# Bowdun Offshore Wind Farm, Offshore EIA Report

## Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report

TWP-BOW-RPS-OFE-RPT-00020 | April 2026

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# Glossary

| Defined term | Definition |
|---|---|
| **Annex I** | Habitats of community interest whose conservation requires the designation of Special Areas of Conservation (SACs), as identified in Annex I of the Habitats Directive (Council Directive 92/43/EEC). |
| **Applicant (the)** | Bowdun Offshore Wind Farm Limited (BOWFL). |
| **Appropriate Assessment (AA)** | An assessment to determine the implications of a plan or project for a European site in view of that site's conservation objectives. An Appropriate Assessment forms part of the Habitats Regulations Appraisal (HRA) and is required when a plan or project (either alone or in combination with other plans or projects) is likely to have a significant adverse effect on a European site. |
| **Array Area** | The Array Area is the area in which the Offshore Generation Assets will be located. |
| **Barrier Effects** | The effect by which an animal or bird has to make longer transits between a breeding or roosting location to an area of foraging. An Offshore Wind Farm (OWF) could act as a barrier in which a species has to fly around to reach the other side, some species are unlikely to travel through or over. |
| **Bowdun Offshore Wind Farm Limited (BOWFL)** | A Special-Purpose Vehicle (SPV) (legal entity) for the purpose of developing the Project. BOWFL are the Applicant for the Offshore Application. |
| **Cetacean** | Marine mammals that are entirely aquatic. These include whales, dolphins, and porpoises. |
| **Collision (Ornithology and Bat)** | The effect by which a bird, or bat, may be impacted by direct collision. Birds passing through an OWF are at risk of colliding with the Wind Turbines (moving and stationary parts). |
| **Collision Risk Model (CRM)** | A model that calculates potential collision risk for a species within a wind farm based on a set of wind farm and bird species-specific parameters. Collision Risk Models can be run deterministically or stochastically. |
| **Commercial Fishing** | Any form of fishing activity legally undertaken where the catch is sold for taxable profit. |
| **Cumulative Effects** | The effects of the Proposed Development assessed together with effects from the Onshore Infrastructure forming the Project as well as one or more different projects on the same receptor/resource. |
| **Digital Aerial Surveys (DAS)** | A method for undertaking baseline ornithological and marine mammal data collection surveys. Usually undertaken over a period of 24 months. |
| **Displacement** | An impact that occurs when an animal is forced away from an area of habitual usage. This can be temporary (i.e. a ship moving) or permanent (i.e. the placement of offshore infrastructure). |
| **Effect** | Term used to express the consequence of an impact (i.e. the result of change or changes on specific environmental resources or receptors). The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity of the receptor or resource in accordance with defined significance criteria. |

| Defined term | Definition |
|---|---|
| **Environmental Impact Assessment (EIA)** | Process for the assessment of likely significant environmental effects of a project on the physical, biological and human environment during construction, Operation and Maintenance (O&M) and decommissioning. |
| **Environmental Impact Assessment Regulations (EIA Regulations)** | Terminology used in this Offshore EIA Report to refer to three sets of regulations:<br>• The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017;<br>• The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017; and<br>• The Marine Works (Environmental Impact Assessment) Regulations 2007. |
| **European Sites** | This term recognises SACs, candidate SACs (cSACs), Sites of Community Importance (SCIs), Special Protection Areas (SPAs), possible SACs (pSACs), potential SPAs (pSPAs) and Ramsar sites (where also designated as another European Site), which protect species and habitats shared across Europe and were originally designated under European legislation. |
| **Export Cable Corridor** | The area seaward of MHWS which connects the Array Area with the Landfall within which the Offshore Export Cables will be installed |
| **Habitats Regulations** | A term that refers to the collective legislation that translates the Habitats Directive into specific legal obligations in Scotland. namely: The Conservation (Natural Habitats, &c.) Regulations 1994; The Conservation of Habitats and Species Regulations 2017; and The Conservation of Offshore Marine Habitats and Species Regulations 2017 (in each case as amended). |
| **Habitats Regulations Appraisal (HRA)** | An assessment carried out under the Habitats Regulations to determine if a plan or project could adversely affect the integrity of a European Site. |
| **Impact** | A change caused by an action that occurs during a project's lifetime. |
| **Inter-Array Cables (IAC)** | Cables which link the Wind Turbines to each other and with the Offshore Substation Platforms (OSPs). |
| **Interconnector Cables** | Cables which will connect individual OSPs to each other to provide redundancy against cable failure elsewhere. |
| **Intertidal Area** | The area between MHWS and Mean Low Water Springs (MLWS). |
| **Landfall** | The area in which the Offshore Export Cables make landfall and is also the transitional area between the Offshore Transmission Assets and the Onshore Transmission Assets. Located in the Intertidal Area at Benholm. |
| **Light Detection and Ranging (LiDAR)** | A remote sensing method using pulsed lasers to measure distances to the earth. |
| **Likely Significant Effect (LSE)** | A significant effect on a designated site that has the potential to occur as a result of the Proposed Development (as determined by the LSE Screening Report). Where a LSE cannot be ruled out, further assessment is needed as part of the AA. |

| Defined term | Definition |
|---|---|
| **Marine Licence** | A Marine Licence permits the undertaking of different activities in the marine environment, including construction, the deposition or removal of substances or objects, and dredging. The Marine (Scotland) Act 2010 requires Marine Licences to be obtained for licensable activities taking place within Scottish Territorial Seas (MHWS to 12 nm). The Marine and Coastal Access Act (MCAA) 2009 requires a Marine Licence to be obtained for licensable marine activities within the Scottish offshore region (12 nm – 200 nm). |
| **Mean High Water Springs (MHWS)** | The average tidal height throughout the year of two successive high waters during those periods of 24 hours when the range of the tide is at its greatest. |
| **Mean Low Water Springs (MLWS)** | The average tidal height throughout the year of two successive low waters during those periods of 24 hours when the range of the tide is at its greatest. |
| **Offshore Application** | Term used to refer to the applications associated with the Proposed Development. The Applicant will apply for:<br>• A Section 36 Consent under the Electricity Act 1989; and<br>• Marine Licence(s) under Marine Scotland Act 2010 and Marine and Coastal Access Act 2009. |
| **Offshore Environmental Impact Assessment (EIA) Report (hereafter, 'Offshore EIA Report')** | Document prepared to report the findings of the EIA for the Proposed Development and produced in accordance with the EIA Regulations. The Offshore EIA Report is submitted to support the Offshore Application for the Proposed Development, and to comply with EIA Regulations. |
| **Offshore Export Cables** | Subsea cables used to transmit electricity generated offshore by the Wind Turbines from the OSPs to shore. The Transition Joint Bay (TJB) is the location where the Offshore Export Cables terminate, and the onshore cabling begins. |
| **Offshore Generation Assets** | The infrastructure of the Proposed Development required to generate electricity comprising of the Wind Turbines, Wind Turbine foundations and associated infrastructure (e.g. IACs). |
| **Offshore Infrastructure** | All of the Offshore Infrastructure associated with the Proposed Development that is located seaward of MHWS, comprising the Offshore Generation Assets and the Offshore Transmission Assets. |
| **Offshore Scoping Report** | The report that presents the findings of the EIA scoping process undertaken for the Proposed Development with the purpose of obtaining a Scoping Opinion. The Offshore Scoping Report defines what is intended to be assessed and reported as part of the EIA. |
| **Offshore Substation Platform(s) (OSPs)** | OSPs comprise the support structure, topside and electrical components used for collecting and/or converting electricity generated by the Wind Turbines for transmission by the Offshore Export Cables. |
| **Offshore Transmission Assets** | The infrastructure of the Proposed Development required to transmit the generated electricity comprising of the OSPs, Offshore Export Cables and associated infrastructure up to MHWS. |

| Defined term | Definition |
|---|---|
| **Operation and Maintenance (O&M)** | The phase of the Proposed Development following completion of construction. This phase of development includes routine inspections, repairs and replacement of infrastructure and equipment (including Interconnector Cables and IACs), Scour Protection replenishment or replacement, major component replacement, painting and/or other coating works, removal of marine growth, and replacement of access ladders. |
| **Oslo-Paris [Convention] (OSPAR)** | Convention for the Protection of the Marine Environment of the North-East Atlantic. |
| **Pathway** | Describes the means or route by which a receptor (such as the seabed) can be affected by an identified impact source (such as Wind Turbine foundations). |
| **Plan Option Area (POA)** | A location identified in the Sectoral Marine Plan (SMP) as a preferred area for commercial scale offshore wind development. |
| **Project (the)** | An overarching term for the Bowdun Offshore Wind Farm (Bowdun OWF) comprising the offshore and onshore infrastructure required to generate and transmit electricity from the Array Area to the onshore Grid Connection Point. The Project includes the Offshore Generation Assets, the Offshore Transmission Assets and the Onshore Transmission Assets. |
| **Proposed Development** | Term used to define the Offshore Infrastructure associated with the Project seaward of MHWS for which consent is being sought. Further details of the parameters are included in Volume 1, Chapter 3: Project Description. |
| **Qualifying Features** | The features for which a European Site has been officially designated to protect. |
| **Ramsar Site** | Wetlands of international importance, designated under the Ramsar Convention on Wetlands of International Importance 1971. |
| **Scoping Opinion** | A document produced by MD-LOT which is issued in response to submission and review of the Offshore Scoping Report. The Scoping Opinion is supported with feedback and advice from consultees, which details what is expected to be included in the Offshore EIA Report and what can be scoped out of the EIA process. |
| **Scottish Ministers (the)** | The decision makers with regard to Marine Licence(s) and Section 36 Consent applications in Scottish Offshore Waters and Scottish Marine Area. |
| **Scottish Territorial Waters** | The territorial waters of Scotland that extend out from MHWS to 12 nm. |
| **Section 36 Consent** | Scottish Ministers' consent under Section 36 of the Electricity Act 1989 required to permit the generation and operation of an energy generation station. |
| **Sectoral Marine Plan (SMP)** | A plan developed by the Scottish Government which provide the strategically planned spatial footprint for offshore wind development in Scotland. |
| **Significance** | Effect factor that is determined by the magnitude of impact along with the sensitivity of the receptor. |

| Defined term | Definition |
|---|---|
| **Special Protection Areas (SPAs)** | SPAs are sites that are designated to protect rare or vulnerable birds (as listed on Annex I of the Directive 2009/147/EC on the conservation of wild birds), as well as regularly occurring migratory species. |
| **Study Area** | For each environmental topic, the baseline environment will be characterised, and the potential environmental impacts will be described within a topic-specific study area. Specific study areas are defined for each topic and are based on the maximum spatial extent across which potential impacts of the Project may be experienced by the relevant receptors (i.e. Zone of Influence). |
| **Thistle Wind Partners (TWP)** | Company established for the development of the Project. |
| **Wind Turbines** | Structures comprising of a tubular tower, rotor blades, and a nacelle which houses the Wind Turbine generator. |

# Acronyms

| Acronym | Definition |
|---|---|
| **AOB** | Apparently Occupied Burrows |
| **AON** | Apparently Occupied Nests |
| **AOS** | Apparently Occupied Sites |
| **AOT** | Apparently Occupied Territories |
| **BDMPS** | Biologically Defined Minimum Population Scales |
| **BOCC5** | Birds of Conservation Concern 5th Review |
| **BOWFL** | Bowdun Offshore Wind Farm Limited |
| **BTO** | British Trust for Ornithology |
| **CRM** | Collision Risk Modelling |
| **DAS** | Digital Aerial Surveys |
| **Defra** | Department for Environment, Food and Rural Affairs |
| **ECC** | East Caithness Cliffs |
| **EIA** | Environmental Impact Assessment |
| **HPAI** | Highly Pathogenic Avian Influence |
| **HRA** | Habitat Regulations Appraisal |
| **IAC** | Inter-Array Cables |
| **IUCN** | International Union for Conservation of Nature |
| **JNCC** | Joint Nature Conservation Committee |
| **LiDAR** | Light Detection and Ranging |
| **MERP** | Marine Ecosystems Research Programme |
| **MHWS** | Mean High Water Spring |
| **MRSea** | Marine Renewables Strategic environmental assessment |
| **NCC** | North Caithness Cliffs |
| **NEEOG** | North-Eastern and Eastern Ornithological Group |

| Acronym | Definition |
|---|---|
| **OSP** | Offshore Substation Platform |
| **OWF** | Offshore Wind Farm |
| **O&M** | Operation and Maintenance |
| **SD** | Standard Deviation |
| **SMP** | Sectoral Marine Plan |
| **SPA** | Special Protected Area |
| **TWP** | Thistle Wind Partners Limited |
| **UK** | United Kingdom |
| **UTC** | Coordinated Universal Time |
| **VOR** | Valued Ornithological Receptor |

# Table of Units

| Units | Definition |
|---|---|
| **cm** | Centimetre |
| **ft** | Feet |
| **km** | Kilometre |
| **km$^2$** | Square kilometre |
| **kts** | knots |
| **m** | Metre |
| **nm** | Nautical mile |
| **%** | Percent |

# 1 Introduction

1.1.1 This Offshore Ornithology Baseline Characterisation Report presents the offshore ornithology baseline characterisation for the Bowdun Offshore Wind Farm (OWF) Project (hereafter referred to as the Proposed Development). The Proposed Development covers the Option Lease Area (OLA) comprises of the Array Area, which is located in the E3 Plan Option Area (POA) detailed in the Scottish Sectoral Marine Plan (SMP) (Scottish Government, 2020), and the Export Cable Corridor. The Array Area is located 38 km from the Aberdeenshire coast at its closest point, covering an area of 187 $km^2$ (Figure 1.1). The Proposed Development will comprise of Wind Turbines (fixed foundations), Inter-Array Cables (IACs), Offshore Substation Platforms (OSPs), Interconnector Cables, Offshore Export Cables and any necessary scour/cable protection. The Export Cable Corridor will include a maximum of three High Voltage Alternating Current (HVAC) Offshore Export Cables, each with a length of up to 70 km and will make Landfall at Benholm, Aberdeenshire.

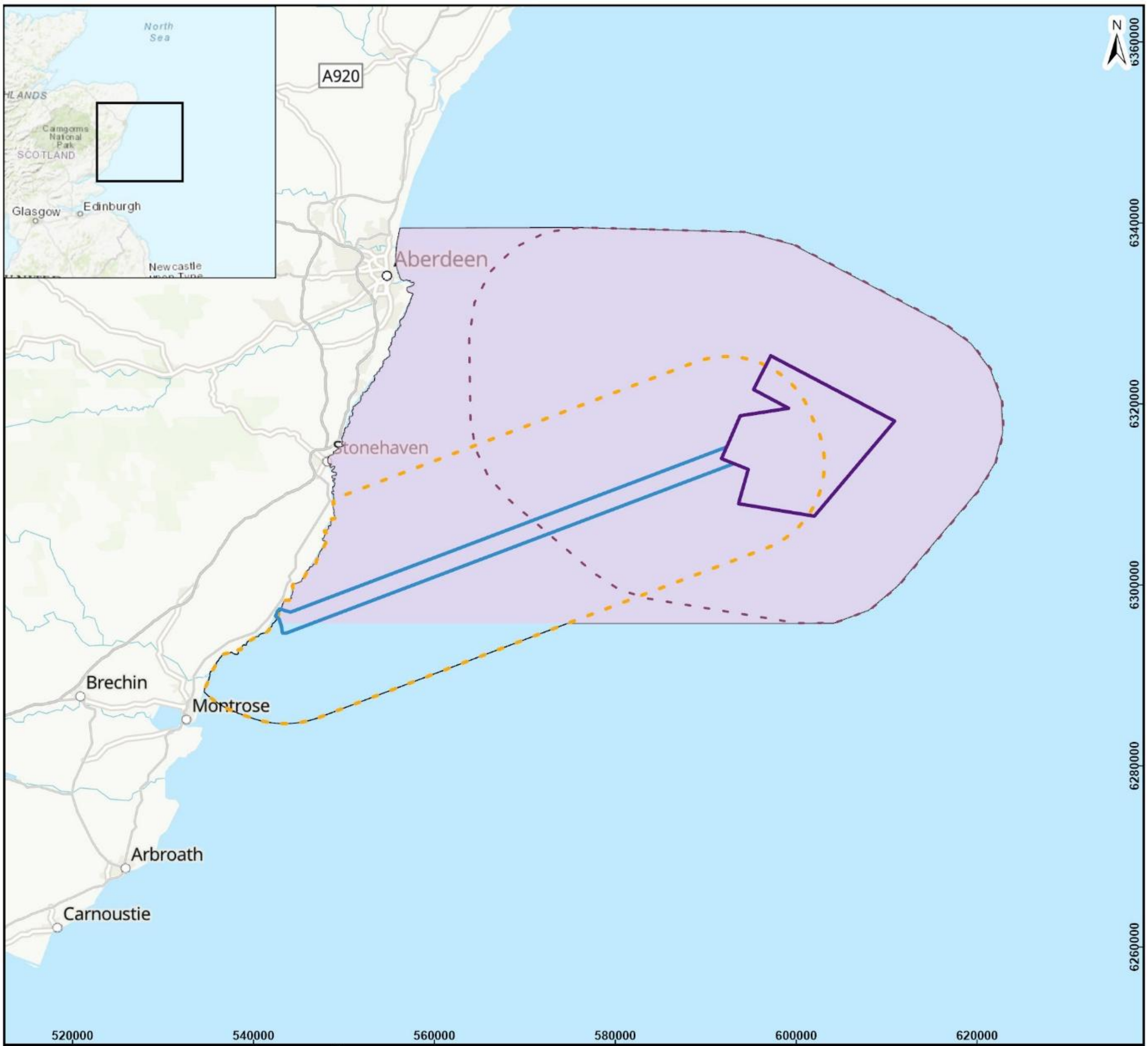
1.1.2 For the baseline characterisation of the Offshore Ornithology Export Cable Corridor Study Area of the Proposed Development, see Volume 3, Technical Appendix 11.2: Nearshore, Intertidal and Offshore Ornithology Along the Export Cable Corridor Baseline Report.

1.1.3 The Array Area is within foraging range of several seabird species which nest at colonies mainly located within Special Protection Areas (SPAs). These are Qualifying Features and/or named within a qualifying species assemblage of these SPAs.

1.1.4 A comprehensive desk-based literature review and site-specific Digital Aerial Surveys (DAS) have been used to characterise the baseline conditions of the Offshore Ornithology Array Area Study Area (hereafter 'Array Area Study Area'). This has enabled the abundance and distribution of seabirds and other bird groups within the offshore environment to be assessed.

1.1.5 In addition to the DAS and desk-based literature review, Light Detection and Ranging (LiDAR) surveys were also undertaken within the Array Area only to assess flight heights of key seabird species (see Section 3.5). As part of the North East and East Ornithology Group (NEEOG), the Applicant also commissioned seabird colony censuses of East Caithness Cliffs SPA and North Caithness Cliffs SPA (see Section 3.4), and contributed to tracking studies (Johnston *et al.*, 2024; O'Donovan *et al.*, 2024). These provide updated information regarding population trends and seabird movements to contextualise results of the assessment.

1.1.6 Intertidal and nearshore surveys at Haughs Bay were undertaken by TetraTech RPS Energy Limited (formerly RPS) between September 2023 and March 2024 (inclusive). The DAS Area was extended to the Aberdeenshire coastline from April to August inclusive (see Section 3.3), which covered a large section of the Export Cable Corridor (Figure 1.1). These surveys are discussed further in Volume 3, Technical Appendix 11.2: Nearshore, Intertidal and Offshore Ornithology Along the Export Cable Corridor Baseline Report.




| Project Title: Bowdun Offshore Wind Farm | Figure Title: Offshore Ornithology Study Area |
|---|---|

**LEGEND**

- Array Area
- Export Cable Corridor
- DAS Area
- Extended DAS Area
- Export Cable Corridor Study Area
- Offshore Ornithology Study Area

Scale: 0 5 10 nm; 0 5 10 20 km

**Geodetic Information:**
Datum: ETRS 1989
Projection: ETRS 1989 UTM Zone 30N

**Data Sources:** Thistle Wind Partners, RPS Group Waggitt et al.(2019)

**Service Layer Credits:** Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, HERE, Garmin, FAO, NOAA, USGS

| VER | DATE | DETAILS | BY | CHK |
|---|---|---|---|---|
| 01 | 25/04/24 | Draft | OW | JS |
| 02 | 23/06/25 | Issue | GNL | JS |
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| 04 | 23/10/25 | Revision | PE | JS |

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THISTLE WIND PARTNERS | TETRA TECH RPS ENERGY

**Figure 1.1: Offshore Ornithology Study Areas**

# 2 Offshore Ornithology Study Area

2.1.1 The Offshore Ornithology Study Area is comprised of two component areas (Figure 1.1):

- Offshore Ornithology Array Area Study Area: consists of the E3 POA, and a 12 km buffer except westwards, where it extends all the way to the Aberdeenshire coast; and
- Offshore Ornithology Export Cable Corridor Study Area: consists of the Export Cable Corridor route plus a 10 km buffer to the Mean High Water Springs (MHWS).

2.1.2 Guidance from the Joint Nature Conservation Committee (JNCC, 2022) requires impacts of displacement and barrier effects from OWF be assessed to a minimum of a 2 km buffer from the development footprint, while NatureScot (2023a) recommend a buffer of 4 km to 6 km for aerial surveys. A larger 12 km buffer around the E3 POA was flown as part of the DAS to provide context to the Array Area Study Area, the E3 POA and the surrounding environment during winter months (September to March, inclusive). During the summer months (April to August, inclusive), DAS flights were extended to include up to the coast where breeding colonies are located (e.g. Fowlsheugh SPA), also to provide important additional context on bird distribution and abundance.

2.1.3 Several protected areas designated for seabirds and other waterbirds have connectivity with the Proposed Development. These protected areas are comprised of SPAs within the United Kingdom (UK) National Site Network (JNCC, 2023), Ramsar sites under the Ramsar Convention, and national designations such as Sites of Special Scientific Interest (SSSIs).

2.1.4 There are two existing SPAs within the Offshore Ornithology Study Area: 'Ythan Estuary, Sands of Forvie and Meikle Loch SPA' and 'Fowlsheugh SPA'. There are a number of SPAs located along the coastlines of Scotland and the wider UK which support qualifying seabird and waterbird species within foraging range of the Proposed Development and which have been identified within the Array Area Study Area during DAS. There is also potential for connectivity of qualifying waterbird species from inland SPAs and Ramsar sites in Scotland and the wider UK during breeding and non-breeding seasons and during migratory periods.

2.1.5 Where breeding seabird colonies are located within a species' foraging range of the Proposed Development, there is a potential for connectivity and therefore impact.

2.1.6 Recommended foraging ranges are derived from Woodward *et al*. (2019) and NatureScot (2023b). The most widely used metric is the mean maximum plus 1 standard deviation (mean max + 1 SD) foraging range of a species, derived from all available site-specific maximum foraging range values for each species. Exceptions arise for some colonies with which there are more accurate site-specific foraging ranges for certain colonies or for species with which there is insufficient data, in which cases the mean maximum, maximum or mean foraging ranges are used.

# 3 Methodology

## 3.1 Desktop Review of Data Sources

3.1.1 A review of existing data and evidence sources has been undertaken to define the baseline offshore ornithology environment and contextualise the findings of site-specific surveys.

3.1.2 The initial desk-based review of data sources was undertaken for the Scoping Report and identified sources to determine the existing baseline offshore ornithological environment. The initial list of data sources identified in the Scoping Report has been updated to reflect additional sources used (Table 3.1).

3.1.3 To aid readability, the following bird species names have been shortened:

- northern fulmar *Fulmarus glacialis*, hereafter 'fulmar';
- northern gannet *Morus bassanus*, hereafter 'gannet';
- black-legged kittiwake *Rissa tridactyla*, hereafter 'kittiwake';
- European herring gull *Larus argentatus*, hereafter 'herring gull';
- common guillemot *Uria aalge*, hereafter 'guillemot'; and
- Atlantic puffin *Fratercula arctica*, hereafter 'puffin'.

**Table 3.1: Summary of Desk-Based Data Sources Consulted in Search of Information on Associated Topics**

| Topics | Source(s) consulted |
|---|---|
| **Population trends, population scale estimates and conservation concern classifications** | Mudge (1979)<br>Mudge (1986)<br>Stone *et al.* (1995)<br>Wernham *et al.* (2002)<br>Cleasby *et al.* (2015)<br>Furness (2015)<br>Woodward *et al.* (2020)<br>JNCC (2021)<br>Stanbury *et al.* (2021)<br>Burnell *et al.* (2023)<br>Zisman and Swann (2023)<br>British Trust for Ornithology (BTO) (2024)<br>Laurenson *et al.* (2024)<br>Seabird Monitoring Programme database (2024)<br>Zisman and Swann (2024)<br>Zisman *et al.* (2025) |
| **Vulnerability of seabird to impacts of OWFs** | Bradbury *et al.* (2014)<br>Wade *et al.* (2016) |
| **Seasonal definitions, species distribution and seasonal ranges** | Furness (2015)<br>NatureScot (2020)<br>BirdLife International (2024)<br>BTO (2024)<br>Wetlands International (2024) |

| Topics | Source(s) consulted |
|---|---|
| **Foraging ranges and species demographics** | Del Hoyo *et al.* (1992)<br>Horswill and Robinson (2015)<br>Woodward *et al.* (2019)<br>NatureScot guidance documents for OWFs (2023b) |
| **Data analysis guidance** | NatureScot guidance documents for OWFs (2023a; 2023c; 2023d) |
| **Seabirds at sea data** | Waggitt *et al.* (2019)<br>Waggitt (2019) |
| **Scientific research into potential impacts of OWFs on seabirds, which provides relevant information** | Bradbury *et al.* (2014)<br>Cook (2014)<br>Johnston *et al.* (2014)<br>Cook *et al.* (2018)<br>Croll *et al.* (2022)<br>JNCC (2022)<br>NatureScot (2023c; 2023d; 2023e) |
| **Current and previous offshore wind projects, which provide relevant information pertaining to offshore ornithology** | East Anglia ONE North (East Anglia ONE, 2018)<br>Berwick Bank (Berwick Bank, 2022)<br>Pentland Floating Offshore Wind (HiDef, 2022)<br>Muir Mhòr (Natural Power Limited, 2024)<br>Ossian (Ossian, 2024) |

### UK Seabird Population Trends

3.1.4 The UK hosts globally significant populations of seabirds, but these populations have been in notable decline over the past two decades following a period of population expansion throughout much of the last century (Mitchell *et al.*, 2020), making seabirds one of the most threatened bird groups globally (Dias *et al.*, 2019). The Department for Environment, Food and Rural Affairs (Defra) reported in 2019 that UK breeding seabirds had not achieved Good Environmental Status (Defra, 2019), and over a third of UK seabird species have been assessed as experiencing breeding abundance declines of 20% to 30% since the early 1990s (Mitchell *et al.*, 2018, as cited in Mitchell *et al.*, 2020).

