



ElAR Volume 4: Offshore Infrastructure Technical Appendices Appendix 4.3.6-1 Technical Baseline Report – Ornithology

Kish Offshore Wind Ltd

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Dublin Array Offshore Wind Farm

Environmental Impact Assessment Report

Volume 4, Appendix 3.6-1 - Technical Baseline Report – Ornithology

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Acronyms

Term	Definition
BDMPS	Biologically Defined Minimum Population Scale
CI	Confidence Interval
COWRIE	Collaborative Offshore Wind Research Into the Environment
DCCAE	Department of Communications, Climate Action and Environment
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
ESAS	European Seabirds At Sea
HPAI	Highly Pathogenic Avian Influenza
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
MSL	Mean sea level
NPWS	National Parks and Wildlife Service
RWE	RWE Renewables Ireland Limited
SD	Standard Deviation
SNH	Scottish Natural Heritage, now called NatureScot
UK	United Kingdom

1 Introduction

1.1 Overview

- 1.1.1 Dublin Array Offshore Wind Farm (Dublin Array) is a proposed offshore wind farm on the Kish and Bray Banks. The Kish and Bray Banks are located, approximately 10 km off the east coast of Ireland, immediately south of Dublin city off the coast of counties of Dublin and Wicklow. Dublin Array will be located within an area of approximately 59 km², in water depths ranging from 2 metres to 50 metres lowest astronomical tide (LAT)
- 1.1.2 This document has been prepared by Cork Ecology to support the Environmental Impact Assessment (EIA) of the Dublin Array Offshore Wind Farm (Dublin Array).
- 1.1.3 This technical baseline should be read in conjunction with the following documents included within the Environmental Impact Assessment Report (EIAR):
- Offshore Ornithology boat based Survey Report June 2019 to September 2020 - Volume 4, Appendix 4.3.5-4 of the EIAR (hereafter referred to as the Offshore Ornithology Survey Report 1).
 - Offshore Ornithology boat based Survey Report October 2020 to April 2021 - Volume 4, Appendix 4.3.5-5 of the EIAR (hereafter referred to as the Offshore Ornithology Survey Report 2).
 - Report on Intertidal Bird Surveys at Two Potential Grid Connection Cable Landfall Locations - Winter 2019/20 and Autumn 2020 - Volume 4, Appendix 4.3.6-8; and
 - Report on Intertidal Bird Surveys at Shanganagh- Winter 2023/24 – Volume 4, Appendix 4.3.6-9.

1.2 Purpose of this report

- 1.2.1 The purpose of this technical report is to provide a robust characterisation of the baseline environment in terms of intertidal and offshore ornithology. Please note that the determination of sensitivity of the receiving environment; the magnitude of the effect, and the overall significance of each effect are presented within Chapter 3.7 (Offshore Ornithology) of the EIAR.

1.3 Report structure

- 1.3.1 This report is structured as follows:
- Section 1 introduces the report and outlines its aims;
 - Section 2 presents the methodology and data sources applied to characterise the receiving environment;

- Section 3 presents the characterisation of the existing receiving environment for the ornithology assessment;
- Section 4 presents the characterisation of the future receiving environment;
- Section 5 presents any uncertainties or data gaps which were identified during the baseline characterisation; and
- Section 6 provides a high-level summary of the findings of this report.

2 Methodology

2.1 Approach

- 2.1.1 The baseline has been characterised through a combination of site-specific bird survey data within the ornithology study area (Section 2.2 and Figure 1) and publicly available seabird data for the wider region. Site-specific surveys included recent surveys undertaken across the offshore and intertidal study areas to provide up to date information on the birds present, combined with previous data collected and analysed across the study areas. This section outlines details of these surveys, as well as details of relevant publicly available seabird data. In addition, analysis methods for the site-specific survey data are also presented.

2.2 Study areas

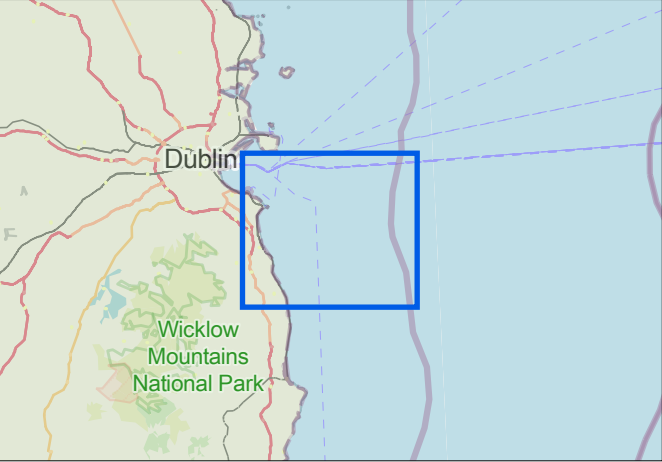
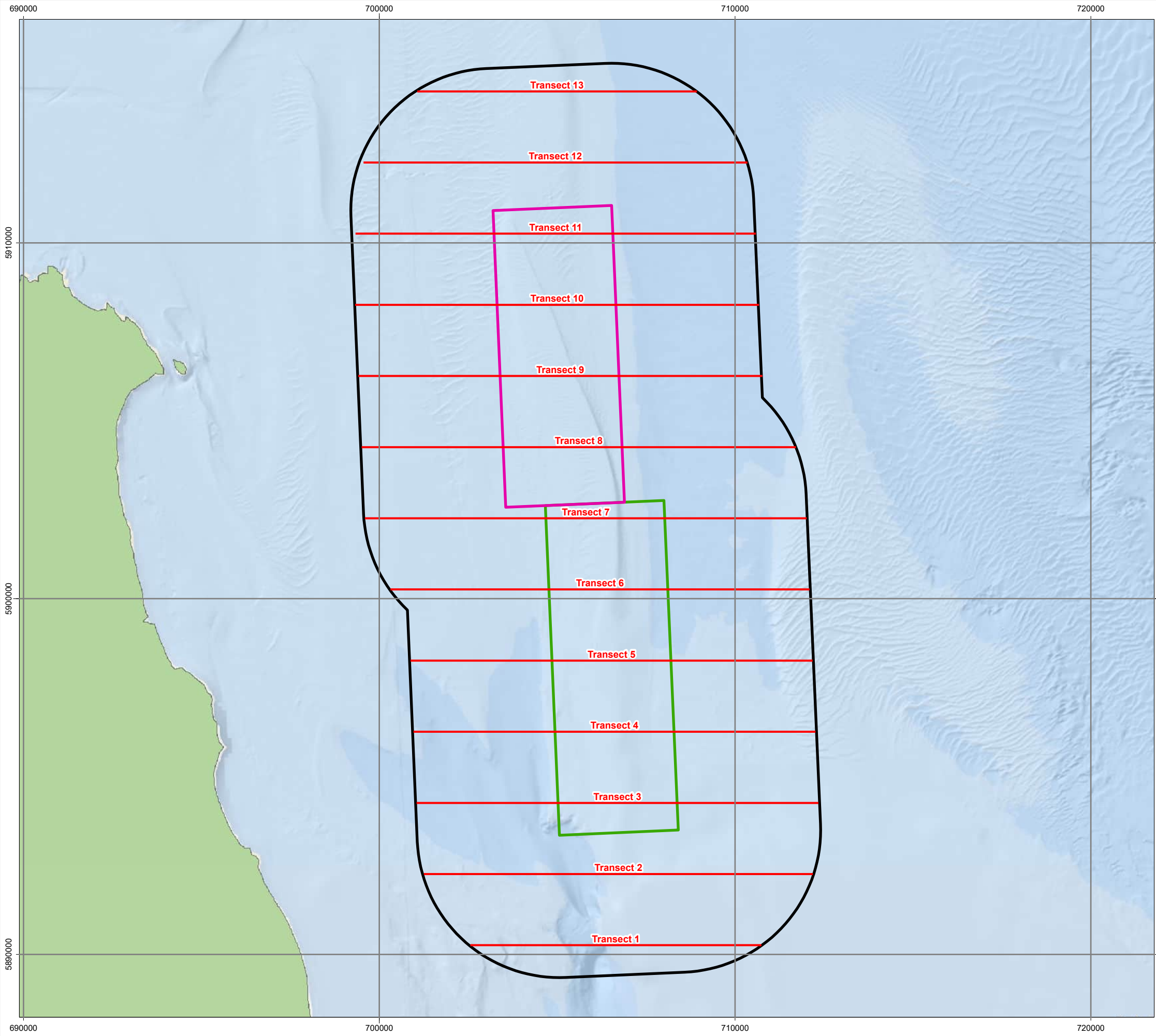
- 2.2.1 For the purposes of this technical report on ornithology, the offshore ornithology study area is defined as the array area and a four km buffer around this (Figure 1). The guidance (DCCAE, 2018) suggests that for sites larger than 10 km², a buffer of four km around the site is adequate. A buffer of four km around a potential offshore wind farm site was also recommended in a review of assessment methodologies for offshore wind farms for COWRIE¹ in the UK (MacLean *et al.*, 2009).
- 2.2.2 For the intertidal surveys for the Offshore Export Cable landfall, the intertidal study area for the potential landfall location at Shanganagh is shown in Figure 2 additional information on the intertidal surveys is presented in the Intertidal Bird Surveys Report (Volume 4, Appendix 4.3.6-9)

2.3 Data sources

- 2.3.1 Data to inform the characterisation of the receiving environment has been collated by combining information from a thorough desk-based study of published data with a series of site-specific surveys. Data was drawn from previous site surveys, contemporary studies commissioned by Dublin Array and existing published datasets (Table 1).
- 2.3.2 Two main studies were used to inform seabird distribution and abundance within the wider region of the western Irish Sea. Published at-sea survey data from ESAS surveys undertaken between 1980 and 1997 (Pollock *et al.*, 1997), was used in conjunction with more recent visual aerial surveys of the western Irish Sea undertaken in summer, autumn and winter 2016 (Jessopp *et al.*, 2018).

¹ Collaborative Offshore Wind Research into the Environment (COWRIE) was set up by The Crown Estate as an independent body to carry out research into the impact of offshore wind farm development on the environment and wildlife.

- 2.3.3 In addition to the data sources identified relevant to the Irish Sea and study area, consideration has been given to relevant scientific literature and research material in relation to ornithology.
- 2.3.4 More details on the various datasets used in this report are provided in Sections 2.4 and 2.5.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number

DRAWING STATUS

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PROJECT TITLE

Dublin Array

DRAWING TITLE

Array area and 4km buffer area. 16

DRAWING NUMBER: **02036.00590.0069** PAGE NUMBER: **Figure 1**

VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2024-04-24	DRAFT	MM	AB	AE

01 Kilometers
0 0.5 1 Miles

N

ORIENT NORTH

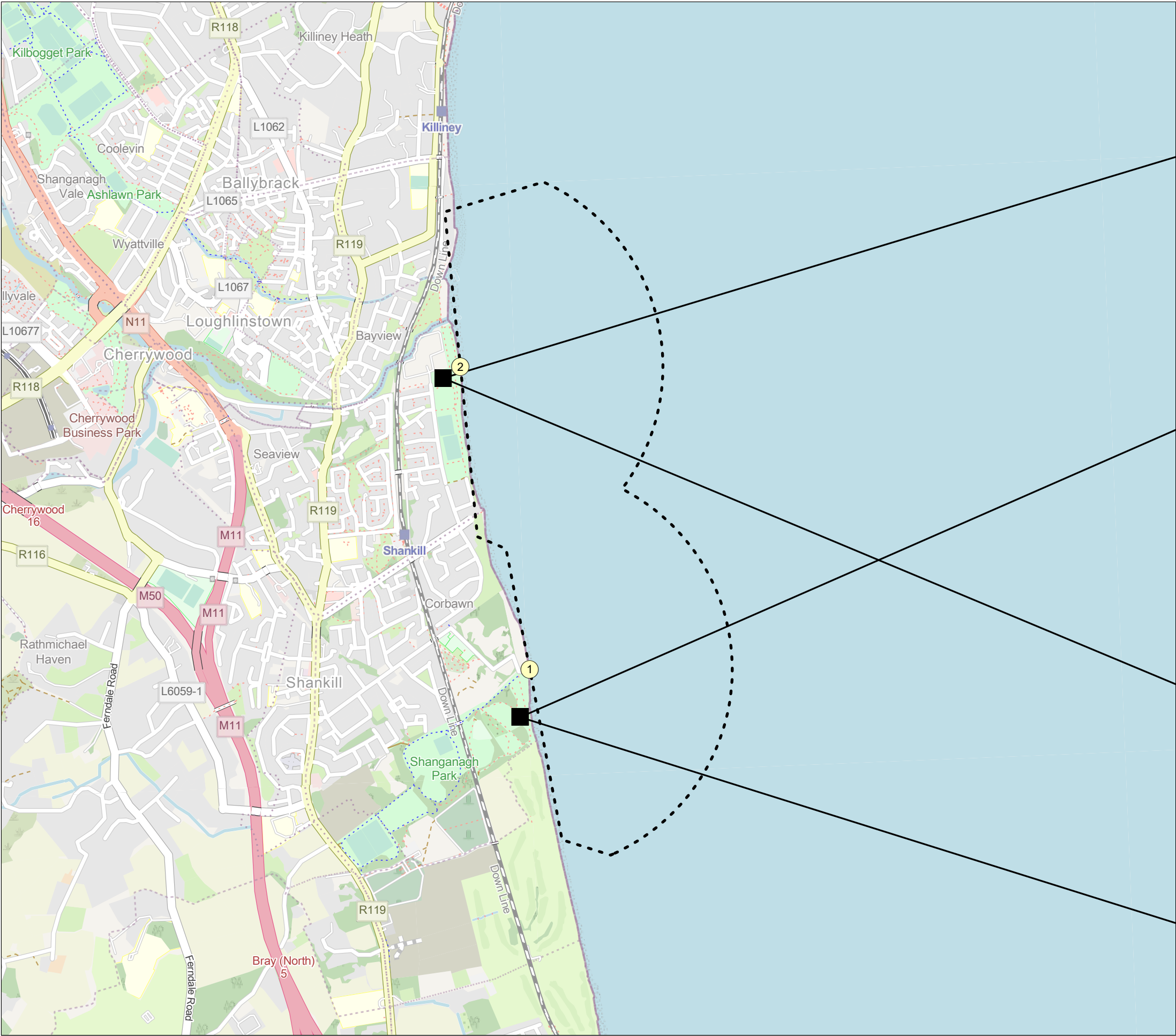
SCALE 1:110,000

DATUM WGS 1984

PRJ WGS 1984 UTM Zone 29N

PLOT SIZE A3

VERTICAL REF. DDN/LAT/MLLW



- Study Area
- Potential Subsea Cable Route Corridor
- Vantage Point
- Potential Landfall Location

DRAWING STATUS

PUBLIC

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PROJECT TITLE

Dublin Array

DRAWING TITLE

Study Area Including Vantage Points, Potential Subsea Cable Routes and Landfall Locations Winter, 2019/20

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Table 1 Data sources considered in the development of the Ornithology baseline

Data source	Type of data	Temporal and spatial coverage
Site specific survey data		
2001/02 Survey Report	Summary report of project-specific boat-based surveys	14 surveys conducted between September 2001 and September 2002. Used to provide context for the more recent survey data.
2010/11 Survey Report	Summary report of project-specific boat-based surveys	15 surveys conducted between June 2010 and June 2011. Used to provide context for the more recent survey data.
2016/17 Survey data & Report	Summary report and project-specific boat-based survey data	11 surveys conducted between September 2016 and September 2017. Used in the EIAR Assessment.
2019/21 Survey data	Project-specific boat-based survey data	24 surveys conducted between June 2019 and April 2021. Used in the EIAR Assessment.
Winter 2019/20, Autumn 2020 Volume 4, Appendix 4.3.6-8 and Winter 2023/2024 survey data (Volume 4, Appendix 4.3.6-9)	Intertidal surveys at Offshore Export Cable landfall location	Intertidal surveys conducted between November 2019 and March 2020, September and October 2020 and September 2023 to March 2024. Used to inform EIAR Assessment
Published at-sea survey data from the wider region		
JNCC Report No. 267 (Pollock et al. 1997)	Published Report	ESAS survey data collected between 1980 and 1997 in Irish waters, including a period of intensive surveys between 1994 and 1997, which targeted areas around Ireland with poor survey coverage. Used to provide historic context for the wider Irish Sea.
ObSERVE 2016 aerial surveys (Jessopp et al. 2018)	Published Report	Fine-scale aerial surveys conducted in summer, autumn and winter 2016 to assess the occurrence and distribution of seabird species in the western Irish Sea. Used to provide recent context for the wider Irish Sea.
Seabird colony data from the wider region		
Burnell et al., 2023	Published seabird colony counts	Published data from a census of breeding seabirds in Britain and Ireland between 2015 and 2021. Used to provide SPA reference populations for the EIAR.
Seabird Monitoring Programme	Online Colony Counts	Online database of seabird colony counts in Ireland and UK – most recent data from Seabirds Count national census 2015-2020. Used to provide SPA reference populations for the EIAR.
Cummins et al., 2019	NPWS Published Report	The Status of Ireland's Breeding Seabirds: Birds Directive Article 12 Reporting 2013 – 2018. Used to provide SPA reference populations for the EIAR.

2.4 Site specific surveys

- 2.4.1 The DCCAE 2018 Guidance Part 1² outlines the requirement for data gathering to inform the baseline and the importance of any studies being able to detect any change that can be attributable to the development and distinguish these from natural levels or other developments. The DCCAE Guidance recommends that three years of ornithological baseline surveys should be undertaken where no data previously exist (DCCAE, 2018). In accordance with this requirement, the sections below provide details of all site specific surveys undertaken across the study area.

June 2019 to April 2021 boat-based surveys

- 2.4.2 Site specific boat-based surveys were undertaken in the study area on a monthly basis between June 2019 and April 2021 (Figure 1). Data were collected along 13 transects spaced 2 km apart and aligned east-west across the offshore ornithology study area. Two surveys were conducted in both August and September 2019 to provide additional coverage of post breeding seabird activity and distribution. In addition, two surveys were conducted in May 2020, and also in March and April 2021.
- 2.4.3 As recommended in the DCCAE 2018 Guidance Part 2, the methods used to conduct the baseline seabird surveys followed standard COWRIE approved survey methodology (Camphuysen *et al.*, 2004).
- 2.4.4 Surveys were conducted using four different survey vessels over the survey period. MV Keary and Husky were used for one survey each, Fastnet Petrel was used for two trips, and AMS Panther was used for 20 trips. All survey vessels used had an observer eye-height of greater than 5 m, as recommended for ESAS surveys (Webb & Durinck 1992, Camphuysen *et al.*, 2004).
- 2.4.5 On each survey, birds were counted ahead of the ship and out to one side of the survey vessel in a 90° arc, with a 300 m transect width, using two surveyors, as per Camphuysen *et al.*, (2004). Three ESAS accredited surveyors were on board for surveys between June 2019 and January 2020. Due to Covid-19 restrictions, there was only space for two ESAS accredited surveyors on surveys between May 2021 and September 2021. At any one time, one surveyor was acting as the primary observer, with a second acting as scribe and secondary observer, while the third surveyor (if present) was on a break.
- 2.4.6 Binoculars were used to confirm identifications as well as to scan ahead for species such as red-throated divers, which are easily disturbed and take flight at some distance from the approaching vessel. Birds on the water were assigned to distance bands (A = <50 m, B = 51-100 m, C = 101-200 m, D = 201-300 m, E =>300 m), according to their perpendicular distance from the ship's track.

² Department of Communications, Climate Action & Environment: Guidance on Marine Baseline Ecological Assessments and Monitoring Activities for offshore Renewable Energy Projects Part 1, April 2018

- 2.4.7 A snapshot method was used for flying birds, which considers the ship's speed and prevents overestimation of flying seabird densities. In addition, the estimated height of flying birds was also recorded in five height bands above sea level; 0-5 m, 5-10 m, 10-20 m, 20-30 m, >30 m.
- 2.4.8 The count interval for surveys was one minute intervals, and synchronised GPS recorders were used to record the vessel position every minute. Any uncommon bird species or large flocks of feeding birds seen on the 'non-survey' side of the vessel were also recorded. All terrestrial bird species seen were also recorded.
- 2.4.9 Environmental conditions such as wind direction and force, sea state, swell height and visibility were recorded every 15 minutes throughout survey days. Surveys were carried out in good weather where possible, to maximise detection rates of birds on the water. Surveys were generally halted if the sea state exceeded sea state 4, as recommended in Camphuysen *et al.*, (2004).
- 2.4.10 Baseline surveys were conducted by Ciáran Cronin (Survey Leader), André Robinson, Laura Kavanagh, Niall Keogh, Nick Veale and Paul Connaughton. All surveyors were ESAS accredited.
- 2.4.11 Due to unsuitable weather conditions and Covid-19 the planned surveys between February and April 2020 were not conducted. As a result of missing the April 2020 survey, two surveys were undertaken in May 2020. In addition, as the March 2020 survey was missed due to unsuitable weather conditions, two surveys were undertaken in March 2021. Two surveys were also undertaken in April 2021, as the April 2020 survey was previously missed.
- 2.4.12 Results from the site specific surveys conducted between June 2019 and April 2021 are presented in the Offshore Ornithology Survey Reports 1 & 2.

Intertidal Survey Methods

- 2.4.13 The scope of the intertidal surveys at Shanganagh was to provide robust baseline ornithological survey data of non-breeding waterbird species density, abundance, distribution and patterns of behaviour within the intertidal study area during the winter period 2019/20 and autumn period 2020 and during the winter period 2034/24 and the 2023 autumn migration period.
- 2.4.14 The Irish Wetland Bird Survey (IWeBS) regularly collects count data for non-breeding intertidal birds around Ireland, however IWeBS does not cover the potential landfall location at Shanganagh Cliffs, hence the requirement for surveys at those locations.
- 2.4.15 The intertidal survey methodology was based on the IWeBS methods (BirdWatch Ireland and NPWS, 2009) with some minor adjustments. In the 2019/2020 surveys, regular counts were made at two vantage points covering the potential cable landfall locations between November 2019 and March 2020, and also September and October 2020 (Volume 4, Appendix 4.3.6-8). In the second survey period (September 2023 to March 2024), four surveys per month were conducted at one vantage point covering the cable landfall location (Volume 4, Appendix 4.3.6-9).

- 2.4.16 The vantage point locations were chosen to maximise visibility of birds within the intertidal zone up to 750m to the north and to the south of each potential cable landfall location i.e. a total shoreline distance of 1.5 km and looking east out to 1 km offshore.
- 2.4.17 Survey periods lasted three hours and began either four hours before or one hour after high tide or four hours before or one hour after low tide. The survey aimed to capture bird species assemblages and numbers on a range of rising and ebbing tides from each vantage point. The numbers and locations of all waders and waterbirds visible from each vantage point were mapped every 30 minutes throughout the duration of each survey in order to determine the abundance and distribution of birds across a range of tidal states. Where flocks of birds were present, the location of each flock was recorded on the field map at the approximate central point. Bird flyovers and flypasts were also recorded on field maps and datasheets. If disturbance events were noted during counts, then the focus switched to the disturbance event with the count resuming once the event had concluded.
- 2.4.18 In the 2023/2024 surveys, the landfall location was visited four times per month. The visits were coordinated so that counts were made at different tidal states in each survey month.
- 2.4.19 In addition to recording bird numbers, all potentially disturbing events visible from the vantage points were also recorded during each survey period, including those where no evidence of disturbance of waterbirds was observed.
- 2.4.20 Further details of the survey methods are presented in the two intertidal survey reports (Volume 4, Appendix 4.3.6-8; Volume 4, Appendix 4.3.6-9).

Previous Site Specific Survey Datasets

- 2.4.21 In addition to the 2019-2021 boat-based surveys outlined above, boat-based surveys were also conducted between September 2016 and September 2017, with a total of 11 surveys conducted over this period (Newton & Kavanagh 2018). Surveys were not conducted in January 2017 due to bad weather, or in April 2017 due to a lack of vessel availability. These surveys covered a similar core area to the 2019-2020 surveys, although the buffer width was less than four km, and only 12 transect lines running east-west were used, compared to 13 transects on the more recent surveys. Transect lines were spaced between 1.4 km and 2.4 km apart from each other, and transect length was between 7.4 km and 7.8 km.
- 2.4.22 There was one main difference between the methods used for these surveys and the 2019-2020 surveys. Although two surveyors were on board for each survey, each surveyor covered one side of vessel, with one also acting as recorder, rather than both surveyors covering the same side, as per ESAS methods (Camphusyen *et al.*, 2004). However, the remaining methods were based on the ESAS method, and height of flying birds was recorded using height bands that were compatible with those used on the 2019-2020 surveys.

- 2.4.23 In order to ensure that sufficient site specific data is used to support the assessment, as required in the DCCAE Guidance Part 1 (DCCAE, 2018), the data collected during the 2016-2017 surveys and the 2019-2020 surveys have been combined in this assessment. Relevant data from both survey datasets were incorporated into a Distance analysis and the results used to inform this assessment (see Section 2.5).
- 2.4.24 In addition, there are two further historic datasets covering a similar area. Between June 2010 and June 2011, 15 boat-based surveys were conducted (Newton and Trewby 2011) and there were also 14 boat-based surveys conducted between September 2001 and September 2002 (Percival *et al.*, 2002). Relevant information from these surveys are presented throughout this technical report to provide context, information on flight height, and on how seabirds use the study area over time.

2.5 Data Analysis

- 2.5.1 Following completion of each survey, survey datasheets were entered onto an Excel spreadsheet based on the Joint Nature Conservation Committee (JNCC) Seabirds at Sea Team database structure, then printed and manually checked for any errors before any subsequent analysis of the data was conducted.
- 2.5.2 These data formed the basis for estimating population sizes and densities of seabirds in the study area. These estimates were derived by applying distance sampling techniques using Distance 6.0 software. Further details on this technique and associated corrections in relation to the baseline survey data are presented below.

Distance Analysis

- 2.5.3 Baseline surveys were conducted in two periods, between September 2016 and September 2017 (11 surveys) and June 2019 and April 2021 (24 surveys). Data for each survey were processed separately, and the results combined to obtain monthly averaged values.
- 2.5.4 For more commonly encountered species, those with at least 50 observations of birds on the water, distance analysis (Thomas *et al.*, 2010) was undertaken, using the package of the same name in the statistical software 'R' (R Core Team, 2008). For the 2016-2017 dataset, it was possible to conduct distance analysis for six species: Manx shearwater, shag, herring gull, kittiwake, guillemot and razorbill. For the 2019-2021 dataset, distance analysis was again possible for these six species, plus an additional two species: gannet and great black-backed gull. In addition, distance analysis was also conducted on one unidentified species group from the 2019-2020 dataset: guillemot/razorbill.
- 2.5.5 The analysis produced detection functions for each species using the methods of Buckland *et al.*, (2001). These used the distribution of observations in distance bands aligned with the direction of vessel travel to estimate the number of unobserved individuals present in the line transect area. Detection functions were pooled across the surveys (separately for each survey period to allow for differences in vessels and personnel).

- 2.5.6 A standard methodology was applied, using a half-normal decay function with cosine adjustments and observations pooled by cluster (i.e. flock) size, to accommodate the likelihood of higher detection rates for larger groups than for individuals. The data were combined across the array area and buffer area, since the size of each area (array area and buffer) was considered too small for robust independent analysis. To obtain abundance estimates appropriate to the array area and buffer area, the area of each was multiplied by the overall density estimate. Outputs also included upper and lower 95% confidence intervals, derived from combinations of the encounter rate, detection rate and cluster size.
- 2.5.7 At regular intervals during the surveys a snapshot of birds in flight within a zone 300 m in front and to one side of the vessel was recorded. The timing for these was based on obtaining an unbroken sample along the transects (i.e. they took place with a spacing of 300 m). The snapshot counts on each survey were summed across all snapshots for each species and then divided by the total area of snapshots to obtain an estimate of the density of each species in flight. A bootstrap method was used to resample the data to calculate upper and lower 95% confidence intervals on the estimates.
- 2.5.8 The birds recorded in flight during snapshots were also assigned to height bands, which were used to estimate the proportions at, and below, rotor height (defined as 20 m above mean sea level).
- 2.5.9 After the distance analysis was conducted, monthly mean densities were calculated by summing the density estimates for each month and dividing them by the total number of surveys for each month. This mean monthly density figure was then multiplied by the area of the array area (58.9 km²) or the area of the 4 km buffer area (222.0 km²) to calculate an estimated monthly number of birds for each area.
- 2.5.10 The total number of surveys for each month for the combined 2016-2017 and 2019-2020 datasets is shown in Table 2.
- 2.5.11 For species with fewer than 50 observations, distance analysis is considered unreliable (Buckland *et al.*, 2001). For these species, the number of each species seen on each survey was divided by the total length of transect travelled, to provide an estimate of numbers per km. This was undertaken both for birds on the water only and also for combined birds in flight and on the water (i.e. all birds). Average abundance (birds/km) was then calculated by dividing the totals for each month by the number of surveys for that month (Table 2).

Table 2 Number of surveys per month in the 2016-2017 and 2019-2021 datasets.

Month	No of surveys in 2016-2017	No of surveys in 2019-2021	Total
January	0	2; Jan 2020 & Jan 2021	2
February	1; Feb 2017	0	1
March	1; Mar 2017	2; Both March 2021	3
April	0	2; Both April 2021	2
May	1; May 2017	2; Both May 2020	3
June	1; June 2017	2; June 2019 & June 2020	3
July	1; July 2017	2; July 2019 & July 2020	3
August	1; Aug 2017	3; 2 in Aug 2019 & Aug 2020	4
September	2; Sept 2016 & Sept 2017	3; 2 in Sept 2019 & Sept 2020	5
October	1; Oct 2016	2; Oct 2019 & Oct 2020	3
November	1; Nov 2016	2; Nov 2019 & Nov 2020	3
December	1; Dec 2016	2; Dec 2019 & Dec 2020	3

2.6 Definition of Seasons and Reference Populations

Definition of Seasons

- 2.6.1 A breakdown of months to consider as breeding season or non-breeding season is not included in the Irish guidance (DCCAE, 2017, DCCAE, 2018). Two options were therefore considered for determining a breakdown of months for the breeding and non-breeding seasons for seabird species covered in this technical report. The first option considered was to follow the season definitions published by NatureScot (formerly called Scottish Natural Heritage) (NatureScot, 2020), which have been used in assessments of offshore wind farms in Scotland. The second option was to use those presented in Furness (2015).
- 2.6.2 It was considered that there may be differences in season timings with the NatureScot definitions due to differences in day length and temperature between seabird colonies in Ireland and the Scottish colonies for which these definitions were drawn up. It was therefore decided to use season definitions presented in Furness (2015), which were based on colony attendance data from the whole of the UK, as this was considered likely to be more representative of the seasons in Ireland. This approach has also been agreed with the other East Coast Phase 1 developers, as presented in the combined method statement (Appendix 4.3.6-2³). Furness (2015) has also been used as a source of season definitions for several other offshore wind farm EIA assessments including East Anglia Three (Vattenfall, 2015), East Anglia One North (Scottish Power Renewables, 2019a) and East Anglia Two (Scottish Power Renewables, 2019b), demonstrating that this approach is not novel. Where species were not included in Furness (2015), season definitions from NatureScot (2020) were used as an alternative.
- 2.6.3 Season definitions used in this assessment are presented in Table 3 below.

³ Method Statement presents the intended approach to all major aspects of the ornithological assessment, including collision risk modelling, displacement analysis and population viability analysis.

Table 3 Definitions of breeding and non-breeding season used in this assessment (From Furness, 2015 unless otherwise stated)

Species	Breeding Season	Migration periods	Non-breeding Season
Red-throated Diver	March to August	September to November February to April	December to January
Great Northern Diver	June to August		September to May
Fulmar	January to August	September to October December to March	September to December
Manx Shearwater	April to August	August to early October Late March to May	Not present in Irish waters in significant numbers
Storm Petrel ³	Mid-May to October		Not present in Irish waters in significant numbers
Gannet	March to September	September to November December to March	October to February
Cormorant	April to August		September to March
Shag	February to August		September to January
Common Scoter ¹	May to August		September to April
Arctic Skua	May to July	August to October April to May	Not present in Irish waters in significant numbers
Great Skua	May to August	August to October March to April	November to February
Mediterranean Gull ²	May to July		August to April
Little Gull ²	May to July		August to April
Black-headed Gull ³	March to August		September to February
Common Gull ³	March to August		September to February
Lesser black-backed Gull	April to August	August to October March to April	November to February
Herring Gull	March to August		September to February
Great black-backed Gull	Late March to August		September to March
Kittiwake	March to August (Migration free – May to July)	August to December January to April	September to February
Sandwich Tern	April to August	July to September March to May	Not present in Irish waters in significant numbers

Species	Breeding Season	Migration periods	Non-breeding Season
Roseate Tern	May to August	August to September April to May	Not present in Irish waters in significant numbers
Common Tern	May to August	Late July to early September April to May	Not present in Irish waters in significant numbers
Arctic Tern	May to early August	July to early September Late April to May	Not present in Irish waters in significant numbers
Little Tern	May to early August	July to early September Mid-April to May	Not present in Irish waters in significant numbers
Guillemot	March to July		August to February
Razorbill	April to July	August to October January to March	November to December
Black Guillemot	April to August		September to March
Puffin	April to early August		Mid-August to March

1 Based on information presented in Heffernan & Hunt, (2022)

2 Snow & Perrins, (1998) as species not included in Furness (2015)

3 Based on NatureScot (2020) season definition as species not included in Furness (2015)

Reference Populations

- 2.6.4 For national populations of seabird species, totals were taken from Burnell *et al.*, (2023), or Cummins *et al.*, (2019). Most recent population counts for the key seabirds and breeding colonies of relevance to this assessment have been taken from Burnell *et al.*, (2023), Cummins *et al.*, (2019) or the Seabirds Monitoring Programme (SMP) online database and are presented in the relevant species accounts. Where other data sources have been used, these are referenced in the text.
- 2.6.5 For the breeding season, colony counts from SPA and non-SPA colonies within mean maximum foraging range (+1 Standard Deviation (SD)) for each species, based on Woodward *et al.*, (2019) were used. Colony counts used in the assessment are listed in the individual species accounts.
- 2.6.6 For the non-breeding season, the Biologically Defined Minimum Population Scale (BDMPS) approach devised by Furness, (2015) has been used as a basis to estimate suitable regional reference populations for use in the EIAR.
- 2.6.7 To alter Furness BDMPS regions to incorporate western Irish Sea areas the following general approach was followed:

- ▲ For each species, BDMPS (Furness, 2015) regional populations incorporate a proportion of the estimated Irish breeding population. This component was removed from the BDMPS population and replaced with the breeding population as estimated in Burnell *et al.*, (2023), for east coast and south counties between County Louth and Mizen Head in County Cork. Further refinements for individual species are presented in the following species accounts. These population estimates were corrected to include non-adult birds using age group proportions from Horswill and Robinson (2015) (Table 4). Note that for roseate tern, 100% of the Irish breeding population as estimated in Burnell *et al.*, (2023) was used, as there are no breeding colonies away from the east coast.

Table 4 Demographic rates used to calculate stable age structures and average mortality rates (from Horswill and Robinson, 2015)

Species	Parameter	Survival (Age Class)										Imm/ Adult ratio	Productivity (chicks per pair)	Average Mortality
		0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	Ad			
Kittiwake	Population Age Ratio	0.790	0.854	0.854	0.854						0.854		0.690	0.156
	Demographic Rate	0.155	0.123	0.105	0.090						0.527	0.898		
Black-headed gull	Demographic Rate	0.825	0.825								0.825		0.625	0.175
	Population Age Ratio	0.175	0.145								0.680	0.471		
Little gull	Demographic Rate	0.800	0.800								0.800		0.625	0.200
	Population Age Ratio	0.175	0.145								0.680	0.471		
Great black-backed gull	Demographic Rate	0.798	0.930	0.930	0.930	0.930					0.930		1.139	0.095
	Population Age Ratio	0.188	0.134	0.112	0.094	0.078					0.394	1.538		
Common gull	Demographic Rate	0.410	0.710	0.828							0.828		0.543	0.253
	Population Age Ratio	0.172	0.078	0.061							0.689	0.452		
Herring gull	Demographic Rate	0.798	0.834	0.834	0.834	0.834					0.834		0.920	0.172
	Population Age Ratio	0.163	0.132	0.111	0.094	0.079					0.422	1.370		
Lesser black-backed gull	Demographic Rate	0.820	0.885	0.885	0.885	0.885					0.885		0.530	0.123
	Population Age Ratio	0.125	0.102	0.090	0.080	0.070					0.533	0.876		
Sandwich tern	Demographic Rate	0.358	0.741	0.741							0.898		0.702	0.238
	Population Age Ratio	0.212	0.078	0.060							0.650	0.538		

Species	Parameter	Survival (Age Class)										Imm/ Adult ratio	Productivity (chicks per pair)	Average Mortality
		0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	Ad			
Roseate tern	Demographic Rate	0.664	0.664	0.850							0.883		0.764	0.191
	Population Age Ratio	0.197	0.130	0.086							0.588	0.701		
Common tern	Demographic Rate	0.664	0.664	0.850							0.883		0.764	0.191
	Population Age Ratio	0.197	0.130	0.086							0.588	0.701		
Arctic tern	Demographic Rate	0.664	0.837	0.837	0.837						0.837		0.380	0.183
	Population Age Ratio	0.114	0.082	0.074	0.068						0.662	0.511		
Guillemot	Demographic Rate	0.560	0.792	0.917	0.939	0.939	0.939				0.939		0.672	0.136
	Population Age Ratio	0.160	0.087	0.067	0.060	0.055	0.050				0.522	0.916		
Razorbill	Demographic Rate	0.794	0.794	0.895	0.895	0.895					0.895		0.570	0.129
	Population Age Ratio	0.135	0.107	0.084	0.075	0.066					0.533	0.876		
Black guillemot	Demographic Rate	0.731	0.870	0.870	0.870	0.870					0.870		1.298	0.158
	Population Age Ratio	0.200	0.139	0.115	0.095	0.078					0.373	1.681		
Puffin	Demographic Rate	0.709	0.709	0.709	0.760	0.805					0.906		0.617	0.177
	Population Age Ratio	0.156	0.113	0.082	0.060	0.047					0.543	0.842		
Red- throated diver	Demographic Rate	0.600	0.620	0.840							0.840		0.571	0.224
	Population Age Ratio	0.168	0.108	0.072							0.652	0.534		

Species	Parameter	Survival (Age Class)										Imm/ Adult ratio	Productivity (chicks per pair)	Average Mortality
		0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	Ad			
Great northern diver	Demographic Rate	0.770	0.770	0.770	0.870	0.870	0.870				0.870		0.543	0.161
	Population Age Ratio	0.126	0.101	0.081	0.065	0.059	0.053				0.514	0.947		
Fulmar	Demographic Rate	0.861	0.861	0.861	0.861	0.861	0.861	0.861	0.861	0.861	0.936		0.419	0.103
	Population Age Ratio	0.095	0.083	0.072	0.062	0.054	0.047	0.041	0.035	0.031	0.480	1.083		
Manx shearwater	Demographic Rate	0.870	0.870	0.870	0.870	0.870					0.870		0.697	0.130
	Population Age Ratio	0.141	0.121	0.104	0.089	0.077					0.469	1.132		
Gannet	Demographic Rate	0.424	0.829	0.891	0.895	0.919					0.919		0.700	0.181
	Population Age Ratio	0.183	0.077	0.064	0.057	0.051					0.568	0.761		
Cormorant	Demographic Rate	0.540	0.540	0.868							0.868		1.985	0.297
	Population Age Ratio	0.334	0.171	0.088							0.408	1.451		
Shag	Demographic Rate	0.513	0.737								0.858		1.303	0.262
	Population Age Ratio	0.297	0.145								0.558	0.792		

- ▲ For red-throated diver, the Irish breeding population is very small, with no breeding birds within mean maximum foraging range. However, there is a substantial non-breeding population in the western Irish Sea which was not incorporated into the BDMPS regional population estimates in Furness, (2015). To improve on this, western Irish Sea abundance estimates derived from 2016 ObSERVE datasets (Jessopp *et al.*, 2018) were incorporated into adopted BDMPS regional populations. As ObSERVE surveys were not undertaken during the spring period (roughly corresponding with the return migration bio-season), autumn abundance estimates (roughly corresponding with the post-breeding migration bio-season) were used as a proxy for spring abundance within the western Irish Sea region.
- 2.6.8 Where no seasonal BDMPS population was defined in Furness, (2015) or consideration of these populations was not considered relevant, as in the case of black guillemot (populations of which are typically highly sedentary/non-migratory) the following approaches were taken:

 - ▲ Black-headed and common gull: national population estimates from Crowe (2005) were used to define minimum regional non-breeding season populations.
 - ▲ Little gull: the estimated winter abundance within the western Irish Sea region covered by ObSERVE surveys (Jessopp *et al.*, 2018) was used to define the regional population during all non-breeding bio-seasons. This estimate does not include unidentified small gull records, a proportion of which would be little gull. As such it is considered an underestimate.
 - ▲ Black guillemot: the breeding population as estimated in Burnell *et al.*, (2023), for east and south coast counties between County Louth and Mizen Head in County Cork, corrected to include non-adults using age group proportions from Furness, (2015), was used to define the breeding and non-breeding bio-season regional populations.
- 2.6.9 Further details and revised BDMPS regional reference populations are presented in the relevant species accounts section of this document.

3 Receiving Environment

3.1 Published at-sea survey data from the wider region

- 3.1.1 There are two main sources of published at-sea survey data that are relevant to the waters around Dublin Array. The first of these is Pollock *et al.*, (1997), which summarises seabird distribution and abundance in the Irish Sea and around the coast of Ireland based on largely boat-based surveys undertaken between 1980 and 1997.
- 3.1.2 Secondly, Jessopp *et al.*, (2018) details results of visual aerial surveys undertaken in the inshore western Irish Sea in summer, autumn and winter 2016. Table 5 summarises the status of seabird species recorded on these two sets of surveys. Further details are provided in the individual species accounts.

Table 5 Status of regularly recorded seabird species in the western Irish Sea based on published reports

Species	Pollock <i>et al.</i> , (1997)	Jessopp <i>et al.</i> , (2018)
Red-throated Diver	Recorded in inshore, coastal waters off the Dublin coast between September to March in low numbers	Recorded as diver species, with highest numbers recorded in winter in predominantly inshore coastal waters
Great Northern Diver	Not recorded due to insufficient inshore coverage	
Fulmar	Widespread in the western Irish Sea between July and September	Peak numbers recorded in autumn, generally over deeper water
Manx Shearwater	Recorded between March and September, with peak numbers between July and September	Vast majority of sightings in summer, generally at least 4 km from shore, with a clear preference for deeper water
European Storm Petrel	Recorded occasionally in summer	Very low numbers recorded in the southern part of the western Irish Sea in summer and autumn
Gannet	Recorded in low densities throughout the year	Mostly recorded in summer and autumn, with very few recorded in winter
Cormorant	Recorded in coastal waters in low densities throughout the year	Not identified to species. All sightings were coastal, with a preference for shallow water. More sightings in summer and autumn, with fewer in winter
Shag	Recorded in coastal waters in low densities throughout the year	
Common Scoter	Not recorded due to insufficient inshore coverage	Low numbers recorded in autumn and winter, with no summer sightings. Sightings were mostly coastal with peak numbers recorded in Dundalk Bay

Species	Pollock <i>et al.</i> , (1997)	Jessopp <i>et al.</i> , (2018)
Arctic Skua	Low numbers recorded in inshore waters in autumn	Not recorded
Great Skua	Low numbers recorded in inshore waters in autumn	Very low numbers recorded in the southern part of the western Irish Sea in autumn
Mediterranean Gull	Not recorded	Not recorded
Little Gull	Low numbers recorded in the southern part of the western Irish Sea in autumn and winter	Low numbers recorded in western Irish Sea in winter
Black-headed Gull	Highest densities recorded in coastal waters between September and February	Most common in winter, with fewer sightings in autumn and low numbers in summer
Common Gull	Highest densities recorded in coastal waters between October and March	These two species not differentiated on surveys. Most common with a more coastal distribution in autumn. More widespread in lower numbers in winter.
Herring Gull	Recorded in low densities in coastal waters throughout the year	
Lesser black-backed Gull	Recorded in low densities in coastal waters primarily between July and October	These two species not fully differentiated on surveys. Highest numbers recorded in autumn
Great black-backed Gull	Recorded in low densities in coastal waters primarily between July and September	
Kittiwake	Recorded throughout the year with highest densities recorded in coastal waters between April and September	Recorded in summer, autumn and winter, with peak numbers recorded in autumn. Birds were widespread throughout the western Irish Sea
Sandwich Tern	Recorded in low densities in coastal waters between March and September	Recorded in summer and autumn in coastal waters
Roseate Tern	Not recorded	Recorded in summer around Rockabill colony, with lower numbers recorded in autumn
Common Tern	These two species not differentiated on surveys. Recorded in low densities in coastal waters between May and September	These two species not differentiated on surveys. Primarily recorded off Dublin coast in summer, with fewer, less widespread sightings in autumn
Arctic Tern		
Little Tern	Not recorded due to insufficient inshore coverage	Recorded in the central and south of western Irish Sea in summer and autumn

Species	Pollock <i>et al.</i> , (1997)	Jessopp <i>et al.</i> , (2018)
Guillemot	Recorded in all months, with highest densities between July and September	These two species not differentiated on surveys. Highest numbers recorded in autumn, but birds were widespread across the western Irish Sea on all three surveys
Razorbill	Recorded in all months, with highest densities between July and August	
Black Guillemot	Not recorded due to insufficient inshore coverage	Not recorded
Puffin	Recorded in low densities between June and October	Low numbers recorded in summer off Dublin coast

3.2 Species recorded on baseline surveys

3.2.1 Between June 2019 and April 2021, 28 seabird species were regularly recorded (more than 10 birds) on boat-based baseline surveys in the offshore study area. This compares to 25 species between September 2016 and September 2017) (Table 6).

Table 6 Raw numbers of regularly recorded seabirds in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

Species	2016-2017	2019-2021
Red-throated Diver	12	51
Great Northern Diver	1	20
Fulmar	19	96
Manx Shearwater	1,064	4,690
European Storm Petrel	5	11
Gannet	237	3,099
Cormorant	226	393
Shag	1,277	1,930
Common Scoter	9	124
Arctic Skua	4	21
Great Skua	2	13
Mediterranean Gull	0	37
Little Gull	15	157
Black-headed Gull	141	355
Common Gull	33	547
Lesser black-backed Gull	9	332
Herring Gull	630	3,234

Species	2016-2017	2019-2021
Great black-backed Gull	203	560
Kittiwake	2,068	10,225
Sandwich Tern	0	13
Roseate Tern	56	63
Common Tern	462	957
Arctic Tern	26	174
Little Tern	0	14
Guillemot	2,747	32,343
Razorbill	1,870	6,193
Black Guillemot	5	125
Puffin	2	56

3.2.2 In addition, there were a further five species that were recorded infrequently on 2019-2021 baseline surveys, as well as 10 species groups where full identification was not possible (Table 7). This compares to four infrequently recorded species and four species groups where full identification was not possible on 2016-2017 baseline surveys. All recorded species are discussed in more detail within Section 3.4.

Table 7 Raw numbers of less regular species and unidentified species groups recorded in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

Species	2016-2017	2019-2021
Black-throated Diver	0	2
Great Shearwater	1	0
Sooty Shearwater	1	0
Balearic Shearwater	4	0
Eider	0	1
Pomarine Skua	0	4
Yellow-legged Gull	1	1
Black Tern	0	8
Unidentified diver species	0	3
Unidentified Cormorant/Shag	0	139
Unidentified Skua species	0	1
Unidentified small gull	0	150
Unidentified large gull	60	428

Species	2016-2017	2019-2021
Unidentified gull	56	725
Unidentified Common/Arctic tern	99	261
Unidentified tern species	0	219
Unidentified Guillemot/Razorbill	368	12,966
Unidentified auk species	0	20

3.2.3 A further 15 species of non-seabird were recorded on 2019-2021 baseline surveys, as well as three non-seabird species groups where full identification was not possible (Table 8). In comparison, five non-seabird species were recorded on 2016-2017 baseline surveys.

Table 8 Raw numbers of non-seabird species and unidentified non-seabird species groups recorded in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

Species	2016-2017	2019-2021
Mute Swan	7	0
Brent Goose	0	43
Shelduck	1	0
Purple Sandpiper	0	4
Dunlin	7	11
Whimbrel	0	1
Curlew	0	2
Turnstone	0	3
Swift	1	3
Sand Martin	0	1
Swallow	0	42
Meadow Pipit	0	46
Pied Wagtail	0	1
Song Thrush	0	4
Goldcrest	0	3
Starling	0	88
Chaffinch	0	1
Linnet	13	0
Unidentified <i>Calidrid</i> wader species	0	8
Unidentified wader species	0	2
Unidentified passerine species	0	17

3.3 Flight height

3.3.1 Information on the height of flying birds recorded on the 2016-2017 and 2019-2021 boat-based surveys is summarised in Table 9. Overall, 95.4% of all flying birds on baseline surveys were recorded flying below 20 m in height, i.e. below the wind turbine rotor swept zone.

Table 9 Flight heights of seabirds recorded in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

Species ¹	0-5 m	5-10 m	10-20 m	20-30 m	>30 m	Total	% above 20 m
Red-throated Diver	19	9	9	3	1	41	9.8%
Fulmar	79	11	0	0	0	90	0.0%
Manx shearwater	2,307	251	8	0	0	2,566	0.0%
Gannet	639	417	529	154	22	1,761	10.0%
Cormorant	299	30	9	0	0	338	0.0%
Shag	796	31	2	0	0	829	0.0%
Common Scoter	59	62	6	0	0	127	0.0%
Arctic Skua	12	11	1	0	0	24	0.0%
Mediterranean Gull	2	6	10	4	0	22	18.2%
Little Gull	17	102	3	30	0	152	19.7%
Black-headed Gull	96	65	49	15	1	226	7.1%
Common Gull	47	55	100	24	10	236	14.4%
Lesser black-backed Gull	38	36	73	20	4	171	14.0%
Herring Gull	288	479	360	224	65	1,416	20.4%
Great black-backed Gull	67	95	90	60	37	349	27.8%
Kittiwake	956	2,161	2,776	300	41	6,234	5.5%
Roseate Tern	22	57	21	0	0	100	0.0%
Common Tern	199	758	143	6	0	1,106	0.5%
Arctic Tern	57	88	30	2	0	177	1.1%
Guillemot	4,523	586	9	0	0	5,118	0.0%
Razorbill	1,100	210	40	2	0	1,352	0.1%
Black Guillemot	51	2	0	0	0	53	0.0%
Puffin	21	2	0	0	0	23	0.0%

Species ¹	0-5 m	5-10 m	10-20 m	20-30 m	>30 m	Total	% above 20 m
Total	11,694	5,524	4,268	844	181	22,511	4.6%

¹ Where fewer than 20 individuals of a species were recorded in flight, the species is not shown.

- 3.3.2 Species where fewer than 20 individuals were recorded were excluded from this table, but the flight height information is presented in the individual species accounts.
- 3.3.3 For fulmar, Manx shearwater, cormorant, shag, common scoter, Arctic skua, roseate tern, common tern, guillemot, razorbill, black guillemot and puffin less than 1% of all recorded birds were flying above 20 m in height. For other seabirds, a greater proportion of birds were recorded flying above 20 m.

3.4 Species Accounts

- 3.4.1 Species accounts summarising the main findings of the baseline surveys and published information for each of these species are presented below. Distance analysis was possible for eight species (Manx shearwater, gannet, shag, herring gull, great black-backed gull, kittiwake, guillemot and razorbill), and for these species monthly population estimates are presented for the array area, and also for a four km buffer around the array area. For six species (Manx shearwater, gannet, shag, kittiwake, guillemot and razorbill), monthly population estimates for a two km buffer around the array area are also presented, as this is required for the displacement assessment being undertaken for these species.
- 3.4.2 For the remaining species, the peak count in the study area for each month is presented. Where more than one count was made in a month then the highest count is presented. Full results from the baseline seabird surveys undertaken between June 2019 and April 2021 are presented in the Offshore Ornithology Survey Reports 1 & 2.

Red-throated Diver

- 3.4.3 There is a small breeding population of red-throated divers in County Donegal, with a maximum estimate of nine pairs in 2018 (Burke *et al.*, 2020). The breeding season has been defined as March to August (Furness, 2015). In the non-breeding season, red-throated divers are widespread off Irish coasts, with birds from Scandinavia, Iceland and Scotland moving into Irish waters. Largest numbers are recorded off the south west coast of Ireland in winter months (Balmer *et al.*, 2013).
- 3.4.4 The species is listed on Annex 1 of the EC Birds Directive and is Amber-listed in Ireland due to the breeding population being less than 100 pairs and because there has been a moderate decline in the non-breeding population of between 25% to 49% between 1994 and 2015/16. In addition, the species also has an unfavourable conservation status in Europe (Gilbert *et al.*, 2021).

- 3.4.5 Furness (2015) considered that for red-throated diver outside the breeding season there were three BDMPS periods; autumn migration (September to November), winter (December to January) and spring migration (February to April). In addition to the western Irish Sea, the relevant BDMPS regions for red-throated diver are the “UK Western Waters plus Channel” for the autumn and spring migration periods and “NW England and Wales” for the winter period, as defined in Furness (2015).
- 3.4.6 For red-throated diver, the population that occurs in the western Irish Sea in the non-breeding season was not incorporated into the BDMPS regional population estimates presented in Furness, (2015). To improve on this, western Irish Sea abundance estimates derived from 2016 ObSERVE datasets (Jessopp *et al.*, 2018) were incorporated into adopted BDMPS regional populations. The total estimated population of divers for the ObSERVE study area in autumn was 8,916 birds, with an estimated 2,942 birds recorded in winter. It was considered likely that these birds were either red-throated divers or great northern divers (Jessopp *et al.*, 2018).
- 3.4.7 As divers were not identified to species on the ObSERVE surveys, the estimated ratio of red throated diver to great northern diver was calculated by comparing the seasonal populations of each species for the relevant BDMPS region from Furness (2015) (Table 10).

Table 10 Ratio of red-throated diver and great northern divers based on Furness (2015)

BDMPS region	Red-throated Diver Furness (2015) BDMPS estimate	Great Northern Diver Furness (2015) BDMPS estimate	Combined Total	Ratio of RTD to GND
UK Western Waters plus Channel	4,373	300	4,673	0.936-0.064
NW England and Wales	1,657	300	1,957	0.847-0.153

- 3.4.8 These ratios were then applied to the estimated population of divers for autumn and winter from the ObSERVE surveys (Jessopp *et al.*, 2018) and the corresponding value was added to the relevant BDMPS estimate from Furness (2015) (Table 11). As ObSERVE surveys were not undertaken during the spring period (roughly corresponding with the spring migration period from Furness, 2015), autumn abundance estimates (roughly corresponding with the autumn migration period) were used as a proxy for spring abundance within the western Irish Sea region.

Table 11 Estimated BDMPS regional reference population of red-throated divers

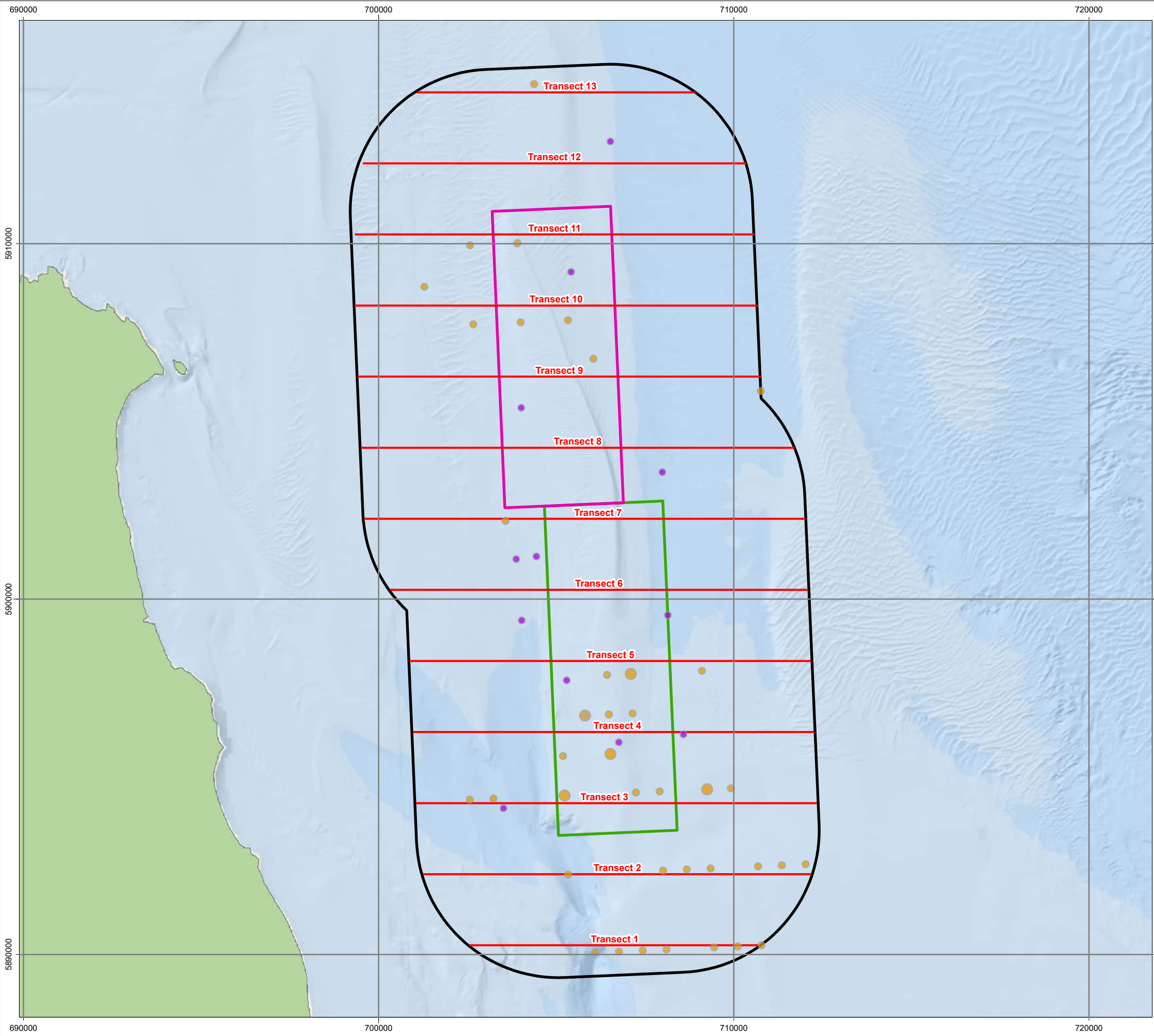
Period	Furness (2015) BDMPS estimate	Additional western Irish Sea population	Combined Total
Autumn migration	4,373	8,345 (8,916 x 0.936)	12,718
Winter	1,657	2,492 (2,942 x 0.847)	4,149
Spring migration	4,373	8,345 (8,916 x 0.936)	12,718

- 3.4.9 For red-throated diver, the revised autumn and spring migration BDMPS regional population was estimated to be 12,718 birds. The revised winter period BDMPS regional population was estimated to be 4,149 birds (Table 11).
- 3.4.10 ESAS surveys in Irish waters between 1980 and 1997 recorded low numbers of red-throated divers off the Dublin and Wicklow coasts from September to March, although coverage of inshore waters on these surveys was limited (Pollock *et al.*, 1997).
- 3.4.11 A total of 12 red-throated divers were recorded on 2016-2017 baseline surveys between October and May, with a peak count of five birds in February 2017 (Table 12). On 2019-2020 surveys, 51 red-throated divers were recorded between September and April, with a peak of nine birds in January 2020. Combined average abundance (birds/km) over the two survey periods was highest in February, with 0.12 birds/km recorded, however there was no February survey in the 2019-2021 period.

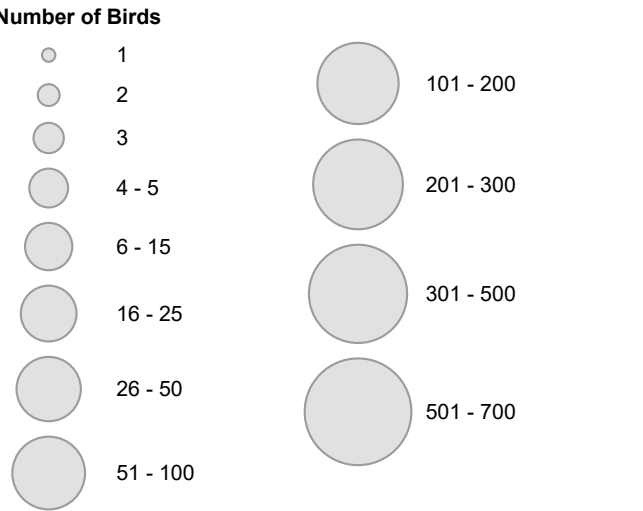
Table 12 Peak monthly counts (raw numbers) of red-throated divers in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	5	1	-	1	0	0	0	0	3	2	0
2019-21	9	-	7	8	0	0	0	0	1	5	5	8
Average abundance (birds/km)	0.07	0.12	0.05	0.05	0.01	0.00	0.00	0.00	0.00	0.05	0.04	0.05

- 3.4.12 Red-throated divers were scattered in low numbers predominantly across the southern half of the offshore ornithology study area, with fewer birds recorded in the northern half, during both periods of baseline surveys (Figure 3). There were no sightings between June and August inclusive.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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PROJECT TITLE

Dublin Array

DRAWING TITLE

Marine Bird Survey
Red-throated Diver Sightings on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER: Figure 3			PAGE NUMBER: Page 1 of 64		
VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE



- 3.4.13 Previous 2001-2002 surveys recorded five red-throated divers, with one bird seen in November 2001, two in March 2002 and two in April 2002 (Percival *et al.*, 2002). On 2010-2011 surveys, 29 red-throated divers were recorded, with a peak of 22 birds foraging at the south end of the Kish Bank in late March 2011. It was considered that these birds may have been early migrants, as numbers of divers in inshore waters off the east coast of Ireland tend to increase in April and May as part of their northward spring migration (Newton and Trewby, 2011).
- 3.4.14 Aerial surveys off the Irish east coast on the ObSERVE 2016 aerial surveys recorded an estimated 1,135 divers, with the majority of sightings in autumn and winter. Although it was not possible to identify individuals to species level on these surveys, it was considered likely that most birds would be red-throated or great northern divers. Surveys found that divers were concentrated in the shallower coastal waters of the Irish Sea, and showed a preference for waters of 5-20 m depth, with very few observations of divers in deeper waters. Mean density of divers across all surveys was 0.01 birds/km² in summer, 0.97 birds/km² in autumn, and 0.32 birds/km² in winter (Jessopp *et al.*, 2018).
- 3.4.15 Flight height was recorded for 23 red-throated divers on baseline surveys in 2016-2017 and 2019-2021, with 87.0% of all birds recorded flying below 20 m Mean Sea Level (MSL) in height i.e. below likely rotor-swept height. A total of 12 birds were recorded flying below 5 m in height, with four birds flying between 5 and 10 m, four birds flying between 10 and 20 m, two birds flying between 20 and 30 m and one bird flying above 30 m in height (Table 9).

Black-throated Diver

- 3.4.16 Black-throated divers are the least common species of diver that winter in Irish coastal waters, with highest numbers recorded off the north west coast, between February and April (Crowe, 2005). The species is listed on Annex 1 of the EC Birds Directive, and is Amber-listed in Ireland as the species has an unfavourable conservation status in Europe (Gilbert *et al.*, 2021).
- 3.4.17 Two black-throated divers were recorded on 2019-2021 surveys, with one recorded flying south west between 10 and 20 m in height in December 2020, and one flying north, inshore of the array area, below 5 m in height in April 2021 (Figure 4). This species was not recorded on 2016-2017 surveys.

Great Northern Diver

- 3.4.18 The great northern diver is a winter visitor to Ireland, with peak numbers found mainly in west and northwest of the country (Crowe, 2005). The species is listed on Annex 1 of the EC Birds Directive and is Amber-listed in Ireland as the Irish population in the non-breeding season is considered internationally important, and because the species has an unfavourable conservation status in Europe (Gilbert *et al.*, 2021).
- 3.4.19 Furness (2015) considered that for great northern diver outside the breeding season there was one BDMPS period; non-breeding season (September to May). The relevant BDMPS region for great northern diver is “NW England and Wales”, as defined in Furness (2015).

- 3.4.20 For great northern diver, the population that occurs in the western Irish Sea in the non-breeding season was not incorporated into the BDMPS regional population estimates presented in Furness, (2015). To improve on this, western Irish Sea abundance estimates derived from 2016 ObSERVE datasets (Jessopp *et al.*, 2018) were incorporated into adopted BDMPS regional populations. The total estimated population of divers for the ObSERVE study area in autumn was 8,916 birds, with an estimated 2,942 birds recorded in winter. It was considered likely that these birds were either red-throated divers or great northern divers (Jessopp *et al.*, 2018).
- 3.4.21 As divers were not identified to species on the ObSERVE surveys, the estimated ratio of red throated diver to great northern diver was calculated by comparing the seasonal populations of each species for the relevant BDMPS region from Furness (2015) (Table 8).
- 3.4.22 These ratios were then applied to the estimated population of divers for autumn and winter from the ObSERVE surveys (Jessopp *et al.*, 2018) and the corresponding value was added to the relevant BDMPS estimate from Furness (2015) (Table 13). As ObSERVE surveys were not undertaken during the spring period (roughly corresponding with the spring migration period from Furness, 2015), autumn abundance estimates (roughly corresponding with the autumn migration period) were used as a proxy for spring abundance within the western Irish Sea region.

