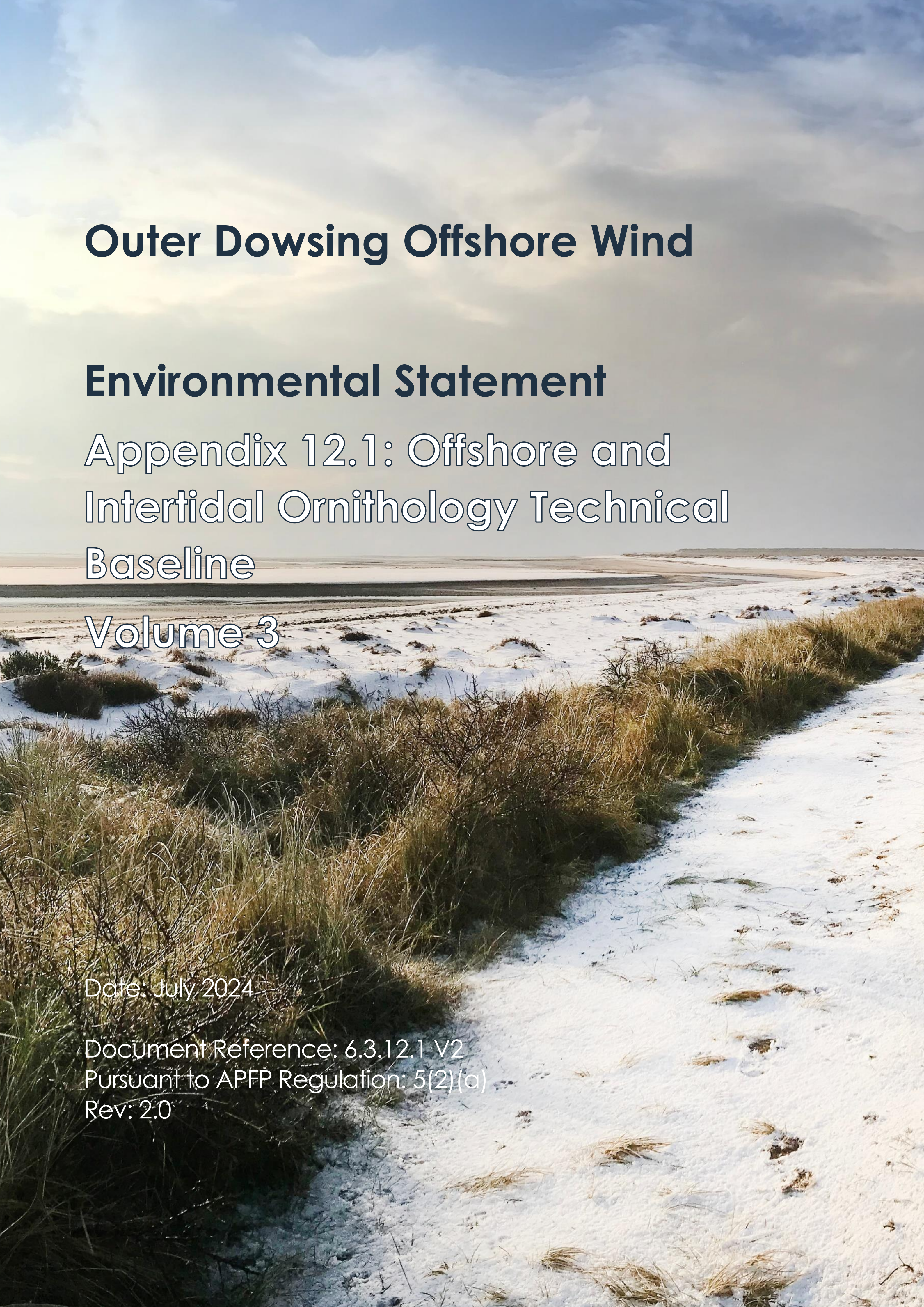

Outer Dowsing Offshore Wind

Environmental Statement

Appendix 12.1: Offshore and Intertidal Ornithology Technical Baseline

Volume 3

Date: July 2024

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</table>

Table of Contents

Table of Tables

Table of Figures

Acronyms & Definitions

Abbreviations / Acronyms

Abbreviation / Acronym	Description
ANS	Artificial Nesting Structure
AoS	Area of Search
ASL	Above Sea level
BDMPS	Biologically Defined Minimum Population Scales
BTO	British Trust for Ornithology
CI	Confidence Interval
CL	Confidence Limits
CV	Coefficient of Variance
DAS	Digital Aerial Survey
DCO	Development Consent Order
ECC	Export Cable Corridor
ETG	Expert Topic Group
GSD	Ground Sample Distance
GT R4 ltd	The Applicant. The special project vehicle created in partnership between Corio Generation (a wholly owned Green Investment Group portfolio company), Gulf Energy Development and TotalEnergies.
JNCC	Joint Nature Conservation Committee
LCL	Lowe Confidence Level
NA	Not Applicable
NEWS	Non-Estuarine Waterbird Surveys
ODOW	Outer Dowsing Offshore Wind (The Project)
ORCP	Offshore Reactive Compensation Platform
QA	Quality Assurance
SPA	Special Protection Area
UCL	Upper Confidence Level
WeBS	Wetland Bird Survey
WTG	Wind Turbine Generator

Terminology

Term	Definition
AfL array area	The area of the seabed awarded to GT R4 Ltd. through an Agreement for Lease (AfL) for the development of an offshore wind farm, as part of The Crown Estate's Offshore Wind Leasing Round 4.
Array Area	The area offshore within which the generating stations will be situated (including wind turbine generators (WTG), offshore platforms and Inter-array cables).
Baseline	The status of the environment at the time of assessment without the development in place.
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of an impact with the sensitivity of a receptor, in accordance with defined significance criteria.
GT R4 Ltd	The Applicant making the application for a DCO. Refer to as GT R4 Ltd on first introduction, then "the Applicant" thereafter. The Applicant is GTR4 Limited (a joint venture between Corio Generation and Total Energies), trading as Outer Dowsing Offshore Wind. The project is being developed by Corio Generation (a wholly owned Green Investment Group portfolio company) and Total Energies.
Impact	An impact to the receiving environment is defined as any change to its baseline condition, either adverse or beneficial.
Intertidal	Area where the ocean meets the land between high and low tides.
Landfall	The location at the land-sea interface where the offshore export cable will come ashore.
Outer Dowsing Offshore Wind (ODOW)	The project
Offshore Export Cable Corridor (ECC)	The Offshore Export Cable Corridor (Offshore ECC) is the area within the ES Boundary within which the export cable running from the array to landfall will be situated.
Onshore infrastructure	The combined name for all onshore infrastructure associated with the Project from landfall to grid connection.
Receptor	A distinct part of the environment on which effects could occur and can be the subject of specific assessments. Examples of receptors include species (or groups) of animals or plants, people (often categorised further such as 'residential' or those using areas for amenity or recreation), watercourses etc.
Study Area	Area(s) within which environmental impact may occur –to be defined on a receptor-by-receptor basis by the relevant technical specialist.
The Project	Outer Dowsing Offshore Wind including proposed onshore and offshore infrastructure

12 Offshore and Intertidal Ornithology

12.1 Introduction

12.1.1 Project background

1. GT R4 Limited (trading as Outer Dowsing Offshore Wind) hereafter referred to as the 'Applicant', is proposing to develop the Project. The Project array area will be located approximately 54km from the Lincolnshire coastline in the southern North Sea. The Project will include both offshore and onshore infrastructure including an offshore generating station (windfarm), export cables to landfall, Offshore Reactive Compensation Platforms (ORCPs), onshore cables, connection to the electricity transmission network, ancillary and associated development and areas for the delivery of up to two Artificial Nesting Structures (ANS) and the creation of a biogenic reef (if these compensation measures are deemed to be required by the Secretary of State) (see Volume 1, Chapter 3: Project Description (document reference 6.1.3) for full details.).
2. This technical appendix provides and interprets offshore and intertidal ornithology data to determine the receptors that characterise the baseline and are of relevance to the assessment of potential impacts from the Project. It has also been produced to support Volume 1, Chapter 12: Offshore and Intertidal Ornithology (document reference 6.1.12). In addition, the data within this report are used to inform potential Project impacts as presented within Volume 3, Appendix 12.2: Collision Risk Modelling Assessment Appendix (document reference 6.3.12.2) and Volume 3, Appendix 12.3: Displacement Assessment Appendix (document reference 6.3.12.3).

12.1.2 Aims and Objectives

3. The aim of this report is to present the results from offshore and intertidal bird surveys, to determine the species that characterise the baseline environment, and to determine which are of relevance to the assessment of potential impacts from the Project. The data sources used to define the baseline characteristics include site-specific digital aerial surveys (DAS), vantage point and landfall surveys for offshore ornithology, alongside existing data sources extracted from a desk-based review.
4. This report is primarily based on information on ornithological receptors in the Project array area and associated buffer from the 30 consecutive months of DAS undertaken between March 2021 and August 2023. Data were used to determine:
   - Abundance and density estimates of birds (monthly and for bio-seasons);
   - Bird behaviours (flying and sitting on the water);
   - Spatial distribution within the site and across bio-seasons.

12.1.3 Study Area

5. The study area for the offshore ornithological receptors covers 926km^2, covering the Project array area and a 4km surrounding buffer, the Export Cable Corridor (ECC) and the cable landfall area. Within the assessment, the high levels of mobility of birds were also taken into account, recognising that some recorded birds may nest outside of the Project survey area but fly into or across the area at different times of the year for feeding and/or migration.
6. The study area for offshore ornithology and its relation to the Project is presented in Figure 12.1.

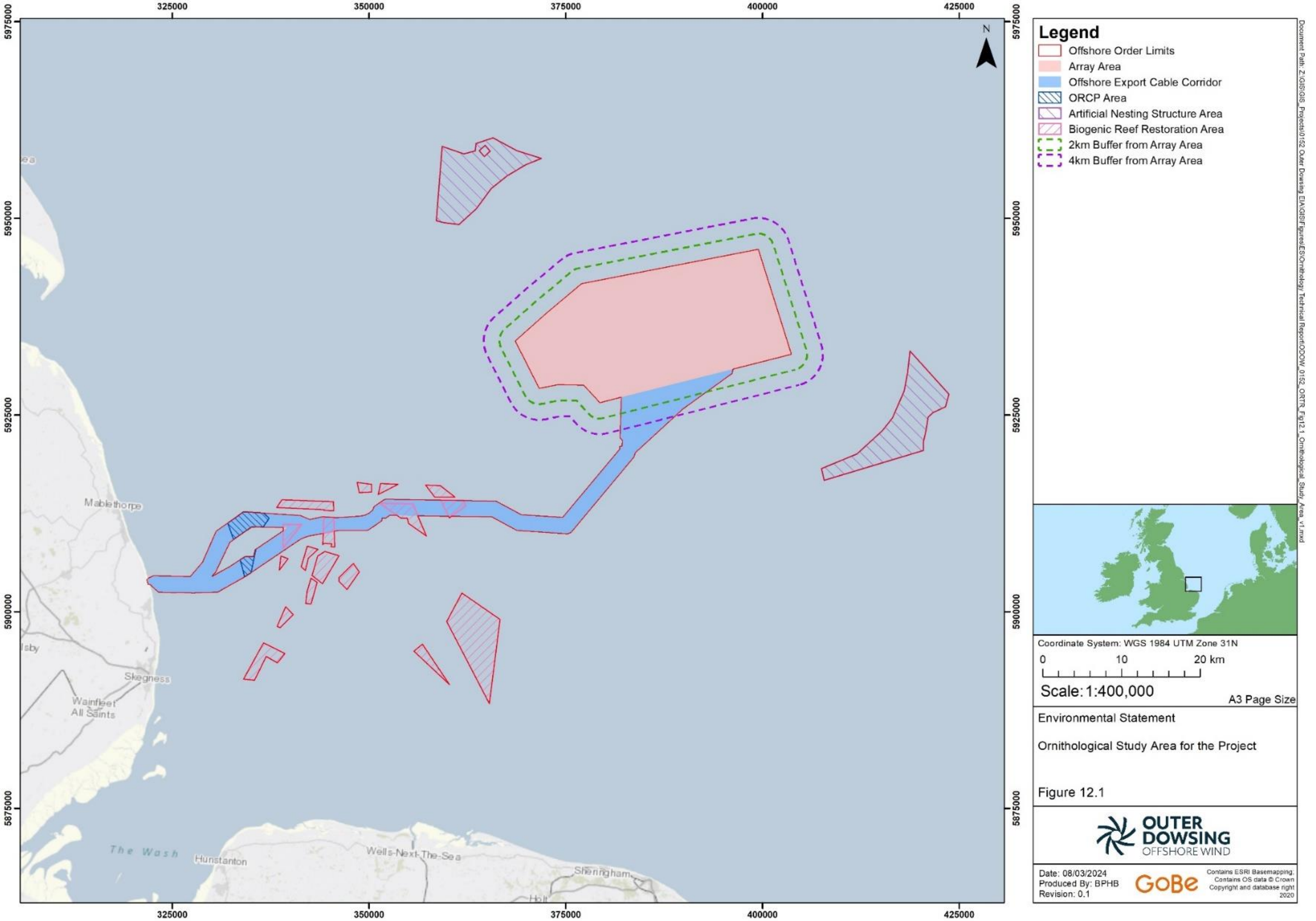

Figure 12.1. Offshore Order Limits relevant to offshore Ornithology.

12.1.4 Nomenclature

7. Throughout this report the bird species names that are used are those that are in common use amongst English ornithologists, and this corresponds to the "British (English) vernacular name 2022" column of the list of English and scientific names prepared by the British Ornithologists' Union (BOU, 2022). The corresponding scientific names from that publication are listed in the glossary on scientific bird names at the front of this document.

12.2 Ornithological Data to Inform Baseline

12.2.1 Key Data Sources

8. The data sources in Table 12.1 provide species-specific information on the distribution and abundance of birds in the Project study area.

Table 12.1. Key sources of ornithological data used to characterise the baseline environment for the Project.

Source	Date	Summary	Coverage of study area
Outer Dowsing DAS data.	2021 – 2023	DASs conducted monthly by HiDef between March 2021 and August 2023.	Surveys covered the AfL array area plus a 4km buffer, which incorporates the Project array area, plus a 4km buffer.
JNCC – red-throated diver, little gull and common scoter winter numbers in the Greater Wash survey report (Lawson *et al.,* 2016).	2002 - 2008	DASs undertaken to assess the importance of the Greater Wash to red-throated diver, little gull and common scoter.	Coverage of inshore areas and Offshore ECC relevant to the Project.
Wildfowl and Wetlands Trust – Aerial surveys of waterbirds in the UK.	2004-2009	Aerial surveys of waterbirds around the UK.	Coverage of inshore waters relevant to the Project from survey grids GW4, GW8, GW9 and GW10.
British Trust for Ornithology (BTO) Non-Estuarine Waterbird Surveys (NEWS).	1984 - 2016	NEWS provides recordings focused on intertidal habitats along the UK coastline. These were conducted in 1984/1985, 1997/98, 2006/07 and 2015/16.	Covers the Offshore ECC and cable landfall.
BTO Wetland Bird Survey (WeBS).	Annual Reports	Annual survey reports of wetland waterbirds. Most recent being Frost *et al.*, (2021).	Coverage of UK intertidal and wetland zones. Source contains

Source	Date	Summary	Coverage of study area
			information which can be drawn upon at a Project specific scale, or a wider regional scale.
Census of kittiwake breeding on offshore oil and gas platforms.	July 2022 & June 2023	Two Project led surveys of kittiwake breeding on oil and gas platforms in proximity to the Project array area. Undertaken during July 2022 and June 2023.	All oil and gas platforms within 20km of the Project array area.
Potential impacts of offshore wind farms on birds	Various dates	Data on seabird populations and demographic rates for use in assessments e.g. Mitchell *et al.,* (2004); BirdLife International (2004); Eaton *et al.,* (2015); Musgrove *et al.*, (2013); Furness, (2015); Horswill *et al.*, (2017), JNCC (2020); Brenchley *et al.*, (2013)	These sources contain information which can be drawn upon at a Project specific scale, or a wider regional scale.
Bird breeding ecology	Various dates	Information on the breeding ecology of various bird species e.g. Cramp and Simmons (1977-94); Del Hoyo *et al.*, (1992-2011); Robinson (2005).	Generic information applicable to the Project ornithological receptors.
Bird distribution	Various dates	Publicly available reports of bird distribution in UK waters e.g. Stone *et al.*, (1995); Brown and Grice (2005); Kober *et al.*, (2010); Balmer *et al.* (2013); WWT (2013); Brenchley *et al.*, (2013). Waggitt et al., (2020).	UK wide coverage with information that can be drawn upon at an Project specific scale, or a wider regional scale. Also covers ANS areas of search, and ORCPs.
Bird migration and foraging movements	Various dates	Bird movements during breeding season foraging trips and migratory movements e.g. Wernham *et al.*, (2002); Thaxter *et al.,* (2012); Woodward *et al.,* (2019).	These sources contain information which can be drawn upon at an Project specific scale, or a wider regional scale. Also covers ANS areas of search, and ORCPs.

12.2.2 Digital Aerial Surveys

12.2.2.1 Digital Aerial Survey Methodology

9. A programme of high-resolution DAS took place March 2021 and August 2023, conducted by HiDef Ltd. Surveys consisted of 2.5km-spaced transects across the Project AfL area (500km^2) plus a 4km buffer, creating an overall survey area of 926.39km^2. An additional monthly survey was carried out between March and August 2022 providing two monthly surveys (doubling survey effort) for these months. It should be noted that the ornithology study area encompasses the final array area plus a 4km buffer. Therefore the data presented in this report is primarily based on this reduced area, not the full AfL area plus 4km buffer, unless otherwise stated.
10. Surveys were undertaken using an aircraft equipped system with four HiDef Gen II cameras with sensors set to a resolution of 2cm Ground Sample Distance (GSD) aligning with the best practice guidance from Natural England (Parker *et al.*, 2022a). Each camera sampled a strip of 125m width, separated from the next camera by ~25m, thus providing a combined sampled width of 500m within a 575m overall strip. The survey aimed to achieve a minimum of 15% coverage of the survey area, and data from two out of the four cameras were processed to achieve this. This ensured the survey had sufficient coverage and number of transects for precise abundance and density estimation, with the remaining unprocessed data archived. The survey dates and area coverage for the surveys are provided in Table 12.2 below. A figure outlining the project survey design is shown below in Figure 12.2.
11. Surveys were flown at a height of approximately 550m above sea level (ASL; ~1800'). Flying at this height ensures that there is reduced risk of flushing species that are easily disturbed by aircraft noise. Thaxter *et al.*, (2016) recommends a minimum flight altitude of 460 – 500m ASL.

Table 12.2. Dates and coverage of digital aerial surveys of the Project study area included in the ES.

Survey date	Area covered (km^2)	Area covered (%)	Total number of transects analysed	Total length of transects analysed (km)
22 March 2021	151.84	16.4	22	607.36
04 April 2021	151.97	16.4	22	607.88
12 May 2021	152.19	16.4	22	608.74
09 June 2021	151.38	16.4	22	605.53
24 July 2021	151.68	16.4	22	606.71
14 August 2021	152.13	16.4	22	608.53
07 September 2021	151.71	16.4	22	606.83
09 October 2021	152.23	16.5	22	608.92
02 November 2021	152.07	16.4	22	608.29
15 December 2021	151.63	16.4	22	606.51
06 January 2022	151.63	16.4	22	606.50
23 February 2022	151.65	16.4	22	606.59
11 March 2022	152.19	16.4	22	608.74
22 March 2022	152.29	16.5	22	609.15

Survey date	Area covered (km^2)	Area covered (%)	Total number of transects analysed	Total length of transects analysed (km)
02 April 2022	151.55	16.4	22	606.22
15 April 2022	151.94	16.4	22	607.75
02 May 2022	151.53	16.4	22	606.13
17 May 2022	152.28	16.5	22	609.14
09 June 2022	151.75	16.4	22	607.01
21 June 2022	151.18	16.3	22	604.74
04 July 2022	151.89	16.4	22	607.55
16 July 2022	152.29	16.5	22	609.17
08 August 2022	152.16	16.4	22	608.66
23 August 2022	151.91	16.4	22	607.65
13 September 2022	152.27	16.5	22	609.01
25 September 2022	152.22	16.4	22	608.87
10 October 2022	151.98	16.4	22	607.94
07 November 2022	147.99	16.0	22	591.95
13 December 2022	150.94	16.3	22	603.76
26 January 2023	151.49	16.3	22	605.98
10 February 2023	152.01	16.4	22	608.31
24 March 2023	152.52	16.5	22	610.07
05 April 2023	152.25	16.5	22	609.01
03 May 2023	151.36	16.4	22	605.42
17 June 2023	150.97	16.3	22	603.88
05 July 2023	151.75	16.4	22	606.99
10 August 2023	151.84	16.4	22	607.35

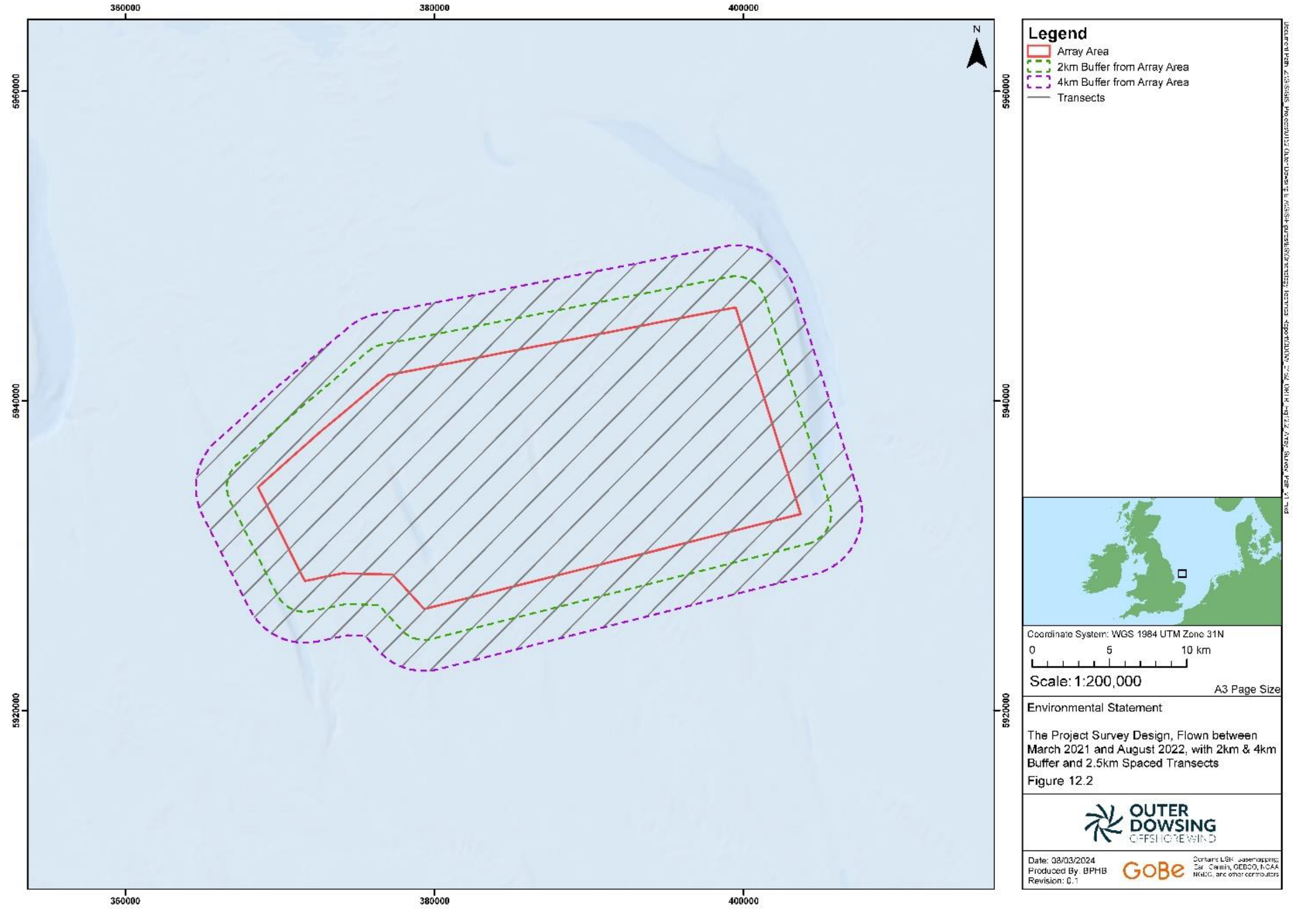

Figure 12.2. The Project survey design, flown between March 2021 and August 2023, with 2km & 4km buffer and 2.5km spaced transects.

12.2.2.2 Image analysis

12. Images were analysed by trained reviewers who located, identified and recorded all birds in each image. Where identification to species was not possible, a group level was assigned (e.g., 'Shearwater species'). The grouping for birds not identifiable to species level is provided in Table 12.3. Additional behavioural information was also recorded, including whether the bird was sitting, loafing on land or other objects, flying, diving, or taking off. Detail on approximate age, sex and any other details of interest was also recorded where possible.
13. To ensure high data quality, an internal quality assurance (QA) process was carried out on the data from each survey. A 'blind' review of 20% of the raw data was carried out and results compared to those of the original analysis. If 90% agreement was not achieved during the QA process, then corrective action was initiated: the remaining data set was reviewed and where appropriate, the failed reviewer's data discarded and all the data re-reviewed.

Table 12.3. Groupings for birds not identifiable to species level.

<table>
<tr><th>Species</th><th>Species Grouping Level 1</th><th>Species Grouping Level 2</th><th colspan="2">Species Grouping Level 3</th><th>Species Grouping Level 4</th></tr>
<tr><td>Fulmar</td><td>NA</td><td>NA</td><td>NA</td><td rowspan="4">NA</td><td rowspan="8">Fulmar/gull species</td></tr>
<tr><td>Lesser black-backed gull</td><td rowspan="3">Large gull species</td><td rowspan="7">Unknown gull species</td><td rowspan="3">NA</td></tr>
<tr><td>Great black-backed gull</td></tr>
<tr><td>Herring gull</td></tr>
<tr><td>Kittiwake</td><td rowspan="4">Small gull species</td><td rowspan="7">Tern/small gull species</td><td rowspan="4">Auk/small gull species</td></tr>
<tr><td>Little gull</td></tr>
<tr><td>Black-headed gull</td></tr>
<tr><td>Common gull</td></tr>
<tr><td>Sandwich tern</td><td>NA</td><td rowspan="3">Tern species</td><td rowspan="3">NA</td><td rowspan="6">NA</td></tr>
<tr><td>Common tern</td><td rowspan="2">Arctic/common tern ('Commic tern')</td></tr>
<tr><td>Arctic tern</td></tr>
<tr><td>Arctic skua</td><td rowspan="2">Skua species</td><td rowspan="2">NA</td><td rowspan="2">NA</td><td rowspan="2">NA</td></tr>
<tr><td>Great skua</td></tr>
<tr><td>Red-throated diver</td><td>Diver species</td><td>NA</td><td rowspan="2">Large auk/diver species</td><td>NA</td></tr>
<tr><td>Guillemot</td><td>Large auk</td><td>Auk species</td><td></td><td></td></tr>
</table>

Species	Species Grouping Level 1	Species Grouping Level 2	Species Grouping Level 3		Species Grouping Level 4
Razorbill				Auk/small gull species	Auk/shearwater species
Little Auk	Small auk		NA		
Puffin					
Manx shearwater	Shearwater species	NA	NA	NA	
Curlew	Wader species	NA	NA	NA	NA

12.2.3 Intertidal bird surveys to inform the baseline of the landfall area

14. A total of 14 hour long vantage point surveys were carried out at the proposed Wolla Bank landfall site through the autumn of 2022 and the winter of 2022/2023. These surveys focussed on waterbird species, along with any species noted that were listed on Annex 1 of the Birds Directive, or any large groups of other species of conservation concern.
15. Results from these surveys are presented in Table 12.8.

12.2.4 Existing Datasets to Inform Baseline of the Array Area and ORCP locations

16. The DAS carried out over the array area from March 2021 to August 2023 found 25 species of seabird utilising the area and two species of terrestrial bird (curlew and oystercatcher) passing through it. The most abundant species found were guillemot (maximum abundance 12,999 birds), razorbill (maximum abundance 5,244 birds) and kittiwake (maximum abundance 5,479 birds). Further information on the Project array area habitat is provided in the species accounts below.
17. Site specific data were augmented by datasets for offshore bird distribution, numbers and migration as outlined in Table 12.1.

12.2.5 Existing datasets to inform the Baseline of the ANS search area

18. Assuming a requirement to provide compensation for impacts on breeding kittiwakes from FFC SPA, areas suitable for the siting of artificial nesting structures were considered. The search was refined through consideration of distance to existing colonies (in order to avoid competition with existing breeders but be close enough to attract immigrant first time breeders), wind farms, and densities of forage fish (Kittiwake Compensation Plan 7.7.1).
19. Details of SPA locations were taken from the JNCC Website (List of UK SPAs (jncc.gov.uk)). Locations of OWF's were collated from the PINS website National Infrastructure Planning (planninginspectorate.gov.uk). Data on densities of forage fish were taken from Jensen *et al.*, (2011).

12.2.6 Existing Datasets to Inform Baseline of the Offshore ECC

20. The baseline of the Offshore ECC is based on Lawson *et al.*, (2016), which provides information on the abundance of red-throated diver, little gull and common scoter in the Greater Wash SPA survey area. Data collection (DAS) was undertaken between 2002 and 2008. The resulting mean peak population estimate for these species were 1,787, 2,153, and 3,517 individuals, respectively. Of these species, little gull is not considered at risk of displacement in the Offshore ECC, and therefore further consideration below is given to red-throated diver and common scoter only.

21. The Project Offshore ECC covers 151.2km^2 of the Greater Wash SPA. Based on these data and the overlap of the Offshore ECC with the Greater Wash SPA, the average and maximum predicted densities of common scoter and red-throated diver in the Offshore ECC are presented in Table 12.4 below. The estimated number of birds present in this overlap is based on the average density of birds (per km^2) within the Offshore ECC area multiplied by the overlap area (km^2), which results in a mean estimate of 35.1 for red-throated diver and 0.6 for common scoter within the Greater Wash SPA section of the Project Offshore ECC at any one time.

Table 12.4. Predicted average and maximum density of common scoter and red-throated diver in the Project Offshore ECC based on data by Lawson *et al.*, (2016).

Species	Average density in the Offshore ECC (birds/km^2)	Maximum density in the Offshore ECC (birds/km^2)
Common scoter	0.004	0.029
Red-throated diver	0.232	0.692

12.2.7 Data analysis

12.2.7.1 Data treatment

22. For presentation in this report, raw count data were trimmed to the survey area. Data were processed to estimate density, abundance and distribution of key species and species groups.

23. Records which were identified to species level were separated out from those identified to group level. Birds identified to group level only were apportioned to species level as outlined in Table 12.3 above.

24. The most appropriate method to incorporate data from months during which two surveys were undertaken (between March and August 2022) was to calculate the mean abundance or density of birds within each month for which two surveys were undertaken. The mean monthly abundance or density was then used within the assessments as normal. For example, the mean seasonal peak abundance was then calculated across the same bio-season between years, using the mean abundance from May 2022, with the single survey abundance from May 2021 and May 2023. Assessing impacts of collisions or displacement is carried out on a monthly, or bioseasonal basis. Assessing against a mean monthly population ensures that impacts are less likely to be under or overestimated. Likewise, for displacement, using an average acknowledges that displacement mortality is not instant. It cannot be assumed that displacement causes mortality at any given rate in response to individual episodes of displacement (especially in species like auks that feed in the water column and are therefore able to find adequate alternative foraging easily). It is more likely that displacement causes mortality in response to multiple episodes of displacement. As such, the impact of displacement should be considered using the average monthly population of the site, rather than the maximum.

12.2.7.2 Population Estimates

25. Population estimates for seabirds recorded in the Project array area, array area plus 2km buffer and array area plus 4km buffer were calculated for each species.
26. Each strip transect was treated as a statistically independent random sample from the site. The length and breadth (i.e. the width of the field of view of the camera) of each transect were multiplied together to give the transect area; dividing the number of observations for each species on each transect by the transect area gives a point estimate of the density of that species for the transect. The density of animals at the site (and hence the population size by multiplying by the area of the site), the standard deviation, the 95% confidence intervals (CIs) and coefficient of variance (CV) were then estimated using a nonparametric block bootstrap method with replacement (Buckland *et al.*, 2001), to ensure equal transect effort was sampled across each bootstrap iteration. This was done by using transect ID as the sampling unit with replacement. A group of transects were randomly sampled until their total length equalled approximately the same length as the total survey length.
27. A total of 1,000 bootstrap iterations were performed from which the mean and standard deviation of the sampled means were calculated, as well as the relative standard error (or CV) as defined by the standard deviation divided by the mean. Data were processed in the R programming language (R Core Team, 2021; version 4.1.1). The upper and lower confidence limits (CLs) define the range that the population estimate falls within with 95% certainty. The CV is a measure of the precision of the population and density estimates.
28. For most species these abundance estimates relate to absolute abundance, but for diving species such as auks, the abundance relates to relative abundance due to a proportion of animals being submerged at the time of survey.

12.2.7.3 Apportioning of Unidentified Birds

29. As per Table 12.3, birds which were not possible to identify to species were categorised as belonging to a higher-level group. Where it was not possible to assign a bird to the species group level, the bird was categorised as potentially belonging to a number of different higher-level groups. To avoid underestimating abundances due to the omission of birds not identifiable to species, the proportions of positively identified birds within a species group were assigned to the pool of unidentified birds from that species group, on a survey by survey basis. All confidence levels of species identifications (i.e. those identified as possible, probable or definite of a given species) were used in the analysis.

12.2.7.4 Correction for Availability Bias

30. During DAS, a proportion of seabirds that spend any time underwater will not be detectable at the surface. For the project, this is predominantly applicable to auk species such as guillemot, razorbill and puffin which undertake regular foraging dives underwater. To account for this, the density and abundance estimates therefore need to be corrected to allow for this 'availability bias'.
31. A species-specific correction factor was applied for each auk species recorded on the sea surface. For guillemots and razorbills, correction factors were derived from Thaxter *et al.*, (2010), estimating that the proportion of time spent at the surface for guillemots and razorbills was 0.7595 and 0.8182 respectively. For puffins, results from data loggers reported in Spencer (2012) were used, showing that the proportion of time spent at the surface was 0.8584.

12.2.7.5 Flight Direction of seabirds

32. Windrose diagrams were created to present the flight direction of seabirds, where each cardinal point (north, east, south, west, and intercardinal point (north-east, south-east, south-west, north-west) indicates the total number of birds recorded flying in that direction from a given survey. Flight direction rose diagrams have been presented for each survey.

12.2.7.6 Flight heights

33. Flight heights were calculated from images of flying birds where sample sizes and image suitability allowed. Flight height was derived from the body length of known species, when compared to body lengths of birds flying at a known height (in this case, birds flying low enough for their reflection on the water to be visible).

12.2.7.7 Bio-seasons

34. Bird behaviour and abundance will vary depending upon the bio-season (species specific, ecologically defined periods related to breeding, migration, and non-breeding). The bio-seasons used here are the biologically defined minimum population scales (BDMPS) in Furness (2015). The use of the BDMPS bio-seasons has been agreed through the Offshore and Intertidal Ornithology Expert Topic Group (ETG) (Volume 1, Chapter 12: Offshore and Intertidal Ornithology, Section 12.3).

35. Six bio-seasons are defined in this report, though not all six are applicable for all seabird species, with different combinations used depending on the biology and life history of each species. The bio-seasons are as follows:

   - Return migration: when birds are migrating to breeding grounds;
   - Migration-free breeding: when birds are attending colonies, nesting and provisioning young, and no birds within the population are migrating;
   - Post-breeding migration: when birds are migrating to wintering areas or dispersing from colonies;
   - Migration-free winter: when non-breeding birds are over-wintering in an area and all migration has ceased;
   - Breeding: Bio-season from modal return to the colony until the modal departure from the colony at the end of the breeding season; and
   - Non-breeding: bio-season from modal departure from the colony at the end of the breeding season to modal return to the colony the following year.

36. The bio-seasons used for the species accounts in Section 12.2 are outlined in Table 12.5. Notably, bio-seasons for little gull were not included in Furness (2015), and so bio-seasons were based on Cramp & Simmons (1983) and expert judgement based on data presented in Table 12.5.

Table 12.5. Bio-seasons used for detailed species accounts, based on Furness (2015) unless specified otherwise.

Species	Return Migration	Breeding	Post-breeding Migration	Migration-free Winter	Non-breeding
Kittiwake	January to February	March - August	September to December	NA	NA
Little gull[1]	NA	April to June	NA	NA	July to March

Species	Return Migration	Breeding	Post-breeding Migration	Migration-free Winter	Non-breeding
Common gull[2]	January to April	May - August	September to December	NA	NA
Great black-backed gull	NA	March to August	NA	NA	September to March
Herring gull	NA	March to August	NA	NA	September to February
Lesser black-backed gull	March to April	April to August	August to October	November to February	NA
Sandwich tern	March to May	April to August	July to September	NA	NA
Common tern	April to May	May-August	July to September	NA	NA
Guillemot	NA	March to July	NA	NA	August to February
Razorbill	January to March	April to July	August to October	November to December	NA
Puffin	NA	April to July	NA	NA	August to March
Red-throated diver	February to April	March to August	September to November	December to January	NA
Gannet	December to March	March to September	September to November	NA	NA

[1] Little gull bio-seasons defined from Cramp & Simmons (1977); [2] Common gull bio-seasons defined from NatureScot (2020).

12.2.7.8 Highly Pathogenic Avian Influenza

37. Highly Pathogenic Avian Influenza (HPAI) virus was identified as a concern within seabird populations during 2022 (e.g. EFSA, 2023). Natural England have noted that the influence of HPAI may be apparent within the DAS data for offshore windfarm (windfarms) projects undertaking surveys from June 2022 onwards (Natural England, 2022).
38. The Project undertook DAS of the array area and a 4km buffer around the proposed array area from March 2021 to August 2023 (inclusive). A single survey per month was undertaken every month, with two surveys per month undertaken between March 2022 and September 2022.
39. To determine whether the DAS data recorded before the HPAI outbreak is representative of seabird abundance and densities during a standard year (pre-HPAI), an assessment of comparable datasets from other windfarms projects in the area, as well as regional datasets was carried out.
40. Table 12.6 presents the windfarm projects that have been included within this assessment due to their close proximity to the array area. As they are in the same region of the North Sea, it is considered reasonable to assume that they may share similar characteristics influencing seabird usage and distributions.

Table 12.6. Offshore windfarm projects considered within the DAS data comparison.

Windfarm project	Distance from array	Date of DAS
Hornsea Project Four	20km (north-east)	April 2016 to March 2018
Sheringham Shoal Extension Project (SEP)	26km (south)	May 2018 and April 2020.
Dudgeon Extension Project (DEP)	14km (south)	

41. The data have also been compared to the Waggitt *et al.* (2019) dataset, a modelled density map of seabirds in the North Sea region. The census data used in the report analysis was collated from varying sources, dating from 1980 to 2018 and therefore any comparison should be caveated due to the use of boat-based techniques.
42. Mean and peak densities for each species (i.e., kittiwake; guillemot; razorbill; puffin; gannet; sandwich tern and red-throated diver) for the relevant bio-seasons as per Furness (2015) were collated for comparison with the Project's DAS data. It was assumed that HPAI would have not spread before the 2022 breeding season began, and therefore the beginning of the species-specific breeding season could be used as a proxy for the start of HPAI.
43. A description of the DAS data is found in Section 12.2. In months that had two surveys, the mean value has been presented. The mean densities and mean peak densities per bio-seasons (Table 12.7) have been calculated with the appropriate months incorporated. All months prior to the 2022 breeding season are assumed to be unimpacted by HPAI and have been included in the "pre-HPAI" calculated bio-season mean densities.
44. The Hornsea Project Four density data were extracted for the key species from the Environmental Statement (ES) Ornithology Report Appendix B. The density data were previously apportioned and corrected for all species. The estimates were analysed using the Marine Renewables Strategic environmental assessment (MRSea) R package, for all species except Sandwich tern and Red-throated diver. The array plus 4km buffer was used for all species.
45. The Sheringham Shoal Extension Project & Dudgeon Extension Project density data were extracted for the key species from the Environmental Statement (ES) Ornithology Report Appendix 1. The density data were previously apportioned to account for unidentified individuals to species level and for the proportion of birds flying, sitting and the combination of other behaviours. Sandwich tern data were analysed using MRSea. The array plus 4km buffer was used for all species.
46. The data from Waggitt *et al.* (2019) has been extracted from the distribution maps produced from the report at 10km resolution, created from species distribution models. The data were clipped using GIS to a 50km buffer around the Project array where the mean, minimum and maximum density values were extracted. The densities within the Project array plus 4km buffer were also extracted. These data were included in the comparison to highlight any differences in the Project's DAS to historical regional data. Both the collection methods and age of this data must be considered when making comparisons to the abundances and densities of seabirds collected by the Project.

47. As per Table 12.7 the Projects densities were higher or comparable to the densities presented by other projects and Waggitt *et al.* (2019), importantly for key species: kittiwake, guillemot and gannet. Therefore, it was considered reasonable to assume that the Project's DAS data are representative of a standard year pre-HPAI and as such were used within the assessments as normal. In addition, there were no obvious impacts to the densities of birds due to HPAI in the post-HPAI DAS data.
48. It is important to note that there are large differences in the distribution of the seabirds annually. Some variation between different months within the same dataset are larger than the variation between projects/regional datasets. The data have been collated from surveys spanning from 1980s (Waggitt *et al.*, 2019) to Hornsea Project Four which was first collected in 2016 and more recent data collected from 2018/2019. The variation in densities could be due to the annual variation observed in seabirds due to other factors unrelated to HPAI, including prey availability and distribution.
49. Lastly, it is important to note that seabird counts at FFC SPA, the closest SPA to the Project array area, seem to be relatively unaffected by HPAI impacts to survival. For example, guillemot and razorbill counts have increased by 4.5% and 9.5% respectively, between 2017 and 2022. In addition, Butcher *et al.,* (2023) reported relatively minor impacts from HPAI at FFC SPA for kittiwake and auk species, and although gannets have been badly impacted by HPAI further North, the colony at FFC SPA reached its largest recorded size in the 2023 census.

Table 12.7. Summary of mean and peak key species densities by bio-seasons (Furness, 2015)

Bio-season	Outer Dowsing windfarm pre-HPAI		Outer Dowsing windfarm post-HPAI		Waggitt Outer Dowsing windfarm +4km		Waggitt Outer Dowsing windfarm +50km		Hornsea Four		Dudgeon Extension Project		Sheringham Shoal Extension Project	
	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities
Kittiwake														
Return Migration	3.85	10.19	1.45	2.9	0.35	0.45	0.4	0.51	1.3	4.35	2.22	8.02	0.46	1.74
Migration-free breeding	2.51	3.23	3.24	5.05	0.18	0.19	0.22	0.23	2.02	3.44	1.56	2.42	0.09	0.22
Post-breeding migration	1.85	6.13	1.32	4.14	0.33	0.42	0.38	0.48	2.69	6.24	1.7	4.01	0.25	0.46
Guillemot														
Breeding season	12.84	32.77	13.98	28.75	0.62	0.91	0.63	0.94	8.53	11.4	7.96	25.4	2.55	5.01
Non-breeding	14.06	34.39	7.57	25.5	1.22	1.35	1.23	1.39	15.82	39.45	16.61	57.81	2.08	5.21
Razorbill														
Return Migration	5.79	7.02	6.53	11.66	0.20	0.24	0.19	0.23	0.33	0.37	0.56	1.12	0.3	0.45
Migration-free breeding	3.88	10	2.36	4.28	0.06	0.07	0.06	0.06	0.25	0.39	1.8	6.36	0.75	2.86
Post-breeding migration	2.89	5.12	1.22	2.38	0.18	0.21	0.16	0.2	2.51	4.41	6.52	12.24	1.37	3.65
Migration-free winter	3.39	3.79	1.88	2.48	0.11	0.22	0.21	0.22	0.63	0.76	2.21	2.74	2.24	3.39

Bio-season	Outer Dowsing windfarm pre-HPAI		Outer Dowsing windfarm post-HPAI		Waggitt Outer Dowsing windfarm +4km		Waggitt Outer Dowsing windfarm +50km		Hornsea Four		Dudgeon Extension Project		Sheringham Shoal Extension Project	
	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities
Puffin														
Breeding season	0.14	0.41	0.17	0.31	0.02	0.03	0.03	0.03	0.10	0.25	0.05	0.06	0.02	0.04
Non-breeding	0.83	2.46	0.20	0.37	0.03	0.04	0.02	0.03	0.13	0.48	0.04	0.12	0.01	0.05
Gannet														
Return Migration	0.11	0.31	0.09	0.24	0.06	0.06	0.06	0.07	0.18	0.35	0.06	0.11	0.02	0.04
Migration-free breeding	0.34	1.01	0.72	1.22	0.12	0.17	0.13	0.19	0.63	0.8	0.48	1.26	0.09	0.18
Post-breeding migration	0.23	0.33	0.64	1.41	0.12	0.17	0.14	0.18	0.84	1.00	0.99	1.19	0.5	1.42
Sandwich tern														
Return Migration	0.24	0.28	-	-	-	-	-	-	0.00	0.00	1.16	2.48	0.32	0.92
Migration-free breeding	0.05	0.05	0.13	0.13	-	-	-	-	0.00	0.00	0.91	0.91	0.81	0.81
Post-breeding migration	0.01	0.02	0.00	0.01	-	-	-	-	0.01	0.01	0.76	1.85	0.6	1.68
Red-throated diver														
Return Migration	0.28	0.30	0.00	0.00	-	-	-	-	0.00	0.00	0.11	0.15	0.21	0.55

Bio-season	Outer Dowsing windfarm pre-HPAI		Outer Dowsing windfarm post-HPAI		Waggitt Outer Dowsing windfarm +4km		Waggitt Outer Dowsing windfarm +50km		Hornsea Four		Dudgeon Extension Project		Sheringham Shoal Extension Project	
	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities	Mean densities	Mean peak densities
Migration-free breeding	0.01	0.02	0.00	0.01	-	-	-	-	0.00	0.00	0.01	0.02	0.00	0.01
Post-breeding migration	0.01	0.03	0.01	0.01	-	-	-	-	0.00	0.00	0.03	0.05	0.11	0.22
Migration-free winter	0.01	0.02	0.02	0.03	-	-	-	-	0.00	0.00	0.01	0.01	0.02	0.03

12.3 Results

12.3.1 Intertidal survey results

50. Results from intertidal bird surveys carried out over the autumn of 2022 and the winter of 2022/2023 are presented in Table 12.8. A total of 14 counts were made over that period on the Wolla Bank landfall site, with data collected by observers using a standard vantage point survey methodology. On each date surveyed, data were recorded during hour long watches with a focus on waterbirds, any species listed on Annex 1 of the Birds Directive, and large groups of other species of conservation concern.

Table 12.8 Summarised observations from vantage point surveys at Wolla Bank.

Species	13/09/22	29/09/22	14/10/22	24/10/22	14/11/22	29/11/22	05/12/22	20/12/22	10/01/23	24/01/23	01/02/23	13/02/23	28/02/23	27/03/23	Total
Pink-footed goose	0	0	0	2	1	0	0	0	0	0	0	0	0	0	3
Greylag goose	0	32	0	0	0	0	0	0	0	0	0	0	0	0	32
Canada goose	0	0	0	0	0	0	0	11	0	0	0	0	0	0	11
Dark-bellied brent goose	0	0	0	7	0	0	4	0	0	0	0	0	0	0	11
Shelduck	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Mallard	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
Wigeon	0	0	33	0	0	0	0	0	0	0	0	500	0	0	533
Teal	0	0	0	12	0	0	0	0	0	0	0	0	0	0	12
Pintail	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
Eider	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Common scoter	0	0	0	18	23	13	7	10	40	14	0	0	0	15	140
Oystercatcher	2	2	0	2	0	4	2	0	3	0	3	2	0	0	20
Golden plover	23	0	0	0	34	0	0	0	0	0	0	0	0	0	57
Grey plover	0	0	0	0	0	1	0	1	1	0	0	0	0	0	3
Curlew	0	0	2	1	2	0	0	2	0	8	16	18	5	6	60
Sanderling	0	3	11	0	0	12	19	7	11	3	7	4	4	3	84
Dunlin	0	0	0	0	17	7	12	6	0	0	0	0	0	0	42
Redshank	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Black-headed gull	4	8	12	12	13	9	10	17	10	9	16	15	9	30	174
Common gull	18	11	55	10	7	16	16	32	35	12	16	59	12	19	308

Species	13/09/22	29/09/22	14/10/22	24/10/22	14/11/22	29/11/22	05/12/22	20/12/22	10/01/23	24/01/23	01/02/23	13/02/23	28/02/23	27/03/23	Total
Great black-backed gull	0	0	0	0	0	0	3	2	4	0	0	0	2	1	12
Herring gull	3	3	9	4	5	2	2	5	4	3	16	5	3	4	68
Lesser black-backed gull	0	2	2	0	2	2	1	0	0	2	2	0	1	2	16
Red-throated diver	0	0	0	0	1	1	0	0	0	0	1	1	1	1	6
Great northern diver	0	0	0	0	0	1	1	1	1	1	0	0	0	0	5
Cormorant	0	0	0	2	2	2	0	2	2	0	3	1	2	3	19
Marsh harrier	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1

51. The landfall will be implemented using the Horizontal Directional Drill technique, meaning that cables will be pulled into place without any surface activity in the intertidal zone. As such, there will be no short term impacts of disturbance and displacement through human activity, and no longer term displacement impacts through infrastructure in the intertidal area. Therefore, combined with the low numbers of birds present in the search area, it is considered that impacts from landfall will be minimal, and are therefore not considered further.

12.3.2 Offshore Ornithology Survey Results

52. Over the 30-month survey period (March 2021 to August 2023) the following bird species (Table 12.9) were recorded within the Project array area and associated 4km buffer. Several species were recorded in the Project survey area in numbers deemed too low to warrant detailed species accounts; the raw data for these species is presented within Appendix B.
53. Following the recent guidance from Natural England (Parker *et al.*, 2022a) the data used for all species were from the array area plus 2km buffer except for red-throated diver where data from the array area plus 4km buffer were used (the maximum extent of the surveys).

Table 12.9. Bird species recorded in site-specific DAS of the Project array area and 4km buffer.

Oystercatcher	Lesser black-backed gull
Curlew	Great black-backed gull
Great skua	Common tern
Pomarine Skua	Arctic tern
Arctic skua	Sandwich tern
Guillemot	Red-throated diver
Razorbill	Great northern diver
Puffin	Fulmar
Little auk	Sooty shearwater
Kittiwake	Manx shearwater
Black-headed gull	Gannet
Little gull	Cormorant
Common gull	Shag
Herring gull	

54. Details regarding the abundance, distribution and phenology of each of the species listed in Table 12.9 are presented in the following species accounts, or are covered briefly in paragraphs 183 to 193.
55. Average flight heights were calculated for five species for each of the 30 months of DAS surveys. The results are shown in Table 12.65 in Annex A.

12.3.3 Kittiwake

12.3.3.1 Digital aerial survey data

56. Kittiwake were observed within the Project array area in all of the 30 months surveyed. Kittiwake presence was relatively high across the Project survey area through all three bio-seasons, with abundance and density peaking at 5,479 birds and 12.55 birds/km^2 respectively in April 2021 (Table 12.11).
57. In the array area plus 2km buffer, abundance and density peaked at a mean of 6,833 birds and 10.91 birds/km^2 respectively in April 2021 (Table 12.11). The monthly mean population estimates are presented in Table 12.11.

12.3.3.2 Kittiwake overview

58. The nearest kittiwake colony to the Project is the Flamborough and Filey Coast SPA (FFC). This is located approximately 95km from the Project and is within the mean maximum foraging range of kittiwake (156.1km, plus one standard deviation 144.5km) (Woodward *et al.*, 2019). Outside the breeding season, impacts on kittiwake have been compared to the UK North Sea BDMPS, consisting of 829,937 individuals during autumn migration (August to December), and 627,816 individuals during spring migration (January to April) (Furness, 2015).

12.3.3.3 Foraging/Usage hotspots

59. A tracking study of 20 birds breeding at the FFC SPA in 2017 found an average foraging range of 88.7km. Trips ranged in length from 3.2km to 324km, with birds travelling into the North Sea northwest and southwest of the colony (Wischnewski *et al.*, 2017). The utilisation distributions produced from the 2017 tracking data indicate that the Project is just outside the core and home foraging ranges of kittiwake from this SPA but there are high densities during the migration bio-seasons.
60. The FFC SPA is the closest SPA to the Project array area and using species distribution models (Cleasby et al, 2020) hotspots were identified on the east end of the Project footprint (Figure 12.3) using Getis-Ord hotspot analysis (Cleasby et al, 2020).
61. Figure 12.3 presents the foraging hotspots from kittiwakes tracked from FFC SPA. The red areas in this figure portray the area within which 99% of the tracked birds foraging took place. As can be seen, there is overlap with the north eastern corner of the array area. This foraging distribution is similar, but not identical, to the distribution described by the DAS data during the breeding season.

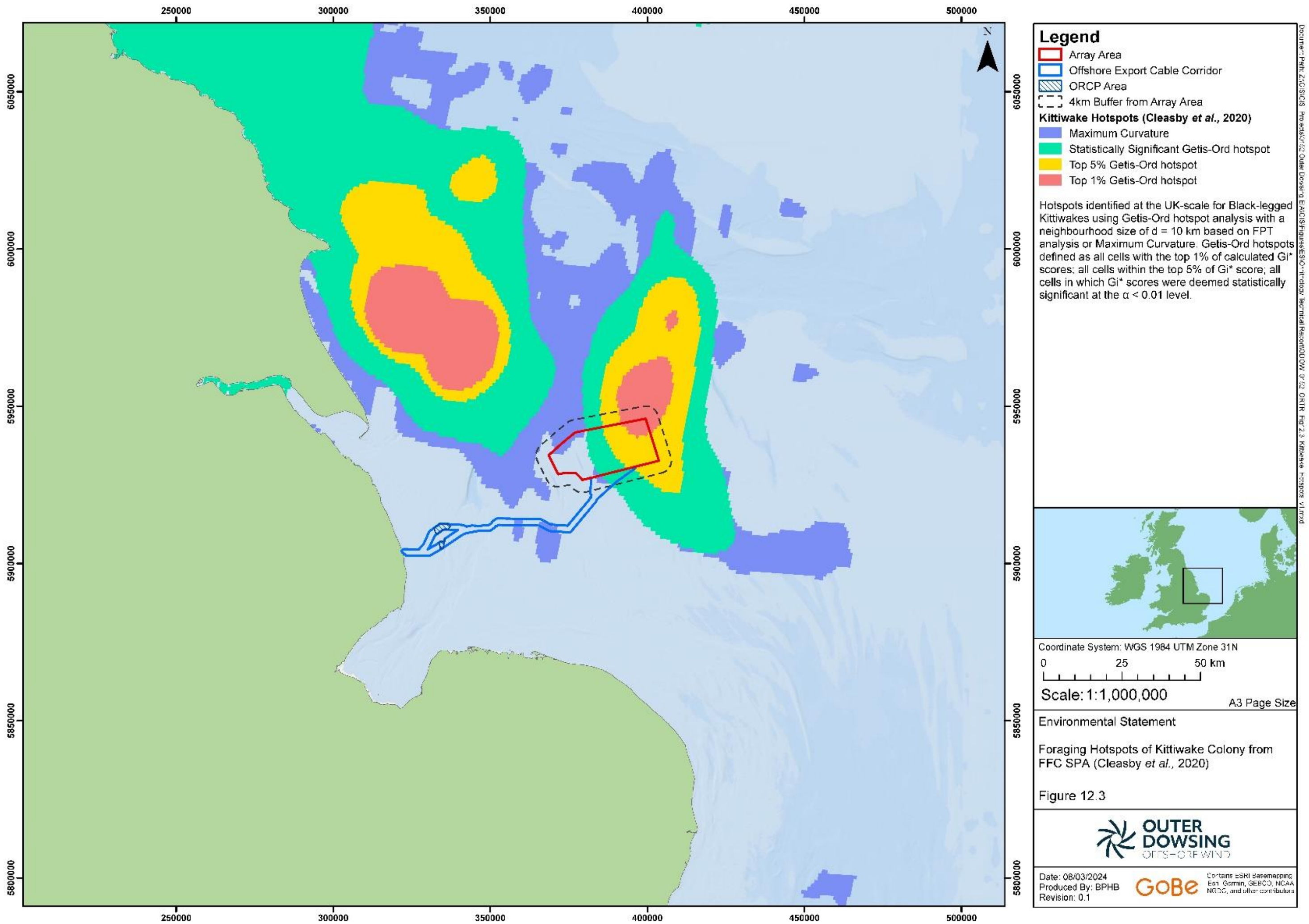

Figure 12.3. Foraging hotspots of kittiwake colony from FFC SPA (Cleasby et al, 2020).

12.3.3.4 Abundance and Phenology

62. Peak abundances of kittiwake in the species bio-seasons (as defined in Furness 2015) are presented in Table 12.10. Estimates of monthly abundance, density and percentage flying within the array area, and monthly abundance and density within the array plus 2km buffer are presented in Table 12.11. The spatial density distribution of kittiwake within the Outer Dowsing Array Area plus 2km buffer is shown for three years of surveys in Figure 12.4, Figure 12.5, and Figure 12.6.

Table 12.10. Kittiwake bio-season peak apportioned abundance and density estimates in the Project array area.

		Array area		Array area +2km buffer	
BDMPS Bio-seasons	Months	Bio-season peak abundance (n)	Bio-season peak density (n/km^2)	Bio-season peak abundance (n)	Bio-season peak density (n/km^2)
Return migration	Jan-Apr	3,860.5 (2,211.3 – 3,941.5)	8.84 (5.07 – 9.02)	5,206.8 (3,435.8 – 5,457.0)	8.31 (5.48 – 8.71)
Breeding season	Mar-Aug	3,860.5 (2,841.5 – 4992.3)	8.84 (6.51 – 11.43)	5,206.8 (4,080.2 – 6,469.7)	8.31 (6.51 – 10.33)
Post-breeding migration	Aug-Dec	808 7(399.0 – 1,439.5)	1.85 (0.91 – 3.30)	1,760.3 (757.8 – 4377.5)	2.81 (1.21 – 6.99)

Table 12.11. Kittiwake estimated apportioned abundance and estimated density in the Project array area, array area plus 2km buffer.

Month	Survey number	Array only			Array plus 2km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
March 21	1	2802	6.42	25	4044	6.45
April 21	1	5479	12.55	40	6833	10.91
May 21	1	751	1.72	34	1500	2.39
June 21	1	348	0.8	53	640	1.02
July 21	1	1009	2.31	73	2124	3.39
Aug 21	1	798	1.83	53	2999	4.79
Sept 21	1	1221	2.8	31	1644	2.62
Oct 21	1	54	0.12	83	86	0.14
Nov 21	1	106	0.24	62	144	0.23
Dec 21	1	151	0.34	88	227	0.36

Month	Survey number	Array only			Array plus 2km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
Jan 22	1	61	0.14	80	96	0.15
Feb 22	1	494	1.13	49	704	1.12
March 22	1	2843	6.51	45	3318	5.30
March 22	2	1552	3.55	58	2518	4.02
April 22	1	2960	6.78	35	4202	6.71
April 22	2	4143	9.49	54	5860	9.35
May 22	1	3058	7	48	4397	7.02
May 22	2	1072	2.45	37	2372	3.78
June 22	1	250	0.57	68	903	1.44
June 22	2	2080	4.76	41	3153	5.03
July 22	1	269	0.62	71	436	0.70
July 22	2	368	0.84	76	891	1.42
Aug 22	1	810	1.85	47	1946	3.11
Aug 22	2	210	0.48	44	526	0.84
Sept 22	1	133	0.3	86	821	1.31
Sept 22	2	19	0.04	100	24	0.04
Oct 22	1	119	0.27	76	42	0.07
Nov 22	1	303	0.69	57	408	0.65
Dec 22	1	286	0.65	89	367	0.58
Jan 23	1	579	1.32	51	776	1.24
Feb 23	1	1296	2.97	33	1883	3.00
Mar 23	1	2502	5.73	31	3659	5.84
April 23	1	3420	7.83	28	4490	7.17
May 23	1	372	0.85	34	830	1.32
Jun23	1	1434	3.28	31	2201	3.51
Jul 23	1	160	0.37	30	1102	1.76
Aug 23	1	695	1.59	36	1046	1.67

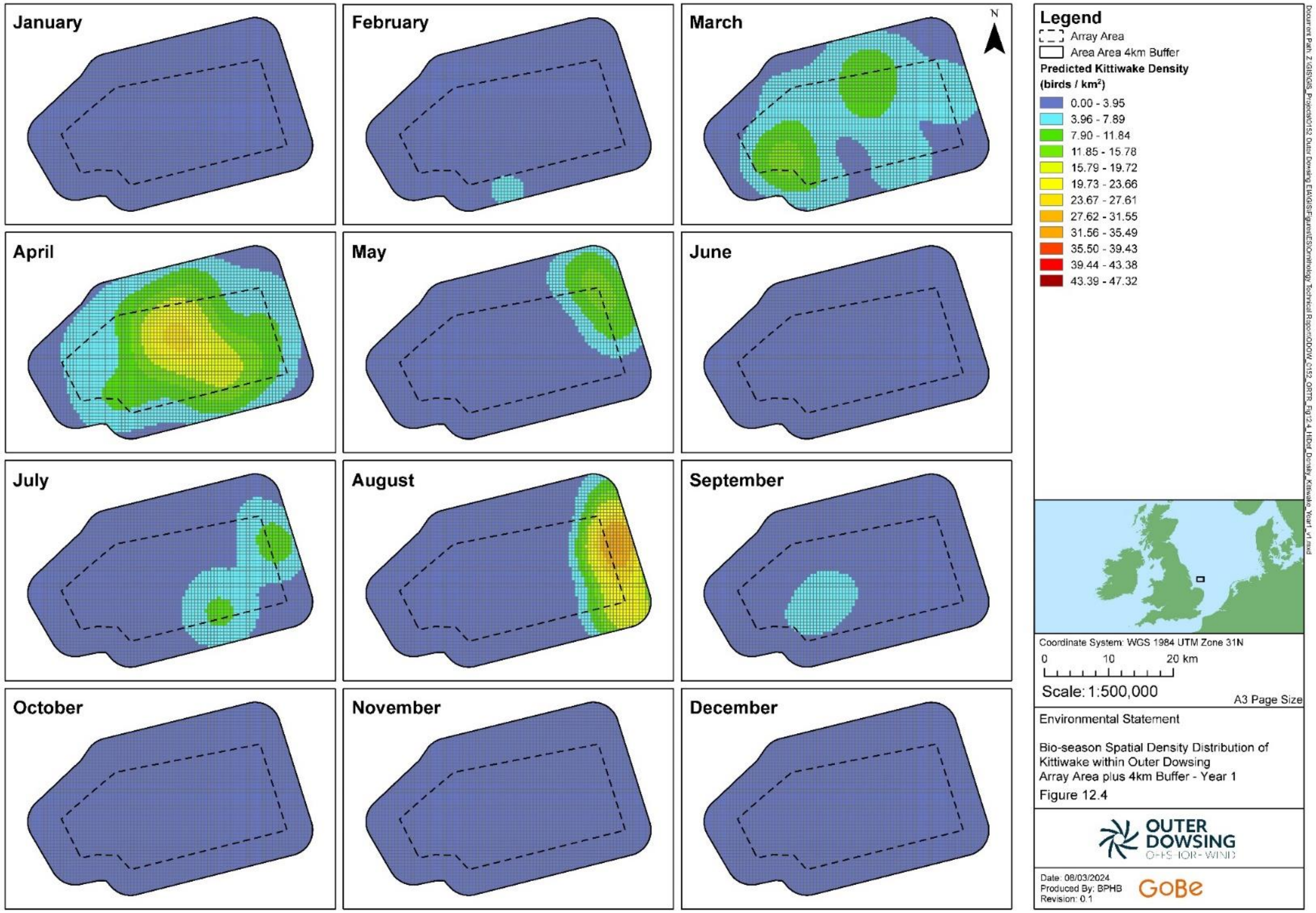

Figure 12.4 Bio-season spatial density distribution of kittiwake within the Array Area plus 2km buffer Year 1

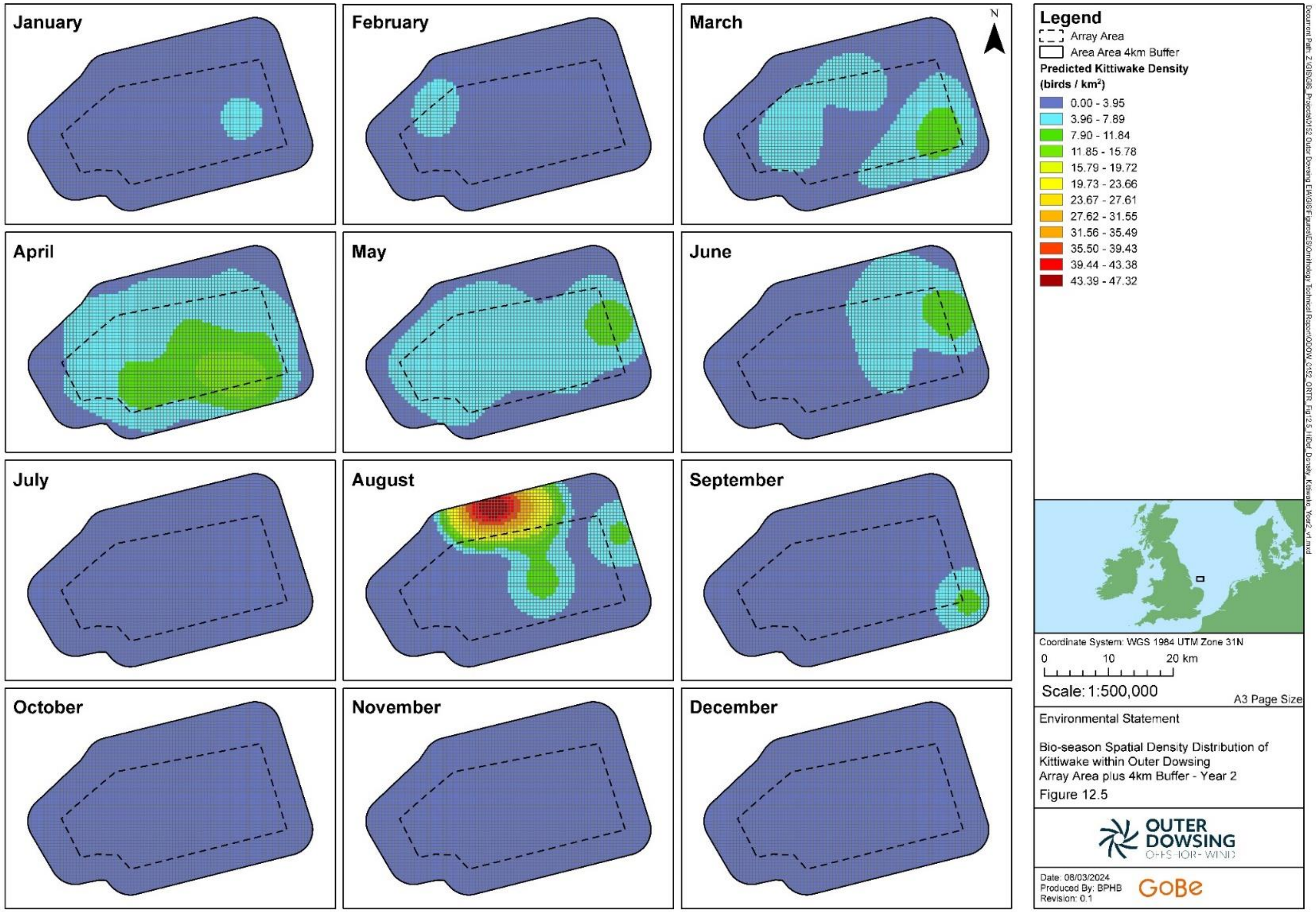

Figure 12.5 Bio-season spatial density distribution of kittiwake within the Array Area plus 2km buffer – Year 2

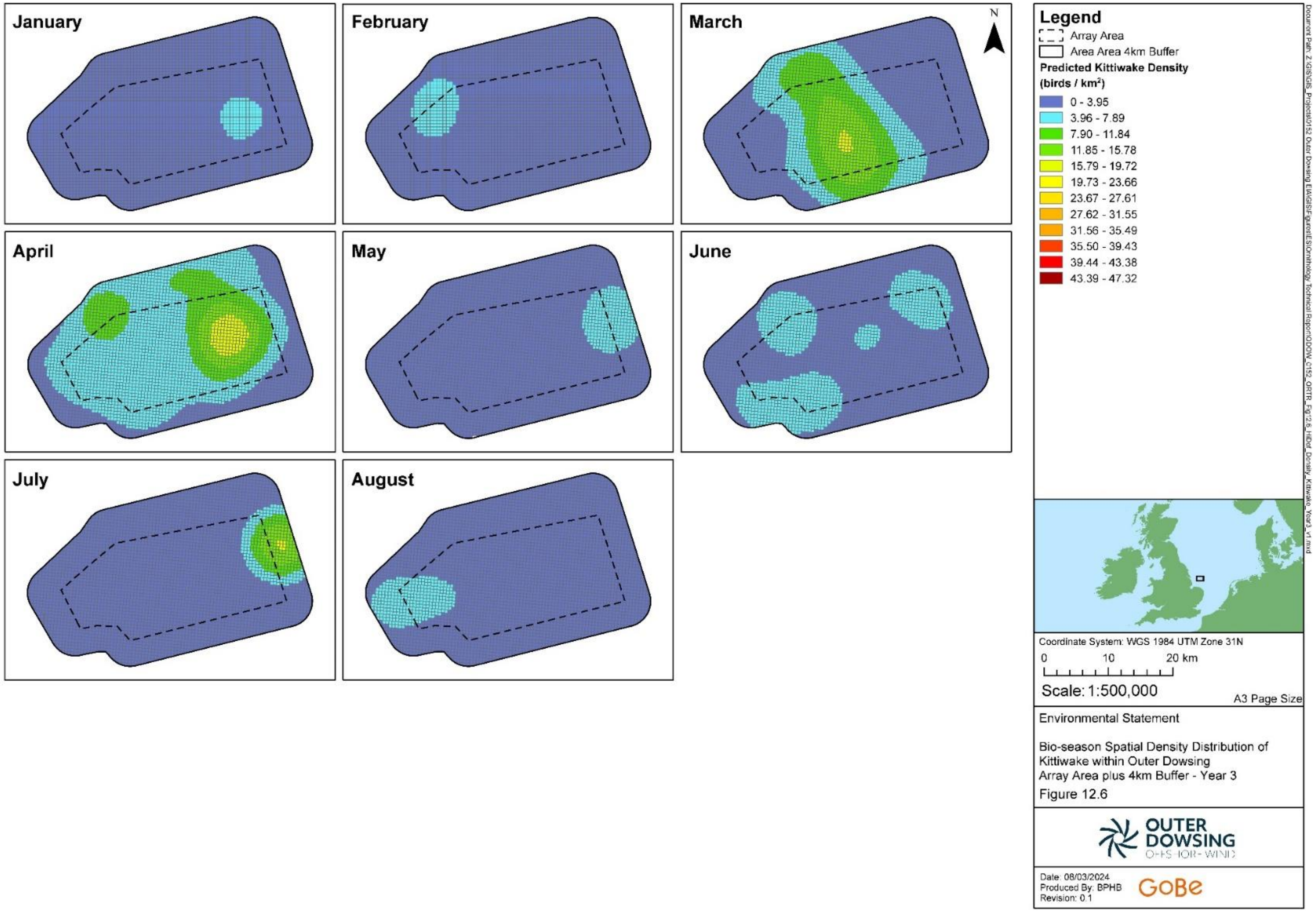

Figure 12.6 Bio-season spatial density distribution of kittiwake within the Array Area plus 2km buffer – Year 3

63. Kittiwake abundance followed a similar pattern over both years of DAS. In each year, populations peaked in early spring (April) with a much lower secondary peak in summer (June – September). The pattern of abundance within the array area was mirrored in the array plus 2km buffer data. The changes in abundance over the two years of DAS data, for both the array, and the array plus 2km buffer, can be seen in Figure 12.7.

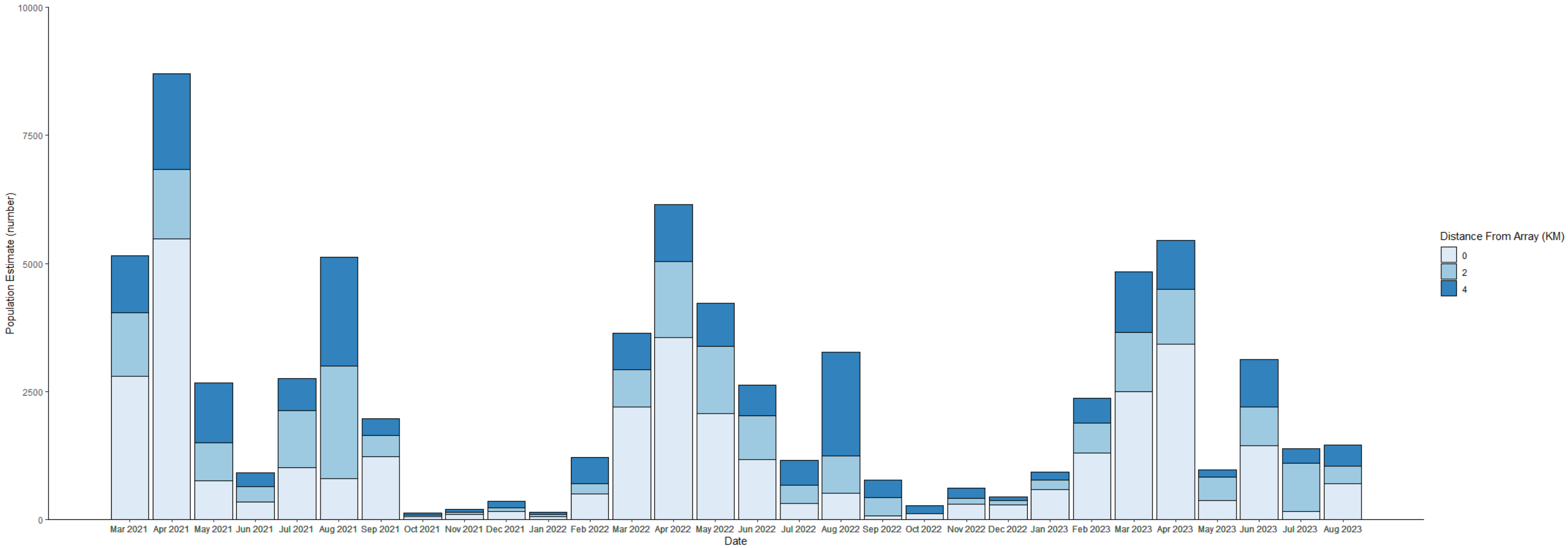

Figure 12.7. Monthly abundance of kittiwake in the array and array plus 2km buffer.

64. The peaks in April correspond with the end of the pre-breeding migration period. High numbers of birds during this month could be related to the passage of birds migrating towards more northerly colonies, or it could relate to increased feeding activity as birds prepare for the energetically demanding breeding season.

12.3.3.5 Flight direction

65. Figure 12.8 shows windrose diagrams presenting the flight directions recorded for kittiwake within the array area plus a 4km buffer.

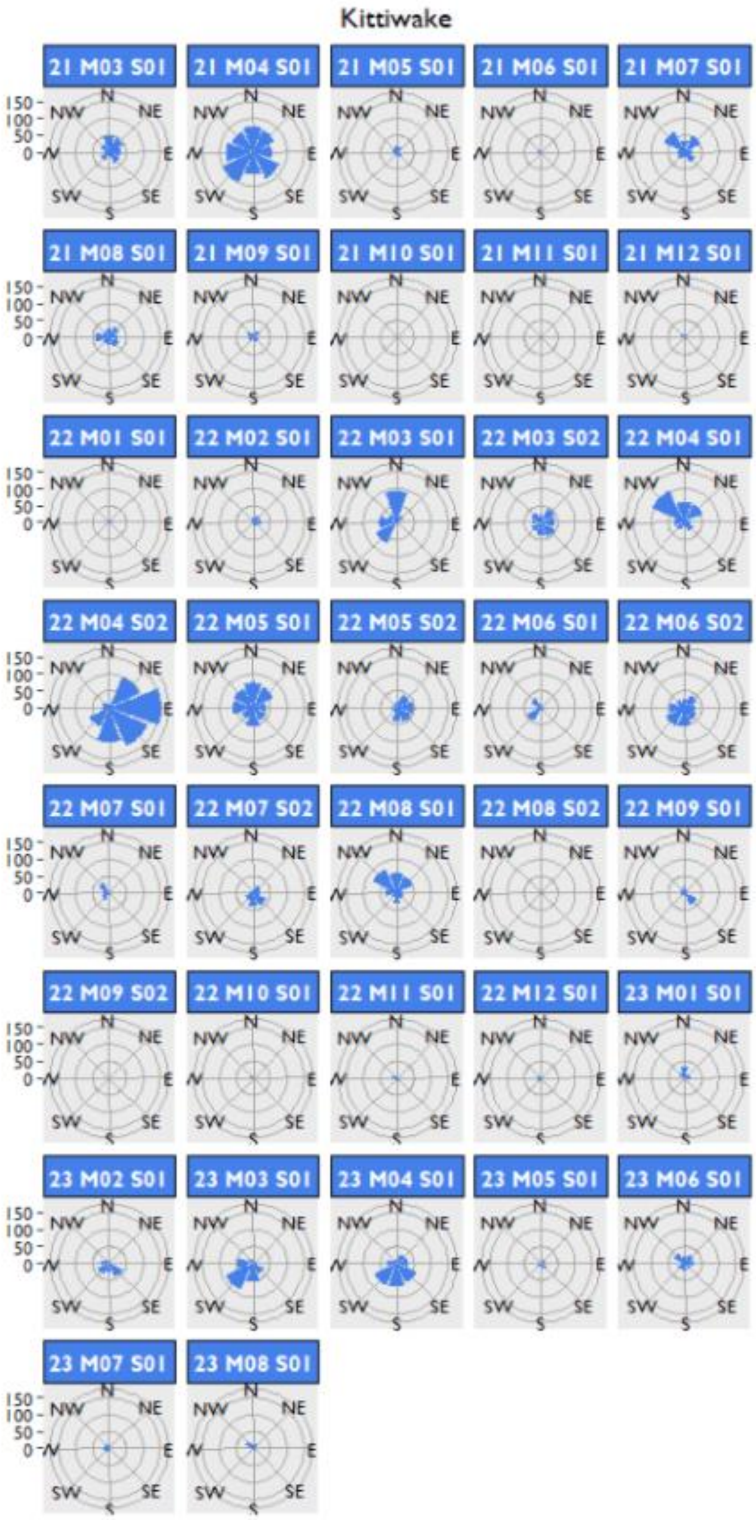

Figure 12.8. Windrose diagrams for months during which flying kittiwake were recorded within the array area plus a 4km buffer.