3.1.5 Climate change is identified as a primary factor contributing to declining seabird populations, both indirectly through changes in prey availability, and directly through increased mortality from extreme weather events (Daunt and Mitchell, 2013; OSPAR, 2017; Laurenson *et al.,* 2024). For example, surface-feeding species such as kittiwake have shown frequent breeding failures due to reduced availability of prey species, such as sandeels *Ammodytes sp*., driven by rising sea surface temperatures which are altering the phenological timing of sandeel and their prey species, plankton (Mitchell *et al.*, 2020). Rising sea surface temperatures have been found to adversely affect breeding success in other seabird species in UK waters, including increasing the rate of missed breeding in guillemot and an adverse correlation between sea surface temperature and annual survival rates of shag *Gulosus aristotelis* (Burthe *et al.*, 2014).

3.1.6 Extreme weather events pose another significant threat to seabirds, directly impacting survival and breeding success (Daunt and Mitchell, 2013) and are predicted to become more frequent with a changing and warming climate (Mitchell *et al.*, 2020). Strong winds and heavy rainfall lead to more frequent nest failures and have resulted in extensive breeding failures (Mitchell *et al.*, 2020). Extreme weather events offshore can affect foraging efficiency at sea, leading to deteriorated body condition and lower survival rate, and causes mass mortality events or 'wrecks' as flying and diving become more energy-costly to seabirds in high wind conditions (Mitchell *et al.*, 2020). Mass mortality events, such as those caused by extreme weather, have the potential to cause long-lasting effects on seabird populations as they are relatively long-lived species with slow reproductive rates (Mitchell *et al.*, 2020, Laurenson *et al.*, 2024), causing population recoveries to be relatively slow.

3.1.7 Additional threats to seabird populations in the UK and globally include bycatch in fisheries (the unintentional capture of seabirds during commercial fishing operations), overfishing, and disturbance (Dias *et al.*, 2019; Power *et al.*, 2023). A cumulative impact occurs where 89% of seabirds impacted by the effects of climate change are also impacted by additional threats (Power *et al.*, 2023), highlighting the complex multitude of threats facing seabird populations today.

3.1.8 The JNCC, in partnership with several UK Statutory Nature Conservation Bodies, present the long term population trends of 25 seabird species in the UK since 1986 through the Seabird Monitoring Programme (JNCC, 2023), as summarised in Table 3.2.

**Table 3.2: Population Trends (% Change) of Seabird Species in the UK Between Complete Census Periods (JNCC, 2021; Harris *et al.*, 2024)**

| Species | Population Change (%) | | | | Breeding Abundance change (%) | |
|---|---|---|---|---|---|---|
| | 1969-70 to 1985-88 census | 1985-88 to 1998-2002 census | 1984-85 to 2003-04 census | 2003-04 to 2013-15 census | Long term trend (1986 to 2023) | 23-year trend (2000 to 2023) |
| **Common eider *Somateria mollissima*** | Not available | | | | | |
| **Fulmar** | +77 | -3 | N/A | N/A | -42 | -40 |
| **Manx shearwater *Puffinus puffinus*** | Not available | | | | | |
| **Sooty shearwater *Ardenna grisea*** | Not available | | | | | |
| **European storm petrel *Hydribates pelagicus*** | Not available | | | | | |
| **Gannet** | +39 | N/A | +39 | +34 | N/A | N/A |
| **Great skua *Stercorarius skua*** | +148 | +26 | N/A | N/A | N/A | N/A |

| Species | Population Change (%) | | | | Breeding Abundance change (%) | |
|---|---|---|---|---|---|---|
| | 1969-70 to 1985-88 census | 1985-88 to 1998-2002 census | 1984-85 to 2003-04 census | 2003-04 to 2013-15 census | Long term trend (1986 to 2023) | 23-year trend (2000 to 2023) |
| **Kittiwake** | +24 | -25 | N/A | N/A | -53 | -40 |
| **Great black-backed gull *Larus marinus*** | -7 | -4 | N/A | N/A | -72 | -70 |
| **Lesser black-backed gull *Larus fuscus*** | +29 | +40 | N/A | N/A | -62 | -63 |
| **Herring gull** | -48 | -13 | N/A | N/A | -53 | -43 |
| **Arctic tern *Sterna paradisaea*** | +50 | -31 | N/A | N/A | -49 | -49 |
| **Common tern *Stern hirundo*** | +9 | -9 | N/A | N/A | -41 | -28 |
| **Guillemot** | +77 | +31 | N/A | N/A | -9 | -25 |
| **Razorbill *Alca torda*** | +16 | +21 | N/A | N/A | +88 | +16 |
| **Puffin** | +15 | +19 | N/A | N/A | N/A | N/A |
| **Snipe *Gallinago gallinago*** | Not available | | | | | |

### Mapping Seabirds at Sea Data Sources

3.1.9 Estimates of abundance and densities of marine ornithological features in the footprint of the Array Area Study Area and its surrounding area have been obtained from the Marine Ecosystems Research Programme (MERP) study of seabird surveys across the North-East Atlantic (Waggitt *et al.*, 2019). The outcome of the study was the production of a set of monthly spatial data layers of 12 cetacean and 12 seabird species in the North-East Atlantic study area, representing fitted modelled density estimates at a 10 km monthly resolution.

3.1.10 The seabird element of the MERP dataset (Waggitt, 2019) was produced using 1,649,297 km of survey data from both boat-based and aircraft-based transect surveys. The production of distribution maps comprised of three stages: collation of survey data, standardisation of survey data, and species distribution modelling (Waggitt *et al.*, 2019). Transect data was modelled using a Generalised Estimating Equation-Generalised Linear Model (GEE-GLM) approach to interpolate the data to the entire North-East Atlantic study area, at a 10 km and monthly resolution (Waggitt *et al.*, 2019).

3.1.11 Density mapping was produced from the accompanying dataset (Waggitt, 2019) using QGIS mapping software (QGIS Development Team, 2024). Two maps were produced for each species included in the dataset, representing the predicted density distribution during the breeding and non-breeding bio-seasons as defined by NatureScot (2020). Monthly densities in each 10 km grid square were summed and averaged within each bio-season to produce a mean seasonal density estimate from the modelled dataset, to visualise the seasonal differences in distribution of each species in the seas and coasts off north-east Scotland. Where a bio-season was defined by NatureScot (2020) as including a half-month, the modelled density of the month was included in both the breeding and non-breeding seasonal mean density estimate.

## 3.2 Seasonal Definitions and Population Scales

### Seasonal Definitions

3.2.1 Seasonal definitions are attributed to each species, defining distinct phenological periods. Furness (2015) defines four distinct seasons which can be attributed to different months of the year for different seabird species in UK waters, dependent on their biology and life history. In some cases, it is not applicable to attribute all four seasonal definitions to a species. NatureScot (2020) define a streamlined approach to the recommended seasonal definitions for birds in the Scottish marine environment (Table 3.3). Seasons are defined as:

- **breeding season:** strongly associated with nest site, including nesting, egg laying and provisioning of young; and
- **non-breeding season:** birds are not strongly associated with nest site but present in significant numbers in Scottish marine areas, including migration and wintering.

3.2.2 NatureScot (2020) provide a further breakdown of time outside of the breeding season, including winter, migration and flightless moult period. For the purposes of this assessment, anything outside of the breeding season defined by NatureScot (2020) is defined as the non-breeding season.

3.2.3 NatureScot (2020) define a further period in the phenology of some seabird species, where birds attend breeding sites but are not closely associated with nest sites, occurring immediately before and/or after the breeding season. For the purpose of this assessment, the breeding site attendance period is attributed to the non-breeding season.

**Table 3.3: Seasonal Definitions of Key Seabird Species Recorded in the Array Area Study Area Taken from NatureScot (2020). The Range is Inclusive of Whole Months**

| Species | Breeding Season | Non-breeding Season |
|---|---|---|
| **Common eider** | mid-April to August | September to mid-April |
| **Fulmar** | April to mid-September | mid-September to March |
| **Manx shearwater** | April to mid-October | N/A |
| **Sooty shearwater**[1] | Jul to November | December to June |

| Species | Breeding Season | Non-breeding Season |
|---|---|---|
| **European storm petrel** | mid-May to October | N/A |
| **Gannet** | mid-March to September | October to mid-March |
| **Great skua** | mid-April to mid-September | mid-September to mid-April |
| **Kittiwake** | mid-April to August | September to mid-April |
| **Great black-backed gull** | April to August | September to March |
| **Lesser black-backed gull** | mid-March to August | N/A |
| **Herring gull** | April to August | September to March |
| **Common gull** | April to August | September to March |
| **Arctic tern** | May to August | N/A |
| **Common tern** | May to mid-September | N/A |
| **Guillemot** | April to mid-August | mid-August to March |
| **Razorbill** | April to mid-August | mid-August to March |
| **Puffin** | April to mid-August | mid-August to March |
| **Snipe** | April to mid-August | mid-August to March |

[1]Seasonal definition for sooty shearwater derived from Kober (2012)

### Population Scales

3.2.4 Population estimates of seabird species occurring in the Array Area Study Area at a foraging range scale and a regional/national scale are provided in Table 3.4.

3.2.5 The foraging range population in the breeding season reflects the central-place foraging behaviour of seabirds during this time, when their foraging range extends out to sea from a fixed nesting location. The foraging range of seabird species (defined in Woodward *et al*., 2019; NatureScot, 2023b) is therefore used to determine connectivity between breeding colonies and the Proposed Development. Colonies located within foraging range of the Proposed Development are deemed to have potential for connectivity as it is possible birds may use the area to forage. The foraging range population is a sum of population census estimates of colonies within a species' foraging range of the Array Area Study Area, using Seabirds Count census data from 2015 to 2021 (Burnell *et al*., 2023).

3.2.6 The population estimate for most species is provided as a count of Apparently Occupied Nests (AON), Apparently Occupied Sites (AOS), Apparently Occupied Territories (AOT) or Apparently Occupied Burrows (AOB). Each measure is assumed to equal one pair of breeding adult birds and is therefore multiplied by two to find the number of individual breeding adult birds. Guillemot and razorbill colony counts are provided as individual birds, as the nature of the species to breed in high density colonies affects the ability of surveyors to identify nests or breeding pairs among ledges and crevices in cliffs. It is accepted that a count of one bird for these species represents 0.67 breeding adult pairs, which can be used to estimate the number of adult breeding pairs from the individual count data. This accounts for those which are missed during census counts (Walsh *et al*., 1995). We can extend this logic and use a conversion factor of 1.34 to estimate the total number of breeding adults from the count data.

3.2.7 The Seabirds Count dataset (Burnell *et al*., 2023) provides counts of occupied breeding sites and breeding adult birds only and does not include immature or juvenile birds. Furness (2015) provide a ratio of immature birds per adult for most seabird species occurring in the Array Area Study Area. The number of breeding adults within foraging range of the Array Area is multiplied by the proportion of immature birds to obtain an estimate of immature birds in the population. The number of breeding adult birds and immature birds are summed to find the total number of individuals in the foraging range population.

3.2.8 An estimate of the breeding season population in the UK is derived from Woodward *et al*. (2020), a summary of the fourth report by the Avian Population Estimates Panel. The report is a collation of the best available estimates for breeding and non-breeding populations of birds in Great Britain and the UK.

3.2.9 Outside of the breeding season, seabirds are not constrained to their specific foraging range as they are not associated with breeding sites. As a result, there is potential for connectivity outside of the breeding season for a greater number of birds from a wider range of breeding colony origin. Furness (2015) defines the regions within which seabird populations are distributed in each season outside of the breeding season: post-breeding, non-breeding and pre-breeding (where applicable). Within each season, regional Biologically Defined Minimum Population Scales (BDMPS) are calculated for each species, separated geographically based on the typical movement of birds in UK waters and their migration paths. Where the Array Area overlaps with a BDMPS region, it is assumed there is potential for connectivity with that region and the colonies (including SPA colonies) contributing to that population.

3.2.10 A recent study on guillemot (Buckingham *et al*., 2022) found that the species is more likely to remain in the vicinity of breeding colonies during the non-breeding season than previously believed. Therefore, the non-breeding population is defined as comprising the breeding population within the mean maximum foraging range +1 SD (mean max + 1 SD) of the Array Area, plus the associated non-breeding individuals, as in Furness (2015). This approach was recommended in NatureScot's Advice on marine renewables development in Guidance Note 4 (NatureScot, 2023f).

3.2.11 For three species (black-headed gull, common gull and sandwich tern), Furness (2015) does not provide accounts of seasonal populations. Non-breeding season population estimates of these species are taken from the wintering population estimate in Woodward *et al*. (2020).

**Table 3.4: Population Size Estimates of Seabird Species Recorded in the Array Area Study Area at a Foraging Range Scale and Regional/National Scale. All Numbers Represent Number of Individual Birds**

| Species | Foraging Range Population | | | UK and Ireland Population[1] | Regional Seas (BDMPS) Population With Connectivity to the Proposed Development[2] | | |
|---|---|---|---|---|---|---|---|
| | Breeding Season | | | Breeding Season | Post-breeding | Non-breeding | Pre-breeding |
| | Breeding Adults[1] | Juveniles and Immatures[3] | Total Individuals | Breeding Adults | Total Individuals | Total Individuals | Total Individuals |
| **Common eider** | 0 | 0 | 0 | 72,000[3] | N/A | 86,000[4] | N/A |
| **Fulmar** | 696,724 | 431,969 | 1,128,693 | 705,990 | 957,502 | 568,736 | 957,502 |
| **Manx shearwater** | 0 | 0 | 0 | 1,843,236 | 8,507 | N/A | 8,507 |
| **Sooty shearwater** | 0 | 0 | 0 | 0 | Not available | Not available | Not available |
| **European storm petrel** | 0 | 0 | 0 | 295,156 | Not available | Not available | Not available |
| **Gannet** | 465,054 | 376,694 | 841,748 | 721,496 | 456,299 | N/A | 248,385 |
| **Great skua** | 0 | 0 | 0 | 21,942 | 19,556 | 143 | 8,485 |
| **Kittiwake** | 321,586 | 282,996 | 604,582 | 482,642 | 829,937 | N/A | 627,816 |
| **Great black-backed gull** | 161 | 203 | 364 | 22,530 | N/A | 91,399 | N/A |
| **Lesser black-backed gull** | 0 | 0 | 0 | 128,534 | 209,007 | 39,314 | 197,483 |
| **Herring gull** | 19,175 | 20,901 | 40,076 | 149,852 | N/A | 59,816[5] | N/A |
| **Common gull** | 0 | 0 | 0 | 51,050 | Not available | 710,000[4] | Not available |
| **Arctic tern** | 3,196 | 1,854 | 5,050 | 66,430 | 163,930 | N/A | 163,930 |
| **Common tern** | 0 | 0 | 0 | 34,178 | 144,911 | N/A | 144,911 |

| Species | Foraging Range Population | | | UK and Ireland Population[1] | Regional Seas (BDMPS) Population With Connectivity to the Proposed Development[2] | | |
|---|---|---|---|---|---|---|---|
| | Breeding Season | | | Breeding Season | Post-breeding | Non-breeding | Pre-breeding |
| | Breeding Adults[1] | Juveniles and Immatures[3] | Total Individuals | Breeding Adults | Total Individuals | Total Individuals | Total Individuals |
| **Guillemot** | 143,969 | 106,537 | 250,506 | 1,942,449 | N/A | 250,506[6] | N/A |
| **Razorbill** | 51,725 | 38,794 | 90,519 | 346,563 | 591,874 | 218,622 | 591,874 |
| **Puffin** | 248,823 | 258,776 | 507,599 | 508,324 | N/A | 231,957 | N/A |
| **Snipe** | 0 | 0 | 0 | 129,000[3] | N/A | 1,100,000[4] | N/A |

[1]Burnell *et al.* (2023).
[2]Furness (2015); [4]Woodward *et al.* (2020); [5]non-breeding population estimate assumed to be equal to the total individuals in the foraging range during the breeding season plus a 0.325 correction factor to account for the influx of non-UK and west coast UK birds following advice in the Scoping Opinion for Salamander Offshore Wind Farm (MD-LOT, 2023); [6]non-breeding population estimate assumed to be equal to the total individuals in the foraging range during the breeding season (NatureScot, 2023b).
[3]Estimated number of juveniles and immatures calculated from the estimated number of breeding adults (Burnell *et al.*, 2023) and the estimated proportion of immatures per breeding adult in a population (Furness, 2015).

## 3.3 Site-specific Digital Aerial Surveys

### Survey Area

3.3.1 DAS were commissioned to collect seabird data across the extent of the Array Area Study Area. Twenty-four monthly surveys were undertaken by APEM Limited from March 2022 to February 2024 inclusive. The DAS data collection covered two areas dependant on the season. During the winter months (September to March, inclusive), the area for the DAS campaign was delineated as the ScotWind E3 POA plus a 12 km buffer (hereafter known as 'DAS Area'). During the summer months (April to August, inclusive) the area was extended to the Aberdeenshire coastline (hereafter known as the 'Extended DAS Area') (Figure 3.1).

3.3.2 The DAS method was designed to collect data on marine fauna (including seabirds) covering at least 25% of the sea surface and with a minimum of 16.5% analysed (Table 3.5).

**Table 3.5: Coverage Achieved by the Bowdun DAS Surveys**

| Survey | Coverage ($km^2$) | Coverage (%) |
|---|---|---|
| **2022-03** | 347.2 | 17.43% |
| **2022-04** | 487.3 | 17.49% |
| **2022-05** | 485.4 | 17.42% |
| **2022-06** | 491.4 | 17.64% |
| **2022-07** | 482.9 | 17.33% |
| **2022-08** | 486.1 | 17.45% |
| **2022-09** | 346.6 | 17.40% |
| **2022-10** | 349.5 | 17.55% |
| **2022-11** | 341.3 | 17.13% |
| **2022-12** | 347.1 | 17.43% |
| **2023-01** | 337.2 | 16.93% |
| **2023-02** | 346.5 | 17.40% |
| **2023-03** | 349.4 | 17.54% |
| **2023-04** | 486.9 | 17.47% |
| **2023-05** | 485.8 | 17.43% |
| **2023-06** | 486.7 | 17.47% |
| **2023-07** | 482.3 | 17.31% |
| **2023-08** | 486.8 | 17.47% |
| **2023-09** | 353.4 | 17.74% |
| **2023-10** | 343.2 | 17.23% |
| **2023-11** | 328.7 | 16.50% |

| Survey | Coverage ($km^2$) | Coverage (%) |
|---|---|---|
| **2023-12** | 349.9 | 17.57% |
| **2024-01** | 341.4 | 17.14% |
| **2024-02** | 346.6 | 17.40% |

### Survey Methodology

3.3.3 DAS were conducted using a bespoke camera system, optimised for surveying in offshore environments, and fitted to a twin-engine aircraft. Flight-planning software and customised camera design allows the camera system to accurately capture images along pre-determined transect survey lines (to an accuracy of +/- 3 m to 5 m) and at desired intervals.

3.3.4 The monthly DAS consisted of 17 x strip transects approximately 2 km apart with a width of at least 250 m, flown at approximately 400 m altitude and at a speed of 120 kts. The survey lines are shown in Figure 3.1. Images were captured continuously at 1.5 cm ground sampling distance (GSD). Data was collected along the same transect lines in each survey with a DAS considered complete when all transect lines were covered.

3.3.5 All DAS imagery were subject to rigorous analysis and quality control by APEM Limited. Images were reviewed by experienced and qualified analysts to count marine fauna (birds and marine megafauna) to species level where possible. Species level identification was only made with 100% confidence otherwise identification was made to a higher taxonomic level.

3.3.6 Internal quality control was undertaken by APEM Limited on data collected from each survey to ensure accurate species identification, check for missed targets and confirm blank DAS images. Quality control ensured each image containing birds and 10% of blank images were reviewed by a second member of staff. Where there was <90% agreement between reviewers within an image batch, the entire batch was independently re-analysed.

3.3.7 Additional quality assurance was undertaken by TetraTech RPS Consulting to ensure data was fit for analysis. TetraTech RPS Consulting and APEM Limited had regular consultations about any anomalies encountered to ensure data robustness.

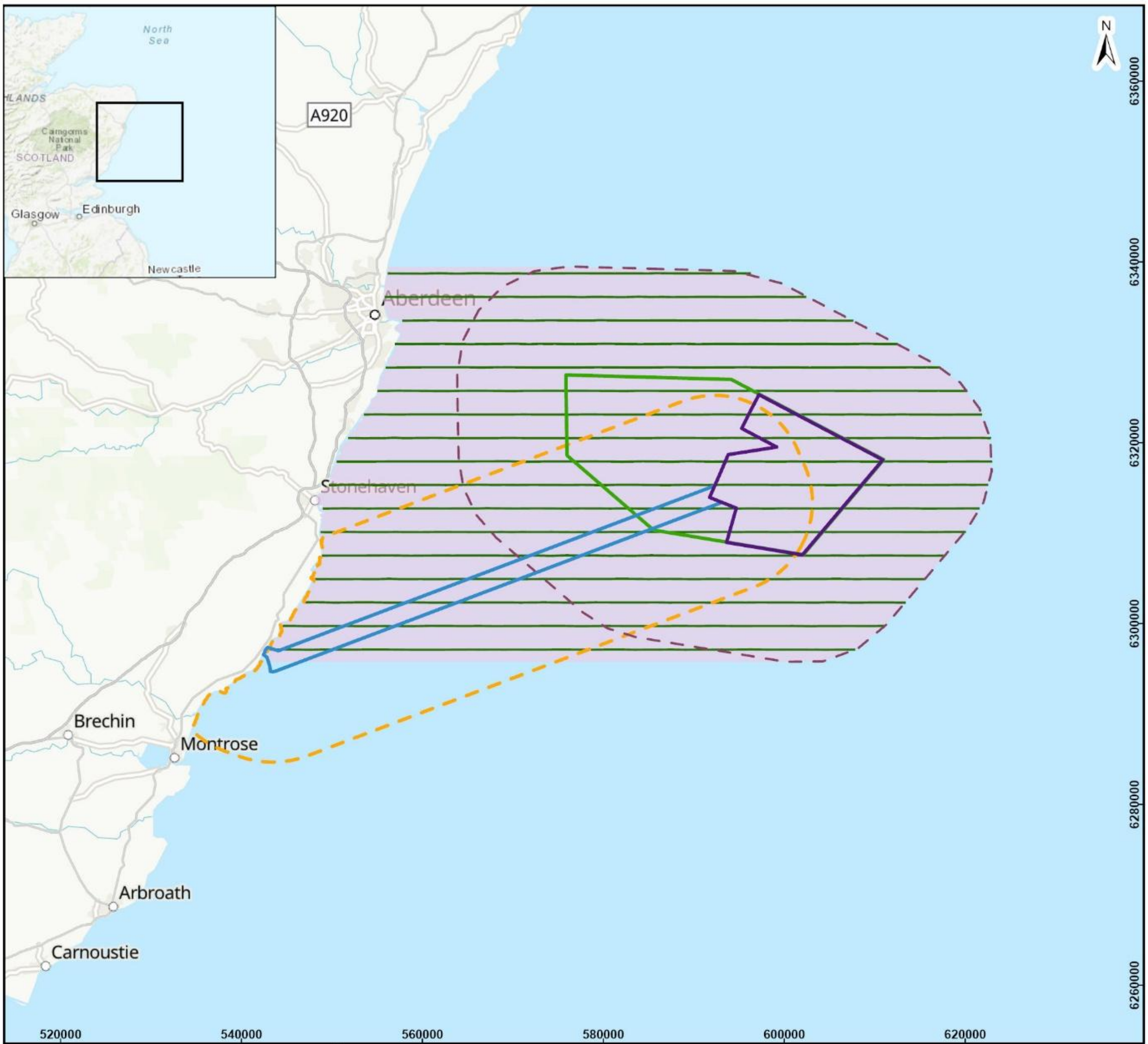
3.3.8 The flight direction of all birds in flight were recorded from DAS images. This was undertaken by APEM Limited using bespoke image analysis software, measuring the axis of the bill to tail to take a bearing relative to the bird's head. The bearing was attributed to the geo-referenced image to provide an accurate representation of the orientation of the flying bird at the time the image was captured.

3.3.9 All DAS were undertaken in weather conditions that did not impact image quality and analysis. Favourable conditions for surveys were defined by APEM Limited as a cloud base >1,700 ft (~518 m), visibility >5 km, wind speed <30 kts and Douglas Scale sea state of three (slight) or less. In the interest of safety, DAS were not conducted in icing conditions.

3.3.10 To minimise impacts to image quality, surveys avoided times when the angle of the sun increased glint and glare conditions, which can impede the identification of marine fauna if not avoided.

3.3.11 Date, start time and end time for each DAS are provided in Table 3.6 with the corresponding weather conditions reported in Table 3.7. Three surveys were not flown within the target month and were instead flown in the following month (intended months of rescheduled surveys: March 2022, May 2022 and April 2023). To avoid confusion and to attribute counts to defined seasonal periods, these surveys are considered in this report as having occurred during their target month.