Table 13 Estimated BDMPS regional reference population of great northern divers

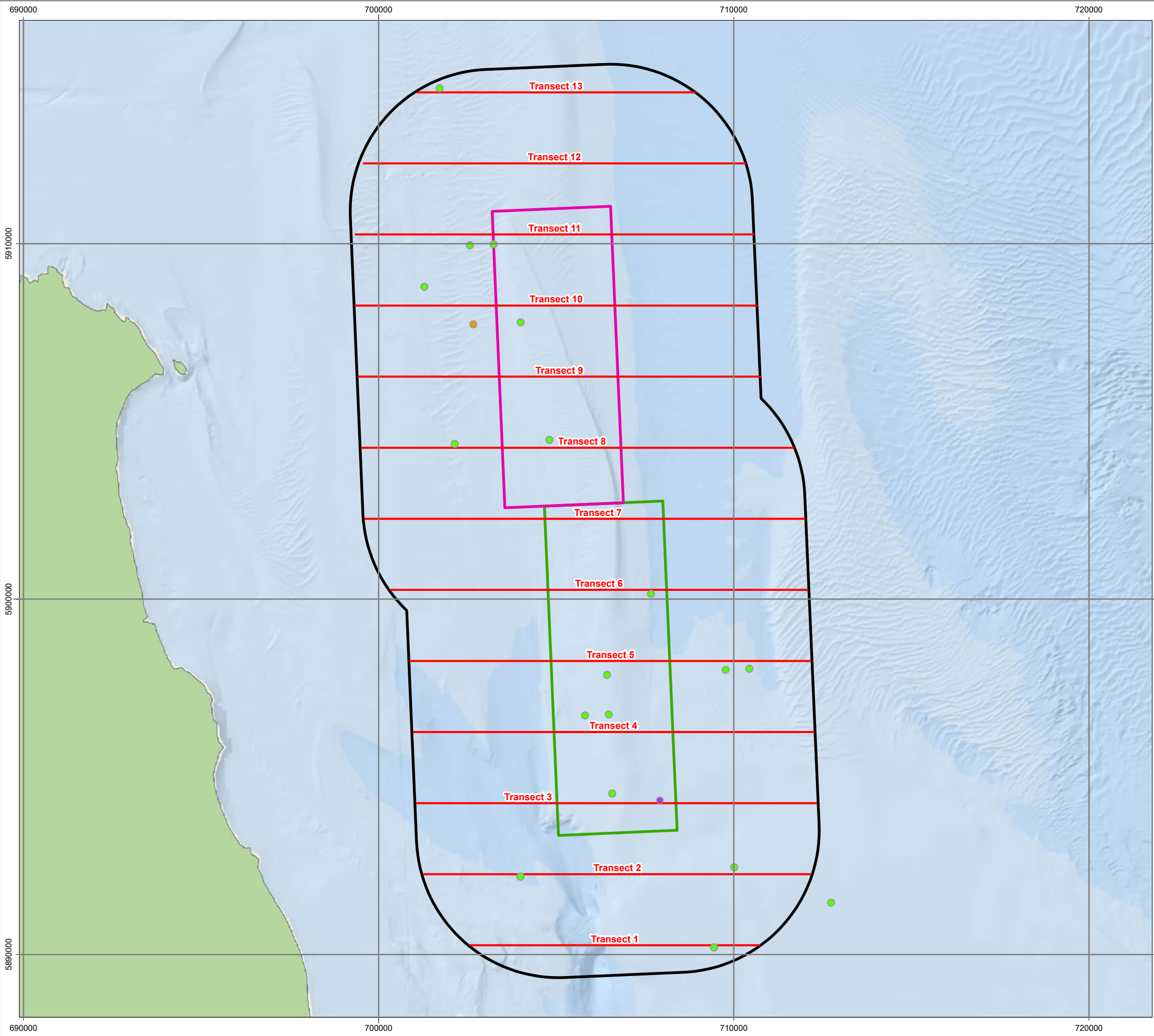
Period	Furness (2015) BDMPS estimate	Additional western Irish Sea population	Combined Total
Non-breeding season	300	1,364 (8,916 x 0.153)	1,664

- 3.4.23 For great northern diver, the revised non-breeding season BDMPS regional population was estimated to be 1,664 birds (Table 13).
- 3.4.24 One great northern diver was recorded on 2016-2017 baseline surveys, in March 2017 (Table 14). On 2019-2021 surveys, 20 great northern divers were recorded between November and May, with a peak of three birds in December 2020, and two birds recorded in other months over this period. Average abundance (birds/km) over the two survey periods was highest on the December 2020 survey, with 0.03 birds/km recorded.

Table 14 Peak monthly counts (raw numbers) of great northern divers in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	0	1	-	0	0	0	0	0	0	0	0
2019-21	2	-	2	2	2	0	0	0	0	0	2	3
Average abundance (birds/km)	0.02	0.00	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.03

- 3.4.25 On 2019-2021 baseline surveys, great northern divers were occasionally recorded in low numbers across the array area and buffer area between November and January. One great northern diver was recorded in the south of the array area on 2016-2017 baseline surveys (Figure 4).
- 3.4.26 Previous 2001-2002 surveys recorded five great northern divers, with three birds seen in November 2001 and two in September 2002 (Percival *et al.*, 2002). No great northern divers were recorded on 2010-2011 surveys (Newton and Trewby, 2011).
- 3.4.27 As presented under red-throated diver above, aerial surveys off the Irish east coast on the ObSERVE 2016 aerial surveys recorded an estimated 1,135 divers, with the majority of sightings in autumn and winter, but identification to species level was not possible on these surveys (Jessopp *et al.*, 2018).
- 3.4.28 Flight height was estimated for 12 great northern divers on baseline surveys in 2016-2017 and 2019-2021, with 91.7% of all birds recorded flying below 20 m MSL in height i.e. below likely rotor-swept height. A total of six birds were recorded flying below 5 m in height, with two birds flying between 5 and 10 m, three birds flying between 10 and 20 m and one bird flying between 20 and 30 m in height.



Bray Bank Array Area

Kish Bank Array Area

4km Survey Buffer

Transect Line and Number

Great Northern Diver Sighting 2016 - 2017

Great Northern Diver Sighting 2019 - 2021

Black-Throated Diver Sighting 2019 - 2021

Number of Birds

1

2

3

4 - 5

6 - 15

16 - 25

26 - 50

51 - 100

101 - 200

201 - 300

301 - 500

501 - 700

DRAWING STATUS

PUBLIC

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PROJECT TITLE

Dublin Array

DRAWING TITLE

Marine Bird Survey

Great Northern & Black-Throated Diver Sightings on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER:

Figure 4

PAGE NUMBER:

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VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE

0 1 2 Kilometers

0 1 2 Miles

N

ORIG NORTH

SCALE 1:110,000

DATUM WGS 1984

PRJ WGS 1984 UTM Zone 29N

PLOT SIZE A3

VERTICAL REF DDN/LAT/MLLW

SLR

DublinArray

Generation for generations

Kish Offshore Wind Limited - Bray Offshore Wind Limited

Northern Fulmar

3.4.29 Fulmars are one of the most common breeding seabirds in Ireland, with an estimated breeding population of 32,899 pairs between 2015 and 2018. Despite some changes in numbers at individual colonies, the overall Irish population was found to be stable between the Seabird 2000 census undertaken between 1998 and 2002, and the 2015 – 2018 counts. Comparing the overall population between 2015 and 2018 with the previous national census between 1985 and 1987 showed an increase of 68% in the breeding population over the period (Cummins *et al.*, 2019), although some of this increase may have been due to increased survey coverage. The species is Amber-listed in Ireland due to an unfavourable conservation status in Europe (Gilbert *et al.*, 2021).

3.4.30 The breeding season for fulmar has been defined as January to August (Furness, 2015) (Table 3). During the breeding season, adults travel considerable distances from their colonies, particularly during the pre-laying and egg incubation period, with a mean maximum foraging range of 542.3 ± 657.9 km. Although available data are limited, there is some evidence that foraging distances during the chick-rearing period are shorter, however one maximum distance of over 1,000 km has been recorded during chick-rearing (Woodward *et al.*, 2019). Counts of the nearest fulmar colonies to Dublin Array are shown in Table 15.

Table 15 Recent counts for the nearest Fulmar colonies to Dublin Array

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Fulmar (within 509.4 km) ¹	Bray Head (Wicklow)	11.8 km	64 pairs (2015)
	Howth Head (Dublin)	18.6 km	14 pairs (2015)
	Ireland's Eye (Dublin)	22.1 km	34 pairs (2016) ²
	Lambay Island (Dublin)	30.4 km	375 pairs (2015)
	Wicklow Head (Wicklow)	30.3 km	23 pairs (2021)
	Estimated breeding season population within 509.4 km		34,142 pairs

¹ 509.4 km is the maximum foraging distance considered for all species for this assessment

² Newton *et al.*, (2016)

3.4.31 Furness (2015) considered that outside the breeding season there were three BDMPS periods for fulmar; autumn migration (September to October), winter (November) and spring migration (December to March). In addition to Irish waters off the east and south coasts, the relevant BDMPS region for fulmar is the "UK Western Waters plus Channel", as defined in Furness (2015).

3.4.32 The original BDMPS population for fulmar for the “UK Western Waters plus Channel” region was estimated as 828,194 birds (all ages) for the autumn and spring migration periods and 556,367 birds in the winter period (Furness 2015). There was no Irish component included in this estimate. To include an estimate of Irish fulmars in the BDMPS reference population, the number of breeding adults from the most recent Seabirds Count census (Burnell *et al.*, 2023) for the Irish east and south coast county totals was calculated. In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds (Table 16). The ratio of adult to immature birds was based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 16 Estimated Irish component of BDMPS regional reference population for fulmar

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
64,262 adults	7,484 adults	1.083	8,105 (7,484x1.083)	15,589 birds

3.4.33 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the “UK Western Waters plus Channel” for the relevant non-breeding period, as defined in Furness (2015) (Table 17).

Table 17 Estimated BDMPS regional reference populations for fulmar

Period	Furness (2015) BDMPS estimate	Irish east & south coast estimate (all ages)	Combined Total
Autumn migration	828,194	15,589	843,783 birds
Winter	556,367	15,589	571,956 birds
Spring migration	828,194	15,589	843,783 birds

3.4.34 For fulmar, the revised autumn and spring migration BDMPS regional populations were estimated to be 843,783 birds (all ages). The revised winter period BDMPS regional population was estimated to be 571,956 birds (all ages) (Table 17).

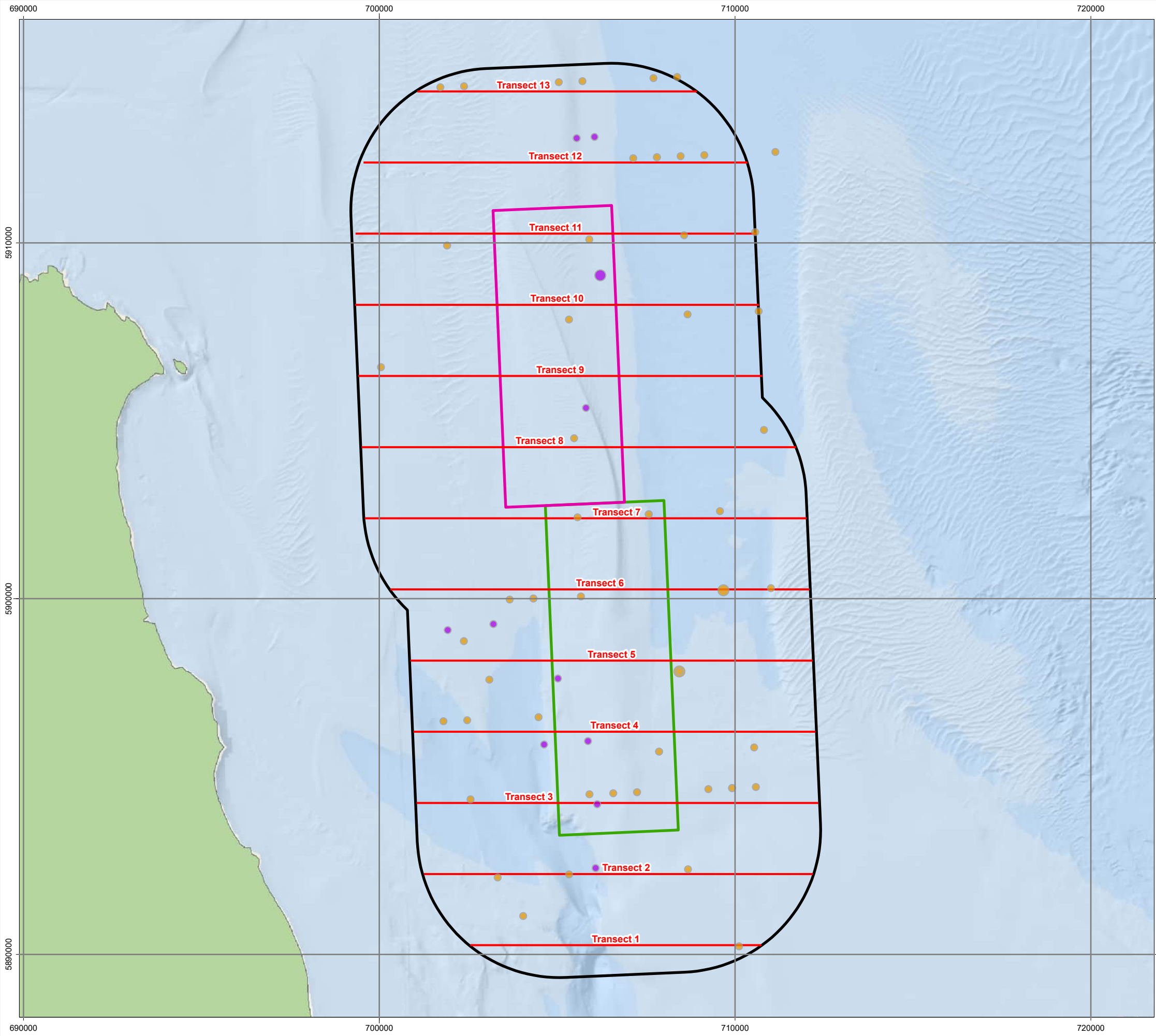
3.4.35 ESAS surveys in Irish waters between 1980 and 1997 recorded fulmars as widespread at low densities in the Irish Sea between February and June. Between July and September, fulmars were again present at low densities in the Irish Sea, apart from where they concentrated on the Irish Sea front, where higher densities (>5 birds/km²) were recorded. Between October and January, fulmar densities in the Irish Sea were mostly low (Pollock *et al.*, 1997).

3.4.36 A total of 19 fulmars were recorded on 2016-2017 baseline surveys, with a peak of seven birds in September 2016 (Table 18). On the 2019-2021 surveys, a total of 96 fulmars were recorded on all surveys, with a peak of 13 birds in early September 2019. Average abundance (birds/km) over the two survey periods was highest in May and September, with 0.09 birds/km recorded in both months. For months with more than one survey, the peak number recorded on any one survey is shown.

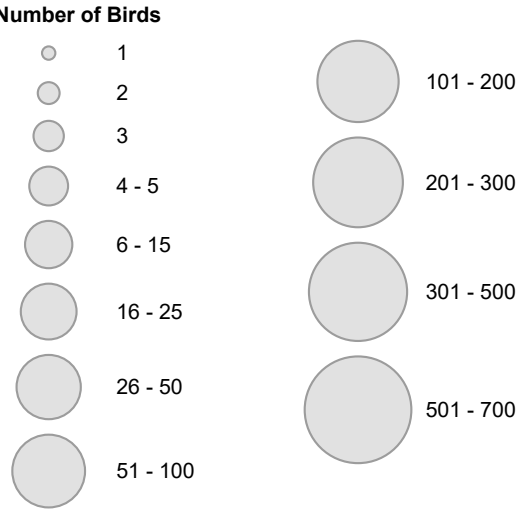
Table 18 Peak monthly counts (raw numbers) of fulmars in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	3	0	-	6	0	1	2	7	0	0	0
2019-21	5	-	8	3	5	7	4	9	13	0	1	6
Average abundance (birds/km)	0.04	0.07	0.05	0.03	0.09	0.04	0.04	0.09	0.09	0.00	0.00	0.03

- 3.4.37 Fulmars were recorded in the offshore ornithology study area in low numbers on baseline surveys in both the breeding and non-breeding seasons, although numbers were higher in the breeding season (Figure 5 and Figure 6).
- 3.4.38 Previous 2001-2002 surveys recorded fulmars in all months except November, with an estimated peak of 42 birds in August 2002 (Percival et al., 2002). On 2010-2011 surveys, fulmars were recorded in low numbers in all months except October and November, with a peak of 14 birds in June 2010 and 14 birds in March 2011 (raw counts) (Newton and Trewby, 2011).
- 3.4.39 Fulmar numbers off the Irish east coast on the ObSERVE 2016 aerial surveys showed a similar pattern of occurrence, with highest numbers recorded in autumn, compared to summer and winter surveys. Fulmars were recorded throughout the survey area, but showed a preference for water depths greater than 60 m. Mean density across the survey area ranged from 0.07 birds/km² in summer, 1.52 birds/km² in autumn and 0.16 birds/km² in winter (Jessopp et al., 2018).
- 3.4.40 Flight height was recorded for 90 fulmars on baseline surveys in 2016-2017 and 2019-2021, with all birds recorded flying below 20 m MSL in height i.e. below likely rotor-swept height. A total of 79 birds were recorded flying below 5 m, with 11 birds flying between 5 and 10 m in height (Table 8).



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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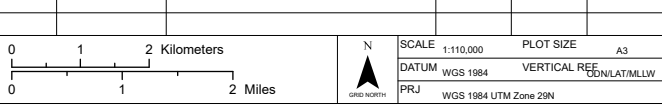
Dublin Array

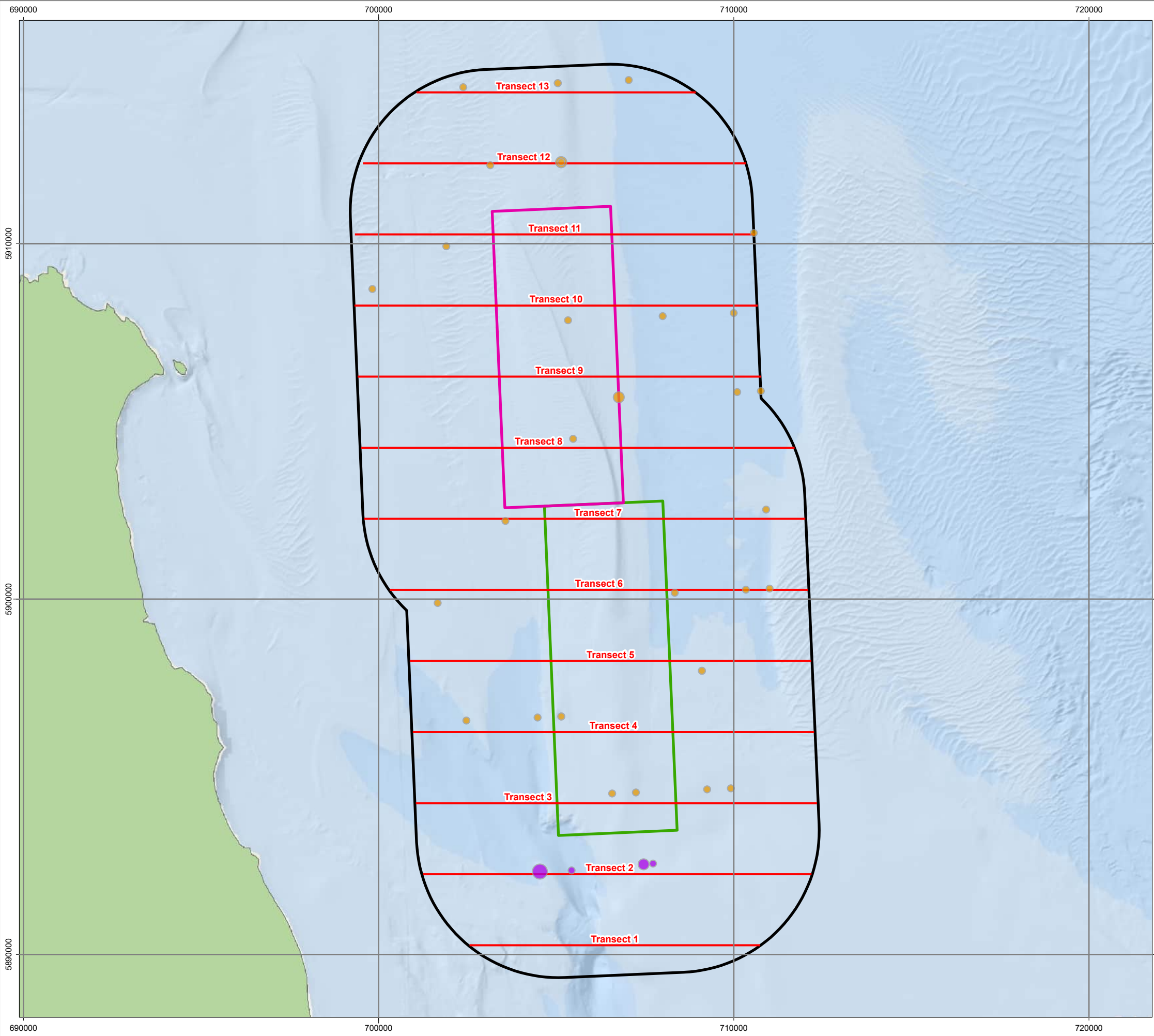
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Marine Bird Survey
Fulmar Sightings in the Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys

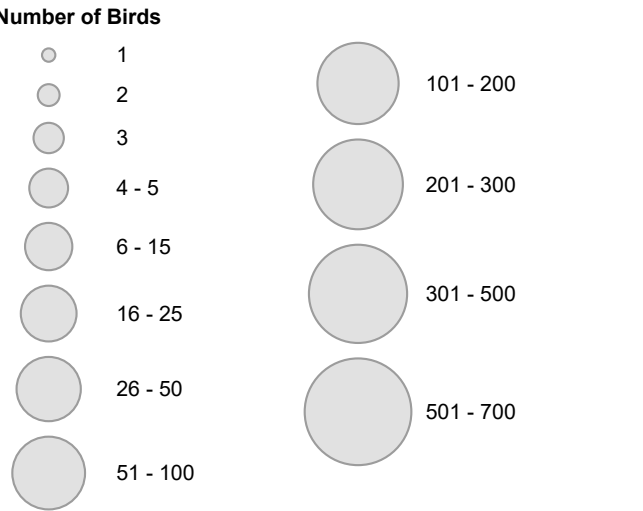
DRAWING NUMBER: **Figure 5** PAGE NUMBER: **Page 3 of 64**

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02	2025-01-16	PUBLIC	JK	AE	AE





- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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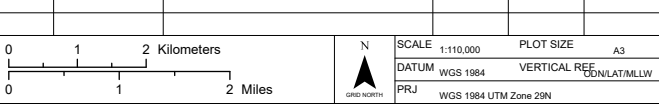
Dublin Array

DRAWING TITLE

**Marine Bird Survey
Fulmar Sightings in the Non-Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys**

DRAWING NUMBER: **Figure 6** PAGE NUMBER: **Page 4 of 64**

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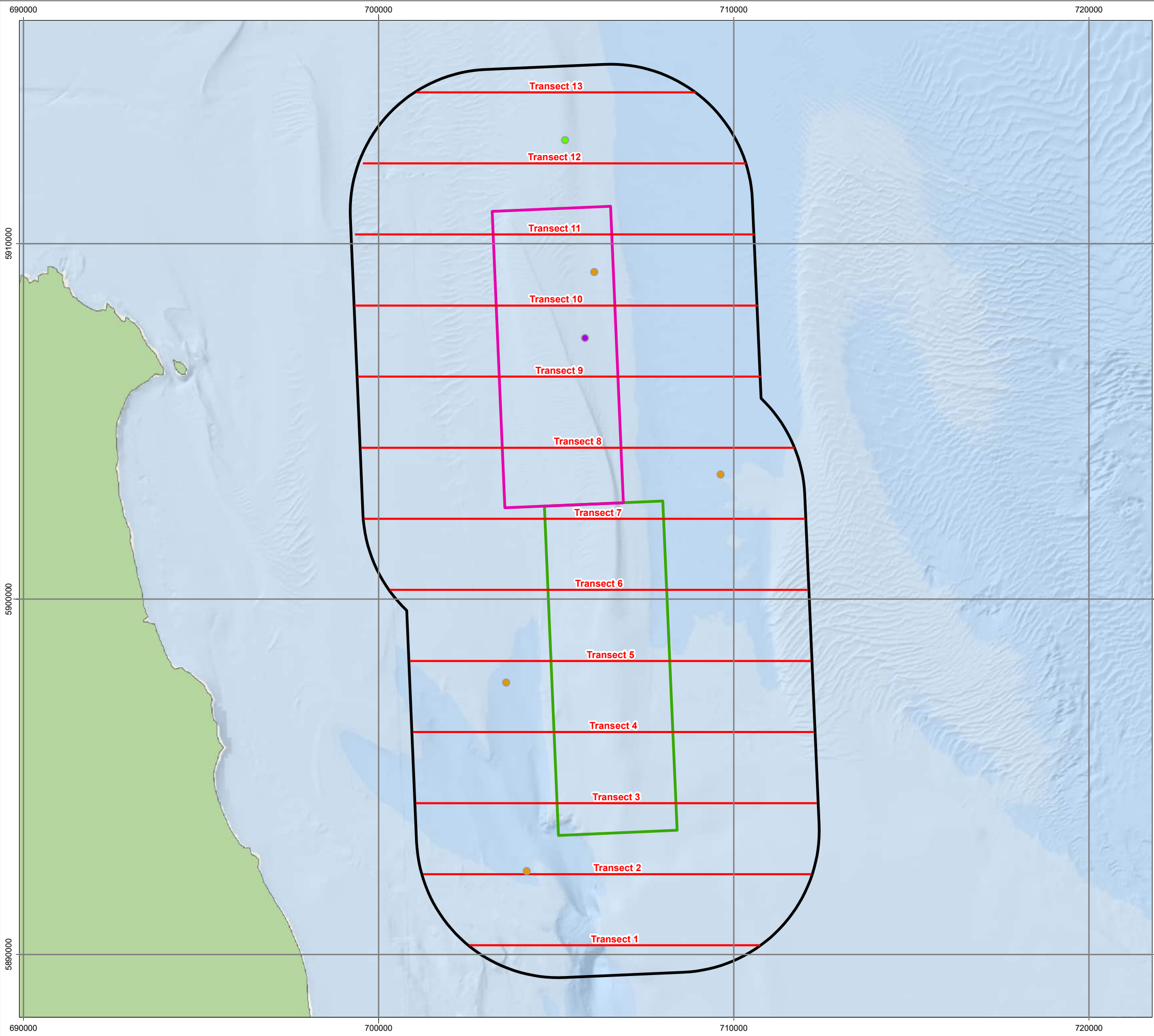


Great Shearwater

- 3.4.41 Great shearwaters are regular passage migrants in waters off the south and west coast of Ireland in autumn months, but are recorded less frequently in the Irish Sea (Hutchinson 1989). ESAS surveys in Irish waters recorded great shearwaters to the west of Ireland between July and November, but only occasionally at very low densities in the Irish Sea at this time (Pollock *et al.*, 1997). The species is Green-listed in Ireland, in terms of its conservation status (Gilbert *et al.*, 2021).
- 3.4.42 One great shearwater was recorded on the sea in the northern half of the array area on 2016-2017 baseline surveys, in September 2016 (Figure 7). The species was not recorded on 2019-2021 surveys. Previous 2001-2002 surveys recorded two great shearwaters in September 2002 (Percival *et al.*, 2002). The species was not recorded on 2010-2011 surveys (Newton and Trewby, 2011).

Sooty Shearwater

- 3.4.43 Sooty shearwaters breed in the South Atlantic but pass through Irish waters in late summer and autumn on their annual migration to North Atlantic waters. Like great shearwaters, sooty shearwaters are less frequently recorded in the Irish Sea (Hutchinson 1989). ESAS surveys recorded sooty shearwaters predominantly off the south west of Ireland between July and October, with occasional low densities recorded in the Irish Sea at this time (Pollock *et al.*, 1997). The species is Green-listed in Ireland, in terms of its conservation status (Gilbert *et al.*, 2021).
- 3.4.44 One sooty shearwater was recorded flying below 5 m in height on the 2016-2017 baseline surveys, in the north of the buffer area in July 2017 (Figure 7). The species was not recorded on 2019-2021 surveys.
- 3.4.45 Previous 2001-2002 surveys recorded three sooty shearwaters in September 2002 (Percival *et al.*, 2002). The species was not recorded on 2010-2011 surveys (Newton and Trewby, 2011).



Bray Bank Array Area

Kish Bank Array Area

4km Survey Buffer

Transect Line and Number

Great Northern Diver Sighting 2016 - 2017

Balearic Shearwater Sighting 2016 - 2017

Sooty Shearwater Sighting 2016 - 2017

Number of Birds

1

2

3

4 - 5

6 - 15

16 - 25

26 - 50

51 - 100

101 - 200

201 - 300

301 - 500

501 - 700

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PROJECT TITLE

Dublin Array

DRAWING TITLE

Marine Bird Survey

Shearwater Sightings on 2016-2017 Baseline Surveys

DRAWING NUMBER: **Figure 7**

PAGE NUMBER: **Page 5 of 64**

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0 1 2 Kilometers

0 1 2 Miles

N

ORIENT NORTH

SCALE 1:110,000

DATUM WGS 1984

PRJ WGS 1984 UTM Zone 29N

PLOT SIZE A3

VERTICAL REF. DDN/LAT/MLLW

SLR

Dublin Array
Generation for generations
Kish Offshore Wind Limited - Bray Offshore Wind Limited

Manx Shearwater

3.4.46 Manx shearwaters breed in a few large colonies around Ireland and off the west coast of the UK. The recent Seabirds Count national census gives the total Irish population as 134,220 pairs (Burnell *et al.*, 2023). Counts of Manx shearwater colonies within 509.4 km of Dublin Array are shown in Table 19.

Table 19 Recent counts for Manx shearwater colonies within 509.4 km of Dublin Array (from Burnell *et al.*, 2023)

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Manx shearwater (within 509.4 km) ¹	Lambay Island (Dublin)	30.4 km	25 pairs (2001)
	Copeland Islands (Down)	153.3 km	4,850 pairs (2007)
	Bardsey Island (Wales)	92.1 km	20,675 pairs (2015)
	Calf of Man	118.6 km	650 pairs (2019)
	Ramsey Island (Wales)	160.9 km	4,796 pairs (2016)
	Great Saltee Island (Wexford)	144.9 km	341 pairs (2021)
	Little Saltee Island (Wexford)	144.9 km	719 pairs (2021)
	Skomer, Midland Island and Skokholm Islands (Wales)	171 km	455,156 pairs (2018)
	Inishtrahull (Donegal)	247.2 km	50 pairs (2021)
	Blasket Islands (Kerry)	321.5 km	109,390 pairs (2016-2021)
	Scarriff & Deenish (Kerry)	333.4 km	15,508 pairs (2021)
	Puffin Island (Kerry)	329.4 km	3,381 pairs (2019)
	Lunga, Treshnish Isles (Scotland)	351.2 km	1,992 pairs (2018)
	Rum (Scotland)	400.1 km	288,894 pairs (2021)
	Great Skellig (Kerry)	348.6 km	573 pairs (2021)
	Estimated breeding season population within 509.4 km		907,000 pairs

¹ 509.4 km is the maximum foraging distance considered for all species for this assessment

3.4.47 The species is Amber-listed in Ireland as there has been a moderate decline of between 35% to 69% in the species breeding range between 1968 and 2011, and because more than 50% of the breeding population is found at 10 or fewer colonies in Ireland (Gilbert *et al.*, 2021).

- 3.4.48 The breeding season for Manx shearwater has been defined as April to August (Table 3), (Furness, 2015). During the breeding season, adults range widely from their colonies to feed, with a mean maximum foraging range of $1,346.8 \pm 1,018.7$ km (Woodward *et al.*, 2019). The mean foraging range, which is probably more typical of the foraging distances travelled during the chick-rearing period is estimated to be 136.1 ± 88.7 km (Woodward *et al.*, 2019). However, for this assessment, a maximum foraging distance of 509.4 km was applied for Manx shearwaters.
- 3.4.49 The majority of Manx shearwaters that breed in Ireland and the UK spend the winter months in the western South Atlantic, predominantly off the coast of Brazil (Wernham *et al.*, 2002). Furness (2015) considered that outside the breeding season there were two BDMPS periods for Manx shearwater; autumn migration (August to early October) and spring migration (late March to May). In addition to waters off the Irish east and south coasts, the relevant BDMPS region for Manx shearwater is the “UK Western Waters plus Channel”, as defined in Furness (2015).
- 3.4.50 The original BDMPS population for the “UK Western Waters plus Channel” was estimated as 1,580,895 birds (all ages), which included an Irish component of 8,737 birds (3,260 adults and 5,477 immature birds) (Furness, 2015). This Irish component was subtracted from the original BDMPS population, which gives an estimate of 1,572,158 birds (all ages).
- 3.4.51 To include an estimate of Irish Manx shearwaters in the BDMPS reference population, an estimate of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals was calculated (Burnell *et al.*, 2023) (Table 20). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 20 Estimated Irish component of BDMPS regional reference population for Manx shearwater

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
268,440 adults	2,170 adults	1.132	2,456 (2,170x1.132)	4,626 birds

- 3.4.52 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the “UK Western Waters plus Channel” for the relevant non-breeding period, as defined in Furness (2015) (Table 21).

Table 21 Estimated BDMPS regional reference populations for Manx shearwater

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Autumn migration	1,572,158	4,626	1,576,784 birds
Spring migration	1,572,158	4,626	1,576,784 birds

- 3.4.53 For Manx shearwater, the revised autumn and spring migration BDMPS regional populations were estimated to be 1,576,784 birds (all ages) (Table 21).
- 3.4.54 ESAS surveys in Irish waters between 1980 and 1997 recorded Manx shearwaters in low to moderate densities in the Irish Sea between March and June, and in high densities (>10 birds/km²), between July and September. Very few were recorded after September (Pollock *et al.*, 1997).
- 3.4.55 Estimated numbers of Manx shearwaters were derived from baseline survey data by applying Distance sampling techniques to the 2016-2017 and 2019-2021 datasets (Table 22 and Table 23). In addition to the mean values, lower and upper confidence limits around these values are also shown.
- 3.4.56 The confidence limits from the Distance analysis for density estimates of birds on the water in the June 2017 survey were very large (0.01 to 2,491,470 birds/km²) indicating that there were a small number of large flocks recorded on this survey and that the Distance estimate for this month was not very reliable. As a result, the June estimated numbers for birds on the water presented in the tables below were based on the June 2019 and June 2020 surveys only.

Table 22 Estimated numbers of Manx shearwaters in the array area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	0	0	0	313	32	85	88	6	6	0	0	0
Mean	0	0	2	778	90	186	231	31	13	0	0	0
Upper	0	0	6	1,936	256	430	614	182	31	0	0	0
Birds in flight												
Lower	0	0	0	4	10	24	19	1	46	0	0	0
Mean	0	0	0	15	23	55	39	7	83	0	0	0
Upper	0	0	0	30	39	97	64	16	128	0	0	0
Total												
Lower	0	0	0	317	42	109	107	6	52	0	0	0
Mean	0	0	2	794	114	241	270	37	96	0	0	0
Upper	0	0	6	1,966	295	526	679	198	159	0	0	0

Table 23 Estimated numbers of Manx shearwaters in the 4 km buffer area based on 2016-2017 and 2019-2021 surveys

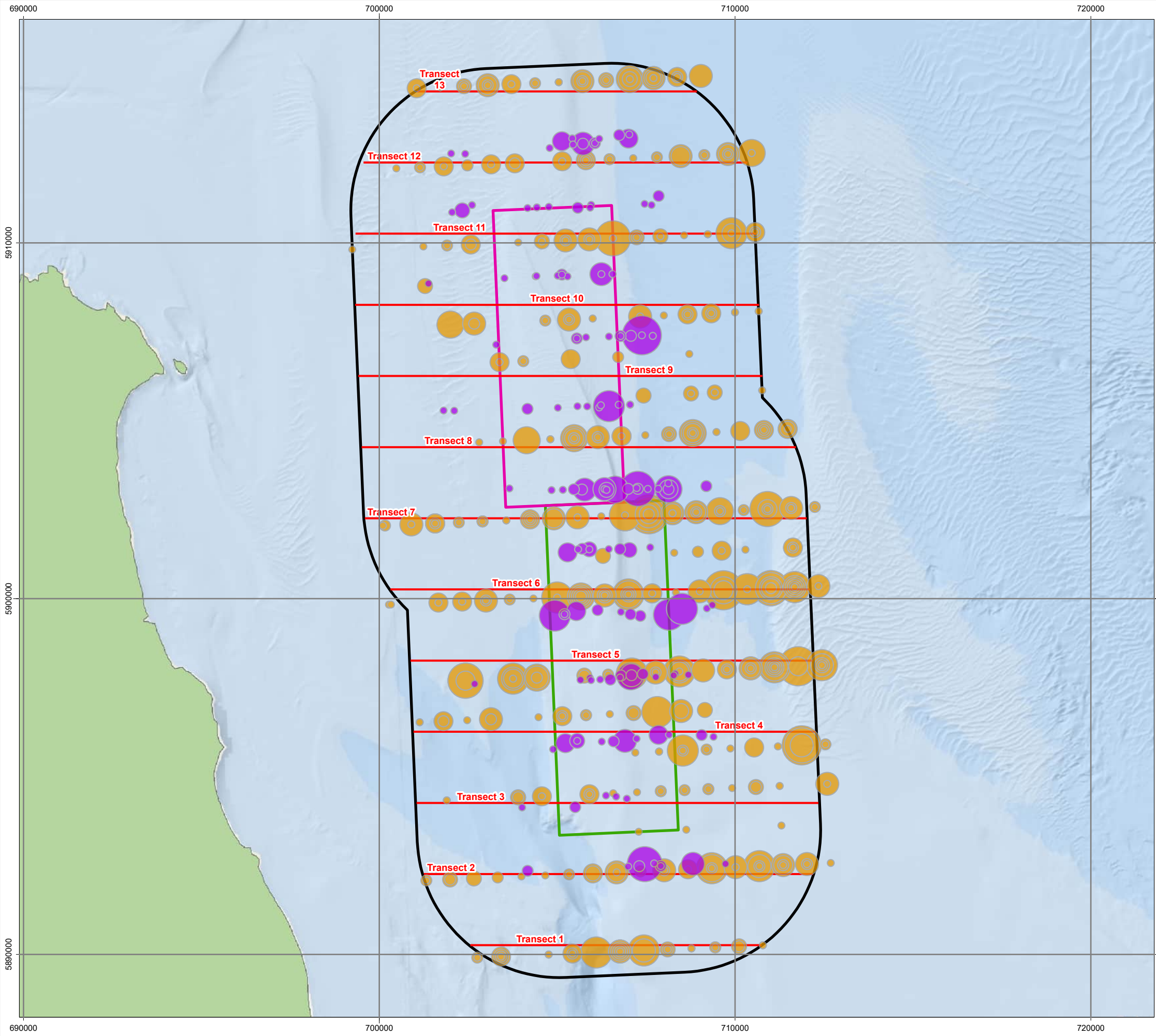
	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	0	0	2	1,180	120	322	331	21	23	0	0	0
Mean	0	0	6	2,934	341	701	870	117	51	0	0	0
Upper	0	0	22	7,298	964	1,620	2,316	685	118	0	0	0
Birds in flight												
Lower	0	0	0	16	38	89	72	3	172	0	0	0
Mean	0	0	0	57	88	206	148	25	313	0	0	0
Upper	0	0	0	114	148	365	243	61	482	0	0	0
Total												
Lower	0	0	2	1,196	158	411	403	23	195	0	0	0
Mean	0	0	6	2,991	429	907	1,018	141	364	0	0	0
Upper	0	0	22	7,412	1,111	1,984	2,558	746	600	0	0	0

1.1.1 Overall, estimated numbers of Manx shearwaters in the array area and buffer area on baseline surveys were highest in the breeding season, with a peak mean of 3,785 birds in April (Table 24). Lower numbers of Manx shearwaters were recorded on baseline surveys in the non-breeding period (September to March), with a peak mean of 460 birds in September.

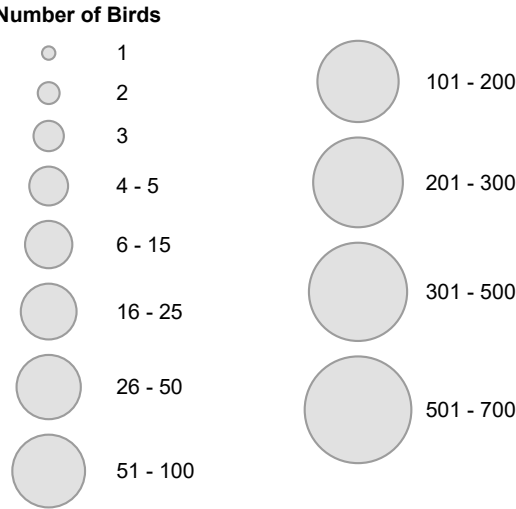
Table 24 Estimated numbers of Manx shearwaters in the array area plus 2km and 4km buffer areas, based on data from 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Array area and 2km Buffer												
Lower	0	0	1	881	99	320	292	51	86	0	0	0
Mean	0	0	4	2,198	293	682	733	148	176	2	0	0
Upper	0	0	16	5,403	785	1,464	1,834	587	312	5	0	0
Array area and 4km Buffer												
Lower	0	0	2	1,513	200	520	510	29	247	0	0	0
Mean	0	0	8	3,785	543	1,148	1,288	178	460	0	0	0
Upper	0	0	28	9,378	1,406	2,510	3,237	944	759	0	0	0

3.4.57 Manx shearwaters were widely distributed across the array area and buffer area in the breeding season (April to August) on baseline surveys (Figure 8). Higher numbers were recorded during the 2019-2021 surveys, compared to the 2016-2017 surveys.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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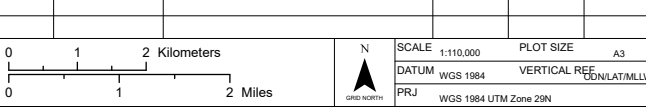
Dublin Array

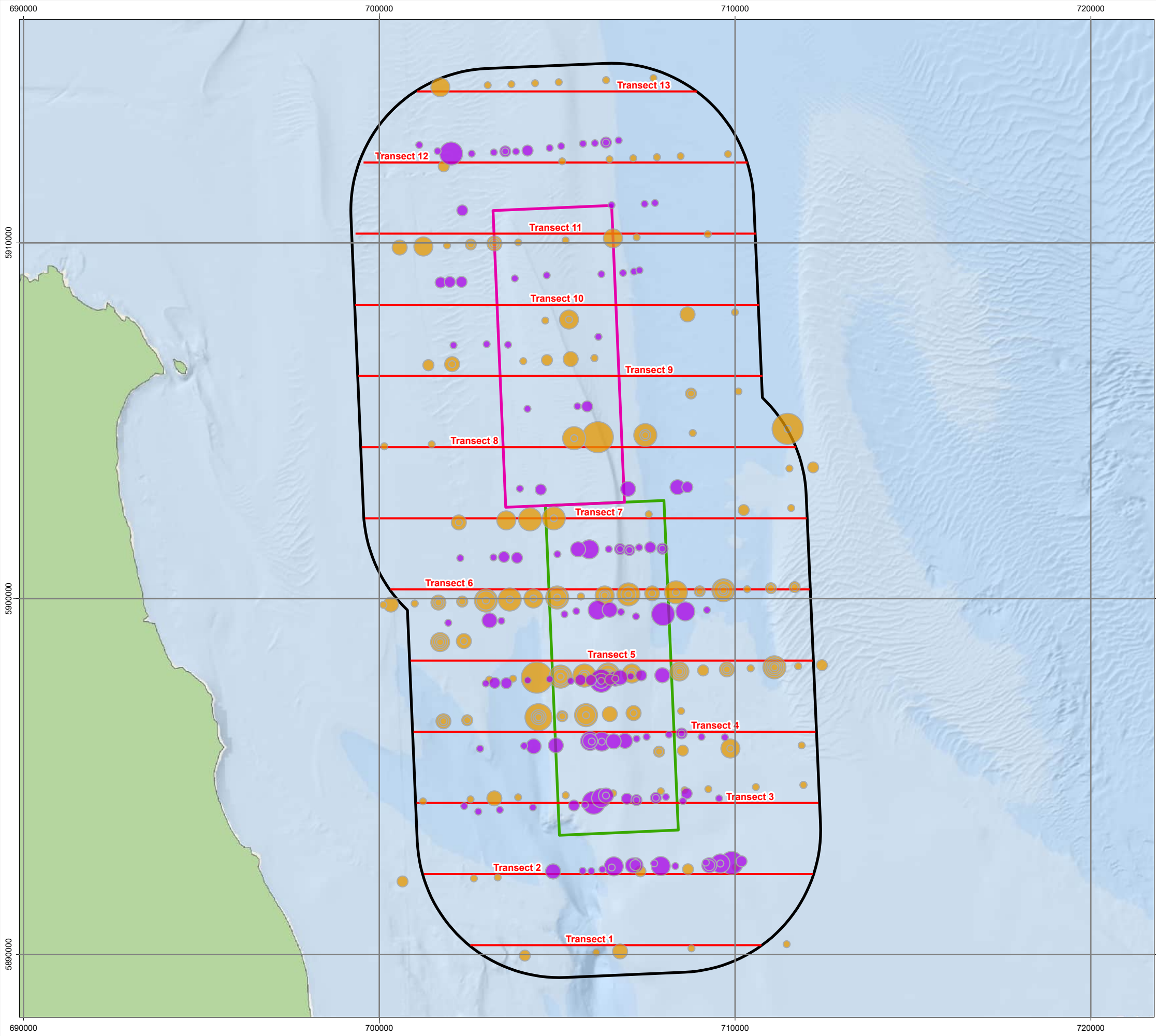
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Marine Bird Survey
Manx Shearwater Sightings in Breeding Season on 2016-2017 & 2019-2021 Surveys

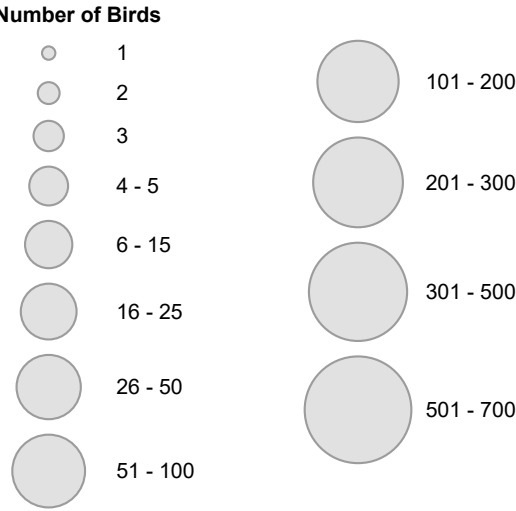
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- Bray Bank Array Area
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- 4km Survey Buffer
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- Bird Sighting 2019 - 2021



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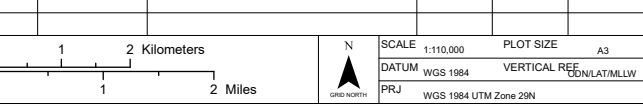
Dublin Array

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Marine Bird Survey
Manx Shearwater Sightings in Autumn & Spring Migration on 2016-2017 & 2019-2021 Surveys

DRAWING NUMBER: **Figure 9** PAGE NUMBER: **Page 7 of 64**

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- 1.1.1 Manx shearwaters were less widespread on baseline surveys across the array area and buffer area in the spring and autumn migration periods compared to the breeding season distribution (Figure 9).
- 3.4.58 Previous 2001-2002 surveys recorded Manx shearwaters between March and September, with an estimated peak of 3,764 birds in early August 2002 (Percival *et al.*, 2002). On 2010-2011 surveys, Manx shearwaters were recorded between March and October, with a peak count of 4,513 birds in mid-August. This was reported as a raw count, i.e. not an extrapolated estimate (Newton and Trewby, 2011).
- 3.4.59 Manx shearwaters were also recorded mainly in the summer months off the Irish east coast on the ObSERVE 2016 aerial surveys. A total of 4,736 individuals were recorded on transect, with the vast majority (3,669 individuals) recorded during the breeding season. Birds were generally recorded at least four km from shore and showed a clear preference for deeper waters in the survey area, with few birds recorded over shallow areas and sandbars with less than 20 m water depth. Mean density of Manx shearwaters across the survey area was 3.37 birds/km² in summer, 1.15 birds/km² in autumn, and 0.01 birds/km² in winter. Abundance of Manx shearwaters across the survey area was estimated at 30,928 (95% Confidence Intervals (Cis) 26,815 – 35,671) individuals in summer, 10,566 (95% CIs 5,462 – 20,441) in autumn, and 114 (95% CIs 47-278) in winter (Jessopp *et al.*, 2018).
- 3.4.60 Flight height was recorded for 2,566 Manx shearwaters on baseline surveys in 2016/17 and 2019/21, with all birds recorded flying below 20 m MSL in height i.e. below rotor-swept height. A total of 2,307 birds were recorded flying below 5 m, with 251 birds flying between 5 and 10 m and eight birds flying between 10 and 20 m in height (Table 9).

Balearic Shearwater

- 3.4.61 Balearic Shearwaters are scarce passage migrants from the Balearic Islands, Spain which can occur off all Irish coasts, generally between July and November. The species is listed as Red-listed in Ireland as it has been classified as being Critically Endangered by the International Union for Conservation of Nature (IUCN), and is of global conservation concern (Gilbert *et al.*, 2021). The population is estimated to be 19,000 individuals but is declining due to fisheries by-catch and predation at breeding colonies (Birdlife International, 2020).
- 3.4.62 Balearic shearwaters are recorded annually in varying numbers off the south coast of Ireland, but are less regular elsewhere in Irish waters (Hutchinson, 1989). ESAS surveys between 1980 and 1997 recorded the majority of sightings to the south of Ireland in July and August, with occasional birds recorded in the Irish Sea (Pollock *et al.*, 1997).
- 3.4.63 A similar pattern was recorded on recent site-specific baseline surveys. On 2016-2017 surveys, one Balearic shearwater was recorded in May 2017 (a further two birds were seen but were off survey effort – not shown), and three birds were recorded in July 2017 (Figure 7). All birds were recorded flying below 5 m in height. The species was not recorded on 2019-2021 surveys.

3.4.64 Previous 2001-2002 surveys recorded two Balearic shearwaters in September 2002 (Percival *et al.*, 2002), while four birds were recorded on 2010-2011 surveys, with one in July 2010, two in August 2010 and one in September 2010 (Newton and Trewby, 2011).

European Storm Petrel

3.4.65 Storm petrels breed at colonies in the west and south west of Ireland. The recent Seabirds Count national census gives the total Irish population as 108,423 pairs (Burnell *et al.*, 2023). The species is listed on Annex I of the EC Birds Directive and is Amber-listed in Ireland, as 50% of the breeding population occurs at ten or fewer sites (Gilbert *et al.*, 2021).

3.4.66 The breeding season for storm petrel has been defined as Mid-May to October (NatureScot, 2020) (Table 3). Although GPS data on foraging range in the breeding season is limited to one study, there is evidence that adults do travel widely from their colonies to forage, with a mean maximum foraging range of 336 km (Woodward *et al.*, 2019). There are no known breeding colonies on the east coast of Ireland (Burnell *et al.*, 2023). The nearest known breeding colony to Dublin Array is on Bardsey Island, off the coast of Wales, where the population was estimated to be 175 pairs in 2016 (Burnell *et al.*, 2023) (Table 25).

Table 25 Recent counts for storm petrel colonies within mean maximum foraging range of Dublin Array (from Burnell *et al.*, 2023)

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Storm petrel (336 km)	Sanda Island (Scotland)	220.6 km	12 pairs (2021)
	Bishop and Clerks Islands (Wales)	160.9 km	163 pairs (2017)
	Bardsey Island (Wales)	92.1 km	175 pairs (2016)
	Ramsey Island (Wales)	160.9 km	8 pairs (2021)
	Grassholm (Wales)	173.1 km	11 pairs (2014)
	Skomer, Midland Island and Skokholm Islands (Wales)	171 km	2,586 pairs (2016-2018)
	Inishtrahull (Donegal)	247.2 km	675 pairs (2021)
	Estimated breeding season population within 336 km		3,630 pairs

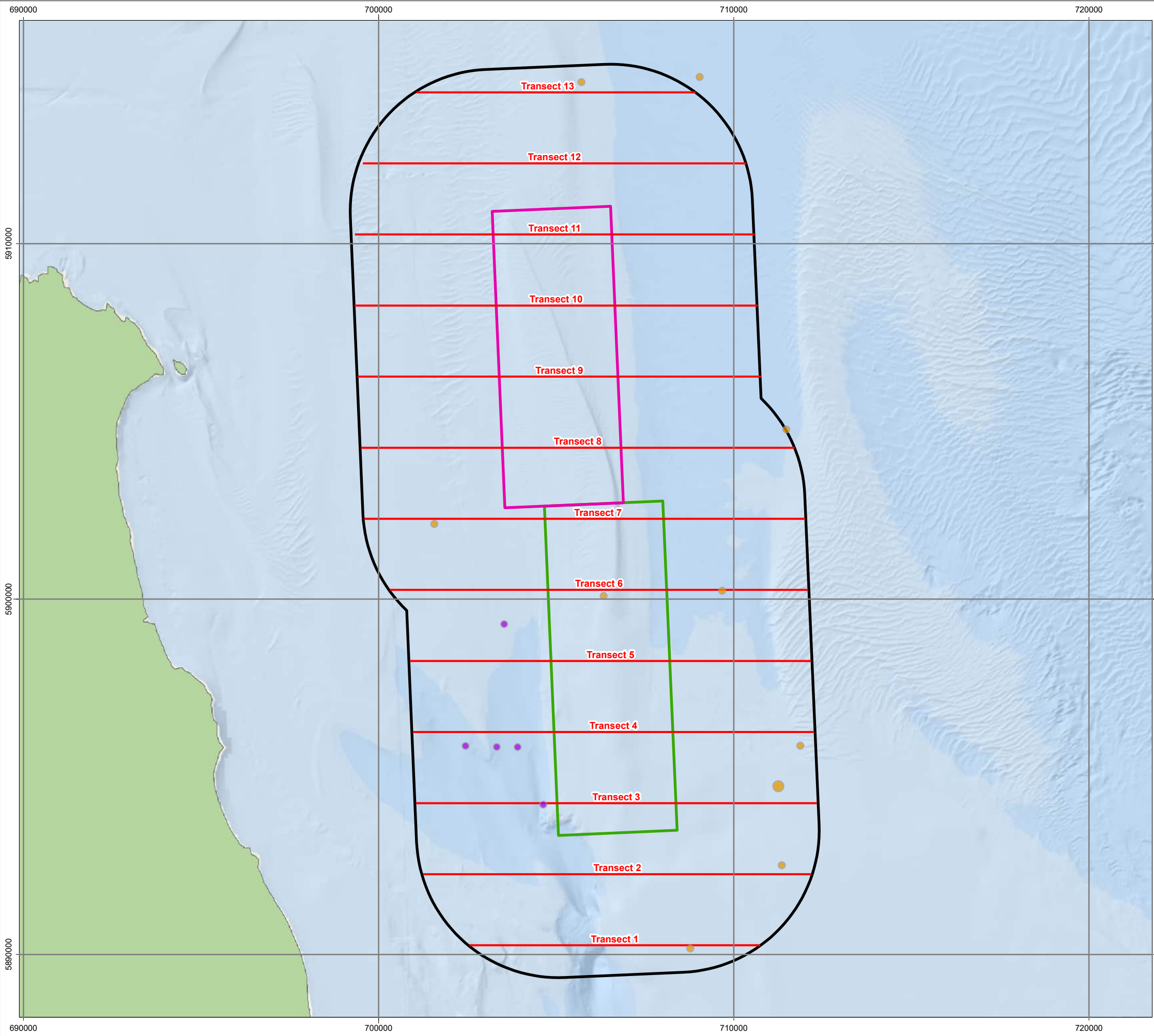
3.4.67 In the non-breeding season, birds disperse southwards to waters off western and southern Africa, and into the Indian Ocean (Wernham *et al.*, 2002). As no storm petrels were recorded on baseline surveys between September and April, it was considered that the species was not present in the offshore ornithology study area in the winter months. Storm petrel was not included in the BDMPS report (Furness, 2015) as the species is also absent from UK waters in the winter months.

- 3.4.68 ESAS surveys in Irish waters between 1980 and 1997 recorded storm petrels in low densities in the Irish Sea in July and August, and occasionally between September and November (Pollock *et al.*, 1997).
- 3.4.69 Five storm petrels were recorded on 2016-2017 surveys, with all five birds recorded in August 2017. On 2019-2021 surveys, 11 storm petrels were recorded between May and August, with a peak count of seven birds in late May 2020. Average abundance (birds/km) over the two survey periods was low, with a peak of 0.04 birds/km recorded in May and August (Table 26). A total of 14 storm petrels were recorded in flight over both survey periods, with all birds flying below 5 m in height i.e. below rotor-swept height.

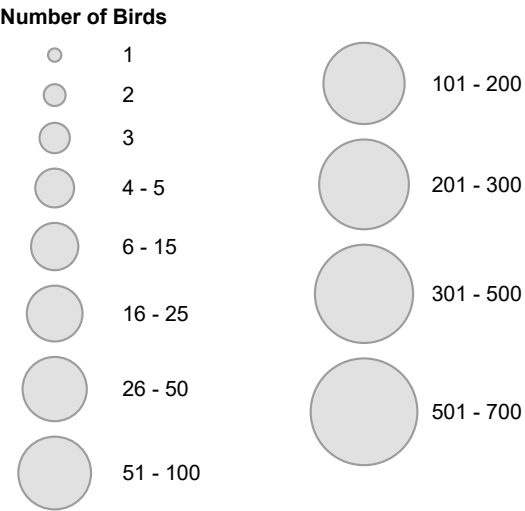
Table 26 Peak monthly counts (raw numbers) of storm petrels in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	0	0	-	0	0	0	5	0	0	0	0
2019-21	0	-	0	0	7	1	0	2	0	0	0	0
Average abundance (birds/km)	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.04	0.00	0.00	0.00	0.00

- 3.4.70 On 2016-2017 surveys, all five storm petrels were recorded inshore of the southern half of the array area in August (Figure 10). On 2019-2020 surveys, storm petrels were predominantly recorded in the buffer area in low numbers between April and August, with only one sighting from inside the array area.
- 3.4.71 Storm petrels were not recorded on 2001-2002 surveys (Percival *et al.*, 2002), however 35 storm petrels were recorded on 2010-2011 surveys, with peak counts of nine birds in both August 2010 and May 2011 (Newton and Trewby, 2011).



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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PROJECT TITLE

Dublin Array

DRAWING TITLE

**Marine Bird Survey
Storm Petrel Sightings on 2016-2017 & 2019-2021 Baseline Surveys**

DRAWING NUMBER: Figure 10			PAGE NUMBER: Page 8 of 64		
VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE



Gannet

- 3.4.72 Gannets breed in a few, typically very large, colonies around Ireland and the UK. The Irish breeding population was estimated at 48,032 pairs between 2013 and 2014 (Burnell *et al.*, 2023). The species is Amber-listed in Ireland, as 50% or more of the Irish breeding population is found at 10 breeding colonies or less (Gilbert *et al.*, 2021).
- 3.4.73 The breeding season for gannet has been defined as March to September (Furness, 2015) (Table 3). During the breeding season, adults range widely from their colonies to fish, with a mean maximum foraging range of 315.2 ± 194.2 km (Woodward *et al.*, 2019). Gannets feed by plunge diving for fish, typically from around 25 to 40 m above the surface (Robinson 2017).
- 3.4.74 The Irish gannet population has increased by an estimated 33% over the 10-year period from 2004 to 2014 (Cummins *et al.*, 2019). In 2015, the gannetry on Lambay Island was re-surveyed using land-based vantage points and had increased from 728 pairs in 2013 to 926 pairs in 2015, an increase of 27% in just two years (Newton *et al.*, 2015). Gannets at some Irish breeding colonies were affected by Highly Pathogenic Avian Influenza (HPAI) during the 2022 breeding season (BWI, 2022), although effects at the population level are not yet known. Recent counts for colonies within mean maximum foraging range ± 1 SD are shown in Table 27.

Table 27 Recent counts for gannet colonies within mean maximum foraging range of Dublin Array (from Burnell *et al.*, 2023)

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Gannet (315.2 ± 194.2 km)	Ireland's Eye (Dublin)	22.1 km	350 pairs (2015)
	Lambay Island (Dublin)	30.4 km	926 pairs (2015)
	Middle Mouse (Wales)	103.9 km	21 pairs (2022)
	Great Saltee Island (Wexford)	144.9 km	4,722 pairs (2014)
	Grassholm (Wales)	169.4 km	36,011 pairs (2015)
	Big Scar (Scotland)	178.6 km	2,376 pairs (2014)
	Ailsa Craig (Scotland)	230.8 km	33,226 pairs (2014)
	Garvan Isles (Donegal)	321.8 km	30 pairs (2016)
	Bull Rock (Cork)	421.8 km	6,388 pairs (2014)
	Berneray (Scotland)	440.0 km	15 pairs (2021)
	Little Skellig (Kerry)	446.8 km	35,294 pairs (2014)
	Estimated breeding season population within mean maximum foraging range ± 1 SD		119,359 pairs

- 3.4.75 Outside the breeding period, gannets disperse away from the breeding colonies and typically move southward with birds wintering in the Bay of Biscay and off West Africa (Wernham *et al.*, 2002).
- 3.4.76 Furness (2015) considered that outside the breeding season there were two BDMPS periods for gannet; autumn migration (September to November) and spring migration (December to March). In addition to waters off the Irish east and south coasts, the relevant BDMPS region for gannet is the “UK Western Waters”, as defined in Furness (2015).
- 3.4.77 The original BDMPS population for gannet for the “UK Western Waters” was estimated as 545,954 birds (all ages) for the autumn migration period, which included an Irish component of 31,896 birds (14,400 adults and 17,496 immature birds) (Furness, 2015). This Irish component was subtracted from the original BDMPS autumn migration population, which gives an estimate of 514,058 birds (all ages). Similarly, the original BDMPS population for gannet for the “UK Western Waters” was estimated as 661,888 birds (all ages) for the spring migration period, which included an Irish component of 39,096 birds (21,600 adults and 17,496 immature birds) (Furness, 2015). This Irish component was subtracted from the original BDMPS spring migration population, which gives an estimate of 622,792 birds (all ages).
- 3.4.78 To include an estimate of Irish gannets in the BDMPS reference population, an estimate of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals was calculated (Burnell *et al.*, 2023) (Table 28). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 28 Estimated Irish component of BDMPS regional reference population for gannet

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
96,064 adults	11,996 adults	0.761	9,129 (11,996x0.761)	21,125 birds

- 3.4.79 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the “UK Western Waters” for the relevant non-breeding period, as defined in Furness (2015) (Table 29).

Table 29 Estimated BDMPS regional reference populations for gannet

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Autumn migration	514,058	21,125	535,183 birds
Spring migration	622,792	21,125	643,917 birds

- 3.4.80 For gannet, the revised autumn migration BDMPS regional population was estimated to be 535,183 birds (all ages), while the revised spring migration BDMPS regional population was estimated to be 643,917 birds (all ages) (Table 29).

3.4.81 ESAS surveys in Irish waters between 1980 and 1997 recorded gannets in low densities in the Irish Sea throughout the year, with a peak in numbers in the Irish Sea in September and October. Numbers were lowest in the Irish Sea between November and January (Pollock *et al.*, 1997).

3.4.82 Estimated numbers of gannets were derived from baseline survey data by applying Distance sampling techniques to the 2019-2021 dataset only for birds on the water, as there were insufficient sightings of gannets on the water in the 2016-2017 dataset to run a Distance analysis. Both datasets were used for birds in flight (Table 30, Table 31 and Table 32).