66. Proportions of kittiwake in flight are presented in Table 12.12.

Table 12.12. Proportions of kittiwake in flight recorded in the in the Project array area.

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2021-03-22	0	117	344	0	25	0	461
2021-04-04	0	365	549	0	40	1	915
2021-05-12	0	41	78	0	34	0	119
2021-06-09	0	30	27	0	53	0	57
2021-07-24	0	121	44	0	73	0	165
2021-08-14	0	70	63	0	53	0	133
2021-09-07	0	60	133	0	31	0	193
2021-10-09	0	5	1	0	83	0	6
2021-11-02	0	10	6	0	62	0	16
2021-12-15	0	23	3	0	88	0	26
2022-01-06	0	8	2	0	80	0	10
2022-02-23	0	40	41	0	49	0	81
2022-03-11	0	209	256	3	45	0	468
2022-03-22	0	144	104	2	58	0	250
2022-04-02	0	168	315	1	35	0	484
2022-04-15	0	379	317	0	54	0	696
2022-05-02	0	248	263	2	48	0	513
2022-05-17	0	60	103	0	37	0	163
2022-06-09	0	30	13	0	68	1	44
2022-06-21	0	143	202	1	41	0	346
2022-07-04	0	32	13	0	71	0	45
2022-07-16	0	47	15	0	76	0	62
2022-08-08	0	134	149	0	47	1	284

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2022-08-23	0	14	17	1	44	0	32
2022-09-13	0	18	3	0	86	0	21
2022-09-25	0	3	0	0	100	0	3
2022-10-10	0	13	4	0	76	0	17
2022-11-07	0	28	21	0	57	0	49
2022-12-13	0	41	5	0	89	0	46
2023-01-26	0	49	47	0	51	0	96
2023-02-10	0	69	138	0	33	0	207
2023-03-24	0	131	289	1	31	0	421
2023-04-05	0	162	410	1	28	0	573
2023-05-03	0	21	40	0	34	0	61
2023-06-17	0	72	160	0	31	0	232
2023-07-05	0	8	19	0	30	0	27
2023-08-10	0	41	74	0	36	0	115
Total	0	3154	4268	12	-	3	7437

12.3.3.6 Birds aged from DAS data

67. Proportions of kittiwake aged from DAS images are presented in Table 12.12.

Table 12.13. Proportions of kittiwake aged from DAS images within the array area plus a 2km buffer.

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
22/03/2021	175	7	0	485	96	667	182
04/04/2021	449	13	0	677	97	1139	462
12/05/2021	119	17	0	113	88	249	136
09/06/2021	41	9	0	57	82	107	50
24/07/2021	196	2	8	173	95	379	206
14/08/2021	323	0	71	150	82	544	394
07/09/2021	120	6	19	116	83	261	145
09/10/2021	5	0	4	2	56	11	9
02/11/2021	13	0	2	7	87	22	15
15/12/2021	27	1	6	5	79	39	34
06/01/2022	10	3	0	3	77	16	13
23/02/2022	60	1	0	54	98	115	61
11/03/2022	241	12	0	294	95	547	253
22/03/2022	212	18	0	187	92	417	230
02/04/2022	242	23	0	432	91	697	265
15/04/2022	495	22	0	462	96	979	517
02/05/2022	327	25	0	378	93	730	352
17/05/2022	211	36	0	135	85	382	247
09/06/2022	105	9	0	34	92	148	114
21/06/2022	295	30	0	194	91	519	325
04/07/2022	55	2	1	15	95	73	58
16/07/2022	110	6	1	32	94	149	117
08/08/2022	113	7	4	188	91	312	124
23/08/2022	25	0	3	65	89	93	28
13/09/2022	62	1	19	58	76	140	82
25/09/2022	1	2	1	0	25	4	4

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
10/10/2022	8	0	14	6	36	28	22
07/11/2022	37	0	2	27	95	66	39
13/12/2022	47	2	2	8	92	59	51
26/01/2023	57	9	3	61	83	130	69
10/02/2023	145	14	0	150	91	309	159
24/03/2023	170	43	0	402	80	615	213
05/04/2023	214	27	0	502	89	743	241
03/05/2023	56	9	0	76	86	141	65
17/06/2023	95	26	7	241	74	369	128
05/07/2023	54	1	0	123	98	178	55
10/08/2023	56	1	11	107	82	175	68

12.3.4 Little gull

12.3.4.1 Digital aerial survey data

68. Little gull were recorded in the Project array area in 13 out of the 30 months surveyed, with abundance and density peaking at 191 birds and 0.44 birds/km^2 respectively in October 2021 (Table 12.15).

69. In the array area plus 2km buffer, abundance and density peaked at 368 birds and 0.59 birds/km^2 respectively in October 2021 (Table 12.15). The monthly mean population estimates are presented in Table 12.15.

12.3.4.2 Little gull overview

70. The little gull breeding bio-season is from April to July, with non-breeding August to March (based on Cramp & Simmons 1983). Data from the DAS show that no birds were recorded during the breeding season apart from in July. Little gulls are considered passage migrants to Britain and Ireland, generally remaining close inshore while using the English Channel to leave the North Sea and move towards wintering areas predominantly in the western Mediterranean (Stone *et al.*, 1995; Skov *et al.*, 1995). With little gulls only recorded in July within the breeding season, it was considered that these birds were unlikely to be locally breeding birds but instead undertaking early post-breeding migration, or potentially adults taking sabbatical from breeding. To reflect this, the non-breeding bio-season was extended to include July.

12.3.4.3 Abundance and Phenology

71. Peak abundances of little gull in the species bio-seasons (as defined in Furness 2015) are presented in Table 12.14. Estimates of monthly abundance, density and percentage flying within the array area, and monthly abundance and density within the array plus 2km buffer are presented in Table 12.16. The spatial density distribution of little gull within the Outer Dowsing Array Area plus 2km buffer is shown for three years of surveys in Figure 12.9, Figure 12.10, and Figure 12.11.

Table 12.14. Little gull bio-season apportioned abundance and density estimates in the Project array area.

		Array area		Array area +2km buffer	
BDMPS Bio-seasons	Months	Bio-season peak abundance in array area (n)	Bio-season peak density estimate in array area (n/km^2)	Bio-season peak abundance in array area plus 2km buffer (n)	Bio-season peak density estimate in array area plus 2km buffer (n/km2)
Breeding	May-Jun	0.3 (0.0 – 0.3)	0.00 (0.00 – 0.00)	12.3 (0.0 – 36.3)	0.02 (0.0 – 0.06)

BDMPS Bio-seasons	Months	Array area		Array area +2km buffer	
		Bio-season peak abundance in array area (n)	Bio-season peak density estimate in array area (n/km^2)	Bio-season peak abundance in array area plus 2km buffer (n)	Bio-season peak density estimate in array area plus 2km buffer (n/km2)
Non-breeding	Jul-April	103.7 (62.0 – 152.8)	0.23 (0.13 – 0.35)	178.2 (110.8 – 257.3)	0.28 (0.17 – 0.41)

Table 12.15. Little gull estimated apportioned abundance and estimated density in the Project array area and array area plus 2km buffer.

Month	Survey number	Array only		Array plus 2km buffer		
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
March 21	1	0	0	0	0	0
April 21	1	0	0	0	0	0
May 21	1	0	0	0	0	0
June 21	1	0	0	0	7	0.03
July 21	1	13	0.03	100	13	0.02
Aug 21	1	6	0.01	100	7	0.01
Sept 21	1	84	0.19	86	91	0.14
Oct 21	1	191	0.44	85	368	0.59
Nov 21	1	0	0	0	0	0
Dec 21	1	0	0	0	0	0
Jan 22	1	0	0	0	0	0
Feb 22	1	0	0	0	0	0
March 22	1	7	0.01	100	7	0.01
March 22	2	13	0.03	100	12	0.02
April 22	1	0	0	0	0	0
April 22	2	0	0	0	0	0
May 22	1	0	0	0	0	0
May 22	2	0	0	0	0	0
June 22	1	0	0	0	0	0
June 22	2	0	0	0	0	0
July 22	1	0	0	0	0	0
July 22	2	0	0	0	0	0
Aug 22	1	0	0	0	0	0
Aug 22	2	7	0.01	100	6	0.01
Sept 22	1	167	0.38	92	249	0.4
Sept 22	2	37	0.08	100	48	0.08
Oct 22	1	1	0	0	0	0

Month	Survey number	Array only		Array plus 2km buffer		
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
Nov 22	1	19	0.04	67	20	0.03
Dec 22	1	0	0	0	0	0
Jan 23	1	6	0.01	0	7	0.01
Feb 23	1	0	0	0	0	0
Mar 23	1	0	0	0	0	0
April 23	1	0	0	0	0	0
May 23	1	1	0	0	30	0.05
June 23	1	0	0	0	0	0
July 23	1	0	0	0	0	0
Aug 23	1	0	0	0	0	0

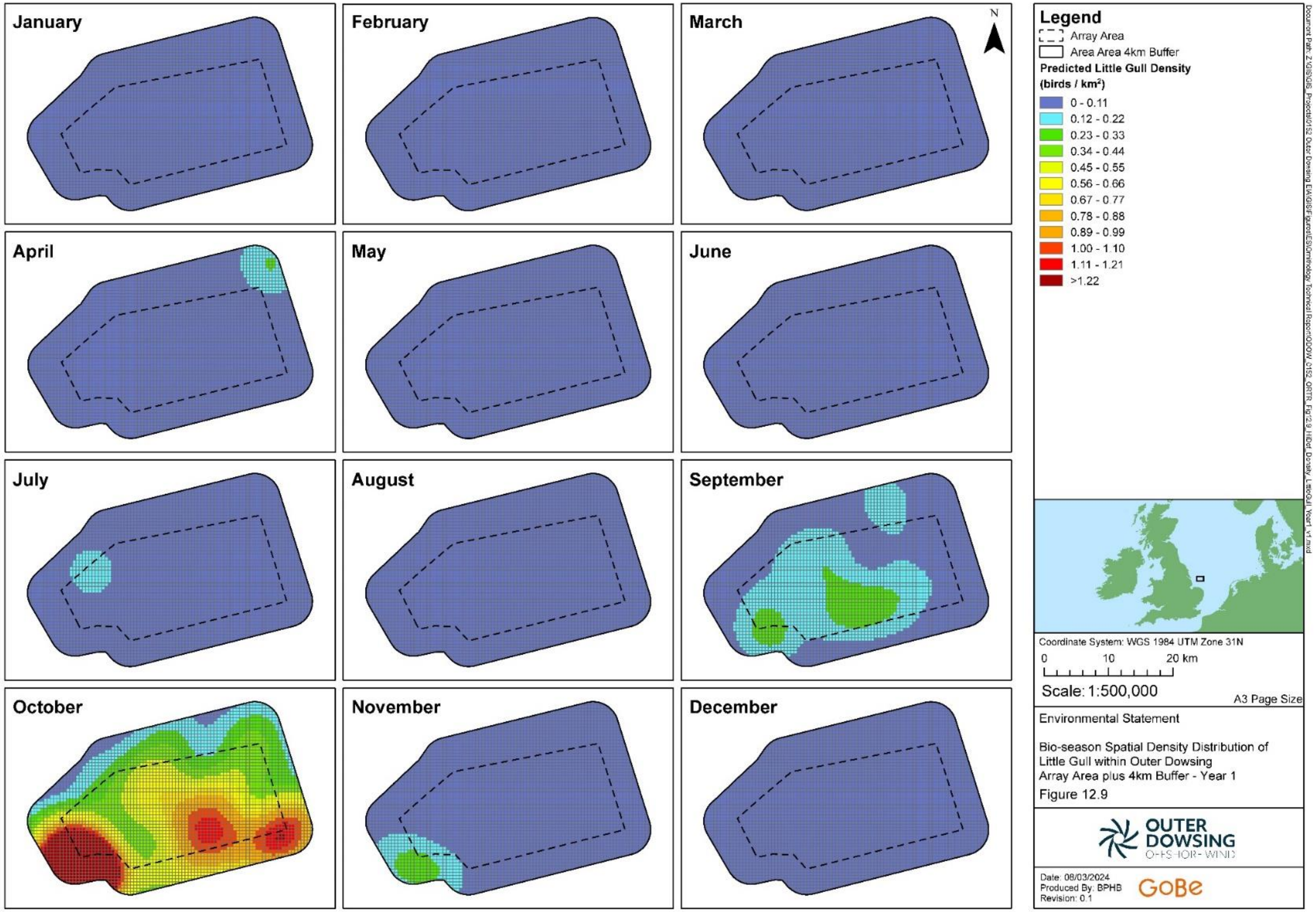

Figure 12.9 Bio-season spatial density distribution of little gull the Array Area plus 2km buffer – Year 1

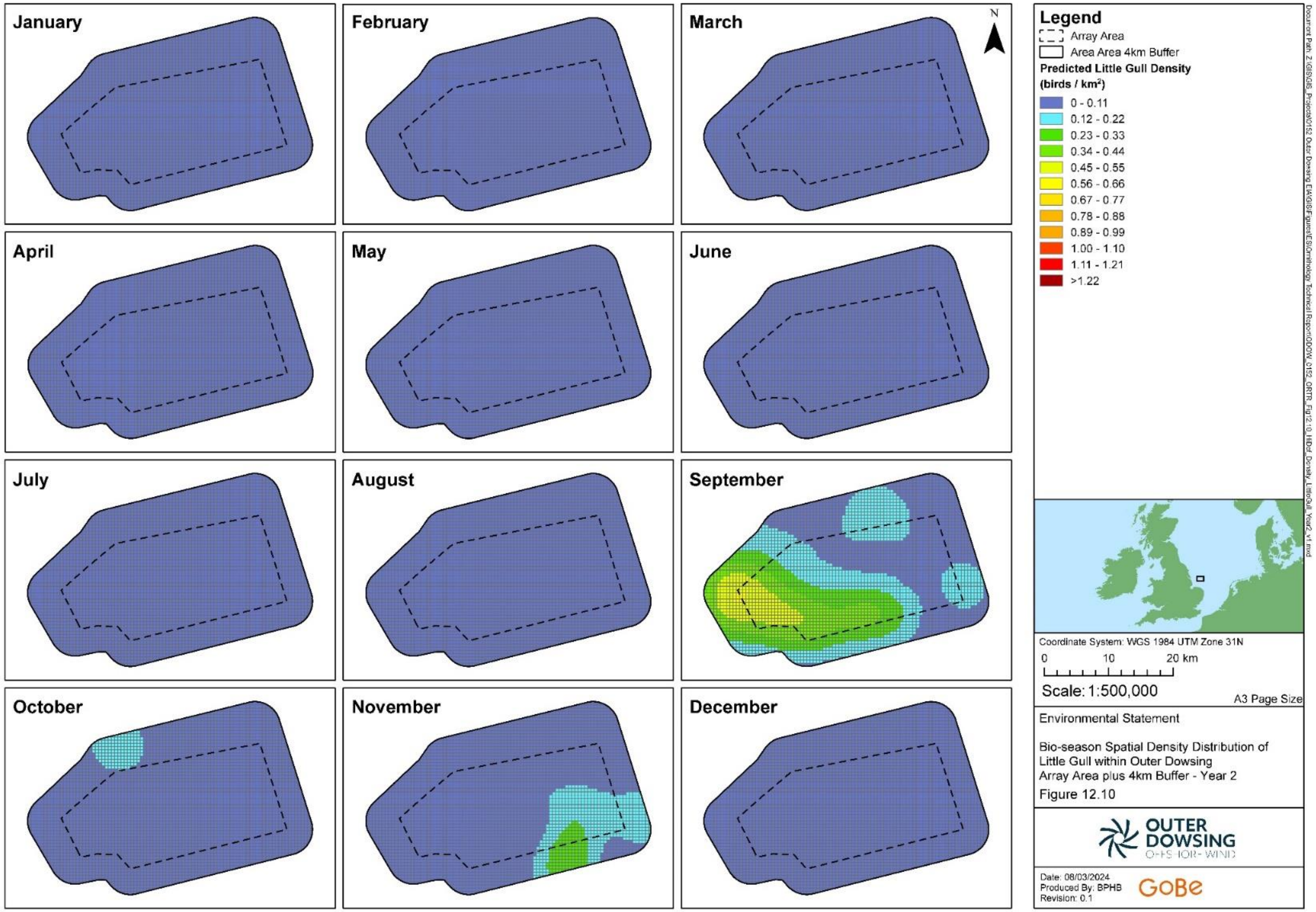

Figure 12.10 Bio-season spatial density distribution of little gull within the Array Area plus 2km buffer – Year 2

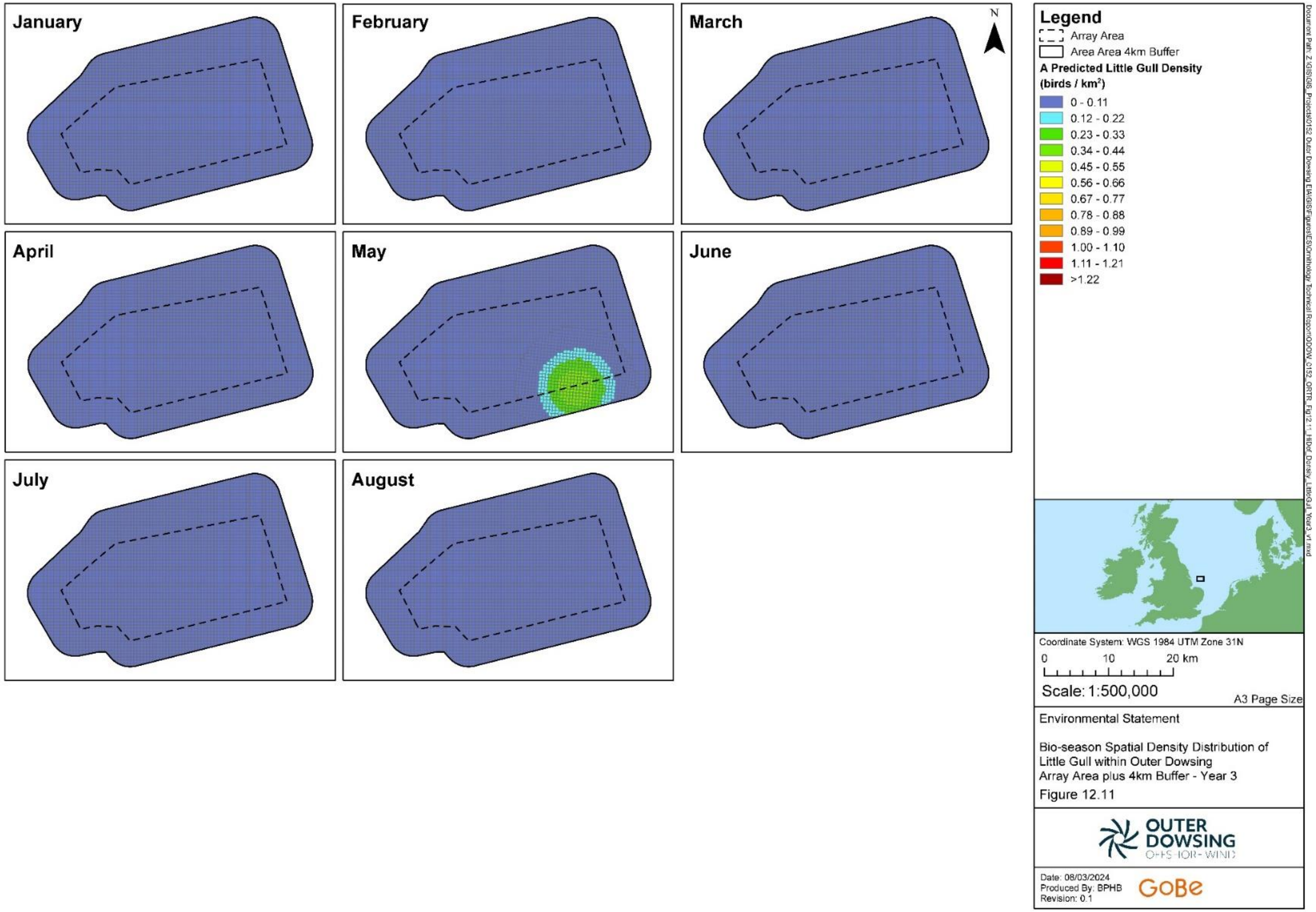

Figure 12.11 Bio-season spatial density distribution of little gull within the Array Area plus 2km buffer – Year 3

72. Little gull abundance showed the same pattern across both years for which DAS data were collected. In both years, abundance was very low throughout the year, apart from a peak in autumn (in October 2021 and September 2022). This pattern was observed across both the array area and the array area plus 4km buffer.

73. The autumn peaks observed here are likely to correspond to influx of birds that spend the non-breeding seasons in the UK or its UK waters, or to passage of birds moving to non-breeding areas elsewhere.

12.3.4.4 Flight direction

74. Figure 12.12 shows windrose diagrams presenting flight directions recorded for little gull within the array area plus a 4km buffer.

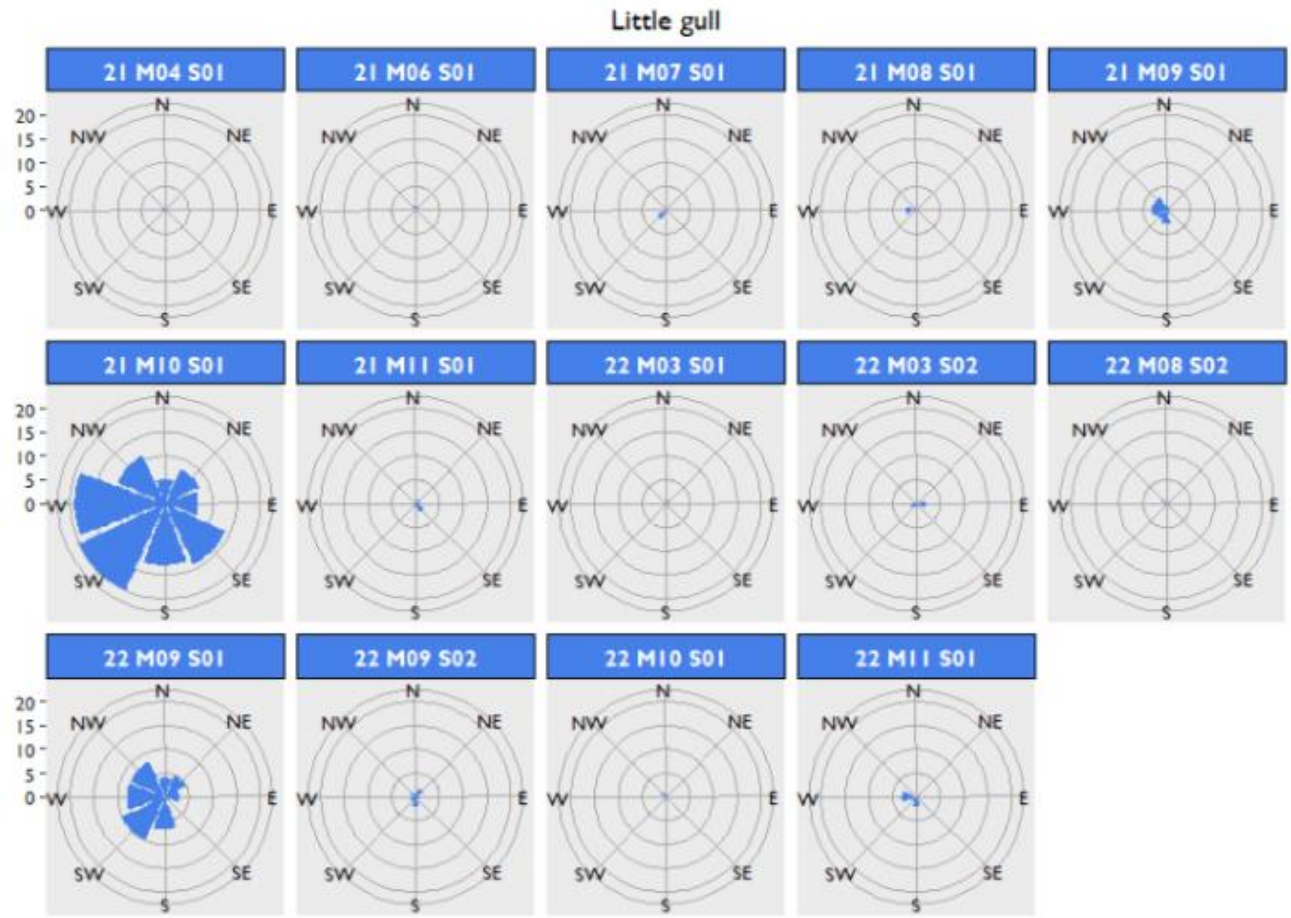

Figure 12.12. Windrose diagrams for months during which flying little gull were recorded within the array area plus a 4km buffer.

75. Proportions of little gull in flight are presented in Table 12.16.

Table 12.16. Proportions of little gull in flight recorded in the in the Project array area.

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2021-03-22	0	0	0	0	0	0	0
2021-04-04	0	0	0	0	0	0	0
2021-05-12	0	0	0	0	0	0	0
2021-06-09	0	0	0	0	0	0	0
2021-07-24	0	2	0	0	100	0	2
2021-08-14	0	1	0	0	100	0	1
2021-09-07	0	12	2	0	86	0	14
2021-10-09	0	28	5	0	85	0	33
2021-11-02	0	0	0	0	0	0	0
2021-12-15	0	0	0	0	0	0	0
2022-01-06	0	0	0	0	0	0	0
2022-02-23	0	0	0	0	0	0	0
2022-03-11	0	1	0	0	100	0	1
2022-03-22	0	2	0	0	100	0	2
2022-04-02	0	0	0	0	0	0	0
2022-04-15	0	0	0	0	0	0	0
2022-05-02	0	0	0	0	0	0	0
2022-05-17	0	0	0	0	0	0	0
2022-06-09	0	0	0	0	0	0	0
2022-06-21	0	0	0	0	0	0	0
2022-07-04	0	0	0	0	0	0	0
2022-07-16	0	0	0	0	0	0	0
2022-08-08	0	0	0	0	0	0	0
2022-08-23	0	1	0	0	100	0	1
2022-09-13	0	23	2	0	92	0	25
2022-09-25	0	4	0	0	100	0	4
2022-10-10	0	0	0	0	0	0	0

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2022-11-07	0	2	1	0	67	0	3
2022-12-13	0	0	0	0	0	0	0
2023-01-26	0	0	0	0	0	0	0
2023-02-10	0	0	0	0	0	0	0
2023-03-24	0	0	0	0	0	0	0
2023-04-05	0	0	0	0	0	0	0
2023-05-03	0	0	0	0	0	0	0
2023-06-17	0	0	0	0	0	0	0
2023-07-05	0	0	0	0	0	0	0
2023-08-10	0	0	0	0	0	0	0
Total	0	76	10	0	-	0	86

12.3.4.5 Birds aged from DAS data

76. Proportions of little gull aged from DAS images are presented in Table 12.17.

Table 12.17. Proportions of little gull aged from DAS images within the array area plus a 2km buffer.

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
22/03/2021	0	0	0	0	0	0	0
04/04/2021	0	0	0	0	0	0	0
12/05/2021	0	0	0	0	0	0	0
09/06/2021	0	0	0	1	0	1	0
24/07/2021	2	0	0	0	100	2	2
14/08/2021	0	0	1	0	0	1	1
07/09/2021	11	0	1	3	92	15	12
09/10/2021	45	1	7	9	85	62	53
02/11/2021	0	0	0	0	0	0	0
15/12/2021	0	0	0	0	0	0	0
06/01/2022	0	0	0	0	0	0	0
23/02/2022	0	0	0	0	0	0	0
11/03/2022	1	0	0	0	100	1	1
22/03/2022	2	0	0	0	100	2	2
02/04/2022	0	0	0	0	0	0	0
15/04/2022	0	0	0	0	0	0	0
02/05/2022	0	0	0	0	0	0	0
17/05/2022	0	0	0	0	0	0	0
09/06/2022	0	0	0	0	0	0	0
21/06/2022	0	0	0	0	0	0	0
04/07/2022	0	0	0	0	0	0	0
16/07/2022	0	0	0	0	0	0	0
08/08/2022	0	0	0	0	0	0	0
23/08/2022	0	0	1	0	0	1	1
13/09/2022	27	1	6	4	79	38	34
25/09/2022	5	1	0	0	83	6	6

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
10/10/2022	1	0	0	0	100	1	1
07/11/2022	3	0	0	0	100	3	3
13/12/2022	0	0	0	0	0	0	0
26/01/2023	0	0	0	1	0	1	0
10/02/2023	0	0	0	0	0	0	0
24/03/2023	0	0	0	0	0	0	0
05/04/2023	0	0	0	0	0	0	0
03/05/2023	0	0	0	5	0	5	0
17/06/2023	0	0	0	0	0	0	0
05/07/2023	0	0	0	0	0	0	0
10/08/2023	0	0	0	0	0	0	0

12.3.5 Great black-backed gull

12.3.5.1 Digital aerial survey data

77. Great black-backed gull was recorded within the Project array area on 21 of the 30 months surveyed, with abundance and density peaking at 94 birds and 0.22 birds/km^2 respectively in January 2023 (Table 12.19).
78. In the array area plus 2km buffer, abundance and density peaked at 110 birds and 0.17 birds/km^2 respectively in September 2021 (Table 12.19).

12.3.5.2 Great black-backed gull overview

79. The mean maximum foraging range of this species is 73km, though this was recorded from just a single study so is of low confidence (Woodward *et al.*, 2019). There are no known large colonies within this range of the Project.

12.3.5.3 Abundance and Phenology

80. Peak abundances of great black-backed gull in the species bio-seasons (as defined in Furness 2015) are presented in Table 12.18. Estimates of monthly abundance, density and percentage flying within the array area, and monthly abundance and density within the array plus 2km buffer are presented in Table 12.18.
81. Great black-backed gull was present in the Project array area across both bio-seasons. Presence was greatest during the non-breeding bio-season (September to March), with a peak estimate of 94 birds and peak density of 0.22 birds/km^2 in January 2023 (Table 12.19). The spatial density distribution of great black-backed gull within the Outer Dowsing Array Area plus 2km buffer is shown for three years of surveys in Figure 12.13, Figure 12.14, and Figure 12.15.

Table 12.18. Great black-backed gull bio-season apportioned abundance and density estimates in the Project array area plus 2km buffer.

BDMPS Bio-seasons	Months	Array area		Array area +2km buffer	
		Bio-season peak abundance (n)	Bio-season peak density (n/km^2)	Bio-season peak abundance (n)	Bio-season peak density (n/km^2)
Breeding	Apr - Aug	22.8 (1.7 – 59.8)	0.05 (0.00 – 0.14)	33.3 (5.7 – 75.5)	0.06 (0.01 – 0.12)
Non-breeding	Sep - Mar	69.3 (21.3– 134.7)	0.16 (0.05– 0.31)	93.0 (36.0 – 196.0)	0.15 (0.06 – 0.31

Table 12.19. Great black-backed gull estimated apportioned abundance and estimated density in the Project array area, and array area plus 2km buffer.

Month	Survey number	Array only			Array plus 2km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
March 21	1	6	0.01	100	18	0.03
April 21	1	17	0.04	0	29	0.05
May 21	1	0	0	0	7	0.01
June 21	1	0	0	0	0	0
July 21	1	0	0	0	0	0
Aug 21	1	0	0	0	0	0
Sept 21	1	72	0.16	31	110	0.17
Oct 21	1	38	0.09	17	84	0.13
Nov 21	1	38	0.08	67	36	0.06
Dec 21	1	24	0.05	25	60	0.09
Jan 22	1	19	0.04	33	25	0.04
Feb 22	1	0	0	0	7	0.01
March 22	1	12	0.03	0	12	0.02
March 22	2	0	0	0	0	0.02
April 22	1	13	0.03	0	12	0
April 22	2	0	0	0	7	0.01
May 22	1	0	0	0	0	0
May 22	2	7	0.01	100	6	0.01
June 22	1	4	0.01	0	18	0.03
June 22	2	13	0.03	50	19	0.03
July 22	1	0	0	0	0	0
July 22	2	0	0	0	18	0.03
Aug 22	1	12	0.03	33	37	0.06
Aug 22	2	0	0	0	7	0.01
Sept 22	1	0	0.07	0	99	0.16
Sept 22	2	25	0.06	25	31	0.05
Oct 22	1	0	0	0	7	0.01
Nov 22	1	31	0	40	30	0.05
Dec 22	1	42	0.09	43	67	0.11
Jan 23	1	94	0.22	77	102	0.16
Feb 23	1	0	0	0	0	0
Mar 23	1	36	0.08	17	38	0.06
April 23	1	43	0.10	0	49	0.08
May 23	1	0	0	0	13	0.02
June 23	1	6	0.01	0	13	0.02
July 23	1	0	0	0	6	0.01
Aug 23	1	13	0.03	50	18	0.03

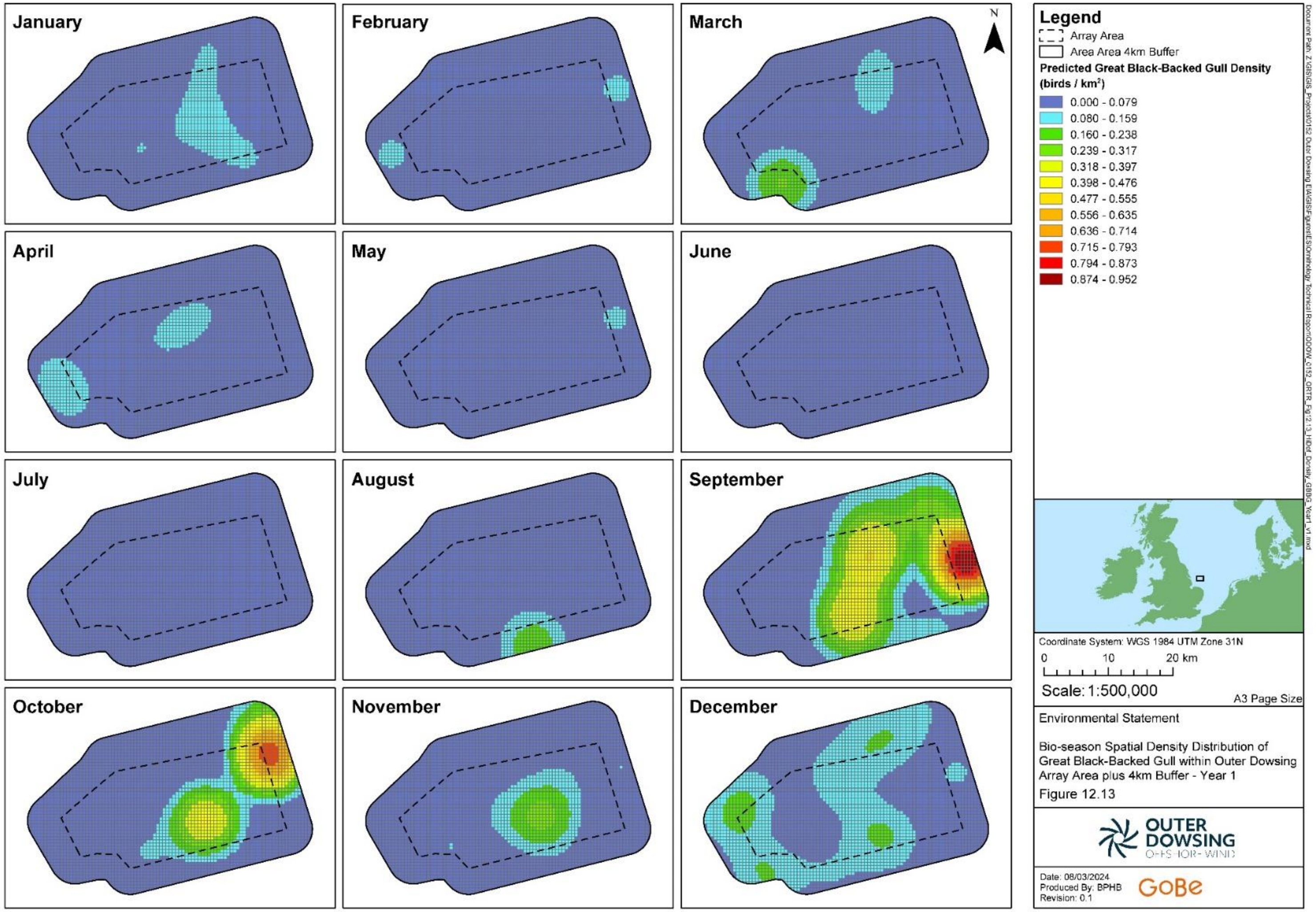

Figure 12.13 Bio-season spatial density distribution of great black-backed gull within the Array Area plus 2km buffer – Year 1

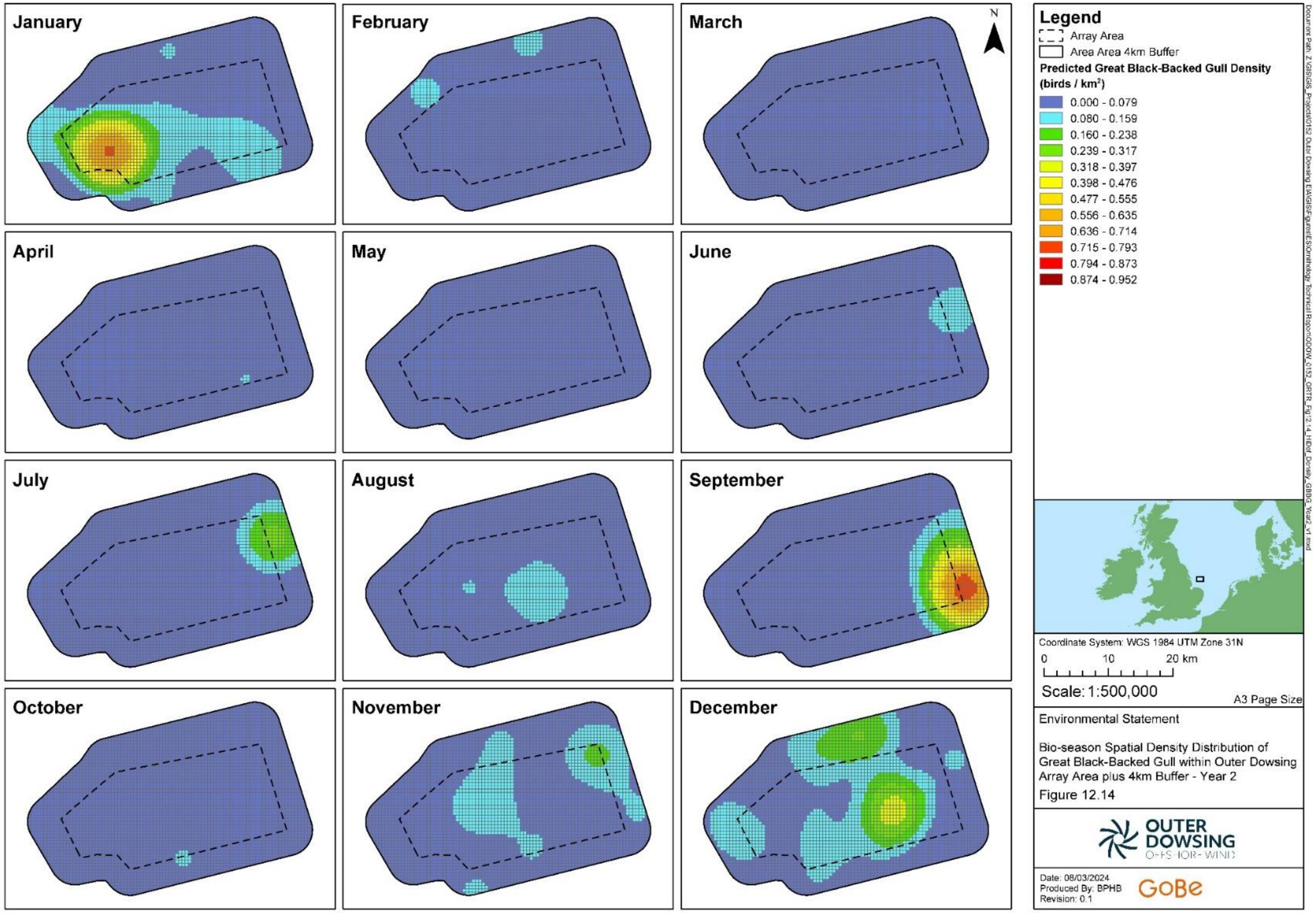

Figure 12.14 Bio-season spatial density distribution of great black-backed gull within the Array Area plus 2km buffer – Year 2

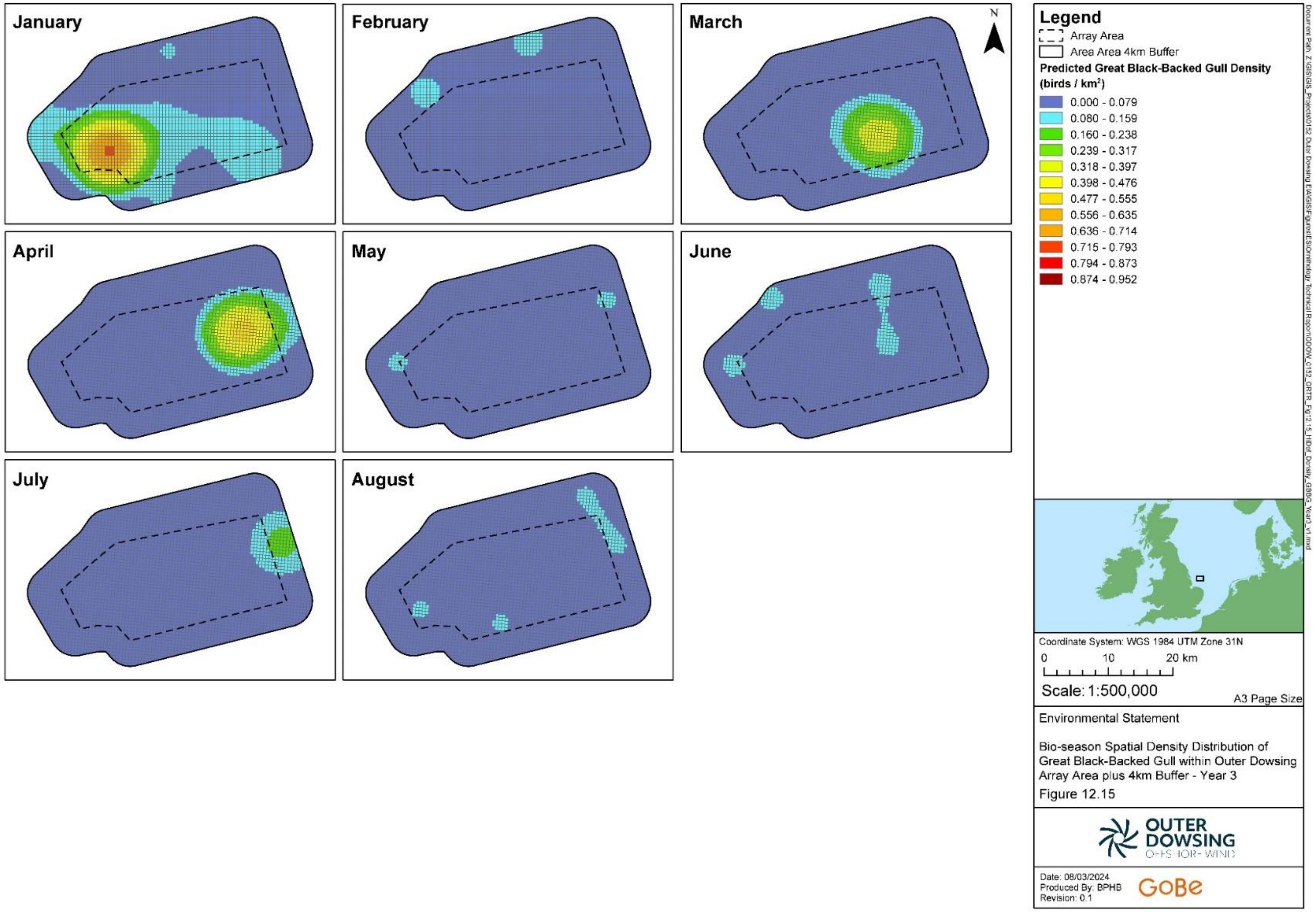

Figure 12.15 Bio-season spatial density distribution of great black-backed gull within the Array Area plus 2km buffer – Year 3

82. Great black-backed gull showed some variation in patterns of abundance across both years for which DAS data were collected. In both years, abundance was higher in autumn, however the highest abundance was estimated for January 2023. This peak did not occur the previous winter, and numbers in January 2023 were almost five times higher than those estimated for January 2022. This pattern was observed across both the array area and the array area plus 2km buffer.

83. High abundance in autumn is likely to correspond to post breeding dispersal from both the U.K. and colonies in Europe. The high numbers in winter 2022/23 are more difficult to account for but may be linked to improved breeding success in that year, or improved offshore foraging that winter.

12.3.5.4 Flight direction

84. Figure 12.16 shows windrose diagrams presenting flight directions recorded for great black-backed gull within the array area plus a 4km buffer.

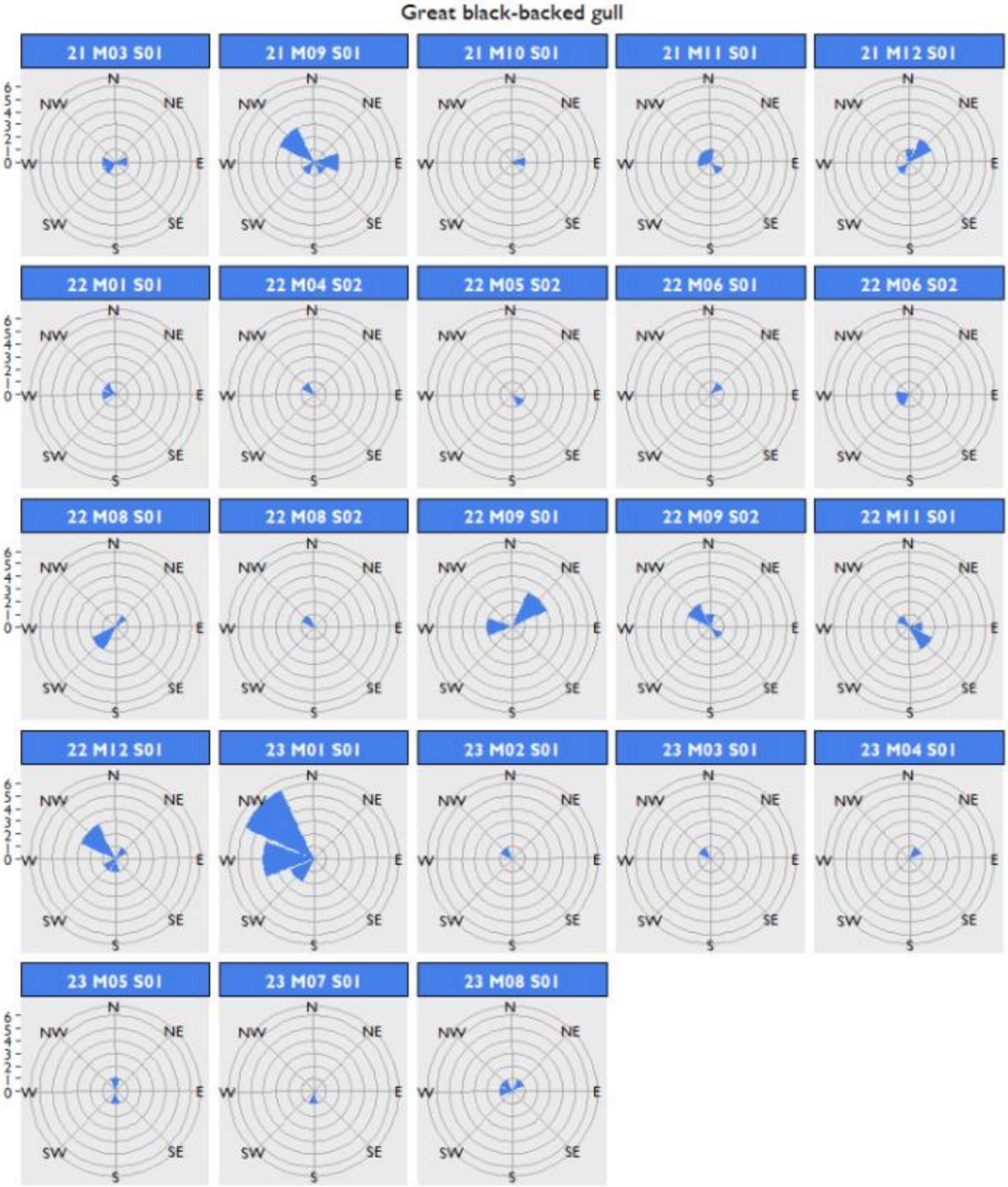

Figure 12.16. Windrose diagrams for months during which flying great black-backed gull were recorded within the array area plus a 4km buffer.

85. Proportions of great black-backed gull in flight are presented in Table 12.20.

Table 12.20. Proportions of great black-backed gull in flight recorded in the in the Project array area.

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2021-03-22	0	1	0	0	100	0	1
2021-04-04	0	0	2	0	0	0	2
2021-05-12	0	0	0	0	0	0	0
2021-06-09	0	0	0	0	0	0	0
2021-07-24	0	0	0	0	0	0	0
2021-08-14	0	0	0	0	0	0	0
2021-09-07	0	4	9	0	31	0	13
2021-10-09	0	1	0	0	17	5	6
2021-11-02	0	4	2	0	67	0	6
2021-12-15	0	1	3	0	25	0	4
2022-01-06	0	1	2	0	33	0	3
2022-02-23	0	0	0	0	0	0	0
2022-03-11	0	0	2	0	0	0	2
2022-03-22	0	0	0	0	0	0	0
2022-04-02	0	0	2	0	0	0	2
2022-04-15	0	0	0	0	0	0	0
2022-05-02	0	0	0	0	0	0	0
2022-05-17	0	1	0	0	100	0	1
2022-06-09	0	0	0	0	0	0	0
2022-06-21	0	1	1	0	50	0	2
2022-07-04	0	0	0	0	0	0	0
2022-07-16	0	0	0	0	0	0	0
2022-08-08	0	2	4	0	33	0	6
2022-08-23	0	0	0	0	0	0	0
2022-09-13	0	0	0	0	0	0	0
2022-09-25	0	1	3	0	25	0	4
2022-10-10	0	0	0	0	0	0	0

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2022-11-07	0	2	3	0	40	0	5
2022-12-13	0	3	4	0	43	0	7
2023-01-26	0	10	3	0	77	0	13
2023-02-10	0	0	0	0	0	0	0
2023-03-24	0	1	5	0	17	0	6
2023-04-05	0	0	7	0	0	0	7
2023-05-03	0	0	0	0	0	0	0
2023-06-17	0	0	1	0	0	0	1
2023-07-05	0	0	0	0	0	0	0
2023-08-10	0	1	1	0	50	0	2
Total	0	34	54	0	-	5	93

12.3.5.5 Birds aged from DAS data

86. Proportions of great black-backed gull aged from DAS images are presented in Table 12.21.

Table 12.21. Proportions of great black-backed gull aged from DAS images within the array area plus a 2km buffer.

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
22/03/2021	0	2	0	0	0	2	2
04/04/2021	1	0	0	3	100	4	1
12/05/2021	0	1	0	0	0	1	1
09/06/2021	0	0	0	0	0	0	0
24/07/2021	0	0	0	0	0	0	0
14/08/2021	0	0	0	0	0	0	0
07/09/2021	8	0	0	9	100	17	8
09/10/2021	0	0	1	13	0	14	1
02/11/2021	2	2	0	2	50	6	4
15/12/2021	3	0	0	7	100	10	3
06/01/2022	1	0	0	3	100	4	1
23/02/2022	0	0	0	1	0	1	0
11/03/2022	0	0	0	2	0	2	0
22/03/2022	0	0	0	0	0	0	0
02/04/2022	0	0	0	2	0	2	0
15/04/2022	1	0	0	0	100	1	1
02/05/2022	0	0	0	0	0	0	0
17/05/2022	0	1	0	0	0	1	1
09/06/2022	0	1	0	1	0	2	1
21/06/2022	0	2	0	1	0	3	2
04/07/2022	0	0	0	0	0	0	0
16/07/2022	0	0	0	3	0	3	0
08/08/2022	2	0	0	5	100	7	2
23/08/2022	0	1	0	0	0	1	1
13/09/2022	1	2	0	13	33	16	3
25/09/2022	0	0	1	3	0	4	1

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
10/10/2022	0	0	0	1	0	1	0
07/11/2022	0	3	1	1	0	5	4
13/12/2022	5	1	0	4	83	10	6
26/01/2023	8	3	0	3	73	14	11
10/02/2023	0	0	0	0	0	0	0
24/03/2023	1	0	0	5	100	6	1
05/04/2023	0	2	0	6	0	8	2
03/05/2023	0	2	0	0	0	2	2
17/06/2023	0	0	0	2	0	2	0
05/07/2023	1	0	0	0	100	1	1
10/08/2023	2	0	1	0	67	3	3

12.3.6 Herring gull

12.3.6.1 Digital aerial survey data

87. Herring gull were recorded within the Project the array area in 21of the 30 months, with abundance and density peaking at 152 birds and 0.35 birds/km^2 respectively in June 2022 (Table 12.23).
88. In the array area plus 2km buffer, abundance and density peaked at 382 birds and 0.61 birds/km^2 respectively in July 2023 (Table 12.23).

12.3.6.2 Herring gull overview

89. The nearest herring gull breeding sites to the Project lie at FFC SPA and on the north Norfolk coast. In recent years, birds have been recorded breeding at several locations, including Blakeney Point (latest count 39 nests in 2022), Holkham (latest count 119 nests in 2018) and Outer Trial Bank (latest count 776 nests in 2023) (JNCC, 2022). These sites are located approximately 60km from the Project. The mean maximum foraging range of herring gull is 58.8km (standard deviation = 14.9km) (Woodward *et al.*, 2019) and is thus within foraging range of the Project. In addition, none of these breeding locations are part of a designated population and it is not considered that there is any connectivity with other designated breeding populations of herring gull.
90. It is therefore considered that herring gulls recorded at the Project during the breeding season originate from the north Norfolk coast (approximately 196 pairs) and the Outer Trial Bank.
91. Outside the breeding season, impacts on herring gull have been compared to the UK North Sea and Channel BDMPS, consisting of 466,511 individuals during the non-breeding season (September to February) (Furness, 2015).

12.3.6.3 Abundance and Phenology

92. Peak abundances of herring gull in the species bio-seasons (as defined in Furness 2015) are presented in Table 12.22. Estimates of monthly abundance, density and percentage flying within the array area, and monthly abundance and density within the array plus 2km buffer, are presented in Table 12.23. The spatial density distribution of herring gull within the Outer Dowsing Array Area plus 2km buffer is shown for three years of surveys in Figure 12.17, Figure 12.18, and Figure 12.19.
93. Herring gull were present in the Project array area across both bio-seasons. Presence was greatest during the breeding bio-season (April to August), with a seasonal peak estimate of 86.2 birds and seasonal peak density of 0.20 birds/km^2 (Table 12.22).

Table 12.22. Herring gull bio-season apportioned abundance and density estimates in the Project array area and array area +2km buffer.

BDMPS Bio-seasons	Months	Array only		Array plus 2km buffer	
		Bio-season peak abundance in array area (n)	Bio-season peak density estimate in array area (n/km^2)	Bio-season peak abundance within 2km buffer (n)	Bio-season peak density within 2km buffer (n/km^2)
Breeding	Apr - Aug	86.2 (32.3 – 161.0)	0.20 (0.70 – 0.37)	186.8 (49.5 – 488.7)	0.30 (0.08– 0.78)
Non-breeding	Sep - Mar	39.0 (28.3 – 54.0)	0.06 (0.03 – 0.12)	49.0 (34.7 – 66.3)	0.06 (0.03 – 0.11)

Table 12.23. Herring gull estimated apportioned abundance and estimated density, in the Project array area and array area plus 2km buffer.

Month	Survey number	Array only		Array plus 2km buffer		
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
March 21	1	7	0.01	100	12	0.02
April 21	1	8	0.02	0	14	0.02
May 21	1	0	0	0	0	0
June 21	1	37	0.08	83	36	0.06
July 21	1	12	0.03	100	12	0.02
Aug 21	1	0	0	0	0	0
Sept 21	1	0	0	0	1	0
Oct 21	1	0	0	0	6	0.01
Nov 21	1	0	0	0	0	0
Dec 21	1	0	0	0	0	0
Jan 22	1	12	0.03	50	12	0.02
Feb 22	1	0	0	0	0	0
March 22	1	7	0.01	0	6	0.01
March 22	2	0	0	0	0	0
April 22	1	24	0.05	75	31	0.05
April 22	2	12	0.03	50	13	0.02
May 22	1	12	0.03	100	12	0.02
May 22	2	6	0.01	100	7	0.01
June 22	1	7	0.01	0	26	0.04
June 22	2	132	0.30	11	259	0.41
July 22	1	18	0.04	100	36	0.06
July 22	2	0	0	0	7	0.01

Month	Survey number	Array only		Array plus 2km buffer		
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
Aug 22	1	0	0	0	1	0
Aug 22	2	0	0	0	0	0
Sept 22	1	0	0	0	7	0.01
Sept 22	2	0	0	0	0	0
Oct 22	1	7	0.01	0	6	0.01
Nov 22	1	12	0.03	50	13	0.02
Dec 22	1	43	0.1	71	61	0.1
Jan 23	1	33	0.08	50	39	0.06
Feb 23	1	0	0	0	0	0
March 23	1	30	0.07	20	42	0.07
April 23	1	19	0.04	0	18	0.03
May 23	1	0	0	0	63	0.1
June 23	1	152	0.35	44	183	0.29
July 23	1	13	0.03	50	382	0.61
Aug 23	1	0	0	0	0	0

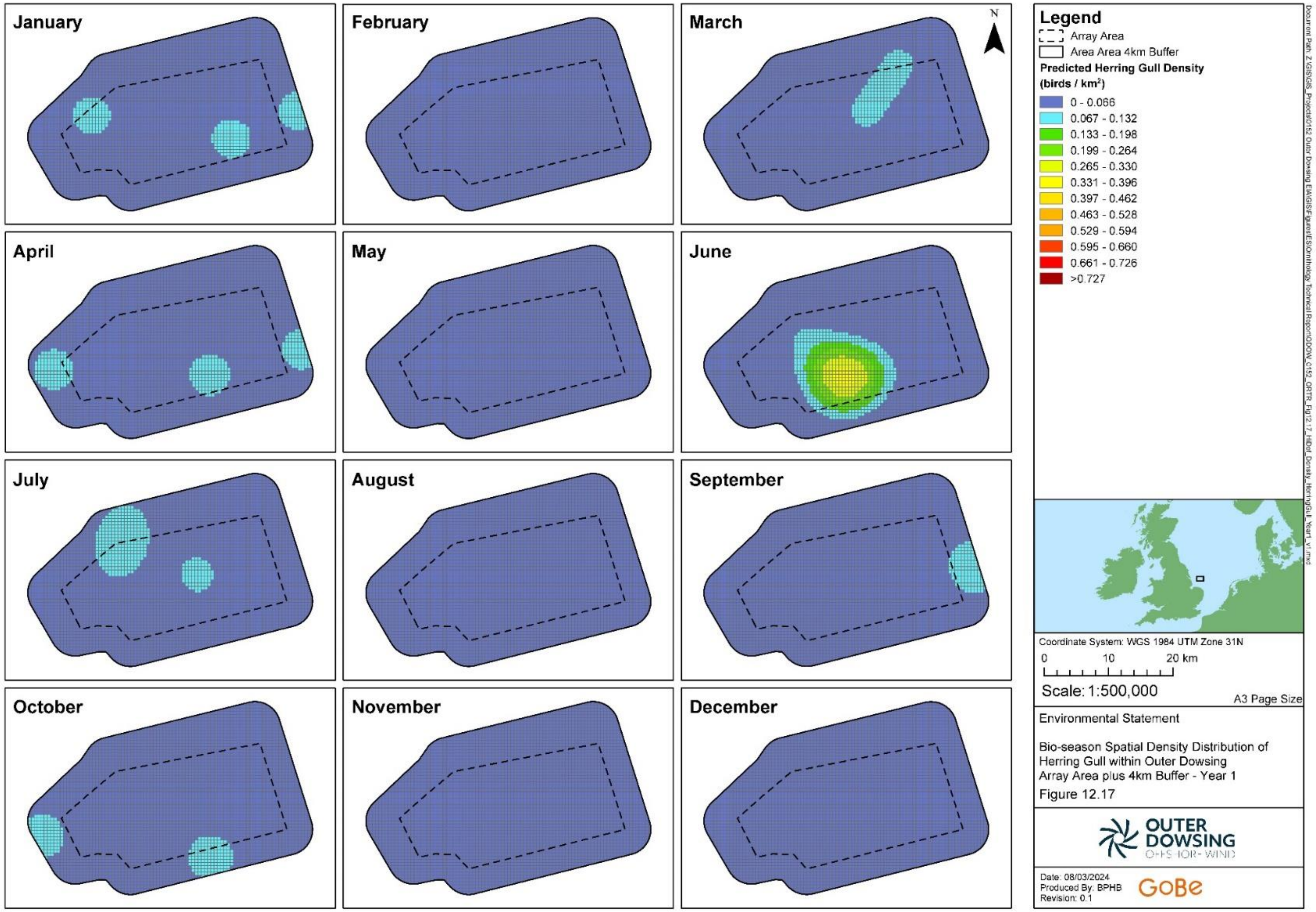

Figure 12.17 Bio-season spatial density distribution of herring gull within the Array Area plus 2km buffer – Year 1

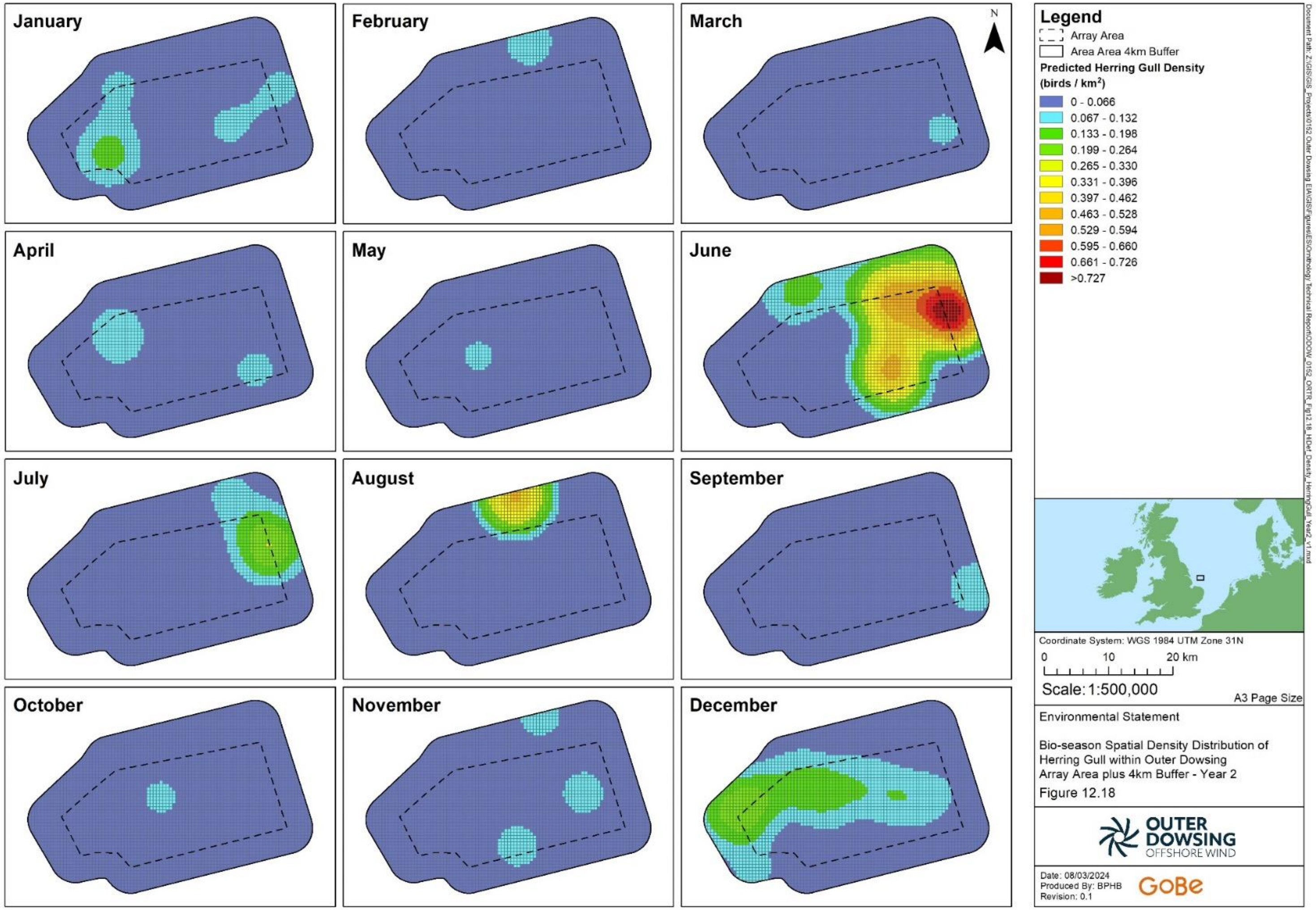

Figure 12.18 Bio-season spatial density distribution of herring gull within the Array Area plus 2km buffer - Year 2

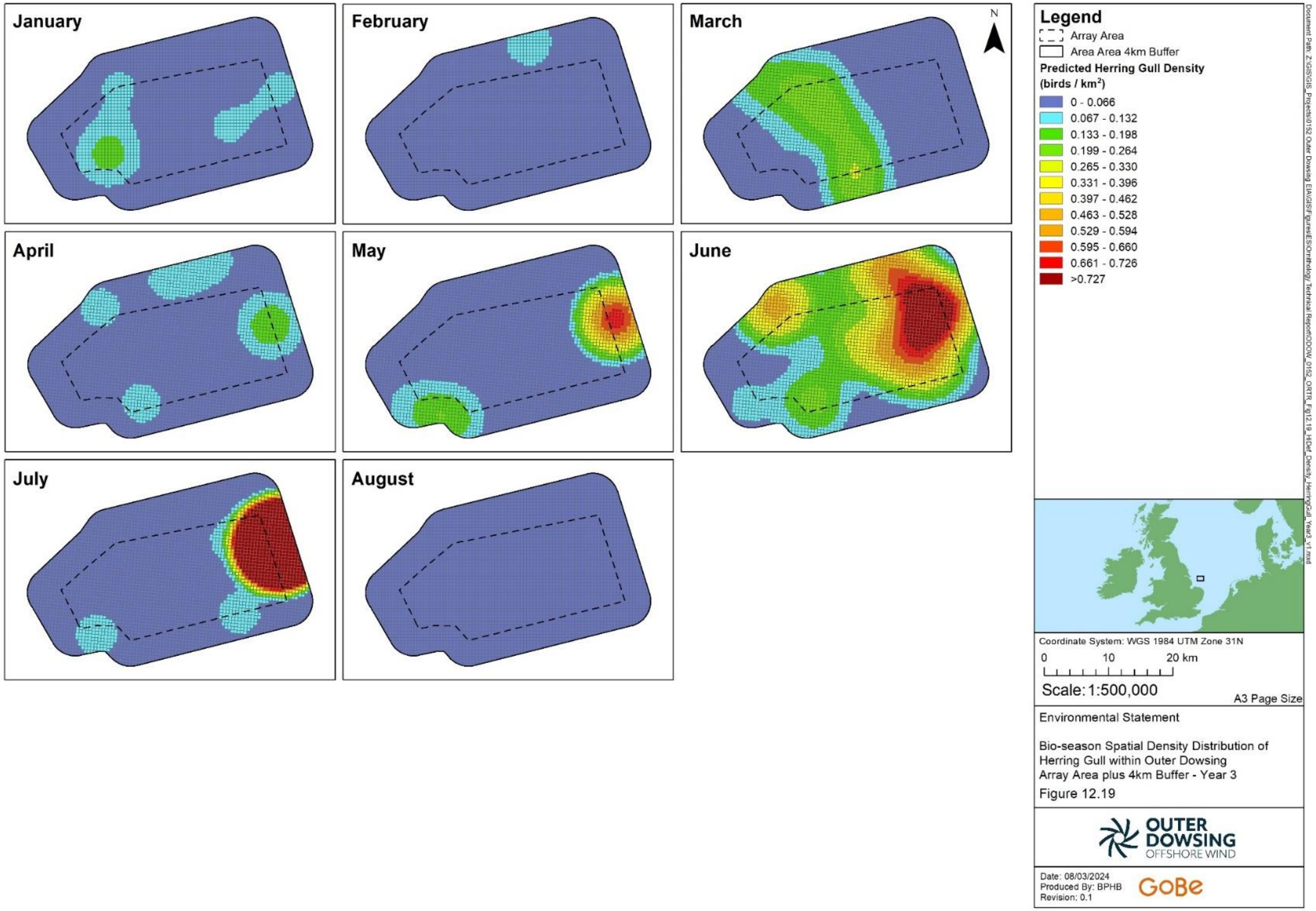

Figure 12.19 Bio-season spatial density distribution of herring gull within the Array Area plus 2km buffer - Year 3

94. Herring gull showed some variation in patterns of abundance across both years for which DAS data were collected. In both years, abundance offshore was high in the summer, corresponding with the chick rearing period for this species a time when adults are most likely to be foraging for soft food to provision young chicks. However, there was also high abundance estimated for December 2022 and January 2023. This peak did not occur the previous winter, and numbers in January 2023 were almost three times higher than those estimated for January 2022. This pattern was observed across both the array area and the array area plus 2km buffer and shows a similar pattern to that shown by great black-backed gull, suggesting that abundance of large gulls in that period was driven by food availability.

12.3.6.4 Flight direction

95. Figure 12.20 shows windrose diagrams presenting flight directions recorded for herring gull within the array area plus 4km.

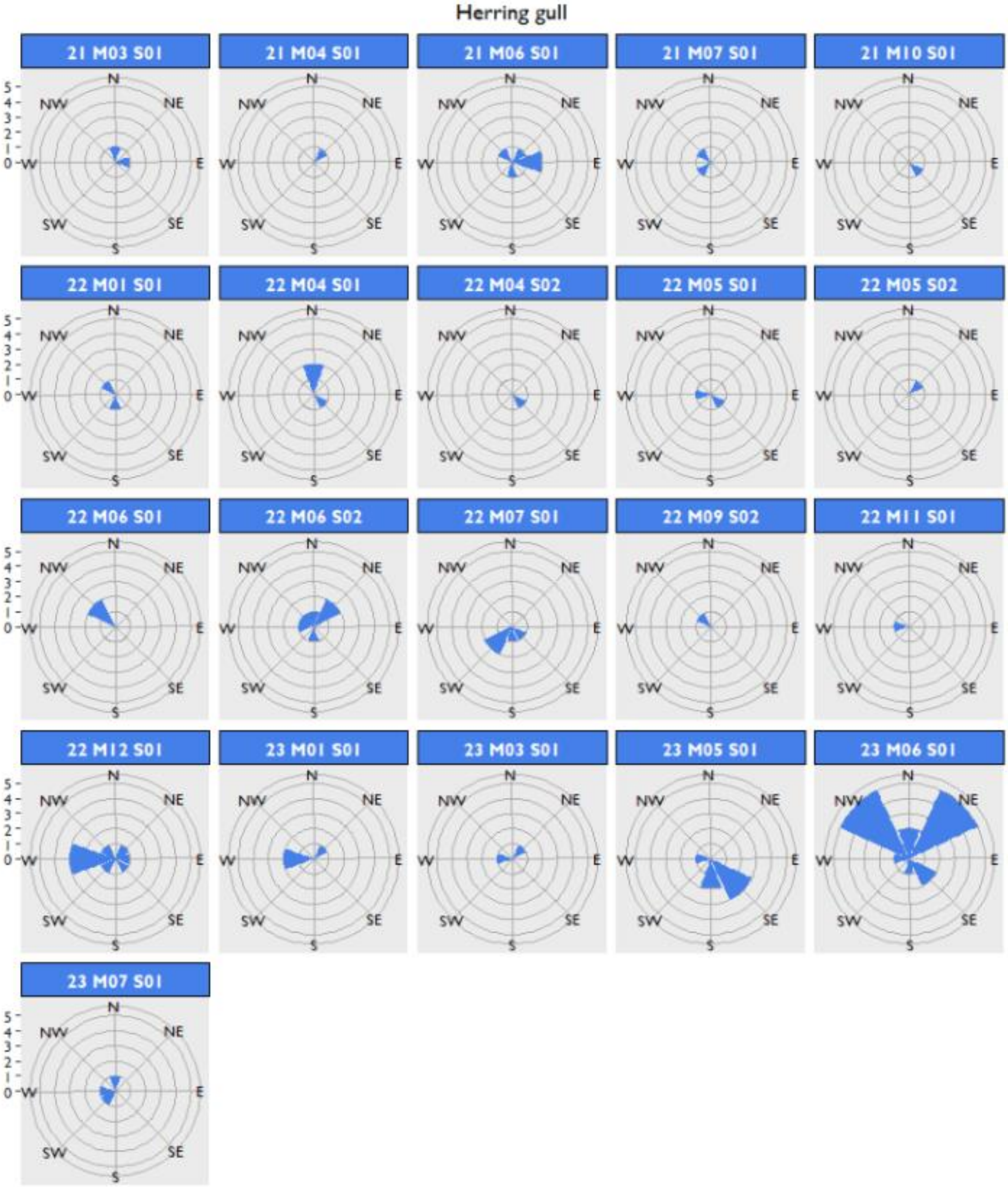

Figure 12.20. Windrose diagrams for months during which flying herring gull were recorded within the array area plus a 4km buffer,

96. Proportions of herring gull in flight are presented in Table 12.24.

Table 12.24. Proportions of herring gull in flight recorded in the in the Project array area.

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2021-03-22	0	1	0	0	100	0	1
2021-04-04	0	0	1	0	0	0	1
2021-05-12	0	0	0	0	0	0	0
2021-06-09	0	5	1	0	83	0	6
2021-07-24	0	2	0	0	100	0	2
2021-08-14	0	0	0	0	0	0	0
2021-09-07	0	0	0	0	0	0	0
2021-10-09	0	0	0	0	0	0	0
2021-11-02	0	0	0	0	0	0	0
2021-12-15	0	0	0	0	0	0	0
2022-01-06	0	1	1	0	50	0	2
2022-02-23	0	0	0	0	0	0	0
2022-03-11	0	0	1	0	0	0	1
2022-03-22	0	0	0	0	0	0	0
2022-04-02	0	3	1	0	75	0	4
2022-04-15	0	1	1	0	50	0	2
2022-05-02	0	2	0	0	100	0	2
2022-05-17	0	1	0	0	100	0	1
2022-06-09	0	0	1	0	0	0	1
2022-06-21	0	2	16	1	11	0	19
2022-07-04	0	3	0	0	100	0	3
2022-07-16	0	0	0	0	0	0	0
2022-08-08	0	0	0	0	0	0	0
2022-08-23	0	0	0	0	0	0	0
2022-09-13	0	0	0	0	0	0	0
2022-09-25	0	0	0	0	0	0	0
2022-10-10	0	0	1	0	0	0	1

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2022-11-07	0	1	1	0	50	0	2
2022-12-13	0	5	2	0	71	0	7
2023-01-26	0	2	2	0	50	0	4
2023-02-10	0	0	0	0	0	0	0
2023-03-24	0	1	4	0	20	0	5
2023-04-05	0	0	3	0	0	0	3
2023-05-03	0	0	0	0	0	0	0
2023-06-17	0	11	14	0	44	0	25
2023-07-05	0	1	1	0	50	0	2
2023-08-10	0	0	0	0	0	0	0
Total	0	42	51	1	-	0	94

12.3.6.5 Birds aged from DAS data

97. Proportions of herring gull aged from DAS images are presented in Table 12.25.

Table 12.25. Proportions of herring gull aged from DAS images within the array area plus a 2km buffer.