3.3.12 NatureScot and MD-LOT were consulted on the DAS survey methods on the 18 July 2022 and agreed that the scope, timing and surveys were appropriate. On 20 November 2024 NatureScot was also consulted on the DAS annual reports from APEM Limited, in which the DAS methodologies and timings were deemed fit for purpose.




**Project Title:** Bowdun Offshore Wind Farm

**Figure Title:** Transect Lines Covering the Array Area Study Area

**LEGEND**

- Array Area
- Export Cable Corridor
- E3 PO Area
- DAS Area
- Extended DAS Area
- Export Cable Corridor Study Area
- Survey Lines

0 5 10 nm
0 5 10 20 km

**Geodetic Information:**
Datum: ETRS 1989
Projection: ETRS 1989 UTM Zone 30N

**Data Sources:** Thistle Wind Partners, RPS Group Waggitt et al.(2019)

**Service Layer Credits:** Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, HERE, Garmin, FAO, NOAA, USGS

| VER | DATE | DETAILS | BY | CHK |
|---|---|---|---|---|
| 01 | 25/04/24 | Draft | OW | JS |
| 02 | 23/06/25 | Issue | GNL | JS |
| 03 | 06/08/25 | Revision | GNL | JS |
| 04 | 23/10/25 | Revision | PE | JS |

**Drawing Number:** ECO03021-TWP-ORN-TR2-02-04

THISTLE WIND PARTNERS
TETRA TECH RPS ENERGY

**Figure 3.1: Transect Lines Covering the Array Area Study Area**

**Table 3.6: Date (Target Date and Actual Date), Start and End Times (Coordinated Universal Time (UTC)) of DAS Flights from March 2022 to February 2024**

| Survey | Target Date | Actual Date | Flight Number* | Start Time (HH:MM) | End Time (HH:MM) |
|---|---|---|---|---|---|
| **1** | March 2022 | 02/04/2022 | 1 | 10:25am | 2:30pm |
| **2** | April 2022 | 28/04/2022 | 1 | 8:34am | 09:59am |
| | | 28/04/2022 | 2 | 12:44pm | 3:47pm |
| | | 29/04/2022 | 3 | 9:00am | 10:51am |
| **3** | May 2022 | 02/06/2022 | 1 | 7:59am | 4:21pm |
| **4** | June 2022 | 25/07/2022 | 1 | 10:54am | 6:50pm |
| **5** | July 2022 | 07/07/2022 | 1 | 10:39am | 6:22pm |
| **6** | August 2022 | 01/08/2022 | 1 | 10:26am | 5:57pm |
| **7** | September 2022 | 21/09/2022 | 1 | 8:12am | 12:17pm |
| **8** | October 2022 | 25/10/2022 | 1 | 9:48am | 1:55pm |
| **9** | November 2022 | 24/11/2022 | 1 | 10:21am | 12:43pm |
| | | 24/11/2022 | 2 | 10:28am | 12:13pm |
| **10** | December 2022 | 22/12/2022 | 1 | 10:29am | 12:40pm |
| | | 22/12/2022 | 2 | 10:50am | 1:16pm |
| **11** | January 2023 | 08/01/2023 | 1 | 9:53am | 12:01pm |
| **12** | February 2023 | 23/02/2023 | 1 | 9:34am | 1:30pm |
| **13** | March 2023 | 10/03/2023 | 1 | 11:16am | 3:34pm |
| **14** | April 2023 | 18/05/2023 | 1 | 2:42pm | 3:58pm |
| | | 19/05/2023 | 2 | 8:39am | 9:56am |
| | | 19/05/2023 | 3 | 10:56am | 3:36pm |
| **15** | May 2023 | 27/05/2023 | 1 | 8:05am | 10:07am |
| | | 27/05/2023 | 2 | 9:38am | 10:48am |
| | | 27/05/2023 | 3 | 12:58pm | 2:24pm |
| | | 27/05/2023 | 4 | 1:00pm | 2:14pm |
| **16** | June 2023 | 12/06/2023 | 1 | 9:40am | 4:40pm |
| **17** | July 2023 | 23/07/2023 | 1 | 8:56am | 11:31am |
| | | 23/07/2023 | 2 | 1:19pm | 4:56pm |
| **18** | August 2023 | 10/08/2023 | 1 | 8:31am | 11:38am |
| | | 10/08/2023 | 2 | 1:56pm | 4:53pm |
| **19** | September 2023 | 13/09/2023 | 1 | 7:59am | 11:45am |
| | | 13/09/2023 | 2 | 12:54pm | 4:00pm |
| **20** | October 2023 | 01/10/2023 | 1 | 8:03am | 1:02pm |
| **21** | November 2023 | 06/11/2023 | 1 | 9:25am | 2:28pm |
| **22** | December 2023 | 13/12/2023 | 1 | 9:40am | 2:15pm |
| **23** | January 2024 | 09/01/2024 | 1 | 10:35am | 2:39pm |
| **24** | February 2024 | 12/02/2024 | 1 | 9:59am | 2:24pm |

*Flight number differentiates multiple flights per monthly survey.

**Table 3.7: Weather Conditions During DAS Flights from March 2022 to February 2024**

| Survey | Actual Date | Visibility (km) | Sea State | Turbidity | Cloud Cover | Wind Speed (kts/direction) |
|---|---|---|---|---|---|---|
| **1** | 02/04/2022 | 10+ | 1 | 1 | 35 | 6/N |
| **2** | 28/04/2022<br>29/04/2022 | 30+<br>30+ | 0<br>0 | 0<br>0 | 0 to 96<br>96 to 100 | 0 to 2/SW<br>0 to 2/SW |
| **3** | 02/06/2022 | 10+ | 1 | 0 | 0 | 1 to 8/S to W to N to E |
| **4** | 25/06/2022 | 10+ | 2 | 1 | 15 to 35 | 24 to 37/S |
| **5** | 07/07/2022 | 10+ | 1 to 2 | 2 | 50 to 70 | 10 to 28/W |
| **6** | 01/08/2022 | 10+ | 2 - 4 | 1 | 0 to 80 | 14 to 26/W |
| **7** | 21/09/2022 | 10+ | 0 - 1 | 0 | 1 to 10 | 17 to 21/W |
| **8** | 25/10/2022 | 20+ | 3 | 2 | 10 to 40 | 10 to 22/W |
| **9** | 24/11/2022 | 8+ | 3 to 4 | 0 to 1 | 0 to 90 | 20 to 21/S, W |
| **10** | 22/12/2022 | 10+ to 30+ | 1 to 2 | 0 to 1 | 0 to 50 | 14 to 22/S, W |
| **11** | 08/01/2023 | 10+ | 2 | 1 | 20 | 30/S to SE |
| **12** | 23/02/2023 | 10+ | 2 | 2 | 0 to 100 | 19 to 23/SW to NW |
| **13** | 10/03/2023 | 10+ | 2 to 4 | 2 to 3 | 10 | 12 to 25/NW to N |
| **14** | 18/05/2023<br>19/05/2023 | 10+<br>10+ | 1<br>1 to 2 | 1<br>0 to 1 | 70<br>0 to 90 | 10/W<br>3 to 8/E, S, W |
| **15** | 27/05/2023 | 10 to 20 | 1 to 3 | 1 to 2 | 40 to 95 | 5 to 19/SW to N |
| **16** | 12/06/2023 | 10+ | 0 to 1 | 0 | 50 to 80 | 1 to 17/SW to N |
| **17** | 23/07/2023 | 10+ | 1 | 1 | 10 | 16 to 22/NE |
| **18** | 10/08/2023 | 10+ | 0 to 1 | 0 to 1 | 80 to 90 | 2 to 8/NW to E |
| **19** | 13/09/2023 | 10+ | 2 | 0 | 100 | 2/SW |
| **20** | 01/10/2023 | 10+ | 1 | 0 to 1 | 30 to 50 | 26 to 36/W, SW |
| **21** | 06/11/2023 | 10+ | 3 | 1 | 50 to 75 | 14/SW |

| Survey | Actual Date | Visibility (km) | Sea State | Turbidity | Cloud Cover | Wind Speed (kts/direction) |
|---|---|---|---|---|---|---|
| **22** | 13/12/2023 | 10+ | 1 | 1 | 40 to 50 | 14/NE |
| **23** | 09/01/2024 | 10+ | 0 | 0 to 1 | 70 to 100 | 3 to 10/NE to SE |
| **24** | 12/02/2024 | 8+ | 2 to 3 | 3 | 10 to 70 | 24 to 26/SW to W |

Sea State: 0 = Calm (Glass), 1 = Calm (Rippled), 2 = Smooth, 3 = Slightly Moderate, 4 = Moderate
Turbidity: 0 = Clear, 1 = Slightly Turbid, 2 = Moderately Turbid, 3 = Highly Turbid
Cloud Cover: 0 = Clear, 1 to 10 = Few, 11 to 50 = Scattered, 51 to 95 = Broken, 96 to 100 = Overcast

### Data Processing and Analysis

3.3.13 DAS were conducted across the extent of the Array Area Study Area, encompassing the Extended DAS Area from April to August (inclusive) and the DAS Area only from September to March (inclusive). The raw counts of all birds captured in the DAS are provided in Annex A of this technical report. Abundance and density estimates were calculated from the raw survey data in order to establish a baseline offshore ornithological environment to be used in the assessment of potential impacts.

3.3.14 NatureScot (2023e; 2023d) guidance for assessing impacts from (i) collision and (ii) displacement and barrier effects, requires impacts to be assessed using specific population metrics and considering specific study areas (Table 3.8).

3.3.15 Mean seasonal peak abundance estimates are required Displacement Report (see Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report). Mean seasonal peak estimates were calculated using the seasonal definitions from NatureScot (2020), by summing and averaging the abundance estimates across months within defined seasons between years of DAS.

**Table 3.8: Information Required for Impact Assessment Analysis of DAS Data**

| Impact assessed | Study area | Bird behaviour | Population metric |
|---|---|---|---|
| **Collision risk** | Array Area | Flying birds only | Monthly flying bird densities (birds per $km^2$) |
| **Distributional responses, displacement and barrier effects** | Array Area plus 2 km buffer | All birds (flying and sitting) | Mean peak seasonal abundance (mean no. of birds per season across months and years) |

3.3.16 The full suite of DAS data was analysed to produce abundance and density estimates, extrapolated to specific areas (Array Area, Array Area plus a 2 km buffer, DAS Area, Extended DAS Area). Abundance and density estimates were calculated before unknown groups were attributed to known species or corrected for availability bias (Annex B), and after unknown groups were attributed to known species, and corrected for availability bias (Annex C). Annex B was not used in further assessment and is presented for comparative purposes only. Analysis was conducted using either a model-based or design-based approach, dependent on the nature of the data for each species.

#### *Model-based Approach*

3.3.17 The Marine Renewable Strategic Environmental Assessment (MRSea) package was used to predict numbers of seabirds across the Array Area Study Area alongside 95% confidence intervals derived from 1,000 bootstraps of the full DAS dataset (DAS Area from September to March, Extended DAS Area from April to August) to provide a range of uncertainty predicted by the model.

3.3.18 MRSea is a modelling package recommended as a density modelling approach by NatureScot (2023a) where applicable, dependent on the nature of the site-specific data collected. MRSea was implemented for species with ten or more data points and with non-uniform distribution across the Array Area Study Area (NatureScot, 2023a). Where MRSea modelling could not be used, design-based estimates of density and abundance were used.

3.3.19 The advantage of using MRSea over design-based approaches is that MRSea can handle missing segments and transects better than design-based approaches by using a 2-dimensional Spatially Adaptive Local Smoothing Algorithm (SALSA) (Scott-Hayward *et al*., 2014).

*3.3.20* The basic model to explain bird abundance had the following form: *Count ~ Month + offset(log(area)), family = quasipoisson.*

3.3.21 To reduce autocorrelation, the transects within each survey were used as a blocking structure in the model. In the 2-dimensional stage, the x-y coordinates were fitted to the basic model using SALSA. For the model to run properly, a minimum number of birds is required in each month, and it was determined that a minimum of ten was required to produce sensible outputs, though this could vary depending on whether birds were sufficiently spread out throughout the survey area.

3.3.22 Where MRSea modelling could not be used, design-based estimates of density and abundance were used.

3.3.23 The resulting abundance estimates represent birds which were visible and identified to species level, therefore resulting in an underestimate of populations. The MRSea abundance estimates were thus corrected for the sources of bias arising from birds not identified to species level (attribution of unidentified birds) and birds spending time below the sea surface (availability bias).

### *Design-based Approach*

3.3.24 Design-based abundance and density estimates, and confidence intervals were produced from DAS data, using a non-parametric bootstrapping procedure with 1,000 iterations, in the R environment (R Core Team, 2021). Each iteration resampled the full dataset with replacement, to create a new dataset that was the same length as the original. In each iteration, a subset was produced of each of the relevant area boundaries (such as the Array Area, Array Area plus a 2 km etc.). In each iteration, the number of birds and area covered by DAS were summed for each boundary area and month. From this, the estimated relative bird population for each boundary area could be calculated using the following formula:

Relative population estimate = (raw birds observed) / (coverage of DAS) * (total area of boundary)

3.3.25 A confidence interval for each of the population estimates was derived from the 1,000 resampling iterations of the non-parametric bootstrapping procedure. Upper and lower estimates of the 95% confidence intervals were calculated from the variability in the 1,000 values generated.

3.3.26 The resulting abundance estimates represent birds which were visible and identified to species level, therefore resulting in an underestimate of populations. The design-based abundance estimates were then corrected for the sources of bias arising from birds not identified to species level (attribution of unidentified birds) and birds spending time below the sea surface (availability bias).

3.3.27 A comparison of abundance estimates produced using the design-based and model-based approaches are presented in Annex D.

#### *Attribution of Unidentified Birds*

3.3.28 Where birds could not be identified to species level from DAS images, a higher taxonomic level was assigned. These ‘unidentified’ birds were attributed to known species, based on the abundance ratios of relevant species within the higher taxonomic level assigned.

3.3.29 There were 21 unidentified taxon groups (Table 3.9) to be attributed to known species. The known species estimates for each survey month were increased proportionally to account for the unidentified birds. Each species received a single proportional increase for each survey month, these ratios were summed to find the total proportional increase.

**Table 3.9: Unknown Species Groups and the Number of Records from DAS to be Attributed to Corresponding Known Species. Extended DAS Area is from April to August (inclusive)**

| Unknown Species Group | Number of Records | | Known Species Attributed to Species Group |
|---|---|---|---|
| | DAS Area | Extended DAS Area | |
| **Diver** | 1 | 0 | great northern diver*, red-throated diver. |
| **Duck** | 6 | 50 | mallard*, common eider, red-breasted merganser, common scoter |
| **Fulmar/Gull** | 94 | 115 | fulmar, kittiwake, great black-backed gull, lesser black-backed gull, herring gull, common gull, black-headed gull*, and little gull* |
| **Small Shearwater** | 3 | 4 | Manx shearwater, and sooty shearwater |
| **Shearwater** | 3 | 2 | Manx shearwater, and sooty shearwater |
| **Auk/Shearwater** | 158 | 423 | Manx shearwater, sooty shearwater, guillemot, razorbill, puffin, black guillemot*, and little auk* |
| **Storm Petrel** | 30 | 28 | European storm petrel, and Leach's storm petrel* |
| **Cormorant/Shag** | 2 | 177 | great cormorant*, and European shag* |
| **Skua** | 0 | 2 | great skua, Arctic skua* |
| **Small Gull** | 31 | 81 | kittiwake, common gull, black-headed gull*, and little gull* |
| **Black-backed Gull** | 3 | 6 | great black-backed gull, and lesser black-backed gull |
| **Large Gull** | 52 | 92 | great black-backed gull, lesser black-backed gull, and herring gull |
| **Gull** | 61 | 142 | kittiwake, great black-backed gull, lesser black-backed gull, herring gull, common gull, black-headed gull*, and little gull* |
| **'Commic' Tern** | 284 | 382 | Arctic tern, and common tern |
| **'Commic' Tern/ Roseate Tern** | 27 | 27 | Arctic tern, and common tern |
| **Tern** | 1 | 7 | Arctic tern, common tern, and sandwich tern* |
| **Guillemot/ Razorbill** | 7,739 | 9,692 | Guillemot, razorbill, and black guillemot* |
| **Auk** | 904 | 1,050 | guillemot, razorbill, puffin, black guillemot*, and little auk* |
| **Wader** | 18 | 18 | grey plover*, golden plover*, snipe, Eurasian curlew*, Eurasian oystercatcher*, and common redshank* |
| **Passerine** | 77 | 0 | Canada goose*, grey heron*, rock dove/feral pigeon*. |
| **Unidentified Bird** | 199 | 468 | All species recorded in DAS |

*mallard Anas platyrhynchos; red-breasted merganser Mergus serrator; red-throated diver Gavia stellata; great northern diver Gavia immer; black-headed gull Chroicocephalus ridibundus; little gull Hydrocoleus minutus; black guillemot Cepphus grylle; little auk Alle alle; Leach's storm petrel Oceanodroma leucorhoa; great cormorant Phalacrocorax carbo; European shag Gulosus aristotelis; Arctic skua Stercorarius parasiticus; sandwich tern Thalasseus sandvicensis; grey plover Pluvialis squatarola; golden plover Pluvia apricaria; Eurasian curlew Numenius arquata; Eurasian oystercatcher Haematopus ostralegus; common redshank Tringa totanus; Canada goose Branta canadensis; grey heron Ardea cinerea; rock dove/feral pigeon Columba livia.

3.3.30 To exemplify this, in the case of a month with 1,200 "guillemot/razorbills", 200 of which are unknown, 900 identified guillemots, and 100 identified razorbills. Applying the formula leads to a ratio of:

*200 (unknown "guillemot/razorbill") / (900 guillemot + 100 razorbill) = 0.20*

3.3.31 Thus, both razorbill and guillemot need to be increased by 0.20 (or multiplied by 1.20), which leads to an absolute estimate of 900*1.20 = 1,080 guillemots and 100*1.2 = 120 razorbill. The 200 unknown birds have thus been proportionally attributed to razorbill and guillemot (180 to guillemot, and 20 to razorbill).

### *Correction Factors to Account for Availability Bias*

3.3.32 For seabird species which spend significant periods of time below the surface of the water, such as auk species spending time underwater on foraging dives, a proportion of birds will not be detectable when surveyed. This is a particular issue for DAS as birds may be below the sea surface at the time of imagery as the survey provides a snapshot of bird behaviour. The abundance and density estimates of sitting birds (not birds in flight) are therefore adjusted for these species to account for this availability bias.

3.3.33 To correct for birds not captured by DAS, a correction factor is applied on the number of detected sitting birds based on the known time each species spends underwater. Correction factors were applied to sitting guillemot, razorbill and puffin, derived from recommendations made by JNCC during the examination phase of East Anglia ONE OWF (JNCC, 2013) and Spencer (2012). The correction factors advised assume 23.75% of guillemot, 17.4% of razorbill, and 14.2% of puffin are underwater when DAS imagery is captured. These figures result in correction factors of 1.311, 1.211 and 1.165 for guillemot, razorbill and puffin, respectively.

3.3.34 Availability bias is corrected for by applying the above correction factors to sitting auks (excluding other behaviours) using the following formula:

*(Absolute birds) = (Relative birds * proportion(sitting) / proportion(visible)) + (Relative birds * (1-proportion(sitting))*

3.3.35 For example, if it was estimated from the visible data (relative number) that there were 1,000 guillemot in an area, 900 of which were sitting, it would result in an adjusted absolute number of: (1,000 * 0.90 * 1.311) + (1,000 * (1-0.90)) = (900 * 1.311) + (1,000 * 0.10) = 1,180 + 100 = 1,280.

### *Estimates for Flying and Sitting Birds*

3.3.36 Model-based and design-based estimates were based on all behaviours (excluding deceased birds). However, for collision risk modelling the number of birds in flight is required. To ensure the most robust estimate of birds in flight was obtained, the proportion of each bird species in flight was calculated across the Array Area Study Area for each survey month. This method was preferred over separate models for birds in flight, as these are more prone to random chance factors, like low sample size and flushing events. Such random chance factors have the potential to distort the average bird behaviour, potentially leading to under- or overestimation of bird densities.

3.3.37 The DAS already reflect a snapshot of bird activity in themselves, and making selections of behaviours within a smaller area within that survey area further increases statistical uncertainty. Moreover, there is *no a priori* reason to assume the Array Area is fundamentally different from the surrounding areas in terms of bird behaviour.

3.3.38 To justify this approach, an analysis was done of the proportional difference in flying birds in the Array Area versus the Array Area Study Area (Figure 3.2). At low sample sizes in the Array Area, there was large variation in this proportional difference, but at large sample sizes this difference converged to zero. This demonstrates that most of the differences in flying bird proportions between the Array Area and the Array Area Study Area are driven by sample size.

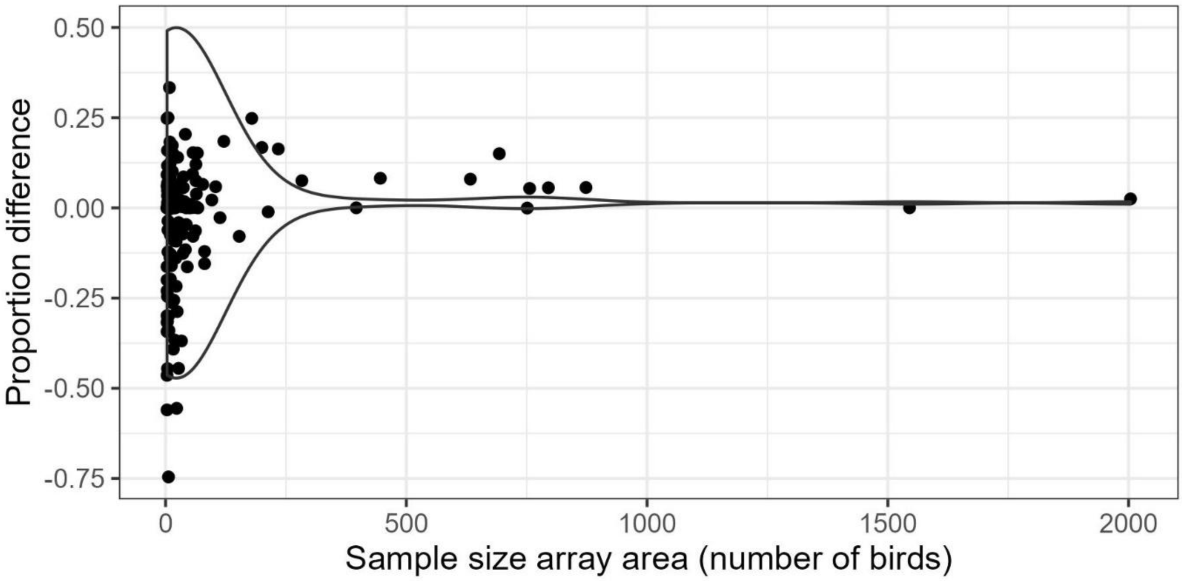



**Figure 3.2: Analysis of the Proportional Difference in Flying Birds Between the Array Area Study Area and the Array Area**

3.3.39 Based on this analysis, the proportion of birds in flight was calculated across the Array Area Study Area, and used as a modifier on the “all behaviours” estimate (excluding availability bias to avoid overestimation). This was done for both model-based and design-based abundances.

## 3.4 NEEOG and Previous Surveys of the North and East Caithness Cliffs

3.4.1 The populations and distribution of seabirds along both these key coastlines have been monitored over almost 50 years, providing an important source of contextual data to inform the ornithological baseline. Systematic surveys along the East Caithness coast, from Helmsdale to John o’ Groats, were instigated in the 1970s, ahead of the development of the Beatrice Oilfield (Addy, 1987; Mudge, 1979). These surveys continued through the 1980s (Mudge, 1986) and into the late 1990s (Evans, 2001). They were undertaken primarily by RSPB and latterly what is now NatureScot. Census surveys along the East Caithness Cliffs (ECC) were carried out in 1986 (reported in Callaghan *et al.,* 1999), in 1999 (reported in Callaghan *et al*., 1999), and in 2015 (reported in Swann, 2016a). Sample plots along the ECC were also surveyed in 2013 (reported in Swann, 2016b). Census surveys were completed along the North Caithness Cliffs (NCC) coast in 1986 (for the Seabird Colonies Register), 1999/2000 (reported in Tovey *et al.,* 2000), then 2015/2016 (reported by Swann, 2018). Sample plots along the NCC were surveyed in 2000 (see Patterson, 2000) but were not surveyed subsequently (until 2025 – see below).

3.4.2 To provide more contemporary data, and to continue this long run of data collection, the Applicant commissioned TetraTech RPS Energy Limited (formerly RPS) following agreement with contributing members of the NEEOG, to undertake seabird colony censuses of NCC and ECC including the respective SPAs. The aim of this work was to provide a more up-to-date understanding of the abundance and distribution of nesting seabirds within these protected areas to understand what impact the highly pathogenic avian influenza (HPAI) outbreak may have had on the seabird populations, and provide a baseline for any future monitoring. Data collected was uploaded to the Seabird Monitoring Programme database.

3.4.3 A full census of seabird colonies along the NCC was completed in 2023, and partial survey coverage completed in 2024 (reported in Zisman and Swann, 2023 and 2024). A full census of ECC was completed in 2024 and 2025 (reported in Zisman and Swann 2024 and Zisman *et al*., 2025). These censuses followed the same count sections documented in previous census counts (Table 3.10). It should be noted that 2024 was an anomalous year for seabird breeding in many parts of Scotland, including Caithness, so the 2024 data reflect low attendance at breeding colonies. The sample plots originally established in 2000 by Patterson (2000) were re-surveyed in 2025, and additional sample plots established along this North Caithness coast also, between Strathy Point and John o’ Groats, with details reported in Zisman *et al*., (in prep). Seabird population trend data for NCC and ECC are provided in Zisman and Swann 2024 and Zisman *et al*., 2025 respectively.