Table 30 Estimated numbers of gannets in the array area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water (2019/21 data only)												
Lower	0	-	4	28	112	23	39	11	5	0	1	2
Mean	0	-	13	73	240	44	86	20	20	1	4	6
Upper	0	-	42	189	562	92	190	42	82	4	14	21
Birds in flight (2016/17 data & 2019/21 data)												
Lower	0	0	0	4	1	7	2	6	6	3	0	3
Mean	8	7	5	15	5	30	9	18	17	9	0	9
Upper	22	16	12	31	11	65	17	32	33	17	0	16
Total (2016/17 data & 2019/21 data)												
Lower	0	0	4	32	113	31	41	17	11	3	1	5
Mean	8	7	17	88	245	74	94	38	37	10	4	15
Upper	22	16	54	221	572	157	208	74	115	22	14	37

Table 31 Estimated numbers of gannets in the 2km buffer area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water (2019/21 data only)												
Lower	0	-	7	47	189	39	65	18	8	0	2	3
Mean	0	-	21	123	403	74	144	34	33	1	6	11
Upper	0	-	70	318	945	154	320	70	138	8	23	35
Birds in flight (2016/17 data & 2019/21 data)												
Lower	0	0	4	27	14	9	6	5	10	2	0	0
Mean	1	8	11	58	52	32	20	20	29	10	0	2
Upper	3	20	22	97	110	68	39	41	53	19	0	5

	J	F	M	A	M	J	J	A	S	O	N	D
Total (2016/17 data & 2019/21 data)												
Lower	0	0	11	75	202	49	72	23	18	3	2	3
Mean	1	8	32	181	455	106	165	54	62	11	6	12
Upper	3	20	93	416	1,055	222	359	111	191	27	23	40

Table 32 Estimated numbers of gannets in the 4km buffer area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water (2019/21 data only)												
Lower	0	-	15	106	422	88	146	40	19	0	4	8
Mean	0	-	47	275	903	166	323	76	75	3	14	24
Upper	0	-	157	713	2,117	345	717	157	310	17	52	79
Birds in flight (2016/17 data & 2019/21 data)												
Lower	0	0	0	15	5	27	9	23	23	10	0	13
Mean	31	26	18	57	20	113	32	67	63	34	0	34
Upper	83	61	45	118	41	245	66	121	125	66	0	59
Total (2016/17 data & 2019/21 data)												
Lower	0	0	15	121	427	115	155	64	42	11	4	21
Mean	31	26	65	332	922	279	355	143	138	37	14	58
Upper	83	61	203	832	2,158	591	783	279	435	82	52	139

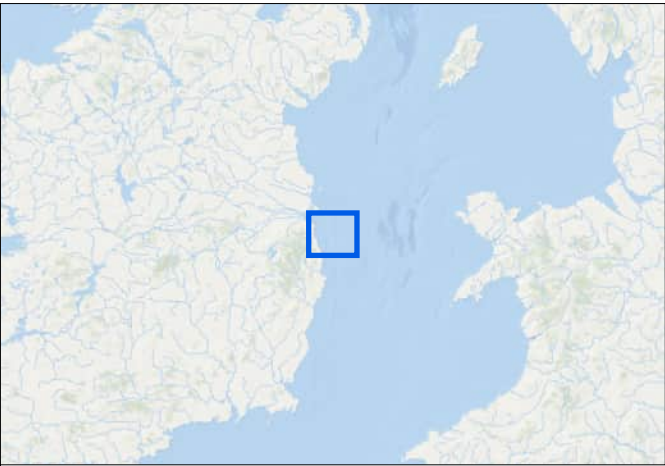
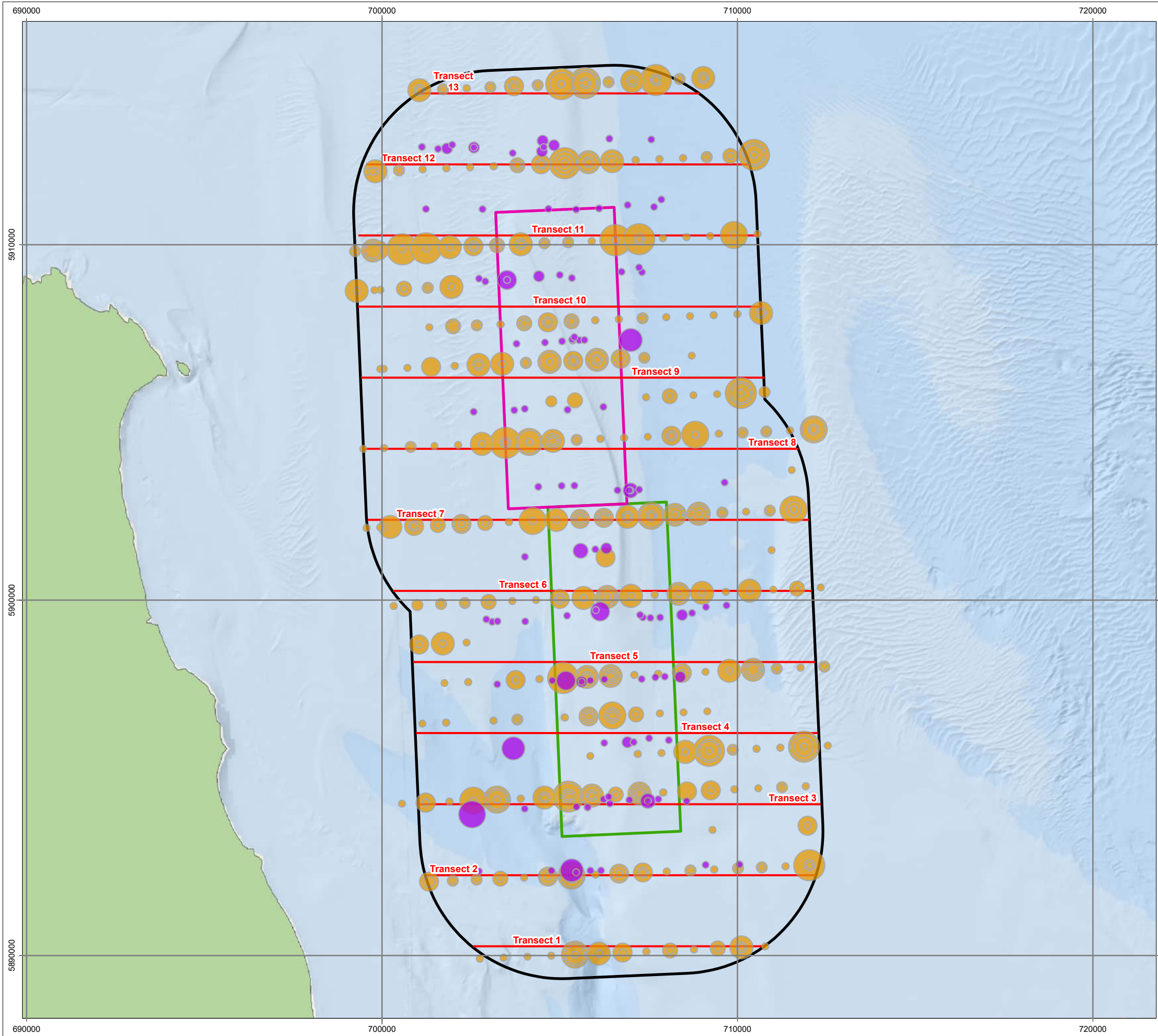
3.4.83 Overall, estimated numbers of gannets in the study area on baseline surveys were highest in the breeding season, with a peak mean of 1,167 birds in May in the array area plus 4km buffer (Table 33). Estimated numbers for the non-breeding season were considerably lower, with peaks of 47 birds in October and 73 birds in December in the array area plus 4 km buffer.

Table 33 Estimated numbers of gannets in the array area plus 2km and 4km buffer areas, based on data from 2016-2017 and 2019-2021 surveys

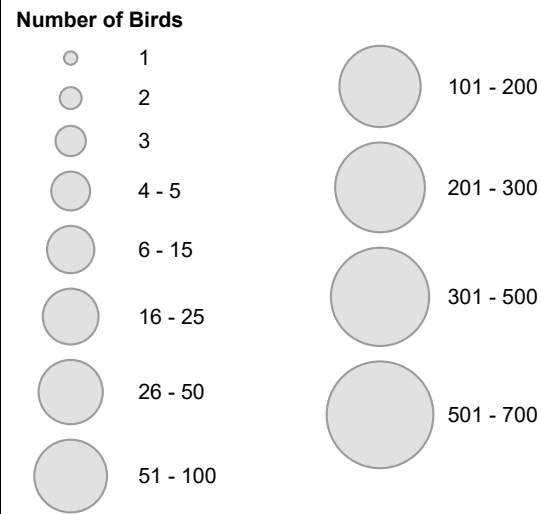
	J	F	M	A	M	J	J	A	S	O	N	D
Array area and 2km Buffer												
Lower	0	0	15	107	315	80	113	40	29	6	3	8
Mean	9	15	49	269	700	180	259	92	99	21	10	27
Upper	25	36	147	637	1,627	379	567	185	306	49	37	77
Array area and 4km Buffer												
Lower	0	0	19	153	540	146	196	81	53	14	5	26

	J	F	M	A	M	J	J	A	S	O	N	D
Mean	39	33	82	420	1,167	353	449	181	175	47	18	73
Upper	105	77	257	1,053	2,730	748	991	353	550	104	66	176

3.4.84 Gannets were widely distributed on baseline surveys across the array area and buffer area in the breeding season (March to September) (Figure 11).



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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PROJECT TITLE

Dublin Array

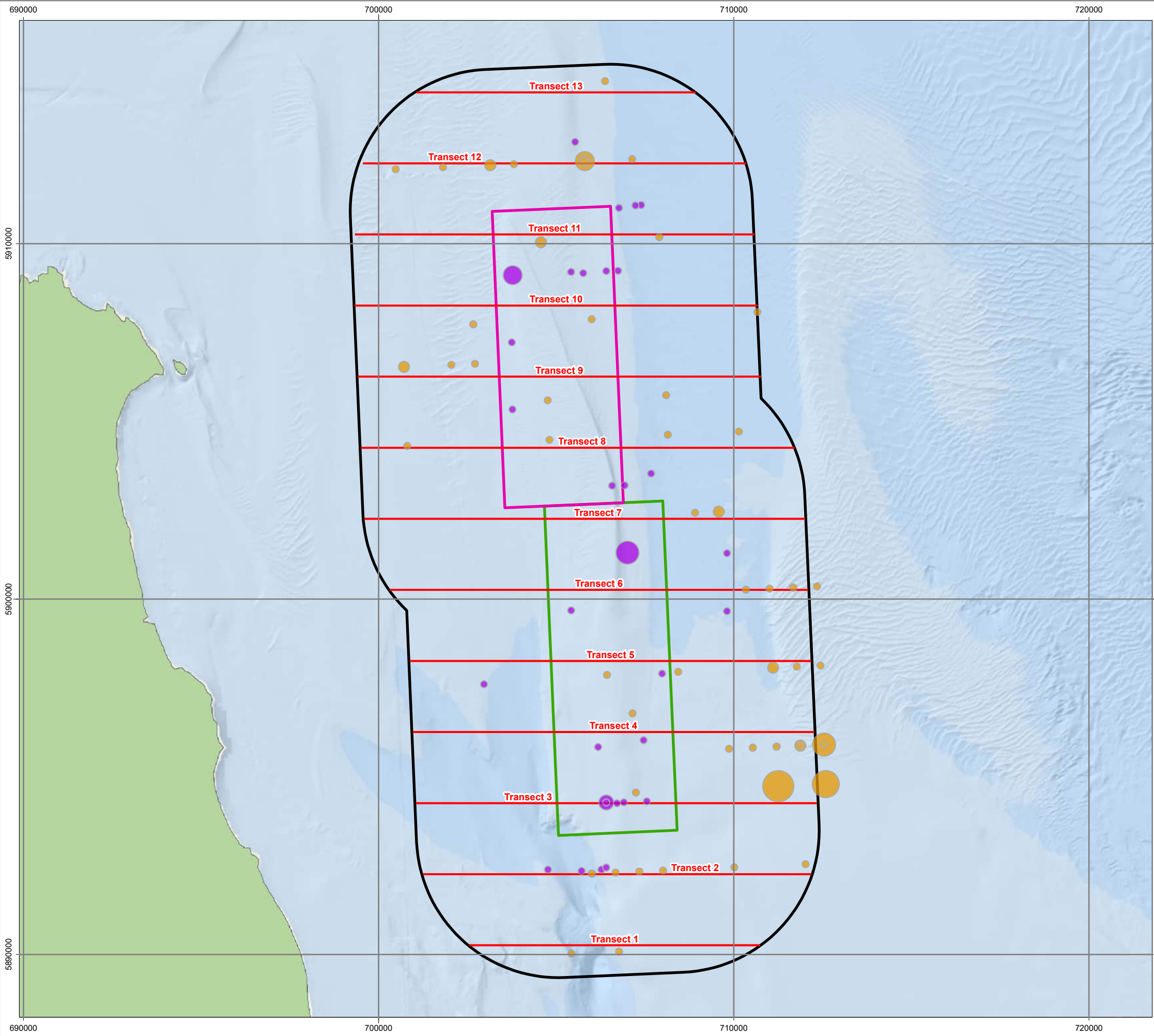
DRAWING TITLE

Marine Bird Survey
Gannet Distribution in Breeding Season on 2016-2017 & 2019-2021 Surveys

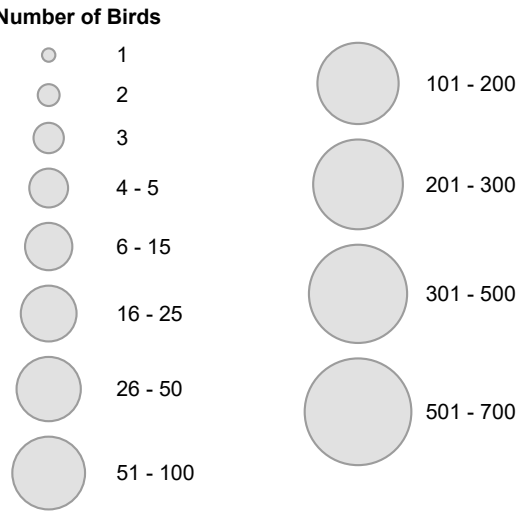
DRAWING NUMBER: **Figure 11** PAGE NUMBER: **Page 9 of 64**

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- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
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- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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**Marine Bird Survey
Gannet Distribution in Non-Breeding Season on 2016-2017 & 2019-2021 Surveys**

DRAWING NUMBER: **Figure 12** PAGE NUMBER: **Page 10 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
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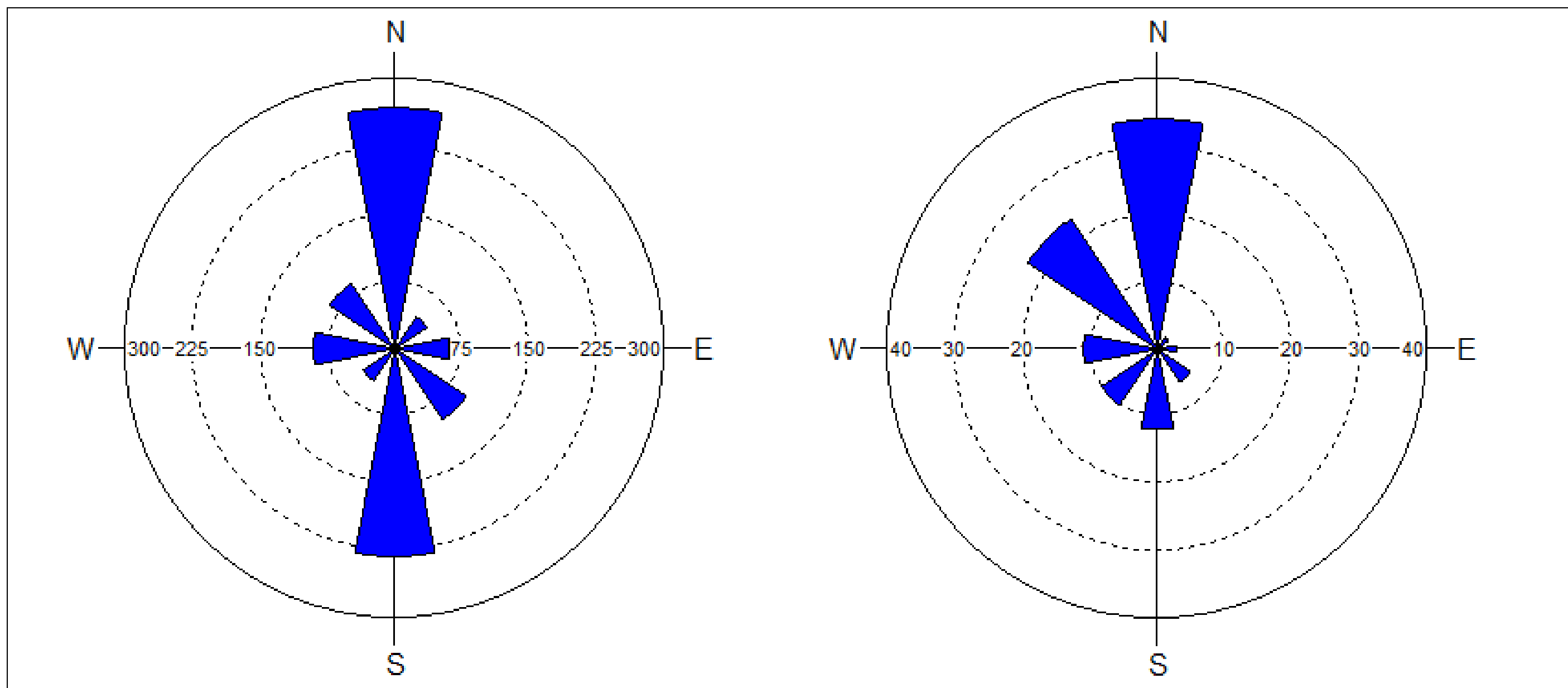


- 3.4.85 Numbers of gannets recorded on baseline surveys during the non-breeding season were much lower than in the breeding season, although birds were still widespread throughout the study area (Figure 12).
- 3.4.86 Previous 2001-2002 surveys recorded gannets in low numbers in all months except November and December, with an estimated peak of 107 birds in April 2002 (Percival *et al.*, 2002). On 2010-2011 surveys, gannets were recorded in all months, with peak counts of 978 birds in July 2010 and 1,326 birds in May 2011 (raw counts) (Newton and Trewby, 2011).
- 3.4.87 Gannets were recorded mainly in the summer and autumn months off the Irish east coast on the ObSERVE 2016 aerial surveys, with very few sightings in winter months, all involving adult birds. A total of 1,192 individuals were recorded over the three surveys. Gannets did not appear to show any depth preference, with sightings occurring across the range of available depths within the survey area. Surveys indicated that in particular, the waters around Lambay Island, where there is a gannet breeding colony, were important year-round. Mean density of gannets across the ObSERVE survey area ranged from 0.88 birds/km² in autumn, 0.33 birds/km² in summer and 0.03 birds/km² in winter. Abundance of gannets across the survey area was estimated at 3,228 (95% CIs 2,425 – 4,296) individuals in summer, 8,059 (95% CIs 6,396 – 10,154) in autumn, and 315 (95% CIs 226 – 438) in winter (Jessopp *et al.*, 2018).
- 3.4.88 Flight height was recorded for 1,761 gannets on baseline surveys in the Offshore Ornithology Study Area in 2016-2017 and 2019-2021, with 1,585 birds (90.0%) recorded flying below 20 m MSL in height i.e. below rotor-swept height. A total of 639 birds were recorded flying below 5 m, with 417 birds flying between 5 and 10 m, 529 birds flying between 10 and 20 m, 154 birds flying between 20 and 30 m and 22 birds flying above 30 m in height (Table 9).
- 3.4.89 A total of 1,453 gannets were aged on baseline surveys between 2016-2017 and 2019-2021. In the breeding season (March to September) age was recorded for 1,362 gannets, with 219 immature (non-breeding) birds (16.1%) and 1,143 adults (83.9%) recorded (Table 34).

Table 34 Monthly breakdown of immature and adult gannets in the offshore ornithology study area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Immature	1	0	0	7	77	29	49	18	39	8	0	3
Adult	5	2	69	250	306	100	152	107	159	51	14	7
Number aged	6	2	69	257	383	129	201	125	198	59	14	10
Percentage of immature birds	16.7	0	0	2.8	20.1	29.0	24.4	14.4	19.7	13.6	0	30.0

- 3.4.90 Flight direction was recorded for 918 gannets in the breeding season (March to September), with direction recorded for 101 birds in the non-breeding season (October to February) (Figure 13).



March to September (n=918 birds)

Numbers shown on figures are number of birds recorded

October to February (n=101 birds)

Figure 13 Flight direction of gannets recorded on 2016-2017 and 2019-2021 surveys

3.4.91 In the breeding season, the majority of gannets were recorded flying either north (29.1%) or south (25.2%), with fewer birds recorded flying in other directions. In the non-breeding period, 33.7% of all gannets were recorded flying north, with 22.8% recorded flying north west, although the sample size was small. An additional 762 birds were recorded as circling on baseline surveys (not shown).

Great Cormorant

3.4.92 Cormorants breed in colonies, and their distribution is closely linked to sheltered shallow coastal waters, usually less than 20 m deep, where foraging birds can reach the seabed. Cormorants typically prey on a wide range of small fish species, from shallow, inshore waters (Forrester *et al.*, 2007). The Irish breeding population was estimated at 4,124 pairs by the recent Seabirds Count national census, which is an 8% decrease on numbers recorded by the Seabird 2000 census (1998 to 2002) (Burnell *et al.*, 2023). The species is Amber-listed in Ireland as 50% or more of the Irish breeding population is found at 10 breeding colonies or less (Gilbert *et al.*, 2021).

3.4.93 The breeding season for cormorant has been defined as April to August, with the corresponding non-breeding season defined as September to March (Furness, 2015) (Table 3). During the breeding season, adults forage fairly close to their colonies, with a mean maximum foraging range of 25.6 ± 8.3 km (Woodward *et al.*, 2019). Recent counts for colonies within mean maximum foraging range ± 1 SD are shown in Table 35.

Table 35 Recent counts for cormorant colonies within mean maximum foraging range of Dublin Array (from Burnell *et al.*, 2023)

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Cormorant (25.6 ± 8.3 km)	Ireland's Eye (Dublin)	22.1 km	424 pairs (2015)
	Lambay Island (Dublin)	30.4 km	282 pairs (2015)
	Estimated breeding season population within mean maximum foraging range ± 1 SD		706 pairs

3.4.94 In the non-breeding season, many cormorants remain in the vicinity of their breeding colonies, while some birds move south to France and Portugal for the winter (Wernham *et al.*, 2002). Furness (2015) considered that outside the breeding season there was one BDMPS period for cormorant; the non-breeding season (September to March). In addition to waters off the Irish east and south coasts, the relevant BDMPS region for cormorant is "SW England and Wales", as defined in Furness (2015).

- 3.4.95 The original BDMPS population for cormorant for the “SW England and Wales” region was estimated as 9,602 birds (all ages) for the non-breeding season, which included an Irish component of 96 immature birds (Furness, 2015). This Irish component was subtracted from the original BDMPS non-breeding season population, which gives an estimate of 9,506 birds (all ages).
- 3.4.96 To include an estimate of Irish cormorants in the BDMPS reference population, an estimate of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals was calculated (Burnell et al., 2023) (Table 36). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 36 Estimated Irish component of BDMPS regional reference population for cormorant

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
8,248 adults	4,044 adults	1.451	5,868 (4,044x1.451)	9,912 birds

- 3.4.97 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the “UK Western Waters” for the relevant non-breeding period, as defined in Furness (2015) (Table 37).

Table 37 Estimated BDMPS regional reference populations for cormorant

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Non-breeding season	9,506	9,912	19,418 birds

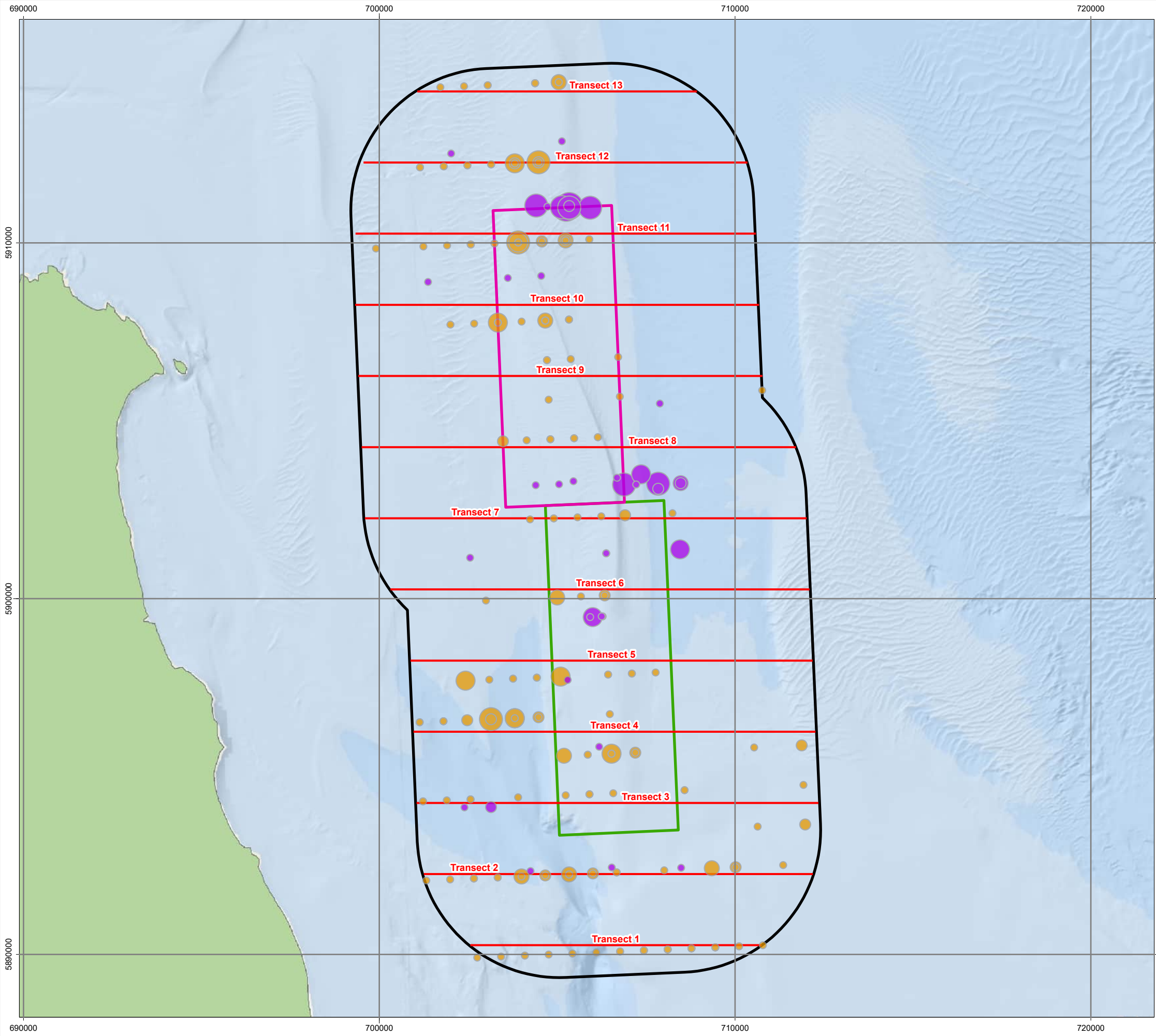
- 3.4.98 For cormorant, the revised non-breeding season BDMPS regional population was estimated to be 19,418 birds (all ages) (Table 37).
- 3.4.99 ESAS surveys in Irish waters between 1980 and 1997 recorded cormorants in low densities off the Dublin and Wicklow coasts throughout the year, although coverage of inshore waters on these surveys was limited (Pollock *et al.*, 1997).
- 3.4.100 A total of 226 cormorants were recorded on 2016-2017 baseline surveys, with peaks of 31 birds in September 2016 and 27 birds in November 2016. On 2019-2021 surveys, 393 cormorants were recorded, with a peak of 135 birds in July 2020. Totals for other months were similar to corresponding months in the 2016-2017 surveys. Across both survey periods, numbers were lowest between December and February. Average abundance (birds/km) over the two survey periods was highest in July, with 0.88 birds/km recorded (Table 38). For months with more than one survey, the peak number recorded on any one survey is shown.

Table 38 Peak monthly counts (raw numbers) of cormorants in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

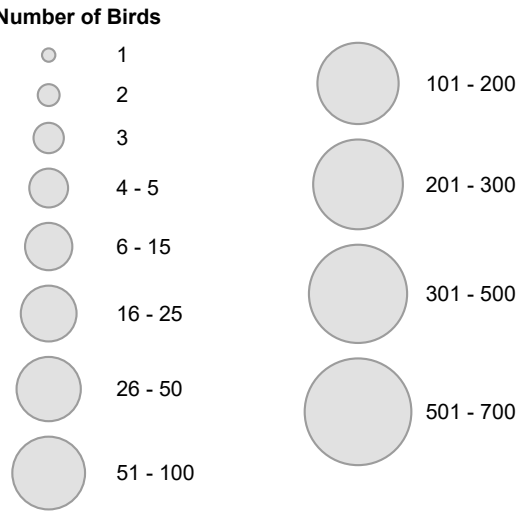
	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	9	20	-	24	25	21	21	31	20	27	1
2019-21	3	-	10	15	14	27	135	32	17	13	6	5
Average abundance (birds/km)	0.02	0.24	0.20	0.13	0.31	0.43	0.88	0.35	0.37	0.23	0.24	0.05

3.4.101 In addition, on 2019-2020 surveys, a further 82 birds could not be identified to species and were recorded as cormorant/shag. Of these unidentified birds, 81 were recorded roosting on the Kish Lighthouse from the survey vessel, with eight birds roosting on 24th January 2020, 45 roosting on 6th May 2020 and 28 roosting on 28th August 2020. The remaining unidentified cormorant/shag was recorded between 50 and 100 m from the survey vessel on 7th August 2019, but it dived before it was identified. There were no unidentified cormorants/shags recorded on 2016-2017 surveys.

3.4.102 On baseline surveys in the breeding season (April to August), cormorants were predominantly recorded in low to moderate numbers at the north and south ends of the buffer area, and in lower numbers in the array area (Figure 14).



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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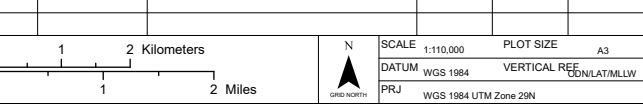
Dublin Array

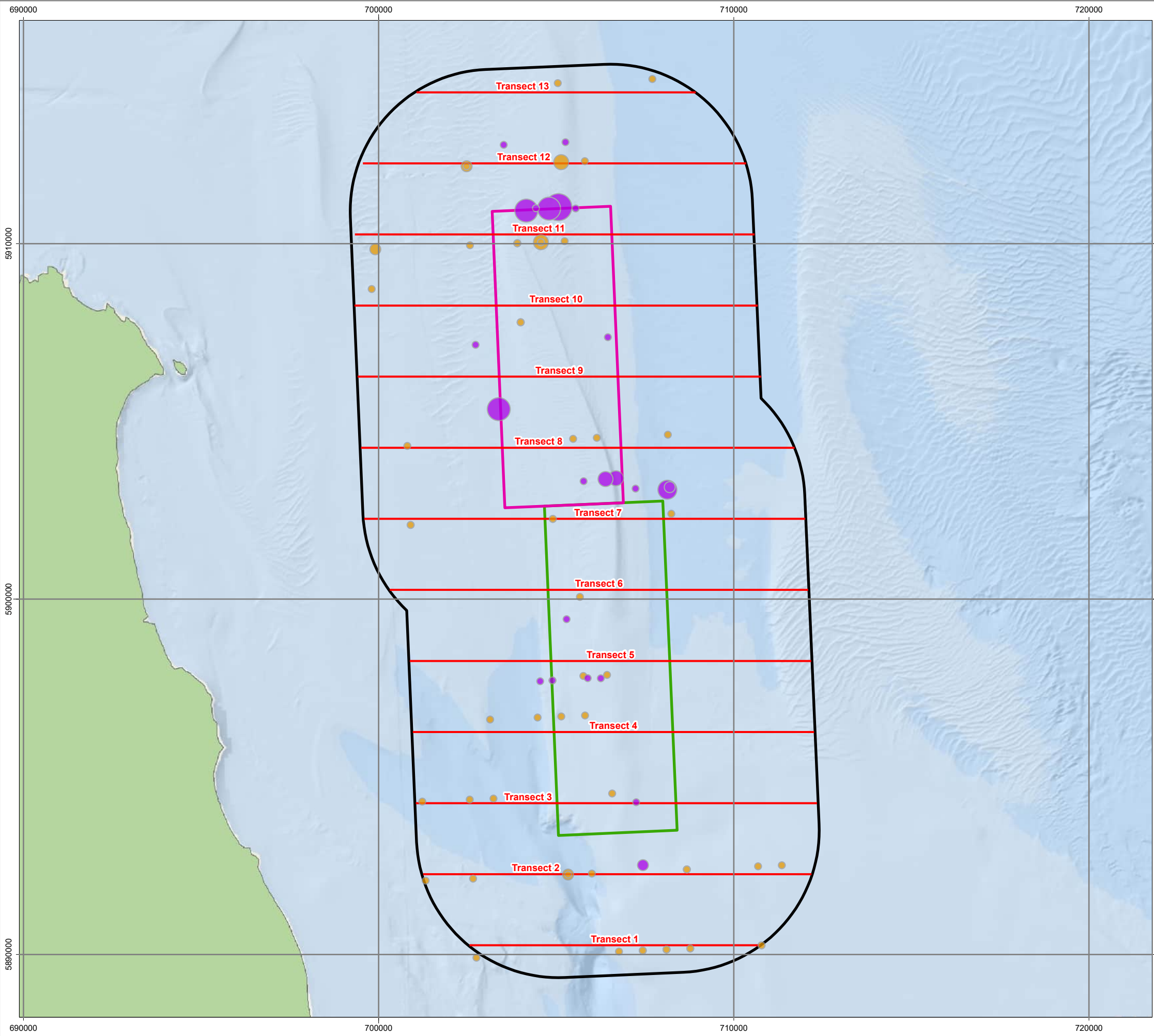
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**Marine Bird Survey
Cormorant Sightings in the Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys**

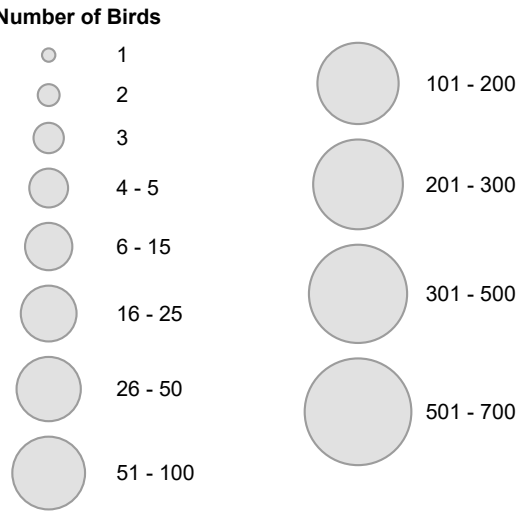
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02	2025-01-16	PUBLIC	JK	AE	AE





- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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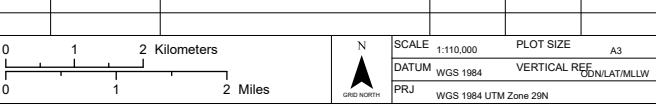
Dublin Array

DRAWING TITLE

**Marine Bird Survey
Cormorant Sightings in the Non-Breeding Season on 2016-2017 & 2019-2021
Baseline Surveys**

DRAWING NUMBER: **Figure 15** PAGE NUMBER: **Page 12 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE



- 3.4.103 In comparison, lower numbers of cormorants were recorded on baseline surveys in the non-breeding season (September to March), with few birds recorded within the array area (Figure 15). Cormorant distribution on the 2016-2017 surveys was more clumped in the northern half of the array area compared to the 2019-2021 surveys, when birds were more widely scattered.
- 3.4.104 Previous 2001-2002 surveys recorded cormorants in all months, with an estimated peak of 81 birds in September 2002 (Percival *et al.*, 2002). On 2010-2011 surveys, cormorants were recorded in all months except January, with peak counts of 103 birds in July 2010 and 102 birds in August 2010 (raw counts) (Newton and Trewby, 2011). As with the more recent surveys, numbers recorded on both these survey periods were lowest in winter.
- 3.4.105 As cormorants and shags could not be identified to species level on the ObSERVE 2016 aerial surveys, combined numbers were presented. A total of 543 cormorants/shags were recorded over the three surveys, with a clear peak in the distribution of sightings in water depths around 10 m indicating a preference for shallow waters. There were very few observations occurring in water depths greater than 20 m. Utilization distributions highlighted highest density of sightings coastally, concentrated around Howth, across all three seasons, indicating that this area is important throughout the year. Abundance of cormorants/shags across the survey area was estimated at 2,805 (95% CIs 1,730 – 4,546) individuals in summer, 2,796 (95% CIs 1,422 – 5,495) in autumn, and 1,321 (95% CIs 1,009 – 1,730) in winter. The wide confidence intervals on these estimates were due to the largely inshore distribution which resulted in high variability in density between coastal grid cells and those occurring further offshore (Jessopp *et al.*, 2018).
- 3.4.106 Flight height was recorded for 338 cormorants on baseline surveys in 2016-2017 and 2019-2021, with 100% of birds recorded flying below 20 m MSL in height, i.e. below likely rotor-swept height. A total of 299 birds were recorded flying below 5 m, with 30 birds flying between 5 and 10 m and nine birds flying between 10 and 20 m in height (Table 9).

European Shag

- 3.4.107 Shags are surface-diving bottom-foraging seabirds that generally forage in inshore waters, at depths of between 20 and 40 m. The main prey species is the lesser sandeel, caught on or near the seabed (Forrester *et al.*, 2007). The Irish breeding population was estimated at 4,748 pairs by the recent Seabirds Count national census, which is an 40% increase on numbers recorded by the Seabird 2000 census (1998 to 2002) (Burnell *et al.*, 2023). The species is Amber-listed in Ireland, because 50% of the breeding population occurs at 10 or fewer sites, and because of an unfavourable conservation status in Europe (Gilbert *et al.*, 2021).
- 3.4.108 The breeding season for shag has been defined as February to August (Furness, 2015) (Table 3). During the breeding season, adults forage close to their colonies, with a mean maximum foraging range of 13.2 ± 10.5 km (Woodward *et al.*, 2019). Colonies within mean maximum foraging distance ± 1 SD of Dublin Array are shown in Table 39.

Table 39 Recent counts for shag colonies within mean maximum foraging range of Dublin Array

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Shag (13.2 ± 10.5 km)	Bray Head (Wicklow)	11.8 km	15 pairs (2015)
	Howth Head (Dublin)	18.6 km	41 pairs (2015)
	Ireland's Eye (Dublin)	22.1 km	81 pairs (2015)
	Estimated breeding season population within mean maximum foraging range ± 1 SD		137 pairs

3.4.109 In the non-breeding season (September to January), juveniles, immatures and some adult shags show a limited dispersal southwards from their breeding colonies (Wernham *et al.*, 2002). Furness (2015) considered that outside the breeding season there was one BDMPS period for shag; the non-breeding season (September to January). In addition to waters off the Irish east and south coasts, the relevant BDMPS region for shag is “SW England and Wales”, as defined in Furness (2015).

3.4.110 The original BDMPS population for shag for the “SW England and Wales” region was estimated as 13,075 birds (all ages) for the non-breeding season, which included an Irish component of 157 immature birds (Furness, 2015). This Irish component was subtracted from the original BDMPS non-breeding season population, which gives an estimate of 12,918 birds (all ages).

3.4.111 To include an estimate of Irish shags in the BDMPS reference population, an estimate of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals was calculated (Burnell *et al.*, 2023) (Table 40). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 40 Estimated Irish component of BDMPS regional reference population for shag

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
9,496 adults	2,340 adults	0.792	1,853 (2,340x0.792)	4,193 birds

3.4.112 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the “UK Western Waters” for the relevant non-breeding period, as defined in Furness (2015) (Table 41).

Table 41 Estimated BDMPS regional reference populations for shag

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Non-breeding season	12,918	4,193	17,111 birds

3.4.113 For shag, the revised non-breeding season BDMPS regional population was estimated to be 17,111 birds (all ages) (Table 41).

3.4.114 ESAS surveys in Irish waters between 1980 and 1997 recorded shags in low densities off the Dublin and Wicklow coasts throughout the year, although coverage of inshore waters on these surveys was limited (Pollock *et al.*, 1997).

3.4.115 Estimated numbers of shags were derived from baseline survey data by applying Distance sampling techniques to the 2016-2017 and 2019-2021 datasets (Table 42, Table 43 and Table 44).

Table 42 Estimated numbers of shags in the array area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	16	22	44	29	21	46	56	71	72	65	88	62
Mean	38	53	90	48	48	90	146	147	177	140	218	140
Upper	97	126	196	84	113	198	380	316	453	304	550	341
Birds in flight												
Lower	3	0	0	3	3	1	0	2	12	8	3	0
Mean	10	2	2	11	9	8	6	9	27	22	13	1
Upper	16	7	7	22	18	18	12	16	47	40	26	2
Total												
Lower	18	22	44	32	23	48	57	74	84	73	91	62
Mean	48	55	93	59	57	98	152	156	204	163	231	141
Upper	113	133	204	106	131	216	393	332	500	344	576	343

Table 43 Estimated numbers of shags in the 2km buffer area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	26	38	74	49	35	78	95	120	122	110	148	104
Mean	64	89	152	80	81	151	246	248	298	236	367	236
Upper	163	212	330	142	190	332	640	532	762	512	925	573
Birds in flight												
Lower	0	0	0	0	0	8	21	10	5	3	0	2
Mean	8	4	6	4	4	24	49	27	23	11	6	11
Upper	20	12	16	11	12	45	84	51	46	24	17	24
Total												
Lower	26	38	74	49	35	86	116	130	127	113	148	106
Mean	72	93	158	85	85	175	295	275	321	248	373	247
Upper	182	224	346	153	202	377	723	582	808	535	942	597

Table 44 Estimated numbers of shags in the 4 km buffer area based on 2016-2017 and 2019-2021 surveys

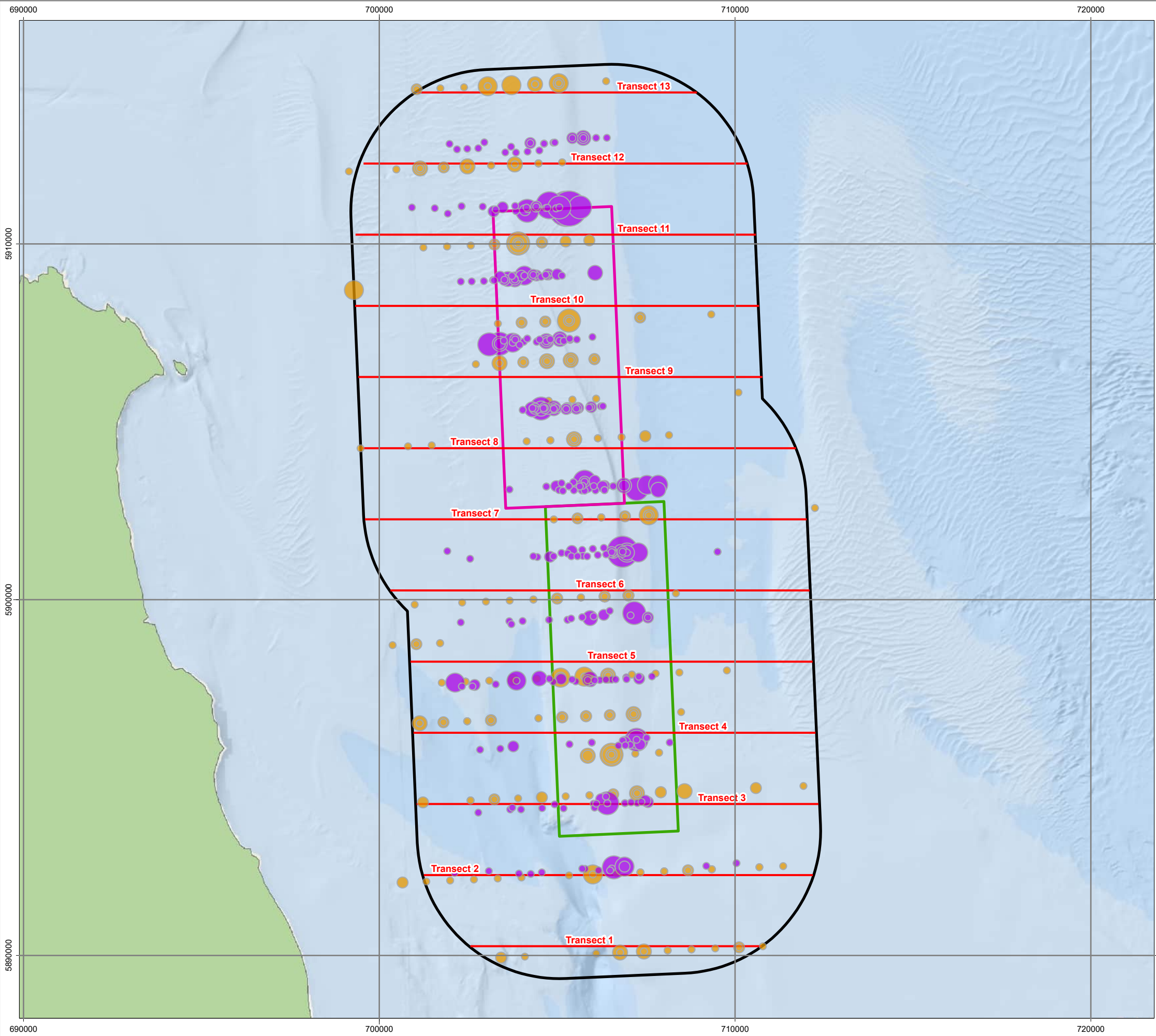
	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	59	84	165	110	78	174	213	269	272	245	332	233
Mean	144	200	341	180	181	338	551	555	668	529	823	529
Upper	364	476	740	318	426	745	1,433	1,191	1,708	1,146	2,072	1,284
Birds in flight												
Lower	10	0	0	10	10	5	2	9	44	31	11	0
Mean	36	9	9	41	36	32	22	32	102	85	50	3
Upper	62	26	27	81	68	68	47	61	178	149	98	8
Total												
Lower	69	84	165	120	88	180	214	278	316	277	343	233
Mean	180	208	350	221	216	370	573	587	769	614	872	532
Upper	426	501	767	400	494	813	1,480	1,252	1,886	1,296	2,170	1,292

3.4.116 Overall, estimated numbers of shags in the study area on baseline surveys were highest in the non-breeding season, with a peak mean of 1,103 birds in November (Table 45). In the breeding season (February to August), estimated peak numbers in the study area were highest in July (573 birds) and August (587 birds).

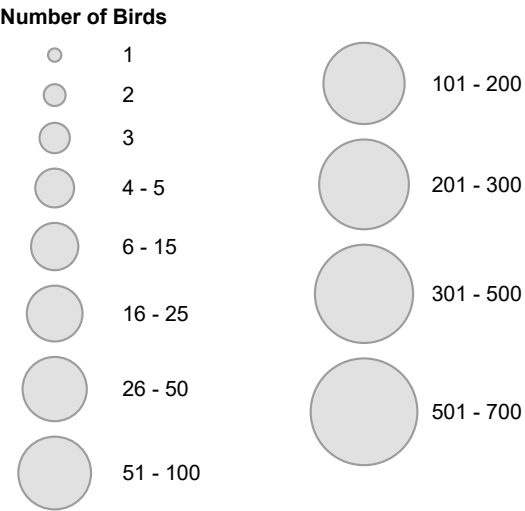
Table 45 Estimated numbers of shags in the array area plus 2km and 4km buffer areas based on data from 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Array area and 2km Buffer												
Lower	44	60	118	81	58	134	173	204	211	186	239	168
Mean	120	148	251	144	142	273	447	431	525	411	604	388
Upper	295	357	550	259	333	593	1,116	914	1,308	879	1,518	940
Array area and 4km Buffer												
Lower	87	106	209	152	111	228	271	352	400	350	434	295
Mean	228	263	443	280	273	468	725	743	973	777	1,103	673
Upper	539	634	971	506	625	1,029	1,873	1,584	2,386	1,640	2,746	1,635

3.4.117 In the breeding season, shags were widespread throughout in the offshore ornithology study area on both the 2016-2017 baseline surveys and the 2019-2021 surveys (Figure 16). Larger flocks were recorded on the 2016-2017 baseline surveys compared to the 2019-2021 surveys, when birds were more scattered along the transect route. Shags appeared to be mainly distributed closest to the Bray and Kish Banks on both sets of baseline surveys.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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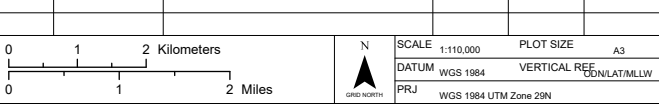
Dublin Array

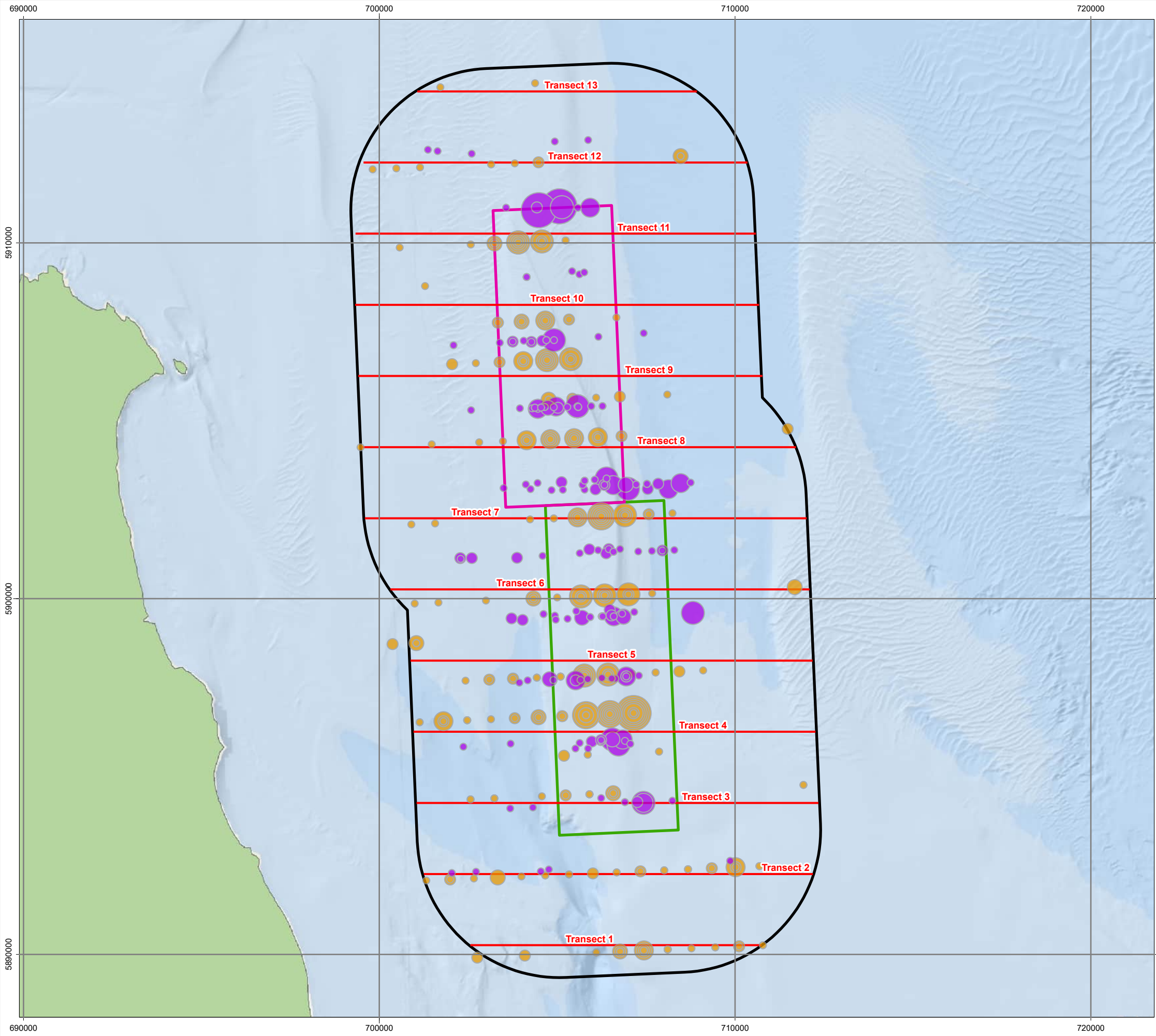
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Marine Bird Survey
Shag Distribution in the Breeding Season on 2016-2017 & 2019-2021 Surveys

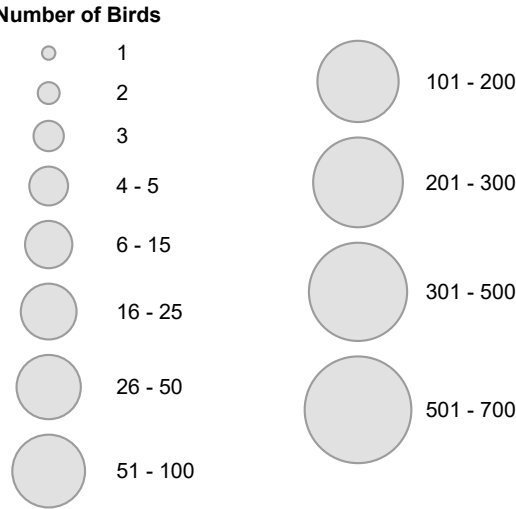
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- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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Marine Bird Survey
Shag Distribution in the Non-Breeding Season on 2016-2017 & 2019-2021 Surveys

DRAWING NUMBER: **Figure 17** PAGE NUMBER: **Page 14 of 64**

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3.4.118 In the non-breeding season, shags were also widespread throughout the offshore ornithology study area on baseline surveys (Figure 17). As with the breeding season, highest numbers of shags were predominantly recorded closest to the Bray and Kish Banks, presumably preferring the shallower water for foraging for prey.

3.4.119 Previous 2001-2002 surveys recorded shags in all months, with estimated peaks of 159 birds in April 2002 and 293 birds in September 2002 (Percival *et al.*, 2002). On 2010-2011 surveys shags were recorded in all months, with peak counts of 588 birds in June 2010 and 255 birds in August 2010 (raw counts) (Newton and Trewby, 2011).

3.4.120 Results for shags from the 2016 ObSERVE aerial survey report (Jessop *et al.*, 2018) are presented under cormorant.

3.4.121 Flight height was recorded for 829 shags on baseline surveys in 2016-2017 and 2019-2021, with 100% of birds recorded flying below 20 m MSL in height, i.e. below likely rotor-swept height. A total of 796 birds were recorded flying below 5 m, with 31 birds flying between 5 and 10 m in height and two birds flying between 10 and 20 m in height (Table 9).

3.4.122 A total of 662 shags were aged on baseline surveys in the offshore ornithology study area between 2016-2017 and 2019-2021. In the breeding season (February to August), age was recorded for 228 shags, with 66 immature (non-breeding) birds (28.9%) and 162 adults (71.1%) aged on surveys (Table 46).

Table 46 Monthly breakdown of immature and adult shags in the offshore ornithology study area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Immature	13	0	4	0	3	2	6	51	64	63	43	19
Adult	22	0	23	60	12	10	15	42	54	25	63	68
Number aged	35	0	27	60	15	12	21	93	118	88	106	87
Percentage of immature birds	37.1	0	14.8	0	20.0	16.7	28.6	54.8	54.2	71.6	40.6	21.8

Common Scoter

3.4.123 Common scoter are a species of seaduck that typically winter on shallow inshore waters less than 20 m deep and generally between ca. 500 m and two km from shore (Birdlife International, 2020). The small and declining Irish breeding population is restricted to a few loughs in the north west of Ireland, and was estimated to be 39 pairs in 2012 (Hunt *et al.*, 2012). The species is Red-listed in Ireland, because there has been a decline of more than 61% in the breeding population over 25 years between 1998 and 2018, as well as a moderate decline of 43% in the non-breeding population over the same period (Gilbert *et al.*, 2021).

3.4.124 ESAS surveys in Irish waters between 1980 and 1997 only recorded common scoter off Wexford Harbour between October and March, although coverage of inshore waters on these surveys was limited (Pollock *et al.*, 1997).

3.4.125 Baseline surveys in the study area recorded highest numbers of common scoter in autumn. A total of nine common scoter were recorded on 2016-2017 baseline surveys, with eight birds in October 2016 and one bird in February 2017. On 2019-2021 surveys, 124 common scoter were recorded, with a peak count of 55 in late April 2021. Average abundance (birds/km) over the two survey periods was highest in April, with 0.27 birds/km recorded, and October, with 0.18 birds/km recorded (Table 47). For months with more than one survey, the peak number recorded on any one survey is shown.

Table 47 Peak monthly counts (raw numbers) of common scoter in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

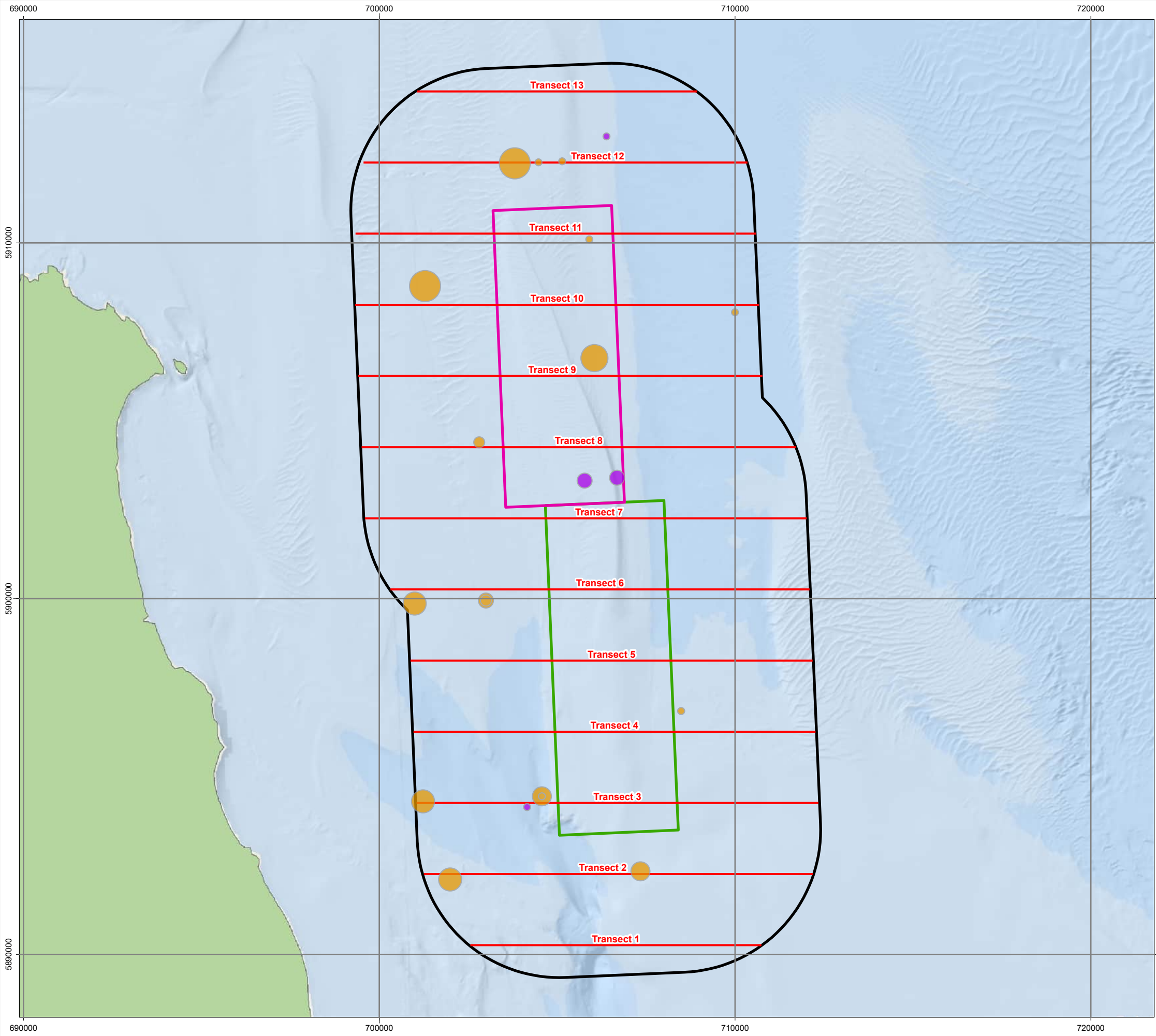
	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	1	0	-	0	0	0	0	0	8	0	0
2019-20	0	-	0	55	1	5	5	8	7	26	13	0
Average abundance (birds/km)	0.00	0.02	0.00	0.38	0.00	0.02	0.02	0.03	0.03	0.18	0.06	0.00

3.4.126 Common Scoters were mostly recorded inshore of the array area in low numbers on 2019-2020 baseline surveys (Figure 18), with just two sightings in the array area, the largest of which involved a flock of 25 birds flying south in October 2019. Fewer birds were recorded on the 2016-2017 baseline surveys.

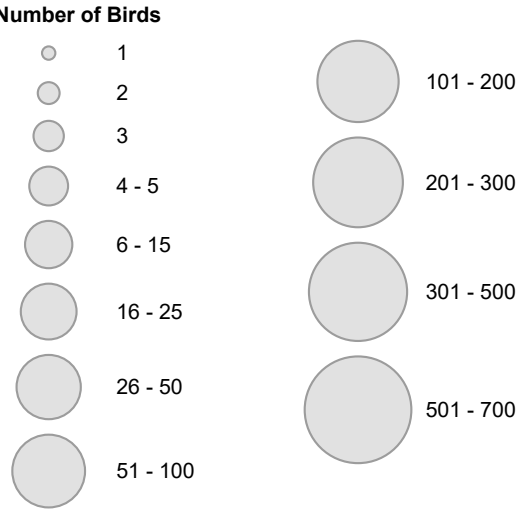
3.4.127 Previous 2001-2002 surveys recorded 31 common scoter in September 2002 (Percival *et al.*, 2002). On 2010-2011 surveys, 13 common scoters were recorded in June 2010 (Newton and Trewby, 2011).

3.4.128 A total of 1,183 common scoter were recorded off the Irish east coast on the ObSERVE 2016 aerial surveys over the autumn and winter surveys, with no sightings in the summer survey. This seasonal distribution is similar to ESAS surveys in Irish waters and to the baseline surveys in the Study area. In autumn, all sightings were recorded very close to the coast, particularly around Dundalk Bay. This was also an important area for common scoter on the winter surveys, although birds were also seen east of Dublin Bay and further offshore than on the autumn surveys. Average density of common scoter was 0.94 birds/km² in autumn and 0.34 birds/km² in winter. Common scoter abundance across the survey area was estimated at 8,616 (95% CIs 4,200 – 17,677) individuals in autumn and 3,089 (95% CIs 1,962 – 4,863) in winter, with a further 426 (95% CIs 233 – 780) unidentified scoter species in autumn and 110 (95% CIs 46-259) birds in winter (Jessopp *et al.*, 2018).

3.4.129 Flight height was recorded for 127 common scoter on baseline surveys in 2016-2017 and 2019-2021, with 100% of birds recorded flying below 20 m MSL in height, i.e. below likely rotor-swept height. A total of 59 birds were recorded flying below 5 m, with 62 birds flying between 5 and 10 m, and six birds flying between 10 and 20 m (Table 9).



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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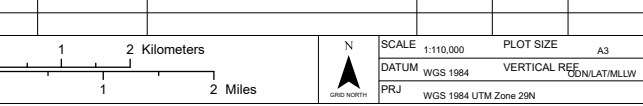
Dublin Array

DRAWING TITLE

Marine Bird Survey
Common Scoter Sightings in All Months on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER: **Figure 18** PAGE NUMBER: **Page 15 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE



Pomarine Skua

- 3.4.130 Pomarine skuas breed in northern Siberia, and winter off the coast of West Africa. They are therefore spring and autumn migrants in Irish waters, most frequently seen off the south and west coasts (Hutchinson, 1989). The species is Green-listed in Ireland, in terms of its conservation status (Gilbert *et al.*, 2021).
- 3.4.131 ESAS surveys in Irish waters between 1980 and 1997 recorded low numbers of pomarine skuas in the Irish Sea, predominantly in May and September on migration between their breeding and wintering areas (Pollock *et al.*, 1997).
- 3.4.132 Four pomarine skuas were recorded in the offshore ornithology study area on 2019-2021 baseline surveys, with one in August 2019, and three in October 2020 (Figure 20). The species was not recorded on 2016-2017 surveys, or during previous surveys in 2001-2002 (Percival *et al.*, 2002), or 2010-2011 (Newton and Trewby, 2011).
- 3.4.133 All four birds were recorded flying below 20 m MSL in height, i.e. below likely rotor-swept height, with one bird flying below 5 m, two birds flying between 5 and 10 m, and one bird flying between 10 and 20 m.

Arctic Skua

- 3.4.134 Arctic skuas are regular spring and autumn passage migrants on all Irish coasts, with the largest numbers recorded in autumn (Hutchinson, 1989). Arctic skuas do not breed in Ireland, with the nearest breeding territories off the west and north coasts of Scotland (Balmer *et al.*, 2013). The species is Green-listed in Ireland, in terms of its conservation status (Gilbert *et al.*, 2021).
- 3.4.135 ESAS surveys in Irish waters between 1980 and 1997 recorded low numbers of Arctic skuas in the Irish Sea, between April and November, with birds on their spring migration north in April and on their southward migration in August and September, when peak numbers were recorded (Pollock *et al.*, 1997).
- 3.4.136 Low numbers of Arctic skuas were recorded on baseline surveys in the offshore ornithology study area between June and November. Four Arctic skuas were recorded on 2016-2017 surveys, with two birds in June 2017 and single birds in September 2016 and 2017. On 2019-2021 surveys, 21 Arctic skuas were recorded, with a peak count of 13 in early September 2019. Average abundance (birds/km) over the two survey periods was very low, with a peak of 0.06 birds/km recorded in September (Table 48). For months with more than one survey, the peak number recorded on any one survey is shown.

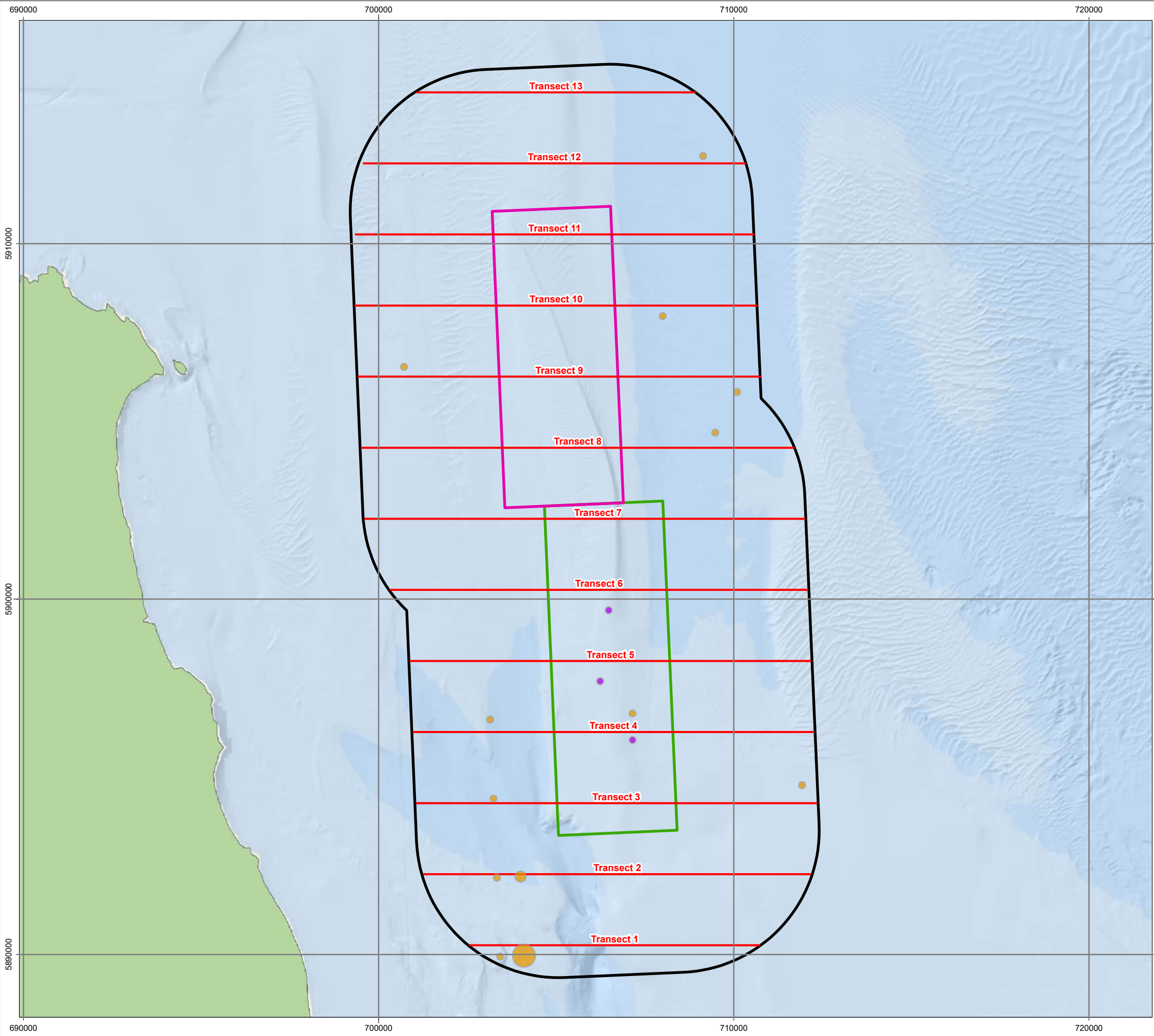
Table 48 Peak monthly counts (raw numbers) of Arctic skuas in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	0	0	-	0	2	0	0	1	0	0	0
2019-21	0	-	0	0	0	0	1	1	13	0	1	0
Average abundance (birds/km)	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.06	0.00	0.00	0.00

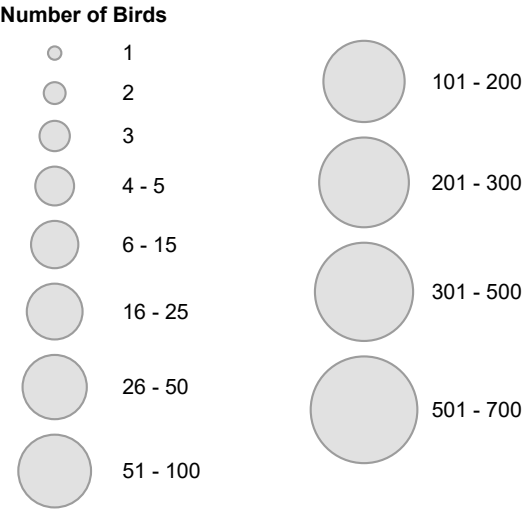
3.4.137 On 2019-2021 baseline surveys, Arctic skuas were predominantly recorded in the buffer area in low numbers between July and September, with highest numbers recorded in the south west corner of the buffer area. Lower numbers were recorded on the 2016-2017 baseline surveys. Overall, there were four Arctic skua sightings within the array area during the baseline surveys (Figure 19).