Survey Date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
22/03/2021	0	2	0	0	0	2	2
04/04/2021	0	0	0	2	0	2	0
12/05/2021	0	0	0	0	0	0	0
09/06/2021	1	4	0	1	20	6	5
24/07/2021	0	1	0	1	0	2	1
14/08/2021	0	0	0	0	0	0	0
07/09/2021	0	0	0	0	0	0	0
09/10/2021	1	0	0	0	100	1	1
02/11/2021	0	0	0	0	0	0	0
15/12/2021	0	0	0	0	0	0	0
06/01/2022	0	1	0	1	0	2	1
23/02/2022	0	0	0	0	0	0	0
11/03/2022	0	0	0	1	0	1	0
22/03/2022	0	0	0	0	0	0	0
02/04/2022	2	0	0	3	100	5	2
15/04/2022	0	1	0	1	0	2	1
02/05/2022	0	2	0	0	0	2	2
17/05/2022	0	1	0	0	0	1	1
09/06/2022	1	0	0	3	100	4	1
21/06/2022	3	7	0	28	30	38	10
04/07/2022	0	3	0	3	0	6	3
16/07/2022	0	0	0	1	0	1	0
08/08/2022	0	0	0	0	0	0	0
23/08/2022	0	0	0	0	0	0	0
13/09/2022	0	0	0	1	0	1	0
25/09/2022	0	0	0	0	0	0	0

Survey Date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
10/10/2022	0	0	0	1	0	1	0
07/11/2022	1	0	0	1	100	2	1
13/12/2022	6	0	1	3	86	10	7
26/01/2023	0	2	1	2	0	5	3
10/02/2023	0	0	0	0	0	0	0
24/03/2023	1	0	0	6	100	7	1
05/04/2023	1	1	0	1	50	3	2
03/05/2023	2	7	0	0	22	9	9
17/06/2023	2	10	0	18	17	30	12
05/07/2023	55	5	0	3	92	63	60
10/08/2023	0	0	0	0	0	0	0

12.3.7 Lesser black-backed gull

12.3.7.1 Digital aerial survey data

98. Lesser black-backed gull were recorded in the array area in 20 of the 30 months surveyed, with abundance and density peaking at 200 birds and 0.46 birds/km^2 respectively in June 2023 (Table 12.27).

99. In the array area plus 2km buffer, abundance and density peaked at 267 birds and 0.43 birds/km^2 respectively in June 2023 (Table 12.27).

12.3.7.2 Lesser black-backed gull overview

100. The nearest lesser black-backed gull breeding sites to the Project are found on the north Norfolk coast with the vast majority found on the Outer Trial Bank (582 nests in 2023) (BTO, 2022). This site is located approximately 90km from the Project array area, which means it is within the mean maximum foraging range of lesser black-backed gull (127km, standard deviation 109km) (Woodward *et al.*, 2019).

101. The nearest SPA that supports breeding lesser black-backed gull as a qualifying feature is the Alde-Ore Estuary SPA (population approximately 1,630 AON as of 2023. This SPA lies 147km from the Project array area and is beyond the mean maximum foraging range but within the mean maximum foraging range plus one standard deviation. Tracking data collected from breeding adults at this colony suggest that the Project does not fall within the home range of this population (Thaxter *et al.*, 2015).

102. Outside the breeding season, impacts on lesser black-backed gull have been compared to the UK North Sea and Channel BDMPS, consisting of 209,007 individuals during autumn migration (August to December), 39,314 individuals during the winter (November to February) and 197,483 individuals during spring migration (March to April) (Furness, 2015).

12.3.7.3 Abundance and Phenology

103. Peak abundances of lesser black-backed gull in the species bio-seasons (as defined in Furness 2015) are presented in Table 12.26. Estimates of monthly abundance, density and percentage flying within the array area, and monthly abundance and density within the array plus 2km buffer are presented in Table 12.27. The spatial density distribution of lesser black-backed gull within the Outer Dowsing Array Area plus 2km buffer is shown for three years of surveys in Figure 12.21, Figure 12.22, and Figure 12.23.

104. Lesser black-backed gull was present in the Project array area in consistent numbers across all four bio-seasons. Abundance was highest during the breeding bio-season (April to August), with a peak estimate of 200 birds and peak density of 0.46 birds/km^2 in June 2023 (Table 12.27).

Table 12.26. Lesser black-backed gull bio-season apportioned abundance and density estimates in the Project array area plus 2km buffer.GT

BDMPS Bio-seasons	Months	Array area		Array area +2km buffer	
		Bio-season peak abundance (n)	Bio-season peak density (n/km²)	Bio-season peak abundance (n)	Bio-season peak density (n/km²)
Return migration	March - April	10.3 (0.0 – 9.0)	0.02 (0.00 – 0.02)	19.7 (0.0 – 40.5)	0.03 (0.00 – 0.07)
Breeding	April - Aug	85.0 (45.3 – 133.2)	0.19 (0.10– 0.30)	111.2 (62.0 – 168.8)	0.18 (0.10 – 0.27)
Post-breeding migration	Aug – Oct	18.7 (3.0 – 54.8)	0.04 (0.01– 0.12)	26.5 (7.5 – 71.8)	0.04 (0.01 – 0.11)
Winter	Nov - Feb	3.5 (0.0 – 9.0)	0.01 (0.0 – 0.02)	3.5 (0.0 – 9.5)	0.01 (0.00 – 0.02)

Table 12.27. Lesser black-backed gull estimated apportioned abundance and estimated density in the Project array area and array area plus 2km buffer.

Month	Survey number	Array only			Array plus 2 km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
March 21	1	0	0	0	7	0.01
April 21	1	24	0.05	100	24	0.04
May 21	1	6	0.01	100	6	0.01
June 21	1	18	0.04	100	19	0.03
July 21	1	18	0.04	67	19	0.03
Aug 21	1	0	0	0	0	0
Sept 21	1	18	0.04	0	31	0.05
Oct 21	1	6	0.01	100	6	0.01
Nov 21	1	7	0.01	100	7	0.01
Dec 21	1	0	0	0	0	0
Jan 22	1	0	0	0	0	0
Feb 22	1	0	0	0	0	0
March 22	1	0	0	67	31	0.05
March 22	2	19	0.04	0	0	0
April 22	1	12	0.03	100	13	0.02
April 22	2	7	0.01	100	13	0.02
May 22	1	7	0.01	0	25	0.04
May 22	2	0	0	100	7	0.01
June 22	1	6	0.01	0	18	0.03
June 22	2	12	0.03	50	18	0.03
July 22	1	12	0.03	100	13	0.02

Month	Survey number	Array only			Array plus 2 km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
July 22	2	6	0.01	100	6	0.01
Aug 22	1	55	0.13	90	66	0.1
Aug 22	2	7	0.01	0	19	0.03
Sept 22	1	0	0	0	16	0.02
Sept 22	2	0	0	0	0	0
Oct 22	1	0	0	0	0	0
Nov 22	1	0	0	0	0	0
Dec 22	1	0	0	0	0	0
Jan 23	1	0	0	0	0	0
Feb 23	1	0	0	0	0	0
March 23	1	0	0	0	13	0.02
April 23	1	13	0.03	0	12	0.02
May 23	1	0	0	0	0	0
June 23	1	200	0.46	39	267	0.43
July 23	1	0	0	0	101	0.16
Aug 23	1	7	0.01	100	6	0.01

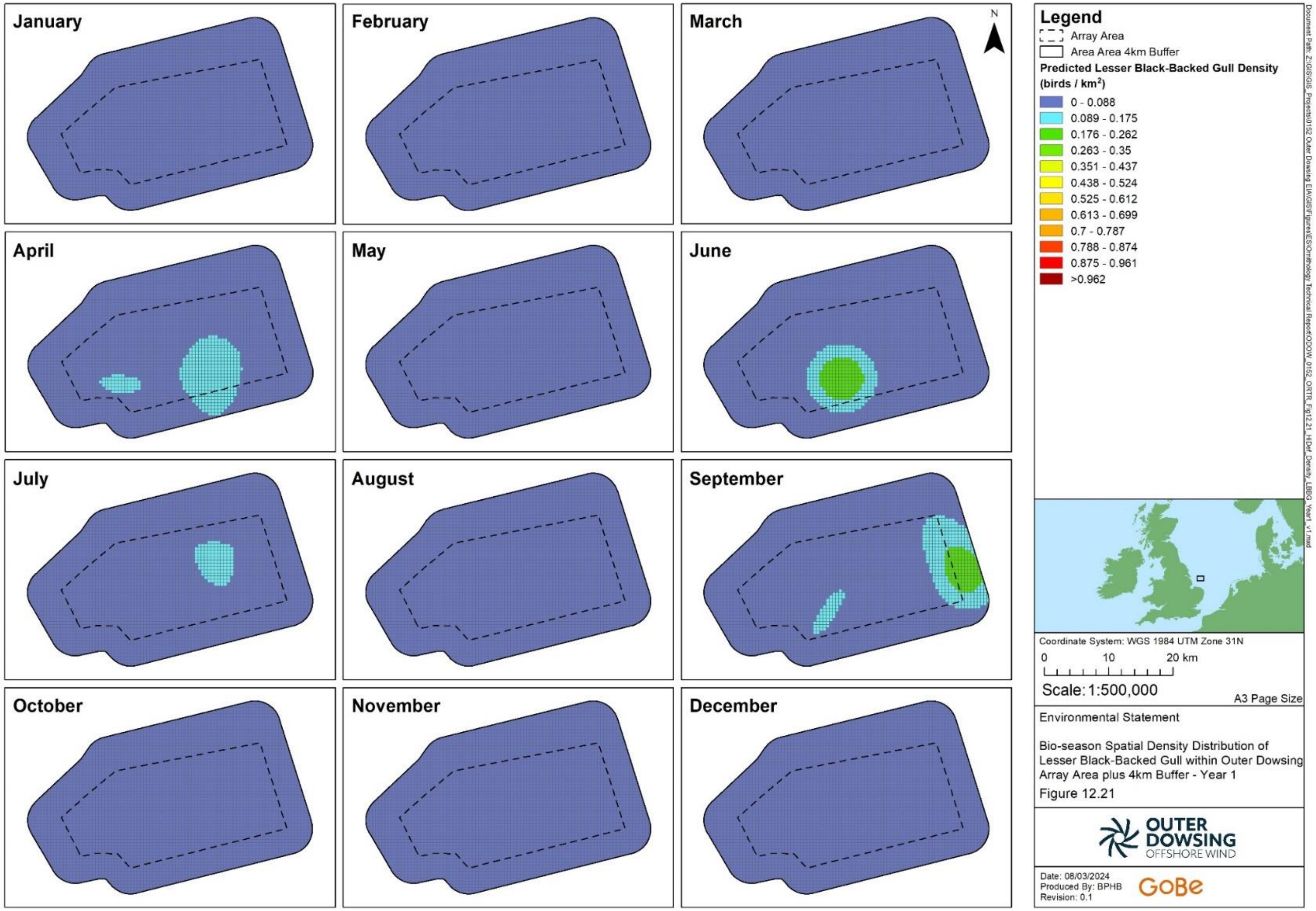

Figure 12.21 Bio-season spatial density distribution of lesser black-backed gull within the Array Area plus 2km buffer - Year 1

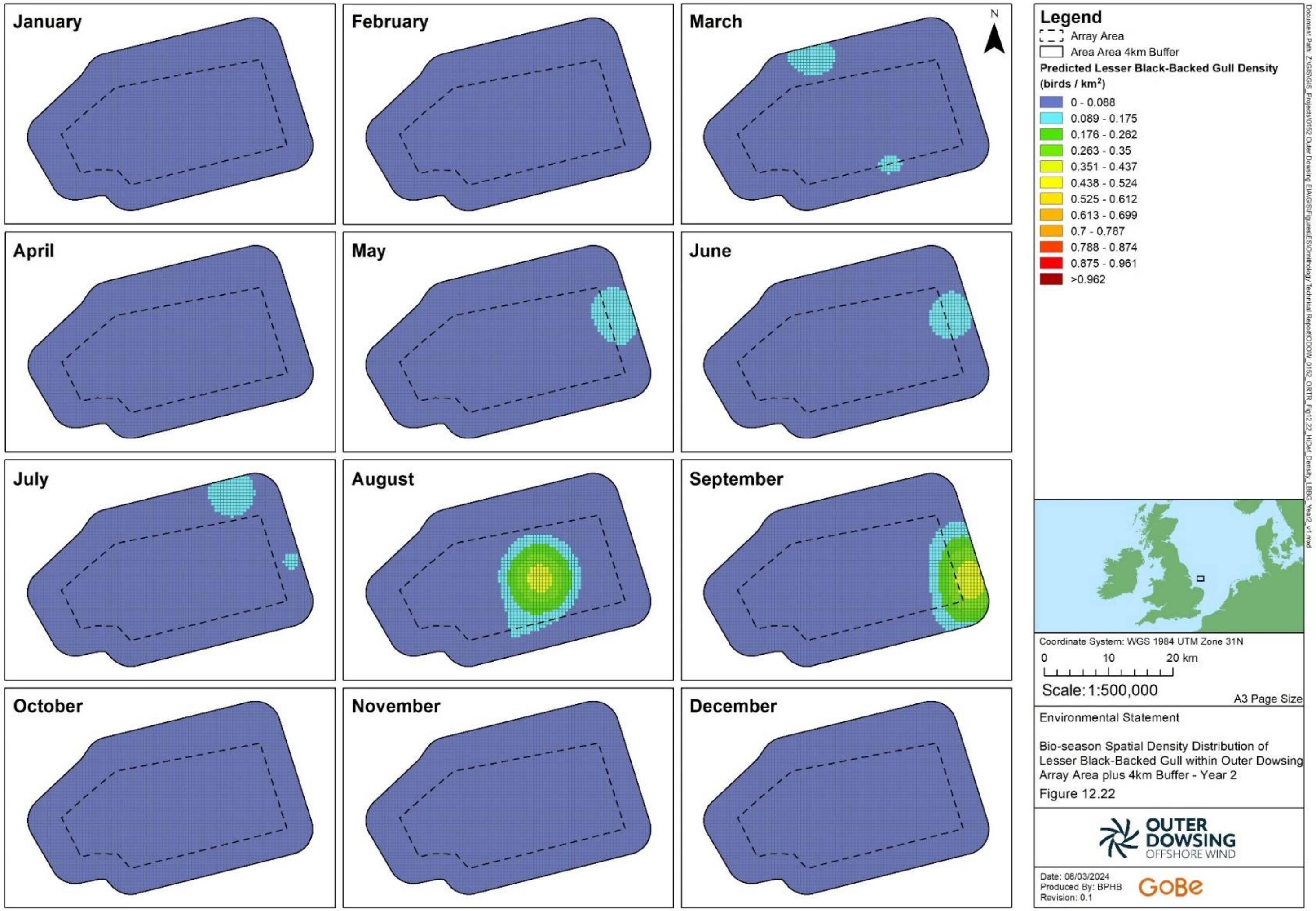

Figure 12.22 Bio-season spatial density distribution of lesser black-backed gull within the Array Area plus 2km buffer - Year 2

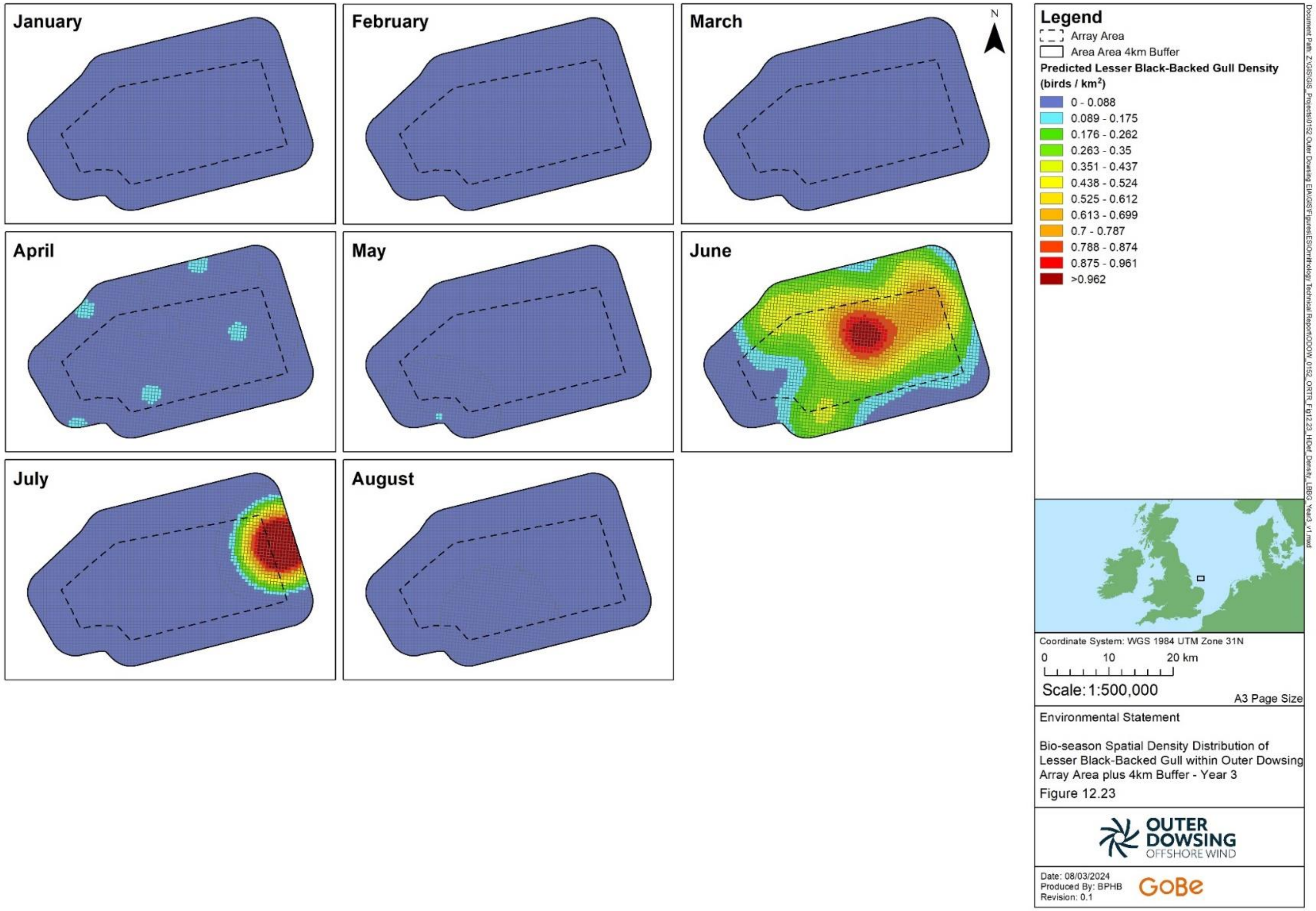

Figure 12.23 Bio-season spatial density distribution of lesser black-backed gull within the Array Area plus 2km buffer - Year 3.

105. Lesser black-backed gull showed some variation in patterns of abundance across both years for which DAS data were collected. In both years, abundance offshore was high in the autumn, corresponding with the period during which recently fledged birds start to become more independent and those undertaking their annual south westerly post breeding migration begin to do so. In the array area, this autumn peak was much higher in 2022 than in 2021. This pattern observed across the array area plus 2km buffer is much more difficult to interpret, with peaks in abundance in many months that do not correspond with high abundances in the array area.

12.3.7.4 Flight direction

106. Figure 12.24 shows windrose diagrams presenting flight directions recorded for lesser black-backed gull within the array area plus a 4km buffer.

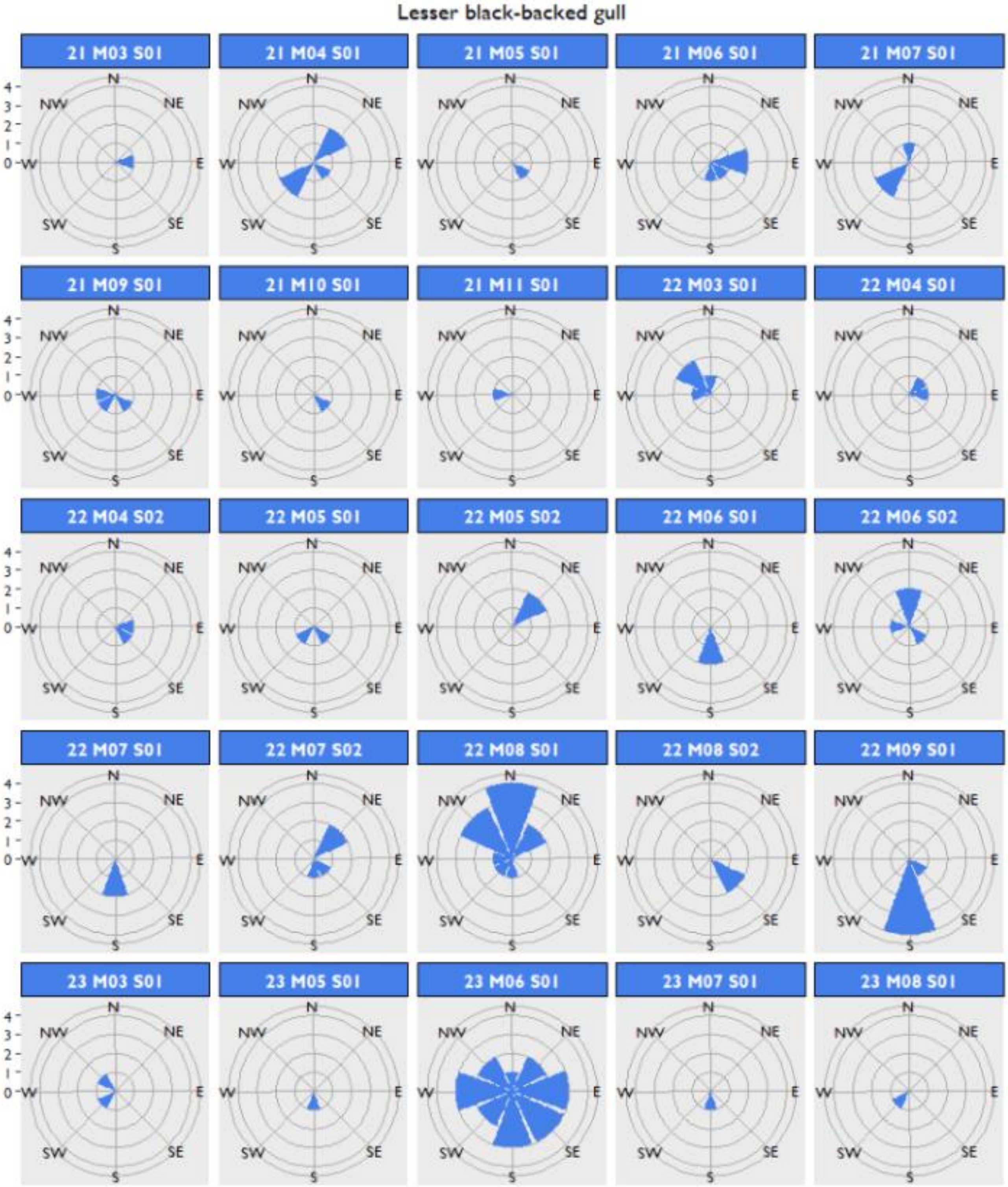

Figure 12.24. Windrose diagrams for months during which flying lesser black-backed gull were recorded within the array area plus a 4km buffer.

107. Proportions of herring gull in flight are presented in Table 12.28.

Table 12.28. Proportions of lesser black-backed gull in flight recorded in the in the Project array area.

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2021-03-22	0	0	0	0	0	0	0
2021-04-04	0	4	0	0	100	0	4
2021-05-12	0	1	0	0	100	0	1
2021-06-09	0	3	0	0	100	0	3
2021-07-24	0	2	1	0	67	0	3
2021-08-14	0	0	0	0	0	0	0
2021-09-07	0	0	3	0	0	0	3
2021-10-09	0	1	0	0	100	0	1
2021-11-02	0	1	0	0	100	0	1
2021-12-15	0	0	0	0	0	0	0
2022-01-06	0	0	0	0	0	0	0
2022-02-23	0	0	0	0	0	0	0
2022-03-11	0	2	1	0	67	0	3
2022-03-22	0	0	0	0	0	0	0
2022-04-02	0	2	0	0	100	0	2
2022-04-15	0	1	0	0	100	0	1
2022-05-02	0	0	0	0	0	0	0
2022-05-17	0	1	0	0	100	0	1
2022-06-09	0	0	1	0	0	0	1
2022-06-21	0	1	1	0	50	0	2
2022-07-04	0	2	0	0	100	0	2
2022-07-16	0	1	0	0	100	0	1
2022-08-08	0	9	1	0	90	0	10
2022-08-23	0	0	1	0	0	0	1
2022-09-13	0	0	0	0	0	0	0
2022-09-25	0	0	0	0	0	0	0
2022-10-10	0	0	0	0	0	0	0

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2022-11-07	0	0	0	0	0	0	0
2022-12-13	0	0	0	0	0	0	0
2023-01-26	0	0	0	0	0	0	0
2023-02-10	0	0	0	0	0	0	0
2023-03-24	0	0	0	0	0	0	0
2023-04-05	0	0	2	0	0	0	2
2023-05-03	0	0	0	0	0	0	0
2023-06-17	0	13	20	0	39	0	33
2023-07-05	0	0	0	0	0	0	0
2023-08-10	0	1	0	0	100	0	1
Total	0	45	31	0	-	0	76

12.3.7.5 Birds aged from DAS data

108. Proportions of lesser black-backed gull aged from DAS images are presented in Table 12.29.

Table 12.29. Proportions of lesser black-backed gull aged from DAS images within the array area plus a 2km buffer.

Survey Date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
22/03/2021	1	0	0	0	100	1	1
04/04/2021	4	0	0	0	100	4	4
12/05/2021	0	1	0	0	0	1	1
09/06/2021	1	2	0	0	33	3	3
24/07/2021	2	0	0	1	100	3	2
14/08/2021	0	0	0	0	0	0	0
07/09/2021	2	0	0	4	100	6	2
09/10/2021	1	0	0	0	100	1	1
02/11/2021	1	0	0	0	100	1	1
15/12/2021	0	0	0	0	0	0	0
06/01/2022	0	0	0	0	0	0	0
23/02/2022	0	0	0	0	0	0	0
11/03/2022	2	2	0	1	50	5	4
22/03/2022	0	0	0	0	0	0	0
02/04/2022	1	1	0	0	50	2	2
15/04/2022	2	0	0	0	100	2	2
02/05/2022	1	1	0	2	50	4	2
17/05/2022	0	1	0	0	0	1	1
09/06/2022	0	2	0	1	0	3	2
21/06/2022	1	1	0	1	50	3	2
04/07/2022	0	2	0	0	0	2	2
16/07/2022	1	0	0	0	100	1	1
08/08/2022	5	2	1	3	62	11	8
23/08/2022	2	0	0	1	100	3	2
13/09/2022	0	1	0	1	0	2	1
25/09/2022	0	0	0	0	0	0	0

Survey Date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
10/10/2022	0	0	0	0	0	0	0
07/11/2022	0	0	0	0	0	0	0
13/12/2022	0	0	0	0	0	0	0
26/01/2023	0	0	0	0	0	0	0
10/02/2023	0	0	0	0	0	0	0
24/03/2023	0	1	0	0	0	1	1
05/04/2023	1	0	0	1	100	2	1
03/05/2023	0	0	0	0	0	0	0
17/06/2023	9	7	1	27	53	44	17
05/07/2023	14	0	2	0	88	16	16
10/08/2023	0	1	0	0	0	1	1

12.3.8 Sandwich tern

12.3.8.1 Digital aerial survey data

109. Sandwich tern were recorded in the array area in 12 of the 30 months surveyed with abundance and density peaking at 150 birds and 0.34 birds/km^2 respectively in May 2023 (Table 12.31).

110. In the array area plus 2km buffer, abundance and density peaked at 217 birds and 0.35 birds/km^2 respectively in May 2023 (Table 12.31).

12.3.8.2 Sandwich tern overview

111. The nearest breeding population of Sandwich terns to the Project is at the North Norfolk Coast SPA (NNC SPA), of which Sandwich tern is a qualifying feature. Within the boundary of the NNC SPA, Sandwich tern breed at two principal colonies; Blakeney Point and Scolt Head (JNCC, 2022; Perrow *et al.*, 2017), approximately 70km and 77km from the Project array, respectively. These sites both lie outside the species mean maximum foraging range plus one standard deviation, 34.3km (±23.2km) from the Project array area.

112. The most recent breeding numbers for Sandwich tern were 3,730 nests at Scolt Head (2023) and 3,134 nests at Blakeney Point (2021) with a total number of breeding adults within the North Norfolk Coast SPA found to be 6,864 based on the most recent 2020-2023 colony count (BTO, 2023).

113. Outside the breeding season, the predicted mortality impact from the Project has been compared to the appropriate BDMPS for the relevant bio-season. The relevant background population is considered to be the UK North Sea and Channel BDMPS, consisting of 38,051 individuals during autumn migration (July to September), and spring migration (March to May) (Furness, 2015).

12.3.8.3 Abundance and Phenology

114. Peak abundances of Sandwich tern in the species bio-seasons (as defined in Furness 2015) are presented in Table 12.30. Estimates of monthly abundance, density and percentage flying within the array area, and monthly abundance and density within the array plus 2km buffer are presented in Table 12.31. The spatial density distribution of sandwich tern within the Outer Dowsing Array Area plus 2km buffer is shown for three years of surveys in Figure 12.25, Figure 12.26, and Figure 12.27.

115. Sandwich tern were present in the Project array area across all three bio-seasons. Abundance was highest during the breeding bio-season (April to August), with a seasonal peak estimate of 123 birds and seasonal peak density of 0.30 birds/km^2 (Table 12.30).

Table 12.30. Sandwich tern bio-season apportioned abundance and density estimates in the Project array area and array area plus 2km buffer.

BDMPS Bio-seasons	Months	Array area: Bio-season peak abundance (n)	Array area: Bio-season peak density (n/km^2)	Array area +2km buffer: Bio-season peak abundance (n)	Array area +2km buffer: Bio-season peak density (n/km^2)
Return migration	Mar - May	123.0 (57.8 – 187.0)	0.28 (0.13 – 0.43)	194.3 (96.5 – 297.0)	0.31 (0.15 – 0.47)
Breeding season	April - Aug	123.0 (67.5 – 191.3)	0.28 (0.15 – 0.44)	194.3 (105.3 – 295.7)	0.31 (0.17 – 0.47)
Post-breeding migration	July - Sep	9.5 (0.5 – 19.5)	0.20 (0.0 – 0.05)	9.3 (0.5 - 19.5)	0.02 (0.0 – 0.03)

Table 12.31. Sandwich tern estimated apportioned abundance and estimated density, in the Project array area and array area plus 2km buffer.

Month	Survey number	Array only: Population estimate	Array only: Density estimate	Array plus 2km buffer: Percentage flying	Array plus 2km buffer: Population estimate	Array plus 2km buffer: Density estimate
March 21	1	0	0	0	0	0
April 21	1	0	0	0	6	0.01
May 21	1	137	0.31	94	203	0.32
June 21	1	13	0.03	100	18	0.03
July 21	1	0	0	0	0	0
Aug 21	1	0	0	0	0	0
Sept 21	1	13	0.03	100	13	0.02
Oct 21	1	0	0	0	0	0
Nov 21	1	0	0	0	0	0
Dec 21	1	0	0	0	0	0
Jan 22	1	0	0	0	0	0
Feb 22	1	0	0	0	0	0
March 22	1	0	0	0	0	0
March 22	2	0	0	0	0	0
April 22	1	0	0	0	0	0
April 22	2	85	0.19	100	169	0.27
May 22	1	36	0	100	157	0.25
May 22	2	73	0.17	100	91	0.14
June 22	1	91	0.21	100	140	0.22
June 22	2	31	0.07	100	59	0.09
July 22	1	0	0	0	0	0
July 22	2	7	0.01	100	6	0.01

Month	Survey number	Array only		Array plus 2km buffer		
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
Aug 22	1	0	0	0	0	0
Aug 22	2	0	0	0	0	0
Sept 22	1	0	0	0	0	0
Sept 22	2	0	0	0	0	0
Oct 22	1	0	0	0	0	0
Nov 22	1	0	0	0	0	0
Dec 22	1	0	0	0	0	0
Jan 23	1	0	0	0	0	0
Feb 23	1	0	0	0	0	0
March 23	1	0	0	0	0	0
April 23	1	0	0	0	0	0
May 23	1	150	0.34	100	217	0.35
June 23	1	0	0	0	0	0
July 23	1	7	0.01	100	6	0.01
Aug 23	1	12	0.03	100	12	0.02

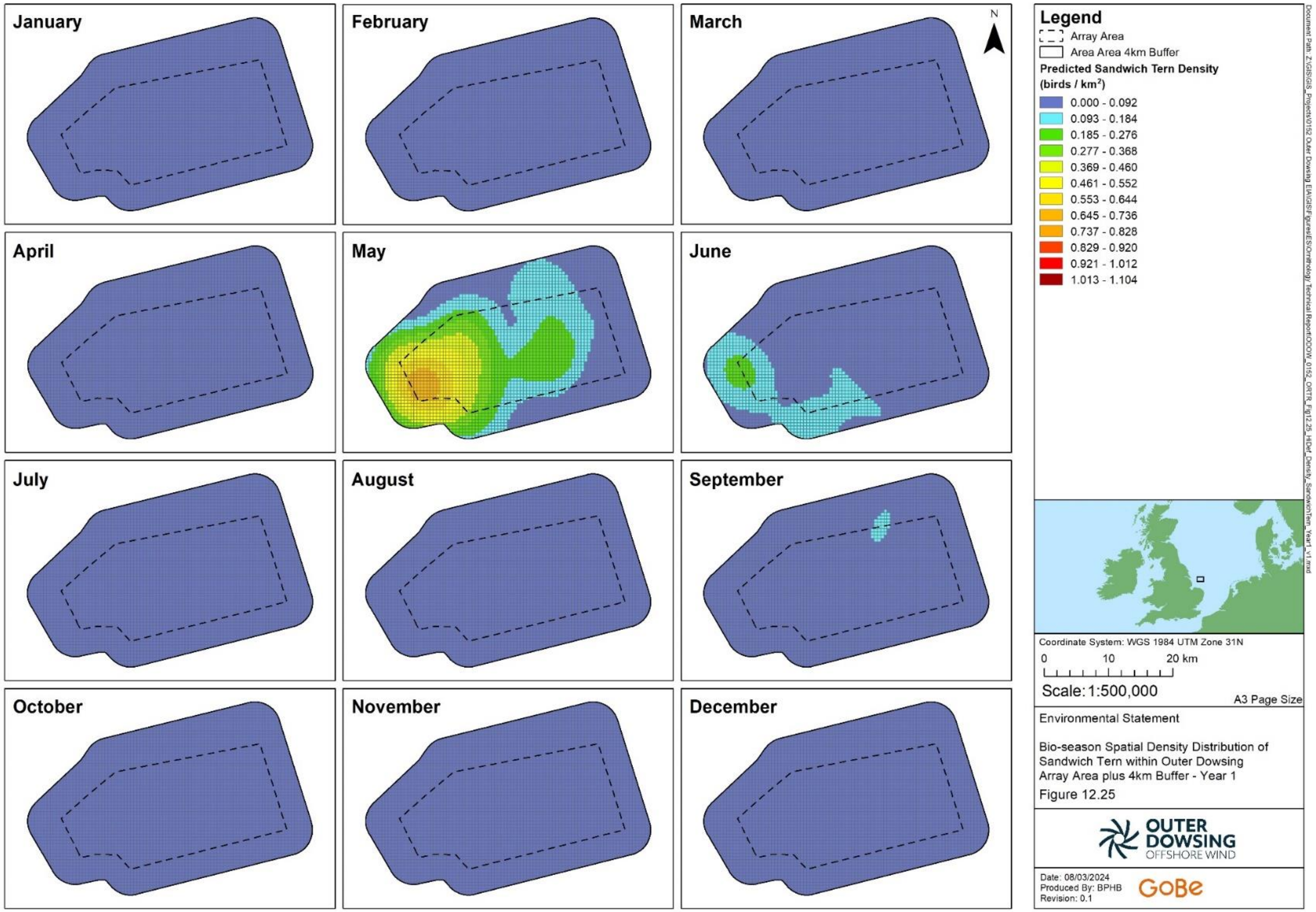

Figure 12.25 Bio-season spatial density distribution of sandwich tern within the Array Area plus 2km buffer - Year 1

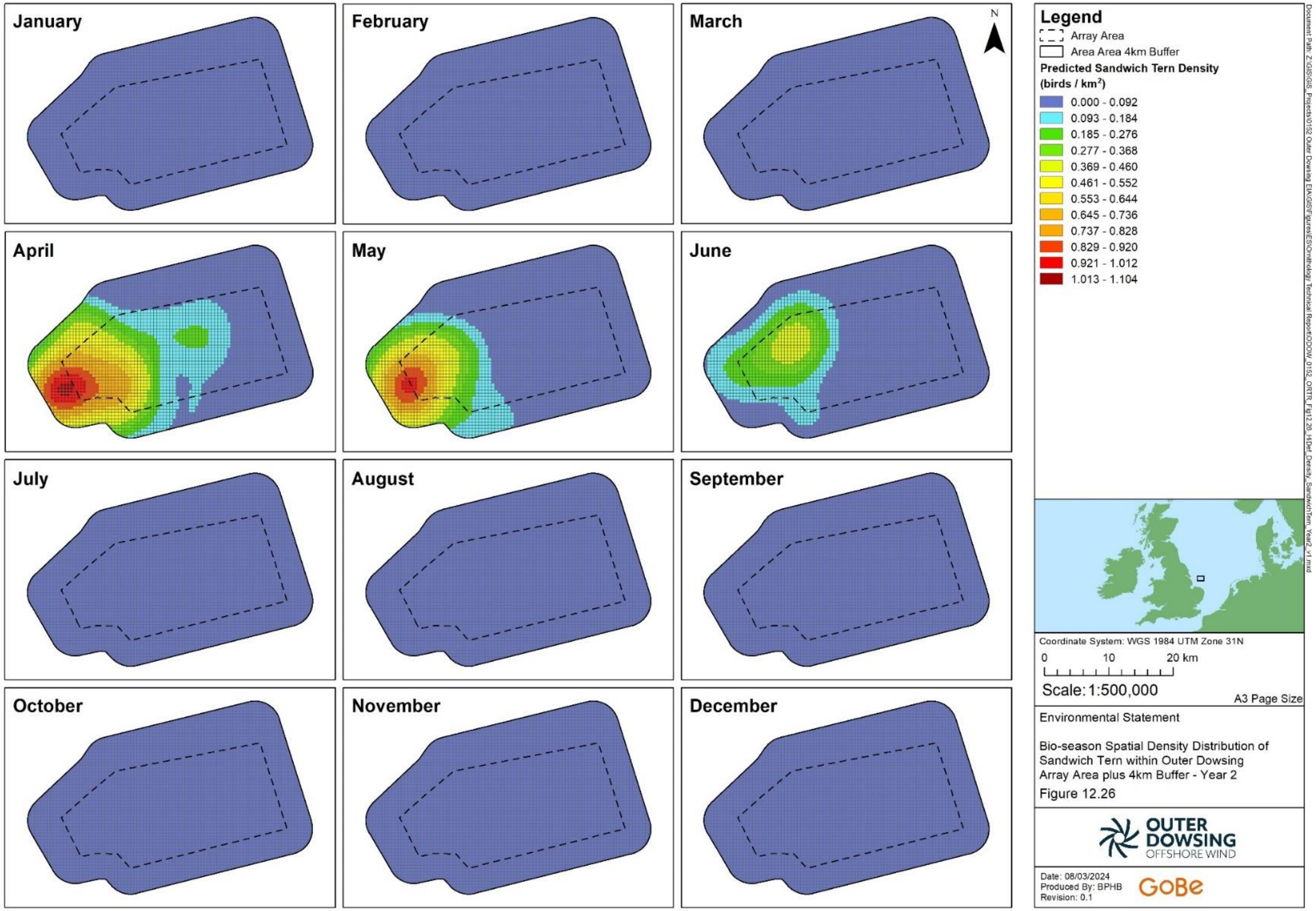

Figure 12.26 Bio-season spatial density distribution of sandwich tern within the Array Area plus 2km buffer - Year 2

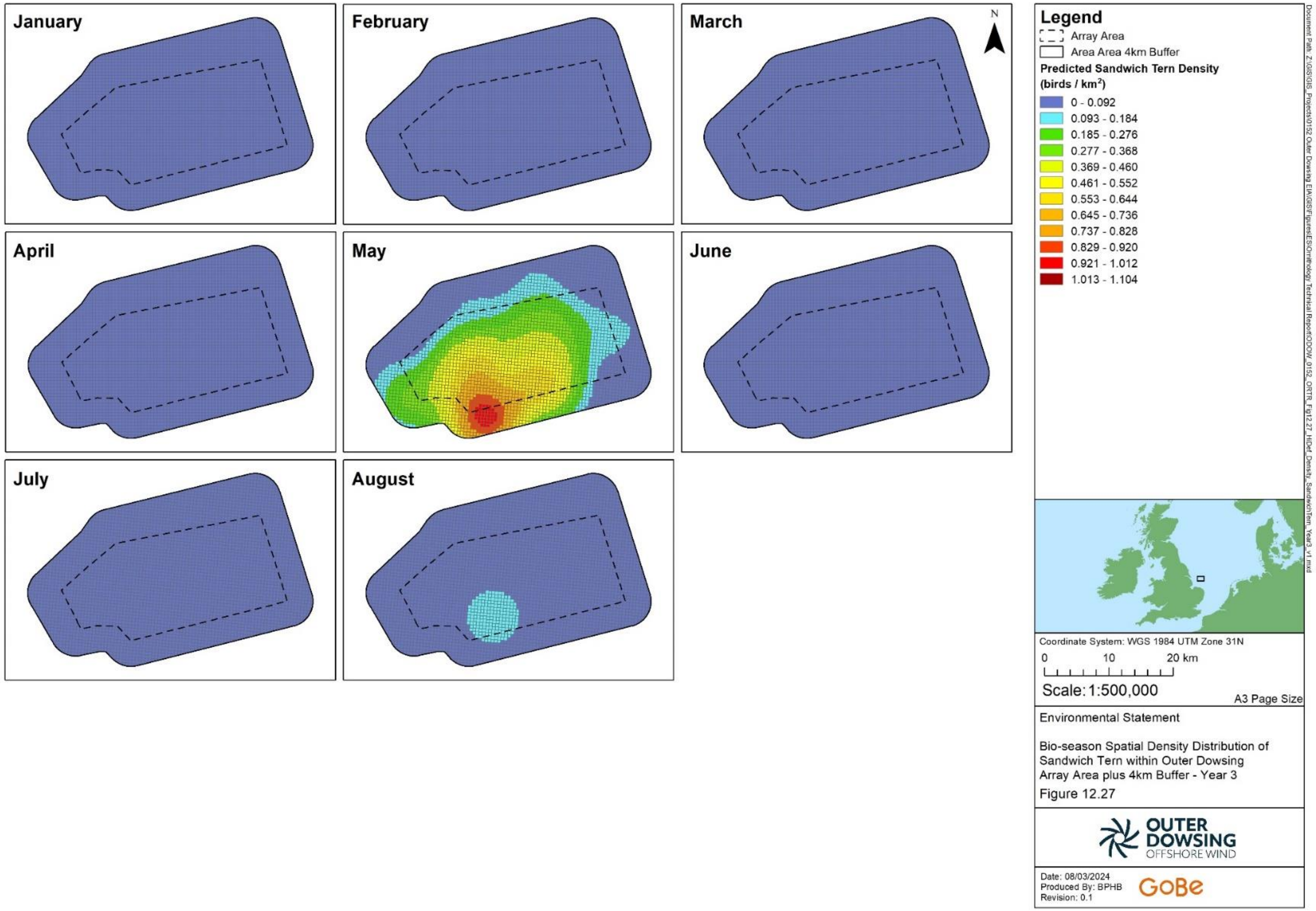

Figure 12.27 Bio-season spatial density distribution of sandwich tern within the Array Area plus 2km buffer - Year 3

116. Sandwich tern showed a very clear pattern of presence and abundance in both the array area and the array plus 2km buffer. Birds were present during the early part of the breeding season, peaking in May all three years in the array plus 2km buffer area and in the array area only; there was also a peak in the array area in June 2022. In all three years, the species was largely absent from the site from August onwards, although a slight peak in September 2021 suggests the presence of a small number of birds on migration.

12.3.8.4 Flight direction

117. Figure 12.28 shows windrose diagrams presenting flight directions recorded for sandwich tern within the array area plus a 4km buffer.

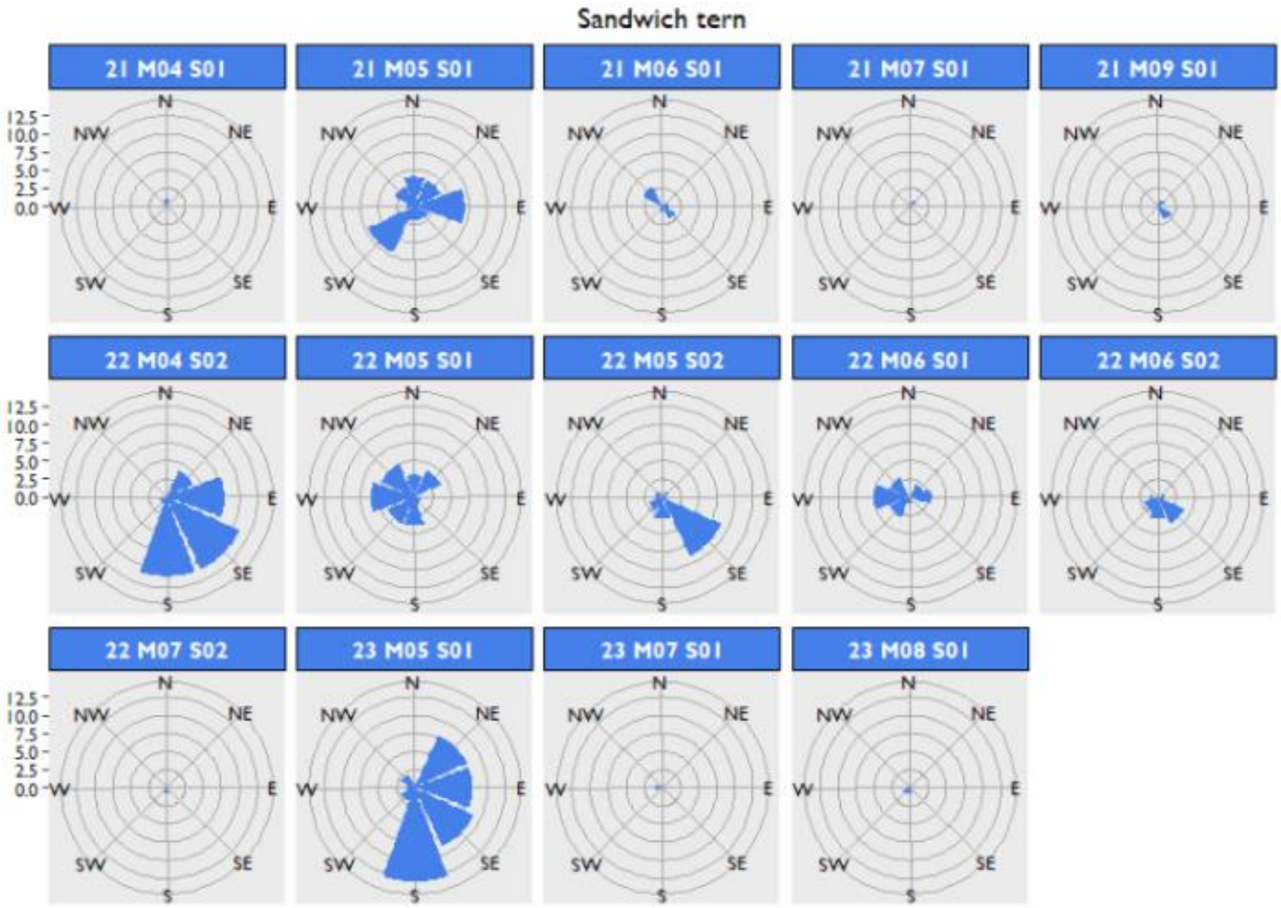

Figure 12.28. Windrose diagrams for months during which flying sandwich tern were recorded within the array area plus a 4km buffer.

118. Proportions of sandwich tern in flight are presented in Table 12.32.

Table 12.32. Proportions of sandwich tern in flight recorded in the in the Project array area.

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2021-03-22	0	0	0	0	0	0	0
2021-04-04	0	0	0	0	0	0	0
2021-05-12	0	16	1	0	94	0	17
2021-06-09	0	2	0	0	100	0	2
2021-07-24	0	0	0	0	0	0	0
2021-08-14	0	0	0	0	0	0	0
2021-09-07	0	2	0	0	100	0	2
2021-10-09	0	0	0	0	0	0	0
2021-11-02	0	0	0	0	0	0	0
2021-12-15	0	0	0	0	0	0	0
2022-01-06	0	0	0	0	0	0	0
2022-02-23	0	0	0	0	0	0	0
2022-03-11	0	0	0	0	0	0	0
2022-03-22	0	0	0	0	0	0	0
2022-04-02	0	0	0	0	0	0	0
2022-04-15	0	14	0	0	100	0	14
2022-05-02	0	5	0	0	100	0	5
2022-05-17	0	12	0	0	100	0	12
2022-06-09	0	10	0	0	100	0	10
2022-06-21	0	5	0	0	100	0	5
2022-07-04	0	0	0	0	0	0	0
2022-07-16	0	1	0	0	100	0	1
2022-08-08	0	0	0	0	0	0	0
2022-08-23	0	0	0	0	0	0	0
2022-09-13	0	0	0	0	0	0	0
2022-09-25	0	0	0	0	0	0	0
2022-10-10	0	0	0	0	0	0	0

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2022-11-07	0	0	0	0	0	0	0
2022-12-13	0	0	0	0	0	0	0
2023-01-26	0	0	0	0	0	0	0
2023-02-10	0	0	0	0	0	0	0
2023-03-24	0	0	0	0	0	0	0
2023-04-05	0	0	0	0	0	0	0
2023-05-03	0	23	0	0	100	0	23
2023-06-17	0	0	0	0	0	0	0
2023-07-05	0	1	0	0	100	0	1
2023-08-10	0	2	0	0	100	0	2
Total	0	93	1	0	-	0	94

12.3.8.5 Birds aged from DAS data

119. Proportions of sandwich tern aged from DAS images are presented in Table 12.33.

Table 12.33. Proportions of sandwich tern aged from DAS images within the array area plus a 2km buffer.

Survey Date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
22/03/2021	0	0	0	0	0	0	0
04/04/2021	0	0	0	1	0	1	0
12/05/2021	13	0	0	14	100	27	13
09/06/2021	2	0	0	1	100	3	2
24/07/2021	1	0	0	0	100	1	1
14/08/2021	0	0	0	0	0	0	0
07/09/2021	1	1	0	0	50	2	2
09/10/2021	0	0	0	0	0	0	0
02/11/2021	0	0	0	0	0	0	0
15/12/2021	0	0	0	0	0	0	0
06/01/2022	0	0	0	0	0	0	0
23/02/2022	0	0	0	0	0	0	0
11/03/2022	0	0	0	0	0	0	0
22/03/2022	0	0	0	0	0	0	0
02/04/2022	0	0	0	0	0	0	0
15/04/2022	28	0	0	0	100	28	28
02/05/2022	19	0	0	3	100	22	19
17/05/2022	14	0	0	0	100	14	14
09/06/2022	14	0	0	2	100	16	14
21/06/2022	10	0	0	0	100	10	10
04/07/2022	0	0	0	0	0	0	0
16/07/2022	0	0	0	1	0	1	0
08/08/2022	0	0	0	0	0	0	0
23/08/2022	0	0	0	0	0	0	0
13/09/2022	0	0	0	0	0	0	0
25/09/2022	0	0	0	0	0	0	0

Survey Date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
10/10/2022	0	0	0	0	0	0	0
07/11/2022	0	0	0	0	0	0	0
13/12/2022	0	0	0	0	0	0	0
26/01/2023	0	0	0	0	0	0	0
10/02/2023	0	0	0	0	0	0	0
24/03/2023	0	0	0	0	0	0	0
05/04/2023	0	0	0	0	0	0	0
03/05/2023	32	0	0	0	100	32	32
17/06/2023	0	0	0	0	0	0	0
05/07/2023	1	0	0	0	100	1	1
10/08/2023	2	0	0	0	100	2	2

12.3.9 Common tern

12.3.9.1 Digital aerial survey data

120. Common terns were recorded in the array area in 16 out of the 30 months surveyed with abundance and density peaking at 1,655 and 3.79 birds/km^2 respectively in September 2021 (Table 12.35).

121. In the array area plus 2km buffer, raw counts ranged from 0 (June 2022) to 189 (September 2021), with abundance and density peaking at 2,577 and 4.11 birds/km^2 respectively in September 2021 (Table 12.35). The spatial density distribution of common tern within the Outer Dowsing Array Area plus 2km buffer is shown for three years of surveys in Figure 12.29, Figure 12.30, and Figure 12.31.

12.3.9.2 Common tern overview

122. The mean maximum foraging range (±SD) of common tern is 18km (±8.9km), and the maximum recorded foraging range is 30km (Woodward *et al.*, 2019). The nearest colonies are in the NNC SPA, at least 65km from the Project and therefore out with the core foraging range of the colonies. The SPA breeding population is 110 pairs (BTO, 2023).

123. Outside the breeding season, impacts on common tern have been assessed against the UK North Sea and Channel BDMPS, consisting of 144,911 individuals during autumn migration (late July to early September), and spring migration (April to May) (Furness, 2015).

12.3.9.3 Abundance and Phenology

124. Peak abundances of common tern in the species bio-seasons (as defined in Furness 2015) are presented in Table 12.34. Estimates of monthly abundance, density and percentage flying within the array area, and monthly abundance and density within the array plus 2km buffer, are presented in Table 12.35.

125. Common tern was present in the Project array area in three bio-seasons; return migration, breeding, and post-breeding migration. Abundance in the array area was highest during the post-breeding migration bio-season (July to September), with a seasonal peak estimate of 583.3 birds and peak density of 1.34 birds/km^2 (Table 12.34).

Table 12.34. Common tern bio-season apportioned abundance and density estimates in the Project array area.

BDMPS Bio-seasons	Months	Array only		Array plus 2km buffer	
		Bio-season peak abundance (n)	Bio-season peak density (n/km^2)	Bio-season peak abundance (n)	Bio-season peak density (n/km^2)
Return Migration	April–May	70.3 (22.5 – 103.3)	0.16 (0.05 – 0.24)	109.8 (46.3 – 163.5)	0.18 (0.07 – 0.26)
Breeding	May – Aug	74.3 (29.3 – 139.2)	0.17 (0.07 – 0.32)	132.8 (56.5 – 299.2)	0.21 (0.09 – 0.48)

BDMPS Bio-seasons	Months	Array only		Array plus 2km buffer	
		Bio-season peak abundance (n)	Bio-season peak density (n/km^2)	Bio-season peak abundance (n)	Bio-season peak density (n/km^2)
Post-breeding migration	Jul- Sep	583.3 (547.5 – 1232.8)	1.34 (1.25 – 2.82)	946.3 (975.5 – 1731.3)	1.51 (1.56 – 2.76)

Table 12.35. Common tern estimated apportioned abundance and estimated density in the Project array area and array area plus 2km buffer.

Month	Survey number	Array only			Array plus 2km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
March 21	1	0	0	0	0	0
April 21	1	0	0	0	0	0
May 21	1	92	0.21	64	130	0.21
June 21	1	13	0.03	100	18	0.03
July 21	1	0	0	0	0	0
Aug 21	1	63	0.14	0	135	0.21
Sept 21	1	1,655	3.79	84	2,577	4.11
Oct 21	1	0	0	0	0	0
Nov 21	1	0	0	0	0	0
Dec 21	1	0	0	0	0	0
Jan 22	1	0	0	0	0	0
Feb 22	1	0	0	0	0	0
March 22	1	0	0	0	0	0
March 22	2	0	0	0	0	0
April 22	1	0	0	0	0	0
April 22	2	61	0.14	100	109	0.17
May 22	1	0	0	0	0	0
May 22	2	68	0.15	100	131	0.21
June 22	1	12	0.03	100	24	0.04
June 22	2	7	0.01	100	6	0.01
July 22	1	0	0	0	0	0
July 22	2	13	0.03	100	18	0.03
Aug 22	1	67	0.15	100	85	0.13
Aug 22	2	37	0.08	100	67	0.11
Sept 22	1	19	0.04	100	37	0.06
Sept 22	2	0	0	0	0	0
Oct 22	1	7	0.01	100	0	0
Nov 22	1	0	0	0	0	0

Month	Survey number	Array only			Array plus 2km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
Dec 22	1	0	0	0	0	0
Jan 23	1	0	0	0	0	0
Feb 23	1	0	0	0	0	0
March 23	1	0	0	0	0	0
April 23	1	6	0.01	0	7	0.01
May 23	1	79	0.18	100	122	0.19
June 23	1	0	0	0	0	0
July 23	1	0	0	0	0	0
Aug 23	1	43	0.10	100	186	0.30

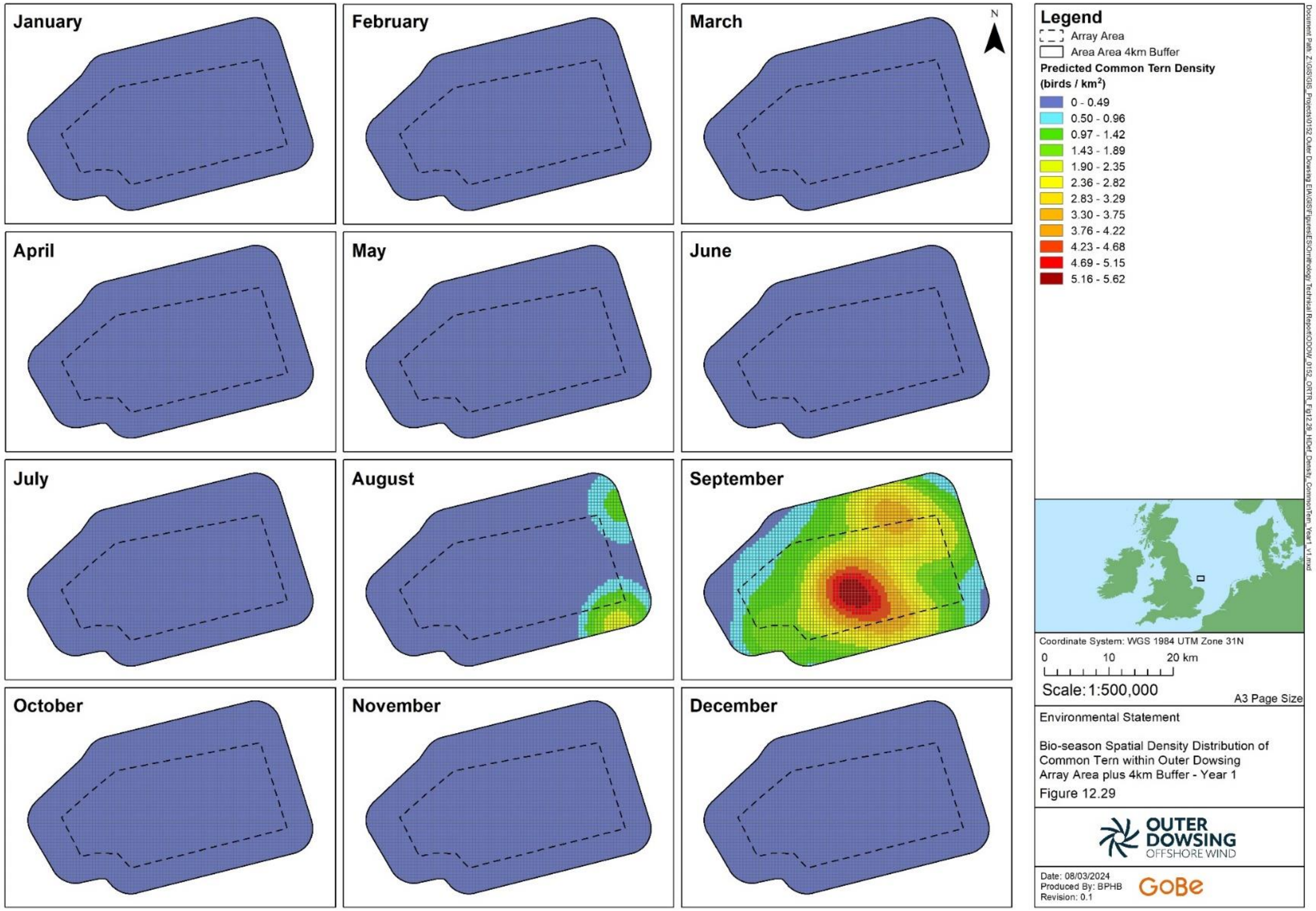

Figure 12.29 Bio-season spatial density distribution of common tern within the Array Area plus 2km buffer - Year 1

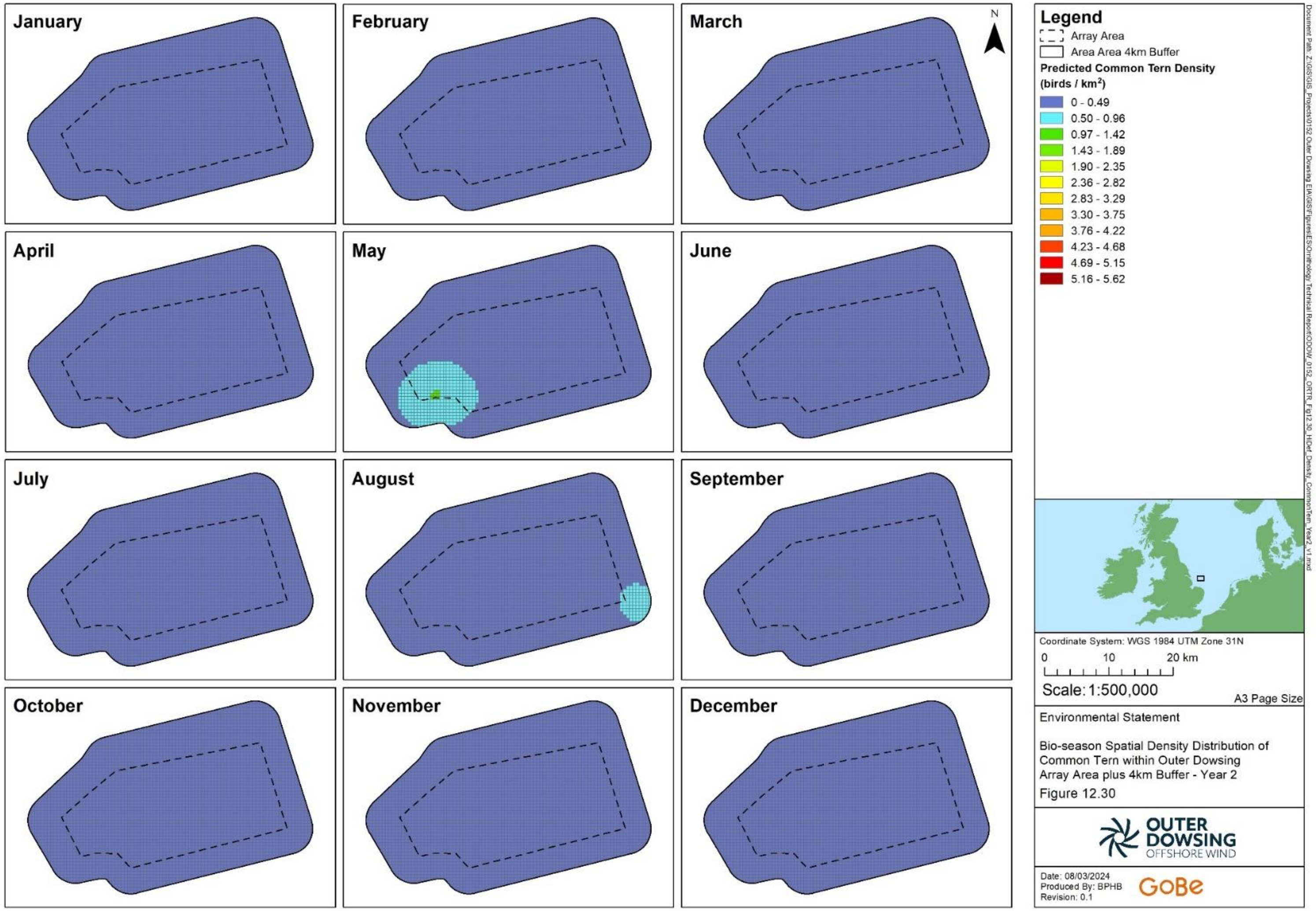

Figure 12.30 Bio-season spatial density distribution of common tern within the Array Area plus 2km buffer – Year 2

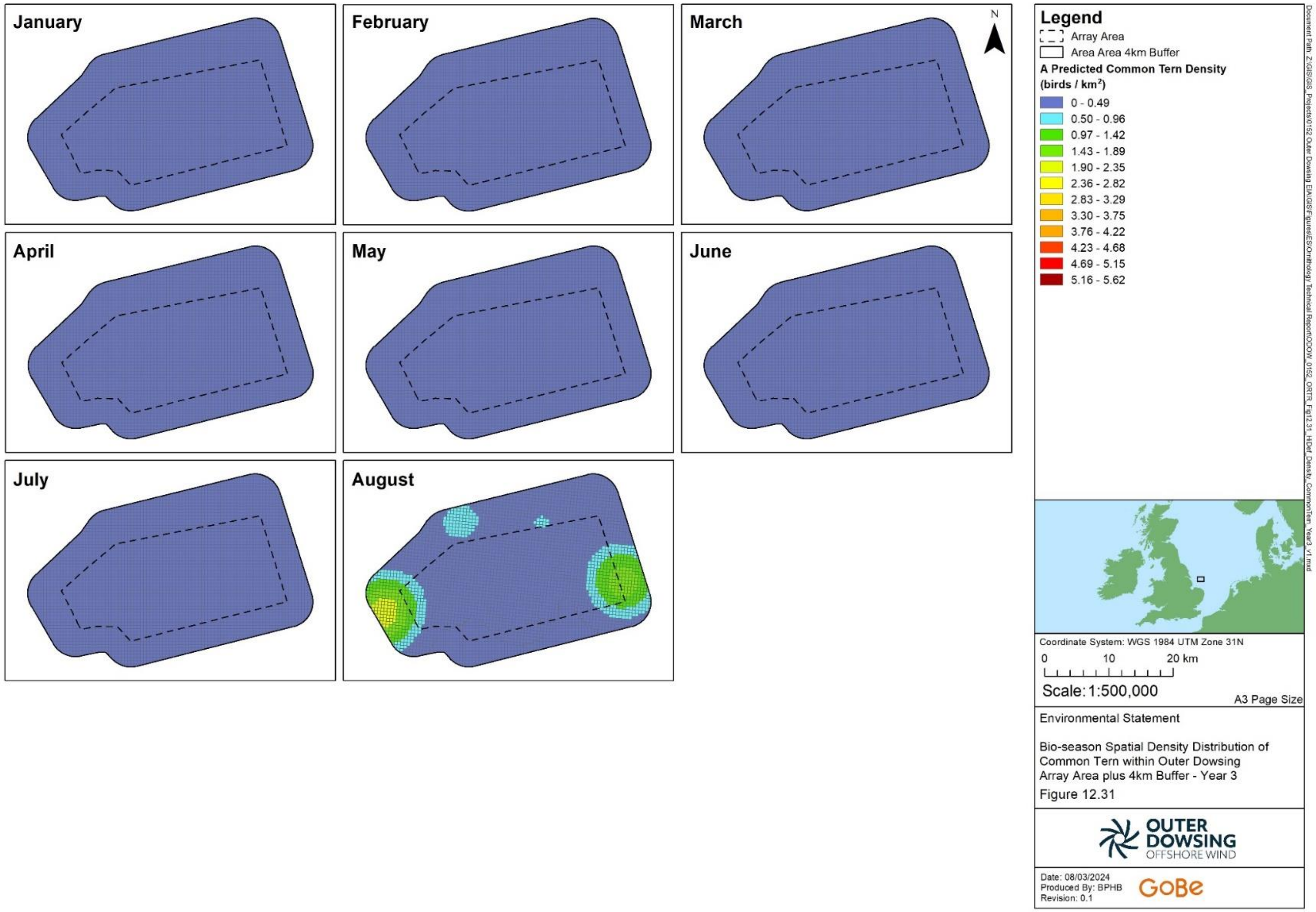

Figure 12.31 Bio-season spatial density distribution of common tern within the Array Area plus 2km buffer – Year 3

126. Common tern abundance varied between years. In 2021, the species was present in high numbers in both the array area and array area plus 2km buffer in September, suggesting a movement of migrating birds through the site in that month. In 2022, only very small numbers appeared during that period. The birds were also observed in both the array area and array plus 2km buffer in spring, but in very low numbers. This again suggests the presence of birds on migration, as if breeding common tern were using the area their presence would be expected throughout the breeding season.

12.3.9.4 Flight direction

127. Figure 12.32 shows windrose diagrams presenting flight directions recorded for common tern within the array area plus a 4km buffer.

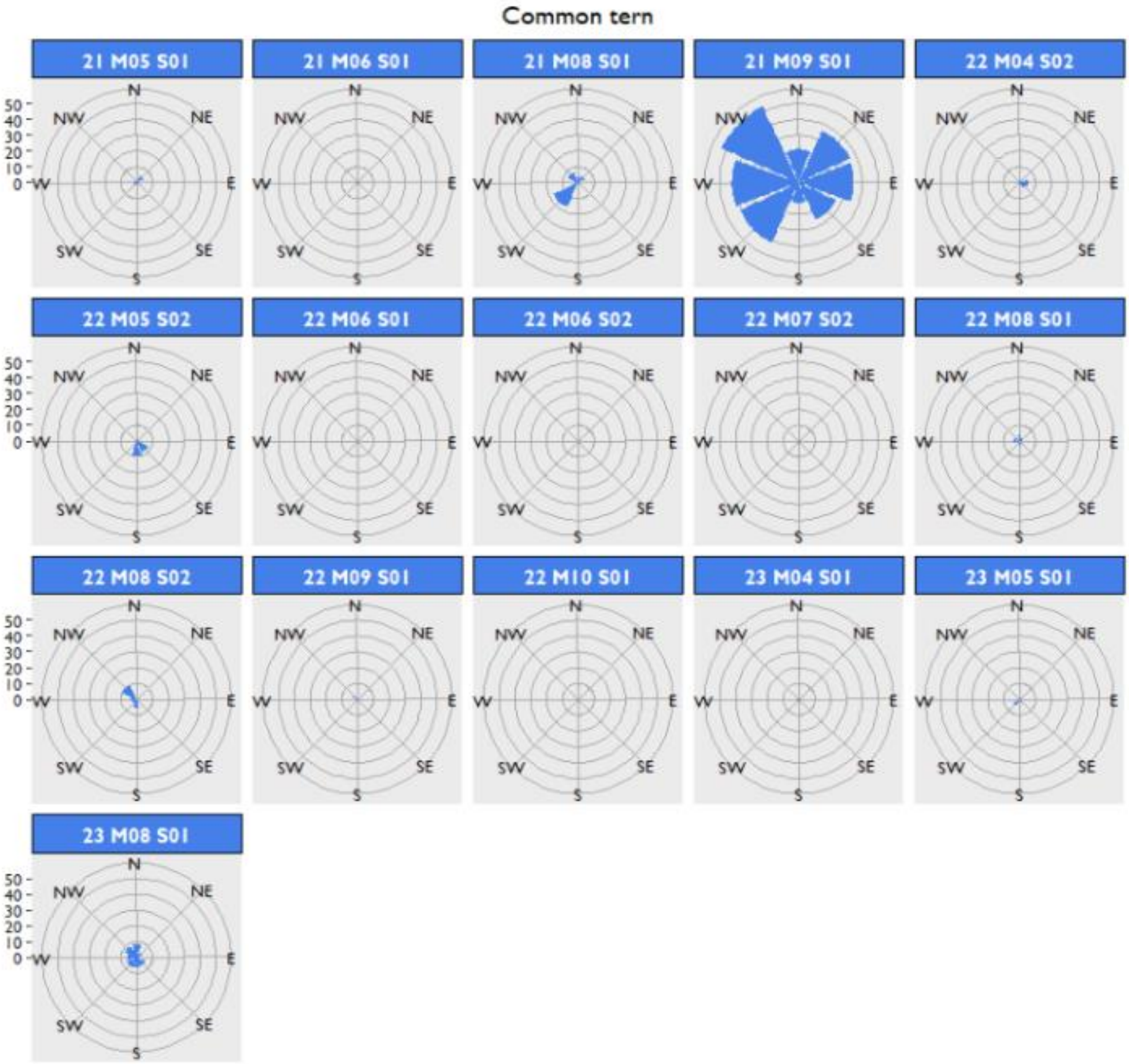

Figure 12.32. Windrose diagrams for months during which flying common tern were recorded within the array area plus a 4km buffer.

128. Proportions of common tern in flight are presented in Table 12.36.

Table 12.36. Proportions of common tern in flight recorded in the in the Project array area.

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2021-03-22	0	0	0	0	0	0	0
2021-04-04	0	0	0	0	0	0	0
2021-05-12	0	7	4	0	64	0	11
2021-06-09	0	2	0	0	100	0	2
2021-07-24	0	0	0	0	0	0	0
2021-08-14	0	0	0	0	0	0	0
2021-09-07	0	144	27	1	84	0	172
2021-10-09	0	0	0	0	0	0	0
2021-11-02	0	0	0	0	0	0	0
2021-12-15	0	0	0	0	0	0	0
2022-01-06	0	0	0	0	0	0	0
2022-02-23	0	0	0	0	0	0	0
2022-03-11	0	0	0	0	0	0	0
2022-03-22	0	0	0	0	0	0	0
2022-04-02	0	0	0	0	0	0	0
2022-04-15	0	5	0	0	100	0	5
2022-05-02	0	0	0	0	0	0	0
2022-05-17	0	10	0	0	100	0	10
2022-06-09	0	1	0	0	100	0	1
2022-06-21	0	1	0	0	100	0	1
2022-07-04	0	0	0	0	0	0	0
2022-07-16	0	2	0	0	100	0	2
2022-08-08	0	4	0	0	100	0	4
2022-08-23	0	4	0	0	100	0	4
2022-09-13	0	2	0	0	100	0	2
2022-09-25	0	0	0	0	0	0	0
2022-10-10	0	1	0	0	100	0	1

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2022-11-07	0	0	0	0	0	0	0
2022-12-13	0	0	0	0	0	0	0
2023-01-26	0	0	0	0	0	0	0
2023-02-10	0	0	0	0	0	0	0
2023-03-24	0	0	0	0	0	0	0
2023-04-05	0	0	0	0	0	0	0
2023-05-03	0	10	0	0	100	0	10
2023-06-17	0	0	0	0	0	0	0
2023-07-05	0	0	0	0	0	0	0
2023-08-10	0	6	0	0	100	0	6
Total	0	199	31	1	-	0	231

12.3.9.5 Birds aged from DAS data

112. Proportions of sandwich tern aged from DAS images are presented in Table 12.37.

Table 12.37. Proportions of common tern aged from DAS images within the array area plus a 2km buffer.

Survey Date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
22/03/2021	0	0	0	0	0	0	0
04/04/2021	0	0	0	0	0	0	0
12/05/2021	8	0	0	8	100	16	8
09/06/2021	2	0	0	0	100	2	2
24/07/2021	0	0	0	0	0	0	0
14/08/2021	0	0	2	2	0	4	2
07/09/2021	141	0	25	72	85	238	166
09/10/2021	0	0	0	0	0	0	0
02/11/2021	0	0	0	0	0	0	0
15/12/2021	0	0	0	0	0	0	0
06/01/2022	0	0	0	0	0	0	0
23/02/2022	0	0	0	0	0	0	0
11/03/2022	0	0	0	0	0	0	0
22/03/2022	0	0	0	0	0	0	0
02/04/2022	0	0	0	0	0	0	0
15/04/2022	3	0	0	6	100	9	3
02/05/2022	0	0	0	0	0	0	0
17/05/2022	8	0	0	10	100	18	8
09/06/2022	1	0	0	0	100	1	1
21/06/2022	0	0	0	1	0	1	0
04/07/2022	0	0	0	0	0	0	0
16/07/2022	2	0	0	0	100	2	2
08/08/2022	1	0	0	5	100	6	1
23/08/2022	5	0	3	1	62	9	8
13/09/2022	2	0	1	0	67	3	3
25/09/2022	0	0	0	0	0	0	0

Survey Date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
10/10/2022	0	0	1	0	0	1	1
07/11/2022	0	0	0	0	0	0	0
13/12/2022	0	0	0	0	0	0	0
26/01/2023	0	0	0	0	0	0	0
10/02/2023	0	0	0	0	0	0	0
24/03/2023	0	0	0	0	0	0	0
05/04/2023	2	0	0	0	100	2	2
03/05/2023	11	0	0	0	100	11	11
17/06/2023	0	0	0	0	0	0	0
05/07/2023	0	0	0	0	0	0	0
10/08/2023	13	0	10	5	57	28	23

12.3.10 Guillemot

12.3.10.1 Digital aerial survey data

129. Guillemot were recorded in the array area in all 24 months surveyed with abundance and density peaking at 16,821 birds and 38.52 birds/km^2 respectively in April 2021 (Table 12.39).

130. In the array area plus 2km buffer, abundance and density peaked at 24,984 birds and 39.88 birds/km^2 respectively in April 2022 (Table 12.39).

12.3.10.2 Guillemot overview

131. The mean maximum foraging range of breeding adult guillemots is 73.2km plus one standard deviation of 80.5km. The Project lies beyond the mean maximum foraging range though within the mean maximum foraging range plus one standard deviation (Woodward *et al.*, 2019). Based on the existing information regarding this species, its foraging range, and at sea distribution, it is concluded that there is connectivity between the Project during the breeding season with the nearest breeding population of the FFC SPA (Figure 12.18). The UK North Sea and Channel BDMPS is considered to be the relevant background population for guillemot during the non-breeding season (Furness, 2015), which consists of 1,617,306 birds.

12.3.10.3 Abundance and Phenology

132. Peak abundances of guillemot in the species bio-seasons (as defined in Furness 2015) are presented in Table 12.38. Estimates of monthly abundance, density and percentage flying within the array area, and monthly abundance and density within the array plus 2km buffer, are presented in Table 12.39. The spatial density distribution of guillemot within the Outer Dowsing Array Area plus 2km buffer is shown for three years of surveys in Figure 12.33, Figure 12.34, and Figure 12.35.

