assessed, values for the proportion of adults within each population, the proportion of sabbatical adults[13] during the breeding season and adult mortality rates used to calculate the change in the adult baseline mortality are presented in Table 13-9 (for calculations of the proportion of adults refer to the SS12: Offshore ornithology technical supporting study, Annex 12.10).

*Table 13-9 Proportion of adults and baseline adult mortality rate for the breeding and non-breeding seasons*

| SPECIES | PROPORTION OF ADULTS | SABBATICAL PROPORTION DURING BREEDING SEASON | BASELINE ADULT MORTALITY RATE |
|---|---|---|---|
| **Kittiwake** | 0.6811 | 0.1 | 0.146 |
| **Great black-backed gull** | 0.4847 | 0.35 | 0.07 |
| **Arctic tern** | 0.7730 | 0 | 0.163 |
| **Great skua** | 0.4320 | 0.089 | 0.118 |
| **Guillemot** | 0.6798 | 0.07 | 0.06 |
| **Razorbill** | 0.7225 | 0.07 | 0.105 |
| **Puffin** | 0.7297 | 0.07 | 0.093 |
| **Fulmar** | 0.5515 | 0 | 0.064 |
| **Gannet** | 0.6913 | 0.1 | 0.081 |

### 13.4.4.6 The Offshore ECC and Landfall

The cable landfall options are relatively small areas of rocky shore available only at low tide (below MHWS). The two shoreline areas are at the base of cliffs to the south. Thus, a limited suite of species were recorded at landfall areas, including curlew, dunlin, lapwing, oystercatcher, purple sandpiper, redshank, and ringed plover. All species were

[13] *Sabbatical adult birds are those individuals present during the breeding season, but not actively attempting to breed.*

recorded in small numbers, well below any thresholds of regional or national significance (see Onshore EIA Report, chapter 11: Terrestrial ornithology).

## 13.4.5 Future baseline

Key drivers of seabird population size in western Europe are climate change (Sandvik *et al.*, 2012; Frederiksen *et al.*, 2004, 2013; Burthe *et al.*, 2014; Macdonald *et al.*, 2015; Furness 2016; JNCC 2016; Pearce-Higgins 2021), and fisheries (Tasker *et al.*, 2000; Frederiksen *et al.*, 2004; Ratcliffe 2004; Carroll *et al.*, 2017; Sydeman *et al.*, 2017). Pollutants (including oil, persistent organic pollutants, and plastics), invasive mammal predators at colonies, disease, and loss of nesting habitat also impact on seabird populations but are generally much less important and are often more local factors (Ratcliffe 2004; Votier *et al.*, 2005, 2008; JNCC 2016). In 2022 and 2023, highly pathogenic avian influenza virus (HPAIV) adversely affected survival and productivity within seabird colonies across the UK, and investigations are underway to determine the long-term effects on species' populations, combined with the other aforementioned pressures (see section 13.4.5.1.1).

Trends in seabird numbers in breeding populations prior to the HPAIV outbreak, are better known, and better understood than trends in numbers at sea within particular areas. Breeding numbers are regularly monitored at many colonies (JNCC 2021), and in the British Isles there have been three comprehensive censuses of breeding seabirds in 1969-70, 1985-88 and 1998-2002 (Mitchell *et al.*, 2004) as well as single-species surveys (such as the decadal counts of breeding gannet numbers, Murray *et al.*, 2015). In contrast, the ESAS database is incomplete, and few data have been added since 2000, so that current trends in numbers at sea in areas of the North Sea are not so easy to assess.

Breeding numbers of many seabird species in the British Isles have declined since the 1980's, especially in the northern North Sea (Foster and Marrs 2012; Macdonald *et al.*, 2015; JNCC 2021). The most striking exception is gannet, which continues to increase (Murray *et al.*, 2015), although the rate of increase has been slowing (Murray *et al.*, 2015). Recent trends in Scottish seabird populations (which make up the majority of UK seabirds) have been stable over the last decade with breeding success generally higher between 2011 and 2018 than in the preceding decade (Moffat *et al.*, 2020).

Climate change has been identified as one of three key threats to UK seabirds and a key cause of recent declines, along with invasive alien species and by-catch in fisheries (Burthe *et al.*, 2014; Macdonald *et al.*, 2015; Capuzzo *et al.*, 2018; Dias *et al.*, 2019, Mitchell *et al.*, 2020. Pearce-Higgins 2021). Pearce-Higgins (2021) assessed the impact that climate change has already had on UK bird populations by relating their long-term trends to separately published species' responses to climate change, temperature and rainfall. It was found that of the 20 seabird species found in the UK, 14 are regarded as being at high or medium risk of negative climate change impacts.

Whilst the results of the current seabird census (Seabirds Count) will provide important information, there is already good evidence that kittiwake, Arctic skua, puffin and fulmar are being affected by climate processes (Frederiksen *et al.*, 2004; Burthe *et al.*, 2014; Cook *et al.*, 2014). It is therefore highly likely that breeding numbers of most of our seabird species will continue to decline under a scenario with continuing climate change due to increasing levels of greenhouse gases, should all other drivers of seabird population change remain the same.

Fisheries management is also likely to influence future numbers of seabird populations. The Common Fisheries Policy (CFP) Landings Obligation ('discard ban') will further reduce food supply for scavenging seabirds such as great black-backed gulls, lesser black-backed gulls, herring gulls, fulmars, kittiwakes and gannets (Votier *et al.*, 2004; Bicknell *et al.*, 2013; Votier *et al.*, 2013; Foster *et al.*, 2017). Recent changes in fisheries management that aid recovery of predatory fish stock biomass are likely to further reduce food supply for seabirds that feed primarily on small fish such as sandeels, as those small fish are major prey of large predatory fish. Therefore, anticipated future increases in predatory fish abundance resulting from improved management to constrain fishing mortality on those commercially important species at more sustainable levels than in the past are likely to cause further declines in stocks of small pelagic seabird 'food-fish' such as sandeels (Frederiksen *et al.*, 2007; Macdonald *et al.*, 2015). Lindegren *et al.*, (2018) concluded that sandeel stocks in the North Sea, the most important prey fish stock for North Sea seabirds during the breeding season (Furness and Tasker 2000), have been depleted by high levels of fishing effort. In the ICES Sandeel Area (SA) relevant to the offshore Project (SA7) the sandeel population was heavily depleted and collapsed through the 1980's and 1990's. There has been no fishing effort on sandeels in SA7 since the collapse of the stock, but the stock appears to have been slow to recover, perhaps due to the predation pressure from recovering populations of predatory fish. Indication of recovery of breeding success in Scotland breeding seabirds (Moffat *et al.*, 2020) may be, at least in part, due to the recovery of sandeel stocks in SA7.

Future decreases in kittiwake breeding numbers could be particularly pronounced, as kittiwakes appear to be sensitive to climate change (Frederiksen *et al.*, 2013; Carroll *et al.*, 2015) and to fishery impacts on sandeel stocks near breeding colonies (Frederiksen *et al.*, 2004; Carroll *et al.*, 2017), and the species will lose the opportunity to feed on fishery discards as the Landings Obligation comes into effect. Gannet numbers may continue to increase for some years, but evidence suggests that this increase is slowing (Murray *et al.*, 2015), and numbers may peak not too far into the future. While the Landings Obligation (i.e. discards ban) will reduce discard availability to gannets in European waters, in recent years increasing proportions of adult gannets have wintered in west African waters rather than in UK waters (Kubetzki *et al.*, 2009), probably because there are large amounts of fish discarded by west African trawl fisheries and decreasing amounts available in the North Sea (Kubetzki *et al.*, 2009; Garthe *et al.*, 2012). The flexible behaviour and diet of gannets probably reduces their vulnerability to changes in fishery practices or to climate change impacts on fish communities (Garthe *et al.*, 2012).

Fulmars, terns, common guillemot, razorbill and puffin appear to be highly vulnerable to climate change, so numbers may decline over the next few decades (Burthe *et al.*, 2014).

A long-term decrease in numbers of great black-backed gulls breeding in the north of Scotland (Moffat *et al.*, 2020), and the Landings Obligation will probably result in further decreases in numbers of north Norwegian great black-backed gulls, and herring gulls, coming to the North Sea in winter. Some of the human impacts on seabirds are amenable to effective mitigation (Ratcliffe *et al.*, 2009; Brooke *et al.*, 2018), but the scale of efforts to reduce these impacts on seabird populations has been small by comparison with the major influences of climate change and fisheries.

For offshore ornithology, the ecological impact assessment is therefore carried out in a context of potential recovery of baseline populations of a number of species, and ongoing declines in other species. Where a species is declining, the assessment takes into account whether a given impact is likely to exacerbate a decline in the relevant reference population and prevent a species from recovery should environmental conditions become more favourable.

Climate change has been identified as the strongest influence on future seabird population trends. In this context it is noted that a key component of global strategies to reduce climate change is the development of low-carbon renewable energy developments such as offshore windfarms.

#### 13.4.5.1.1 Highly pathogenic avian influenza

Baseline DASs for the Project were mostly undertaken prior to the widespread effects of HPAIV within seabird populations in the north of Scotland before June 2022. HPAIV affected a range of seabird species, particularly great skua and gannet; an overview of HPAIV in relation to the offshore Project is presented in the SS12: Offshore ornithology technical supporting study, Annex 12.8. At present the only guidance from a statutory body on the effects of HPAIV on seabird populations is from Natural England (2022), who state that, "We expect seabird data collected prior to summer 2022 (June) to remain a valid representation of 'typical' seabird distribution and density, as this was before mass mortality events began to take place.". If this advice is also applied in Scotland only the last three, or four, months of survey data collected for the offshore Project would potentially not match with the most recently available counts of seabird colonies (which would not reflect the impacts of HPAIV on populations).

For the purposes of this assessment, all reference populations used have been estimated from data collected prior to the widespread effects of HPAIV on seabirds in 2022 and 2023, and therefore because the baseline DAS data were also mostly collected prior to the outbreak, the predicted magnitudes of impacts on seabird populations should remain consistent with current populations (i.e. it is assumed that the proportion of the population affected by an impact will be similar before and after HPAIV impacts, with numbers of birds recorded within the study area declining proportionately with population sizes). Consequently, no adjustments to account for impacts of HPAIV on populations are considered necessary for the assessment.

Despite this, it is important to take in to account the potential effects of HPAIV on populations and their likely recovery. A review of HPAIV effects undertaken by Bob Furness (SS12: Offshore ornithology technical supporting study, Annex 12.8) stated that, "recovery of seabird populations depleted by HPAIV may take many years and possibly several decades. Populations might never recover to previous numbers if carrying capacity has reduced as a consequence of ecological change (climate change in particular, but also change in fisheries management affecting availability of food to scavenging seabirds)". So, it is important to note that some of the populations assessed here were likely to have been impacted by HPAIV in 2022, and 2023, and may be impacted in future breeding seasons. These populations will be smaller than the estimates used here, but it is likely that predicted impacts on these populations would be smaller by the same proportion and so the overall effects on populations would be the same, or very similar. The most important factor is to ensure that the estimated abundance of birds within the OAA is matched to the appropriate seabird population size.

### 13.4.6 Summary and key issues

*Table 13-10 Summary and key issues for offshore and intertidal ornithology*

| SUMMARY AND KEY ISSUES | OFFSHORE PROJECT |
|---|---|
| | Impact: Disturbance and displacement (including barrier effects) from construction, operation and decommissioning activities. |
| | Key sensitive receptors are seabirds sensitive to disturbance present within the OAA and offshore ECC. |
| | Impact: Collision risk during operation. |
| | Key sensitive receptors are seabirds sensitive to collision risk present within the OAA. The species taken through to assessment are Kittiwake, Arctic tern, guillemot, razorbill, puffin, fulmar, and gannet. |
| | IMPACT: INDIRECT EFFECTS FROM CONSTRUCTION, OPERATION AND DECOMMISSIONING ACTIVITIES. |
| | Key sensitive receptors are seabirds affected by the availability of key prey species within the OAA and offshore ECC. |

Kittiwake, Arctic tern and gannet have been scoped in for displacement and collision impacts from the Project (as the only species assessed for both impacts), it is possible that these impacts could combine to adversely affect the relevant populations of these species.

### 13.4.7 Data limitations and uncertainties

The marine environment is highly variable, both spatially and temporally. The baseline characterisation for this assessment is based on 27 months of DAS data which are considered to be representative of the study area for the purpose of impact assessment.

Although no project-specific DASs were undertaken within the majority of the offshore ECC, sufficient data are considered to be available from other sources, in particular the most recent DAS conducted for the PFOWF in order to inform a robust assessment from cable installation, operation and maintenance and decommissioning activities.

## 13.5 Impact assessment methodology

### 13.5.1 Impacts requiring assessment

The impacts identified as requiring consideration for offshore and intertidal ornithology are listed in Table 13-11. Information on the nature of impact (i.e. direct or indirect) is also described.

*Table 13-11 Impacts requiring assessment for offshore and intertidal ornithology*

| POTENTIAL IMPACT | NATURE OF IMPACT |
|---|---|
| Construction (including pre-construction) and decommissioning* | |
| Direct distributional responses and displacement effects | Direct |
| Indirect effects as a result of disturbance and displacement of prey species | Indirect |
| Operation and maintenance | |
| Direct distributional responses, displacement and barrier effects | Direct |
| Indirect effects due to habitat loss / change for prey species | Indirect |
| Direct collision risk | Direct |
| Combined operational displacement and collision risk | Direct |

** In the absence of detailed information regarding decommissioning works, and unless otherwise stated, the impacts during the decommissioning of the offshore Project considered analogous with, or likely less than, those of the construction stage. Where this is not the case, decommissioning impacts have been listed separately and have been assessed in section 13.6.3.*

## 13.5.2 Impacts scoped out of the assessment

The impacts scoped out of the assessment during EIA scoping, and the justification for this, are listed in Table 13-12.

*Table 13-12 Impacts scoped out for offshore and intertidal ornithology*

| IMPACT SCOPED OUT | JUSTIFICATION |
|---|---|
| Construction and decommissioning | |
| No impacts have been scoped out for offshore ornithology. | |
| Operation and maintenance | |

| IMPACT SCOPED OUT | JUSTIFICATION |
|---|---|
| Ghost fishing | Agreed with consultees that ghost fishing is scoped out as floating WTGs have been removed from the offshore Project design for the current application. |

### 13.5.3 Assessment methodology

An assessment of potential impacts is provided separately for the construction, operation and maintenance and decommissioning stages.

IOFs are those species recorded during the DAS which are considered to be at potential risk either due to their abundance, potential sensitivity to windfarm impacts or due to biological characteristics which make them potentially susceptible (e.g. commonly fly at rotor heights).

The assessment for offshore and intertidal ornithology is undertaken following the principles set out in chapter 7: EIA methodology, tailored to make it applicable to ornithology IOFs, and aligned with the key guidance document produced on impact assessment of ecological/ornithological receptors (CIEEM 2022). The sensitivity of the receptor is combined with the magnitude to determine the impact significance. Sensitivity and magnitude criteria are assigned based on professional judgement, as described in Table 13-13 to Table 13-15.

The assessment approach uses a 'source-pathway-receptor' model, which identifies likely impacts on IOFs resulting from the proposed construction, operation and decommissioning of the offshore infrastructure. The parameters of this model are defined as follows:

- Source – the origin of a potential impact (noting that one source may have several pathways and receptors), e.g. an activity such as WTG installation and a resultant effect such as the presence of a new WTG structure in the offshore environment;
- Pathway – the means by which the impact of the activity could affect an IOF, e.g. for the example above, presence of a WTG could potentially cause a collision risk; and
- Receptor (in this case 'feature', as per Chartered Institute of Ecology and Environmental Management (CIEEM) (2022) guidance) – the element of the receiving environment that is impacted, e.g. for the above example, bird species foraging within or passing through the windfarm.

#### 13.5.3.1 Sensitivity

Table 13-13 provides example definitions of the different sensitivity levels for ornithology receptors using as its example the potential impact of disturbance through construction activity.

*Table 13-13 Sensitivity criteria for Ornithological Features*

| SENSITIVITY OF RECEPTOR | DEFINITION |
|---|---|
| **High** | Ornithological receptor (bird species) has very limited tolerance of a potential impact, e.g. strongly displaced by sources of disturbance such as noise, light, vessel movements and the sight of people. |
| **Medium** | Ornithological receptor (bird species) has limited tolerance of a potential impact, e.g. moderately displaced by sources of disturbance such as noise, light, vessel movements and the sight of people. |
| **Low** | Ornithological receptor (bird species) has some tolerance of a potential impact, e.g. partially displaced by sources of disturbance such as noise, light, vessel movements and the sight of people. |
| **Negligible** | Ornithological receptor (bird species) is generally tolerant of a potential impact e.g. not displaced by sources of disturbance such as noise, light, vessel movements and the sight of people. |

It should be noted that although sensitivity is a core component of the assessment, conservation value (Table 13-14) is also taken into account in determining each potential impact's significance. Furthermore, high conservation value and high sensitivity are not necessarily linked within a particular impact. A receptor could be categorised as being of high conservation value (e.g. an interest feature of a SPA) but have a low or negligible physical/ecological sensitivity to an effect and vice versa. Determination of potential impact significance takes both of these into consideration. The narrative behind the assessment is important here; the conservation value of an ornithological receptor can be used where relevant as a modifier for the sensitivity (to the effect) already assigned to the receptor.

The conservation value of ornithological features is based on the population from which individuals are predicted to be drawn. This reflects current understanding of the movements of bird species. Therefore, conservation value for a species can vary through the year depending on the relative sizes of the number of individuals predicted to be at risk of impact and the population from which they are estimated to be drawn. Ranking therefore corresponds to the degree of connectivity which is predicted between the study area and protected populations. Using this approach, the conservation importance of a species seen at different times of year may fall into any of the defined categories.

Example definitions of the value levels for ornithological features are given in Table 13-14. These are related to connectivity with populations that are protected as qualifying features of SPAs. SPAs are internationally designated sites which carry strong protection for populations of qualifying bird species. These SPA qualifying features are a key consideration for the ornithology assessment.

*Table 13-14 Definitions of the Conservation Value Levels for an Ornithological Feature*

| VALUE | DEFINITION |
|---|---|
| High | A species for which individuals at risk can be clearly connected to a particular SPA. |
| Medium | A species for which individuals at risk are probably drawn from particular SPA populations, although other populations (both SPA and non-SPA) may also contribute to individuals at risk. |
| Low | A species for which individuals at risk have no known connectivity to SPAs, or for which no SPAs are designated. |

#### 13.5.3.2 Magnitude of impact

The definitions of the magnitudes of impact on ornithological features are set out in Table 13-15. This set of definitions has been determined on the basis of changes to bird populations.

*Table 13-15 Magnitude criteria for an Ornithological Feature*

| MAGNITUDE CRITERIA | DEFINITION |
|---|---|
| High | A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific designated site that is predicted to irreversibly alter the population in the short-to-long term and to alter the long-term viability of the population and / or the integrity of the designated site. Recovery from that change predicted to be achieved in the long-term (i.e. more than 5 years) following cessation of the development activity. |
| Medium | A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific designated site that occurs in the short and long-term, but which is not predicted to alter the long-term viability of the population and / or the integrity of the designated site. Recovery from that change predicted to be achieved in the medium-term (i.e. no more than five years) following cessation of the development activity. |
| Low | A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific designated site that is sufficiently small-scale or of short duration to cause no long-term harm to the feature / population. Recovery from that change predicted to be achieved in the short-term (i.e. no more than one year) following cessation of the development activity. |
| Negligible | Very slight change from the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific designated site. Recovery |

| MAGNITUDE CRITERIA | DEFINITION |
|---|---|
| | from that change predicted to be rapid (i.e. no more than circa 6 months) following cessation of the development related activity. |
| **No change** | No loss of, or gain in, size or extent of distribution of the relevant biogeographic population or the population that is the interest features of a specific designated site. If no change for an ornithological receptor was concluded, then the receptor was not included in the assessment. |

The consequence and significance of effect is then determined using the matrix provided in chapter 7: EIA methodology.

### 13.5.3.3 Significance of effect

Following the identification of the ornithological feature's overall sensitivity and the determination of the magnitude of the impact, the significance of the effect can be determined. That determination will be guided by the matrix as presented in Table 13-16. Effects shaded red or orange represent those with the potential to be significant in the context of the EIA Regulations as defined in defined in chapter 3: Planning policy and legislative context.

*Table 13-16 Consequence of effect*

| CONSEQUENCE OF EFFECT | | MAGNITUDE | | | |
|---|---|---|---|---|---|
| | | NEGLIGIBLE | LOW | MEDIUM | HIGH |
| SENSITIVITY | NEGLIGIBLE | Negligible | Negligible | Negligible | Negligible |
| | LOW | Negligible | Negligible | Minor | Minor |
| | MEDIUM | Negligible | Minor | Moderate | Moderate |
| | HIGH | Negligible | Minor | Moderate | Major |

The categories provide a threshold to determine whether or not significant effects may result from the offshore Project, with Moderate and Major effects possibly being 'significant' in EIA terms, as highlighted in amber and red. A typical categorisation is shown below (Table 13-17), noting that effects can be both beneficial or adverse.

*Table 13-17 Definitions of consequence of effect and associated significance*

| CATEGORY | DEFINITION |
|---|---|
| Major | A fundamental change to the ornithological receptor, resulting in a significant effect. |
| Moderate | A material but non-fundamental change to the ornithological receptor, resulting in a possible significant effect. |
| Minor | A detectable but non-material change to the ornithological receptor resulting in no significant effect or small-scale temporary changes. |
| Negligible | No detectable change to the ornithological receptor resulting in no significant effect. |

It is important that the matrix (and indeed the definitions of sensitivity and magnitude) is seen as a framework to aid understanding of how a judgement has been reached from the narrative of each impact assessment. It is not a prescriptive formulaic method. Expert judgement has been applied to the assessment of likelihood and ecological significance of a predicted impact.

In particular, it should be noted that conservation value and behavioural sensitivity levels may not be consistent for a particular impact. A feature could be of high conservation value (e.g. an interest feature of an SPA) but have a low or negligible behavioural sensitivity to an effect and vice versa. Potential impact significance will not be inflated simply because a feature is 'valued'. Similarly, potentially highly significant impacts will not be deflated simply because a feature is not valued. The narrative behind the assessment is important here; the conservation value of an ornithological feature can be used where relevant as a modifier for the sensitivity (to the effect) already assigned to the feature.

For the purpose of the assessment of significance, the CIEEM (2022) guidance has been followed. This states that 'significance is a concept related to the weight that should be attached to effects when decisions are made so that the decision maker is adequately informed of the environment consequences of permitting a project'. CIEEM (2022) defines significance as follows: 'In broad terms, significant effects encompass impacts on the structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance, and distribution). Significant effects should be qualified with reference to an appropriate geographic scale, for example a significant effect on a Site of Special Scientific Interest ... is likely to be of national significance.'

Where possible, assessment is based upon quantitative and accepted criteria and/or methods (for example, guidance from SNCBs on collision risk modelling (SNCB 2014), and displacement (SNCB 2022), and /or biological removal thresholds determined through population modelling), together with the use of value judgement and expert interpretation to establish to what extent an effect is significant.

## 13.5.3.4 Approach to assessment

### 13.5.3.4.1 Assessment methodologies

**Construction impacts**

Direct distributional response and displacement effects during construction – this impact considers a range of disturbance sources (e.g. light, vessel presence) and has been assessed qualitatively. The species considered susceptible to disturbance were identified using SNCB (2022) guidance and discussed and agreed with consultees. The qualitative assessment is presented in section 13.6.1.1.

Indirect effects as a result of disturbance and displacement of prey – this impact has been assessed qualitatively in section 13.6.1.2 drawing on information from chapter 10: Benthic subtidal and intertidal ecology and chapter 11: Fish and shellfish ecology.

**Operation and maintenance impacts**

Displacement and barrier effects - The full methodology is provided within SS12: Offshore ornithology technical supporting study and summarised within section 13.6.2.1. A screening exercise, agreed through consultation, identified seven species at potential risk to disturbance and displacement. The displacement assessment followed the 'Matrix Approach' as advised by SNCB (2022). Displacement matrix table inputs and outputs are provided in Annex 12.3. The *Alternative Approach* is presented in Annex 12.13 and signposted throughout the EIA chapter in bold italics where relevant.

Collision risk - The full methodology is provided within SS12: Offshore ornithology technical supporting study and summarised in section 13.6.2.3. A screening exercise, agreed through consultation, identified five species at potential risk to collision. The Marine Scotland stochastic CRM tool was used to assess collision risk. The collision risk modelling inputs are presented in Annex 12.5 and the outputs presented in Annex 12.6.

A combined displacement and collision risk assessment is presented in section 13.6.2.4.

Indirect effect as a result of disturbance and displacement of prey – this impact has been assessed qualitatively in section 13.6.2.2 drawing on information from chapter 10: Benthic subtidal and intertidal ecology and chapter 11: Fish and shellfish ecology.

### 13.5.3.4.2 PVA for impacts requiring assessment

Where impacts are assessed and the predicted impact from each source can be estimated quantitatively, a PVA was used (PVA-tool_Nov2022) to assess the effect on the regional population size where the predicted change in adult survival was 0.02% point or larger (following NatureScot Guidance Note 11).

In all cases, PVA's were run for 35 years, to provide predicted impacts across the Project operational lifespan[14]. Counterfactual and quantile metrics from each PVA are provided at 35 years and at shorter timespans between impacts being applied to populations and the end of the Project lifespan.

PVA's were undertaken for three regional population scales:

1. Breeding populations within foraging range;
2. Non-breeding populations in the UK North Sea (and Channel where appropriate for the species being assessed) from Furness (2015) (eastern region BDMPS); and
3. Non-breeding populations in the Western waters (and Channel where appropriate for the species being assessed) from Furness (2015) (western region BDMPS).

Two non-breeding population scales were used as the Project sits on, or close to, the boundary between the eastern region BDMPS and the western region BDMPS. The PVA assessment was only completed for the BDMPS region with the largest predicted impact on the adult survival of the relevant regional population.

For full details on the PVA methodology, including input parameters, used refer to SS12: Ornithology technical supporting study, Annex 12.10.

### 13.5.4 Embedded mitigation

As described in chapter 7: EIA methodology, certain measures have been adopted as part of the Project development process in order to reduce the potential for impacts to the environment, as presented in Table 13-18. These have been accounted for in the assessment presented below. General mitigation measures, which would apply to all parts of the Project, are set out first. Thereafter mitigation measures that would apply specifically to offshore ornithology issues associated with the OAA and offshore ECC, are described separately.

The requirement for additional mitigation measures (secondary mitigation) will be dependent on the significance of the effects on offshore and intertidal ornithology receptors.

[14] *PVA outputs across 50 years have been provided to NatureScot separately.*

*Table 13-18 Embedded mitigation measures relevant to offshore and intertidal ornithology*

| MITIGATION MEASURE | FORM (PRIMARY/ TERTIARY) | DESCRIPTION | HOW MITIGATION WILL BE SECURED |
|---|---|---|---|
| **Embedded mitigation** | | | |
| **Site selection** | Primary | The offshore Project including the OAA and the offshore ECC avoids any overlap with designated sites (i.e. SPAs) for birds. | Already secured through the OAA boundary. |
| **Minimum WTG blade clearance** | Primary | Blade clearance of 27.05 m above MSL (29.52 m above LAT), which is in excess of the minimum requirement of 22 m above mean high water springs (MHWS). | Secured through the description of the development within the Section 36 Consent and/or Marine Licence. |
| **Lighting** | Primary | Excess lighting, above levels set by regulatory requirements for navigation, aviation, escape/emergency procedures and general activity, will be avoided wherever possible. External general lighting will use timers and/or PIR devices to reduce excessive lighting of the WTGs and OSPs. | Requirements will be detailed in the LMP, required under Section 36 Consent and/or Marine Licence conditions.<br>An outline LMP is provided as part of the offshore application in OP6: Outline Lighting and Marking Plan. The outline LMP contains details on the proposed lighting requirements for the construction and operation and maintenance stage. |
| **Decommissioning Programme** | Tertiary | The development of, and adherence to, a Decommissioning Programme approved by Scottish Ministers prior to construction and updated throughout the Project lifespan. | The production and approval of a Decommissioning Programme will be required under Section 105 of the Energy Act 2004 (as amended). |

### 13.5.5 Worst case scenario

As detailed in chapter 7: EIA methodology, this assessment considers the worst case scenario for the offshore Project parameters which are predicted to result in the greatest environmental impact, known as the 'worst case scenario'. The worst case scenario represents, for any given receptor and potential impact, the design option (or combination of options) that would result in the greatest potential for change.

Given that the worst case scenario is based on the design option (or combination of options) that represents the greatest potential for change, the development of any alternative options within the design parameters will give rise to no worse effects than those assessed in this impact assessment. Table 13-19 presents the worst case scenario for potential impacts on offshore and intertidal ornithology during construction, operation and maintenance, and decommissioning.

Since the Project design is dependent upon site constraints, the detailed design can only take place post-consent once all the data has been gathered including seabed survey data, Unexploded Ordnance (UXO) and boulder presence. The final design of the offshore Project will be confirmed through detailed ongoing engineering design studies, including the development of the ground model. The final design, including array area and number of WTG, will be captured in the Development Specification and Layout Plan (DSLP) which will be informed by this ongoing engineering work and in consultation with interested stakeholders. It is likely that the number of WTG and array area will be less than those values that have been used to inform the predicted collision risk and displacement effects to seabirds presented in the assessment. As a result, the assessment of predicted impacts on birds is a worst case scenario.