3.4.138 The pattern of peak numbers of Arctic skuas occurring in autumn months was also recorded on previous surveys. On 2001-2002 surveys, 32 Arctic skuas were recorded in August and September, with a peak count of 19 in September 2002 (Percival *et al.*, 2002). On 2010-2011 surveys, 22 Arctic skuas were recorded between June and October, with a peak of 10 birds in September 2010 (Newton and Trewby, 2011).

3.4.139 Flight height was recorded for 24 Arctic skuas on baseline surveys in 2016-2017 and 2019-2021, with 100% of birds recorded flying below 20 m MSL in height, i.e. below likely rotor-swept height. A total of 12 birds were recorded flying below 5 m, with 11 birds flying between 5 and 10 m, and one bird flying between 10 and 20 m in height (Table 9).



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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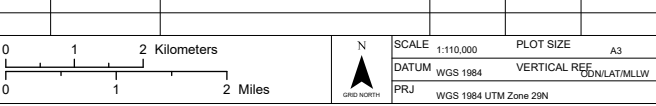
Dublin Array

DRAWING TITLE

Marine Bird Survey
Arctic Skua Sightings Between June & November on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER: **Figure 19** PAGE NUMBER: **Page 16 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE



Great Skua

3.4.140 Great skuas are regular spring and autumn passage migrants on all Irish coasts, although in smallest numbers off the east coast (Hutchinson, 1989). There is a recently established, small but expanding breeding population in Ireland, with an estimate of 34 pairs from the recent Seabirds Count national census (Burnell *et al.*, 2023). In the UK, there are breeding colonies on Shetland and Orkney and the north west coast of Scotland. The breeding season for great skua has been defined as May to August (Furness, 2015) (Table 3). During the breeding season, adults range widely from their colonies, with a mean maximum foraging range of 443.3 ± 487.9 km (Woodward *et al.*, 2019).

3.4.141 Great skuas from Irish and UK colonies typically winter off the coasts of southern Europe (Wernham *et al.*, 2002). The species is Amber-listed in Ireland due to the breeding population being less than 100 pairs (Gilbert *et al.*, 2021).

3.4.142 ESAS surveys in Irish waters between 1980 and 1997 recorded very few great skuas in the Irish Sea between November and June. Numbers increased during southward autumn migration between July and October, when birds were widespread at low densities in the Irish Sea (Pollock *et al.*, 1997).

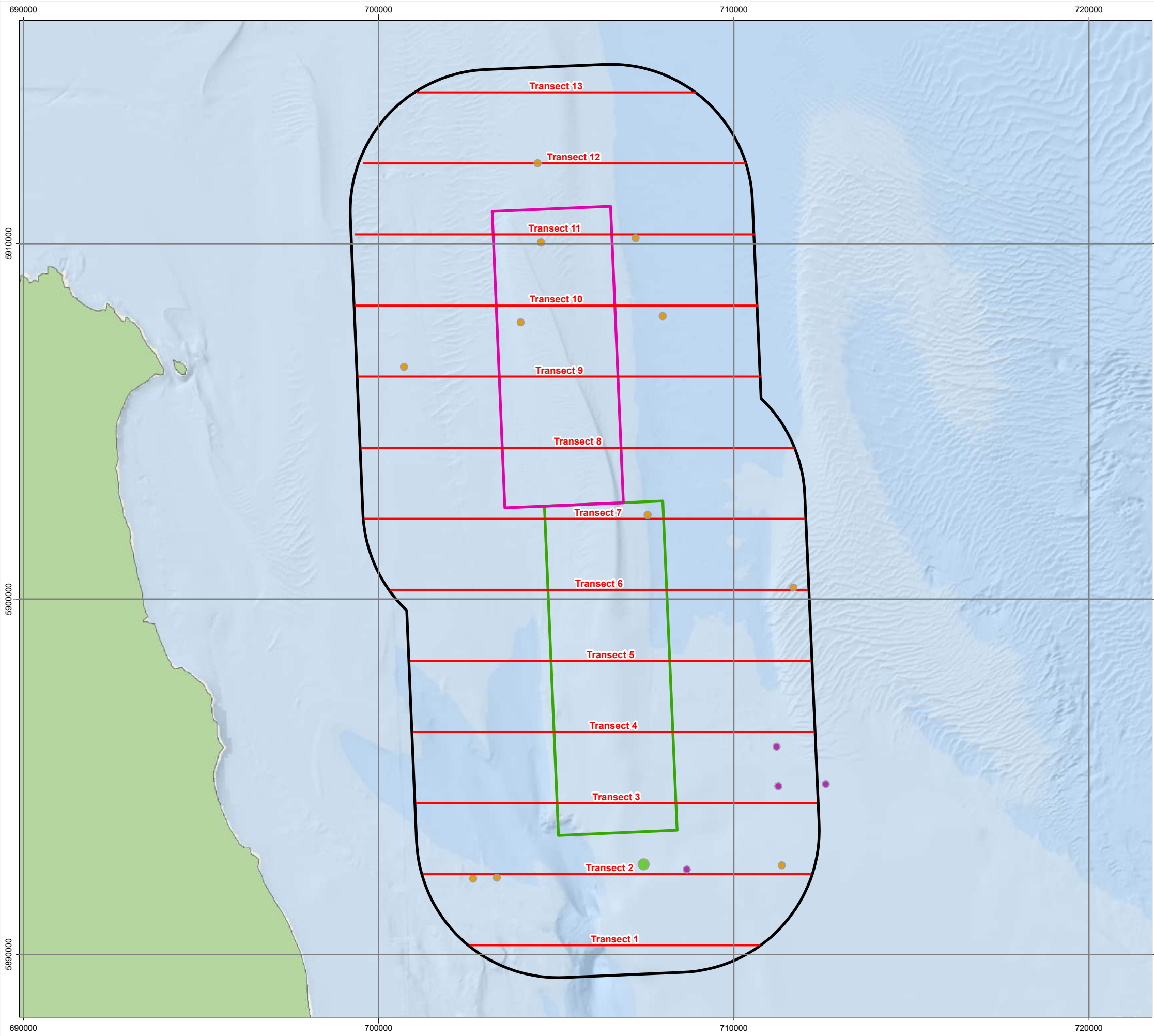
3.4.143 Numbers of great skuas recorded on baseline surveys in the offshore ornithology study area showed a similar pattern (Table 49). On 2016-2017 surveys, two great skuas were recorded in September 2016. On 2019-2021 surveys, 12 great skuas were recorded between August and December, with one recorded in April. Peak counts involved three birds in late September 2019 and three birds in October 2020.

Table 49 Peak monthly counts (raw numbers) of great skuas in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	0	0	-	0	0	0	0	2	0	0	0
2019-20	0	-	0	1	0	0	0	1	3	3	0	1
Average abundance (birds/km)	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00

3.4.144 Average abundance (birds/km) over the two survey periods was very low, with a peak of 0.02 birds/km recorded in September and October (Table 49). For months with more than one survey, the peak number recorded on any one survey is shown.

3.4.145 Great skua sightings were scattered across the offshore ornithology study area on 2019-2021 baseline surveys, with single birds recorded between August and December 2019. There were three birds recorded within the array area over this period (Figure 20). In addition, one great skua was recorded in April 2021 (not mapped). On 2016-2017 surveys, two great skuas were recorded in September 2016 in the south end of the buffer area.



Bray Bank Array Area

Kish Bank Array Area

4km Survey Buffer

Transect Line and Number

Great Skua Sighting 2016 - 2017

Great Skua Sighting 2019 - 2021

Pomarine Skua Sighting 2019 - 2021

Number of Birds

1

2

3

4 - 5

6 - 15

16 - 25

26 - 50

51 - 100

101 - 200

201 - 300

301 - 500

501 - 700

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PROJECT TITLE

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DRAWING TITLE

Marine Bird Survey

Great Skua & Pomarine Skua Sightings Between August & December on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER:

Figure 20

PAGE NUMBER:

Page 17 of 64

VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE

0 1 2 Kilometers

0 1 2 Miles

N

ORIENT NORTH

SCALE 1:110,000

DATUM WGS 1984

PRJ WGS 1984 UTM Zone 29N

PLOT SIZE A3

VERTICAL REF DDN/LAT/MLLW

SLR

DublinArray

Generation for generations

Kish Offshore Wind Limited - Bray Offshore Wind Limited

- 3.4.146 Great skuas showed a similar seasonal pattern on previous surveys. On 2001-2002 surveys, 10 great skuas were recorded between June and September, with peak counts of three birds in June 2002, and three birds in August 2002 (Percival *et al.*, 2002). On 2010-2011 surveys, single great skuas were recorded in August and September 2010 (Newton and Trewby, 2011).
- 3.4.147 There were five great skuas recorded off the Irish east coast on the ObSERVE 2016 aerial surveys, with four birds recorded in the autumn surveys and one recorded on the winter surveys. All five birds were recorded in the southern half of the survey area, to the south of Wicklow Head. Abundance of great skuas across the survey area was estimated at 40 (95% CIs 19 - 83) individuals in autumn, and 10 (95% CIs 3 - 89) individuals in winter (Jessopp *et al.*, 2018).
- 3.4.148 Flight height was recorded for 11 great skuas on baseline surveys in 2016-2017 and 2019-2021, with 90.9% of birds recorded flying below 20 m MSL in height, i.e. below likely rotor-swept height. A total of six birds were recorded flying below 5 m, with three birds flying between 5 and 10 m in height, one bird flying between 10 and 20 m in height and one bird flying above 30 m in height, at an estimated height of 40 m.

Mediterranean Gull

- 3.4.149 A recent colonist to Ireland, the Mediterranean gull first bred in 1996 in County Wexford. Breeding numbers have increased following a similar expansion in southern England in the latter part of the 20th century, and the most recent estimate for the breeding population in Ireland is 16 pairs recorded on the recent Seabirds Count national census (Burnell *et al.*, 2023). The majority of birds breed in County Wexford, but breeding has also been confirmed in Mayo and Tipperary (Cummins *et al.*, 2019). Although data is limited, mean maximum foraging range for Mediterranean gull has been estimated as 20 km (Woodward *et al.*, 2019). Numbers of birds present in the non-breeding season are also increasing, particularly on the east and south coasts. The species is Amber-listed in Ireland due to the breeding population being less than 100 pairs (Gilbert *et al.*, 2021).
- 3.4.150 Mediterranean gulls were rarely recorded on ESAS surveys in Irish waters between 1980 and 1997, with just one bird recorded in the Irish Sea in July over this period (Pollock *et al.*, 1997).
- 3.4.151 Mediterranean gulls were not recorded on surveys between September 2016 and September 2017. A total of 37 Mediterranean gulls were recorded on 2019-2021 baseline surveys between August and March, with a peak count of 20 in November 2019. Average abundance (birds/km) on baseline surveys was very low, with a peak of 0.15 birds/km recorded in November (Table 50).

Table 50 Peak monthly counts (raw numbers) of Mediterranean gulls in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

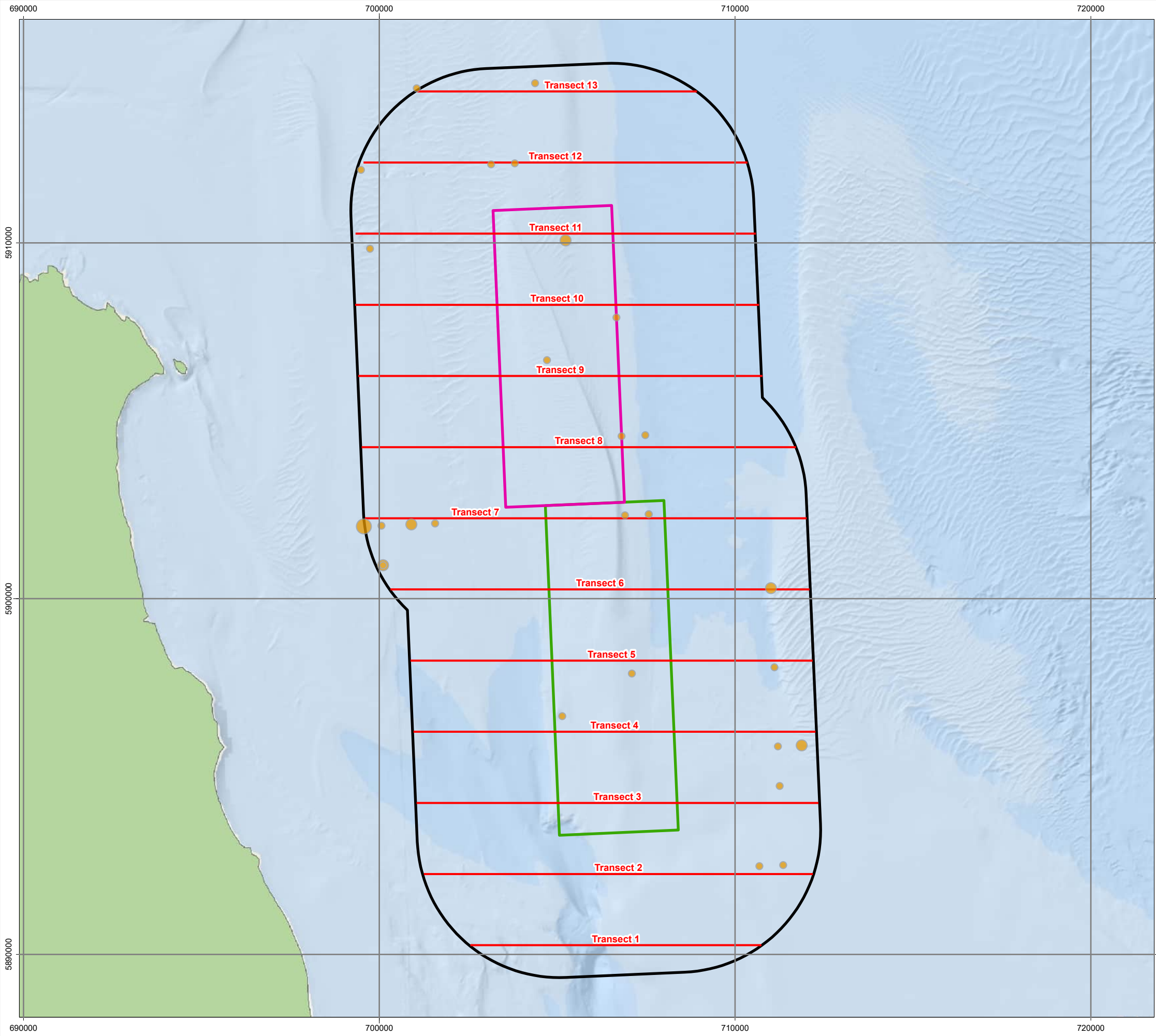
	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	0	0	-	0	0	0	0	0	0	0	0
2019-21	1	-	1	0	0	0	0	1	1	8	20	1
Average abundance (birds/km)	0.01	-	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.15	0.01

3.4.152 Mediterranean gulls were recorded in low numbers predominantly in the northern half of the offshore ornithology study area on 2019-2021 baseline surveys, with occasional sightings within the array area (Figure 21). The species was not recorded on 2016-2017 baseline surveys.

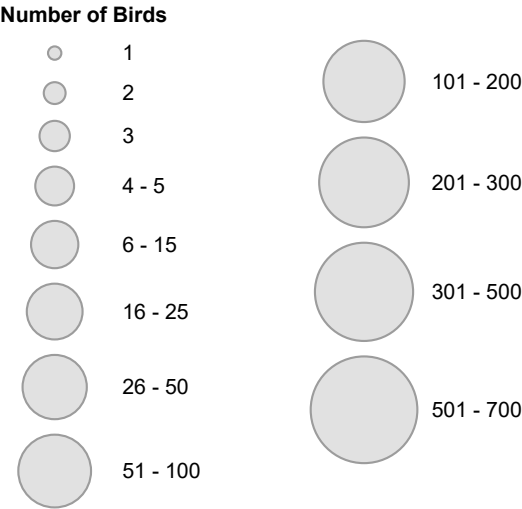
3.4.153 Mediterranean gull was not recorded on previous 2001-2002 surveys (Percival *et al.*, 2002), or on 2010-2011 surveys (Newton and Trewby, 2011), reflecting the recent increase in numbers of this species in Ireland.

3.4.154 Flight height was recorded for 22 Mediterranean gulls on baseline surveys in 2016-2017 and 2019-2021, with 81.8% of birds recorded flying below 20 m MSL in height, i.e. below likely rotor-swept height. Two birds were recorded flying below 5 m, with six birds between 5 and 10 m, 10 birds between 10 and 20 m and four birds between 20 and 30 m in height.

3.4.155 A total of 27 Mediterranean gulls were aged on baseline surveys, with 23 adults, one third-calendar year bird, one immature and two juvenile birds recorded.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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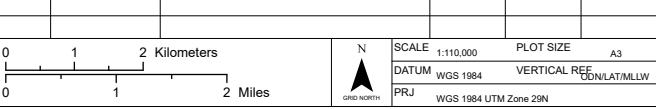
Dublin Array

DRAWING TITLE

Marine Bird Survey
Mediterranean Gull Sightings in All Months on 2019-2021 Baseline Surveys

DRAWING NUMBER: **Figure 21** PAGE NUMBER: **Page 18 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE



Little Gull

3.4.156 The little gull is a passage migrant and winter visitor bird to Irish waters. The nearest breeding colonies are in European countries such as the Netherlands and Denmark. Little gulls winter in the Mediterranean Sea, with smaller numbers in the Irish Sea, the English Channel and off north west Africa (Wernham *et al.*, 2002). The species is listed on Annex 1 of the EC Birds Directive, and is Amber-listed in Ireland, due to its unfavourable conservation status in Europe (Gilbert *et al.*, 2021).

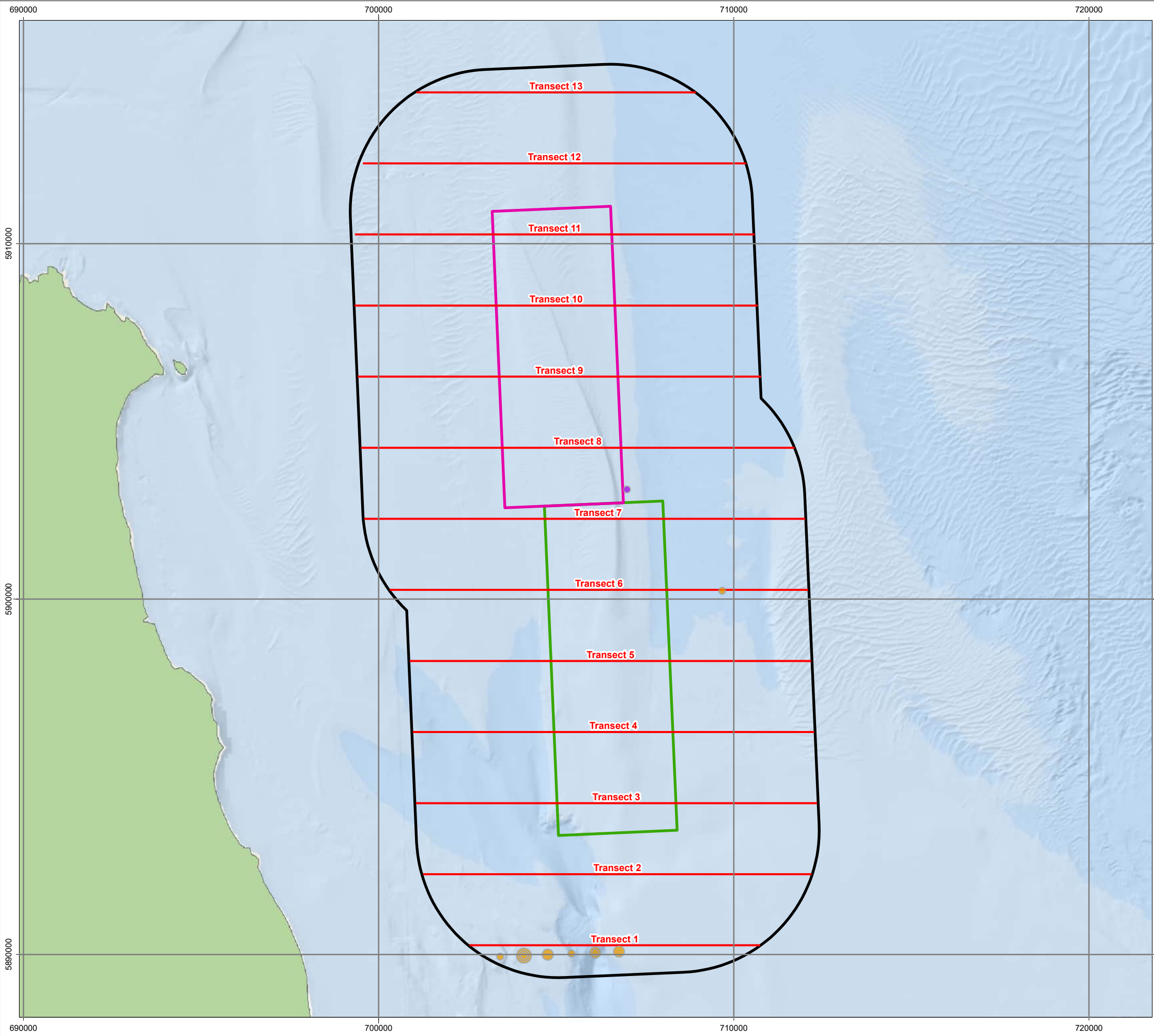
3.4.157 ESAS surveys in Irish waters between 1980 and 1997 recorded little gulls in low densities off the Wicklow and Wexford coasts in winter months. There were very few sightings in the Irish Sea in other seasons (Pollock *et al.*, 1997).

1.1.1 Baseline surveys in the offshore ornithology study area showed a similar pattern to ESAS surveys, with highest numbers of little gulls recorded in the winter months. On 2016-2017 surveys, 15 little gulls were recorded, with a peak of 10 birds in February 2017. On 2019-2021 surveys, 157 little gulls were recorded between July and January, with peak counts of 90 in January 2020 and 30 in December 2020. Average abundance (birds/km) over the two survey periods was generally low, apart from the peak in January 2020, when an average abundance of 0.64 birds/km was recorded (Table 51).

Table 51 Peak monthly counts (raw numbers) of little gulls in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	10	0	-	0	0	0	0	1	0	3	1
2019-21	90	-	0	0	0	0	5	1	8	1	8	30
Average abundance (birds/km)	0.64	0.24	0.00	0.00	0.00	0.00	0.02	0.00	0.04	0.00	0.07	0.17

3.4.158 Very low numbers of little gulls were recorded on baseline surveys in the summer and autumn months, with the majority of birds recorded at the southern end of the buffer area at this time (Figure 22).



Bray Bank Array Area

Kish Bank Array Area

4km Survey Buffer

Transect Line and Number

Bird Sighting 2016 - 2017

Bird Sighting 2019 - 2021

Number of Birds

1

2

3

4 - 5

6 - 15

16 - 25

26 - 50

51 - 100

101 - 200

201 - 300

301 - 500

501 - 700

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DRAWING TITLE

Marine Bird Survey

Little Gull Sightings Between July & September on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER: **Figure 22**

PAGE NUMBER: **Page 19 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE

0 1 2 Kilometers

0 1 2 Miles

N

ORIENT NORTH

SCALE 1:110,000

DATUM WGS 1984

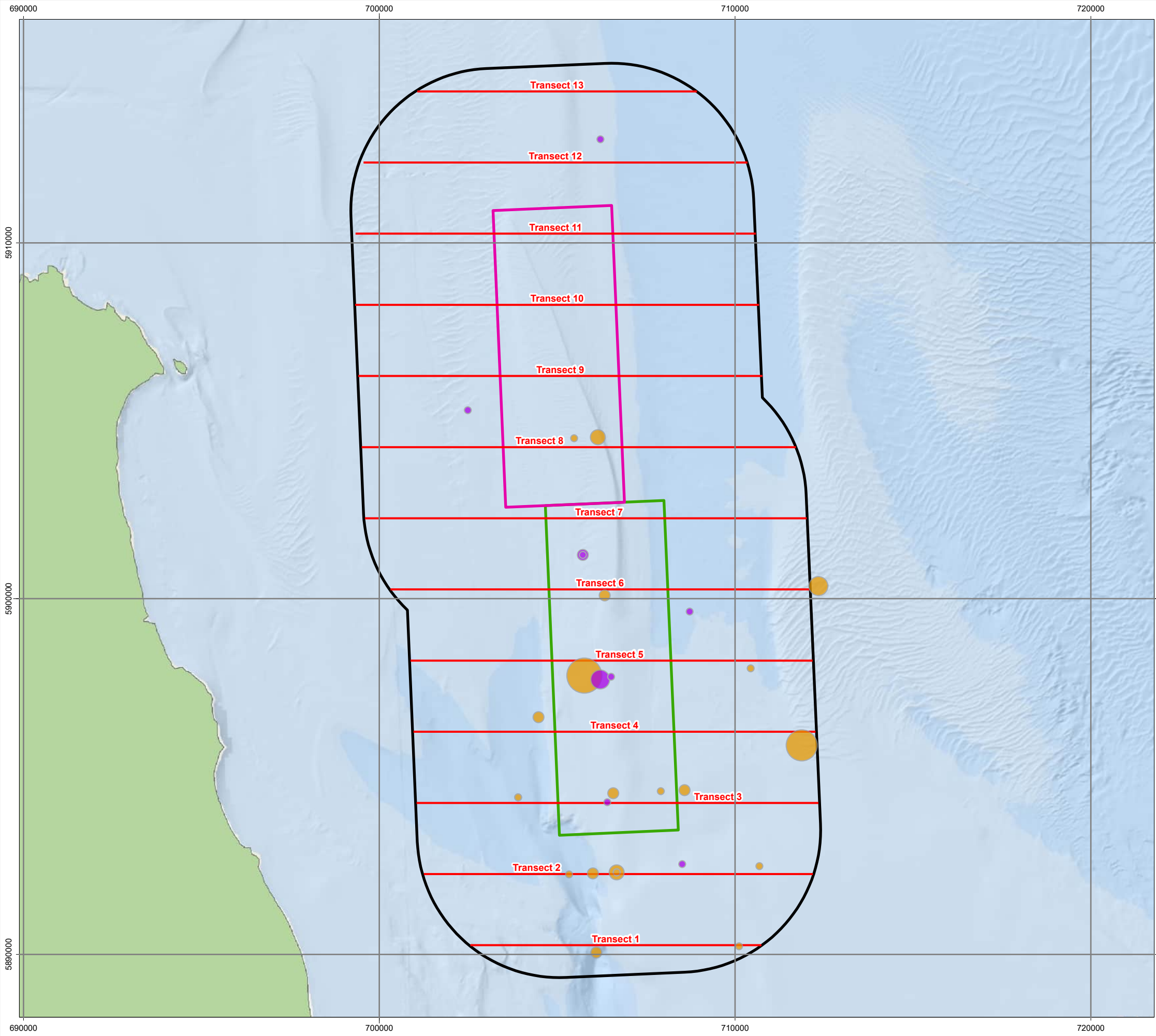
PRJ WGS 1984 UTM Zone 29N

PLOT SIZE A3

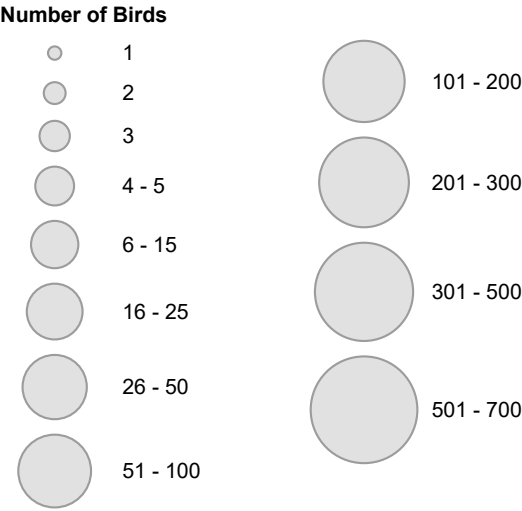
VERTICAL REF. DONILATIMLLW

SLR

DublinArray
Generation for generations
Kish Offshore Wind Limited - Bray Offshore Wind Limited



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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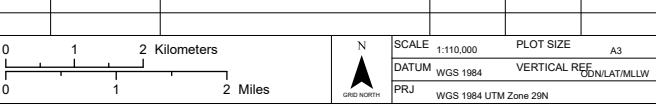
Dublin Array

DRAWING TITLE

Marine Bird Survey
Little Gull Sightings Between October & March on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER: **Figure 23** PAGE NUMBER: **Page 20 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE



- 3.4.159 In the winter months, little gulls were mainly recorded in the southern half of the offshore ornithology study area on baseline surveys and tended to be concentrated over the Bray and Kish Banks. Peak numbers were recorded on surveys in January 2019 (Figure 23).
- 3.4.160 Little gulls showed a similar seasonal pattern on previous surveys. On 2001-2002 surveys, five little gulls were recorded in December 2001 (Percival *et al.*, 2002). On 2010-2011 surveys, 205 little gulls were recorded, with the majority of birds again recorded between October and January. Peak raw counts were 23 birds in October 2010 and 153 birds in November 2010. There were only five sightings outside of the winter months, with three birds recorded in July and two birds in August (Newton and Trewby, 2011).
- 3.4.161 A total of 80 little gulls were recorded off the Irish east coast on the ObSERVE 2016 aerial surveys, with all sightings recorded on the winter surveys. There were no obvious concentrations of birds recorded on surveys, and sightings occurred over a wide range of water depths. Mean density across the survey area was 0.17 birds/km². Little gull abundance across the entire survey area was estimated as 1,539 (95% CIs 822 – 2880) individuals in winter (Jessopp *et al.*, 2018).
- 3.4.162 Flight height was recorded for 152 little gulls on baseline surveys in 2016-2017 and 2019-2021, with 80.3% of birds recorded flying below 20 m MSL in height, i.e. below likely rotor-swept height. A total of 17 birds were recorded flying below 5 m, with 102 birds between 5 and 10 m, three birds between 10 and 20 m and 30 birds between 20 and 30 m in height (Table 9).
- 3.4.163 A total of 36 little gulls were aged on baseline surveys, with 32 adults, two second calendar year birds, one immature and one juvenile bird recorded.

Black-headed Gull

- 3.4.164 Black-headed gulls are common and widespread in Ireland and occur both inland and on the coast, although they are rarely found far offshore. In summer, birds breed at inland and coastal colonies. The breeding population in Ireland has been estimated at 7,146 pairs by the recent Seabirds Count national census, which represents an 84% increase in the breeding population compared to Seabird 2000 estimates (1998 to 2002) (Burnell *et al.*, 2023). However, it is considered that while there has been some increase in the population, the Seabird 2000 estimate may not have covered all small, dispersed breeding colonies, and this overall increase is likely to be an underestimate (Cummins *et al.*, 2019).
- 3.4.165 The breeding season for black-headed gull has been defined as March to August (NatureScot, 2020) (Table 3). Although data is limited, the mean maximum foraging range for black-headed gull has been estimated as 18.5 km (Woodward *et al.*, 2019). There are no black-headed gull breeding colonies within mean maximum foraging range of Dublin Array.

3.4.166 The species is Amber-listed in Ireland, because there was a moderate decline of 58% in the breeding range between 1988 and 2011, and a similar longer-term decline of 55% in the breeding range between 1968 and 2011. In addition, 50% of the breeding population occurs at 10 or fewer sites (Gilbert *et al.*, 2021). In the non-breeding season, Irish breeding birds are joined by birds from the UK and Europe, and the non-breeding season Irish population has been estimated at up to 100,000 birds (Crowe, 2005). To estimate a regional non-breeding population for the east and south coasts of Ireland, including sites in Northern Ireland, mean I-WeBS counts from 2011/12 to 2015/16 for sites that regularly supported 1,000 or more black-headed gulls as presented in Lewis *et al.*, (2019) and Woodward *et al.*, (2024), were summed. This gave a regional population estimate for the non-breeding season of 28,049 birds (Table 52). It should be noted that this is likely to be an under-estimate of the overall number of black-headed gulls in the region in the non-breeding season, as sites that held less than 1,000 birds were not included.

Table 52 Mean counts of black-headed gulls from east and south coast I-WeBS sites between 2011/12 and 2015/16 (Lewis *et al.*, 2019 and Woodward *et al.*, 2024)

Site	Mean count (2011/12-2015/16)
Dundalk Bay (Louth)	2,042
Belfast Lough (Antrim)	3,580
Outer Ards (Down)	3,177
Dublin Bay (Dublin)	2,113
Malahide Estuary (Dublin)	588
River Slaney (Wexford)	204
Ballymacoda (Cork)	1,302
Ballycrenane/Warren (Cork)	1,032
Blackwater Estuary (Cork/Waterford)	1,023
Strangford Lough (Down)	3,330
Courtmacsherry Bay (Cork)	1,372
Cork Harbour (Cork)	3,409
Wexford Harbour and Slobs (Wexford)	1,452
Lady's Island Lake (Wexford)	1,696
Larne Lough (Antrim)	1,033
Dundrum Bay (Down)	696
Total	28,049

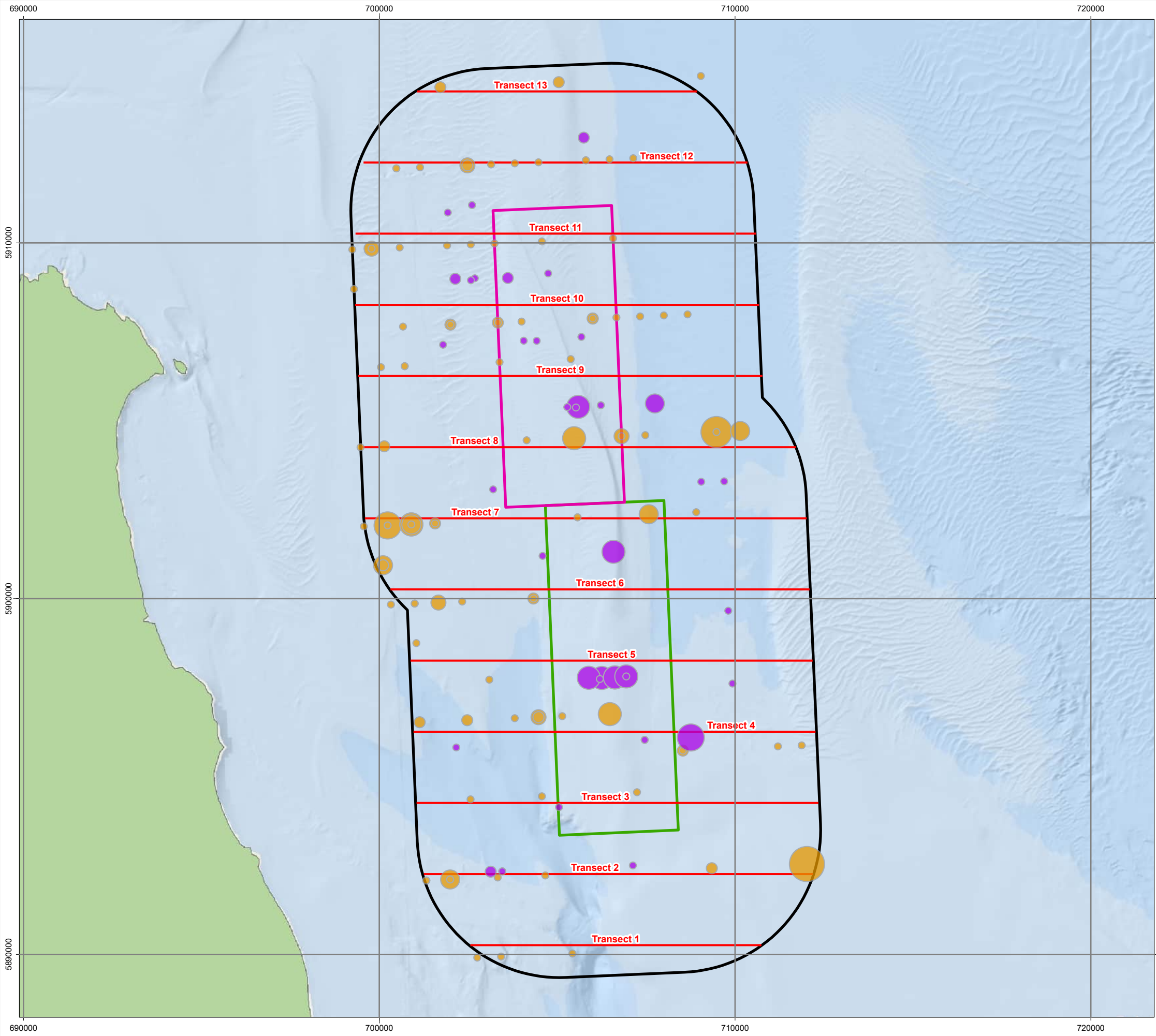
3.4.167 ESAS surveys in Irish waters between 1980 and 1997 recorded black-headed gulls in low to moderate densities in the Irish Sea between March and August. Between September and February, black-headed gulls were more commonly recorded offshore in the Irish Sea and elsewhere, while high densities of birds (> 1.00 birds/km²) were recorded off the coast of Dublin over this period (Pollock *et al.*, 1997).

3.4.168 Baseline surveys in the offshore ornithology study area showed a similar pattern to ESAS surveys, with highest numbers of black-headed gulls recorded in the non-breeding season. On 2016-2017 surveys, 141 black-headed gulls were recorded in the non-breeding season only, with a peak of 109 birds in December 2016. On 2019-2021 surveys, a total of 355 black-headed gulls were recorded, again predominantly in the non-breeding season. Peak counts were 96 birds in November 2019, 145 birds in December 2019, 68 birds in December 2020 and 20 birds in January 2021. Average abundance (birds/km) over the two survey periods was very low in the breeding season, and higher in the non-breeding season, with a peak average abundance of 1.82 birds/km in December (Table 53).

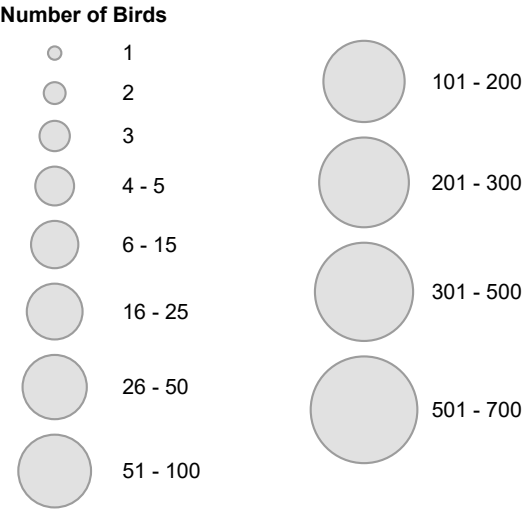
Table 53 Peak monthly counts (raw numbers) of black-headed gulls in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	7	0	-	0	0	0	0	0	4	21	109
2019-20	20	-	3	0	2	0	0	0	3	6	96	145
Average abundance (birds/km)	0.20	0.17	0.02	0.00	0.01	0.00	0.00	0.00	0.01	0.06	0.61	1.82

3.4.169 In the non-breeding season, black-headed gull sightings were scattered across the study area, with highest numbers recorded in the southern half of the offshore ornithology study area, including the array area at this time (Figure 24). There were only two birds recorded in the breeding season, in late May 2020 (not mapped), in the north west corner of the buffer area (Offshore Ornithology Survey Report).



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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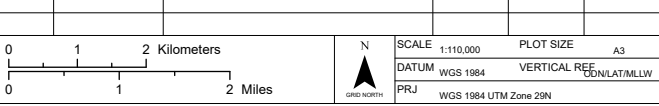
Dublin Array

DRAWING TITLE

Marine Bird Survey
Black-Headed Gull Sightings in the Non-Breeding Season on 2016-2017 & 2019-2021
Baseline Surveys

DRAWING NUMBER: **Figure 24** PAGE NUMBER: **Page 21 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
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- 3.4.170 Black-headed gulls showed a similar seasonal pattern on previous surveys. On 2001-2002 surveys, 14 black-headed gulls were recorded between September and December, with a peak of eight birds in December 2001 (Percival *et al.*, 2002). On 2010-2011 surveys, 13 black-headed gulls were recorded between August and January, with a peak count of six birds in November 2010 (Newton and Trewby, 2011).
- 3.4.171 A total of 298 black-headed gulls were recorded off the Irish east coast on the ObSERVE 2016 aerial surveys, across all three seasons covered. As on the more recent baseline surveys for Dublin Array, black-headed gulls were most frequently recorded on the winter surveys, with birds distributed across the survey area. Birds were less widespread in autumn and showed a more inshore distribution. Fewest records were recorded on the summer surveys when most birds were seen offshore. Mean density of black-headed gulls across the entire survey area was 0.03 birds/km² in summer, 0.15 birds/km² in autumn, and 0.2 birds/km² in winter. Abundance of black-headed gulls across the survey area was estimated at 266 (95% CIs 120 - 593) individuals in summer, 1,332 (95% CIs 591 – 3,002) in autumn, and 1,804 (95% CIs 1,287 – 2,529) in winter (Jessopp *et al.*, 2018).
- 3.4.172 Flight height was recorded for 226 black-headed gulls on Dublin Array baseline surveys in 2016-2017 and 2019-2021, with 92.9% of all birds recorded flying below 20 m MSL in height, i.e. below likely rotor-swept height. A total of 96 birds were recorded flying below 5 m, with 65 birds flying between 5 and 10 m, 49 birds flying between 10 and 20 m, 15 birds between 20 and 30 m and one bird flying above 30 m in height (Table 9).
- 3.4.173 A total of 197 black-headed gulls were aged on baseline surveys, with 191 adults, two second calendar year birds, two immature and two juvenile birds recorded.

Common Gull

- 3.4.174 Common gulls are common and widespread in Ireland, with birds occurring both inland and on the coast, although they show a mostly coastal distribution. The breeding population in Ireland has been estimated at 1,983 pairs on the recent Seabirds Count national census, which represents an 89% increase compared to the previous Seabird 2000 census (1998-2002) (Burnell *et al.*, 2023). The majority of colonies are confined to the north and west of Ireland. It is considered that while there has been some recent increase in the population, the Seabird 2000 estimate is likely to have been an underestimate (Cummins *et al.*, 2019). The species is Amber-listed in Ireland, as there has been a moderate decline of 25% in the breeding population between 1980 and 2018 (Gilbert *et al.*, 2021).
- 3.4.175 The breeding season for common gull has been defined as March to August (NatureScot, 2020) (Table 3). Although data is limited, mean maximum foraging range for common gull has been estimated as 50 km (Woodward *et al.*, 2019). Lambay Island is the only common gull colony within mean maximum foraging range, with a population of 28 pairs in 2015 (Burnell *et al.*, 2023).

3.4.176 In the non-breeding season, birds from Europe move into the UK and Ireland, resulting in a large wintering population. This was estimated at 7,000 Irish individuals plus “many thousands” of immigrants from elsewhere in Europe, resulting in a range of 18,050 individuals based on I-WeBS data, up to 67,500 birds in the original 1981-83 Winter Atlas (Crowe, 2005). To estimate a regional non-breeding population for the east and south coasts of Ireland, including sites in Northern Ireland, mean I-WeBS counts from 2011/12 to 2015/16 for sites that regularly supported 500 or more common gulls as presented in Lewis *et al.*, (2019) and Woodward *et al.*, (2024), were summed. This gave a regional population estimate for the non-breeding season of 10,242 birds (Table 54). It should be noted that this is likely to be an under-estimate of the overall number of common gulls in the region in the non-breeding season, as sites that held less than 500 birds were not included.

Table 54 Mean counts of common gulls from east and south coast I-WeBS sites between 2011/12 and 2015/16 (Lewis *et al.*, 2019 and Woodward *et al.*, 2024

Site	Mean count (2011/12-2015/16)
Ballymacoda (Cork)	577
Courtmacsherry Bay (Cork)	841
Ballycotton/Shanagarry (Cork)	308
Larne Lough (Antrim)	1,107
Belfast Lough (Antrim)	604
Strangford Lough (Down)	786
Dublin Bay (Dublin)	573
Dundalk Bay (Louth)	1,594
Clogher Head (Louth)	549
Waterford Harbour (Waterford)	1,236
Blackwater Estuary (Cork/Waterford)	459
Dundrum Bay (Down)	167
Outer Ards (Down)	1,188
Carlingford Lough (Down)	253
Total	10,242

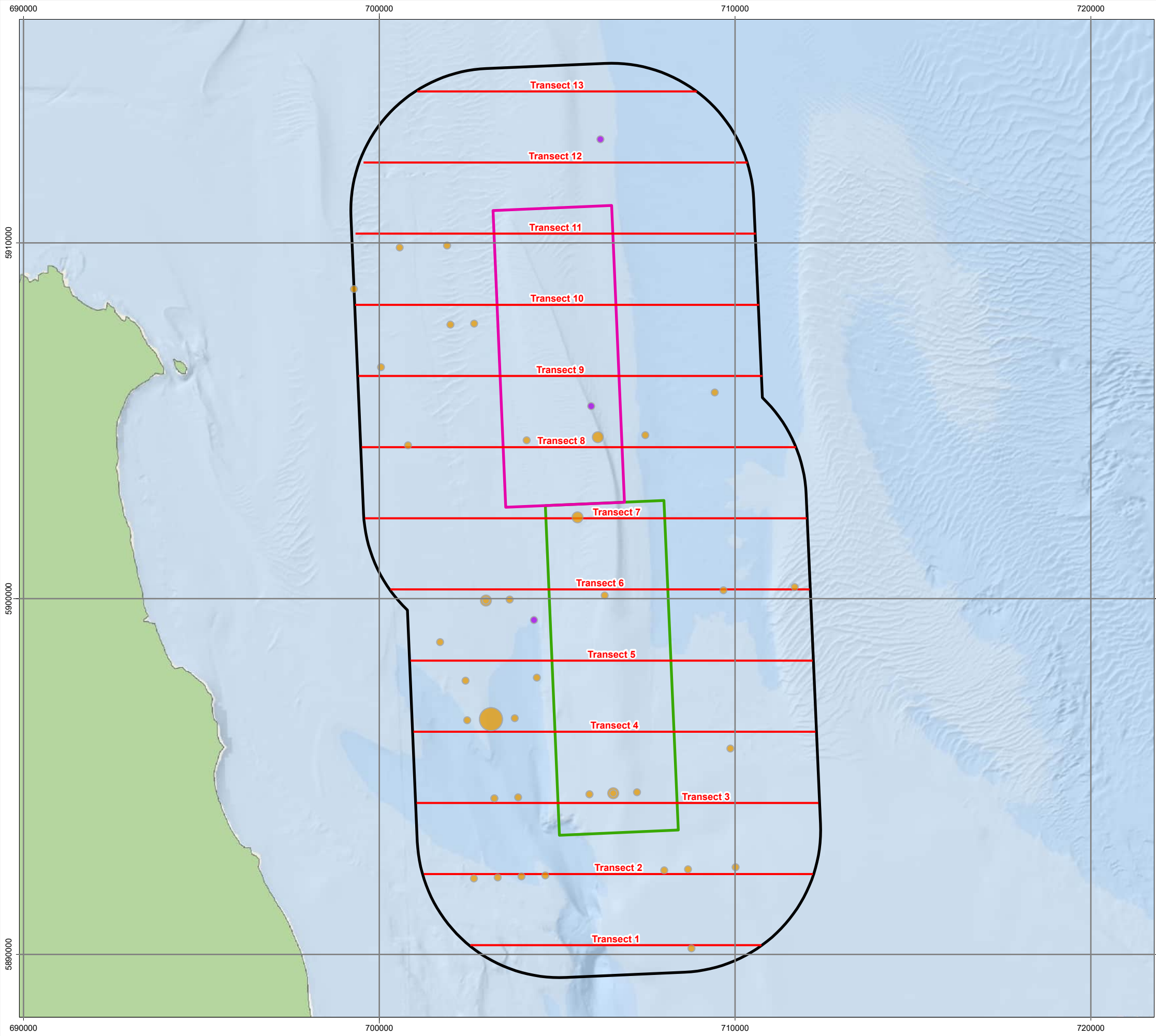
3.4.177 ESAS surveys in Irish waters between 1980 and 1997 recorded common gulls in low to moderate densities off the Dublin and Wicklow coasts in April and May, with no birds recorded off the Irish east coast between June and September. Between October and March, common gulls were more widespread in the Irish Sea, with high densities of birds (> 1.00 birds/km²) recorded off the Dublin coast over this period (Pollock *et al.*, 1997).

3.4.178 Like black-headed gulls, common gulls were mainly recorded in the offshore ornithology study area in the non-breeding season. The 2016-2017 baseline surveys recorded 33 common gulls in the non-breeding season only, with peak counts of 11 birds in November 2016 and 17 birds in December 2016. On 2019-2021 baseline surveys, a total of 547 common gulls were recorded, again predominantly in the non-breeding season. Peak counts were 52 birds in November 2019, 246 birds in December 2019, 45 birds in December 2020 and 94 birds in January 2021. Average abundance (birds/km) over the two survey periods was low in the breeding season, and higher in the winter months, with a peak average abundance of 1.48 birds/km in December and 0.78 birds/km in January (Table 55).

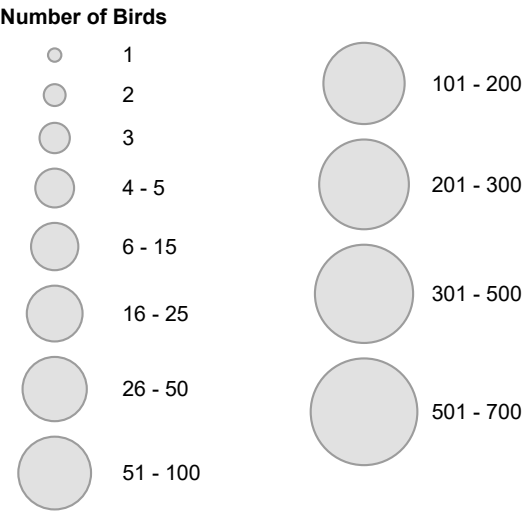
Table 55 Peak monthly counts (raw numbers) of common gulls in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	2	3	-	0	0	0	0	0	0	11	17
2019-21	94	-	46	2	4	2	1	0	1	13	52	246
Average abundance (birds/km)	0.78	0.05	0.25	0.02	0.02	0.01	0.00	0.00	0.00	0.06	0.40	1.48

3.4.179 Low numbers of common gulls were recorded on baseline surveys during the breeding season, with the majority of sightings occurring inshore of the array area and in the southern half of the offshore ornithology study area at this time (Figure 25).



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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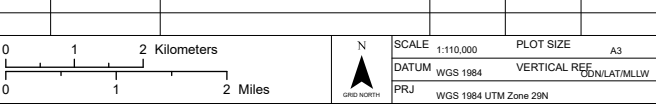
Dublin Array

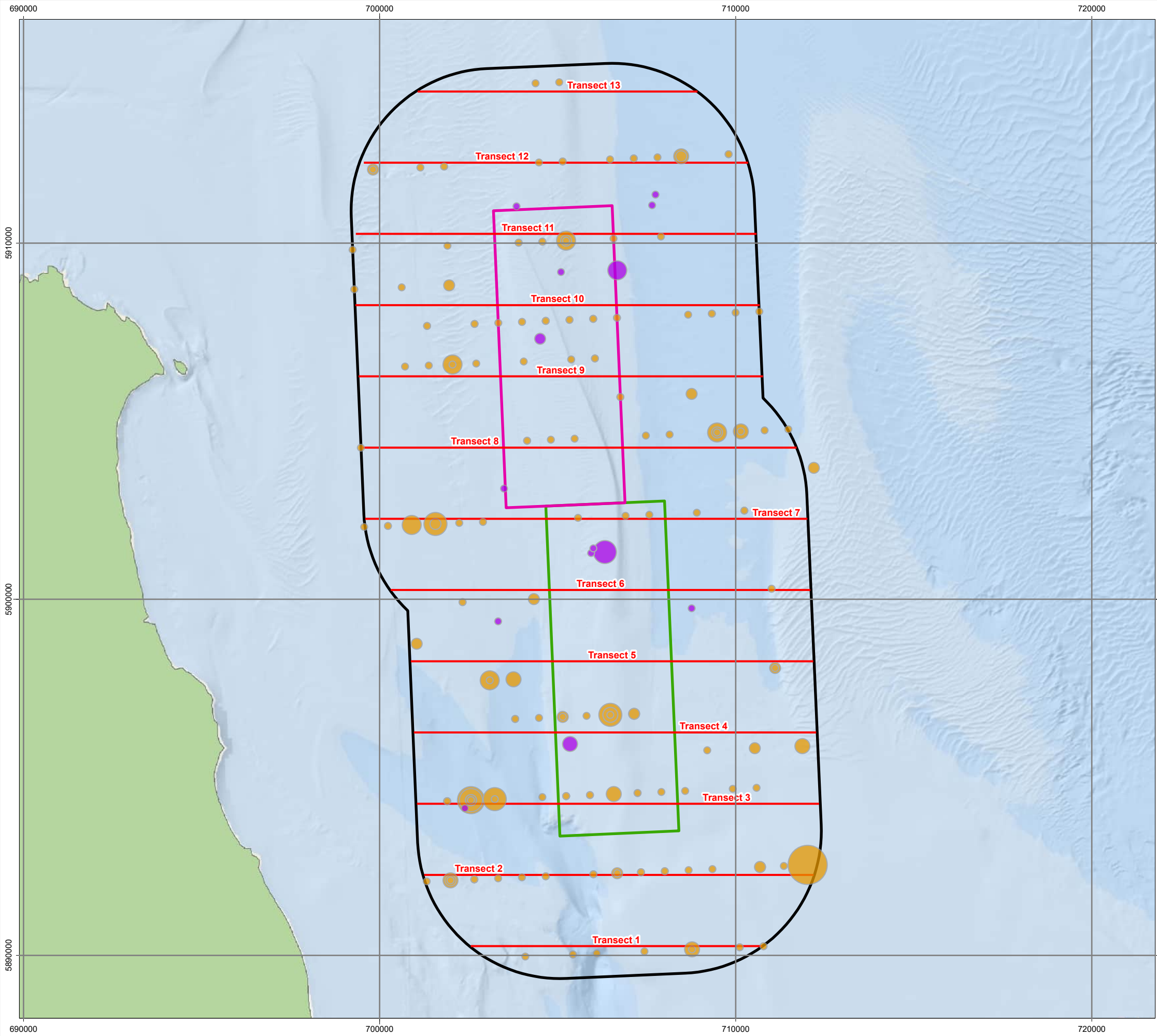
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**Marine Bird Survey
Common Gull Sightings in the Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys**

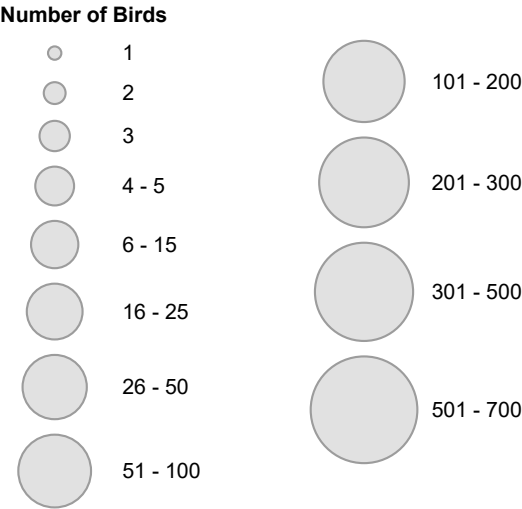
DRAWING NUMBER: **Figure 25** PAGE NUMBER: **Page 22 of 64**

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02	2025-01-16	PUBLIC	JK	AE	AE





- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
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- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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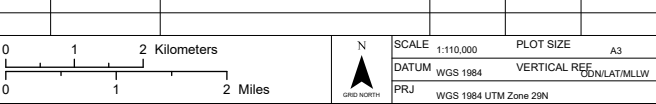
Dublin Array

DRAWING TITLE

**Marine Bird Survey
Common Gull Sightings in the Non-Breeding Season on 2016-2017 & 2019-2021
Baseline Surveys**

DRAWING NUMBER: **Figure 26** PAGE NUMBER: **Page 23 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE



- 3.4.180 Common gulls were more widespread throughout the offshore ornithology study area on baseline surveys in the non-breeding season, with slightly larger concentrations recorded in the southern half of the offshore ornithology study area over the period (Figure 26). Numbers were higher on the 2019-2021 baseline surveys compared to the 2016-2017 surveys.
- 3.4.181 Previous boat-based surveys in the area also recorded common gulls predominantly in the non-breeding season. On 2001-2002 surveys, 59 common gulls were recorded between September and April, with a peak of 39 birds in December 2001 (Percival *et al.*, 2002). On 2010-2011 surveys, 28 common gulls were recorded between November and April, with a peak count of 21 birds in November 2010 (Newton and Trewby, 2011).
- 3.4.182 Common and herring gulls could not be differentiated by eye on the ObSERVE 2016 aerial surveys, and so sightings were grouped together for the purposes of analysis. A total of 2,726 common or herring gulls were recorded throughout the survey area off the Irish east coast on surveys, with birds being most frequently recorded in autumn, then winter months and then the summer. There was no obvious association with any particular water depth on surveys. Mean density of common or herring gulls across the entire survey area was 0.75 birds/km² in summer, 3.82 birds/km² in autumn, and 1.76 birds/km² in winter. Analysis highlighted the coastal waters north of Dublin Bay as being particularly important for common or herring gulls in all seasons. Abundance of common or herring gulls across the survey area was estimated at 6,196 (95% CIs 5,303 – 9,019) individuals in summer, 35,015 (95% CIs 14,829 – 82,680) birds in autumn, and 16,110 (95% CIs 11,489 – 22,590) birds in winter (Jessopp *et al.*, 2018).
- 3.4.183 Flight height was recorded for 236 common gulls on baseline surveys in 2016-2017 and 2019-2021, with 85.6% of all birds flying below 20 m MSL in height, i.e. below likely rotor-swept height. A total of 47 birds were recorded flying below 5 m, with 55 birds flying between 5 and 10 m, 100 birds flying between 10 and 20 m, 24 birds between 20 and 30 m and 10 birds flying above 30 m (Table 9).
- 3.4.184 A total of 263 common gulls were aged on baseline surveys, with 225 adults, two third calendar year birds, 26 second calendar year birds, one immature and nine juvenile birds recorded.

Lesser black-backed Gull

- 3.4.185 Lesser black-backed gulls are common and widespread in summer, and breed in predominantly coastal colonies around the coast of Ireland, although there are some inland colonies. The coastal breeding population in Ireland has been estimated at 7,471 pairs on the recent Seabirds Count national census, with an additional 2,497 pairs nesting in urban areas, resulting in a combined total estimated population of 9,968 pairs (Burnell *et al.*, 2023). The species is Amber-listed in Ireland because 50% of the breeding population occurs at 10 or fewer sites (Gilbert *et al.*, 2021).

3.4.186 The breeding season for lesser black-backed gull has been defined as April to August (Furness, 2015) (Table 3). During the breeding season, adults may travel widely from their colonies to forage, with a mean maximum foraging range of 127 ± 109 km (Woodward *et al.*, 2019). Recent counts for lesser black-backed gull colonies within mean maximum foraging range ± 1 SD of Dublin Array are shown in Table 56 (Burnell *et al.*, 2023).

Table 56 Recent counts for lesser black-backed gull colonies within mean maximum foraging range of Dublin Array

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Lesser black-backed gull (127 ± 109 km)	Dalkey Island (Dublin)	12.2 km	35 pairs (2016)
	Ireland's Eye (Dublin)	22.1 km	3 pairs (2016) ¹
	Dublin City South (Dublin)	28.2 km	5 pairs (2002)
	Lambay Island (Dublin)	30.4 km	345 pairs (2015)
	St Patrick's Island (Dublin)	42.3 km	1 pair (2010)
	Lady's Island Lake (Wexford)	108.2 km	1 pair (2016)
	Little Saltee (Wexford)	141.1 km	20 pairs (2000)
	Great Saltee (Wexford)	143.6 km	131 pairs (2014)
	Waterford south coast (Waterford)	Within 236 km	8 pairs (2018)
	Capel Island (Cork)	235.1 km	1 pair (2018)
	Northern Ireland colonies	Within 236 km	1,970 pairs (2001-2023)
	Isle of Man colonies	Within 236 km	49 pairs (2017-2022)
	Wales colonies	Within 236 km	9,719 pairs (2001-2023)
	Scotland colonies	Within 236 km	482 pairs (2013-2021)
	England colonies	Within 236 km	7,073 pairs (2001-2023)
	Estimated breeding season population within mean maximum foraging range ± 1 SD		19,842 pairs

¹ Newton *et al.*, (2016)

3.4.187 In the non-breeding season, some Irish birds migrate south to North Africa, whilst there is an influx of birds into Irish waters from north and north west Europe in winter (Wernham *et al.*, 2002). Furness (2015) considered that outside the breeding season there were three BDMPS periods for lesser black-backed gull; autumn migration (August to October), winter (November to February) and spring migration (March to April). In addition to waters off the Irish east and south coasts, the relevant BDMPS region for lesser black-backed gull is "UK Western Waters", as defined in Furness (2015).

3.4.188 The original BDMPS population for lesser black-backed gull for the “UK Western Waters” region was estimated as 163,304 birds (all ages) for the autumn and spring migration periods, which included an Irish component of 4,074 birds (3,040 adults and 1,034 immature birds) (Furness, 2015). This Irish component was subtracted from the original BDMPS autumn and spring migration populations, which gives an estimate of 159,230 birds (all ages). For the winter period, the original BDMPS population for lesser black-backed gull for the “UK Western Waters” region was estimated as 41,159 birds (all ages), which included an Irish component of 1,778 birds (1,520 adults and 258 immature birds)) (Furness, 2015). This Irish component was subtracted from the original BDMPS winter period population, which gives an estimate of 39,381 birds (all ages).

3.4.189 To include an estimate of Irish lesser black-backed gulls in the BDMPS reference population, an estimate of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals was calculated (Burnell *et al.*, 2023) (Table 57). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 57 Estimated Irish component of BDMPS regional reference population for lesser black-backed gull

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
14,942 adults ¹	6,932 adults ¹	0.876	6,072 (6,932x0.876)	13,004 birds

¹ Does not include urban roof-nesting birds

3.4.190 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the “UK Western Waters” for the relevant non-breeding period, as defined in Furness (2015) (Table 58).

Table 58 Estimated BDMPS regional reference populations for lesser black-backed gull

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Autumn migration	159,230	13,004	172,234
Winter	39,381	13,004	52,385
Spring migration	159,230	13,004	172,234

3.4.191 For lesser black-backed gull, the revised BDMPS regional populations for the autumn and spring migration periods were estimated to be 172,234 birds (all ages). For the winter period, the revised BDMPS regional population was estimated to be 52,385 birds (all ages) (Table 58).

3.4.192 ESAS surveys in Irish waters between 1980 and 1997 found that lesser black-backed gulls were not present off the east coast of Ireland between February and June, but were recorded in low densities further east in the Irish Sea at this time. Birds were recorded closer to the Irish east coast in low densities between July and October, although distribution was still patchy. Lesser black-backed gulls were largely absent from the Irish Sea between November to January (Pollock *et al.*, 1997).