133. Guillemot was present in the Project array area consistently across both bio-seasons. Abundance in the array area was highest during the breeding bio-season (March to July), with a seasonal peak estimate of 11,848.7 birds and peak density of 27.13 birds/km^2 (Table 12.38).

134. In the array area plus 2km buffer, guillemot numbers were similarly greatest during the breeding bio-season, with a seasonal peak abundance of 16,445.3 birds and peak density of 26.25 birds/km^2 (Table 12.38).

Table 12.38. Guillemot bio-season apportioned abundance and density estimates in the Project array area plus 2km buffer.

BDMPS Bio-seasons	Months	Array only		Array plus 2km buffer	
		Bio-season peak abundance in array area (n)	Bio-season peak density estimate in array area (n/km^2)	Bio-season peak abundance within 2km buffer (n)	Bio-season peak density within 2km buffer (n/km^2)
Breeding	Mar-Jul	11,848.7 (8,538.0 – 15,781.3)	27.13 (19.55 – 36.14)	16,445.3 (12,548.0 – 21,072.7)	26.25 (20.03 – 33.64)

BDMPS Bio-seasons	Months	Array only		Array plus 2km buffer	
		Bio-season peak abundance in array area (n)	Bio-season peak density estimate in array area (n/km²)	Bio-season peak abundance within 2km buffer (n)	Bio-season peak density within 2km buffer (n/km²)
Non-breeding	Aug-Feb	7,229.0 (5,442.0 – 9,975.3)	16.55 (12.88 – 22.84)	11,208.0 (8,548.7 – 14,918.8)	17.89 (13.65 – 23.81)

Table 12.39. Guillemot estimated apportioned abundance and estimated density, in the Project array area and array area plus 2km buffer.

Month	Survey number	Array only		Array plus 2km buffer		
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
March 21	1	4251	9.74	6	6369	10.17
April 21	1	16821	38.52	3	21585	34.45
May 21	1	2889	6.61	1	4719	7.53
June 21	1	657	1.5	4	1062	1.7
July 21	1	5199	11.91	2	7644	12.19
Aug 21	1	10319	23.63	0	15222	24.29
Sept 21	1	12442	28.49	0	17488	27.91
Oct 21	1	4196	9.61	6	6050	9.66
Nov 21	1	3761	8.62	2	5431	8.66
Dec 21	1	2070	4.73	4	2888	4.6
Jan 22	1	409	0.94	2	579	0.93
Feb 22	1	3330	7.63	7	4203	6.7
March 22	1	5679	13	4	6972	11.14
March 22	2	5896	13.51	6	8171	13.04
April 22	1	15207	34.82	14	24984	39.88
April 22	2	7905	18.1	7	11594	18.51
May 22	1	7640	17.5	1	12806	20.45
May 22	2	2126	4.87	3	4110	6.56
June 22	1	959	2.19	4	2253	3.59
June 22	2	2679	6.12	1	4221	6.74
July 22	1	1123	2.56	3	2089	3.33
July 22	2	3954	9.05	2	6525	10.41
Aug 22	1	6209	14.22	0	11998	19.15
Aug 22	2	1675	3.83	0	2932	4.67
Sept 22	1	2493	5.7	2	6113	9.76
Sept 22	2	878	2.01	1	1333	2.13
Oct 22	1	1335	3.06	18	2346	3.74

Month	Survey number	Array only		Array plus 2km buffer		
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
Nov 22	1	1012	2.32	2	1681	2.68
Dec 22	1	2435	5.57	19	3554	5.66
Jan 23	1	1475	3.37	6	1702	2.71
Feb 23	1	2099	4.81	6	2931	4.68
March 23	1	5114	11.72	13	6667	10.64
April 23	1	7169	16.42	1	9462	15.1
May 23	1	999	2.29	3	3929	6.27
June 23	1	1179	2.7	1	1881	3
July 23	1	1340	3.06	3	2166	3.46
Aug 23	1	5303	12.14	0	8671	13.84

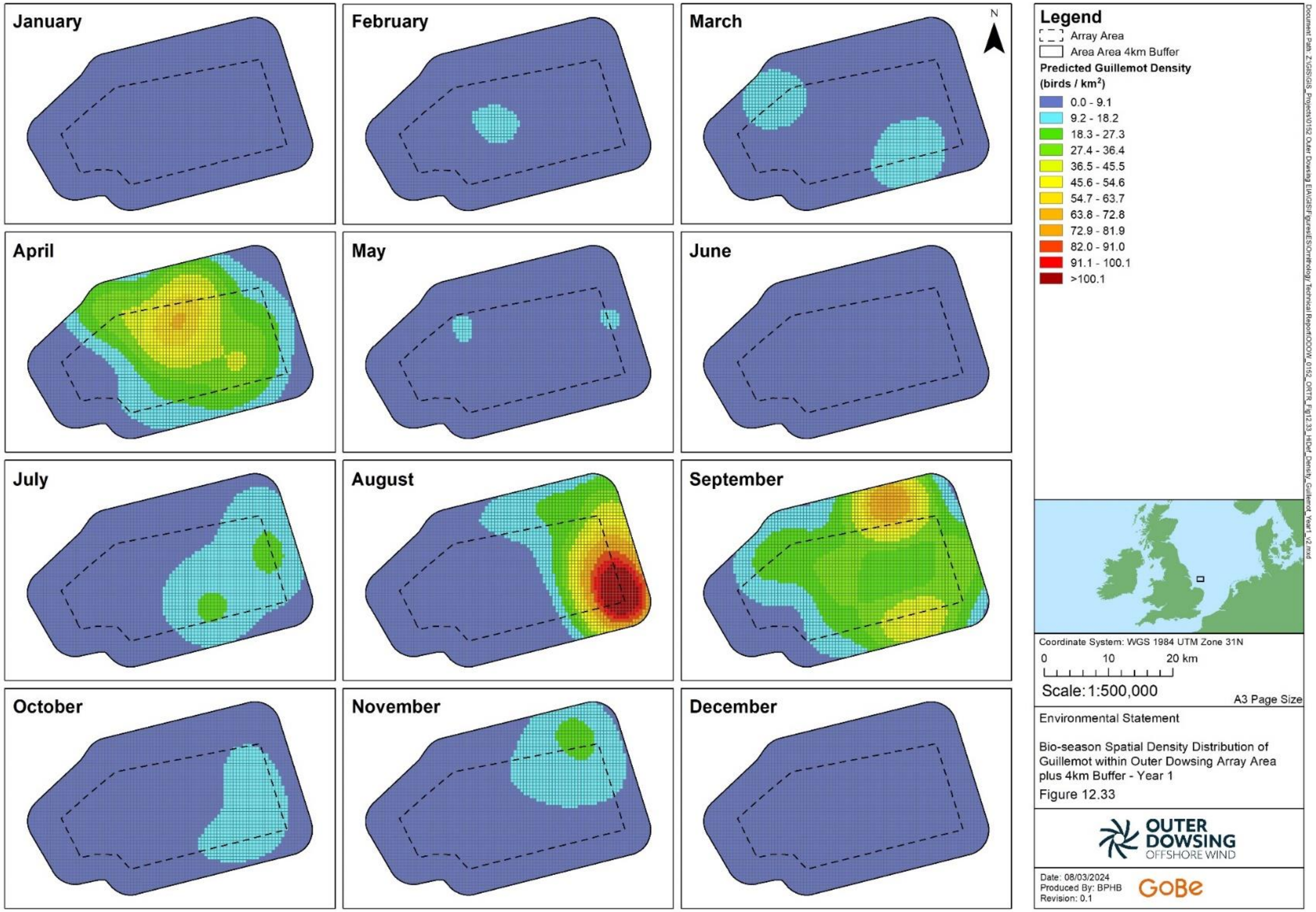

Figure 12.33 Bio-season spatial density distribution of guillemot within the Array Area plus 2km buffer – Year 1

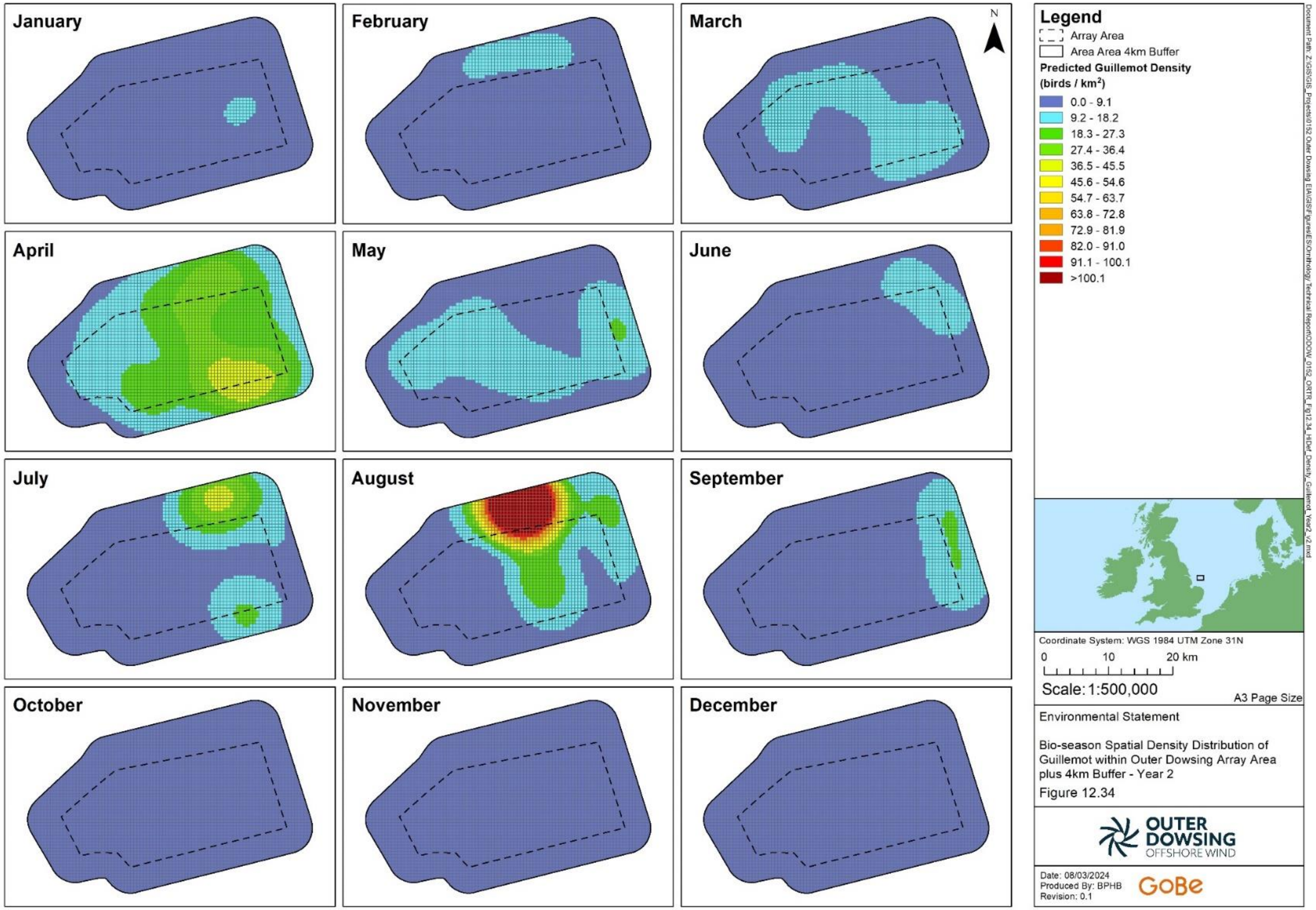

Figure 12.34 Bio-season spatial density distribution of guillemot within the Array Area plus 2km buffer – Year 2

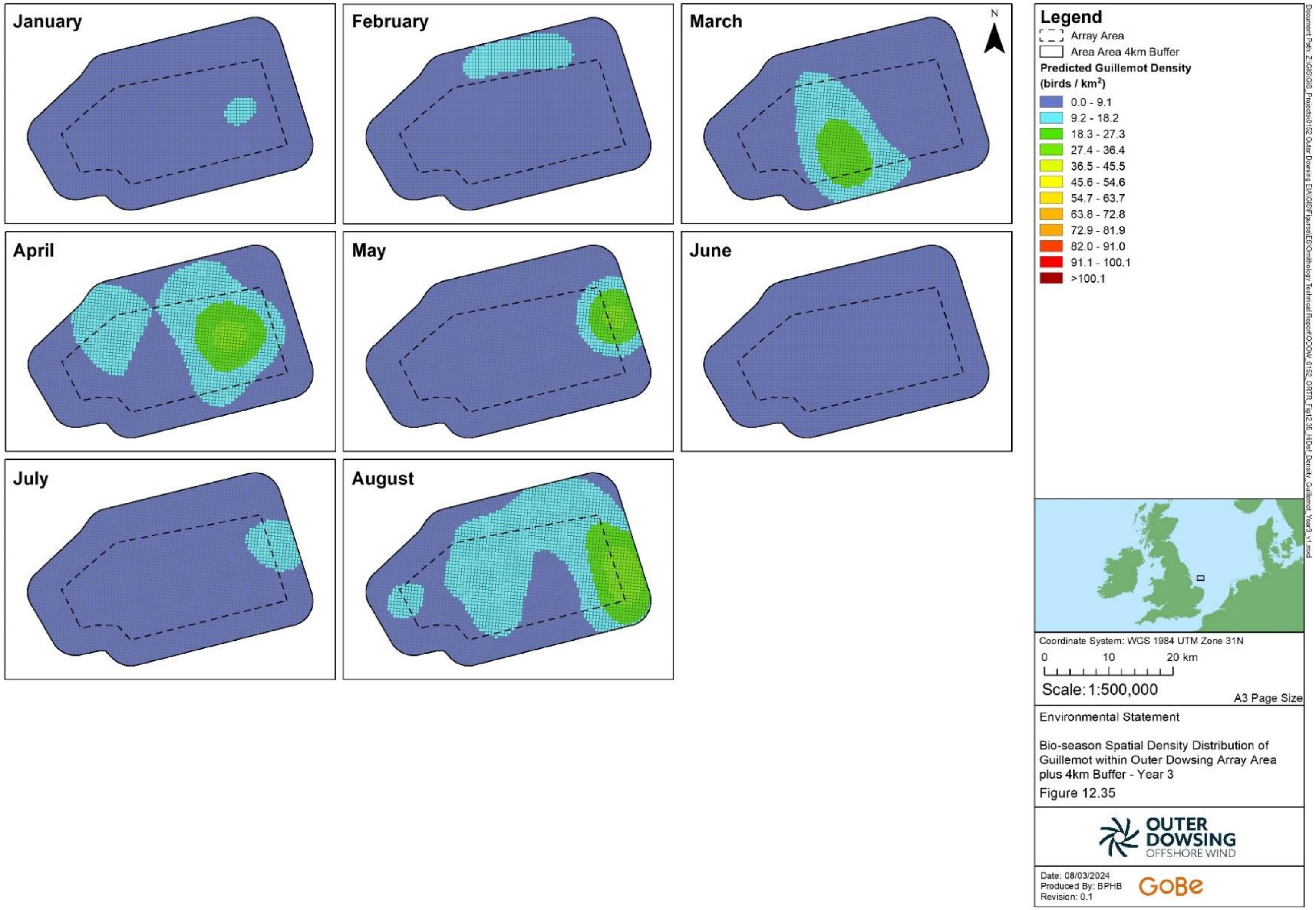

Figure 12.35 Bio-season spatial density distribution of guillemot within the Array Area plus 2km buffer – Year 3

135. Guillemot presence and abundance followed a clear pattern over the 30 months of survey in both the array area and array area plus 2km buffer. Abundance was highest in April all three years, reducing through the breeding season and then peaking again in August and September, corresponding with the period during which fledged young are accompanied offshore by male parents, before becoming independent. The late summer peak in 2021 is substantially higher than in 2022, perhaps reflecting breeding success. Birds were generally present but in low numbers during the winter months, as can be seen in Figure 12.36.

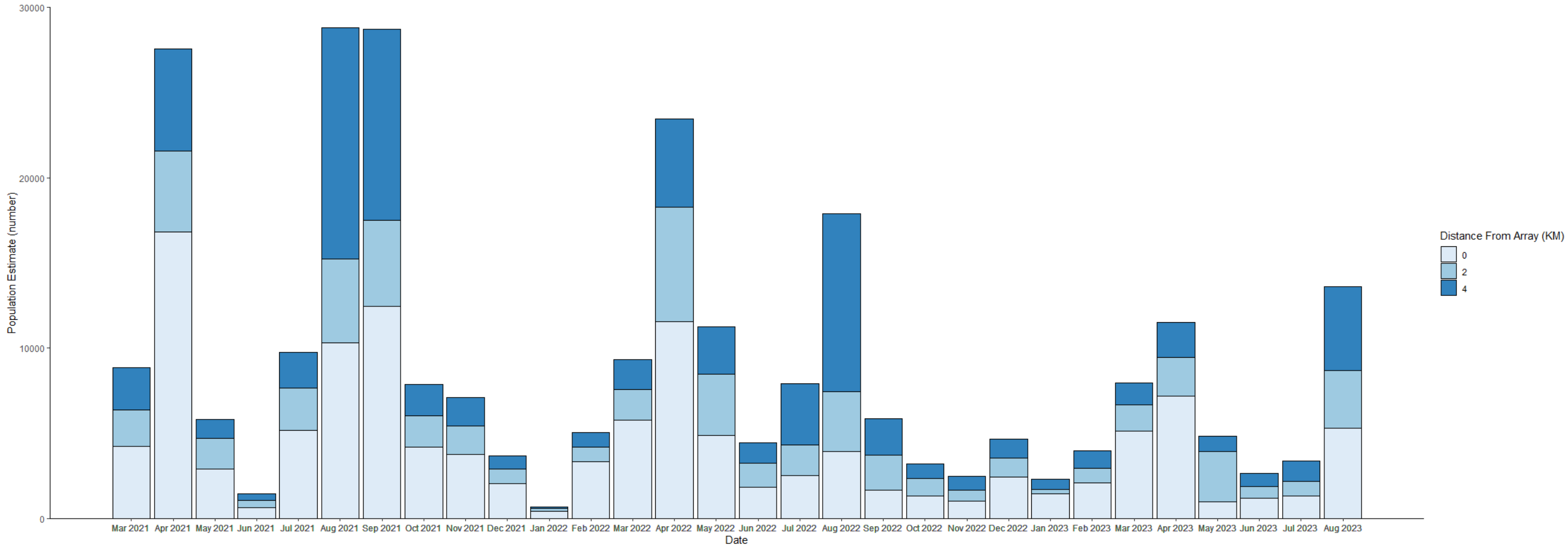

Figure 12.36. Monthly abundance of guillemot in the array only, array plus 2km buffer and array plus 4km buffer.

12.3.10.4 Flight direction

136. Figure 12.37 shows windrose diagrams presenting flight directions recorded for guillemot within the array area plus a 4km buffer. As can be seen generally there are very few guillemots in flight but a large number of birds are shown to be flying north and north-west during April 2022. Proportions of guillemot in flight are presented in Table 12.40.

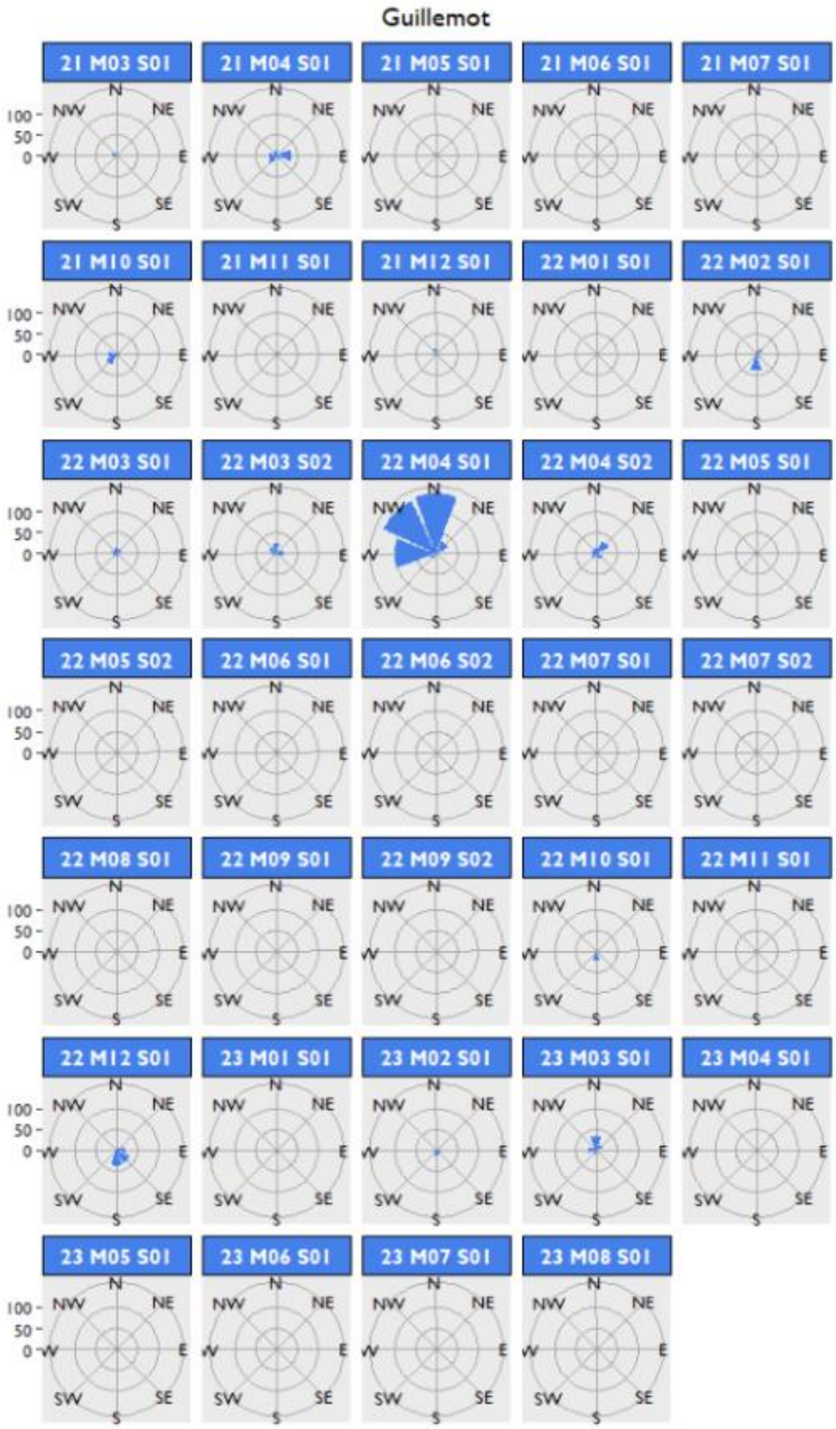

Figure 12.37. Windrose diagrams for months during which flying guillemot were recorded within the array area and a 4km buffer.

Table 12.40. Proportions of guillemot in flight recorded in the in the Project array area.

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2021-03-22	0	27	453	0	6	0	480
2021-04-04	1	71	2016	0	3	0	2088
2021-05-12	0	4	356	0	1	0	360
2021-06-09	0	3	73	0	4	0	76
2021-07-24	0	14	623	0	2	0	637
2021-08-14	0	0	1233	0	0	0	1233
2021-09-07	0	0	1517	0	0	0	1517
2021-10-09	1	29	469	0	6	0	499
2021-11-02	0	9	440	0	2	0	449
2021-12-15	0	10	234	0	4	0	244
2022-01-06	0	1	44	0	2	0	45
2022-02-23	0	29	381	0	7	0	410
2022-03-11	0	29	621	0	4	0	650
2022-03-22	1	41	632	0	6	0	674
2022-04-02	0	272	1661	1	14	0	1934
2022-04-15	0	68	915	0	7	0	983
2022-05-02	2	5	938	0	1	0	945
2022-05-17	0	7	248	0	3	2	257
2022-06-09	0	5	118	0	4	1	124
2022-06-21	0	3	335	0	1	0	338
2022-07-04	0	4	141	0	3	0	145
2022-07-16	0	8	471	0	2	0	479
2022-08-08	1	1	742	0	0	0	744
2022-08-23	0	0	210	0	0	0	210
2022-09-13	0	5	278	0	2	0	283
2022-09-25	0	1	103	0	1	0	104
2022-10-10	0	29	132	0	18	0	161

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2022-11-07	0	2	116	0	2	0	118
2022-12-13	0	57	240	1	19	0	298
2023-01-26	0	10	159	0	6	0	169
2023-02-10	0	17	245	0	6	0	262
2023-03-24	1	84	560	0	13	0	645
2023-04-05	0	5	885	1	1	0	891
2023-05-03	0	4	122	0	3	0	126
2023-06-17	0	1	147	0	1	0	148
2023-07-05	0	5	145	0	3	0	150
2023-08-10	0	3	648	0	0	0	651
Total	7	863	18651	3	-	3	19527

12.3.10.5 Foraging/Usage hotspots

137. The FFC SPA is the closest SPA to the Project array area that has guillemot listed as a feature. Using the species distribution model, hotspots were identified to the north of the Project footprint (Figure 12.38) using Getis-Ord hotspot analysis (Cleasby *et al,*. 2020). However, the Project array is clearly considerably further south and beyond the core foraging range of guillemot from FFC SPA.

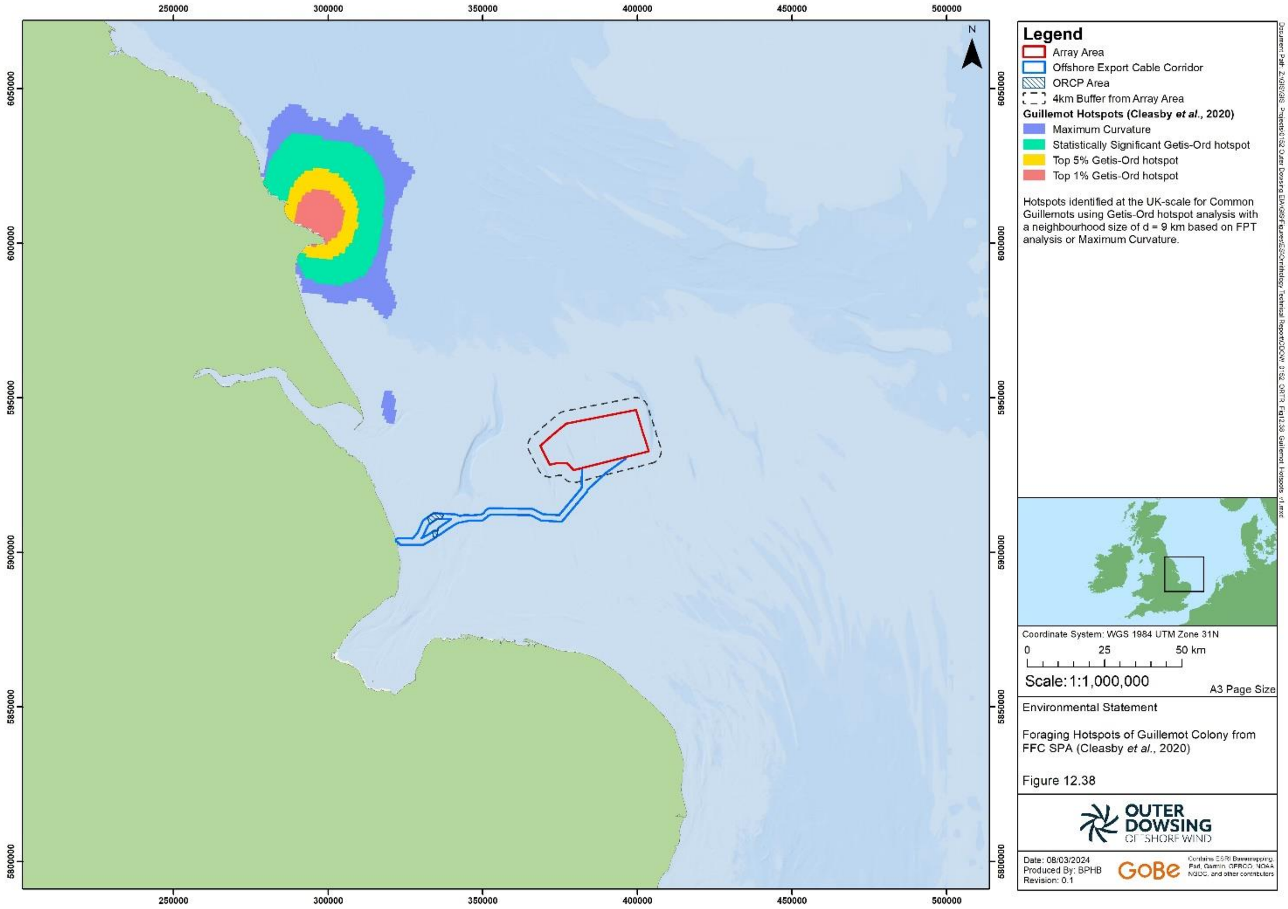

Figure 12.38. Foraging hotspots of guillemot colony from FFC SPA (Cleasby et al, 2020).

12.3.10.6 Birds aged from DAS data

138. Proportions of guillemot aged from DAS images are presented in Table 12.41.

Table 12.41. Proportions of guillemot aged from DAS images within the array area plus a 2km buffer.

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
22/03/2021	0	0	0	741	0	741	0
04/04/2021	1	0	0	2689	100	2690	1
12/05/2021	0	0	0	570	0	570	0
09/06/2021	0	0	0	124	0	124	0
24/07/2021	58	0	67	815	46	940	125
14/08/2021	8	0	8	1866	50	1882	16
07/09/2021	3	0	3	2049	50	2055	6
09/10/2021	0	0	0	718	0	718	0
02/11/2021	0	0	0	659	0	659	0
15/12/2021	0	0	0	342	0	342	0
06/01/2022	0	0	0	64	0	64	0
23/02/2022	0	0	0	510	0	510	0
11/03/2022	1	0	0	848	100	849	1
22/03/2022	0	0	0	948	0	948	0
02/04/2022	0	0	0	3183	0	3183	0
15/04/2022	0	0	0	1478	0	1478	0
02/05/2022	0	0	0	1561	0	1561	0
17/05/2022	31	0	0	472	100	503	31
09/06/2022	0	0	0	294	0	294	0
21/06/2022	13	0	13	502	50	528	26
04/07/2022	74	0	76	109	49	259	150
16/07/2022	45	0	45	702	50	792	90
08/08/2022	6	0	7	1404	46	1417	13
23/08/2022	0	0	0	414	0	414	0
13/09/2022	0	0	0	763	0	763	0
25/09/2022	0	0	0	172	0	172	0

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
10/10/2022	0	0	0	285	0	285	0
07/11/2022	0	0	0	188	0	188	0
13/12/2022	0	0	0	431	0	431	0
26/01/2023	0	0	0	204	0	204	0
10/02/2023	0	0	0	361	0	361	0
24/03/2023	0	0	0	834	0	834	0
05/04/2023	0	0	0	1180	0	1180	0
03/05/2023	0	0	0	497	0	497	0
17/06/2023	1	0	1	232	50	234	2
05/07/2023	46	0	47	173	49	266	93
10/08/2023	15	0	15	1031	50	1061	30

12.3.11Razorbill

12.3.11.1 Digital aerial survey data

139. Razorbill were recorded in the array area in all 24 months surveyed with abundance and density peaking at 6,465 and 14.80 birds/km respectively in February 2023 (Table 12.43).

140. In the array area plus 2km buffer, abundance and density peaked at 7,608 and 12.14 birds/km respectively in February 2023 (Table 12.43).

12.3.11.2 Razorbill overview

141. The nearest razorbill colony to the Project is the FFC SPA. Located approximately 95km from the Project, it is beyond the mean maximum foraging range of (88.7km ±75.9km), though within the mean maximum foraging range plus a standard deviation (Woodward *et al.*, 2019).

142. Based on the existing information regarding this species foraging range and at sea distribution, it is concluded that there is some connectivity between the Project and the breeding population of the FFC SPA during the breeding season. The UK North Sea and Channel BDMPS consists of 591,874 individuals during migration periods (August to October and January to March), and 218,622 individuals during winter (November and December) (Furness, 2015). Since immature seabirds are known often to remain in wintering areas, the number of immature birds in the relevant population during the breeding season may be estimated as 43% of the total wintering BDMPS population (Furness, 2015). This gives a breeding season population of 94,007 (BDMPS for the UK North Sea and Channel, 218,622 x 0.43).

12.3.11.3 Abundance and Phenology

143. Peak abundances of razorbill in the species bio-seasons (as defined in Furness 2015) are presented in Table 12.42. Estimates of monthly abundance, density and percentage flying within the array area, and monthly abundance and density within the array plus 2km buffer are presented in Table 12.43. The spatial density distribution of razorbill within the Outer Dowsing Array Area plus 2km buffer is shown for three years of surveys in Figure 12.39, Figure 12.40, and Figure 12.41.

144. Razorbill were present in the Project array area across all four bio-seasons. Abundance in the Project array area was highest during the return migration bio-season (January to March), with a seasonal peak abundance of 4,326 birds and a peak density of 9.91 birds/km (Table 12.43).

145. In the array area plus 2km buffer, razorbill numbers were similarly greatest during the return migration bio-season, with a seasonal peak abundance of 5,537 birds and peak density of 8.84 birds/km^2 (Table 12.42).

Table 12.42. Razorbill bio-season apportioned abundance and density estimates in the Project array area plus 2km buffer.

BDMPS Bio-seasons	Months	Array area		Array + 2km buffer	
		Bio-season peak abundance (n)	Bio-season peak density (n/km²)	Bio-season peak abundance (n)	Bio-season peak density (n/km²)
Return Migration	Jan - Mar	4326.0 (3565.5 – 6505.5)	9.91 (8.16 – 14.91)	5536.7 (4739.0 – 7856.0)	8.84 (7.56 – 12.54)
Breeding	April - Jul	2,819.3 (1721.7 - 4157.0)	6.46 (3.95 – 9.52)	3596.2 (2349.0 – 5085.2)	5.74 (3.75 – 8.12)
Post-breeding migration	Aug – Oct	1197.5 (450.0 - 1567.3)	2.74 (1.0 3– 3.59)	2390.5 (763.8 – 3314.0)	3.82 (1.22 – 5.29)
Winter	Nov - Dec	1367.5 (966.5 – 1850.5)	3.13 (2.21 – 4.24)	1956.0 (1510.5 – 2436.0)	3.13 (2.41 – 3.89)

Table 12.43. Razorbill estimated apportioned abundance and estimated density, in the Project array area and array area plus 2km buffer.

Month	Survey number	Array only		Array plus 2 km buffer		
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
March 21	1	2965	6.8	4	4190	6.69
April 21	1	5799	13.28	3	7028	11.22
May 21	1	304	0.69	9	473	0.75
June 21	1	171	0.4	12	183	0.29
July 21	1	1469	3.36	4	2235	3.56
Aug 21	1	1370	3.14	0	2300	3.67
Sept 21	1	962	2.2	0	1337	2.14
Oct 21	1	617	1.41	19	821	1.31
Nov 21	1	1520	3.49	3	2299	3.67
Dec 21	1	1567	3.58	0	2102	3.36
Jan 22	1	433	0.99	0	505	0.81
Feb 22	1	3548	8.12	1	4812	7.69
March 22	1	2163	4.95	5	2947	4.7
March 22	2	977	2.23	1	1287	2.05
April 22	1	1201	2.76	22	1866	2.97

Month	Survey number	Array only		Array plus 2 km buffer		
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
April 22	2	775	1.78	17	1119	1.79
May 22	1	1518	3.48	5	2393	3.82
May 22	2	199	0.45	0	348	0.56
June 22	1	141	0.32	0	319	0.51
June 22	2	163	0.37	0	248	0.4
July 22	1	63	0.14	25	288	0.46
July 22	2	1481	3.39	2	2194	3.5
Aug 22	1	84	0.2	0	209	0.33
Aug 22	2	219	0.5	0	277	0.44
Sept 22	1	848	1.93	2	2405	3.84
Sept 22	2	95	0.21	8	128	0.21
Oct 22	1	268	0.6	0	512	0.82
Nov 22	1	375	0.85	2	618	0.99
Dec 22	1	1168	2.68	5	1613	2.58
Jan 23	1	847	1.94	0	972	1.55
Feb 23	1	6465	14.8	5	7608	12.14
March 23	1	3987	9.13	10	5526	8.81
April 23	1	1671	3.83	3	2268	3.63
May 23	1	104	0.24	15	173	0.28
June 23	1	442	1.01	0	484	0.77
July 23	1	619	1.41	4	844	1.35
Aug 23	1	1751	4.01	1	3605	5.75

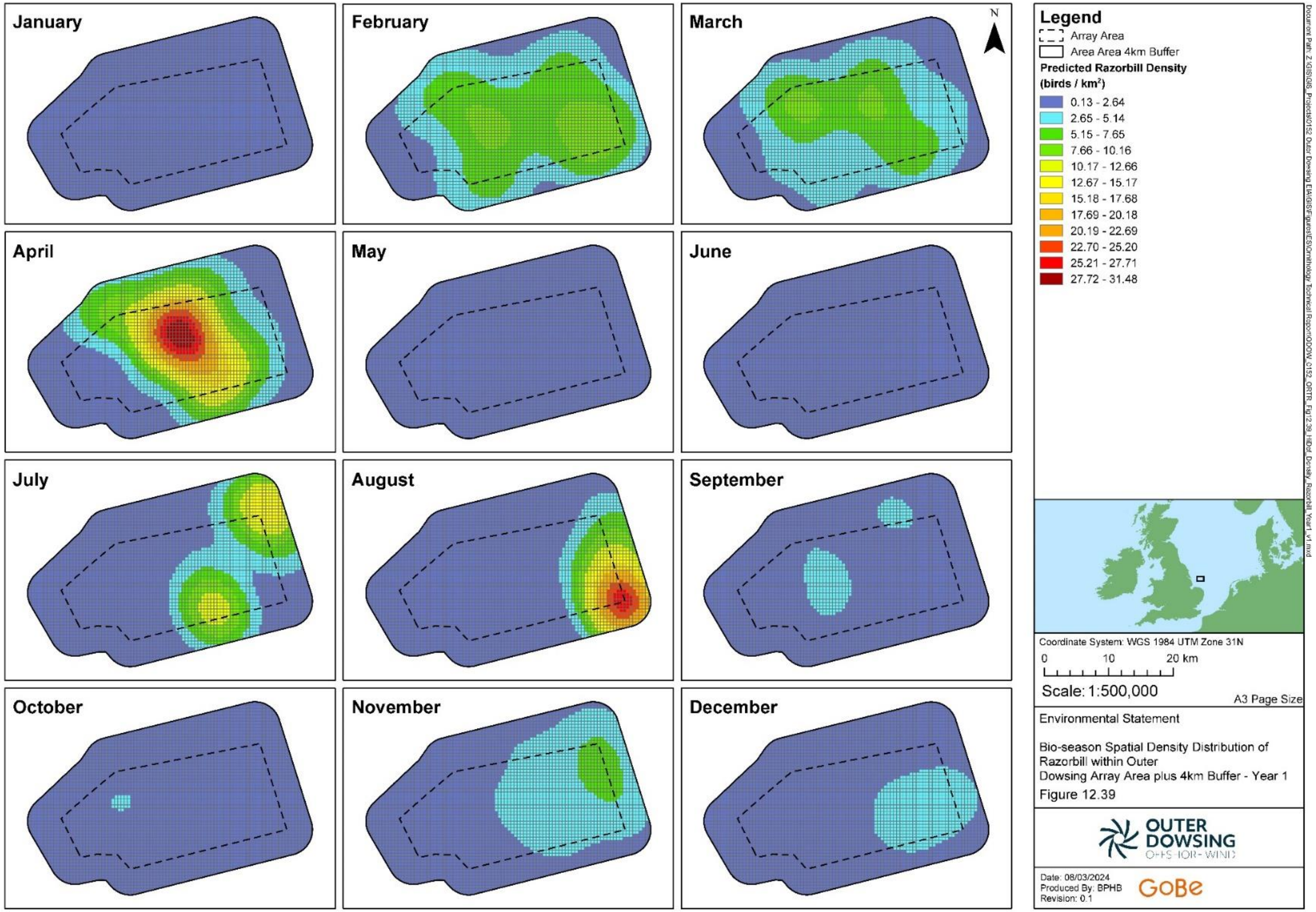

Figure 12.39 Bio-season spatial density distribution of razorbill within the Array Area plus 2km buffer – Year 1

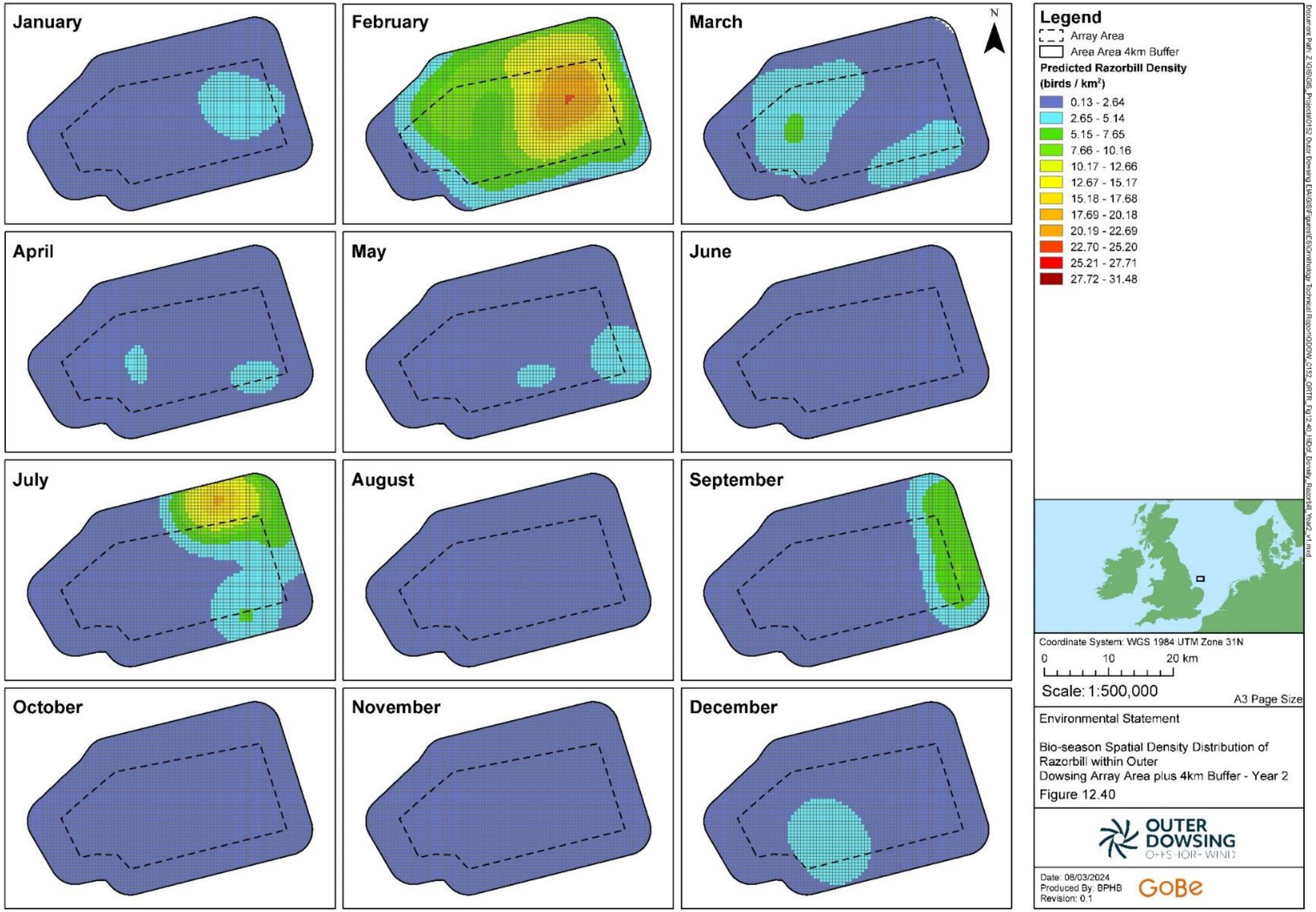

Figure 12.40 Bio-season spatial density distribution of razorbill within the Array Area plus 2km buffer – Year 2

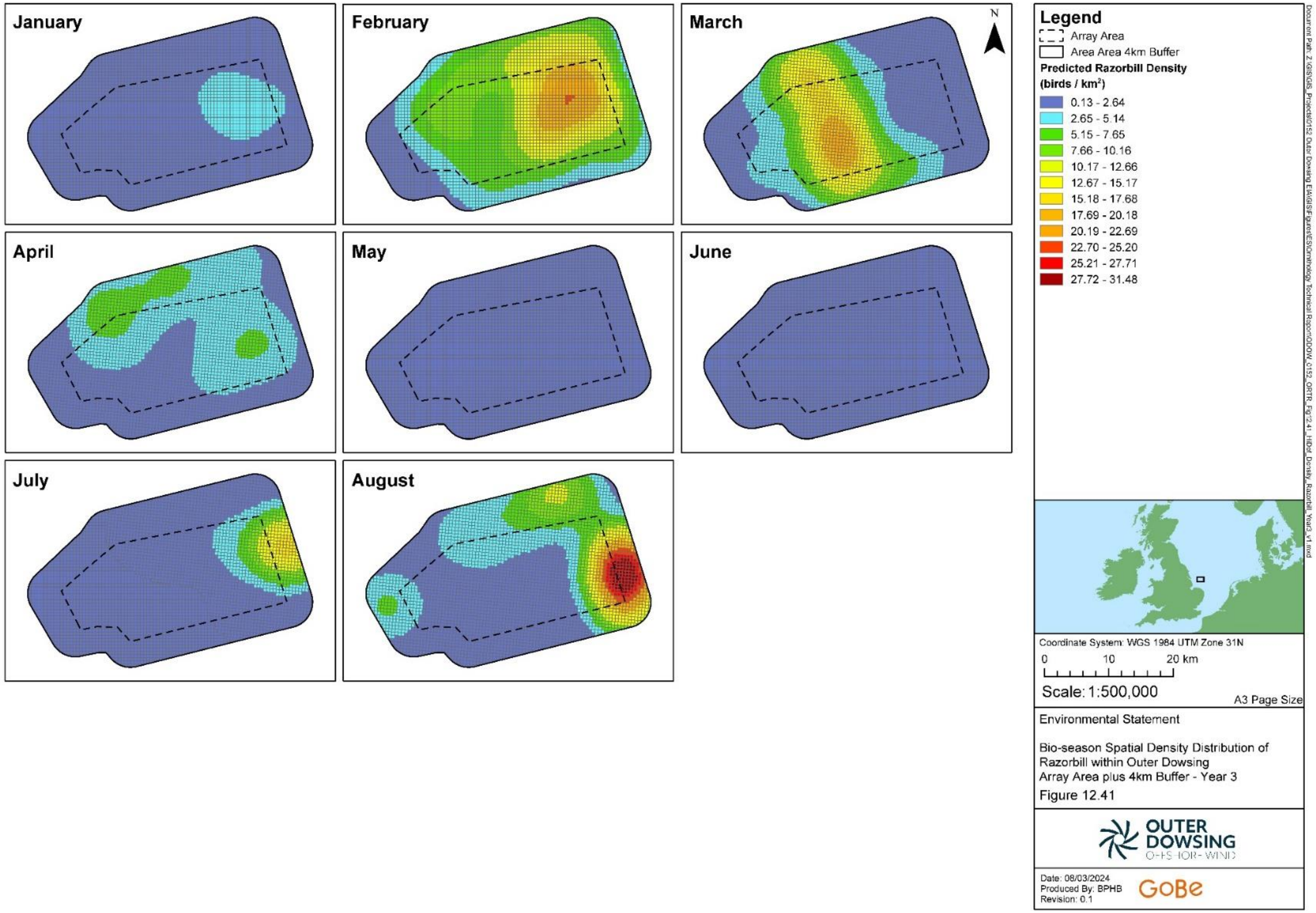

Figure 12.41 Bio-season spatial density distribution of razorbill within the Array Area plus 2km buffer – Year 3

146. Razorbill presence and distribution showed some similarities to that displayed by guillemot, particularly the high abundances seen in the build up to the breeding season, in March and April. However, post-breeding and non-breeding abundance was generally low, over both the array area and the array plus 2km buffer. Of note is the very high abundance recorded in February 2023, appearing earlier, and in higher numbers than the spring peaks recorded in the two previous years surveyed. Patterns of abundance of razorbill were similar across the array area and the array plus 2km buffer, as can be seen in Figure 12.42.

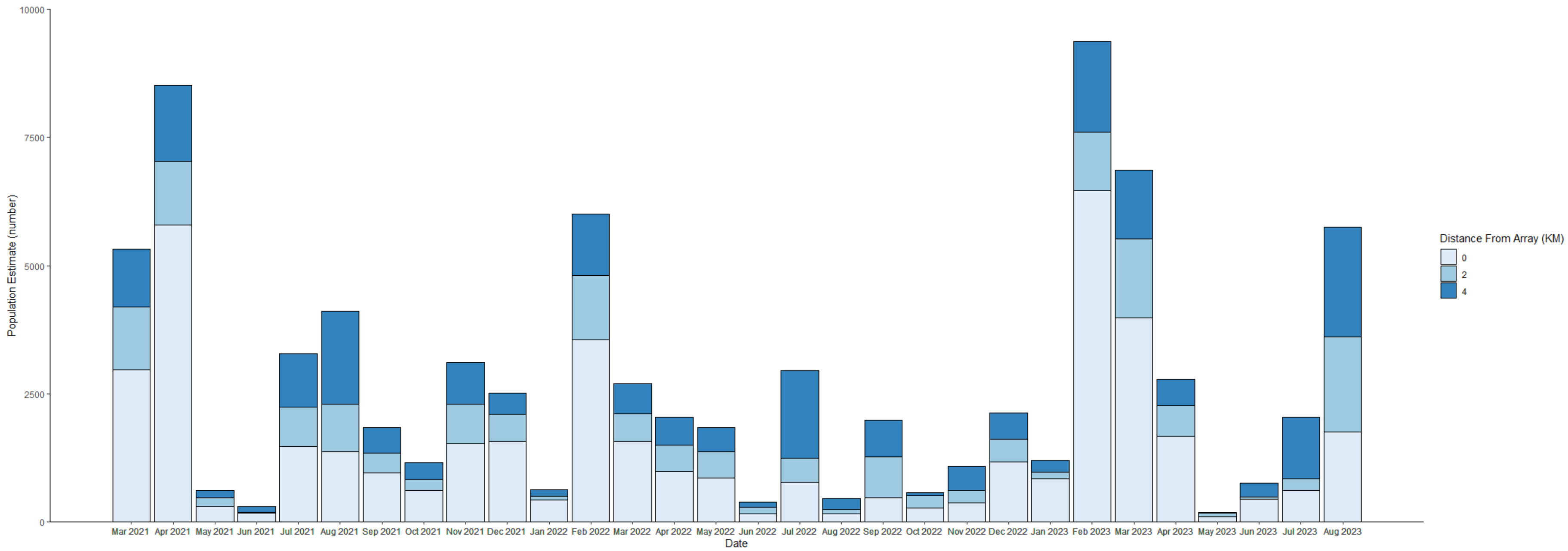

Figure 12.42. Monthly abundance of razorbill in the array only, array plus 2km buffer and array plus 4km buffer.

12.3.11.4 Flight direction

147. Figure 12.43 shows windrose diagrams presenting flight directions recorded for razorbill within the array area plus a 4km buffer.

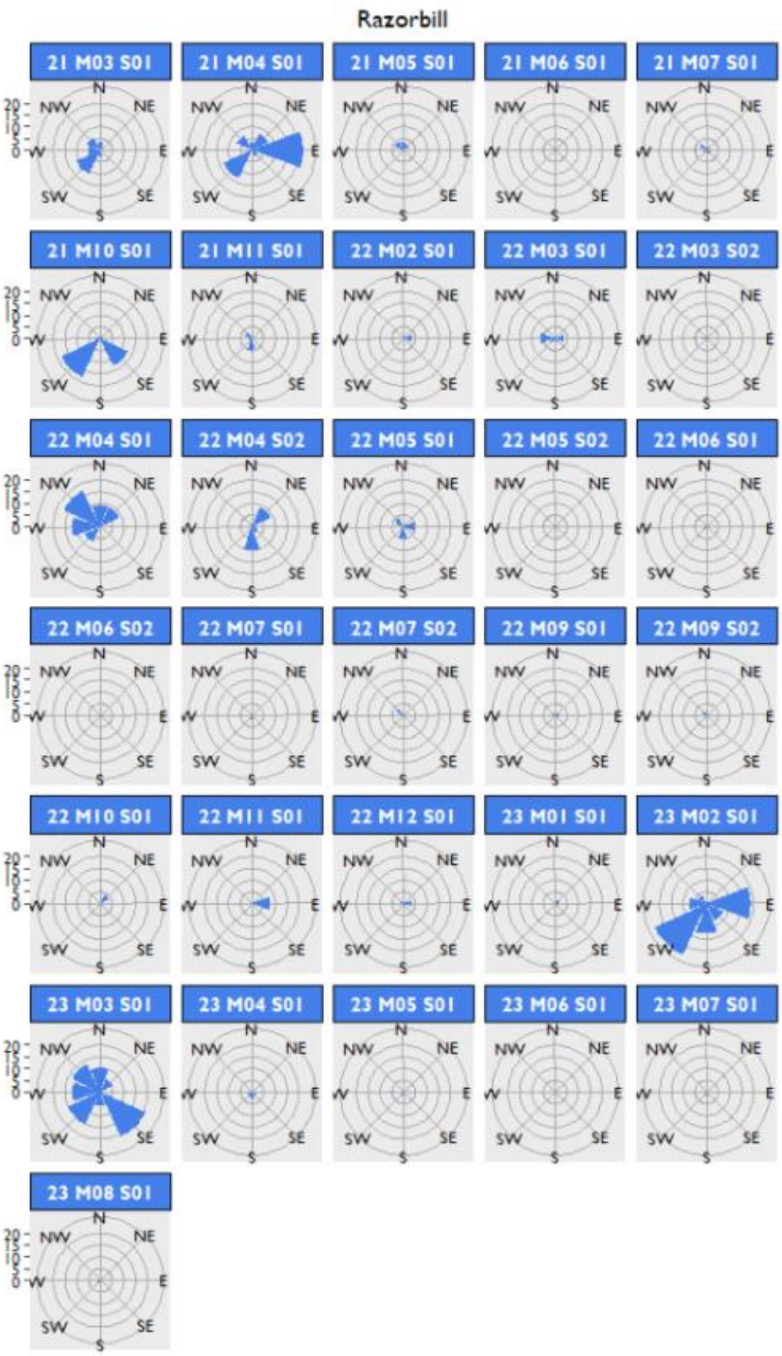

Figure 12.43. Windrose diagrams for months during which flying razorbill were recorded within the array area plus a 4km buffer.

148. Proportions of razorbill in flight are presented in Table 12.44.

Table 12.44. Proportions of razorbill in flight recorded in the in the Project array area.

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2021-03-22	0	15	344	0	4	0	359
2021-04-04	0	24	754	2	3	0	780
2021-05-12	0	3	32	0	9	0	35
2021-06-09	0	2	14	0	12	0	16
2021-07-24	0	7	175	0	4	0	182
2021-08-14	0	0	163	0	0	0	163
2021-09-07	0	0	126	0	0	0	126
2021-10-09	0	15	62	0	19	0	77
2021-11-02	0	5	182	0	3	0	187
2021-12-15	0	0	177	0	0	0	177
2022-01-06	0	0	50	0	0	0	50
2022-02-23	0	5	455	0	1	0	460
2022-03-11	0	13	259	0	5	0	272
2022-03-22	0	1	107	0	1	0	108
2022-04-02	0	36	124	0	22	0	160
2022-04-15	0	17	85	0	17	0	102
2022-05-02	0	10	183	1	5	0	194
2022-05-17	0	0	23	0	0	0	23
2022-06-09	0	0	15	0	0	0	15
2022-06-21	0	0	21	0	0	0	21
2022-07-04	0	2	6	0	25	0	8
2022-07-16	0	3	179	1	2	0	183
2022-08-08	0	0	11	0	0	0	11
2022-08-23	0	0	29	0	0	0	29
2022-09-13	1	2	96	0	2	0	99
2022-09-25	0	1	11	0	8	0	12
2022-10-10	0	0	32	0	0	0	32

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2022-11-07	0	1	43	0	2	0	44
2022-12-13	0	7	137	0	5	0	144
2023-01-26	0	0	108	0	0	0	108
2023-02-10	2	39	816	0	5	0	857
2023-03-24	0	54	483	0	10	0	537
2023-04-05	0	7	213	0	3	0	220
2023-05-03	0	2	11	0	15	0	13
2023-06-17	0	0	58	0	0	0	58
2023-07-05	0	3	77	0	4	0	80
2023-08-10	0	2	226	0	1	0	228
Total	3	276	5887	4	-	0	6170

12.3.11.5 Foraging/Usage hotspots

149. The FFC SPA is the closest SPA to the Project array area. Using species distribution models, hotspots were identified to the north of the Project footprint (Figure 12.44) using Getis-Ord hotspot analysis (Cleasby et al, 2020). As with guillemot, the Project is clearly considerably further south-east, and beyond the core breeding season foraging hotspots from FFC SPA.

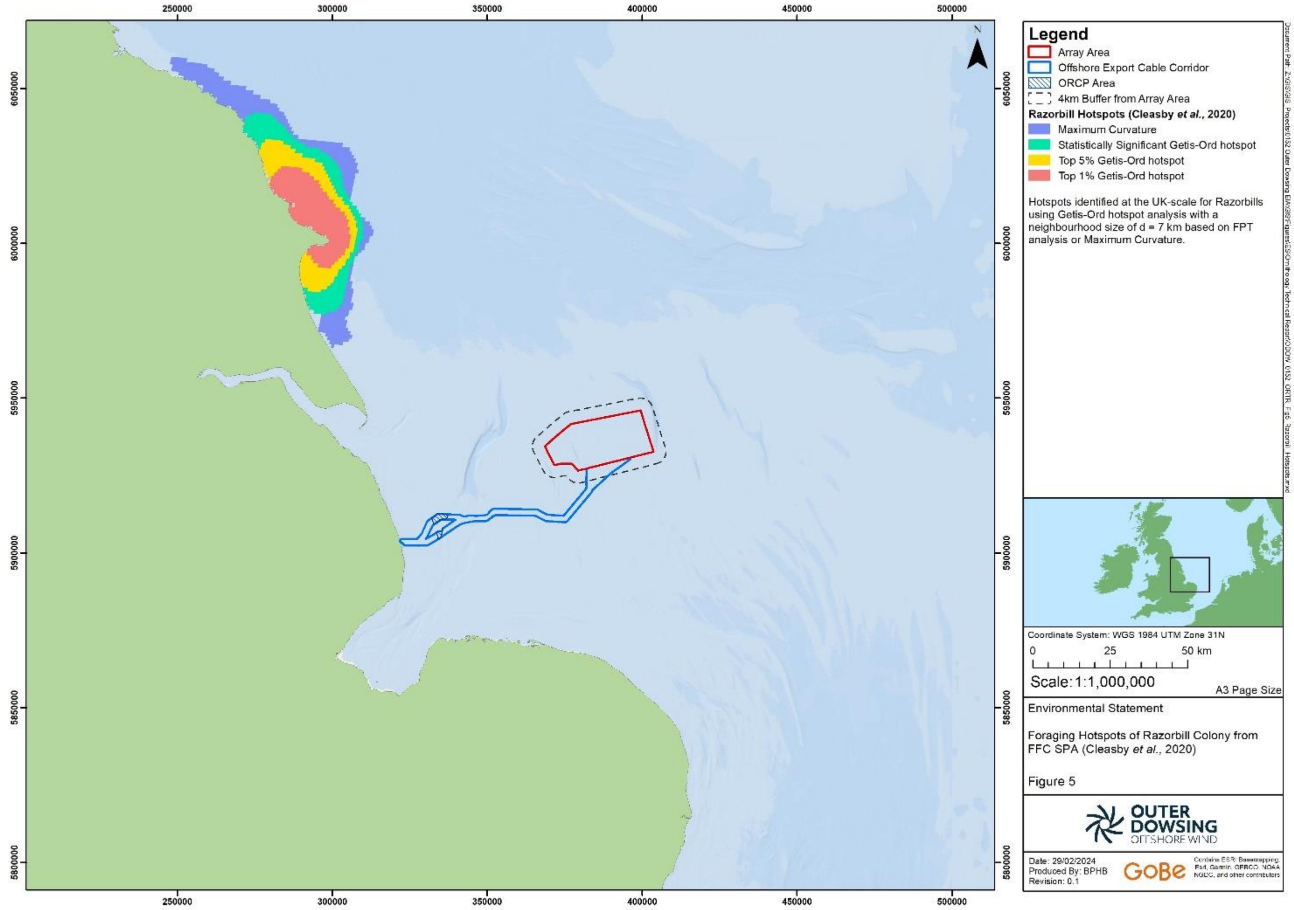

Figure 12.44. Foraging hotspots of razorbill colony from FFC SPA (Cleasby et al, 2020).G

12.3.11.6 Birds aged from DAS data

150. Proportions of razorbill aged from DAS images are presented in Table 12.45.

Table 12.45. Proportions of razorbill aged from DAS images within the array area plus a 2km buffer.

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
22/03/2021	0	0	0	491	0	491	0
04/04/2021	0	0	0	941	0	941	0
12/05/2021	0	0	0	56	0	56	0
09/06/2021	0	0	0	16	0	16	0
24/07/2021	7	0	8	299	47	314	15
14/08/2021	5	0	2	317	71	324	7
07/09/2021	0	0	0	171	0	171	0
09/10/2021	0	0	0	100	0	100	0
02/11/2021	0	0	0	284	0	284	0
15/12/2021	0	0	0	237	0	237	0
06/01/2022	0	0	0	58	0	58	0
23/02/2022	0	0	0	642	0	642	0
11/03/2022	0	0	0	378	0	378	0
22/03/2022	0	0	0	157	0	157	0
02/04/2022	0	0	0	247	0	247	0
15/04/2022	0	0	0	158	0	158	0
02/05/2022	0	0	0	312	0	312	0
17/05/2022	0	0	0	42	0	42	0
09/06/2022	0	0	0	38	0	38	0
21/06/2022	0	0	0	33	0	33	0
04/07/2022	3	0	3	28	50	34	6
16/07/2022	10	0	10	249	50	269	20
08/08/2022	0	0	0	28	0	28	0
23/08/2022	0	0	0	39	0	39	0
13/09/2022	0	0	0	329	0	329	0
25/09/2022	0	0	0	16	0	16	0

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
10/10/2022	0	0	0	60	0	60	0
07/11/2022	0	0	0	68	0	68	0
13/12/2022	0	0	0	194	0	194	0
26/01/2023	0	0	0	121	0	121	0
10/02/2023	0	0	0	1021	0	1021	0
24/03/2023	0	0	0	739	0	739	0
05/04/2023	0	0	0	292	0	292	0
03/05/2023	0	0	0	23	0	23	0
17/06/2023	0	0	0	64	0	64	0
05/07/2023	23	0	24	63	49	110	47
10/08/2023	4	0	4	443	50	451	8

12.3.12Puffin

12.3.12.1 Digital aerial survey data

151. Puffin were recorded in the array area in 27 of the 30 months surveyed, with abundance and density peaking at 997 and 2.24 birds/km^2 respectively in August 2021 (Table 12.47).

152. In the array area plus 2km buffer, abundance and density peaking at 1,420 and 2.27 birds/km^2 respectively in August 2021 (Table 12.47).

12.3.12.2 Puffin overview

153. The nearest puffin colony to the Project is the FFC SPA, where it is listed as a component of the breeding seabird assemblage. The colony is 95km from the Project and within the mean maximum foraging range of breeding adult puffin (137.1km, standard deviation 128.3km) (Woodward *et al.*, 2019). The latest colony count from FFC SPA was 2,986 individuals in 2022 (BTO, 2023).

154. Outside the breeding season, impacts on puffin have been compared to the UK North Sea and Channel BDMPS, consisting of 231,957 individuals during the non-breeding season (mid-August to March) (Furness, 2015).

12.3.12.3 Abundance and Phenology

155. Peak abundances of puffin in the species bio-seasons (as defined in Furness 2015) are presented in Table 12.46. Estimates of monthly abundance, density and percentage flying in the array area, and monthly abundance and density within the array plus 2km buffer are presented in Table 12.47. The spatial density distribution of puffin within the Outer Dowsing Array Area plus 2km buffer is shown for three years of surveys in Figure 12.45, Figure 12.46, and Figure 12.47.

156. Puffin were present in the Project array area across both bio-seasons, although comparatively, abundance was lower in the non-breeding bio-season. Abundance in the array area was greatest during the breeding bio-season (April to July), with a seasonal peak abundance of 522.3 birds and peak density of 1.20 birds/km^2 (Table 12.46).

157. In the array area plus 2km buffer, puffin numbers were similarly greatest during the breeding bio-season, with a seasonal peak abundance of 760 and peak density of 1.22/km^2 (Table 12.46).

Table 12.46. Puffin bio-season apportioned abundance and density estimates in the Project array area plus 2km buffer.

BDMPS Bio-seasons	Months	Array area		Array area + 2km buffer	
		Bio-season peak abundance (n)	Bio-season peak density (n/km^2)	Bio-season peak abundance (n)	Bio-season peak density (n/km^2)
Breeding	Apr – July	522.3 (329.3 – 742.5)	1.20 (0.75 – 1.70)	760.0 (510.7 – 1062.8)	1.22 (0.82 – 1.69)
Non-breeding	Aug – Mar	448.0 (318.5 – 607.5)	1.02 (0.37 – 1.39)	636.5 (457.0 – 859.5)	1.02 (0.73 – 1.37)

Table 12.47. Puffin estimated apportioned abundance and estimated density, in the Project array area and array area plus 2km buffer.

Month	Survey number	Array only			Array plus 2km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
March 21	1	155	0.34	12	244	0.38
April 21	1	30	0.07	25	30	0.04
May 21	1	22	0.05	0	23	0.03
June 21	1	22	0.05	0	27	0.05
July 21	1	150	0.34	0	238	0.37
Aug 21	1	977	2.24	0	1420	2.27
Sept 21	1	756	1.72	0	1011	1.62
Oct 21	1	718	1.64	1	1046	1.67
Nov 21	1	349	0.8	0	457	0.73
Dec 21	1	26	0.06	0	58	0.09
Jan 22	1	0	0	0	0	0
Feb 22	1	5	0.01	0	13	0.02
March 22	1	216	0.49	0	325	0.51
March 22	2	93	0.22	20	147	0.23
April 22	1	20	0.05	0	30	0.05
April 22	2	69	0.16	50	112	0.17
May 22	1	226	0.51	0	284	0.45
May 22	2	10	0.02	0	12	0.02
June 22	1	26	0.06	33	41	0.07
June 22	2	0	0	0	0	0
July 22	1	15	0.03	0	59	0.09
July 22	2	106	0.23	8	196	0.31
Aug 22	1	47	0.1	0	73	0.12
Aug 22	2	17	0.03	0	19	0.03
Sept 22	1	127	0.29	0	178	0.28

Month	Survey number	Array only			Array plus 2km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
Sept 22	2	56	0.13	0	103	0.16
Oct 22	1	130	0.29	0	227	0.36
Nov 22	1	66	0.15	0	105	0.16
Dec 22	1	140	0.31	0	178	0.28
Jan 23	1	0	0	0	0	0
Feb 23	1	59	0.14	0	139	0.22
March 23	1	70	0.15	0	101	0.17
April 23	1	96	0.22	0	129	0.21
May 23	1	102	0.23	22	133	0.22
June 23	1	27	0.06	33	67	0.1
July 23	1	156	0.36	0	205	0.33
Aug 23	1	472	1.08	0	712	1.14

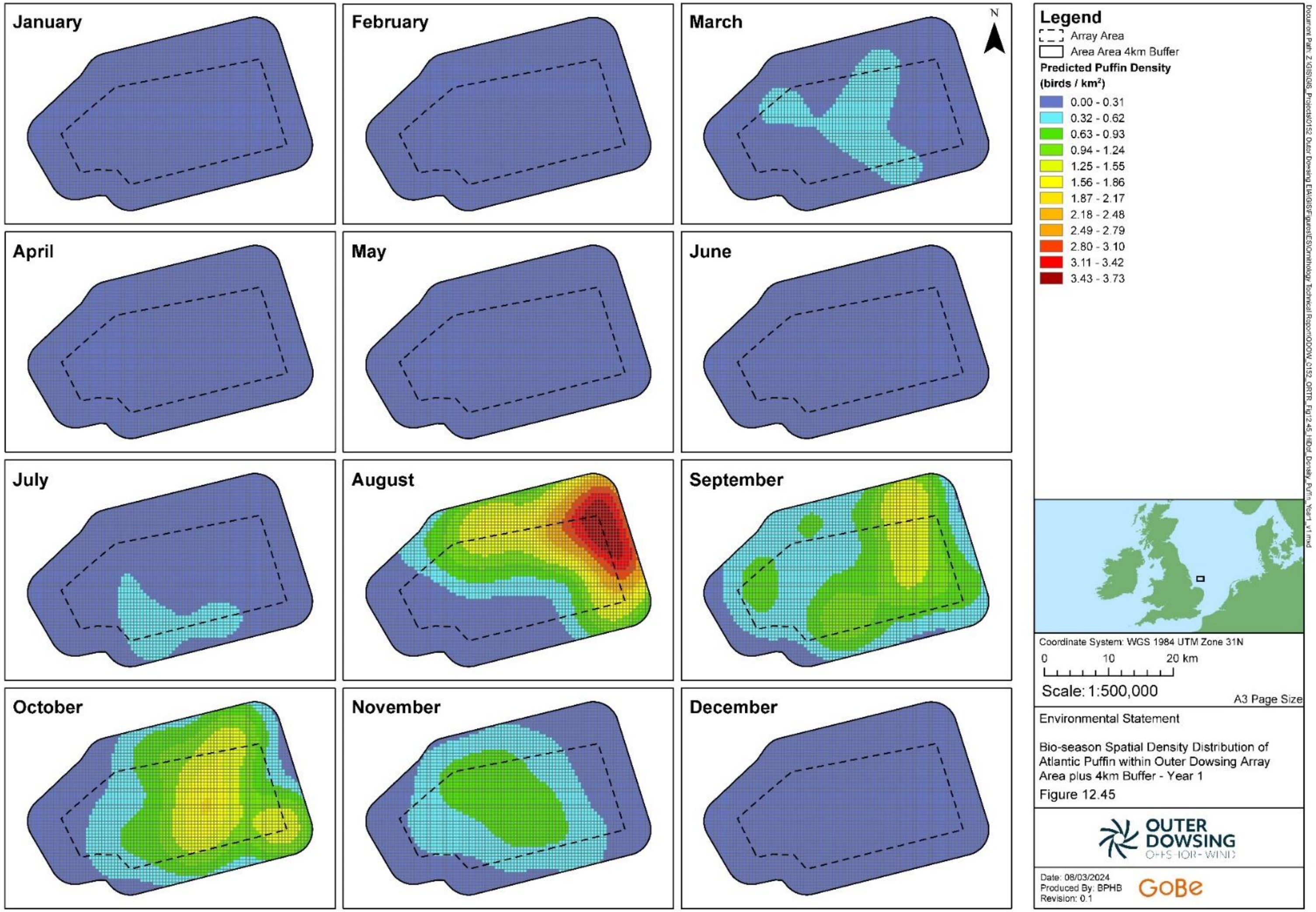

Figure 12.45 Bio-season spatial density distribution of puffin within the Array Area plus 2km buffer – Year 1

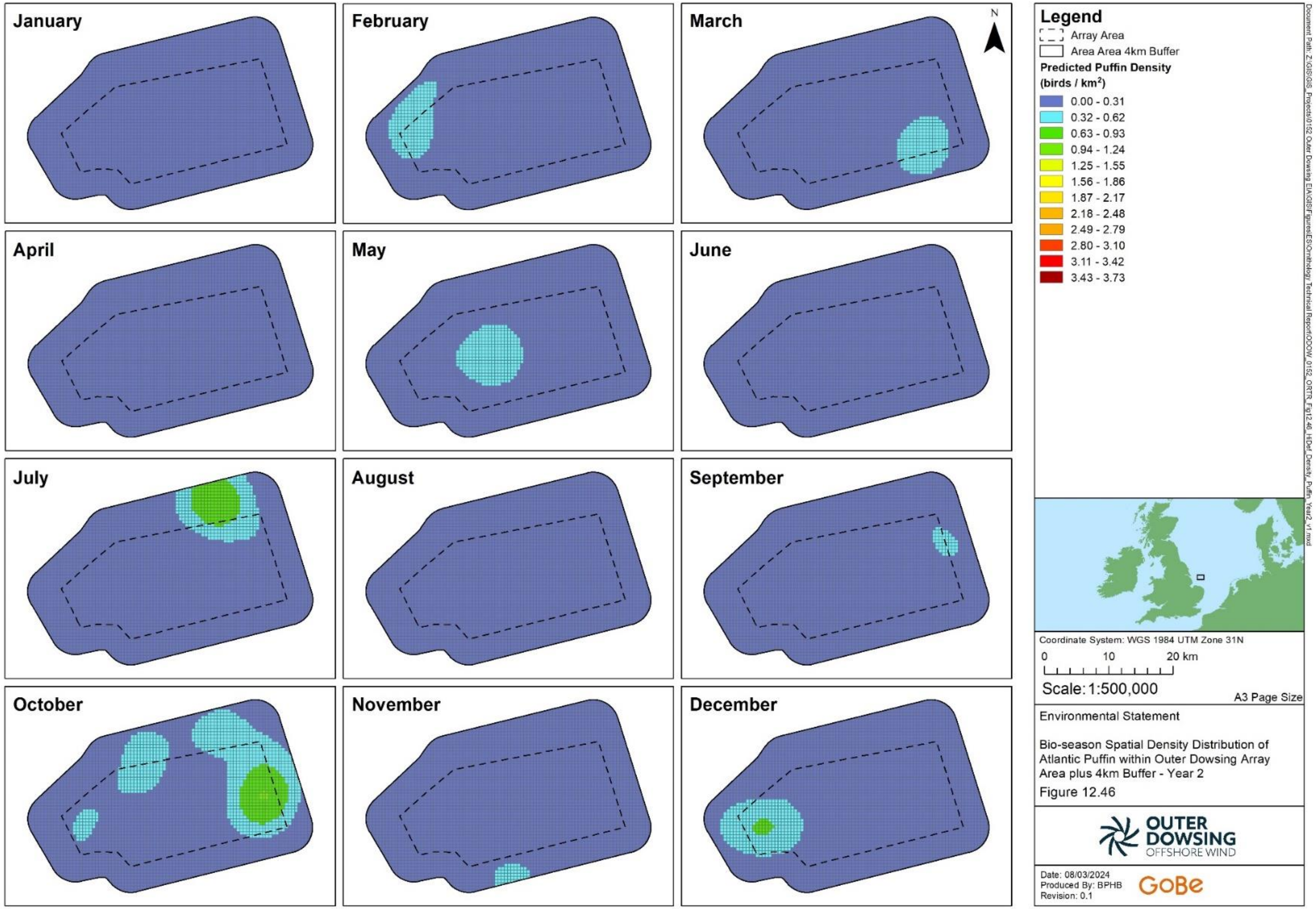

Figure 12.46 Bio-season spatial density distribution of puffin within the Array Area plus 2km buffer – Year 2

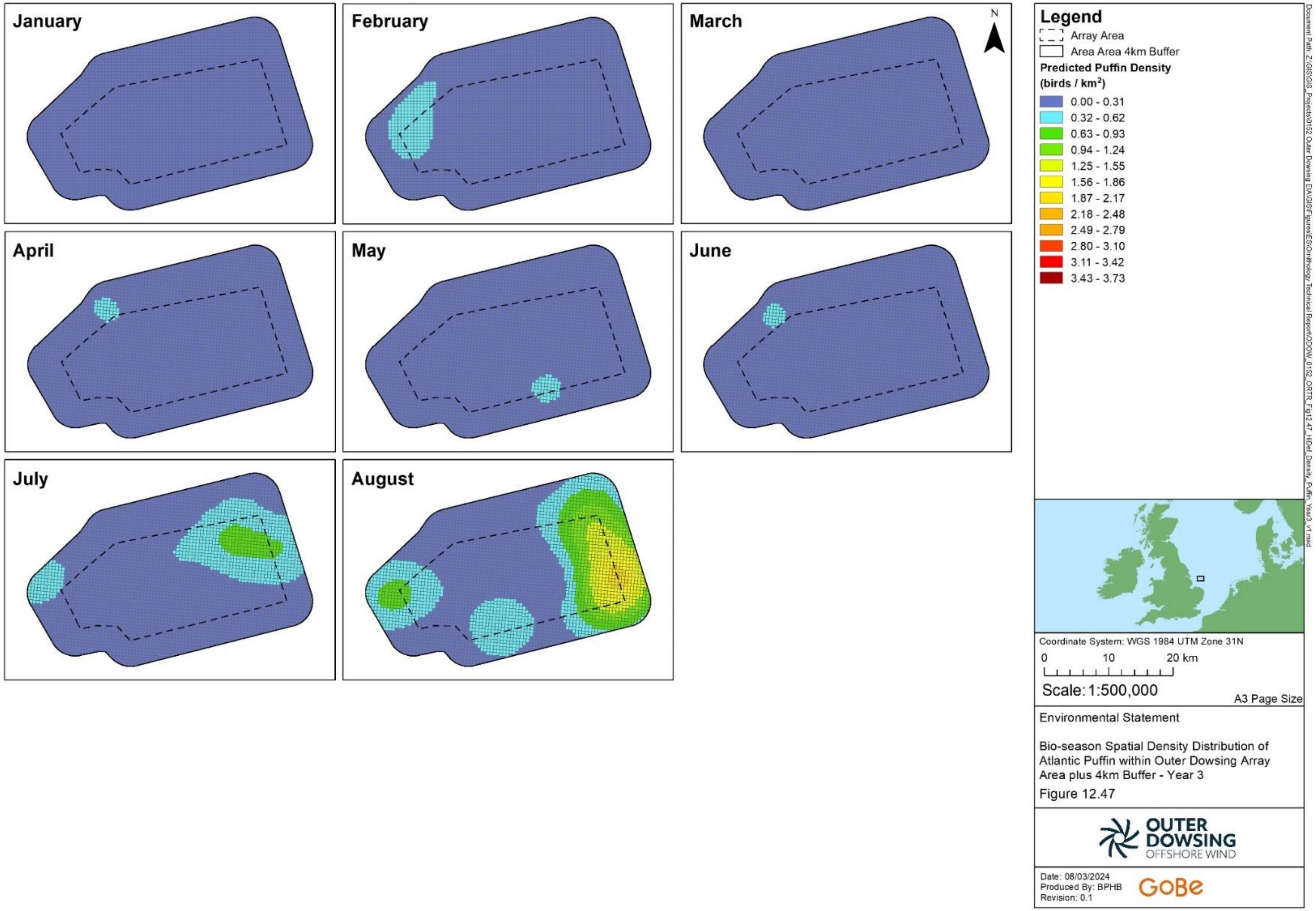

Figure 12.47 Bio-season spatial density distribution of puffin within the Array Area plus 2km buffer – Year 3

158. Puffin showed an interesting pattern of presence and abundance across the two years that were surveyed. Abundance was generally low (rarely occurring in numbers of over 200 birds in the array area plus 2km buffer), apart from a very high peak in abundance in late Summer and Autumn 2021. Patterns in abundance were similar across both the array area and array plus 2km buffer, as can be seen in Figure 12.48.