*Table 13-19 Worst case scenario specific to offshore and intertidal ornithology receptor impact assessment*

| POTENTIAL IMPACT | WORST CASE SCENARIO | JUSTIFICATION |
|---|---|---|
| **Construction** | | |
| **Direct distributional responses and displacement effects** | • Up to a maximum of 30 construction vessels within the offshore Project simultaneously;<br>• Maximum piling duration of 290 days;<br>• Maximum construction schedule of 24 hours a day, 7 days a week; and<br>• Maximum construction period of up to four years with an additional year of pre-construction activities (e.g. UXO clearance) | • Maximum estimated number of vessels, duration of piling and construction activity within the OAA and offshore ECC would cause greatest disturbance and displacement to birds. |
| **Indirect effects as a result of disturbance and displacement of prey species** | • Maximum spatial disturbance to fish and shellfish during construction due to underwater noise from piling of up to 125 WTGs with monopile foundations is maximum hammer energy of 5,000 kJ with maximum of 1 pile per day and up to 16 hours piling per day (over 125 days);<br>• Maximum temporal disturbance to fish and shellfish during construction piling of up to 125 jacket foundations (500 piles) using maximum hammer energy of 3,000 kJ with maximum of 2 piles per day and up to 8 hours piling per day (over 250 days).<br>• Additionally piling of up to five OSP pin-pile jacket foundations, each with 16 piles required (total of 80 piles) with a maximum of two piles per day and up to eight hours of piling per day (40 piling days), at 3,000 kJ hammer energy (in hard or soft sediment). | • Breakdown is given in chapter 11: Fish and shellfish ecology, Table 11-15.<br>• Maximum disturbance to prey species would cause greatest displacement to birds from OAA and offshore ECC. |

| POTENTIAL IMPACT | WORST CASE SCENARIO | JUSTIFICATION |
|---|---|---|
| | • Maximum area of temporary habitat disturbance or loss to benthic habitats during construction would be approximately 69.12 $km^2$ across the offshore Project. | • Breakdown is given in chapter 10: Benthic subtidal and intertidal ecology, Table 11-15.<br>• Maximum disturbance to benthic species would cause greatest displacement to prey species and consequently birds from OAA and offshore ECC. |
| **Operation and maintenance** | | |
| **Direct distributional responses, displacement and barrier effects** | • WTGs and OSPs across the full OAA;<br>• Maximum of 125 WTGs with minimum spacing of 944 m (smallest WTG size) between WTGs;<br>• Maximum of five high voltage alternating current (HVAC) offshore substation platforms (OSPs); and<br>• Up to 12,695 transits from operation and maintenance vessels estimated throughout the operational life of the Project; and<br>• Maximum of 19 vessels at the site simultaneously. | • Represents maximum density of WTGs and structures across the offshore Project, which maximises the potential for avoidance and displacement (including potential barrier) to birds from OAA.<br>• Other options represent a smaller total area occupied and reduced density of WTGs (e.g. increased spacing).<br>• Assessment assumes varying displacement from site and a buffer, where appropriate.<br>• See chapter 5: Project description. |
| **Indirect effects due to habitat loss / change for key prey species** | • Maximum area of seabed footprint occupied by the offshore Project resulting in permanent habitat loss is up to 7.34 $km^2$. | • Breakdown is given in chapter 11: Fish and shellfish ecology, Table 11-15.<br>• Maximum area of seabed lost potentially causes greatest displacement to prey species and consequently birds from OAA and offshore ECC. |

| POTENTIAL IMPACT | WORST CASE SCENARIO | JUSTIFICATION |
|---|---|---|
| | • Up to 7.34 $km^2$ of permanent habitat creation. | • Breakdown is given in chapter 11: Fish and shellfish ecology, Table 11-15.<br>• Maximum area of permanent habitat creation causes greatest attraction to prey species and consequently birds from OAA and offshore ECC. |
| | • Maximum cable EMF is:<br>- Inter-array HVAC cables (up to 145 kV) with a maximum length of 500 km;<br>- Up to six interconnector HVAC cables (up to 420 kV) with a maximum length of 150 km;<br>- Up to five offshore export HVAC cables (up to 420 kV) with a maximum length of 320 km;<br>• A total of 10 crossings across the offshore Project area requiring cable protection at a height of 3 m, with a total area of 0.125 $km^2$; and<br>• Operational life up to 30 years[15]. | • Breakdown is given in chapter 11: Fish and shellfish ecology, Table 11-15.<br>• The maximum length of inter-array, interconnector and offshore export cable will result in the greatest potential for EMF effects on prey species. |
| Direct collision risk | • Maximum of 125 WTGs x 330 m rotor diameter;<br>• WTGs and OSPs across the full OAA; and<br>• Operational life up to 30 years. | • Collision risk modelling shows that 125 x 330 m rotor diameter WTGs (WTG scenario 5) have largest collision impact risk. |

[15] *An operational period of 35 years has been assumed for collision risk modelling as WTGs will be present in the OAA and potentially turning ahead of first power.*

| POTENTIAL IMPACT | WORST CASE SCENARIO | JUSTIFICATION |
|---|---|---|
| | | • Other WTG scenarios have lower collision risks, although the difference in predicted collisions between different WTG options is very small (SS12: Offshore ornithology technical supporting study). |
| **Combined operational displacement and collision risk** | • As per operational disturbance and displacement and collision risk. | Represents maximum number and density of WTGs and structures across the offshore Project. A larger number of WTGs is likely to result in increased displacement. A larger number of WTGs is also likely to increase the possibility of collisions. |
| **Decommissioning** | | |
| **Direct and indirect distributional responses and displacement effects from decommissioning activities** | • Disturbance is anticipated to be similar in nature but of lower magnitude than during construction, but specific details are not currently known. | Maximum estimated number of vessel movements would cause greatest displacement to birds on site. |

## 13.6 Assessment of potential effects

In the assessment of potential effects, the impacts are assessed:

- In the order of construction, operation and decommissioning;
- Following the impact assessment methodology that is described in section 13.5.3;
- On the basis of the worst case scenario for each impact as set out in Table 13-19; and
- Accounting for the embedded mitigation that is described in Table 13-18.

### 13.6.1 Potential effects during construction (including pre-construction)

#### 13.6.1.1 Direct distributional responses and displacement effects

The construction stage of the offshore Project has the potential to disturb bird populations in the marine environment leading to displacement of birds from construction areas. The construction stage would require the mobilisation of vessels and the installation of foundations, offshore export cables and other infrastructure (WTGs and OSPs). These activities could result in temporary habitat loss through reduction in the area available for foraging, loafing and moulting birds within the OAA and the offshore ECC.

Causes of potential disturbance would comprise the use of artificial light, presence of construction vessels and associated human activity, noise and vibration from construction activities associated with construction sites as discussed below.

At the landfall, birds using the tidal area below MHWS could be disturbed by both onshore and offshore works. As the cable will be installed using Horizontal Directional Drilling (HDD), rather than trenching across the foreshore, this is likely to be limited to a relatively short period when vessels are located offshore during the HDD works and cable pull through. As such the disturbance will likely only be due to the presence of vessels nearshore, with associated personnel and noise.

##### 13.6.1.1.1 Artificial light disturbance

Lighting of construction sites, vessels and other structures at night may potentially be a source of attraction (phototaxis), or displacement for birds (see Furness 2018[16] for a review). Phototaxis can be a serious hazard for fledglings of burrow-nesting seabird species, particularly families belonging to the *Procellariiformes* including shearwaters and storm-petrels (Rodríguez *et al.*, 2014). Adults of shearwater and storm-petrel species are nocturnally active at their breeding colonies and their chicks fledge from the burrows at night; strong phototaxis helps nestlings navigate away from their dark burrows towards the sea, as light intensity is naturally higher over the sea than onshore (Furness, 2018). Puffin, also a burrow nesting species whose chicks fledge at night, show the same response to light as petrels (Furness, 2018).

[16] DBS+PEIR+TA12.8+Review+of+turbine+lighting+-+Furness+2018.pdf (rwe-dogger-bank.s3.eu-west-2.amazonaws.com)

Shearwater, petrel, and puffin fledglings can be exposed to a high mortality by colliding with onshore structures with bright lights or becoming grounded due to attraction to onshore artificial lights (Montevecchi, 2006; Wilhelm *et al.*, 2013; Rodriguez *et al.*, 2012a,b; Rodriguez *et al.*, 2014; 2017; Gineste *et al.*, 2017). In Scotland, on the islands of Rum and St Kilda (Harris *et al.*, 1978; Miles *et al.*, 2010), Manx shearwaters, European storm-petrels, Leach's storm-petrels and Atlantic puffin fledglings have been found grounded at street lights and illuminated windows during the short period in late summer when chicks are departing from nesting burrows, possibly in part due to an under-developed visual acuity due to a lack of visual stimulation in the darkness of the nest chamber (Atchoi *et al.*, 2020). Attraction towards bright artificial light can be strong at times of poor visibility, particularly affecting migrating birds during the autumn, but it is generally seen where birds are exposed to intense white lighting, such as from lighthouses (Furness 2018; Ronconi *et al.*, 2015; and Day *et al.*, 2015) all report that poor weather (e.g. fog, rain, low cloud cover) exacerbate nocturnal attraction of migrant bird to lights at oil and gas production platforms, with on occasions thousands of birds being killed in a night, especially where gas is being flared. However, there is limited evidence for attraction of shearwaters and storm-petrels to oil and gas platform in the UK (Bourne, 1979; Sage, 1979), likely due to low densities of these species in the northern North Sea where seabird interactions with oil platforms have been studied.

The closest seabird colony to the offshore Project is Sule Skerry and Sule Stack SPA (minimum of 1.7 km to the offshore Project, refer to Offshore RIAA) which is designated for breeding seabirds, including amongst other species, European storm-petrel, Leach's storm and puffin. European storm-petrels and Manx shearwaters were recorded very infrequently within the study area during the baseline DAS; storm-petrels were recorded in August and September 2020 and 2021 (one to 36 birds per survey) and Manx shearwaters were recorded during the breeding season prior to dispersal in very low numbers (one to three birds per survey). Puffins were recorded in relatively high numbers in the late spring, summer and autumn months (SS12: Offshore ornithology technical supporting study). However, attraction of fledglings towards artificial light is thought to occur only over short distances (hundreds of metres) in response to bright white light close to breeding colonies (Furness, 2018). The offshore construction areas within the OAA lit with artificial light would be very small and restricted to isolated areas which are active at a given time and at a distance of at least 1.7 km but likely considerably larger distances (potentially up to 37 km), depending on the final windfarm layout. The construction sites associated with the development of the offshore Project are considered to be far enough removed from any seabird breeding colonies as to render the risk to fledgling phototaxis negligible.

There are no records of phototaxis of nocturnal migrating birds towards navigation lights and although young birds may show phototaxis over short distances during fledging, there seems to be little or no attraction of older birds to lights except when they are exposed to intense white lighting such as from lighthouses. As light from construction sites is likely to be one or two orders of magnitude less powerful than that from lighthouses (Furness, 2018), phototaxis of migrating birds towards areas of construction is considered a negligible risk.

#### 13.6.1.1.2 Vessel movement disturbance

The level of disturbance at each work location within the construction area of the offshore Project would differ dependent on the activities taking place, but there could be vessel movements at any time of the day or night over the maximum four year construction period and over the additional year of pre-construction activities.

Some species are more susceptible to disturbance than others. Gulls are not considered susceptible to disturbance, as they are often associated with fishing boats (e.g. Camphuysen, 1995; Hüppop and Wurm, 2000) and have been noted in association with construction vessels at the Greater Gabbard offshore windfarm (GGOWL, 2011) and close to active foundation piling activity at the Egmond aan Zee (OWEZ) windfarm, where they showed no noticeable reactions to the works (Leopold and Camphuysen, 2007). Irwin *et al.*, (2019) found that great black-backed gull distribution within the Outer Thames Estuary SPA showed a slight skew towards shipping lanes in the southern sector. However, species such as divers and scoters have been noted to be particularly sensitive to vessel disturbance and are known to avoid shipping by several kilometres (Mitschke *et al.*, 2001 from Exo *et al.*, 2003; Garthe and Hüppop, 2004; Schwemmer *et al.*, 2011).

There are a number of different measures used to assess bird disturbance and displacement from areas of sea in response to activities associated with an offshore windfarm. Garthe and Hüppop (2004) developed an index of marine bird population vulnerability to offshore windfarms, based on scores of conservation importance of different species' populations and perceived behaviour-related risks of collision and displacement, combined into a single index which they applied to seabird species in German sectors of the North Sea. The work of Garthe and Hüppop (2004) was refined by Furness and Wade (2012) and Furness *et al.*, (2013) incorporating new data from recent research on flight behaviour with a focus on seabirds using Scottish offshore waters. Bradbury *et al.*, (2017) expanded the bird list for wider English and Welsh waters covering additional species not previously included in Furness *et al.*, (2013). The indexes use information in the scientific and 'grey' literature, as well as expert opinion to identify disturbance ratings for individual species, alongside scores for habitat flexibility and conservation importance. Many of these references also relate to disturbance from helicopter and vessel activities which are considered relevant to this assessment. The scores assessed by Bradbury *et al.*, (2017) and Furness *et al.*, (2013) have been summarised by the SNCB (SNCB, 2022) to show which species should be considered sensitive to disturbance in offshore windfarm assessments.

Referring to the SNCB (2022) guidance, a screening assessment identified seven seabird species (kittiwake, Arctic tern, guillemot, razorbill, puffin, fulmar and gannet) that could potentially be affected by disturbance and displacement effects, including vessel traffic (refer to the SS12: Offshore ornithology technical supporting study for screening details). The list of birds potentially at risk of disturbance and displacement was agreed with NatureScot during consultation (meeting dated 8th February 2023 and letter dated 5th April 2023). Red-throated diver is known to be particularly sensitive to vessel activity (Jarrett *et al.*, 2018; Garthe and Hüppop, 2004; Schwemmer *et al.*, 2011; Furness and Wade, 2012; Bradbury *et al.*, 2017; Dierschke *et al.*, 2017), but as this species was rarely recorded in the baseline DAS (one bird was recorded in October 2020, November 2021 and May 2022; refer to the SS12: Offshore ornithology technical supporting study Annex 12.11) and the offshore ECC does not pass through the Scapa Flow SPA (designated for breeding red-throated diver; export cables to the Flotta Hydrogen Hub are not part of this current consent application and therefore not considered within this Offshore EIA Report), vessel disturbance to red-throated divers during construction is considered a negligible risk.

Within the OAA, there is potential for disturbance and displacement of kittiwakes, Arctic terns, guillemots, razorbills, puffins, fulmars and gannets due to construction activity, including WTG construction and associated vessel traffic. However, construction will not occur across the whole of the OAA simultaneously or every day and in all months of the year but will be undertaken over a maximum four year construction period. Consequently, the effects will occur only in the discrete areas where vessels are operating at any given point and not the entire offshore Project area; the potential magnitude of disturbance is considered to be very small. Within the offshore ECC, there is potential for disturbance and displacement to the same seven species resulting from the presence of construction vessels installing the offshore cables. However, cable laying vessels are static for large periods of time and move only short distances as cable installation takes place, and offshore cable installation activity is a relatively low noise emitting operation. Therefore, the potential risk of disturbance is very small.

#### 13.6.1.1.3 Noise disturbance

Bird species differ in their susceptibility to anthropogenic disturbance and in their responses to noise and visual disturbance stimuli (e.g. Jarrett *et al.*, 2018; Goodship & Furness, 2019). Jarrett *et al.* (2018) found that red-breasted mergansers appeared particularly sensitive to ferry noise in comparison to divers, but empirical data specifically linking marine bird response to noise disturbance, separate from other sources of disturbance (e.g. vessel movement or human presence), is limited and this source of disturbance on marine birds is not yet well understood.

The principal source of noise during construction would be subsea noise from piling works within the OAA associated with the installation of foundations for WTGs and offshore substation platforms; the maximum duration of piling within the OAA would be 290 days. Bird species diving under the water to forage for fish such as guillemots, razorbills, puffins and gannets, all of which were recorded within the OAA during baseline DAS, are most likely to be affected by underwater noise. Although it is thought that birds generally do not hear well under water (Dooling and Therrien, 2012), a recent study has shown that captive common guillemots are capable of hearing underwater noise (broadband sound burst stimulus signals and naval mid-frequency sonar signals) under controlled experimental conditions and can respond by momentarily stopping feeding activity or moving away from the noise source (Hansen *et al.*, 2020). Another recent study on cormorants (a diving bird species not recorded in the OAA) has suggested that this species can hear well underwater (Larsen *et al.*, 2020). However, diving birds and other seabird species will spend most of their time above or on the water surface, where hearing will detect sound propagated through the air. Due to the limited empirical evidence available showing the affect that noise disturbance alone has on wild marine birds, subsea and above water noise disturbance from construction activities is not considered in isolation as a risk factor for birds; but rather, combined with the presence of vessels, man-made structures, and human activity, part of the overall disturbance stimulus that causes birds to avoid boats and other structures.

#### 13.6.1.1.4 Cable landfall construction disturbance

The cable landfall location(s) are relatively small areas of rocky shore available only at low tide (below MHWS). The two shoreline areas are at the base of cliffs to the south. Thus, a limited suite of species were recorded at landfall areas, including curlew, dunlin, lapwing, oystercatcher, purple sandpiper, redshank, and ringed plover. All species were recorded in small numbers, well below any thresholds of regional or national significance (see Onshore EIA Report, chapter 11: Terrestrial ornithology). Disturbance from offshore vessels during cable installation is predicted to be short term (relative to the longevity of the species distributed), temporary (disturbance is only during cable installation) and reversible (once the works are complete the impact source will be removed). When combined with a small number of individuals, this disturbance effect is predicted of negligible magnitude.

#### 13.6.1.1.5 Evaluation of significance

Disturbance and displacement effects associated with artificial lighting, vessel movement and noise are assessed for the seven relevant bird species (kittiwake, Arctic tern, guillemot, razorbill, puffin, fulmar and gannet) in the direct disturbance and displacement assessment for the operation and maintenance stage (section 13.6.2.1). A medium sensitivity to disturbance and displacement and an impact of negligible magnitude has been concluded for all seven species for the operation and maintenance stage (refer to section 13.6.2.1 for details).

The maximum construction duration for the offshore Project would be four years with an additional year of pre-construction activities which would overlap with a maximum of five breeding seasons, five winter periods and up to

10 spring/autumn migration periods for birds. During the construction stage, any impacts resulting from disturbance and displacement from construction activities would be short-term, temporary and reversible in nature, lasting only for the duration of construction activity, with birds expected to return to the area once construction activities have ceased. Construction will not occur across the whole of the offshore Project simultaneously or every day but will be undertaken across the four year construction stage and the effects will occur only in the discrete areas where vessels are operating at any given point. As the operation and maintenance stage of the Project will take place at a much larger scale - both temporal (with an operational life of not more than 30 years) and spatial - than the construction stage, any disturbance and displacement effects generated during the earlier stage of the offshore Project are expected to be less than those generated during the operation and maintenance stage. At such a time as the WTGs (and other infrastructure) are installed onto foundations during the construction stage, the impact of displacement would increase incrementally to the same level as operational impacts. For these reasons, the magnitude of impact during construction is predicted to be negligible and the overall effect to species of medium sensitivity is considered to be negligible and not significant in EIA terms.

Evaluation of significance

Taking the medium sensitivity of kittiwakes, Arctic terns, guillemots, razorbills, puffins, fulmars and gannets and the negligible magnitude of impact, the overall effect to these breeding and non-breeding species is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |

Impact significance - NOT SIGNIFICANT

Disturbance from the cable installation at the landfall locations was assessed for the recorded non-breeding wader assemblage. A medium sensitivity (see Onshore EIA Report, chapter 11: Terrestrial ornithology) to disturbance and an impact of negligible magnitude has been concluded for all species for the operation and maintenance stage. The magnitude of impact during construction is predicted to be negligible and the overall effect to species of medium sensitivity is considered to be negligible and not significant in EIA terms.

Evaluation of significance

Taking the medium sensitivity of non-breeding wader assemblage and the negligible magnitude of impact, the overall effect to these breeding and non-breeding species is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |

Impact significance - NOT SIGNIFICANT

#### 13.6.1.2 Indirect effects as a result of disturbance and displacement of prey species

Indirect disturbance and displacement of birds may occur during the construction stage if there are impacts on prey species and the habitats of prey species. These indirect effects include those resulting from the production of underwater noise (e.g. during piling), temporary habitat loss and disturbance (e.g. during preparation of the seabed for foundations and cable installation) that may alter the behaviour or availability of bird prey species.

Underwater noise may cause fish and mobile invertebrates to avoid the construction area and also affect their physiology and behaviour. Temporary habitat loss and disturbance may cause fish and mobile invertebrates to avoid the construction area. These mechanisms may result in less prey being available within the construction area to foraging seabirds. Such potential effects on benthic invertebrates and fish have been assessed in chapter 10: Benthic subtidal and intertidal ecology and chapter 11: Fish and shellfish ecology and the conclusions of those assessments inform this assessment of indirect effects on IOFs.

With regard to changes to the seabed and to suspended sediment levels, chapter 10: Benthic subtidal and intertidal ecology discusses the nature of any change and impacts on the seabed and benthic habitats. The impact on benthic habitats is predicted to be of low of negligible magnitude with no significant impacts to any benthic reports. The consequent indirect impact for fish and shellfish ecology is considered to be minor and not significant, and this is also likely to be the case for species such as herring, sprat and sandeel which are the main prey items of seabirds such as gannet and auks. As outlined in chapter 11: Fish and shellfish ecology, sandeel and herring are potentially vulnerable to seabed disturbance as these species are demersal spawners with specific habitat requirements. However, considering the temporary, intermittent, and localised nature of this effect, it is considered to be a minor adverse impact. The majority of the OAA is not suitable as spawning habitat for herring. However, a majority of benthic sediment samples were suitable habitats for sandeel spawning (see chapter 11 Fish and shellfish ecology, section 11.4.4.2.1). The impact of increased suspended sediments during the construction stage on fish and shellfish ecology was scoped out of the EIA, as outlined in chapter 11: Fish and shellfish ecology, and therefore, any effect would be negligible. Therefore, with a minor impact (or below) on fish that are bird prey species, it is concluded that the indirect impact significance on seabirds occurring in or around the OAA during the construction stage is similarly a minor or negligible adverse impact.

With regard to noise impacts on fish, chapter 11 Fish and shellfish ecology discusses the potential impacts upon fish relevant to ornithology as prey species of the proposed Project. For species such as herring, sprat and sandeel, which are the main prey items of seabirds such as gannet and auks, underwater noise impacts (physical injury or behavioural changes) during construction are considered to be minor (see chapter 11: Fish and shellfish ecology) for herring and sprat (group 3, most sensitive species) and minor for sandeel (group 1, least sensitive species). With a minor impact on fish that are bird prey species, it is concluded that the indirect impact significance on seabirds occurring in or around the OAA during the construction stage is similarly a minor adverse impact.

Disturbance and displacement effects are associated with seven relevant bird species (kittiwake, Arctic tern, guillemot, razorbill, puffin, fulmar and gannet) in the direct disturbance and displacement assessment for the operation and maintenance stage (section 13.6.2.1). A medium sensitivity to disturbance and displacement has been concluded for all seven species for the operation and maintenance stage (refer to section 13.6.2.1 for details).

For these reasons, the magnitude of impact during construction is predicted to be low and the overall effect to species of medium sensitivity is considered to be minor and not significant in EIA terms.

Evaluation of significance

Taking the medium sensitivity of kittiwakes, Arctic terns, guillemots, razorbills, puffins, fulmars and gannets and the low magnitude of impact, the overall effect to these breeding and non-breeding species is considered to be minor and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Low | Minor |

Impact significance - NOT SIGNIFICANT

## 13.6.2 Potential effects during operation and maintenance

### 13.6.2.1 Direct distributional responses, displacement and barrier effects

The presence of WTGs and associated infrastructure and operational activities have the potential to directly disturb and displace birds from within and around the offshore Project. This is assessed as direct habitat loss as it has the potential to reduce the area available to birds for feeding, loafing and moulting, and may result in reduction in survival rates of displaced birds.

In addition, the presence of WTGs may cause a barrier effect to migrating birds and factors such as the lighting of WTGs could also attract certain species of birds. The causes of direct operational disturbance are discussed below.

#### 13.6.2.1.1 Presence of WTG and infrastructure in the OAA

The focus of this assessment is on the disturbance and displacement of birds within the OAA due to the presence and operation of WTGs, other offshore infrastructure and any maintenance operations associated with them. Following the installation of the offshore export cables (which is itself a slow moving and low noise emitting operation causing minimal disturbance), the required operation and maintenance activities in relation to the cables within the offshore ECC may have temporary and localised disturbance and displacement impacts on birds, but these effects are unlikely to result in detectable effects at either local or regional bird population levels and are considered to be of negligible magnitude. Therefore, no significant impact due to operation and maintenance activity within the offshore ECC is predicted.

Seabird species vary in their reactions to the presence of operational infrastructure (e.g. WTGs, offshore project substations and met masts) and to the maintenance activities that are associated with them (particularly ship and helicopter traffic, e.g. Garthe and Hüppop, 2004). While offshore windfarms have been present in the UK marine environment over the past 25 years, limited robust empirical evidence has been recorded about the disturbance and displacement effects of the operational infrastructure in the long term, although the number of available studies of post-construction monitoring is increasing (e.g. JNCC 2015, Dierschke *et al.*, 2016; Vallejo *et al.*, 2017; MMO 2018;

MacArthur Green, 2019; Krijgsveld *et al.*, 2011; Fox & Petersen, 2006). Dierschke *et al.* (2016) reviewed evidence from 20 operational offshore windfarms in European waters. They found strong avoidance by divers, gannet, great crested grebe, and fulmar; less consistent displacement by razorbill, guillemot, little gull and sandwich tern; no evidence of any consistent response by kittiwake, common tern and Arctic tern, evidence of weak attraction to operating offshore windfarms for common gull, black-headed gull, great black-backed gull, herring gull, lesser black-backed gull and red-breasted merganser, and strong attraction for shags and cormorants. Dierschke *et al.* (2016) suggested that species with strong avoidance would lead to some habitat loss for those species, while attracted birds (shags and cormorants) appear to benefit from increases in food abundance within operational offshore windfarms. Thaxter *et al.* (2018) found no evidence of macro-avoidance (windfarm scale) of offshore windfarms by lesser black-backed gulls, but also found that this species has a potential meso-scale (within windfarm-scale) avoidance of WTGs, at least during daylight hours. Low numbers of most large gull species (lesser black-backed gull and herring gull) were recorded during baseline DAS (refer to SS12: Offshore ornithology technical supporting study, Annex 12.11), but moderate numbers of great black-backed gulls were recorded within the OAA and this species has been included in the operational collision risk assessment (section 13.6.2.3.2).

There is no empirical evidence that birds which are displaced from offshore windfarms, or exposed to barrier effects, have increased mortality. Any mortality due to displacement would most likely be a result of increased densities of foraging birds in locations outside the affected area, resulting in increased competition for food. This would be unlikely for seabirds that have large areas of alternative habitat available but would be more likely to affect seabirds with highly specialised habitat requirements (such as divers and scoters) that are limited in availability to inshore marine waters (Furness and Wade, 2012; Bradbury *et al.*, 2017). Impacts of displacement are also likely to be dependent on other environmental factors such as food supply and are expected to be greater in years of low prey availability (e.g. as could result from unsustainably high fisheries pressures or effects of climatic changes on fish populations). Furthermore, modelling of the consequences of displacement for fitness of displaced birds suggests that even in the case of breeding seabirds that are displaced on a daily basis, there is likely to be little or no impact on survival unless the offshore windfarm is close to the breeding colony (Searle *et al.*, 2014, 2017).

Birds are considered to be most at risk from operational disturbance and displacement effects when they are resident in an area, for example during the breeding or wintering season, as opposed to passage or migratory seasons. Birds that are resident in an area may regularly encounter and be displaced by an offshore windfarm for example during daily commuting trips to foraging areas from nest sites, whereas birds on passage may encounter (and potentially be displaced from) a particular offshore windfarm only once during a given migration journey. As migrating birds will be present in the OAA for a short time and the potential zone of construction displacement will be comparatively small, it has been assumed that there are negligible risks of impact at these times of year. Consequently, the following assessment focuses on the breeding and non-breeding periods following NatureScot 2023 guidance.

#### 13.6.2.1.2 Barrier effects

The small risk of impact to migrating birds resulting from flying around rather than through, the WTG array of an offshore windfarm is considered a potential barrier effect.

This assessment on direct disturbance and displacement effects for the operation and maintenance stage is based on the SNCB (2022) Advice Note which in turn is based on the work of Furness *et al.* (2013) and Bradbury *et al.* (2017). Displacement is defined as '*a reduced number of birds occurring within or immediately adjacent to an offshore windfarm*' (Furness *et al.*, 2013) and involves birds present in the air and on the water (SNCB, 2022). Birds that do not intend to utilise a windfarm area but would have previously flown through the area on the way to a feeding, resting or nesting area, and which either stop short or detour around a development, are subject to barrier effects (SNCB, 2022). For the purposes of assessment of displacement for resident birds, it is usually not possible to distinguish between displacement and barrier effects - for example to define where individual birds may have intended to travel to, or beyond an offshore windfarm, even when tracking data are available. Therefore, in this assessment the effects of displacement and barrier effects on the key resident species are considered together.

Masden *et al.* (2010, 2012) and Speakman *et al.* (2009) calculated that the costs of one-off avoidances during migration were small, accounting for less than 2% of available fat reserves. A recent tracking study on guillemots and razorbills (Buckingham *et al.*, 2022) found that some birds make hitherto unknown lengthy moult migrations (round trips of up to 4,000 km), which suggests that flying a few extra kilometres around an offshore windfarm is very unlikely to reduce their body condition enough to increase their risk of death. Therefore, the impacts on birds that only migrate seasonally through the region (including seabirds, waders and waterbirds on passage) are considered negligible.

#### 13.6.2.1.3 Artificial light disturbance

During operation, the WTGs and OSPs will have lights for air safety and shipping navigational safety, in addition, there would also be other navigational lighting for personnel working at night. These artificial light sources may be a source of attraction (phototaxis), or displacement for birds and may increase the risk of collision for some species - as has been documented for some onshore structures with artificial lights near seabird colonies (see Furness, 2018 for a review). Phototaxis can be a serious hazard for fledglings of burrow-nesting seabirds and for migrating adult birds at times of poor visibility, species particularly affected by phototaxis include shearwaters and storm-petrels and both Manx shearwaters and European storm-petrels were recorded, albeit very infrequently, within the offshore Project study area (refer to section 13.6.1.1.1).

For the offshore Project, air safety lights capable of displaying both a steady and flashing green signal will be placed as close as possible to the top of the WTG structures as well as on WTGs at the periphery of the OAA. Navigational flashing yellow lights for shipping will be placed on some lower on WTG structures and other offshore structures at selected peripheral locations, these lights would be visible to the mariner from all directions in the horizontal plane up to a distance of five nautical miles (9.26 km). Lighting on WTGs is orders of magnitude lower light intensities than artificial light used by ports, towns, lighthouses, oil and gas platforms or ships (Furness, 2018). Furthermore, lighting for personnel working at night will not be as bright as air and shipping navigational safety lighting.