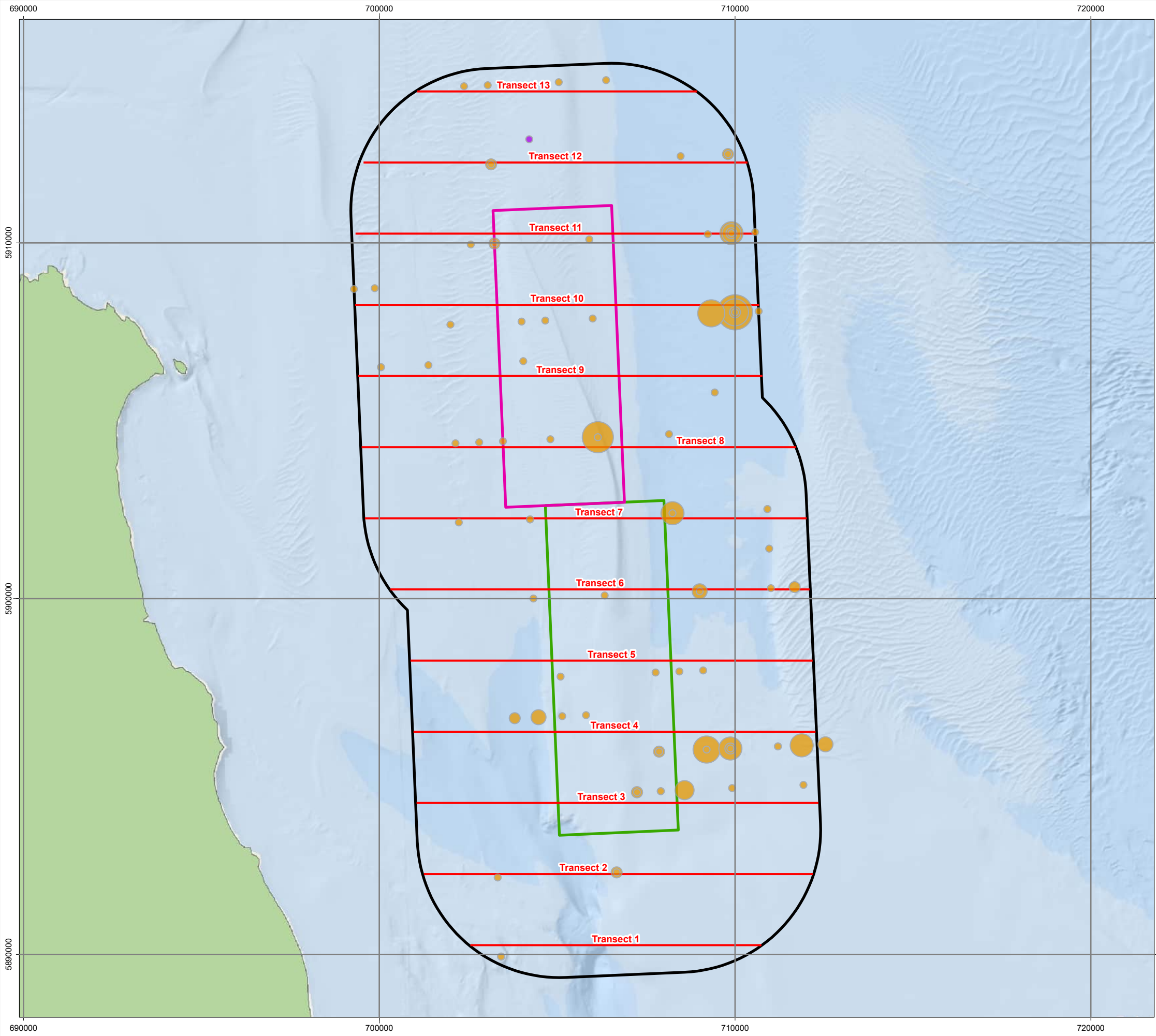
3.4.193 Baseline surveys in the offshore ornithology study area recorded lesser black-backed gulls predominantly in the breeding season (April to August). The 2016-2017 surveys recorded nine lesser black-backed gulls over the survey period, with a peak of four birds in September 2016. On the 2019-2021 baseline surveys, a total of 332 lesser black-backed gulls were recorded, with a peak count of 194 birds in early August 2019. Numbers recorded in other summer months were lower, with a peak of 12 birds in late May 2020 and 13 birds in July 2020. Average abundance (birds/km) over the two survey periods was very low in the winter months, and slightly higher in the breeding season, with a peak of 0.88 birds/km in August (Table 59). For months with more than one survey, the peak number recorded on any one survey is shown.

Table 59 Peak monthly counts (raw numbers) of lesser black-backed gulls in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

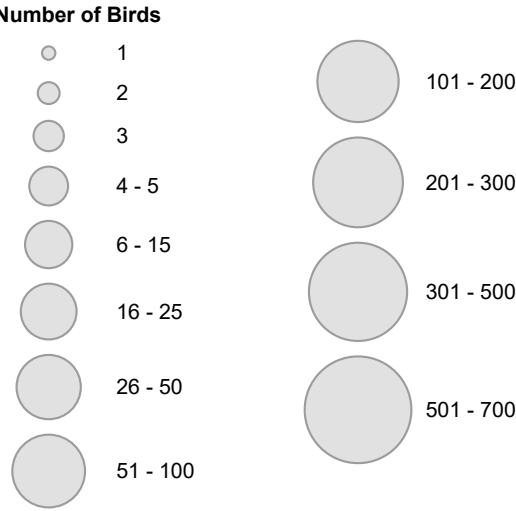
	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	0	0	-	0	0	1	0	4	1	0	0
2019-21	0	-	3	9	12	5	13	194	2	4	4	2
Average abundance (birds/km)	0.00	0.00	0.02	0.07	0.08	0.03	0.08	0.88	0.04	0.03	0.03	0.01

3.4.194 Previous boat-based surveys between September 2001 and September 2002 recorded 18 lesser black-backed gulls over the period, with a peak of five birds in March 2002 and five birds in September 2002 (Percival *et al.*, 2002). A total of 19 lesser black-backed gulls were recorded on 2010-2011 surveys, with a peak count of eight birds in September 2010 (Newton and Trewby, 2011).

- 3.4.195 During the ObSERVE 2016 aerial surveys, it was not possible to differentiate great or lesser black-backed gulls in summer months. However, in autumn and winter surveys, some sightings could be identified to species level. Over the three survey periods there were 39 individual lesser black-backed gulls, 143 great black-backed gulls, and 339 unidentified black-backed gulls recorded. Highest number of sightings of unidentified black-backed gulls occurred during the autumn surveys, although largest group sizes were noted in winter surveys, occurring further offshore. Neither species showed an obvious preference for particular water depths on the surveys. Highest densities of unidentified black-backed gulls were recorded in the northern transects of the survey area, while analysis highlighted the importance of the waters to the north of Lambay Island, particularly in autumn and winter. Overall, there were an estimated 895 (95% CIs 680 – 1,177) unidentified black-backed gulls recorded in summer. In autumn, 316 (95% CIs 228 – 440) lesser black-backed gulls, 2,243 (95% CIs 1081 – 4650) great black-backed gulls, and 1,019 (95% CIs 700 – 1,485) unidentified black-backed gulls were recorded, while 75 (95% CIs 48 – 118) lesser black-backed gulls, 498 (95% CIs 361 – 688) great black-backed gulls, and 1,580 (95% CIs 1,135 – 2,200) unidentified black-backed gull species were recorded across the survey area in winter (Jessopp *et al.*, 2018).
- 3.4.196 Lesser black-backed gulls were mainly recorded in the array area and further offshore in the buffer area on 2019-2021 baseline surveys in the breeding season, with lower numbers recorded inshore of the array area at this time (Figure 27). Very few lesser black-backed gulls were recorded in the offshore ornithology study area in the breeding season on 2016-2017 baseline surveys.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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Dublin Array

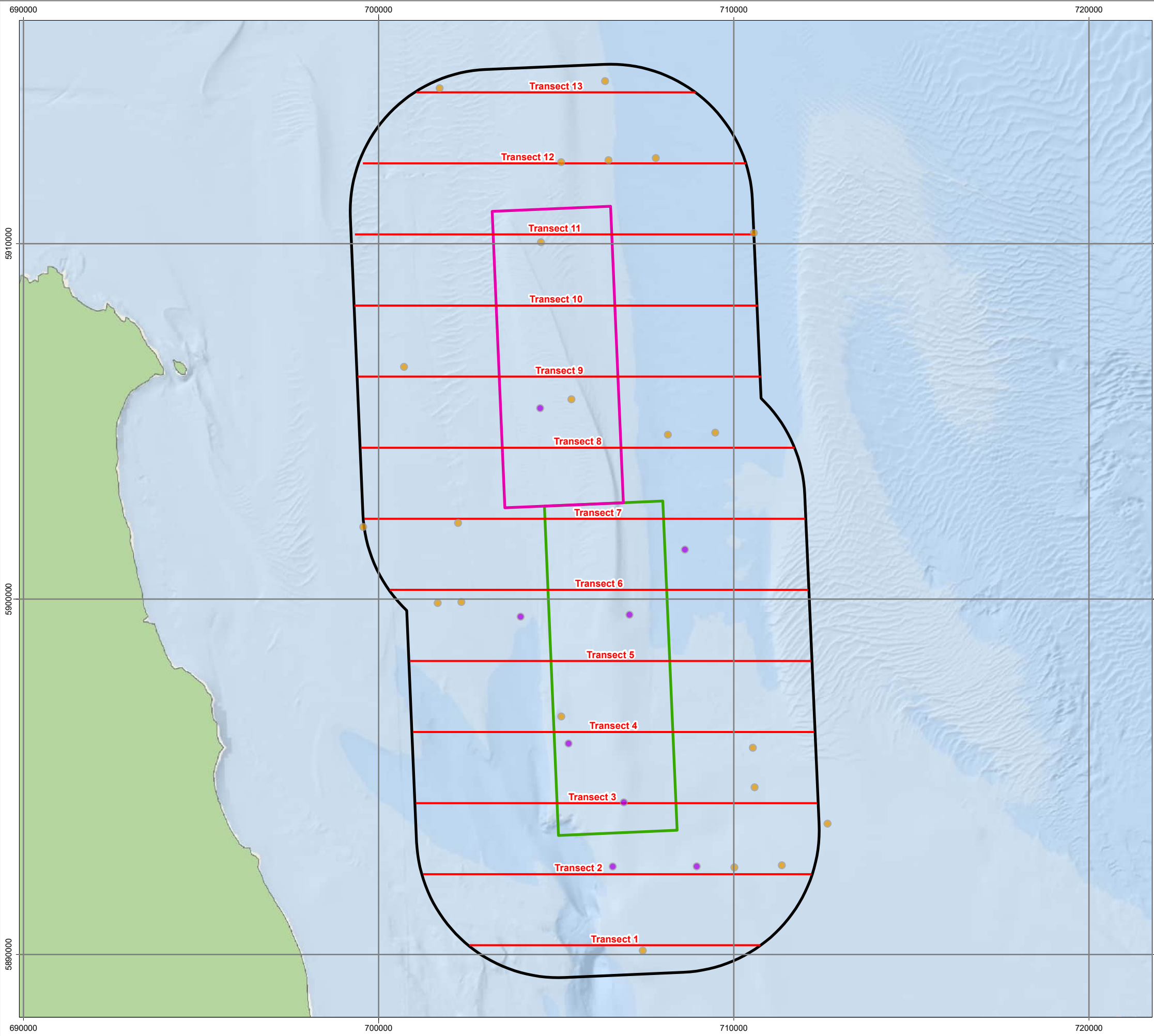
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Lesser Black-Backed Gull Sightings in the Breeding Season on 2016-2017 &
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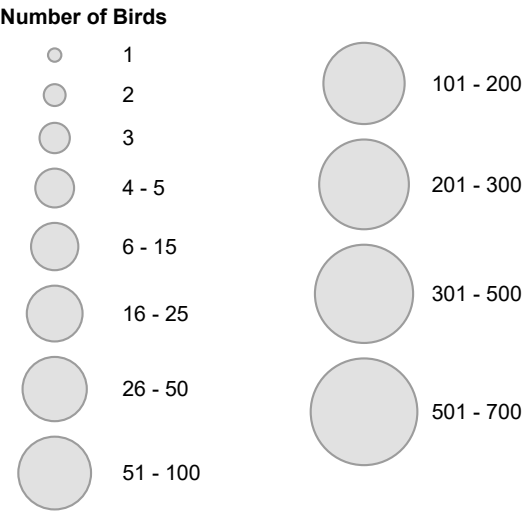
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- Bray Bank Array Area
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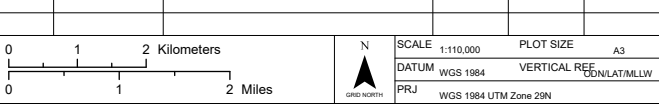
Dublin Array

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Marine Bird Survey
Lesser Black-Backed Gull Sightings in the Non-Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER: **Figure 28** PAGE NUMBER: **Page 25 of 64**

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3.4.197 Numbers of lesser black-backed gulls recorded on baseline surveys in the non-breeding season were much lower than in the breeding season (Figure 28). This distribution reflects the species partial summer migrant status in Irish waters.

1.1.1 Flight height was recorded for 171 lesser black-backed gulls on baseline surveys in 2016/17 and 2019/20, with 86.0% of all birds flying below 20 m MSL in height, i.e. below likely rotor-swept height. A total of 38 birds were recorded flying below 5 m, with 36 birds flying between 5 and 10 m, 73 birds flying between 10 and 20 m, 20 birds between 20 and 30 m and four birds flying above 30 m in height (Table 9).

1.1.2 A total of 109 lesser black-backed gulls were aged on baseline surveys, with 38 adults, one fifth calendar year bird, eight third calendar year birds, 11 second calendar year birds, two immature birds and 49 juvenile birds recorded (Table 60).

Table 60 Monthly breakdown of juvenile, immature and adult lesser black-backed gulls in the breeding season in the offshore ornithology study area based on 2016-2017 and 2019-2021 surveys

	A	M	J	J	A	Total
Juvenile	0	0	0	1	37	38
Immature	1	9	3	2	2	17
Adult	0	7	3	8	11	29
Number aged	1	16	6	11	50	84
Percentage of non-adult birds	100	56.3	50.0	27.3	78.0	65.5

Herring Gull

3.4.198 Herring gulls are resident, common and widespread around the coastline of Ireland, breeding in colonies in coastal locations. The coastal breeding population in Ireland has been estimated at 9,702 pairs on the recent Seabirds Count national census, with an additional 8,943 pairs nesting in urban areas, resulting in a combined total estimated population of 18,645 pairs (Burnell *et al.*, 2023). The species is Amber-listed in Ireland, as there has been a moderate decline of 29% in the breeding population between 1998 and 2018, and a similar longer-term decline of 50% in the breeding population between 1980 and 2018. In addition, the species has an unfavourable conservation status in Europe (Gilbert *et al.*, 2021).

3.4.199 The breeding season for herring gull has been defined as March to August (Furness, 2015) (Table 3). During the breeding season, adults may travel moderate distances from their colonies to forage, with a mean maximum foraging range of 58.8 ± 26.8 km (Woodward *et al.*, 2019). Recent counts for herring gull colonies within mean maximum foraging range ± 1 SD of Dublin Array are shown in Table 61 (Burnell *et al.*, 2023). Estimated urban breeding populations are taken from Keogh and Lauder (2021).

Table 61 Recent counts for herring gull colonies within mean maximum foraging range of Dublin Array

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Herring gull (58.8 ± 26.8 km)	Bray Head (Wicklow)	11.8 km	2 pairs (2015)
	Muglins (Dublin)	11.8 km	22 pairs (2016)
	Bray Town (urban) (Wicklow)	11.9 km	62 pairs (2021) ¹
	Dalkey Islands (Dublin)	12.2 km	40 pairs (2016)
	Howth Head (Dublin)	18.6 km	9 pairs (2015)
	Howth (urban) (Dublin)	22.1 km	460 pairs (2021) ¹
	Ireland's Eye (Dublin)	22.1 km	398 pairs (2016) ²
	Dublin City South	28.2 km	18 pairs (2021)
	Wicklow Head (Wicklow)	30.3 km	7 pairs (2022)
	Lambay Island (Dublin)	30.4 km	906 pairs (2015)
	Skerries Town (urban) (Dublin)	40.7 km	249 pairs (2021) ¹
	Skerries Islands SPA (Dublin)	41.0 km	10 pairs (2010)
	Balbriggan Town (urban) (Dublin)	45.4 km	1,485 pairs (2021) ¹
	Drogheda (urban) (Louth)	52.55km	360 pairs (2021) ¹
	Welsh colonies	Within 85.6km	104 pairs (2016-2021)
	Estimated breeding season population within mean maximum foraging range ± 1 SD		4,132 pairs

¹ Keogh and Lauder (2021)

² Newton *et al.* (2016)

3.4.200 In the non-breeding season, there may be some southward dispersal but many Irish breeding birds remain in Irish waters over this period, with additional birds arriving from Europe (Wernham *et al.*, 2002). Furness (2015) considered that outside the breeding season there was one BDMPS period for herring gull; the non-breeding season (September to February). In addition to waters off the Irish east and south coasts, the relevant BDMPS region for herring gull is “UK Western Waters”, as defined in Furness (2015).

3.4.201 The original BDMPS population for herring gull for the “UK Western Waters” region was estimated as 173,299 birds (all ages) for the non-breeding season, which included an Irish component of 7,360 birds (3,000 adults and 4,360 immature birds) (Furness, 2015). This Irish component was subtracted from the original BDMPS non-breeding season population, which gives an estimate of 165,939 birds (all ages).

3.4.202 To include an estimate of Irish herring gulls in the BDMPS reference population, an estimate of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals was calculated (Burnell et al., 2023) (Table 62). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 62 Estimated Irish component of BDMPS regional reference population for herring gull

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
19,404 adults ¹	8,926 adults ¹	1.370	12,229 (8,926x1.370)	21,155 birds

¹ Does not include urban roof-nesting birds

3.4.203 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the “UK Western Waters” for the relevant non-breeding period, as defined in Furness (2015) (Table 63).

Table 63 Estimated BDMPS regional reference populations for herring gull

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Non-breeding season	165,939	21,155	187,094 birds

3.4.204 For herring gull, the revised non-breeding season BDMPS regional population was estimated to be 187,094 birds (all ages) (Table 63).

3.4.205 ESAS surveys in Irish waters between 1980 and 1997 recorded a patchy distribution of herring gulls at low densities off the east coast of Ireland between March and May. Birds were more widespread off the Irish east coast in low densities between June and October. Distribution and densities were similar off the Irish east coast between November and February (Pollock *et al.*, 1997).

3.4.206 Estimated numbers of herring gulls were derived from baseline survey data by applying Distance sampling techniques to the 2016-2017 and 2019-2021 datasets (Table 64 and Table 65).

Table 64 Estimated numbers of herring gulls in the array area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	6	26	33	21	55	2	18	148	7	7	9	6
Mean	32	69	91	59	203	7	50	384	30	29	50	22
Upper	159	185	269	163	838	31	140	1,000	136	126	298	81
Birds in flight												
Lower	18	17	9	0	5	1	5	1	1	8	0	1
Mean	49	31	22	4	19	7	19	5	4	18	5	8
Upper	98	50	40	8	37	16	39	12	9	34	13	18
Total												
Lower	24	42	42	21	60	3	23	149	8	15	9	8
Mean	81	100	113	63	222	14	69	389	35	47	55	31
Upper	257	235	309	172	875	46	179	1,012	146	159	311	99

Table 65 Estimated numbers of herring gulls in the 4km buffer area based on 2016-2017 and 2019-2021 surveys

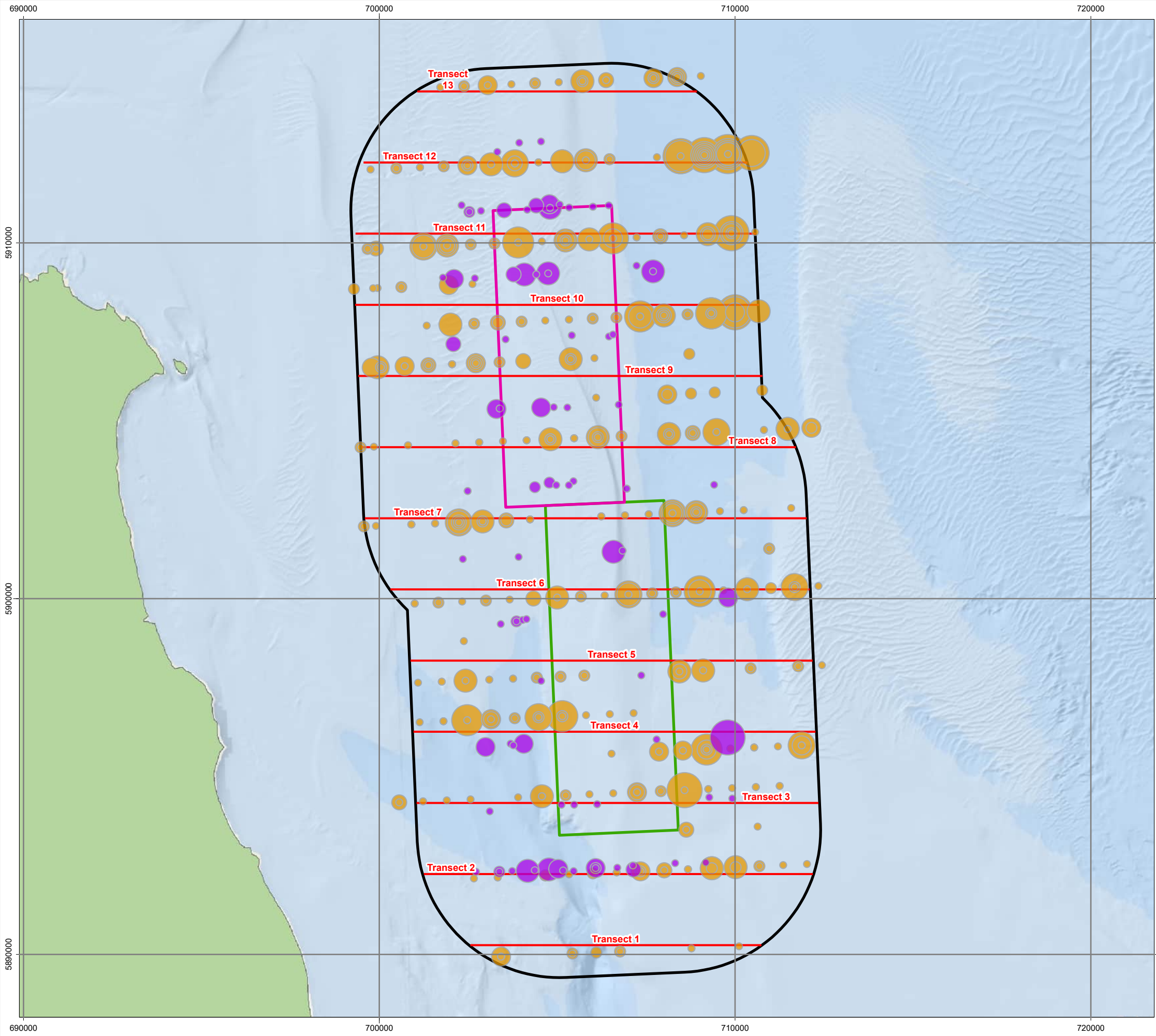
	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	24	96	126	81	206	6	69	559	25	26	32	24
Mean	120	259	342	223	766	25	189	1,446	114	109	188	85
Upper	600	698	1,013	616	3,159	115	527	3,768	514	473	1,123	307
Birds in flight												
Lower	67	63	34	0	21	5	17	3	4	32	0	5
Mean	185	116	85	15	70	28	70	20	17	69	20	31
Upper	370	188	153	30	138	59	148	45	36	126	51	66
Total												
Lower	91	159	160	81	227	10	86	562	29	57	32	29
Mean	305	375	427	238	836	53	259	1,466	131	178	208	116
Upper	970	886	1,165	647	3,297	174	675	3,813	550	599	1,173	373

3.4.207 Overall, estimated numbers of herring gulls on baseline surveys were highest in the breeding season, with peak means of 1,058 birds in the study area in May and 1,855 birds in August (Table 66). In the non-breeding season (September to February), estimated numbers were highest in February, when the estimated mean number of birds in the study area was 475 birds.

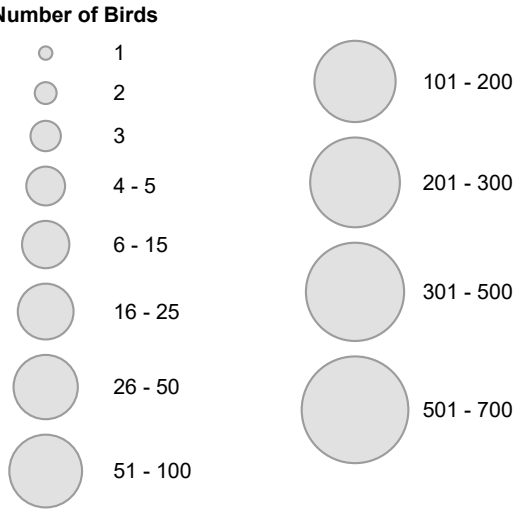
Table 66 Estimated numbers of herring gulls in the array area and 4km buffer area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Lower	115	201	202	102	287	13	109	711	37	72	41	37
Mean	386	475	540	301	1,058	67	328	1,855	166	225	263	147
Upper	1,227	1,121	1,474	819	4,172	220	854	4,825	696	758	1,484	472

3.4.208 Herring gulls were widely distributed across the offshore ornithology study area in the breeding season (March to August) (Figure 29). Highest concentrations were recorded in the buffer area at this time, particularly offshore of the array area on the 2019-2021 baseline surveys.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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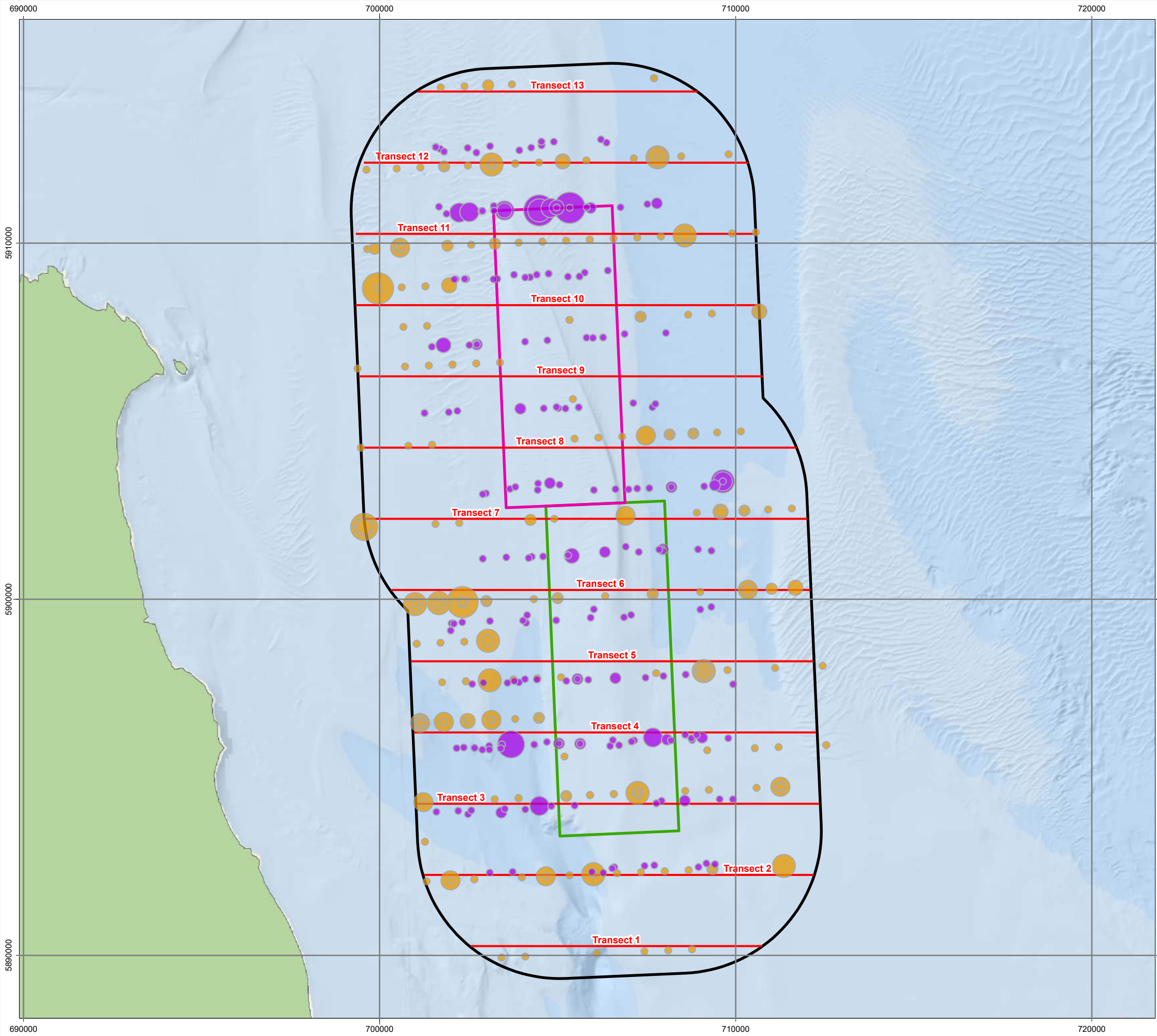
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Herring Gull Sightings in the Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys

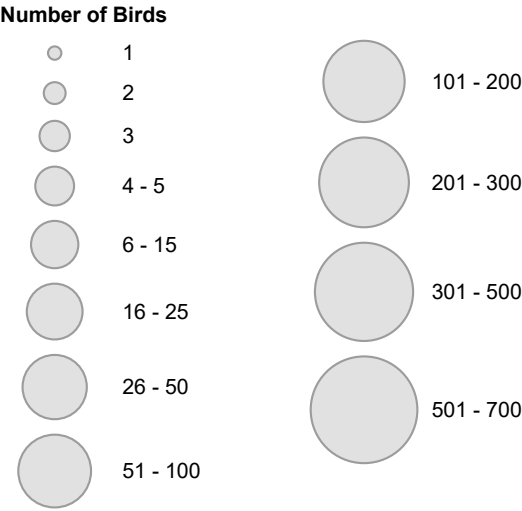
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- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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Dublin Array

DRAWING TITLE

Marine Bird Survey
Herring Gull Sightings in the Non-Breeding Season on 2016-2017 & 2019-2021
Baseline Surveys

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VER	DATE	REMARKS	DRAW	CHEK	APRD
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3.4.209 Herring gulls were widely distributed across the array area and buffer area in lower numbers in the non-breeding season (September to February) (Figure 30). Highest concentrations were recorded inshore of the array area and in the north end of the buffer area at this time.

3.4.210 Previous boat-based surveys between September 2001 and September 2002 recorded herring gulls in low numbers in all survey months except June and July, with an estimated peak of 113 birds in September 2002 (Percival *et al.*, 2002). Surveys between June 2010 and June 2011 recorded herring gulls in every survey month, with peak raw counts of 298 birds in October 2010 and 107 birds in November 2010 (Newton and Trewby, 2011).

3.4.211 Herring gull results from the 2016 ObSERVE aerial surveys off the Irish east coast are presented in the common gull section above.

3.4.212 Flight height was recorded for 1,416 herring gulls on baseline surveys in 2016-2017 and 2019-2021, with 79.6% of all birds flying below 20 m MSL in height, i.e. below likely rotor-swept height. A total of 288 birds were recorded flying below 5 m, with 479 birds flying between 5 and 10 m, 360 birds flying between 10 and 20 m, 224 birds between 20 and 30 m and 65 birds flying above 30 m in height (Table 9).

3.4.213 A total of 1,149 herring gulls were aged on baseline surveys in the offshore ornithology study area between 2016-2017 and 2019-2021. In the breeding season (March to August), age was recorded for 708 herring gulls, with 37 juvenile (fledged in summer 2020) birds (5.2%), 379 immature (non-breeding) birds (53.5%) and 292 adults (41.2%) aged on surveys (Table 67).

Table 67 Monthly breakdown of juvenile, immature and adult herring gulls in the offshore ornithology study area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Juvenile	3	0	0	0	0	0	1	36	45	12	8	24
Immature	28	7	75	105	104	12	54	29	4	37	40	62
Adult	21	20	19	11	39	37	130	56	5	33	33	59
Number aged	52	27	94	116	143	49	185	121	54	82	81	145
Percentage of non-adult birds	59.6	25.9	86.2	90.5	72.7	24.5	29.7	53.7	90.7	59.8	59.3	59.3

Great black-backed Gull

3.4.214 Great black-backed gulls are resident and widespread around the coastline of Ireland, breeding mainly in coastal locations, with highest breeding numbers on the west coast (Mitchell *et al.*, 2004). The breeding population in Ireland has been estimated at 2,825 pairs on the recent Seabirds Count national census, which is an increase of 28% compared to the previous Seabird 2000 population estimate (Burnell *et al.*, 2023). The species is Green-listed in Ireland, in terms of its conservation status (Gilbert *et al.*, 2021).

3.4.215 The breeding season for great black-backed gull has been defined as late March to August (Furness, 2015) (Table 3). During the breeding season, adults may travel moderate distances from their colonies to forage, with a mean maximum foraging range of 73 km, although available data is limited (Woodward *et al.*, 2019). Recent counts for great black-backed gull colonies within mean maximum foraging range ± 1 SD of Dublin Array are shown in Table 68.

Table 68 Recent counts for great black-backed gull colonies within mean maximum foraging range of Dublin Array

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Great black-backed gull (73 km)	Dalkey Islands (Dublin)	12.2 km	60 pairs (2016)
	Ireland's Eye (Dublin)	22.1 km	132 pairs (2016) ¹
	Wicklow Head (Wicklow)	30.3 km	1 pair (2019)
	Lambay Island (Dublin)	30.4 km	180 pairs (2015)
	Mizen Head (Wicklow)	33.5 km	1 pair (2018)
	Skerries Islands (Dublin)	39.8 km	95 pairs (2010)
	Arklow Head (Wicklow)	44.1 km	1 pair (2018)
	Estimated breeding season population within mean maximum foraging range ± 1 SD		470 pairs

¹ Newton *et al.*, (2016)

3.4.216 In the non-breeding season, most breeding birds remain close to their breeding locations, with no evidence of large-scale post-breeding movements (Wernham *et al.*, 2002). Furness (2015) considered that outside the breeding season there was one BDMPS period for great black-backed gull; the non-breeding season (September to March). In addition to waters off the Irish east and south coasts, the relevant BDMPS regions for great black-backed gull are “UK West of Scotland” and “UK South west and Channel”, as defined in Furness (2015). As Dublin Array lies close to both these regions, with connectivity to both, on the basis of the majority of breeding great black-backed gulls being off the west coast of Scotland or the south west of England, the population estimates for these two regions have been combined. This approach is not novel as it was used for the Awel-y-Mor EIAR assessment (RWE, 2022), and was agreed as an approach in consultation with the other East Coast Phase 1 developers.

3.4.217 The combined BDMPS population for great black-backed gull for the “UK West of Scotland” and the “UK South west and Channel” regions was estimated as 52,122 birds (all ages) for the non-breeding season, which included an Irish component of 3,320 birds (800 adults and 2,520 immature birds) (Furness, 2015). This Irish component was subtracted from the original BDMPS non-breeding season population, which gives an estimate of 48,802 birds (all ages).

3.4.218 To include an estimate of Irish great black-backed gulls in the BDMPS reference population, an estimate of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals was calculated (Burnell *et al.*, 2023) (Table 69). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 69 Estimated Irish component of BDMPS regional reference population for great black-backed gull

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
5,650 adults	1,814 adults	1.538	2,790 (1,814x1.538)	4,604 birds

3.4.219 The combined total of breeding adults and estimated number of immature birds was then applied to the existing population for the “UK Western Waters” for the relevant non-breeding period, as defined in Furness (2015) (Table 70).

Table 70 Estimated BDMPS regional reference populations for great black-backed gull

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Non-breeding season	48,802	4,604	53,406 birds

3.4.220 For great black-backed gull, the revised non-breeding season BDMPS regional population was estimated to be 53,406 birds (all ages) (Table 70).

3.4.221 ESAS surveys in Irish waters between 1980 and 1997 recorded a patchy distribution of great black-backed gulls at low densities off the east coast of Ireland between October and January, and no birds off the Irish east coast between February and June, although survey coverage was not complete at this time. Between July and September, great black-backed gulls were recorded off the Dublin and Wicklow coasts in low to moderate densities (Pollock *et al.*, 1997).

3.4.222 Estimated numbers of great black-backed gulls were derived from baseline survey data by applying Distance sampling techniques to the 2019-2021 dataset only for birds on the water, as there were insufficient sightings of gannets on the water in the 2016-2017 dataset to run a Distance analysis. Both datasets were used for birds in flight (Table 71 and Table 72).

3.4.223 The confidence limits from the Distance analysis for density estimates of birds on the water on the 6th May 2020 survey were large (0.0001 to 1,215.3 birds/km²) indicating that there were a small number of large flocks recorded on this survey and that the Distance estimate for this month was not very reliable. As a result, the May estimated numbers presented in the tables below were based on the 26th May 2020 survey only.

Table 71 Estimated numbers of great black-backed gulls in the array area based on 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water (2019/21 data only)												
Lower	3	-	9	4	9	0	6	6	0	1	1	6
Mean	10	-	32	10	29	2	17	15	2	9	4	15
Upper	35	-	121	27	89	14	52	40	13	54	23	40
Birds in flight (2016/17 data & 2019/21 data)												
Lower	0	0	0	0	0	0	0	0	0	0	1	0
Mean	3	2	7	1	0	1	1	2	1	3	5	6
Upper	8	7	19	4	0	2	4	5	3	8	13	12
Total (2016/17 data & 2019/21 data)												
Lower	3	0	9	4	9	0	6	6	0	1	1	6
Mean	13	2	39	12	29	3	18	17	3	12	9	20
Upper	44	7	140	32	89	16	56	44	16	63	35	52

Table 72 Estimated numbers of great black-backed gulls in the 4km buffer area based on 2019-2021 surveys

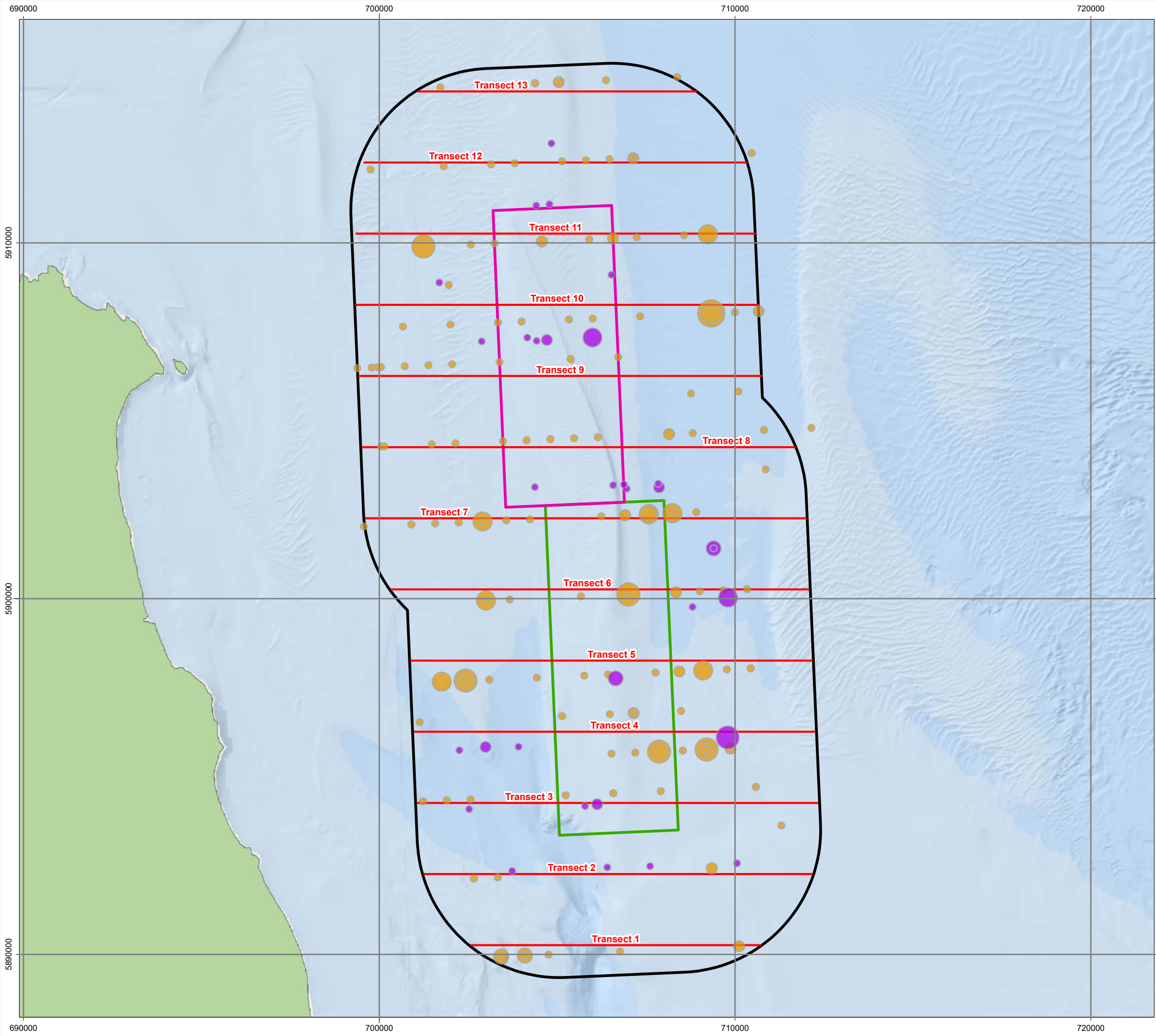
	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water (2019/21 data only)												
Lower	11	-	33	15	35	1	21	22	2	5	2	22
Mean	38	-	120	38	108	8	64	56	9	33	14	56
Upper	134	-	456	103	335	52	196	149	48	205	85	151
Birds in flight (2016/17 data & 2019/21 data)												
Lower	0	0	0	0	0	0	0	0	0	0	3	0
Mean	10	8	27	5	0	3	5	6	4	12	19	21
Upper	31	25	73	16	0	9	14	17	11	31	49	45
Total (2016/17 data & 2019/21 data)												
Lower	11	0	33	15	35	1	21	22	2	5	5	22
Mean	48	8	147	44	108	11	69	62	13	46	33	77
Upper	165	25	529	119	335	60	210	167	59	236	134	196

3.4.224 Overall, peak mean estimated numbers of great black-backed gulls in the offshore ornithology study area on baseline surveys were higher in the breeding season than in the non-breeding season, with a peak mean of 186 birds in March, and a slightly lower peak mean of 137 birds in May (Table 73). In the non-breeding season, the peak mean was 97 birds in December.

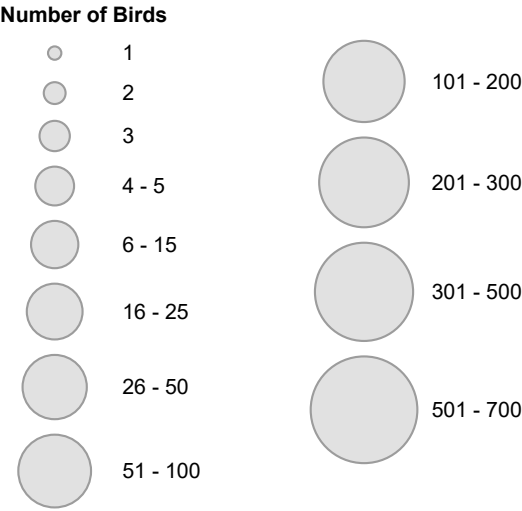
Table 73 Estimated numbers of great black-backed gulls in the array area and 4km buffer area based on data from 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Lower	14	0	42	19	44	1	27	28	2	6	6	28
Mean	61	10	186	56	137	14	87	79	16	58	42	97
Upper	209	32	669	151	424	76	266	211	75	299	169	248

3.4.225 Great black-backed gulls were widely distributed across the offshore ornithology study area in the breeding season (late March to August) (Figure 31). Highest numbers were generally recorded in the buffer area at this time, although there were some higher concentrations in the array area, particularly on 2019-2021 baseline surveys.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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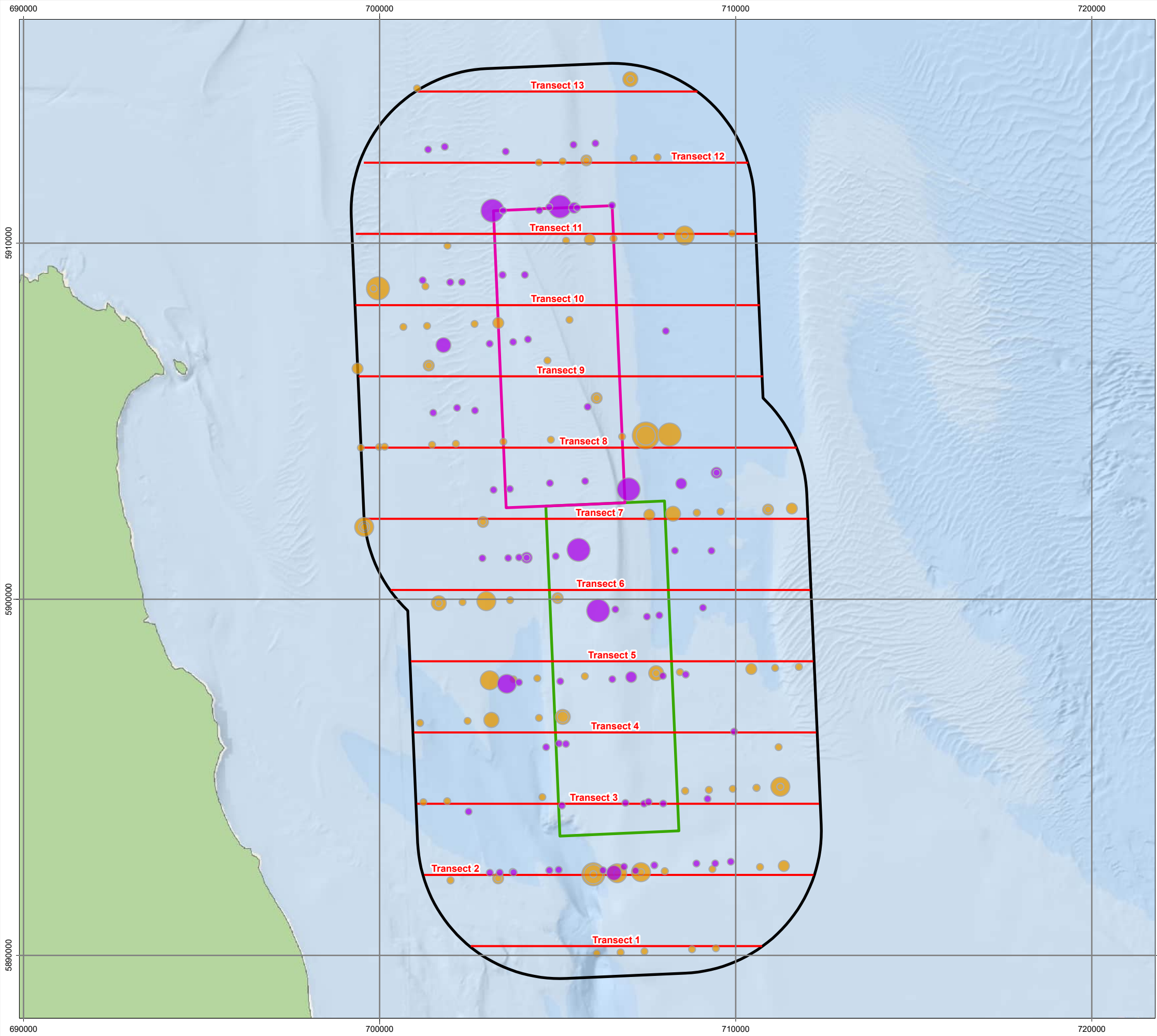
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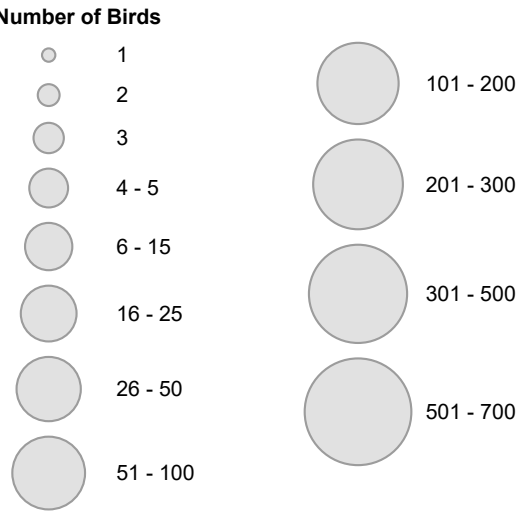
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- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
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- Bird Sighting 2019 - 2021



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Marine Bird Survey
Great Black-Backed Gull Sightings in the Non-Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys

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01	2025-01-16	DRAFT	AM	AB	AE
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- 3.4.226 Great black-backed gulls were widely distributed across the offshore ornithology study area on baseline surveys in the non-breeding season (September to late March), with the distribution pattern being largely similar to that recorded in the breeding season (Figure 32).
- 3.4.227 Previous 2001-2002 surveys recorded great black-backed gulls in low numbers in all survey months, with an estimated peak of 171 birds in September 2002 (Percival *et al.*, 2002). On 2010-2011 surveys, great black-backed gulls were also recorded in every survey month, with peak raw counts of 58 birds in July 2010 and 26 birds in September 2010 (Newton and Trewby, 2011).
- 3.4.228 Great black-backed gull results from the 2016 ObSERVE aerial surveys off the Irish east coast are presented in the lesser black-backed gull section above.
- 3.4.229 Flight height was recorded for 349 great black-backed gulls on baseline surveys in 2016-2017 and 2019-2021, with 72.2% of all birds flying below 20 m MSL in height, i.e. below likely rotor-swept height. A total of 67 birds were recorded flying below 5 m, with 95 birds flying between 5 and 10 m, 90 birds flying between 10 and 20 m, 60 birds between 20 and 30 m and 37 birds flying above 30 m in height (Table 9).
- 3.4.230 A total of 350 great black-backed gulls were aged on baseline surveys between 2016-2017 and 2019-2021. In the breeding season (late March to August), age was recorded for 215 great black-backed gulls, with 10 juvenile (fledged in summer 2020) birds (4.7%), 65 immature (non-breeding) birds (30.2%) and 140 adults (65.1%) aged on surveys (Table 74).

Table 74 Monthly breakdown of juvenile, immature and adult great black-backed gulls in the offshore ornithology study area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Juvenile	0	0	0	0	0	0	0	10	11	6	6	4
Immature	5	3	17	12	31	1	4	0	2	4	4	6
Adult	15	3	28	19	25	13	23	32	18	13	11	24
Number aged	20	6	45	31	56	14	27	42	31	23	21	34
Percentage of non-adult birds	25.0	50.0	37.8	38.7	55.4	7.1	17.4	23.8	41.9	43.5	47.6	29.4

Black-legged Kittiwake

- 3.4.231 Kittiwakes are one of the commonest seabird species in Ireland, breeding in large colonies on suitable coastal cliff habitat. The breeding population in Ireland has been estimated at 24,723 pairs on the recent Seabirds Count national census, which is a decrease of 36% compared to the previous Seabird 2000 population estimate (Burnell *et al.*, 2023). It has been suggested that such declines, which have also been recorded in the UK, may be linked to local levels of fishing for prey species such as sandeels and sprats, as well as increasing sea temperatures due to climate change, which also affects these prey species (RSPB, 2018).

3.4.232 The species is Red-listed in Ireland, as it has been classified as being Vulnerable by the International Union for Conservation of Nature (IUCN). In addition, there has been a moderate decline of 32% in the breeding population between 1998 and 2018, as well as a moderate longer term decline of 35% in the breeding population between 1980 and 2018. More than 50% of the breeding population occurs at 10 or fewer sites and the species has an unfavourable conservation status in Europe (Gilbert *et al.*, 2021). Kittiwakes mostly prey on small fish species such as lesser sandeels and clupeids, as well as fishery discards (Forrester *et al.*, 2007).

3.4.233 The breeding season for kittiwake has been defined as March to August, although May to July is considered the “migration free” breeding season (Furness, 2015) (Table 3). During the breeding season, adults may travel widely from their colonies to forage, with a mean maximum foraging range of 156.1 ± 144.5 km (Woodward *et al.*, 2019). Recent counts for kittiwake colonies within mean maximum foraging range ± 1 SD of Dublin Array are shown in Table 75.

Table 75 Recent counts for kittiwake colonies within mean maximum foraging range of Dublin Array

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Kittiwake (156.1 ± 144.5 km)	Bray Head (Wicklow)	11.8 km	873 pairs (2015)
	Howth Head (Dublin)	18.6 km	1,773 pairs (2015)
	Ireland's Eye (Dublin)	22.1 km	401 pairs (2016) ¹
	Wicklow Head (Wicklow)	30.3 km	674 pairs (2022) ²
	Lambay Island (Dublin)	30.4 km	3,320 pairs (2015)
	Rockabill (Dublin)	41.3 km	165 pairs (2021)
	Great Saltee Island (Wexford)	144.9 km	1,038 pairs (2015)
	Helvick Head SPA (Waterford)	206.8 km	65 pairs (2018)
	Ram Head (Waterford)	180.5 km	226 pairs (2018)
	Ardnamult (Waterford)	130.7 km	26 pairs (2018)
	Dunmore East (Waterford)	132.34 km	401 pairs (2018)
	Portally (Waterford)	134 km	100 pairs (2018)
	Old Head of Kinsale (Cork)	287.6 km	711 pairs (2015)
	Northern Ireland colonies	Within 300.6 km	16,103 pairs (2016-2023)
	Isle of Man colonies	Within 300.6 km	685 pairs (2017)
	Wales colonies	Within 300.6 km	5,370 pairs (2016-2023)

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
	Scotland colonies	Within 300.6 km	1,492 pairs (2018-2023)
	England colonies	Within 300.6 km	1,707 pairs (2016-2023)
	Estimated breeding season population within mean maximum foraging range ± 1 SD		35,130 pairs

1 Newton et al., (2016)

2 SMP (2024)

3.4.234 In the non-breeding season, kittiwakes disperse from the breeding colonies, with some birds heading south into the Bay of Biscay and others moving offshore into the North Atlantic (Coulson, 1966). Furness (2015) considered that for kittiwake outside the breeding season there were two BDMPS periods; autumn migration (August to December) and spring migration (January to April). The relevant BDMPS region for kittiwake is the “UK Western Waters plus Channel”, as defined in Furness (2015).

3.4.235 For this region, the autumn migration BDMPS regional population was estimated to be 911,586 birds, of which 19,040 birds (12,000 adults and 7,040 immature birds) were estimated to be from Irish breeding colonies. This Irish component was subtracted from the original BDMPS autumn migration population, which gives an estimate of 892,546 birds (all ages).

3.4.236 Similarly, the spring migration BDMPS regional population was estimated to be 691,526 birds, of which 19,040 birds (12,000 adults and 7,040 immature birds) were estimated to be from Irish breeding colonies. This Irish component was subtracted from the original BDMPS spring migration population, which gives an estimate of 672,486 birds (all ages).

3.4.237 To include an estimate of Irish kittiwakes in the BDMPS reference population, an estimate of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals was calculated (Burnell *et al.*, 2023) (Table 76). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 76 Estimated Irish component of BDMPS regional reference population for kittiwake

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
49,446 adults	21,418 adults	0.898	19,233 (21,418x0.898)	40,651 birds

3.4.238 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the “UK Western Waters plus Channel” for the relevant non-breeding period, as defined in Furness (2015) (Table 77).

Table 77 Estimated BDMPS regional reference populations for kittiwake

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Autumn migration	892,546	40,651	933,197
Spring migration	672,486	40,651	713,137

3.4.239 For kittiwake, the revised autumn migration BDMPS regional population was estimated to be 933,197 birds (all ages), while the revised spring migration BDMPS regional population was estimated to be 713,137 birds (all ages) (Table 77).

3.4.240 ESAS surveys in Irish waters between 1980 and 1997 recorded moderate densities of kittiwakes off the Dublin coast throughout the year, with higher densities (2.00-4.99 birds/km²) in April and May. Kittiwakes were widespread in the Irish Sea in August and September, when higher densities (>5 birds/km²) were recorded offshore from Dublin. Between October and January, kittiwake distribution in the Irish Sea was more patchy, with some moderate to high density concentrations in the southern half of the Irish Sea at this time (Pollock *et al.*, 1997).

3.4.241 Estimated numbers of kittiwakes were derived from baseline survey data by applying Distance sampling techniques to the 2016-2017 and 2019-2020 datasets (Table 78 and Table 79).

3.4.242 The confidence limits from the Distance analysis for density estimates of birds on the water on the July 2020 survey were large (0.01 to 12,669.9 birds/km²), as were the confidence limits from the Distance analysis for density estimates of birds on the water on the December 2020 survey (0.007 to 11,511.5 birds/km²).

3.4.243 These estimates indicate that there were a small number of large flocks recorded on these surveys and that the Distance estimate for these months were not very reliable. As a result, the on-water estimates for July are based on the July 2017 and July 2019 surveys only, while the on-water estimates for December are based on December 2016 and December 2019.

Table 78 Estimated numbers of kittiwakes in the array area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	8	11	112	130	68	67	23	57	58	25	77	95
Mean	27	36	238	276	143	169	44	134	162	88	230	250
Upper	84	115	508	593	304	429	93	339	459	319	704	674
Birds in flight												
Lower	23	12	0	22	3	82	14	28	42	1	5	9
Mean	44	36	9	38	9	22	34	70	64	7	16	18
Upper	72	66	20	58	19	41	59	135	92	14	31	28

	J	F	M	A	M	J	J	A	S	O	N	D
Total												
Lower	32	23	112	151	72	76	36	86	100	26	81	104
Mean	70	72	247	314	153	191	78	204	227	95	246	268
Upper	157	181	528	651	322	470	153	473	551	333	735	701

Table 79 Estimated numbers of kittiwakes in the 4km buffer area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	32	43	423	489	257	254	85	216	219	92	289	358
Mean	100	136	896	1,041	540	635	166	506	611	330	868	943
Upper	318	432	1,915	2,234	1,144	1,617	351	1,276	1,730	1,201	2,653	2,539
Birds in flight												
Lower	87	45	0	81	13	31	52	106	157	4	17	34
Mean	164	134	34	142	36	83	129	264	243	27	59	68
Upper	272	250	77	218	71	155	224	508	347	52	117	104
Total												
Lower	119	88	423	570	270	285	138	322	377	97	306	392
Mean	265	270	929	1,183	575	718	295	770	854	357	927	1,011
Upper	591	682	1,991	2,453	1,215	1,773	575	1,784	2,077	1,254	2,770	2,643

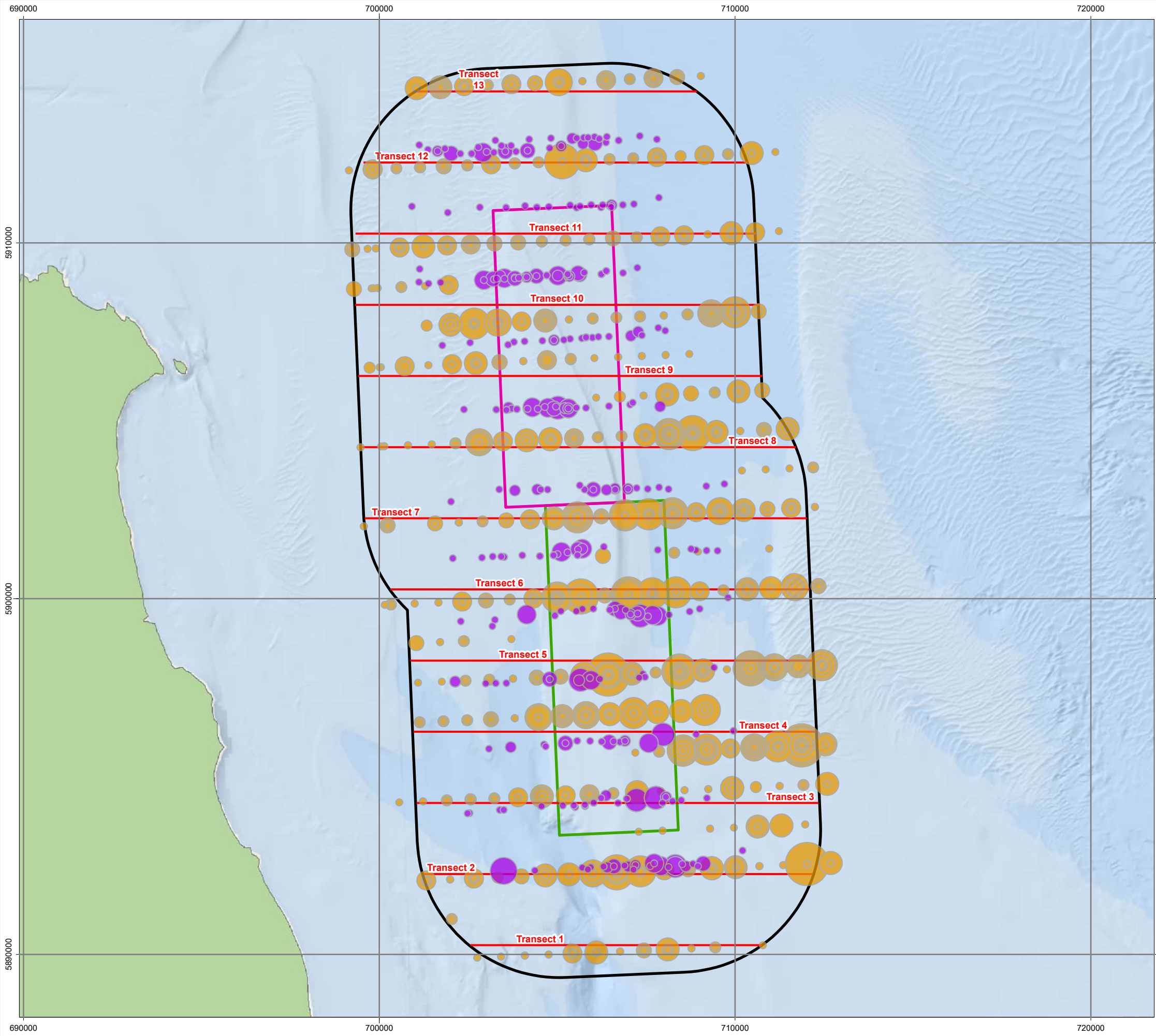
3.4.244 Overall, estimated numbers of kittiwakes in the offshore ornithology study area on baseline surveys were slightly lower in the breeding season than in the non-breeding season. In the migration-free breeding season, the peak mean was 728 birds in April. In the autumn migration period of the non-breeding season, the peak mean was 1,279 birds in December, while in the spring migration period, the peak mean was 1,497 birds in April (Table 80).

Table 80 Estimated numbers of kittiwakes in the array area plus 2km and 4km buffer areas, based on data from 2016-2017 and 2019-2021 surveys

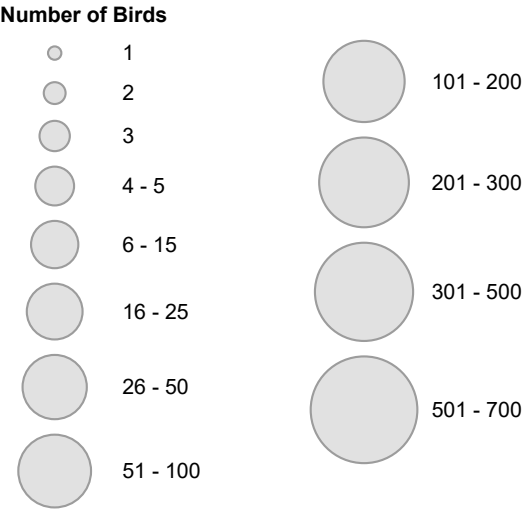
	J	F	M	A	M	J	J	A	S	O	N	D
Array area and 2km Buffer												
Lower	50	42	324	411	202	284	136	202	212	111	221	274
Mean	130	137	709	850	485	622	247	470	538	387	666	749
Upper	328	386	1,506	1,756	1,053	1,405	437	1,108	1,394	1,116	1,979	1,965

	J	F	M	A	M	J	J	A	S	O	N	D
Array area and 4km Buffer												
Lower	151	111	535	721	342	361	174	408	477	123	387	496
Mean	335	342	1,176	1,497	728	909	373	974	1,081	452	1,173	1,279
Upper	748	863	2,519	3,104	1,537	2,243	728	2,257	2,628	1,587	3,505	3,344

3.4.245 Kittiwakes were widely distributed across the offshore ornithology study area in the breeding season (late March to August) (Figure 33). Highest concentrations were generally recorded in the array area and the offshore buffer area at this time, with lower numbers recorded inshore of the array area.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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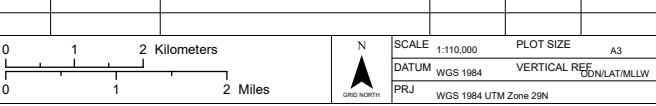
Dublin Array

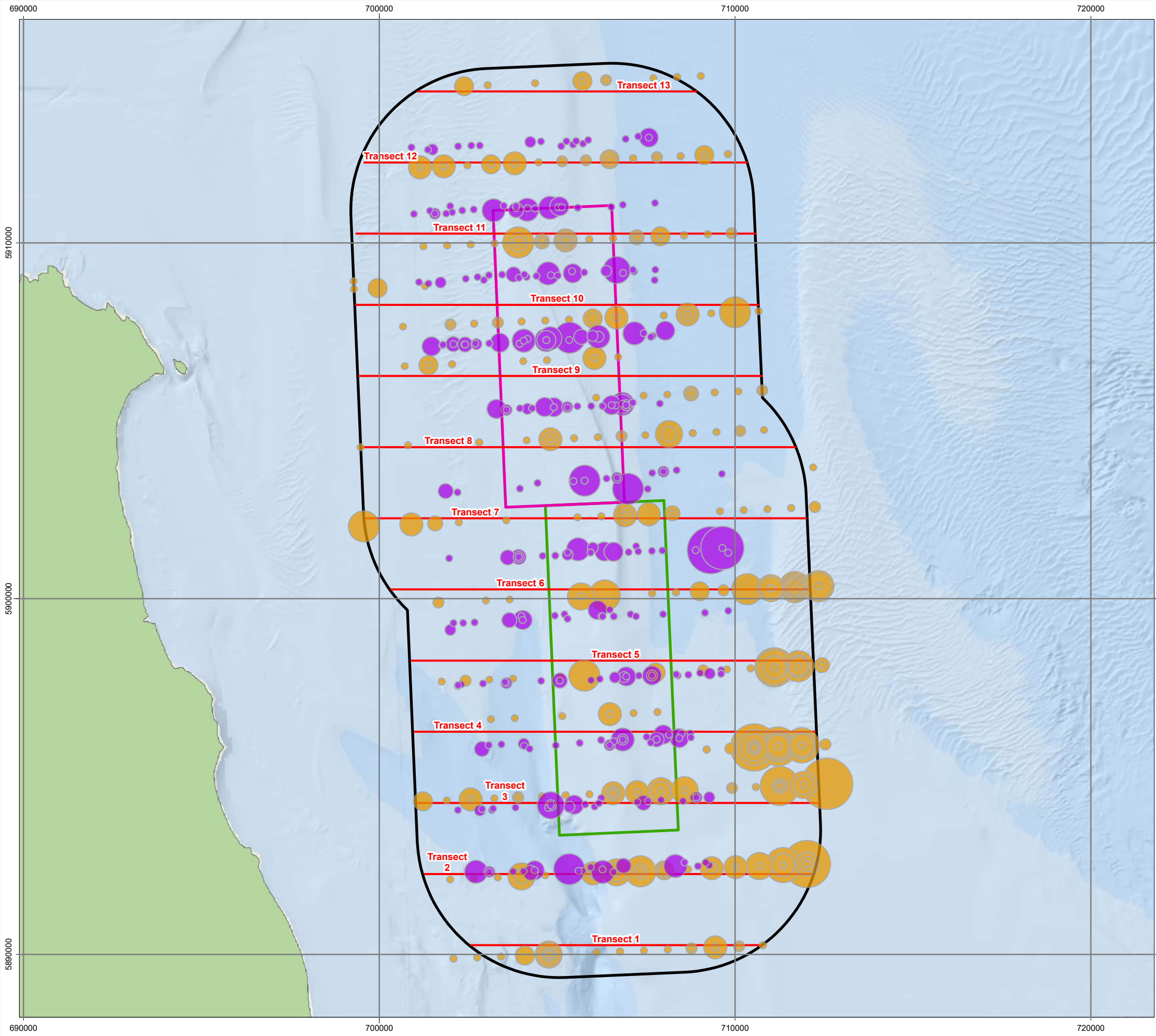
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**Marine Bird Survey
Kittiwake Sightings in the Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys**

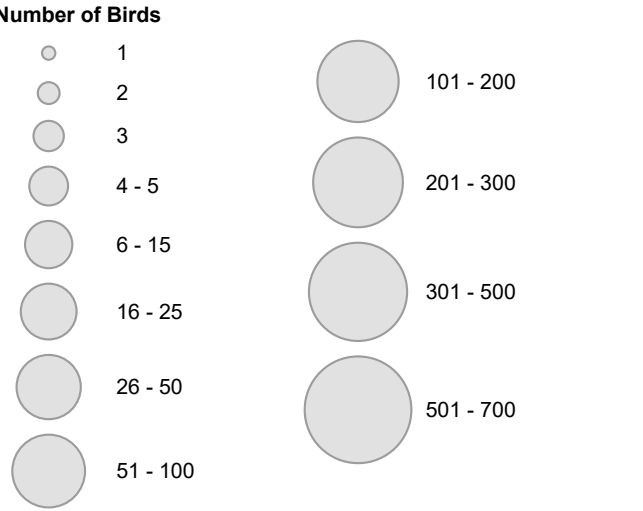
DRAWING NUMBER: **Figure 33** PAGE NUMBER: **Page 30 of 64**

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01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE





- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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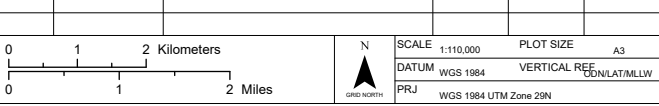
Dublin Array

DRAWING TITLE

Marine Bird Survey
Kittiwake Sightings in the Non-Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER: **Figure 34** PAGE NUMBER: **Page 31 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE



3.4.246 Kittiwakes were also widely distributed across the study area in the non-breeding season, with highest concentrations recorded in the array area and southern half of the outer offshore buffer area (Figure 34).