**Table 3.10: Overview of NEEOG census for NCC and ECC between 2023 and 2025**

| Site | Year | Survey dates | Number of count sections covered compared to previous count census |
|---|---|---|---|
| **NCC** | 2023 | 04/06/2023 to 09/06/2023 | 30/30 |
| | 2024 | 09/06/2024 to 15/07/2024 | 10/30 |
| **ECC** | 2024 | 03/06/2024 to 11/06/2024 | 50/50 |
| | 2025 | 02/06/2025 to 13/06/2025 (plus three residual non-SPA count sections on 18/06/2025) | 50/50 |

3.4.4 Species-specific count methodology was as follows:

- Kittiwake (KI), great cormorant (CA), shag (SA): All AON were counted;
- Great black-backed gull (GB), herring gull (HG), and lesser black-backed gull (LB): In small colonies on or below cliffs all AON were counted. Where actual nests were likely to be obscured by vegetation, but sitting/standing birds were visible, the count was of AOT;
- Guillemot (GU) and razorbill (RA), puffin (PU): All individual birds on land above the spring high water mark were counted; and
- Fulmar (FU): An AOS was counted only when a bird was sitting tightly on a reasonably horizontal area large enough to hold an egg. Two birds on such a site, apparently paired, count as one AOS.

3.4.5 Results demonstrate an overall increase in population size across most species at NCC between the 2015 and 2023 censuses (Table 3.11). In 2024, there were low seabird numbers in both sites across species, but this was likely attributable to a uniquely poor breeding season, with little seabird activity evident across the cliffs. The 2025 results are yet to be published.

3.4.6 In addition to the work for the North and East Caithness Cliffs SPAs, NEEOG also funded other studies to help gain further insights into SPA populations and seabird foraging activity. These include on-going tracking studies at key designated sites, including Fowlsheugh SPA (e.g. Monaghan *et al.* 2025) and Buchan Ness to Collieston SPA (e.g. Bennett *et al.* 2024), carried out by RSPB and BTO respectively. These surveys and associated analyses are on-going, with synopses due to be reported on to NEEOG in late 2026 or 2027.

**Table 3.11: SPA Count Data From NEEOG Census for NCC (2023) and ECC (2024), With Percentage Changes Since Previous Census Years**

| Year | KI[1] | GB[2] | HG[2] | LB[2] | GU[3] | RA[3] | PU[3] | FU[4] | CA[1] | SA[1] |
|---|---|---|---|---|---|---|---|---|---|---|
| **NCC Surveys** | | | | | | | | | | |
| **1999/2000** | 10,147 | 60 | 210 | 2 | 72,725 | 2,603 | 5,614 | 18,060 | - | 111[5] |
| **2015/2016** | 5,573 | 75[6] | 331[6] | 2 | 38,863 | 3,558 | 3,083 | 15,958 | - | 225 |
| **2023** | 8,197 | 94 | 446 | 4 | 48,290 | 10,015 | 2,906 | 14,240 | - | 561 |
| **% change since 2015/2016** | 47% | 25% | 41% | 100% | 24% | 181% | -6% | -11% | - | 149% |
| **% change since 1999/2000** | -19% | 57% | 122% | 100% | -34% | 285% | -48% | -21% | - | 344%[5] |
| **ECC Surveys** | | | | | | | | | | |
| **1977** | 41,692 | 1,011 | 15,836 | - | 107,336 | 12,154 | 632 | 14,984 | 284 | 1,661 |
| **1986** | 32,466 | 789 | 9,370 | - | 106,753 | 15,776 | - | 15,037 | 277 | 2,335 |
| **1999** | 40,450 | 180 | 3,411 | - | 159,108 | 17,727 | 275 | 14,375 | 90 | 1,060 |
| **2015** | 24,460 | 266 | 3,267 | - | 149,228 | 30,042 | 189 | 13,864 | 53 | 1,098 |
| **2024** | 18,281 | 70 | 1,118 | - | 60,400 | 24,728 | 146 | 10,228 | 34 | 175 |
| **2025** | 34,491 | 113 | 1,144 | - | 202,123 | 53,216 | 253 | 13,332 | 42 | 476 |
| **% change 1977 to 2025** | -17% | -89% | -93% | - | +88% | +338% | -60% | -11% | -85% | -71% |
| **% change 1986 to 2025** | +6% | -86% | -88% | - | +89% | +232% | N/A | -11% | -81% | -80% |
| **% change 1999 to 2025** | -15% | -37% | -66% | - | +27% | +195% | -8% | -7% | -53% | -55% |
| **% change 2015 to 2025** | +41% | -58% | -65% | - | +35% | +77% | +34% | -4% | -21% | -57% |

Units of count data are: [1]AON; [2]AOT, [3]individuals; [4]AOS.
[5]Shags were not counted on Stroma in 1999. The % change figure since 1999/2000 excludes the 68 nests counted on Stroma in 2023.
[6]Includes count of individuals at Holburn Head converted to an AOT equivalent by number of individuals/1.5 = AOT

## 3.5 LiDAR Surveys

3.5.1 TWP commissioned APEM Limited to perform site-specific LiDAR surveys within the Array Area Study Area to provide baseline information on the flight height data of birds in the area (Annex E). The aim of this work was to utilise species-specific flight height data of birds in the Array Area Study Area for Collision Risk Modelling (CRM) to inform the Offshore Ornithology component of the EIA and Habitats Regulations Appraisal (HRA).

3.5.2 The LiDAR surveys were conducted in July and September 2022, and April and July 2023. The LiDAR flight height data was compared against data from the site-specific DAS and Johnston *et al*. (2014).

3.5.3 Results demonstrate that DAS-based trigonometry data should be dismissed as a reliable method to inform species-specific flight heights for CRM. DAS data vastly overestimated the proportion of birds flying at rotor blade height compared to data from site-specific LiDAR surveys and Johnston *et al.* (2014).

3.5.4 Sample sizes from LiDAR surveys were relatively small for most species (range one to 83 individuals recorded), except kittiwake (707 records). Therefore, there is enough data to run CRM using site-specific LiDAR flight height data. Given that kittiwake is the key sensitive species for the Proposed Development in the SMP, it is encouraging that site-specific LiDAR data puts more birds below collision risk levels compared to generic data. Results from the site-specific flight heights for kittiwake are therefore presented alongside generic flight heights in Volume 3, Technical Appendix 11.4: Offshore Ornithology Collision Risk Modelling Technical Report.

## 3.6 Vulnerability to Impacts from OWFs

3.6.1 A range of potential impacts from the Proposed Development on seabirds have been identified in the Bowdun Offshore Scoping Report (BOWFL, 2024) and scoped in for assessment (Table 3.12).

**Table 3.12: Potential Impacts to Seabirds Scoped Into the Assessment of the Bowdun Offshore Wind Project**

| Impact | Phase* | | |
|---|---|---|---|
| | C | O&M | D |
| Collision risk mortality due to collision with rotor blades | x | ✓ | x |
| Distributional responses, displacement, and barrier effects from Offshore Infrastructure | ✓ | ✓ | ✓ |
| Disturbance to birds from vessel movements | ✓ | ✓ | ✓ |
| Disturbance to prey species and their habitats | ✓ | ✓ | ✓ |
| Temporary habitat loss and/or habitat disturbance | ✓ | x | ✓ |
| Attraction to light | ✓ | ✓ | ✓ |
| Indirect impacts from Unexploded Ordnance (UXO) clearance | ✓ | x | x |
| Indirect impacts from construction/decommissioning noise | ✓ | x | ✓ |

*C = Construction phase, O&M = Operation and Maintenance phase and D = Decommissioning phase

3.6.2 The abundance of a species is categorised based on the recorded raw count within the Array Area Study Area during monthly DAS as follows:

- low: <100 birds in all surveys;
- moderate: 100 to 500 birds in at least one survey; and
- high: >500 birds in at least one survey

3.6.3 Bradbury *et al*. (2014) and Wade *et al.* (2016) assessed and scored the sensitivity of seabird species to OWFs. Species were attributed a score based on their sensitivity to collision with Wind Turbines and degree of avoidance or displacement from the areas occupied by OWFs. Scores were evidence-based and formed from the assessment of species on four criteria of conservation importance and six criteria of species-specific behaviour influencing specific vulnerability to OWFs. An overview of seabird vulnerability to impact is provided in Table 3.13.

**Table 3.13: Summary of Seabird Vulnerability to Impacts Associated with OWFs**

| Species | Collision* | Displacement | | | Habitat Flexibility[3] | Proportion of Flight Activity at Night[2] |
|---|---|---|---|---|---|---|
| | | Overall[1] | Structures[2] | Vessels and Helicopters[2] | | |
| **Common eider** | Low/Low | Moderate | Moderate | Moderate | Low | Moderate |
| **Fulmar** | Very Low/Very Low | Very Low | Very Low | Very Low | High | High |
| **Manx shearwater** | Very Low/Very Low | Very Low | Very Low | Very Low | High | Moderate |
| **Sooty shearwater** | Very Low/Very Low | Very Low | Very Low | Very Low | High | Moderate |
| **European storm petrel** | Low/Low | Very Low | Very Low | Very Low | High | High |
| **Gannet** | High/High | Very Low | High | Very Low | High | Low |
| **Great skua** | Moderate/Very High | Very Low | Very Low | Very Low | Moderate | Very Low |
| **Kittiwake** | High/Very High | Very Low | Low | Low | Moderate | Moderate |
| **Great black-backed gull** | Very High/Very High | Low | Low | Very Low | Moderate | Moderate |
| **Lesser black-backed gull** | Very High/Very High | Very Low | Low | Very Low | High | Moderate |
| **Herring gull** | Very High/Very High | Very Low | Low | Very Low | High | Moderate |
| **Common gull** | High/Very High | Low | Low | Low | Moderate | Moderate |
| **Arctic tern** | Low/Moderate | Low | Low | Low | Moderate | Very Low |
| **Common tern** | Moderate/Moderate | Low | Low | Low | Moderate | Very Low |
| **Guillemot** | Very Low/Very Low | Moderate | High | Moderate | Moderate | Low |
| **Razorbill** | Very Low/Very Low | Moderate | High | Moderate | Moderate | Very Low |
| **Puffin** | Very Low/Very Low | Low | Moderate | Moderate | Moderate | Very Low |

* Bradbury *et al.* (2014)/Wade *et al.* (2016). The numerical rankings of Wade *et al.* (2016) have been translated to vulnerability: >200 = Very High, 101 to 200 = High, 51 to 100 = Moderate, 1 to 50 = Low, 0 = Very Low.
[1] Bradbury *et al.* (2014).
[2] The numerical rankings of Wade *et al.* (2016) have been translated to vulnerability: 5 = Very High, 4 = High, 3 = Moderate, 2 = Low and 1 = Very Low;
[3] The numerical rankings of Wade *et al.* (2016) have been translated to vulnerability: 4 = Low, 3 = Moderate, 2 = Moderate and 1 = High.

## 3.7 Connectivity with SPA Colonies

### Breeding Season

#### *Foraging Ranges*

3.7.1 During the breeding season, seabirds demonstrate a central-place foraging behaviour, whereby their foraging range extends out to sea from their fixed nesting location. The foraging range of seabird species is therefore used to determine connectivity between breeding colonies and the Proposed Development. Colonies located within foraging range of the Array Area Study Area are deemed to have potential for connectivity as it is possible birds may use the area to forage.

3.7.2 NatureScot (2023b) reviewed foraging ranges presented in Woodward *et al.* (2019) and present recommended foraging ranges and confidence levels for each species (Table 3.14). The use of the mean maximum foraging range + 1 SD (mean max + 1 SD) is recommended for all species and colonies, except for gannet, guillemot and razorbill.

3.7.3 For gannet, data exists for three SPA colonies which exceeds the mean max + 1 SD range and therefore the site-specific maximum foraging range is recommended for birds from Forth Islands (Bass Rock) SPA, Grassholm SPA and St Kilda SPA.

3.7.4 For both guillemot and razorbill, existing tracking data reveals greater foraging ranges for birds from Fair Isle SPA, likely due to low availability of prey during the study, however the pattern is becoming increasingly common for birds from the Northern Isles (NatureScot, 2023b). As a result, for these species NatureScot (2023b) guidance recommends using the mean max + 1 SD foraging range including Fair Isle data for all colonies north of the Pentland Firth and excluding Fair Isle data for all colonies south of the Pentland Firth.

**Table 3.14: Foraging Range of Seabird Species Occurring in the Array Area During the Breeding Season, for Use in Determining Connectivity Between Development and Colonies (Woodward *et al.*, 2019; NatureScot, 2023b), Metric Used (Mean Maximum Range +1 SD, Mean +1 SD, Maximum) and Data Confidence Level**

| Species | Foraging Range (km) | Metric |
|---|---|---|
| **Common Eider** | 21.5 | Mean Max |
| **Fulmar** | 1,200.2 | Mean Max +1SD |
| **Manx Shearwater** | 2,365.5 | Mean Max +1SD |
| **European Storm Petrel** | 336.0 | Max/Mean Max |
| **Gannet** | 509.4<br>516.7 (Grassholm SPA)<br>590.0 (Forth Islands SPA)<br>709.0 (St Kilda SPA) | Mean Max +1SD<br>Max<br>Max |
| **Great Skua** | 931.2 | Mean Max +1SD |
| **Kittiwake** | 300.6 | Mean Max +1SD |
| **Great Black-backed Gull** | 73.0 | Max/Mean Max |
| **Lesser Black-backed Gull** | 236 | Mean Max +1SD |

| Species | Foraging Range (km) | Metric |
|---|---|---|
| **Herring Gull** | 85.6 | Mean Max +1SD |
| **Common Gull** | 50.0 | Mean Max |
| **Arctic Tern** | 40.5 | Mean Max +1SD |
| **Common Tern** | 26.9 | Mean Max +1SD |
| **Guillemot** | 95.2 (excl. Northern Isles)<br>153.7 (incl. Northern Isles) | Mean Max +1SD<br>Mean Max +1SD |
| **Razorbill** | 122.2 (excl. Northern Isles)<br>164.6 (incl. Northern Isles) | Mean Max +1SD<br>Mean Max +1SD |
| **Puffin** | 265.4 | Mean Max +1SD |

### Non-Breeding Season

3.7.5 Seabirds from SPA breeding colonies during the non-breeding seasons are not constrained to a specific colony-centred foraging range by the need to provide for young and will disperse to areas beyond the recommended foraging range from their breeding colonies. As a result, during the non-breeding seasons there is potential for connectivity with the Proposed Development for a greater number of Qualifying Features from SPA and Ramsar site breeding colonies than during the breeding season.

3.7.6 Furness (2015) defines the regions within which non-breeding seabird populations are distributed within bio-seasons and calculates regional BDMPS for each species. Where the Proposed Development overlaps spatially with a BDMPS region, it is assumed that there is potential for connectivity with that region and with the SPA colonies from which birds contribute to the BDMPS population.

#### *Designated Sites*

3.7.7 SPAs with seabird species as Qualifying Features or named as part of a species assemblage, within recommended foraging range of the Array Area for each species, are presented in Table 3.15.

3.7.8 To determine realistic connectivity between the Array Area and SPAs during the breeding season, a marine pathway 'by-sea' foraging distance was measured. The 'by-sea' distance represents the shortest route around land masses, following the coast, on the basis that seabirds will avoid flying over large land masses. The 'by-sea' distance is mainly appropriate for SPAs identified on the west coast of Scotland and England, where the 'by-sea' foraging distance is likely to be greater than the straight-line distance between the Array Area and SPA. SPAs for which the 'by-sea' distance to the Array Area is greater than the recommended foraging range of a species (NatureScot, 2020) are deemed to have no potential connectivity and therefore are not presented in Table 3.15.

**Table 3.15: SPAs with Seabird Species as Qualifying Features or Named as Part of an Assemblage of Species, Within Species-specific Foraging Range (NatureScot, 2020) of Array Area During the Breeding Season, in Order of Distance to the Array Area. Qualifying species within and Outside Foraging Range of the Array Area are Denoted with a ✓ and x Respectively**

| SPA | Distance to the Array Area Study Area (km)[1] | Fulmar | Manx shearwater | European storm petrel | Gannet | Great skua | Kittiwake | Great black-backed gull | Lesser black-backed gull | Herring gull | Arctic tern | Common tern | Guillemot | Razorbill | Puffin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fowlsheugh** | 40.93 | ✓ | | | | | ✓ | | | ✓ | | | ✓ | ✓ | |
| **Buchan Ness to Collieston Coast** | 43.17 | ✓ | | | | | ✓ | | | ✓ | | | ✓ | | |
| **Outer Firth of Forth and St Andrews Bay Complex[2]** | 76.50 | | ✓ | | | | | | | ✓ | x | x | ✓ | | ✓ |
| **Troup, Pennan and Lions Heads** | 96.95 | ✓ | | | | | ✓ | | | x | | | x | ✓ | |
| **Forth Islands** | 101.40 | | | | ✓ | | ✓ | | ✓ | x | x | x | x | ✓ | ✓ |
| **St Abb's Head to Fast Castle** | 117.18 | | | | | | ✓ | | | x | | | x | ✓ | |
| **Farne Islands** | 140.24 | | | | | | ✓ | | | | x | x | x | | ✓ |
| **Coquet Island** | 174.24 | | | | | | | | | | x | x | | | ✓ |
| **ECC** | 180.44 | ✓ | | | | | ✓ | x | | x | | | x | x | |
| **NCC** | 211.12 | ✓ | | | | | ✓ | | | | | | x | x | ✓ |
| **Copinsay** | 214.50 | ✓ | | | | | ✓ | x | | | | | x | | |
| **Hoy** | 223.12 | ✓ | | | | ✓ | ✓ | x | | | | | x | | ✓ |
| **Auskerry** | 229.26 | | | ✓ | | | | | | | x | | | | |
| **Marwick Head** | 254.87 | | | | | | ✓ | | | | | | x | | |
| **Rousay** | 256.09 | ✓ | | | | | ✓ | | | | x | | x | | |
| **Calf of Eday** | 265.66 | ✓ | | | | | ✓ | x | | | | | x | | |
| **West Westray** | 268.75 | ✓ | | | | | ✓ | | | | x | | x | x | |

| SPA | Distance to the Array Area Study Area (km)[1] | Fulmar | Manx shearwater | European storm petrel | Gannet | Great skua | Kittiwake | Great black-backed gull | Lesser black-backed gull | Herring gull | Arctic tern | Common tern | Guillemot | Razorbill | Puffin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fair Isle** | 270.49 | ✓ | | | ✓ | ✓ | ✓ | | | | x | | x | x | x |
| **Sule Skerry and Sule Stack** | 295.55 | | | ✓ | ✓ | | | | | | | | x | | x |
| **Flamborough & Filey Coast** | 300.38 | ✓ | | | ✓ | | ✓ | | | | | | x | x | |
| **Sumburgh Head** | 308.75 | ✓ | | | | | x | | | | x | | x | | |
| **Seas off Foula[2]** | 310.80 | ✓ | | | | ✓ | | | | | | | x | | x |
| **Cape Wrath** | 311.08 | ✓ | | | | | x | | | | | | x | x | x |
| **Mousa** | 326.36 | | | ✓ | | | | | | | x | | | | |
| **Foula** | 339.25 | ✓ | | | | ✓ | x | | | | x | | x | x | x |
| **Noss** | 340.43 | ✓ | | | ✓ | ✓ | x | | | | | | x | | x |
| **Handa** | 351.31 | ✓ | | | | ✓ | x | | | | | | x | x | |
| **North Rona and Sula Sgeir** | 372.79 | ✓ | | x | ✓ | | x | x | | | | | x | x | x |
| **Ronas Hill – North Roe and Tingon** | 425.44 | | | | | ✓ | | | | | | | | | |
| **Shiant Isles** | 433.58 | ✓ | | | | | x | | | | | | x | x | x |
| **Fetlar** | 441.65 | ✓ | | | | ✓ | | | | | x | | | | |
| **Hermaness, Saxa Vord and Valla Field** | 459.96 | ✓ | | | ✓ | ✓ | x | | | | | | x | | x |
| **Flannan Isles** | 475.63 | ✓ | | | | | x | | | | | | x | x | x |
| **Seas off St Kilda[2]** | 510.60 | ✓ | | x | ✓ | | | | | | | | x | | x |
| **Rum** | 535.81 | | ✓ | | | | x | | | | | | x | | |
| **St Kilda** | 542.90 | ✓ | ✓ | x | ✓ | ✓ | x | | | | | | x | x | x |
| **Mingulay and Berneray** | 575.60 | ✓ | | | | | x | | | | | | x | x | x |

| SPA | Distance to the Array Area Study Area (km)[1] | Fulmar | Manx shearwater | European storm petrel | Gannet | Great skua | Kittiwake | Great black-backed gull | Lesser black-backed gull | Herring gull | Arctic tern | Common tern | Guillemot | Razorbill | Puffin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Rathlin Island** | 731.84 | ✓ | ✓ | | | | x | | x | x | | | x | x | x |
| **Horn Head to Fanad Head** | 740.19 | ✓ | | | | | x | | | | | | x | x | |
| **Tory Island** | 750.76 | ✓ | | | | | | | | | | | | x | x |
| **West Donegal Coast** | 769.49 | ✓ | | | | | x | | | x | | | | x | |
| **Ailsa Craig** | 790.06 | | | | x | | x | | x | x | | | x | | |
| **Copeland Islands** | 817.78 | | ✓ | | | | | | | | x | | | | |
| **Duvillaun Islands** | 934.00 | ✓ | | x | | | | | | | | | | | |
| **Clare Island** | 965.62 | ✓ | | | | | x | | | | | | x | x | |
| **Lambay Island** | 968.28 | ✓ | | | | | x | | x | x | | | x | x | x |
| **High Island, Inishshark and Davillaun** | 984.67 | ✓ | | | | | | | | | x | | | | |
| **Cruagh Island** | 995.21 | | ✓ | | | | | | | | | | | | |
| **Aberdaron Coast and Bardsey Island** | 1,034.26 | | ✓ | | | | | | | | | | | | |
| **Cliffs of Moher** | 1,065.97 | ✓ | | | | | x | | | | | | x | x | x |
| **Kerry Head** | 1,116.50 | ✓ | | | | | | | | | | | | | |
| **Saltee Islands** | 1,124.58 | ✓ | | | x | | x | | x | x | | | x | x | x |
| **Dingle Peninsula** | 1,132.46 | ✓ | | | | | | | | | | | | | |
| **Blasket Islands** | 1,150.46 | ✓ | ✓ | x | | | x | | x | x | x | | | x | x |
| **Skomer, Skokholm and the Seas off Pembrokeshire** | 1,151.45 | | ✓ | x | | | x | | x | | | | x | | x |
| **Iveragh Peninsula** | 1,161.11 | ✓ | | | | | x | | | | | | x | | |
| **Puffin Island** | 1,182.79 | ✓ | ✓ | x | | | | | x | | | | | x | x |

| SPA | Distance to the Array Area Study Area (km)[1] | Fulmar | Manx shearwater | European storm petrel | Gannet | Great skua | Kittiwake | Great black-backed gull | Lesser black-backed gull | Herring gull | Arctic tern | Common tern | Guillemot | Razorbill | Puffin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Skelligs** | 1,189.68 | ✓ | ✓ | x | x | | x | | | | | | x | | x |
| **Deenish Island and Scariff Island** | 1,194.02 | ✓ | ✓ | x | | | | | x | | x | | | | |

[1] Distance between Array Area and SPA measured using 'By-Sea' distance where necessary
[2] Marine SPAs with connectivity have been presented. However, these Spas have not been included within apportioning calculations (see Volume 3, Technical Appendix 11.6: Offshore Ornithology Apportioning Technical Report)

# 4 Baseline Characterisation

## 4.1 Overview of DAS Results

4.1.1 A total of 294,798 birds were recorded and identified during the 24-monthly DAS (including Extended DAS Area) between March 2022 and February 2024. Of the birds recorded, 1,620 birds recorded were deceased. Due to the nature of the DAS transects, some birds were recorded outside of the Array Area Study Area. Of the 293,178 birds recorded alive, 4,907 birds were recorded outside the Array Area Study Area and were excluded from further assessment. The remaining recorded birds comprise of 39 species and 21 species groups.

4.1.2 Deceased birds were counted in the DAS but are not included in further analysis. Given the interest in understanding the timing and extent of HPAI on key seabird species, the number of deceased birds is presented in Annex A: Table A.4 and Table A.5. Out of the 1,620 birds recorded dead during DAS, 1,301 were recorded within the Array Area Study Area (Annex A: Table A.5).

4.1.3 Of the birds recorded alive in the Array Area Study Area, 155,958 birds were recorded in the DAS Area, with 107,142 birds recorded in the first 12 months (March 2022 to February 2023), and 48,816 birds recorded in the second 12 months (March 2023 to February 2024) (Annex A: Table A.1 and A.2). 33 species and 20 species groups were recorded in the DAS Area. Within the summer months (April to August inclusive), 248,296 birds were recorded in the Extended DAS Area, with 155,451 birds recorded in the first breeding season (April to August 2022) and 92,845 birds recorded in the second breeding season (April to August 2023) (Annex A: Table A.3). 35 species and 19 species groups were recorded in the Extended DAS Area.

4.1.4 A summary of the number of observations recorded for species included within Section 4.2 is presented in Table 4.1. Species with no species account in Section 4.2 are presented in Table 4.13.