A review by Furness (2018) of the potential effects of operational lighting on birds considered eight categories of potential effect on birds: disruption of photoperiod physiology; extension of daytime activity; phototaxis of seabirds; phototaxis of nocturnal migrant birds; ability of birds to use artificial light to feed at night or to feed on prey aggregating under artificial lights; increased predation risk for nocturnal migrant birds; birds better able to avoid collision when structures are illuminated; displacement of birds due to avoidance of artificial lights. The available evidence suggests that lights on offshore WTGs in European shelf seas are extremely unlikely to have any detectable effect on birds as a consequence of any of the processes listed above. The effects of operational lighting are therefore not assessed separately.

As discussed for construction displacement effects (section 13.6.1.1.1), the closest seabird colony to the offshore Project is Sule Skerry and Sule Stack SPA (approximately 5 km to the offshore Project[17], refer to Offshore RIAA) which is designated for breeding seabirds, including some species of burrow nesting species: European storm-petrel, Leach's storm and puffin. However, although navigational lights from the offshore Project would be visible on Sule Skerry and Sule Stack SPA, attraction of fledglings towards artificial light is thought to occur only over short distances (hundreds of metres), particularly in response to steady bright white light (Furness, 2018). Given the relatively large distance between the offshore Project and Sule Skerry and Sule Stack as well as the type of artificial light to be deployed on offshore infrastructure (i.e. flashing coloured lights, not steady intense white lights) it is considered that the risk of phototaxis to birds is negligible. There are no records of phototaxis of nocturnal migrating birds towards navigation lights and although young birds may show phototaxis over short distances during fledging, there seems to be little or no attraction of older birds to lights except when they are exposed to intense white lighting such as from lighthouses. As the lighting on WTGs is orders of magnitude lower than light used for other offshore structures (e.g. lighthouses, oil and gas platforms or ships), phototaxis of migrating birds towards operational windfarms is considered a negligible risk.

#### 13.6.2.1.4 Key species

The methodology presented in the SNCB Advice Note (SNCB, 2022) recommends a matrix is presented for each key species showing bird losses at differing rates of displacement and mortality. This assessment uses the range of predicted losses to quantify the level of displacement and the potential losses as a consequence of the Project. These losses are then placed in the context of the relevant breeding and non-breeding population (Table 13-8) to determine the magnitude of effect. The priority species for assessment of displacement effects considered by SNCB (2022) guidance are diver and sea duck species, guillemot, razorbill, puffin and gannet.

In order to focus the assessment of operational disturbance and displacement a screening exercise was undertaken to identify those species most likely to be at risk, the results of the screening exercise are presented in Table 3-1 in the SS12: Offshore ornithology technical supporting study. Species screened into the disturbance and displacement assessment were recorded regularly during baseline characterisation DAS (SS12: Offshore ornithology technical supporting study), had a medium or high 'Disturbance Sensitivity' and 'Habitat Specialisation' score (SNCB, 2022) and were known to be present in the wider area surrounding the offshore Project (e.g. Waggitt *et al.*, 2020; Orkney Islands Council, 2020; Wakefield *et al.*, 2017; Cleasby *et al.*, 2018; Stone *et al.*, 1995). NatureScot advised (letter dated 5th April 2023) that a displacement assessment was not required for great skua and European storm petrel.

From the screening assessment, seven species were identified as at potential risk of disturbance and displacement; kittiwake, Arctic tern, guillemot, razorbill, puffin, fulmar and gannet. Following the matrix approach (SNCB, 2022), the mean seasonal peak abundance estimates for each of the seven species within the OAA plus a 2 km buffer (Table 13-7) were placed into individual matrices. Consultees provided advice on the most likely range of displacement and mortality rates to use in each matrix for kittiwake, Arctic tern, guillemot, razorbill, puffin, fulmar and gannet (Table 13-4). The displacement/mortality ranges used in this assessment are presented in the small matrices for each species below, the full matrix ranges are presented in the SS12: Offshore ornithology technical supporting study, Annex 12.3.

[17] *Distance from the OAA to the colony. The distance from the OAA to the SPA marine boundary is 1.7 km.*

The *Alternative Approach* recommended in NatureScot Guidance Note 8[18] is provided in SS12: Offshore ornithology technical supporting study, Annex 12.13.

#### 13.6.2.1.5 Kittiwake

Kittiwakes are assessed to have a medium sensitivity to disturbance and displacement.

Although kittiwakes have a low disturbance susceptibility and habitat specialisation score (SNCB, 2022; Furness *et al.*, 2013; Bradbury *et al.*, 2017), this species is assessed to have a medium conservation value. The mean maximum foraging range (+1SD) for kittiwake is 300.6 km (Table 13-8; Woodward *et al.*, 2019) which places the OAA within theoretical potential foraging range of 25 SPA kittiwake breeding colonies (refer to Offshore RIAA), although other non-SPA populations are also likely to contribute to individuals at risk. This theoretical connectivity between the offshore Project is based only on the mean maximum foraging range plus one SD for kittiwake as recommended by NatureScot (2023) guidance and represents a worst case scenario for connectivity.

**Breeding season**

Table 13-20 presents displacement mortality for kittiwake for a range of displacement rates (20-40%) and mortality rates (1-3%), the shaded central value was used for the assessment. These ranges incorporate the displacement rate of 30% and mortality rates ranging between 1 and 3% as advised by consultees (Table 13-4) and in line with NatureScot guidance (NatureScot, 2023).

During the breeding season, from an estimated mean seasonal peak abundance of 690 individuals (Table 13-7), the estimated number of kittiwakes of all ages subject to mortality due to displacement from the OAA is 4.1 individuals (30% displacement/2% mortality, Table 13-20). The estimated number of adults minus sabbatical birds (Table 13-9) subject to mortality due to displacement from the OAA is 2.4 individuals. ***The estimated mortality using the NatureScot Alternative Approach is presented in Annex 12.13, Table 1-15.***

*Table 13-20 Displacement/mortality matrix for kittiwake (number of individuals killed) during the breeding season. Shaded value was used for the assessment*

| | | DISPLACEMENT | | |
|---|---|---|---|---|
| | | 20% | 30% | 40% |
| MORTALITY | 1% | 1.4 | 2.1 | 2.8 |
| | 2% | 2.8 | 4.1 | 5.5 |
| | 3% | 4.1 | 6.2 | 8.3 |

[18] *https://www.nature.scot/doc/guidance-note-8-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing*

The regional breeding population for kittiwake was estimated as 128,164 pairs (256,327 individuals, Table 13-8). At the average baseline mortality rate for kittiwake of 0.146 (Table 13-9) the number of individuals expected to die during the breeding season is 37,424 (256,327 x 0.146). The addition of a maximum of 2.4 adults predicted to potentially die from operation and maintenance disturbance and displacement would increase the baseline mortality by 0.0009%. This magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*The predicted change in adult survival for the Alternative Approach is provided in Annex 12.13, Table 2-1.*

Evaluation of significance

Taking the medium sensitivity of kittiwakes and the negligible magnitude of impact, the overall effect to breeding kittiwakes is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |

Impact significance - NOT SIGNIFICANT

**Non-breeding season**

Displacement mortality for kittiwake for a range of displacement rates (20-40%) and mortality rates (1-3%) is presented in Table 13-21, the shaded central value was used for the assessment. These ranges incorporate the displacement rate of 30% and mortality rates ranging between 1 and 3% as advised by consultees (Table 13-4) and in line with NatureScot guidance (NatureScot, 2023).

During the non-breeding season, from an estimated mean seasonal peak abundance of 1,217 individuals (Table 13-7), the estimated number of kittiwakes of all ages subject to mortality due to displacement from the OAA is 7.3 individuals (30% displacement/2% mortality, Table 13-21). The estimated number of adult birds (Table 13-9) subject to mortality due to displacement from the OAA is 5.0 individuals. *The estimated mortality using the NatureScot Alternative Approach is presented in Annex 12.13, Table 1-16.*

*Table 13-21 Displacement/mortality matrix for kittiwake (number of individuals killed) during the non-breeding season. Shaded value is used for the assessment*

| | | DISPLACEMENT | | |
|---|---|---|---|---|
| | | 20% | 30% | 40% |
| MORTALITY | 1% | 2.4 | 3.7 | 4.9 |
| | 2% | 4.9 | 7.3 | 9.7 |
| | 3% | 7.3 | 11.0 | 14.6 |

The smallest non-breeding BDMPS for kittiwake (spring migration West coast region) is 375,711 (Table 13-8). At the average baseline mortality rate for kittiwake of 0.146 (Table 13-9) the number of individuals expected to die during the non-breeding season is 54,854 (375,711 x 0.146). The addition of a maximum of 5.0 adults predicted to potentially die from operation and maintenance disturbance and displacement would increase the mortality by 0.0013%. This magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*The predicted change in adult survival for the Alternative Approach is provided in Annex 12.13, Table 2-1.*

Evaluation of significance

Taking the medium sensitivity of kittiwakes and the negligible magnitude of impact, the overall effect to non-breeding kittiwakes is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |

Impact significance - NOT SIGNIFICANT

#### 13.6.2.1.6 Arctic tern

Arctic terns are assessed to have a medium sensitivity to disturbance and displacement based on their disturbance susceptibility and habitat specialisation (SNCB, 2022; Furness *et al.*, 2013; Bradbury *et al.*, 2017).

Arctic terns are assessed to have a low conservation value. The mean maximum foraging range (+1SD) for Arctic tern is 40.5 km (Table 13-8; Woodward *et al.*, 2019) which places the OAA beyond potential foraging range of SPA Arctic tern breeding colonies (refer to Offshore RIAA), although other non-SPA populations may contribute to individuals at risk.

The displacement assessment is based on the breeding season for Arctic tern as this species was only recorded during the breeding season within the study area during baseline DAS (refer to the SS12: Offshore ornithology technical supporting study).

**Breeding season**

Displacement mortality for Arctic tern for a range of displacement rates (30-50%) and a mortality rate of 3% is presented in Table 13-22, the shaded central value was used for the assessment. These rates were advised by NatureScot (letter dated 5th April 2023).

During the breeding season, from an estimated mean seasonal peak abundance of 89 individuals (Table 13-7), the estimated number of Arctic terns of all ages subject to mortality due to displacement from the OAA is 1.1 individual (40% displacement/3% mortality, Table 13-22). The estimated number of adults minus sabbatical birds (Table 13-9) subject to mortality due to displacement from the OAA is less than one (0.8) individual. *The estimated mortality using the NatureScot Alternative Approach is presented in Annex 12.13, Table 1-17.*

*Table 13-22 Displacement/mortality matrix for Arctic tern (number of individuals killed) during the breeding season. Shaded value is used for the assessment*

| | | DISPLACEMENT | | |
|---|---|---|---|---|
| | | 30% | 40% | 50% |
| MORTALITY | 3% | 0.7 | 1.1 | 1.4 |

The regional breeding population for Arctic tern is 1,724 individuals (Table 13-8). At the average baseline mortality rate for Arctic tern of 0.163 (Table 13-9) the number of individuals expected to die during the breeding season is 281 (1,724 x 0.163). The addition of less than one individual predicted to potentially die from operation and maintenance disturbance and displacement would increase the mortality rate by 0.0480%. This magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*The predicted change in adult survival for the Alternative Approach is provided in Annex. 12.13, Table 2-1.*

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for breeding Arctic tern for combined effects of displacement and collision risk (Table 13-36).

Evaluation of significance

Taking the medium sensitivity of Arctic terns and the negligible magnitude of impact, the overall effect to breeding Arctic terns is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |

Impact significance - NOT SIGNIFICANT

#### 13.6.2.1.7 Guillemot

Guillemots were regularly recorded within the OAA and 2 km buffer in all calendar months (SS12: Offshore ornithology technical supporting study. Mean abundance estimates were generally higher during the breeding season (February to August) compared with the non-breeding season (September to January). Within the OAA + 2 km buffer, the estimated peak mean density for all guillemots (including apportioned guillemots from unidentified auk groups as well as accounting for availability bias), was 4,861 individuals in July and during the non-breeding season, 4,275 individuals in September (Table 13-7), both peaks are likely associated with birds dispersing away from colonies out to sea.

Guillemots are assessed to have a medium sensitivity to disturbance and displacement based on their disturbance susceptibility and habitat specialisation (SNCB, 2022; Furness *et al.*, 2013; Bradbury *et al.*, 2017). Dierschke *et al.* (2016) categorized guillemot as 'weakly avoiding offshore windfarms' based on a review of numbers inside and outside of operational offshore windfarms; their behavioural response to construction is likely to be similar and probably slightly stronger than during operation. Common guillemots were displaced at Blighbank (Vanermen *et al.*, 2012, 2014) and only in a minority of surveys at two Dutch windfarms (OWEZ and PAWP; Leopold *et al.*, 2011; Krijgsveld *et al.*, 2011), but were not significantly displaced at Horns Rev (although the data suggest that slight displacement was probably occurring; Petersen *et al.*, 2006) or Thornton Bank (Vanermen *et al.*, 2012).

Guillemots are assessed to have a medium conservation value. The mean maximum foraging range (+1SD) for guillemot (including Fair Isle foraging ranges, refer to section 13.4.4.5.4) is 153.7 km (Table 13-8; Woodward *et al.*, 2019) which places the OAA within the potential foraging range of 14 SPA guillemot breeding colonies (refer to Offshore RIAA), although other non-SPA populations are also likely to contribute to individuals at risk. This theoretical connectivity between the offshore Project is based only on the mean maximum foraging range for guillemot as recommended by NatureScot (2023) guidance and represents a worst case scenario for connectivity.

**Breeding season**

Displacement mortality for guillemot for a range of displacement rates (50-70%) and mortality rates (3-5%) is presented in Table 13-23, the shaded central value was used for the assessment. These ranges incorporate the displacement rate of 60% and mortality rates ranging between 3-5% as advised by consultees (Table 13-4) and in line with NatureScot guidance (NatureScot, 2023).

During the breeding season, from an estimated mean seasonal peak abundance of 4,861 individuals (Table 13-7), the estimated number of guillemots of all ages subject to mortality due to displacement from the OAA is 116.7 individuals (60% displacement/4% mortality, Table 13-23). The estimated number of adults minus sabbatical birds (Table 13-9) subject to mortality due to displacement from the OAA is 71.1 individuals. ***The estimated mortality using the NatureScot Alternative Approach is presented in Annex 12.13, Table 1-18.***

*Table 13-23 Displacement/mortality matrix for guillemot (number of individuals killed) during the breeding season. Shaded value is used for the assessment*

| | | DISPLACEMENT | | |
|---|---|---|---|---|
| | | 50% | 60% | 70% |
| MORTALITY | 3% | 72.9 | 87.5 | 102.1 |
| | 4% | 97.2 | 116.7 | 136.1 |
| | 5% | 121.5 | 145.8 | 170.1 |

The regional breeding population for guillemot is 612,608 individuals (Table 13-8). At the average baseline mortality rate for guillemot of 0.0600 (Table 13-9) the number of individuals expected to die during the breeding season is 36,756 (612,608 x 0.0600). The addition of a maximum of 73.8 adults predicted to potentially die from operation and maintenance disturbance and displacement would increase the mortality rate by 0.0120%. This magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*The predicted change in adult survival for the Alternative Approach is provided in Annex. 12.13, Table 2-1.*

Evaluation of significance

Taking the medium sensitivity of guillemots and the negligible magnitude of impact, the overall effect to breeding guillemots is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

**Non-breeding season**

Displacement mortality for guillemot for a range of displacement rates (50-70%) and mortality rates (1-3%) is presented in Table 13-24, the shaded central value was used for the assessment. These ranges incorporate the displacement rate of 60% and mortality rates ranging between 1 and 3% as advised by consultees (Table 13-4) and in line with NatureScot guidance (NatureScot, 2023).

During the non-breeding season, from an estimated mean seasonal peak abundance of 4,275 individuals (Table 13-7), the estimated number of guillemots of all ages subject to mortality due to displacement from the OAA is 51.3 individuals (60% displacement/2% mortality, Table 13-24). The estimated number of adults (Table 13-9) subject to mortality due to displacement from the OAA is 34.9 individuals. *The estimated mortality using the NatureScot Alternative Approach is presented in Annex 12.13, Table 1-19.*

*Table 13-24 Displacement/mortality matrix for guillemot (number of individuals killed) during the non-breeding season. Shaded value is used for the assessment*

| | | DISPLACEMENT | | |
|---|---|---|---|---|
| | | 50% | 60% | 70% |
| MORTALITY | 1% | 21.4 | 25.7 | 29.9 |
| | 2% | 42.8 | 51.3 | 59.9 |
| | 3% | 64.1 | 77.0 | 89.8 |

As advised by NatureScot in their guidance and scoping advice (refer to section 13.3), the regional breeding population for guillemot of 612,608 individuals was used for the non-breeding season assessment (Table 13-8). At the average baseline mortality rate for guillemot of 0.06 (Table 13-9) the number of individuals expected to die during the non-breeding season is 36,756 (612,608 x 0.06). The addition of a maximum of 34.9 adults predicted to potentially die from operation and maintenance disturbance and displacement would increase the mortality rate by 0.0057%.

This magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*The predicted change in adult survival for the Alternative Approach is provided in Annex. 12.13, Table 2-1.*

Evaluation of significance

Taking the medium sensitivity of guillemots and the negligible magnitude of impact, the overall effect to non-breeding guillemots is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |

Impact significance - NOT SIGNIFICANT

#### 13.6.2.1.8 Razorbill

Razorbills were regularly recorded within the OAA and 2 km buffer in all calendar months except January (refer to the SS12: Offshore ornithology technical supporting study). Mean abundance estimates were generally higher during the breeding season (March to August) compared with the non-breeding season (September to February). Within the OAA + 2 km buffer, the estimated peak mean abundance for all razorbills (including apportioned razorbills from unidentified auk groups as well as accounting for availability bias), was 69.8 individuals in April when birds were likely returning to breeding colonies after the winter and 143.9 individuals in September (Table 13-7) when razorbills were likely dispersing away from colonies out to sea.

Razorbills are assessed to have a medium sensitivity to disturbance and displacement based on their disturbance susceptibility and habitat specialisation (SNCB, 2022; Furness *et al.*, 2013; Bradbury *et al.*, 2017). Dierschke *et al.* (2016) categorized razorbill as 'weakly avoiding offshore windfarms' based on a review of numbers inside and outside of operational offshore windfarms; their behavioural response to construction is likely to be similar and probably slightly stronger than during operation. Razorbills were displaced in one out of six surveys at two Dutch windfarms (OWEZ and PAWP; Leopold *et al.*, 2011; Krijgsveld *et al.*, 2011), but not at Horns Rev (Petersen *et al.*, 2006) or Thornton Bank (Vanermen *et al.*, 2012). At Blighbank, razorbills were found to be significantly displaced when considering the windfarm area and a buffer of 0.5 km, but not when considering the windfarm area and a 3 km buffer, or the buffer alone (0.5-3 km from the windfarm; Vanermen *et al.*, 2014).

Razorbills are assessed to have a medium conservation value. The mean maximum foraging range (+1SD) for razorbill (including Fair Isle foraging ranges) is 164.6 km (Table 13-8; Woodward *et al.*, 2019) which places the OAA within the potential foraging range of 11 SPA razorbill breeding colonies (refer to Offshore RIAA), although other non-SPA populations are also likely to contribute to individuals at risk. This theoretical connectivity between the offshore Project is based only on the mean maximum foraging range for razorbill as recommended by NatureScot (2023) guidance and represents a worst case scenario for connectivity.

### Breeding season

Displacement mortality for razorbill for a range of displacement rates (50-70%) and mortality rates (3-5%) is presented in Table 13-25, the shaded central value was used for the assessment. These ranges incorporate the displacement rate of 60% and mortality rates ranging between 3-5% as advised by consultees (Table 13-4) and in line with NatureScot guidance (NatureScot, 2023).

During the breeding season, from an estimated mean seasonal peak abundance of 69.8 individuals (Table 13-7), the estimated number of razorbills of all ages subject to mortality due to displacement from the OAA is 1.7 individuals (60% displacement/4% mortality, Table 13-25). The estimated number of adults minus sabbatical birds (Table 13-9) subject to mortality due to displacement from the OAA is 1.1 individuals. *The estimated mortality using the NatureScot Alternative Approach is presented in Annex 12.13, Table 1-20.*

*Table 13-25 Displacement/mortality matrix for razorbill (number of individuals killed) during the breeding season. Shaded value is used for the assessment*

| | | DISPLACEMENT | | |
|---|---|---|---|---|
| | | 50% | 60% | 70% |
| MORTALITY | 3% | 1.0 | 1.3 | 1.5 |
| | 4% | 1.4 | 1.7 | 2.0 |
| | 5% | 1.7 | 2.1 | 2.4 |

The regional breeding population for razorbill is 95,725 individuals (Table 13-8). At the average baseline mortality rate for razorbill of 0.105 (Table 13-9) the number of individuals expected to die during the breeding season is 10,051 (95,725 x 0.105). The addition of 1.1 adults predicted to potentially die from operation and maintenance disturbance and displacement would increase the mortality rate by 0.0012%. This magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*The predicted change in adult survival for the Alternative Approach is provided in Annex 12.13, Table 2-1.*

Evaluation of significance

Taking the medium sensitivity of razorbills and the negligible magnitude of impact, the overall effect to breeding razorbills is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

### Non-breeding season

Displacement mortality for razorbill for a range of displacement rates (50-70%) and mortality rates (1-3%) is presented in Table 13-26, the shaded central value was used for the assessment. These ranges incorporate the displacement rate of 60% and mortality rates ranging between 1 and 3% as advised by consultees (Table 13-4) and in line with NatureScot guidance (NatureScot, 2023).

During the non-breeding season, from an estimated mean seasonal peak abundance of 143.9 individuals (Table 13-7), the estimated number of razorbills subject to mortality due to displacement from the OAA is less than two (1.7) individuals (60% displacement/2% mortality, Table 13-26). The estimated number of adults (Table 13-9) subject to mortality due to displacement from the OAA is 1.2 individuals. *The estimated mortality using the NatureScot Alternative Approach is presented in Annex 12.13, Table 1-21.*

*Table 13-26 Displacement/mortality matrix for razorbill (number of individuals killed) during the non-breeding season. Shaded value is used for the assessment*

| | | DISPLACEMENT | | |
|---|---|---|---|---|
| | | 50% | 60% | 70% |
| MORTALITY | 1% | 0.7 | 0.9 | 1.0 |
| | 2% | 1.4 | 1.7 | 2.0 |
| | 3% | 2.2 | 2.6 | 3.0 |

The smallest non-breeding BDMPS for razorbill (winter east coast region) is 106,183 individuals (Table 13-8). At the average baseline mortality rate for razorbill of 0.105 (Table 13-9) the number of individuals expected to die during the non-breeding season is 11,149 (106,183 x 0.105). The addition of a maximum of 1.2 adult predicted to potentially die from operation and maintenance disturbance and displacement would increase the mortality rate by 0.0012%. This magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*The predicted change in adult survival for the Alternative Approach is provided in Annex 12.13, Table 2-1.*

Evaluation of significance

Taking the medium sensitivity of razorbills and the negligible magnitude of impact, the overall effect to non-breeding razorbills is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

#### 13.6.2.1.9 Puffin

Puffins were regularly recorded within the OAA and 2 km buffer in all calendar months except March and November (refer to the SS12: Offshore ornithology technical supporting study). Mean abundance estimates were higher during the breeding season (Mid-March to August) compared with the non-breeding season (September to mid-March). Within the OAA + 2 km buffer, the estimated peak mean abundance for puffins, was 5,271.9 individuals in June and 2663.4 individuals in August during the non-breeding (Table 13-7), both peaks are likely associated with birds dispersing away from colonies out to sea.

Puffins are assessed to have a medium sensitivity to disturbance and displacement based on their disturbance susceptibility and habitat specialisation (SNCB, 2022; Furness *et al.*, 2013; Bradbury *et al.*, 2017).

Puffins are assessed to have a medium conservation value. The mean maximum foraging range (+1SD) for puffin is 265.4 km (Table 13-8; Woodward *et al.*, 2019) which places the OAA within the potential foraging range of 13 SPA puffin breeding colonies (refer to Offshore RIAA), although other non-SPA populations are also likely to contribute to individuals at risk. This theoretical connectivity between the offshore Project is based only on the mean maximum foraging range for puffin as recommended by NatureScot (2023) guidance and represents a worst case scenario for connectivity.

**Breeding season**

Displacement mortality for puffin for a range of displacement rates (50-70%) and mortality rates (3-5%) is presented in Table 13-27, the shaded central value was used for the assessment. These ranges incorporate the displacement rate of 60% and mortality rates ranging between 3-5% as advised by consultees (Table 13-4) and in line with NatureScot guidance (NatureScot, 2023).

During the breeding season, from an estimated mean seasonal peak abundance of 5,272 individuals (Table 13-7), the estimated number of puffins of all ages subject to mortality due to displacement from the OAA is 126.5 individuals (60% displacement/4% mortality, Table 13-27). The estimated number of adults minus sabbatical birds (Table 13-9) subject to mortality due to displacement from the OAA is 85.9 individuals. ***The estimated mortality using the NatureScot Alternative Approach is presented in Annex 12.13, Table 1-22.***

*Table 13-27 Displacement/mortality matrix for puffin (number of individuals killed) during the breeding season. Shaded value is used for the assessment*

| | | DISPLACEMENT | | |
|---|---|---|---|---|
| | | 50% | 60% | 70% |
| MORTALITY | 3% | 79.1 | 94.9 | 110.7 |
| | 4% | 105.4 | 126.5 | 147.6 |
| | 5% | 131.8 | 158.2 | 184.5 |

The regional breeding population for puffin is 333,421 individuals (Table 13-8). At the average baseline mortality rate for puffin of 0.093 (Table 13-9) the number of individuals expected to die during the breeding season is 31,008 (333,421 x 0.093). The addition of a maximum of 85.9 adults predicted to potentially die from operation and maintenance disturbance and displacement would increase the mortality rate by 0.0258%.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for breeding puffin (Table 13-28). With an additional mortality of 85.9 adults the model predicts over 35 years a reduction in growth rate by 0.02% (CGR = 0.9998; Table 13-28) and a reduction in population size by 0.79% (CPS = 0.9921; Table 13-28).

This magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*Table 13-28 Projected PVA metrics after 35 years for puffin in the breeding season for the Project alone. (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| PUFFIN – BREEDING SEASON | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I=50%%U |
| 0.9998 | 0.9998 | 0.0002 | 0.9993 | 1.0003 | 0.9921 | 0.9923 | 0.0084 | 0.9755 | 1.0093 | 49.4 | 50.5 |

*The predicted change in adult survival for the Alternative Approach is provided in Annex. 12.13, Table 2-1.*

Evaluation of significance

Taking the medium sensitivity of puffins and the negligible magnitude of impact, the overall effect to breeding puffins is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

### Non-breeding season

Displacement mortality for puffin for a range of displacement rates (50-70%) and mortality rates (1-3%) is presented in Table 13-29, the shaded central value was used for the assessment. These ranges incorporate the displacement rate of 60% and mortality rates ranging between 1 and 3% as advised by consultees (Table 13-4) and in line with NatureScot guidance (NatureScot, 2023).

During the non-breeding season, from an estimated mean seasonal peak abundance of 2,663 individuals (Table 13-7), the estimated number of puffins of all ages subject to mortality due to displacement from the OAA is 32 individuals (60% displacement/2% mortality, Table 13-29). The estimated number of adults (Table 13-9) subject to mortality due to displacement from the OAA is 23.3 individuals. *The estimated mortality using the NatureScot Alternative Approach is presented in Annex 2.13, Table 1-23.*

*Table 13-29 Displacement/mortality matrix for puffin (number of individuals killed) during the non-breeding season. Shaded value is used for the assessment*

| | | DISPLACEMENT | | |
|---|---|---|---|---|
| | | 50% | 60% | 70% |
| MORTALITY | 1% | 13 | 16 | 19 |
| | 2% | 27 | 32 | 37 |
| | 3% | 40 | 48 | 56 |

The smallest non-breeding BDMPS for puffin (winter East coast region) is 199,974 individuals (Table 13-8). At the average baseline mortality rate for puffin of 0.093 (Table 13-9) the number of individuals expected to die during the non-breeding season is 18,598 (199,974 x 0.093). The addition of a maximum of 23.3 adults predicted to potentially die from operation and maintenance disturbance and displacement would increase the mortality rate by 0.0093%. This magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*The predicted change in adult survival for the Alternative Approach is provided in Annex. 12.13, Table 2-1.*

Evaluation of significance

Taking the medium sensitivity of puffins and the negligible magnitude of impact, the overall effect to non-breeding puffins is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

### 13.6.2.1.10 Fulmar

Fulmar are assessed to have a medium sensitivity to disturbance and displacement.

Although fulmar have a low disturbance susceptibility and habitat specialisation score (SNCB, 2022; Furness *et al.*, 2013; Bradbury *et al.*, 2017), this species is assessed to have a medium conservation value. The mean maximum foraging range (+1SD) for fulmar is 1,200.2 km (Table 13-8; Woodward *et al.*, 2019) which places the OAA within the potential foraging range of 23 SPA fulmar breeding colonies (refer to Offshore RIAA), although other non-SPA populations are also likely to contribute to individuals at risk. This theoretical connectivity between the offshore Project is based only on the mean maximum foraging range for fulmar as recommended by NatureScot (2023) guidance and represents a worst case scenario for connectivity.

#### Breeding season

Displacement mortality for fulmar for a range of displacement rates (10-30%) and mortality rates (1-3%) as advised by consultees (Table 13-4), and in line with NatureScot guidance (2023) is presented in Table 13-30, the shaded central value was used for the assessment.