3.4.247 Previous 2001-2002 surveys recorded kittiwakes in all survey months, with estimated peaks of 1,052 birds in April 2002 and 4,382 birds in September 2002 (Percival *et al.*, 2002). On 2010-2011 surveys, kittiwakes were also recorded in every survey month, with peak raw counts of 1,577 birds in July 2010 and 1,753 birds in August 2010 (Newton and Trewby, 2011).

3.4.248 A total of 2,421 kittiwakes were recorded off the Irish east coast on the ObSERVE 2016 aerial surveys, across all three seasons covered. 1,355 individuals were recorded in autumn, with 567 birds recorded in winter and 499 birds in summer. During the breeding season, sightings were concentrated in the central part of the survey area, with hotspots shifting further north and south during the non-breeding period. Kittiwakes were recorded over a wide range of depths across the survey area, although there were comparatively fewer sightings over waters deeper than 80 m. Mean density of kittiwakes across the survey area was 0.57 birds/km² in summer, 1.47 birds/km² in autumn, and 0.57 birds/km² in winter. Abundance of kittiwakes across the survey area was estimated at 628 (95% CIs 425 - 929) individuals in summer, 13,892 (95% CIs 11,314 – 17,057) birds in autumn, and 1,453 (95% CIs 908 – 2,326) birds in winter (Jessopp *et al.*, 2018).

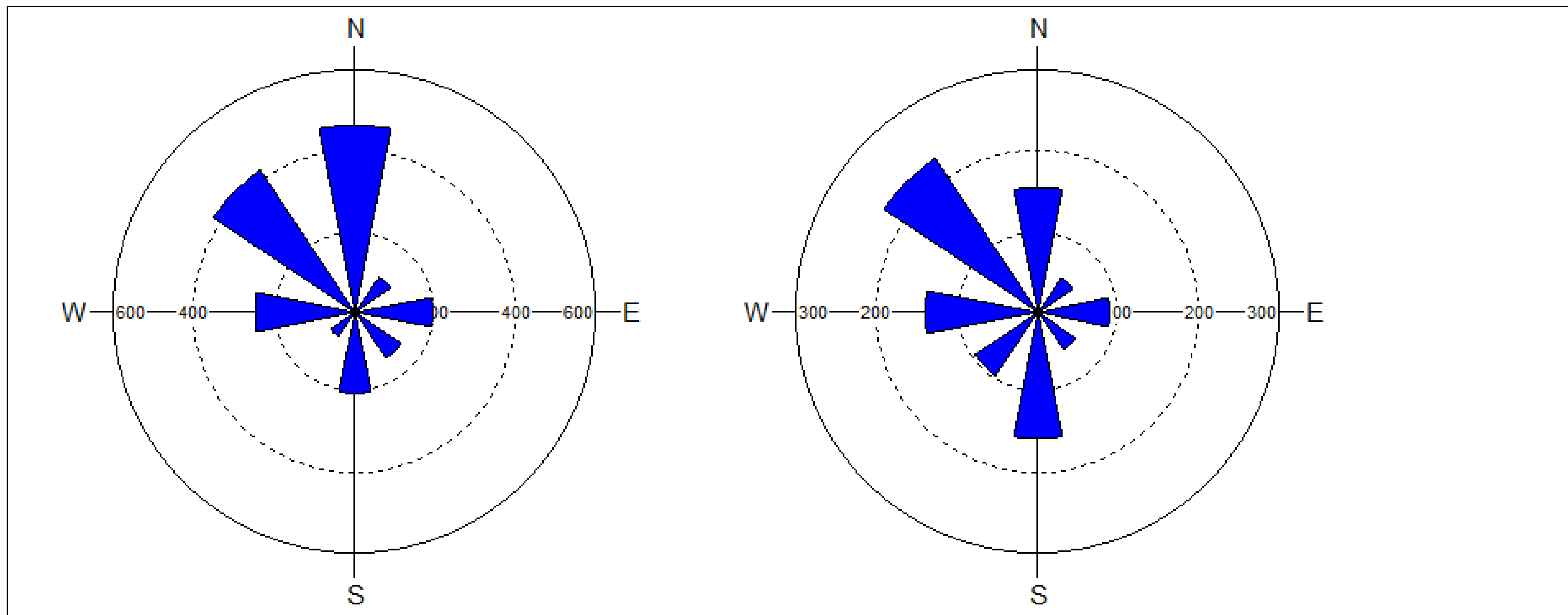
3.4.249 Flight height was recorded for 6,234 kittiwakes on baseline surveys in 2016-2017 and 2019-2021, with 94.5% of all birds flying below 20 m MSL in height, i.e. below likely rotor-swept height. A total of 956 birds were recorded flying below 5 m, with 2,161 birds flying between 5 and 10 m, 2,776 birds flying between 10 and 20 m, 300 birds between 20 and 30 m and 41 birds flying above 30 m in height (Table 9).

3.4.250 A total of 4,064 kittiwakes were aged on baseline surveys in the study area between 2016-2017 and 2019-2021. In the migration-free breeding season (May to July), age was recorded for 1,399 kittiwakes, with zero juvenile birds, 35 immature (non-breeding) birds (2.5%) and 1,364 adults (97.5%) aged on surveys (Table 81). Overall, 2.5% of aged kittiwakes in the migration-free breeding season were immature birds.

Table 81 Monthly breakdown of juvenile, immature and adult kittiwakes in the offshore ornithology study area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Juvenile	0	0	0	0	0	0	0	22	20	22	14	4
Immature	0	0	6	1	30	0	5	3	1	3	2	2
Adult	48	5	440	362	331	624	409	263	296	374	144	633
Number aged	48	5	446	363	361	624	414	288	317	399	160	639
Percentage of non-adult birds	0	0	1.3	0.3	8.3	0	1.2	8.7	6.6	6.3	10.0	0.9

3.4.251 Flight direction was recorded for 1,849 kittiwakes in the breeding season (March to August), with direction recorded for 973 birds in the non-breeding season (September to February) (Figure 35).



March to August (n=1,849 birds)

Numbers shown on figures are number of birds recorded

September to February (n=973 birds)

Figure 35 Flight direction of kittiwakes recorded on 2016-2017 and 2019-2021 surveys

3.4.252 In the breeding season, the majority of kittiwakes were recorded flying either north (25.0%) or north west (22.8%), with fewer birds recorded flying in other directions. In the non-breeding period, 23.5% of all kittiwakes were recorded flying north west, with 16.1% recorded flying south, and 15.9% flying north. An additional 3,436 kittiwakes were recorded as circling on baseline surveys (not shown).

Sandwich Tern

3.4.253 Sandwich Terns are summer visitors to Irish waters, breeding at coastal colonies predominantly on the east coast. The breeding population in Ireland has been estimated at 2,464 pairs on the recent Seabirds Count national census, which is an increase of 39% compared to the previous Seabird 2000 population estimate (Burnell *et al.*, 2023). It is considered that these increases are at least partially due to increases at the largest colony at Lady's Island Lake, in Wexford (Cummins *et al.*, 2019).

3.4.254 The breeding season for Sandwich tern has been defined as April to August (Furness, 2015) (Table 3). During the breeding season, adults may travel moderate distances from their colonies to forage, with a mean maximum foraging range of 34.3 ± 23.2 km (Woodward *et al.*, 2019). There are no Sandwich tern breeding colonies within foraging range of Dublin Array. The closest colonies are Lady's Island Lake (1,780 pairs in 2018) and Carlingford Lough (24 pairs in 2019) (SMP, 2020).

3.4.255 Sandwich terns are Amber-listed in Ireland because 50% of the breeding population occurs at 10 or fewer sites (Gilbert *et al.*, 2021).

3.4.256 Sandwich terns winter off the coast of West Africa (Wernham *et al.*, 2002). Furness (2015) considered that for Sandwich tern outside the breeding season there were two BDMPS periods; autumn migration (July to September) and spring migration (March to May). The relevant BDMPS region for Sandwich tern is the "UK Western Waters", as defined in Furness (2015).

3.4.257 For this region, the autumn and spring migration BDMPS regional populations were estimated to be 10,761 birds, of which 1,760 birds (1,080 adults and 680 immature birds) were estimated to be from Irish breeding colonies. This Irish component was subtracted from the original BDMPS autumn and spring migration populations, which gives an estimate of 9,001 birds (all ages).

3.4.258 To include an estimate of Irish Sandwich terns in the BDMPS reference population, an estimate of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals was calculated (Burnell *et al.*, 2023) (Table 82). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 82 Estimated Irish component of BDMPS regional reference population for Sandwich tern

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
4,928 adults	3,598 adults	0.538	1,936 (3,598x0.538)	5,534 birds

3.4.259 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the “UK Western Waters plus Channel” for the relevant non-breeding period, as defined in Furness (2015) (Table 83).

Table 83 Estimated BDMPS regional reference populations for Sandwich tern

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Autumn migration	9,001	5,534	14,535 birds
Spring migration	9,001	5,534	14,535 birds

3.4.260 For Sandwich tern, the revised autumn and spring migration BDMPS regional populations were estimated to be 14,535 birds (all ages)(Table 83).

3.4.261 ESAS surveys in Irish waters between 1980 and 1997 recorded low numbers of Sandwich terns off the Dublin coast between March and September, although coverage of inshore waters, where this species tends to occur, was limited on these surveys (Pollock *et al.*, 1997).

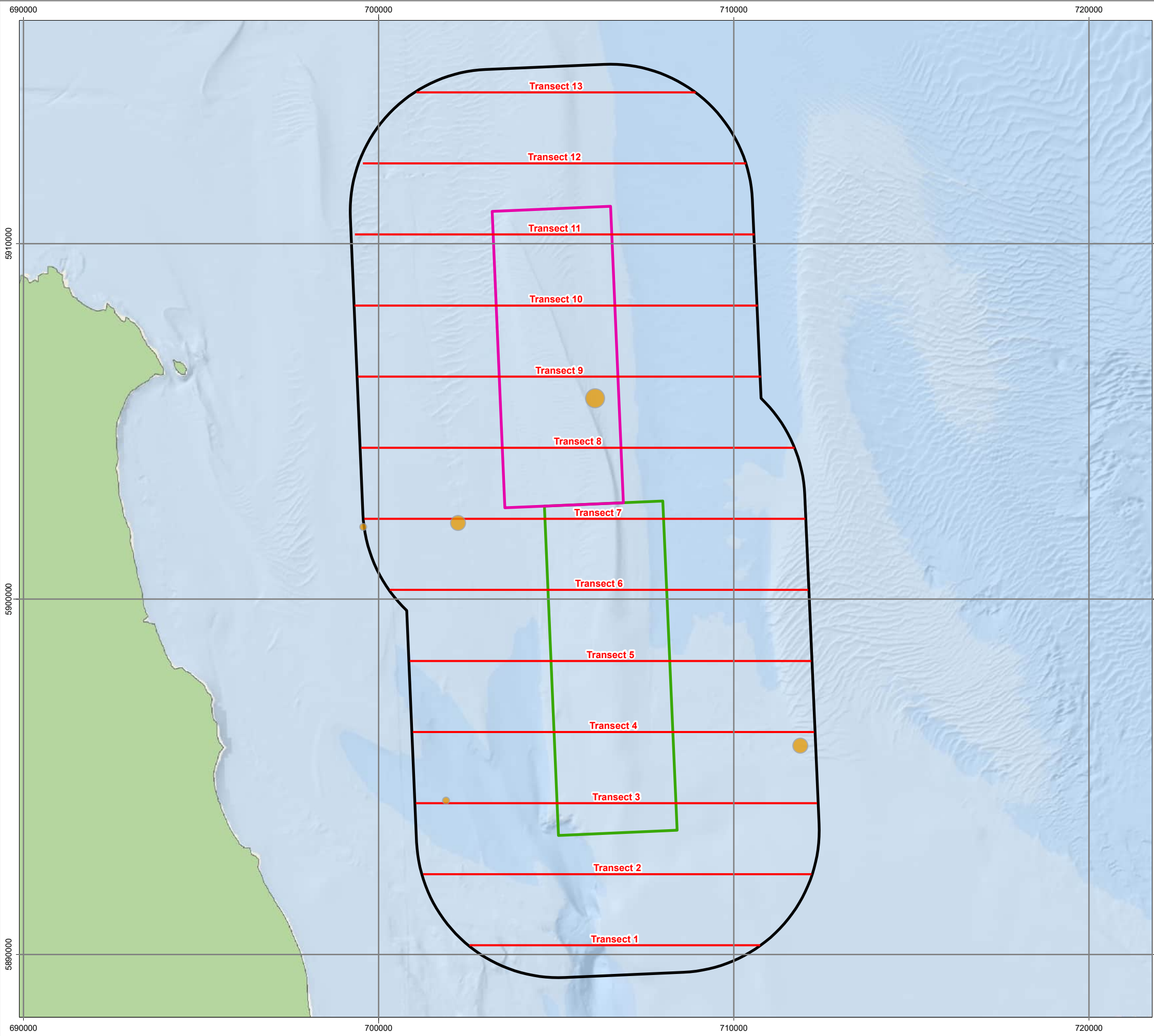
3.4.262 Sandwich terns were not recorded on 2016-2017 baseline surveys. On 2019-2021 surveys, a total of 13 Sandwich terns were recorded, with seven birds recorded in early August 2019, three birds in late August 2019 and three birds on 6th May 2020. Birds were scattered throughout the study area, with sightings of five birds in the array area in August, while the remaining birds were recorded in the buffer area in May and August (Figure 36).

3.4.263 No Sandwich terns were recorded on previous 2001-2002 surveys (Percival *et al.*, 2002), or on 2010-2011 surveys (Newton and Trewby, 2011).

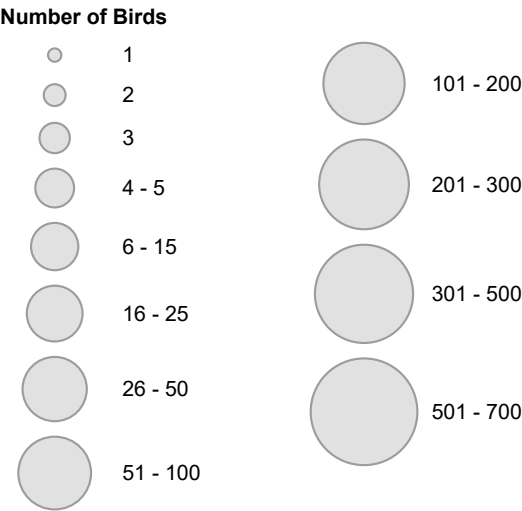
3.4.264 A total of 90 Sandwich terns were recorded off the Irish east coast on the ObSERVE 2016 aerial surveys, in summer and autumn months. The aerial surveys found that Sandwich terns showed a clear preference for shallower waters, with a peak in waters of 10 m depth, likely associated with shallow sandbanks. Average density on surveys was 0.07 birds/km² in summer and 0.04 birds/km² in autumn. Abundance of Sandwich terns across the survey area was estimated at 642 (95% CIs 450 - 917) individuals in summer, and 331 (95% CIs 230 - 476) birds in autumn (Jessopp *et al.*, 2018).

3.4.265 The ObSERVE report concluded that the distribution of Sandwich tern in the breeding season was largely influenced by the location of Lady’s Island Lake colony in Wexford, and that the absence of a more northerly breeding colony on the Irish east coast suggested that sightings in the northern survey transects are likely to be non-breeding birds. This suggests that the few Sandwich terns recorded on the 2019-2020 surveys between May and August were also likely to be non-breeding birds.

3.4.266 Flight height was recorded for eight Sandwich terns, with 62.5% of all birds flying below 20 m MSL in height, i.e. below likely rotor-swept height. Four birds recorded flying between five and 10 m, with one flying between 10 and 20 m and three birds flying between 20 and 30 m in height.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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Dublin Array

DRAWING TITLE

Marine Bird Survey
Sandwich Tern Sightings in the Breeding Season on 2019-2021 Baseline Surveys

DRAWING NUMBER: Figure 36

PAGE NUMBER: Page 32 of 64

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01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE



Roseate Tern

- 3.4.267 Roseate terns in Ireland breed at two colonies, Rockabill Island in County Dublin, and Lady's Island Lake in County Wexford. The breeding population in Ireland has been estimated at 1,869 pairs on the recent Seabirds Count national census, which is an increase of 155% compared to the previous Seabird 2000 population estimate (Burnell *et al.*, 2023). The species is Amber-listed in Ireland because there has been a moderate decline of 46% in the breeding range between 1968 and 2011, and because more than 50% of the Irish breeding population is concentrated in less than 10 sites. In addition, the Irish population represents 40% of the European population and the species has an unfavourable conservation status in Europe (Gilbert *et al.*, 2021). Roseate tern is also listed on Annex I of the EC Birds Directive.
- 3.4.268 The most recently available counts for the two colonies were 1,704 pairs at Rockabill in 2021 (BWI, 2021), and 273 pairs at Lady's Island Lake in 2020, up from 195 pairs there in 2019 (Irish Times, 2020). However, Roseate terns breeding at both colonies were affected by Highly Pathogenic Avian Influenza (HPAI) during the 2023 breeding season (BWI, 2023), although effects at the population level are not yet known.
- 3.4.269 The breeding season has been defined as May to August (Furness, 2015) (Table 3). During the breeding season, adults travel short distances from their colonies to forage, with a mean maximum foraging range of 12.6 ± 10.6 km (Woodward *et al.*, 2019). Dublin Array is outside the mean maximum foraging range for both the Rockabill and Lady's Island Lake colonies.
- 3.4.270 In addition to the two current Irish colonies, roseate terns did breed on Dalkey Island in County Dublin between 2004 (11 pairs) and 2015 (1 pair). Dalkey Island is within mean maximum foraging range of Dublin Array. However, although birds were recorded present in subsequent breeding seasons, there was no proven evidence of definite breeding during recent surveys for Seabirds Count (Burnell *et al.*, 2023), so for the purposes of the EIA assessment, it was considered that there are no breeding colonies of roseate tern within foraging range of Dublin Array.
- 3.4.271 After the breeding season, Roseate terns migrate south along the Atlantic seaboard to winter in the Gulf of Guinea, West Africa (Wernham *et al.*, 2002). Furness (2015) considered that for roseate tern outside the breeding season there were two BDMPS periods; autumn migration (August to September) and spring migration (late April to May). The relevant BDMPS region for roseate tern is the "West England and Wales", as defined in Furness (2015).
- 3.4.272 For this region, Furness (2015) based the autumn and spring migration BDMPS regional populations entirely on the Irish population, which at the time was estimated to be 2,100 birds (1,425 adults and 675 immature birds). On this basis, the revised BDMPS estimate has been based on the number of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals (Burnell *et al.*, 2023) (Table 84). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 84 Estimated Irish component of BDMPS regional reference population for roseate tern

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
3,738 adults	3,738 adults	0.701	2,620 (3,738x0.701)	6,358 birds

3.4.273 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the “West England and Wales” for the relevant non-breeding period, as defined in Furness (2015) (Table 85).

Table 85 Estimated BDMPS regional reference populations for roseate tern

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Autumn migration	0	6,358	6,358 birds
Spring migration	0	6,358	6,358 birds

3.4.274 For roseate tern, the revised autumn and spring migration BDMPS regional populations were estimated to be 6,358 birds (all ages)(Table 85).

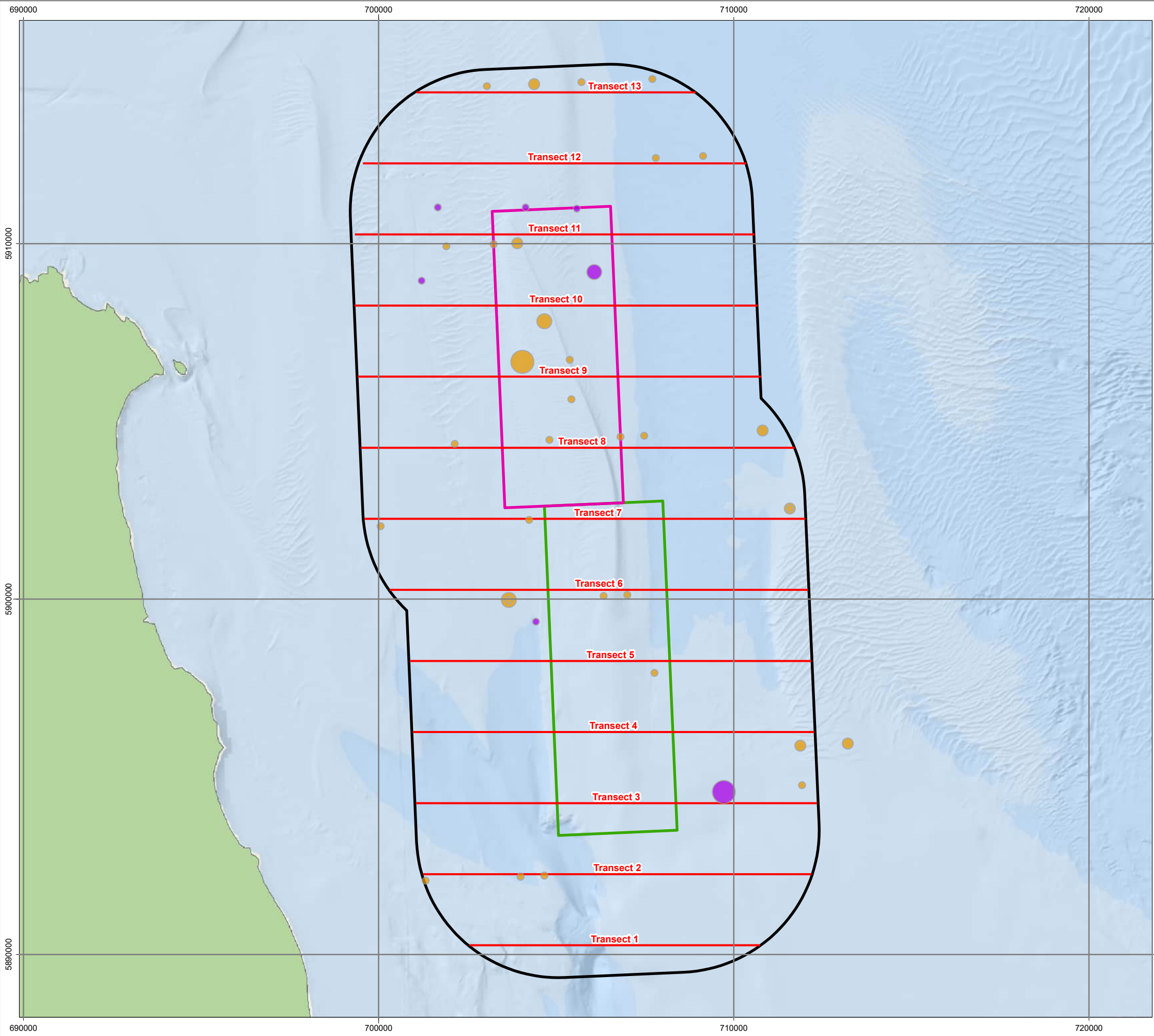
3.4.275 There were only six roseate terns recorded on ESAS surveys in Irish waters between 1980 and 1997. All six sightings were in the Irish Sea, with four birds in May and two birds in August (Pollock *et al.*, 1997).

3.4.276 Baseline surveys in the offshore ornithology study area recorded roseate terns between May and September. The 2016-2017 surveys recorded 56 roseate terns over the survey period, with peak counts of 19 birds in September 2016, and 20 birds in September 2017. On 2019-2021 surveys, 63 roseate terns were recorded, with peak counts of 11 birds on 6th May 2020 (not shown in Table 86), 16 birds in late May 2020, and 10 birds in early August 2019. Average abundance (birds/km) over the two survey periods was low, with a peak of 0.12 birds/km in May, 0.13 birds/km in August and 0.19 birds/km in September (Table 86). For months with more than one survey, the peak number recorded on any one survey is shown.

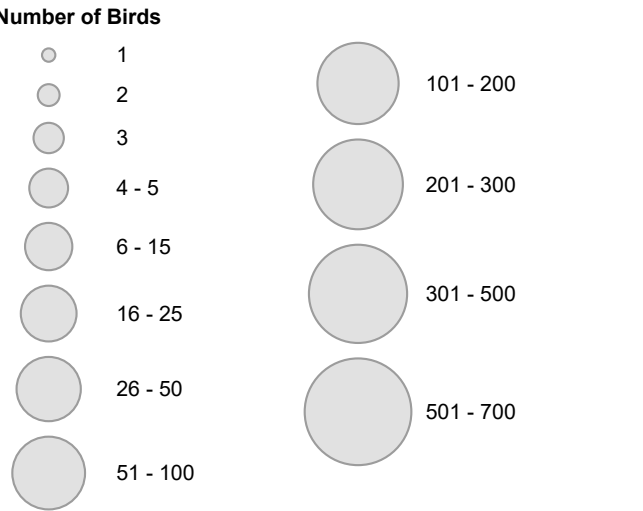
Table 86 Peak monthly counts (raw numbers) of roseate terns in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	0	0	-	0	0	9	8	20	0	0	0
2019-21	0	-	0	0	16	4	5	10	2	0	0	0
Average abundance (birds/km)	0.00	0.00	0.00	0.00	0.12	0.02	0.09	0.13	0.19	0.00	0.00	0.00

3.4.277 In the breeding season (May to August), roseate terns were scattered throughout the offshore ornithology study area in low numbers, with occasional higher numbers recorded in or close to the array area (Figure 37).



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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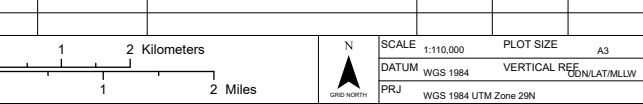
Dublin Array

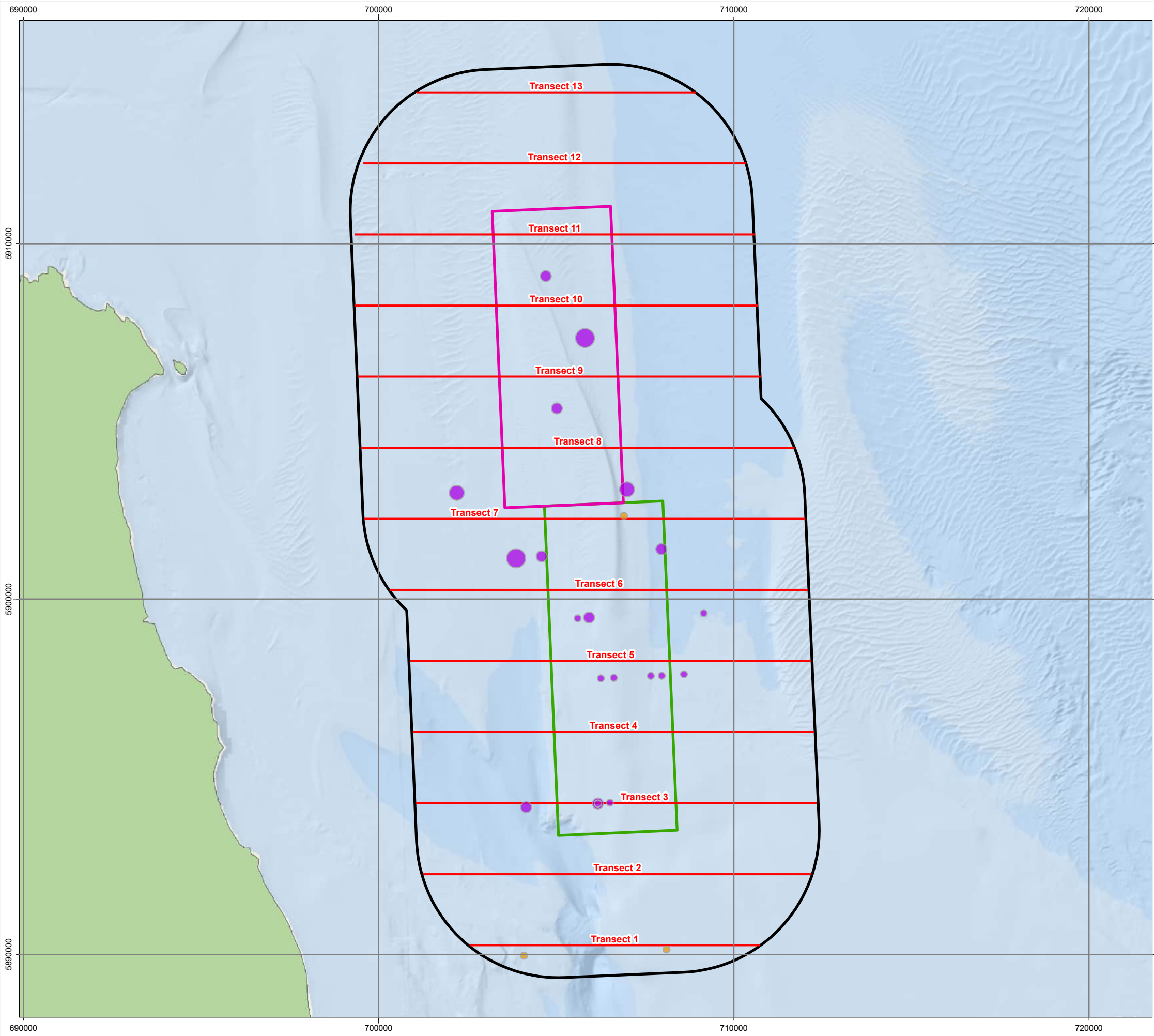
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Marine Bird Survey
Roseate Tern Sightings in the Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys

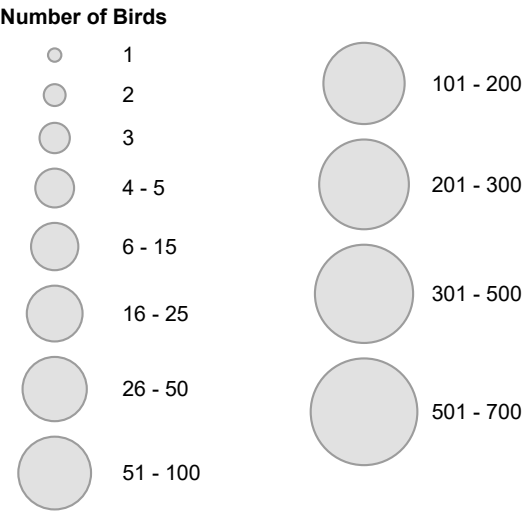
DRAWING NUMBER: **Figure 37** PAGE NUMBER: **Page 33 of 64**

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- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
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- Bird Sighting 2019 - 2021



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Dublin Array

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Marine Bird Survey
Roseate Tern Sightings in September on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER: **Figure 38** PAGE NUMBER: **Page 34 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE



- 1.1.1 After the breeding season (September), roseate terns were scattered predominantly in the northern half of the offshore ornithology study area in low numbers on 2016-2017 baseline surveys (Figure 38). There were only two roseate terns recorded in September on the 2019-2021 baseline surveys, in the southern end of the buffer area.
- 3.4.278 Previous 2001-2002 surveys roseate terns between June and September, with estimated peaks of 282 birds in August 2002 and 250 birds in September 2002 (Percival *et al.*, 2002). On 2010-2011 surveys, roseate terns were recorded between July and September, with a peak of 157 birds (raw count) in July 2010 (Newton and Trewby, 2011).
- 3.4.279 A total of 165 roseate terns were recorded off the Irish east coast on the ObSERVE 2016 aerial surveys, in summer and autumn months. Sightings were mainly in the northernmost transects, closer to the colony on Rockabill, although there were some observations in more southerly transects east and north of Wexford harbour. The surveys found that Roseate terns were recorded over a wide range of water depths, with a peak in occurrence from 20-50 m water depth, suggesting that there was no particular association with shallow sandbanks. Average density was 0.14 birds/km² in summer and 0.04 birds/km² in autumn. Abundance of roseate tern across the survey area was estimated at 1,260 (95% CIs 724 – 2,190) individuals in summer, and 347 (95% CIs 198 - 608) birds in autumn (Jessopp *et al.*, 2018).
- 3.4.280 Flight height was recorded for 100 roseate terns on baseline surveys in 2016/17 and 2019/20, with 100% of birds flying below 20 m MSL in height i.e. below likely rotor-swept height. A total of 22 birds were recorded flying below 5 m, with 57 birds flying between 5 and 10 m and 21 birds flying between 10 and 20 m in height (Table 9).
- 3.4.281 A total of 48 roseate terns were aged on baseline surveys, with 37 adults and 11 juvenile birds recorded.

Common Tern

- 3.4.282 Common terns are summer visitors to Ireland, breeding in colonies at coastal sites and also at a few inland colonies. The breeding population in Ireland has been estimated at 4,728 pairs on the recent Seabirds Count national census, which is an increase of 91% compared to the previous Seabird 2000 population estimate (Burnell *et al.*, 2023). The species is Amber-listed in Ireland because more than 50% of the Irish breeding population is concentrated at 10 sites or less (Gilbert *et al.*, 2021). In addition, the species is also listed on Annex I of the EC Birds Directive.
- 3.4.283 Over half of all Irish common terns breed at two large colonies; Rockabill in County Dublin (2,034 pairs between 2016 and 2018), and Lady's Island Lake in County Wexford (979 pairs between 2016 and 2018). Although survey effort increased for the Seabirds Count surveys compared to previous surveys in 1984 and 1995, the main reason for the increasing population trends in both the short and long-term, has been direct conservation measures taken at these colonies (Cummins *et al.*, 2019).

3.4.284 The breeding season has been defined as May to August (Furness, 2015) (Table 3). During the breeding season, adults travel short distances from their colonies to forage, with a mean maximum foraging range of 18.0 ± 8.9 km (Woodward *et al.*, 2019). Dublin Array is outside the mean maximum foraging range for both the Rockabill and Lady's Island Lake colonies, however, three colonies are within mean maximum foraging range ± 1 SD of Dublin Array (Table 87) (Burnell *et al.*, 2023).

Table 87 Recent counts for common tern colonies within mean maximum foraging range of Dublin Array

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Common tern (18.0 ± 8.9 km)	Dalkey Islands (Dublin)	12.5 km	23 pairs (2016-2017)
	Dublin Port (Dublin)	22.4 km	494 pairs (2016)
	Estimated breeding season population within mean maximum foraging range ± 1 SD		517 pairs

3.4.285 Common terns breeding at several Irish colonies were affected by HPAI during the 2023 breeding season (BWI, 2023), although effects at the population level are not yet known.

3.4.286 After the breeding season, common terns migrate south along the Atlantic seaboard to winter along the west coast of Africa (Wernham *et al.*, 2002). Furness (2015) considered that for common tern outside the breeding season there were two BDMPS periods; autumn migration (late July to early September) and spring migration (April to May). The relevant BDMPS region for common tern is the "UK Western Waters", as defined in Furness (2015).

3.4.287 For this region, the autumn and spring migration BDMPS regional populations were estimated to be 64,659 birds, of which 3,607 birds (2,160 adults and 1,447 immature birds) were estimated to be from Irish breeding colonies. This Irish component was subtracted from the original BDMPS autumn and spring migration populations, which gives an estimate of 61,052 birds (all ages).

3.4.288 To include an estimate of Irish common terns in the BDMPS reference population, an estimate of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals was calculated (Burnell *et al.*, 2023) (Table 88). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 88 Estimated Irish component of BDMPS regional reference population for common tern

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
9,456 adults	7,612 adults	0.701	5,336 (7,612x0.701)	12,948 birds

3.4.289 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the “UK Western Waters” for the relevant non-breeding period, as defined in Furness (2015) (Table 89).

Table 89 Estimated BDMPS regional reference populations for common tern

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Autumn migration	61,052	12,948	74,000 birds
Spring migration	61,052	12,948	74,000 birds

3.4.290 For common tern, the revised autumn and spring migration BDMPS regional populations were estimated to be 74,000 birds (all ages)(Table 89).

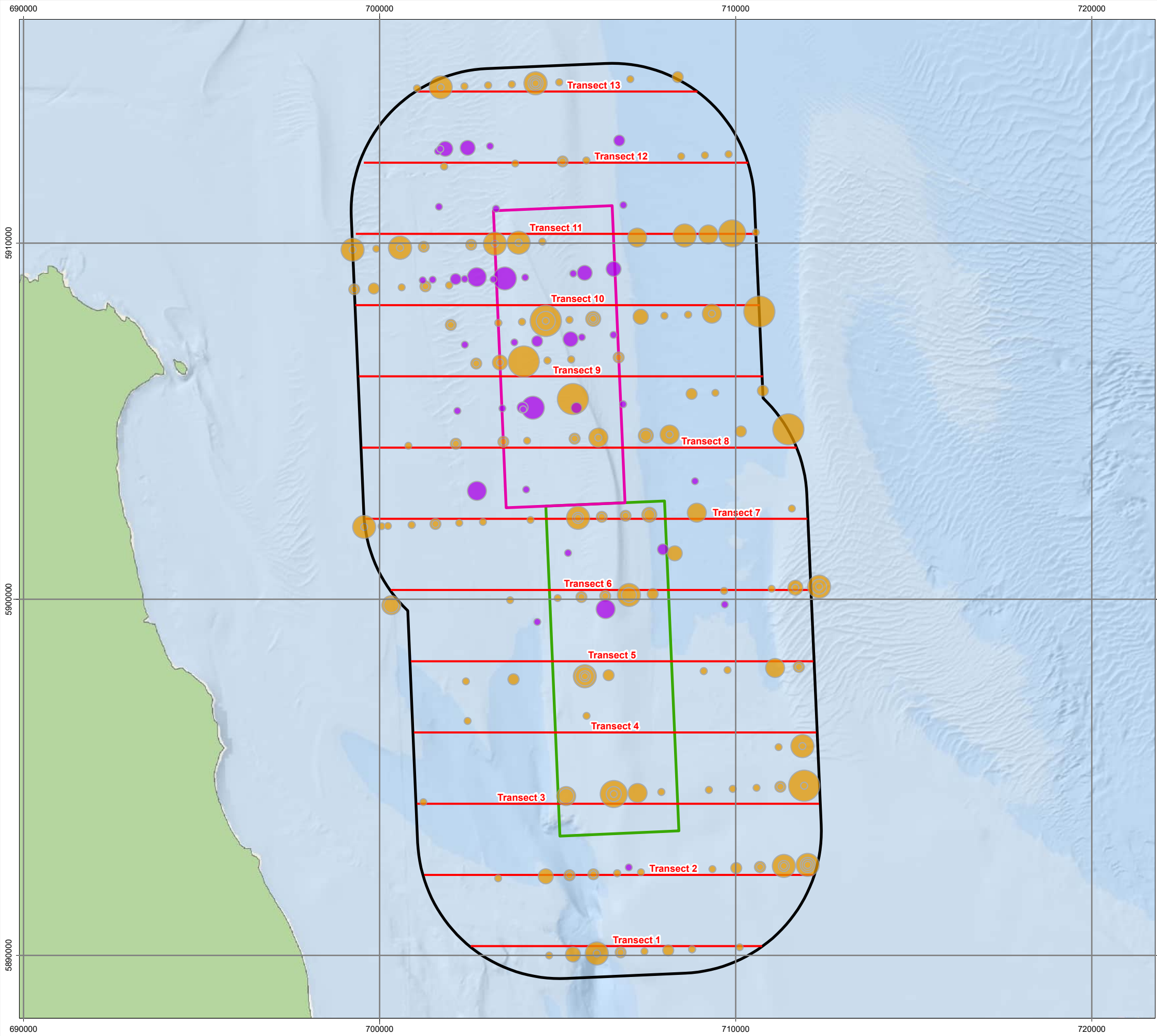
3.4.291 ESAS surveys in Irish waters between 1980 and 1997 presented combined data for common and Arctic terns, due to their similarity. Surveys recorded low densities of common and Arctic terns off the Dublin coast in May and June, close to the main breeding colonies on Rockabill. Common and Arctic terns were more widespread at low to moderate densities in the Irish Sea between July and September following chick fledging (Pollock *et al.*, 1997).

3.4.292 The 2016-2017 baseline surveys recorded 462 common terns between May and October, with peak counts of 97 birds in September 2016 and 279 birds in September 2017. On the 2019-2021 baseline surveys, a total of 957 common terns were recorded between April and September, with peak counts of 123 birds in July 2019, 106 birds in early August 2019 and 279 birds in August 2020. Average abundance (birds/km) between April and October was moderate, with a peak of 2.00 birds/km in September (Table 90). For months with more than one survey, the peak number recorded on any one survey is shown.

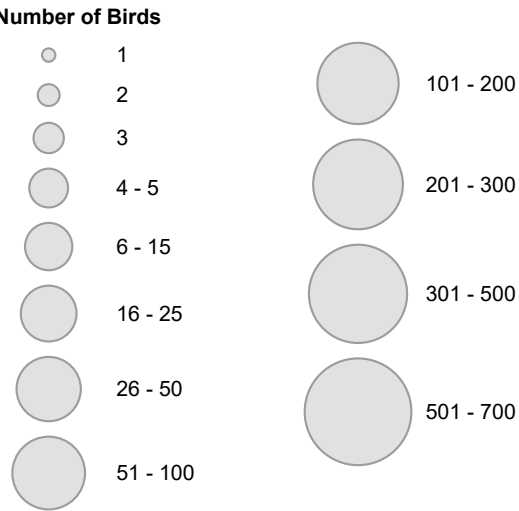
Table 90 Peak monthly counts (raw numbers) of common terns in the offshore ornithology study area on 2016-2017 and 2019-2020 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	0	0	-	37	7	28	12	279	2	0	0
2019-21	0	-	0	22	97	43	123	279	42	0	0	0
Average abundance (birds/km)	0.00	0.00	0.00	0.15	0.99	0.31	1.05	1.68	2.00	0.02	0.00	0.00

- 3.4.293 Previous boat-based surveys between September 2001 and September 2002 recorded common terns between June and September, with estimated peaks of 583 birds in August 2002 and 487 birds in September 2002 (Percival *et al.*, 2002). Surveys between June 2010 and June 2011 recorded common terns between May and October, with peak raw counts of 654 birds in August 2010 and 391 birds in September 2010 (Newton and Trewby, 2011).
- 3.4.294 Common and Arctic terns could not be differentiated by eye on the ObSERVE 2016 aerial surveys, and so sightings were grouped together for the purposes of analysis. A total of 1,235 common/Arctic terns were recorded throughout the survey area off the Irish east coast in summer and autumn. The majority of sightings were recorded over shallow areas in the central transects of the survey area during the summer breeding season, with some sightings also concentrated around Wexford harbour. Mean density of common/Arctic terns was 0.49 birds/km² in summer, and 0.79 birds/km² in autumn. Abundance of common/Arctic terns across the survey area was estimated at 4,514 (95% CIs 3,883 – 5,247) individuals in summer, and 7,268 (95% CIs 5,178 – 10,202) birds in autumn (Jessopp *et al.*, 2018).
- 3.4.295 Common terns were widespread throughout the offshore ornithology study area on baseline surveys in the breeding season (May to August) (Figure 39). Larger numbers of birds were recorded on the 2019-2021 baseline surveys compared to the 2016-2017 surveys. Generally, common terns were predominantly recorded in the north and east of the offshore ornithology study area, with fewer birds in the west and south at this time.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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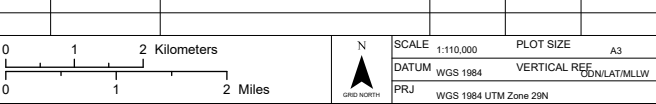
Dublin Array

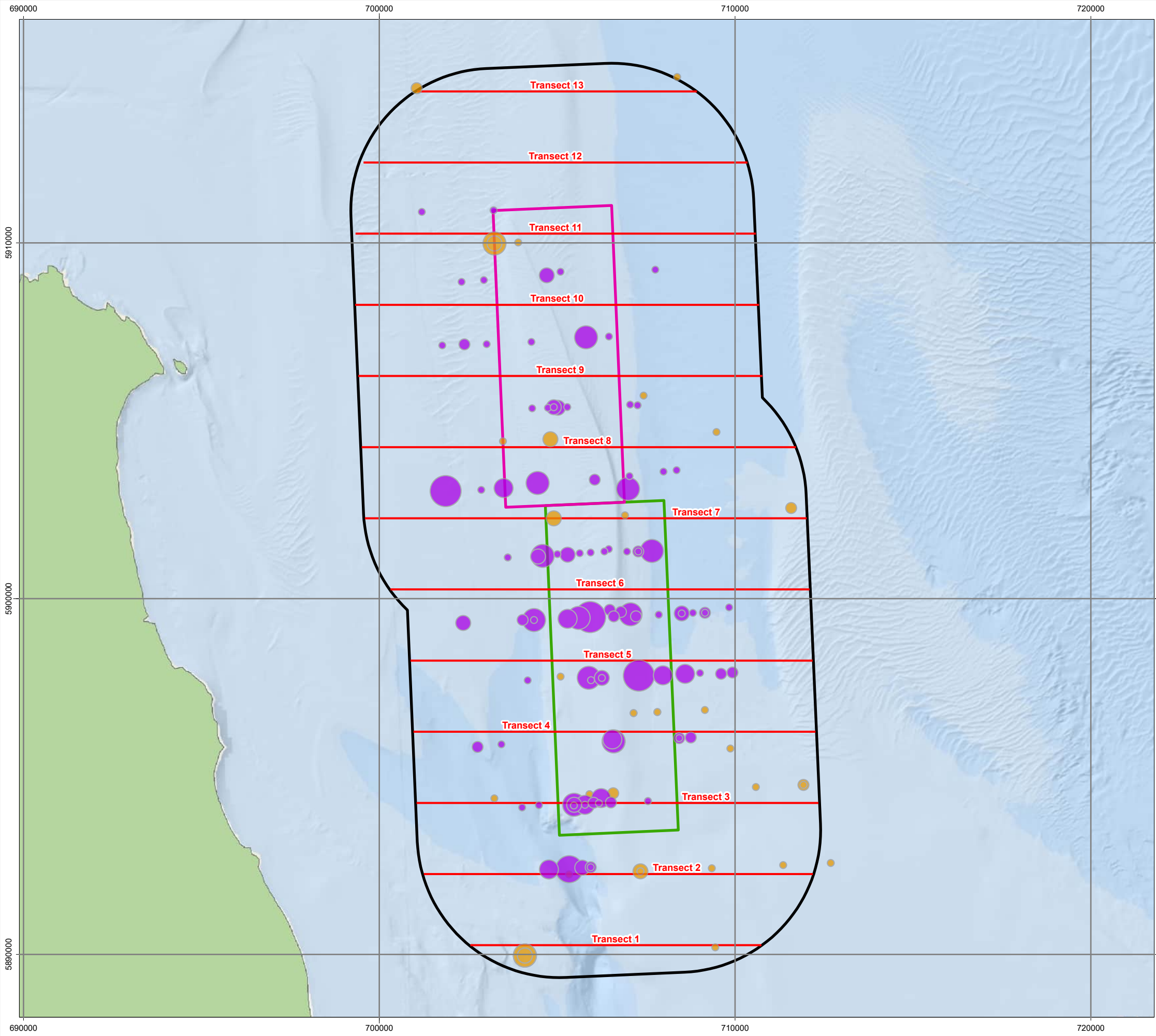
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**Marine Bird Survey
Common Tern Sightings in the Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys**

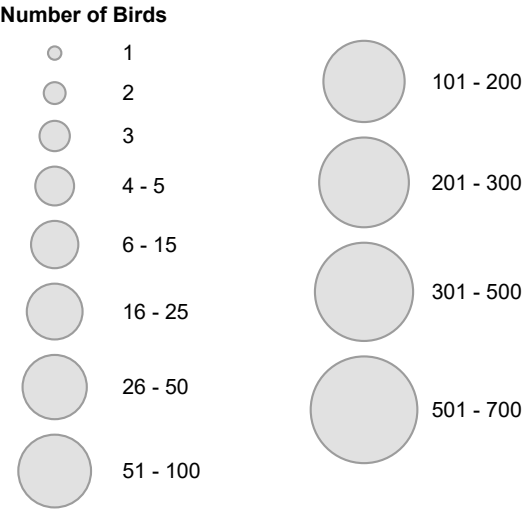
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- Bray Bank Array Area
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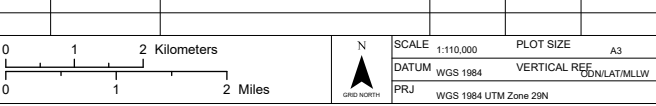
Dublin Array

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Marine Bird Survey
Common Tern Sightings in April and September on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER: **Figure 40** PAGE NUMBER: **Page 36 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
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3.4.296 On 2016-2017 baseline surveys in the spring and autumn migration periods (April and September), common terns were recorded predominantly in or close to the southern half of the array area (Figure 40). Lower numbers were recorded in these months on 2019-2021 baseline surveys.

3.4.297 Flight height was recorded for 1,106 common terns on baseline surveys in 2016-2017 and 2019-2021, with 99.5% of all birds recorded flying below 20 m MSL in height i.e. below likely rotor-swept height. A total of 199 birds were recorded flying below 5 m, with 758 birds flying between 5 and 10 m, 143 birds flying between 10 and 20 m, and six birds flying between 20 and 30 m in height (Table 9).

3.4.298 A total of 371 common terns were aged on baseline surveys between 2016-2017 and 2019-2021. In the breeding season (May to August), age was recorded for 243 common terns, with 58 juvenile (fledged in summer 2020) birds (23.9%), two immature (non-breeding) birds (0.8%) and 183 adults (75.3%) aged on surveys (Table 91).

Table 91 Monthly breakdown of juvenile, immature and adult common terns in the Dublin Array study area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Juvenile	0	0	0	0	0	0	11	47	32	0	0	0
Immature	0	0	0	0	1	0	1	0	0	0	0	0
Adult	0	0	0	18	24	26	29	104	77	1	0	0
Number aged	0	0	0	18	25	26	41	151	109	1	0	0
Percentage of non-adult birds	0	0	0	0	4.0	0	29.3	31.1	29.4	0	0	0

Arctic Tern

3.4.299 Arctic terns are summer visitors to Ireland, breeding in colonies at coastal sites and also at a few inland colonies. The breeding population in Ireland has been estimated at 2,708 pairs on the recent Seabirds Count national census, which is a decrease of 1% compared to the previous Seabird 2000 population estimate (Burnell *et al.*, 2023). The species is Amber-listed in Ireland because there has been a moderate decline of 44% in the breeding range between 1998 and 2018, and a longer term decline of 57% in the breeding range between 1980 and 2018, and because more than 50% of the Irish breeding population is concentrated in less than 10 sites (Gilbert *et al.*, 2021). In addition, the species is also listed on Annex I of the EC Birds Directive.

3.4.300 The breeding season has been defined as May to early August (Furness, 2015) (Table 3). During the breeding season, adults travel short distances from their colonies to forage, with a mean maximum foraging range ± 1 SD of 25.7 ± 14.8 km (Woodward *et al.*, 2019). Dublin Array is within foraging range of four Arctic tern colonies (Table 92) (Burnell *et al.*, 2023).

Table 92 Recent counts for Arctic tern colonies within mean maximum foraging range of Dublin Array

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Arctic tern (25.7 ± 14.8 km)	Dalkey Islands (Dublin)	12.5 km	97 pairs (2016)
	South Dublin Port (Dublin)	22.4 km	9 pairs (2016)
	Rockabill (Dublin)	41.3 km	60 pairs (2016)
	Estimated breeding season population within mean maximum foraging range ± 1 SD		166 pairs

3.4.301 Arctic terns breeding at several Irish colonies were affected by HPAI during the 2023 breeding season (BWI, 2023), although effects at the population level are not yet known.

3.4.302 After the breeding season, Arctic terns migrate south along the Atlantic seaboard and the west coast of Africa to winter in the Antarctic seas (Wernham *et al.*, 2002). Furness (2015) considered that for Arctic tern outside the breeding season there were two BDMPS periods; autumn migration (July to early September) and spring migration (late April to May). The relevant BDMPS region for Arctic tern is the “UK Western Waters”, as defined in Furness (2015).

3.4.303 For this region, the autumn and spring migration BDMPS regional populations were estimated to be 71,398 birds, of which 2,370 birds (1,500 adults and 870 immature birds) were estimated to be from Irish breeding colonies. This Irish component was subtracted from the original BDMPS autumn and spring migration populations, which gives an estimate of 69,028 birds (all ages).

3.4.304 To include an estimate of Irish Arctic terns in the BDMPS reference population, an estimate of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals was calculated (Burnell *et al.*, 2023) (Table 93). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 93 Estimated Irish component of BDMPS regional reference population for Arctic tern

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
5,416 adults	2,120 adults	0.511	1,083 (2,120x0.511)	3,203 birds

3.4.305 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the “UK Western Waters” for the relevant non-breeding period, as defined in Furness (2015) (Table 94).

Table 94 Estimated BDMPS regional reference populations for Arctic tern

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Autumn migration	69,028	3,203	72,231 birds
Spring migration	69,028	3,203	72,231 birds

3.4.306 For Arctic tern, the revised autumn and spring migration BDMPS regional populations were estimated to be 72,231 birds (all ages)(Table 94).

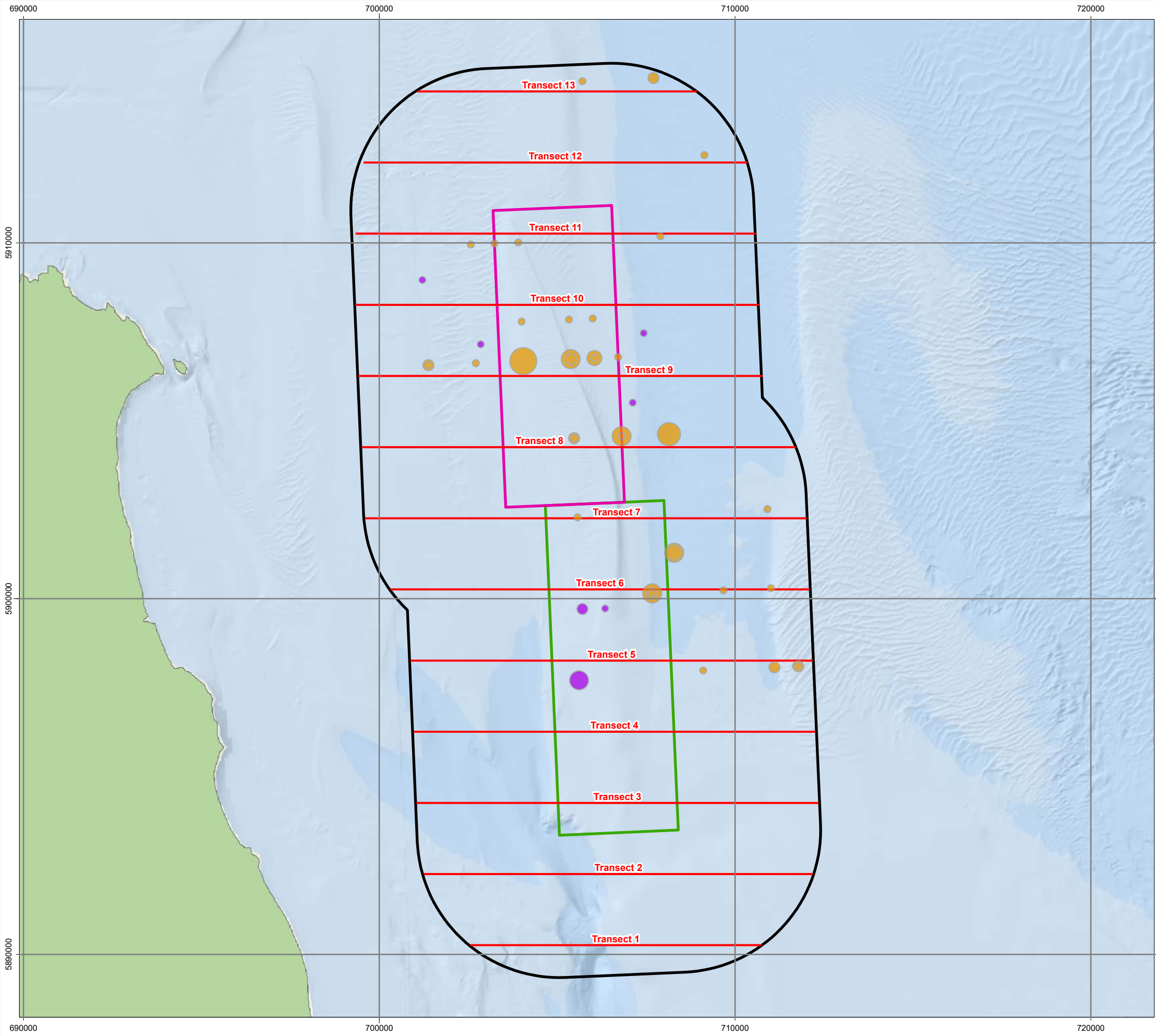
3.4.307 ESAS surveys in Irish waters between 1980 and 1997 presented combined data for common and Arctic terns, due to their similarity. See common tern section above.

3.4.308 The 2016-2017 baseline surveys recorded 26 Arctic terns between May and September, with a peak count of 13 birds in September 2016. On 2019-2021 surveys, 174 Arctic terns were recorded between May and September, with peak counts of 39 birds in July 2020, and 49 birds in August 2020. Average abundance (birds/km) between May and September was low, with peaks of 0.31 birds/km in July and 0.27 birds/km in August (Table 95). For months with more than one survey, the peak number recorded on any one survey is shown.

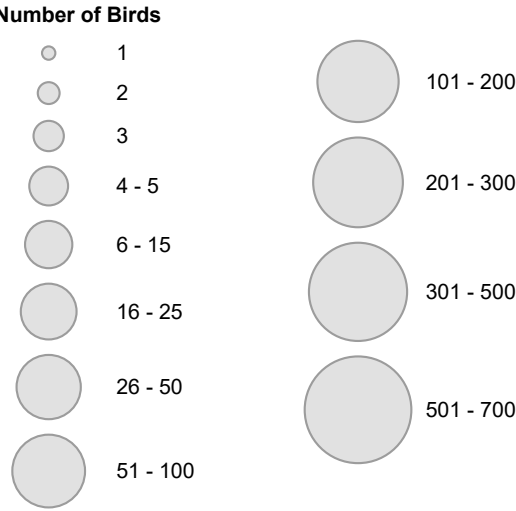
Table 95 Peak monthly counts (raw numbers) of Arctic terns in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	0	0	-	8	0	3	0	13	0	0	0
2019-21	0	-	-	0	20	9	39	49	3	0	0	0
Average abundance (birds/km)	0.00	0.00	0.00	0.00	0.16	0.05	0.31	0.27	0.09	0.00	0.00	0.00

3.4.309 In the breeding season (May to early August), Arctic terns were predominantly recorded in or close to the array area on baseline surveys (Figure 41). Larger numbers were recorded on the 2019-2021 baseline surveys, compared to 2016-2017 surveys.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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Dublin Array

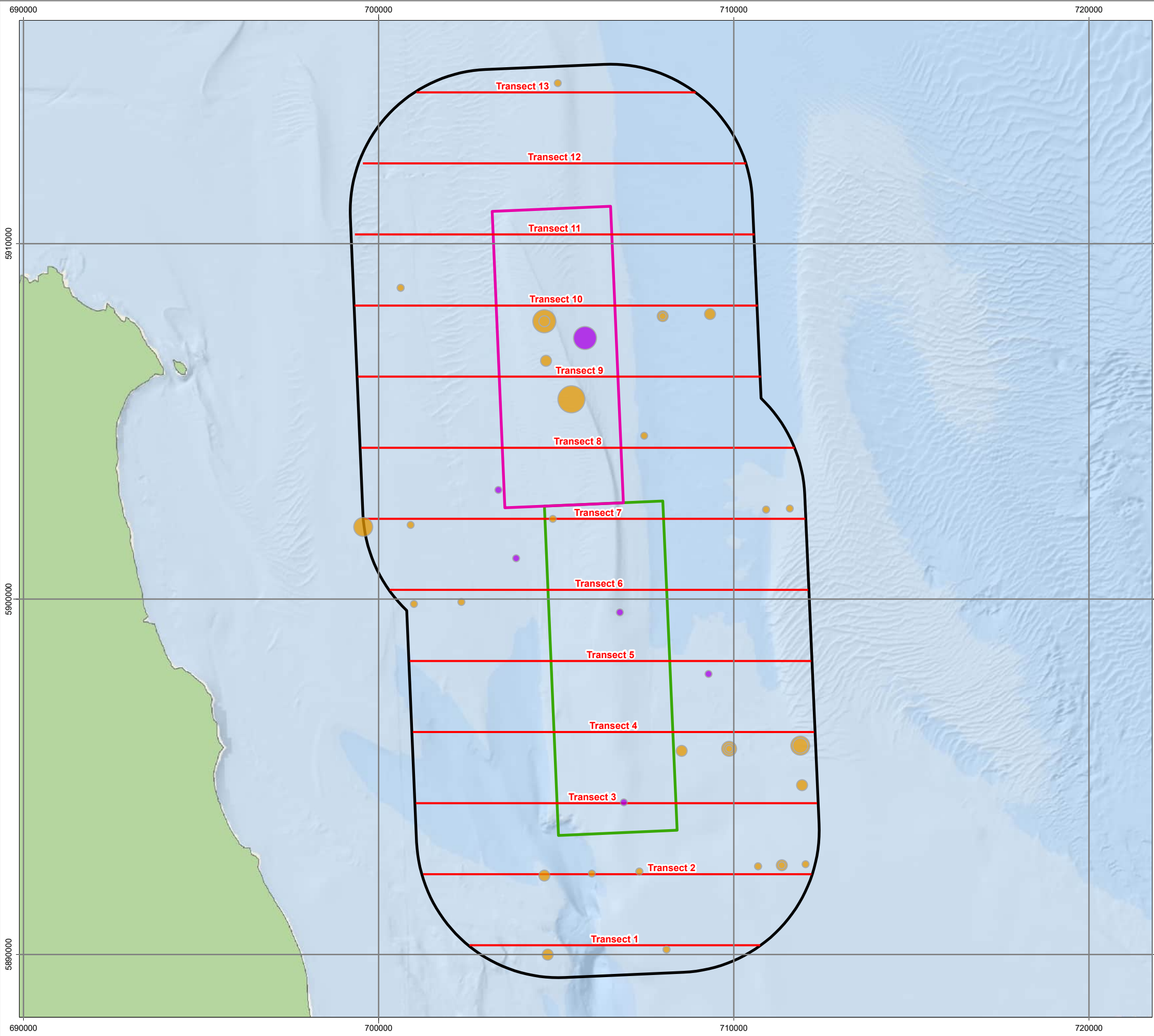
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Marine Bird Survey
Arctic Tern Sightings in the Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys

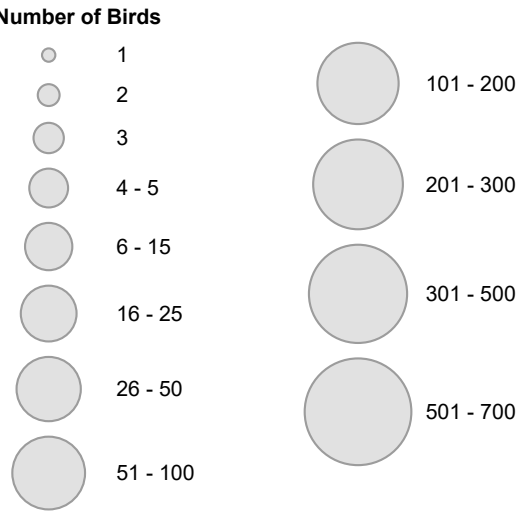
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- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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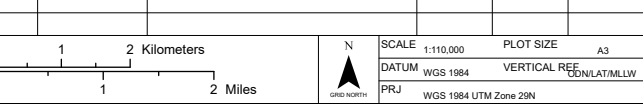
Dublin Array

DRAWING TITLE

Marine Bird Survey
Arctic Tern Sightings in Late August and September on 2016-2017 & 2019-2021
Baseline Surveys

DRAWING NUMBER: **Figure 42** PAGE NUMBER: **Page 38 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
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3.4.310 On autumn migration (late August and September), Arctic terns were scattered throughout the offshore ornithology study area in low numbers, with highest concentrations recorded in the northern half of the array area (Figure 42).