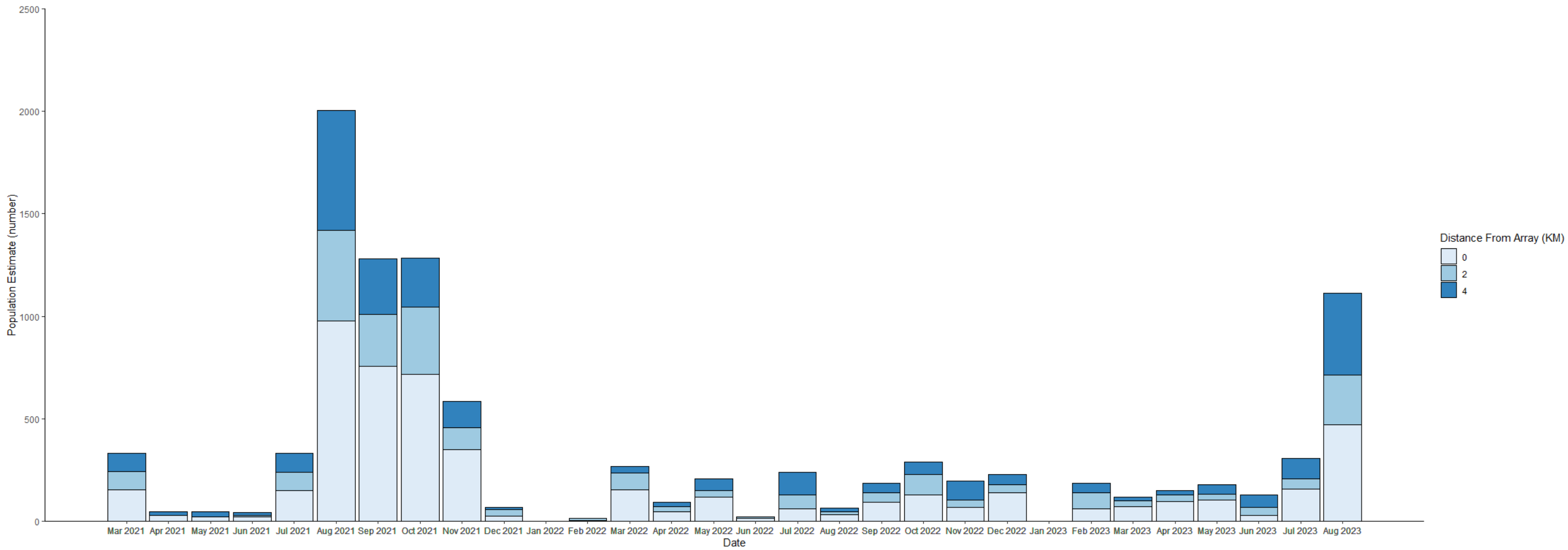

Figure 12.48. Monthly abundance of puffin in the array only, array plus 2km buffer and array plus 4km buffer.

12.3.12.4 Flight direction

159. Figure 12.49 shows windrose diagrams presenting flight directions recorded for puffin within the array area plus a 4km buffer.

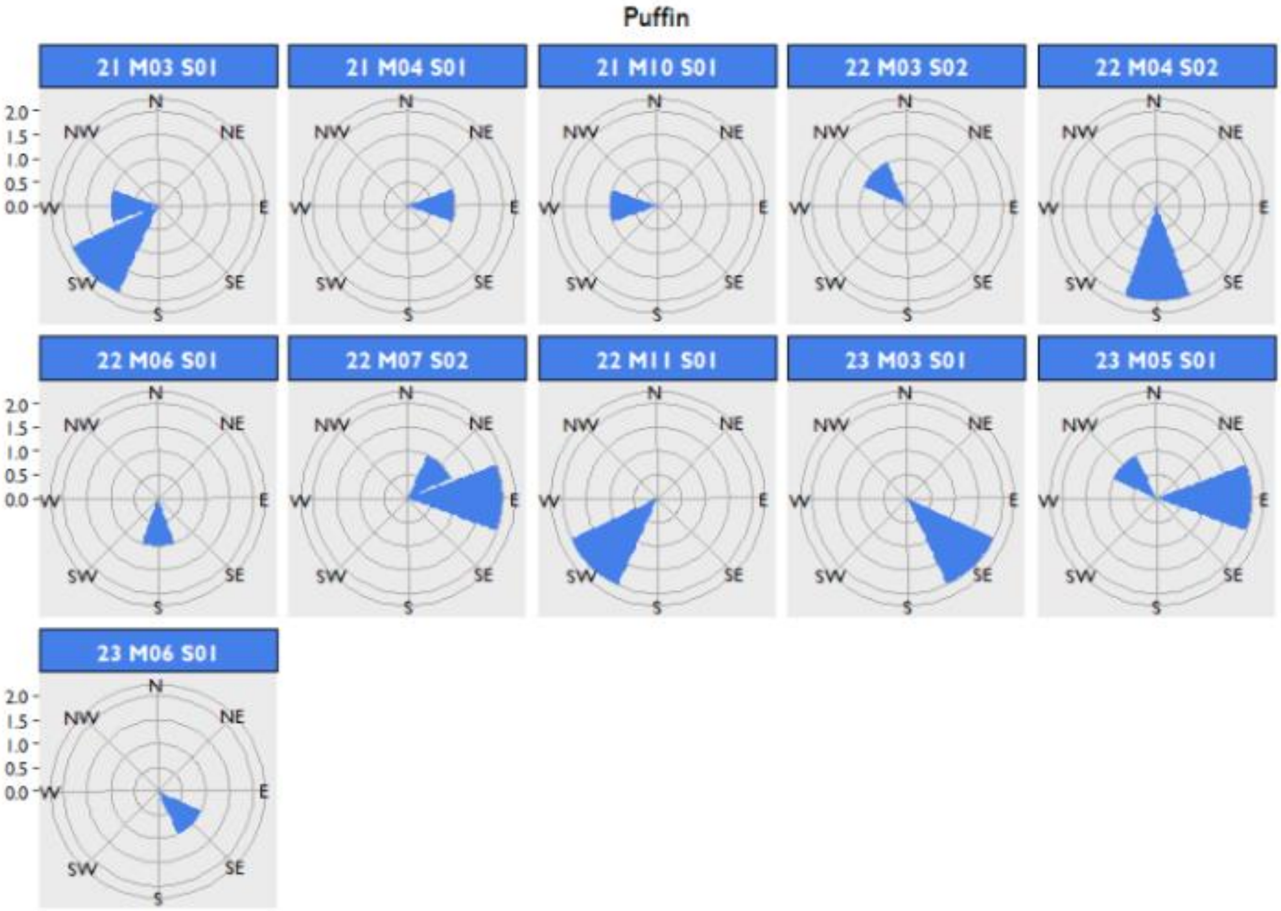

Figure 12.49. Windrose diagrams for months during which flying puffin were recorded within the array area plus a 4km buffer.

160. Proportions of puffin in flight are presented in Table 12.48.

Table 12.48. Proportions of puffin in flight recorded in the in the Project array area.

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2021-03-22	0	2	14	0	12	0	16
2021-04-04	0	1	3	0	25	0	4
2021-05-12	0	0	2	0	0	0	2
2021-06-09	0	0	1	0	0	0	1
2021-07-24	0	0	13	0	0	0	13
2021-08-14	0	0	57	0	0	0	57
2021-09-07	0	0	61	0	0	0	61
2021-10-09	0	1	68	0	1	0	69
2021-11-02	0	0	37	0	0	0	37
2021-12-15	0	0	1	0	0	0	1
2022-01-06	0	0	0	0	0	0	0
2022-02-23	0	0	0	0	0	0	0
2022-03-11	0	0	16	0	0	0	16
2022-03-22	0	1	4	0	20	0	5
2022-04-02	0	0	2	0	0	0	2
2022-04-15	0	2	2	0	50	0	4
2022-05-02	1	0	25	0	0	0	26
2022-05-17	0	0	1	0	0	0	1
2022-06-09	0	1	2	0	33	0	3
2022-06-21	0	0	0	0	0	0	0
2022-07-04	0	0	1	0	0	0	1
2022-07-16	0	1	11	0	8	0	12
2022-08-08	0	0	4	0	0	0	4
2022-08-23	0	0	1	0	0	0	1
2022-09-13	0	0	12	0	0	0	12
2022-09-25	0	0	4	0	0	0	4
2022-10-10	1	0	17	0	0	0	18

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2022-11-07	0	0	4	0	0	0	4
2022-12-13	0	0	13	0	0	0	13
2023-01-26	0	0	0	0	0	0	0
2023-02-10	0	0	2	0	0	0	2
2023-03-24	0	0	4	0	0	0	4
2023-04-05	0	0	3	0	0	0	3
2023-05-03	0	2	7	0	22	0	9
2023-06-17	0	1	2	0	33	0	3
2023-07-05	0	0	15	0	0	0	15
2023-08-10	0	0	35	0	0	0	35
Total	2	12	444	0	-	0	458

12.3.12.5 Birds aged from DAS data

161. Proportions of puffin aged from DAS images are presented in Table 12.49.

Table 12.49. Proportions of puffin aged from DAS images within the array area plus a 2km buffer.

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
22/03/2021	0	0	0	25	0	25	0
04/04/2021	0	0	0	4	0	4	0
12/05/2021	0	0	0	2	0	2	0
09/06/2021	0	0	0	1	0	1	0
24/07/2021	0	0	0	19	0	19	0
14/08/2021	0	0	0	101	0	101	0
07/09/2021	0	0	0	81	0	81	0
09/10/2021	0	0	0	99	0	99	0
02/11/2021	0	0	0	47	0	47	0
15/12/2021	0	0	0	5	0	5	0
06/01/2022	0	0	0	0	0	0	0
23/02/2022	0	0	0	1	0	1	0
11/03/2022	0	0	0	26	0	26	0
22/03/2022	0	0	0	8	0	8	0
02/04/2022	0	0	0	3	0	3	0
15/04/2022	0	0	0	6	0	6	0
02/05/2022	0	0	0	28	0	28	0
17/05/2022	0	0	0	1	0	1	0
09/06/2022	0	0	0	4	0	4	0
21/06/2022	0	0	0	0	0	0	0
04/07/2022	0	0	0	5	0	5	0
16/07/2022	0	0	0	17	0	17	0
08/08/2022	0	0	0	6	0	6	0
23/08/2022	0	0	0	1	0	1	0
13/09/2022	0	0	0	15	0	15	0
25/09/2022	0	0	0	6	0	6	0

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
10/10/2022	0	0	0	31	0	31	0
07/11/2022	0	0	0	6	0	6	0
13/12/2022	0	0	0	15	0	15	0
26/01/2023	0	0	0	0	0	0	0
10/02/2023	0	0	0	6	0	6	0
24/03/2023	0	0	0	6	0	6	0
05/04/2023	0	0	0	3	0	3	0
03/05/2023	0	0	0	14	0	14	0
17/06/2023	0	0	0	8	0	8	0
05/07/2023	0	0	0	16	0	16	0
10/08/2023	0	0	0	53	0	53	0

12.3.13Red-throated diver

12.3.13.1 Digital aerial survey data

162. Red-throated diver were recorded in the array area in 18 of the 30 months surveyed, with abundance and density peaking at 169 and 0.39 respectively in March 2022 (Table 12.51).

163. In the array area plus 4km buffer abundance and density peaked at 284 and 0.21 respectively in April 2022 (Table 12.51).

12.3.13.2 Red-throated diver overview

164. The nearest SPA with red-throated diver as a qualifying feature to the Project is the Greater Wash SPA, which is 23.4km from the Project array area and overlaps with the offshore ECC. The SPA has a wintering aggregation of 1,787 red-throated divers which is approximately 8% of the wintering UK population (JNCC, 2022).

165. During the migration seasons (September to November and February to April), the relevant background population is considered to be the UK North Sea BDMPS, consisting of 13,277 individuals (Furness, 2015). The southwest North Sea BDMPS population of 10,177 individuals is relevant to the winter period (December and January) (Furness, 2015).

12.3.13.3 Abundance and Phenology

166. Peak abundances of red-throated diver in the species bio-seasons (as defined in Furness 2015) are presented in Table 12.50. Estimates of monthly abundance, density and percentage flying within the array area, and monthly abundance and density within the array plus 2km buffer are presented in Table 12.51. The spatial density distribution of red-throated diver within the Outer Dowsing Array Area plus 4km buffer is shown for three years of surveys in Figure 12.50, Figure 12.51, and Figure 12.52.

167. Red-throated diver were present in the Project array area across all bio-seasons. Abundance in the array area was greatest during the breeding bio-season (March to August), with a seasonal peak abundance of 114.8 birds and peak density of 0.26 birds/km^2; a similar abundance was also recorded during the return migration (February to April) (Table 12.50) .

168. In the array area plus 4km buffer, red-throated diver numbers were again similar during the breeding bio-season and return migration, with a peak abundance of 184 birds and peak density of 0.22 birds/km^2 (Table 12.50).

Table 12.50. Red-throated diver bio-season apportioned abundance and density estimates in the Project array area plus 4km buffer

BDMPS Bio-seasons	Months	Array area		Array area + 4km buffer	
		Bio-season peak abundance (n)	Bio-season peak density (n/km²)	Bio-season peak abundance (n)	Bio-season peak density (n/km²)
Return Migration	Feb - April	114.8 (31.3 – 161.3)	0.26 (0.07 – 0.37)	183.8 (76.5 – 228.8)	0.22 (0.09 – 0.28)
Breeding	Mar-Aug	114.8 (45.8 (205.2)	0.26 (0.11 – 0.47)	183.8 (100.7 – 278.5)	0.22 (0.12 – 0.33)
Post-breeding Migration	Sep - Nov	6.5 (0.0 – 15.0)	0.02 (0.00 – 0.04)	16.0 (3.0 – 32.5)	0.02 (0.01 – 0.04)
Winter period	Dec - Jan	12.0 (0.0 – 29.5)	0.03 (0.00 – 0.07)	27.5 (0.0 – 61.5)	0.04 (0.00 – 0.08)

Table 12.51. Red-throated diver estimated apportioned abundance and estimated density, in the Project array area and array area plus 4km buffer.

Month	Survey number	Array only			Array plus 4km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
March 21	1	169	0.39	4	259	0.31
April 21	1	148	0.34	0	200	0.24
May 21	1	13	0.03	0	19	0.02
June 21	1	0	0	0	0	0
July 21	1	0	0	0	0	0
Aug 21	1	0	0	0	0	0
Sept 21	1	0	0	0	0	0
Oct 21	1	13	0.03	0	25	0.03
Nov 21	1	0	0	0	7	0.01
Dec 21	1	12	0.03	50	25	0.03
Jan 22	1	0	0	0	0	
Feb 22	1	18	0.04	0	18	0.02
March 22	1	36	0.08	0	37	0.04
March 22	2	90	0.21	0	132	0.16
April 22	1	185	0.42	6	284	0.34
April 22	2	18	0.04	0	36	0.04
May 22	1	6	0.01	0	19	0.02
May 22	2	6	0.01	0	7	0.01
June 22	1	0	0	0	0	0
June 22	2	0	0	0	0	0

Month	Survey number	Array only			Array plus 4km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
July 22	1	0	0	0	0	0
July 22	2	0	0	0	0	0
Aug 22	1	0	0	0	0	0
Aug 22	2	0	0	0	0	0
Sept 22	1	0	0	0	7	0.01
Sept 22	2	0	0	0	0	0
Oct 22	1	0	0	0	7	0.01
Nov 22	1	0	0	0	0	0
Dec 22	1	12	0.03	0	30	0.04
Jan 23	1	42	0.09	0	73	0.09
Feb 23	1	30	0.07	0	42	0.05
March 23	1	65	0.15	0	132	0.16
April 23	1	85	0.19	7	145	0.17
May 23	1	12	0.03	0	13	0.01
June 23	1	0	0	0	0	0
July 23	1	0	0	0	0	0
Aug 23	1	0	0	0	0	0

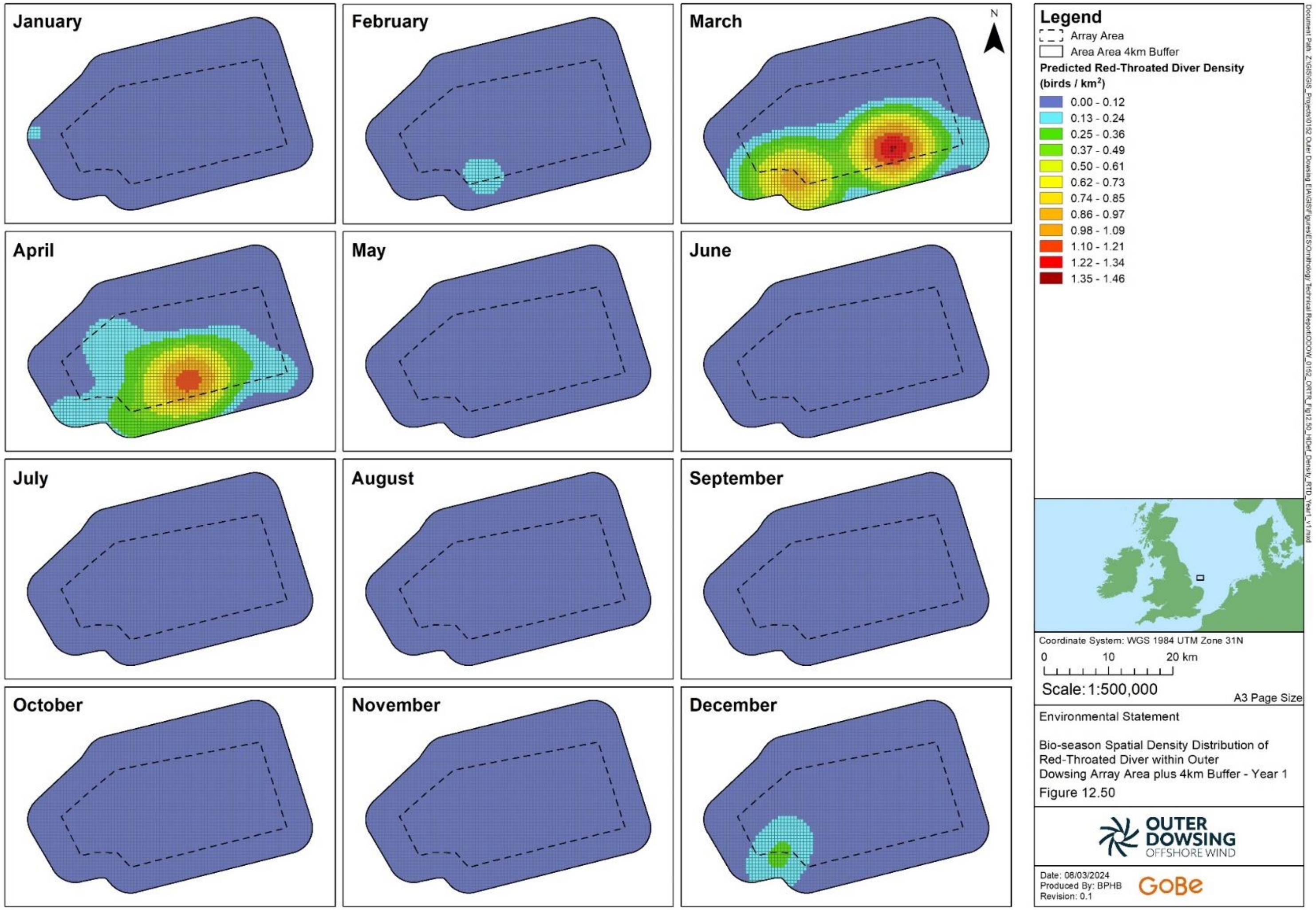

Figure 12.50 Bio-season spatial density distribution of red-throated diver within the Array Area plus 4km buffer – Year 1

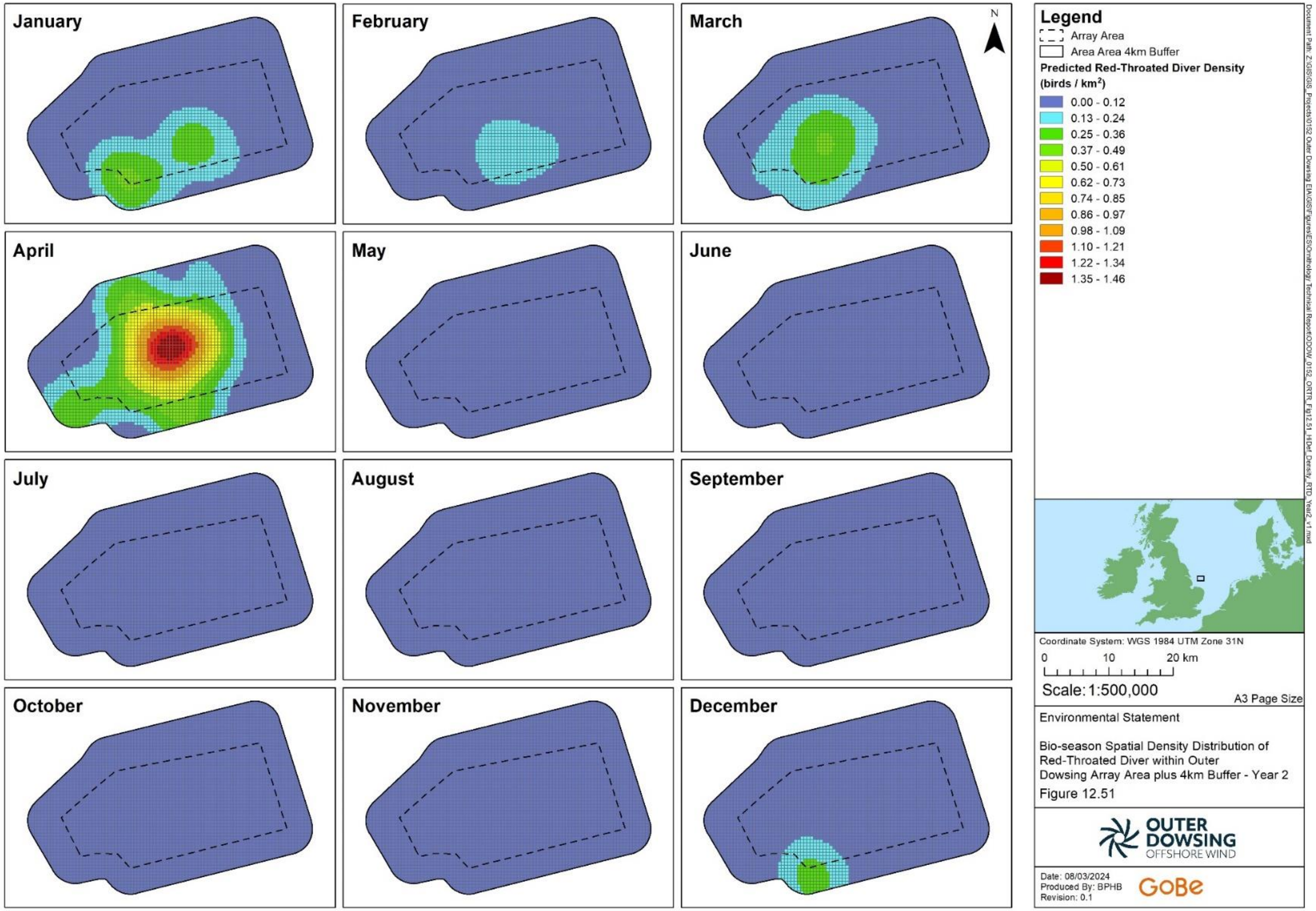

Figure 12.51 Bio-season spatial density distribution of red-throated diver within the Array Area plus 4km buffer – Year 2

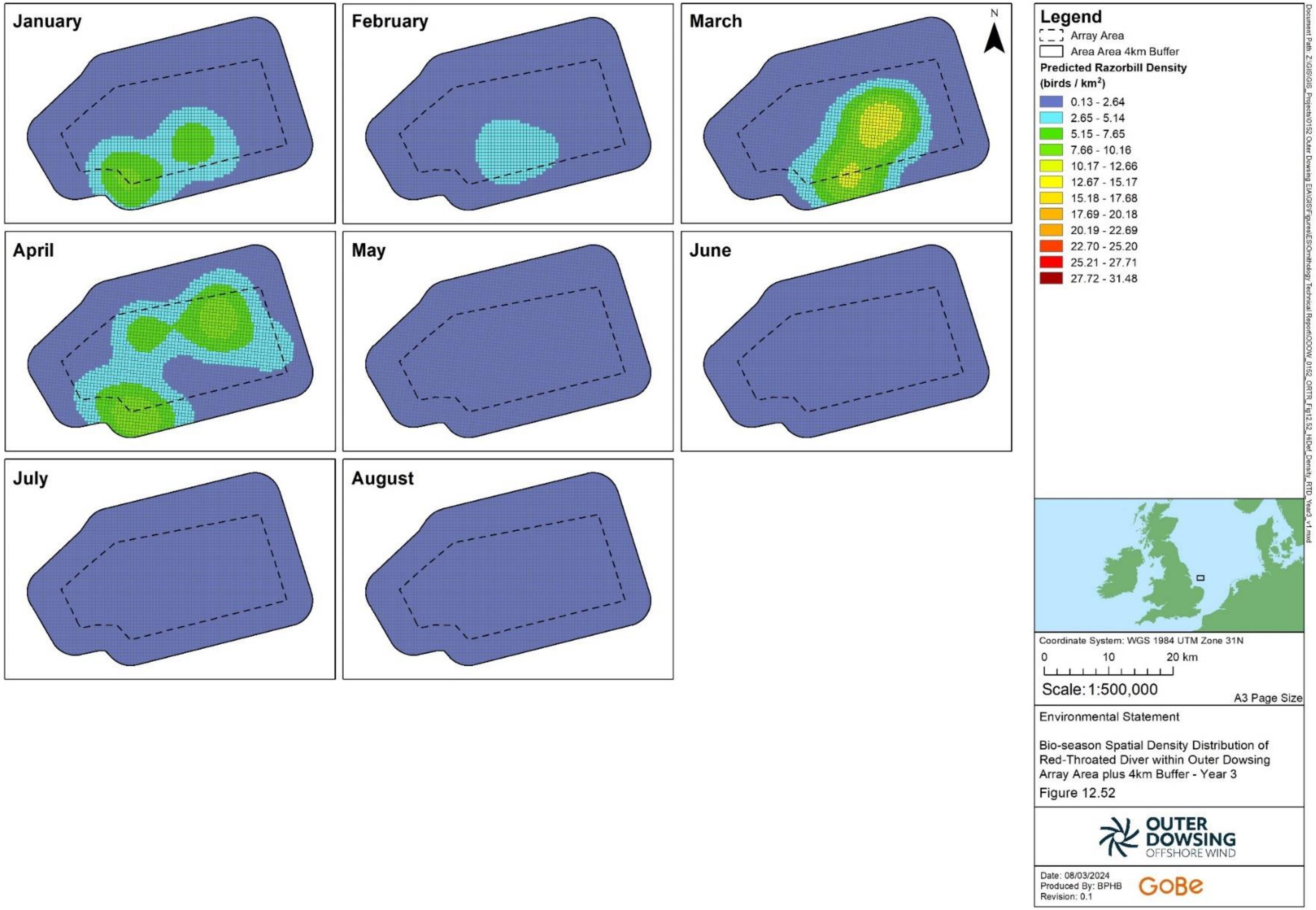

Figure 12.52 Bio-season spatial density distribution of red-throated diver within the Array Area plus 4km buffer – Year 3

169. Red-throated diver showed clear patterns of presence and abundance across both the array area and the array plus 4km buffer. Abundance was highest in the spring (March and April) across both years, and it was largely absent during the breeding season (reflecting the distance to the species breeding range and it's relatively small foraging range). Much smaller peaks were estimated for the Autumn and Winter, possibly reflecting the presence of a small number of birds on post-breeding migration, and potentially very small numbers wintering in the area.

12.3.13.4 Flight direction

170. Figure 12.53 shows windrose diagrams presenting flight directions recorded for red-throated diver within the array area plus a 4km buffer.

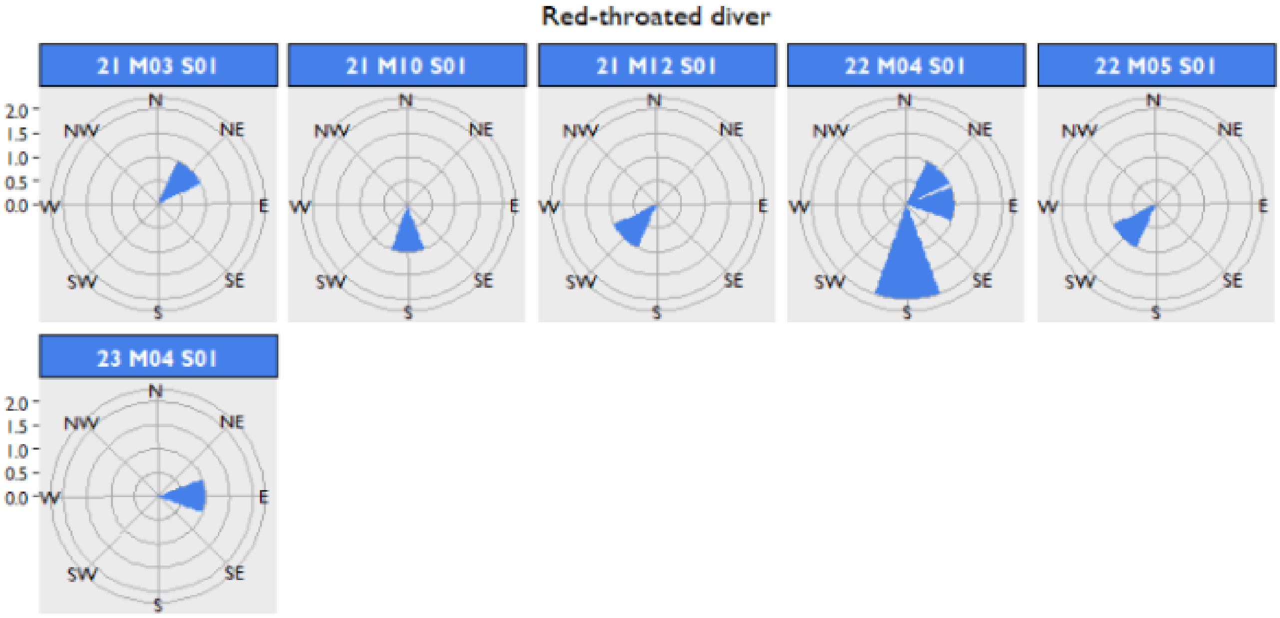

Figure 12.53. Windrose diagrams for months during which red-throated diver were recorded within the array area plus 4km buffer.

171. Proportions of red-throated diver in flight are presented in Table 12.52.

Table 12.52. Proportions of red-throated diver in flight recorded in the in the Project array area.

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2021-03-22	0	1	27	0	4	0	28
2021-04-04	0	0	25	0	0	0	25
2021-05-12	0	0	1	0	0	0	1
2021-06-09	0	0	0	0	0	0	0
2021-07-24	0	0	0	0	0	0	0
2021-08-14	0	0	0	0	0	0	0
2021-09-07	0	0	0	0	0	0	0
2021-10-09	0	0	2	0	0	0	2
2021-11-02	0	0	0	0	0	0	0
2021-12-15	0	1	1	0	50	0	2
2022-01-06	0	0	0	0	0	0	0
2022-02-23	0	0	3	0	0	0	3
2022-03-11	0	0	6	0	0	0	6
2022-03-22	0	0	14	0	0	0	14
2022-04-02	0	2	29	0	6	0	31
2022-04-15	0	0	3	0	0	0	3
2022-05-02	0	0	1	0	0	0	1
2022-05-17	0	0	1	0	0	0	1
2022-06-09	0	0	0	0	0	0	0
2022-06-21	0	0	0	0	0	0	0
2022-07-04	0	0	0	0	0	0	0
2022-07-16	0	0	0	0	0	0	0
2022-08-08	0	0	0	0	0	0	0
2022-08-23	0	0	0	0	0	0	0
2022-09-13	0	0	0	0	0	0	0
2022-09-25	0	0	0	0	0	0	0
2022-10-10	0	0	1	0	0	0	1

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2022-11-07	0	0	0	0	0	0	0
2022-12-13	0	0	2	0	0	0	2
2023-01-26	0	0	8	0	0	0	8
2023-02-10	0	0	5	0	0	0	5
2023-03-24	0	0	11	0	0	0	11
2023-04-05	0	1	14	0	7	0	15
2023-05-03	0	0	2	0	0	0	2
2023-06-17	0	0	0	0	0	0	0
2023-07-05	0	0	0	0	0	0	0
2023-08-10	0	0	0	0	0	0	0
Total	0	5	156	0	-	0	161

12.3.13.5 Birds aged from DAS data

172. Proportions of red-throated diver aged from DAS images are presented in Table 12.53.

Table 12.53. Proportions of red-throated diver aged from DAS images within the array area plus a 2km buffer.

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
22/03/2021	0	0	0	37	0	37	0
04/04/2021	0	0	0	30	0	30	0
12/05/2021	0	0	0	1	0	1	0
09/06/2021	0	0	0	0	0	0	0
24/07/2021	0	0	0	0	0	0	0
14/08/2021	0	0	0	0	0	0	0
07/09/2021	0	0	0	0	0	0	0
09/10/2021	0	0	0	3	0	3	0
02/11/2021	0	0	0	1	0	1	0
15/12/2021	0	0	0	2	0	2	0
06/01/2022	0	0	0	0	0	0	0
23/02/2022	0	0	0	3	0	3	0
11/03/2022	0	0	0	6	0	6	0
22/03/2022	0	0	0	19	0	19	0
02/04/2022	0	0	0	38	0	38	0
15/04/2022	0	0	0	6	0	6	0
02/05/2022	0	0	0	2	0	2	0
17/05/2022	0	0	0	1	0	1	0
09/06/2022	0	0	0	0	0	0	0
21/06/2022	0	0	0	0	0	0	0
04/07/2022	0	0	0	0	0	0	0
16/07/2022	0	0	0	0	0	0	0
08/08/2022	0	0	0	0	0	0	0
23/08/2022	0	0	0	0	0	0	0
13/09/2022	0	0	0	0	0	0	0
25/09/2022	0	0	0	0	0	0	0

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
10/10/2022	0	0	0	1	0	1	0
07/11/2022	0	0	0	0	0	0	0
13/12/2022	0	0	0	3	0	3	0
26/01/2023	0	0	0	10	0	10	0
10/02/2023	0	0	0	6	0	6	0
24/03/2023	0	0	0	19	0	19	0
05/04/2023	0	0	0	20	0	20	0
03/05/2023	0	0	0	2	0	2	0
17/06/2023	0	0	0	0	0	0	0
05/07/2023	0	0	0	0	0	0	0
10/08/2023	0	0	0	0	0	0	0

12.3.14 Fulmar

12.3.14.1 Digital aerial survey data

173. Fulmar were recorded in the array area in 25 of the 30 months surveyed with abundance and density peaking at 95 birds and 0.22 birds/km^2 respectively in April 2022 (Table 12.55).

174. In the array area plus 2km buffer abundance and density peaked at 126 birds and 0.2 birds/km^2 respectively in April 2022 (Table 12.55).

12.3.14.2 Fulmar overview

175. Fulmar has a large mean maximum foraging range plus one standard deviation (542.3km ±657.9km) (Woodward *et al.*, 2019). This means that many of the fulmar breeding colonies in Scotland are within the foraging range of the Project (Stroud *et al.*, 2016) although birds recorded during the breeding season are more likely to come from smaller, closer colonies, including FFC and North Norfolk Coast SPAs. Likewise, during the chick rearing period, birds are much more constrained by the need to return to the nest to feed young. As such, this large mean max foraging range should be considered as most applicable to the incubation period (April to June), with a much smaller foraging range being used when rearing chicks (July to August).

176. Outside the breeding season, impacts on fulmar have been assessed against the UK North Sea BDMPS. This numbers 957,502 individuals during autumn migration (September to October) and spring migration (December to March), and 568,736 individuals during winter (November) (Furness, 2015).

12.3.14.3 Abundance and Phenology

177. Peak abundances of fulmar in the species bio-seasons (as defined in Furness 2015) are presented in Table 12.54. Estimates of monthly abundance, density and percentage flying within the array area, and monthly abundance and density within the array plus 2km buffer, are presented in Table 12.55.

178. Fulmar were present in the Project array area across both bio-seasons. Abundance was highest during the breeding bio-season (January to August), with a seasonal peak abundance of 76 birds and peak density of 0.17 birds/km^2 (Table 12.54).

Table 12.54. Fulmar bio-season apportioned abundance and density estimates in the Project array area plus 2km buffer.

BDMPS Bio-seasons	Months	Array area		Array area +2km buffer	
		Bio-season peak abundance (n)	Bio-season peak density (n/km²)	Bio-season peak abundance (n)	Bio-season peak density (n/km²)
Breeding season	Jan – Aug	75.5 (23.8 – 156.0)	0.17 (0.05 – 0.36)	86.2 (34.0 – 162.0)	0.14 (0.05 – 0.26)
Non-breeding season	Sep – Dec	19.0 (3.0 – 41.5)	0.04 (0.01– 0.09)	24.0 (0.0 – 53.5)	0.06 (0.00 – 0.09)

Table 12.55. Fulmar estimated apportioned abundance and estimated density, in the Project array area and 2km buffer.

Month	Survey number	Array only			Array plus 2 km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
March 21	1	6	0.01	0	86	0.05
April 21	1	48	0.11	71	49	0.08
May 21	1	0	0	0	0	0
June 21	1	13	0.03	0	25	0.04
July 21	1	68	0.16	45	66	0.11
Aug 21	1	7	0.01	0	19	0.03
Sept 21	1	13	0.03	0	19	0.03
Oct 21	1	0	0	0	0	0
Nov 21	1	0	0	0	0	0
Dec 21	1	19	0.04	50	24	0.04
Jan 22	1	19	0.04	67	19	0.03
Feb 22	1	10	0.02	100	10	0.02
March 22	1	0	0	0	0	0
March 22	2	31	0.07	0	43	0.07
April 22	1	95	0.22	67	126	0.2
April 22	2	36	0.08	50	43	0.07
May 22	1	18	0.04	67	60	0.1
May 22	2	0	0	0	0	0
June 22	1	9	0.02	100	12	0.02
June 22	2	42	0.1	67	43	0.07
July 22	1	6	0.01	0	7	0.01
July 22	2	42	0.05	0	49	0.08
Aug 22	1	0	0	0	84	0.13

Month	Survey number	Array only			Array plus 2 km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
Aug 22	2	7	0.01	0	7	0.01
Sept 22	1	0	0	0	13	0.02
Sept 22	2	0	0	0	0	0
Oct 22	1	0	0	0	0	0
Nov 22	1	0	0	0	0	0
Dec 22	1	19	0.04	33	24	0.04
Jan 23	1	93	0.21	60	108	0.17
Feb 23	1	13	0.03	100	12	0.02
March 23	1	0	0	0	0	0
April 23	1	13	0.03	0	13	0.02
May 23	1	19	0.04	33	31	0.05
June 23	1	46	0.1	29	90	0.14
July 23	1	0	0	0	0	0
Aug 23	1	61	0.14	50	66	0.10

179. Fulmar showed similar patterns in presence and abundance across both the array area and the array plus 2km buffer, but the patterns were not the same across both years of survey. In 2021, abundance peaked in June, but in 2022, abundance was highest in April, with a secondary peak in August. There is also a notable peak in abundance in January 2032. Numbers across the array area plus 2km buffer were generally low, with only one abundance estimate reaching more than 100 birds (January 2023).

12.3.14.4 Flight direction

180. Figure 12.54 shows windrose diagrams presenting flight directions recorded for fulmar within the array area plus a 4km buffer.

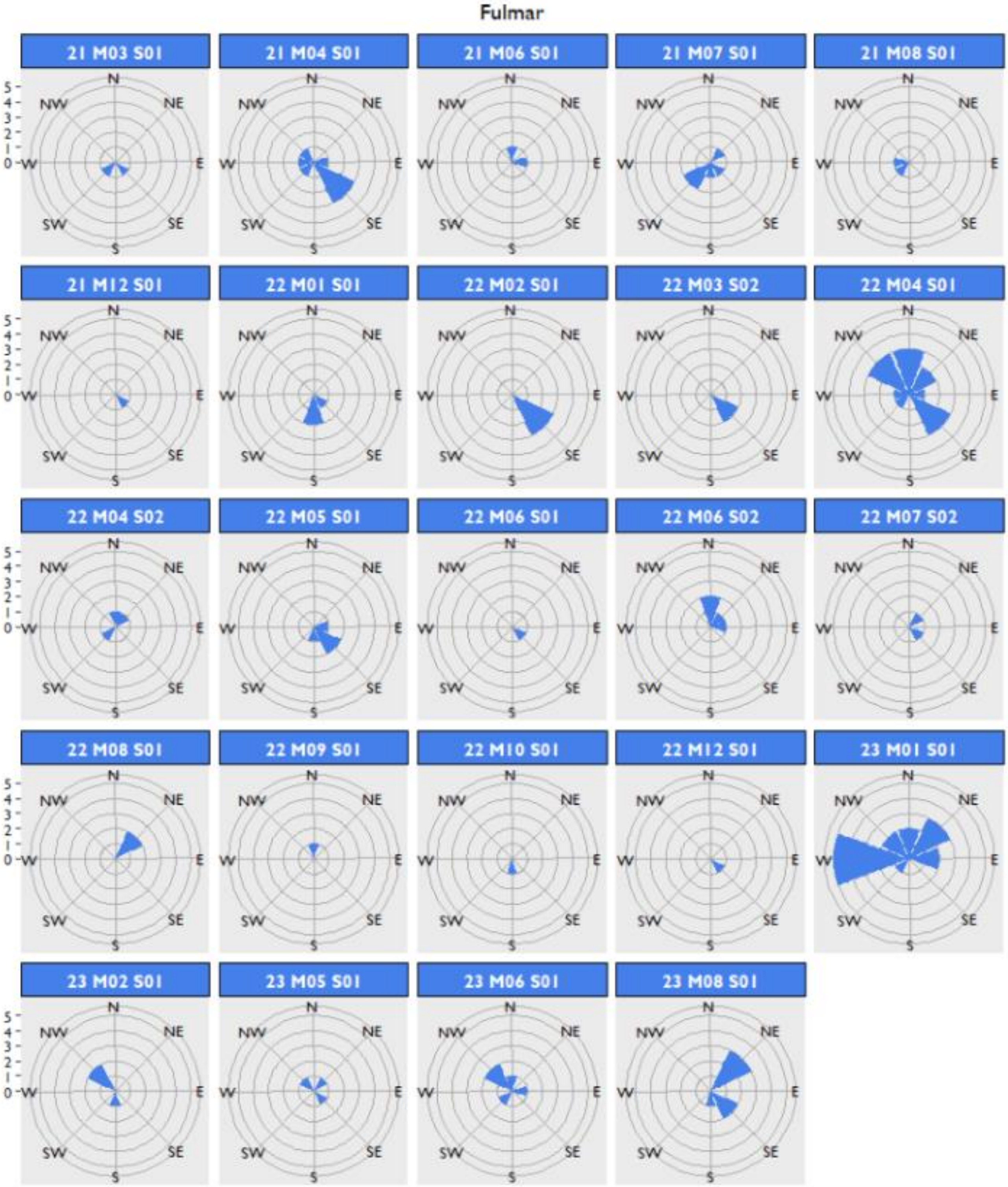

Figure 12.54. Windrose diagrams for months during which flying fulmar were recorded within the array area plus 4km buffer.

181. Proportions of fulmar in flight are presented in Table 12.56.

Table 12.56. Proportions of fulmar in flight recorded in the in the Project array area.

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2021-03-22	0	0	0	0	0	0	0
2021-04-04	0	5	2	0	71	0	7
2021-05-12	0	0	0	0	0	0	0
2021-06-09	0	0	2	0	0	0	2
2021-07-24	0	5	6	0	45	0	11
2021-08-14	0	0	0	0	0	0	0
2021-09-07	0	0	2	0	0	0	2
2021-10-09	0	0	0	0	0	0	0
2021-11-02	0	0	0	0	0	0	0
2021-12-15	0	1	1	0	50	0	2
2022-01-06	0	2	1	0	67	0	3
2022-02-23	0	1	0	0	100	0	1
2022-03-11	0	0	0	0	0	0	0
2022-03-22	0	0	4	0	0	0	4
2022-04-02	0	10	5	0	67	0	15
2022-04-15	0	3	3	0	50	0	6
2022-05-02	0	2	1	0	67	0	3
2022-05-17	0	0	0	0	0	0	0
2022-06-09	0	1	0	0	100	0	1
2022-06-21	0	4	2	0	67	0	6
2022-07-04	0	0	1	0	0	0	1
2022-07-16	0	0	6	0	0	0	6
2022-08-08	0	0	12	0	0	0	12
2022-08-23	0	0	1	0	0	0	1
2022-09-13	0	0	0	0	0	0	0
2022-09-25	0	0	0	0	0	0	0
2022-10-10	0	0	0	0	0	0	0

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2022-11-07	0	0	0	0	0	0	0
2022-12-13	0	1	2	0	33	0	3
2023-01-26	0	9	6	0	60	0	15
2023-02-10	0	2	0	0	100	0	2
2023-03-24	0	0	0	0	0	0	0
2023-04-05	0	0	1	0	0	0	1
2023-05-03	0	1	2	0	33	0	3
2023-06-17	0	2	5	0	29	0	7
2023-07-05	0	0	0	0	0	0	0
2023-08-10	0	5	5	0	50	0	10
Total	0	54	70	0	-	0	124

12.3.14.5 Birds aged from DAS data

182. Proportions of fulmar aged from DAS images are presented in Table 12.57.

Table 12.57. Proportions of fulmar aged from DAS images within the array area plus a 2km buffer.

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
22/03/2021	0	0	0	1	0	1	0
04/04/2021	0	0	0	8	0	8	0
12/05/2021	0	0	0	0	0	0	0
09/06/2021	0	0	0	3	0	3	0
24/07/2021	0	0	0	11	0	11	0
14/08/2021	0	0	0	2	0	2	0
07/09/2021	0	0	0	3	0	3	0
09/10/2021	0	0	0	0	0	0	0
02/11/2021	0	0	0	0	0	0	0
15/12/2021	0	0	0	2	0	2	0
06/01/2022	0	0	0	3	0	3	0
23/02/2022	0	0	0	1	0	1	0
11/03/2022	0	0	0	0	0	0	0
22/03/2022	0	0	0	6	0	6	0
02/04/2022	0	0	0	19	0	19	0
15/04/2022	0	0	0	7	0	7	0
02/05/2022	0	0	0	9	0	9	0
17/05/2022	0	0	0	0	0	0	0
09/06/2022	0	0	0	1	0	1	0
21/06/2022	0	0	0	6	0	6	0
04/07/2022	0	0	0	1	0	1	0
16/07/2022	0	0	0	7	0	7	0
08/08/2022	0	0	0	13	0	13	0
23/08/2022	0	0	0	1	0	1	0
13/09/2022	0	0	0	2	0	2	0
25/09/2022	0	0	0	0	0	0	0

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
10/10/2022	0	0	0	0	0	0	0
07/11/2022	0	0	0	0	0	0	0
13/12/2022	0	0	0	3	0	3	0
26/01/2023	0	0	0	18	0	18	0
10/02/2023	0	0	0	2	0	2	0
24/03/2023	0	0	0	0	0	0	0
05/04/2023	0	0	0	1	0	1	0
03/05/2023	0	0	0	5	0	5	0
17/06/2023	0	0	0	13	0	13	0
05/07/2023	0	0	0	0	0	0	0
10/08/2023	0	0	0	11	0	11	0

12.3.15 Manx shearwater

12.3.15.1 Digital aerial survey data

183. Manx shearwater were recorded in the array area in 9 of the 30 months surveyed, with abundance and density peaking at 182 birds and 0.42 birds/km^2 respectively in September 2022 (Table 12.59).

184. In the array area plus 2km buffer abundance and density peaked at 490 birds and 0.78 birds/km^2 respectively in September 2022 (Table 12.59).

12.3.15.2 Manx shearwater overview

185. Manx shearwater have a large mean maximum foraging range plus one standard deviation (1346.8km ±1018.7km) (Woodward *et al.*, 2019). This means that many of the Manx shearwater breeding colonies in Scotland are within the foraging range of the Project (Stroud *et al.*, 2016).

12.3.15.3 Abundance and Phenology

186. Peak abundances of Manx shearwater in the species bio-seasons (as defined in Furness 2015) are presented in Table 12.58. Estimates of monthly abundance, density and percentage flying within the array area, and monthly abundance and density within the array plus 2km buffer are presented in Table 12.59.

187. Manx shearwater were present in the Project array area across all three bio-seasons. Peak abundance was during the breeding bio-season (April – August), with a seasonal peak abundance of 55 birds and peak density of 0.09 birds/km^2 within the array plus a 2km buffer (Table 12.58).

Table 12.58. Manx shearwater bio-season apportioned abundance and density estimates in the Project array area and array area plus 2km buffer.

		Array area		Array area +2km buffer	
BDMPS Bio-seasons	Months	Bio-season peak abundance (n)	Bio-season peak density (n/km^2)	Bio-season peak abundance (n)	Bio-season peak density (n/km^2)
Breeding season	Apr - Aug	22.8 (4.0 – 58.3)	0.05 (0.01 – 0.13)	54.5 (10.8 – 126.3)	0.09 (0.02 – 0.20)
Post breeding migration	Aug – Oct	2.2 (0.0 – 7.5)	0.01 (0.00 – 0.02)	3.0 (0.0 – 11.75)	0.01 (0.00 – 0.02)
Return migration	Mar - Apr	45.5 (0.0 – 142.75)	0.11 (0.00 – 0.33)	126.3 (10.3 – 289.8)	0.20 (0.02 – 0.46)

Table 12.59. Manx shearwater estimated apportioned abundance and estimated density, in the Project array area and array area plus 2km buffer.

Month	Survey number	Array only			Array plus 2 km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
March 21	1	0	0	0	0	0
April 21	1	0	0	0	0	0
May 21	1	0	0	0	0	0
June 21	1	0	0	0	0	0
July 21	1	11	0.02	0	20	0.03
Aug 21	1	0	0	0	0	0
Sept 21	1	0	0	0	0	0
Oct 21	1	0	0	0	0	0
Nov 21	1	0	0	0	0	0
Dec 21	1	0	0	0	0	0
Jan 22	1	0	0	0	0	0
Feb 22	1	0	0	0	0	0
March 22	1	0	0	0	0	0
March 22	2	0	0	0	0	0
April 22	1	13	0.03	50	18	0.03
April 22	2	0	0	0	0	0
May 22	1	0	0	0	0	0
May 22	2	0	0	0	0	0
June 22	1	0	0	0	0	0
June 22	2	7	0.01	100	6	0.01
July 22	1	0	0	0	0	0
July 22	2	67	0.15	0	225	0.36
Aug 22	1	19	0.04	14	164	0.26
Aug 22	2	40	0.09	0	47	0.07
Sept 22	1	182	0.42	75	505	0.81
Sept 22	2	0	0	0	0	0
Oct 22	1	0	0	0	0	0
Nov 22	1	0	0	0	0	0
Dec 22	1	0	0	0	0	0
Jan 23	1	0	0	0	0	0
Feb 23	1	0	0	0	0	0
March 23	1	0	0	0	0	0
April 23	1	0	0	0	0	0
May 23	1	0	0	0	0	0
June 23	1	24	0.05	0	31	0.05
July 23	1	0	0	0	0	0
Aug 23	1	7	0.01	100	7	0.01

188. Manx shearwater were generally absent from the array area and array area plus 2km buffer apart from in three periods. There is a small peak in July 2021, another very small peak in April 2022, and a much higher peak in the late Summer and Autumn of 2022 (spanning July to September of that year).

12.3.15.4 Flight direction

189. Figure 12.55 shows windrose diagrams presenting flight directions recorded for Manx shearwater within the array area plus a 4km buffer.

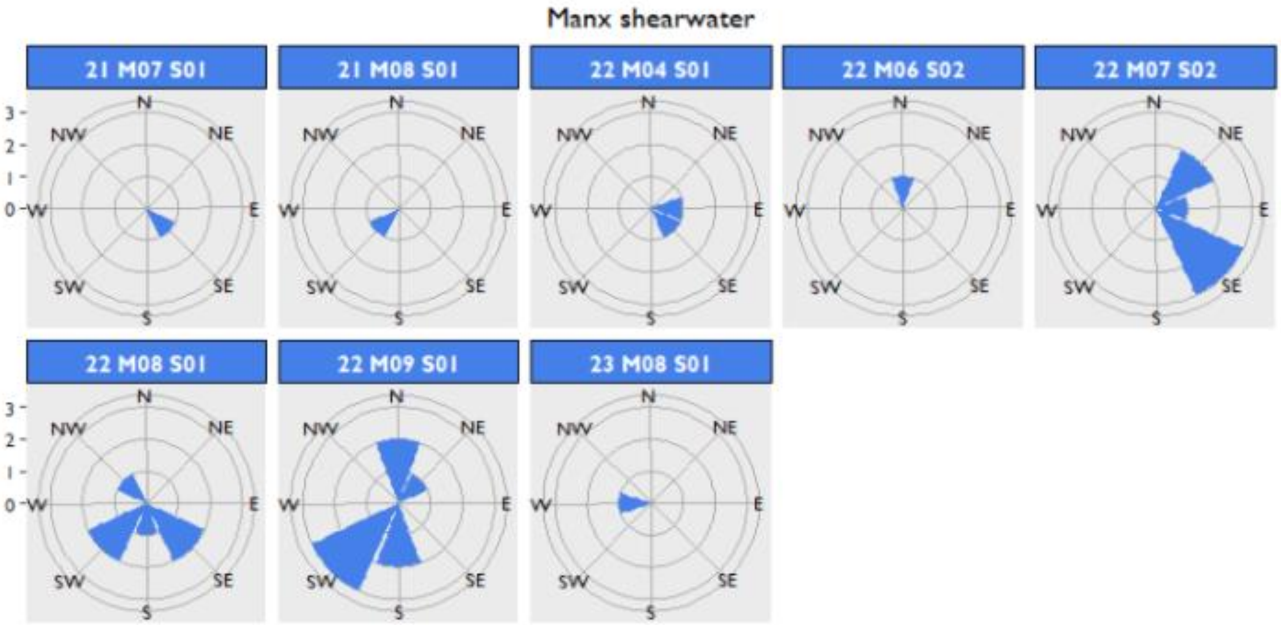

Figure 12.55. Windrose diagrams for months during which flying Manx shearwater were recorded within the array area plus a 4km.

190. Proportions of Manx shearwater in flight are presented in Table 12.60.

Table 12.60. Proportions of Manx shearwater in flight recorded in the in the Project array area.

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2021-03-22	0	0	0	0	0	0	0
2021-04-04	0	0	0	0	0	0	0
2021-05-12	0	0	0	0	0	0	0
2021-06-09	0	0	0	0	0	0	0
2021-07-24	0	0	0	0	0	0	0
2021-08-14	0	0	0	0	0	0	0
2021-09-07	0	0	0	0	0	0	0
2021-10-09	0	0	0	0	0	0	0
2021-11-02	0	0	0	0	0	0	0
2021-12-15	0	0	0	0	0	0	0
2022-01-06	0	0	0	0	0	0	0
2022-02-23	0	0	0	0	0	0	0
2022-03-11	0	0	0	0	0	0	0
2022-03-22	0	0	0	0	0	0	0
2022-04-02	0	1	1	0	50	0	2
2022-04-15	0	0	0	0	0	0	0
2022-05-02	0	0	0	0	0	0	0
2022-05-17	0	0	0	0	0	0	0
2022-06-09	0	0	0	0	0	0	0
2022-06-21	0	1	0	0	100	0	1
2022-07-04	0	0	0	0	0	0	0
2022-07-16	0	0	6	1	0	0	7
2022-08-08	0	3	11	8	14	0	22
2022-08-23	0	0	7	0	0	0	7
2022-09-13	0	3	1	0	75	0	4
2022-09-25	0	0	0	0	0	0	0
2022-10-10	0	0	0	0	0	0	0

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2022-11-07	0	0	0	0	0	0	0
2022-12-13	0	0	0	0	0	0	0
2023-01-26	0	0	0	0	0	0	0
2023-02-10	0	0	0	0	0	0	0
2023-03-24	0	0	0	0	0	0	0
2023-04-05	0	0	0	0	0	0	0
2023-05-03	0	0	0	0	0	0	0
2023-06-17	0	0	4	0	0	0	4
2023-07-05	0	0	0	0	0	0	0
2023-08-10	0	1	0	0	100	0	1
Total	0	9	30	9	-	0	48

12.3.15.5 Digital aerial survey data

191. Gannet were recorded in the array area in 28 of the 30 months surveyed, with abundance and density peaking at 1,091 birds and 2.5 birds/km^2 respectively in April 2022 (Table 12.62).

192. In the array area plus 2km buffer abundance and density peaked at 1,313 birds and 2.1 birds/km^2 respectively in April 2022 (Table 12.62).

12.3.15.6 Gannet overview

193. The nearest breeding gannet to the Project are at the FFC SPA. This is approximately 95km northwest of the Project array area and within the mean maximum foraging range of gannets (315.2km, standard deviation 194.2km) (Woodward *et al.*, 2019). The most recent population found at FFC SPA is 13,125 pairs in 2022 (BTO., 2023).

194. Migration season impacts on gannet have been assessed relative to the UK North Sea and Channel BDMPS. This consists of 456,298 individuals during autumn migration (September to November), and 248,385 individuals during spring migration (December to March) (Furness, 2015).

12.3.15.7 Abundance and Phenology

195. Peak abundances of fulmar in the species bio-seasons (as defined in Furness 2015) are presented in Table 12.61. Estimates of monthly abundance, density and percentage flying within the array area, and monthly abundance and density within the array plus 2km buffer are presented in Table 12.62. The spatial density distribution of gannet within the Outer Dowsing Array Area plus 2km buffer is shown for three years of surveys in Figure 12.57, Figure 12.58, and Figure 12.59.

196. Gannet were present in the Project array area across all three bio-seasons. Abundance was greatest during the breeding bio-season (March to September), with a seasonal peak abundance of 507 birds and peak density of 0.55 birds/km^2 (Table 12.61).

197. In the array area plus 2km buffer, gannet numbers were highest during the breeding bio-season, with a seasonal peak abundance of 635 birds and peak density of 1.02 birds/km^2 (Table 12.61).

Table 12.61. Gannet bio-season apportioned abundance and density estimates in the Outer Dowsing array area plus 2km buffer

BDMPS Bio-seasons	Months	Array area: Bio-season peak abundance (n)	Array area: Bio-season peak density (n/km2)	Array area +2km buffer: Bio-season peak abundance (n)	Array area +2km buffer: Bio-season peak density (n/km2)
Return migration	Dec-Mar	241.5 (112.0 – 410.5)	0.55 (0.26 – 0.18)	303.5 (161.6 – 127.0)	0.49 (0.26 – 0.76)

BDMPS Bio-seasons	Months	Array area		Array area +2km buffer	
		Bio-season peak abundance (n)	Bio-season peak density (n/km2)	Bio-season peak abundance (n)	Bio-season peak density (n/km2)
Breeding	Mar - Sep	507.3 (291.8 – 775.2)	1.16 (0.67 – 1.78)	634.8 (388.5 -950.2)	1.02 (0.62 – 1.52)
Post-breeding migration	Sep-Nov	371.5 (204.0 – 571.5)	0.850 (0.465 – 1.305)	496.0 (265.0 – 782.5)	0.7956 (0.425 – 1.250)

Table 12.62. Gannet estimated apportioned abundance and estimated density in the Project array area and array area plus 2km buffer.

Month	Survey number	Array only			Array plus 2km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
March 21	1	156	0.36	42	222	0.35
April 21	1	438	1	55	608	0.97
May 21	1	49	0.11	75	49	0.08
June 21	1	43	0.10	71	68	0.11
July 21	1	78	0.18	54	146	0.23
Aug 21	1	83	0.19	57	109	0.17
Sept 21	1	54	0.12	22	96	0.15
Oct 21	1	109	0.25	44	121	0.19
Nov 21	1	61	0.14	50	161	0.26
Dec 21	1	0	0	0	0	0
Jan 22	1	7	0.01	100	7	0.01
Feb 22	1	12	0.03	50	25	0.04
March 22	1	188	0.43	44	213	0.34
March 22	2	54	0.12	62	91	0.15
April 22	1	193	0.44	50	318	0.51
April 22	2	1091	2.5	24	1313	2.1
May 22	1	627	1.44	42	907	1.45
May 22	2	91	0.21	45	145	0.23
June 22	1	102	0.23	35	139	0.22
June 22	2	391	0.9	12	427	0.68
July 22	1	168	0.38	53	334	0.53
July 22	2	266	0.61	52	378	0.6
Aug 22	1	67	0.15	37	266	0.42
Aug 22	2	42	0.1	27	48	0.08
Sept 22	1	78	0.18	38	145	0.23
Sept 22	2	90	0.21	69	108	0.17

Month	Survey number	Array only			Array plus 2km buffer	
		Population estimate	Density estimate	Percentage flying	Population estimate	Density estimate
Oct 22	1	127	0.29	86	31	0.05
Nov 22	1	634	1.45	45	831	1.33
Dec 22	1	0	0	0	0	0
Jan 23	1	18	0.04	100	25	0.04
Feb 23	1	85	0.19	80	156	0.25
March 23	1	362	0.83	25	455	0.73
April 23	1	442	1.01	16	481	0.77
May 23	1	7	0.01	0	13	0.02
June 23	1	337	0.77	23	390	0.62
July 23	1	19	0.04	33	37	0.06
Aug 23	1	200	0.46	48	254	0.40

198. Gannet showed similar patterns in abundance between the array area and the array plus 2km buffer over the 24 month survey period. Both years showed a peak in the early spring (April in both years), but after this the patterns of abundance were not the same across the years surveyed. In 2021, gannet was only present in very low numbers after the initial April peak, but in 2022, post April numbers declined more gradually, meaning the species was much more abundant in the breeding season of 2022. 2022 also showed a very high peak in numbers in November (this was the month with the highest estimated abundance for the array area plus 2km buffer. In 2021, estimated abundance in November was very low, as can be seen in Figure 12.56.

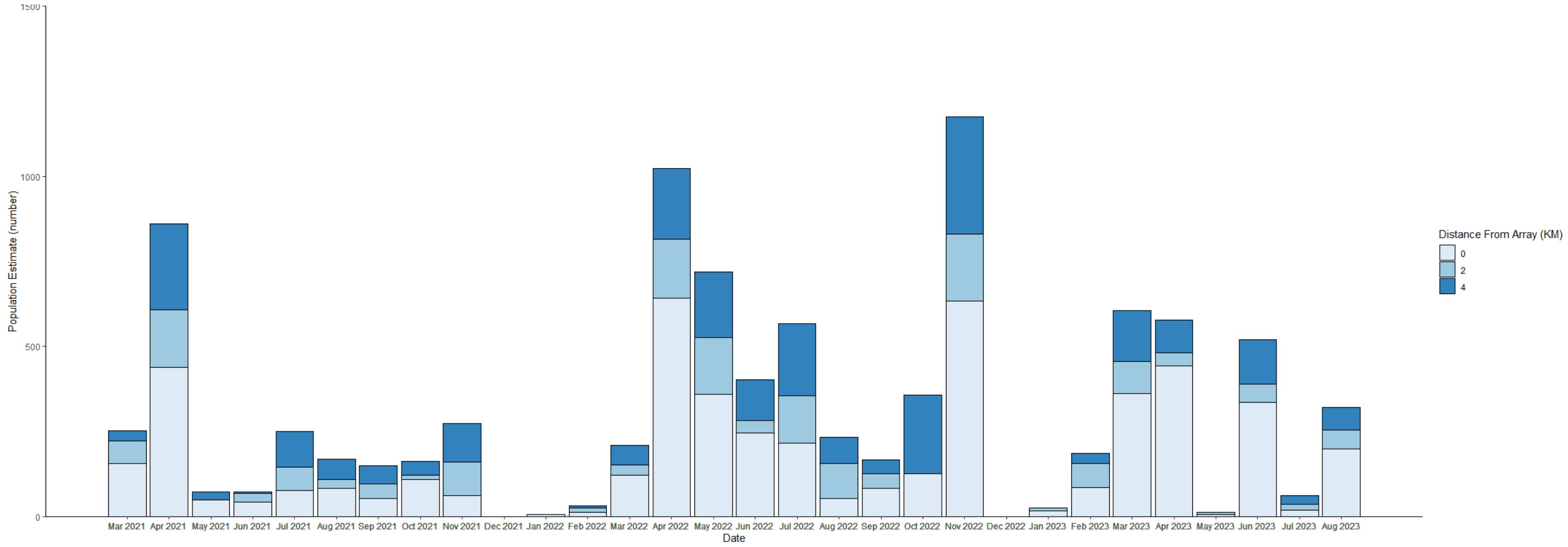

Figure 12.56. Monthly abundance of gannet in the array only, array plus 2km buffer and array plus 4km buffer.

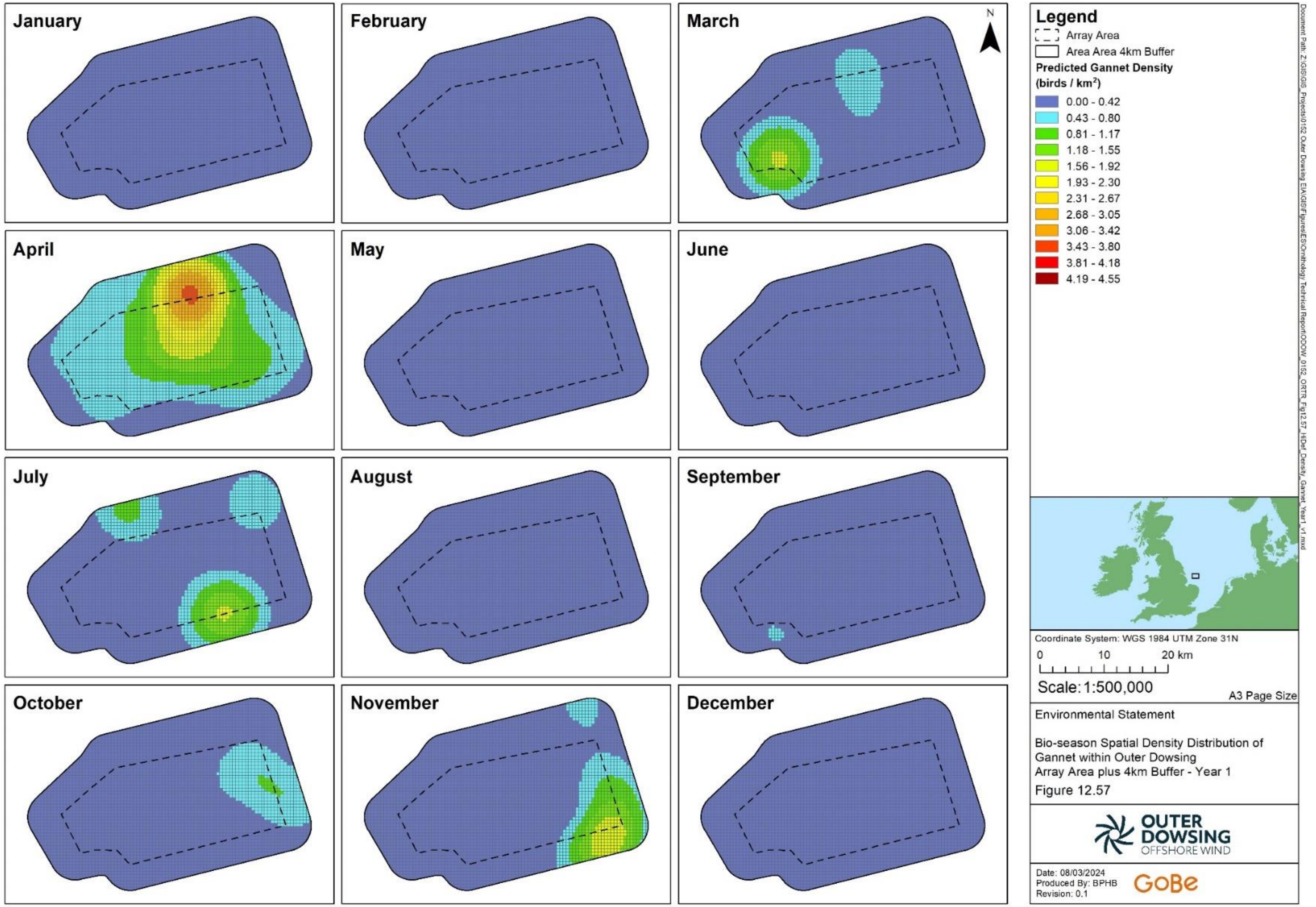

Figure 12.57 Bio-season spatial density distribution of gannet within the Array Area plus 2km buffer – Year 1

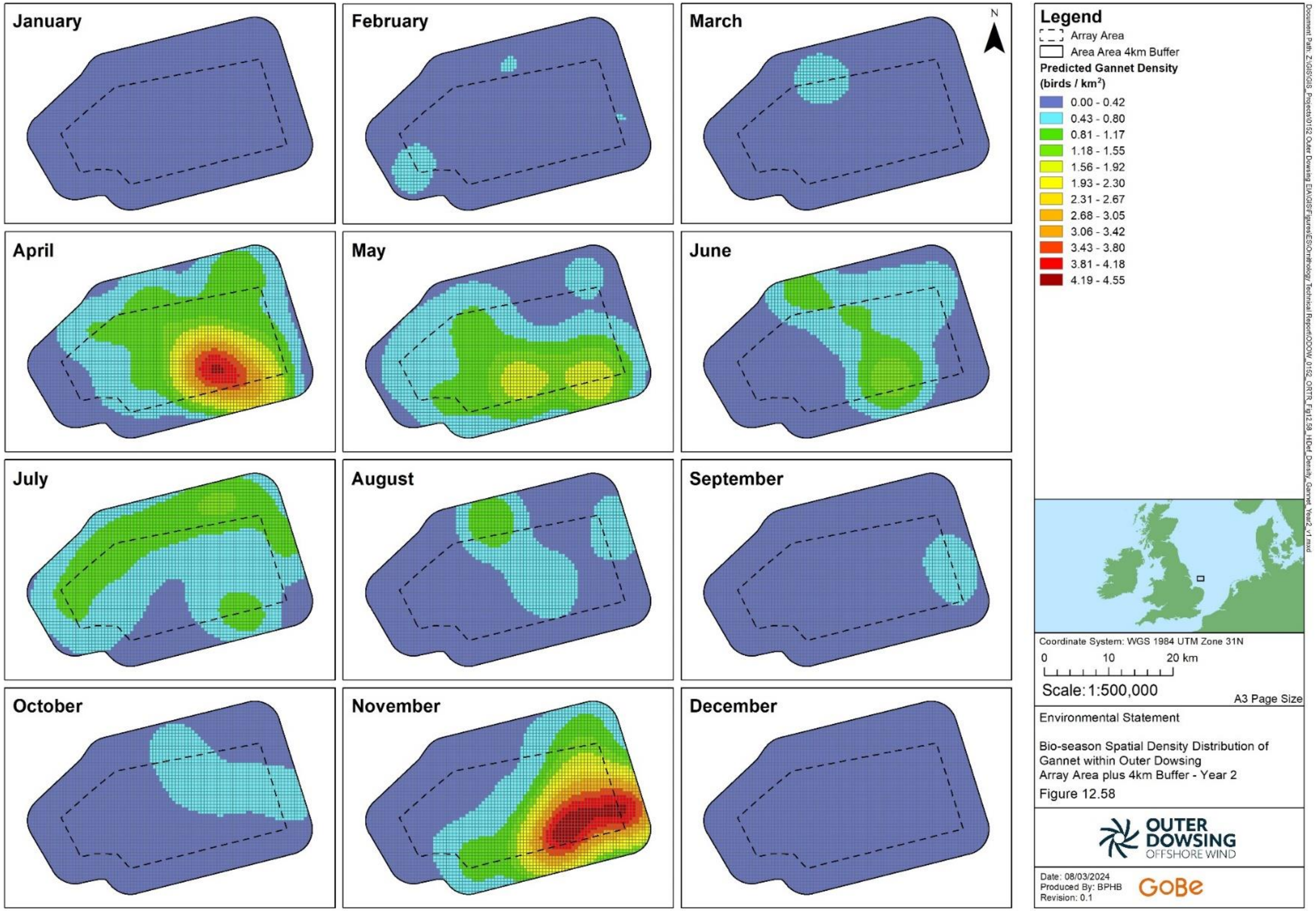

Figure 12.58 Bio-season spatial density distribution of gannet within the Array Area plus 2km buffer – Year 2

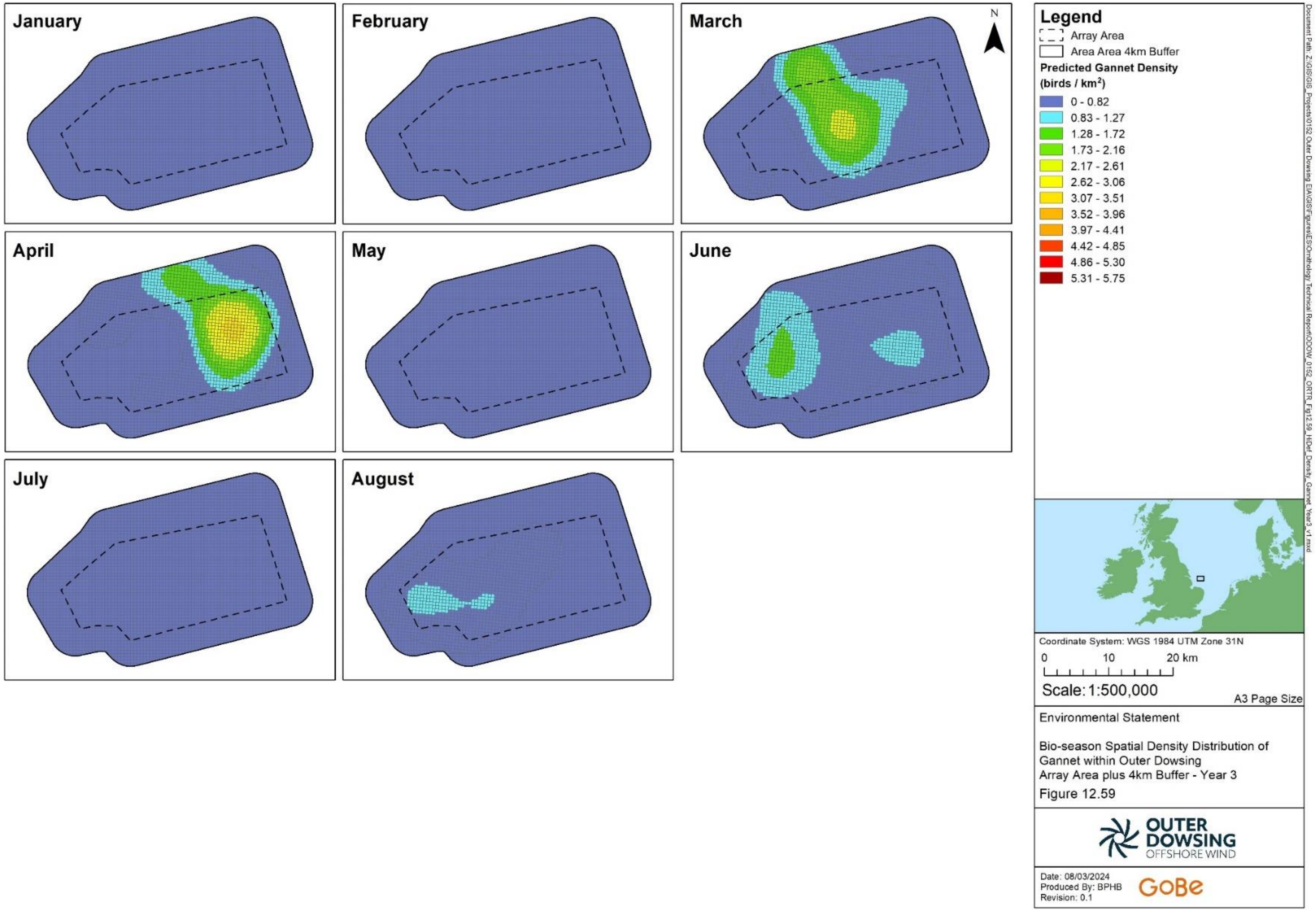

Figure 12.59 Bio-season spatial density distribution of gannet within the Array Area plus 2km buffer – Year 3

12.3.15.8 Flight direction

199. Figure 12.60 shows windrose diagrams presenting flight directions recorded for gannet within the array area plus a 4km buffer.