During the breeding season, from an estimated mean seasonal peak abundance of 1,918 individuals (Table 13-7), the estimated number of fulmars of all ages subject to mortality due to displacement from the OAA is 7.7 individuals (20% displacement/2% mortality, Table 13-30). The estimated number of adults minus sabbatical birds (Table 13-9) subject to mortality due to displacement from the OAA is 4.2 individuals. *The estimated mortality using the NatureScot Alternative Approach is presented in Annex 12.13, Table 1-24.*

*Table 13-30 Displacement/mortality matrix for fulmar (number of individuals killed) during the breeding season. Shaded value is used for the assessment*

| | | DISPLACEMENT | | |
|---|---|---|---|---|
| | | 10% | 20% | 30% |
| MORTALITY | 1% | 1.9 | 3.8 | 5.8 |
| | 2% | 3.8 | 7.7 | 11.5 |
| | 3% | 5.8 | 11.5 | 17.3 |

The regional breeding population for fulmar is 647,236 individuals (Table 13-8). At the average baseline mortality rate for fulmar of 0.064 (Table 13-9) the number of individuals expected to die during the breeding season is 41,423 (647,236 x 0.064). The addition of a maximum of 4.2 adults predicted to potentially die from operation and maintenance disturbance and displacement would increase the mortality rate by 0.0007%. This magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*The predicted change in adult survival for the Alternative Approach is provided in Annex 12.13, Table 2-1.*

Evaluation of significance

Taking the medium sensitivity of fulmars and the negligible magnitude of impact, the overall effect to breeding fulmars is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

**Non-breeding season**

Displacement mortality for fulmar for a range of displacement rates (10-30%) and mortality rates (1-3%) as advised by consultees (Table 13-4), and in line with NatureScot guidance (2023), is presented in Table 13-31, the shaded central value was used for the assessment.

During the non-breeding season, from an estimated mean seasonal peak abundance of 2,774 individuals (Table 13-7), the estimated number of fulmars of all ages subject to mortality due to displacement from the OAA is 11.1 individuals (20% displacement/2% mortality, Table 13-31). The estimated number of adult birds (Table 13-9) subject to mortality due to displacement from the OAA is 6.1 individuals. *The estimated mortality using the NatureScot Alternative Approach is presented in Annex 12.13, Table 1-25.*

*Table 13-31 Displacement/mortality matrix for fulmar (number of individuals killed) during the non-breeding season. Shaded value is used for the assessment*

| | | DISPLACEMENT | | |
|---|---|---|---|---|
| | | 10% | 20% | 30% |
| MORTALITY | 1% | 2.8 | 5.5 | 8.3 |
| | 2% | 5.5 | 11.1 | 16.6 |
| | 3% | 8.3 | 16.6 | 25.0 |

The smallest non-breeding BDMPS for fulmar (winter West coast region) is 363,383 individuals (Table 13-8). At the average baseline mortality rate for fulmar of 0.064 (Table 13-9) the number of individuals expected to die during the non-breeding season is 23,257 (363,383 x 0.064). The addition of a maximum of 6.1 adults predicted to potentially die from operation and maintenance disturbance and displacement would increase the mortality rate by 0.0017%. This magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*The predicted change in adult survival for the Alternative Approach is provided in Annex. 12.13, Table 2-1.*

Evaluation of significance

Taking the medium sensitivity of fulmars and the negligible magnitude of impact, the overall effect to non-breeding fulmars is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

### 13.6.2.1.11 Gannet

Gannets are assessed to have a medium sensitivity to disturbance and displacement.

Although gannets have a low disturbance susceptibility and habitat specialisation score (SNCB, 2022; Furness *et al.*, 2013, Bradbury *et al.*, 2017), this species is assessed to have a medium conservation value. The general mean maximum foraging range (+1SD) for gannet is 509.4 km (exceptions apply to Forth Islands SPA, Grassholm SPA and St Kilda SPA; Table 13-8; Woodward *et al.*, 2019) which places the OAA within the potential foraging range of 8 SPA gannet breeding colonies (refer to Offshore RIAA), although other non-SPA populations are also likely to contribute to individuals at risk. This theoretical connectivity between the offshore Project is based only on the mean maximum foraging range for gannet as recommended by NatureScot (2023) guidance and represents a worst case scenario for connectivity.

#### Breeding season

Displacement mortality for gannet for a range of displacement rates (60-80%) and mortality rates (1-3%) is presented in Table 13-32, the shaded central value was used for the assessment. These ranges incorporate the displacement rate of 70% and mortality rates ranging between 1 and 3% as advised by consultees (Table 13-4) and in line with NatureScot guidance (NatureScot, 2023).

During the breeding season, from an estimated mean seasonal peak abundance of 958 individuals (Table 13-7), the estimated number of gannets of all ages subject to mortality due to displacement from the OAA is 13.4 individuals (70% displacement/2% mortality Table 13-32). The estimated number of adults minus sabbatical birds (Table 13-9) subject to mortality due to displacement from the OAA is 7.9 individuals. *The estimated mortality using the NatureScot Alternative Approach is presented in Annex 12.13, Table 1-26.*

*Table 13-32 Displacement/mortality matrix for gannet (number of individuals killed) during the breeding season. Shaded value is used for the assessment*

| | | DISPLACEMENT | | |
|---|---|---|---|---|
| | | 60% | 70% | 80% |
| MORTALITY | 1% | 5.7 | 6.7 | 7.7 |
| | 2% | 11.5 | 13.4 | 15.3 |
| | 3% | 17.2 | 20.1 | 23.0 |

The regional breeding population for gannet is 404,008 individuals (Table 13-8). At the average baseline mortality rate for gannet of 0.081 (Table 13-9) the number of individuals expected to die during the breeding season is 32,725 (404,008 x 0.081). The addition of a maximum of 7.9 adults predicted to potentially die from operation and maintenance disturbance and displacement would increase the mortality rate by 0.0020%. This magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*The predicted change in adult survival for the Alternative Approach is provided in Annex 12.13, Table 2-1.*

Evaluation of significance

Taking the medium sensitivity of gannets and the negligible magnitude of impact, the overall effect to breeding gannets is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

**Non-breeding season**

Displacement mortality for gannet for a range of displacement rates (60-80%) and mortality rates (1-3%) is presented in Table 13-33, the shaded central value was used for the assessment. These ranges incorporate the displacement rate of 30% and mortality rates ranging between 1 and 3% as advised by consultees (Table 13-4) and in line with NatureScot guidance (NatureScot, 2023).

During the non-breeding season, from an estimated mean seasonal peak abundance of 1,171 individuals (Table 13-7), the estimated number of gannets of all ages subject to mortality due to displacement from the OAA is 16.4 individuals (70% displacement/2% mortality, Table 13-33). The estimated number of adult birds (Table 13-9) subject to mortality due to displacement from the OAA is 11.3 individuals. *The estimated mortality using the NatureScot Alternative Approach is presented in Annex 12.13, Table 1-27.*

*Table 13-33 Displacement/mortality matrix for gannet (number of individuals killed) during the non-breeding season. Shaded value is used for the assessment*

| | | DISPLACEMENT | | |
|---|---|---|---|---|
| | | 60% | 70% | 80% |
| MORTALITY | 1% | 7.0 | 8.2 | 9.4 |
| | 2% | 14.1 | 16.4 | 18.7 |
| | 3% | 21.1 | 24.6 | 28.1 |

The smallest non-breeding BDMPS for gannet (spring migration East coast region) is 163,701 individuals (Table 13-8). At the average baseline mortality rate for gannet of 0.081 (Table 13-9) the number of individuals expected to die during the non-breeding season is 13,260 (163,701 x 0.081). The addition of a maximum of 11.3 adults predicted to potentially die from operation and maintenance disturbance and displacement would increase the mortality rate by 0.0069%. This magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*The predicted change in adult survival for the Alternative Approach is provided in Annex 12.13, Table 2-1.*

Evaluation of significance

Taking the medium sensitivity of gannets and the negligible magnitude of impact, the overall effect to non-breeding gannets is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

### 13.6.2.2 Indirect effects due to habitat loss / change for key prey species

Indirect disturbance and displacement of birds may occur during the operation and maintenance stage of the offshore Project if there are impacts on prey species and the habitats of prey species. These indirect effects include those resulting from the production of underwater noise (e.g. the turning of the WTGs), electro-magnetic fields (EMF), habitat loss and disturbance and the generation of suspended sediments (e.g. due to scour or maintenance activities) that may alter the behaviour or availability of bird prey species. Underwater noise and EMF may cause fish and mobile invertebrates to avoid the operational area and also affect their physiology and behaviour. Habitat loss and disturbance may reduce suitable habitats for key prey species (e.g. spawning or burrowing habitat for sandeel) and suspended sediments may cause fish and mobile invertebrates to avoid the operational area and may smother and hide immobile benthic prey. These mechanisms could result in less prey being available within the operational area to foraging seabirds. Changes in fish and invertebrate communities due to changes in presence of hard substrate (resulting in colonisation by epifauna) may also occur, and changes in fishing activity could influence the communities present.

With regard to noise impacts on fish, as outlined in chapter 11: Fish and shellfish ecology, this impact was scoped out for all receptors with the exception of diadromous fish in relation to barrier effects. For key prey species such as herring, sprat and sandeel, underwater noise impacts during the operation and maintenance stage are expected to be negligible, and therefore, chapter 11: Fish and shellfish ecology concludes that the effects on fish and shellfish species to operational noise are considered to be not significant. With a not significant effect on fish that are bird prey species, it could be concluded that the indirect effects on seabirds occurring in or around the OAA and the offshore ECC during the operation and maintenance stage would also be not significant.

With regard to changes to the seabed and to suspended sediment levels, chapter 8: Marine physical and coastal processes and chapter 10: Benthic subtidal and intertidal ecology discusses the nature of any change and impact. It identifies that changes in physical processes, temporary habitat loss/disturbance, long term habitat loss or damage would be not significant. For fish and shellfish ecology, habitat loss and disturbance could result in a reduction of spawning, nursery or feeding habitats for key prey species. This effect may be long-term in areas of permanent habitat loss (e.g. cable protection) but highly localised, as described in chapter 11: Fish and shellfish ecology. Therefore, the impact is considered to be minor and not significant (see chapter 11: Fish and shellfish ecology). As per the construction stage, increased suspended sediments were scoped out of the assessment of effects on fish and shellfish ecology. With a not significant unmitigated effect on both benthic habitats and species and fish and shellfish ecology, it could be concluded that the indirect effects on seabirds occurring in or around the OAA and the offshore ECC during the operation and maintenance stage would also be not significant.

With regard to EMF effects, these are identified as localised with the majority of cables being buried to a target depth of 1-3 m depth, further reducing the effect of EMF. The magnitude of impact is considered minor on benthic communities and negligible or minor for fish and shellfish ecology, and so it could be concluded that the indirect impact on seabirds occurring in or around the OAA and the offshore export cable during the operation and maintenance stage is similarly of negligible magnitude.

Very little is known about potential long-term changes in invertebrate and fish communities due to colonisation of hard substrate, the potential of new structures to cause fish aggregation and changes in commercial fishing pressures associated with offshore windfarms. The impact of the colonisation of introduced hard substrate is seen as low magnitude in terms of benthic ecology (as it is a change from the baseline conditions). The impact of potential fish or predator aggregation is considered to be negligible. The consequences for seabirds may be positive or negative locally but are not predicted to be significant (either beneficially or adversely) in EIA terms, at a wider scale.

Disturbance and displacement effects are associated with seven relevant bird species (kittiwake, Arctic tern, guillemot, razorbill, puffin, fulmar and gannet) in the direct disturbance and displacement assessment for the operation and maintenance stage (section 13.6.2.1). A medium sensitivity to disturbance and displacement has been concluded for all seven species for the operation and maintenance stage (refer to section 13.6.2.1 for details).

The magnitude of impact during construction is predicted to be low or negligible and the overall effect to species of medium sensitivity is considered to be at worst **minor** and **not significant** in EIA terms.

Evaluation of significance

Taking the medium sensitivity of kittiwake, Arctic tern, guillemot, razorbill, puffin, fulmar and gannet and the negligible or low magnitude of impact, the overall effect to these breeding and non-breeding species is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible/Low | Minor |

Impact significance - NOT SIGNIFICANT

### 13.6.2.3 Direct collision risk

Birds flying through WTG arrays at offshore windfarms may collide with turning rotor blades. This is assumed to result in fatality or injury to birds which fly through the Project OAA whilst foraging for food or commuting between breeding sites and foraging areas.

In order to focus the assessment of collision risk, a screening exercise was undertaken to identify those species most likely to be at risk; the results of the screening assessment are presented in Table 3-2 in the SS12: Offshore ornithology technical supporting study. The screening exercise was based on:

- Density of birds in flight within the OAA; and
- Species risk to collision.

Species screened into the collision risk assessment were recorded regularly during baseline characterisation DAS (SS12: Offshore ornithology technical supporting study), had a medium or high sensitivity to collision risk (Garthe and Hüppop, 2004; Furness and Wade, 2012; Furness *et al.*, 2013; Wade *et al.*, 2016) and were known to be present in the wider area surrounding the offshore Project (e.g. Waggitt *et al.*, 2020; Orkney Islands Council, 2020; Wakefield *et al.*, 2017; Cleasby *et al.*, 2018; Stone *et al.*, 1995).

From the screening assessment, five species were identified as at risk of collision: kittiwake, great black-backed gull, Arctic tern, great skua and gannet.

As advised by consultees (Table 13-4), and in line with NatureScot guidance (2023), the Marine Scotland sCRM tool[19] (McGregor *et al.*, 2018) has been used in this assessment to estimate the risk to birds associated with the Project OAA. Option 2 was used, following NatureScot Scoping advice and guidance (2023), to produce predictions of mortality

[19] https://dmpstats.shinyapps.io/avian_stochcrm/

for species identified to be at risk within breeding and non-breeding seasons. Results for Option 3 are also presented in SS12: Offshore ornithology technical supporting study, Annex 12.6.

Initial sCRM was undertaken based on a five different WTG parameter scenarios (see SS12: Offshore ornithology technical supporting study, Annex 12.5, Table 1-4) in order to understand the worst case scenario. The sCRM results for all five species in each calendar month, across all five WTG scenarios, are presented in the SS12: Offshore ornithology technical supporting study, Annex 12.6.

The input parameters for sCRM are provided in the SS12: Offshore ornithology technical supporting study , Annex 12.5. Input parameters for sCRM followed consultee advice (Table 13-4); avoidance rates used in sCRM were those presented in the NatureScot (2023) guidance. Flight height proportions were taken from Johnston *et al.* (2014a, b) and flight speeds for Arctic tern and great skua were those published in Alerstam *et al*. (2007) and Pennycuick (1997). Body length and wingspan measurements for Arctic tern and great skua taken from Snow and Perrins, 1998 with SD for sCRM based on McGregor *et al.* (2018). As recommended in NatureScot 2023 guidance, two nocturnal activity factors were used for gannet (breeding season = 0.08, non-breeding season = 0.10) based on the most recent available evidence in Furness *et al.* (2018).

The summary of annual collision risk estimates presented in the SS12: Offshore ornithology technical supporting study, Annex 12.6, showed little difference between the five WTG scenarios in predicted collisions for all five species screened into the assessment. The largest WTG Scenario 5 (rotor diameter 330 m) was identified as the worst case collision risk scenario for all species (SS12: Offshore ornithology technical supporting study Annex 12.6).

The assessment of the collision risk impact for the worst case WTG Scenario 5 on kittiwake, great black-backed gull, Arctic tern, great skua and gannet are presented in Table 13-34. For each species, collision estimates are presented for relevant breeding and non-breeding seasons and impacts have been assessed in relation to relevant adult breeding and non-breeding reference populations (Table 13-8). The impacts of mortality caused by collisions on the populations are assessed in terms of the percentage point change in the baseline mortality which could result.

*Table 13-34 Estimates of percentage increases in the background adult mortality of seasonal populations due to predicted collisions*

| SPECIES | SEASON | SEASONAL COLLISION MORTALITY[1] | REFERENCE POPULATION[2] (INDIVIDUALS) | MORTALITY RATE[3] | BACKGROUND MORTALITY[4] (INDIVIDUALS) | BACKGROUND PLUS COLLISION MORTALITY (INDIVIDUALS) | PERCENTAGE POINT INCREASE IN BACKGROUND MORTALITY |
|---|---|---|---|---|---|---|---|
| Kittiwake | Breeding | 9.6 | 256,327 | 0.146 | 37,424 | 37,433 | 0.0038% |
| | Non-breeding | 24.8 | 375,711 | 0.146 | 54,854 | 54,879 | 0.0066% |
| Great black-backed gull | Breeding | 0.1 | 2,524 | 0.07 | 177 | 177 | 0.0044% |
| | Non-breeding | 6.0 | 14,238 | 0.07 | 997 | 1,003 | 0.0421% |
| Arctic tern | Breeding | 0.4 | 1,724 | 0.163 | 281 | 281 | 0.0210% |
| Great skua | Breeding | 0.2 | 21,124 | 0.118 | 2,493 | 2,493 | 0.0011% |
| | Non-breeding | 0.05 | 5,718 | 0.118 | 675 | 675 | 0.0009% |
| Gannet | Breeding | 22.9 | 404,008 | 0.081 | 32,725 | 32,748 | 0.0057% |
| | Non-breeding | 7.6 | 163,701 | 0.081 | 13,260 | 13,267 | 0.0047% |

| SPECIES | SEASON | SEASONAL COLLISION MORTALITY[1] | REFERENCE POPULATION[2] (INDIVIDUALS) | MORTALITY RATE[3] | BACKGROUND MORTALITY[4] (INDIVIDUALS) | BACKGROUND PLUS COLLISION MORTALITY (INDIVIDUALS) | PERCENTAGE POINT INCREASE IN BACKGROUND MORTALITY |
|---|---|---|---|---|---|---|---|

1. Seasonal mortality accounts for the proportion of adults present in the breeding and non-breeding season and removes the number of sabbatical adults during the breeding season (refer to Table 13-9 for adult and sabbatical proportions).

2. For reference populations refer to Table 13-8. For the non-breeding season, the smallest BDMPS for each species are used for the assessment.

3. For adult mortality rates refer to Table 13-9.

4. Background mortality = reference population multiplied by mortality rate.

#### 13.6.2.3.1 Kittiwake

Kittiwakes were assessed to have a medium sensitivity to collision risk based on available data on the percentage of time spent flying at heights within the rotor swept area of offshore WTGs, flight agility, the percentage of time flying, the extent of nocturnal flight activity and conservation importance (with reference to Garthe and Hüppop, 2004; Furness and Wade, 2012; Furness *et al.*, 2013; Wade *et al.*, 2016).

Kittiwake were also assessed to have a medium conservation value. The mean maximum foraging range (+1SD) for kittiwake is 300.6 km (Table 13-8; Woodward *et al.*, 2019) which places the OAA within the potential foraging range of 25 SPA kittiwake breeding colonies (refer to Offshore RIAA), although other non-SPA populations are also likely to contribute to individuals at risk.

The estimated number of adult kittiwakes subject to mortality resulting from collision with worst case WTG Scenario 5 is 9.6 individuals during the breeding season and 24.8 individuals during the non-breeding season (Table 13-34).

Collision risk mortality was assessed within the context of relevant kittiwake populations including a regional breeding population of 256,327 individuals and the smallest non-breeding BDMPS (spring migration West coast region) of 375,711 individuals (Table 13-8). At the average baseline mortality rate for kittiwake of 0.146 (Table 13-9) the number of individuals expected to die during the breeding season is 37,424 (256,327 x 0.146) and during the non-breeding season is 54,854 (375,711 x 0.146). The addition of a maximum of 9.6 (breeding season) and 24.8 (non-breeding season) adults predicted to potentially die from collision risk would increase the baseline mortality by 0.0038% and 0.0066% for the breeding season and non-breeding season respectively (Table 13-34). This magnitude of increase in mortality would not materially alter the background mortality of the populations and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

Evaluation of significance

Taking the medium sensitivity of kittiwakes and the negligible magnitude of impact, the overall effect to breeding and non-breeding kittiwakes is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |

Impact significance - NOT SIGNIFICANT

#### 13.6.2.3.2 Great black-backed gull

Great black-backed gulls were assessed to have a high sensitivity to collision risk based on available data on the percentage of time spent flying at heights within the rotor swept area of offshore WTGs, flight agility, the percentage of time flying, the extent of nocturnal flight activity and conservation importance (with reference to Garthe and Hüppop, 2004; Furness and Wade, 2012; Furness *et al.*, 2013; Wade *et al.*, 2016).

Great black-backed gull was assessed to have a medium conservation value. The mean maximum foraging (+1SD) range for great black-backed gull is 73 km (Table 13-8; Woodward *et al.*, 2019) which places the OAA within the potential foraging range of 6 SPA great black-backed gull breeding colonies (refer to Offshore RIAA), although other non-SPA populations are also likely to contribute to individuals at risk.

The estimated number of adult great black-backed gulls subject to mortality resulting from collision with worst case WTG Scenario 5 is 0.1 individuals during the breeding season and 6.0 individuals during the non-breeding season (Table 13-34).

Collision risk mortality was assessed within the context of relevant great black-backed gull populations including a regional breeding population of 2,524 individuals and the smallest non-breeding BDMPS (wintering West coast region) of 14,238 individuals (Table 13-8). At the average baseline mortality rate for great black-backed gull of 0.07 (Table 13-9) the number of individuals expected to die during the breeding season is 177 (2,524 x 0.07) and during the non-breeding season is 997 (14,238 x 0.07). The addition of a maximum of 0.1 (breeding season) and 6.0 (non-breeding season) adults predicted to potentially die from collision risk would increase the baseline mortality by 0.0044% and 0.0421% for the breeding season and non-breeding season respectively (Table 13-34). For the breeding season, this magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable.

As the change non-breeding adult survival was more than a 0.02% point change, a PVA was conducted for non-breeding great black-backed gulls (Table 13-35). With an additional mortality of 6.0 adults for the non-breeding season, the model predicts a reduction in growth rate over 35 years by 0.02% (CGR=0.9998; Table 13-35) and a reduction in population size by 0.83% (CPR = 0.9917; Table 13-35).

This magnitude of increase in mortality would not materially alter the background mortality of the populations and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*Table 13-35 Project PVA metrics after 35 years for great black-backed gull in the non-breeding season (West) for the Project alone. (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| GREAT BLACK-BACKED GULL - NON-BREEDING SEASON | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9998 | 0.9998 | 0.0001 | 0.9995 | 1.0000 | 0.9917 | 0.9919 | 0.0050 | 0.9820 | 1.0018 | 49.3 | 50.4 |

Evaluation of significance

Taking the high sensitivity of great black-backed gulls and the negligible magnitude of impact, the overall effect to breeding and non-breeding great black-backed gulls is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| High | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

#### 13.6.2.3.3 Arctic tern

Arctic terns were assessed to have a medium sensitivity to collision risk based on available data on the percentage of time spent flying at heights within the rotor swept area of offshore WTGs, flight agility, the percentage of time flying, the extent of nocturnal flight activity and conservation importance (with reference to Garthe and Hüppop, 2004; Furness and Wade, 2012; Furness *et al.*, 2013; Wade *et al.*, 2016).

Arctic terns were assessed to have a low conservation value. The mean maximum foraging range (+1SD) for Arctic tern is 40.5 km (Table 13-8; Woodward *et al.*, 2019) which places the OAA beyond potential foraging range of SPA Arctic tern breeding colonies (refer to Offshore RIAA), although other non-SPA populations may contribute to individuals at risk.

The collision risk assessment was based on the breeding season for Arctic tern as this species was only recorded during the breeding season within the study area during baseline DAS (refer to the SS12: Offshore ornithology technical supporting study).

The estimated number of adult Arctic terns subject to mortality resulting from collision with worst case WTG Scenario 5 was 0.4 individuals during the breeding season (Table 13-34).

The regional breeding population for Arctic tern is 1,724 individuals (Table 13-8). At the average baseline mortality rate for Arctic tern of 0.163 (Table 13-9) the number of individuals expected to die during the breeding season is 281 (1,724 x 0.163). The addition of a maximum of 0.4 adults predicted to potentially die from collision risk would increase the baseline mortality by 0.0210% (Table 13-34).

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for breeding Arctic tern for combined effects of displacement and collision risk (Table 13-36).

Evaluation of significance

Taking the medium sensitivity of Arctic terns and the negligible magnitude of impact, the overall effect to breeding Arctic terns is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

#### 13.6.2.3.4 Great skua

Great skuas were assessed to have a medium sensitivity to collision risk based on available data on the percentage of time spent flying at heights within the rotor swept area of offshore WTGs, flight agility, the percentage of time flying, the extent of nocturnal flight activity and conservation importance (with reference to Garthe and Hüppop, 2004; Furness and Wade, 2012; Furness *et al.*, 2013; Wade *et al.*, 2016).

Great skua was also assessed to have a medium conservation value. The mean maximum foraging range (+1SD) for great skua is 931.2 km (Table 13-8; Woodward *et al.*, 2019) which places the OAA within the potential foraging range of eight SPA great skua breeding colonies (refer to Offshore RIAA), although other non-SPA populations may contribute to individuals at risk.

The estimated number of adult great skuas subject to mortality resulting from collision with worst case WTG Scenario 5 is 0.2 individuals during the breeding season and 0.05 individual during the non-breeding season (Table 13-34).

Collision risk mortality was assessed within the context of relevant great skua populations including a regional breeding population of 21,124 individuals and the smallest non-breeding BDMPS (UK North Sea waters in spring) of 5,718 individuals (Table 13-8). At the average baseline mortality rate for great skua of 0.118 (Table 13-9) the number of individuals expected to die during the breeding season is 2,493 (21,124 x 0.100) and during the non-breeding season is 675 (5,718 x 0.118). The addition of a maximum of 0.2 (breeding season) and 0.05 (non-breeding season) adults predicted to potentially die from collision risk would increase the baseline mortality by 0.0011% and 0.0009% for the breeding season and non-breeding season respectively (Table 13-34). This magnitude of increase in mortality would not materially alter the background mortality of the populations and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

Evaluation of significance

Taking the medium sensitivity of great skuas and the negligible magnitude of impact, the overall effect to breeding and non-breeding great skuas is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |

Impact significance - NOT SIGNIFICANT

#### 13.6.2.3.5 Gannet

Gannets were assessed to have a medium sensitivity to collision risk based on available data on the percentage of time spent flying at heights within the rotor swept area of offshore WTGs, flight agility, the percentage of time flying, the extent of nocturnal flight activity and conservation importance (with reference to Garthe and Hüppop, 2004; Furness and Wade, 2012; Furness *et al.*, 2013; Wade *et al.*, 2016).

Gannet was also assessed to have a medium conservation value. The mean maximum foraging range for gannet (+1SD) is 315.2 + 194.2 km (Table 13-8; Woodward *et al.*, 2019) which places the OAA within the potential foraging range of 8 SPA gannet breeding colonies (refer to Offshore RIAA), although other non-SPA populations are also likely to contribute to individuals at risk.

The estimated number of adult gannets subject to mortality resulting from collision with worst case WTG Scenario 5 is 22.9 individuals during the breeding season and 7.6 individuals during the non-breeding season (Table 13-34).

Collision risk mortality was assessed within the context of relevant gannet populations including a regional breeding population of 404,008 individuals and the smallest non-breeding BDMPS (spring migration East coast region) of 163,701 individuals (Table 13-8). At the average baseline mortality rate for gannet of 0.08 (Table 13-9) the number of individuals expected to die during the breeding season is 32,725 (404,008 x 0.08) and during the non-breeding season is 13,260 (163,701 x 0.08). The addition of a maximum of 22.9 (breeding season) and 7.6 (non-breeding season) adults predicted to potentially die from collision risk would increase the baseline mortality by 0.0057% and 0.0047% for the breeding season and non-breeding season respectively (Table 13-34). This magnitude of increase in mortality would not materially alter the background mortality of the populations and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

Evaluation of significance

Taking the medium sensitivity of gannets and the negligible magnitude of impact, the overall effect to breeding and non-breeding gannets is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |

Impact significance - NOT SIGNIFICANT

### 13.6.2.4 Combined operational displacement and collision risk

Kittiwake, Arctic tern and gannet have been scoped in for displacement and collision impacts from the Project (as the only species assessed for both impacts), it is possible that these impacts could combine to adversely affect the relevant populations of these species. It is important to note that displacement and collision impacts would not act on the same individuals, as birds which do not enter a windfarm cannot be subject to mortality from collision, and vice versa. Avoidance rates used to estimate collision risk, take account of macro-avoidance (where birds avoid entering a windfarm), meso-avoidance (avoidance of the rotor swept zone within a windfarm), and micro-avoidance (avoiding WTG blades). Thus, birds which exhibit macro-avoidance could be subject to mortality from displacement.

#### 13.6.2.4.1 Kittiwake

Kittiwakes have been assessed to have a medium sensitivity to disturbance and displacement (section 13.6.2.1.5) and collision risk (section 13.6.2.3.1).

During the breeding season, the estimated mortality for adult kittiwake displacement is 2.4 individuals at a displacement rate of 30% and mortality of 2% (section 13.6.2.1.5) and the estimated adult kittiwake collision mortality for the worst case WTG Scenario 5 is 9.6 individuals (section 13.6.2.3.1).

During the non-breeding season, the estimated mortality for adult kittiwake displacement is up to 5.0 individuals at a displacement rate of 30% and mortality of 2% ( section 13.6.2.1.5) and the estimated adult kittiwake collision mortality for the worst case WTG Scenario 5 is a maximum of 24.8 individuals (section 13.6.2.3.1).

Based on the baseline adult mortality rate for kittiwake of 0.146 (Table 13-9) the number of individuals expected to die during the breeding season is 37,424 (256,327 x 0.146) and during the non-breeding season is 54,854 (375,711 x 0.146). The addition of a maximum of 12 (breeding season) and 29.8 (non-breeding season) adults predicted to potentially die from a combination of displacement and collision would increase the baseline mortality by 0.005% and 0.00% for the breeding season and non-breeding season respectively. These magnitudes of increase would not materially alter the background mortality of the populations and would be undetectable; the impact is defined as being of negligible magnitude.

Evaluation of significance

Taking the medium sensitivity of kittiwakes and the negligible magnitude of impact, the overall effect to breeding and non-breeding kittiwakes is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |

Impact significance - NOT SIGNIFICANT

#### 13.6.2.4.2 Arctic tern

Arctic terns have been assessed to have a medium sensitivity to disturbance and displacement (section 13.6.2.1.613.6.2.1.5) and collision risk (section 13.6.2.3.3).

During the breeding season, the estimated mortality for adult Arctic tern displacement is 0.8 individuals at a displacement rate of 40% and mortality of 3% (section 13.6.2.1.6) and the estimated adult Arctic tern collision mortality for the worst case WTG Scenario 5 is less than one (0.4) individuals (section 13.6.2.3.3).