3.4.311 Previous 2001-2002 surveys recorded Arctic terns between June and September, with estimated peaks of 120 birds in August 2002 and 144 birds in September 2002 (Percival *et al.*, 2002). On 2010-2011 surveys, Arctic terns were recorded between May and September, with a peak raw count of 323 birds in September 2010 (Newton and Trewby, 2011).

3.4.312 Arctic tern results from the 2016 ObSERVE aerial surveys off the Irish east coast are presented in the common tern section above.

3.4.313 Flight height was recorded for 177 Arctic terns on baseline surveys in 2016/17 and 2019/20, with 98.9% of all birds recorded flying below 20 m MSL in height i.e. below likely rotor-swept height. A total of 57 birds were recorded flying below 5 m, with 88 birds flying between 5 and 10 m, 30 birds flying between 10 and 20 m, and two birds flying between 20 and 30 m in height (Table 9).

3.4.314 A total of 79 Arctic terns were aged on baseline surveys, with 52 adults and 27 juvenile birds recorded.

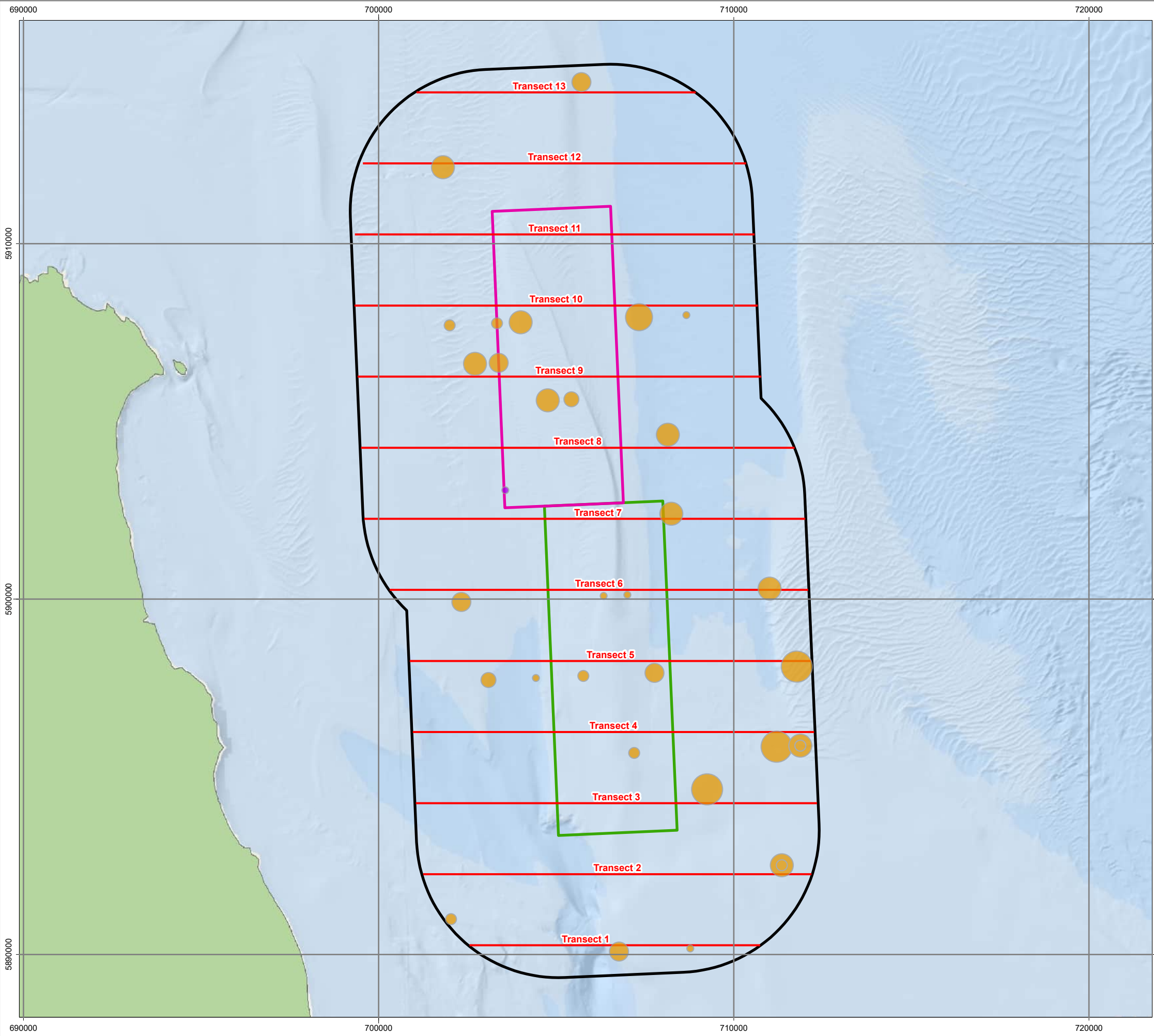
Unidentified common/Arctic terns

3.4.315 A further 99 unidentified common/Arctic terns were also recorded on the 2016-2017 surveys, with 56 of these recorded in September 2016, and 42 recorded in September 2017. On the 2019-2021 surveys, an additional 261 unidentified common/Arctic terns were recorded between July and September, with peak counts of 93 birds in July 2020, and 94 birds in late August 2019. Average abundance (birds/km) was similar between July and September, with a peak of 0.54 birds/km in July and 0.51 birds/km in September (Table 96).

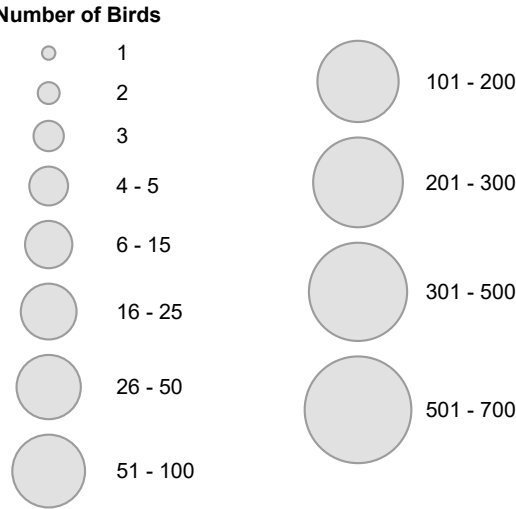
Table 96 Peak monthly counts (raw numbers) of unidentified common/Arctic terns in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	0	0	-	0	0	1	0	56	0	0	0
2019-21		-	-	0	0	0	93	94	15	0	0	0
Average abundance (birds/km)	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.44	0.51	0.00	0.00	0.00

3.4.316 In the breeding season (May to August), unidentified common/Arctic terns were widespread throughout the offshore ornithology study area on the 2019-2021 baseline surveys (Figure 43). Very few unidentified common/Arctic terns were recorded in the breeding season during 2016-2017 baseline surveys.



- Bray Bank Array Area
- Kish Bank Array Area
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- Bird Sighting 2019 - 2021



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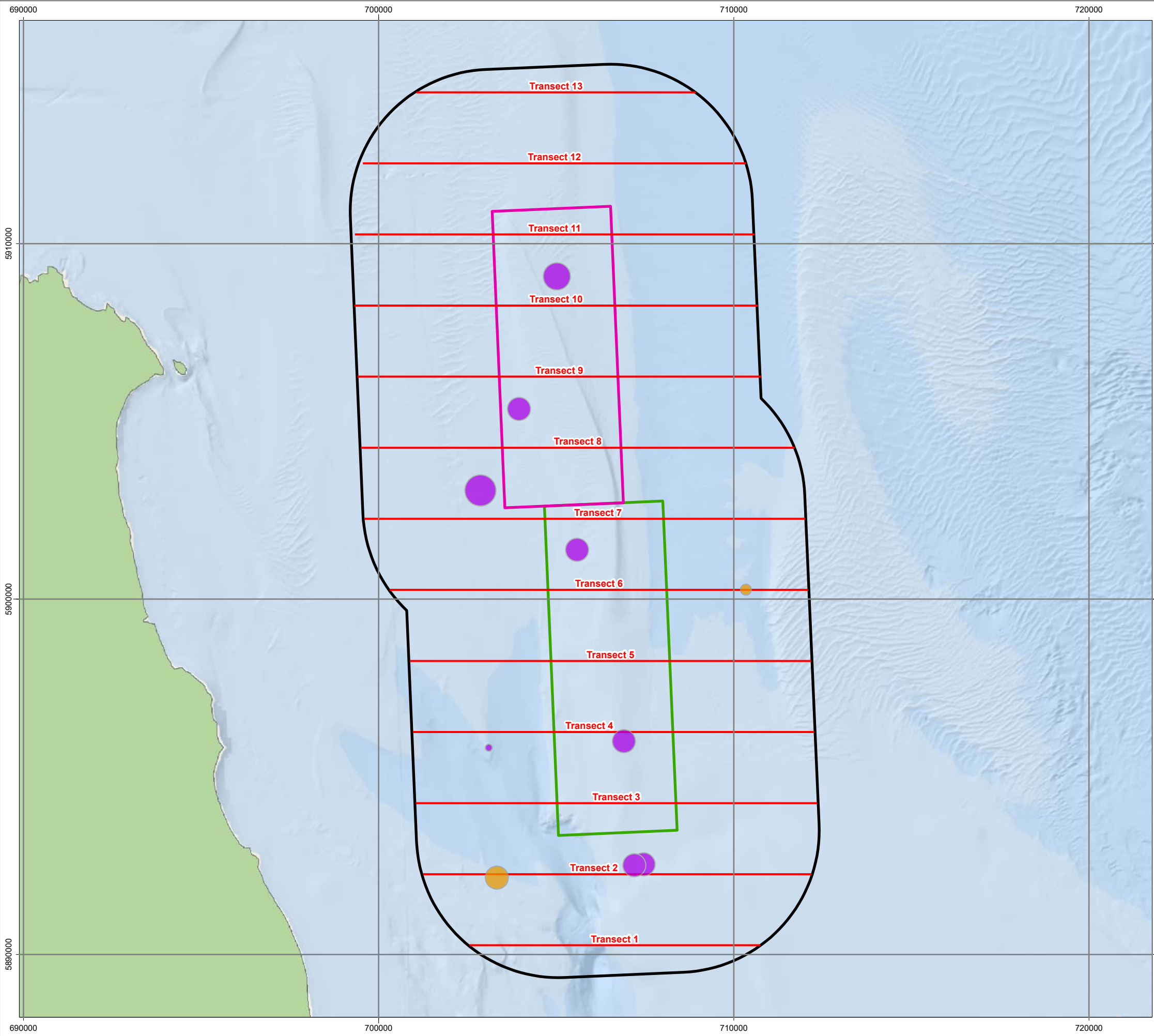
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Marine Bird Survey
Unidentified Common/Arctic Tern Sightings in the Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys

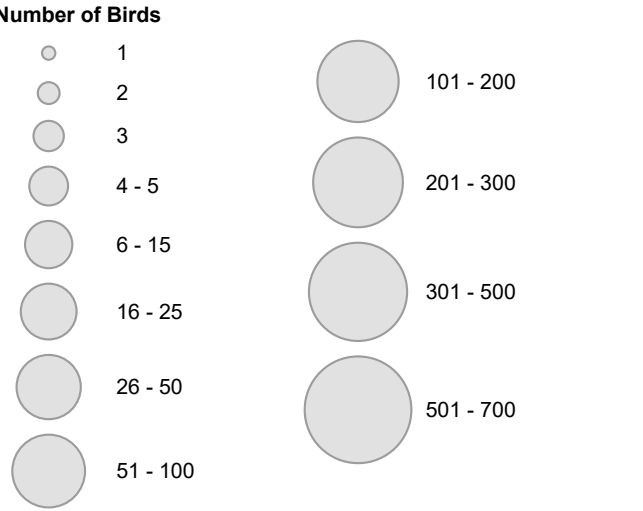
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- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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Marine Bird Survey
Unidentified Common/Arctic Tern Sightings in September on 2016-2017 & 2019-2021
Baseline Surveys

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3.4.317 On 2016-2017 baseline surveys in the autumn migration period (September), unidentified common/Arctic terns were recorded primarily in small groups within the array area (Figure 44). Fewer unidentified common/Arctic terns were recorded on the 2019-2021 surveys over the same period.

Little Tern

3.4.318 Little terns are summer visitors to Ireland, breeding in a few coastal colonies on the east and west coasts. The breeding population in Ireland has been estimated at 335 pairs on the recent Seabirds Count national census, which is an increase of 102% compared to the previous Seabird 2000 population estimate (Burnell *et al.*, 2023).

3.4.319 The colony at Kilcoole, County Wicklow is the largest little tern colony in Ireland, holding over one third of the national population (142 pairs in 2018) (Birdwatch Ireland, 2020). This colony is approximately 9.6km from the study area. The species is Amber-listed in Ireland because more than 50% of the Irish breeding population is concentrated in 10 or less sites, and also because the species has an unfavourable conservation status in Europe (Gilbert *et al.*, 2021). The species is also listed on Annex I of the EC Birds Directive.

3.4.320 The breeding season has been defined as May to early August (Furness, 2015) (Table 3). During the breeding season, adults travel short distances from their colonies to forage, with a mean maximum foraging range of 5 km (Woodward *et al.*, 2019). Dublin Array is not within mean maximum foraging range of any little tern colonies.

3.4.321 After the breeding season, little terns migrate south along the Atlantic seaboard winter off the coasts of Africa (Wernham *et al.*, 2002).

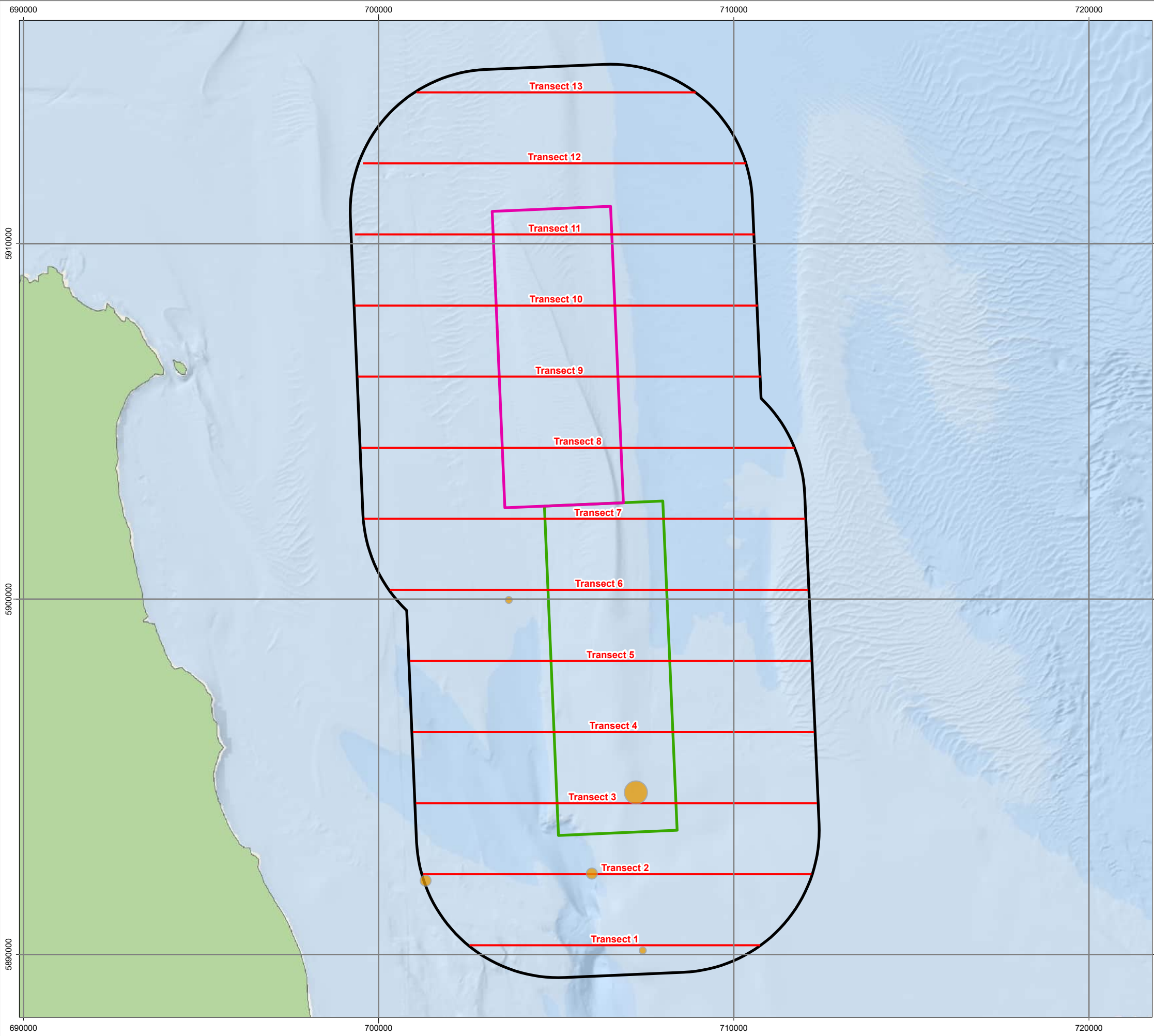
3.4.322 There was only one little tern recorded on ESAS surveys in Irish waters between 1980 and 1997, off the east coast of Ireland, although coverage of inshore waters, where this species tends to occur, was limited on these surveys (Pollock *et al.*, 1997).

1.1.2 Little terns were not recorded on 2016-2017 baseline surveys. On 2019-2021 surveys, 14 little terns were recorded between June and August, with two seen in June 2019, eight in July 2019, one in early August 2019, two in June 2020 and one in July 2020. Average abundance (birds/km) between June and August was very low, with a peak of 0.06 birds/km in July (Table 97). For months with more than one survey, the peak number recorded on any one survey is shown.

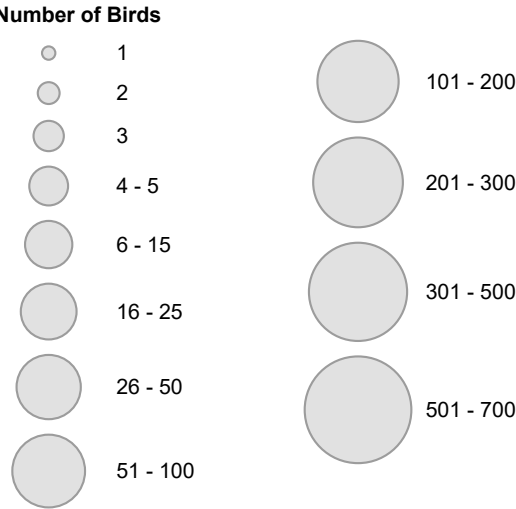
Table 97 Peak monthly counts (raw numbers) of little terns in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	0	0	-	0	0	0	0	0	0	0	0
2019-21	0	-	-	0	0	2	8	1	0	0	0	0
Average abundance (birds/km)	0.0 0	0.00	0.00	0.00	0.00	0.03	0.06	0.00	0.00	0.00	0.00	0.00

- 3.4.323 Little terns were not recorded on previous 2001-2002 surveys (Percival *et al.*, 2002) or on 2010-2011 surveys (Newton and Trewby, 2011).
- 3.4.324 A total of 137 little terns were recorded off the Irish east coast on the ObSERVE 2016 aerial surveys, in summer and autumn months, with sightings mainly in the central and southern transects. Little terns were observed over a wide range of water depths but showed a clear peak in occurrence over water depths of 20-30 m and appeared to be concentrated along the eastern edge of the shallow sandbar areas. Average density was 0.07 birds/km² in both summer and autumn. Abundance of little terns across the survey area was estimated at 652 (95% CIs 470 - 905) individuals in summer, and 642 (95% CIs 386 – 1,065) birds in autumn (Jessopp *et al.*, 2018).
- 3.4.325 Flight height was recorded for 13 little terns on baseline surveys in 2016-2017 and 2019-2020, with 100% of all flying birds recorded below 20 m MSL in height i.e. below likely rotor-swept height. All birds were recorded flying between 5 and 10 m in height. Of the 14 little terns recorded on baseline surveys, four were aged as adult, with the remainder unaged.
- 3.4.326 Little terns were recorded in the southern half of the offshore ornithology study area between June and August, mainly over the shallow bank waters. There was one sighting of eight birds in the array area, in July 2019 (Figure 45).



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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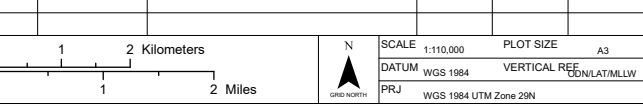
Dublin Array

DRAWING TITLE

Marine Bird Survey
Little Tern Sightings in the Breeding Season on 2019-2021 Baseline Surveys

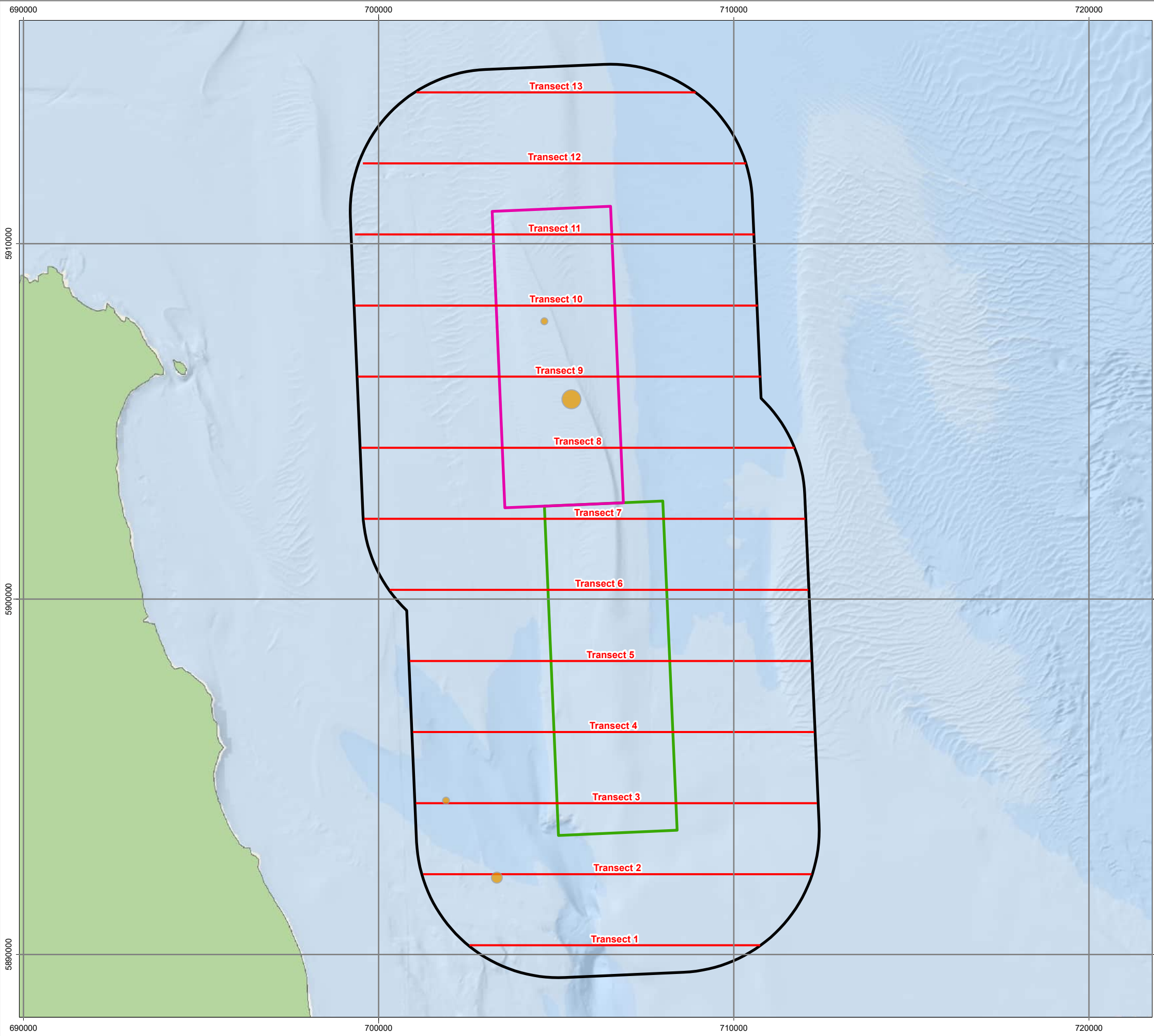
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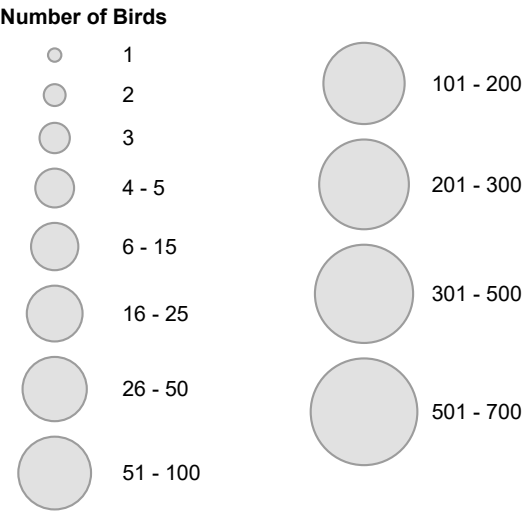


Black Tern

- 3.4.327 Black terns are annual autumn passage migrants and occasional spring migrants in Ireland (Hutchinson, 1989). The nearest breeding areas are France, The Netherlands and Denmark (EBCC, 2017). The species is listed on Annex I of the EC Birds Directive.
- 3.4.328 Black terns were rarely recorded on ESAS surveys in Irish waters between 1980 and 1997, with 13 birds recorded in the Irish Sea, Celtic Sea and English Channel over this period (Pollock *et al.*, 1997).
- 3.4.329 Black terns were not recorded on 2016-2017 baseline surveys. On 2019-2021 surveys, eight black terns were recorded, with two juveniles and one unaged bird seen in the south west of the buffer area in September 2019 and five juveniles seen in the array area in August 2020 (Figure 46). All eight birds were recorded flying between 5 and 10 m above sea level.
- 3.4.330 Low numbers of black terns were recorded at similar times of year on previous boat-based surveys. Two black terns were recorded on 2001-2002 surveys, in September 2002 (Percival *et al.*, 2002). On 2010-2011 surveys, one black tern was recorded in September 2010 (Newton and Trewby, 2011)



- Bray Bank Array Area
- Kish Bank Array Area
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- Transect Line and Number
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- Bird Sighting 2019 - 2021



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Marine Bird Survey
Black Tern Sightings in August and September on 2019-2021 Baseline Surveys

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Common Guillemot

3.4.331 Guillemots are one of the commonest seabird species in Ireland, breeding in large colonies on suitable coastal cliff habitat. The breeding population in Ireland has been estimated at 178,090 individuals on the recent Seabirds Count national census, which is an increase of 28% compared to the previous Seabird 2000 population estimate (Burnell *et al.*, 2023). Compared to previous national surveys, numbers of guillemots show a strong increase in numbers in both the short- and long-term Irish population trend estimates, however, the degree of increase varies between regions. Since Seabird 2000 (1998-2002), there has been a strong recorded increase of more than 50% at colonies in the south and west of Ireland, compared to only marginal increases of less than 10% at colonies in the north west and east of Ireland. Numbers at the Cliffs of Moher on the west coast have increased by 75%, while numbers at Great Saltee Island, off the south coast have increased by 21%. In contrast, numbers at Lambay Island, off the Dublin coast, have remained relatively stable. It is considered that these regional variations in colony growth may be driven by local differences in availability of the preferred prey species (young Sprat and sandeels) (Cummins *et al.*, 2019).

3.4.332 The species is Amber-listed in Ireland because more than 50% of the Irish breeding population is concentrated at 10 or sites, and because the species has an unfavourable conservation status in Europe (Gilbert *et al.*, 2021). The breeding season has been defined as March to July (Furness, 2015) (Table 3). During the breeding season, adults travel moderate distances from their colonies to forage, with a mean maximum foraging range of 73.2 ± 80.5 km (Woodward *et al.*, 2019). Recent counts for guillemot colonies within mean maximum foraging range ± 1 SD of Dublin Array are shown in Table 98 (Burnell *et al.*, 2023).

Table 98 Recent counts for guillemot colonies within mean maximum foraging range of Dublin Array

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Guillemot (73.2 ± 80.5 km)	Bray Head (Wicklow)	11.9 km	1,413 birds (2015)
	Howth Head (Dublin)	18.6 km	871 birds (2015)
	Ireland's Eye (Dublin)	22.5 km	4,274 birds (2016) ¹
	Lambay Island (Dublin)	30.4 km	59,983 birds (2015)
	Wicklow Head (Wicklow)	30.9 km	605 birds (2022) ²
	Great Saltee Island (Wexford)	144.9 km	25,851 birds (2015)
	Isle of Man colonies	Within 153.7 km	4,748 birds (2017)
	Wales colonies	Within 153.7 km	21,313 birds (2016-2021)

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
	Estimated breeding season population within mean maximum foraging range ± 1 SD		119,058 birds

1 Newton *et al.*, (2016)

2 SMP, (2024)

3.4.333 Lambay Island is the largest colony in Ireland, with an estimated population of 59,983 individuals in 2015, while an estimated 4,274 individuals were counted on Ireland's Eye in 2016 (Newton *et al.*, 2016).

3.4.334 Adult and juvenile guillemots leave their breeding colonies in July and August, and high densities of guillemots have been recorded on surveys in the western Irish Sea at this time (Pollock *et al.*, 1997). Many adult guillemots remain in the waters close to the breeding colonies in the non-breeding season, with others dispersing further from the breeding colonies (Wernham *et al.*, 2002). Furness (2015) considered that outside the breeding season there was one BDMPS period for guillemot; the non-breeding season (August to February). In addition to waters off the Irish east and south coasts, the relevant BDMPS region for guillemot is "UK Western Waters", as defined in Furness (2015).

3.4.335 The original BDMPS population for guillemot for the "UK Western Waters" region was estimated as 1,139,220 birds (all ages) for the non-breeding season, and there was no Irish component included in this estimate (Furness 2015). To include an estimate of Irish guillemots in the BDMPS reference population, an estimate of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals was calculated (Burnell *et al.*, 2023) (Table 99). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 99 Estimated Irish component of BDMPS regional reference population for guillemot

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
178,090 adults	100,941 adults	0.916	92,462	193,403 birds

3.4.336 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the "UK Western Waters" for the relevant non-breeding period, as defined in Furness (2015) (Table 100).

Table 100 Estimated BDMPS regional reference populations for guillemot

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Non-breeding season	1,139,220	193,403	1,332,623 birds

3.4.337 For guillemot, the revised non-breeding season BDMPS regional population was estimated to be 1,332,623 birds (all ages) (Table 100).

3.4.338 Guillemots were the most numerous seabird species recorded on ESAS surveys in Irish waters between 1980 and 1997. In March and April, moderate densities (2.00-4.99 birds/km²) were recorded off the Dublin coast, close to the breeding colonies. Moderate to high densities were recorded off the Irish east coast between May and June, with high concentrations (>5.00 birds/km²) off Wicklow at this time of year. Between July and September, high densities (>5.00 birds/km²) were recorded off the Irish east coast, with high to moderate densities elsewhere in the Irish Sea, as adults and juvenile birds moved offshore from the breeding colonies. Between October and February, guillemots were present in low to moderate densities off the Irish east coast (Pollock *et al.*, 1997).

3.4.339 Estimated numbers of guillemots were derived from baseline survey data by applying Distance sampling techniques to the 2016-2017 and 2019-2021 datasets (Table 101, Table 102 and Table 103).

3.4.340 Overall, estimated numbers of guillemots in the array area and 4 km buffer area on baseline surveys were highest in the breeding season, with peak means of 43,913 birds in April and 14,318 birds in May. Estimated numbers in the post-breeding moult period were lower, with peak means of 4,790 birds in August and 4,496 birds in September. In the non-breeding season, the peak mean estimates were 3,117 birds in November and 3,119 birds in December (Table 104).

Table 101 Estimated numbers of guillemots in the array area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	319	142	755	5,556	1,762	967	961	614	585	239	331	357
Mean	503	205	1,375	9,204	2,978	1,415	1,571	1,004	929	406	627	612
Upper	793	297	2,559	15,330	5,195	2,112	2,697	1,684	1,497	710	1,206	1,065
Birds in flight												
Lower	0	0	2	0	6	18	11	0	6	5	11	20
Mean	1	2	10	4	24	38	32	0	13	15	26	42
Upper	4	7	19	10	51	62	59	0	23	30	47	71
Total												
Lower	319	142	758	5,556	1,768	986	972	614	591	243	342	378
Mean	504	207	1,384	9,208	3,002	1,453	1,603	1,004	943	421	654	654
Upper	797	303	2,578	15,340	5,246	2,173	2,755	1,684	1,520	740	1,253	1,136

Table 102 Estimated numbers of guillemots in the 2km buffer area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	537	239	1,271	9,346	2,964	1,627	1,617	1,033	984	402	556	601
Mean	846	345	2,313	15,483	5,010	2,380	2,642	1,690	1,563	683	1,056	1,030
Upper	1,333	499	4,305	25,788	8,740	3,553	4,536	2,832	2,518	1,195	2,029	1,791

	J	F	M	A	M	J	J	A	S	O	N	D
Birds in flight												
Lower	19	4	2	309	30	27	15	0	0	7	18	16
Mean	100	16	45	572	71	64	33	0	2	19	39	40
Upper	215	32	118	903	117	109	60	0	7	37	67	74
Total												
Lower	556	243	1,272	9,655	2,994	1,655	1,632	1,033	984	409	574	617
Mean	946	361	2,358	16,055	5,081	2,444	2,675	1,690	1,566	702	1,095	1,070
Upper	1,549	531	4,423	26,692	8,857	3,662	4,596	2,832	2,525	1,231	2,097	1,866

Table 103 Estimated numbers of guillemots in the 4km buffer area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	1,203	535	2,847	20,939	6,642	3,646	3,623	2,315	2,205	900	1,246	1,347
Mean	1,896	774	5,182	34,689	11,225	5,333	5,920	3,786	3,503	1,531	2,365	2,307
Upper	2,987	1,118	9,645	57,779	19,581	7,959	10,164	6,346	5,643	2,677	4,547	4,013
Birds in flight												
Lower	0	0	9	0	24	69	40	0	22	18	42	77
Mean	5	8	36	16	91	145	120	0	50	57	98	158
Upper	16	25	73	37	193	232	221	0	85	113	176	269
Total												
Lower	1,203	535	2,856	20,939	6,666	3,715	3,664	2,315	2,227	918	1,288	1,424

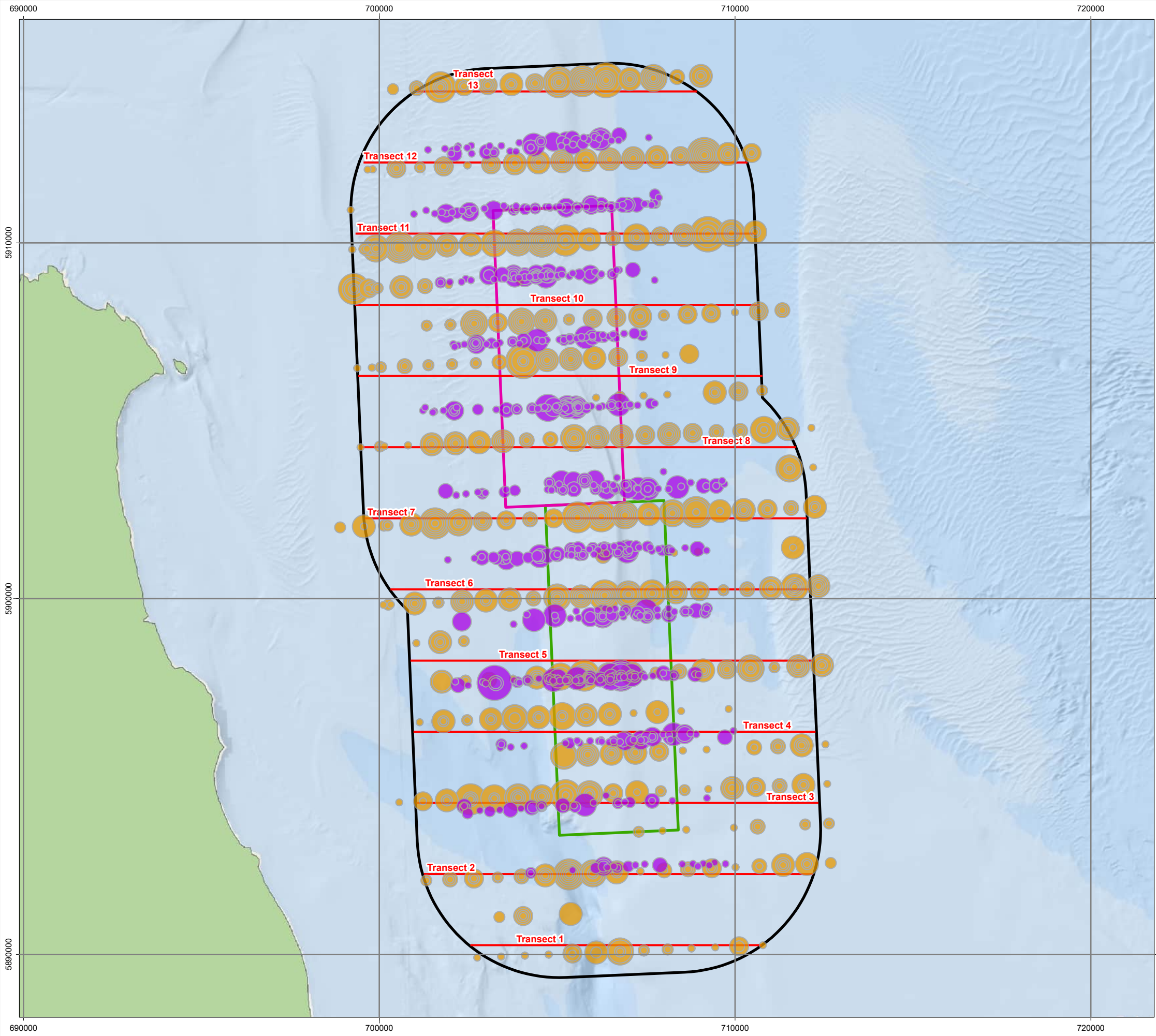
Mean	1,901	782	5,218	34,705	11,316	5,478	6,040	3,786	3,553	1,588	2,463	2,465
Upper	3,003	1,143	9,718	57,816	19,774	8,192	10,385	6,346	5,728	2,790	4,723	4,282

Table 104 Estimated numbers of guillemots in the array area plus 2km and 4km buffer areas based on 2016-2017 and 2019-2021 surveys

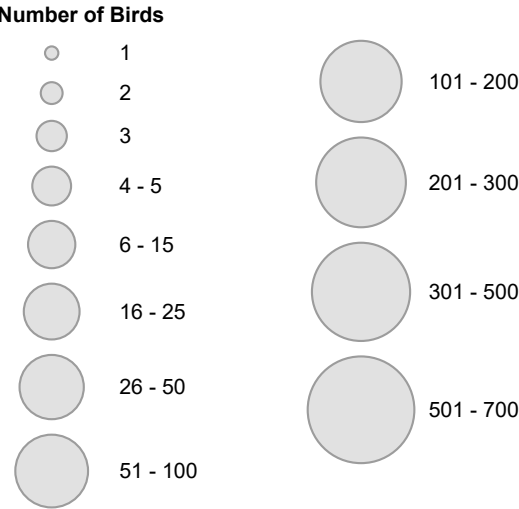
	J	F	M	A	M	J	J	A	S	O	N	D
Array area and 2km Buffer												
Lower	875	385	2,030	15,211	4,762	2,641	2,604	1,647	1,575	652	916	995
Mean	1,450	568	3,742	25,263	8,083	3,897	4,278	2,694	2,509	1,123	1,749	1,724
Upper	2,346	834	7,001	42,032	14,103	5,835	7,351	4,516	4,045	1,971	3,350	3,002
Array area and 4km Buffer												
Lower	1,522	677	3,614	26,495	8,434	4,701	4,636	2,929	2,818	1,161	1,630	1,802
Mean	2,405	989	6,602	43,913	14,318	6,931	7,643	4,790	4,496	2,009	3,117	3,119
Upper	3,800	1,446	12,296	73,156	25,020	10,365	13,140	8,030	7,248	3,530	5,976	5,418

3.4.341 Guillemots were widely distributed throughout the offshore ornithology study area on baseline surveys in the breeding season (March to July) (Figure 47). There was no clear difference in distribution between the array area and the buffer area, with flocks of guillemots recorded along survey transect lines throughout the offshore ornithology study area at this time.

3.4.342 In the post-breeding period (August and September), guillemots were again widespread within the offshore ornithology study area on baseline surveys (Figure 48). Numbers of birds recorded were higher on the 2019-2021 surveys compared to the 2016-2017 surveys over the period. As with the breeding season, there were no major differences in distribution between the array area and the buffer area, although numbers recorded in the array area and offshore buffer areas were slightly higher than numbers recorded in the inshore buffer area.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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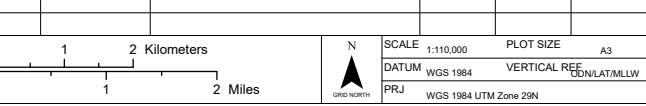
Dublin Array

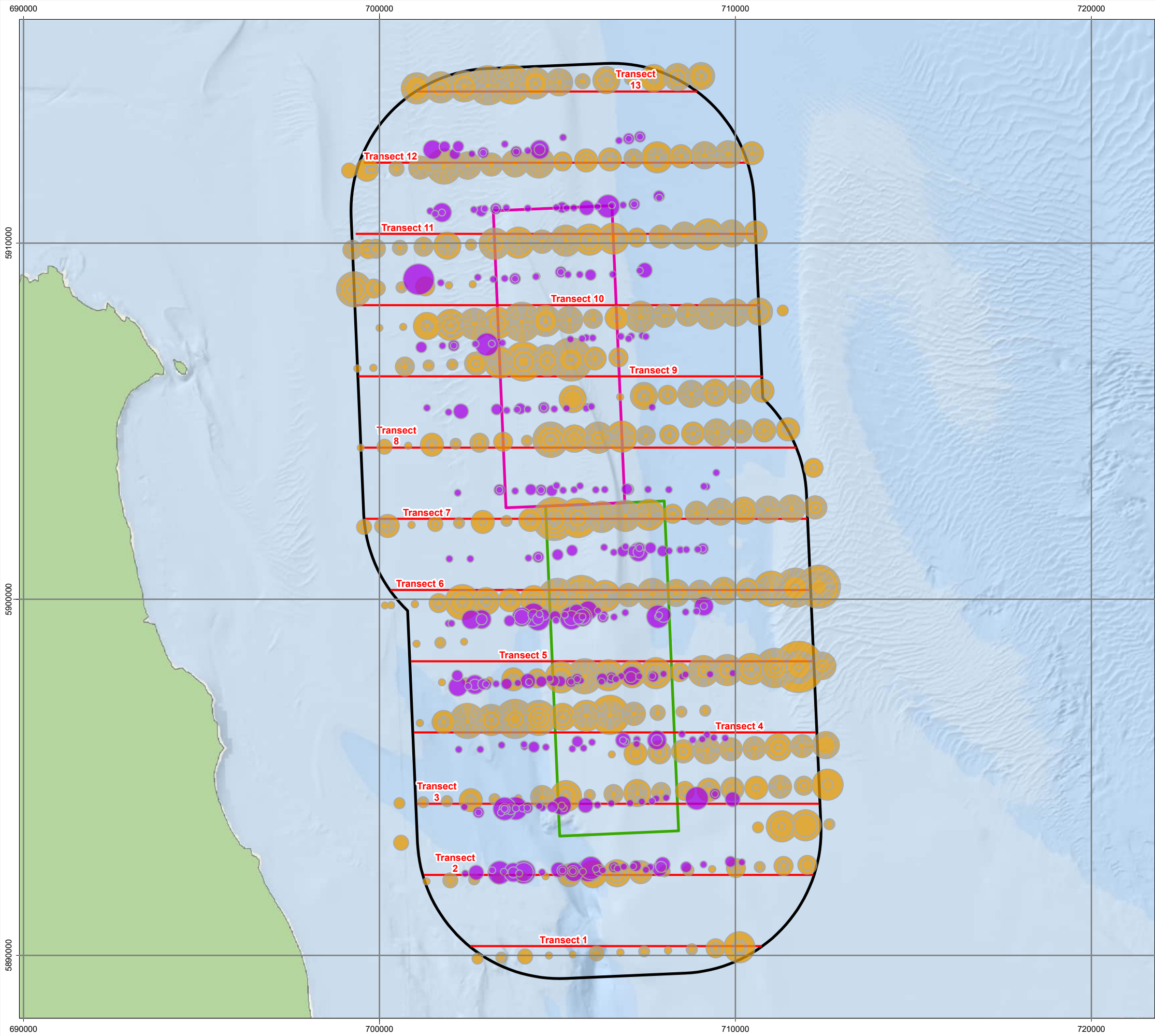
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Marine Bird Survey
Guillemot Sightings in the Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys

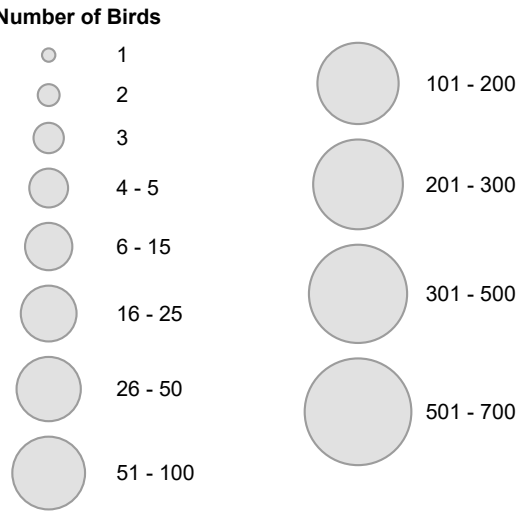
DRAWING NUMBER: **Figure 47** PAGE NUMBER: **Page 43 of 64**

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- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
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- Bird Sighting 2019 - 2021



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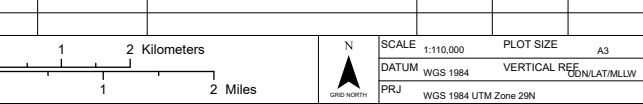
Dublin Array

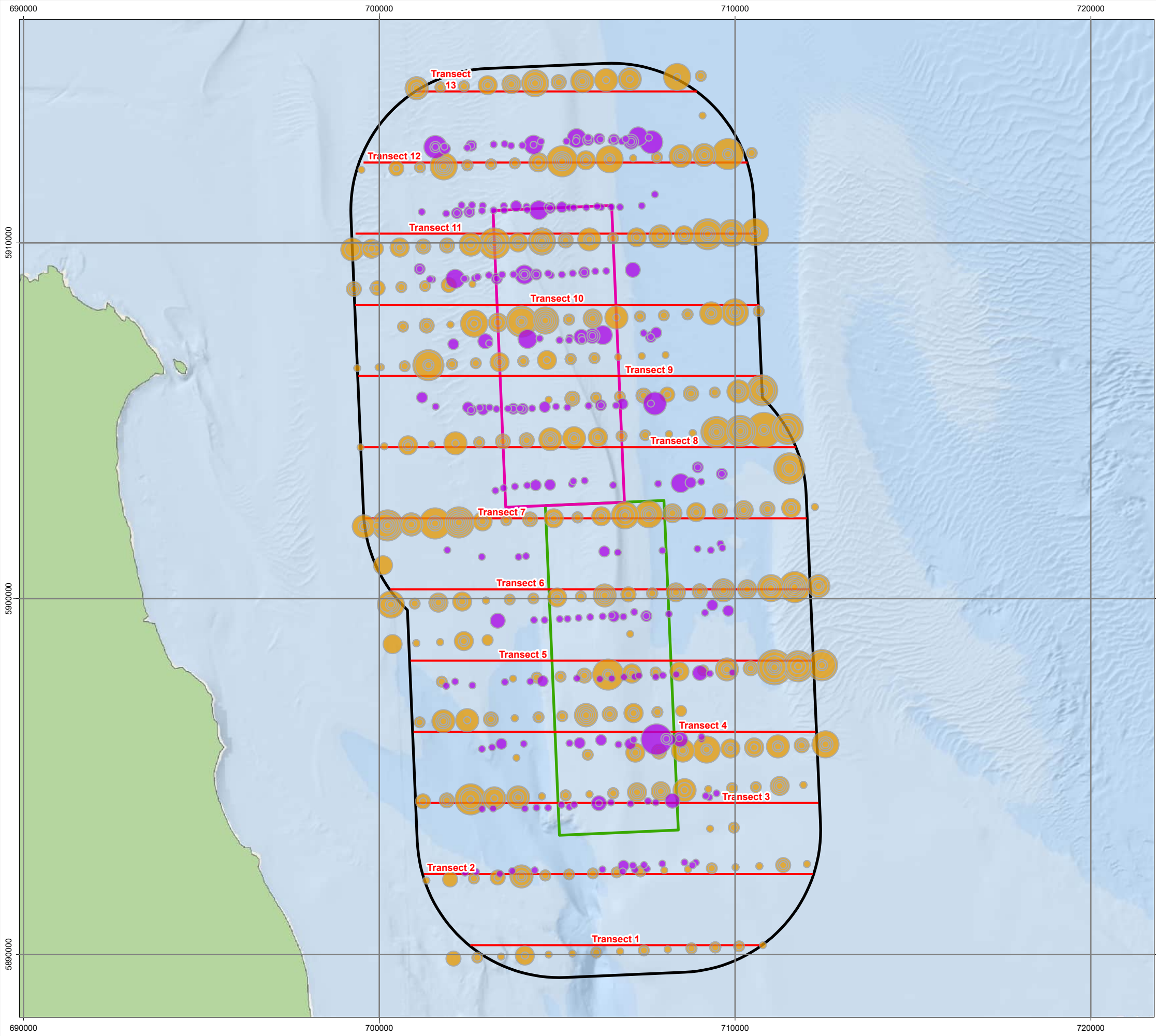
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Marine Bird Survey
Guillemot Sightings in the Post-Breeding Period on 2016-2017 & 2019-2021 Baseline Surveys

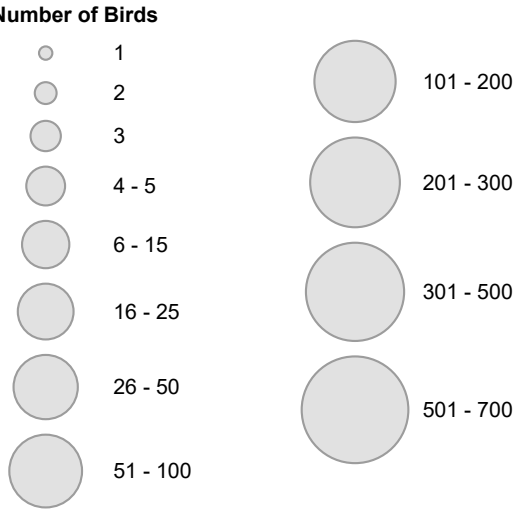
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- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
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- Bird Sighting 2019 - 2021



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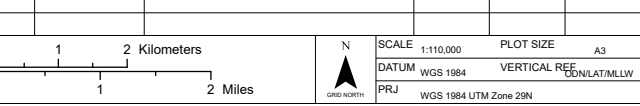
Dublin Array

DRAWING TITLE

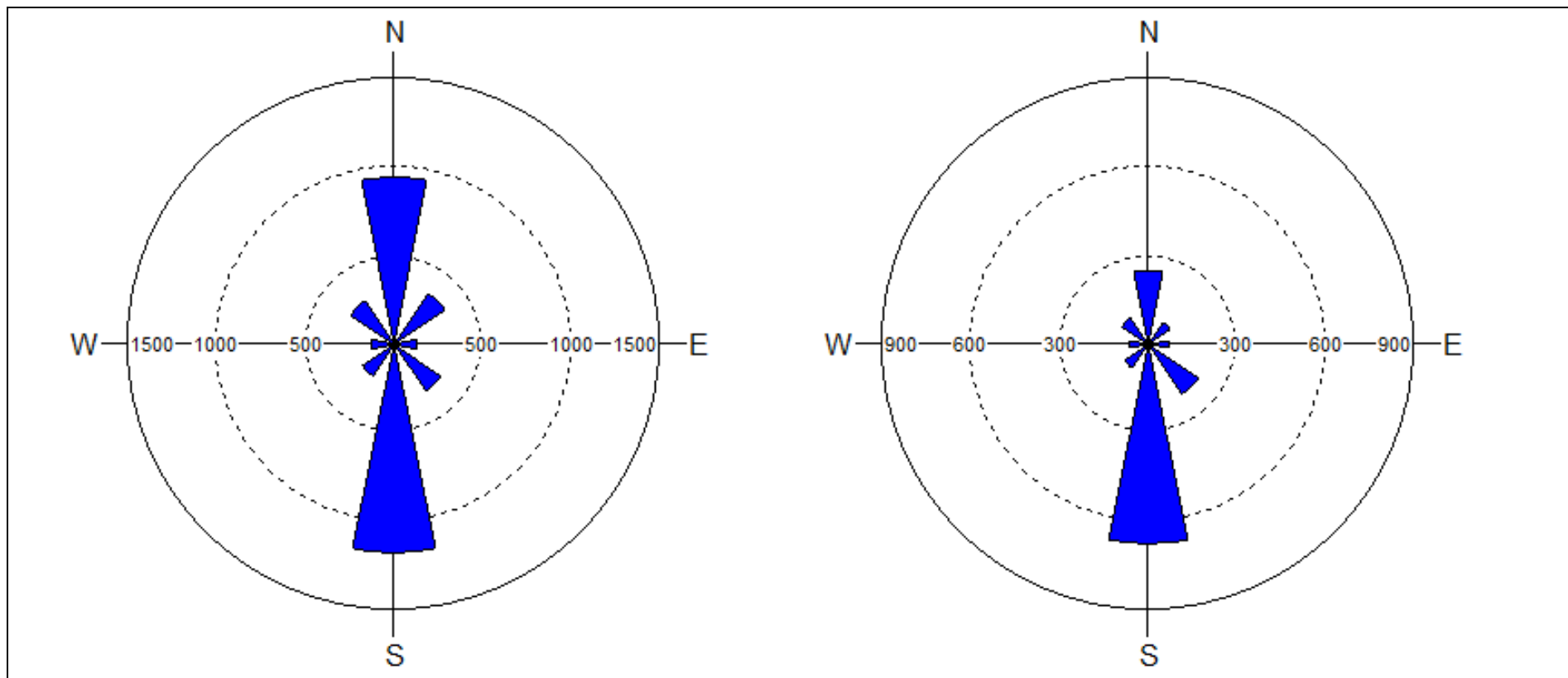
Marine Bird Survey
Guillemot Sightings in the Non-Breeding Period on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER: **Figure 49** PAGE NUMBER: **Page 45 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
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- 3.4.343 Guillemots were again widely distributed across the offshore ornithology study area in the non-breeding season, although numbers were slightly lower than were recorded in the breeding and post-breeding periods (Figure 49).
- 3.4.344 Previous 2001-2002 surveys recorded guillemots in all survey months, with estimated peaks of 14,218 birds in April 2002 and 7,843 birds in September 2002 (Percival *et al.*, 2002). On 2011-2012 surveys, guillemots were also recorded in every survey month, with peak raw counts of 6,932 birds in July 2010 and 2,368 birds in April 2011 (Newton and Trewby, 2011).
- 3.4.345 Guillemot and razorbills could not always be differentiated by eye on the ObSERVE 2016 aerial surveys, and so sightings were grouped together for the purposes of analysis. There were a total of 24,763 guillemots and razorbills recorded in the survey area off the Irish east coast in summer, autumn and winter. During the breeding season, sightings were concentrated around the central transect lines, while on autumn surveys, large numbers of sightings occurred in the northernmost transects. There was no obvious association between guillemots and razorbills and particular water depths on surveys. Mean density of guillemots and razorbills was 3.95 birds/km² in summer, 17.4 birds/km² in autumn, and 4.61 birds/km² in winter. Analysis showed that distributions for guillemots and razorbills showed relatively consistent areas of high sightings density east of Howth in the breeding season, presumably reflecting the distribution of breeding colonies at Bray Head, Howth Head and Ireland's Eye, and a more northerly distribution in autumn. Abundance of guillemots and razorbills across the survey area was estimated at 36,255 (95% CIs 32,869 – 39,990) individuals in summer, 159,503 (95% CIs 143,540 – 177,241) birds in autumn, and 42,296 (95% CIs 37,122 – 48,190) birds in winter (Jessopp *et al.*, 2018).
- 3.4.346 Flight height was recorded for 5,118 guillemots on baseline surveys in 2016-2017 and 2019-2021, with 100% of all birds flying below 20 m MSL in height, i.e. below likely rotor-swept height. A total of 4,523 birds were recorded flying below 5 m, with 586 birds flying between 5 and 10 m and nine birds flying between 10 and 20 m in height (Table 9).
- 3.4.347 Flight direction was recorded for 3,554 guillemots in the breeding season (March to July), with direction recorded for 1,563 birds in the non-breeding season (August to February) (Figure 50).
- 3.4.348 In the breeding season, the majority of guillemots were recorded flying either south (33.0%) or north (26.5%), with fewer birds recorded flying in other directions. In the non-breeding period, 43.1% of all guillemots were recorded flying south, with fewer birds recorded flying in other directions. An additional four guillemots were recorded as circling on baseline surveys (not shown).



March to July (n=3,554 birds)

Numbers shown on figures are number of birds recorded

August to February (n=1,563 birds)

Figure 50 Flight direction of guillemots recorded on 2016-2017 and 2019-2021 surveys

Razorbill

3.4.349 Razorbills are less numerous than guillemots in Ireland, but show a similar distribution, breeding in large colonies on suitable cliff habitat around the Irish coast. The breeding population in Ireland has been estimated at 32,904 individuals on the recent Seabirds Count national census, which is an increase of 19% compared to the previous Seabird 2000 population estimate (Burnell *et al.*, 2023). There has been a strong increase in both numbers and range over the last 35 years, following a steep decline in numbers between 1969-1970 and 1985-1987. The current population estimate is marginally lower (6%) than the total estimated in 1969-1970 (Cummins *et al.*, 2019).

3.4.350 The species is Red-listed in Ireland because it has been classified as being of global conservation concern by Birdlife International. In addition, more than 50% of the Irish breeding population is concentrated in 10 or less sites (Gilbert *et al.*, 2021).

3.4.351 The breeding season has been defined as April to July (Furness, 2015) (Table 3). During the breeding season, adults travel moderate distances from their colonies to forage, with a mean maximum foraging range of 88.7 ± 75.9 km (Woodward *et al.*, 2019). Recent counts for razorbill colonies within mean maximum foraging range ± 1 SD of Dublin Array are shown in Table 105 (Burnell *et al.*, 2023).

Table 105 Recent counts for razorbill colonies within mean maximum foraging range of Dublin Array

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Razorbill (88.7 ± 75.9 km)	Bray Head (Wicklow)	11.8 km	150 birds (2010)
	Howth Head (Dublin)	18.6 km	279 birds (2015)
	Ireland's Eye (Dublin)	22.1 km	1,335 birds (2016) ¹
	Wicklow Head (Wicklow)	30.3 km	157 birds (2022)
	Lambay Island (Dublin)	30.4 km	7,353 birds (2015)
	Little Saltee Island (Wexford)	142.9 km	850 birds (2015)
	Great Saltee Island (Wexford)	144.9 km	5,669 birds (2015)
	Wales colonies	Within 164.6 km	9,906 birds (2016-2023)
	Isle of Man colonies	Within 164.6 km	639 birds (2016-2017)
	Estimated breeding season population within mean maximum foraging range ± 1 SD		26,338 birds

¹ Newton *et al.*, (2016)

3.4.352 After the breeding and post-breeding moult period, razorbills gradually move southwards, with birds wintering as far south as Iberia and Morocco (Wernham *et al.*, 2002). Furness (2015) considered that outside the breeding season there were three BDMPS periods for razorbill; autumn migration (August to October), winter (November to December) and spring migration (January to March). In addition to waters off the Irish east and south coasts, the relevant BDMPS region for razorbill is “UK Western Waters”, as defined in Furness (2015).

3.4.353 The original BDMPS population for razorbill for the “UK Western Waters” region was estimated as 606,914 birds (all ages) for the autumn and spring migration periods, which included an Irish component of 5,950 birds (3,400 adults and 2,550 immature birds) (Furness, 2015). This Irish component was subtracted from the original BDMPS autumn and spring migration populations, which gives an estimate of 600,964 birds (all ages). For the winter period, the original BDMPS population for razorbill for the “UK Western Waters” region was estimated as 341,422 birds (all ages), which included an Irish component of 5,950 birds (3,400 adults and 2,550 immature birds) (Furness, 2015). This Irish component was subtracted from the original BDMPS winter period population, which gives an estimate of 335,472 birds (all ages).

3.4.354 To include an estimate of Irish razorbills in the BDMPS reference population, an estimate of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals was calculated (Burnell *et al.*, 2023) (Table 106). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 106 Estimated Irish component of BDMPS regional reference population for razorbill

Irish breeding population	East & South coast population	Ratio of ad:imm birds	Estimate of immature birds	Combined Total
32,904 adults	16,785 adults	0.876	14,704 (16,785x0.876)	31,489 birds

3.4.355 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the “UK Western Waters” for the relevant non-breeding period, as defined in Furness (2015) (Table 107).

Table 107 Estimated BDMPS regional reference populations for razorbill

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Autumn migration	600,964	31,489	632,453 birds
Winter	335,472	31,489	366,961 birds
Spring migration	600,964	31,489	632,453 birds

3.4.356 For razorbill, the revised BDMPS regional populations for the autumn and spring migration periods were estimated to be 632,453 birds (all ages). For the winter period, the revised BDMPS regional population was estimated to be 366,961 birds (all ages) (Table 107).

3.4.357 ESAS surveys in Irish waters between 1980 and 1997 recorded razorbills in low densities, off the Dublin coast close to the breeding colonies between March and June. Like guillemots, razorbill numbers in the Irish Sea increase in July and August, as adult and juvenile birds leave the breeding colonies, and ESAS surveys recorded high densities of razorbills (> 5.00 birds/km²) off the Dublin coast at this time. In September and October, razorbills were more widespread in the Irish Sea than earlier in the year, with high densities (> 5.00 birds/km²) recorded off the Irish east coast at this time. Between November and February, razorbills were widely distributed at low densities off the Dublin coast and elsewhere in the Irish Sea (Pollock *et al.*, 1997).

3.4.358 Estimated numbers of razorbills were derived from baseline survey data by applying Distance sampling techniques to the 2016-2017 and 2019-2021 datasets (Table 108, Table 109 and Table 110). The confidence limits from the Distance analysis for density estimates of birds on the water on the 7th August 2019 survey were large (0.05 to 7,294,209.9 birds/km²) indicating that there were a small number of large flocks recorded on this survey and that the Distance estimate for this month was not very reliable. As a result, the August estimates for birds on the water were based on surveys conducted in August 2017, 27th August 2019 and August 2020 only.