**Table 4.1: Species Recorded in High Numbers (Excluding Dead Birds) in the DAS Area and Extended DAS Area. Extended DAS Area only includes summer months (April to August inclusive)**

| Species | Total Months Species were Recorded* | Total Birds Recorded in the DAS Area | Total Birds Recorded in the Extended DAS Area |
|---|---|---|---|
| **Common eider** | 2/10 | 2 | 522 |
| **Fulmar** | 24/10 | 4,845 | 3,199 |
| **Manx shearwater** | 8/9 | 16 | 55 |
| **Sooty shearwater** | 3/3 | 4 | 3 |
| **European storm petrel** | 4/2 | 43 | 16 |
| **Gannet** | 23/10 | 4,471 | 4,958 |
| **Great skua** | 5/5 | 5 | 8 |
| **Kittiwake** | 24/10 | 15,375 | 34,843 |
| **Great black-backed gull** | 15/10 | 162 | 97 |
| **Lesser black-backed gull** | 2/7 | 60 | 89 |
| **Herring gull** | 20/10 | 4,010 | 12,156 |
| **Common gull** | 13/9 | 127 | 379 |
| **Arctic tern** | 7/9 | 522 | 879 |
| **Common tern** | 1/5 | 3 | 9 |
| **Guillemot** | 24/10 | 99,580 | 147,939 |
| **Razorbill** | 24/10 | 12,974 | 26,323 |
| **Puffin** | 24/10 | 3,957 | 3,914 |
| **Snipe** | 1/0 | 20 | 0 |

*DAS Area/Extended DAS Area

## 4.2 Species Accounts

4.2.1 Within this section, information regarding the conservation status, connectivity to designated sites, species distribution and vulnerability to relevant impacts have been presented for the most abundant and consistently recorded species.

4.2.2 For the sake of brevity, other species recorded in low numbers (<25 observations within the DAS Area across the survey program) and/or inconsistently (i.e. less than three surveys) are presented within Table 4.13 only.

### Fulmar

#### *Desk-based Review*

4.2.3 Fulmar is currently classed as an Amber-listed species of conservation concern by the Birds of Conservation Concern 5th Review (BoCC5) (Stanbury *et al*., 2021) and Least Concern by the IUCNs global Red List of Threatened Species (BTO, 2024). Fulmar is not listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), or under Annex I of the EU Birds Directive 2009/147/EC.

4.2.4 Fulmar is one of the most common seabirds in the UK, with birds present year-round. Breeding colonies are situated on sea cliffs or slopes, with most birds nesting on ledges (Ratcliffe *et al*., 2004). Breeding colonies in the UK are found on almost all of the coastline of Scotland, Wales and Ireland, and in the north-east and south-west of England. Winter distribution is similar to that of the breeding season, but with birds occupying some of the areas in south-east England where they are absent in the breeding season (BTO, 2024). The UK breeding population is estimated as 352,998 breeding pairs (2015 to 2021 estimate) (Burnell, *et al*., 2023), the UK North Sea waters winter BDMPS population is estimated as 568,736 individuals (Furness, 2015).

4.2.5 Fulmar have a circumpolar breeding range, with the subspecies *glacialis* found in UK waters currently breeding in Canada, Greenland and Svalbard, Europe (including Iceland, Norway, Faroe and northern France) and north-east North America including Canada (BirdLife International, 2024). The species' colonisation of mainland Scotland and the Orkney Isles is only relatively recent, from the 1900s onwards, as illustrated in Forrester *et al*. (2007).

4.2.6 At the end of the breeding season, young fulmar spend up to four years at sea before returning to land, with UK birds dispersing throughout the east and west of the North Atlantic, the Norwegian Sea, Barents Sea and the Arctic. Adult birds disperse from breeding sites to moult at sea and will return to nest sites between two and six months later, occupying nest sites from winter to the end of the breeding season (Furness, 2015).

4.2.7 Mean seasonal modelled densities of fulmar in the seas off north-east Scotland from Waggitt (2019) shows birds predicted to occur in high densities to the north of the Scottish mainland during the breeding season (April to mid-September), particularly around the Shetland Islands (Figure 4.1). During the breeding season, fulmar are also present in moderate densities in offshore areas around north-east Scotland, with lower densities predicted around much of the mainland coast. During the non-breeding season (mid-September to March), fulmar are predicted to occur in low-to-moderate densities in offshore areas, and lower densities around the mainland coast. The highest mean seasonal modelled densities of fulmar are not predicted within the Array Area or the Export Cable Corridor, instead occurring to the north-east of the Array Area at the southern tip of Shetland.

4.2.8 There are 42 SPAs with fulmar as a qualifying feature or named as part of a qualifying species assemblage within mean max + 1 SD foraging range (Table 3.15) of the Array Area. The Seabirds Count census data from 2015 to 2021 (Burnell *et al*., 2023) reports a total of 182,951 breeding pairs of fulmar across the 24 SPAs within foraging range. This represents 52.27% of the 350,000 breeding pairs reported by Woodward *et al*. (2020) in the UK.

4.2.9 Fulmar score very low in vulnerability to displacement impacts, due to scoring very low in sensitivity to structures, vessels and helicopters and high in habitat flexibility, indicating very limited disturbance behaviour and a very good ability to utilise alternative habitats (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13).

4.2.10 Fulmar score very low in vulnerability to collision impacts, due to scoring moderately in flight manoeuvrability, low percentage of flight at Wind Turbine blade height (1%), low in percentage of time at sea in flight, and high in nocturnal activity. When considered with positive scoring in conservation factors, an overall score of low vulnerability to collision impacts was given to fulmar (Bradbury *et al*., 2014; Wade *et al*., 2016).

4.2.11 Fulmar score high in proportion of nocturnal flight activity (Bradbury *et al*., 2014; Wade *et al*., 2016), indicating a high vulnerability to impacts arising from attraction to light emitted from Offshore Infrastructure.

#### *Site-based Survey Data*

4.2.12 Fulmar were recorded in all 24 of the 24 monthly DAS surveys from March 2022 to February 2024 in the DAS Area (Annex A). A total of 4,845 fulmar were recorded in the DAS Area across the 24 surveys, with 2,563 recorded in the first 12 months (March 2022 to February 2023), and 2,282 recorded in the second 12 months (March 2023 to February 2024). Fulmar has a high abundance in the DAS Area with a peak of 717 fulmar recorded in April 2023 at the start of the breeding season (April to mid-September, Table 3.3; NatureScot 2020).

#### *Conclusion*

4.2.13 Fulmar score very low in vulnerability to collision impact so not included in CRM. Although fulmar score very low in vulnerability to displacement impacts, fulmar is included in displacement analysis due to their extensive foraging range (NatureScot, 2024). Peak abundances of fulmar in the Array Area plus a 2 km buffer (relevant for displacement) are summarised in Table 4.2 (also see Annex C).

**Table 4.2: Seasonal Peak Abundance Estimates of Fulmar in the Array Area Plus a 2 km Buffer (Based on Seasons in NatureScot (2020)), to be Used for Displacement Analysis**

| Area | Season | Peak year 1 | Peak year 2 | Mean peak |
|---|---|---|---|---|
| **Array Area plus 2 km buffer** | Breeding | 1,440 | 366 | 903 |
| **Array Area plus 2 km buffer** | Non-breeding | 390 | 150 | 270 |

4.2.14 Fulmar are not included in CRM as advised by NatureScot (NatureScot, 2024). Fulmar score very low in vulnerability to collision as flight height is close to the sea surface and below collision risk height.

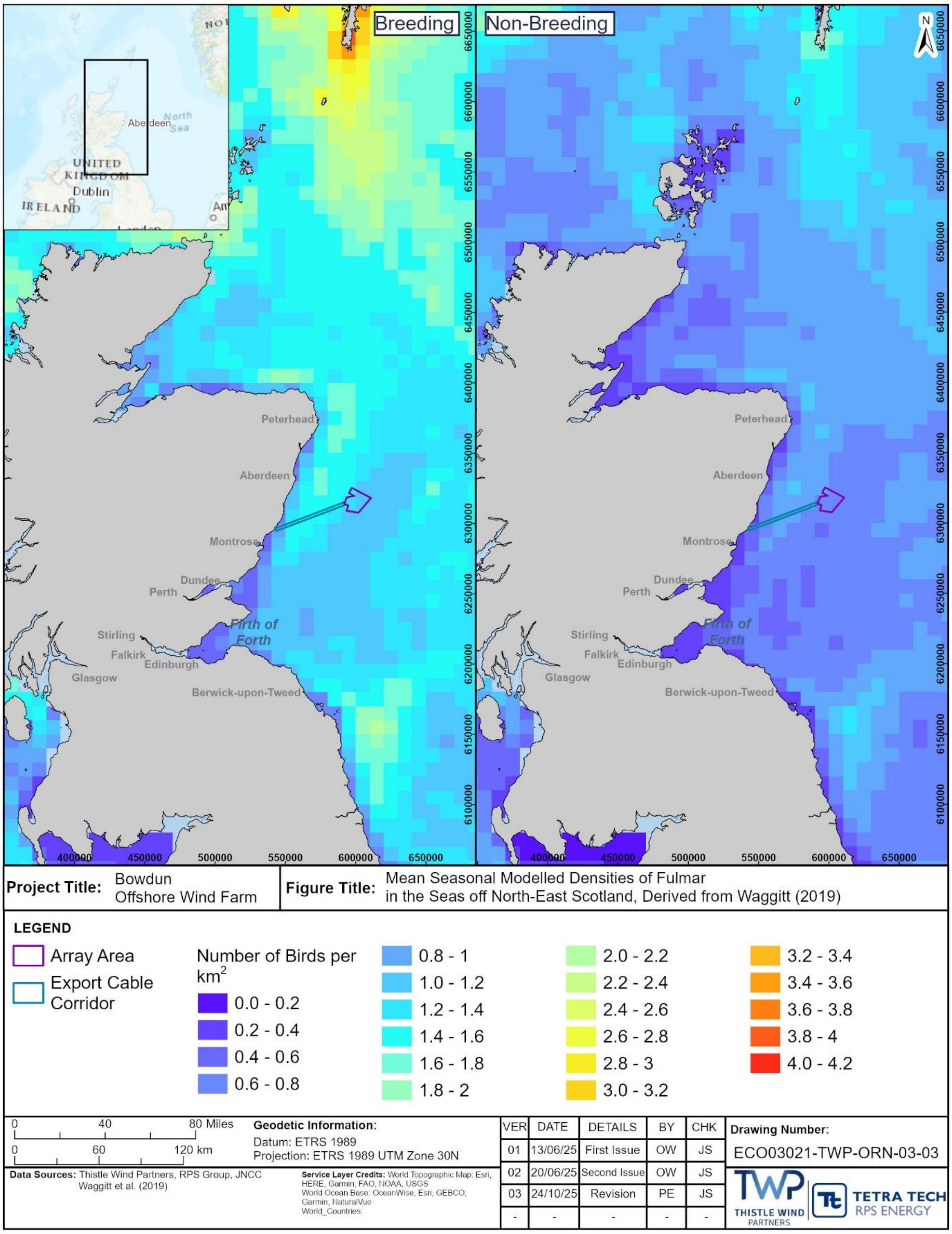



**Figure 4.1: Mean Seasonal Modelled Densities of Fulmar in the Seas off North-East Scotland, Derived from Waggitt (2019)**

### European Storm Petrel

#### *Desk-based Review*

4.2.15 European storm petrel is currently classed as an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al*., 2021) and Least Concern by the IUCNs global Red List of Threatened Species (BTO, 2024). European storm petrel is not listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), but is listed under Annex I of the EU Birds Directive 2009/147/EC.

4.2.16 European storm petrel is a pelagic seabird species, only returning to land to breed on remote offshore islands on the Atlantic coast during the hours of darkness. UK breeding populations are sparsely located on the north and west coasts from Shetland in the north to the Channel Islands in the south (BTO, 2024). Outside of the breeding season, European storm petrel are completely pelagic, wintering off the coast of western and southern Africa (BirdLife International, 2024). The UK breeding population is estimated as 25,500 breeding pairs (1998 to 2002 estimate) (Woodward *et al*., 2020). The species is absent from the UK during the non-breeding season.

4.2.17 Only Sule Skerry and Sule Stack SPA has European storm petrel as a qualifying feature or named as part of a qualifying species assemblage within max/mean max foraging range (Table 3.15) of the Array Area. The Seabirds Count census data from 2015 to 2021 (Burnell *et al*., 2023) reports a total of 177 breeding pairs of European storm petrel across the SPA. This represents 0.69% of the 25,500 breeding pairs reported by Woodward *et al*. (2020) in the UK.

4.2.18 Modelled densities are not provided for European storm petrel in Waggitt (2019).

4.2.19 European storm petrel score very low in vulnerability to displacement impacts, due to scoring very low in sensitivity to structures, vessels and helicopters and very low in habitat specialisation, indicating very limited disturbance behaviour and a very good ability to utilise alternative habitats (high habitat flexibility) (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13).

4.2.20 European storm petrel score low in vulnerability to collision impacts. European storm petrel scored high in flight manoeuvrability, low percentage of flight at Wind Turbine blade height (2%), moderately in percentage of time at sea in flight, and high in nocturnal activity. This combination of factors resulted in an overall scoring of low vulnerability to collision risk (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13).

4.2.21 European storm petrel score high in proportion of nocturnal flight activity (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13), indicating a high vulnerability to impacts arising from attraction to light emitted from Offshore Infrastructure.

#### *Site-based Survey Data*

4.2.22 A total of 43 European storm petrel were recorded in four of the 24 monthly DAS from March 2022 to February 2024 in the DAS Area (Annex A: Table A1.1 and Table A1.2). European storm petrel has a low abundance in the DAS Area with a peak of 18 European storm petrels recorded in September 2023 during the breeding season (July to November, Table 3.3; NatureScot 2020). Of the four months European storm petrel were recorded in the DAS Area, European storm petrel were only recorded within the Array Area, or the Array Area plus a 2 km buffer, in two and three months respectively. Therefore, this species was deemed to be too low in abundance to be considered for CRM or displacement analysis.

#### *Conclusion*

4.2.23 European storm petrel is not included in CRM or displacement analysis as European storm petrel has a low and very low vulnerability to collision and displacement impacts respectively, and abundance is low in the Array Area and Array Area plus a 2 km buffer.

### Gannet

#### *Desk-based Review*

4.2.24 Gannet is currently classed as an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al*., 2021) and Least Concern by the IUCNs global Red List of Threatened Species (BTO, 2024). Gannet is not listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), or under Annex I of the EU Birds Directive 2009/147/EC.

4.2.25 Gannet is the largest seabird in the North Atlantic Ocean region, recorded across the whole of the UK year-round (BTO, 2024). Twenty-one breeding colonies are found in the UK, mostly located on remote offshore islands and sea stacks, with just two colonies located on mainland cliff sites (Ratcliffe *et al*., 2004). Colonies are scattered around the UK, with the largest being Bass Rock in the Firth of Forth, with the most recent census recording 75,359 AON (Burnell *et al.,* 2023), and the highest number of colonies off the north coast of Scotland including the Northern Isles (BTO, 2024). After the breeding season, most birds migrate south to wintering areas, though some remain in UK waters and the North Sea, with the highest wintering concentrations in the UK recorded around the Northern Isles, south-east Scotland, north-west and south-west England, and south-west Ireland (BTO, 2024). The most recent seabird census recorded a total of 349,804 AON across 23 SPAs within the British Isles (Burnell *et al*., 2023). Within Scotland, gannet colonies are found within 15 SPAs with a combined population size of 252,369 AON (Burnell *et al.,* 2023).

4.2.26 The UK breeding population of gannet represents the core breeding distribution of the species (Furness, 2015). Adult gannet breeding in the UK leave colonies between August and October (Furness, 2015) to migrate southwards to wintering areas including the Bay of Biscay, Mediterranean Sea and the West African coast (BTO, 2024). Some birds remain in UK waters to overwinter in the North Sea, English Channel and Celtic Sea, though numbers of wintering adults in UK waters are thought to be decreasing while numbers increase off West Africa instead (Furness, 2015). Immature birds typically migrate further south, with most birds below three years old remaining in wintering areas year-round, and birds three to four years old attending colonies as non-breeders (Furness, 2015). Differences in the migration behaviour of adults and newly fledged immatures has also been identified (Lane *et al.*, 2021).

4.2.27 Mean seasonal modelled densities of gannet in the seas off north-east Scotland from Waggitt (2019) shows birds predicted to occur in moderate densities across much of the area during the breeding season (mid-March to September), with peak hotspots reflecting breeding colony distribution in the Firth of Forth (Bass Rock), North Rona, and Noss, Shetland (Figure 4.2). The lowest densities of birds during the breeding season are predicted around the north and north-east coasts of the Scottish mainland, the Moray Firth and Orkney. During the non-breeding season (October to mid-March), gannet are predicted to occur in relatively low densities across coastal and offshore areas, with slightly higher densities predicted in the Firth of Forth and off the north coast of the mainland. The highest mean seasonal modelled densities of gannet are not predicted to occur within the Array Area or the Export Cable Corridor. The foraging and migratory patterns of species have been comprehensively studied through sustained satellite and ringing studies from a number of key UK breeding colonies, including Bass Rock (e.g. Lane *et al.*, (2021) and Hamer *et al.* (2000)).

4.2.28 There are eight SPAs with gannet as a qualifying feature or named as part of a qualifying species assemblage within mean max + 1 SD foraging range (Table 3.15) of the Array Area. The Seabirds Count census data from 2015 to 2021 (Burnell *et al.*, 2023) reports a total of 222,239 breeding pairs of gannet across the seven SPAs within foraging range. This represents 75.34% of the 295,000 breeding pairs reported by Woodward *et al.* (2020) in the UK.

4.2.29 Gannet score very low in vulnerability to displacement impacts, due to scoring low in sensitivity to structures, vessels and helicopters and very low in habitat specialisation, indicating limited disturbance behaviour and a very good ability to utilise alternative habitats (Bradbury *et al.*, 2014).

4.2.30 Gannet score high in vulnerability to collision impacts. Gannet scored moderately in most factors associated with collision impact vulnerability, including having 12% of flight at Wind Turbine blade height. As a result, gannet were assessed as having high vulnerability to collision impacts (Bradbury *et al.*, 2014; Wade *et al.*, 2016; Table 3.13).

4.2.31 Gannet score low in proportion of nocturnal flight activity (Bradbury *et al.*, 2014), indicating a low vulnerability to impacts arising from attraction to light emitted from Offshore Infrastructure.

### *Site-based Survey Data*

4.2.32 Gannet were recorded in 23 of the 24 monthly DAS surveys from March 2022 to February 2024 in the DAS Area (Annex A: Table A1.1 and Table A1.2). A total of 4,471 gannet were recorded in the DAS Area across the 23 surveys, with 2,717 recorded in the first 12 months (March 2022 to February 2023), and 1,754 recorded in the second 12 months (March 2023 to February 2024). Gannet has a high abundance in the DAS Area with a peak of 794 gannet recorded in June 2022 during the breeding season (mid-March to September, Table 3.3; NatureScot 2020).

### *Conclusion*

4.2.33 Gannet are included in both CRM and displacement analysis. Peak abundances of gannet in the Array Area plus a 2 km buffer (relevant for displacement) are summarised in Table 4.3, and densities of flying gannet in the Array Area (relevant for CRM) are summarised in Table 4.4 (also see Annex C). MRSea model-based estimates of abundance and density of gannet in the Array Area, Array Area plus a 2 km buffer and DAS Area are presented in Annex C.

**Table 4.3: Seasonal Peak Abundance Estimates of Gannet in the Array Area Plus a 2 km Buffer (Based on Seasons in NatureScot (2020)), to be Used for Displacement Analysis**

| Area | Season | Peak year 1 | Peak year 2 | Mean peak |
|---|---|---|---|---|
| **Array Area plus 2 km buffer** | Breeding | 767 | 458 | 613 |
| **Array Area plus 2 km buffer** | Non-breeding | 54 | 153 | 104 |

**Table 4.4: Monthly Density Estimates (Birds Per km²) of Flying Gannet in the Array Area, to be Used for CRM**

| Month | Density estimates | | |
|---|---|---|---|
| | Year 1 | Year 2 | Mean |
| **January** | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| **February** | 0.03 (0.01 to 0.06) | 0.00 (0.00 to 0.00) | 0.02 (0.01 to 0.03) |
| **March** | 0.06 (0.01 to 0.17) | 0.00 (0.00 to 0.00) | 0.03 (0.01 to 0.09) |
| **April** | 1.26 (0.65 to 2.11) | 0.48 (0.19 to 0.92) | 0.87 (0.42 to 1.52) |
| **May** | 0.84 (0.42 to 1.42) | 0.45 (0.19 to 0.87) | 0.65 (0.31 to 1.15) |
| **June** | 0.66 (0.43 to 0.94) | 0.62 (0.44 to 0.84) | 0.64 (0.44 to 0.89) |
| **July** | 0.26 (0.11 to 0.47) | 0.30 (0.12 to 0.56) | 0.28 (0.12 to 0.52) |
| **August** | 0.10 (0.02 to 0.25) | 0.85 (0.45 to 1.36) | 0.48 (0.24 to 0.81) |
| **September** | 1.82 (1.11 to 2.71) | 0.68 (0.34 to 1.17) | 1.25 (0.73 to 1.94) |
| **October** | 0.06 (0.02 to 0.14) | 0.37 (0.13 to 0.77) | 0.22 (0.08 to 0.46) |
| **November** | 0.02 (0.01 to 0.05) | 0.00 (0.00 to 0.00) | 0.01 (0.01 to 0.03) |

| Month | Density estimates | | |
|---|---|---|---|
| | Year 1 | Year 2 | Mean |
| December | 0.11 (0.03 to 0.30) | 0.00 (0.00 to 0.00) | 0.06 (0.02 to 0.15) |

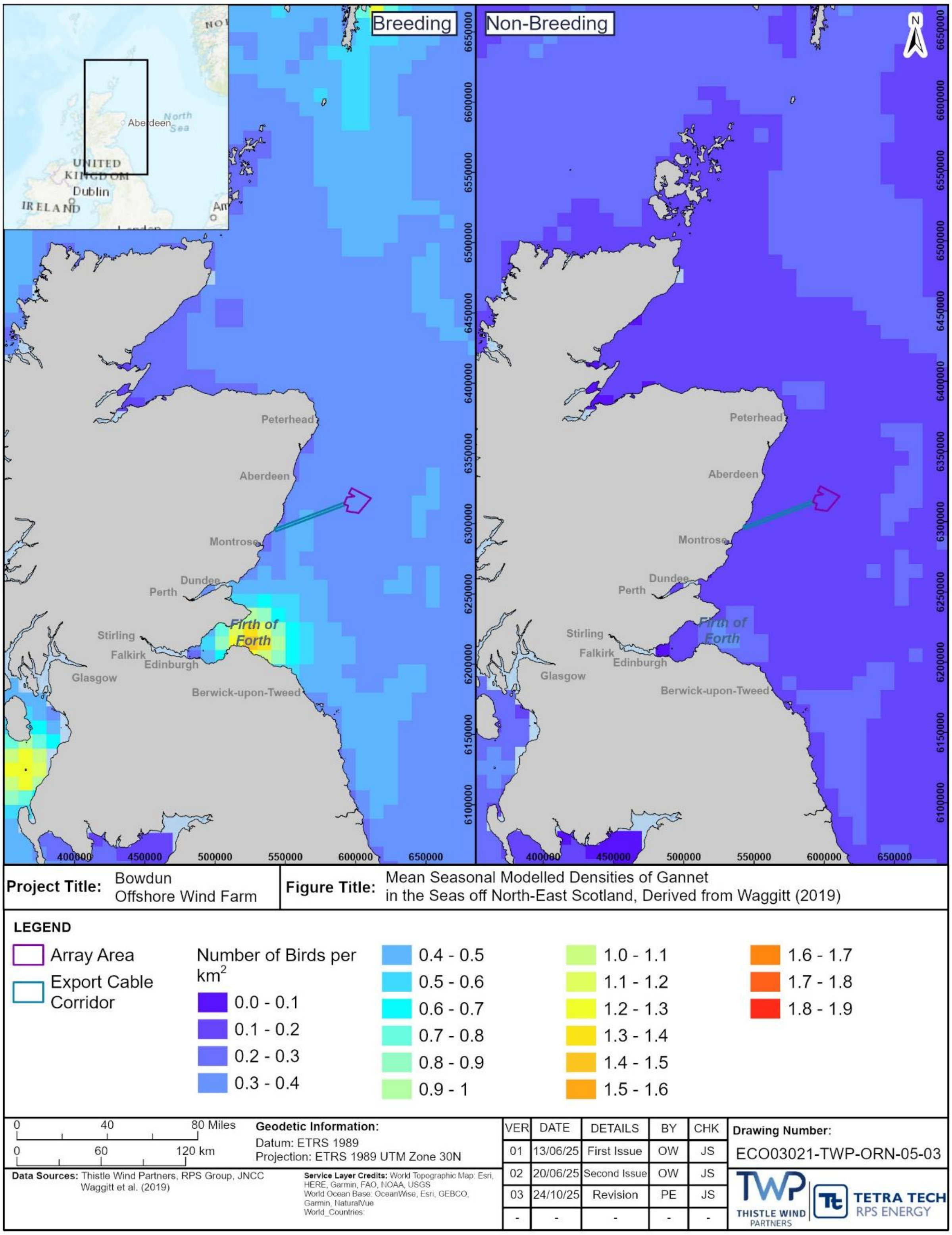



**Figure 4.2: Mean Seasonal Modelled Densities of Gannet in the Seas off North-East Scotland, Derived from Waggitt (2019)**

### Kittiwake

#### *Desk-based Review*

4.2.34 Kittiwake is currently classed as a Red-listed species of conservation concern by the BoCC5 (Stanbury *et al*., 2021) and Vulnerable by the IUCNs global Red List of Threatened Species (BTO, 2024). Kittiwake is not listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) or under Annex I of the EU Birds Directive 2009/147/EC.

4.2.35 Kittiwake is the most numerous gull species in the UK and its waters. Kittiwake are present in the UK year-round with breeding populations concentrated on the east coast of the UK while birds are mostly pelagic outside of the breeding season (BTO, 2024).

4.2.36 The spring migration period of kittiwake returning to UK breeding colonies occurs between March and April, with migration complete by May. Breeding birds remain at colonies until August, with peak autumn migration away from coastal breeding colonies occurring from August to November (Furness, 2015). The distribution of kittiwake in the non-breeding season varies and is often influenced by factors such as food supply and weather patterns. Therefore, birds may either disperse widely over the North Atlantic Ocean or remain close to the UK, within 500 km of breeding colonies (Coulson, 2011; Furness, 2015).