Based on the baseline adult mortality rate for Arctic tern of 0.163 (Table 13-9) the number of individuals expected to die during the breeding season is 281 (1,724 x 0.163). The addition of 1.2 adults predicted to potentially die from a combination of displacement and collision would increase the baseline mortality by 0.069% for the breeding season.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for breeding Arctic tern (Table 13-36). With an additional combined mortality (displacement + collision) of 1.2 adults the model predicts over 35 years a reduction in growth rate by 0.06% (CGR = 0.9994; Table 13-36) and an increase in population size by 0% (CPS = 1.000; Table 13-36).

As the population is predicted to rise over 35 years, this magnitude of increase in mortality would not materially alter the background mortality of the population and would be undetectable. Taking this into account, the impact is defined as being of negligible magnitude.

*Table 13-36 Projected PVA metrics after 35 years for Arctic tern in the breeding season for the Project alone.*

| ARCTIC TERN – BREEDING SEASON | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9994 | 0.9981 | 0.0337 | 0.9763 | 1.0225 | 1.0000 | 1.0577 | 0.5062 | 0.4167 | 2.2000 | 49.8 | 55.5 |

Evaluation of significance

Taking the medium sensitivity of Arctic terns and the negligible magnitude of impact, the overall effect to breeding Arctic terns is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

#### 13.6.2.4.3 Gannet

Gannets have been assessed to have a medium sensitivity to disturbance and displacement (section 13.6.2.1.11) and collision risk (section 13.6.2.3.5).

During the breeding season, the estimated mortality for adult gannet displacement is 7.9 individuals at a displacement rate of 70% and mortality of 2% (section 13.6.2.1.11) and the estimated adult gannet collision mortality for the worst case WTG Scenario 5 is a maximum 22.9 individuals (section 13.6.2.3.5).

During the non-breeding season, the estimated mortality for adult gannet displacement is up to 11.3 individuals at a displacement rate of 70% and mortality of 2% (section 13.6.2.1.11) and the estimated adult gannet collision mortality for the worst case WTG Scenario 5 is a maximum of 7.6 individuals (section 13.6.2.3.5).

Based on the baseline adult mortality rate for gannet of 0.08 (Table 13-9) the number of individuals expected to die during the breeding season is 32,725 (404,008 x 0.08) and during the non-breeding season is 13,260 (163,701 x 0.08). The addition of a maximum of 30.8 (breeding season) and 18.9 (non-breeding season) adults predicted to potentially die from a combination of displacement and collision would increase the baseline mortality by 0.008% and 0.012% for the breeding season and non-breeding season respectively. This magnitude would not materially alter the background mortality of the populations. Taking this into account, the impact for the breeding season is defined as being of negligible magnitude.

Evaluation of significance

Taking the medium sensitivity of gannets and the negligible magnitude of impact, the overall effect to breeding and non-breeding gannets is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

## 13.6.3 Potential effects during decommissioning

There are two potential impacts that may affect bird populations during the decommissioning stage of the Project:

- Direct distributional responses and displacement effects; and
- Indirect effects as a result of disturbance and displacement of prey species.

Any impacts generated during the decommissioning stage of the Project are expected to be similar, or of reduced magnitude, to those generated during the construction stage, as certain activities such as piling would not be required. This is because it would generally involve a reverse of the construction stage through the removal of some structures and materials installed.

It is anticipated that any future activities would be programmed in close consultation with the relevant statutory marine and nature conservation bodies, to allow any future guidance and best practice to be incorporated to minimise any potential impacts.

### 13.6.3.1 Direct and indirect distributional responses and displacement effects

Direct impacts (disturbance and displacement) and indirect impacts (displacement of seabird prey species) have already been assessed for relevant bird species in the construction section above and have been found to be of negligible magnitude.

Any impacts generated during the decommissioning stage of the Project are expected to be similar, but likely of reduced magnitude compared to those generated during the construction stage; therefore, the magnitude of impact is predicted to be negligible. The resultant effect on a range of species of low to high sensitivity to disturbance is of negligible to minor significance.

## 13.6.4 Summary of potential effects

A summary of the outcomes of the assessment of potential effects from the construction, operation and maintenance and decommissioning of the Project is provided in Table 13-37.

No significant effects on offshore ornithology receptors were identified. Therefore, mitigation measures in addition to the embedded mitigation measures listed in section 13.5.3.4 are not considered necessary.

*Table 13-37 Summary of potential effects*

| POTENTIAL EFFECT | RECEPTOR | SENSITIVITY OF RECEPTOR | MAGNITUDE OF IMPACT | CONSEQUENCE (SIGNIFICANCE OF EFFECT) | SECONDARY MITIGATION REQUIREMENTS | RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT) |
|---|---|---|---|---|---|---|
| Construction and decommissioning | | | | | | |
| Direct distributional responses and displacement effects (including cable landfall) | All IOFs - breeding and non-breeding. | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| Indirect effects as a result of disturbance and displacement of prey species | All IOFs - breeding and non-breeding. | Medium | Low | Minor (not significant) | None required above embedded mitigation measures. | Minor (not significant) |
| Operation and maintenance | | | | | | |
| Direct distributional responses, displacement and barrier effects | Kittiwake - breeding and non-breeding. | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Arctic tern - breeding. | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |

| POTENTIAL EFFECT | RECEPTOR | SENSITIVITY OF RECEPTOR | MAGNITUDE OF IMPACT | CONSEQUENCE (SIGNIFICANCE OF EFFECT) | SECONDARY MITIGATION REQUIREMENTS | RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT) |
|---|---|---|---|---|---|---|
| | Guillemot - breeding and non-breeding. | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Razorbill - breeding and non-breeding. | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Puffin – breeding and non-breeding | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Fulmar - breeding and non-breeding. | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Gannet - breeding and non-breeding. | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| **Indirect effects due to habitat loss / change for key prey species** | All IOFs- breeding and non-breeding. | Medium | Negligible/Low | Minor (not significant) | None required above embedded mitigation measures. | Minor (not significant) |

| POTENTIAL EFFECT | RECEPTOR | SENSITIVITY OF RECEPTOR | MAGNITUDE OF IMPACT | CONSEQUENCE (SIGNIFICANCE OF EFFECT) | SECONDARY MITIGATION REQUIREMENTS | RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT) |
|---|---|---|---|---|---|---|
| Direct collision risk | Kittiwake - breeding and non-breeding. | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Great black-backed gull - breeding and non-breeding. | High | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Arctic tern – breeding. | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Great skua – breeding and non-breeding. | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Gannet - breeding and non-breeding. | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| Combined operational displacement and collision risk | Kittiwake - breeding and non-breeding. | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |

| POTENTIAL EFFECT | RECEPTOR | SENSITIVITY OF RECEPTOR | MAGNITUDE OF IMPACT | CONSEQUENCE (SIGNIFICANCE OF EFFECT) | SECONDARY MITIGATION REQUIREMENTS | RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT) |
|---|---|---|---|---|---|---|
| | Arctic tern - breeding | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Gannet - breeding and non-breeding | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |

# 13.7 Assessment of cumulative effects

## 13.7.1 Introduction

Potential impacts from the offshore Project have the potential to interact with those from other developments, plans and activities, resulting in cumulative impacts on offshore and intertidal ornithology receptors. The general approach to the cumulative effects assessment is described in chapter 7: EIA methodology and further detail is provided below.

The developments and plans selected as relevant to the assessment of cumulative impacts to offshore and intertidal ornithology are based upon an initial screening exercise undertaken on a long list presented in Table 13-38.

As advised by NatureScot (Table 13-4), for the breeding season cumulative impact assessment, developments incorporated into the long screening list included developments within foraging range (+1SD) for key species (Table 13-8) surrounding the OAA and the offshore ECC. A total of six species were included in the cumulative assessment: kittiwake, great black-backed gull, guillemot, razorbill, puffin, and gannet. These key species were assessed for Project alone impacts (section 13.6) and in addition, data on displacement and cumulative risk were available from other developments to add to the cumulative assessment. For Arctic tern, great skua and fulmar, although these species were also included in the Project alone assessment, data assessing displacement and collision impacts were not available from other developments, therefore these species were not included in the cumulative assessment.

- Arctic tern has a short foraging range (Woodward *et al.*, 2019) and tends to forage in coastal waters close to colonies. Most recent offshore windfarms are further offshore than the typical foraging patterns of Arctic terns, particularly the PFOWF and Moray Firth projects, which likely explains the lack of impact assessments from these projects. There has also been little guidance or advice in the past on the assessment of Arctic tern (e.g., it's not included in the sCRM or NE PVA tool as a default species). Cumulative impacts to the regional population are therefore very unlikely to be significant.
- Great skua mostly breed in the far north of Scotland, particularly Shetland and Orkney. Therefore, in the breeding season few previous projects would have been likely to have recorded this species in the breeding season. Most records of great skua from offshore windfarm assessments are likely to refer to birds on migration. In addition, as with Arctic tern, there has also been little guidance or advice in the past on the assessment of great skuas (e.g., it is not included in the sCRM or NE PVA tool as a default species). This species is likely to be more important for cumulative effects in the assessment of future ScotWind projects that are closer to the breeding colonies of great skua. These projects will need to consider the Project in their cumulative impact assessments.
- Fulmar is a species that has generally been recognised as having a low vulnerability to offshore windfarm developments (e.g., see Furness *et al.*, 2013). As such, it appears to have had a low priority in the impact assessment of past projects. The current advice from NatureScot recommends a low displacement effect (20%) and low mortality as a result of displacement (1% to 3%). Current guidance does not provide specific recommendations for fulmar. As a result, there has been little focus on this species in past assessments. With a relatively small, predicted impact from offshore windfarms and a relatively large, albeit apparently declining, population in Scotland the risk to the regional population from the Project alone or cumulatively is likely to be very low.

At the consultation meeting on 8th February 2023 the approach to cumulative assessment in the breeding season was presented and agreed with NatureScot, with the PFOWF, Moray West, Moray East and Beatrice projects being included in the quantitative assessment.

For the non-breeding season cumulative impact assessment, developments incorporated into the long screening list (including developments within foraging range +1SD for the six species surrounding the OAA and the offshore ECC included developments within two BDMPS regions including the East Coast Region and the West Coast Region (Table 13-38) because the offshore Project is located on the boundary of these two BDMPS regions.

The classes of marine developments listed by Marine Scotland[20] as well as the Space Hub Sutherland Project[21] that were considered for the cumulative assessment of offshore ornithological receptors in Table 13-38 include:

- Offshore windfarms;
- Marine aggregate extraction;
- Harbour expansions;
- Sub-sea cables and pipelines;
- Space Hub Sutherland; and
- Commercial shipping.

Onshore WTGs have not been considered within the cumulative assessment. There are not considered to be shared receptors between onshore WTGs and the offshore Project.

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[20] *Marine Scotland Marine Project list available at: https://marine.gov.scot/marine-projects.*

[21] *Space Hub Sutherland Project: https://www.hie.co.uk/our-region/regional-projects/space-hub-sutherland/*

*Table 13-38 Developments considered for the Offshore ornithology cumulative impact screening assessment*

| DEVELOPMENT NAME | APPLICATION STAGE[22] | DEVELOPMENT TYPE |
|---|---|---|
| Space Hub Sutherland | Consented | Space hub |
| Toft Pier Re-development, Shetland | Consented | Dredging |
| Aberdeen Harbour Expansion | Consented | Port / harbour |
| Aberdeen Harbour Maintenance Dredging and Sea Disposal | Consented | Dredging |
| Ardersier Port Development | Consented | Port / harbour |
| Ardersier Port Dredge | Consented | Dredging |
| Beatrice Offshore Windfarm | Operational | Offshore wind farm |
| Berwick Bank Offshore Wind Farm | Consented | Offshore wind farm |
| Bridge Maintenance Works, A87 Kyle of Lochalsh | Consented | Maintenance works |
| Caithness - Moray HVDC Cable | Consented | Cable |
| SHET-L Caithness to Orkney HVAC | Consented | Cable |
| Caledonia Offshore Wind Farm | Pre-application | Offshore wind farm |
| Clyde Waterfront Renfrew Riverside (CWRR) | Consented | Bridge |
| Colonsay Ferry Terminal Upgrade | Pre-application | Port / harbour |
| Construction of bridge access system and walkway - Forth Rail Bridge, South Queensferry | Pre-application | Port / harbour |

[22] *Consent includes operational projects.*

| DEVELOPMENT NAME | APPLICATION STAGE[22] | DEVELOPMENT TYPE |
|---|---|---|
| COVID-19 Wellboat Variations | Licence | Chemotherapeutant |
| Deep Water Port, Glumaig Bay, Stornoway | Consented | Dredging |
| Edinburgh Marina, Granton Harbour Redevelopment | Consented | Port / harbour |
| Fall of Warness Tidal Test Site | Pre-application (for proposed change to operational development) | Tidal power |
| EMEC Billia Croo Wave Test Site | Operational | Wave power |
| Faray Slipway Extension and Landing Jetty | Consented | Port / harbour |
| Tarbert Ferry Terminal Development | Consented | Port / harbour |
| Fionnphort Breakwater Project | Pre-application | Port / harbour |
| Sound of Islay Community Tidal turbine | Application | Tidal power |
| Forthwind Demonstration Project | Consented (with a Section 36 Consent variation application now also consented, see below) | Offshore wind WTG |
| Forthwind Offshore Development Phase 1 | Consented | Offshore WTG |
| Glasgow Airport Investment Area (GAIA) | Consented | Bridge |
| Grangemouth Flood Defence Works | Pre-application | Flood protection |
| Granton Harbour Redevelopment | Consented | Port / harbour |
| Green Volt Floating Offshore Wind Farm | Application | Offshore wind farm |
| Harbour Development - Staffin, Skye | Consented | Port / harbour |
| Hatston Pier and Terminal Expansion | Pre-application | Port / harbour |

| DEVELOPMENT NAME | APPLICATION STAGE[22] | DEVELOPMENT TYPE |
|---|---|---|
| Havfrue Telecommunications Cable | Pre-application | Cable |
| Hunterston Marine Construction Yard Redevelopment | Pre-application | Port / harbour |
| Hywind Scotland Pilot Park | Operational | Offshore wind farm |
| Inch Cape Offshore Windfarm | Consented | Offshore wind farm |
| Iona Harbour Redevelopment | Pre-application | Port / harbour |
| Kennacraig Harbour Repairs | Pre-application | Port / harbour |
| Kilfinichen Pier Development | Consented | Port / harbour |
| Kincardine Offshore Windfarm | Consented | Renewables - Wind |
| Kirkwall Pier and Harbour Enhancements | Pre-application | Port / harbour |
| Kishorn Port Land Reclamation for Laydown Area | Pre-application | Port / harbour |
| Kyleakin Feed Mill Construction | Consented | Fish feed plan |
| Govan Wet Basin, BAE Systems Govan Shipyard | Application | Shipyard |
| Lerwick Port Authority - Proposed Dales Voe Decommissioning Base | Pre-application | Decommissioning base |
| Levenmouth Demonstration Turbine | Operational | Offshore WTG |
| Lochmaddy Ferry Terminal Development | Consented | Port / harbour |
| Mallaig Harbour Development | Consented | Port / harbour |
| MeyGen Tidal Energy Project | Consented | Tidal power |
| Mocean Energy Limited | Consented | Wave power |
| Moray East Offshore Windfarm | Operational | Offshore wind farm |

| DEVELOPMENT NAME | APPLICATION STAGE[22] | DEVELOPMENT TYPE |
|---|---|---|
| Moray West Offshore Windfarm | Consented | Offshore wind farm |
| Neart na Gaoithe Offshore Wind Farm (Revised Design) | Consented | Offshore wind farm |
| Newton Marina Development | Consented | Port / harbour |
| Nigg Energy Park East Quay | Consented | Port / harbour |
| NorthConnect HVDC Cable | Consented (UK) | Cable |
| Ossian Wind | Pre-application | Offshore wind farm |
| PFOWF[1] [23] | Consented | Offshore wind farm |
| Peterhead Sea Wall Repair and Extension | Consented | Port / harbour |
| Port Ellen Harbour Refurbishments | Pre-application | Port / harbour |
| Port of Cromarty Forth - Phase 4 Development, Invergordon Service Base | Consented | Port / harbour |
| Port of Dundee Expansion | Pre-application | Port / harbour |
| Port of Leith | Consented | Port / harbour |
| Port of Leith Outer Berth | Pre-application (for proposed changes to consented development) | Port / harbour |
| Quay Improvement Works, Ardrossan Harbour | Pre-application | Port / harbour |

[23] *PFOWF will incorporate the currently consented Pentland Floating Offshore Wind Demonstrator turbine, and hence PFOWF only has been considered. The PFOWF Section 36 Consent and Marine Licence was granted for 10 years. However, the cumulative effects assessment has been based on the Project Design Envelope, as specified within the EIA, and therefore, an operational life of up to 30 years for the PFOWF has been considered. Since consent was granted in June 2023, PFOWF have submitted a Screening Report to MD-LOT with the intention to request a variation to the Section 36 Consent. This variation will incorporate refinements to the Project Design Envelope and to extend the operational life to 25 years.*

| DEVELOPMENT NAME | APPLICATION STAGE[22] | DEVELOPMENT TYPE |
|---|---|---|
| Redevelopment of Dundee East | Consented | Port / harbour |
| Robin Rigg Offshore Windfarm | Consented | Offshore wind farm |
| Rosyth International Container Terminal | Pre-application | Port / harbour |
| Sanday to Eday & Eday to Westray Cable Replacement Applications | Consented | Cable |
| Scapa Deep Water Quay | Pre-application | Port / harbour |
| Scapa Pier Enhancements | Pre-application | Port / harbour |
| Scotstoun Deep Water Berth Project | Consented | Port / harbour |
| Seagreen 1A Export Cable Corridor | Consented | Offshore wind farm |
| Seagreen | Consented | Offshore wind farm |
| Shetland Tidal Array | Consented | Tidal power |
| New Landing Facility - Loch Etive, Argyll & Bute | Pre-application | Port / harbour |
| St. Ola Pier Redevelopment, Scrabster | Consented | Port / harbour |
| Uig Ferry Terminal Development, Uig, Isle of Skye | Consented | Port / harbour |
| West Islay Tidal Energy Park Project | Consented | Tidal power |
| Western Isles to Mainland Scotland HVDC Interconnector | Consented | Cable |
| Telecommunications Cable Installation - Inner Hebrides | Consented | Cable |
| Telecommunications Cable Installation - Orkney | Consented | Cable |
| Telecommunications Cable Installation - Shetland | Consented | Cable |
| Wild Seaweed Harvesting, West Coast of Scotland | Pre-application | Seaweed harvesting |

### 13.7.1.1 Developments considered for cumulative impacts

Each development, plan or activity presented in Table 13-38 has been considered and scoped in or out on the basis of effect–receptor pathway, data confidence and the temporal and spatial scales involved. The cumulative assessment takes into account the fact that birds may already be habituated to long-term, on-going activities and therefore these may be considered to be part of the baseline conditions, to avoid double-counting or exaggeration of potential impacts.

The cumulative impact assessment for the breeding and non-breeding seasons has been split between a quantitative assessment (section 13.7.1.1.1) and a qualitative assessment (section 13.7.1.1.2).

#### 13.7.1.1.1 Quantitative cumulative assessment

The quantitative assessment for the breeding season follows a similar approach to the cumulative assessment undertaken by the PFOWF, the assessment focuses on cumulative impacts from offshore windfarms in the north and north-east including the PFOWF, Beatrice Offshore Windfarm Ltd (BOWL), Moray East offshore windfarm (Moray East) and Moray West offshore windfarm (Moray West) where data on displacement and collision mortality are publicly available (Table 13-39). This approach was shared with NatureScot on 8th February 2023.

The quantitative assessment for the non-breeding season focuses on cumulative impacts for offshore windfarms within the eastern region BDMPS and separately, the western region BDMPS (Table 13-39).

*Table 13-39 List of offshore windfarms considered for the offshore ornithology quantitative cumulative impact assessment*

| DEVELOPMENT NAME | STATUS | DISTANCE TO OAA (KM) | DISTANCE TO OFFSHORE ECC (KM) | SEASON | RELAVENT RECEPTORS |
|---|---|---|---|---|---|
| PFOWF | Consented | 20.01 | 1.89 | Breeding, Non-breeding (Eastern BDPMS and Western BDMPS) | Kittiwake, great black-backed gull, great skua, guillemot, razorbill and puffin. |
| Beatrice Offshore Windfarm Ltd (BOWL) | Operational | 86.42 | 55.39 | Breeding, Non-breeding (Eastern BDPMS) | Kittiwake, great black-backed gull, great skua, guillemot, razorbill and puffin. |
| Berwick Bank | Application | 86.42 | 55.39 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, gannet, and great black-backed gull |

| DEVELOPMENT NAME | STATUS | DISTANCE TO OAA (KM) | DISTANCE TO OFFSHORE ECC (KM) | SEASON | RELAVENT RECEPTORS |
|---|---|---|---|---|---|
| Moray East offshore windfarm (Moray East) | Operational | 92.35 | 62.99 | Breeding, Non-breeding (Eastern BDPMS) | Kittiwake, great black-backed gull, great skua, guillemot, razorbill and puffin. |
| Caledonia | Pre-application | 92.46 | 63.66 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, gannet, and great black-backed gull |
| Moray West offshore windfarm (Moray West) | Under construction | 96.26 | 63.86 | Breeding, Non-breeding (Eastern BDPMS) | Kittiwake, great black-backed gull, great skua, guillemot, razorbill and puffin. |
| Hywind Scotland | Operational | 213.53 | 182.42 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot razorbill, puffin, gannet, and great black-backed gull. |
| EOWDC (Aberdeen) | Operational | 213.87 | 180.55 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot razorbill, puffin, gannet, and great black-backed gull. |
| Kincardine | Operational | 238.24 | 204.95 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| Seagreen (Phase 1) | Under construction | 270.40 | 238.42 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot razorbill, puffin, gannet, and great black-backed gull. |
| Inch Cape | Consented | 271.74 | 241.15 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot razorbill, puffin, gannet, and great black-backed gull. |
| Neart na Gaoithe | Under construction | 295.55 | 265.67 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot razorbill, puffin, gannet, and great black-backed gull. |
| Levenmouth Demonstration Turbine (Methil) | Operational | 299.03 | 272.64 | Non-breeding (Eastern BDMPS) | Kittiwake and gannet. |

| DEVELOPMENT NAME | STATUS | DISTANCE TO OAA (KM) | DISTANCE TO OFFSHORE ECC (KM) | SEASON | RELAVENT RECEPTORS |
|---|---|---|---|---|---|
| **Forthwind** | Consented (with a Section 36 Consent variation application now also consented) | 299.99 | 273.55 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot razorbill, puffin, gannet, and great black-backed gull. |
| **Blyth Demonstration Site** | Operational (Phase 1)<br>Consented (Phase 2) | 429.56 | 399.32 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot razorbill, puffin, gannet, and great black-backed gull. |
| **Robin Rigg Offshore Windfarm** | Operational | 446.52 | 424.17 | Non-breeding (Western BDMPS) | Kittiwake, guillemot razorbill, puffin, gannet, and great black-backed gull. |
| **Teesside** | Operational | 496.84 | 466.77 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| **Walney Extension** | Operational | 515.40 | 493.66 | Non-breeding (Western BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| **Ormonde** | Operational | 522.51 | 499.49 | Non-breeding (Western BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| **Walney (Phase 1 & Phase 2)** | Operational | 525.61 | 502.90 | Non-breeding (Western BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| **West of Duddon Sands** | Operational | 531.26 | 508.26 | Non-breeding (Western BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| **Barrow** | Operational | 534.04 | 510.60 | Non-breeding (Western BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| **Dogger Bank B** | Under Construction | 536.57 | 504.21 | Non-breeding (Eastern BDMPS) | Guillemot, razorbill, puffin, gannet, and great black-backed gull. |

| DEVELOPMENT NAME | STATUS | DISTANCE TO OAA (KM) | DISTANCE TO OFFSHORE ECC (KM) | SEASON | RELAVENT RECEPTORS |
|---|---|---|---|---|---|
| Dogger Bank C and Sofia | Under Construction | 536.57 | 504.21 | Non-breeding (Eastern BDMPS) | Gannet and great black-backed gull. |
| Sofia | Under Construction | 556.90 | 525.26 | Non-breeding (Eastern BDMPS) | Guillemot, razorbill, and puffin. |
| Dogger Bank A & B | Under Construction | 563.10 | 530.57 | Non-breeding (Eastern BDMPS) | Kittiwake. |
| Dogger Bank A | Under Construction | 563.10 | 530.57 | Non-breeding (Eastern BDMPS) | Guillemot, razorbill, puffin, gannet, and great black-backed gull. |
| Dogger Bank C and Sofia | Under Construction | 563.10 | 530.57 | Non-breeding (Eastern BDMPS) | Guillemot, razorbill, and puffin. |
| Dogger Bank C & Sofia | Under Construction | 574.99 | 543.82 | Non-breeding (Eastern BDMPS) | Kittiwake. |
| Gwynt y Môr | Operational | 590.31 | 567.94 | Non-breeding (Western BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| North Hoyle | Operational | 597.74 | 574.85 | Non-breeding (Western BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| Awel y Môr | Application | 589.82 | 567.97 | Non-breeding (Western BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| Burbo Bank Extension | Operational | 590.09 | 567.04 | Non-breeding (Western BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| Burbo Bank | Operational | 590.95 | 567.44 | Non-breeding (Western BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| Hornsea Project Four | Consented | 598.08 | 564.92 | Non-breeding (Eastern BDMPS) | Kittiwake. |
| Rhyl Flats | Operational | 601.05 | 578.86 | Non-breeding (Western BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |

| DEVELOPMENT NAME | STATUS | DISTANCE TO OAA (KM) | DISTANCE TO OFFSHORE ECC (KM) | SEASON | RELAVENT RECEPTORS |
|---|---|---|---|---|---|
| Westermost Rough | Operational | 612.29 | 580.89 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| Humber Gateway | Operational | 633.15 | 601.82 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, gannet, and great black-backed gull. |
| Hornsea Project Two | Operational | 634.68 | 601.38 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, gannet, and great black-backed gull. |
| Hornsea Project One | Operational | 654.26 | 621.13 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, gannet, and great black-backed gull. |
| Triton Knoll | Operational | 659.46 | 627.50 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| Hornsea Project Three | Consented | 661.93 | 629.09 | Non-breeding (Eastern BDMPS) | Kittiwake. |
| Race Bank | Operational | 680.56 | 648.75 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| Lincs, Lynn & Inner Dowsing | Operational | 681.46 | 650.29 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| Dudgeon and Sherringham Shoal Extension Project | Application | 690.43 | 657.99 | Non-breeding (Eastern BDMPS) | Kittiwake. |
| Dudgeon | Operational | 699.36 | 666.72 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| Sheringham Shoal | Operational | 705.48 | 673.39 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| Norfolk Boreas | On hold/stopped | 762.89 | 730.09 | Non-breeding (Eastern BDMPS) | Kittiwake. |

| DEVELOPMENT NAME | STATUS | DISTANCE TO OAA (KM) | DISTANCE TO OFFSHORE ECC (KM) | SEASON | RELAVENT RECEPTORS |
|---|---|---|---|---|---|
| Scroby Sands | Operational | 777.31 | 744.81 | Non-breeding (Eastern BDMPS) | Kittiwake. |
| Norfolk Vanguard | Consented | 780.32 | 747.20 | Non-breeding (Eastern BDMPS) | Kittiwake. |
| East Anglia THREE | Consented | 799.69 | 766.47 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, gannet, and great black-backed gull. |
| Erebus Floating Wind Demo | Consented | 814.23 | 798.95 | Non-breeding (Western BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| East Anglia ONE North | Consented | 817.09 | 784.13 | Non-breeding (Eastern BDMPS) | Kittiwake. |
| East Anglia TWO | Consented | 822.75 | 790.13 | Non-breeding (Eastern BDMPS) | Kittiwake. |
| East Anglia ONE | Operational | 833.34 | 800.30 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, gannet, and great black-backed gull. |
| Galloper | Operational | 850.25 | 818.13 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, gannet, and great black-backed gull. |
| Greater Gabbard | Operational | 850.74 | 818.71 | Non-breeding (Eastern BDMPS) | Kittiwake, guillemot, razorbill, puffin, and gannet. |
| Gunfleet Sands | Operational | 855.14 | 824.23 | Non-breeding (Eastern BDMPS) | Kittiwake. |
| London Array | Operational | 866.97 | 835.77 | Non-breeding (Eastern BDMPS) | Kittiwake guillemot razorbill puffin and gannet. |
| Kentish Flats | Operational | 879.87 | 849.40 | Non-breeding (Eastern BDMPS) | Kittiwake. |

| DEVELOPMENT NAME | STATUS | DISTANCE TO OAA (KM) | DISTANCE TO OFFSHORE ECC (KM) | SEASON | RELAVENT RECEPTORS |
|---|---|---|---|---|---|
| Kentish Flats Extension | Operational | 879.58 | 849.14 | Non-breeding (Eastern BDMPS) | Kittiwake, gannet, and great black-backed gull. |
| Thanet | Operational | 894.47 | 863.35 | Non-breeding (Eastern BDMPS) | Kittiwake guillemot razorbill puffin and gannet. |
| Rampion | Operational | 933.96 | 905.89 | Non-breeding (Western BDMPS) | Kittiwake. |
| Rampion | Operational | 933.96 | 905.89 | Non-breeding (Eastern BDMPS) | Guillemot, razorbill, puffin, and gannet. |

#### 13.7.1.1.2 Qualitative cumulative assessment

For all other types of developments listed in Table 13-38 the detail of data available and the ease with which impacts can be combined is variable, reflecting the availability of relevant data for older developments and the approach to assessment taken.

Due to the difficulty in obtaining and combining data for these other types of developments, a qualitative cumulative assessment has been undertaken.

All developments scoped into the qualitative cumulative assessment were considered to have a negligible impact and are therefore not significant in EIA terms, the justifications are presented in Table 13-40.