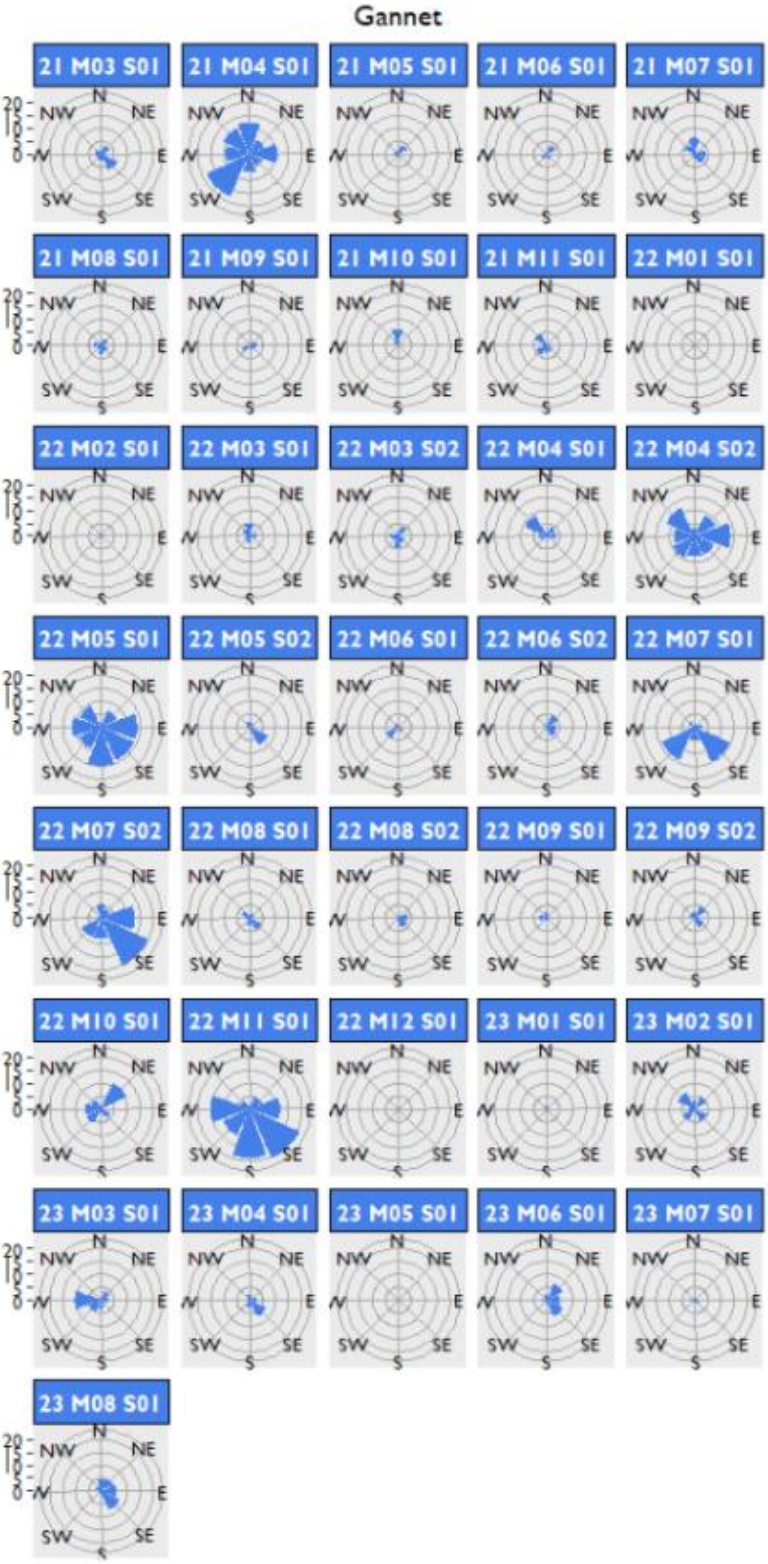

Figure 12.60. Windrose diagrams for months during which flying gannet were recorded within the array area plus a 4km buffer.

200. Proportions of gannet in flight are presented in Table 12.63.

Table 12.63. Proportions of gannet in flight recorded in the in the Project array area.

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2021-03-22	0	11	13	2	42	0	26
2021-04-04	0	40	31	2	55	0	73
2021-05-12	0	6	2	0	75	0	8
2021-06-09	0	5	2	0	71	0	7
2021-07-24	0	7	6	0	54	0	13
2021-08-14	0	8	6	0	57	0	14
2021-09-07	0	2	7	0	22	0	9
2021-10-09	0	8	10	0	44	0	18
2021-11-02	0	5	5	0	50	0	10
2021-12-15	0	0	0	0	0	0	0
2022-01-06	0	1	0	0	100	0	1
2022-02-23	0	1	1	0	50	0	2
2022-03-11	0	12	15	0	44	0	27
2022-03-22	0	5	3	0	62	0	8
2022-04-02	0	17	17	0	50	0	34
2022-04-15	0	43	138	0	24	0	181
2022-05-02	1	45	60	0	42	1	107
2022-05-17	0	5	6	0	45	0	11
2022-06-09	0	6	11	0	35	0	17
2022-06-21	0	8	58	0	12	1	67
2022-07-04	0	16	12	1	53	1	30
2022-07-16	0	21	19	0	52	0	40
2022-08-08	0	11	18	1	37	0	30
2022-08-23	0	3	5	0	27	3	11
2022-09-13	0	5	8	0	38	0	13
2022-09-25	0	9	3	1	69	0	13
2022-10-10	0	18	3	0	86	0	21

Survey date	Diving	Flying	Sitting	Taking Off	Flying%	Other	Total
2022-11-07	0	47	57	0	45	1	105
2022-12-13	0	0	0	0	0	0	0
2023-01-26	0	3	0	0	100	0	3
2023-02-10	0	12	3	0	80	0	15
2023-03-24	0	15	45	0	25	0	60
2023-04-05	0	12	61	0	16	0	73
2023-05-03	0	0	1	0	0	0	1
2023-06-17	0	13	43	0	23	0	56
2023-07-05	0	1	2	0	33	0	3
2023-08-10	0	16	17	0	48	0	33
Total	1	437	688	7	-	7	1140

12.3.15.9 Birds aged from DAS data

201. Proportions of gannet aged from DAS images are presented in Table 12.64.

Table 12.64. Proportions of gannet aged from DAS images within the array area plus a 2km buffer.

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
22/03/2021	20	0	0	17	100	37	20
04/04/2021	57	1	0	46	98	104	58
12/05/2021	6	0	0	2	100	8	6
09/06/2021	4	5	0	2	44	11	9
24/07/2021	8	10	0	14	44	32	18
14/08/2021	15	1	0	3	94	19	16
07/09/2021	7	2	1	7	70	17	10
09/10/2021	6	2	0	12	75	20	8
02/11/2021	10	0	0	18	100	28	10
15/12/2021	0	0	0	0	0	0	0
06/01/2022	1	0	0	0	100	1	1
23/02/2022	4	0	0	0	100	4	4
11/03/2022	23	0	0	12	100	35	23
22/03/2022	9	0	0	6	100	15	9
02/04/2022	22	0	0	32	100	54	22
15/04/2022	81	0	0	135	100	216	81
02/05/2022	65	1	0	83	98	149	66
17/05/2022	13	1	0	7	93	21	14
09/06/2022	11	1	0	13	92	25	12
21/06/2022	29	1	0	42	97	72	30
04/07/2022	35	2	0	17	95	54	37
16/07/2022	32	7	0	25	82	64	39
08/08/2022	13	0	0	31	100	44	13
23/08/2022	2	1	0	5	67	8	3
13/09/2022	6	0	0	18	100	24	6
25/09/2022	9	4	1	4	64	18	14

Survey date	Adult	Immature	Juvenile	Unknown	Adult%	Total	Number of aged birds
10/10/2022	25	0	1	4	96	30	26
07/11/2022	78	0	1	62	99	141	79
13/12/2022	0	0	0	0	0	0	0
26/01/2023	3	1	0	0	75	4	4
10/02/2023	24	0	0	2	100	26	24
24/03/2023	23	0	0	53	100	76	23
05/04/2023	39	1	0	39	98	79	40
03/05/2023	2	0	0	0	100	2	2
17/06/2023	8	9	0	49	47	66	17
05/07/2023	5	1	0	0	83	6	6
10/08/2023	33	7	1	1	80	42	41

12.3.16 Less abundant bird species

202. Less abundance species recorded across surveys are outlined below, with abundance and density estimates presented in Appendix A.

203. Oystercatcher were recorded in the array area in a single survey in August 2021, with a raw count of 3 individuals. This corresponded to an abundance estimate of 50 individuals, and density estimate of 0.1 individuals per km^2. No further individuals were recorded across the wider survey area.

204. Curlew were recorded in the array area in four surveys, single individuals in June and July 2022 and a peak of two individuals in August 2022, corresponding to an abundance of 12 individuals and a density estimate of 0.01 individuals per km^2.

205. Black-headed gull were recorded across seven surveys in the Project array area. The peak occurred in October 2022, with 26 individuals, and a density estimate of 0.06 individuals perkm2. Across the wider survey area, (i.e., within the project area and 4km buffer) higher numbers were recorded in July 2021, with estimated abundance of 140 individuals at a density of 0.17 birds/km^2.

206. Arctic tern was recorded in low numbers across the Project array area, recorded in six survey months, and a peak abundance estimate of 49, at a density of 0.11 individuals perkm2. Across the project area and 4km buffer, peak abundance was higher, with 156 individuals estimated within the 4km buffer in May 2022 at a density of 0.18 birds/km^2.

207. Great skua was recorded from one survey in the Project array area, in August 2021. This month saw an abundance estimate of 7 individuals, at a density of 0.01 individuals per km^2. Across the project area and 4km buffer, great skua was recorded in three months with a maximum abundance estimate of 13 birds, at a density of 0.02 birds/km^2.

208. Arctic skua were recorded across 2 surveys in the Project array area, with a peak abundance estimate of 13 individuals recorded in September 2021. This corresponded to a density estimate of 0.06 individuals per km^2. Across the project area and 4km buffer, birds were not recorded during any additional months, and peak abundance was estimated at 30 birds, at a density of 0.04 birds/km^2.

209. A single little auk was recorded in March 2021 in the Project array area, corresponding to an abundance estimate of two and a density estimate of 0 individuals per km^2. No further individuals were recorded across the wider survey area.

210. A single great northern diver was recorded in April 2021 in the Project array area, corresponding to an abundance estimate of six and a density estimate of 0.01 individuals perkm2. No further individuals were recorded across the wider survey area.

211. Shags were recorded in the Project array area during three of the months surveyed, with one individual recorded in December 2021, February 2022 and March 2022. This corresponded to an abundance estimate of 6 and density estimate of 0.01 individuals per km^2 across all three months. Across the wider survey area, an additional 3 individuals were recorded within the 4km buffer, with 2 additional individuals in December 2021, and one individual in January 2022.

212. Notably, while being highlighted as present in the area by other data sources (e.g. Lawson *et al.*, 2016), no common scoter were recorded within the survey area.

12.3.17 Unidentified birds

213. Unidentified birds were recorded throughout the survey period with the greatest numbers recorded in August and September 2021. The summer peaks of non-identification relate primarily to difficulties separating razorbill and guillemot and reflect the large number of birds present at that time. These are especially hard to distinguish when birds are in moult and accompanied by juveniles.

12.4 References

Austin, G., Frost, T., Mellan, H. and Balmer, D. E. (2017), 'Results of the third Non-estuarine Waterbird Survey, including population estimates for key waterbird species', British Trust for Ornithology.

Balmer, D., Gillings, S., Caffrey, B., Swann, B., Downie, I. and Fuller, R. (2013), 'Bird Atlas 2007-11: The Breeding and Wintering Birds of Britain and Ireland', (Thetford: BTO Books).

British Ornithologists' Union (BOU). (2022), 'The British List: a checklist of birds of Britain (10th edition)', Ibis, 164: 860–910. URL https://onlinelibrary.wiley.com/doi/epdf/10.1111/ibi.13065

Brown, A. and Grice, P. (2005), 'Birds in England', T and AD (eds.), (London: Poyser).

Cramp, S., Simmons, K. E. L. (Eds.), (1983), 'Handbook of the Birds of Europe, the Middle East and North Africa: The Birds of the Western Palearctic', Volume 3: Waders to Gulls, Oxford University Press.

Del Hoyo, J., Elliott, A. and Sargatal, J. (Eds.), (1992 – 2011), 'Handbook of the Birds of the World'. (Madrid: Lynx Editions).

Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD. (2015). Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. British Birds 108, 708–746.

ENNA2. (2023). European Breeding Bird Atlas.

Frost, T. M., Calbrade, N. A., Birtles, G. A., Hall, C., Robinson, A. E., Wotton, S. R., Balmer, D. E. and Austin, G. E. (2021), 'Waterbirds in the UK 2019/20: The Wetland Bird Survey', BTO/RSPB/JNCC, Thetford.

Furness, R. W., (2015), 'Non-breeding season populations of seabirds in UK waters: population sizes for Biologically Defined Minimum Population Scales (BDMPS)', Natural England Commissioned Report 164.

Hornsea Project Four: Environmental Statement (ES). Volume A5, Annex 5.1: Offshore and Intertidal Ornithology Baseline Characterisation Report. Available online at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010098/EN010098-000641-

A5.5.1%20ES%20Volume%20A5%20Annex%205.1%20Offshore%20and%20Intertidal%20Ornithology%20Baseline%20Characterisation%20Report.pdf (Accessed January 2024)

Horswill, C., O'Brien, S. H. and Robinson, R. A. (2017), 'Density dependence and marine bird populations: are wind farm assessments precautionary?', Journal of Applied Ecology, 54, 1406-1414.

Jensen, H., Rindorf, A., Wright, P.J. and Mosegaard, H., 2011. Inferring the location and scale of mixing between habitat areas of lesser sandeel through information from the fishery. ICES Journal of Marine Science: Journal du Conseil, 68 (1), pp. 43-51.

JNCC. (2020), 'Seabird Monitoring Programme Online Database'. http://jncc.defra.gov.uk/smp/ [Accessed March 2023].

JNCC (2024) https://jncc.gov.uk/our-work/list-of-spas/ Accessed February 2024

Kober, K., Webb, A., Win, I., Lewis, M., O'Brien, S., Wilson, L. J. and Reid, J. B. (2010)., 'An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs', JNCC Report, No. 431. JNCC, Peterborough.

Lawson, J., Kober, K., Win, I., Allcock, Z., Black, J. Reid, J. B., Way, L. and O'Brien, S. H. (2016), 'An assessment of the numbers and distribution of wintering red-throated diver, little gull and common scoter in the Greater Wash', JNCC Report No 574. JNCC, Peterborough.

Musgrove, A. J., Aebischer, N. J., Eaton, M. A., Hearn, R. D., Newson, S. E., Noble, D. G., Parsons, M., Risely, K. and Stroud, D. A. (2013), 'Population estimates on birds in Great Britain and the United Kingdom', British Birds, 106, 64–100.

NatureScot. (2020), 'Seasonal Periods for Birds in the Scottish Marine Environment', Version 2. October 2020.

Parker, J., Banks, A., Fawcett, A., Axelsson, M., Rowell, H., Allen, S., Ludgate, C., Humphrey, O., Baker, A. & Copley, V. (2022a). Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase I: Expectations for pre-application baseline data for designated nature conservation and landscape receptors to support offshore wind applications. Natural England. Version 1.1. 79 pp.

Planning Inspectorate National Infrastructure Planning (planninginspectorate.gov.uk) Accessed February 2024

R Core Team. (2021), 'R: A language and environment for statistical computing', R Foundation for Statistical Computing, Vienna, Austria, https://www.R-project.org/.

Robinson, R. A. (2005), 'Bird Facts: profiles of birds occurring in Britain and Ireland', BTO Research Report 407, BTO, Thetford.

Scov, H., Durinck, J., Leopold, M. F. and Tasker, M. L. (1995), 'Important Bird Areas for seabirds in the North Sea'. BirdLife International, Cambridge.

Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects: Environmental Statement, Volume 3 Appendix 11.1 -Offshore Ornithology Technical Report. Available online at:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010109/EN010109-000424-6.3.11.1%20Offshore%20Ornithology%20Technical%20Report.pdf (Accessed January 2024)

Spencer, S. M. (2012), 'Diving behaviour and identification of sex of breeding Atlantic puffins (Fratercula arctica), and nest-site characteristics of Alcids on Petit Manan Island, Maine', MSc Thesis submitted to University of Massachusetts Amherst in May 2012.

Stone, C. J. Webb, A., Barton, C., Ratcliffe, N., Reed, T. C. Tasker, M. L. Camphuysen, C. J. and Pienkowski, M. W. (1995), 'An atlas of seabird distribution in north-west European waters', (Peterborough: JNCC).

Stone, C. J., Webb, A., Barton, C., Ratcliffe, N., Reed, T. C., Tasker, M. L., Camphuysen, C. J. and Pienkowski, M. W. (1995), 'An atlas of seabird distribution in north-west European waters', (Peterborough: JNCC).

Thaxter C. B., Wanless S., Daunt F., Harris M. P., Benvenuti S., Watanuki Y., Grémillet D. and Hamer K.C. (2010), 'Influence of wing loading on the trade-off between pursuit-diving and flight in common guillemots and razorbills', The Journal of Experimental Biology, 213, 1018-1025.

Thaxter, C. B., Lascelles, B., Sugar, K., Cook, A. S. C. P., Roos, S., Bolton, M., Langston, R. H. W. and Burton, N. H. K. (2012), 'Seabird foraging ranges as a preliminary tool for identifying Marine Protected Areas', Biological Conservation, 156, 53-61.

Thaxter, C. B., Ross-Smith, V. H. and Cook, A. S. C. P. (2016), 'How high do birds fly? A review of current datasets and an appraisal of current methodologies for collecting flight height data: Literature review', BTO Research Report No. 666.

Wernham, C. V., Toms, M. P., Marchant, J. H., Clark, J. A., Siriwardena, G. M. and Baillie, S. R., (2002), 'The Migration Atlas: Movements of the birds of Britain and Ireland', T. and A.D. (Eds.), (London: Poyser).

Woodward, I., Thaxter, C. B., Owen, E. and Cook, A. S. C. P. (2019), 'Desk-based revision of seabird foraging ranges used for HRA screening', Report of work carried out by the British Trust for Ornithology on behalf of NIRAS and The Crown Estate, BTO Research Report No. 724. The British Trust for Ornithology, Thetford.

WWT (2013), 'Aerial Surveys of Waterbirds in the UK: 2012 Final Report', WWT Consulting.

WWT. (2008), 'Aerial Surveys of Waterbirds in Strategic Windfarm Areas: 2007 Final Report', WWT Consulting.

WWT. (2009), 'Aerial Surveys of Waterbirds in the UK: 2007/08 Final Report', WWT Consulting.

Annex A – Flight heights from DAS

Table 12.65. Proportions of birds at potential collision height, calculated from DAS imagery.

Species	Proportion at Potential Collision Height	Sample size	Proportion at Potential Collision Height	Sample size
	Year 1		Year 2	
Kittiwake	15.6	840	33.4	1,516
Great black-backed gull	49.7	8	53.3	13
Herring gull	60.7	10	37.7	13
Lesser black-backed gull	84.6	13	55.8	16
Gannet	50.7	77	57.7	222

Annex B – Counts of Offshore and Intertidal Ornithological Receptors

Table 12.66. Overview of survey data for the array area.

Month - Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
Mar-21	1	Guillemot	7.5	6.24	8.72	3275	2725	3808	270	8.22
		Kittiwake	6.42	4.17	8.71	2802	1820	3804	504	17.99
		Razorbill	5.56	4.52	6.55	2427	1973	2862	239	9.83
		Gannet	0.36	0.12	0.67	156	54	291	60	38.48
		Red-throated diver	0.39	0.17	0.67	169	75	293	57	33.42
		Herring gull	0.01	0	0.04	7	0	18	6	91.62
		Puffin	0.3	0.2	0.42	134	90	183	24	18.01
		Fulmar	0.01	0	0.03	6	0	16	6	93.4
		Great black-backed gull	0.01	0	0.04	6	0	18	6	97.08
		Black-headed gull	0.01	0	0.04	7	0	19	6	93.21
		Little auk	0	0	0	2	1	2	1	19.32
Apr-21	1	Guillemot	29.77	21.69	39.81	12999	9472	17380	2085	16.04
		Razorbill	10.94	6.55	16.3	4776	2861	7116	1148	24.03
		Kittiwake	12.55	9.39	16.25	5479	4102	7094	749	13.66
		Gannet	1	0.7	1.36	438	308	595	73	16.65

Month - Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Lesser black-backed gull	0.05	0.01	0.1	24	6	45	10	38.95
		Red-throated diver	0.34	0.15	0.57	148	65	248	48	32.1
		Herring gull	0.02	0	0.05	8	0	21	6	77.99
		Fulmar	0.11	0.04	0.18	48	18	78	15	31.44
		Great black-backed gull	0.04	0.01	0.08	17	5	34	9	48.37
		Puffin	0.06	0.02	0.11	26	8	48	10	38.96
		Common gull	0.03	0	0.06	13	0	25	8	60.07
		Great northern diver	0.01	0	0.04	6	0	18	6	94.78
May-21	1	Guillemot	5.04	4.16	6.01	2202	1819	2626	215	9.75
		Kittiwake	1.72	1.06	2.51	751	462	1098	165	21.97
		Common tern	0.21	0.1	0.37	92	43	162	31	33.25
		Gannet	0.11	0.03	0.2	49	12	89	20	40.3
		Razorbill	0.58	0.3	0.88	253	132	383	66	26.08
		Sandwich tern	0.31	0.2	0.46	137	87	200	29	21.08
		Red-throated diver	0.03	0	0.07	13	0	30	8	63.69
		Lesser black-backed gull	0.01	0	0.04	6	0	18	6	98.84
		Puffin	0.04	0.01	0.1	18	4	43	11	61.46
		Common gull	0.01	0	0.04	6	0	18	6	94.7

Month - Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
Jun-21	1	Guillemot	1.15	0.83	1.47	502	361	643	71	14.1
		Kittiwake	0.8	0.53	1.11	348	231	485	67	19.19
		Gannet	0.1	0.01	0.21	43	6	91	23	52.4
		Razorbill	0.32	0.2	0.46	141	87	202	30	20.98
		Sandwich tern	0.03	0	0.07	13	0	30	8	61.78
		Common tern	0.03	0	0.08	13	0	36	12	94.1
		Fulmar	0.03	0	0.07	13	0	30	8	63.11
		Herring gull	0.08	0	0.2	37	0	87	23	63.16
		Lesser black-backed gull	0.04	0	0.12	18	0	54	17	93.31
		Puffin	0.04	0.01	0.09	19	6	40	10	48.44
		Common gull	0.01	0	0.04	7	0	18	6	90.4
		Black-headed gull	0.01	0	0.04	6	0	18	6	94.23
		Arctic tern	0.01	0	0.04	6	0	18	6	98.79
Jul-21	1	Guillemot	9.01	6.39	11.87	3936	2791	5184	630	15.99
		Kittiwake	2.31	1.52	3.31	1009	664	1446	201	19.87
		Razorbill	2.72	1.11	4.8	1187	485	2096	430	36.21
		Gannet	0.18	0.07	0.32	78	30	141	28	35.65
		Little gull	0.03	0	0.08	13	0	37	12	95.43
		Manx shearwater	0.02	0	0.07	11	0	30	10	95.32
		Puffin	0.29	0.2	0.37	128	89	164	20	15.11

Month - Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Fulmar	0.16	0.05	0.27	68	24	118	25	36.07
		Herring gull	0.03	0	0.07	12	0	30	8	65.7
		Lesser black-backed gull	0.04	0	0.08	18	0	36	9	49.16
		Black-headed gull	0.01	0	0.04	7	0	18	6	91.22
Aug-21	1	Guillemot	18.55	7.52	33.43	8100	3286	14595	2898	35.78
		Kittiwake	1.83	0.97	3.22	798	422	1406	252	31.55
		Razorbill	2.49	0.86	4.58	1088	376	1998	422	38.79
		Puffin	1.89	1.18	2.67	824	515	1165	167	20.23
		Gannet	0.19	0.09	0.28	83	41	124	22	25.78
		Little gull	0.01	0	0.04	6	0	18	6	93.37
		Common tern	0.14	0.01	0.38	63	6	165	43	67.77
		Fulmar	0.01	0	0.05	7	0	23	6	93.9
		Oystercatcher	0.08	0	0.25	37	0	108	35	93.31
		Great skua	0.01	0	0.04	7	0	18	6	92.85
		Arctic tern	0.01	0	0.02	3	1	7	2	65.64
Sept-21	1	Guillemot	21.75	16.91	26.68	9497	7385	11647	1120	11.78
		Kittiwake	2.8	1.33	4.66	1221	581	2035	362	29.61
		Razorbill	1.79	1.2	2.5	783	524	1090	146	18.59
		Puffin	1.48	1.13	1.86	649	492	811	83	12.76
		Gannet	0.12	0.06	0.19	54	29	83	15	27.28

Month - Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Sandwich tern	0.03	0	0.07	13	1	30	8	61.11
		Little gull	0.19	0.1	0.29	84	42	128	22	25.95
		Common tern	3.79	2.49	5.36	1655	1089	2341	326	19.68
		Fulmar	0.03	0	0.07	13	0	30	8	62.49
		Great black-backed gull	0.16	0.08	0.26	72	34	115	22	29.99
		Arctic tern	0.06	0.02	0.12	26	8	52	12	44.19
		Lesser black-backed gull	0.04	0.01	0.08	18	6	36	9	47.96
		Arctic skua	0.04	0.01	0.08	18	6	36	9	48.62
		Common gull	0	0	0	1	1	1	1	53.86
Oct-21	1	Guillemot	7.42	6.03	8.85	3240	2632	3863	320	9.86
		Kittiwake	0.12	0.04	0.21	54	18	91	19	34.09
		Puffin	1.42	1.15	1.73	618	504	756	68	10.86
		Razorbill	1.18	0.65	1.86	518	285	814	138	26.55
		Gannet	0.25	0.12	0.39	109	55	172	32	28.73
		Red-throated diver	0.03	0	0.07	13	0	30	8	64.39
		Great black-backed gull	0.09	0	0.23	38	0	99	30	78.06
		Little gull	0.44	0.28	0.63	191	121	276	40	20.67
		Black-headed gull	0.06	0	0.11	25	0	51	13	51.41

Month - Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Common gull	0.04	0	0.09	19	0	41	11	55.41
		Lesser black-backed gull	0.01	0	0.04	6	0	18	6	95.77
		Arctic skua	0.01	0	0.04	7	0	18	6	93.33
Nov-21	1	Guillemot	6.54	5.08	7.93	2856	2220	3461	316	11.06
		Kittiwake	0.24	0.15	0.34	106	64	151	23	21.04
		Razorbill	2.89	2.19	3.67	1263	959	1604	165	13.04
		Puffin	0.69	0.54	0.83	301	237	363	31	10.28
		Gannet	0.14	0.07	0.22	61	29	97	18	29.36
		Great black-backed gull	0.08	0.01	0.17	38	6	76	18	48.31
		Lesser black-backed gull	0.01	0	0.04	7	0	18	6	95.7
Dec-21	1	Guillemot	3.63	3.15	4.06	1583	1375	1775	100	6.26
		Kittiwake	0.34	0.2	0.51	151	86	223	35	22.87
		Razorbill	2.96	2.17	3.87	1291	948	1692	195	15.1
		Red-throated diver	0.03	0	0.07	12	0	30	8	65.1
		Fulmar	0.04	0.01	0.08	19	6	37	9	49.44
		Great black-backed gull	0.05	0.01	0.1	24	6	46	11	44.12
		Puffin	0.05	0.03	0.08	22	12	36	7	28.96

Month - Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Shag	0.01	0	0.04	7	0	18	6	92.6
Jan-22	1	Guillemot	0.7	0.47	0.95	307	205	417	56	18.11
		Kittiwake	0.14	0.07	0.22	61	29	95	18	28.16
		Razorbill	0.83	0.47	1.21	365	208	531	88	23.93
		Gannet	0.01	0	0.04	7	0	18	6	92.2
		Fulmar	0.04	0	0.11	19	0	48	13	68.48
		Great black-backed gull	0.04	0	0.08	19	0	36	9	47
		Herring gull	0.03	0	0.07	12	0	30	9	70
Feb-22	1	Guillemot	5.86	4.57	7.25	2561	1995	3165	305	11.9
		Razorbill	6.6	5.57	7.58	2883	2431	3312	227	7.85
		Kittiwake	1.13	0.82	1.42	494	358	623	67	13.55
		Gannet	0.03	0	0.07	12	0	29	8	62.27
		Red-throated diver	0.04	0	0.08	18	0	36	9	47.36
		Fulmar	0.02	0	0.07	10	0	30	10	98.23
		Common gull	0.01	0	0.04	6	0	18	6	99.65
		Shag	0.01	0	0.04	6	0	18	6	97.77
		Puffin	0.01	0	0.01	4	2	6	2	37.42
Mar-22	1	Guillemot	9.86	6.57	13.82	4304	2868	6036	827	19.21
		Razorbill	4.11	2.22	6.09	1793	968	2660	434	24.2
		Kittiwake	6.51	3.65	10.2	2843	1595	4455	739	25.98

Month - Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Gannet	0.43	0.18	0.76	188	77	333	65	34.59
		Puffin	0.42	0.23	0.61	182	100	268	45	24.39
		Common gull	0.2	0.08	0.35	90	34	151	32	34.72
		Red-throated diver	0.08	0.03	0.14	36	12	62	13	35.8
		Great black-backed gull	0.03	0	0.07	12	0	30	9	67.88
		Herring gull	0.01	0	0.05	7	0	23	7	98.67
		Little gull	0.01	0	0.04	7	0	18	6	96.41
		Lesser black-backed gull	0.04	0	0.11	19	0	47	13	70.32
		Shag	0.01	0	0.04	6	0	18	6	96.59
Mar-22	2	Guillemot	10.41	8.72	12.11	4546	3807	5287	383	8.41
		Kittiwake	3.55	2.86	4.38	1552	1249	1912	164	10.54
		Razorbill	1.8	1.19	2.43	786	520	1060	140	17.8
		Gannet	0.12	0.05	0.21	54	23	93	19	34.46
		Puffin	0.19	0.1	0.29	82	44	127	21	25.41
		Red-throated diver	0.21	0.11	0.3	90	47	133	22	24.4
		Fulmar	0.07	0.01	0.13	31	6	59	13	42.69
		Little gull	0.03	0	0.1	13	0	45	13	94.45
Apr-22	1	Guillemot	27.35	21.99	33.01	11942	9604	14415	1228	10.28
		Razorbill	2.37	1.62	3.24	1034	710	1416	181	17.5

Month - Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Kittiwake	6.78	4.84	9.07	2960	2114	3959	479	16.18
		Gannet	0.44	0.21	0.69	193	90	302	54	27.8
		Manx shearwater	0.03	0	0.07	13	0	30	8	64.23
		Red-throated diver	0.42	0.2	0.68	185	89	299	54	29.25
		Great black-backed gull	0.03	0	0.1	13	0	45	13	99.21
		Herring gull	0.05	0	0.12	24	0	53	13	55.97
		Fulmar	0.22	0.1	0.36	95	45	156	29	30.48
		Puffin	0.04	0.01	0.07	17	4	33	8	44.83
		Lesser black-backed gull	0.03	0	0.07	12	0	30	8	65.1
		Black-headed gull	0.01	0	0.04	7	0	18	6	91.05
Apr-22	2	Guillemot	14.04	9.51	18.52	6131	4152	8087	1028	16.77
		Kittiwake	9.49	6.86	12.09	4143	2996	5281	598	14.42
		Razorbill	1.49	0.86	2.12	649	375	928	142	21.8
		Gannet	2.5	1.34	3.86	1091	585	1685	282	25.8
		Sandwich tern	0.19	0.07	0.38	85	29	167	36	42.18
		Common tern	0.14	0.04	0.25	61	18	108	23	37.13
		Puffin	0.14	0.05	0.24	61	22	106	23	37.28
		Arctic tern	0.05	0.01	0.1	23	6	46	11	45.66
		Fulmar	0.08	0.01	0.15	36	6	66	16	45.17

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		Herring gull	0.03	0	0.07	12	0	30	9	69.72
		Red-throated diver	0.04	0	0.08	18	0	36	10	51.74
		Lesser black-backed gull	0.01	0	0.04	7	0	18	6	90.71
May-22	1	Guillemot	13.46	10.62	16.04	5878	4636	7006	604	10.27
		Razorbill	2.86	2.03	3.81	1249	887	1666	195	15.59
		Kittiwake	7	5.78	8.38	3058	2525	3661	300	9.79
		Puffin	0.46	0.26	0.69	199	116	302	46	23.03
		Gannet	1.44	0.98	2.04	627	427	892	125	19.85
		Sandwich tern	0.08	0	0.16	36	0	72	19	52.58
		Arctic tern	0.12	0.05	0.2	55	24	88	16	29.11
		Fulmar	0.04	0	0.08	18	0	36	9	50.18
		Red-throated diver	0.01	0	0.04	6	0	18	6	92.13
		Herring gull	0.03	0	0.07	12	0	29	8	62.39
May-22	2	Guillemot	3.72	3.06	4.41	1625	1335	1928	159	9.76
		Kittiwake	2.45	1.92	3.09	1072	841	1348	130	12.07
		Razorbill	0.39	0.2	0.59	169	88	259	46	26.93
		Gannet	0.21	0.08	0.37	91	35	163	32	35.11
		Common tern	0.15	0.04	0.29	68	18	127	30	43.18
		Sandwich tern	0.17	0.07	0.28	73	30	124	24	32.39

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		Great black-backed gull	0.01	0	0.04	7	0	19	6	95.76
		Red-throated diver	0.01	0	0.04	6	0	18	6	96.39
		Herring gull	0.01	0	0.04	6	0	18	6	94.74
		Lesser black-backed gull	0.01	0	0.04	7	0	18	6	90.12
		Puffin	0.02	0	0.05	9	1	21	6	65.67
		Arctic tern	0	0	0	1	0	1	1	93.19
Jun-22	1	Guillemot	1.67	1.28	2.1	730	558	917	93	12.7
		Kittiwake	0.57	0.29	0.98	250	127	430	79	31.49
		Razorbill	0.26	0.09	0.45	114	39	197	42	36.55
		Gannet	0.23	0.11	0.38	102	46	168	32	30.69
		Common tern	0.03	0	0.07	12	0	30	9	66.96
		Sandwich tern	0.21	0.05	0.44	91	23	190	44	48.68
		Puffin	0.05	0.01	0.13	24	3	56	15	61.1
		Great black-backed gull	0.01	0	0.02	4	0	9	3	92.83
		Fulmar	0.02	0	0.05	9	0	21	6	67.8
		Herring gull	0.01	0	0.04	7	0	18	6	90.52
		Lesser black-backed gull	0.01	0	0.04	6	0	18	6	92.13

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Jun-22	2	Guillemot	4.72	3.56	5.91	2063	1554	2582	267	12.94
		Kittiwake	4.76	3.35	6.3	2080	1462	2751	326	15.64
		Razorbill	0.3	0.1	0.53	130	46	234	50	38.4
		Gannet	0.9	0.41	1.55	391	180	677	125	31.89
		Common tern	0.01	0	0.04	7	0	18	6	93.73
		Manx shearwater	0.01	0	0.04	7	0	18	6	89.83
		Fulmar	0.1	0.04	0.17	42	17	77	17	38.46
		Great black-backed gull	0.03	0	0.07	13	0	30	8	62.96
		Sandwich tern	0.07	0.01	0.14	31	6	60	14	45.32
		Herring gull	0.30	0.09	0.66	132	40	288	64	48.11
		Lesser black-backed gull	0.03	0	0.07	12	0	29	8	62.09
		Curlew	0.01	0	0.04	6	0	19	6	97.65
Jul-22	1	Guillemot	1.98	1.37	2.61	863	598	1139	140	16.16
		Kittiwake	0.62	0.4	0.84	269	175	367	50	18.59
		Gannet	0.38	0.16	0.68	168	70	298	57	34.02
		Razorbill	0.12	0.02	0.24	54	10	105	24	44.69
		Fulmar	0.01	0	0.04	6	0	18	7	103.4
		Puffin	0.03	0	0.07	13	0	32	9	63.67
		Herring gull	0.04	0	0.1	18	0	46	12	68.73

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		Lesser black-backed gull	0.03	0	0.08	12	0	36	12	101.36
		Curlew	0.01	0	0.04	7	0	18	6	89.13
Jul-22	2	Guillemot	6.91	5.37	8.81	3019	2345	3847	379	12.53
		Razorbill	2.84	1.69	4.33	1239	739	1891	290	23.38
		Kittiwake	0.84	0.55	1.16	368	240	507	69	18.73
		Puffin	0.21	0.11	0.33	93	47	145	26	27.9
		Gannet	0.61	0.43	0.79	266	187	347	42	15.55
		Common tern	0.03	0	0.07	13	0	30	8	63.63
		Manx shearwater	0.15	0.05	0.27	67	24	118	25	37.11
		Fulmar	0.1	0.01	0.19	42	6	83	20	47.14
		Sandwich tern	0.01	0	0.04	7	0	18	6	94.07
		Common gull	0.03	0	0.06	12	0	29	8	60.82
		Black-headed gull	0.01	0	0.04	7	0	18	6	94.82
		Lesser black-backed gull	0.01	0	0.04	6	0	18	6	95.02
		Curlew	0.01	0	0.04	6	0	18	6	97.56
Aug-22	1	Guillemot	0.01	0	0.04	6	0	18	6	95.88
		Kittiwake	1.85	0.75	3.12	810	329	1361	278	34.34
		Gannet	0.15	0.05	0.29	67	23	128	29	41.83
		Manx shearwater	0.04	0	0.11	19	0	47	13	65

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		Common tern	0.15	0.01	0.4	67	6	176	51	76.18
		Great black-backed gull	0.03	0	0.08	12	0	36	11	95.39
		Arctic tern	0.02	0	0.07	11	0	30	10	83.99
		Lesser black-backed gull	0.13	0	0.29	55	0	129	34	60.4
		Guillemot	0.01	0	0.04	6	0	18	6	95.88
		Kittiwake	1.85	0.75	3.12	810	329	1361	278	34.34
		Gannet	0.15	0.05	0.29	67	23	128	29	41.83
		Manx shearwater	0.04	0	0.11	19	0	47	13	65
Aug-22	2	Guillemot	2.95	1.73	4.59	1290	757	2005	322	24.96
		Kittiwake	0.48	0.24	0.75	210	105	327	59	27.7
		Razorbill	0.4	0.09	0.88	175	41	386	89	50.98
		Gannet	0.1	0.03	0.18	42	12	78	17	39.75
		Puffin	0.03	0	0.07	14	2	30	7	50.5
		Common tern	0.08	0.01	0.17	37	6	73	18	47.45
		Little gull	0.01	0	0.04	7	0	18	6	93.81
		Manx shearwater	0.09	0	0.29	40	0	125	40	97.93
		Fulmar	0.01	0	0.04	7	0	18	6	92.28
		Curlew	0.03	0	0.08	12	0	36	12	95.86

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		Lesser black-backed gull	0.01	0	0.04	7	0	18	6	92.28
Sept-22	1	Guillemot	4.4	2.91	6.47	1920	1271	2827	392	20.38
		Razorbill	1.59	1	2.36	695	439	1032	152	21.86
		Kittiwake	0.3	0.13	0.52	133	58	228	45	33.52
		Puffin	0.25	0.13	0.38	108	58	167	29	26.3
		Gannet	0.18	0.08	0.29	78	35	125	24	30.61
		Sooty shearwater	0.1	0	0.29	44	0	126	42	93.79
		Common tern	0.04	0	0.1	19	0	46	12	65.58
		Manx shearwater	0.42	0	1.31	182	0	571	172	94.25
		Little gull	0.38	0.21	0.55	167	94	241	37	21.8
Sept-22	2	Guillemot	1.54	1.08	2.08	671	473	909	113	16.73
		Kittiwake	0.04	0	0.1	19	0	46	13	67.08
		Razorbill	0.18	0.06	0.33	79	28	145	30	37.94
		Gannet	0.21	0.08	0.38	90	36	168	35	38.71
		Puffin	0.11	0.03	0.21	50	15	94	22	42.4
		Great black-backed gull	0.06	0	0.15	25	0	67	19	74.14
		Little gull	0.08	0	0.2	37	0	88	23	62.44
Oct-22	1	Guillemot	2.41	1.69	3.11	1055	740	1359	161	15.25
		Kittiwake	0.27	0.16	0.38	119	70	168	26	21.33

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		Razorbill	0.51	0.22	0.88	223	95	386	75	33.56
		Puffin	0.27	0.09	0.56	117	39	244	54	45.77
		Gannet	0.29	0.18	0.4	127	81	174	24	18.64
		Black-headed gull	0.06	0	0.15	26	0	65	19	73.05
		Common gull	0.03	0	0.07	13	0	30	8	62.2
		Herring gull	0.01	0	0.04	7	0	18	6	94.75
		Common tern	0.01	0	0.04	7	0	18	6	97.36
		Little gull	0	0	0	1	0	2	1	92.11
Nov-22	1	Guillemot	1.78	0.97	2.71	776	426	1184	196	25.17
		Razorbill	0.73	0.39	1.13	317	172	493	86	27.12
		Kittiwake	0.69	0.44	1.02	303	192	445	66	21.56
		Puffin	0.12	0.05	0.23	55	21	101	21	37.21
		Gannet	1.45	0.81	2.22	634	353	971	165	25.97
		Great black-backed gull	0.07	0	0.15	31	0	64	16	52.32
		Herring gull	0.03	0	0.07	12	0	29	8	62.84
		Pomarine skua	0.01	0	0.04	6	0	18	6	97.57
		Little gull	0.04	0	0.11	19	0	48	13	67.93
Dec-22	1	Razorbill	2.19	1.53	3.08	959	666	1345	172	17.92
		Guillemot	4.42	3.66	5.22	1931	1599	2282	175	9.05
		Kittiwake	0.65	0.49	0.83	286	215	364	39	13.5

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		Puffin	0.27	0.11	0.45	118	47	198	39	32.77
		Common gull	0.04	0.01	0.09	18	6	39	10	51.93
		Red-throated diver	0.03	0	0.07	12	0	29	8	65.34
		Fulmar	0.04	0	0.1	19	0	46	13	64.86
		Great black-backed gull	0.09	0.01	0.21	42	6	92	24	56.81
		Herring gull	0.10	0.04	0.17	43	18	77	15	35.52
		Shag	0.01	0	0.04	7	0	18	6	90.27
Jan-23	1	Guillemot	2.58	0.72	5.11	1126	316	2231	519	46.1
		Razorbill	1.58	0.63	2.66	689	275	1161	226	32.77
		Kittiwake	1.32	0.69	2.18	579	301	951	171	29.48
		Gannet	0.04	0	0.08	18	0	36	10	54.01
		Common gull	0.07	0.01	0.16	30	6	70	18	58.99
		Cormorant	0.03	0	0.08	13	0	36	12	94.34
		Red-throated diver	0.09	0.04	0.16	42	17	71	15	35.21
		Great black-backed gull	0.22	0.05	0.45	94	24	197	47	49.27
		Fulmar	0.21	0.01	0.55	93	6	239	65	70.14
		Herring gull	0.08	0.01	0.15	33	5	67	17	49.03
		Little gull	0.01	0	0.04	6	0	18	6	96.01
Feb-23	1	Razorbill	12.01	7.98	16.54	5244	3483	7224	966	18.41

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		Guillemot	3.71	2.4	5.37	1620	1047	2346	336	20.71
		Kittiwake	2.97	2.05	3.91	1296	897	1708	210	16.13
		Puffin	0.12	0.04	0.22	51	16	97	21	41.52
		Gannet	0.19	0.12	0.29	85	53	126	19	22.04
		Common gull	0.04	0.01	0.08	19	6	36	9	47.63
		Red-throated diver	0.07	0	0.14	30	0	63	16	52.4
		Fulmar	0.03	0	0.07	13	0	30	8	65.59
March-23	1	Razorbill	7.55	4.16	11.36	3298	1815	4960	792	24
		Guillemot	9.22	6.68	12.23	4027	2919	5341	617	15.3
		Kittiwake	5.73	3.81	7.81	2502	1662	3412	454	18.11
		Puffin	0.14	0.05	0.24	62	24	106	22	35.46
		Gannet	0.83	0.4	1.39	362	174	608	112	30.91
		Common gull	0.03	0	0.07	12	0	30	8	65.73
		Red-throated diver	0.15	0.03	0.32	65	12	142	35	53.1
		Herring gull	0.07	0.01	0.13	30	6	57	13	43.89
		Great black-backed gull	0.08	0	0.21	36	0	94	28	76.82
April-23	1	Razorbill	3.16	2.35	4.05	1381	1026	1768	189	13.65
		Guillemot	12.45	9.41	16.85	5435	4107	7357	827	15.21
		Kittiwake	7.83	5.57	10.45	3420	2432	4562	549	16.05
		Puffin	0.19	0.11	0.28	82	49	122	19	23.12

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		Common gull	0.17	0.07	0.29	73	29	126	25	33.26
		Gannet	1.01	0.45	1.69	442	198	737	136	30.57
		Fulmar	0.03	0	0.07	13	0	30	8	63.14
		Herring gull	0.04	0	0.11	19	0	47	13	68.83
		Common tern	0.01	0	0.04	6	0	18	6	101.19
		Great black-backed gull	0.1	0	0.28	43	0	123	35	82.29
		Lesser black-backed gull	0.03	0	0.07	13	0	29	8	60.24
		Red-throated diver	0.19	0.1	0.29	85	42	128	22	25.51
		Arctic tern	0.01	0	0.04	6	0	18	6	95.47
		Cormorant	0.01	0	0.04	6	0	18	6	102.21
May-23	1	Guillemot	1.76	1.5	2	769	655	875	56	7.29
		Kittiwake	0.85	0.46	1.31	372	202	572	95	25.56
		Puffin	0.2	0.1	0.31	88	43	136	24	26.47
		Razorbill	0.2	0.1	0.31	88	45	137	25	27.43
		Gannet	0.01	0	0.04	7	0	18	6	95.05
		Whooper swan	0.04	0	0.15	18	0	66	18	100.25
		Sandwich tern	0.34	0.2	0.5	150	89	217	33	21.76
		Fulmar	0.04	0	0.09	19	0	42	12	63.79
		Common tern	0.18	0.08	0.29	79	36	128	25	30.93

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		Red-throated diver	0.03	0	0.07	12	0	30	8	66.55
		Common gull	0.01	0	0.04	6	0	18	6	93.12
		Little gull	0	0	0	1	0	1	1	91.37
June-23	1	Guillemot	2.07	1.37	2.91	905	597	1272	175	19.27
		Razorbill	0.82	0.46	1.23	359	202	536	83	23
		Kittiwake	3.28	2.39	4.21	1434	1045	1838	203	14.16
		Puffin	0.05	0.01	0.1	24	6	44	10	39.62
		Gannet	0.77	0.53	1.12	337	230	490	67	19.79
		Manx shearwater	0.05	0	0.13	24	0	59	16	64.94
		Herring gull	0.35	0.17	0.56	152	77	243	44	28.44
		Fulmar	0.1	0.03	0.19	46	12	84	19	40.5
		Lesser black-backed gull	0.46	0.3	0.62	200	130	272	37	18.34
		Curlew	0.01	0	0.04	6	0	18	7	103.42
		Common gull	0.01	0	0.05	6	0	23	6	102.82
		Great black-backed gull	0.01	0	0.04	6	0	18	6	93.39
July-23	1	Razorbill	1.17	0.61	1.82	509	269	795	134	26.28
		Guillemot	2.37	1.64	3.11	1037	716	1358	171	16.41
		Puffin	0.31	0.15	0.49	135	68	213	37	26.87
		Kittiwake	0.37	0.16	0.61	160	72	269	50	31.04

Month - Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Gannet	0.04	0	0.09	19	0	41	10	54.46
		Sandwich tern	0.01	0	0.04	7	0	18	6	92.45
		Herring gull	0.03	0	0.07	13	0	30	9	68.31
Aug-23	1	Razorbill	3.19	1.62	5.7	1393	707	2490	481	34.48
		Puffin	0.94	0.62	1.38	409	271	603	88	21.42
		Kittiwake	1.59	1.01	2.17	695	442	948	132	18.92
		Black-headed gull	0.04	0	0.1	19	0	46	13	66.91
		Gannet	0.46	0.25	0.72	200	109	314	52	25.94
		Sandwich tern	0.03	0	0.08	12	0	36	12	96.76
		Common gull	0.01	0	0.04	7	0	18	6	95.28
		Great skua	0.01	0	0.04	7	0	18	6	91.64
		Manx shearwater	0.01	0	0.04	7	0	18	6	92.72
		Fulmar	0.14	0.05	0.25	61	22	111	24	39.06
		Lesser black-backed gull	0.01	0	0.04	7	0	18	6	94.39
		Guillemot	9.23	8.08	10.47	4029	3530	4570	269	6.68
		Common tern	0.1	0.04	0.16	43	18	71	15	33.17
		Great black-backed gull	0.03	0	0.07	13	0	30	8	63.4
		Arctic tern	0	0	0	1	0	1	1	97.85

Table 12.67. Overview of survey data for the array area plus 2km buffer.

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
Mar-21	1	Kittiwake	6.45	4.79	8.21	4044	3000	5146	556	13.74
		Great black-backed gull	0.03	0	0.06	18	0	36	9	50.41
		Herring gull	0.02	0	0.05	12	0	29	8	62.46
		Guillemot	7.79	6.51	9.39	4883	4076	5880	478	9.77
		Razorbill	5.5	4.73	6.32	3443	2964	3958	262	7.59
		Fulmar	0.05	0	0.11	29	0	67	18	63.27
		Gannet	0.35	0.14	0.61	222	89	385	79	35.45
		Puffin	0.34	0.23	0.45	211	145	284	36	16.84
		Black-headed gull	0.01	0	0.03	6	0	18	6	94.56
		Common gull	0.03	0	0.07	18	0	46	13	68.03
		Lesser black-backed gull	0.01	0	0.03	7	0	18	6	96.1
		Little auk	0	0	0	2	2	3	1	14.05
		Red-throated diver	0.36	0.2	0.55	225	124	348	58	25.6
Apr-21	1	Kittiwake	10.91	8.57	13.56	6833	5369	8495	803	11.75
		Great black-backed gull	0.05	0.02	0.08	29	11	51	11	37.47
		Herring gull	0.02	0	0.05	14	0	31	8	59.56

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Guillemot	26.48	20.46	34.03	16592	12820	21318	2164	13.04
		Razorbill	9.39	6.03	13.24	5886	3778	8293	1152	19.56
		Fulmar	0.08	0.04	0.12	49	23	78	15	30.2
		Gannet	0.97	0.66	1.3	608	415	817	102	16.78
		Puffin	0.04	0.01	0.08	27	9	48	10	38.15
		Lesser black-backed gull	0.04	0.01	0.07	24	6	46	11	42.84
		Common gull	0.02	0	0.05	12	0	30	8	64.75
		Sandwich tern	0.01	0	0.03	6	0	18	6	93.77
		Red-throated diver	0.29	0.15	0.45	181	96	280	47	25.66
		Great northern diver	0.01	0	0.03	7	0	18	6	90.58
May-21	1	Kittiwake	2.39	1.1	4.42	1500	688	2769	563	37.54
		Great black-backed gull	0.01	0	0.04	7	0	23	7	101.77
		Guillemot	5.73	4.43	7.5	3591	2777	4699	499	13.89
		Razorbill	0.63	0.36	0.94	398	223	588	95	23.69
		Gannet	0.08	0.02	0.14	49	12	89	20	41.08
		Puffin	0.03	0.01	0.07	20	6	44	11	55.98
		Lesser black-backed gull	0.01	0	0.03	6	0	19	6	99.13

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Common tern	0.21	0.12	0.32	130	77	200	32	24.11
		Sandwich tern	0.32	0.2	0.47	203	123	293	42	20.56
		Common gull	0.01	0	0.03	7	0	18	6	90.9
		Red-throated diver	0.02	0	0.05	12	0	30	8	66.51
Jun-21	1	Little gull	0.01	0	0.03	7	0	18	6	94.14
		Fulmar	0.04	0.01	0.07	25	6	47	11	45.09
		Kittiwake	1.02	0.52	1.83	640	326	1145	217	33.88
		Guillemot	1.31	0.97	1.67	823	610	1046	116	14.06
		Razorbill	0.24	0.15	0.34	153	97	216	31	20.25
		Gannet	0.11	0.04	0.2	68	24	125	26	37.79
		Herring gull	0.06	0.01	0.14	36	6	88	24	65.09
		Puffin	0.03	0.01	0.07	22	9	44	10	42.11
		Lesser black-backed gull	0.03	0	0.09	19	0	54	18	96.08
		Common tern	0.03	0	0.07	18	0	43	12	63.29
		Sandwich tern	0.03	0	0.07	18	0	47	13	73.85
		Black-headed gull	0.01	0	0.03	6	0	18	6	92.94
		Common gull	0.02	0	0.05	13	0	30	8	63.49
		Arctic tern	0.02	0	0.04	13	0	27	7	57.49
Jul-21	1	Fulmar	0.11	0.04	0.18	66	24	116	24	36.11
		Kittiwake	3.39	1.79	5.95	2124	1119	3726	662	31.15

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Guillemot	9.17	6.45	12.26	5744	4042	7681	934	16.25
		Razorbill	2.93	1.57	4.71	1835	984	2951	514	27.99
		Gannet	0.23	0.08	0.47	146	53	293	63	42.99
		Little gull	0.02	0	0.07	13	0	47	13	98.35
		Herring gull	0.02	0	0.05	12	0	30	8	65.2
		Puffin	0.32	0.23	0.42	203	144	262	31	15.26
		Lesser black-backed gull	0.03	0	0.06	19	0	36	9	48.98
		Manx shearwater	0.03	0	0.08	20	0	49	13	65.54
		Black-headed gull	0.01	0	0.03	6	0	18	6	100.47
		Common gull	0.01	0	0.03	6	0	19	6	100.36
		Arctic tern	0.01	0	0.03	7	0	19	6	98.1
Aug-21	1	Fulmar	0.03	0	0.08	19	0	53	14	74.73
		Kittiwake	4.79	1.38	10.46	2999	865	6553	1627	54.24
		Guillemot	18.53	9.56	29.85	11611	5992	18698	3243	27.93
		Razorbill	3.03	1.07	5.71	1901	673	3579	748	39.35
		Gannet	0.17	0.1	0.25	109	64	155	24	21.47
		Little gull	0.01	0	0.03	7	0	18	6	93.45
		Puffin	1.96	1.31	2.67	1229	823	1675	220	17.85
		Common tern	0.21	0.04	0.48	135	23	302	75	55.41
		Oystercatcher	0.08	0	0.22	51	0	136	37	72.12

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Arctic tern	0.01	0	0.02	6	1	13	4	61.16
		Great skua	0.02	0	0.05	12	0	30	8	68.11
Sep-21	1	Great black-backed gull	0.17	0.09	0.26	110	54	163	29	25.97
		Kittiwake	2.62	1.6	3.83	1644	1000	2399	369	22.42
		Herring gull	0	0	0	1	0	2	1	99.12
		Guillemot	21.28	17.04	26.47	13330	10674	16584	1566	11.74
		Razorbill	1.73	1.26	2.25	1085	790	1413	163	14.94
		Gannet	0.15	0.09	0.21	96	59	135	20	20.44
		Fulmar	0.03	0	0.06	19	0	36	9	47.84
		Puffin	1.38	1.1	1.71	867	692	1074	99	11.36
		Lesser black-backed gull	0.05	0.02	0.08	31	12	53	11	35
		Sandwich tern	0.02	0	0.05	13	1	30	8	56.93
		Little gull	0.14	0.08	0.21	91	49	134	23	24.37
		Common tern	4.11	3.08	5.28	2577	1931	3308	346	13.4
		Common gull	0	0	0	1	1	1	1	55.34
		Arctic tern	0.07	0.02	0.14	47	15	87	20	41.33
		Arctic skua	0.05	0.01	0.09	31	6	60	14	45.1
Oct-21	1	Great black-backed gull	0.13	0.01	0.34	84	6	216	63	75.26

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Kittiwake	0.14	0.06	0.23	86	36	145	28	32.47
		Guillemot	7.42	6.04	8.88	4647	3784	5561	448	9.63
		Razorbill	1.13	0.71	1.62	705	447	1015	152	21.49
		Gannet	0.19	0.1	0.3	121	61	188	33	26.77
		Herring gull	0.01	0	0.03	6	0	18	6	98.17
		Puffin	1.43	1.1	1.82	896	691	1143	116	12.94
		Lesser black-backed gull	0.01	0	0.03	6	0	18	6	96.92
		Little gull	0.59	0.37	0.85	368	234	533	77	20.85
		Black-headed gull	0.06	0.01	0.11	37	6	71	17	44.05
		Common gull	0.04	0.01	0.07	24	6	47	11	44.41
		Arctic skua	0.01	0	0.03	6	0	19	6	103.03
		Red-throated diver	0.04	0.01	0.07	25	6	47	11	43.52
Nov-21	1	Great black-backed gull	0.06	0.01	0.12	36	6	75	18	49.03
		Kittiwake	0.23	0.15	0.31	144	96	195	26	18.07
		Guillemot	6.63	5.38	7.97	4152	3370	4992	419	10.08
		Razorbill	3.03	2.32	3.71	1897	1455	2325	222	11.68
		Gannet	0.26	0.12	0.46	161	74	288	55	33.86
		Puffin	0.63	0.52	0.74	392	326	467	36	8.96

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Lesser black-backed gull	0.01	0	0.03	7	0	19	6	93.15
		Red-throated diver	0.01	0	0.03	6	0	18	6	96.09
Dec-21	1	Shag	0.02	0	0.05	12	0	30	8	62.58
		Great black-backed gull	0.09	0.05	0.16	60	29	98	19	31.2
		Fulmar	0.04	0	0.08	24	0	53	13	55.88
		Kittiwake	0.36	0.23	0.49	227	146	310	44	19.33
		Guillemot	3.53	3.1	4.01	2212	1945	2513	148	6.66
		Razorbill	2.76	2.08	3.52	1727	1304	2205	240	13.9
		Puffin	0.08	0.03	0.16	48	17	98	23	47.44
		Red-throated diver	0.02	0	0.05	13	0	30	8	63.98
Jan-22	1	Great black-backed gull	0.04	0.01	0.07	25	6	46	11	41.8
		Herring gull	0.02	0	0.05	12	0	30	9	70.22
		Fulmar	0.03	0	0.07	19	0	47	13	70.11
		Gannet	0.01	0	0.03	7	0	18	6	96.15
		Kittiwake	0.15	0.08	0.24	96	48	152	28	29.02
		Guillemot	0.7	0.48	0.91	436	299	572	69	15.72
		Razorbill	0.65	0.4	0.95	408	251	595	90	22.01
Feb-22	1	Common gull	0.01	0	0.03	7	0	19	6	95.16

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Red-throated diver	0.03	0	0.06	18	0	36	9	50.07
		Shag	0.01	0	0.03	6	0	19	7	101.69
		Great black-backed gull	0.01	0	0.03	7	0	18	6	95.24
		Fulmar	0.02	0	0.05	10	0	30	10	93.96
		Gannet	0.04	0.01	0.07	25	6	47	11	43.54
		Kittiwake	1.12	0.84	1.41	704	529	884	93	13.1
		Guillemot	5.17	4.07	6.39	3240	2549	4002	366	11.28
		Razorbill	6.3	5.38	7.35	3949	3370	4602	309	7.81
		Puffin	0.02	0	0.04	11	3	25	7	62.15
Mar-22	1	Common gull	0.15	0.06	0.25	95	36	159	32	33.71
		Red-throated diver	0.06	0.02	0.1	36	12	66	14	38.66
		Herring gull	0.01	0	0.03	6	0	18	6	98.29
		Great black-backed gull	0.02	0	0.05	12	0	30	9	68.03
		Gannet	0.34	0.15	0.54	213	93	340	67	31.18
		Kittiwake	5.30	3.34	7.59	3318	2093	4753	724	21.8
		Guillemot	8.53	6.11	11.23	5346	3831	7034	858	16.04
		Razorbill	3.91	2.51	5.33	2453	1570	3342	459	18.72
		Lesser black-backed gull	0.05	0	0.11	31	0	72	20	63.25

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Puffin	0.44	0.28	0.63	275	174	392	56	20.4
		Little gull	0.01	0	0.03	7	0	19	7	100.05
		Shag	0.01	0	0.03	7	0	19	6	89.33
Mar-22	2	Black-headed gull	0.01	0	0.04	7	0	23	6	92.44
		Red-throated diver	0.37	0.19	0.56	230	122	351	61	26.24
		Herring gull	0.05	0.01	0.1	31	6	63	15	46.67
		Great black-backed gull	0.02	0	0.06	12	0	36	12	98.06
		Fulmar	0.2	0.1	0.3	126	66	186	31	24.19
		Gannet	0.51	0.28	0.78	318	174	487	80	25.07
		Kittiwake	6.71	5.09	8.49	4202	3192	5316	556	13.21
		Guillemot	31.04	25.69	36.67	19448	16096	22975	1818	9.34
		Razorbill	2.49	1.98	3.06	1561	1241	1920	184	11.76
		Lesser black-backed gull	0.02	0	0.05	13	0	30	8	62.21
		Puffin	0.04	0.01	0.07	25	9	45	10	38.56
		Manx shearwater	0.03	0	0.07	18	0	47	13	72.5
Apr-22	1	Black-headed gull	0.01	0	0.04	7	0	23	6	92.44
		Red-throated diver	0.37	0.19	0.56	230	122	351	61	26.24
		Herring gull	0.05	0.01	0.1	31	6	63	15	46.67

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Great black-backed gull	0.02	0	0.06	12	0	36	12	98.06
		Fulmar	0.2	0.1	0.3	126	66	186	31	24.19
		Gannet	0.51	0.28	0.78	318	174	487	80	25.07
		Kittiwake	6.71	5.09	8.49	4202	3192	5316	556	13.21
		Guillemot	31.04	25.69	36.67	19448	16096	22975	1818	9.34
		Razorbill	2.49	1.98	3.06	1561	1241	1920	184	11.76
		Lesser black-backed gull	0.02	0	0.05	13	0	30	8	62.21
		Puffin	0.04	0.01	0.07	25	9	45	10	38.56
		Manx shearwater	0.03	0	0.07	18	0	47	13	72.5
Apr-22	2	Arctic tern	0.08	0.03	0.14	48	19	86	18	36.21
		Red-throated diver	0.06	0.03	0.09	36	17	59	12	32.01
		Herring gull	0.02	0	0.05	13	0	30	8	63.34
		Great black-backed gull	0.01	0	0.03	7	0	18	7	100.51
		Sandwich tern	0.27	0.12	0.43	169	76	273	51	30.15
		Fulmar	0.07	0.02	0.12	43	12	78	18	40.3
		Gannet	2.1	1.24	3.1	1313	777	1944	299	22.75
		Kittiwake	9.35	6.96	11.95	5860	4363	7484	785	13.39
		Common tern	0.17	0.08	0.28	109	51	174	31	28.2

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Guillemot	14.35	10.14	18.57	8988	6352	11634	1368	15.22
		Razorbill	1.49	1.01	2	937	635	1256	165	17.58
		Lesser black-backed gull	0.02	0	0.05	13	0	30	9	68.9
		Puffin	0.16	0.07	0.25	98	46	160	30	30.08
May-22	1	Common gull	0.01	0	0.03	6	0	18	6	99.75
		Arctic tern	0.16	0.08	0.26	102	54	166	29	28.54
		Great skua	0.01	0	0.03	7	0	19	6	96.09
		Red-throated diver	0.02	0	0.05	13	0	30	8	61.11
		Herring gull	0.02	0	0.05	12	0	30	8	63.82
		Sandwich tern	0.25	0.08	0.46	157	52	289	62	39.19
		Gannet	1.45	1.03	1.92	907	648	1204	141	15.5
		Kittiwake	7.02	5.87	8.4	4397	3676	5264	403	9.15
		Guillemot	15.51	12.62	18.73	9716	7909	11735	1003	10.32
		Razorbill	3.16	2.35	3.98	1979	1471	2492	264	13.34
		Fulmar	0.1	0.04	0.17	60	24	105	21	34.51
		Lesser black-backed gull	0.04	0	0.09	25	0	54	14	56.93
		Puffin	0.4	0.25	0.57	252	156	360	53	20.94
May-22	2	Great black-backed gull	0.01	0	0.03	6	0	18	6	101.39

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Herring gull	0.01	0	0.03	7	0	18	6	91.25
		Arctic tern	0.01	0	0.03	8	1	20	6	81.06
		Red-throated diver	0.01	0	0.03	7	0	18	6	92.19
		Sandwich tern	0.14	0.07	0.22	91	43	141	25	27.22
		Common tern	0.21	0.09	0.35	131	57	218	42	32.12
		Gannet	0.23	0.13	0.35	145	81	219	37	25.06
		Kittiwake	3.78	2.31	6.18	2372	1445	3875	682	28.76
		Guillemot	5.12	3.89	6.59	3209	2439	4127	463	14.42
		Razorbill	0.45	0.3	0.62	285	186	389	53	18.56
		Lesser black-backed gull	0.01	0	0.03	7	0	19	6	96.17
		Puffin	0.02	0	0.04	10	2	23	6	56.76
Jun-22	1	Herring gull	0.04	0	0.11	26	0	70	19	73.27
		Great black-backed gull	0.03	0	0.07	18	0	44	12	67.1
		Sandwich tern	0.22	0.09	0.4	140	59	249	50	35.17
		Common tern	0.04	0	0.1	24	0	60	18	74.28
		Fulmar	0.02	0	0.04	12	0	26	7	53.17
		Gannet	0.22	0.13	0.33	139	79	208	32	23.1
		Kittiwake	1.44	0.57	2.81	903	359	1761	396	43.86
		Guillemot	2.8	1.52	5.42	1757	955	3396	649	36.89

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Razorbill	0.39	0.14	0.73	248	87	461	99	39.92
		Lesser black-backed gull	0.03	0	0.07	18	0	47	13	70.12
		Puffin	0.06	0.02	0.11	36	11	67	16	42.69
Jun-22	2	Herring gull	0.41	0.15	0.73	259	97	458	92	35.28
		Great black-backed gull	0.03	0	0.06	19	0	41	10	50.67
		Fulmar	0.07	0.02	0.12	43	12	76	17	38.16
		Gannet	0.68	0.35	1.13	427	218	708	123	28.62
		Curlew	0.01	0	0.03	7	0	18	6	91.86
		Kittiwake	5.03	3.29	7.29	3153	2063	4567	667	21.15
		Sandwich tern	0.09	0.03	0.17	59	18	107	24	39.07
		Common tern	0.01	0	0.03	6	0	18	6	95.05
		Guillemot	5.09	4.05	6.19	3189	2538	3877	339	10.61
		Razorbill	0.33	0.12	0.6	204	76	374	77	37.33
		Manx shearwater	0.01	0	0.03	6	0	18	6	94.97
		Lesser black-backed gull	0.03	0	0.06	18	0	37	10	52.51
Jul-22	1	Herring gull	0.06	0	0.15	36	0	95	26	70.41
		Fulmar	0.01	0	0.03	7	0	18	7	98.34
		Gannet	0.53	0.29	0.81	334	182	507	84	25.04

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		Curlew	0.01	0	0.03	7	0	18	6	87.67
		Kittiwake	0.70	0.51	0.87	436	321	545	59	13.43
		Guillemot	2.56	1.85	3.34	1603	1161	2094	241	14.98
		Razorbill	0.37	0.05	0.95	233	30	596	169	72.63
		Lesser black-backed gull	0.02	0	0.07	13	0	46	12	95.63
		Puffin	0.08	0.01	0.17	50	5	108	27	53.45
Jul-22	2	Great black-backed gull	0.03	0	0.09	18	0	54	18	95.74
		Herring gull	0.01	0	0.03	7	0	18	6	94.92
		Fulmar	0.08	0.02	0.14	49	12	88	20	41.19
		Gannet	0.6	0.45	0.78	378	284	487	51	13.46
		Kittiwake	1.42	0.76	2.36	891	479	1478	262	29.4
		Sandwich tern	0.01	0	0.03	6	0	18	6	96.14
		Guillemot	7.99	5.5	11.47	5003	3445	7186	978	19.55
		Razorbill	2.85	1.87	3.97	1784	1170	2488	346	19.36
		Curlew	0.01	0	0.03	7	0	18	6	92.35
		Black-headed gull	0.01	0	0.03	6	0	18	6	94.44
		Common gull	0.02	0	0.05	13	0	30	8	64.08
		Lesser black-backed gull	0.01	0	0.03	6	0	19	7	101.28

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Common tern	0.03	0	0.06	18	0	36	10	51.1
		Puffin	0.27	0.17	0.39	170	105	242	37	21.52
		Manx shearwater	0.36	0.08	0.84	225	53	528	134	59.15
Aug-22	1	Herring gull	0	0	0	1	0	2	1	94.55
		Great black-backed gull	0.06	0	0.13	37	0	83	21	56.98
		Gannet	0.42	0.25	0.6	266	159	378	58	21.73
		Kittiwake	3.11	1.4	5.36	1946	878	3357	624	32.04
		Guillemot	14.49	8.75	20.67	9080	5482	12952	1939	21.35
		Razorbill	0.27	0.09	0.56	173	54	354	78	45.15
		Fulmar	0.13	0.03	0.27	84	17	167	40	47.24
		Lesser black-backed gull	0.1	0.01	0.22	66	6	139	34	51.49
		Puffin	0.1	0.04	0.17	62	27	107	21	33.28
		Manx shearwater	0.26	0.06	0.57	164	41	356	82	50.08
		Common tern	0.13	0.02	0.31	85	16	193	51	59.73
		Arctic tern	0.02	0	0.05	12	1	31	9	79.96
Aug-22	2	Great black-backed gull	0.01	0	0.03	7	0	18	7	97.5
		Gannet	0.08	0.03	0.13	48	18	84	18	36.32
		Kittiwake	0.84	0.24	1.67	526	153	1047	252	47.94

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		Guillemot	3.59	2.48	4.92	2247	1551	3081	402	17.86
		Razorbill	0.35	0.12	0.65	222	74	408	91	40.66
		Fulmar	0.01	0	0.03	7	0	18	6	92.13
		Puffin	0.03	0.01	0.05	17	4	30	7	41.36
		Lesser black-backed gull	0.03	0	0.07	19	0	42	12	65.67
		Common tern	0.11	0.04	0.18	67	24	116	24	35.08
		Manx shearwater	0.07	0	0.21	47	0	134	40	85.13
		Golden plover	0.04	0	0.11	25	0	72	23	94.58
		Curlew	0.02	0	0.06	12	0	36	12	96.13
		Little gull	0.01	0	0.03	6	0	18	6	95.32
Sept-22	1	Herring gull	0.01	0	0.03	7	0	19	6	97.93
		Gannet	0.23	0.1	0.39	145	64	247	48	32.92
		Kittiwake	1.31	0.27	2.78	821	172	1745	419	51.05
		Guillemot	7.48	4.46	11.51	4687	2796	7210	1137	24.25
		Razorbill	3.11	1.5	5.38	1949	938	3368	634	32.5
		Fulmar	0.02	0	0.05	13	0	30	8	62.27
		Great black-backed gull	0.16	0	0.44	99	0	276	72	73.07
		Puffin	0.24	0.16	0.35	153	100	217	30	19.43

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		Lesser black-backed gull	0.02	0	0.06	16	0	38	11	69.37
		Common tern	0.06	0.02	0.11	37	12	71	16	42.56
		Manx shearwater	0.81	0.06	1.85	505	39	1159	290	57.48
		Little gull	0.4	0.26	0.53	249	161	334	45	17.72
		Common gull	0.04	0	0.09	25	0	59	16	60.99
		Great skua	0.01	0	0.03	6	0	19	6	99.79
		Sooty shearwater	0.16	0	0.44	99	0	279	83	83.59
Sept-22	2	Gannet	0.17	0.07	0.3	108	47	190	36	33.44
		Kittiwake	0.04	0	0.08	24	0	54	14	57.54
		Guillemot	1.63	1.23	2.11	1023	773	1321	138	13.48
		Razorbill	0.17	0.07	0.29	108	44	184	35	32.07
		Great black-backed gull	0.05	0	0.11	31	0	72	19	62.57
		Puffin	0.14	0.05	0.23	88	31	143	29	33.15
		Little gull	0.08	0	0.17	48	0	108	27	56.6
Oct-22	1	Herring gull	0.01	0	0.03	6	0	18	6	95.15
		Gannet	0.05	0.01	0.1	31	6	60	14	44.32
		Kittiwake	0.07	0.03	0.1	42	18	66	13	29.76
		Guillemot	2.55	1.92	3.23	1601	1206	2025	219	13.63
		Razorbill	0.63	0.37	0.91	394	230	569	87	21.89

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		Great black-backed gull	0.01	0	0.03	7	0	18	6	88.91
		Puffin	0.31	0.15	0.51	195	93	322	62	31.71
		Red-throated diver	0.01	0	0.03	7	0	18	6	94.85
Nov-22	1	Herring gull	0.02	0	0.05	13	0	30	9	66.1
		Gannet	1.33	0.73	2.04	831	456	1277	212	25.43
		Kittiwake	0.65	0.43	0.9	408	272	564	75	18.31
		Guillemot	2.05	1.23	2.94	1288	772	1841	272	21.12
		Razorbill	0.8	0.46	1.27	503	291	794	133	26.38
		Great black-backed gull	0.05	0	0.11	30	0	67	17	54.76
		Puffin	0.14	0.06	0.24	91	38	152	30	32.19
		Little gull	0.03	0	0.08	20	0	48	13	65.44
		Pomarine skua	0.01	0	0.03	6	0	18	6	96.28
Dec-22	1	Herring gull	0.1	0.05	0.15	61	30	96	17	27.09
		Fulmar	0.04	0	0.09	24	0	54	15	59.89
		Kittiwake	0.58	0.43	0.75	367	269	471	52	14.17
		Guillemot	4.47	3.82	5.14	2800	2392	3221	218	7.78
		Razorbill	2.1	1.64	2.64	1317	1031	1652	163	12.33
		Great black-backed gull	0.11	0.04	0.19	67	24	119	25	36.62

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		Puffin	0.24	0.1	0.4	150	64	254	50	32.82
		Common gull	0.07	0.02	0.13	42	12	83	19	45.52
		Red-throated diver	0.03	0	0.06	19	0	40	10	50.85
		Shag	0.01	0	0.03	6	0	18	6	96.28
Jan-23	1	Common gull	0.06	0.01	0.12	37	6	78	20	52.28
		Red-throated diver	0.09	0.03	0.16	59	18	100	22	36.63
		Cormorant	0.02	0	0.06	13	0	36	12	91.59
		Fulmar	0.17	0.04	0.38	108	23	238	63	58.35
		Gannet	0.04	0	0.09	25	0	54	14	56.09
		Herring gull	0.06	0.01	0.12	39	10	74	17	42.75
		Kittiwake	1.24	0.69	1.88	776	435	1175	190	24.36
		Guillemot	2.11	0.73	3.85	1324	461	2413	518	39.12
		Razorbill	1.22	0.58	1.95	768	362	1221	221	28.76
		Great black-backed gull	0.16	0.05	0.32	102	30	198	46	44.93
		Little gull	0.01	0	0.03	7	0	18	6	91.17
Feb-23	1	Common gull	0.06	0.02	0.09	36	12	60	13	34.21
		Red-throated diver	0.06	0.01	0.12	36	6	75	19	51.34
		Fulmar	0.02	0	0.05	12	0	30	8	66.27
		Gannet	0.25	0.18	0.33	156	111	207	25	15.68
		Kittiwake	3.00	2.14	3.92	1883	1344	2455	277	14.7

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		Guillemot	3.6	2.68	4.68	2255	1682	2929	328	14.52
		Razorbill	10.04	7.17	13.22	6289	4493	8281	994	15.8
		Puffin	0.19	0.06	0.35	117	40	218	46	38.81
March-23	1	Common gull	0.05	0.01	0.1	30	6	60	15	49.25
		Red-throated diver	0.18	0.08	0.31	114	48	197	39	34.1
		Lesser black-backed gull	0.02	0	0.05	13	0	30	9	68.03
		Herring gull	0.07	0.03	0.11	42	18	71	15	34.69
		Gannet	0.73	0.41	1.12	455	256	705	118	25.9
		Kittiwake	5.84	4.55	7.25	3659	2852	4540	440	12.02
		Great black-backed gull	0.06	0	0.18	38	0	113	31	82.42
		Guillemot	8.27	6.28	10.3	5182	3937	6456	642	12.38
		Razorbill	7.4	4.8	10.46	4638	3008	6552	910	19.61
		Puffin	0.14	0.07	0.24	91	46	151	28	30.26
April-23	1	Common gull	0.17	0.09	0.27	108	54	172	29	26.92
		Arctic tern	0.01	0	0.03	7	0	18	6	89.71
		Red-throated diver	0.19	0.12	0.27	122	76	169	25	20.11
		Cormorant	0.01	0	0.03	6	0	18	6	99.23
		Common tern	0.01	0	0.03	7	0	19	7	93.43

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		Lesser black-backed gull	0.02	0	0.05	12	0	30	8	62.03
		Fulmar	0.02	0	0.05	13	0	30	8	64.43
		Gannet	0.77	0.37	1.31	481	235	818	152	31.49
		Herring gull	0.03	0	0.07	18	0	47	13	68.36
		Kittiwake	7.17	5.5	9.22	4490	3447	5775	587	13.05
		Great black-backed gull	0.08	0	0.2	49	0	125	34	70.35
		Guillemot	11.54	9.14	14.92	7233	5728	9348	944	13.05
		Razorbill	2.97	2.15	3.83	1859	1345	2401	266	14.29
		Puffin	0.18	0.12	0.25	112	73	159	23	19.95
May-23	1	Whooper swan	0.03	0	0.09	20	0	55	18	92.5
		Common gull	0.01	0	0.03	6	0	18	6	100.59
		Red-throated diver	0.02	0	0.05	13	0	30	8	62.39
		Sandwich tern	0.35	0.2	0.5	217	129	313	49	22.31
		Common tern	0.19	0.1	0.3	122	64	188	31	25.59
		Fulmar	0.05	0.01	0.09	31	6	59	14	44.53
		Gannet	0.02	0	0.05	13	0	30	8	65.08
		Herring gull	0.1	0	0.25	63	0	156	46	72.65
		Kittiwake	1.32	0.43	2.89	830	267	1808	447	53.78

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		Great black-backed gull	0.02	0	0.05	13	0	30	9	67.92
		Guillemot	4.85	1.84	10.55	3039	1152	6607	1740	57.26
		Razorbill	0.23	0.09	0.43	143	60	267	53	36.85
		Puffin	0.19	0.1	0.29	118	64	180	30	24.85
		Little gull	0.05	0	0.14	30	0	91	30	97.87
June-23	1	Whimbrel	0.01	0	0.03	6	0	19	6	98.05
		Curlew	0.01	0	0.03	7	0	18	7	97.91
		Common gull	0.01	0	0.04	7	0	23	7	98.6
		Manx shearwater	0.05	0.01	0.1	31	6	66	16	52.4
		Lesser black-backed gull	0.43	0.28	0.58	267	177	362	46	17.21
		Gannet	0.62	0.44	0.89	390	275	561	76	19.24
		Kittiwake	3.51	2.81	4.27	2201	1764	2674	232	10.5
		Great black-backed gull	0.02	0	0.05	13	0	30	8	63.27
		Herring gull	0.29	0.15	0.45	183	94	284	52	28
		Guillemot	2.29	1.53	3.28	1436	962	2056	285	19.8
		Razorbill	0.64	0.39	0.9	399	242	567	85	21.21
		Puffin	0.09	0.04	0.16	60	28	100	19	32.1
		Fulmar	0.14	0.06	0.24	90	39	148	30	32.68

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July-23	1	Common gull	0.02	0	0.07	13	0	46	13	99.9
		Sandwich tern	0.01	0	0.03	6	0	18	6	94.96
		Lesser black-backed gull	0.16	0	0.47	101	0	292	93	92.01
		Gannet	0.06	0.01	0.11	37	6	71	17	44.51
		Kittiwake	1.76	0.32	4.32	1102	202	2705	784	71.18
		Great black-backed gull	0.01	0	0.03	6	0	19	6	98.85
		Guillemot	2.65	1.91	3.4	1664	1199	2129	239	14.35
		Razorbill	1.09	0.64	1.59	686	404	995	160	23.28
		Puffin	0.28	0.15	0.41	173	95	260	43	24.79
		Herring gull	0.61	0.01	1.78	382	6	1114	346	90.59
Aug-23	1	Black-headed gull	0.03	0	0.07	18	0	46	13	69.43
		Common gull	0.01	0	0.03	7	0	18	6	92.71
		Arctic tern	0	0	0	1	0	1	1	70.83
		Great skua	0.02	0	0.05	12	0	29	8	65.94
		Sandwich tern	0.02	0	0.06	12	0	36	12	95.31
		Common tern	0.3	0.08	0.7	186	51	441	103	54.97
		Manx shearwater	0.01	0	0.03	7	0	18	6	91.56
		Lesser black-backed gull	0.01	0	0.03	6	0	18	6	98.15

Month-Year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Gannet	0.4	0.26	0.57	254	163	360	50	19.37
		Kittiwake	1.67	1.2	2.22	1046	755	1389	162	15.48
		Great black-backed gull	0.03	0.01	0.06	18	6	36	9	50.67
		Guillemot	10.52	8.92	12.53	6593	5591	7851	592	8.97
		Razorbill	4.75	2.35	7.98	2976	1474	5000	923	31.01
		Puffin	0.97	0.63	1.46	611	395	913	134	21.82
		Fulmar	0.1	0.05	0.18	66	29	113	23	34.84

Table 12.68. Overview of survey data for the array area plus 4km buffer.