4.2.37 Mean seasonal modelled densities from Waggitt (2019) show kittiwake predicted in high densities around coastal areas of north-east Scotland during the breeding season (mid-April to August), with the largest concentrations around Caithness and Orkney (Figure 4.3). Densities further offshore are lower during the breeding season, with density increasing with increasing proximity to the coastline. During the non-breeding season (September to mid-April), kittiwake are predicted in a moderate density across the entire offshore area, with slightly lower densities predicted around the coastline and a slightly higher density around the north-west of Orkney. The overall highest mean seasonal modelled density of kittiwake does not occur within the Array Area but does occur within the Export Cable Corridor.

4.2.38 A total of 16 SPAs with kittiwake as a qualifying feature, or as a named species within a qualifying assemblage, are within foraging range (mean max + 1 SD) of the Array Area (Table 3.15). The Seabirds Count census data from 2015 to 2021 (Burnell *et al*., 2023) reports a total of 131,594 breeding pairs of kittiwake across the 16 SPAs within foraging range. This represents 64.19% of the 205,000 breeding pairs reported by Woodward *et al*. (2020) in the UK (2015 estimate).

4.2.39 Kittiwake score very low in vulnerability to displacement impacts (Bradbury *et al*., 2014; Table 3.13). Wade *et al*. (2016) increased this, scoring a low vulnerability to displacement by structures, and vessels and helicopters (Table 3.13). Kittiwake scored moderate in habitat flexibility, indicating limited disturbance behaviour and a good ability to utilise alternative habitats (Wade *et al*., 2016; Table 3.13).

4.2.40 Kittiwake score high and very high in vulnerability to collision impacts with Bradbury *et al*. (2014) and Wade *et al*. (2016) respectively (Table 3.13). Kittiwake scored very low-to-moderate in the factors associated with vulnerability to collision but were assessed as spending a relatively moderate 15% of flight at Wind Turbine blade height indicating a high vulnerability to collision risk overall (Bradbury *et al*., 2014).

4.2.41 Kittiwake scored moderate in proportion of nocturnal flight (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13), indicating a moderate vulnerability to impacts arising from attraction to light emitted from Offshore Infrastructure.

#### *Site-based Survey Data*

4.2.42 Kittiwake were recorded in all 24 of the 24 monthly DAS from March 2022 to February 2024 in the DAS Area (Annex A). A total of 15,375 kittiwake were recorded in the DAS Area across the 24 surveys, with 11,558 recorded in the first 12 months (March 2022 to February 2023), and 3,817 recorded in the second 12 months (March 2023 to February 2024). Kittiwake has a high abundance in the DAS Area with a peak of 3,633 kittiwake recorded in August 2022 at the end of the breeding season (mid-April to August, Table 3.3; NatureScot 2020). Having the baseline data from the larger DAS breeding season survey extent contributes useful wider background data for consideration of displacement effects on this species.

#### *Conclusion*

4.2.43 Although kittiwake scores low in vulnerability to displacement impacts, NatureScot (2023e) recommends the inclusion of kittiwake in displacement analysis. Therefore, peak abundances of kittiwake in the Array Area plus a 2 km buffer (relevant for displacement analysis) are summarised in Table 4.5.

4.2.44 Kittiwake is included in CRM as kittiwake score high vulnerability to collision impact and abundance in the DAS Area is high. Therefore, the densities of flying kittiwake in the Array Area (relevant for CRM) are summarised in Table 4.6 (also see Annex C).

**Table 4.5: Seasonal Mean Abundance Estimates of Abundance (Number of Birds) of Kittiwake in the Array Area Plus a 2 km Buffer (Based on Seasons in NatureScot (2020)), to Be Used for Displacement Analysis**

| Area | Season | Peak year 1 | Peak year 2 | Mean peak |
|---|---|---|---|---|
| **Array Area plus 2 km buffer** | Breeding | 1,721 | 1,776 | 1,749 |
| **Array Area plus 2 km buffer** | Non-breeding | 603 | 217 | 410 |

**Table 4.6: Monthly Density Estimates (Birds per km²) of Flying Kittiwake in the Array Area, to be Used for CRM**

| Month | Density estimates | | |
|---|---|---|---|
| | Year 1 | Year 2 | Mean |
| **January** | 0.31 (0.10 to 0.65) | 0.02 (0.00 to 0.05) | 0.17 (0.05 to 0.35) |
| **February** | 0.51 (0.16 to 1.15) | 0.00 (0.00 to 0.02) | 0.26 (0.08 to 0.59) |
| **March** | 0.40 (0.15 to 0.84) | 0.51 (0.32 to 0.76) | 0.46 (0.24 to 0.80) |
| **April** | 1.07 (0.41 to 2.09) | 1.53 (1.07 to 2.12) | 1.30 (0.74 to 2.11) |
| **May** | 0.24 (0.01 to 1.61) | 1.19 (0.77 to 1.74) | 0.72 (0.39 to 1.68) |
| **June** | 1.92 (1.00 to 3.14) | 3.76 (2.58 to 5.17) | 2.84 (1.79 to 4.16) |
| **July** | 3.55 (2.40 to 4.83) | 0.21 (0.12 to 0.35) | 1.88 (1.26 to 2.59) |
| **August** | 1.30 (0.44 to 2.74) | 0.44 (0.12 to 1.06) | 0.87 (0.28 to 1.90) |
| **September** | 0.33 (0.16 to 0.59) | 0.01 (0.00 to 0.02) | 0.17 (0.08 to 0.31) |
| **October** | 0.15 (0.04 to 0.34) | 0.03 (0.00 to 0.11) | 0.09 (0.02 to 0.23) |
| **November** | 0.23 (0.10 to 0.43) | 0.04 (0.01 to 0.14) | 0.14 (0.06 to 0.29) |
| **December** | 0.42 (0.18 to 0.79) | 0.06 (0.03 to 0.10) | 0.24 (0.11 to 0.45) |

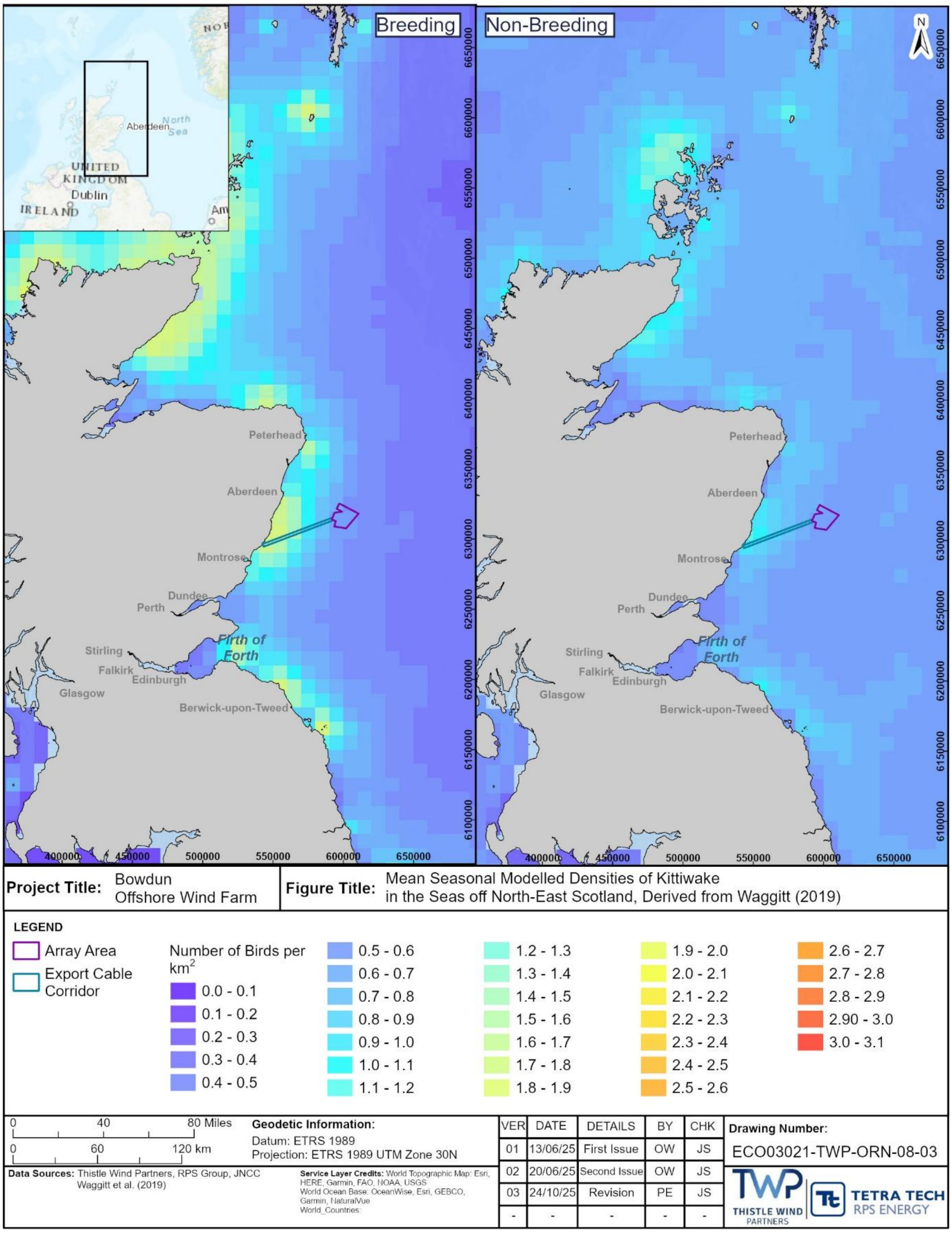



**Figure 4.3: Mean Seasonal Modelled Densities of Kittiwake in the Seas off North-East Scotland, Derived from Waggitt (2019)**

## Great Black-backed Gull

### *Desk-based Review*

4.2.45 Great black-backed gull is currently classed as an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al*., 2021) and Least Concern by the IUCNs global Red List of Threatened Species (BTO, 2024). Great black-backed gull is not listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) or under Annex I of the EU Birds Directive 2009/147/EC.

4.2.46 Great black-backed gull are present in the UK year-round with breeding populations found at coastal sites around much of the UK but absent from much of the North Sea's UK east coast between central Scotland and south-east England. In winter, the UK population of great black-backed gull increases as birds arrive from Scandinavia, with a substantial increase in the distribution of birds on parts of the east coast, where birds are largely absent in the breeding season (BTO, 2024). The UK breeding population is estimated as 15,000 breeding pairs (2015 estimate), increasing to a wintering population of 77,000 non-breeding individuals (2003/04 to 2005/06 estimate) (Woodward *et al*., 2020).

4.2.47 The UK North Sea great black-backed gull BDMPS population breeds widely across west coasts of western Europe, the UK, north to Iceland and Svalbard and north-east to Scandinavia and the White Sea (Wetlands International, 2024) from April to August (NatureScot, 2020). After breeding, northern and north-eastern populations migrate to the East Atlantic Coast, dispersing as far south as Iberia and Morocco, and dispersing across the UK mainland and the North Sea (Furness, 2015; Wetlands International, 2024). UK breeding birds are partial migrants, dispersing short distances south or east from colonies to winter grounds and returning to breeding areas in late winter (Furness, 2015).

4.2.48 Modelled densities are not provided for great black-backed gull in Waggitt (2019).

4.2.49 No SPAs with great black-backed gull as a qualifying feature or named as part of a qualifying species assemblage are within mean max foraging range (Table 3.15) of the Array Area.

4.2.50 Great black-backed gull score low in vulnerability to displacement impacts, due to scoring low in sensitivity to structures, and very low in sensitivity to vessels and helicopters (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13). Great black-backed gull scored moderate in habitat flexibility, indicating limited disturbance behaviour and a good ability to utilise alternative habitats (Wade *et al*., 2016; Table 3.13).

4.2.51 Great black-backed gull score very high in vulnerability to collision impacts (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13). Great black-backed gull scored moderate to low in the factors associated with vulnerability to collision but were assessed as spending a very high percentage of flight at Wind Turbine blade height (35%), indicating a very high vulnerability to collision risk overall (Bradbury *et al*., 2014).

4.2.52 Great black-backed gull scored moderately in proportion of nocturnal flight (Bradbury *et al.*, 2014; Wade *et al.*, 2016; Table 3.13), indicating a moderate vulnerability to impacts arising from attraction to light emitted from Offshore Infrastructure.

#### *Site-based Survey Data*

4.2.53 Great black-backed gull were recorded in 15 of the 24 monthly DAS from March 2022 to February 2024 in the DAS Area (Annex A). A total of 162 great black-backed gull were recorded in the DAS Area across the 15 surveys, with 104 recorded in the first 12 months (March 2022 to February 2023), and 58 recorded in the second 12 months (March 2023 to February 2024). Great black-backed gull has a low abundance in the DAS Area with a peak of 54 individuals recorded in December 2022 during the non-breeding season (September to March, Table 3.3; NatureScot 2020).

#### *Conclusion*

4.2.54 Great black-backed gull are not included in displacement analysis due to low vulnerability to displacement and low abundance in the DAS Area.

4.2.55 Although great black-backed gull have a low abundance, this species is included in CRM due to very high vulnerability to collision and persistent presence in the Array Area. Densities of great black-backed gull in the Array Area (relevant for CRM) are summarised in Table 4.7 (also see Annex C).

**Table 4.7: Monthly Density Estimates (Birds per km$^2$) of Flying Great Black-Backed Gull in the Array Area, to be Used for CRM**

| Month | Density estimates | | |
|---|---|---|---|
| | Year 1 | Year 2 | Mean |
| January | 0.00 (0.00 to 0.00) | 0.02 (0.00 to 0.07) | 0.01 (0.00 to 0.04) |
| February | 0.00 (0.00 to 0.00) | 0.01 (0.00 to 0.02) | 0.01 (0.00 to 0.01) |
| March | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| April | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| May | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| June | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.01) | 0.00 (0.00 to 0.01) |
| July | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| August | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| September | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| October | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| November | 0.04 (0.00 to 0.14) | 0.00 (0.00 to 0.01) | 0.02 (0.00 to 0.08) |
| December | 0.11 (0.02 to 0.31) | 0.07 (0.03 to 0.12) | 0.09 (0.03 to 0.22) |

### Lesser Black-backed Gull

#### *Desk-based Review*

4.2.56 Lesser black-backed gull is currently classed as an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al*., 2021) and Least Concern by the IUCNs global Red List of Threatened Species (BTO, 2024). Fulmar is not listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), or under Annex I of the EU Birds Directive 2009/147/EC.

4.2.57 Lesser black-backed gull are present in the UK year-round with breeding colonies predominately found on windswept, low-lying coastal islands and flat roofs of city centre buildings and industrial buildings during the summer. Part of the UK breeding population heads south during the autumn to winter (BTO, 2024). The UK breeding population is estimated as 110,000 breeding pairs (1998 to 2002 estimate), increasing to a wintering population of 130,000 non-breeding individuals (2003/04 to 2005/06 estimate) (Woodward *et al*., 2020). The UK North Sea waters winter BDMPS population is estimated as 39,314 individuals (Furness, 2015).

4.2.58 Modelled densities are not provided for lesser black-backed gull in Waggitt (2019).

4.2.59 Only Forth Islands SPA has lesser black-backed gull as a qualifying feature within the mean max + 1 SD foraging range of the Array Area (Table 3.15). The Seabirds Count census data from 2015 to 2021 (Burnell *et al*., 2023) reports a total of 2,015 breeding pairs of herring gull at the two SPAs. This represents 1.55% of the 130,000 breeding pairs reported by Woodward *et al*. (2020) in the UK.

4.2.60 Lesser black-backed gull score very low in vulnerability to displacement impacts, with a score of low in sensitivity to structures, and very low in vessels and helicopters (Bradbury *et al*., 2014; Wade *et al*., 2016). Lesser black-backed gull score high in habitat flexibility, indicating limited disturbance behaviour and a very good ability to utilise alternative habitats (Wade *et al*., 2016).

4.2.61 Lesser black-backed gull score very high in vulnerability to collision impacts (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13). Lesser black-backed gull scored moderate to low in the factors associated with vulnerability to collision but were assessed as spending a very high percentage of flight at Wind Turbine blade height (35%), indicating a very high vulnerability to collision risk overall (Bradbury *et al*., 2014).

4.2.62 Lesser black-backed gull scored moderately in proportion of nocturnal flight (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13), indicating a moderate vulnerability to impacts arising from attraction to light emitted from Offshore Infrastructure.

#### *Site-based Survey Data*

4.2.63 Lesser black-backed gull were recorded in six of the 24 monthly DAS from March 2022 to February 2024 in the DAS Area (Annex A). A total of 60 lesser black-backed gull were recorded in the DAS Area, with 23 lesser black-backed gull recorded in the first 12 months (March 2022 to February 2023), and 37 recorded in the second 12 months (March 2023 to February 2024). Lesser black-backed gull has a low abundance in the DAS Area with a peak of 24 individuals recorded in April 2023 during the breeding season (mid-March to August, Table 3.3; NatureScot 2020).

4.2.64 Of the six months lesser black-backed gull were recorded in the DAS Area, lesser black-backed gull were only recorded within the Array Area, or the Array Area plus a 2 km buffer, in one and two months respectively.

#### *Conclusion*

4.2.65 Although lesser black-backed gull scored very high vulnerability to collision impact, lesser black-backed gull were excluded from CRM as abundance in the Array Area is very low. Lesser black-backed gull is not included in displacement analysis as lesser black-backed gull scored very low in vulnerability to displacement impacts and abundance in the Array Area plus a 2 km buffer is very low.

### Herring Gull

#### *Desk-based Review*

4.2.66 Herring gull is currently classed as a Red-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Least Concern by the IUCNs global Red List of Threatened Species (BTO, 2024). Herring gull is not listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) or under Annex I of the EU Birds Directive 2009/147/EC.

4.2.67 Herring gull are present in the UK year-round with breeding populations predominantly found at coastal sites around the UK but are increasingly colonising and nesting in urban areas (Burnell *et al.*, 2023). In winter, the UK population of herring gull increases as birds arrive from Iceland and Scandinavia, with a substantial increase in the distribution of birds across the UK (BTO, 2024). The UK breeding population is estimated as 130,000 breeding pairs (1998 to 2002 estimate), increasing to a wintering population of 740,000 non-breeding individuals (2003/04 to 2005/06 estimate) (Woodward *et al.*, 2020).

4.2.68 The UK North Sea and Channel herring gull BDMPS population consists of two subspecies: *argenteus* breeding in the UK and Ireland, Iceland, and north-west France and Germany, and *argentatus* breeding in Denmark, Scandinavia and east to the White Sea (Wetlands International, 2024). The subspecies populations overlap in the east of the UK and north-west mainland Europe. After the breeding season from April to August (NatureScot, 2020), many argenteus populations are sedentary and do not migrate after the breeding season, dispersing to wintering areas within the breeding country instead (Wetlands International, 2024; Furness, 2015).

4.2.69 Mean seasonal modelled densities of herring gull in the seas off north-east Scotland from Waggitt (2019) show herring gull dispersed in relatively low densities in the offshore area in both the breeding (April to August) and non-breeding (September to March) seasons (Figure 4.4). During both the breeding and non-breeding seasons, the mean modelled density of herring gull is higher along the coastline of the north-east of Scotland and the Northern Isles than on the west coast of Scotland and the offshore area. Coastal densities of herring gull are predicted to be higher in the breeding season than the non-breeding season, with the highest densities on the coast of Aberdeenshire and in the Firth of Forth. The overall highest mean seasonal modelled density of herring gull is not predicted within the Array Area or the Export Cable Corridor.

4.2.70 Two SPAs have herring gull as a qualifying feature within the mean max + 1 SD foraging range of the Array Area (Table 3.15). The Seabirds Count census data from 2015 to 2021 (Burnell *et al*., 2023) reports a total of 3,112 breeding pairs of herring gull at the two SPAs. This represents 2.39% of the 130,000 breeding pairs reported by Woodward *et al*. (2020) in the UK. Herring gull populations at both Buchan Ness to Collieston Coast SPA and Fowlsheugh SPA have been found to decrease, with a comparison of the Seabird 2000 and Seabird Counts censuses showing a decrease of 34% and 13% respectively.

4.2.71 Herring gull score very low in vulnerability to displacement impacts, with a score of low in sensitivity to structures, and very low in sensitivity to vessels and helicopters (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13). Herring gull score high in habitat flexibility, indicating limited disturbance behaviour and a very good ability to utilise alternative habitats (Wade *et al*., 2016; Table 3.13).

4.2.72 Herring gull score very high in vulnerability to collision impacts (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13). Herring gull scored moderate to low in the factors associated with vulnerability to collision but were assessed as spending a very high percentage of flight at Wind Turbine blade height (35%), indicating a very high vulnerability to collision risk overall (Bradbury *et al*., 2014; Table 3.13).

4.2.73 Herring gull scored moderately in proportion of nocturnal flight (Bradbury *et al*., 2014; Wade *et al*., 2016), indicating a moderate vulnerability to impacts arising from attraction to light emitted from Offshore Infrastructure.

#### *Site-based Survey Data*

4.2.74 Herring gull were recorded in 21 of the 24 monthly DAS from March 2022 to February 2024 in the DAS Area (Annex A: Table A1.1 and Table A1.2). A total of 4,010 herring gull were recorded in the DAS Area, with 2,456 herring gull recorded in the first 12 months (March 2022 to February 2023), and 1,554 recorded in the second 12 months (March 2023 to February 2024).

4.2.75 Herring gull have a high abundance in the DAS Area with a peak of 1,489 herring gull recorded in June 2023 during the breeding season (April to August, Table 3.3; NatureScot 2020).

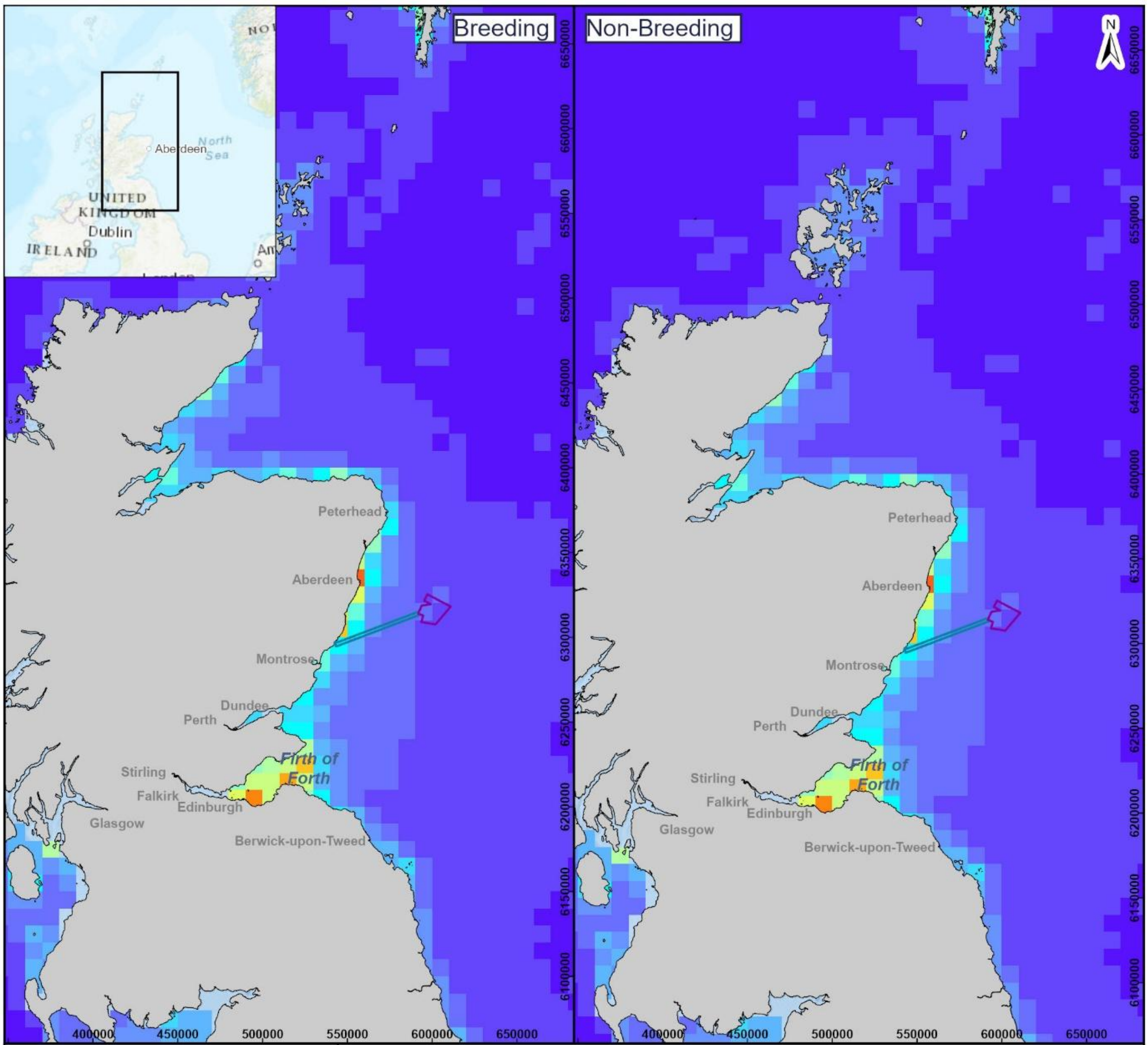
### *Conclusion*

4.2.76 Herring gull is excluded from displacement analysis as this species has very low vulnerability to displacement impacts.

4.2.77 Herring gull is included in CRM as this species has very high vulnerability to collision and abundance in the Array Area is high. Therefore, densities of herring gull in the Array Area (relevant for CRM) are summarised in Table 4.8 (also see Annex C).