*Table 13-40 List of developments considered for the offshore ornithology qualitative cumulative impact assessment*

| DEVELOPMENT TYPE | DEVELOPMENT NAME | STATUS | KEY SPECIES WITHIN FORAGING RANGE FROM THE PROJECT | JUSTIFICATION FOR NEGLIGIBLE IMPACT |
|---|---|---|---|---|
| **Renewables - Wind** | Green Volt Floating Offshore Wind Farm | Application | Gannet, kittiwake | Data from these windfarms are not yet publicly available to add to the quantitative cumulative assessment. These developments will be assessed after the effects of the Project have been assessed and will therefore need to include impacts from the Project in their cumulative impact assessment. |
| | Ossian Wind | Pre-Application (scoping report not submitted at the time of writing) | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| **Energy park works including renewable wave and tidal energy** | Nigg Energy Park East Quay | Consented | Gannet, kittiwake, puffin, razorbill | Any impacts resulting from disturbance and displacement from ports and harbours would be short-term, temporary and reversible in nature, lasting only for the duration of the activity.<br><br>Assessments of wave and tidal developments have some deal of uncertainty associated with their environmental impacts. All of these developments are very small in spatial scale with much of the assessments being qualitative. All developments have been found to have a negligible, not significant, effect on the environment. |
| | European Marine Energy Centre (EMEC)–Ltd - Fall of Warness Tidal Test Site | Pre-application (for proposed change to operational development) | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| | European Marine Energy Centre (EMEC) –td. - Billia Croo Wave Test Site | Operational | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| | Mocean Energy Limited | Post-consent | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| | West Islay Tidal Energy Park Project | Post-consent | Gannet, kittiwake, puffin | |
| | MeyGen Tidal Energy Project | Post-consent | Gannet, kittiwake | |

| DEVELOPMENT TYPE | DEVELOPMENT NAME | STATUS | KEY SPECIES WITHIN FORAGING RANGE FROM THE PROJECT | JUSTIFICATION FOR NEGLIGIBLE IMPACT |
|---|---|---|---|---|
| | Flex Marine Power Ltd | Pre-application | Gannet, kittiwake | |
| | Shetland Tidal Array | Post-consent | Gannet, kittiwake, puffin | |
| | Morlais Demonstration Zone Phase One (TIDAL) | Post-consent | Guillemot, razorbill | |
| Cables | West of Orkney Windfarm transmission connection to Flotta Hydrogen Hub | Pre-application | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | Any impacts resulting from disturbance and displacement from cable installation and maintenance activities would be short-term, temporary and reversible in nature, lasting only for the duration of the activity. Birds would be expected to return to the cable route corridors once installation activities have ceased. |
| | Caithness Moray HVDC Cable | Post-consent | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| | Caithness Orkney HVDC Cable | Pre-application | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| | Havfrue Telecommunications Cable | Pre-application | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| | NorthConnect HVDC Cable | Consented | Gannet, kittiwake, puffin | |
| | Western Isles to Mainland Scotland HVDC Interconnector | Consented | Gannet, kittiwake, puffin | |

| DEVELOPMENT TYPE | DEVELOPMENT NAME | STATUS | KEY SPECIES WITHIN FORAGING RANGE FROM THE PROJECT | JUSTIFICATION FOR NEGLIGIBLE IMPACT |
|---|---|---|---|---|
| | Telecommunications Cable Installation - Inner Hebrides | Consented | Gannet | |
| | Telecommunications Cable Installation – Orkney | Consented | Gannet, guillemot, kittiwake, puffin, razorbill | |
| | Telecommunications Cable Installation – Shetland | Consented | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| | Sanday to Eday & Eday to Westray Cable Replacement Applications | Consented | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| | Seagreen 1A Export Cable Corridor | Consented | Gannet, kittiwake, puffin | |
| **Dredging** | Toft Pier Re-development, Shetland | Consented | Gannet, kittiwake, puffin | Any impacts resulting from disturbance and displacement from dredging activities would be short-term, temporary and reversible in nature, lasting only for the duration of the dredging activity. Birds would be expected to return to the area once dredging activities have ceased. |
| | Aberdeen Harbour Maintenance Dredging and Sea Disposal | Consented | Gannet, kittiwake, puffin | |
| | Ardersier Port Dredge | Consented | Gannet, guillemot, kittiwake, puffin, razorbill | |
| **Airport and rocket launch works** | Glasgow Airport Investment Area (GAIA) | Consented | Gannet, kittiwake | Glasgow airport and the Space Hub Sutherland developments are located on land |

| DEVELOPMENT TYPE | DEVELOPMENT NAME | STATUS | KEY SPECIES WITHIN FORAGING RANGE FROM THE PROJECT | JUSTIFICATION FOR NEGLIGIBLE IMPACT |
|---|---|---|---|---|
| | Space Hub Sutherland | Consented | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | and impacts of displacement and collision risk are considered to have no effect (i.e. a negligible impact) on pelagic seabird species. |
| **Construction and maintenance of new harbours, piers, ports, ferry terminals, and sea wall defences.** | Aberdeen Harbour Expansion | Licence | Gannet, kittiwake, puffin | Any impacts resulting from disturbance and displacement from construction and maintenance activities around ports, harbours, piers and ferry terminals potentially could impact coastal bird species, but the risks are considered to have a negligible impact on pelagic seabird species due to the relative spatial overlap between developments and seabird distributions. The relative temporary loss of habitat to pelagic seabirds from these developments is negligible compared to their habitat use of the marine environment throughout the year. |
| | Ardersier Port Development | Consented | Gannet, guillemot, kittiwake, puffin, razorbill | |
| | Clyde Waterfront Renfrew Riverside (CWRR) | Licence | Gannet | |
| | Colonsay Ferry Terminal Upgrade | Pre-application | Gannet | |
| | Faray Slipway Extension and Landing Jetty | Consented | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| | Ferry Terminal Development –Tarbert, Isle of Harris | Consented | Gannet, kittiwake, puffin | |
| | Fionnphort Harbour Redevelopment | Pre-application | Gannet, kittiwake | |
| | Edinburgh Marina, Granton Harbour Redevelopment | Consented | Gannet, kittiwake | |
| | Deep Water Port, Glumaig Bay, Stornoway | Consented | Gannet, guillemot, kittiwake, puffin, razorbill | |

| DEVELOPMENT TYPE | DEVELOPMENT NAME | STATUS | KEY SPECIES WITHIN FORAGING RANGE FROM THE PROJECT | JUSTIFICATION FOR NEGLIGIBLE IMPACT |
|---|---|---|---|---|
| | Grangemouth Flood Defence Works | Pre-application | Gannet, kittiwake | |
| | Harbour Development - Staffin, Skye | Consented | Gannet, kittiwake, puffin | |
| | Hatston Pier and Terminal Expansion | Pre-application | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| | Hunterston Marine Construction Yard Redevelopment - Hunterston, North Ayrshire | Pre-application | Gannet | |
| | Iona Harbour Redevelopment | Pre-application | Gannet, kittiwake | |
| | Kennacraig Harbour Repairs | Pre-application | Gannet, kittiwake | |
| | Kilfinichen Pier Development, Isle of Mull | Consented | Gannet, kittiwake | |
| | Kirkwall Pier and Harbour Enhancements | Pre-application | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| | Lerwick Port Authority - Proposed Dales Voe Decommisioning Base | Pre-application | Gannet, kittiwake | |
| | Lochmaddy Ferry Terminal Development | Consented | Gannet, kittiwake, puffin | |

| DEVELOPMENT TYPE | DEVELOPMENT NAME | STATUS | KEY SPECIES WITHIN FORAGING RANGE FROM THE PROJECT | JUSTIFICATION FOR NEGLIGIBLE IMPACT |
|---|---|---|---|---|
| | Mallaig Harbour Development | Consented | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| | Newton Marina Development | Consented | Gannet, guillemot, kittiwake, puffin, razorbill | |
| | Peterhead Sea Wall Repair and Extension | Consented | Gannet | |
| | Port Ellen Harbour Refurbishments | Pre-application | Gannet, guillemot, kittiwake, puffin, razorbill | |
| | Port of Cromarty Firth - Phase 4 Development, Invergordon Service Base | Consented | Gannet, kittiwake, puffin | |
| | Port of Dundee Expansion | Pre-application | Gannet, kittiwake | |
| | Port of Leith | Pre-application | Gannet, kittiwake | |
| | Port of Leith Outer Berth | Application | Gannet | |
| | Quay Improvement Works, Ardrossan Harbour | Pre-application | Gannet, kittiwake, puffin | |
| | Redevelopment of Dundee East | Consented | Gannet | |

| DEVELOPMENT TYPE | DEVELOPMENT NAME | STATUS | KEY SPECIES WITHIN FORAGING RANGE FROM THE PROJECT | JUSTIFICATION FOR NEGLIGIBLE IMPACT |
|---|---|---|---|---|
| | Rosyth International Container Terminal | Pre-application | Gannet, kittiwake, puffin, razorbill | |
| | Scapa Deep Water Quay | Pre-application | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| | Scapa Pier Enhancements | Pre-application | Gannet, kittiwake | |
| | Scotstoun Deep Water Berth Project | Consented | Gannet, kittiwake | |
| | SIMEC GHR–LTD - New Landing Facility - Loch Etive, Argyll & Bute | Pre-application | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| | St. Ola Pier Redevelopment, Scrabster | Consented | Gannet, kittiwake, puffin | |
| | Uig Ferry Terminal Development, Uig, Isle of Skye | Consented | Gannet, great black-backed gull, guillemot, kittiwake, puffin, razorbill | |
| **Bridge works** | Construction of bridge access system and walk way - Forth Rail Bridge, South Queensferry | Pre-application | Gannet, kittiwake | Any impacts resulting from disturbance and displacement from bridge works could impact coastal and other terrestrial bird species, but the risks are considered to have a negligible impact on pelagic seabird species. The relative temporary loss of habitat to pelagic seabirds from these developments is negligible |
| | Bridge Maintenance Works, A87 Kyle of Lochalsh | Consented | Gannet, kittiwake, puffin | |

| DEVELOPMENT TYPE | DEVELOPMENT NAME | STATUS | KEY SPECIES WITHIN FORAGING RANGE FROM THE PROJECT | JUSTIFICATION FOR NEGLIGIBLE IMPACT |
|---|---|---|---|---|
| | | | | compared to their habitat use of the marine environment throughout the year. |
| Other works | Wild Seaweed Harvesting, West Coast of Scotland | Pre-application | Gannet, kittiwake, puffin | Any impacts resulting from disturbance and displacement from activities on the land (seaweed harvesting and land reclamation) or inshore waters (aquaculture) are considered to potentially impact coastal and other terrestrial bird species but have a negligible impact on pelagic seabird species. The relative temporary loss of habitat to pelagic seabirds from these developments is negligible compared to their habitat use of the marine environment throughout the year. |
| | Kishorn Port Land Reclamation for Laydown Area | Pre-application | Gannet, kittiwake, puffin | |
| | Land Reclama–ion - Govan Wet Basin, BAE Systems Govan Shipyard, River Clyde | Application | Gannet, kittiwake, puffin | |
| | COVID-19 Wellboat Variations | Licence | Gannet, guillemot, kittiwake, puffin, razorbill | |
| | Kyleakin Feed Mill Construction | Consented | Gannet, kittiwake, puffin | |

## 13.7.2 Cumulative construction effects

All impacts assessed for the Project alone during the construction stage are considered too small to contribute to a cumulative impact (section 13.6.1). The magnitude of all impacts during construction are predicted to be negligible or low and the overall effect to species of medium to high sensitivity are considered to be negligible and not significant in EIA terms. Due to this, impacts are not considered to contribute materially to any cumulative impact.

## 13.7.3 Cumulative operation and maintenance effects

### 13.7.3.1 Combined operational collision risk and displacement

As presented in the following sections, a cumulative impact assessment on combined displacement and collision mortality has been carried out separately for the breeding season and non-breeding season (separate assessment based on the eastern BDMPS and western BDMPS) where data are available for the following species: kittiwake, great black-backed gull, guillemot, razorbill, puffin, and gannet.

Further analyses using the ***Alternative Approach*** as described in NatureScot Guidance Note 8[24] and SNCB (2022)[25] is provided in SS12: Offshore ornithology technical supporting study, Annex 12.13.

#### 13.7.3.1.1 Kittiwake

Kittiwakes have been assessed to have a medium sensitivity to disturbance and displacement (section 13.6.2.1.5) and collision risk (section 13.6.2.3.1).

**Breeding season**

The cumulative kittiwake displacement and collision risk mortality which has been estimated for north and north-east offshore windfarms in the Pentland Firth and the Moray Firth (Table 13-39) is summarised in Table 13-41.

During the breeding season, the cumulative number of kittiwakes of all ages subject to mortality due to displacement and collision from all developments is 305.6 individuals (Table 13-41). The cumulative number of adults minus sabbatical birds subject to mortality from displacement and collision from all developments is 187.3 individuals (305.6 * 0.6811 adult proportion minus 0.1 sabbatical proportion, Table 13-9).

[24] *https://www.nature.scot/doc/guidance-note-8-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing*

[25] *https://data.jncc.gov.uk/data/9aecb87c-80c5-4cfb-9102-39f0228dcc9a/joint-sncb-interim-displacement-advice-note-2022.pdf*

*Table 13-41 Kittiwake cumulative displacement and collision risk mortality during the breeding season*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| **PFOWF** | PFOWF Volume 2: Offshore EIAR. Chapter 12: Marine Ornithology | 3.3 | 7.0 | 10.3 |
| **BOWL** | Moray West EIAR (CRM) & PFOWF (Displacement) | 13.3 | 30.0 | 43.3 |
| **Moray East** | Moray West EIAR (CRM) & PFOWF (Displacement) | 24.5 | 73.0 | 97.5 |
| **Moray West** | Moray West EIAR (CRM) & PFOWF (Displacement) | 41.4 | 79.0 | 120.4 |
| **The offshore Project** | Project alone assessment | 4.1 | 29.9 | 34.0 |
| **Total for all projects** | | 86.7 | 218.9 | 305.6 |

The regional breeding population for kittiwake is 256,327 individuals (Table 13-8). At the average baseline mortality rate for kittiwake of 0.146 (Table 13-9) the number of individuals expected to die during the breeding season is 37,424 (256,327 x 0.146). The addition of a maximum of 187.3 adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality to 0.073%.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative breeding kittiwakes (Table 13-42). With an additional cumulative displacement and collision mortality of 187.3 adults the model predicted over 35 years a reduction in growth rate by 0.09% (CGR = 0.9995; Table 13-42) and a reduction in population size by 3.29% (CGR = 0.9816; Table 13-42).

This magnitude would be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude.

*Table 13-42 Projected PVA metrics after 35 years for kittiwake in the breeding season for the Project cumulatively. (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| KITTIWAKE – BREEDING SEASON | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9995 | 0.9995 | 0.0002 | 0.9991 | 0.9999 | 0.9816 | 0.9814 | 0.0072 | 0.9671 | 0.9956 | 48.9 | 51.3 |

*The PVA outputs using the Alternative Approach is provided in Annex 12.13.*

Evaluation of significance

Taking the medium sensitivity of kittiwakes and the negligible magnitude of impact, the overall cumulative effect to breeding kittiwakes is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

**Non-breeding season – Eastern region BDMPS**

Table 13-43 summarises the cumulative kittiwake displacement and collision risk mortality which has been estimated for offshore windfarms within the eastern region BDMPS (Table 13-39).

During the non-breeding season in the eastern region BDMPS, the cumulative number of kittiwakes of all ages subject to mortality due to displacement and collision from all developments is 4,560 individuals (Table 13-43). The cumulative number of adults subject to mortality from displacement and collision from all developments is 3,106 individuals (4,560 * 0.681 adult proportion, Table 13-9).

*Table 13-43 Kittiwake cumulative displacement and collision risk mortality during the non-breeding season for the eastern region BDMPS*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES)[1] | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| PFOWF | PFOWF Volume 2: Offshore EIAR. Chapter 12: Marine Ornithology | 0.7 | 1 | 1.7 |
| BOWL | Moray West EIAR | 13.3 | 14 | 27.3 |
| Blyth Demonstration Site | Moray West EIAR | 8.9 | 3 | 11.9 |
| Dogger Bank A & B | Moray West EIAR | 185.8 | 402 | 587.8 |
| Dogger Bank C & Sofia | Moray West EIAR | 141.7 | 296 | 437.7 |
| Dudgeon | Moray West EIAR | - | 0 | 0.0 |
| Dudgeon Extension Project | Berwick Bank CIA | - | 12 | 12.0 |
| East Anglia ONE | Moray West EIAR | 13.9 | 538 | 551.9 |
| East Anglia ONE North | Berwick Bank CIA | 5.2 | 8.4 | 13.6 |
| East Anglia THREE | Moray West EIAR | 15.7 | 95 | 110.7 |
| East Anglia TWO | Berwick Bank CIA | 3.6 | 12 | 15.6 |
| EOWDC | Moray West EIAR | 0.3 | 3 | 3.3 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES)[1] | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| Galloper | Moray West EIAR | - | 54 | 54.0 |
| Greater Gabbard | Moray West EIAR | - | 23 | 23.0 |
| Gunfleet Sands | Moray West EIAR | - | 0 | 0.0 |
| Hornsea Project Four | Berwick Bank CIA | 43.3 | 30 | 73.3 |
| Hornsea Project One | Moray West EIAR | 377.8 | 66 | 443.8 |
| Hornsea Project Two | Moray West EIAR | 23.7 | 10 | 33.7 |
| Hornsea Project Three | Moray West EIAR | 45.5 | 69 | 114.5 |
| Humber Gateway | Moray West EIAR | - | 4 | 4.0 |
| Hywind Scotland | Moray West EIAR | - | 2 | 2.0 |
| Inch Cape | Berwick Bank CIA | 12.8 | 32 | 44.8 |
| Kentish Flats | Berwick Bank CIA | - | 2 | 2.0 |
| Kentish Flats Extension | Moray West EIAR | - | 2 | 2.0 |
| Kincardine | Moray West EIAR | - | 7 | 7.0 |
| Lincs, Lynn & Inner Dowsing | Moray West EIAR | - | 2 | 2.0 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES)[1] | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| London Array | Moray West EIAR | - | 5 | 5.0 |
| Levenmouth Demonstration Turbine | Berwick Bank CIA | - | 0 | 0.0 |
| Moray East | Moray West EIAR | 9.7 | 14 | 23.7 |
| Moray West | Moray West EIAR | 15.3 | 31 | 46.3 |
| Neart na Gaoithe | Moray West EIAR | 24.2 | 61 | 85.2 |
| Norfolk Boreas | Berwick Bank CIA | 30.9 | 44 | 74.9 |
| Norfolk Vanguard | Berwick Bank CIA | 15.5 | 35 | 50.5 |
| Race Bank | Moray West EIAR | - | 17.6 | 17.6 |
| Scroby Sands | Moray West EIAR | - | 0 | 0.0 |
| Seagreen (Phase 1) | Moray West EIAR | - | 459 | 459.0 |
| Sheringham Shoal | Moray West EIAR | - | 0 | 0.0 |
| Teesside | Moray West EIAR | - | 16 | 16.0 |
| Thanet | Moray West EIAR | - | 0 | 0.0 |
| Triton Knoll | Moray West EIAR | 4.0 | 166 | 170.0 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES)[1] | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| **Westermost Rough** | Moray West EIAR | | 0 | 0.0 |
| **Forthwind** | Forthwind EIA | 0 | 0 | 0.0 |
| **Berwick Bank** | Berwick Bank CRM & Displacement Technical Appendices (worst values only) | 225 | 738.39 | 963.4 |
| **Caledonia** | https://marine.gov.scot/sites/default/files/chapter_12._marine_orn ithology.pdf | 0 | 0 | 0 |
| **The offshore Project** | Project alone assessment | 7.3 | 61.4 | 68.7 |
| **Total for all projects** | | 1,224.1 | 3,335.8 | 4,559.9 |

**Note:**

**1: A "-" indicates that no displacement data is available. A "0" indicates that displacement data is available, but the value is zero.**

The smallest eastern region BDMPS non-breeding kittiwake population (spring migration) is 375,815 individuals (Table 13-8). At the average baseline mortality rate for kittiwake of 0.146 (Table 13-9) the number of individuals expected to die during the non-breeding season in the eastern region BDMPS is 54,869 (375,815 x 0.146). The addition of a maximum of 3,106 adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.7438% points.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative non-breeding kittiwakes in the eastern region BDMPS (Table 13-44). With an additional cumulative displacement and collision mortality of 3,106 adults the model predicts over 35 years a reduction in growth rate by 0.60% (CGR = 0.9940; Table 13-44) and a reduction in population size by 19.4% (CPS = 0.8059; Table 13-44).

This magnitude would be potentially detectable but as the increase in baseline mortality is less than 1% and the predicted change in population growth rate was less than 1% it would not materially alter the background mortality or trend in change of the population; the impact is defined as being of low magnitude. While the projected reduction in population size would be detectable if it occurred, the use of a density independent population model means that the CPS result is unlikely to be robust. The population models used here were not density dependent (to follow NatureScot guidance). As a result, population size predictions are not constrained by the model and can be predicted to grow, or decline, in unrealist ways. This results in the CPS metrics from the model being sensitive to the projected duration of the model. Projected population growth rates (and hence CGR metrics) are much less sensitive to the assumption of density dependence and as a result are not as sensitive to the projected duration of the model. Thus, based on the greater utility of the CGR metric in this case it is considered that the cumulative impacts on the great black-backed gull are negligible and not significant in EIA terms.

*Table 13-44 Projected PVA metrics after 35 years for kittiwake in the non-breeding season for the Project cumulatively in the East. (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| KITTIWAKE – NON-BREEDING SEASON EASTERN REGION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9940 | 0.9940 | 0.0003 | 0.9935 | 0.9945 | 0.8059 | 0.8059 | 0.0082 | 0.7906 | 0.8210 | 36.4 | 64.7 |

*The PVA outputs using the Alternative Approach is provided in Annex. 12.13.*

Evaluation of significance

Taking the medium sensitivity of kittiwakes and the low magnitude of impact, the overall cumulative effect to non-breeding kittiwakes in the eastern region BDMPS is considered to be minor and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Low | Minor |

Impact significance - NOT SIGNIFICANT

**Non-breeding season – Western region BDMPS**

The cumulative kittiwake displacement and collision risk mortality which has been estimated for offshore windfarms within the western region BDMPS (Table 13-39) is summarised in Table 13-45.

During the non-breeding season in the western region BDMPS, the cumulative number of kittiwakes of all ages subject to mortality due to displacement and collision from all developments is 524.0 individuals (Table 13-45). The cumulative number of adults subject to mortality from displacement and collision from all developments is 356.9 individuals (524.0 *0.681 adult proportion, Table 13-9).

*Table 13-45 Kittiwake cumulative displacement and collision risk mortality during the non-breeding season for the western region BDMPS*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES)[1] | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| North Hoyle | Awel y Môr EIAR | - | 0 | 0 |
| Barrow | Awel y Môr EIAR | - | 0 | 0 |
| Burbo Bank | Awel y Môr EIAR | - | 0 | 0 |
| Rhyl Flats | Awel y Môr EIAR | - | 0 | 0 |
| Robin Rigg | Awel y Môr EIAR | - | 0 | 0 |
| Walney (Phase 1 & Phase 2) | Awel y Môr EIAR | - | 0 | 0 |
| Ormonde | Awel y Môr EIAR | - | 0 | 0 |
| West of Duddon Sands | Awel y Môr EIAR | - | 0 | 0 |
| Gwynt y Môr | Awel y Môr EIAR | - | 0 | 0 |
| Burbo Bank Extension | Awel y Môr EIAR | 0 | 20.7* | 20.7 |
| Rampion | Rampion written response to NE | - | 111.1 | 111.1 |
| Walney Extension | Walney EIA | 9 | 168.85 | 177.85 |
| Erebus Floating Wind Demo | Erebus EIAR | 9 | 57 | 66 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES)[1] | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| **Awel y Môr** | Awel y Môr EIAR | 0 | 77.94 | 77.94 |
| **Pentland Floating Demo** | PFOWF Volume 2: Offshore EIAR. Chapter 12: Marine Ornithology | 0.71 | 1 | 1.71 |
| **The offshore Project** | Project alone assessment | 7.3 | 61.4 | 68.7 |
| **Total for all projects** | | 26.0 | 498.0 | 524.0 |

**Note:**

***CRM for Burbo Bank Extension is an annual value.**

**1: A "-" indicates that no displacement data is available. A "0" indicates that displacement data is available, but the value is zero.**

The smallest western region BDMPS non-breeding kittiwake population (spring migration) is 375,711 individuals (Table 13-8). At the average baseline mortality rate for kittiwake of 0.146 (Table 13-9) the number of individuals expected to die during the breeding season is 54,854 (375,711 x 0.146). The addition of a maximum of 356.90 adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.0950% points.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative non-breeding kittiwakes in the western region BDMPS (Table 13-46). With an additional cumulative displacement and collision mortality of 356.9 adults the model predicts over 35 years a reduction in growth rate by 0.07% (CGR = 0.9993; Table 13-46) and reduction in population size by 2.44% (0.9756; Table 13-46.

This magnitude would be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude. While the projected reduction in population size would detectable if it occurred, the use of a density independent population model means that the ~~counterfactual of population size~~ CPS result is unlikely to be robust.

*Table 13-46 Projected PVA metrics over 35 years for kittiwake in the non-breeding season for the Project cumulatively in the West. (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| KITTIWAKE – NON-BREEDING SEASON WESTERN REGION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9993 | 0.9993 | 0.0002 | 0.9990 | 0.9996 | 0.9756 | 0.9756 | 0.0057 | 0.9637 | 0.9865 | 48.9 | 52.0 |

*The PVA outputs using the Alternative Approach is provided in Annex. 12.13.*

Evaluation of significance

Taking the medium sensitivity of kittiwakes and the negligible magnitude of impact, the overall cumulative effect to non-breeding kittiwakes in the western region BDMPS is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

### 13.7.3.1.2 Great black-backed gull

Great black-backed gulls have been assessed to have a high sensitivity to collision risk (section 13.6.2.3.2).

**Breeding season**

The cumulative great black-backed gull displacement and collision risk mortality which has been estimated for north and north-east offshore windfarms in the Pentland Firth and the Moray Firth (Table 13-39) is summarised in Table 13-45.

During the breeding season, the cumulative number of great black-backed gulls of all ages subject to mortality due to displacement and collision from all developments is 41.8 individuals (Table 13-47). The cumulative number of adults minus sabbatical birds subject to mortality from displacement and collision from all developments is 13.2 individuals (41.8 * 0.485 adult proportion minus 0.35 sabbatical proportion, Table 13-9).

*Table 13-47 Great black-backed gull cumulative displacement and collision risk mortality during the breeding season*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| PFOWF | PFOWF Volume 3: Appendix A.12.3. Marine Ornithology: Collision Risk Modelling | 0 | 0 | 0 |
| BOWL | Moray West EIAR | 0 | 4.0 | 4.0 |
| Moray East | Moray West EIAR | 0 | 23.0 | 23.0 |
| Moray West | Moray West EIAR | 0 | 14.0 | 14.0 |
| The offshore Project | Project alone assessment | 0 | 0.8 | 0.8 |
| Total for all projects | | 0 | 41.8 | 41.8 |

The regional breeding population for great black-backed gull is 2,524 (Table 13-8). At the average baseline mortality rate for great black-backed gull of 0.07 (Table 13-9) the number of individuals expected to die during the breeding season is 177 (2,524 x 0.07). The addition of a maximum of 13.2 adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.4125%.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative breeding great black-backed gulls (Table 13-48). With an additional cumulative displacement and collision mortality of 10.4 adults the model over 35 years predicts a reduction in growth rate by 0.28% (CGR = 0.9972; Table 13-48) and a reduction in population size by 9.73% (CPS = 0.9027; Table 13-48). This magnitude would potentially be detectable but would not materially alter the background mortality of the population; the impact is defined as being of low magnitude.

*Table 13-48 Projected PVA metrics over 35 years for great black-backed gull in the breeding season for the Project cumulatively. (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| GREAT BLACK-BACKED GULL – BREEDING SEASON | | |
|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | COUNTERFACTUAL OF POPULATION SIZE | QUANTILES |

| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.9972 | 0.9972 | 0.0005 | 0.9962 | 0.9981 | 0.9027 | 0.9029 | 0.0173 | 0.8696 | 0.9378 | 40.2 | 58.4 |

Evaluation of significance

Taking the high sensitivity of great black-backed gulls and the low magnitude of impact, the overall cumulative effect to breeding great black-backed gulls is considered to be minor and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| High | Low | Minor |
| Impact significance - NOT SIGNIFICANT | | |

**Non-breeding season – Eastern region BDMPS**

The cumulative great black-backed gull displacement and collision risk mortality which has been estimated for offshore windfarms within the eastern region BDMPS (Table 13-39) is summarised in Table 13-49.

During the non-breeding season in the eastern region BDMPS, the cumulative number of great black-backed gulls of all ages subject to mortality due to displacement and collision from all developments is 480.4 individuals (Table 13-49). The cumulative number of adults subject to mortality from displacement and collision from all developments is 232.8 individuals (480.4 * 0.4847adult proportion, Table 13-9).

*Table 13-49 Great black-backed gull cumulative displacement and collision risk mortality during the non-breeding season for the eastern region BDMPS*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| PFOWF | PFOWF Volume 3: Appendix A.12.3. Marine Ornithology: Collision Risk Modelling | 0 | 3 | 3 |
| BOWL | Moray West EIAR | 0 | 31 | 31 |
| Moray East | Moray West EIAR | 0 | 12 | 12 |
| Moray West | Moray West EIAR | 0 | 5 | 5 |
| EOWDC (Aberdeen Demo) | Moray West EIAR | 0 | 2 | 2 |
| Blyth Demo | Moray West EIAR | 0 | 5 | 5 |
| Dogger Bank Creyke Beck A and B | Moray West EIAR | 0 | 28 | 28 |
| Dogger Bank Teesside A and Sofia (formerly Dogger Bank Teesside B) | Moray West EIAR | 0 | 29 | 29 |
| East Anglia ONE | Moray West EIAR | 0 | 122 | 122 |
| East Anglia Three | Moray West EIAR | 0 | 37 | 37 |
| Galloper | Moray West EIAR | 0 | 21 | 21 |
| Hornsea Project One | Moray West EIAR | 0 | 71 | 71 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| Hornsea Project Two | Moray West EIAR | 0 | 18 | 18 |
| Humber Gateway | Moray West EIAR | 0 | 4 | 4 |
| Hywind | Moray West EIAR | 0 | 5 | 5 |
| Inchcape | Moray West EIAR | 0 | 37 | 37 |
| Kentish Flats Extension | Moray West EIAR | 0 | 0 | 0 |
| Neart na Gaoithe | Moray West EIAR | 0 | 7 | 7 |
| Seagreen Alpha | Moray West EIAR | 0 | 31 | 31 |
| Forthwind | Forthwind EIA | 0 | 0 | 0 |
| Berwick Bank | Berwick Bank CRM & Displacement Technical Appendices (worst values only) | 0 | 0 | 0 |
| Caledonia | Development only at scoping stage | 0 | 0 | 0 |
| The offshore Project | Project alone assessment | 0 | 12.4 | 12.4 |
| Total for all projects | | 0 | 480.4 | 480.4 |

The eastern region BDMPS non-breeding (wintering) great black-backed gull population is 32,070 individuals (Table 13-8). At the average baseline mortality rate for great black-backed gull of 0.07 (Table 13-9) the number of individuals expected to die during the non-breeding season in the eastern region BDMPS is 2,243 (32,048 x 0.07). The addition of a maximum of 232.8 adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.726%.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative non-breeding eastern region BDMPS great black-backed gulls (Table 13-50). With an additional cumulative displacement and collision mortality of 232.8 adults the model predicted over 35 years a reduction in growth rate by 0.03% (CGR = 0.9997; Table 13-50) and a reduction in population size by 1.04% (CPS = 0.9896; Table 13-50).