Month-year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
	1	Red-throated diver	0.31	0.18	0.45	259	149	378	59	22.78

Month-year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
Mar-21		Kittiwake	6.12	4.64	7.68	5150	3906	6463	649	12.59
		Black-headed gull	0.01	0	0.02	7	0	18	6	90.6
		Common gull	0.04	0.01	0.08	37	12	71	17	45.14
		Great black-backed gull	0.04	0	0.08	30	0	67	18	60.03
		Herring gull	0.01	0	0.03	13	0	30	8	63.62
		Lesser black-backed gull	0.01	0	0.02	7	0	19	6	94.06
		Little auk	0.01	0	0.03	10	3	22	6	60.6
		Guillemot	8.05	6.64	9.63	6772	5589	8104	655	9.67
		Razorbill	5.21	4.42	6.02	4387	3719	5065	343	7.8
		Puffin	0.34	0.26	0.44	288	217	367	38	13.18
		Fulmar	0.08	0.01	0.18	68	11	152	38	55.39
		Gannet	0.3	0.14	0.5	252	120	419	79	31.18
Apr-21	1	Red-throated diver	0.24	0.13	0.36	200	109	303	51	25.17
		Kittiwake	10.34	8.5	12.28	8701	7148	10329	827	9.5
		Little gull	0.01	0	0.02	7	0	18	6	89.92
		Common gull	0.01	0	0.04	13	0	30	8	64.34
		Great black-backed gull	0.04	0.01	0.06	30	11	54	12	37.93
		Herring gull	0.02	0	0.05	20	4	42	10	49.61
		Lesser black-backed gull	0.04	0.01	0.06	31	12	54	12	37.36
		Sandwich tern	0.01	0	0.02	7	0	18	7	97.63
		Guillemot	25.34	19.82	31.54	21316	16673	26535	2558	12

Month-year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Razorbill	8.37	5.92	11.2	7042	4982	9420	1165	16.53
		Puffin	0.05	0.02	0.08	40	16	69	15	35.46
		Great northern diver	0.01	0	0.02	6	0	18	6	92.65
		Fulmar	0.06	0.03	0.11	55	24	90	17	30.93
		Gannet	1.02	0.74	1.31	860	623	1103	123	14.23
May-21	1	Red-throated diver	0.02	0	0.04	19	0	37	10	49.69
		Kittiwake	3.17	1.4	5.46	2667	1182	4598	887	33.24
		Common gull	0.01	0	0.02	6	0	18	6	94.33
		Great black-backed gull	0.01	0	0.02	7	0	19	6	95.02
		Lesser black-backed gull	0.01	0	0.02	7	0	19	6	98.12
		Sandwich tern	0.27	0.17	0.38	228	144	320	45	19.7
		Common tern	0.17	0.1	0.25	141	85	213	33	22.87
		Guillemot	5.29	4.34	6.57	4451	3649	5524	483	10.83
		Razorbill	0.63	0.39	0.91	531	325	768	114	21.41
		Puffin	0.04	0.01	0.09	38	10	74	17	44.41
		Gannet	0.09	0.04	0.14	73	35	118	22	29.74
Jun-21	1	Kittiwake	1.08	0.65	1.72	908	546	1451	237	26.11
		Black-headed gull	0.01	0	0.02	7	0	18	6	92.61
		Little gull	0.01	0	0.02	6	0	18	6	100.55
		Common gull	0.01	0	0.04	12	0	30	8	68.12
		Herring gull	0.04	0	0.11	37	0	90	24	63.86

Month-year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Lesser black-backed gull	0.03	0	0.08	24	0	64	18	73.43
		Sandwich tern	0.05	0.02	0.1	47	17	83	18	38.39
		Common tern	0.03	0	0.06	25	2	53	14	53.65
		Arctic tern	0.01	0	0.03	12	0	27	7	57.77
		Guillemot	1.33	1.06	1.62	1117	889	1362	123	11
		Razorbill	0.29	0.18	0.41	247	154	342	50	20.03
		Puffin	0.04	0.02	0.07	36	13	63	14	36.99
		Fulmar	0.04	0.01	0.07	36	12	60	13	34.38
		Gannet	0.08	0.03	0.16	72	24	135	30	41.67
Jul-21	1	Kittiwake	3.27	2.02	4.97	2752	1700	4180	649	23.56
		Black-headed gull	0.01	0	0.03	12	0	30	8	65.15
		Little gull	0.01	0	0.04	13	0	37	12	93.93
		Common gull	0.04	0.01	0.09	37	6	78	20	53.5
		Herring gull	0.02	0	0.05	19	0	41	10	53.41
		Lesser black-backed gull	0.03	0.01	0.05	25	6	46	11	40.7
		Sandwich tern	0.01	0	0.02	6	0	18	6	95.1
		Arctic tern	0.01	0	0.02	7	0	18	6	95.53
		Guillemot	8.86	6.5	11.59	7455	5469	9752	1092	14.65
		Razorbill	3.21	1.78	4.82	2702	1498	4058	668	24.72
		Puffin	0.34	0.27	0.42	286	225	351	33	11.32
		Fulmar	0.08	0.03	0.14	69	24	118	25	36.47

Month-year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Manx shearwater	0.13	0.01	0.35	112	10	293	82	72.76
		Gannet	0.3	0.14	0.48	250	118	403	75	29.87
Aug-21	1	Oystercatcher	0.06	0	0.16	51	0	132	38	73.76
		Kittiwake	6.09	2.49	10.69	5125	2098	8997	1787	34.87
		Little gull	0.01	0	0.04	13	0	30	8	64
		Great black-backed gull	0.01	0	0.04	12	0	36	12	98.13
		Common tern	0.52	0.14	1.09	439	122	918	214	48.57
		Arctic tern	0.02	0	0.05	17	2	43	12	67.3
		Great skua	0.01	0	0.04	13	0	30	9	66.34
		Guillemot	25.45	13.94	40.75	21411	11724	34278	5599	26.15
		Razorbill	4.13	1.59	7.11	3474	1338	5985	1191	34.29
		Puffin	2.03	1.5	2.69	1706	1264	2262	262	15.34
		Fulmar	0.04	0.01	0.08	30	6	65	16	51.54
		Manx shearwater	0.01	0	0.02	6	0	18	6	100.41
		Gannet	0.2	0.14	0.27	169	114	227	29	16.71
Sept-21	1	Kittiwake	2.34	1.51	3.34	1968	1267	2806	400	20.31
		Little gull	0.12	0.08	0.18	104	64	148	23	21.61
		Common gull	0.01	0	0.02	7	1	19	6	90.4
		Great black-backed gull	0.22	0.1	0.39	185	83	329	67	35.92
		Herring gull	0.01	0	0.02	7	0	19	6	91.75
		Lesser black-backed gull	0.04	0.02	0.07	37	17	60	13	33.78

Month-year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Sandwich tern	0.02	0.01	0.05	20	6	41	10	47.94
		Common tern	4.02	3.1	5.07	3382	2606	4266	427	12.62
		Arctic tern	0.06	0.02	0.11	55	21	93	19	34.76
		Arctic skua	0.04	0.01	0.07	30	6	60	14	46.73
		Guillemot	26.12	20.27	33.27	21974	17055	27988	2795	12.72
		Razorbill	1.78	1.33	2.28	1497	1117	1915	198	13.21
		Puffin	1.31	1.06	1.58	1101	895	1329	110	9.99
		Fulmar	0.02	0	0.04	19	0	36	9	48.54
		Manx shearwater	0.05	0	0.15	42	0	127	43	100.88
		Gannet	0.18	0.12	0.24	150	101	201	27	17.72
Oct-21	1	Red-throated diver	0.03	0.01	0.06	25	6	47	11	42.72
		Kittiwake	0.16	0.09	0.23	135	78	192	30	21.64
		Black-headed gull	0.06	0.02	0.11	49	18	90	19	38.97
		Little gull	0.78	0.57	1.03	660	482	864	100	15.03
		Common gull	0.04	0.01	0.06	30	6	54	12	39.09
		Great black-backed gull	0.11	0.01	0.28	90	6	234	65	72.07
		Herring gull	0.01	0	0.04	13	0	30	9	68.3
		Lesser black-backed gull	0.01	0	0.02	7	0	18	6	94.17
		Arctic skua	0.01	0	0.02	7	0	19	6	96.66
		Guillemot	7.23	6.05	8.53	6084	5087	7179	525	8.62
		Razorbill	1.18	0.82	1.6	996	694	1347	166	16.58

Month-year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Puffin	1.31	1.03	1.61	1098	870	1357	131	11.86
		Gannet	0.19	0.09	0.3	163	78	255	45	27.29
Nov-21	1	Red-throated diver	0.01	0	0.02	7	0	19	6	94.51
		Kittiwake	0.24	0.19	0.3	205	158	253	25	11.71
		Little gull	0.03	0	0.07	26	0	60	16	63.4
		Great black-backed gull	0.05	0.01	0.1	43	12	84	19	43.05
		Lesser black-backed gull	0.01	0	0.02	6	0	18	6	92.5
		Guillemot	6.48	5.35	7.53	5455	4505	6333	483	8.84
		Razorbill	3.09	2.5	3.74	2599	2101	3147	270	10.38
		Puffin	0.6	0.51	0.7	505	429	585	41	8.08
		Fulmar	0.01	0	0.02	6	0	19	6	102.68
		Gannet	0.33	0.14	0.54	274	119	457	89	32.45
Dec-21	1	Red-throated diver	0.03	0	0.07	25	0	58	14	55
		Kittiwake	0.42	0.28	0.56	355	240	471	61	17.06
		Little gull	0.01	0	0.02	7	0	19	6	97.42
		Great black-backed gull	0.09	0.05	0.14	79	41	120	21	25.92
		Guillemot	3.39	2.88	3.89	2851	2427	3276	208	7.29
		Razorbill	2.44	1.87	3.08	2051	1571	2593	260	12.67
		Puffin	0.07	0.03	0.13	57	24	110	24	41.17
		Fulmar	0.03	0	0.06	24	0	53	14	56.31
		Shag	0.02	0	0.06	19	0	48	13	67.83

Month-year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
Jan-22	1	Kittiwake	0.16	0.09	0.25	139	78	209	34	23.9
		Great black-backed gull	0.04	0.01	0.06	31	12	54	12	36.16
		Herring gull	0.02	0	0.05	19	0	41	11	55.26
		Guillemot	0.63	0.45	0.83	534	383	699	80	14.96
		Razorbill	0.62	0.41	0.86	519	342	722	97	18.63
		Fulmar	0.04	0.01	0.08	37	12	71	16	41.92
		Gannet	0.01	0	0.02	6	0	18	6	97.54
		Shag	0.01	0	0.02	6	0	18	6	93.49
Feb-22	1	Kittiwake	1.44	1.02	2.01	1211	862	1692	217	17.9
		Common gull	0.04	0	0.1	33	1	86	25	76.48
		Great black-backed gull	0.01	0	0.04	12	0	30	8	67.8
		Guillemot	4.69	3.77	5.71	3947	3170	4808	431	10.91
		Razorbill	5.89	4.94	6.74	4958	4157	5670	377	7.59
		Puffin	0.01	0	0.03	11	3	26	7	57.52
		Fulmar	0.05	0.01	0.11	45	10	93	22	48.82
		Gannet	0.04	0.01	0.07	31	6	61	15	47.56
		Shag	0.01	0	0.02	7	0	19	6	95.78
		Red-throated diver	0.02	0	0.04	18	0	37	10	52.01
Mar-22	1	Kittiwake	4.54	2.91	6.45	3824	2445	5426	760	19.86
		Black-headed gull	0.01	0	0.02	7	0	18	6	93.49
		Little gull	0.01	0	0.02	7	0	18	6	98.53

Month-year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Common gull	0.11	0.04	0.19	96	36	160	31	32.39
		Great black-backed gull	0.01	0	0.04	13	0	30	9	67.78
		Herring gull	0.01	0	0.02	7	0	18	6	94.42
		Lesser black-backed gull	0.04	0.01	0.1	37	6	81	20	52.31
		Guillemot	7.72	5.74	10.09	6498	4828	8486	907	13.95
		Razorbill	3.6	2.43	4.83	3032	2041	4066	517	17.02
		Puffin	0.36	0.23	0.49	299	195	414	58	19.23
		Gannet	0.3	0.16	0.46	252	132	389	68	26.71
		Shag	0.01	0	0.02	6	0	18	6	96.82
		Red-throated diver	0.04	0.01	0.08	37	12	66	15	39.31
Mar-22	2	Kittiwake	4.12	3.31	4.87	3464	2787	4093	326	9.4
		Little gull	0.03	0	0.07	25	0	60	17	68.47
		Guillemot	9.5	8.24	10.89	7991	6934	9165	571	7.14
		Razorbill	1.71	1.24	2.23	1437	1044	1878	210	14.59
		Puffin	0.19	0.14	0.24	160	118	205	23	14.18
		Fulmar	0.06	0.02	0.11	54	18	94	20	36.03
		Gannet	0.2	0.12	0.28	167	98	239	37	22.06
		Red-throated diver	0.16	0.09	0.24	132	72	203	34	25.44
Apr-22	1	Kittiwake	6.21	4.89	7.66	5225	4118	6441	585	11.2
		Black-headed gull	0.01	0	0.02	6	0	18	6	95.01
		Great black-backed gull	0.01	0	0.04	12	0	36	12	101.28

Month-year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Herring gull	0.04	0.01	0.08	31	6	65	15	46.47
		Lesser black-backed gull	0.01	0	0.03	12	0	30	8	64.03
		Guillemot	29.67	24.76	35.11	24964	20830	29538	2251	9.02
		Razorbill	2.31	1.83	2.84	1943	1536	2389	213	10.94
		Puffin	0.03	0.01	0.06	28	11	48	10	35.19
		Fulmar	0.2	0.13	0.28	170	108	240	35	20.44
		Manx shearwater	0.02	0	0.06	18	0	47	13	68.66
		Gannet	0.44	0.24	0.66	367	206	557	92	24.88
		Red-throated diver	0.34	0.21	0.48	284	176	401	59	20.51
Apr-22	2	Kittiwake	8.4	6.66	10.17	7067	5604	8555	774	10.94
		Great black-backed gull	0.01	0	0.02	6	0	18	6	99.89
		Herring gull	0.01	0	0.04	13	0	30	9	68.5
		Lesser black-backed gull	0.01	0	0.04	13	0	30	9	67.71
		Sandwich tern	0.27	0.16	0.39	226	136	329	50	21.95
		Common tern	0.16	0.08	0.26	139	69	217	39	27.95
		Arctic tern	0.06	0.02	0.1	51	20	86	18	34.36
		Guillemot	13.98	10.67	17.18	11759	8973	14454	1384	11.77
		Razorbill	1.75	1.06	2.55	1471	894	2143	315	21.4
		Puffin	0.16	0.08	0.25	132	66	208	36	27.31
		Red-throated diver	0.04	0.01	0.07	36	12	60	12	33.29
		Fulmar	0.05	0.01	0.09	43	12	78	18	40.4

Month-year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Gannet	2	1.26	2.81	1680	1060	2362	343	20.36
May-22	1	Red-throated diver	0.02	0	0.04	19	0	37	10	50.93
		Kittiwake	6.62	5.67	7.65	5569	4767	6435	438	7.86
		Common gull	0.01	0	0.02	6	0	18	6	100.45
		Herring gull	0.01	0	0.04	13	0	30	8	63.21
		Lesser black-backed gull	0.03	0	0.06	24	0	53	14	56.76
		Sandwich tern	0.23	0.09	0.4	196	78	340	69	34.98
		Arctic tern	0.19	0.12	0.26	157	102	222	30	19.04
		Great skua	0.01	0	0.02	7	0	18	6	93.2
		Guillemot	15.5	12.77	18.44	13039	10739	15514	1234	9.46
		Razorbill	3.15	2.37	4.02	2646	1995	3378	352	13.29
		Puffin	0.42	0.29	0.56	351	247	472	60	16.96
		Fulmar	0.09	0.04	0.15	79	36	126	23	29.08
		Gannet	1.46	1.1	1.88	1228	923	1580	169	13.71
May-22	2	Red-throated diver	0.01	0	0.02	7	0	18	6	96.65
		Kittiwake	3.42	2.37	5.2	2881	1990	4376	651	22.58
		Great black-backed gull	0.01	0	0.02	6	0	18	6	100.35
		Herring gull	0.01	0	0.04	12	0	37	12	100.27
		Lesser black-backed gull	0.01	0	0.03	12	0	30	8	67.77
		Sandwich tern	0.12	0.06	0.18	97	53	151	26	26.43
		Common tern	0.2	0.09	0.32	167	80	266	50	29.59

Month-year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Arctic tern	0.01	0	0.02	8	1	20	7	81.44
		Guillemot	4.79	3.8	5.96	4034	3201	5013	477	11.82
		Razorbill	0.47	0.33	0.61	394	279	512	61	15.34
		Puffin	0.02	0	0.04	17	4	34	8	48.98
		Gannet	0.25	0.16	0.36	212	139	303	43	20.1
Jun -22	1	Kittiwake	1.65	0.86	2.88	1387	723	2421	438	31.55
		Great black-backed gull	0.02	0	0.05	18	0	46	12	66.77
		Herring gull	0.04	0	0.1	32	0	82	24	75.52
		Lesser black-backed gull	0.02	0	0.06	19	0	47	13	66.62
		Sandwich tern	0.17	0.07	0.3	145	63	254	49	33.21
		Common tern	0.04	0	0.1	37	0	82	21	56.26
		Guillemot	2.99	1.82	4.8	2515	1528	4035	714	28.36
		Razorbill	0.42	0.21	0.69	353	173	577	108	30.52
		Puffin	0.04	0.01	0.08	37	11	67	15	40.18
		Fulmar	0.02	0	0.04	18	3	36	9	45.44
		Gannet	0.24	0.15	0.33	200	126	280	41	20.17
Jun-22	2	Curlew	0.01	0	0.02	7	0	18	6	93.94
		Kittiwake	4.58	3.34	6.25	3857	2811	5258	655	16.96
		Great black-backed gull	0.04	0.01	0.07	31	6	60	15	46.81
		Herring gull	0.4	0.2	0.64	340	168	541	96	28.07
		Lesser black-backed gull	0.03	0.01	0.07	29	6	59	15	48.64

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		Sandwich tern	0.08	0.03	0.14	67	24	116	25	36.39
		Common tern	0.01	0	0.02	7	0	18	6	96.96
		Guillemot	5.03	4.18	5.93	4230	3517	4993	387	9.13
		Razorbill	0.32	0.13	0.55	269	113	464	90	33.36
		Fulmar	0.05	0.01	0.09	42	12	77	17	39.21
		Manx shearwater	0.01	0	0.02	7	0	18	6	95.51
		Gannet	0.72	0.47	1	606	394	845	120	19.72
Jul-22	1	Curlew	0.01	0	0.02	6	0	18	6	98.68
		Kittiwake	0.97	0.62	1.48	813	526	1245	193	23.7
		Herring gull	0.04	0	0.11	37	0	93	25	67.39
		Lesser black-backed gull	0.01	0	0.04	12	0	36	12	93.97
		Guillemot	3.26	2.35	4.3	2745	1978	3617	434	15.78
		Razorbill	0.62	0.22	1.22	524	186	1031	220	42.01
		Puffin	0.1	0.03	0.2	85	25	168	39	45.15
		Fulmar	0.01	0	0.02	7	0	18	7	96.6
		Manx shearwater	0.03	0	0.07	26	0	60	17	65.41
		Gannet	0.52	0.32	0.74	437	272	623	92	20.87
Jul-22	2	Curlew	0.01	0	0.02	7	0	18	6	94.21
		Kittiwake	1.78	1.14	2.6	1501	960	2190	313	20.84
		Black-headed gull	0.01	0	0.03	12	0	30	8	66.02
		Common gull	0.03	0.01	0.06	25	6	47	11	43.98

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		Great black-backed gull	0.02	0	0.06	18	0	54	18	98.21
		Herring gull	0.02	0	0.05	19	0	46	13	66.9
		Lesser black-backed gull	0.04	0.01	0.08	37	6	71	17	44.84
		Sandwich tern	0.01	0	0.02	6	0	18	6	94.72
		Common tern	0.02	0	0.05	19	0	41	10	53.51
		Guillemot	11.13	7.37	15.4	9367	6196	12953	1807	19.28
		Razorbill	5.15	3.27	6.95	4331	2753	5849	815	18.8
		Puffin	0.39	0.25	0.56	329	213	472	67	20.16
		Fulmar	0.09	0.04	0.13	73	36	114	20	27.14
		Manx shearwater	0.44	0.19	0.8	371	158	675	139	37.41
		Gannet	0.83	0.64	1.04	696	539	876	87	12.51
Aug-22	1	Kittiwake	6.57	2.72	11.26	5525	2293	9471	1882	34.05
		Great black-backed gull	0.06	0.01	0.11	49	12	94	22	43.77
		Herring gull	0	0	0	1	0	2	1	94.33
		Lesser black-backed gull	0.09	0.02	0.18	79	19	151	34	42.97
		Common tern	0.19	0.06	0.34	161	54	290	59	36.71
		Arctic tern	0.01	0	0.04	11	0	32	10	85.61
		Guillemot	27.99	11.44	49.76	23543	9623	41857	8442	35.86
		Razorbill	0.41	0.18	0.73	345	148	613	121	35.03
		Puffin	0.09	0.05	0.14	78	40	120	21	25.71
		Fulmar	0.12	0.04	0.22	98	34	185	39	38.84

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		Manx shearwater	0.24	0.06	0.46	199	53	386	88	44.27
		Gannet	0.44	0.3	0.61	370	252	513	68	18.34
Aug-22	2	Golden plover	0.09	0	0.22	72	0	185	50	69.14
		Curlew	0.01	0	0.04	13	0	36	12	93.27
		Kittiwake	1.19	0.32	2.53	1001	268	2131	517	51.6
		Little gull	0.01	0	0.02	7	0	18	6	95.6
		Great black-backed gull	0.01	0	0.02	7	0	19	7	99.45
		Lesser black-backed gull	0.02	0	0.06	19	0	47	13	68.69
		Common tern	0.2	0.06	0.38	171	48	324	70	40.63
		Guillemot	4.04	2.77	5.53	3396	2331	4648	611	17.98
		Razorbill	0.45	0.22	0.75	383	182	633	115	29.84
		Puffin	0.04	0.01	0.06	31	12	52	11	33.8
		Fulmar	0.01	0	0.02	7	0	18	6	96.47
		Manx shearwater	0.06	0	0.17	51	0	143	42	82.46
		Gannet	0.11	0.05	0.18	96	42	156	29	30.14
Sept-22	1	Red-throated diver	0.01	0	0.02	7	0	18	6	95.4
		Kittiwake	1.8	0.47	3.65	1515	399	3075	702	46.33
		Little gull	0.37	0.25	0.5	315	213	425	53	16.85
		Common gull	0.03	0	0.06	24	0	54	14	58.35
		Great black-backed gull	0.14	0.01	0.37	119	6	310	81	67.72
		Herring gull	0.01	0	0.02	6	0	19	6	102.76

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		Lesser black-backed gull	0.05	0	0.1	39	0	87	23	58.1
		Common tern	0.05	0.01	0.09	43	12	79	18	41.28
		Great skua	0.01	0	0.03	7	0	23	7	98.14
		Guillemot	8.88	5.74	12.65	7475	4833	10642	1448	19.36
		Razorbill	3.71	2.11	5.57	3119	1775	4686	753	24.14
		Puffin	0.24	0.16	0.32	202	139	274	35	17.25
		Fulmar	0.01	0	0.04	13	0	30	8	65.3
		Sooty shearwater	0.12	0	0.33	102	0	280	84	82.22
		Manx shearwater	0.64	0.09	1.36	541	77	1141	285	52.55
		Gannet	0.24	0.13	0.37	204	107	316	56	27.24
Sept-22	2	Kittiwake	0.03	0	0.06	25	0	53	14	54.26
		Little gull	0.07	0.01	0.14	60	12	120	28	45.57
		Great black-backed gull	0.05	0	0.13	42	0	109	30	72.19
		Herring gull	0.01	0	0.03	7	0	24	7	105.35
		Guillemot	1.69	1.34	2.11	1425	1126	1778	172	12.04
		Razorbill	0.21	0.1	0.32	174	81	273	52	29.56
		Puffin	0.14	0.07	0.23	121	63	195	34	27.98
		Gannet	0.15	0.07	0.25	129	61	208	39	29.89
Oct-22	1	Red-throated diver	0.01	0	0.02	7	0	18	6	96.67
		Kittiwake	0.23	0.15	0.3	194	130	256	32	16.02
		Black-headed gull	0.08	0.02	0.14	65	20	116	25	38.38

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		Little gull	0.02	0	0.04	14	1	31	8	60.57
		Common gull	0.01	0	0.04	13	1	30	8	59.89
		Great black-backed gull	0.01	0	0.02	6	0	19	6	96.97
		Herring gull	0.01	0	0.02	7	0	18	6	89.04
		Common tern	0.01	0	0.02	7	0	19	6	95.11
		Guillemot	2.95	2.4	3.53	2479	2015	2966	244	9.84
		Razorbill	0.55	0.36	0.76	467	306	642	86	18.36
		Puffin	0.31	0.18	0.48	264	148	403	66	24.95
		Fulmar	0.01	0	0.03	13	0	30	8	65.11
		Gannet	0.31	0.21	0.41	262	181	349	44	16.69
Nov-22	1	Kittiwake	0.73	0.48	1	611	403	844	113	18.39
		Little gull	0.06	0.01	0.12	51	12	101	24	47.19
		Great black-backed gull	0.06	0.02	0.1	50	19	85	18	34.69
		Herring gull	0.01	0	0.04	13	0	31	8	62.9
		Pomarine skua	0.01	0	0.02	7	0	19	6	93.94
		Guillemot	2.26	1.51	3.1	1905	1273	2611	357	18.74
		Razorbill	1.06	0.62	1.62	894	519	1359	212	23.65
		Puffin	0.2	0.09	0.32	170	79	268	49	28.56
		Gannet	1.4	0.82	2.02	1175	692	1700	266	22.61
Dec-22	1	Red-throated diver	0.04	0	0.08	30	0	65	17	54.19
		Kittiwake	0.53	0.4	0.67	447	337	561	60	13.24

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		Common gull	0.06	0.01	0.13	54	12	107	26	47.09
		Great black-backed gull	0.1	0.05	0.16	83	40	135	25	29.92
		Herring gull	0.08	0.04	0.13	68	35	108	19	26.81
		Guillemot	4.42	3.79	5.18	3723	3186	4357	285	7.64
		Razorbill	2.07	1.69	2.47	1738	1421	2078	172	9.9
		Puffin	0.23	0.13	0.35	196	107	294	49	24.82
		Fulmar	0.04	0.01	0.08	36	12	66	15	42.23
		Gannet	0.01	0	0.02	7	0	18	6	96.65
		Shag	0.01	0	0.02	7	0	18	6	94.4
Jan-23	1	Kittiwake	1.1	0.69	1.6	925	581	1347	199	21.43
		Little gull	0.01	0	0.02	7	0	19	6	91.23
		Common gull	0.05	0.01	0.1	43	12	87	21	47.62
		Great black-backed gull	0.15	0.06	0.27	125	54	226	47	37.23
		Herring gull	0.05	0.01	0.09	41	10	75	18	42.54
		Guillemot	2.11	0.91	3.74	1774	767	3144	607	34.18
		Razorbill	1.18	0.64	1.75	989	536	1471	244	24.62
		Fulmar	0.18	0.04	0.37	150	37	315	72	47.83
		Gannet	0.03	0	0.06	24	0	54	14	58.98
		Cormorant	0.01	0	0.04	13	0	36	12	96.07
		Red-throated diver	0.09	0.04	0.14	73	30	121	23	31.29
Feb-23	1	Kittiwake	2.82	2.17	3.5	2374	1824	2941	291	12.25

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		Common gull	0.04	0.01	0.07	36	12	60	12	32.91
		Great black-backed gull	0.01	0	0.02	7	0	18	6	96.91
		Guillemot	3.65	2.72	4.84	3072	2292	4072	456	14.81
		Razorbill	9.28	6.69	11.88	7809	5624	9993	1095	14.02
		Puffin	0.19	0.08	0.33	161	65	278	54	33.35
		Fulmar	0.02	0	0.04	18	0	36	10	51.63
		Gannet	0.22	0.16	0.3	187	131	249	32	16.69
		Red-throated diver	0.05	0.01	0.1	42	6	84	20	47.62
March-23	1	Kittiwake	5.74	4.64	6.85	4830	3905	5764	480	9.93
		Common gull	0.05	0.01	0.09	43	12	75	16	37.52
		Great black-backed gull	0.04	0	0.12	36	0	99	29	79.51
		Herring gull	0.08	0.04	0.12	67	30	105	19	28.48
		Lesser black-backed gull	0.01	0	0.04	13	0	30	9	68.79
		Guillemot	7.41	6.07	8.95	6231	5108	7529	614	9.85
		Razorbill	6.71	4.86	8.81	5643	4088	7411	872	15.45
		Puffin	0.12	0.06	0.19	101	52	160	30	29.07
		Gannet	0.72	0.44	1.09	605	368	915	134	22.13
		Red-throated diver	0.16	0.07	0.27	132	59	224	42	31.82
April-23	1	Kittiwake	6.48	5.08	7.98	5450	4270	6714	633	11.6
		Common gull	0.16	0.08	0.24	132	71	203	34	25.65
		Great black-backed gull	0.06	0	0.17	49	0	140	38	76.71

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		Herring gull	0.03	0.01	0.08	30	6	65	15	49.59
		Lesser black-backed gull	0.03	0.01	0.06	24	6	47	11	44.03
		Common tern	0.01	0	0.04	13	0	36	12	94.62
		Arctic tern	0.01	0	0.02	7	0	18	6	94.19
		Guillemot	10.4	8.47	12.83	8747	7122	10793	947	10.82
		Razorbill	2.72	2.16	3.32	2289	1822	2790	249	10.86
		Puffin	0.15	0.1	0.2	129	89	173	22	16.83
		Fulmar	0.02	0.01	0.05	19	6	41	10	51.19
		Gannet	0.69	0.37	1.05	577	316	885	149	25.74
		Cormorant	0.01	0	0.02	7	0	18	6	93.38
		Red-throated diver	0.17	0.1	0.25	145	82	212	34	23.23
May-23	1	Whooper swan	0.02	0	0.06	19	0	54	18	94.57
		Kittiwake	1.16	0.43	2.42	972	359	2038	477	49.06
		Little gull	0.04	0	0.11	32	0	91	30	92.98
		Common gull	0.01	0	0.04	13	0	30	8	61.21
		Great black-backed gull	0.01	0	0.04	13	0	30	9	67.41
		Herring gull	0.09	0.01	0.21	75	6	177	48	63.89
		Lesser black-backed gull	0.01	0	0.02	6	0	19	6	96.87
		Sandwich tern	0.34	0.2	0.49	285	171	415	63	22.07
		Common tern	0.15	0.08	0.23	128	71	195	33	25.19
		Guillemot	4.46	2.01	8.68	3752	1689	7300	1764	47

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		Razorbill	0.18	0.08	0.32	155	69	272	53	33.95
		Puffin	0.18	0.1	0.27	155	83	229	37	23.68
		Fulmar	0.04	0.01	0.08	37	12	66	15	40.63
		Gannet	0.01	0	0.03	12	0	30	8	64.01
		Red-throated diver	0.01	0	0.04	13	0	30	9	65.08
June-23	1	Whimbrel	0.01	0	0.02	7	0	19	7	99.33
		Curlew	0.01	0	0.03	7	0	24	7	104.13
		Kittiwake	3.72	3.05	4.4	3126	2563	3705	292	9.34
		Common gull	0.02	0	0.04	19	1	37	10	50.79
		Great black-backed gull	0.03	0.01	0.06	26	7	48	11	41.98
		Herring gull	0.3	0.19	0.41	249	158	346	48	19.05
		Lesser black-backed gull	0.36	0.25	0.48	303	207	406	52	16.88
		Guillemot	2.39	1.72	3.19	2012	1449	2681	308	15.26
		Razorbill	0.72	0.42	1.01	609	350	853	133	21.83
		Puffin	0.13	0.06	0.22	110	53	183	33	30.09
		Fulmar	0.12	0.06	0.2	105	51	167	31	28.7
		Manx shearwater	0.04	0	0.08	31	0	66	17	52.92
		Gannet	0.62	0.45	0.82	520	378	691	82	15.59
July-23	1	Kittiwake	1.65	0.47	3.68	1390	393	3096	766	55.08
		Common gull	0.02	0	0.06	19	0	48	13	68.58
		Great black-backed gull	0.01	0	0.04	13	0	37	12	95.37

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		Herring gull	0.49	0.02	1.35	410	18	1135	347	84.71
		Lesser black-backed gull	0.13	0	0.37	109	0	315	94	85.49
		Sandwich tern	0.01	0	0.02	7	0	18	6	90.65
		Guillemot	3.07	2.1	4.12	2581	1764	3468	439	16.99
		Razorbill	1.99	0.89	3.4	1676	753	2865	550	32.78
		Puffin	0.31	0.18	0.47	265	149	393	62	23.4
		Manx shearwater	0.03	0	0.08	25	0	71	19	77.63
		Gannet	0.07	0.03	0.12	61	29	99	19	29.98
Aug-23	1	Kittiwake	1.73	1.23	2.33	1459	1034	1962	248	16.99
		Black-headed gull	0.02	0	0.06	18	0	48	13	69.99
		Common gull	0.01	0	0.02	7	0	18	6	96.41
		Great black-backed gull	0.03	0.01	0.06	25	6	47	11	42.66
		Lesser black-backed gull	0.01	0	0.02	7	0	18	6	95.63
		Sandwich tern	0.02	0	0.04	13	0	36	12	89.64
		Common tern	0.42	0.15	0.79	358	126	667	141	39.29
		Arctic tern	0	0	0	2	1	3	1	47.78
		Great skua	0.01	0	0.03	12	0	30	8	64.56
		Guillemot	12.3	9.69	15.53	10345	8150	13065	1248	12.06
		Razorbill	5.55	3.16	8.77	4669	2658	7382	1189	25.46
		Puffin	1.11	0.75	1.52	938	634	1276	169	17.97
		Fulmar	0.09	0.03	0.16	73	24	136	29	39.75

Month-year	Survey no.	Species	Density Estimate (n/km²)	Lower 95% Confidence Limit of Density	Upper 95% Confidence Limit of Density	Population Estimate (number)	Lower 95% Confidence Limit of Population Estimate (number)	Upper 95% Confidence Limit of Population Estimate (number)	Standard Deviation of Population Estimate (number)	CV (%)
		Manx shearwater	0.01	0	0.02	7	0	18	6	90.74
		Gannet	0.38	0.27	0.51	320	225	431	54	16.87

Annex C - Availability bias counts for Auks

Table 12.69. Overview of survey data with availability bias for auks in the array area both apportioned and unapportioned.

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
Apportioned										
22/03/2021	1	Guillemot	10.17	8.42	12.47	6369	5271	7820	587	9.22%
04/04/2021	1	Guillemot	34.45	25.63	45.08	21585	16061	28239	2911	13.48%
12/05/2021	1	Guillemot	7.53	5.68	9.76	4719	3559	6110	588	12.47%
09/06/2021	1	Guillemot	1.7	1.25	2.2	1062	785	1380	138	12.97%
24/07/2021	3	Guillemot	12.19	8.55	16.46	7644	5357	10312	1272	16.65%
14/08/2021	1	Guillemot	24.29	12.93	38.06	15222	8100	23847	4074	26.76%
07/09/2021	1	Guillemot	27.91	21.91	34.44	17488	13725	21577	1976	11.3%
09/10/2021	1	Guillemot	9.66	7.54	12	6050	4725	7515	628	10.38%
02/11/2021	1	Guillemot	8.66	6.89	10.51	5431	4319	6590	527	9.71%
15/12/2021	1	Guillemot	4.6	3.85	5.41	2888	2412	3388	219	7.59%
06/01/2022	1	Guillemot	0.93	0.62	1.26	579	391	790	95	16.42%
23/02/2022	1	Guillemot	6.7	5.15	8.61	4203	3236	5392	497	11.82%
11/03/2022	1	Guillemot	11.14	7.76	14.85	6972	4865	9300	1099	15.77%
22/03/2022	2	Guillemot	13.04	10.58	16.22	8171	6630	10166	802	9.82%
02/04/2022	1	Guillemot	39.88	32	48.26	24984	20044	30234	2491	9.97%
15/04/2022	2	Guillemot	18.51	13.03	24.43	11594	8156	15302	1740	15.01%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
02/05/2022	1	Guillemot	20.45	16.51	24.91	12806	10349	15600	1296	10.12%
17/05/2022	2	Guillemot	6.56	5.01	8.73	4110	3137	5473	546	13.29%
09/06/2022	1	Guillemot	3.59	2.02	6.58	2253	1266	4129	778	34.55%
21/06/2022	2	Guillemot	6.74	5.35	8.3	4221	3351	5202	444	10.53%
04/07/2022	1	Guillemot	3.33	2.36	4.43	2089	1475	2775	310	14.84%
16/07/2022	2	Guillemot	10.41	6.99	15.01	6525	4381	9406	1317	20.18%
08/08/2022	1	Guillemot	19.15	11.53	26.98	11998	7222	16899	2467	20.57%
23/08/2022	2	Guillemot	4.67	3.16	6.61	2932	1982	4142	531	18.1%
13/09/2022	1	Guillemot	9.76	5.8	14.74	6113	3631	9238	1458	23.85%
25/09/2022	2	Guillemot	2.13	1.59	2.76	1333	997	1732	181	13.55%
10/10/2022	1	Guillemot	3.74	2.67	4.92	2346	1674	3085	302	12.88%
07/11/2022	1	Guillemot	2.68	1.55	3.86	1681	973	2418	354	21.08%
13/12/2022	1	Guillemot	5.66	4.65	6.84	3554	2909	4287	262	7.38%
26/01/2023	1	Guillemot	2.71	0.91	5.15	1702	571	3233	639	37.56%
10/02/2023	1	Guillemot	4.68	3.13	6.47	2931	1959	4053	464	15.82%
24/03/2023	1	Guillemot	10.64	7.94	13.73	6667	4975	8594	843	12.65%
05/04/2023	1	Guillemot	15.1	11.95	19.49	9462	7483	12211	1239	13.1%
03/05/2023	1	Guillemot	6.27	2.33	13.71	3929	1456	8586	2174	55.34%
17/06/2023	1	Guillemot	3	1.96	4.26	1881	1231	2673	351	18.64%
05/07/2023	1	Guillemot	3.46	2.46	4.5	2166	1544	2821	318	14.66%
10/08/2023	1	Guillemot	13.84	11.68	16.58	8671	7319	10389	776	8.94%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
22/03/2021	1	Razorbill	6.69	5.57	7.76	4190	3490	4864	311	7.42%
04/04/2021	1	Razorbill	11.22	7.02	16.29	7028	4402	10208	1399	19.91%
12/05/2021	1	Razorbill	0.75	0.38	1.17	473	238	732	110	23.28%
09/06/2021	1	Razorbill	0.29	0.17	0.43	183	110	269	36	19.84%
24/07/2021	3	Razorbill	3.56	1.81	5.74	2235	1131	3599	628	28.11%
14/08/2021	1	Razorbill	3.67	1.32	7.06	2300	829	4428	926	40.28%
07/09/2021	1	Razorbill	2.14	1.54	2.85	1337	964	1786	208	15.54%
09/10/2021	1	Razorbill	1.31	0.81	1.94	821	512	1213	136	16.52%
02/11/2021	1	Razorbill	3.67	2.82	4.54	2299	1768	2841	256	11.13%
15/12/2021	1	Razorbill	3.36	2.54	4.27	2102	1594	2669	287	13.66%
06/01/2022	1	Razorbill	0.81	0.48	1.19	505	299	744	116	23%
23/02/2022	1	Razorbill	7.69	6.51	9.05	4812	4082	5673	385	7.99%
11/03/2022	1	Razorbill	4.7	2.95	6.55	2947	1850	4104	552	18.74%
22/03/2022	2	Razorbill	2.05	1.42	2.69	1287	890	1689	198	15.4%
02/04/2022	1	Razorbill	2.97	2.17	3.97	1866	1355	2487	248	13.29%
15/04/2022	2	Razorbill	1.79	1.08	2.62	1119	681	1640	194	17.3%
02/05/2022	1	Razorbill	3.82	2.79	4.95	2393	1748	3096	308	12.86%
17/05/2022	2	Razorbill	0.56	0.35	0.78	348	220	487	65	18.69%
09/06/2022	1	Razorbill	0.51	0.18	1.01	319	112	630	128	40.32%
21/06/2022	2	Razorbill	0.4	0.15	0.72	248	92	449	85	34.36%
04/07/2022	1	Razorbill	0.46	0.02	1.2	288	20	747	201	69.67%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
16/07/2022	2	Razorbill	3.5	2.2	4.91	2194	1380	3076	438	19.95%
08/08/2022	1	Razorbill	0.33	0.1	0.67	209	60	420	98	46.78%
23/08/2022	2	Razorbill	0.44	0.15	0.87	277	90	543	120	43.17%
13/09/2022	1	Razorbill	3.84	1.71	6.68	2405	1076	4185	781	32.48%
25/09/2022	2	Razorbill	0.21	0.09	0.35	128	51	215	40	30.91%
10/10/2022	1	Razorbill	0.82	0.46	1.2	512	290	753	107	20.94%
07/11/2022	1	Razorbill	0.99	0.53	1.56	618	330	974	163	26.31%
13/12/2022	1	Razorbill	2.58	2	3.24	1613	1253	2031	188	11.64%
26/01/2023	1	Razorbill	1.55	0.68	2.59	972	430	1624	291	29.95%
10/02/2023	1	Razorbill	12.14	8.61	16.03	7608	5396	10039	1144	15.04%
24/03/2023	1	Razorbill	8.81	5.51	12.5	5526	3459	7830	1059	19.17%
05/04/2023	1	Razorbill	3.63	2.59	4.76	2268	1627	2984	331	14.59%
03/05/2023	1	Razorbill	0.28	0.1	0.55	173	60	344	67	38.75%
17/06/2023	1	Razorbill	0.77	0.46	1.14	484	288	718	107	22.03%
05/07/2023	1	Razorbill	1.35	0.75	2.07	844	471	1307	202	23.94%
10/08/2023	1	Razorbill	5.75	3.02	9.38	3605	1891	5873	1058	29.36%
22/03/2021	1	Puffin	0.38	0.23	0.57	244	150	358	44	18.03%
04/04/2021	1	Puffin	0.04	0.01	0.1	30	6	63	12	39.65%
12/05/2021	1	Puffin	0.03	0.01	0.08	23	7	51	14	60%
09/06/2021	1	Puffin	0.05	0.01	0.08	27	10	50	12	43.48%
24/07/2021	3	Puffin	0.37	0.27	0.49	238	170	308	36	15.2%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
14/08/2021	1	Puffin	2.27	1.54	3.09	1420	965	1934	252	17.72%
07/09/2021	1	Puffin	1.62	1.28	1.97	1011	806	1234	107	10.6%
09/10/2021	1	Puffin	1.67	1.27	2.15	1046	792	1344	136	12.97%
02/11/2021	1	Puffin	0.73	0.61	0.85	457	381	536	41	8.93%
15/12/2021	1	Puffin	0.09	0.03	0.2	58	22	127	28	48%
06/01/2022	1	Puffin	0	0	0	0	0	0	0	0
23/02/2022	1	Puffin	0.02	0	0.05	13	3	29	8	63.64%
11/03/2022	1	Puffin	0.51	0.33	0.75	325	204	466	68	20.79%
22/03/2022	2	Puffin	0.23	0.14	0.33	147	91	215	27	18.7%
02/04/2022	1	Puffin	0.05	0.01	0.09	30	9	56	12	38.46%
15/04/2022	2	Puffin	0.17	0.07	0.34	112	41	211	37	33.03%
02/05/2022	1	Puffin	0.45	0.3	0.63	284	188	396	56	19.67%
17/05/2022	2	Puffin	0.02	0	0.05	12	2	27	7	60%
09/06/2022	1	Puffin	0.07	0.01	0.13	41	8	85	16	38.08%
21/06/2022	2	Puffin	0	0	0	0	0	0	0	0
04/07/2022	1	Puffin	0.09	0.01	0.2	59	8	125	30	50.98%
16/07/2022	2	Puffin	0.31	0.19	0.48	196	116	304	38	19.2%
08/08/2022	1	Puffin	0.12	0.05	0.2	73	30	125	24	33.33%
23/08/2022	2	Puffin	0.03	0.01	0.06	19	5	37	8	43.75%
13/09/2022	1	Puffin	0.28	0.19	0.4	178	116	250	35	19.61%
25/09/2022	2	Puffin	0.16	0.06	0.27	103	36	165	35	34.09%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
10/10/2022	1	Puffin	0.36	0.17	0.59	227	108	375	72	31.79%
07/11/2022	1	Puffin	0.16	0.07	0.29	105	47	182	35	33.33%
13/12/2022	1	Puffin	0.28	0.12	0.48	178	73	299	57	32.03%
26/01/2023	1	Puffin	0	0	0	0	0	0	0	0
10/02/2023	1	Puffin	0.22	0.08	0.41	139	51	253	52	37.82%
24/03/2023	1	Puffin	0.17	0.05	0.33	101	28	209	35	34.66%
05/04/2023	1	Puffin	0.21	0.13	0.29	129	84	182	26	19.82%
03/05/2023	1	Puffin	0.22	0.09	0.35	133	56	226	35	26.34%
17/06/2023	1	Puffin	0.1	0.02	0.21	67	19	131	25	36.9%
05/07/2023	1	Puffin	0.33	0.16	0.48	205	103	302	52	25.57%
10/08/2023	1	Puffin	1.14	0.76	1.65	712	472	1040	151	21.28%
Unapportioned										
22/03/2021	1	Guillemot	8.7	6.96	10.52	3801	3035	4598	364	9.59%
04/04/2021	1	Guillemot	37.2	27.45	51.16	16243	11989	22341	2648	16.3%
12/05/2021	1	Guillemot	6.38	5.17	7.75	2785	2257	3381	285	10.22%
09/06/2021	1	Guillemot	1.32	0.86	1.77	573	373	773	98	17.06%
24/07/2021	3	Guillemot	11.41	7.99	15.48	4982	3488	6761	805	16.17%
14/08/2021	1	Guillemot	22.61	10.24	39.41	9868	4473	17206	3433	34.78%
07/09/2021	1	Guillemot	27.2	21.24	33.22	11879	9276	14502	1357	11.43%
09/10/2021	1	Guillemot	8.85	6.82	11.35	3867	2980	4961	432	11.17%
02/11/2021	1	Guillemot	8.12	6.3	9.89	3546	2753	4319	396	11.16%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
15/12/2021	1	Guillemot	4.41	3.77	5.06	1924	1645	2210	127	6.61%
06/01/2022	1	Guillemot	0.77	0.46	1.11	338	200	484	67	19.96%
23/02/2022	1	Guillemot	7.29	5.42	9.42	3186	2369	4112	400	12.57%
11/03/2022	1	Guillemot	12.45	8.12	17.77	5433	3545	7761	1021	18.79%
22/03/2022	2	Guillemot	12.2	9.78	14.74	5328	4266	6439	493	9.25%
02/04/2022	1	Guillemot	34.31	26.46	42.33	14978	11551	18486	1589	10.61%
15/04/2022	2	Guillemot	17.68	11.73	23.95	7719	5120	10460	1270	16.46%
02/05/2022	1	Guillemot	17.21	13.94	20.78	7515	6092	9073	748	9.95%
17/05/2022	2	Guillemot	4.63	3.61	5.62	2022	1576	2453	211	10.46%
09/06/2022	1	Guillemot	2.15	1.62	2.7	939	706	1179	114	12.11%
21/06/2022	2	Guillemot	6.11	4.58	7.85	2667	2000	3427	349	13.09%
04/07/2022	1	Guillemot	2.57	1.72	3.44	1123	756	1501	184	16.34%
16/07/2022	2	Guillemot	8.64	6.69	10.87	3775	2919	4748	442	11.7%
08/08/2022	1	Guillemot	13.52	6.36	23.02	5907	2777	10048	1924	32.57%
23/08/2022	2	Guillemot	3.84	2.2	5.75	1680	962	2511	406	24.14%
13/09/2022	1	Guillemot	5.4	3.59	7.94	2359	1570	3468	485	20.55%
25/09/2022	2	Guillemot	1.89	1.32	2.52	828	577	1098	132	15.93%
10/10/2022	1	Guillemot	2.69	1.62	3.89	1177	708	1697	205	17.41%
07/11/2022	1	Guillemot	2.15	1.09	3.36	939	478	1470	249	26.54%
13/12/2022	1	Guillemot	5.16	4.08	6.31	2254	1781	2753	181	8.01%
26/01/2023	1	Guillemot	3.17	0.68	6.29	1387	300	2753	609	43.93%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
10/02/2023	1	Guillemot	4.63	2.92	6.73	2026	1275	2941	407	20.1%
24/03/2023	1	Guillemot	11.24	7.78	15.2	4909	3400	6640	790	16.08%
05/04/2023	1	Guillemot	16.05	11.96	21.58	7013	5219	9426	1102	15.72%
03/05/2023	1	Guillemot	2.26	1.87	2.64	987	816	1152	76	7.67%
17/06/2023	1	Guillemot	2.62	1.66	3.71	1145	725	1624	227	19.79%
05/07/2023	1	Guillemot	2.91	1.91	3.9	1273	835	1702	206	16.16%
10/08/2023	1	Guillemot	11.86	10.41	13.52	5180	4545	5906	335	6.46%
22/03/2021	1	Razorbill	5.89	4.56	7.22	2571	1993	3150	270	10.49%
04/04/2021	1	Razorbill	13.03	7.72	20.2	5685	3375	8818	1309	23.02%
12/05/2021	1	Razorbill	0.58	0.21	1.04	254	94	459	85	33.61%
09/06/2021	1	Razorbill	0.26	0.11	0.44	116	49	189	30	26.24%
24/07/2021	3	Razorbill	3	1.03	5.67	1309	451	2481	511	39.03%
14/08/2021	1	Razorbill	2.73	0.95	5.23	1192	414	2284	478	40.1%
07/09/2021	1	Razorbill	2.03	1.25	2.87	884	544	1255	183	20.75%
09/10/2021	1	Razorbill	1.25	0.57	2.09	546	253	909	130	23.72%
02/11/2021	1	Razorbill	3.04	2.22	4.02	1330	972	1755	192	14.46%
15/12/2021	1	Razorbill	2.98	2.05	4.08	1305	898	1786	224	17.13%
06/01/2022	1	Razorbill	0.88	0.44	1.36	384	193	593	104	27.07%
23/02/2022	1	Razorbill	7.57	6.36	8.87	3310	2777	3873	261	7.9%
11/03/2022	1	Razorbill	4.76	2.45	7.21	2079	1069	3148	494	23.75%
22/03/2022	2	Razorbill	1.99	1.32	2.74	873	578	1196	158	18.08%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
02/04/2022	1	Razorbill	2.59	1.62	3.73	1132	711	1630	207	18.27%
15/04/2022	2	Razorbill	1.67	0.83	2.71	730	367	1184	165	22.55%
02/05/2022	1	Razorbill	3.34	2.27	4.65	1463	995	2029	230	15.7%
17/05/2022	2	Razorbill	0.42	0.2	0.68	181	88	298	55	30.41%
09/06/2022	1	Razorbill	0.27	0.06	0.5	116	29	221	51	44.21%
21/06/2022	2	Razorbill	0.35	0.11	0.64	154	51	280	64	41.27%
04/07/2022	1	Razorbill	0.13	0	0.34	58	0	146	32	54.43%
16/07/2022	2	Razorbill	3.21	1.91	4.97	1399	835	2173	336	24.05%
08/08/2022	1	Razorbill	0.18	0.04	0.37	82	15	159	38	46.27%
23/08/2022	2	Razorbill	0.48	0.1	1.06	209	43	464	111	53.22%
13/09/2022	1	Razorbill	1.79	1.04	2.72	782	456	1186	175	22.37%
25/09/2022	2	Razorbill	0.19	0.06	0.39	88	28	173	35	39.63%
10/10/2022	1	Razorbill	0.56	0.18	1.04	244	78	454	93	38.1%
07/11/2022	1	Razorbill	0.74	0.33	1.29	330	143	563	104	31.57%
13/12/2022	1	Razorbill	2.37	1.53	3.37	1034	668	1474	197	19.09%
26/01/2023	1	Razorbill	1.81	0.68	3.09	788	298	1349	264	33.49%
10/02/2023	1	Razorbill	14.28	8.92	19.76	6237	3892	8629	1131	18.13%
24/03/2023	1	Razorbill	8.71	4.88	12.79	3801	2129	5589	856	22.51%
05/04/2023	1	Razorbill	3.66	2.58	4.89	1595	1126	2139	238	14.93%
03/05/2023	1	Razorbill	0.24	0.09	0.42	101	35	185	32	32.08%
17/06/2023	1	Razorbill	0.99	0.59	1.44	433	254	632	99	22.88%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
05/07/2023	1	Razorbill	1.34	0.65	2.21	585	285	965	164	28.09%
10/08/2023	1	Razorbill	3.77	1.94	7.2	1647	851	3139	588	35.7%
22/03/2021	1	Puffin	0.25	0.1	0.43	111	48	189	30	27.45%
04/04/2021	1	Puffin	0.06	0.01	0.13	29	7	60	12	41.46%
12/05/2021	1	Puffin	0.03	0	0.09	15	0	42	14	92.31%
09/06/2021	1	Puffin	0.01	0	0.05	7	0	21	7	100%
24/07/2021	3	Puffin	0.21	0.13	0.3	92	56	132	20	21.52%
14/08/2021	1	Puffin	0.96	0.61	1.34	417	266	588	80	19.27%
07/09/2021	1	Puffin	0.97	0.66	1.27	421	289	556	70	16.62%
09/10/2021	1	Puffin	1.11	0.73	1.52	486	320	666	84	17.31%
02/11/2021	1	Puffin	0.58	0.42	0.73	254	182	320	35	13.76%
15/12/2021	1	Puffin	0.01	0	0.05	7	0	21	7	100%
06/01/2022	1	Puffin	0	0	0	0	0	0	0	0
23/02/2022	1	Puffin	0	0	0	0	0	0	0	0
11/03/2022	1	Puffin	0.26	0.09	0.47	112	42	205	43	38.54%
22/03/2022	2	Puffin	0.07	0	0.23	34	0	101	23	67.53%
02/04/2022	1	Puffin	0.03	0	0.08	14	0	34	9	66.67%
15/04/2022	2	Puffin	0.06	0	0.17	26	0	78	18	67.58%
02/05/2022	1	Puffin	0.4	0.19	0.64	174	84	282	51	29.53%
17/05/2022	2	Puffin	0.01	0	0.05	7	0	21	7	100%
09/06/2022	1	Puffin	0.04	0	0.13	20	0	58	13	63.1%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
21/06/2022	2	Puffin	0	0	0	0	0	0	0	0
04/07/2022	1	Puffin	0.01	0	0.05	8	0	21	7	85.71%
16/07/2022	2	Puffin	0.18	0.06	0.35	83	28	155	29	34.57%
08/08/2022	1	Puffin	0.07	0.01	0.13	29	7	58	15	52%
23/08/2022	2	Puffin	0.01	0	0.05	7	0	21	7	100%
13/09/2022	1	Puffin	0.2	0.08	0.31	85	35	137	27	31.51%
25/09/2022	2	Puffin	0.07	0	0.17	29	0	79	22	76%
10/10/2022	1	Puffin	0.27	0.06	0.61	116	27	266	65	56%
07/11/2022	1	Puffin	0.07	0	0.15	29	0	68	16	56%
13/12/2022	1	Puffin	0.21	0.06	0.4	92	27	174	40	43.04%
26/01/2023	1	Puffin	0	0	0	0	0	0	0	0
10/02/2023	1	Puffin	0.03	0	0.08	14	0	35	9	66.67%
24/03/2023	1	Puffin	0.06	0	0.19	28	0	83	27	95.83%
05/04/2023	1	Puffin	0.05	0	0.13	22	0	56	15	68.42%
03/05/2023	1	Puffin	0.15	0.03	0.29	62	14	129	23	37.29%
17/06/2023	1	Puffin	0.04	0	0.12	21	0	53	11	52.42%
05/07/2023	1	Puffin	0.24	0.13	0.36	106	55	158	27	25.27%
10/08/2023	1	Puffin	0.56	0.23	1	246	105	437	87	35.55%

Table 12.70. Overview of survey data with availability bias for auks in the array area plus 2km both apportioned and unapportioned..

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
Apportioned										
22/03/2021	1	Guillemot	10.17	8.42	12.47	6369	5271	7820	587	9.22%
04/04/2021	1	Guillemot	34.45	25.63	45.08	21585	16061	28239	2911	13.48%
12/05/2021	1	Guillemot	7.53	5.68	9.76	4719	3559	6110	588	12.47%
09/06/2021	1	Guillemot	1.7	1.25	2.2	1062	785	1380	138	12.97%
24/07/2021	3	Guillemot	12.19	8.55	16.46	7644	5357	10312	1272	16.65%
14/08/2021	1	Guillemot	24.29	12.93	38.06	15222	8100	23847	4074	26.76%
07/09/2021	1	Guillemot	27.91	21.91	34.44	17488	13725	21577	1976	11.3%
09/10/2021	1	Guillemot	9.66	7.54	12	6050	4725	7515	628	10.38%
02/11/2021	1	Guillemot	8.66	6.89	10.51	5431	4319	6590	527	9.71%
15/12/2021	1	Guillemot	4.6	3.85	5.41	2888	2412	3388	219	7.59%
06/01/2022	1	Guillemot	0.93	0.62	1.26	579	391	790	95	16.42%
23/02/2022	1	Guillemot	6.7	5.15	8.61	4203	3236	5392	497	11.82%
11/03/2022	1	Guillemot	11.14	7.76	14.85	6972	4865	9300	1099	15.77%
22/03/2022	2	Guillemot	13.04	10.58	16.22	8171	6630	10166	802	9.82%
02/04/2022	1	Guillemot	39.88	32	48.26	24984	20044	30234	2491	9.97%
15/04/2022	2	Guillemot	18.51	13.03	24.43	11594	8156	15302	1740	15.01%
02/05/2022	1	Guillemot	20.45	16.51	24.91	12806	10349	15600	1296	10.12%
17/05/2022	2	Guillemot	6.56	5.01	8.73	4110	3137	5473	546	13.29%
09/06/2022	1	Guillemot	3.59	2.02	6.58	2253	1266	4129	778	34.55%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
21/06/2022	2	Guillemot	6.74	5.35	8.3	4221	3351	5202	444	10.53%
04/07/2022	1	Guillemot	3.33	2.36	4.43	2089	1475	2775	310	14.84%
16/07/2022	2	Guillemot	10.41	6.99	15.01	6525	4381	9406	1317	20.18%
08/08/2022	1	Guillemot	19.15	11.53	26.98	11998	7222	16899	2467	20.57%
23/08/2022	2	Guillemot	4.67	3.16	6.61	2932	1982	4142	531	18.1%
13/09/2022	1	Guillemot	9.76	5.8	14.74	6113	3631	9238	1458	23.85%
25/09/2022	2	Guillemot	2.13	1.59	2.76	1333	997	1732	181	13.55%
10/10/2022	1	Guillemot	3.74	2.67	4.92	2346	1674	3085	302	12.88%
07/11/2022	1	Guillemot	2.68	1.55	3.86	1681	973	2418	354	21.08%
13/12/2022	1	Guillemot	5.66	4.65	6.84	3554	2909	4287	262	7.38%
26/01/2023	1	Guillemot	2.71	0.91	5.15	1702	571	3233	639	37.56%
10/02/2023	1	Guillemot	4.68	3.13	6.47	2931	1959	4053	464	15.82%
24/03/2023	1	Guillemot	10.64	7.94	13.73	6667	4975	8594	843	12.65%
05/04/2023	1	Guillemot	15.1	11.95	19.49	9462	7483	12211	1239	13.1%
03/05/2023	1	Guillemot	6.27	2.33	13.71	3929	1456	8586	2174	55.34%
17/06/2023	1	Guillemot	3	1.96	4.26	1881	1231	2673	351	18.64%
05/07/2023	1	Guillemot	3.46	2.46	4.5	2166	1544	2821	318	14.66%
10/08/2023	1	Guillemot	13.84	11.68	16.58	8671	7319	10389	776	8.94%
22/03/2021	1	Razorbill	6.69	5.57	7.76	4190	3490	4864	311	7.42%
04/04/2021	1	Razorbill	11.22	7.02	16.29	7028	4402	10208	1399	19.91%
12/05/2021	1	Razorbill	0.75	0.38	1.17	473	238	732	110	23.28%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
09/06/2021	1	Razorbill	0.29	0.17	0.43	183	110	269	36	19.84%
24/07/2021	3	Razorbill	3.56	1.81	5.74	2235	1131	3599	628	28.11%
14/08/2021	1	Razorbill	3.67	1.32	7.06	2300	829	4428	926	40.28%
07/09/2021	1	Razorbill	2.14	1.54	2.85	1337	964	1786	208	15.54%
09/10/2021	1	Razorbill	1.31	0.81	1.94	821	512	1213	136	16.52%
02/11/2021	1	Razorbill	3.67	2.82	4.54	2299	1768	2841	256	11.13%
15/12/2021	1	Razorbill	3.36	2.54	4.27	2102	1594	2669	287	13.66%
06/01/2022	1	Razorbill	0.81	0.48	1.19	505	299	744	116	23%
23/02/2022	1	Razorbill	7.69	6.51	9.05	4812	4082	5673	385	7.99%
11/03/2022	1	Razorbill	4.7	2.95	6.55	2947	1850	4104	552	18.74%
22/03/2022	2	Razorbill	2.05	1.42	2.69	1287	890	1689	198	15.4%
02/04/2022	1	Razorbill	2.97	2.17	3.97	1866	1355	2487	248	13.29%
15/04/2022	2	Razorbill	1.79	1.08	2.62	1119	681	1640	194	17.3%
02/05/2022	1	Razorbill	3.82	2.79	4.95	2393	1748	3096	308	12.86%
17/05/2022	2	Razorbill	0.56	0.35	0.78	348	220	487	65	18.69%
09/06/2022	1	Razorbill	0.51	0.18	1.01	319	112	630	128	40.32%
21/06/2022	2	Razorbill	0.4	0.15	0.72	248	92	449	85	34.36%
04/07/2022	1	Razorbill	0.46	0.02	1.2	288	20	747	201	69.67%
16/07/2022	2	Razorbill	3.5	2.2	4.91	2194	1380	3076	438	19.95%
08/08/2022	1	Razorbill	0.33	0.1	0.67	209	60	420	98	46.78%
23/08/2022	2	Razorbill	0.44	0.15	0.87	277	90	543	120	43.17%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
13/09/2022	1	Razorbill	3.84	1.71	6.68	2405	1076	4185	781	32.48%
25/09/2022	2	Razorbill	0.21	0.09	0.35	128	51	215	40	30.91%
10/10/2022	1	Razorbill	0.82	0.46	1.2	512	290	753	107	20.94%
07/11/2022	1	Razorbill	0.99	0.53	1.56	618	330	974	163	26.31%
13/12/2022	1	Razorbill	2.58	2	3.24	1613	1253	2031	188	11.64%
26/01/2023	1	Razorbill	1.55	0.68	2.59	972	430	1624	291	29.95%
10/02/2023	1	Razorbill	12.14	8.61	16.03	7608	5396	10039	1144	15.04%
24/03/2023	1	Razorbill	8.81	5.51	12.5	5526	3459	7830	1059	19.17%
05/04/2023	1	Razorbill	3.63	2.59	4.76	2268	1627	2984	331	14.59%
03/05/2023	1	Razorbill	0.28	0.1	0.55	173	60	344	67	38.75%
17/06/2023	1	Razorbill	0.77	0.46	1.14	484	288	718	107	22.03%
05/07/2023	1	Razorbill	1.35	0.75	2.07	844	471	1307	202	23.94%
10/08/2023	1	Razorbill	5.75	3.02	9.38	3605	1891	5873	1058	29.36%
22/03/2021	1	Puffin	0.38	0.23	0.57	244	150	358	44	18.03%
04/04/2021	1	Puffin	0.04	0.01	0.1	30	6	63	12	39.65%
12/05/2021	1	Puffin	0.03	0.01	0.08	23	7	51	14	60%
09/06/2021	1	Puffin	0.05	0.01	0.08	27	10	50	12	43.48%
24/07/2021	3	Puffin	0.37	0.27	0.49	238	170	308	36	15.2%
14/08/2021	1	Puffin	2.27	1.54	3.09	1420	965	1934	252	17.72%
07/09/2021	1	Puffin	1.62	1.28	1.97	1011	806	1234	107	10.6%
09/10/2021	1	Puffin	1.67	1.27	2.15	1046	792	1344	136	12.97%

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02/11/2021	1	Puffin	0.73	0.61	0.85	457	381	536	41	8.93%
15/12/2021	1	Puffin	0.09	0.03	0.2	58	22	127	28	48%
06/01/2022	1	Puffin	0	0	0	0	0	0	0	0
23/02/2022	1	Puffin	0.02	0	0.05	13	3	29	8	63.64%
11/03/2022	1	Puffin	0.51	0.33	0.75	325	204	466	68	20.79%
22/03/2022	2	Puffin	0.23	0.14	0.33	147	91	215	27	18.7%
02/04/2022	1	Puffin	0.05	0.01	0.09	30	9	56	12	38.46%
15/04/2022	2	Puffin	0.17	0.07	0.34	112	41	211	37	33.03%
02/05/2022	1	Puffin	0.45	0.3	0.63	284	188	396	56	19.67%
17/05/2022	2	Puffin	0.02	0	0.05	12	2	27	7	60%
09/06/2022	1	Puffin	0.07	0.01	0.13	41	8	85	16	38.08%
21/06/2022	2	Puffin	0	0	0	0	0	0	0	0
04/07/2022	1	Puffin	0.09	0.01	0.2	59	8	125	30	50.98%
16/07/2022	2	Puffin	0.31	0.19	0.48	196	116	304	38	19.2%
08/08/2022	1	Puffin	0.12	0.05	0.2	73	30	125	24	33.33%
23/08/2022	2	Puffin	0.03	0.01	0.06	19	5	37	8	43.75%
13/09/2022	1	Puffin	0.28	0.19	0.4	178	116	250	35	19.61%
25/09/2022	2	Puffin	0.16	0.06	0.27	103	36	165	35	34.09%
10/10/2022	1	Puffin	0.36	0.17	0.59	227	108	375	72	31.79%
07/11/2022	1	Puffin	0.16	0.07	0.29	105	47	182	35	33.33%
13/12/2022	1	Puffin	0.28	0.12	0.48	178	73	299	57	32.03%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
26/01/2023	1	Puffin	0	0	0	0	0	0	0	0
10/02/2023	1	Puffin	0.22	0.08	0.41	139	51	253	52	37.82%
24/03/2023	1	Puffin	0.17	0.05	0.33	101	28	209	35	34.66%
05/04/2023	1	Puffin	0.21	0.13	0.29	129	84	182	26	19.82%
03/05/2023	1	Puffin	0.22	0.09	0.35	133	56	226	35	26.34%
17/06/2023	1	Puffin	0.1	0.02	0.21	67	19	131	25	36.9%
05/07/2023	1	Puffin	0.33	0.16	0.48	205	103	302	52	25.57%
10/08/2023	1	Puffin	1.14	0.76	1.65	712	472	1040	151	21.28%
Unapportioned										
22/03/2021	1	Guillemot	9.17	7.26	11.42	5745	4547	7152	612	10.66%
04/04/2021	1	Guillemot	33.36	25.45	43.41	20900	15941	27192	2782	13.31%
12/05/2021	1	Guillemot	7.13	5.4	9.53	4466	3382	5967	615	13.76%
09/06/2021	1	Guillemot	1.55	1.08	2.03	967	676	1268	139	14.36%
24/07/2021	3	Guillemot	11.6	8.26	15.81	7270	5170	9903	1193	16.42%
14/08/2021	1	Guillemot	22.88	12.53	36.22	14340	7856	22693	3816	26.61%
07/09/2021	1	Guillemot	26.65	20.84	33.11	16694	13060	20745	1959	11.74%
09/10/2021	1	Guillemot	8.84	6.8	11.07	5534	4262	6937	623	11.26%
02/11/2021	1	Guillemot	8.18	6.46	9.91	5127	4050	6208	527	10.28%
15/12/2021	1	Guillemot	4.2	3.49	4.92	2634	2183	3077	202	7.68%
06/01/2022	1	Guillemot	0.77	0.51	1.06	490	321	663	82	16.7%
23/02/2022	1	Guillemot	6.4	4.85	8.31	4009	3040	5205	484	12.06%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
11/03/2022	1	Guillemot	10.6	7.39	14.03	6636	4632	8788	1042	15.7%
22/03/2022	2	Guillemot	11.82	9.57	14.54	7410	6004	9116	741	10%
02/04/2022	1	Guillemot	39.05	31.63	48.38	24465	19816	30310	2453	10.03%
15/04/2022	2	Guillemot	18.06	12.08	24.08	11317	7567	15082	1789	15.81%
02/05/2022	1	Guillemot	19.77	16.09	23.59	12391	10076	14786	1177	9.5%
17/05/2022	2	Guillemot	6.43	4.88	8.64	4030	3058	5412	552	13.69%
09/06/2022	1	Guillemot	3.59	1.94	6.31	2250	1216	3958	744	33.07%
21/06/2022	2	Guillemot	6.61	5.25	8.07	4141	3292	5065	410	9.91%
04/07/2022	1	Guillemot	3.29	2.42	4.31	2065	1522	2699	284	13.74%
16/07/2022	2	Guillemot	9.88	6.8	14.53	6185	4262	9101	1267	20.48%
08/08/2022	1	Guillemot	18.38	11.36	26.31	11511	7115	16480	2494	21.66%
23/08/2022	2	Guillemot	4.63	3.17	6.31	2905	1992	3953	513	17.68%
13/09/2022	1	Guillemot	9.21	5.35	14.16	5769	3355	8875	1417	24.56%
25/09/2022	2	Guillemot	2.05	1.51	2.7	1285	952	1689	182	14.16%
10/10/2022	1	Guillemot	3.36	2.31	4.56	2108	1444	2854	291	13.81%
07/11/2022	1	Guillemot	2.43	1.46	3.61	1520	915	2260	335	22.01%
13/12/2022	1	Guillemot	5.16	4.2	6.24	3235	2629	3910	242	7.49%
26/01/2023	1	Guillemot	2.55	0.76	5.06	1595	475	3172	655	41.07%
10/02/2023	1	Guillemot	4.47	3.04	6.09	2805	1908	3817	430	15.34%
24/03/2023	1	Guillemot	10.24	7.64	13.21	6422	4789	8284	830	12.93%
05/04/2023	1	Guillemot	14.78	11.66	19	9257	7303	11900	1180	12.75%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
03/05/2023	1	Guillemot	6.15	2.3	13.51	3847	1441	8465	2110	54.83%
17/06/2023	1	Guillemot	2.93	1.91	4.19	1840	1196	2620	336	18.27%
05/07/2023	1	Guillemot	3.34	2.39	4.38	2091	1494	2750	306	14.62%
10/08/2023	1	Guillemot	13.54	11.52	16.24	8481	7217	10173	745	8.79%
22/03/2021	1	Razorbill	5.76	4.77	6.85	3611	2994	4289	295	8.18%
04/04/2021	1	Razorbill	10.89	6.87	15.8	6823	4310	9904	1366	20.02%
12/05/2021	1	Razorbill	0.63	0.27	1.02	395	165	640	105	26.54%
09/06/2021	1	Razorbill	0.18	0.07	0.32	117	44	196	33	28.03%
24/07/2021	3	Razorbill	3.21	1.52	5.35	2010	946	3348	591	29.38%
14/08/2021	1	Razorbill	3.41	1.16	6.33	2140	728	3968	887	41.46%
07/09/2021	1	Razorbill	1.97	1.39	2.59	1234	876	1622	193	15.64%
09/10/2021	1	Razorbill	1.17	0.68	1.8	734	424	1125	138	18.83%
02/11/2021	1	Razorbill	3.24	2.39	4.07	2026	1501	2554	253	12.51%
15/12/2021	1	Razorbill	2.79	1.97	3.61	1748	1232	2256	273	15.59%
06/01/2022	1	Razorbill	0.68	0.39	1.05	427	246	655	108	25.21%
23/02/2022	1	Razorbill	7.27	6.09	8.6	4553	3814	5389	392	8.61%
11/03/2022	1	Razorbill	4.37	2.65	6.27	2738	1664	3933	551	20.13%
22/03/2022	2	Razorbill	1.82	1.26	2.49	1144	792	1560	197	17.21%
02/04/2022	1	Razorbill	2.73	1.92	3.68	1708	1204	2305	232	13.59%
15/04/2022	2	Razorbill	1.71	1.04	2.48	1070	649	1553	187	17.49%
02/05/2022	1	Razorbill	3.62	2.6	4.82	2274	1632	3016	305	13.4%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
17/05/2022	2	Razorbill	0.49	0.29	0.7	309	188	440	61	19.88%
09/06/2022	1	Razorbill	0.44	0.12	0.89	274	78	552	119	43.38%
21/06/2022	2	Razorbill	0.39	0.13	0.72	242	88	450	85	35.23%
04/07/2022	1	Razorbill	0.44	0.02	1.19	279	15	751	200	71.5%
16/07/2022	2	Razorbill	3.11	1.86	4.59	1949	1162	2881	422	21.64%
08/08/2022	1	Razorbill	0.33	0.09	0.66	208	51	412	94	45.29%
23/08/2022	2	Razorbill	0.42	0.12	0.82	264	78	511	115	43.52%
13/09/2022	1	Razorbill	3.64	1.66	6.12	2278	1041	3831	730	32.03%
25/09/2022	2	Razorbill	0.19	0.07	0.34	119	44	210	41	34.14%
10/10/2022	1	Razorbill	0.76	0.44	1.12	474	276	706	102	21.58%
07/11/2022	1	Razorbill	0.8	0.43	1.31	504	268	824	141	27.89%
13/12/2022	1	Razorbill	2.23	1.65	2.87	1394	1031	1799	188	13.47%
26/01/2023	1	Razorbill	1.41	0.6	2.32	889	375	1453	262	29.44%
10/02/2023	1	Razorbill	11.91	7.97	15.97	7460	4997	10011	1194	16.01%
24/03/2023	1	Razorbill	8.51	5.32	11.82	5334	3331	7402	1005	18.85%
05/04/2023	1	Razorbill	3.44	2.43	4.55	2155	1524	2856	329	15.29%
03/05/2023	1	Razorbill	0.26	0.07	0.52	167	45	329	67	40.12%
17/06/2023	1	Razorbill	0.74	0.45	1.09	470	282	684	104	22.13%
05/07/2023	1	Razorbill	1.25	0.67	1.92	786	419	1203	197	25.1%
10/08/2023	1	Razorbill	5.67	2.86	9.62	3552	1793	6024	1068	30.07%
22/03/2021	1	Puffin	0.27	0.14	0.44	174	87	280	39	22.7%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
04/04/2021	1	Puffin	0.04	0	0.1	28	0	60	12	43.19%
12/05/2021	1	Puffin	0.02	0	0.07	14	0	42	14	100%
09/06/2021	1	Puffin	0.01	0	0.03	8	0	21	7	85.71%
24/07/2021	3	Puffin	0.21	0.13	0.29	134	84	184	26	19.13%
14/08/2021	1	Puffin	1.12	0.8	1.46	702	504	911	110	15.59%
07/09/2021	1	Puffin	0.94	0.71	1.18	588	443	736	78	13.27%
09/10/2021	1	Puffin	1.11	0.75	1.58	694	469	989	127	18.31%
02/11/2021	1	Puffin	0.55	0.43	0.68	344	273	422	38	11.19%
15/12/2021	1	Puffin	0.06	0	0.15	36	0	98	29	80.65%
06/01/2022	1	Puffin	0	0	0	0	0	0	0	0
23/02/2022	1	Puffin	0.01	0	0.03	8	0	21	7	85.71%
11/03/2022	1	Puffin	0.29	0.15	0.45	184	97	285	49	26.58%
22/03/2022	2	Puffin	0.1	0.02	0.2	62	14	129	26	42.51%
02/04/2022	1	Puffin	0.03	0	0.07	22	0	47	12	52.63%
15/04/2022	2	Puffin	0.1	0	0.23	63	0	150	31	49.93%
02/05/2022	1	Puffin	0.3	0.15	0.48	190	93	301	54	28.22%
17/05/2022	2	Puffin	0.01	0	0.03	8	0	22	7	85.71%
09/06/2022	1	Puffin	0.04	0	0.1	29	0	61	13	44.98%
21/06/2022	2	Puffin	0	0	0	0	0	0	0	0
04/07/2022	1	Puffin	0.06	0	0.13	35	0	84	23	66.67%
16/07/2022	2	Puffin	0.19	0.07	0.35	119	42	215	34	28.89%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
08/08/2022	1	Puffin	0.07	0.01	0.13	43	7	84	20	45.95%
23/08/2022	2	Puffin	0.01	0	0.03	7	0	21	7	100%
13/09/2022	1	Puffin	0.17	0.09	0.27	107	56	167	29	27.17%
25/09/2022	2	Puffin	0.07	0.01	0.15	42	7	92	22	52.78%
10/10/2022	1	Puffin	0.34	0.15	0.58	211	96	365	69	32.6%
07/11/2022	1	Puffin	0.07	0.01	0.14	43	7	85	21	48.65%
13/12/2022	1	Puffin	0.16	0.05	0.31	105	28	195	43	41.11%
26/01/2023	1	Puffin	0	0	0	0	0	0	0	0
10/02/2023	1	Puffin	0.07	0	0.15	42	0	97	26	61.11%
24/03/2023	1	Puffin	0.07	0	0.2	41	0	130	31	74.98%
05/04/2023	1	Puffin	0.03	0	0.09	22	0	56	15	68.42%
03/05/2023	1	Puffin	0.15	0.06	0.28	96	36	169	26	27.31%
17/06/2023	1	Puffin	0.08	0.01	0.17	49	7	110	23	46.86%
05/07/2023	1	Puffin	0.17	0.08	0.27	113	55	167	29	25.77%
10/08/2023	1	Puffin	0.56	0.26	0.99	348	161	617	118	33.78%

Table 12.71. Overview of survey data with availability bias for auks in the array area plus 4km both apportioned and unapportioned.