**Table 4.8: Monthly Density Estimates (Birds per km$^2$) of Flying Herring Gull in the Array Area, to be Used for CRM (Annex C)**

| Month | Density estimates | | |
|---|---|---|---|
| | Year 1 | Year 2 | Mean |
| January | 0.00 (0.00 to 0.02) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.01) |
| February | 0.00 (0.00 to 0.00) | 0.03 (0.00 to 0.10) | 0.02 (0.00 to 0.05) |
| March | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| April | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.01) | 0.00 (0.00 to 0.01) |
| May | 0.20 (0.00 to 4.26) | 0.01 (0.00 to 0.02) | 0.11 (0.00 to 2.14) |
| June | 0.06 (0.03 to 0.11) | 2.16 (1.10 to 3.67) | 1.11 (0.57 to 1.89) |
| July | 0.37 (0.13 to 0.74) | 0.00 (0.00 to 0.00) | 0.19 (0.07 to 0.37) |
| August | 0.09 (0.03 to 0.19) | 0.00 (0.00 to 0.00) | 0.05 (0.02 to 0.10) |
| September | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| October | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| November | 0.03 (0.00 to 0.06) | 0.00 (0.00 to 0.00) | 0.02 (0.00 to 0.03) |
| December | 0.13 (0.03 to 0.36) | 0.00 (0.00 to 0.00) | 0.07 (0.02 to 0.18) |




**Project Title:** Bowdun Offshore Wind Farm

**Figure Title:** Mean Seasonal Modelled Densities of Herring Gull in the Seas off North-East Scotland, Derived from Waggitt (2019)

**LEGEND**

- Array Area
- Export Cable Corridor

Number of Birds per km$^2$

- 0.0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1
- 1.0 - 1.1
- 1.1 - 1.2
- 1.2 - 1.3
- 1.3 - 1.4
- 1.4 - 1.5
- 1.5 - 1.6
- 1.6 - 1.7
- 1.7 - 1.8
- 1.8 - 1.9

0 40 80 Miles
0 60 120 km

**Geodetic Information:**
Datum: ETRS 1989
Projection: ETRS 1989 UTM Zone 30N

| VER | DATE | DETAILS | BY | CHK |
|---|---|---|---|---|
| 01 | 13/06/25 | First Issue | OW | JS |
| 02 | 20/06/25 | Second Issue | OW | JS |
| 03 | 24/10/25 | Revision | PE | JS |
| - | - | - | - | - |

**Drawing Number:** ECO03021-TWP-ORN-10-03

**Data Sources:** Thistle Wind Partners, RPS Group, JNCC Waggitt et al. (2019)

**Service Layer Credits:** World Ocean Base: OceanWise, Esri, GEBCO, Garmin, NaturalVue World_Countries: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA

THISTLE WIND PARTNERS | TETRA TECH RPS ENERGY

**Figure 4.4: Mean Seasonal Modelled Densities of Herring Gull in the Seas off North-East Scotland, Derived from Waggitt (2019)**

### Common Gull

#### *Desk-based Review*

4.2.78 Common gull is currently classed as an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al*., 2021) and Least Concern by the IUCN's global Red List of Threatened Species (BTO, 2024). Common gull is not listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) or under Annex I of the EU Birds Directive 2009/147/EC.

4.2.79 Common gull are present in the UK year-round with breeding populations found across the north and west of the UK. The highest density breeding populations in Scotland are found in the east of the country between Angus, the Moray Firth, Caithness and the Northern Isles. An influx of birds arrive to the UK in winter from the wider breeding range of continental Europe (Delany *et al*., 2006), with birds found throughout the UK with the exception of upland areas (BTO, 2024). The UK breeding population is estimated as 48,500 breeding pairs (1998 to 2002 estimate), increasing to a wintering population of 710,000 non-breeding individuals (2003/04 to 2005/06 estimate) (Woodward *et al*., 2020).

4.2.80 The UK common gull population breeds widely across the UK, Iceland and northern Europe as far east as the White Sea (Wetlands International, 2024) from March to August (NatureScot, 2020). After breeding, northern populations migrate to south-western Europe from breeding areas. UK breeding birds show less distinct Autumn migration but disperse widely within the country (European Commission, 2009).

4.2.81 Modelled densities are not provided for common gull in Waggitt (2019).

4.2.82 No SPAs with common gull as a qualifying feature or named as part of a qualifying species assemblage are within mean max foraging range (Table 3.15) of the Array Area.

4.2.83 Common gull score low in vulnerability to displacement impacts, due to scoring low in sensitivity to structures, vessels and helicopters (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13). Common gull score moderate and in habitat flexibility, indicating limited disturbance behaviour and a good ability to utilise alternative habitats (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13).

4.2.84 Common gull score high and very high in vulnerability to collision impacts in Bradbury *et al*. (2014) and Wade *et al*. (2016) respectively (Table 3.13). Common gull scored low to very low in the factors associated with vulnerability to collision but were assessed as spending a relatively high 20% of flight at Wind Turbine blade height. Common gull also scored moderate to very high in conservation status factor which are included in the equation to calculate vulnerability to collision. This combination of factors indicates a high vulnerability to collision risk overall (Bradbury *et al*., 2014).

4.2.85 Common gull scored moderately in proportion of nocturnal flight (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13), indicating a moderate vulnerability to impacts arising from attraction to light emitted from Offshore Infrastructure.

#### *Site-based Survey Data*

4.2.86 Common gull were recorded in 13 of the 24 monthly DAS from March 2022 to February 2024 in the DAS Area (Annex A: Table A1.1 and Table A1.2). A total of 127 common gull were recorded in the DAS Area, with 89 common gull recorded in the first 12 months (March 2022 to February 2023), and 38 recorded in the second 12 months (March 2023 to February 2024).

4.2.87 Common gull has a low abundance in the DAS Area with a peak of 71 common gull recorded in August 2022 during the breeding season (April to August, Table 3.3; NatureScot 2020). Of the 13 months common gull were recorded in DAS Area, common gull were only recorded within the Array Area, in two months (April 2023). Therefore, this species was deemed to be too low in abundance in the Array Area to be considered for CRM.

#### *Conclusion*

4.2.88 Common gull is excluded from displacement analysis as this species scores low in vulnerability to displacement impacts. Although this species has high vulnerability to collision impacts, common gull is excluded from CRM as this species has low abundance in the Array Area (Annex C).

### Arctic Tern

#### *Desk-based Review*

4.2.89 Arctic tern is currently classed as an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al*., 2021) and Least Concern by the IUCNs global Red List of Threatened Species (BTO, 2024). Arctic tern is not listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), but is listed under Annex I of the EU Birds Directive 2009/147/EC.

4.2.90 Arctic tern are summer visitors to the UK during the breeding season only. UK breeding colonies are predominantly coastal and concentrated in the north and north-west of Scotland, including the Northern Isles, Western Isles and Outer Hebrides. Colonies are also found in islands off north Wales and clustered around the coast of Ireland (BTO, 2024). The UK breeding population is estimated as 53,500 breeding pairs (2000 estimate) (Woodward *et al*., 2020).

4.2.91 Arctic tern have the longest migration of any bird, demonstrating a circumpolar breeding distribution and strong migratory movements following the summer season to wintering grounds in the southern hemisphere. The UK and Europe breeding populations begin their autumn migration at the end of the breeding season from September, migrating to Antarctic wintering grounds, before returning to breeding grounds at the beginning of the breeding season in May (NatureScot, 2020; BTO, 2024)

4.2.92 Modelled densities are not provided for Arctic tern in Waggitt (2019).

4.2.93 No SPAs with Arctic tern as a qualifying feature or named as part of a qualifying species assemblage are within mean max foraging range (Table 3.15) of the Array Area.

4.2.94 Arctic tern score low in vulnerability to displacement impacts, due to scoring low in sensitivity to structures, vessels and helicopters and moderate in habitat flexibility, indicating limited disturbance behaviour and a moderate ability to utilise alternative habitats (Bradbury *et al*., 2014; Wade *et al*., 2016).

4.2.95 Arctic tern score low in vulnerability to collision impacts in Bradbury *et al.* (2014) but Wade *et al*. (2016) contradict this with a moderate vulnerability to collision impacts (Table 3.13). Arctic tern have high manoeuvrability, very low proportion of nocturnal activity and relatively low percentage of flight at Wind Turbine blade height (5%) (Wade *et al*., 2016; Bradbury *et al*., 2014). However, Arctic tern scored very high in percentage of time spent in flight, with a moderate uncertainty in time spent at blade height (Wade *et al*., 2016). Thus, Arctic tern are assessed as a moderate vulnerability to collision risk overall.

4.2.96 Arctic tern scored very low in proportion of nocturnal flight (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13), indicating a very low vulnerability to impacts arising from attraction to light emitted from Offshore Infrastructure.

#### *Site-based Survey Data*

4.2.97 Arctic tern were recorded in seven of the 24 monthly DAS from March 2022 to February 2024 in the DAS Area (Annex A: Table A1.1 and Table A1.2). A total of 522 Arctic tern were recorded in the DAS Area, with 164 Arctic tern recorded in the first 12 months (March 2022 to February 2023), and 358 recorded in the second 12 months (March 2023 to February 2024). Arctic tern has a moderate abundance in the DAS Area with a peak of 174 Arctic tern recorded in July 2023 during the breeding season (May to August, Table 3.3; NatureScot 2020).

#### *Conclusion*

4.2.98 Although Bradbury *et al*. (2014) scored Arctic tern low vulnerability to collision, Wade *et al*. (2016) deemed a moderate vulnerability to collision impacts. Therefore, as this Arctic tern has a moderate abundance, this species is included in CRM. Arctic tern was excluded from displacement analysis as Arctic tern have low vulnerability to displacement impacts.

4.2.99 Densities of flying birds within the Array Area (relevant for CRM) are summarised in Table 4.9 (also see Annex C).

**Table 4.9: Monthly Density Estimates (Birds per km$^2$) of Flying Herring Gull in the Array Area, to be Used for CRM (Annex C)**

| Month | Density estimates | | |
|---|---|---|---|
| | Year 1 | Year 2 | Mean |
| **January** | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| **February** | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| **March** | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| **April** | 0.44 (0.00 to 1.08) | 0.00 (0.00 to 0.00) | 0.22 (0.00 to 0.54) |
| **May** | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |

| Month | Density estimates | | |
|---|---|---|---|
| | Year 1 | Year 2 | Mean |
| June | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| July | 0.00 (0.00 to 0.00) | 0.19 (0.02 to 0.80) | 0.10 (0.01 to 0.40) |
| August | 4.73 (2.08 to 8.58) | 0.12 (0.03 to 0.31) | 2.43 (1.06 to 4.45) |
| September | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| October | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| November | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |
| December | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) | 0.00 (0.00 to 0.00) |

### Guillemot

#### *Desk-based Review*

4.2.100 Guillemot is currently classed as an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Least Concern by the IUCNs global Red List of Threatened Species (BTO, 2024). Guillemot is not listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), or under Annex I of the EU Birds Directive 2009/147/EC.

4.2.101 Guillemot breed in large colonies on much of the UK's coastline. Breeding colonies are located on steep cliffs, stacks and islands and their distribution is linked to the presence of suitable habitat, with a notable lack of breeding colonies in the south-east of England. Guillemot winter offshore in the seas around much of the UK, with high densities of wintering birds in west coast waters and in the North Sea off south-east Scotland and north-east England (BTO, 2024). The UK breeding population is estimated as 950,000 breeding pairs (1998 to 2002 estimate) (Woodward *et al.*, 2020) and the non-breeding season UK North Sea and Channel BDMPS is estimated as 1,617,306 individuals (Furness, 2015).

4.2.102 Three of the five subspecies of guillemot occur in the UK and/or its waters. The subspecies *hyperborea* is the most northerly-breeding subspecies, breeding in northern Norway, Northern Russia and Svalbard, with small numbers wintering in UK waters. Subspecies *albionis* breeds in England, Wales, Ireland, France and Iberia, wintering off the coast of the UK and north and west Europe. Subspecies *aalge* has the largest breeding range, with breeding populations in Scotland, northern England, southern Norway, Faroe, Iceland, Greenland and much of west Europe (Furness, 2015; Wetlands International, 2024). Movements of UK breeding populations to wintering areas are dependent on prey distribution and vary between adults and juveniles. Adult birds remain close to colonies year-round with few birds dispersing beyond UK waters. Immature birds disperse further, with a general range between north Norway and Portugal (Furness, 2015).

4.2.103 Mean seasonal modelled densities of guillemot in the seas off north-east Scotland from Waggitt (2019) show birds predicted in high densities during the breeding season (April to August) off the coasts of the Northern Isles, Cape Wrath and Caithness, with small hotspots of high density on the Aberdeenshire coast and in the Firth of Forth (Figure 4.5). Moderate densities are predicted in the offshore area, with densities decreasing further from the coastline. During the non-breeding season (mid-August to March), moderate densities are predicted across both the coastal area and almost all of the offshore area. Slightly higher densities are predicted in coastal areas around Shetland and the Aberdeenshire coast. The highest mean seasonal modelled density is not predicted to occur within the Array Area or the Export Cable Corridor.

4.2.104 There are two SPAs with guillemot as a qualifying feature or named as part of a qualifying species assemblage within mean max + 1 SD foraging range (Table 3.15) of the Array Area. The Seabirds Count census data from 2015 to 2021 (Burnell *et al*., 2023) reports a total of 99,261 breeding pairs (corrected for birds missed during census) of guillemot across the two SPAs within foraging range. This represents 10.45% of the 950,000 breeding pairs reported by Woodward *et al*. (2020) in the UK. Guillemot populations at Buchan Ness to Collieston Coast SPA and Fowlsheugh SPA have been found to remain relatively stable, with a comparison of the Seabird 2000 and Seabird Counts censuses showing no change in the guillemot population at Buchan Ness to Collieston Coast SPA and a 1% increase at Fowlsheugh SPA.

4.2.105 Guillemot score moderate in vulnerability to displacement impacts (Bradbury *et al*., 2014), with a score of high in sensitivity to structures, and moderate in sensitivity to vessels and helicopters (Wade *et al*., 2016) (Table 3.13). Furthermore, guillemot score moderately in habitat flexibility, indicating moderate disturbance behaviour and a moderate ability to utilise alternative habitats (Wade *et al*., 2016). It is notable that NEEOG-funded tracking data from Buchan Ness to Collieston SPA found that guillemot rarely ventured more than 25km from the shore, with the vast majority of trips remaining within 5km of land (O'Donovan *et al*., 2024), therefore reducing their likelihood of engaging with the Array Area Study Area.

4.2.106 Guillemot score very low in vulnerability to collision impacts (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13). Guillemot have poor flight manoeuvrability but scored very low in other vulnerability factors associated with collision impacts. Guillemot were assessed as spending a very low percentage of flight at Wind Turbine blade height (1%), indicating a very low vulnerability to collision risk overall (Bradbury *et al*., 2014).

4.2.107 Guillemot score low in proportion of nocturnal flight (Bradbury *et al*., 2014; Wade *et al*., 2016), indicating a low vulnerability to impacts arising from attraction to light emitted from Offshore Infrastructure.

#### *Site-based Survey Data*

4.2.108 Guillemot were recorded in all 24 monthly DAS from March 2022 to February 2024 in the DAS Area (Annex A). A total of 99,580 guillemot were recorded in the DAS Area, with 69,115 guillemot recorded in the first 12 months (March 2022 to February 2023), and 30,465 recorded in the second 12 months (March 2023 to February 2024). Guillemot has a high abundance in the DAS Area with a peak of 19,250 guillemot recorded in August 2022 at the end of the breeding season (April to mid-August, Table 3.3; NatureScot 2020). Having the baseline data from the larger DAS breeding season survey extent, plus Fowlsheugh SPA and NEEOG-funded tracking data from Buchan Ness to Collieston SPA all contribute useful wider background data for consideration of displacement effects on this species. Indeed, it was found that guillemot rarely ventured more than 25 km from the shore, with the vast majority of trips remaining within 5km of land (O'Donovan *et al*., 2024).

#### *Conclusion*

4.2.109 Guillemot is included in displacement analysis as guillemot have a high abundance in the Array Area plus 2 km buffer and moderate vulnerability to displacement impacts. Peak abundances of guillemot in the Array Area plus a 2 km buffer (relevant for displacement) are summarised in Table 4.10 (also see Annex C). Guillemot are excluded from CRM due to very low vulnerability to collision impacts.

**Table 4.10: Seasonal Peak Abundance Estimates of Guillemot in the Array Area Plus a 2 km Buffer (Based on Seasons in NatureScot (2020)), to be Used for Displacement Analysis**

| Area | Season | Peak year 1 | Peak year 2 | Mean peak |
|---|---|---|---|---|
| **Array Area plus 2 km buffer** | Breeding | 19,932 | 11,987 | 15,960 |
| **Array Area plus 2 km buffer** | Non-breeding | 8,556 | 27,868 | 18,212 |

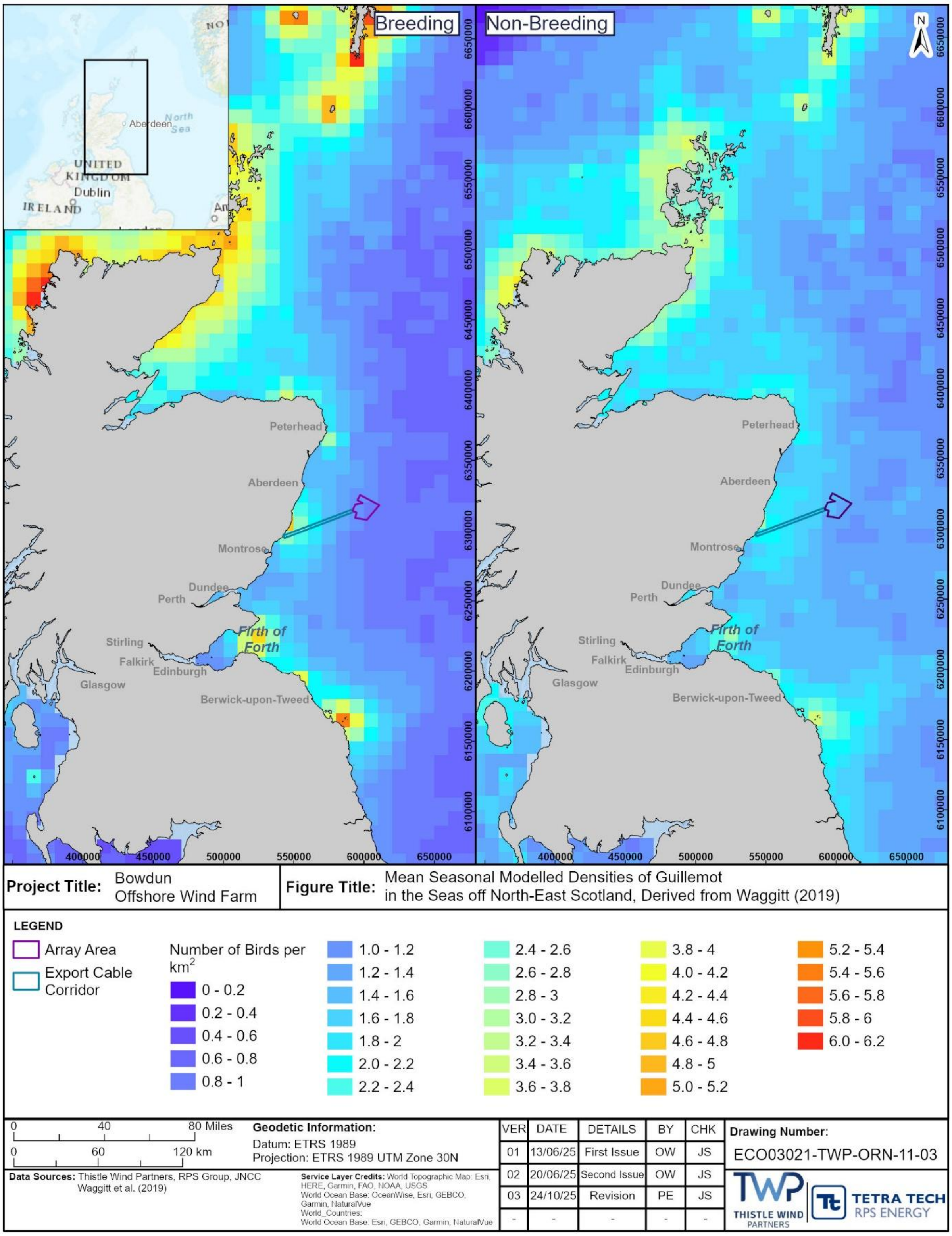



**Figure 4.5: Mean Seasonal Modelled Densities of Guillemot in the Seas off North-East Scotland, Derived from Waggitt (2019)**

### Razorbill

#### *Desk-based Review*

4.2.110 Razorbill is currently classed as an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Near Threatened by the IUCNs global Red List of Threatened Species (BTO, 2024). Razorbill is not listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), or under Annex I of the EU Birds Directive 2009/147/EC.

4.2.111 Razorbill breed on much of the UK's coastline, often in mixed colonies with other species, notably guillemot and kittiwake (Ratcliffe *et al.*, 2004). Breeding colonies occupy similar habitat to those of guillemot: on steep cliffs, stacks and islands. The highest concentrations of breeding razorbill are found on the UK's north-east North Sea coast, from Flamborough Head in north-east England to the Northern Isles of Scotland. Concentrations are also found on the west coast of the UK and Ireland. Birds from the UK winter at sea, distributed around most of the UK coastline (BTO, 2024). The UK breeding population is estimated as 165,000 breeding pairs (2015 estimate) (Woodward *et al.*, 2020) and the non-breeding season UK North Sea and Channel BDMPS is estimated as 215,622 individuals (Furness, 2015).

4.2.112 Razorbill subspecies *islandica* breeds in Iceland, Faroe, Germany and France, as well as the UK and Ireland. At the end of the breeding season (March to August (NatureScot, 2020)) fledged young and moulting adults remain close to the colony until September, while immature non-breeders disperse further. By September, razorbill start migration movements southwards from breeding colonies, with wintering birds found as far south as Portugal and as far north as southern Norway, but with most birds wintering in the North Sea, Celtic Sea, English Channel or further south in the Bay of Biscay (Furness, 2015; Wetlands International, 2024).

4.2.113 Mean seasonal modelled densities of razorbill in the seas off north-east Scotland from Waggitt (2019) show birds predicted to be dispersed in scattered areas of high density around the north and east coasts during the breeding season (April to August) (Figure 4.6). The largest concentrations of razorbill in the breeding season are predicted off the coast of Cape Wrath and East Caithness, with smaller concentrations around Orkney, Fair Isle, Shetland, North Caithness, Shiant Isles, the Aberdeenshire Coast and the Firth of Forth. Densities around the rest of the coastline and the offshore area are relatively low. During the non-breeding season (mid-August to March), the densities of razorbill are relatively low across much of the offshore area, with low-to-moderate densities around the coastline and the Northern Isles. The highest mean seasonal densities of razorbill are not predicted within the Array Area or the Export Cable Corridor. However, moderate densities are predicted within the Export Cable Corridor during the breeding season.

4.2.114 There are four SPAs with razorbill as a qualifying feature or named as part of a qualifying species assemblage within mean max + 1 SD foraging range of the Array Area (Table 3.15). The Seabirds Count census data from 2015 to 2021 (Burnell *et al*., 2023) reports a total of 18,970 breeding pairs of razorbill (corrected for birds missed during census) across the four SPAs within foraging range. This represents 11.50% of the 165,000 breeding pairs reported by Woodward *et al*. (2020) in the UK.

4.2.115 Population trends at the four SPAs with connectivity to the Array Area for razorbill vary. Fowlsheugh SPA and Forth Islands SPA populations have both shown to increase by 92% and 23% respectively when comparing the most recent seabird censuses (Burnell *et al*., 2023). Whereas both St Abb's Head to Fast Castle SPA and Troup, Pennan and Lion's Heads SPA populations have shown decreases of 7% and 9% respectively when comparing seabird censuses (Burnell *et al*., 2023).

4.2.116 Razorbill score moderate in vulnerability to displacement impacts (Bradbury *et al*., 2014), with a score of high in sensitivity to structures, and moderate in sensitivity to vessels and helicopters (Wade *et al*., 2016) (Table 3.13). Furthermore, razorbill score moderately in habitat flexibility, indicating moderate disturbance behaviour and a moderate ability to utilise alternative habitats (Wade *et al*., 2016; Table 3.13). It is notable that NEEOG-funded tracking data from Buchan Ness to Collieston SPA found that razorbill rarely ventured more than 25km from the shore, with the vast majority of trips remaining within 5km of land (O'Donovan *et al*., 2024), therefore reducing their likelihood of engaging with the Array Area Study Area.

4.2.117 Razorbill score very low in vulnerability to collision impacts (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13). Razorbill have poor flight manoeuvrability but scored very low in other vulnerability factors associated with collision impacts. Razorbill were assessed as spending a very low percentage of flight at Wind Turbine blade height (0.5%), indicating a very low vulnerability to collision risk overall (Bradbury *et al*., 2014).

4.2.118 Razorbill score very low in proportion of nocturnal flight (Bradbury *et al*., 2014; Wade *et al*., 2016; Table 3.13), indicating a very low vulnerability to impacts arising from attraction to light emitted from Offshore Infrastructure.

#### *Site-based Survey Data*

4.2.119 Razorbill were recorded in all 24 monthly DAS from March 2022 to February 2024 in the DAS Area (Annex A). A total of 12,974 razorbill were recorded in the DAS Area, with 10,295 razorbill recorded in the first 12 months (March 2022 to February 2023), and 2,679 recorded in the second 12 months (March 2023 to February 2024). Razorbill has a high abundance in the DAS Area with a peak of 6,426 razorbill recorded in August 2022 at the end of the breeding season (April to mid-August, Table 3.3; NatureScot 2020). Having the baseline data from the larger DAS breeding season survey extent, plus NEEOG-funded tracking data from Buchan Ness to Collieston SPA all contribute useful wider background data for consideration of displacement effects on this species.

### *Conclusion*

4.2.120 Razorbill is included in displacement analysis as razorbill have a high abundance in the Array Area plus 2 km buffer and moderate vulnerability to displacement impacts. Peak abundances of razorbill in the Array Area plus a 2 km buffer (relevant for displacement) are summarised in Table 4.11 (also see Annex C). Razorbill is excluded from CRM due to very low in vulnerability to collision impacts.