This magnitude would potentially be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude.

*Table 13-50 Projected PVA metrics over 35 years for great black-backed gull in the non-breeding season for the Project cumulatively in the East (North Sea & Channel). (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| GREAT BLACK-BACKED GULL – NON-BREEDING SEASON EASTERN REGION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9997 | 0.9997 | 0.0001 | 0.9995 | 1.0000 | 0.9896 | 0.9898 | 0.0053 | 0.9796 | 1.0006 | 49.3 | 50.9 |

Evaluation of significance

Taking the high sensitivity of great black-backed gulls and the low magnitude of impact, the overall cumulative effect to non-breeding great black-backed gulls in the eastern region BDMPS is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| High | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

### Non-breeding season – Western region BDMPS

The cumulative great black-backed gull displacement and collision risk mortality which has been estimated for offshore windfarms within the western region BDMPS (Table 13-39) is summarised in Table 13-51.

During the non-breeding season in the western region BDMPS, the cumulative number of great black-backed gulls of all ages subject to mortality due to displacement and collision from all developments is 15.4 individuals (Table 13-51). The cumulative number of adults subject to mortality from displacement and collision from all developments is 7.4 individuals (15.4 * 0.485 adult proportion, Table 13-9).

*Table 13-51 Great black-backed gull cumulative displacement and collision risk mortality during the non-breeding season for the western region BDMPS*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| **Robin Rigg** | Awel y Mor EIAR | 0 | 0 | 0 |
| **Pentland Floating Demo** | PFOWF Volume 2: Offshore EIAR. Chapter 12: Marine Ornithology | 0 | 3.0 | 3.0 |
| **The offshore Project** | Project alone assessment | 0 | 12.4 | 12.4 |
| **Total for all projects** | | 0 | 15.4 | 15.4 |

The western region BDMPS non-breeding (wintering) great black-backed gull population is 14,238 individuals (Table 13-8). At the average baseline mortality rate for great black-backed gull of 0.07 (Table 13-9) the number of individuals expected to die during the non-breeding season in the western region BDMPS is 997 (14,238 x 0.07). The addition of a maximum of 7.4 adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.0414%.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative non-breeding western region BDMPS great black-backed gulls (Table 13-52). With an additional cumulative displacement and collision mortality of 7.4 adults the model predicted over 35 years a reduction in growth rate by 0.01% (CGR = 0.9999; Table 13-52) and a reduction in population size by 0.38% (CPS = 0.9962; Table 13-52).

This magnitude would be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude.

*Table 13-52 Projected PVA metrics from 10 to 35 years for great black-backed gull in the non-breeding season for the Project cumulatively in the West. (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| GREAT BLACK-BACKED GULL – NON-BREEDING SEASON WESTERN REGION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| **0.9961** | 0.9961 | 0.0002 | 0.9956 | 0.9965 | 0.8680 | 0.8679 | 0.0078 | 0.8530 | 0.8830 | 37.6 | 61.5 |

*The PVA outputs using the Alternative Approach is provided in Annex 12.13.*

Evaluation of significance

Taking the high sensitivity of great black-backed gulls and the negligible magnitude of impact, the overall cumulative effect to non-breeding great black-backed gulls in the western region BDMPS is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| High | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

#### 13.7.3.1.3 Guillemot

Guillemots have been assessed to have a medium sensitivity to disturbance and displacement (section 13.6.2.1.7).

**Breeding season**

The cumulative guillemot displacement and collision risk mortality which has been estimated for north and north-east offshore windfarms in the Pentland Firth and the Moray Firth (Table 13-39) is summarised in Table 13-51.

During the breeding season, the cumulative number of guillemots of all ages subject to mortality due to displacement and collision from all developments is 386.6 individuals (Table 13-53). The cumulative number of adults minus sabbatical birds subject to mortality from displacement and collision from all developments is 244.4individuals (386.6 * 0.6798 adult proportion minus 0.07 sabbatical proportion, Table 13-9).

*Table 13-53 Guillemot cumulative displacement and collision risk mortality during the breeding season*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| PFOWF | PFOWF Volume 2: Offshore EIAR. Chapter 12: Marine Ornithology | 6.9 | 0 | 6.9 |
| BOWL | Moray West EIAR | 82.0 | 0 | 82.0 |
| Moray East | Moray West EIAR | 59.0 | 0 | 59.0 |
| Moray West | Moray West EIAR | 122.0 | 0 | 122.0 |
| The offshore Project | Project alone assessment | 116.7 | 0 | 116.7 |
| Total for all projects | | 386.6 | 0 | 386.6 |

The regional breeding population for guillemot is 612,608 individuals (Table 13-8). At the average baseline mortality rate for guillemot of 0.060 (Table 13-9) the number of individuals expected to die during the breeding season is 36,756 (612,608 x 0.060). The addition of a maximum of 244.4adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.0332%.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative breeding guillemots (Table 13-54). With an additional cumulative displacement and collision mortality of 244.4adults the model predicts over 35 years a reduction in growth rate by 0.03% (CGR = 0.9997; Table 13-54) and a reduction in population size by 1.04% (CPS = 0.9896; Table 13-54).

This magnitude would be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude.

*Table 13-54 Projected PVA metrics over 35 years for guillemot in the breeding season for the Project cumulatively. (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| GUILLEMOT – BREEDING SEASON | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9997 | 0.9997 | 0.0001 | 0.9996 | 0.9998 | 0.9896 | 0.9895 | 0.0024 | 0.9847 | 0.9944 | 48.1 | 51.8 |

*The PVA outputs using the Alternative Approach is provided in Annex 12.13.*

Evaluation of significance

Taking the medium sensitivity of guillemots and the negligible magnitude of impact, the overall cumulative effect to breeding guillemots is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

**Non-breeding season – Eastern region BDMPS**

The cumulative guillemot displacement and collision risk mortality which has been estimated for offshore windfarms within the eastern region BDMPS (Table 13-39) is summarised in Table 13-55.

During the non-breeding season in the eastern region BDMPS, the cumulative number of guillemots of all ages subject to mortality due to displacement and collision from all developments is 1,451.2 individuals (Table 13-55). The cumulative number of adults birds subject to mortality from displacement and collision from all developments is 986.5individuals (1,451.2* 06798 adult proportion, Table 13-9).

*Table 13-55 Guillemot cumulative displacement and collision risk mortality during the non-breeding season for the eastern region BDMPS*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| PFOWF | PFOWF Volume 2: Offshore EIAR. Chapter 12: Marine Ornithology | 3.9 | 0 | 3.9 |
| BOWL | Moray West EIAR | 17 | 0 | 17 |
| Moray East | Moray West EIAR | 7 | 0 | 7 |
| Moray West | Moray West EIAR | 191 | 0 | 191 |
| EOWDC (Aberdeen) | Moray West EIAR | 1 | 0 | 1 |
| Blyth Demonstration | Moray West EIAR | 8 | 0 | 8 |
| Dogger Bank Creyke Beck A | Moray West EIAR | 40 | 0 | 40 |
| Dogger Bank Creyke Beck B | Moray West EIAR | 68 | 0 | 68 |
| Dogger Bank Teesside A | Moray West EIAR | 17 | 0 | 17 |
| Dudgeon | Moray West EIAR | 4 | 0 | 4 |
| East Anglia ONE | Moray West EIAR | 4 | 0 | 4 |
| East Anglia Three | Moray West EIAR | 8 | 0 | 8 |
| Galloper | Moray West EIAR | 4 | 0 | 4 |
| Greater Gabbard | Moray West EIAR | 4 | 0 | 4 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| Hornsea Project One | Moray West EIAR | 44 | 0 | 44 |
| Hornsea Project Two | Moray West EIAR | 79 | 0 | 79 |
| Humber Gateway | Moray West EIAR | 1 | 0 | 1 |
| Hywind | Moray West EIAR | 0 | 0 | 0 |
| Inch Cape | Moray West EIAR | 19 | 0 | 19 |
| Kincardine | Moray West EIAR | 0 | 0 | 0 |
| Lincs and LID6 | Moray West EIAR | 6 | 0 | 6 |
| London Array | Moray West EIAR | 3 | 0 | 3 |
| Neart na Gaoithe | Moray West EIAR | 20 | 0 | 20 |
| Race Bank | Moray West EIAR | 6 | 0 | 6 |
| Rampion | Awel y Môr EIAR | 0 | 0 | 0 |
| Seagreen A | Moray West EIAR | 0 | 0 | 0 |
| Seagreen B | Moray West EIAR | 0 | 0 | 0 |
| Sheringham Shoal | Moray West EIAR | 5 | 0 | 5 |
| Sofia (formerly Dogger Bank Teesside B) | Moray West EIAR | 28 | 0 | 28 |
| Teesside | Moray West EIAR | 6 | 0 | 6 |
| Thanet | Moray West EIAR | 1 | 0 | 1 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| Triton Knoll | Moray West EIAR | 5 | 0 | 5 |
| Westermost Rough | Moray West EIAR | 3 | 0 | 3 |
| Forthwind | Forthwind EIA | 2 | 0 | 2 |
| Berwick Bank | Berwick Bank CRM & Displacement Technical Appendices (worst values only) | 795 | 0 | 795 |
| Caledonia | https://marine.gov.scot/sites/default/files/chapter_12._marine_ornithology.pdf | 0 | 0 | 0 |
| The offshore Project | Project alone assessment | 51.3 | 0 | 51.3 |
| Total for all projects | | 1,451.2 | 0 | 1,451.2 |

As advised by NatureScot (refer to section 13.3), the regional breeding population for guillemot of 612,608 individuals was used for the non-breeding season assessment (Table 13-8). At the average baseline mortality rate for guillemot of 0.060 (Table 13-9) the number of individuals expected to die during the non-breeding season in the eastern region BDMPS is 36,756 (612,608 x 0.06). The addition of a maximum of 986.5adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.1610%.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative non-breeding eastern region BDMPS guillemots (Table 13-56). With an additional cumulative displacement and collision mortality of 986.5adults the model predicts over 35 years a reduction in growth rate by 0.12% (CGR = 0.9988; Table 13-56) and a reduction in population size by 4.17% (CPS = 0.9583; Table 13-56).

This magnitude would be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude.

*Table 13-56 Projected PVA metrics over 35 years for guillemot in the non-breeding season for the Project cumulatively in the East (North Sea & Channel). (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| GUILLEMOT – NON-BREEDING SEASON EASTERN REGION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9988 | 0.9988 | 0.0001 | 0.9987 | 0.9990 | 0.9583 | 0.9583 | 0.0026 | 0.9531 | 0.9631 | 43.3 | 57.3 |

*The PVA outputs using the Alternative Approach is provided in Annex 12.13.*

Evaluation of significance

Taking the medium sensitivity of guillemots and the negligible magnitude of impact, the overall cumulative effect to non-breeding guillemots in the eastern region BDMPS is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

**Non-breeding season – Western region BDMPS**

The cumulative guillemot displacement and collision risk mortality which has been estimated for offshore windfarms within the western region BDMPS (Table 13-39) is summarised in Table 13-57.

During the non-breeding season in the western region BDMPS, the cumulative number of guillemots of all ages subject to mortality due to displacement and collision from all developments is 195.3individuals (Table 13-57). The cumulative number of adults birds subject to mortality from displacement and collision from all developments is 132.8individuals (195.3 * 0.6798 adult proportion, Table 13-9).

*Table 13-57 Guillemot cumulative displacement and collision risk mortality during the non-breeding season for the western region BDMPS*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| North Hoyle | Awel y Môr EIAR | 0 | 0 | 0 |
| Barrow | Awel y Môr EIAR | 0 | 0 | 0 |
| Burbo Bank | Awel y Môr EIAR | 0 | 0 | 0 |
| Rhyl Flats | Awel y Môr EIAR | 0 | 0 | 0 |
| Robin Rigg | Awel y Môr EIAR | 0 | 0 | 0 |
| Walney (Phase 1 & Phase 2) | Awel y Môr EIAR | 0 | 0 | 0 |
| Ormonde | Awel y Môr EIAR | 0 | 0 | 0 |
| West of Duddon Sands | Awel y Môr EIAR | 0 | 0 | 0 |
| Gwynt y Môr | Awel y Môr EIAR | 0 | 0 | 0 |
| Burbo Bank Extension | Awel y Môr EIAR | 25 | 0 | 25 |
| Walney Extension | Awel y Môr EIAR | 46 | 0 | 46 |
| Erebus Floating Wind Demo | Awel y Môr EIAR | 25 | 0 | 25 |
| Awel y Môr | Awel y Môr EIAR | 36 | 0 | 36 |
| Pentland Floating Demo | Awel y Môr EIAR | 3.9 | 0 | 3.9 |
| The offshore Project | Project alone assessment | 51.3 | 0.0 | 51.3 |
| Total for all developments | | 195.3 | 0.0 | 195.3 |

As advised by NatureScot (refer to section 13.3), the regional breeding population for guillemot of 612,608 individuals was used for the non-breeding season assessment (Table 13-8). At the average baseline mortality rate for guillemot of 0.060 (Table 13-9) the number of individuals expected to die during the non-breeding season in the eastern region BDMPS is 36,756 (612,608 x 0.060). The addition of a maximum of 132.8 adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.0182%. This magnitude would be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude.

Evaluation of significance

Taking the medium sensitivity of guillemots and the negligible magnitude of impact, the overall cumulative effect to non-breeding guillemots in the western region BDMPS is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

#### 13.7.3.1.4 Razorbill

Razorbills have been assessed to have a medium sensitivity to disturbance and displacement (section 13.6.2.1.8).

**Breeding season**

The cumulative razorbill displacement and collision risk mortality which has been estimated for north and north-east offshore windfarms in the Pentland Firth and the Moray Firth (Table 13-39) is summarised in Table 13-58.

During the breeding season, the cumulative number of razorbills of all ages subject to mortality due to displacement and collision from all developments is 40.3 individuals (Table 13-58). The cumulative number of adults minus sabbatical birds subject to mortality from displacement and collision from all developments is 27.1individuals (40.3 * 0.7225 adult proportion minus 0.07 sabbatical proportion, Table 13-9).

*Table 13-58 Razorbill cumulative displacement and collision risk mortality during the breeding season*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| PFOWF | PFOWF Volume 2: Offshore EIAR. Chapter 12: Marine Ornithology | 1.6 | 0 | 1.6 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| BOWL | Moray West EIAR | 5.0 | 0 | 5.0 |
| Moray East | Moray West EIAR | 15.0 | 0 | 15.0 |
| Moray West | Moray West EIAR | 17.0 | 0 | 17.0 |
| The offshore Project | Project alone assessment | 1.7 | 0 | 1.7 |
| Total for all projects | | 40.3 | 0 | 40.3 |

The regional breeding population for razorbill is 95,725 individuals (Table 13-8). At the average baseline mortality rate for razorbill of 0.105 (Table 13-9) the number of individuals expected to die during the breeding season is 10,051 (95,725x 0.105). The addition of a maximum of 27.1adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.0283%.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative breeding razorbills (Table 13-59). With an additional cumulative displacement and collision mortality of 27.1 adults the model predicts over 35 years a reduction in growth rate by 0.02% (CGR = 0.9998; Table 13-59 and a reduction in population size by 0.79% (CPS = 0.9921; Table 13-59).

This magnitude would be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude.

*Table 13-59 Projected PVA metrics over 35 years for razorbill in the breeding season for the Project cumulatively. (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| RAZORBILL – BREEDING SEASON | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9998 | 0.9998 | 0.0004 | 0.9990 | 1.0006 | 0.9921 | 0.9923 | 0.0144 | 0.9641 | 1.0223 | 49.0 | 50.6 |

*The PVA outputs using the Alternative Approach is provided in Annex 12.13.*

EVALUATION OF SIGNIFICANCE

Taking the medium sensitivity of razorbills and the negligible magnitude of impact, the overall cumulative effect to breeding razorbills is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

**Non-breeding season – Eastern region BDMPS**

The cumulative razorbill displacement and collision risk mortality which has been estimated for offshore windfarms within the eastern region BDMPS (Table 13-39) is summarised in Table 13-60.

During the non-breeding season in the eastern region BDMPS, the cumulative number of razorbills of all ages subject to mortality due to displacement and collision from all developments is 764.7 individuals (Table 13-60). The cumulative number of adults birds subject to mortality from displacement and collision from all developments is 552.5 individuals (764.7 * 0.7225 adult proportion, Table 13-9).

*Table 13-60 Razorbill cumulative displacement and collision risk mortality during the non-breeding season for the eastern region BDMPS*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| PFOWF | PFOWF Volume 2: Offshore EIAR. Chapter 12: Marine Ornithology | 0 | 0 | 0 |
| BOWL | Moray West EIAR | 13 | 0 | 13 |
| Moray East | Moray West EIAR | 8 | 0 | 8 |
| Moray West | Moray West EIAR | 44 | 0 | 44 |
| EOWDC (Aberdeen) | Moray West EIAR | 0 | 0 | 0 |
| Blyth Demonstration | Moray West EIAR | 1 | 0 | 1 |
| Dogger Bank Creyke Beck A | Moray West EIAR | 48 | 0 | 48 |
| Dogger Bank Creyke Beck B | Moray West EIAR | 60 | 0 | 60 |
| Dogger Bank Teesside A | Moray West EIAR | 21 | 0 | 21 |
| Dudgeon | Moray West EIAR | 8 | 0 | 8 |
| East Anglia ONE | Moray West EIAR | 3 | 0 | 3 |
| East Anglia Three | Moray West EIAR | 21 | 0 | 21 |
| Galloper | Moray West EIAR | 3 | 0 | 3 |
| Greater Gabbard | Moray West EIAR | 3 | 0 | 3 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| Hornsea Project One | Moray West EIAR | 63 | 0 | 63 |
| Hornsea Project Two | Moray West EIAR | 39 | 0 | 39 |
| Humber Gateway | Moray West EIAR | 0 | 0 | 0 |
| Hywind | Moray West EIAR | 0 | 0 | 0 |
| Inch Cape | Moray West EIAR | 21 | 0 | 21 |
| Kincardine | Moray West EIAR | 0 | 0 | 0 |
| Lincs and LID6 | Moray West EIAR | 0 | 0 | 0 |
| London Array | Moray West EIAR | 0 | 0 | 0 |
| Neart na Gaoithe | Moray West EIAR | 36 | 0 | 36 |
| Race Bank | Moray West EIAR | 0 | 0 | 0 |
| Rampion | Awel y Môr EIAR | 0 | 0 | 0 |
| Seagreen A | Moray West EIAR | 0 | 0 | 0 |
| Seagreen B | Moray West EIAR | 0 | 0 | 0 |
| Sheringham Shoal | Moray West EIAR | 9 | 0 | 9 |
| Sofia (formerly Dogger Bank Teesside B) | Moray West EIAR | 32 | 0 | 32 |
| Teesside | Moray West EIAR | 0 | 0 | 0 |
| Thanet | Moray West EIAR | 0 | 0 | 0 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| Triton Knoll | Moray West EIAR | 8 | 0 | 8 |
| Westermost Rough | Moray West EIAR | 3 | 0 | 3 |
| Forthwind | Forthwind EIA | 0 | 0 | 0 |
| Berwick Bank | Berwick Bank CRM & Displacement Technical Appendices (worst values only) | 319 | 0 | 319 |
| Caledonia | https://marine.gov.scot/sites/default/files/chapter_12._marine_ornithol ogy.pdf | 0 | 0 | 0 |
| The offshore Project | Project alone assessment | 1.7 | 0 | 1.7 |
| Total for all projects | | 764.7 | 0 | 764.7 |

The smallest eastern region BDMPS non-breeding (wintering) razorbill population is 106,183 individuals (Table 13-8). At the average baseline mortality rate for razorbill of 0.105 (Table 13-9) the number of individuals expected to die during the non-breeding season in the eastern region BDMPS is 11,149 (106,183 x 0.105). The addition of a maximum of 552.5adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.5204%.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative non-breeding razorbills in the eastern region BDMPS (Table 13-61). With an additional cumulative displacement and collision mortality of 552.5adults the model predicts over 35 years a reduction in growth rate by 0.42% (CGR = 0.9966; Table 13-61) and a reduction in population size by 14.0% (CPS = 0.8531; Table 13-61).

This magnitude would potentially be detectable but would not materially alter the background mortality of the population; the impact is defined as being of low magnitude.

*Table 13-61 Projected PVA metrics over 35 years for razorbill in the non-breeding season for the Project cumulatively in the East (North Sea & Channel). (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| RAZORBILL – NON-BREEDING SEASON EASTERN REGION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9956 | 0.9956 | 0.0003 | 0.9949 | 0.9963 | 0.8531 | 0.8531 | 0.0105 | 0.8315 | 0.8744 | 34.9 | 66.7 |

*The PVA outputs using the Alternative Approach is provided in Annex 12.13.*

Evaluation of significance

Taking the medium sensitivity of razorbills and the low magnitude of impact, the overall cumulative effect to non-breeding razorbills in the eastern region BDMPS is considered to be minor and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Low | Minor |
| Impact significance - NOT SIGNIFICANT | | |

**Non-breeding season – Western region BDMPS**

The cumulative razorbill displacement and collision risk mortality which has been estimated for offshore windfarms within the western region BDMPS (Table 13-39) is summarised in Table 13-62.

During the non-breeding season in the western region BDMPS, the cumulative number of razorbills of all ages subject to mortality due to displacement and collision from all developments is 73.5 individuals (Table 13-62). The cumulative number of adults birds subject to mortality from displacement and collision from all developments is 53.1individuals (73.5 * 0.7225 adult proportion, Table 13-9).

*Table 13-62 Razorbill cumulative displacement and collision risk mortality during the non-breeding season for the western region BDMPS*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| North Hoyle | Awel y Môr EIAR | 0 | 0 | 0 |
| Barrow | Awel y Môr EIAR | 0 | 0 | 0 |
| Burbo Bank | Awel y Môr EIAR | 0 | 0 | 0 |
| Rhyl Flats | Awel y Môr EIAR | 0 | 0 | 0 |
| Robin Rigg | Awel y Môr EIAR | 0 | 0 | 0 |
| Walney (Phase 1 & Phase 2) | Awel y Môr EIAR | 0 | 0 | 0 |
| Ormonde | Awel y Môr EIAR | 0 | 0 | 0 |
| West of Duddon Sands | Awel y Môr EIAR | 0 | 0 | 0 |
| Gwynt y Môr | Awel y Môr EIAR | 0 | 0 | 0 |
| Burbo Bank Extension | Awel y Môr EIAR | 1.104 | 1.104 | 1.104 |
| Walney Extension | Awel y Môr EIAR | 43 | 43 | 43 |
| Erebus Floating Wind Demo | Awel y Môr EIAR | 8 | 8 | 8 |
| Awel y Môr | Awel y Môr EIAR | 8 | 8 | 8 |
| Pentland Floating Demo | https://marine.gov.scot/sites/default/files/chapter_12._marine_ornithology.pdf | 0 | 0 | 0 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| **The offshore Project** | Project alone assessment | 1.7 | 0 | 1.7 |
| **Total for all projects** | | 61.8 | 11.7 | 73.5 |

The smallest western region BDMPS non-breeding (wintering) razorbill population is 179,183 individuals (Table 13-8). At the average baseline mortality rate for razorbill of 0.105 (Table 13-9) the number of individuals expected to die during the non-breeding season in the western region BDMPS is 18,815 (179,183 x 0.105). The addition of a maximum of 53.1 adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.0296%

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative non-breeding razorbills in the western region BDMPS (Table 13-63). With an additional cumulative displacement and collision mortality of 53.1 adults the model predicts over 35 years a reduction in growth rate by 0.02% (CGR = 0.9998; Table 13-63) and a reduction in population size by 0.85% (CPS = 0.9915; Table 13-63).

This magnitude would be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude.

*Table 13-63 Projected PVA metrics over 35 years for razorbill in the non-breeding season for the Project cumulatively in the West. (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| RAZORBILL – NON-BREEDING SEASON WESTERN REGION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9998 | 0.9998 | 0.0003 | 0.9992 | 1.0004 | 0.9915 | 0.9916 | 0.0101 | 0.9710 | 1.0130 | 48.7 | 50.7 |

*The PVA outputs using the Alternative Approach is provided in Annex 12.13.*

Evaluation of significance

Taking the medium sensitivity of razorbills and the negligible magnitude of impact, the overall cumulative effect to non-breeding razorbills in the western region BDMPS is considered to be minor and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

#### 13.7.3.1.5 Puffin

Puffins have been assessed to have a medium sensitivity to disturbance and displacement (section 13.6.2.1.8).

**Breeding season**

The cumulative puffin displacement and collision risk mortality which has been estimated for north and north-east offshore windfarms in the Pentland Firth and the Moray Firth (Table 13-39) is summarised in Table 13-64.

During the breeding season, the cumulative number of puffins of all ages subject to mortality due to displacement and collision from all developments is 214.8 individuals (Table 13-64). The cumulative number of adults minus sabbatical birds subject to mortality from displacement and collision from all developments is 145.8individuals (214.8 * 0.7297 adult proportion minus 0.07 sabbatical proportion, Table 13-9).

*Table 13-64 Puffin cumulative displacement and collision risk mortality during the breeding season*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| PFOWF | PFOWF Volume 2: Offshore EIAR. Chapter 12: Marine Ornithology | 7.3 | 0 | 7.3 |
| BOWL | Moray West EIAR | 34.0 | 0 | 34.0 |
| Moray East | Moray West EIAR | 34.0 | 0 | 34.0 |
| Moray West | Moray West EIAR | 13.0 | 0 | 13.0 |

| | | | | |
|---|---|---|---|---|
| The offshore Project | Project alone assessment | 126.5 | 0 | 126.5 |
| Total for all projects | | 214.8 | 0 | 214.8 |

The regional breeding population for puffin is 333,421 individuals (Table 13-8). At the average baseline mortality rate for puffin of 0.093 (Table 13-9) the number of individuals expected to die during the breeding season is 31,008 (333,421 x 0.093). The addition of a maximum of 145.8adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.0437%.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative breeding puffins (Table 13-65). With an additional cumulative displacement and collision mortality of 145.8adults the model predicts over 3 years a reduction in growth rate by 0.04% (CGR = 0.9996; Table 13-65) and a reduction in population size by 1.37% (CPS = 0.9863; Table 13-65).

This magnitude would be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude.

*Table 13-65 Projected PVA metrics over 35 years for puffin in the breeding season for the Project cumulatively. (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| PUFFIN – BREEDING SEASON | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9996 | 0.9996 | 0.0002 | 0.9991 | 1.0001 | 0.9863 | 0.9864 | 0.0085 | 0.9683 | 1.0027 | 49.1 | 51.1 |

*The PVA outputs using the Alternative Approach is provided in Annex 12.13.*

Evaluation of significance

Taking the medium sensitivity of puffins and the negligible magnitude of impact, the overall cumulative effect to breeding puffins is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

**Non-breeding season – Eastern region BDMPS**

The cumulative puffin displacement and collision risk mortality which has been estimated for offshore windfarms within the eastern region BDMPS (Table 13-39) is summarised in Table 13-66.

During the non-breeding season in the eastern region BDMPS, the cumulative number of puffins of all ages subject to mortality due to displacement and collision from all developments is 191.7 individuals (Table 13-66). The cumulative number of adults birds subject to mortality from displacement and collision from all developments is 139.9 individuals (191.7 * 0.7297 adult proportion, Table 13-9).

*Table 13-66 Puffin cumulative displacement and collision risk mortality during the non-breeding season for the eastern region BDMPS*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| PFOWF | PFOWF Volume 2: Offshore EIAR. Chapter 12: Marine Ornithology | 0 | 0 | 0 |
| BOWL | Moray West EIAR | 29 | 0 | 29 |
| Moray East | Moray West EIAR | 2 | 0 | 2 |
| Moray West | Moray West EIAR | 48 | 0 | 48 |
| EOWDC (Aberdeen) | Moray West EIAR | 1 | 0 | 1 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| Blyth Demonstration | Moray West EIAR | 1 | 0 | 1 |
| Dogger Bank Creyke Beck A | Moray West EIAR | 3 | 0 | 3 |
| Dogger Bank Creyke Beck B | Moray West EIAR | 9 | 0 | 9 |
| Dogger Bank Teesside A | Moray West EIAR | 3 | 0 | 3 |
| Dudgeon | Moray West EIAR | 0 | 0 | 0 |
| East Anglia ONE | Moray West EIAR | 0 | 0 | 0 |
| East Anglia Three | Moray West EIAR | 1 | 0 | 1 |
| Galloper | Moray West EIAR | 0 | 0 | 0 |
| Greater Gabbard | Moray West EIAR | 0 | 0 | 0 |
| Hornsea Project One | Moray West EIAR | 15 | 0 | 15 |
| Hornsea Project Two | Moray West EIAR | 24 | 0 | 24 |
| Humber Gateway | Moray West EIAR | 0 | 0 | 0 |
| Hywind | Moray West EIAR | 0 | 0 | 0 |
| Inch Cape | Moray West EIAR | 32 | 0 | 32 |
| Kincardine | Moray West EIAR | 0 | 0 | 0 |
| Lincs and LID6 | Moray West EIAR | 0 | 0 | 0 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| London Array | Moray West EIAR | 0 | 0 | 0 |
| Neart na Gaoithe | Moray West EIAR | 11 | 0 | 11 |
| Race Bank | Moray West EIAR | 0 | 0 | 0 |
| Rampion | Awel y Mor EIAR | 0 | 0 | 0 |
| Seagreen A | Moray West EIAR | 0 | 0 | 0 |
| Seagreen B | Moray West EIAR | 0 | 0 | 0 |
| Sheringham Shoal | Moray West EIAR | 0 | 0 | 0 |
| Sofia (formerly Dogger Bank Teesside B) | Moray West EIAR | 4 | 0 | 4 |
| Teesside | Moray West EIAR | 0 | 0 | 0 |
| Thanet | Moray West EIAR | 0 | 0 | 0 |
| Triton Knoll | Moray West EIAR | 1 | 0 | 1 |
| Westermost Rough | Moray West EIAR | 0 | 0 | 0 |
| Forthwind | Forthwind EIA | 0 | 0 | 0 |
| Berwick Bank | Berwick Bank CRM & Displacement Technical Appendices (worst values only) | 0 | 0 | 0 |
| Caledonia | https://marine.gov.scot/ sites/default/files/chapt | 0 | 0 | 0 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| | er_12._marine_ornithology.pdf | | | |
| **The offshore Project** | Project alone assessment | 7.7 | 0 | 7.7 |
| **Total for all projects** | | 191.7 | 0 | 191.7 |

The eastern region BDMPS non-breeding (wintering) puffin population is 199,974 individuals (Table 13-8). At the average baseline mortality rate for puffin of 0.093 (Table 13-9) the number of individuals expected to die during the non-breeding season in the eastern region BDMPS is 18,598 (199,974 x 0.093). The addition of a maximum of 139.9 adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.0699%.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative non-breeding puffins in the eastern region BDMPS (Table 13-67). With an additional cumulative displacement and collision mortality of 132.2 adults the model over 35 years predicts a reduction in growth rate by 0.06% (CGR = 0.9994; Table 13-67) and a reduction in population size by 2.16% (CPS = 0.9784; Table 13-67).