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
Apportioned										
22/03/2021	1	Guillemot	10.55	8.62	12.7	8870	7254	10695	831	9.37%
04/04/2021	1	Guillemot	32.76	25.34	41.77	27559	21318	35147	3439	12.48%
12/05/2021	1	Guillemot	6.93	5.69	8.67	5832	4788	7292	581	9.97%
09/06/2021	1	Guillemot	1.72	1.34	2.14	1451	1129	1806	163	11.22%
24/07/2021	3	Guillemot	11.59	8.28	15.57	9756	6967	13102	1479	15.16%
14/08/2021	1	Guillemot	34.23	18.49	53.82	28795	15551	45276	7566	26.27%
07/09/2021	1	Guillemot	34.11	26.69	43.59	28702	22452	36673	3567	12.43%
09/10/2021	1	Guillemot	9.33	7.38	11.51	7854	6217	9692	763	9.71%
02/11/2021	1	Guillemot	8.45	7	9.91	7111	5889	8343	620	8.72%
15/12/2021	1	Guillemot	4.35	3.62	5.09	3660	3047	4283	273	7.46%
06/01/2022	1	Guillemot	0.82	0.59	1.07	689	489	908	96	13.9%
23/02/2022	1	Guillemot	5.99	4.54	7.73	5041	3823	6504	549	10.9%
11/03/2022	1	Guillemot	9.91	7.42	12.9	8338	6252	10854	1127	13.51%
22/03/2022	2	Guillemot	12.23	10.19	14.37	10287	8569	12086	790	7.67%
02/04/2022	1	Guillemot	37.79	30.88	45.61	31785	25974	38375	2959	9.31%
15/04/2022	2	Guillemot	17.94	13.29	22.56	15087	11173	18985	1823	12.08%
02/05/2022	1	Guillemot	20.54	17.06	24.1	17288	14356	20273	1540	8.91%
17/05/2022	2	Guillemot	6.24	4.93	7.88	5255	4145	6626	574	10.92%
09/06/2022	1	Guillemot	3.92	2.36	6.27	3294	1994	5282	864	26.23%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
21/06/2022	2	Guillemot	6.61	5.46	7.93	5567	4593	6673	495	8.88%
04/07/2022	1	Guillemot	4.29	3.05	5.8	3604	2569	4882	563	15.61%
16/07/2022	2	Guillemot	14.52	9.37	20.14	12212	7882	16946	2347	19.22%
08/08/2022	1	Guillemot	37.21	15.64	63.63	31300	13157	53531	10685	34.14%
23/08/2022	2	Guillemot	5.32	3.73	7.37	4474	3139	6203	807	18.04%
13/09/2022	1	Guillemot	11.75	7.38	16.82	9883	6205	14151	1990	20.13%
25/09/2022	2	Guillemot	2.22	1.7	2.77	1860	1433	2332	222	11.91%
10/10/2022	1	Guillemot	3.8	2.86	4.85	3194	2403	4077	348	10.89%
07/11/2022	1	Guillemot	2.96	1.87	4.21	2490	1575	3542	481	19.31%
13/12/2022	1	Guillemot	5.57	4.62	6.73	4682	3888	5659	336	7.18%
26/01/2023	1	Guillemot	2.73	1.08	4.85	2295	908	4077	753	32.81%
10/02/2023	1	Guillemot	4.71	3.34	6.56	3969	2817	5519	609	15.34%
24/03/2023	1	Guillemot	9.48	7.58	11.62	7976	6377	9772	800	10.02%
05/04/2023	1	Guillemot	13.68	11.03	17.26	11504	9274	14530	1276	11.09%
03/05/2023	1	Guillemot	5.74	2.57	11.39	4825	2160	9582	2316	48.01%
17/06/2023	1	Guillemot	3.14	2.24	4.2	2645	1887	3530	389	14.72%
05/07/2023	1	Guillemot	4.01	2.74	5.39	3372	2311	4534	558	16.56%
10/08/2023	1	Guillemot	16.19	12.77	20.74	13620	10741	17446	1726	12.67%
22/03/2021	1	Razorbill	6.32	5.27	7.38	5319	4442	6214	410	7.7%
04/04/2021	1	Razorbill	10.13	6.87	14.11	8517	5785	11865	1458	17.12%
12/05/2021	1	Razorbill	0.74	0.42	1.1	619	348	922	125	20.17%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
09/06/2021	1	Razorbill	0.35	0.21	0.5	296	174	427	56	18.86%
24/07/2021	3	Razorbill	3.91	2.08	5.95	3286	1748	5007	807	24.55%
14/08/2021	1	Razorbill	4.89	1.89	8.91	4111	1597	7495	1522	37.01%
07/09/2021	1	Razorbill	2.18	1.63	2.74	1833	1368	2306	241	13.13%
09/10/2021	1	Razorbill	1.37	0.88	1.98	1156	743	1664	163	14.09%
02/11/2021	1	Razorbill	3.7	2.94	4.46	3117	2468	3754	301	9.65%
15/12/2021	1	Razorbill	2.97	2.26	3.75	2504	1907	3153	324	12.93%
06/01/2022	1	Razorbill	0.75	0.5	1.04	627	418	874	116	18.52%
23/02/2022	1	Razorbill	7.14	5.96	8.24	6007	5016	6933	463	7.7%
11/03/2022	1	Razorbill	4.35	2.89	5.86	3659	2427	4929	624	17.06%
22/03/2022	2	Razorbill	2.06	1.48	2.71	1737	1248	2280	258	14.86%
02/04/2022	1	Razorbill	2.75	2	3.56	2306	1677	2991	288	12.51%
15/04/2022	2	Razorbill	2.11	1.23	3.18	1773	1035	2684	369	20.8%
02/05/2022	1	Razorbill	3.79	2.79	4.98	3184	2348	4187	409	12.85%
17/05/2022	2	Razorbill	0.57	0.4	0.75	484	336	639	74	15.21%
09/06/2022	1	Razorbill	0.52	0.23	0.9	440	196	762	142	32.28%
21/06/2022	2	Razorbill	0.38	0.18	0.65	326	150	549	95	29.11%
04/07/2022	1	Razorbill	0.75	0.26	1.51	634	213	1268	274	43.23%
16/07/2022	2	Razorbill	6.25	4.19	8.58	5267	3524	7217	938	17.8%
08/08/2022	1	Razorbill	0.51	0.22	0.9	430	188	759	149	34.66%
23/08/2022	2	Razorbill	0.57	0.27	0.95	480	226	808	147	30.53%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
13/09/2022	1	Razorbill	4.48	2.57	7.01	3765	2157	5903	938	24.9%
25/09/2022	2	Razorbill	0.24	0.1	0.42	205	78	361	55	26.97%
10/10/2022	1	Razorbill	0.68	0.42	0.98	571	359	825	108	18.98%
07/11/2022	1	Razorbill	1.28	0.66	2.03	1082	554	1708	264	24.37%
13/12/2022	1	Razorbill	2.53	2.04	3.06	2129	1719	2578	206	9.68%
26/01/2023	1	Razorbill	1.42	0.75	2.18	1195	628	1832	295	24.72%
10/02/2023	1	Razorbill	11.14	8.18	14.23	9376	6879	11969	1236	13.18%
24/03/2023	1	Razorbill	8.16	5.62	10.76	6869	4728	9054	1039	15.12%
05/04/2023	1	Razorbill	3.31	2.58	4.08	2788	2171	3444	311	11.17%
03/05/2023	1	Razorbill	0.23	0.09	0.43	190	71	371	69	36.53%
17/06/2023	1	Razorbill	0.9	0.5	1.35	760	425	1139	169	22.21%
05/07/2023	1	Razorbill	2.43	1	4.25	2042	842	3582	699	34.25%
10/08/2023	1	Razorbill	6.82	3.98	10.45	5745	3350	8793	1409	24.53%
22/03/2021	1	Puffin	0.4	0.27	0.54	332	224	456	48	14.58%
04/04/2021	1	Puffin	0.04	0.01	0.12	45	6	96	19	41.75%
12/05/2021	1	Puffin	0.06	0.01	0.1	45	12	84	20	43.59%
09/06/2021	1	Puffin	0.05	0.02	0.08	43	16	73	15	35.14%
24/07/2021	3	Puffin	0.4	0.3	0.48	331	253	407	41	12.32%
14/08/2021	1	Puffin	2.38	1.74	3.1	2004	1466	2612	303	15.12%
07/09/2021	1	Puffin	1.53	1.23	1.84	1281	1040	1548	129	10.09%
09/10/2021	1	Puffin	1.52	1.19	1.94	1284	1002	1632	154	12.01%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
02/11/2021	1	Puffin	0.7	0.58	0.8	586	488	675	49	8.35%
15/12/2021	1	Puffin	0.08	0.03	0.15	69	30	129	28	40.68%
06/01/2022	1	Puffin	0	0	0	0	0	0	0	0
23/02/2022	1	Puffin	0.01	0	0.03	14	3	31	8	58.33%
11/03/2022	1	Puffin	0.42	0.27	0.57	352	226	481	66	18.87%
22/03/2022	2	Puffin	0.22	0.15	0.3	185	129	246	25	13.76%
02/04/2022	1	Puffin	0.03	0.01	0.07	34	14	56	12	34.48%
15/04/2022	2	Puffin	0.18	0.07	0.32	152	64	264	43	27.88%
02/05/2022	1	Puffin	0.48	0.31	0.64	398	269	539	70	17.54%
17/05/2022	2	Puffin	0.02	0	0.05	19	5	38	9	50%
09/06/2022	1	Puffin	0.04	0.01	0.1	40	7	82	15	37.81%
21/06/2022	2	Puffin	0	0	0	0	0	0	0	0
04/07/2022	1	Puffin	0.12	0.03	0.24	100	29	202	47	46.51%
16/07/2022	2	Puffin	0.45	0.27	0.65	379	221	551	73	19.37%
08/08/2022	1	Puffin	0.1	0.06	0.16	90	48	134	23	25.97%
23/08/2022	2	Puffin	0.05	0.01	0.07	36	14	61	13	35.48%
13/09/2022	1	Puffin	0.28	0.19	0.37	233	156	315	42	18%
25/09/2022	2	Puffin	0.16	0.08	0.27	141	69	224	41	28.93%
10/10/2022	1	Puffin	0.34	0.19	0.54	289	162	450	75	25.81%
07/11/2022	1	Puffin	0.23	0.09	0.41	197	82	350	59	29.71%
13/12/2022	1	Puffin	0.27	0.15	0.42	228	125	353	57	25%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
26/01/2023	1	Puffin	0	0	0	0	0	0	0	0
10/02/2023	1	Puffin	0.22	0.08	0.38	184	73	323	64	34.81%
24/03/2023	1	Puffin	0.13	0.03	0.25	116	35	216	35	29.92%
05/04/2023	1	Puffin	0.17	0.13	0.24	151	105	206	26	16.92%
03/05/2023	1	Puffin	0.2	0.09	0.35	178	75	293	46	25.7%
17/06/2023	1	Puffin	0.15	0.05	0.27	129	41	230	42	32.67%
05/07/2023	1	Puffin	0.36	0.22	0.55	306	182	461	75	24.33%
10/08/2023	1	Puffin	1.32	0.92	1.83	1113	775	1541	206	18.53%
Unapportioned										
22/03/2021	1	Guillemot	9.64	7.58	11.85	8106	6380	9971	848	10.47%
04/04/2021	1	Guillemot	31.66	23.9	40	26631	20106	33656	3314	12.44%
12/05/2021	1	Guillemot	6.66	5.36	8.32	5606	4520	7005	577	10.29%
09/06/2021	1	Guillemot	1.56	1.17	1.96	1316	977	1651	160	12.17%
24/07/2021	3	Guillemot	10.91	7.81	14.32	9179	6571	12041	1376	15%
14/08/2021	1	Guillemot	32.17	17.17	50.19	27057	14445	42223	7082	26.18%
07/09/2021	1	Guillemot	32.32	24.67	41.8	27196	20754	35171	3589	13.2%
09/10/2021	1	Guillemot	8.67	6.87	10.86	7295	5776	9132	725	9.94%
02/11/2021	1	Guillemot	7.95	6.5	9.44	6688	5470	7938	609	9.1%
15/12/2021	1	Guillemot	3.99	3.28	4.63	3352	2764	3890	246	7.35%
06/01/2022	1	Guillemot	0.7	0.49	0.94	590	407	795	87	14.69%
23/02/2022	1	Guillemot	5.75	4.31	7.57	4841	3628	6364	587	12.12%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
11/03/2022	1	Guillemot	9.45	6.86	12.34	7946	5776	10375	1114	14.02%
22/03/2022	2	Guillemot	11.06	9.34	13.17	9301	7858	11081	719	7.73%
02/04/2022	1	Guillemot	37.16	29.4	45.07	31261	24738	37920	3097	9.91%
15/04/2022	2	Guillemot	17.56	12.94	22.88	14777	10889	19245	1990	13.47%
02/05/2022	1	Guillemot	19.68	15.97	23.44	16549	13440	19727	1572	9.5%
17/05/2022	2	Guillemot	6.05	4.74	7.65	5100	3989	6428	571	11.2%
09/06/2022	1	Guillemot	3.8	2.3	6.11	3198	1936	5139	831	25.97%
21/06/2022	2	Guillemot	6.5	5.3	7.74	5467	4466	6508	493	9.03%
04/07/2022	1	Guillemot	4.11	2.94	5.4	3466	2466	4548	518	14.94%
16/07/2022	2	Guillemot	13.49	8.61	19.23	11353	7236	16176	2225	19.6%
08/08/2022	1	Guillemot	36.55	15.31	64.43	30743	12886	54202	10546	34.3%
23/08/2022	2	Guillemot	5.21	3.55	7.19	4384	2995	6050	770	17.57%
13/09/2022	1	Guillemot	11.11	7.23	15.66	9352	6084	13175	1793	19.18%
25/09/2022	2	Guillemot	2.09	1.63	2.62	1758	1369	2201	217	12.37%
10/10/2022	1	Guillemot	3.5	2.62	4.49	2944	2207	3775	325	11.05%
07/11/2022	1	Guillemot	2.68	1.7	3.88	2251	1426	3271	456	20.25%
13/12/2022	1	Guillemot	5.14	4.22	6.22	4320	3538	5244	323	7.48%
26/01/2023	1	Guillemot	2.44	0.97	4.52	2055	818	3798	705	34.33%
10/02/2023	1	Guillemot	4.56	3.3	6.1	3832	2783	5134	569	14.84%
24/03/2023	1	Guillemot	9.17	7.17	11.35	7716	6039	9551	804	10.42%
05/04/2023	1	Guillemot	13.43	10.6	16.93	11298	8921	14254	1338	11.84%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
03/05/2023	1	Guillemot	5.59	2.53	11.19	4702	2127	9416	2229	47.42%
17/06/2023	1	Guillemot	3.08	2.15	4.15	2584	1808	3499	399	15.43%
05/07/2023	1	Guillemot	3.82	2.7	5.16	3220	2266	4338	532	16.53%
10/08/2023	1	Guillemot	15.83	12.44	20.16	13325	10470	16960	1671	12.54%
22/03/2021	1	Razorbill	5.33	4.4	6.23	4481	3703	5252	362	8.08%
04/04/2021	1	Razorbill	9.53	6.44	13.49	8021	5419	11346	1443	17.99%
12/05/2021	1	Razorbill	0.64	0.33	1.01	545	276	853	123	22.49%
09/06/2021	1	Razorbill	0.25	0.12	0.38	217	105	327	50	23%
24/07/2021	3	Razorbill	3.54	1.85	5.45	2975	1563	4588	765	25.73%
14/08/2021	1	Razorbill	4.63	1.7	8.63	3900	1428	7261	1432	36.73%
07/09/2021	1	Razorbill	2.02	1.53	2.49	1698	1282	2095	208	12.24%
09/10/2021	1	Razorbill	1.23	0.74	1.8	1034	618	1516	165	15.95%
02/11/2021	1	Razorbill	3.29	2.57	4.05	2773	2164	3409	297	10.71%
15/12/2021	1	Razorbill	2.4	1.77	3.15	2012	1491	2657	296	14.7%
06/01/2022	1	Razorbill	0.64	0.38	0.93	539	320	787	117	21.77%
23/02/2022	1	Razorbill	6.71	5.57	7.82	5654	4683	6581	471	8.33%
11/03/2022	1	Razorbill	4.05	2.77	5.6	3403	2325	4714	584	17.16%
22/03/2022	2	Razorbill	1.87	1.31	2.49	1573	1095	2093	239	15.18%
02/04/2022	1	Razorbill	2.54	1.85	3.26	2138	1551	2739	255	11.92%
15/04/2022	2	Razorbill	2.06	1.2	3.21	1738	1012	2701	368	21.15%
02/05/2022	1	Razorbill	3.61	2.64	4.65	3034	2221	3918	395	13.02%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
17/05/2022	2	Razorbill	0.52	0.37	0.7	441	304	595	72	16.41%
09/06/2022	1	Razorbill	0.49	0.18	0.89	408	154	746	146	35.67%
21/06/2022	2	Razorbill	0.38	0.18	0.64	316	153	543	92	29.23%
04/07/2022	1	Razorbill	0.7	0.23	1.42	592	193	1188	262	44.24%
16/07/2022	2	Razorbill	5.65	3.72	7.8	4754	3124	6553	883	18.56%
08/08/2022	1	Razorbill	0.49	0.21	0.9	416	177	760	150	36.18%
23/08/2022	2	Razorbill	0.55	0.26	0.89	463	215	755	141	30.34%
13/09/2022	1	Razorbill	4.21	2.29	6.45	3548	1923	5426	860	24.25%
25/09/2022	2	Razorbill	0.19	0.08	0.34	164	63	296	52	31.66%
10/10/2022	1	Razorbill	0.62	0.37	0.91	520	304	766	106	20.43%
07/11/2022	1	Razorbill	1.07	0.51	1.81	906	436	1522	251	27.76%
13/12/2022	1	Razorbill	2.24	1.75	2.75	1880	1474	2316	207	11.02%
26/01/2023	1	Razorbill	1.3	0.66	2.01	1099	552	1695	279	25.41%
10/02/2023	1	Razorbill	10.89	7.79	14.26	9162	6554	11995	1273	13.89%
24/03/2023	1	Razorbill	7.96	5.74	10.5	6693	4828	8832	998	14.92%
05/04/2023	1	Razorbill	3.19	2.41	4	2682	2030	3373	322	12.01%
03/05/2023	1	Razorbill	0.22	0.07	0.42	185	66	360	69	37.49%
17/06/2023	1	Razorbill	0.88	0.49	1.28	733	414	1074	166	22.68%
05/07/2023	1	Razorbill	2.33	1	4.13	1958	845	3482	648	33.1%
10/08/2023	1	Razorbill	6.7	3.92	10.43	5633	3300	8772	1439	25.54%
22/03/2021	1	Puffin	0.26	0.15	0.4	225	126	332	43	19.16%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
04/04/2021	1	Puffin	0.04	0	0.09	35	0	79	16	46.6%
12/05/2021	1	Puffin	0.05	0	0.09	35	0	83	22	63.33%
09/06/2021	1	Puffin	0.02	0	0.05	22	0	42	10	47.37%
24/07/2021	3	Puffin	0.21	0.13	0.29	175	111	241	35	20%
14/08/2021	1	Puffin	1.26	0.92	1.61	1054	775	1354	149	14.14%
07/09/2021	1	Puffin	0.83	0.65	1	697	552	848	78	11.2%
09/10/2021	1	Puffin	1.01	0.73	1.36	853	614	1143	134	15.73%
02/11/2021	1	Puffin	0.52	0.42	0.64	445	356	542	49	10.99%
15/12/2021	1	Puffin	0.03	0	0.12	34	0	96	28	82.76%
06/01/2022	1	Puffin	0	0	0	0	0	0	0	0
23/02/2022	1	Puffin	0.01	0	0.02	8	0	22	7	85.71%
11/03/2022	1	Puffin	0.24	0.14	0.36	206	119	306	49	23.73%
22/03/2022	2	Puffin	0.09	0.03	0.17	77	28	145	27	35.63%
02/04/2022	1	Puffin	0.02	0	0.06	22	0	48	12	52.63%
15/04/2022	2	Puffin	0.11	0.02	0.24	98	21	207	40	41.08%
02/05/2022	1	Puffin	0.33	0.19	0.48	277	160	398	64	23.11%
17/05/2022	2	Puffin	0.01	0	0.03	14	0	35	9	66.67%
09/06/2022	1	Puffin	0.03	0	0.07	28	0	62	13	46.58%
21/06/2022	2	Puffin	0	0	0	0	0	0	0	0
04/07/2022	1	Puffin	0.06	0	0.14	51	0	120	31	61.36%
16/07/2022	2	Puffin	0.24	0.12	0.39	208	100	331	49	23.57%

Month	Survey no.	Species	Adjusted Density Estimate n km²	Adjusted Density Estimate n km² LCL	Adjusted Density Estimate n km² UCL	Adjusted Population Estimate number	Adjusted Lower 95 Confidence Limit of Population Estimate number	Adjusted Upper 95 Confidence Limit of Population Estimate number	Adjusted Standard Deviation of Population Estimate number	Adjusted CV (%)
08/08/2022	1	Puffin	0.07	0.02	0.12	56	21	97	20	35.42%
23/08/2022	2	Puffin	0.02	0	0.05	15	0	35	9	61.54%
13/09/2022	1	Puffin	0.15	0.07	0.24	127	62	209	37	29.36%
25/09/2022	2	Puffin	0.08	0.03	0.14	70	28	119	24	35%
10/10/2022	1	Puffin	0.3	0.15	0.47	250	127	394	72	28.84%
07/11/2022	1	Puffin	0.1	0.02	0.23	91	22	193	36	39.3%
13/12/2022	1	Puffin	0.16	0.07	0.27	139	63	224	43	31.09%
26/01/2023	1	Puffin	0	0	0	0	0	0	0	0
10/02/2023	1	Puffin	0.08	0.01	0.16	71	14	134	31	44.26%
24/03/2023	1	Puffin	0.04	0	0.14	42	0	120	30	72.23%
05/04/2023	1	Puffin	0.03	0	0.07	28	0	63	16	58.33%
03/05/2023	1	Puffin	0.14	0.06	0.26	118	48	211	34	28.84%
17/06/2023	1	Puffin	0.09	0.02	0.18	77	21	150	27	34.84%
05/07/2023	1	Puffin	0.22	0.12	0.35	189	104	295	51	27.16%
10/08/2023	1	Puffin	0.63	0.35	0.99	528	291	836	147	27.81%

Annex D – Ornithological Census Reports

The following documents present the results of two census surveys of seabird presence on 19 and 17 offshore platforms (respectively) in the North Sea. The reports have been redacted to protect the breeding locations of sensitive species at offshore locations. These locations have been redacted at the request of the platform owners. The surveys were carried out in 2022 and 2023 and focused on offshore platforms within 20 km of the Project.

Outer Dowsing Offshore Wind

Outer Dowsing Offshore Wind

Ornithological Census

2483544

OCTOBER 2022

RSK GENERAL NOTES

Project No.: 2483544

Title: Outer Dowsing Offshore Wind (ODOW) – Ornithological Census 2022

Client: Outer Dowsing Offshore Wind

Date: October 2022

Office: Helsby

Status: Rev01

Author	Tom Smith	**Technical reviewer**	Prof Richard (Dez) Delahay
Signature	[redacted]	Signature	[redacted]
Date:	October 2022		October 2022

EXECUTIVE SUMMARY

1. This report presents the results of an ornithological assessment and in particular, a nesting kittiwake (*Rissa tridactyla*) survey carried out on 19 offshore structures in the southern North Sea. The report was commissioned by Outer Dowsing Offshore Wind (ODOW) to confirm the presence and status of nesting kittiwake colonies to inform future surveys and assessments.
2. The platforms are situated in the southern North Sea and therefore boat-based surveys were undertaken from the Independent.
3. Surveys were completed between 28th July and 1st August 2022.
4. Kittiwakes were recorded on six of the 19 platforms.
5. Updated surveys should be completed annually to provide accurate counts to inform impact assessments, mitigation proposals and additional survey requirements.

CONTENTS

1 INTRODUCTION

1.1 Purpose of this Report

This report presents the results of surveys to establish the presence of nesting birds, and in particular kittiwakes (*Rissa tridactyla*), on offshore structures in the southern North Sea. Outer Dowsing Offshore Wind (ODOW) commissioned surveys from RSK Biocensus to determine the presence of nesting birds on 19 offshore structures within or in close proximity to the proposed Outer Dowsing Offshore Windfarm.

1.2 Project Background

Nesting bird colonies on offshore assets have the potential to be affected by future windfarm development. Monitoring is therefore required to determine whether nesting birds are present at each of the assets within or in close proximity to the Outer Dowsing Offshore Windfarm and to inform future survey and assessment work. Due to recent observations at other platforms, the Offshore Petroleum Regulator for Environment & Decommissioning (OPRED) released an advice note on the risk of kittiwake presence on offshore installations (March 2021). OPRED also requested that the Joint Nature Conservation Committee (JNCC) provide an advice note on kittiwake survey methods for offshore installations (published March 2021).

2 OFFSHORE STRUCTURES

There are 19 offshore structures included within this monitoring survey as detailed in *Table 1* and locations shown in *Figure 1*. PLATFORM NAME REMOVED and PLATFORM NAME REMOVED are small platforms which constitute parts of the PLATFORM NAME REMOVED complex and therefore the table in *Appendix A* (Seabird recording form) only contains 17 entries.

Table 1. TABLE REMOVED**.**

3 METHODS

3.1 Ornithological Assessment

The ornithological assessments were undertaken by Dr Ken Neal and Tom Smith. Ken is an independent expert sub-contracted to RSK Biocensus. Summary details of their experience are provided below:

- Dr Ken Neal is an ecologist with over 23 years of experience. He is trained to JNCC-accredited European Seabirds at Sea (ESAS) standards for offshore boat-based bird and marine mammal surveys and recently completed similar surveys in the southern North Sea. Ken has recently completed BOSIET training (expires 2026).
- Tom Smith is an ecologist (full member of the Chartered Institute of Ecology and Environmental Management and a Chartered Environmentalist) with 20 years consultancy experience and specialises in ornithology. Tom works primarily in the UK but has also completed ornithological studies throughout Europe, the Middle East and Africa. This has also included extensive experience of habitat regulations assessments (HRA) for projects where impacts on sites of ornithological interest have been identified.

3.2 Nesting Kittiwake Survey

The surveys were undertaken in accordance with the Ornithological Monitoring Plan[1] issued to OPRED. Monitoring was undertaken by suitably qualified ornithologists (as detailed above) following the methodology described in the JNCC Advice note[2]. The advice note sets out 19 principals for surveys to ensure they are systematic and repeatable.

Boat-based methods from the Guard Vessel (GV) *Independent* were used as per the standard approach to seabird monitoring and set out in the JNCC Advice Note. This approach provides good visibility of potential nest locations from sea level.

The survey comprised a visual assessment of the platforms from the GV *Independent* vessel, maintaining a minimum distance of 500 m from the installations.

Once the vessel had approached to 500m from the platform, a circumnavigation was commenced at a speed of 4-6 knots which allowed the surveyor ample time to take photographs of the platform and to capture images (at maximum zoom) of any areas that appeared to support nesting kittiwakes. A Panasonic DC-FZ82 Lumic camera with up to

[1] RSK Biocensus (2022) Ornithological Monitoring Plan, July 2022

[2] Thompson, D (2021) Advice Note Seabird Survey Methods for Offshore Installations: Black-legged Kittiwake. JNCC, Peterborough

60 times optical zoom was used with images taken at a maximum resolution of 18 megapixels. The surveyor on deck maintained contact with the vessel skipper using UHF radio, a key part of which was to call out the cardinal point of each face of the platform in order that an accurate record of any nests could be made (but see Survey Constraints below). If any nests were noted on the first circumnavigation, a second was made with the vessel holding position as necessary to allow the surveyor to sketch the platform and estimate the number of nests.

The surveyor used 8x42 binoculars to survey the platform and a x28 telescope was also available (but see survey constraints below).

Standard recording forms were used detailing the numbers of nests recorded. Given the distance from the survey vessel details of trace nests, egg presence and chick age were noted where possible although the main objective of this single survey was to confirm breeding.

In addition to the recording of nest details, observational notes were also recorded. These included information on other species present, non-breeding individuals and observations of any behavioural responses to the presence of surveyors. This included video recording of bird behaviour during vessel approach and the survey.

Estimates of numbers of nests and numbers of kittiwakes plus other gulls made at sea were confirmed by inspection of the photographs.

Full methods are provided in the JNCC Advice Note.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/974338/Kittiwake_survey_advice_v2.1.pdf

Standard recording forms to be used during data collection can be downloaded here:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/974340/seabird_survey_reporting_forms_march2021.docx

3.3 Survey Constraints

Due to proximity agreements with the offshore operators, the *GV Independent* was not permitted to enter within 500 m of any platform. Whilst every effort was made to obtain detailed counts, this was not always possible given the distance. The counts may also have been impacted by the time of year of the survey, because by the third week in July most of the chicks were at or very close to fledging size and therefore often difficult to distinguish from adults at a distance of 500 m, particularly if the bird was at an angle where juvenile plumage could not be seen.

Whilst the weather was within suitable parameters for the survey, swell and wind-driven waves did create motion which was exacerbated by the distance from the vessel to the platform and therefore it was not possible to use the telescope to improve accuracy of nest counts. On Sunday 31st July, the wind dropped and the sea was flat-calm for a few hours but unfortunately coincident fog reduced visibility to less than 300 m.

The distance of the survey vessel from the platforms also precluded counting any nests which were underneath the superstructure though their presence was noted when relevant.

4 RESULTS AND RECOMMENDATIONS

4.1 Results

The results of the nesting bird surveys are provided in the standard installation seabird recording form (see *Appendix A*) and summarised below in *Table 2*. Kittiwakes were present on 15 platforms surveyed and nesting was recorded on at least six of the platforms (PLATFORM NAME REMOVED, PLATFORM NAME REMOVED, PLATFORM NAME REMOVED, PLATFORM NAME REMOVED, PLATFORM NAME REMOVED) with the possibility that they were also nesting on one more (PLATFORM NAME REMOVED– kittiwake present but no obvious nesting material present).

Nests were typically located on the steel 'I'-beams below the cellar deck, the exception being at the PLATFORM NAME REMOVED platforms where the main superstructure has been removed and the kittiwakes were nesting on structures on top of the legs. Nests were mainly composed of seaweed which often made them easier to spot as the silhouettes of fronds hanging down were quite conspicuous. The kittiwakes did not appear to favour any particular aspect of the platforms for nesting based on circumnavigation of the platforms. However, as noted on some platforms it is likely there is an underestimate of numbers due to distance and visibility. This would therefore need to be confirmed during subsequent monitoring surveys within 500m proximity of the platforms.

On the platforms with nests, there were large chicks at the point of fledging (or recently fledged) though it was not possible to establish individual nest productivity owing to the distance of the observations.

There were no immediately apparent trends in terms of which types of platforms supported nesting kittiwakes and which did not. Manned and unmanned platforms supported nests and a cursory examination of charts did not suggest that water depth or proximity of features such as sandbanks were factors.

Most of the platforms were used by a variety of roosting gulls, including kittiwakes, but many had to be recorded as 'large gull sp.' or 'black-backed gull sp.' as confident identification to species was not always possible from 500 m. It is likely, however, that the large majority were great black-backed gulls (*Larus marinus*). The PLATFORM NAME REMOVED platform was also being used by a small number of guillemots (*Uria aalge*) although it was unclear whether they were nesting, and one great cormorant (*Phalacrocorax carbo*) was also present.

Only the PLATFORM NAME REMOVED platform did not support any birds at all although this may have been due to disturbance from an adjacent jack-up rig that was presumably there to provide maintenance support.

Platform	Number of Nests	Survey notes
PLATFORM NAME REMOVED	0	Relatively large number of gulls on helideck (see PLATE REMOVED and Table 3).
PLATFORM NAME REMOVED	0	The superstructure of the rig has been removed and only legs remain.
PLATFORM NAME REMOVED	52 ± 4	The superstructure of the rig has been removed and only legs remain but structures on the tops of the legs have cavities that are being used by nesting kittiwakes.
PLATFORM NAME REMOVED	65	The superstructure of the rig has been removed and only legs remain but structures on the tops of the legs have cavities that are being used by nesting kittiwakes.
PLATFORM NAME REMOVED	n/a	Rig no longer present
PLATFORM NAME REMOVED	0	Apparently suitable ledges available for nesting but only roosting gulls present.
PLATFORM NAME REMOVED	32	There are more nests underneath superstructure but could not be seen to be enumerated and therefore count is likely an underestimate.
PLATFORM NAME REMOVED	0	
PLATFORM NAME REMOVED	0	
PLATFORM NAME REMOVED	?	A number of kittiwakes were seen on the sides of the PLATFORM NAME REMOVED (see PLATE REMOVED) but nesting material was not apparent in the photographs. However, observations from other surveys has indicated that kittiwakes can raise chicks on surprisingly sparse nests and it is therefore the possible that breeding occurred on PLATFORM NAME REMOVED cannot be ruled out. If present, they would be in small numbers.
PLATFORM NAME REMOVED	0	

PLATFORM NAME REMOVED	67+	There are more nests underneath superstructure but could not be seen to be enumerated and therefore count is likely an underestimate.
PLATFORM NAME REMOVED	0	
PLATFORM NAME REMOVED	17	Mostly on east side of structure on 'I' beam.
PLATFORM NAME REMOVED	0	
PLATFORM NAME REMOVED	Approximately 20	6+ nests were under a gantry carrying a blue container and could not be accurately counted owing to the shadow cast by the gantry, 14 on remainder of structure.
PLATFORM NAME REMOVED	0	

Table 2. Summary of kittiwake nest survey results.

Table 3. Numbers of birds recorded on offshore platforms.

Platform	Kittiwake	Black-backed gull sp.	Large gull sp.	Great black-backed gull	Guillemot	Cormorant	Notes
PLATFORM NAME REMOVED	150+		c.50				All birds were on the helideck and therefore not fully visible from sea level. All birds flushed and estimated from count in the air.
PLATFORM NAME REMOVED	21			1			

PLATFORM NAME REMOVED	40+*		4	1			
PLATFORM NAME REMOVED	80		2	10			
PLATFORM NAME REMOVED	4						
PLATFORM NAME REMOVED	64		1				
PLATFORM NAME REMOVED	17		2	8			
PLATFORM NAME REMOVED	39						
PLATFORM NAME REMOVED	55		4				
PLATFORM NAME REMOVED	20	50	2				Most large gulls on the horizontal crossbeams between the legs
PLATFORM NAME REMOVED	129	11	5		7	1	Approximately 20 Manx shearwater flushed off the sea from just inside 500 m exclusion zone
PLATFORM NAME REMOVED	7	5	5	2			

PLATFORM NAME REMOVED	56	6	2	13			Two harbour porpoises seen inside the 500 m exclusion zone
PLATFORM NAME REMOVED	48	17	18	2			
PLATFORM NAME REMOVED	124		6				
PLATFORM NAME REMOVED							Large jack-up rig adjacent to platform, no birds present anywhere on structures

*Difficult to get an accurate count owing to some birds being partially obscured by parts of the structure

4.2 Recommendations

Nesting kittiwakes were confirmed on six of the platforms during the surveys with the possibility of breeding at a further platform. It should be noted that birds are highly mobile and new colonies may form where existing colonies are displaced by decommissioning activities on other platforms. It is therefore recommended that a repeat survey is undertaken each year to update baseline data. In addition, for those platforms where breeding has been confirmed, where possible proximity agreements should be obtained so that the number of nests and their productivity can be accurately assessed to allow for more accurate counts to be obtained. With observations within 500m, future surveys should allow for detailed annotated plans of nest locations to be produced.

5 FIGURES

Figure 1 Location Plan 1 FIGURE REMOVED

6 PLATES

15 PLATES REMOVED

7 APPENDIX A - OFFSHORE INSTALLATION SEABIRD RECORDING FORM

a) Cloud cover: eighths
b) Sea state: Beaufort scale (Appendix 3)
c) Swell: low = less than 2m, moderate = 2 to 4m, and high = >4m
d) Sun strength: none, weak, moderate or strong
e) Rain: 1 = none, 2 = discontinuous light, 3 = discontinuous heavy, 4 = continuous light, 5 = continuous heavy
f) Wind speed and direction: Beaufort scale (Appendix 3) and cardinal points
g) Visibility: excellent = ≥10km, good = >5km, moderate = 1 – 5km, poor = <1km.

Location/ installation	Date of survey	Survey vessel	Name of surveyor	Cloud cover	Sea state	Swell	Sun	Rain	Wind (Beaufort & direction)	Visibility	Start time	End time	Comments/observations
PLATFORM NAME REMOVED	29/07/2022	GV Independent	K. Neal	6/8	2	Low	Moderate	1	F2 SE	Excellent	06:50	07:45	No breeding kittiwakes
PLATFORM NAME REMOVED	29/07/2022	GV Independent	K. Neal	4/8	2	Low	Moderate	1	F2 SE	Excellent	08:50	09:20	No breeding kittiwakes
PLATFORM NAME REMOVED	29/07/2022	GV Independent	K. Neal	4/8	3	Low	Moderate	1	3 E	Excellent	10:30	12:00	Nesting kittiwakes present
PLATFORM NAME REMOVED	29/07/2022	GV Independent	K. Neal	1/8	2	Low	Moderate	1	2 E	Excellent	12:50	14:05	Nesting kittiwakes present

PLATFORM NAME REMOVED	29/07/2022	GV Independent	K. Neal										Rig no longer present
PLATFORM NAME REMOVED	29/07/2022	GV Independent	K. Neal	1/8	2	Low	Strong	1	2 E	Excellent	16:20	16:55	No nesting kittiwakes, four loafing on flare boom
PLATFORM NAME REMOVED	30/07/2022	GV Independent	K. Neal	7/8	3	Low	Weak	1	4 SE	Excellent	06:30	07:50	Nesting kittiwakes on east and west sides
PLATFORM NAME REMOVED	30/07/2022	GV Independent	K. Neal	8/8	3	Low	Weak	1	3 SE	Excellent	08:30	09:05	No nesting kittiwakes
PLATFORM NAME REMOVED	30/07/2022	GV Independent	K. Neal	8/8	3	Low	Weak	2	3 SE	Good	10:25	11:00	No nesting kittiwakes
PLATFORM NAME REMOVED	30/07/2022	GV Independent	K. Neal	8/8	3	Low	Weak	2	3 SE	Good	11:40	12:45	Possibly nesting kittiwakes
PLATFORM NAME REMOVED	30/07/2022	GV Independent	K. Neal	7/8	2	Low	Weak	1	2 SE	Excellent	15:50	16:15	No nesting kittiwakes
PLATFORM NAME REMOVED	30/07/2022	GV Independent	K. Neal	7/8	2	Low	Weak	1	2 SE	Excellent	17:10	18:25	Nesting kittiwakes

PLATFORM NAME REMOVED	31/7/22	GV Independent	K. Neal	8/8	1	Low	Weak	1	F1 NW	Moderate	11:20	11:50	Delayed by fog, no nesting kittiwakes
PLATFORM NAME REMOVED	31/7/22	GV Independent	K. Neal	8/8	1	Low	Moderate	1	F1 NW	Good	13:00	13:50	Nesting kittiwakes
PLATFORM NAME REMOVED	31/7/22	GV Independent	K. Neal	8/8	3	Low	Weak	4	F4 NW	Moderate	15:20	15:50	No nesting kittiwakes
PLATFORM NAME REMOVED	31/7/22	GV Independent	K. Neal	8/8	3	Low	Weak	1	F4 N	Good	16:45	17:25	Nesting kittiwakes
PLATFORM NAME REMOVED	31/7/22	GV Independent	K. Neal	3/8	3	Low	Strong	1	F4 N	Excellent	20:20	20:35	One side obscured by jack-up rig. No nesting kittiwakes or any other birds present.

Outer Dowsing Offshore Wind

Outer Dowsing Offshore Wind

Ornithological Census and Capture Trial

2483544

JULY 2023

RSK GENERAL NOTES

Project No.: 2483544

Title: Outer Dowsing Offshore Wind – Ornithological Census and Capture Trial

Client: Outer Dowsing Offshore Wind

Date: 18th July 2023

Office: Helsby

Status: Rev 00

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EXECUTIVE SUMMARY

1. This report presents the results of an ornithological assessment of 17 offshore platforms in the southern North Sea. Specifically, this assessment focuses on ascertaining the presence and status of nesting kittiwakes (*Rissa tridactyla*) colonies on these platforms. This report also presents the findings of the trialing of chumming methods to attract and catch kittiwakes in flight to enable potential tagging studies.
2. This report was commissioned by Outer Dowsing Offshore Wind (ODOW) to confirm the locations and sizes of any kittiwake colonies, to inform future mitigation measures to ensure adverse impacts on nesting kittiwakes are avoided during all phases of the proposed offshore windfarm, and to explore potential capture methods to facilitate population monitoring.
3. Field surveys to identify and assess kittiwake colonies were undertaken by boat between 12th and 15th June 2023, during which each platform was subject to a detailed inspection, and chumming and capturing methods were trialled at suitable locations.
4. Breeding kittiwake colonies were recorded on six of the 17 platforms, with occupied nests recorded as follows: PLATFORM NAME REMOVED – 40 nests; PLATFORM NAME REMOVED – 36 nests; PLATFORM NAME REMOVED – 69 nests; PLATFORM NAME REMOVED – 273 nests; PLATFORM NAME REMOVED – 402 nests; and PLATFORM NAME REMOVED – 16 nests.
5. No activity by kittiwakes or any other seabirds was recorded on two platforms. The remaining nine platforms had no observed kittiwake nests, although kittiwakes were recorded loafing on and around the platforms. Other seabirds were recorded on and adjacent to these platforms, including razorbills (*Alca torda*) and guillemots (*Uria aalge*) on PLATFORM NAME REMOVED and PLATFORM NAME REMOVED. Whilst no nests of these or any other seabird species were recorded, it is highly likely that guillemots were breeding but, owing to the lack of nesting material used by these species and the distance the observers were from the platforms, it was not possible to confirm this during the survey. Photos provided to RSK Biocensus show nesting guillemots were successful in laying eggs.
6. The results of the surveys will be required to inform environmental impact assessments for the construction and operation of the proposed offshore windfarm.
7. Due to the transient nature of breeding bird populations, updated surveys should be completed annually to provide accurate information on nesting seabird colonies on the platforms to inform mitigation proposals.
8. The chumming and capture technique trialled during this survey was unsuccessful, as chumming failed to attract kittiwakes. For future capturing attempts, boarding platforms and catching birds from their nest locations is considered likely to be the best option.

CONTENTS

TABLES

FIGURES

1.0 INTRODUCTION

1.1 Purpose of this Report

1.1.1 This report presents the results of an ornithological assessment of offshore platforms in the southern North Sea owned by PLATFORM NAMES REMOVED. Specifically, this assessment focuses on ascertaining the presence and status of nesting kittiwake (*Rissa tridactyla*) colonies on the following 17 offshore structures in proximity to the Outer Dowsing Offshore Windfarm (ODOW):

- PLATFORM NAME REMOVED
- PLATFORM NAME REMOVED
- PLATFORM NAME REMOVED
- PLATFORM NAME REMOVED
- PLATFORM NAME REMOVED
- PLATFORM NAME REMOVED
- PLATFORM NAME REMOVED
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- PLATFORM NAME REMOVED
- PLATFORM NAME REMOVED
- PLATFORM NAME REMOVED
- PLATFORM NAME REMOVED

1.1.2 The purpose of this report is to confirm the locations and sizes of any kittiwake colonies on these 17 platforms, and to inform future mitigation measures to ensure adverse impacts on nesting kittiwakes are avoided during all phases of construction of the proposed offshore windfarm. Any other specially protected and notable species (particularly any nesting seabird colonies) encountered were also recorded for consideration within future mitigation proposals where necessary. This survey was a repeat of the 2022 ODOW ornithological census survey (RSK Biocensus, 2022).

1.1.3 This survey was also used to trial the use of chumming from an offshore vessel to capture kittiwakes from the platforms. If successful, this technique could be used in future to tag and ring kittiwakes to monitor their population dynamics; in particular, the level of connectivity between breeding populations using offshore platforms and those of relevant designated sites (e.g. Special Protection Areas (SPA)) for which the species has been identified as a qualifying interest.

1.1.4 The assessment described in this report has been undertaken in accordance with the methods prescribed within the *2023 Outer Dowsing Offshore Wind Ornithological Monitoring Plan* (RSK Biocensus, 2023), as well as the JNCC *Seabird Survey Methods for Offshore Installations: Black-legged kittiwakes* (Thompson, 2021).

1.2 Project Background

1.2.1 Whilst most UK seabirds favor natural nesting sites on offshore islands or mainland sea cliffs, several species have been recorded nesting on artificial offshore structures such as platforms; notably kittiwake[1]. These nesting bird colonies on offshore assets have the potential to be adversely affected by future windfarm development.

1.2.2 As such, monitoring is necessary to identify any colonies on assets in close proximity to the proposed ODOW, to inform future survey work and enable appropriate mitigation plans to be devised such that adverse impacts on seabird populations are avoided.

1.2.3 Following the emergence of this issue on offshore platforms elsewhere, the Offshore Petroleum Regulator for Environment and Decommissioning released an advice note on the risk of kittiwake presence on offshore installations (OPRED, 2021). OPRED also requested that the Joint Nature Conservation Committee produce an advice note on kittiwake survey methods for offshore installations (Thompson, 2021). These guidance documents form the basis of the monitoring approach adopted within this assessment.

1.2.4 The surveys described in this report comprise the second year of monitoring surveys undertaken by RSK Biocensus for the 17 assets. The findings of the previous surveys undertaken in July 2022 are presented in the *ODOW Survey Report 2022* (RSK Biocensus, 2022) and discussed in *Section 4.1.11* in the context of the 2023 survey results. In summary, kittiwake nests were recorded on six of the 17 platforms surveyed in 2022; specifically on PLATFORM NAME REMOVED (at least 52 nests), PLATFORM NAME REMOVED (65 nests), PLATFORM NAME REMOVED (32 nests), PLATFORM NAME REMOVED (at least 67 nests), PLATFORM NAME REMOVED (17 nests) and PLATFORM NAME REMOVED (approximately 20 nests).

[1] Further information on kittiwake breeding ecology and use of offshore platforms is provided in *Section 2* of the *2023 Offshore Ornithological Monitoring Plan* (RSK Biocensus, 2023).

2.0 OFFSHORE STRUCTURES

2.1.1 There are 17 assets[2] owned by PLATFORM NAME REMOVED within the southern North Sea (as indicated in *Table 1* and *Figure 1*) in proximity to the proposed ODOW. These were the same as the assets surveyed in 2022 with the exception of PLATFORM NAME REMOVED which was no longer present; instead an additional platform, PLATFORM NAME REMOVED, was surveyed. All 17 platforms listed below were subject to a detailed inspection for kittiwake and other nesting birds in 2023.

Table 1**. TABLE REMOVED**

[2] The three platforms together forming PLATFORM NAME REMOVED have been treated as one platform in this report, hence the change in the reported number of platforms surveyed between 2022 and 2023.

3.0 METHODS

3.1 Ornithological Assessment

3.1.1 Ornithological assessment of the 17 assets was undertaken by RSK Biocensus ecologists/ornithologists Tim Hounsome (leading field work) and Megan Kett-Brodie (assisting field work).

3.1.2 Dr Tim Hounsome is an ornithologist with nearly 30 years' experience in the field. He is a Fellow of the Chartered Institute of Ecology and Environmental Management and a Chartered Ecologist. Tim has worked primarily in the UK on both terrestrial and marine bird surveys. He is also a licensed bird ringer and has ringed thousands of birds, a large proportion of which have been seabirds. Tim chairs the Birds Survey Guidelines Steering Group which he established to standardise bird surveying in consultancy.

3.1.3 Megan is an ecologist with two years of experience in environmental science with a specialism in marine ecology and ornithology. Megan has conducted multiple UK offshore surveys of marine mammals and birds, including ten weeks of offshore work and six months' experience conducting seabird and marine mammal identification from aerial imagery. This also includes experience in assisting with undertaking appropriate assessments regarding the potential impacts of proposed offshore wind farm geophysical surveys in the Irish Sea.

3.2 Nesting Kittiwake Surveys

3.2.1 Field surveys of the 17 platforms for nesting kittiwakes were undertaken between the 12th and 15th June 2023 in accordance with the *ODOW Offshore Ornithological Monitoring Plan* (RSK Biocensus, 2023). This monitoring approach was based on the JNCC advice note detailing kittiwake survey methods for offshore installations (Thompson, 2021).

3.2.2 Surveys were undertaken by boat from the Marshall Art. Each asset was surveyed at least once (i.e. twice if necessary), during which the ornithologists inspected the asset on all sides and recorded and took photographs of each face. The vessel moved at a speed of 4-6 knots around the platform, allowing the surveyors to record the necessary data. In accordance with best practice guidance, platforms were inspected from a minimum distance of 200 metres (m) where possible, with some platforms accessible to a minimum distance of 500 m only (subject to proximity agreements). Inspection was aided by the use of binoculars and digital photography (Panasonic Lumix DC-FZ82) as necessary.

3.2.3 Standard JNCC recording procedures were followed, with the ornithologists using standard recording forms as provided within the JNCC advice note and producing annotated diagrams and photos of nest locations. Kittiwake observations were initially classified in accordance with JNCC guidance, with numbers of occupied nests, trace nests, eggs, chicks within each age group, estimated fledging dates and any non-breeding birds all recorded where possible. Counts of nests and birds taken in the field were later compared with photographs to ensure they were accurate.

3.2.4 Any other species present on or in close proximity to the platforms were recorded, including any nest locations.

3.2.5 Survey dates and weather conditions are presented in *Appendix A*. All surveys were undertaken in optimal weather conditions, with excellent visibility aiding accurate recording of kittiwake nest numbers and locations.

3.3 Kittiwake Capture Trial

3.3.1 During nesting kittiwake surveys, kittiwake capture techniques to enable ringing were trialed, with the intention of informing future monitoring of kittiwake populations; in particular, the level of connectivity between populations using offshore platforms and known terrestrial colonies including those of relevant designated sites.

3.3.2 As initial project discussions indicated that it would not be possible for bird ringers to access platforms directly, innovative options for kittiwake capture at sea were explored during conversations with experienced seabird ringers and surveyors. One option identified within this process was to attract kittiwakes by offering bait (a method known as chumming). Once kittiwakes were in sufficient proximity to the boat, they would be caught in flight using nets. Whilst this method has been successfully used from land (where it is known as fleyging), the effectiveness of fleyging to enable seabird ringing at sea is not widely understood.

3.3.3 Kittiwake capture was attempted at the PLATFORM NAME REMOVED, PLATFORM NAME REMOVED and PLATFORM NAME REMOVED platforms due to the high numbers of kittiwakes present. Chumming was attempted within 500 m of platforms initially, before moving outside of 500 m (i.e. hoping that kittiwakes would follow the bait), at which range kittiwakes would be captured by net.

3.4 Limitations

3.4.1 There were no limitations to the field survey timings or weather conditions. Whilst strong winds sometimes caused movement of the vessel, this instability was insufficient to negatively affect the accuracy of counts and observations.

Due to proximity agreements with the offshore operators, the boat was not permitted to enter within 500 m of certain platforms. Whilst every effort was made to obtain detailed counts and view all potential nest locations, this was not always possible given the distance from which aspects of platforms were viewed. Therefore, some nest counts should be considered an underestimation on the platforms where breeding occurred. In particular, visibility of PLATFORM NAME REMOVED was hindered by maintenance works. This is taken into consideration when evaluating the survey results.

3.4.2 It should be noted that ecological features (e.g. bird populations) are transient, and that the distributions and numbers of species may be subject to change. Seabirds in particular are highly mobile, and new features (e.g. platforms) that have not previously been used may be colonised in future years; particularly if colonies are displaced from nearby sites by development activities. It is therefore recommended that detailed survey data are collected annually by suitably experienced ornithologists.

4.0 RESULTS

4.1 Nesting Kittiwake Surveys

4.1.1 The results of the nesting kittiwake surveys undertaken between 12th and 15th June 2023 are summarised in *Table 2.* Detailed survey data are provided in *Appendix B.* Photographs from the surveys are provided in *Appendix C*.

Table 2. Summary of nesting kittiwake survey results

Asset	Occupied nests	Trace nests	Kittiwakes recorded loafing/roosting on platform
PLATFORM NAME REMOVED	0	0	8
PLATFORM NAME REMOVED	0	0	8
PLATFORM NAME REMOVED	0	0	11
PLATFORM NAME REMOVED	40	37	16
PLATFORM NAME REMOVED	36	37	11
PLATFORM NAME REMOVED	0	0	0
PLATFORM NAME REMOVED	69	0	17
PLATFORM NAME REMOVED	0	0	1
PLATFORM NAME REMOVED	0	0	0
PLATFORM NAME REMOVED	0	0	2
PLATFORM NAME REMOVED	0	0	6
PLATFORM NAME REMOVED	273	18	324
PLATFORM NAME REMOVED	402	27	283
PLATFORM NAME REMOVED	0	0	28
PLATFORM NAME REMOVED	16	1	31
PLATFORM NAME REMOVED	0	0	11
PLATFORM NAME REMOVED	0	0	3

4.1.2 Kittiwake nests were recorded on six of the 17 assets surveyed, with a total of 836 occupied nests recorded and an additional 120 trace nests recorded. Occupied nests were all at the incubation stage (i.e. 'apparently incubating adults'), with no chicks observed on any platforms.

4.1.3 The largest colony was recorded on PLATFORM NAME REMOVED, with 402 occupied nests and 27 trace nests recorded. The highest number of nests was recorded on the northern aspect, followed by the eastern aspect.

4.1.4 Occupied nests were also recorded on PLATFORM NAME REMOVED and PLATFORM NAME REMOVED, which were very similar decommissioned structures. The tops of the platform legs were readily used as nesting sites by kittiwakes, with the nests relatively evenly distributed on each leg.

4.1.5 The other three platforms used by nesting kittiwakes, PLATFORM NAME REMOVED, PLATFORM NAME REMOVED and PLATFORM NAME REMOVED, had occupied nests on the metal 'I beam' around the base of the body of the platform. Most nests were observed on the east and west sides of PLATFORM NAME REMOVED. Nests on PLATFORM NAME REMOVED were relatively evenly distributed, with slightly higher numbers of nests recorded on the northern and southern sides. PLATFORM NAME REMOVED had 12 nests on its western aspect and four nests on the underside of the platform.

4.1.6 Whilst no nesting kittiwakes were observed on all PLATFORM NAMES REMOVED, PLATFORM NAME REMOVED, PLATFORM NAME REMOVED, PLATFORM NAME REMOVED, PLATFORM NAMES REMOVED and PLATFORM NAME REMOVED, kittiwakes were observed flying around and loafing on all nine structures.

4.1.7 Both PLATFORM NAME REMOVED and PLATFORM NAME REMOVED had no seabird activity on or in the vicinity of the platforms. Whilst other bird species were recorded on many of the platforms, no other nesting species were recorded.

4.1.8 Full details of other species recorded on or in close proximity to platforms are provided in *Appendix B*. No nests of any other species were observed on any platforms. Records of razorbills (*Alca torda*) and guillemots (*Uria aalge*) were all from PLATFORM NAME REMOVED and PLATFORM NAME REMOVED, with the exception of one guillemot on PLATFORM NAME REMOVED. These species were observed roosting and loafing on platforms. Whilst guillemots observed sitting on platform ledges could possibly have been incubating, no eggs or chicks were observed. However, in addition to the surveys reported here, photographs were provided by the operator that show guillemot eggs on PLATFORM NAME REMOVED. It would therefore seem highly likely that guillemots are breeding on these platforms but, due to the distance of the observers, the low angle from the water looking up and the fact that these species do not construct significant nests, it was not possible to confirm breeding during the surveys described in this report.

4.1.9 Loafing and roosting on platforms was observed by the following species (total counts throughout the survey are provided in brackets):

- Cormorant (*Phalacrocorax carbo*) (2)
- Great black-backed gull (*Larus marinus*) (1)
- Lesser black-backed gull (*Larus fuscus)* (2)
- Herring gull (*Larus argentatus*) (111)
- Razorbill (13)

- Guillemot (458)

4.1.10 Loafing on the water or flying past in the vicinity of platforms was observed by the following species:

- Gannet (*Morus bassanus*) (1)
- Fulmar (*Fulmarus glacialis*) (2)

Comparison with 2022 survey data

4.1.11 Numbers of active nests recorded in 2023 are compared with those during the monitoring surveys of the platforms undertaken in 2022 in *Table 3* below.

Table 3. Comparison of 2022 and 2023 kittiwake nest data

Asset	Occupied nests (2022)	Occupied nests (2023)
PLATFORM NAME REMOVED	0	0
PLATFORM NAME REMOVED	0	0
PLATFORM NAME REMOVED	0	0
PLATFORM NAME REMOVED	52 ± 4	40
PLATFORM NAME REMOVED	65	36
PLATFORM NAME REMOVED	0	0
PLATFORM NAME REMOVED	32	69
PLATFORM NAME REMOVED	0	0
PLATFORM NAME REMOVED	0	0
PLATFORM NAME REMOVED	Possible (none confirmed)	0
PLATFORM NAME REMOVED	0	0
PLATFORM NAME REMOVED	67+	273
PLATFORM NAME REMOVED	Not surveyed	402
PLATFORM NAME REMOVED	0	0
PLATFORM NAME REMOVED	17	16
PLATFORM NAME REMOVED	0	0
PLATFORM NAME REMOVED	c.20	0

4.1.12 The number of occupied kittiwake nests recorded in 2023 was significantly higher than in 2022. This was largely due to the inclusion of PLATFORM NAME REMOVED, which was not surveyed in 2022. Significant colony size increases were recorded at PLATFORM NAME REMOVED and PLATFORM NAME REMOVED, although improved visibility of PLATFORM NAME REMOVED in 2023 compared with 2022 potentially contributed to the observed increase at PLATFORM NAME REMOVED. Improved visibility was achieved by being able to approach to within 200m of the assets compared to 500m in 2022. Reduced colony size was recorded at PLATFORM NAME REMOVED and PLATFORM NAME REMOVED. No kittiwake nests were recorded at PLATFORM NAME REMOVED, which had supported c.20 nests in 2022, although this was potentially attributable to maintenance works at PLATFORM NAME REMOVED which reduced visibility of suitable ledges during survey undertaken in 2023. The number of nests at PLATFORM NAME REMOVED was consistent between 2022 and 2023, and no assets recorded as not supporting breeding kittiwakes in 2022 were found to contain occupied nests in 2023.

4.2 Kittiwake Capture Trial

4.2.1 As described in *Section 3.3*, kittiwake capture through chumming and fleyging was attempted at the PLATFORM NAME REMOVED, PLATFORM NAME REMOVED and PLATFORM NAME REMOVED platforms due to the high numbers of kittiwakes present. The capture trial was unsuccessful at all platforms. Kittiwakes were not attracted by chumming, which only attracted one fulmar. Consequently, there was no opportunity to catch kittiwakes using this approach.

5.0 EVALUATION AND RECOMMENDATIONS

5.1.1 Nesting kittiwakes were recorded on six of the 17 platforms surveyed, with a total of 836 occupied nests recorded. This equates to 0.4% (although based on a potential under estimate count in 2023) of the UK breeding population as estimated in 2015 (Woodward *et al.*, 2020). Considering this, and the known regional status of the species, the breeding populations recorded on these assets are considered likely to be significant in the context of the kittiwake population in the North Sea.

5.1.2 Nesting kittiwakes were recorded on the same assets in 2023 as in 2022, with the exception of PLATFORM NAME REMOVED, on which no nests were confirmed in 2023. A significant increase in the number of nests recorded during the surveys in 2023 was attributable to the inclusion of PLATFORM NAME REMOVED (which supported the largest kittiwake colony), and an increase in the number of nests recorded at PLATFORM NAME REMOVED and PLATFORM NAME REMOVED.

Whilst no kittiwake nests were observed on PLATFORM NAME REMOVED, c.20 nests were recorded on PLATFORM NAME REMOVED in 2022, and visibility of suitable ledges during the surveys undertaken in 2023 was hindered by ongoing maintenance works. Kittiwake nesting on PLATFORM NAME REMOVED therefore remains possible.

5.1.3 Whilst no kittiwake nests were recorded on PLATFORM NAME REMOVED, PLATFORM NAME REMOVED, PLATFORM NAME REMOVED, PLATFORM NAME REMOVED, and PLATFORM NAMES REMOVED, as kittiwakes were observed in the vicinity of these platforms, if the platforms were to become more suitable for nesting kittiwakes may potentially nest on these assets in future years. PLATFORM NAME REMOVED and PLATFORM NAME REMOVED and PLATFORM NAME REMOVED generally lacked suitable nesting features, and therefore nesting on these platforms is considered unlikely unless the suitability of the platforms increases significantly.

5.1.4 Results of the surveys will be required to inform environmental impact assessments for the construction and operation of the proposed offshore windfarm. Mitigation plans may also include the provision of replacement nesting opportunities for kittiwake.

5.1.5 Whilst other seabird species were recorded on or in close proximity to assets, no nests of any other species were recorded. However, guillemots were recorded roosting and loafing on PLATFORM NAME REMOVED and PLATFORM NAME REMOVED, and as a result of photographic evidence of guillemot eggs provided from the operator it would seem highly likely that breeding is taking place on the platforms.

5.1.6 Due to the transient nature of breeding bird populations, updated surveys should be completed annually to provide accurate information on nesting seabird colonies on the platforms to inform mitigation proposals.

5.1.7 Regarding capture methods to enable kittiwake population monitoring, chumming and fleyging from the boat was unsuccessful and is therefore not considered to be a viable option. A potential alternative method would be for suitably experienced ornithologists to board the platforms directly and capture kittiwakes from their nests (using a noose or hook on a long pole). This method is used routinely for cliff-nesting kittiwakes and is endorsed by the British Trust for Ornithology (BTO, the licensing body). If safe access by ornithologists can be achieved, kittiwake capture and ringing is recommended at PLATFORM NAME REMOVED and PLATFORM NAME REMOVED due the high numbers of kittiwakes present and the apparent accessibility of the nests.

REFERENCES

CIEEM. (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine.* Version 1.1 – Updated September 2019. [Available at: Guidelines for Ecological Impact Assessment (EcIA) | CIEEM – accessed 20/06/2023].

The Conservation of Habitats and Species Regulations 2017 (as amended). London: HMSO.

Council of the European Communities. (2009) *Directive 2009/147/EC of the European Parliament and of the Council of 20 November 2009 on the conservation of wild birds (codified version).* Official Journal of the European Communities, 20 (2009), 7-25.

Gilbert, G., Gibbons, D. W., & Evans, J. (1998) *Bird Monitoring Methods: a manual of techniques for key UK species*. RSPB.

National Planning Policy Framework. (2019) London: HMSO.

OPRED. (2021) *Protection of Wild Birds in UK Offshore Waters – Advice Notes.* The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended). Offshore Petroleum Regulator for Environment and Decommissioning. [Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/974309/Protection_of_Wild_Birds_Offshore_Advice_Notes_March_2021__002_.pdf – accessed 20/06/2023].

RSK Biocensus. (2022) *Ornithological Census – Outer Dowsing Offshore Wind*. 2483544. ODOW. Rev01. July 2022.

RSK Biocensus. (2022) *Ornithological Assessment – Outer Dowsing Offshore Wind (ODOW).* 2483544. ODOW. Rev01. July 2022.

Stanbury, A.J., Eaton, M.A., Aebischer, N.J., Balmer, D., Brown, A.F., Douse, A., Lindley, P., McCulloch, N., Noble, D.G. & Win, I. (2021) *The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain.* British Birds 114: 723-747. [Available at: Birds of Conservation Concern | BTO - British Trust for Ornithology – accessed 11/07/2023].

Thompson, D. (2021) *Advice Note Seabird Survey Methods for Offshore Installations: Black-legged Kittiwake*. JNCC, Peterborough.

Wildlife and Countryside Act 1981 (as amended). London: HMSO.

Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, S. & Noble, D. (2020) *APEP 4 Population estimates of birds in Great Britain and the United Kingdo*m. British Birds: 113, BTO. [Available at: https://www.bto.org/our-science/publications/peer-reviewed-papers/apep-4-population-estimates-birds-great-britain-and – accessed 12/07/2023].

FIGURES

Figure 1. Location plan for surveyed PLATFORM NAMES & FIGURE REMOVED

APPENDIX A – SURVEY DETAILS

Survey dates and weather conditions for the nesting kittiwake surveys undertaken between the 12th and 15th June 2023 are provided below. Weather conditions were defined as follows:

a) Cloud cover: eighths
b) Sea state: Beaufort scale
c) Swell: low = less than 2m, moderate = 2 to 4m, and high = >4m
d) Sun strength: none, weak, moderate or strong
e) Rain: 1 = none, 2 = discontinuous light, 3 = discontinuous heavy, 4 = continuous light, 5 = continuous heavy
f) Wind speed and direction: Beaufort scale (Appendix 3) and cardinal points
g) Visibility: excellent = ≥10km, good = >5km, moderate = 1 – 5km, poor = <1km

Asset	Date	Cloud cover	Start time (BST)	End time (BST)	Sea state	Swell	Sun	Rain	Wind (Beaufort & direction)	Visibility	Comments/observations
PLATFORM NAME REMOVED	13/06/2023	0	06:55	07:12	1	Low	Strong	0	3 NE	Excellent	Kittiwakes loafing/roosting only
PLATFORM NAME REMOVED	13/06/2023	0	07:45	08:10	2	Low	Strong	0	3 NE	Excellent	Kittiwakes loafing/roosting only
PLATFORM NAME REMOVED	13/06/2023	0	08:47	09:15	2	Low	Strong	0	4 NE	Excellent	Kittiwakes loafing/roosting only

Asset	Date	Cloud cover	Start time (BST)	End time (BST)	Sea state	Swell	Sun	Rain	Wind (Beaufort & direction)	Visibility	Comments/observations
PLATFORM NAME REMOVED	13/06/2023	1	10:10	10:35	2	Low	Strong	0	4 NE	Excellent	40 occupied kittiwake nests
PLATFORM NAME REMOVED	13/06/2023	0	11:30	11:59	2	Low	Strong	0	4 NE	Excellent	36 occupied kittiwake nests
PLATFORM NAME REMOVED	13/06/2023	0	13:15	13:35	2	Low	Strong	0	4 NE	Excellent	No kittiwakes present
PLATFORM NAME REMOVED	13/06/2023	0	14:20	14:32	2	Low	Strong	0	3 NE	Excellent	69 occupied kittiwake nests
PLATFORM NAME REMOVED	13/06/2023	0	15:15	15:25	2	Low	Strong	0	4 NE	Excellent	Kittiwake loafing/roosting only
PLATFORM NAME REMOVED	13/06/2023	1	16:11	16:25	2	Low	Strong	0	4 NE	Excellent	No kittiwakes present
PLATFORM NAME REMOVED	14/06/2023	0	07:14	07:27	3	Low	Strong	0	5 E	Excellent	Kittiwakes loafing/roosting only
PLATFORM NAME REMOVED	14/06/2023	0	10:08	10:24	3	Low	Strong	0	3 NE	Excellent	Kittiwakes loafing/roosting only

Asset	Date	Cloud cover	Start time (BST)	End time (BST)	Sea state	Swell	Sun	Rain	Wind (Beaufort & direction)	Visibility	Comments/observations
PLATFORM NAME REMOVED	14/06/2023	0	12:06	12:34	2	Low	Strong	0	4 NE	Excellent	273 occupied kittiwake nests; guillemots and razorbills present
PLATFORM NAME REMOVED	14/06/2023	0	13:40	13:55	2	Low	Strong	0	4 NE	Excellent	402 occupied kittiwake nests; guillemots and razorbills present
PLATFORM NAME REMOVED	14/06/2023	0	16:03	16:21	2	Low	Strong	0	E 3	Excellent	Kittiwakes loafing/roosting only
PLATFORM NAME REMOVED	14/06/2023	0	16:35	16:55	2	Low	Strong	0	E 3	Excellent	16 occupied kittiwake nests
PLATFORM NAME REMOVED	14/06/2023	0	17:14	17:25	2	Low	Strong	0	NE 3	Excellent	Kittiwakes loafing/roosting only
PLATFORM NAME REMOVED	14/06/2023	0	18:18	18:35	2	Low	Strong	0	NE 3	Excellent	Kittiwakes loafing/roosting, no nests confirmed but recording hindered by maintenance works

APPENDIX B – SURVEY DATA

Full survey data from the nesting kittiwake surveys including all species undertaken between the 12th and 15th June 2023 are provided below. Kittiwake counts are provided for the north (N), east (E), south (S) and west (W) aspects of each asset can be provided on request.

Asset	**Kittiwake** (on nests and loafing)	Herring gull	Lesser black-backed gull	Large gull sp.	Great black-backed gull	Guillemot	Razorbill	Cormorant	Gannet	Fulmar	Notes
PLATFORM NAME REMOVED	8	0	0	0	0	0	0	0	0	0	Kittiwakes loafing on and flying around the platform. No nests.
PLATFORM NAME REMOVED	8	2	0	0	0	0	0	0	0	0	Few loafing kittiwakes and herring gulls around whole platform. No nests.
PLATFORM NAME REMOVED	11	11	0	0	0	0	0	0	0	0	Few loafing kittiwakes and herring gulls around whole platform. No nests.
PLATFORM NAME REMOVED	56+	1	0	0	0	0	0	1	0	0	Nesting and loafing kittiwakes. One roosting cormorant and one roosting herring gull. Kittiwake nesting observed at tops of platform legs. 40 occupied kittiwake nests and 37 trace nests.

Asset	Kittiwake (on nests and loafing)	Herring gull	Lesser black-backed gull	Large gull sp.	Great black-backed gull	Guillemot	Razorbill	Cormorant	Gannet	Fulmar	Notes
PLATFORM NAME REMOVED	47+	0	0	0	0	0	0	0	0	0	Nesting and loafing kittiwakes. Nesting at top of platform legs. 36 occupied kittiwake nests and 37 trace nests.
PLATFORM NAME REMOVED	0	0	0	0	0	0	0	0	0	0	No birds observed on or around platform.
PLATFORM NAME REMOVED	86	0	0	0	0	0	0	0	0	0	Nesting and loafing kittiwakes. 69 occupied kittiwake nests.
PLATFORM NAME REMOVED	1	0	0	0	0	0	0	0	0	0	1 loafing immature kittiwake. No nests.
PLATFORM NAME REMOVED	0	0	0	0	0	0	0	0	0	0	No birds observed loafing or nesting on or around platform.
PLATFORM NAME	2	0	0	0	0	0	0	0	0	0	2 loafing/roosting kittiwakes. No nests.

Asset	Kittiwake (on nests and loafing)	Herring gull	Lesser black-backed gull	Large gull sp.	Great black-backed gull	Guillemot	Razorbill	Cormorant	Gannet	Fulmar	Notes
REMOVED											
PLATFORM NAME REMOVED	6	1	0	2	1	0	0	0	0	0	Loafing herring gull/large gulls and kittiwakes. No nests.
PLATFORM NAME REMOVED	597+	30	0	3	0	181	9	0	0	2	Nests and birds covering all suitable ledges. Few immature kittiwakes and herring gulls. Guillemots tightly packed around ledges on the legs of the platforms and kittiwakes on I beam around whole platform. Birds feeding around platform including 2 fulmars. 273 occupied kittiwake nests and 18 trace nests.
PLATFORM NAME REMOVED	685	43	0	3	0	276	4	1	0	0	Nests and birds covering all suitable ledges. Few immature kittiwakes and herring gulls. Guillemots tightly packed around ledges on the legs of the platforms and kittiwakes on I beam around whole platform. Birds feeding around platform. 402 occupied kittiwake nests and 27 trace nests.
PLATFORM NAME	28	10	2	2	1	0	0	0	0	0	Immature and adult loafing kittiwakes, herring gulls and other large gull species. No nests.

Asset	Kittiwake (on nests and loafing)	Herring gull	Lesser black-backed gull	Large gull sp.	Great black-backed gull	Guillemot	Razorbill	Cormorant	Gannet	Fulmar	Notes
REMOVED											
PLATFORM NAME REMOVED	35	0	0	0	0	1	0	0	0	0	Few nests on west side and underneath, some loafing birds. 1 guillemot. 16 occupied kittiwake nests.
PLATFORM NAME REMOVED	11	13	0	0	0	0	0	0	0	0	Loafing kittiwakes and herring gulls. No nests.
PLATFORM NAME REMOVED	3	0	0	0	0	0	0	0	1	0	Limited visibility due to maintenance works. Few kittiwakes seen around platform and one gannet. No nests recorded.

APPENDIX C – SITE PHOTOGRAPHS

Photographs from the nesting kittiwake surveys undertaken between the 12th and 15th June 2023 are provided below.

36 PHOTOGRAPHS REMOVED