**Table 4.11: Seasonal Peak Abundance Estimates of Razorbill in the Array Area Plus a 2 km Buffer (Based on Seasons in NatureScot (2020)), to be Used for Displacement Analysis**

| Area | Season | Peak year 1 | Peak year 2 | Mean peak |
|---|---|---|---|---|
| **Array Area plus 2 km buffer** | Breeding | 4,445 | 904 | 2,675 |
| **Array Area plus 2 km buffer** | Non-breeding | 1,279 | 177 | 728 |

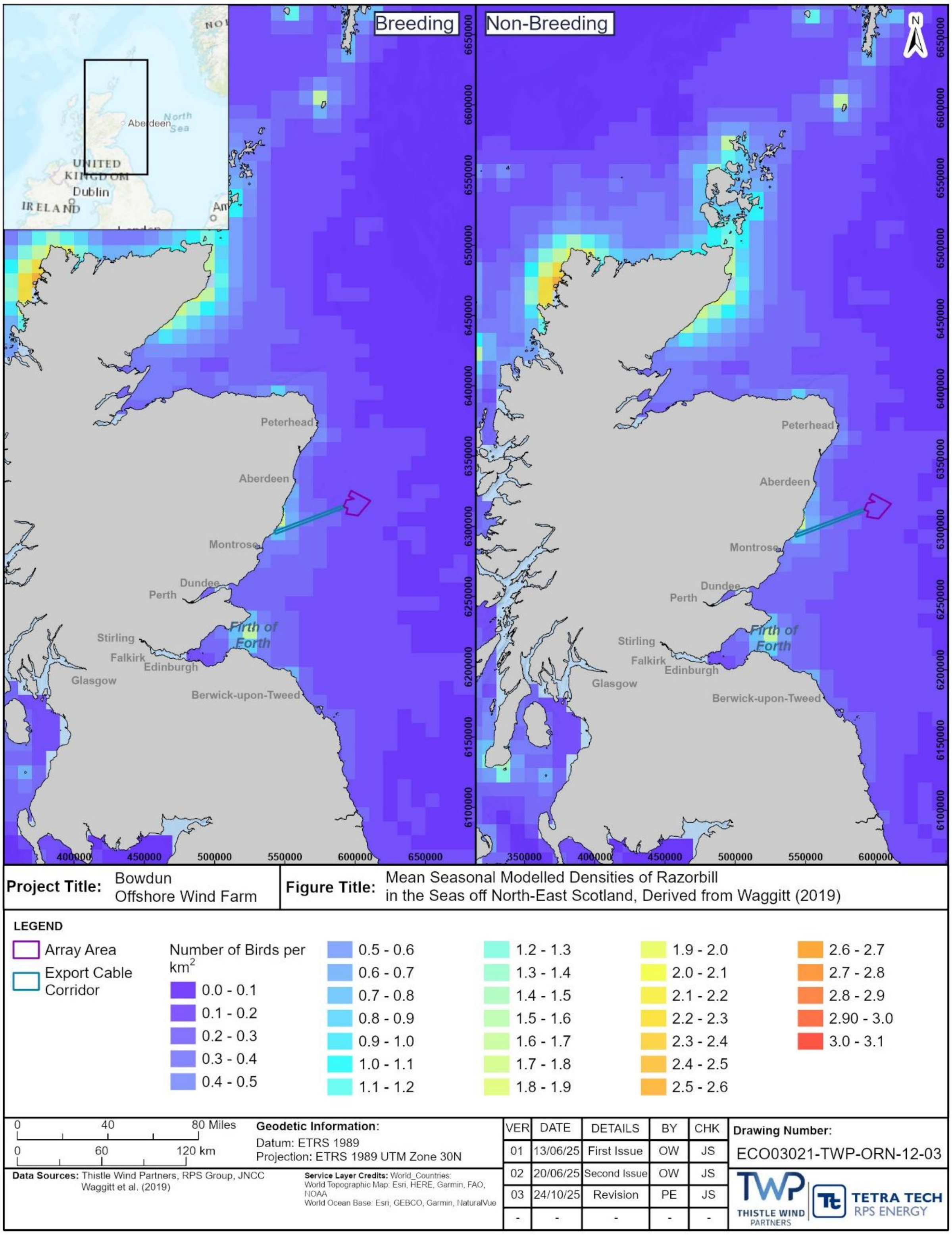



**Figure 4.6: Mean Seasonal Modelled Densities of Razorbill in the Seas off North-East Scotland, Derived from Waggitt (2019)**

## Puffin

### *Desk-based Review*

4.2.121 Puffin is currently classed as a Red-listed species of conservation concern by the BoCC5 (Stanbury *et al*., 2021) and Vulnerable by the IUCNs global Red List of Threatened Species (BTO, 2024). Puffin is not listed under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), or under Annex I of the EU Birds Directive 2009/147/EC.

4.2.122 Puffin breeding colonies in the UK are concentrated in Scotland's Northern Isles, St Kilda, along the North Sea coast from Caithness to Yorkshire and south-west Wales (BTO, 2024). Breeding colonies are found on grass slopes, cliffs and islands where birds nest in safety from mammalian predators (Ratcliffe *et al*., 2004; BTO, 2024). Puffin winter offshore, with birds from north-west UK dispersing widely in the Atlantic Ocean from Newfoundland in the west, the Canary Islands to the south and into the Mediterranean Sea. Birds breeding in the east of the UK disperse into the North Sea, while depleting prey availability and increasing population sizes of east coast puffin population over the last two decades has resulted in birds wintering further south, to the Bay of Biscay (Ratcliffe *et al*., 2004; Furness, 2015). The UK breeding population is estimated as 580,000 breeding pairs (1998 to 2002 estimate) (Woodward *et al*., 2020), and the non-breeding season UK North Sea and Channel BDMPS is estimated as 231,957 individuals (Furness, 2015).

4.2.123 Puffin is broadly divided into three subspecies with connectivity to UK waters. The subspecies *arctica* breeds in Iceland, northern Norway, eastern Canada, and most of Greenland; *naumanni* breeds in the far north of Greenland and Svalbard; and *grabae* breeds in the Faroe Islands, Britain, Ireland, and south-west Norway (Furness, 2015; Kersten *et al*., 2021). Most UK breeding individuals of the *grabae* subspecies migrate rapidly to wintering areas in the north-west North Sea. Approximately one third of individuals migrate to the central North Atlantic, although some initially migrate west to the Newfoundland-Labrador Shelf to access abundant prey at the beginning of the migration period, before moving south-east at the beginning of winter (Furness, 2015).

4.2.124 Mean seasonal modelled densities of puffin in the seas off north-east Scotland from Waggitt (2019) shows birds predicted to occur in five small areas of high density during the breeding season (April to mid-August), reflecting their association with breeding colonies at the Shiant Isles, Sule Skerry, Foula, Fair Isle and the Firth of Forth (Figure 4.7). Low-to-moderate densities are predicted in the offshore area during the breeding season, with the exception of the areas immediately surrounding breeding colonies. During the non-breeding season (mid-August to March), puffin are absent or present in low density in much of the offshore and coastal area, with slightly higher densities predicted at the location of breeding colonies as birds may linger near colonies at the start of the non-breeding season.

4.2.125 There are five SPAs with puffin as a qualifying feature or named as part of a qualifying species assemblage within mean max + 1 SD foraging range of the Array Area (Table 3.15). The Seabirds Count census data from 2015 to 2021 (Burnell *et al.*, 2023) reports a total of 46,392 breeding pairs of puffin across the three SPAs within foraging range. This represents 8.00% of the 580,000 breeding pairs reported by Woodward *et al.* (2020) in the UK.

4.2.126 When comparing the population size of the five SPAs recorded in the Seabird 2000 and Seabird Counts censuses population trends were found to decrease for four of the five SPAs with connectivity to the Array Area. When comparing the 'comparable' accounts within Burnell *et al.* (2023), the largest decreases in population sizes were found to occur in Coquet Island SPA (45%) and Forth Islands SPA (40%). Both Farne Islands SPA and North Caithness Cliffs SPA were found to have decrease by 21%. No comparison is presented within Burnell *et al.* (2023) for Hoy SPA.

4.2.127 Puffin score low in vulnerability to displacement impacts in Bradbury *et al.* (2014) but Wade *et al.* (2016) contradict this, scoring moderate sensitivity to both structures, and vessels and helicopters (Table 3.13). Furthermore, puffin are scored moderately in habitat flexibility, indicating limited disturbance behaviour and a moderate ability to utilise alternative habitats (Wade *et al.*, 2016; Table 3.13). Therefore, as a precautionary measure, we consider the displacement vulnerability of puffin to be moderate.

4.2.128 Puffin score very low in vulnerability to collision impacts (Bradbury *et al.*, 2014; Wade *et al.*, 2016; Table 3.13). Puffin scored moderate in flight manoeuvrability but scored very low in other vulnerability factors associated with collision impacts, including percentage of flight at Wind Turbine blade height (0.5%), indicating a very low vulnerability to collision risk overall (Bradbury *et al.*, 2014; Wade *et al.*, 2016).

4.2.129 Puffin score very low in proportion of nocturnal flight (Bradbury *et al.*, 2014; Wade *et al.*, 2016; Table 3.13), indicating a very low vulnerability to impacts arising from attraction to light emitted from Offshore Infrastructure.

#### *Site-based Survey Data*

4.2.130 Puffin were recorded in all 24 monthly DAS from March 2022 to February 2024 in the DAS Area (Annex A). A total of 3,957 puffin were recorded in the DAS Area, with 1,600 puffin recorded in the first 12 months (March 2022 to February 2023), and 2,357 recorded in the second 12 months (March 2023 to February 2024). Puffin has a high abundance in the DAS Area with a peak of 843 puffin recorded in August 2023 at the end of the breeding season (April to mid-August, Table 3.3; NatureScot 2020). Having the baseline data from the larger DAS breeding season survey extent contributes useful wider background data for consideration of displacement effects on this species.

### *Conclusion*

4.2.131 Puffin have high abundance and, although Bradbury *et al.* (2014) scored puffin low vulnerability to displacement impacts, Wade *et al.* (2016) deemed a moderate vulnerability to displacement impacts for this species (Table 3.13). Therefore, puffin is included in displacement analysis and peak abundances of puffin in the Array Area plus a 2 km buffer (relevant for displacement) are summarised in Table 4.12 (also see Annex C). Puffin are excluded from CRM due to very low in vulnerability to collision impacts.

**Table 4.12: Seasonal Peak Abundance Estimates of Puffin in the Array Area Plus a 2 km Buffer (Based on Seasons in NatureScot (2020)), to be Used for Displacement Analysis**

| Area | Season | Peak year 1 | Peak year 2 | Mean peak |
|---|---|---|---|---|
| **Array Area plus 2 km buffer** | Breeding | 221 | 532 | 377 |
| **Array Area plus 2 km buffer** | Non-breeding | 862 | 547 | 705 |

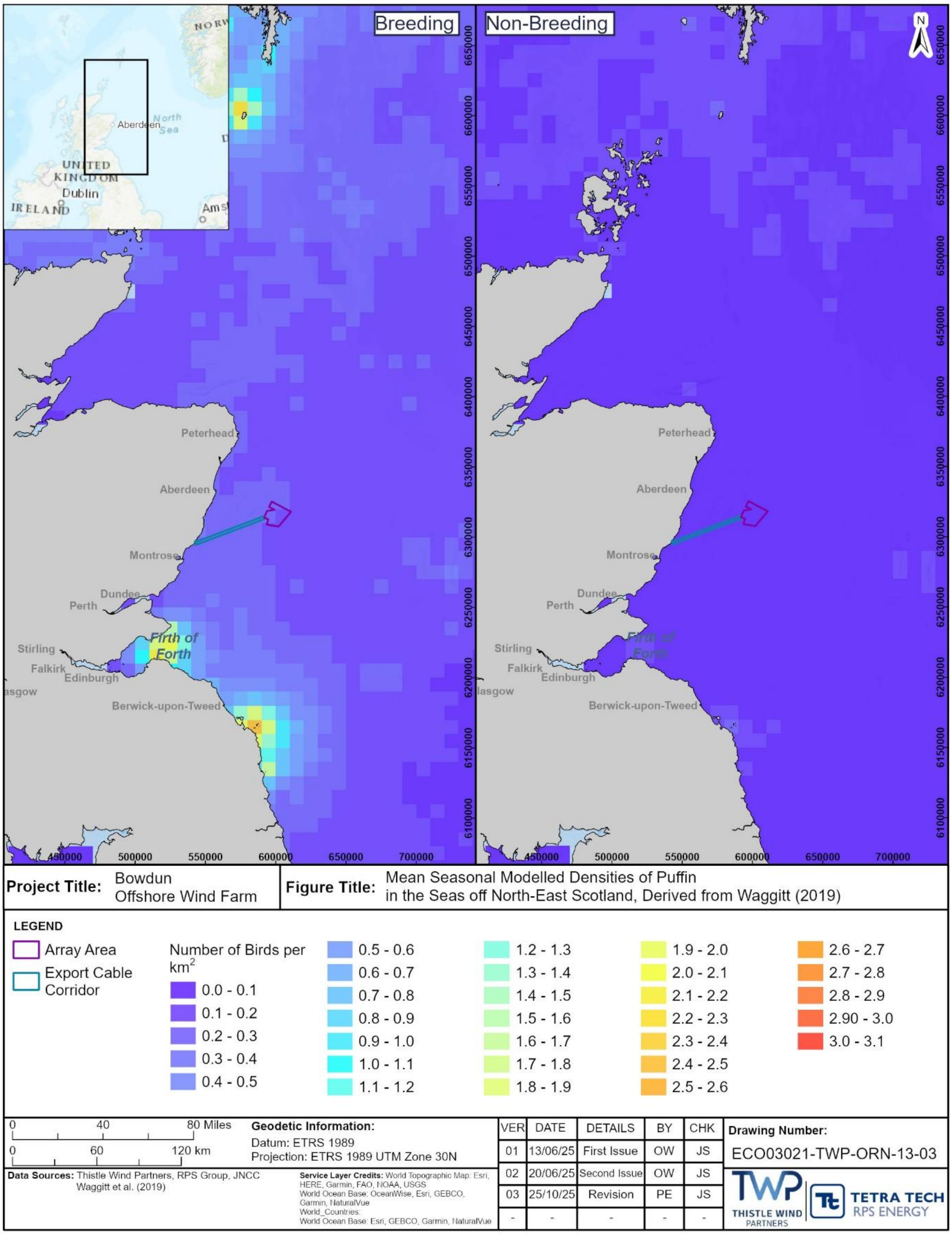



**Figure 4.7: Mean Seasonal Modelled Densities of Puffin in the Seas off North-East Scotland, Derived from Waggitt (2019)**

### Other Species

4.2.132 A number of other species were recorded in small numbers in the DAS Area. These species consist of non-seabird waterbird species (such as seaducks and wading birds) and seabirds recorded in very low numbers (Table 4.13).

**Table 4.13: Species Recorded in Low Numbers in the DAS Area and Extended DAS Area, and Not Considered for Further Assessment. Extended DAS Area only includes summer months (April to August inclusive)**

| Species | Total Months Species were Recorded[1] | Total Birds Recorded in the DAS Area | Total Birds Recorded in the Extended DAS Area |
|---|---|---|---|
| Common Scoter | 0/1 | 0 | 15 |
| Common eider | 2/10 | 2 | 522 |
| Mallard | 0/1 | 0 | 6 |
| Red-breasted Merganser | 0/2 | 0 | 3 |
| Canada Goose | 0/1 | 0 | 5 |
| Great Northern Diver | 1/1 | 1 | 1 |
| Red-throated Diver | 4/7 | 10 | 32 |
| Manx Shearwater | 8/9 | 16 | 55 |
| Sooty Shearwater | 3/1 | 4 | 3 |
| Leach's Storm Petrel | 1/0 | 1 | 0 |
| Great Cormorant | 0/4 | 0 | 15 |
| European Shag | 1/3 | 2 | 9 |
| Great Skua | 5/4 | 5 | 8 |
| Arctic Skua | 3/4 | 5 | 5 |
| Black-headed Gull | 1/7 | 1 | 161 |
| Little Gull | 2/0 | 4 | 0 |
| Common Tern | 2/4 | 3 | 9 |
| Sandwich Tern | 1/8 | 2 | 135 |
| Black Guillemot | 3/2 | 3 | 8 |
| Little Auk | 1/0 | 1 | 0 |
| Grey Plover | 1/1 | 2 | 2 |
| Golden Plover | 1/1 | 2 | 2 |
| Grey Heron | 1/1 | 2 | 2 |
| Snipe | 1/0 | 20 | 0 |
| Eurasian Curlew | 0/1 | 0 | 1 |
| Oystercatcher | 2/3 | 9 | 17 |
| Redshank | 1/1 | 43 | 43 |

[1] DAS Area/Extended DAS Area

## 4.3 Identification of Valued Ornithological Receptors

### Initial Screening of Species

4.3.1 A review of all seabird species recorded during the 24-month DAS within the DAS Area identified the Valued Ornithological Receptors (VORs) to be assessed for potential impacts from the Proposed Development. VORs were identified based on their abundance within the DAS Area, their vulnerability to impacts, and their status as a qualifying feature of SPAs with theoretical connectivity to the Array Area. The benefit of the DAS covering the DAS Area (E3 POA plus a 12 km buffer) was being able to assess the VORs using this wider understanding of bird abundance and distribution, setting the Array Area baseline in its more comprehensive context.

4.3.2 To inform the identification of VORs, the following criteria are defined for each species, and summarised in Table 4.14:

- the vulnerability (low, moderate, high) of each species to displacement and collision impacts, based on Bradbury *et al*. (2014) and Wade *et al.* (2016);
- the abundance of a species is categorised based on the recorded raw count within the DAS Area during monthly DAS:
    - <100 birds in all surveys = low;
    - 100 birds to 500 birds in at least one survey = moderate; and
    - >500 birds in at least one survey = high.

4.3.3 A species was identified as a VOR when the vulnerability to an impact is assessed as moderate or high and/or the abundance of the species is assessed as moderate or high.

### Second Screening of Species

4.3.4 A second screening step was taken to determine whether the species identified in the initial screening process were also present in the Array Area plus a 2 km buffer. JNCC (2022) guidance requires disturbance, displacement and barrier effects to be assessed up to 2 km from the Array Area, as these impacts may affect key seabird species at this distance from the Array Area. Similarly, birds can only be susceptible to collisions if they pass close to Wind Turbines within the Array Area.

4.3.5 Based on abundance measures and vulnerability to impacts, common eider was considered for displacement analysis. However, common eider demonstrates low presence in the Array Area plus 2 km buffer. Therefore, common eider was removed from further assessment (Table 4.14).

**Table 4.14: Seabird Species Present in the DAS Area, with Relative Abundance (Low, Moderate, High), and Vulnerability to Disturbance, Displacement and Barrier Effects, and Collision Impacts (Very Low, Low, Moderate, High, Very High). Species Taken Forward for Further Assessment are Indicated with an Asterisk (*)**

| Species | Abundance in the DAS Area | Collision* | Displacement | | | SPA Connectivity | Species Taken Forward for Further Assessment |
|---|---|---|---|---|---|---|---|
| | | | Overall[1] | Structures[2] | Vessels and Helicopters[2] | | |
| **Common eider** | Moderate | Low/Low | Moderate | Moderate | Moderate | No | No – although species recorded in moderate abundance, low presence in the Array Area plus 2 km buffer |
| **Fulmar*** | High | Very Low/ Very Low | Very Low | Very Low | Very Low | Yes | Yes – species recorded in high numbers |
| **Manx shearwater** | Low | Very Low/ Very Low | Very Low | Very Low | Very Low | Yes | No – species recorded in low numbers |
| **Sooty shearwater** | Low | Very Low/ Very Low | Very Low | Very Low | Very Low | No | No – species recorded in low numbers |
| **European storm petrel** | Low | Low/Low | Very Low | Very Low | Very Low | Yes | No – species recorded in low numbers |
| **Gannet*** | High | High/High | Very Low | High | Very Low | Yes | Yes – high vulnerability, species recorded in high numbers |

| Species | Abundance in the DAS Area | Collision* | Displacement | | | SPA Connectivity | Species Taken Forward for Further Assessment |
|---|---|---|---|---|---|---|---|
| | | | Overall[1] | Structures[2] | Vessels and Helicopters[2] | | |
| **Great skua** | Low | Moderate/ Very High | Very Low | Very Low | Very Low | Yes | No – species recorded in low numbers |
| **Kittiwake*** | High | High/Very High | Very Low | Low | Low | Yes | Yes – species recorded in high numbers |
| **Great black-backed gull*** | Low | Very High/ Very High | Low | Low | Very Low | No | Yes – although species recorded in low abundance, there was persistent presence in the Array Area |
| **Lesser black-backed gull** | Low | Very High/ Very High | Very Low | Low | Very Low | Yes | No – species recorded in low numbers |
| **Herring gull*** | High | Very High/ Very High | Very Low | Low | Very Low | Yes | Yes – very high vulnerability, species recorded in high numbers |
| **Common gull** | Low | High/ Very High | Low | Low | Low | No | No – species recorded in low numbers |
| **Arctic tern*** | Moderate | Low/ Moderate | Low | Low | Low | No | Yes – species recorded in moderate numbers |

| Species | Abundance in the DAS Area | Collision* | Displacement | | | SPA Connectivity | Species Taken Forward for Further Assessment |
|---|---|---|---|---|---|---|---|
| | | | Overall[1] | Structures[2] | Vessels and Helicopters[2] | | |
| **Common tern** | Low | Moderate/ Moderate | Low | Low | Low | No | No – species recorded in low numbers |
| **Guillemot*** | High | Very Low/ Very Low | Moderate | High | Moderate | Yes | Yes – moderate vulnerability, species recorded in high numbers |
| **Razorbill*** | High | Very Low/ Very Low | Moderate | High | Moderate | Yes | Yes – moderate vulnerability, species recorded in high numbers |
| **Puffin*** | High | Very Low/ Very Low | Low | Moderate | Moderate | Yes | Yes – species recorded in high numbers |
| **Snipe** | Low | NA | NA | NA | NA | No | No – species recorded in low numbers |

* Bradbury *et al.* (2014)/Wade *et al.* (2016). The numerical rankings of Wade *et al.* (2016) have been translated to vulnerability: >200 = Very High, 101 to 200 = High, 51 to 100 = Moderate, 1 to 50 = Low, 0 = Very Low.
[1] Bradbury *et al.* (2014).
[2] The numerical rankings of Wade *et al.* (2016) have been translated to vulnerability: 5 = Very High, 4 = High, 3 = Moderate, 2 = Low and 1 = Very Low.
[3] The numerical rankings of Wade *et al.* (2016) have been translated to vulnerability: 4 = Low, 3 = Moderate, 2 = Moderate and 1 = High.

# 5 Summary

5.1.1 This technical report presents the offshore ornithology baseline characterisation for the Array Area Study Area for the Proposed Development (see Figure 1.1).

5.1.2 This technical report uses desk-based and comprehensive site DAS results to assess the abundance and distribution of seabirds within the offshore environment, including in relation to SPAs. LiDAR surveys were also conducted to help characterise flight heights of key species in the Array Area Study Area. NEEOG-funded and other tracking data were also noted for key species.

5.1.3 The baseline DAS data spanned 24 months and covered a 12 km buffer around the POA, with April to August (inclusive) being extended to the Aberdeenshire coast in both years. This has resulted in a particularly thorough and comprehensive understanding of the baseline characteristics of the survey and Array Areas. The fact that the survey period also happened to include one year with a greater abundance of birds (2022/2023) and one year when bird numbers were lower (2023/2024), underscores the value of the two year data collection campaign, and has resulted in a balanced insight into the abundance and distribution of key seabird species over this period, for use in this baseline characterisation and for the EIA and HRA.

5.1.4 From these data, the bird species requiring additional assessment for CRM and displacement analysis for the Proposed Development were identified (Table 5.1).

5.1.5 Out of the 33 species and 20 species groups recorded in the Array Area Study Area, fulmar, gannet, kittiwake, great black-backed gull, herring gull, Arctic tern, guillemot, razorbill and puffin are considered for further assessment (Table 5.1). Guillemot is the most abundant species recorded in the survey and Array Areas. The SPAs with which these species have potential connectivity have also been identified.

5.1.6 The abundance data used for displacement analysis and the densities used for CRM are available in Annex C.

**Table 5.1: Summary of Valued Ornithological Receptors and Potential Impacts. Vulnerability was Precautionarily Summarised from Wade *et al.* (2016) and Bradbury *et al.* (2014)**

| Species | Abundance in the DAS Area | Frequency of months recorded within DAS Area (individuals) | SPA Connectivity | Vulnerability | | Potential Impact | |
|---|---|---|---|---|---|---|---|
| | | | | Disturbance and displacement | Collision risk | Disturbance and displacement | Collision risk |
| **Fulmar** | High | 24/24 | Yes | Very Low | Very Low | ✓ [a] | x [b] |
| **Gannet** | High | 23/24 | Yes | Very low | High | ✓ | ✓ |
| **Kittiwake** | High | 24/24 | Yes | Very low | High | ✓ [a] | ✓ |
| **Great black-backed gull** | Low | 15/24 | No | Low | Very High | x [c] | ✓ |
| **Herring gull** | High | 21/24 | Yes | Very low | Very High | x [c] | ✓ |
| **Arctic tern** | Moderate | 7/24 | No | Low | Moderate | x [c] | ✓ |
| **Guillemot** | High | 24/24 | Yes | Moderate | Very Low | ✓ | x [b] |
| **Razorbill** | High | 24/24 | Yes | Moderate | Very Low | ✓ | x [b] |
| **Puffin** | High | 24/24 | Yes | Low | Very Low | ✓ | x [b] |

a. Recommended for inclusion by NatureScot (2023d).
b. Species flight behaviour indicates as very low risk of collision (Bradbury *et al.*, 2014).
c. Classified as having low to very low vulnerability to disturbance and displacement (Furness *et al.*, 2013; Bradbury *et al.*, 2014).

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