This magnitude would be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude.

*Table 13-67 Projected PVA metrics over 35 years for puffin in the non-breeding season for the Project cumulatively in the East. (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| PUFFIN – NON-BREEDING SEASON – EASTERN REGION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9994 | 0.9994 | 0.0003 | 0.9987 | 1.0000 | 0.9784 | 0.9782 | 0.0110 | 0.9556 | 1.0008 | 48.8 | 51.4 |

*The PVA outputs using the Alternative Approach is provided in Annex 12.13.*

Evaluation of significance

Taking the medium sensitivity of puffins and the negligible magnitude of impact, the overall cumulative effect to non-breeding puffins in the eastern region BDMPS is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

**Non-breeding season – Western region BDMPS**

The cumulative puffin displacement and collision risk mortality which has been estimated for offshore windfarms within the western region BDMPS (Table 13-39) is summarised in Table 13-68.

During the non-breeding season in the western region BDMPS, the cumulative number of puffins of all ages subject to mortality due to displacement and collision from all developments is 35 individuals (Table 13-68). The cumulative number of adults birds subject to mortality from displacement and collision from all developments is 25.5 individuals (35 * 0.7297 adult proportion, Table 13-9).

*Table 13-68 Puffin cumulative displacement and collision risk mortality during the non-breeding season for the western region BDMPS*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| North Hoyle | Awel y Môr EIAR | 0 | 0 | 0 |
| Barrow | Awel y Môr EIAR | 0 | 0 | 0 |
| Burbo Bank | Awel y Môr EIAR | 0 | 0 | 0 |
| Rhyl Flats | Awel y Môr EIAR | 0 | 0 | 0 |
| Robin Rigg | Awel y Môr EIAR | 0 | 0 | 0 |
| Walney (Phase 1 & Phase 2) | Awel y Môr EIAR | 0 | 0 | 0 |
| Ormonde | Awel y Môr EIAR | 0 | 0 | 0 |
| West of Duddon Sands | Awel y Môr EIAR | 0 | 0 | 0 |
| Gwynt y Môr | Awel y Môr EIAR | 0 | 0 | 0 |
| Burbo Bank Extension | Awel y Môr EIAR | 0 | 0 | 0 |
| Walney Extension | Awel y Môr EIAR | 2 | 0 | 2 |
| Erebus Floating Wind Demo | Awel y Môr EIAR | 1 | 0 | 1 |
| Awel y Môr | Awel y Môr EIAR | 0 | 0 | 0 |
| Pentland Floating Demo | https://marine.gov.scot/sites/default/files/chapter_ | 0 | 0 | 0 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| | 12._marine_ornithology.pdf | | | |
| The offshore Project | Project alone assessment | 32.0 | 0 | 32.0 |
| Total for all projects | | 35.0 | 0 | 35.0 |

The western region BDMPS non-breeding (wintering) puffin population is 249,896 individuals (Table 13-8). At the average baseline mortality rate for puffin of 0.093 (Table 13-9) the number of individuals expected to die during the non-breeding season in the western region BDMPS is 23,240 (249,896 x 0.093). The addition of a maximum of 25.5 adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.0102%. This magnitude would be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude.

*The PVA outputs using the Alternative Approach is provided in Annex 12.13.*

Evaluation of significance

Taking the medium sensitivity of puffins and the negligible magnitude of impact, the overall cumulative effect to non-breeding puffins in the western region BDMPS is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

#### 13.7.3.1.6 Gannet

Gannets have been assessed to have a **medium sensitivity** to disturbance and displacement (section 13.6.2.1.5) and collision risk (section 13.6.2.3.1).

**Breeding season**

The cumulative gannet displacement and collision risk mortality which has been estimated for north and north-east offshore windfarms in the Pentland Firth and the Moray Firth (Table 13-39) is summarised in Table 13-69.

During the breeding season, the cumulative number of gannets of all ages subject to mortality due to displacement and collision from all developments is 164.2 individuals (Table 13-69). The cumulative number of adults minus sabbatical birds subject to mortality from displacement and collision from all developments is 102.2individuals (164.2 * 0.6913 adult proportion minus 0.1 sabbatical proportion, Table 13-9).

*Table 13-69 Gannet cumulative displacement and collision risk mortality during the breeding season*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| **PFOWF** | PFOWF Volume 3: Appendix A.12.3. Marine Ornithology: Collision Risk Modelling | 1 | 2 | 3 |
| **BOWL** | Moray West EIAR | 0 | 22 | 22 |
| **Moray East** | Moray West EIAR | 0 | 78 | 78 |
| **Moray West** | Moray West EIAR | 0 | 10 | 10 |
| **The offshore Project** | Project alone assessment | 13.4 | 37.8 | 51.2 |
| **Total for all projects** | | 14.4 | 149.8 | 164.2 |

The regional breeding population for gannet is 404,008 individuals (Table 13-8). At the average baseline mortality rate for gannet of 0.081 (Table 13-9) the number of individuals expected to die during the breeding season is 32,725 (404,008 x 0.081). The addition of a maximum of 102.2 adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.0253%.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative breeding gannets (Table 13-70). With an additional cumulative displacement and collision mortality of 102.2 adults the model predicts over 35 years a reduction in growth rate by 0.02% (CGR = 0.9998; Table 13-70) and a reduction in population size by 0.69% (CPS = 0.9931; Table 13-70).

This magnitude would be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude.

*Table 13-70 Projected PVA metrics over 35 years for gannet in the breeding season for the Project cumulatively. (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile* *from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| PUFFIN – NON-BREEDING SEASON – EASTERN REGION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9998 | 0.9998 | 0.0001 | 0.9996 | 1.0000 | 0.9931 | 0.9932 | 0.0039 | 0.9861 | 1.0012 | 49.4 | 50.9 |

Evaluation of significance

Taking the medium sensitivity of gannets and the negligible magnitude of impact, the overall cumulative effect to breeding gannets is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

**Non-breeding season – Eastern region BDMPS**

The cumulative gannet displacement and collision risk mortality which has been estimated for offshore windfarms within the eastern region BDMPS (Table 13-39) is summarised in Table 13-71.

During the non-breeding season in the eastern region BDMPS, the cumulative number of gannets of all ages subject to mortality due to displacement and collision from all developments is 1,032.3 individuals (Table 13-71). The cumulative number of adults birds subject to mortality from displacement and collision from all developments is 713.6 individuals (1032.3 * 0.6913 adult proportion, Table 13-9).

*Table 13-71 Gannet cumulative displacement and collision risk mortality during the non-breeding season for the eastern region BDMPS*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| PFOWF | PFOWF Volume 3: Appendix A.12.3. Marine Ornithology: Collision Risk Modelling | 0 | 0 | 0 |
| BOWL | Moray West EIAR | 0 | 22 | 22 |
| Moray East | Moray West EIAR | 0 | 78 | 78 |
| Moray West | Moray West EIAR | 0 | 10 | 10 |
| EOWDC (Aberdeen Demo) | Moray West EIAR | 0 | 4 | 4 |
| Blyth Demo | Moray West EIAR | 0 | 4 | 4 |
| Dogger Bank Creyke Beck A and B | Moray West EIAR | 0 | 21 | 21 |
| Dogger Bank Teesside A and Sofia (formerly Dogger Bank Teesside B) | Moray West EIAR | 0 | 18 | 18 |
| Dudgeon | Moray West EIAR | 0 | 49 | 49 |
| East Anglia One | Moray West EIAR | 0 | 173 | 173 |
| East Anglia Three | Moray West EIAR | 0 | 46 | 46 |
| Galloper | Moray West EIAR | 0 | 35 | 35 |
| Greater Gabbard | Moray West EIAR | 0 | 16 | 16 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| Hornsea Project One | Moray West EIAR | 0 | 46 | 46 |
| Hornsea Project Two | Moray West EIAR | 0 | 17 | 17 |
| Humber Gateway | Moray West EIAR | 0 | 2 | 2 |
| Hywind | Moray West EIAR | 0 | 3 | 3 |
| Inchcape | Moray West EIAR | 0 | 13 | 13 |
| Kincardine | Moray West EIAR | 0 | 2 | 2 |
| Kentish Flats Extension | Moray West EIAR | 0 | 0 | 0 |
| Lincs | Moray West EIAR | 0 | 3 | 3 |
| London Array | Moray West EIAR | 0 | 2 | 2 |
| Methil | Moray West EIAR | 0 | 0 | 0 |
| Neart na Gaoithe | Moray West EIAR | 0 | 133 | 133 |
| Race Bank | Moray West EIAR | 0 | 10 | 10 |
| Rampion | Moray West EIAR | 0 | 11 | 11 |
| Seagreen Alpha | Moray West EIAR | 0 | 55 | 55 |
| Seagreen Bravo | Moray West EIAR | 0 | 60 | 60 |
| Sheringham Shoal | Moray West EIAR | 0 | 2 | 2 |
| Teesside | Moray West EIAR | 0 | 0 | 0 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| **Thanet** | Moray West EIAR | 0 | 0 | 0 |
| **Triton Knoll** | Moray West EIAR | 0 | 90 | 90 |
| **Westermost Rough** | Moray West EIAR | 0 | 0 | 0 |
| **Forthwind** | Forthwind EIA | 0 | 0 | 0 |
| **Berwick Bank** | Berwick Bank CRM & Displacement Technical Appendices (worst values only) | 38 | 42.79 | 80.79 |
| **Caledonia** | https://marine.gov.scot/sites/default/files/chapter_12._marine_ornithology.pdf | 0 | 0 | 0 |
| **The offshore Project** | Project alone assessment | 16.4 | 10.2 | 26.6 |
| **Total for all projects** | | 54.4 | 977.9 | 1,032.3 |

The smallest eastern region BDMPS non-breeding (spring migration) gannet population is 163,701 individuals (Table 13-8). At the average baseline mortality rate for gannet of 0.0810 (Table 13-9) the number of individuals expected to die during the non-breeding season in the eastern region BDMPS is 13,260 (163,701 x 0.0810). The addition of a maximum of 713.6 adults predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.4359%.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative non-breeding gannets in the eastern region BDMPS (Table 13-72). With an additional cumulative displacement and collision mortality of 579.1 adults the model predicts over 35 years a reduction in growth rate by 0.02% (CGR = 0.9998; Table 13-72) and a reduction in population size by 0.69% (CPS = 0.9931; Table 13-72).

This magnitude would be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude.

*Table 13-72 Projected PVA metrics over 35 years for gannet in the non-breeding season for the Project cumulatively in the East (North Sea & Channel). (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| GANNET – NON-BREEDING SEASON – EASTERN REGION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9998 | 0.9998 | 0.0002 | 0.9995 | 1.0001 | 0.9931 | 0.9931 | 0.0061 | 0.9818 | 1.0058 | 48.8 | 50.9 |

*The PVA outputs using the Alternative Approach is provided in Annex 12.13.*

Evaluation of significance

Taking the medium sensitivity of gannets and the negligible magnitude of impact, the overall cumulative effect to breeding gannets is considered to be negligible and not significant in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

**Non-breeding season – Western region BDMPS**

The cumulative gannet displacement and collision risk mortality which has been estimated for offshore windfarms within the western region BDMPS (Table 13-39) is summarised in Table 13-73.

During the non-breeding season in the western region BDMPS, the cumulative number of gannets of all ages subject to mortality due to displacement and collision from all developments is 140.6 individuals (Table 13-73). The cumulative number of adults birds subject to mortality from displacement and collision from all developments is 97.2individuals (140.6 * 0.6913 adult proportion, Table 13-8).

*Table 13-73 Gannet cumulative displacement and collision risk mortality during the non-breeding season for the western region BDMPS*

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| North Hoyle | Awel y Môr EIAR | 0 | 0 | 0 |
| Barrow | Awel y Môr EIAR | 0 | 0 | 0 |
| Burbo Bank | Awel y Môr EIAR | 0 | 0 | 0 |
| Rhyl Flats | Awel y Môr EIAR | 0 | 0 | 0 |
| Robin Rigg | Awel y Môr EIAR | 0 | 0 | 0 |
| Walney (Phase 1 & Phase 2) | Awel y Môr EIAR | 0 | 0 | 0 |
| Ormonde | Awel y Môr EIAR | 0 | 0 | 0 |
| West of Duddon Sands | Awel y Môr EIAR | 0 | 0 | 0 |
| Gwynt y Môr | Awel y Môr EIAR | 0 | 0 | 0 |
| Burbo Bank Extension | Erebus EIAR | 0 | 11 | 11 |
| Walney Extension | Walney EIA | 8 | 38 | 46 |
| Erebus Floating Wind Demo | Erebus EIAR | 4 | 28 | 32 |
| Awel y Môr | Awel y Môr EIAR | 6 | 19.04 | 25.04 |
| Pentland Floating Demo | PFOWF Volume 2: Offshore EIAR. Chapter 12: Marine Ornithology | 0 | 0 | 0 |
| The offshore Project | Project alone assessment | 16.4 | 10.2 | 26.6 |

| DEVELOPMENT | DATA SOURCE | DISPLACEMENT MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | COLLISION RISK MORTALITY (INDIVIDUAL ADULTS + JUVENILES) | TOTAL (INDIVIDUAL ADULTS + JUVENILES) |
|---|---|---|---|---|
| **Total for all developments** | | 34.4 | 106.2 | 140.6 |
| *CRM for Burbo Bank Extension and Walney Extension are annual values. | | | | |

The smallest western region BDMPS non-breeding gannet (autumn migration) population is 302,784 individuals (Table 13-8). At the average baseline mortality rate for gannet of 0.146 (Table 13-9) the number of individuals expected to die during the non-breeding season in the eastern region BDMPS is 44,206 (302,784 x 0.146). The addition of a maximum of 97.2 adults (Table 13-73) predicted to potentially die from cumulative operation and maintenance impacts would increase the baseline mortality by 0.0306%.

As the change in adult survival was more than a 0.02% point change, a PVA was conducted for cumulative non-breeding gannets in the western region BDMPS (Table 13-74). With an additional cumulative displacement and collision mortality of 97.2 adults the model predicts a reduction in over 35 years in growth rate by 0.02% (CGR = 0.9998; Table 13-74) and a reduction in population size by 0.84% (CPS = 0.9916; Table 13-74). This magnitude would be undetectable and would not materially alter the background mortality of the population; the impact is defined as being of negligible magnitude.

*Table 13-74 Projected PVA metrics over 35 years for gannet in the non-breeding season for the Project cumulatively in the West. (SD = standard deviation, LCI = lower confidence interval, UCI = upper confidence interval, U=50%I = the quantile from the unimpacted population that matched the 50% quantile for the impacted population, I=50%U = the quantile from the impacted population that match the 50% quantile for the unimpacted population)*

| GANNET – NON-BREEDING SEASON – WESTERN REGION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COUNTERFACTUAL OF GROWTH RATE | | | | | COUNTERFACTUAL OF POPULATION SIZE | | | | | QUANTILES | |
| MEDIAN | MEAN | SD | LOWER CI | UPPER CI | MEDIAN | MEAN | SD | LOWER CI | UPPER CI | U=50%I | I = 50%U |
| 0.9998 | 0.9998 | 0.0001 | 0.9995 | 1.0000 | 0.9916 | 0.9916 | 0.0045 | 0.9830 | 1.0006 | 48.8 | 51.1 |

*The PVA outputs using the Alternative Approach is provided in Annex 12.13.*

Evaluation of significance

Taking the medium sensitivity of gannets and the negligible magnitude of impact, the overall cumulative effect to breeding gannets is considered to be **negligible** and **not significant** in EIA terms.

| Sensitivity | Magnitude of impact | Consequence |
|---|---|---|
| Medium | Negligible | Negligible |
| Impact significance - NOT SIGNIFICANT | | |

### 13.7.4 Cumulative decommissioning effects

As there is limited information on the decommissioning of the offshore Project and around the lifecycle of other developments, it is not possible to provide a meaningful cumulative assessment. However, the cumulative effects are expected to be less than or equal to the construction stage and as such are not expected to contribute materially to any cumulative impact.

A Decommissioning Programme will be developed pre-construction to address the principal decommissioning measures for the offshore Project and will be written in accordance with applicable guidance. The Decommissioning Programme will detail the environmental management, and schedule for decommissioning and will be reviewed and updated throughout the lifetime of the offshore Project to account for changing best practices.

### 13.7.5 Summary of cumulative effects

A summary of the outcomes of the assessment of cumulative effects for the construction, operation and maintenance and decommissioning stages of the offshore Project is provided in Table 13-75.

*Table 13-75 Summary of assessment of cumulative effects*

| POTENTIAL IMPACT | RECEPTOR | SENSITIVITY OF RECEPTOR | MAGNITUDE OF IMPACT | CONSEQUENCE (SIGNIFICANCE OF EFFECT) | SECONDARY MITIGATION REQUIREMENTS | RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT) |
|---|---|---|---|---|---|---|
| **Construction (pre-construction)** | | | | | | |
| The magnitude of all impacts during construction are predicted to be negligible or low and the overall effect to species of low to high sensitivity are considered to be negligible and not significant in EIA terms. | | | | | | |
| **Operation and maintenance** | | | | | | |
| **Combined displacement and collision mortality** | Kittiwake – breeding & non-breeding western region BDMPS | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Kittiwake – non-breeding eastern region BDMPS | Medium | Low | Minor (not significant) | None required above embedded mitigation measures. | Minor (not significant) |

| POTENTIAL IMPACT | RECEPTOR | SENSITIVITY OF RECEPTOR | MAGNITUDE OF IMPACT | CONSEQUENCE (SIGNIFICANCE OF EFFECT) | SECONDARY MITIGATION REQUIREMENTS | RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT) |
|---|---|---|---|---|---|---|
| | Great black-backed gull – breeding & non-breeding eastern region BDMPS | High | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Great black-backed gull - non-breeding western region BDMPS | High | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Guillemot – breeding, non-breeding eastern & western region BDMPS | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |

| POTENTIAL IMPACT | RECEPTOR | SENSITIVITY OF RECEPTOR | MAGNITUDE OF IMPACT | CONSEQUENCE (SIGNIFICANCE OF EFFECT) | SECONDARY MITIGATION REQUIREMENTS | RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT) |
|---|---|---|---|---|---|---|
| | Razorbill – breeding and non-breeding western region BDMPS | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Razorbill – non-breeding eastern region BDMPS | Medium | Low | Minor (not significant) | None required above embedded mitigation measures. | Minor (not significant) |
| | Puffin – breeding, non-breeding eastern & western region BDMPS | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |
| | Gannet – breeding, non- | Medium | Negligible | Negligible (not significant) | None required above embedded mitigation measures. | Negligible (not significant) |

| POTENTIAL IMPACT | RECEPTOR | SENSITIVITY OF RECEPTOR | MAGNITUDE OF IMPACT | CONSEQUENCE (SIGNIFICANCE OF EFFECT) | SECONDARY MITIGATION REQUIREMENTS | RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT) |
|---|---|---|---|---|---|---|
| | breeding eastern & western region BDMPS | | | | | |
| **Decommissioning** | | | | | | |
| Cumulative effects are expected to be less than or equal to the construction stage | | | | | | |

# 13.8 Inter-related effects

Inter-related effects are the potential effects of multiple impacts, effecting one receptor or a group of receptors. Inter-related effects include interactions between the impacts of the different stages of the offshore Project (i.e. interaction of impacts across construction, operation and maintenance and decommissioning), as well as the interaction between impacts on a receptor within an offshore Project stage. The potential inter-related effects for ornithology receptors are described below.

## 13.8.1 Inter-related effects between offshore Project stages

Potential impacts on offshore ornithology receptors would occur during the operation and maintenance stage, when there is potential for direct and indirect displacement as well as collision mortality associated with the operational windfarm. There is no potential for the effects during other stages of the offshore Project to interact in a way that would result in combined effects of greater significance than the assessments for each individual stage.

# 13.9 Whole Project assessment

The onshore Project is summarised in chapter 5: Project description and a summary of the onshore EIA is provided in chapter 21: Onshore EIA summary. These onshore aspects of the Project have been considered in relation to the impacts assessed in section 13.6. There is no overlap between the onshore Project and the impacts on ornithology receptors assessed in section 13.6, and therefore, there is no potential for the onshore Project to exacerbate any of the effects assessed within this chapter. HDD activities during construction would be short term, temporary and reversible and so the ornithology receptors assessed in section 13.6 would not be significantly negatively affected in the long term.

# 13.10 Ecosystem effects

Seabirds largely operate at the upper levels of the North Sea food web and are considered top predators along with marine mammals and certain fish species (BEIS, 2022). A holistic approach has been undertaken in the identification of impacts to consider any potential impacts that may occur at an ecosystem scale and particularly across trophic levels (e.g. impacts on prey species affecting their availability for predators). Changes in the availability or distribution of seabirds could have cascading effect on other species within the ecosystem and may indirectly affect prey species that they feed on (fish species) as well as other predators through any subsequent changes in prey availability. Ecosystem effects are also assessed within Chapter 10: Benthic subtidal and intertidal ecology, chapter 11: Fish and shellfish ecology and chapter 12: Marine mammals and megafauna.

Key drivers of seabird population size in western Europe are climate change (Sandvik *et al.*, 2012; Frederiksen *et al.*, 2004, 2013; Burthe *et al.*, 2014; Macdonald *et al.*, 2015; Furness 2016; JNCC 2016; Pearce-Higgins 2021), and fisheries (Tasker *et al.*, 2000; Frederiksen *et al.*, 2004; Ratcliffe 2004; Carroll *et al.*, 2017; Sydeman *et al.*, 2017). In relation to seabirds, a key effect of climate change and fisheries is largely on prey species abundance and distribution, which subsequently affects seabird numbers. Lindegren *et al.*, (2018) concluded that sandeel stocks in the North Sea, the most important prey fish stock for North Sea seabirds during the breeding season (Furness and Tasker 2000), have been depleted by high levels of fishing effort. In the ICES Sandeel Area (SA) relevant to the offshore Project (SA7), there has been no fishing effort on sandeels since the collapse of the stock in the 1980’s and 1990’s. While recovery of the stock has been slow, the indication of recovery in seabird breeding success in Scotland may be, at least in part, due to the recovery of sandeel stocks in SA7 (Moffat *et al.*, 2020). The key trends in seabird numbers are presented in section 13.4.4.

A number of offshore ornithology species (kittiwakes, Arctic terns, guillemots, razorbills, puffins, fulmars and gannets) are considered to be of medium sensitivity to indirect effects to prey species. Impacts to benthic ecology and fish and shellfish ecology could affect seabird prey species abundance and distribution, and subsequently the foraging ability and success of seabirds. The introduction of infrastructure may result in habitat loss or disturbance for prey species resulting in less prey being available. Infrastructure also may attracted prey species (fish aggregation) and changes in commercial fishing pressure may result in changes in prey communities. The benthic subtidal and intertidal ecology assessments and fish and shellfish assessments concluded no significant effect as a result of the offshore Project. Indirect effects to prey species were assessed in sections 13.6.1.2 and 13.6.2.2, and also concluded no significant effect.

In addition, as no significant effects were identified for any impact on offshore and intertidal ornithology, there is not considered to be a significant long-term change in the presence, abundance or distribution of seabirds at the offshore Project which could cascade to result in an ecosystem-scale effect.

Consideration of ecosystem effects has been considered holistically throughout the ecological chapters of the Offshore EIA. Seabird populations are closing linked with availability and quality of prey. As a result of the offshore Project no ecosystem effects are anticipated to occur in relation to offshore and intertidal ornithology either as direct impacts to seabirds as predators or through indirect effects to their prey species.

## 13.11 Transboundary effects

Transboundary effects arise when impacts from a development within one European Economic Area (EEA) state's territory affects the environment of another EEA state(s).

With regard to the potential for transboundary cumulative impacts, there is clearly potential for collisions and displacement at windfarms outside UK waters. Due to the location of the Project, connectivity, even hypothetically, is highly unlikely to occur in the breeding season. The spatial scale and hence relevant seabird regional nob-breeding populations sizes for a transboundary assessment would be much larger than used for the EIA and cumulative assessment here. Thus, the impacts from the Project alone and cumulatively would have a lower impact on adult survival than assessed here. It is therefore reasonable to conclude that the transboundary effects on a wider population of breeding and non-breeding seabirds would be negligible and not significant in EIA terms.

## 13.12 Summary of mitigation and monitoring

No secondary mitigation, over and above the embedded mitigation measures proposed in section 13.5.3.4, is either required or proposed in relation to the potential effects of the offshore Project on offshore ornithology and intertidal ornithology as no adverse significant impacts are predicted.

Details of any required monitoring will be informed by the findings of the appropriate assessment undertaken by MD-LOT and be discussed and agreed via a Regional Advisory Group (or equivalent). Monitoring details will be presented within the PEMP that will be subject to approval as part of the discharge of consent conditions.

The Project is committed to protecting the environment by ensuring best practice, embedded mitigation and additional mitigation measures are followed at all times during construction, operation and maintenance and decommissioning. Additionally, the Project is committed to enhancing the environment, where possible. The approach includes, but is not limited to, partnering with key stakeholders, neighbouring developers and the local community to ensure that any proposed enhancements are suited to the environment that they are situated in benefit not only the primary species but the wider ecosystem. The Project is proposing a biodiversity enhance project in relation to European storm-petrels. European storm-petrels are an offshore bird pelagic in nature, they only come onto land during the summer months for breeding. They are currently listed as Amber on the UK Birds of Conservation Concern. To help better understand the breeding of European storm petrel the Project proposes to install nesting boxes for storm petrel on Sule Skerry and Sule Skerry Stack within which a camera would be installed. The Biodiversity Enhance Plan provide further detail on this proposal.

## 13.13 References

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## 13.14 Abbreviations

| ACRONYM | DEFINITION |
|---|---|
| BDMPS | Biologically Defined Minimum Population Scales |
| CEF | Cumulative Effects Framework |
| CFP | Common Fisheries Policy |
| CGR | Counterfactual of Growth Rate |
| CI | Confidence Interval |
| CIEEM | Chartered Institute of Ecology and Environmental Management |
| CPS | Counterfactual of Population Size |
| DAS | Digital Aerial Surveys |
| DSLP | Development Specification and Layout Plan |
| DSM | Density Surface Models |
| ESAS | European Seabirds at Sea |
| HPAIV | Highly Pathogenic Avian Influenza Virus |
| IOF | Important Ornithological Features |
| IUCN | International Union for Conservation of Nature |
| JNCC | Joint Nature Conservation Committee |
| MD-LOT | Marine Directorate – Licensing Operations Team |
| MHWS | Mean High Water Spring |
| MS-LOT | Marine Scotland – Licensing Operations Team |

| ACRONYM | DEFINITION |
|---|---|
| PVA | Population Viability Analysis |
| RSPB | Royal Society for the Protection of Birds |
| sCRM | stochastic Collision Risk Modelling |
| SD | Standard Deviation |
| SDM | Species Distribution Model/Surface Density Model |
| SMP | Seabird Monitoring Programme |
| SNCB | Statutory Nature Conservation Bodies |
| SPA | Special Protection Area |
| USB | Universal Serial Bus |

## 13.15 Glossary

| TERM | DEFINITION |
|---|---|
| Biologically Defined Minimum Population Scales (BDMPS) | A proportion of a biogeographic population present in a defined area. Nonbreeding BDMPS considered suitable for use in this EIA chapter are proportions of biogeographic populations with connectivity to UK North Sea and Western waters during the nonbreeding season. |
| Biogeographic population | A group of birds which breed in a particular location (or group of locations), breed freely within the group, and rarely breed or exchange individuals with other groups. |
| Biogeographic populations with connectivity to UK waters | The sum of bird numbers in the UK population plus each overseas population known to visit UK waters either to winter or during migration to winter quarters elsewhere (including adult and immature birds). |
| Breeding (full period) season | Period of months when adult birds return to colonies in the 'spring' to the time of departure from colonies at the end of the breeding season. Includes months when some birds are on breeding grounds while other birds of the same species are travelling to or from the colonies on migration. |
| Breeding (migration-free) season | Core breeding months only; this season does not include months when some birds of the same species may be on migration. |
| Collision Risk Model (CRM) | Quantitative means to estimate the number of predicted collisions between seabirds recorded in the WOW OAA from rotating WTGs. |
| Diadromous fish | Fish that migrate between freshwater and marine environments to fulfil their lifecycle |
| Pelagic seabird species | Seabirds that mostly live a large portion of their lives on the open ocean. |
| Piscivorous species | A species feeding on fish. |
| Population Viability Analysis | Modelling methods used to explore and understand potential consequences of additional mortality on populations. |