Table 108 Estimated numbers of razorbills in the array area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	20	5	128	67	104	65	219	244	807	25	86	56
Mean	43	24	270	121	191	107	478	409	1,207	52	154	112
Upper	90	115	573	218	358	181	1,049	693	1,850	112	286	235
Birds in flight												
Lower	0	0	0	0	0	5	3	1	1	0	3	7
Mean	6	2	0	1	5	16	13	5	6	5	10	18
Upper	17	7	0	4	13	30	26	9	14	14	18	31
Total												
Lower	20	5	128	67	104	70	222	245	808	25	90	63
Mean	48	26	270	122	196	123	492	413	1,213	58	164	130
Upper	107	123	573	222	371	211	1,075	702	1,864	125	304	266

Table 109 Estimated numbers of razorbills in the 2km buffer area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	34	8	216	113	175	110	369	410	1,357	41	145	94
Mean	72	40	455	203	321	180	805	688	2,030	88	259	189
Upper	151	194	964	366	603	304	1,765	1,166	3,112	188	482	395
Birds in flight												
Lower	0	0	0	10	0	7	8	0	3	12	4	3
Mean	9	4	11	35	14	24	24	2	11	32	22	15
Upper	22	12	32	67	34	46	44	7	21	56	50	31
Total												
Lower	34	8	216	122	175	117	377	410	1,360	53	149	97
Mean	81	44	465	238	335	205	829	690	2,041	120	281	204
Upper	173	206	996	433	637	350	1,809	1,173	3,134	244	532	426

Table 110 Estimated numbers of razorbills in the 4km buffer area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water												
Lower	76	19	484	253	393	247	826	919	3,040	92	325	210
Mean	161	91	1,019	455	719	404	1,803	1,541	4,549	197	581	423
Upper	339	435	2,160	820	1,351	681	3,955	2,612	6,973	422	1,079	885
Birds in flight												
Lower	0	0	0	0	0	18	12	4	4	0	13	26
Mean	21	9	0	5	21	60	50	17	22	20	36	66
Upper	63	27	0	16	49	115	96	34	53	51	66	119
Total												
Lower	76	19	484	253	393	264	838	923	3,044	92	339	237
Mean	182	100	1,019	461	740	464	1,854	1,559	4,571	217	617	490
Upper	402	463	2,160	836	1,400	796	4,051	2,646	7,026	473	1,145	1,004

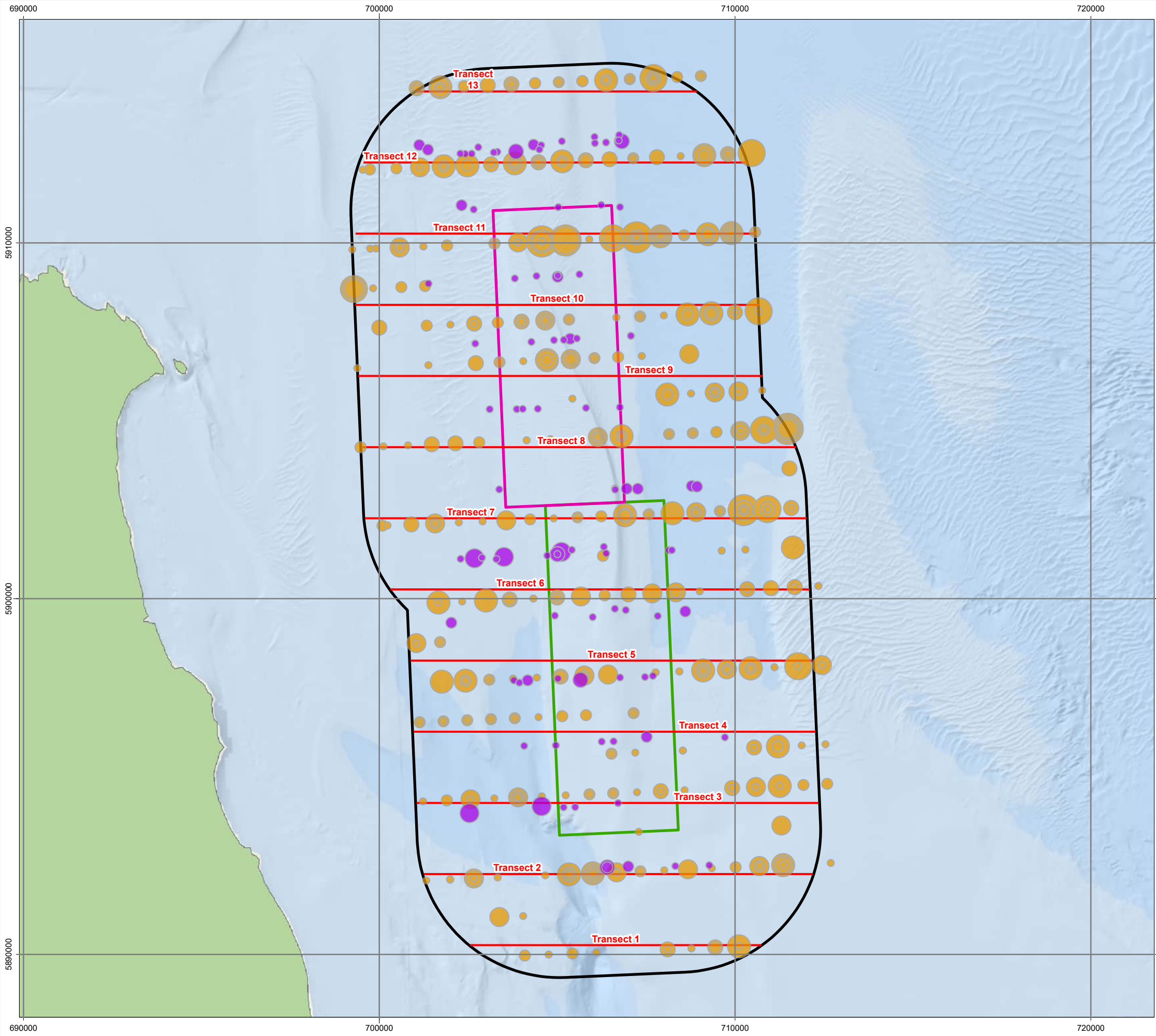
3.4.359 Overall, estimated numbers of razorbills in the study area on baseline surveys were highest in the post-breeding season, with a peak mean of 5,784 birds in September in the array area plus 4 km buffer. Estimated numbers in the breeding season peaked in July, with a peak mean of 2,346 birds in the array area plus 4 km buffer. In the non-breeding season, estimated numbers peaked in March, when the peak mean was 1,289 birds in the array area plus 4 km buffer (Table 111).

Table 111 Estimated numbers of razorbills in the array area plus 2km and 4km buffer areas based on 2016-2017 and 2019-2021 surveys

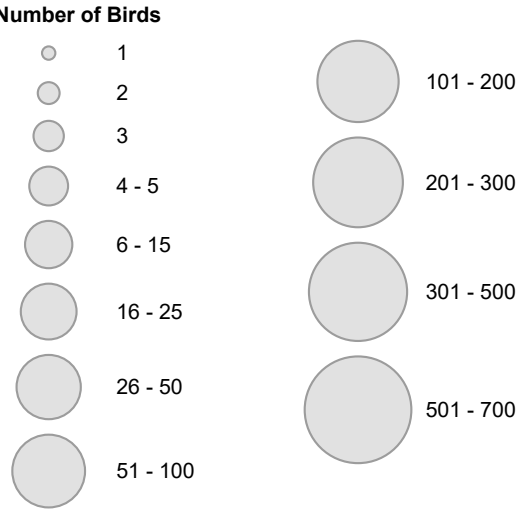
	J	F	M	A	M	J	J	A	S	O	N	D
Array area and 2km Buffer												
Lower	54	13	344	189	279	187	599	655	2,168	78	239	160
Mean	129	70	735	360	531	328	1,321	1,103	3,254	178	445	334
Upper	280	329	1,569	655	1,008	561	2,884	1,875	4,998	369	836	692
Array area and 4km Buffer												
Lower	96	24	612	320	497	334	1,060	1,168	3,852	117	429	300
Mean	230	126	1,289	583	936	587	2,346	1,972	5,784	275	781	620
Upper	509	586	2,733	1,058	1,771	1,007	5,126	3,348	8,890	598	1,449	1,270

3.4.360 Razorbills were widely distributed across the offshore ornithology study area on 2019-2021 baseline surveys in the breeding season (April to July), with higher numbers recorded in the array area and the offshore buffer area (Figure 51). Razorbill distribution on the 2016-2017 baseline surveys in the breeding season was more restricted, and recorded numbers were lower.

3.4.361 In the post-breeding period (August and September), razorbills were widespread throughout the offshore ornithology study area on baseline surveys (Figure 52). Concentrations of birds recorded on the 2016-2017 baseline surveys were similar to those recorded on the 2019-2021 surveys over the period. As with the breeding season, there were no major differences in distribution between the array area and the buffer area, although numbers recorded in the array area and offshore buffer areas were slightly higher than numbers recorded in the inshore buffer area.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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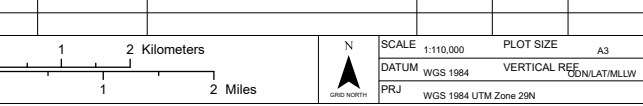
Dublin Array

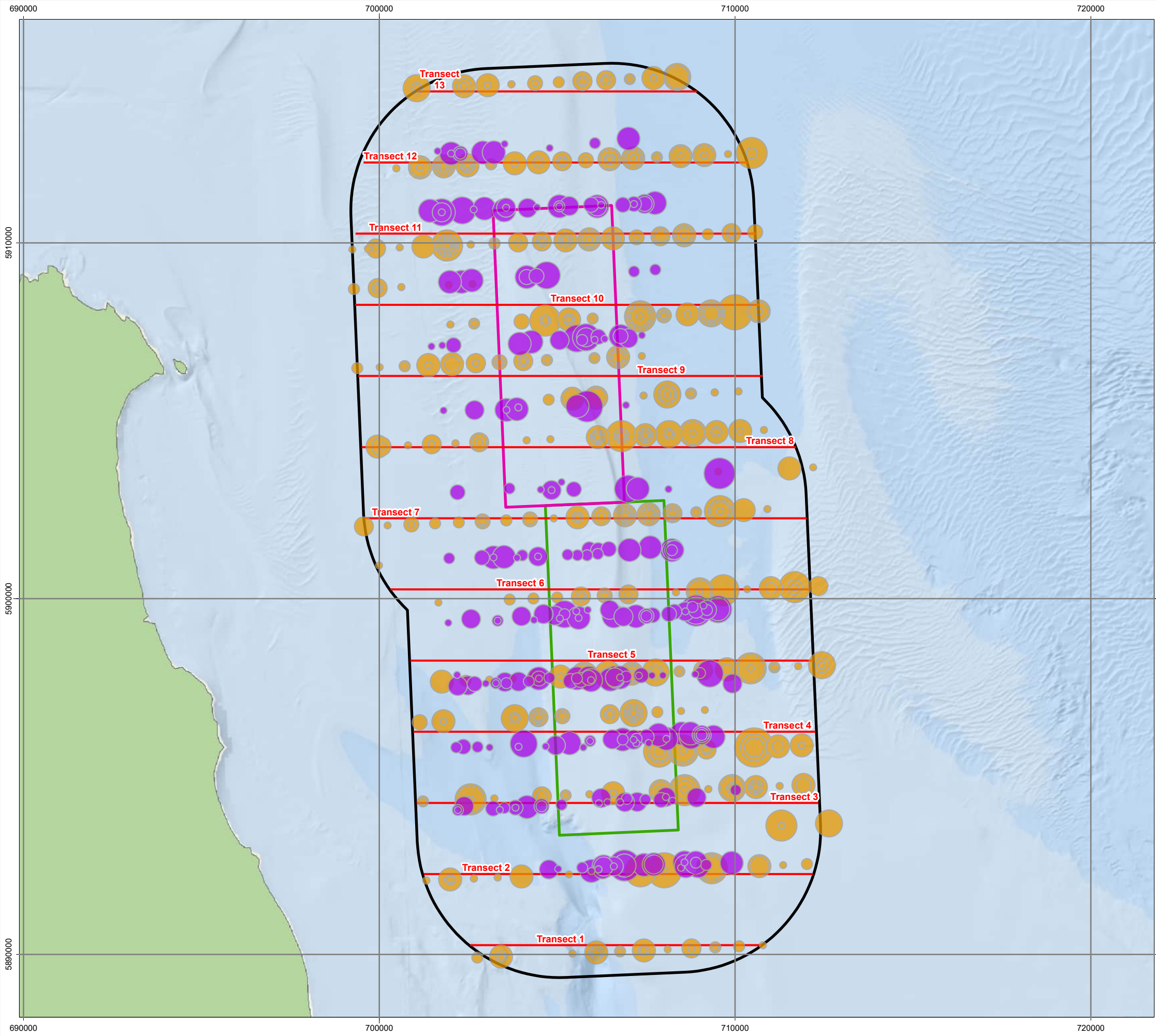
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Razorbill Sightings in the Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys**

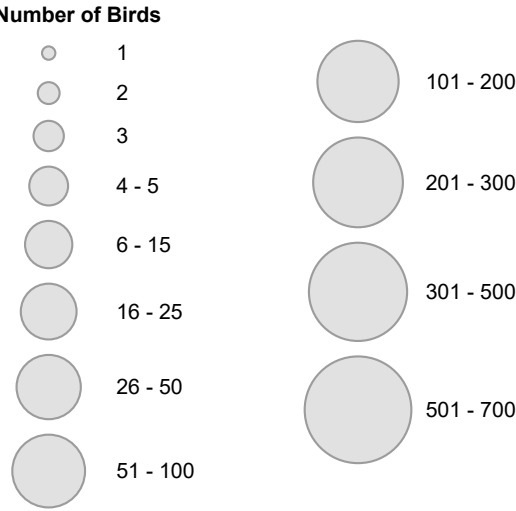
DRAWING NUMBER: **Figure 51** PAGE NUMBER: **Page 46 of 64**

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- Bray Bank Array Area
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- Bird Sighting 2019 - 2021



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Dublin Array

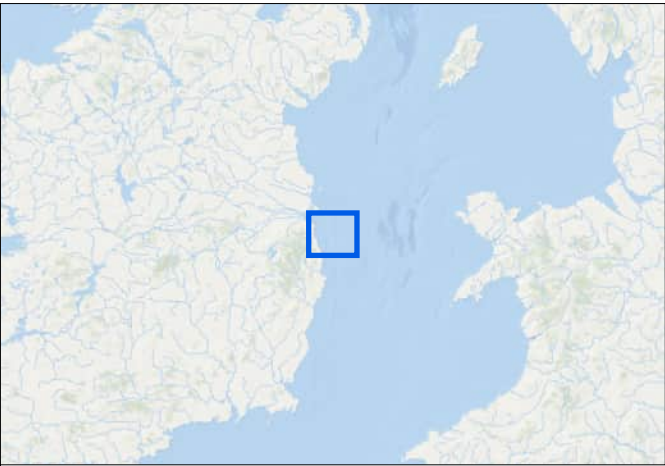
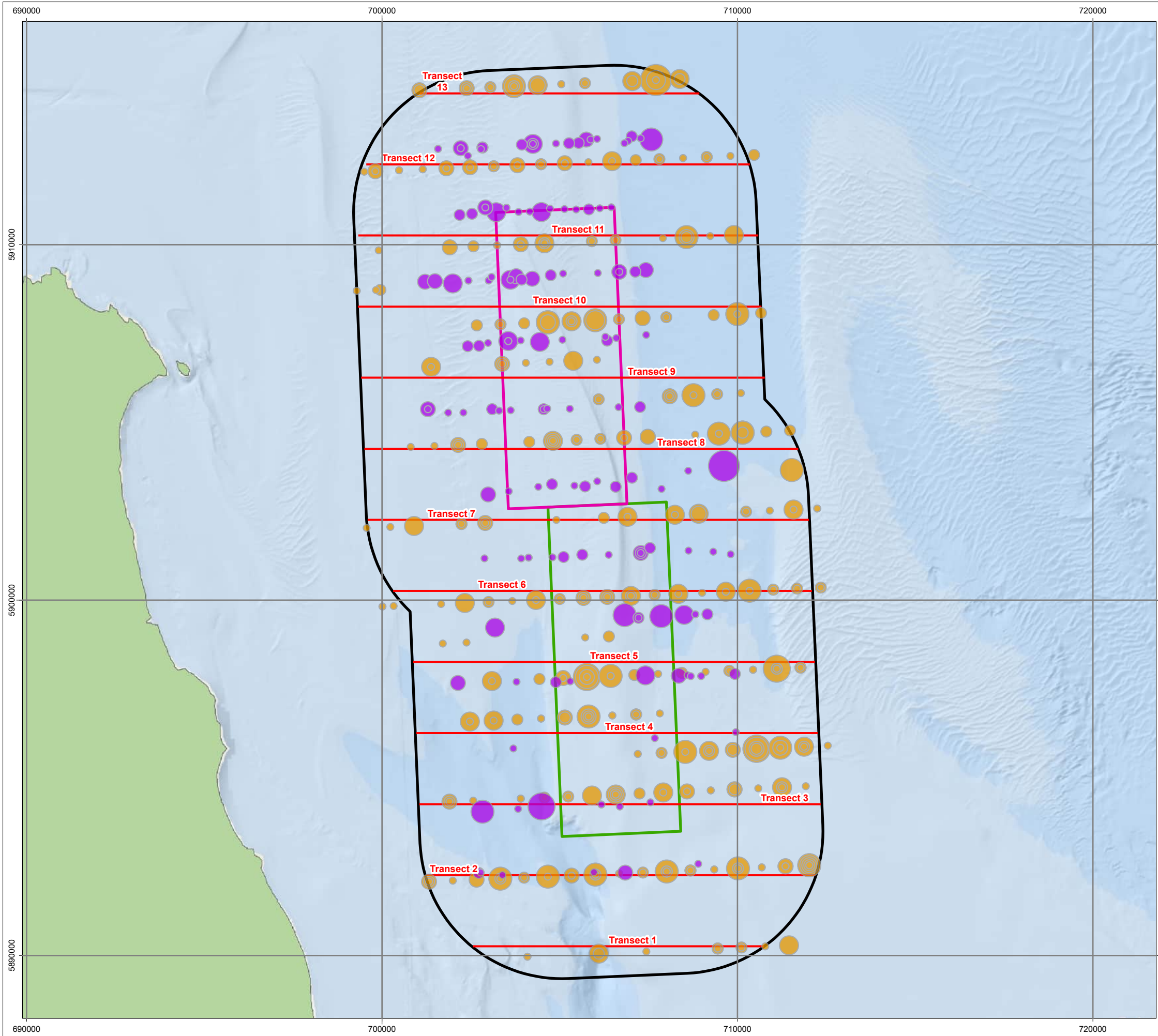
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Razorbill Sightings in the Post-Breeding Period on 2016-2017 & 2019-2021 Baseline Surveys

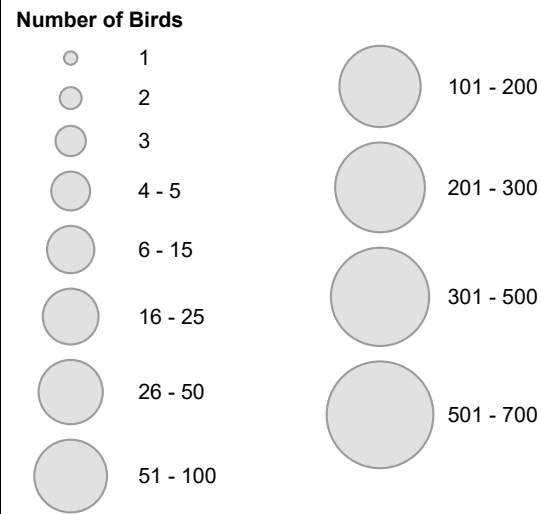
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- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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PROJECT TITLE

Dublin Array

DRAWING TITLE

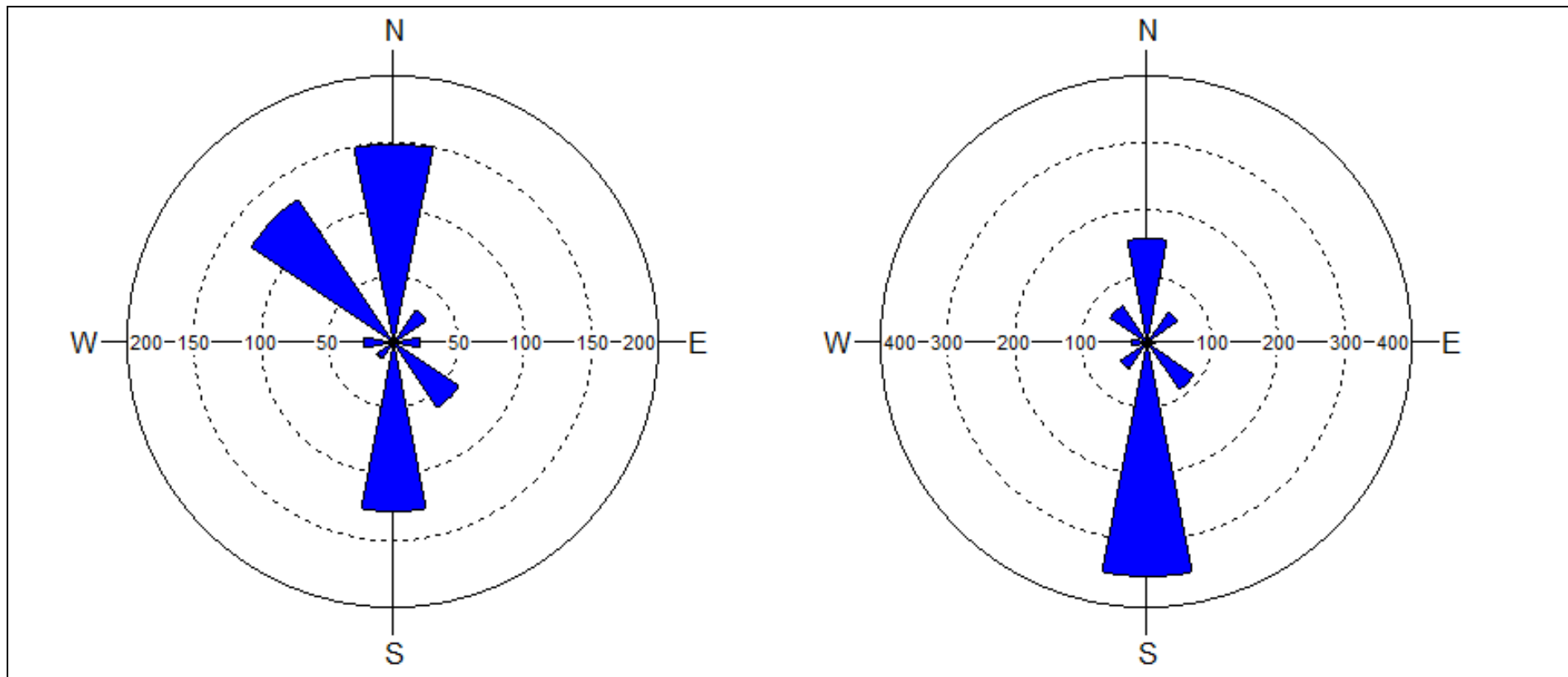
Marine Bird Survey
Razorbill Sightings in the Non-Breeding Period on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER: **Figure 53** PAGE NUMBER: **Page 48 of 64**

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- 1.1.1 Razorbills were widely distributed across the offshore ornithology study area on baseline surveys in the non-breeding season (Figure 53), although numbers were lower than recorded in the post-breeding period.
- 3.4.362 Previous 2001-2002 surveys recorded razorbills in all survey months, with an estimated peak of 3,110 birds in September 2002 (Percival *et al.*, 2002). On 2010-2011 surveys, razorbills were also recorded in every survey month, with peak raw counts of 2,685 birds in July 2010 and 1,450 birds in August 2010 (Newton and Trewby, 2011).
- 3.4.363 Razorbill results from the 2016 ObSERVE aerial surveys off the Irish east coast are presented in the guillemot section above.
- 3.4.364 Flight height was recorded for 1,352 razorbills on baseline surveys in 2016-2017 and 2019-2021, with 99.9% of all birds flying below 20 m MSL in height, i.e. below likely rotor-swept height. A total of 1,100 birds were recorded flying below 5 m, with 210 birds flying between 5 and 10 m, 40 birds flying between 10 and 20 m and two bird flying between 20 and 30 m in height (Table 9).
- 3.4.365 Flight direction was recorded for 552 razorbills in the breeding season (April to July), with direction recorded for 800 birds in the non-breeding season (August to March) (Figure 54).



April to July (n=552 birds)

Numbers shown on figures are number of birds recorded

August to March (n=800 birds)

Figure 54 Flight direction of razorbills recorded on 2016-2017 and 2019-2021 surveys

3.4.366 In the breeding season, the majority of razorbills were recorded flying either north (27.2%), north west (23.4%) or south (23.0%), with fewer birds recorded flying in other directions. In the non-breeding period, 43.9% of all razorbills were recorded flying south, with fewer birds recorded flying in other directions. An additional four razorbills were recorded as circling on baseline surveys (not shown).

Unidentified guillemot/razorbills

1.1.1 It was not always possible to fully identify guillemots and razorbills to species, particularly at greater distances from the survey vessel, and when numbers of birds were high. Estimated numbers of unidentified guillemots and razorbills were derived from baseline survey data by applying Distance sampling techniques to the 2019-2021 dataset only for birds on the water, as there were insufficient sightings on the water in the 2016-2017 dataset to run a Distance analysis. Both datasets were used for birds in flight (Table 112, Table 113 and Table 114).

Table 112 Estimated numbers of unidentified guillemots/razorbills in the array area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water (2019/21 data only)												
Lower	1	-	9	315	171	1	127	51	5	0	0	1
Mean	3	-	30	961	427	7	388	196	19	1	1	6
Upper	16	-	103	3,037	1,094	37	1,225	809	71	4	4	37
Birds in flight (2016/17 data & 2019/21 data)												
Lower	0	0	0	0	0	0	0	0	0	0	0	0
Mean	0	0	0	0	0	12	0	0	0	0	0	3
Upper	0	0	0	0	0	36	0	0	0	0	0	14
Total (2016/17 data & 2019/21 data)												
Lower	1	0	9	315	171	1	127	51	5	0	0	1
Mean	3	0	30	961	427	19	388	196	19	1	1	10
Upper	16	0	103	3,037	1,094	73	1,225	809	71	4	4	51

Table 113 Estimated numbers of unidentified guillemots/razorbills in the 2km buffer area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water (2019/21 data only)												
Lower	1	-	15	530	287	2	214	86	8	0	0	2
Mean	6	-	50	1,617	719	11	653	330	32	1	1	10
Upper	26	-	173	5,109	1,841	62	2,060	1,360	119	7	7	63

	J	F	M	A	M	J	J	A	S	O	N	D
Birds in flight (2016/17 data & 2019/21 data)												
Lower	0	0	0	0	0	0	0	0	0	0	0	0
Mean	34	0	0	81	0	5	0	0	0	0	0	19
Upper	102	0	0	243	0	16	0	0	0	0	0	56
Total (2016/17 data & 2019/21 data)												
Lower	1	0	15	530	287	2	214	86	8	0	0	2
Mean	40	0	50	1,698	719	17	653	330	32	1	1	29
Upper	129	0	173	5,352	1,841	78	2,060	1,360	119	7	7	119

Table 114 Estimated numbers of unidentified guillemots/razorbills in the 4km buffer area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Birds on water (2019/21 data only)												
Lower	3	-	33	1,188	643	5	479	193	19	0	0	4
Mean	13	-	112	3,622	1,611	26	1,464	739	71	3	3	23
Upper	59	-	387	11,447	4,124	139	4,615	3,048	267	16	16	141
Birds in flight (2016/17 data & 2019/21 data)												
Lower	0	0	0	0	0	0	0	0	0	0	0	0
Mean	0	0	0	0	0	45	0	0	0	0	0	13
Upper	0	0	0	0	0	136	0	0	0	0	0	53
Total (2016/17 data & 2019/21 data)												
Lower	3	0	33	1,188	643	5	479	193	19	0	0	4
Mean	13	0	112	3,622	1,611	71	1,464	739	71	3	3	37
Upper	59	0	387	11,447	4,124	275	4,615	3,048	267	16	16	193

3.4.367 Overall, estimated numbers of unidentified guillemots/razorbills in the study area on baseline surveys were highest in the breeding season, with a peak mean of 4,583 birds in April in the array area plus 4km buffer. Estimated numbers in the post-breeding season were lower, with a peak mean of 935 birds in August in the array area plus 4 km buffer. Numbers of unidentified guillemots/razorbills were low in the non-breeding season (Table 115).

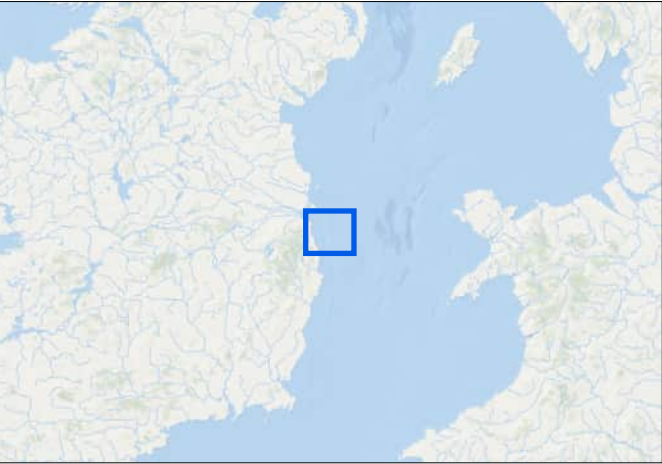
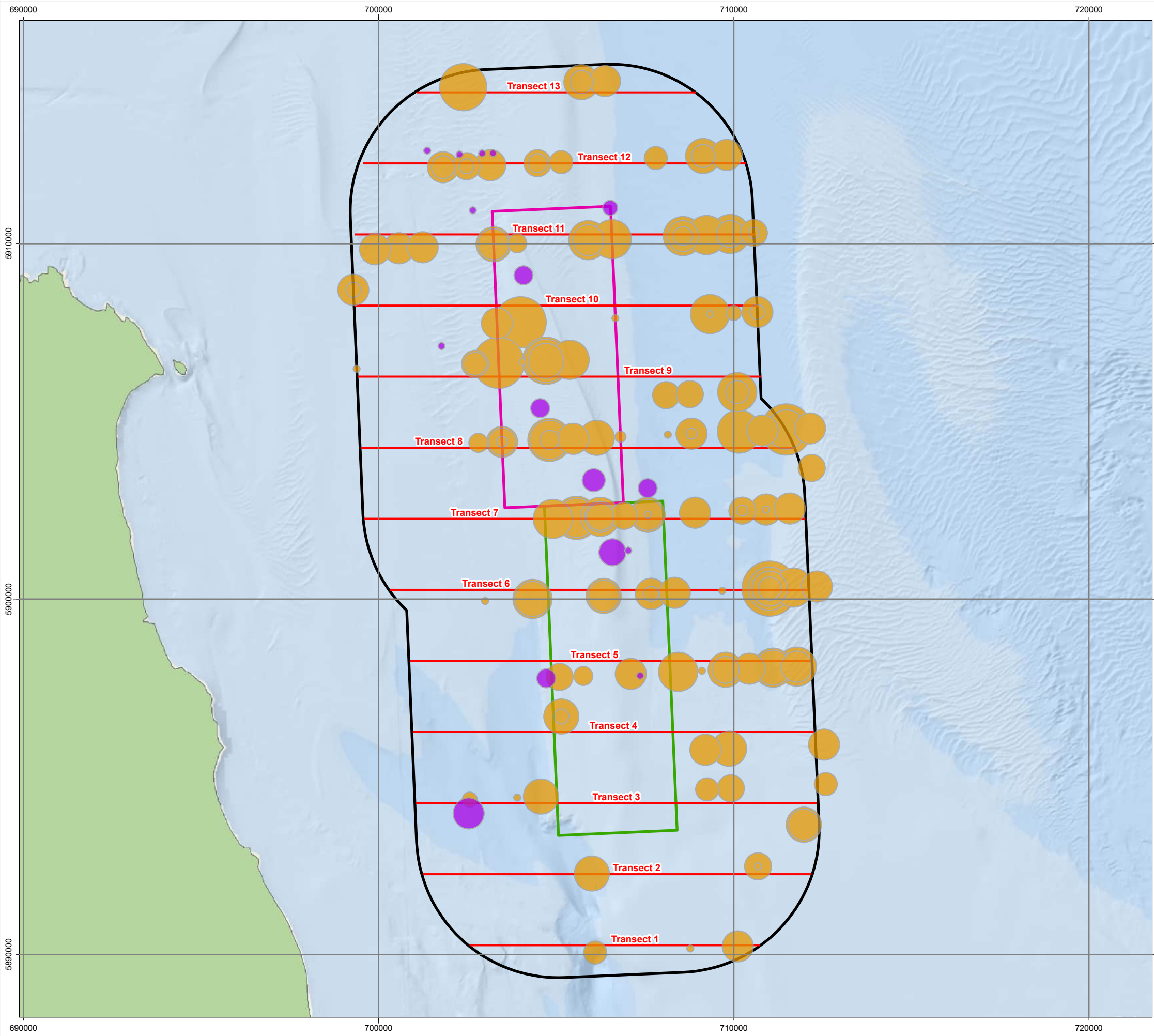
Table 115 Estimated numbers of unidentified guillemots/razorbills in the Dublin Array study area based on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
Array area and 2km Buffer												
Lower	2	0	24	845	458	3	341	137	13	0	0	3
Mean	43	0	80	2,659	1,146	36	1,041	526	51	2	2	39
Upper	145	0	276	8,389	2,935	151	3,285	2,169	190	11	11	170
Array area and 4km Buffer												
Lower	4	0	42	1,503	814	6	606	244	24	0	0	5
Mean	16	0	142	4,583	2,038	90	1,852	935	90	4	4	47
Upper	75	0	490	14,484	5,218	348	5,840	3,857	338	20	20	244

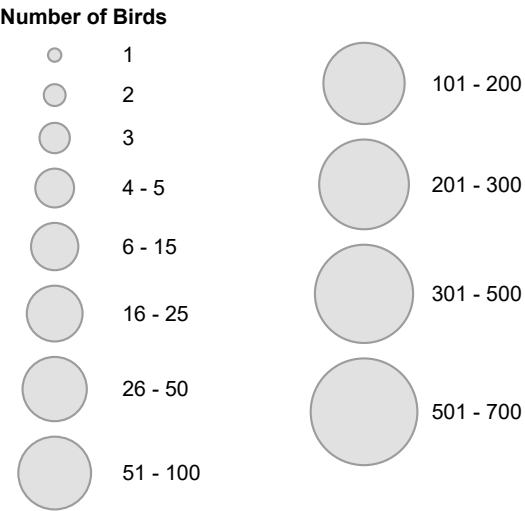
3.4.368 Unidentified guillemots/razorbills were more frequently recorded in the breeding season on the 2019-2021 baseline surveys compared to the 2016-2017 surveys (Figure 55). Unidentified guillemots/razorbills were widely distributed across the array area and buffer area at this time, although fewer unidentified birds were recorded inshore of the array area.

3.4.369 In the post-breeding season, unidentified guillemots/razorbills were predominantly recorded in the array area on the 2016-2017 baseline surveys, although fewer unidentified birds were recorded compared to the breeding season (Figure 56). On the 2019-2021 surveys, unidentified guillemots/razorbills were recorded offshore of the array area in the northern half of the offshore ornithology study area and were more scattered in the southern half of the array area at this time.

3.4.370 In the non-breeding season, fewer unidentified guillemots/razorbills were recorded on baseline surveys, with birds mainly distributed in the array area and in the north end of the buffer area at this time (Figure 57).



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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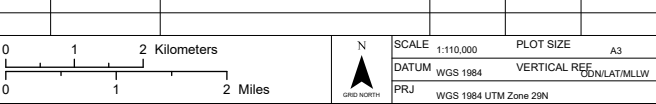
Dublin Array

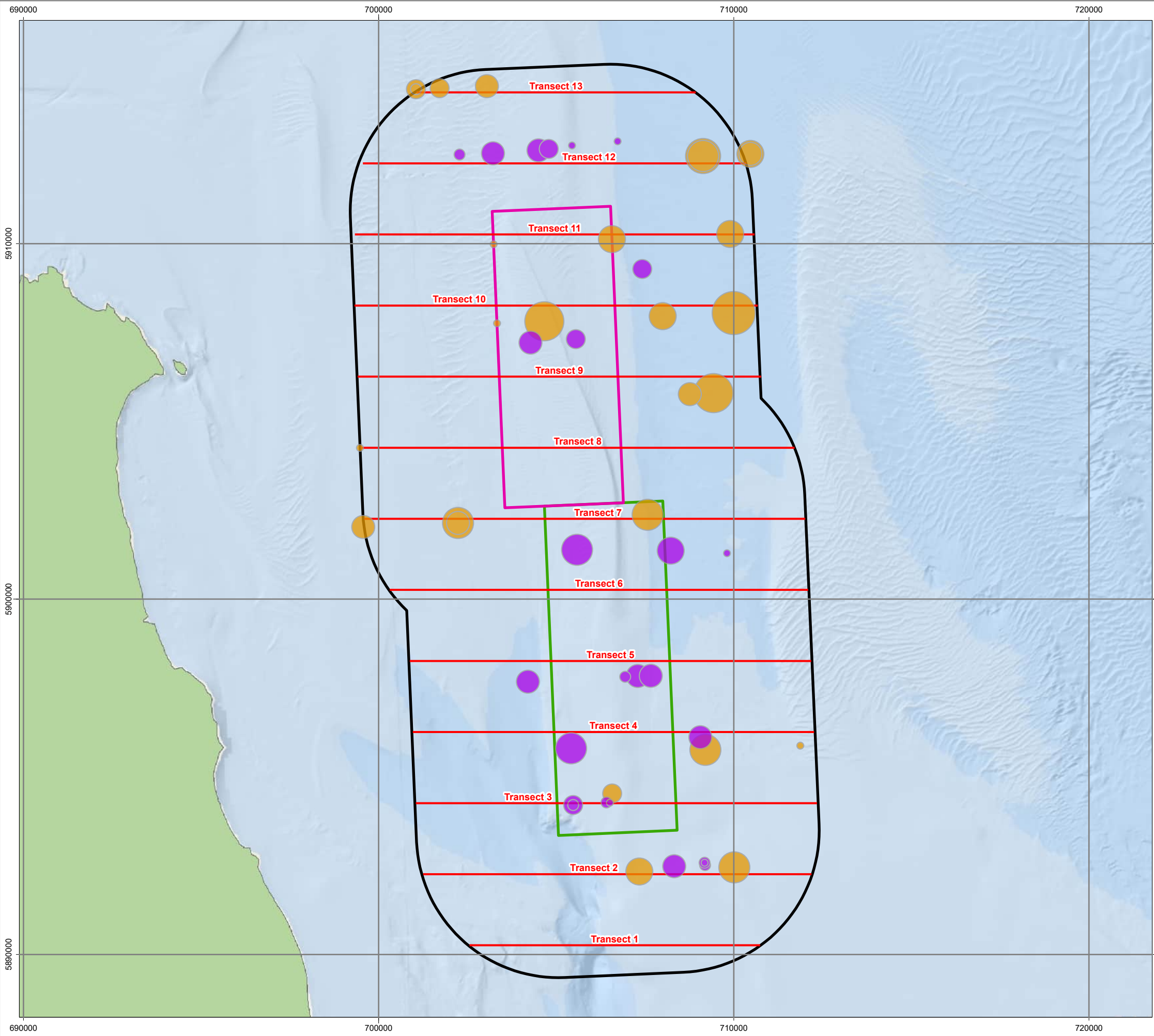
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Marine Bird Survey
Unidentified Guillemot/Razorbill Sightings in the Breeding Season & 2016-2017 and 2019-2021 Baseline Surveys

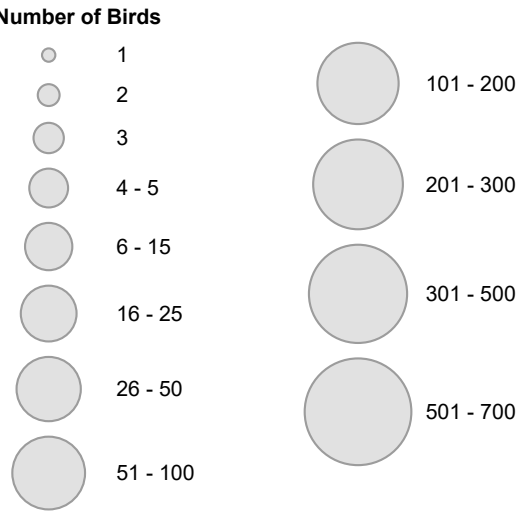
DRAWING NUMBER: **Figure 55** PAGE NUMBER: **Page 49 of 64**

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- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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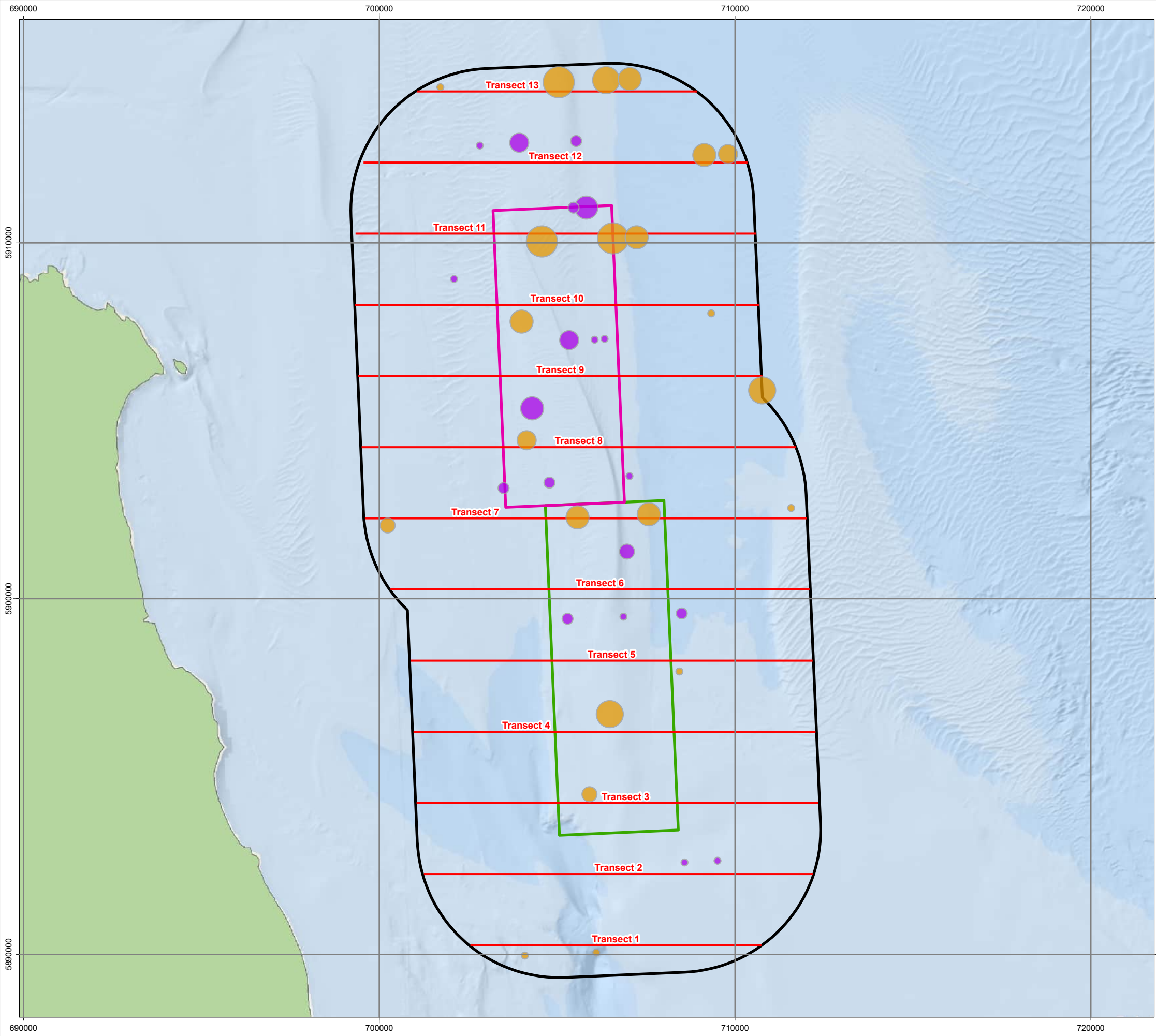
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Marine Bird Survey
Unidentified Guillemot/Razorbill Sightings in the Post-Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys

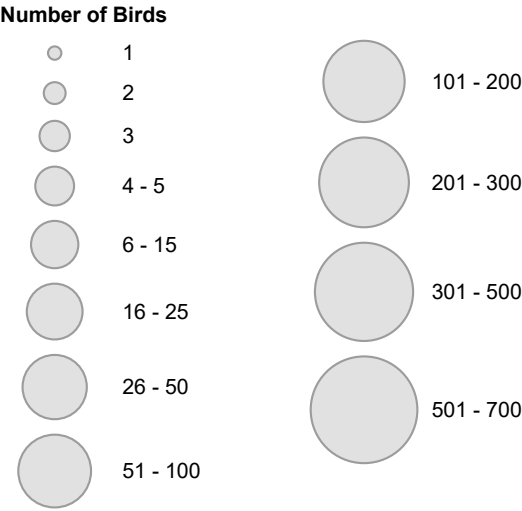
DRAWING NUMBER: **Figure 56** PAGE NUMBER: **Page 50 of 64**

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- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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Marine Bird Survey
Unidentified Guillemot/Razorbill Sightings in the Non-Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER: **Figure 57** PAGE NUMBER: **Page 51 of 64**

VER	DATE	REMARKS	DRAW	CHEK	APRD
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Black Guillemot

3.4.371 Black guillemots breed in small numbers around most of the Irish coast, except for low-lying sections of the east coast, where suitable breeding habitat is lacking (Hutchinson, 1989). The breeding population in Ireland has been estimated at 4,119 individuals on the recent Seabirds Count national census, which is an increase of 23% compared to the previous Seabird 2000 population estimate (Burnell *et al.*, 2023). The species is Amber-listed in Ireland because it has an unfavourable conservation status in Europe (Gilbert *et al.*, 2021).

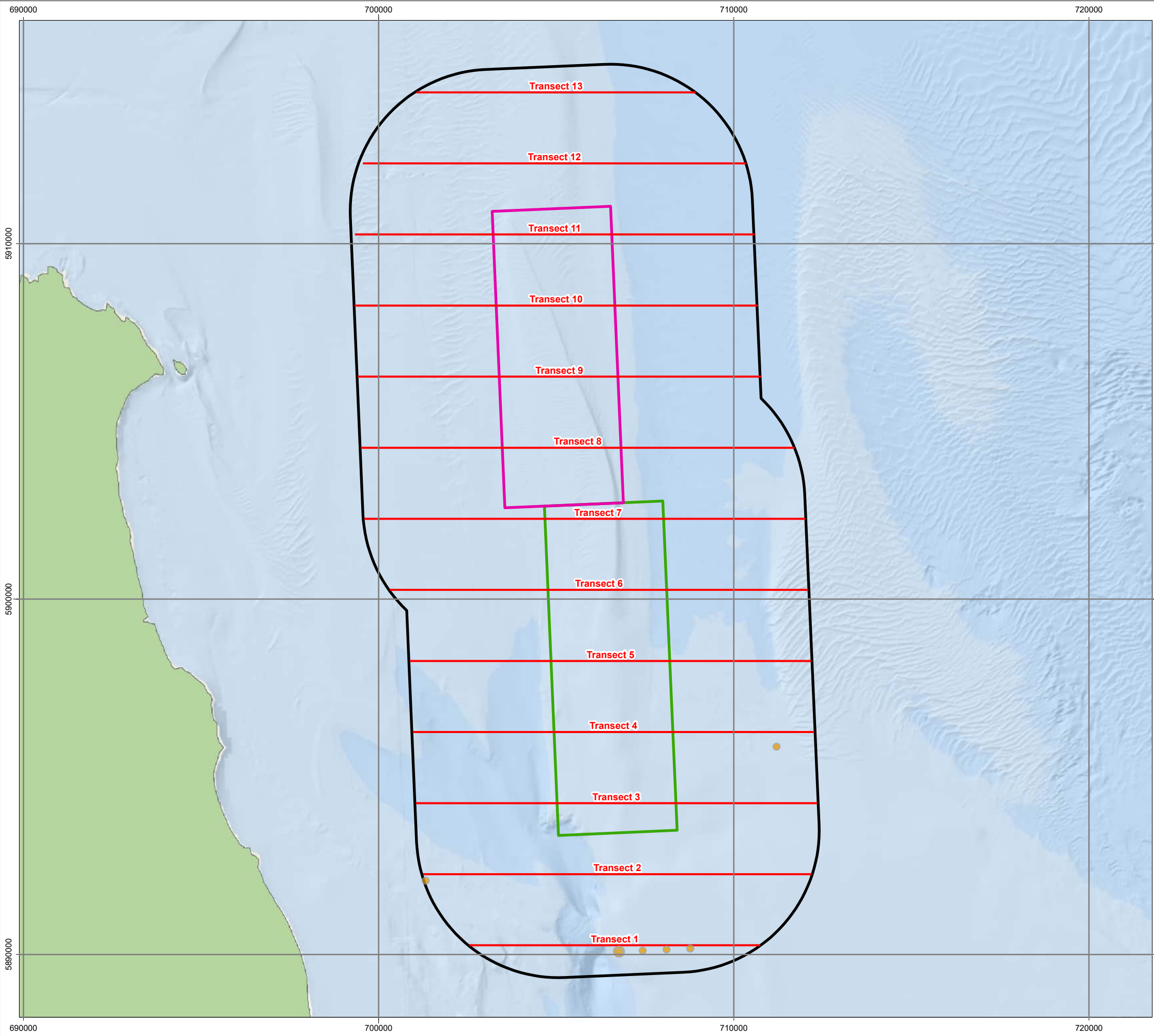
3.4.372 The breeding season has been defined as April to August (Furness, 2015) (Table 3). During the breeding season, adults travel short distances from their colonies to forage, with a mean maximum foraging range of 4.8 ± 4.3 km (Woodward *et al.*, 2019). Based on this, there are no black guillemot colonies with foraging range of Dublin Array. The nearest breeding birds to the study area are on Rockabill (168 individuals in 2018), Ireland's Eye (two individuals in 2015) and Lambay Island (two individuals in 2015) (SMP, 2020). Black guillemots remain near their breeding sites in the non-breeding season (Wernham *et al.*, 2002).

1.1.2 Five black guillemots were recorded on 2016-2017 baseline surveys, with four birds seen in November 2016 and one in February 2017. On the 2019-2021 baseline surveys, 125 black guillemots were recorded, with birds seen in most months. Peak counts were 17 birds in late September 2019, 37 in October 2019 and 22 in December 2019. Average abundance (birds/km) over the two survey periods was low, with a peak of 0.22 birds/km in October (Table 116). For months with more than one survey, the peak number recorded on any one survey is shown.

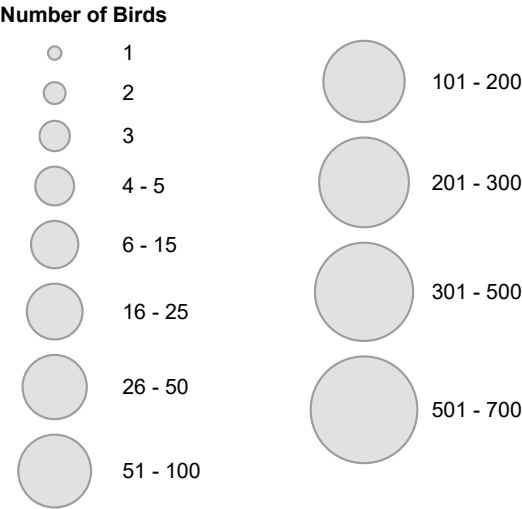
Table 116 Peak monthly counts (raw numbers) of black guillemots in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	1	0	-	0	0	0	0	0	0	4	0
2019-21	5	-	4	1	0	0	6	0	17	37	15	22
Average abundance (birds/km)	0.03	0.02	0.02	0.01	0.00	0.00	0.04	0.00	0.06	0.22	0.11	0.10

3.4.373 Only seven black guillemots were recorded in the offshore ornithology study area during the 2019-2021 baseline surveys in the breeding season, with the majority recorded on the southernmost transect in the buffer area (Figure 58). No black guillemots were recorded in the breeding season on the 2016-2017 surveys.



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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Dublin Array

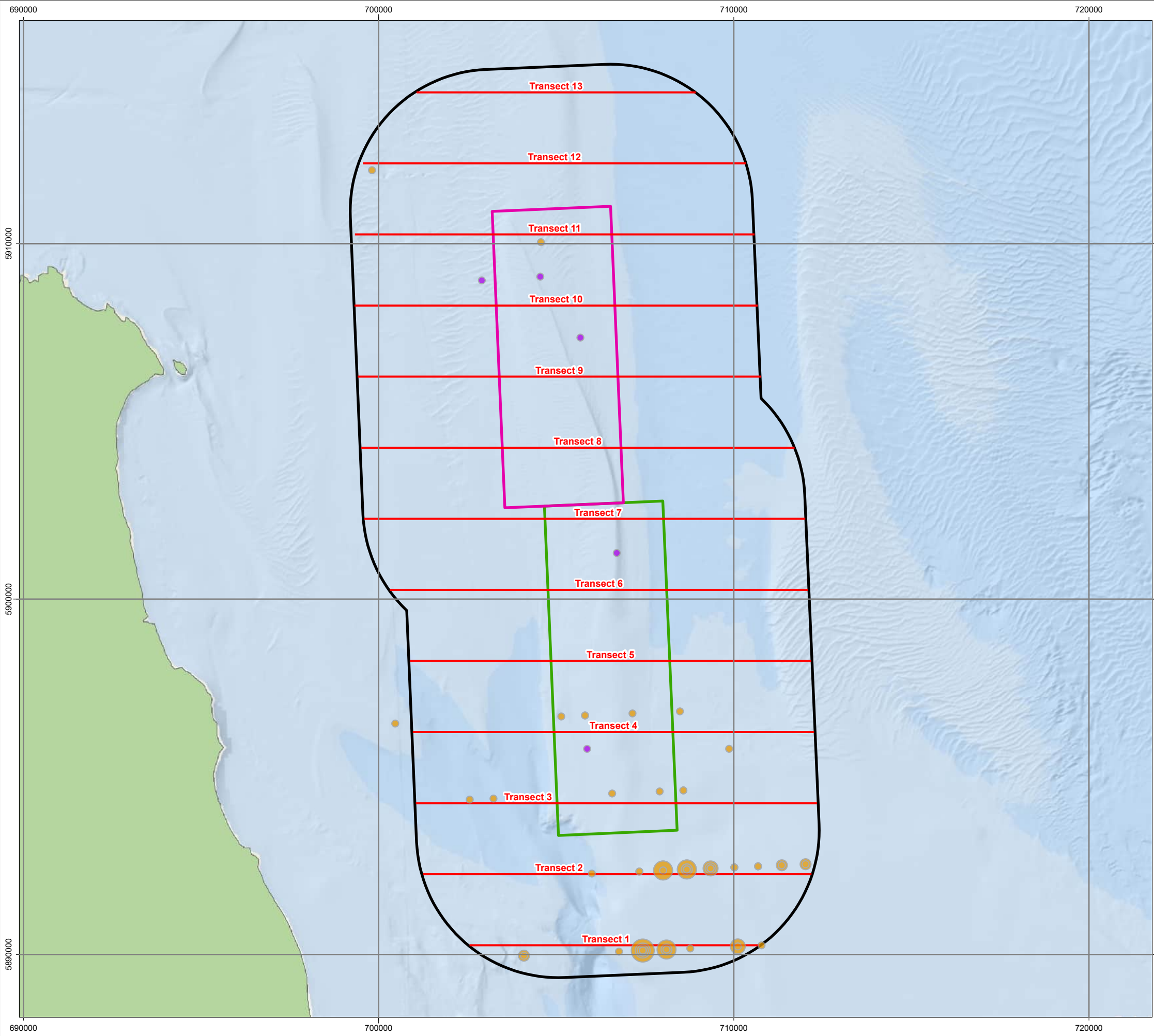
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Black Guillemot Sightings in the Breeding Season on 2019-2021 Baseline Surveys

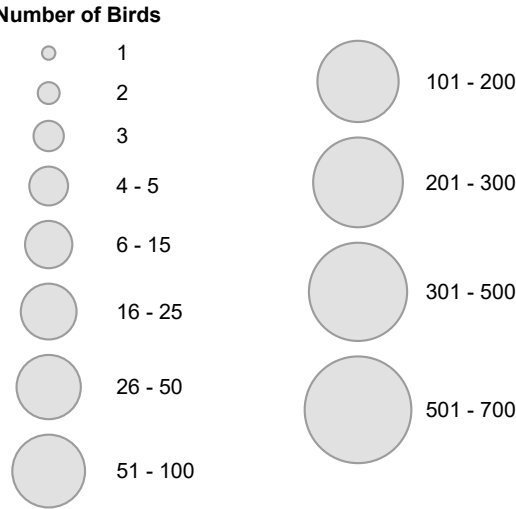
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- Bray Bank Array Area
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- 4km Survey Buffer
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- Bird Sighting 2019 - 2021



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Dublin Array

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Marine Bird Survey
Black Guillemot Sightings in the Non-Breeding Season on 2016-2017 & 2019-2021
Baseline Surveys

DRAWING NUMBER: Figure 59

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- 3.4.374 Black guillemots were more regularly recorded in the offshore ornithology study area on baseline surveys in the non-breeding season, but still showed a preference for the southern half of the offshore ornithology study area. Highest numbers of black guillemots were recorded on the two most southern transect lines, in the buffer area, with single birds recorded occasionally in the array area over the period (Figure 59).
- 3.4.375 Previous 2001-2002 surveys recorded a total of 46 black guillemots on six out of 14 surveys, with peak counts of 15 birds in November 2001, 11 birds in April 2002, eight birds in August 2002, and low numbers or no sightings in other months (Percival *et al.*, 2002). On 2010-2011 surveys, black guillemots were recorded in all months except September, January and March, with peak counts of 11 birds in April 2011 and eight birds in May 2011 (Newton and Trewby, 2011).
- 3.4.376 A total of 12 black guillemots were recorded off the Irish east coast on the ObSERVE 2016 aerial surveys, in summer and autumn months. The mean density of black guillemots across the survey study area was 0.01 birds/km² in both summer and autumn giving an estimated abundance of 52 (95% CIs 29 – 93) birds in summer and 60 (95% CIs 23 – 156) birds in autumn (Jessopp *et al.*, 2018).
- 3.4.377 Flight height was recorded for 53 black guillemots on baseline surveys in 2016-2017 and 2019-2020, with 100% of all flying birds recorded below 20 m MSL in height i.e. below likely rotor-swept height. A total of 51 birds were recorded flying below 5m in height, with one bird recorded flying between 5 and 10 m in height.

Atlantic Puffin

- 3.4.378 Puffins are present at the breeding colonies around the Irish coast during the summer months. The breeding population in Ireland has been estimated at 14,232 pairs on the recent Seabirds Count national census, which is a decrease of 26% compared to the previous Seabird 2000 population estimate (Burnell *et al.*, 2023). The species is Red-listed in Ireland, as it has been classified as being Vulnerable by the IUCN, and because it has been classified as being of global conservation concern by Birdlife International (Gilbert *et al.*, 2021).
- 3.4.379 The breeding season for puffin has been defined as April to early August (Furness, 2015) (Table 3). During the breeding season, adults may travel widely from their colonies to feed, with a mean maximum foraging range of 137.1 ± 128.3 km (Woodward *et al.*, 2019). Recent counts for puffin colonies within mean maximum foraging range ± 1 SD of Dublin Array are shown in Table 117 (Burnell *et al.*, 2023).

Table 117 Recent counts for puffin colonies within mean maximum foraging range of Dublin Array

Species & mean maximum foraging range	Colony	Distance from Dublin Array	Most recent count & year
Puffin (137.1 ± 128.3 km)	Ireland's Eye (Dublin)	22.1 km	127 pairs (2015)
	Lambay Island (Dublin)	30.4 km	144 pairs (2015)
	Little Saltee Island (Wexford)	142.9 km	270 pairs (2016)
	Great Saltee Island (Wexford)	144.9 km	549 pairs (2021)
	N Ireland colonies	Within 265.4 km	574 pairs (2016-2021)
	Wales colonies	Within 265.4 km	30,663 pairs (2018-2021)
	Isle of Man colonies	Within 265.4 km	8 pairs (2016)
	Scotland colonies	Within 265.4 km	125 pairs (2021)
	England colonies	Within 265.4 km	853 pairs (2021)
	Estimated breeding season population within mean maximum foraging range ± 1 SD		33,313 pairs

3.4.380 Puffins have been shown to disperse widely from their breeding colonies, into the North Atlantic after the breeding season (Harris and Wanless, 2011). Furness (2015) considered that outside the breeding season there was one BDMPS period for puffin; the non-breeding season (mid-August to March). In addition to waters off the Irish east and south coasts, the relevant BDMPS region for puffin is “UK Western Waters”, as defined in Furness (2015).

3.4.381 The original BDMPS population for puffin for the “UK Western Waters” region was estimated as 304,557 birds (all ages) for the non-breeding season, which included an Irish component of 8,160 birds (4,000 adults and 4,160 immature birds)) (Furness, 2015). This Irish component was subtracted from the original BDMPS winter period population, which gives an estimate of 293,397 birds (all ages). To include an estimate of Irish puffins in the BDMPS reference population, an estimate of breeding adults from the most recent Seabirds Count census for the Irish east and south coast county totals was calculated (Burnell *et al.*, 2023) (Table 118). In addition, the number of non-breeding immature birds was also estimated by multiplying the number of breeding adults by the ratio of adult to immature birds, based on stable age structure population compositions derived from demographic parameters presented in Horswill and Robinson, (2015) (Table 4).

Table 118 Estimated Irish component of BDMPS regional reference population for puffin

Irish breeding population	East & South coast population	Ratio of adult:immature birds	Estimate of immature birds	Combined Total
28,464 adults	2,188 adults	0.842	2,189 (2,188x0.842)	4,377 birds

3.4.382 The combined total of breeding adults and estimated number of immature birds were then applied to the existing population for the “UK Western Waters” for the relevant non-breeding period, as defined in Furness (2015) (Table 119).

Table 119 Estimated BDMPS regional reference populations for puffin

Period	Furness (2015) BDMPS estimate without Irish component	Irish east & south coast estimate (all ages)	Combined Total
Non-breeding season	293,397	4,377	297,774 birds

3.4.383 For puffin, the revised non-breeding season BDMPS regional population was estimated to be 297,774 birds (all ages) (Table 119).

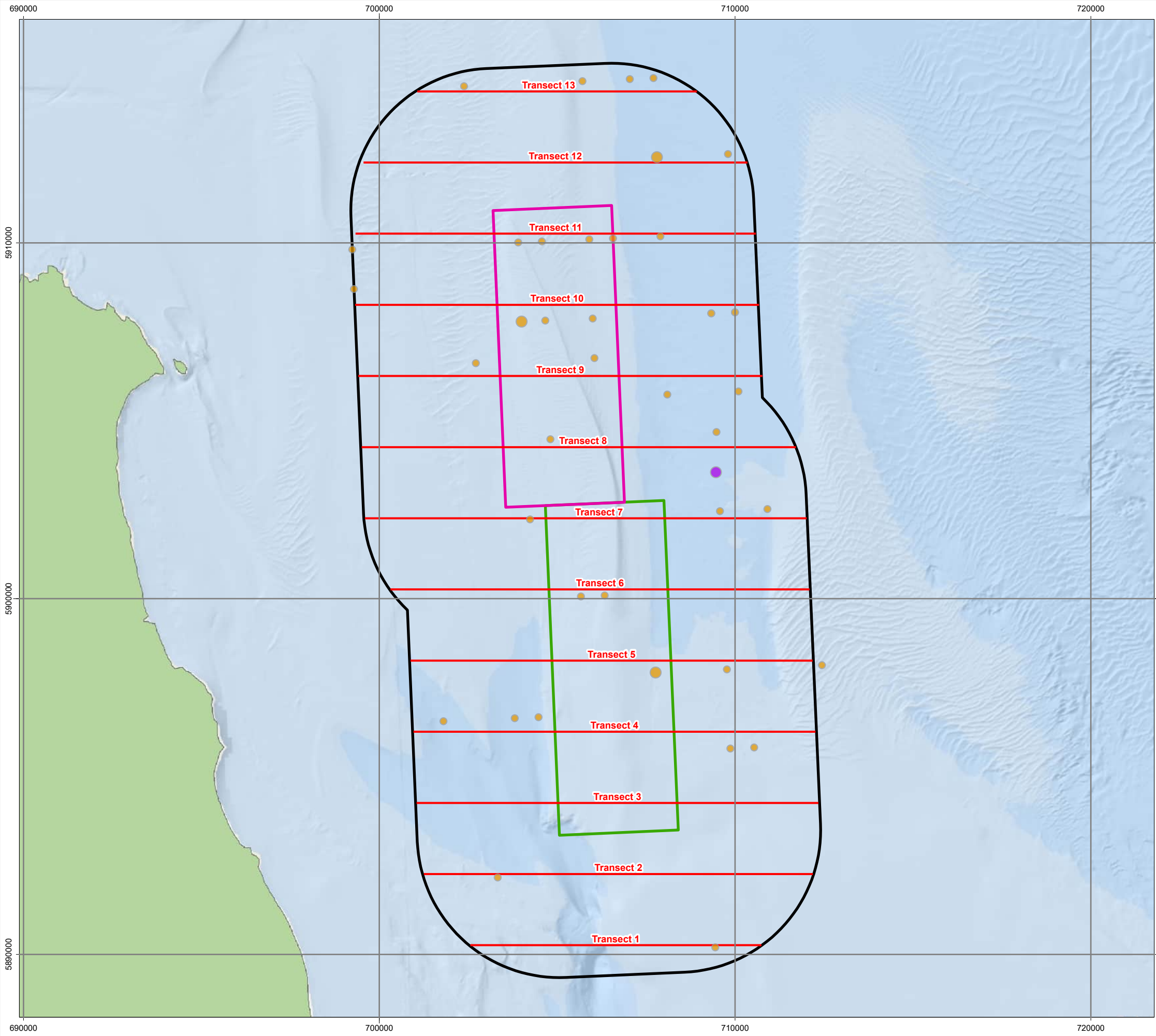
3.4.384 ESAS surveys recorded low concentrations of puffins off the Irish east coast in late summer, but virtually no birds in the Irish Sea in winter months (Pollock *et al.*, 1997).

3.4.385 Two puffins were recorded on 2016-2017 baseline surveys, in May 2017. On 2019-2021 surveys, 56 puffins were recorded between April and November, with peak counts of 7 birds in mid-April 2021, 12 birds in June 2019, and eight birds in both July 2019 and July 2020 (Table 120). Average abundance (birds/km) over the two survey periods was low, with a peak of 0.07 birds/km recorded in August. The peak count recorded on any one survey is shown.

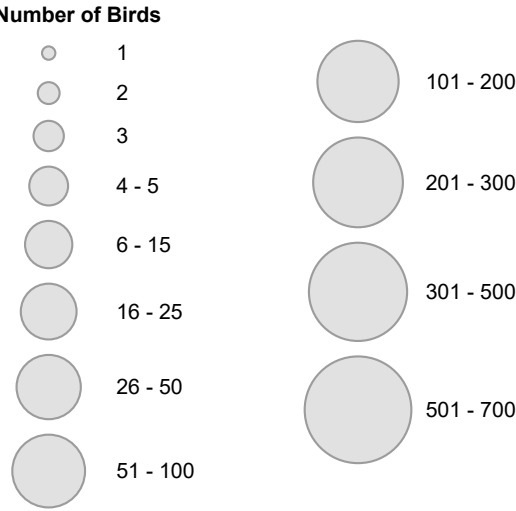
Table 120 Peak monthly counts (raw numbers) of puffins in the offshore ornithology study area on 2016-2017 and 2019-2021 surveys

	J	F	M	A	M	J	J	A	S	O	N	D
2016-17	-	0	0	-	2	0	0	0	0	0	0	0
2019-21	1	-	0	7	3	12	8	3	0	1	6	0
Average abundance (birds/km)	0.01	0.00	0.00	0.06	0.03	0.06	0.07	0.01	0.00	0.00	0.03	0.00

3.4.386 Puffins were recorded in low numbers in the offshore ornithology study area on 2019-2021 baseline surveys in the breeding season (April to early August), with most sightings occurring in the array area or further offshore in the buffer area (Figure 60). There were very few sightings of puffins in the breeding season on the 2016-2017 surveys, with just two individuals recorded in May 2017 in the offshore buffer area



- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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PROJECT TITLE

Dublin Array

DRAWING TITLE

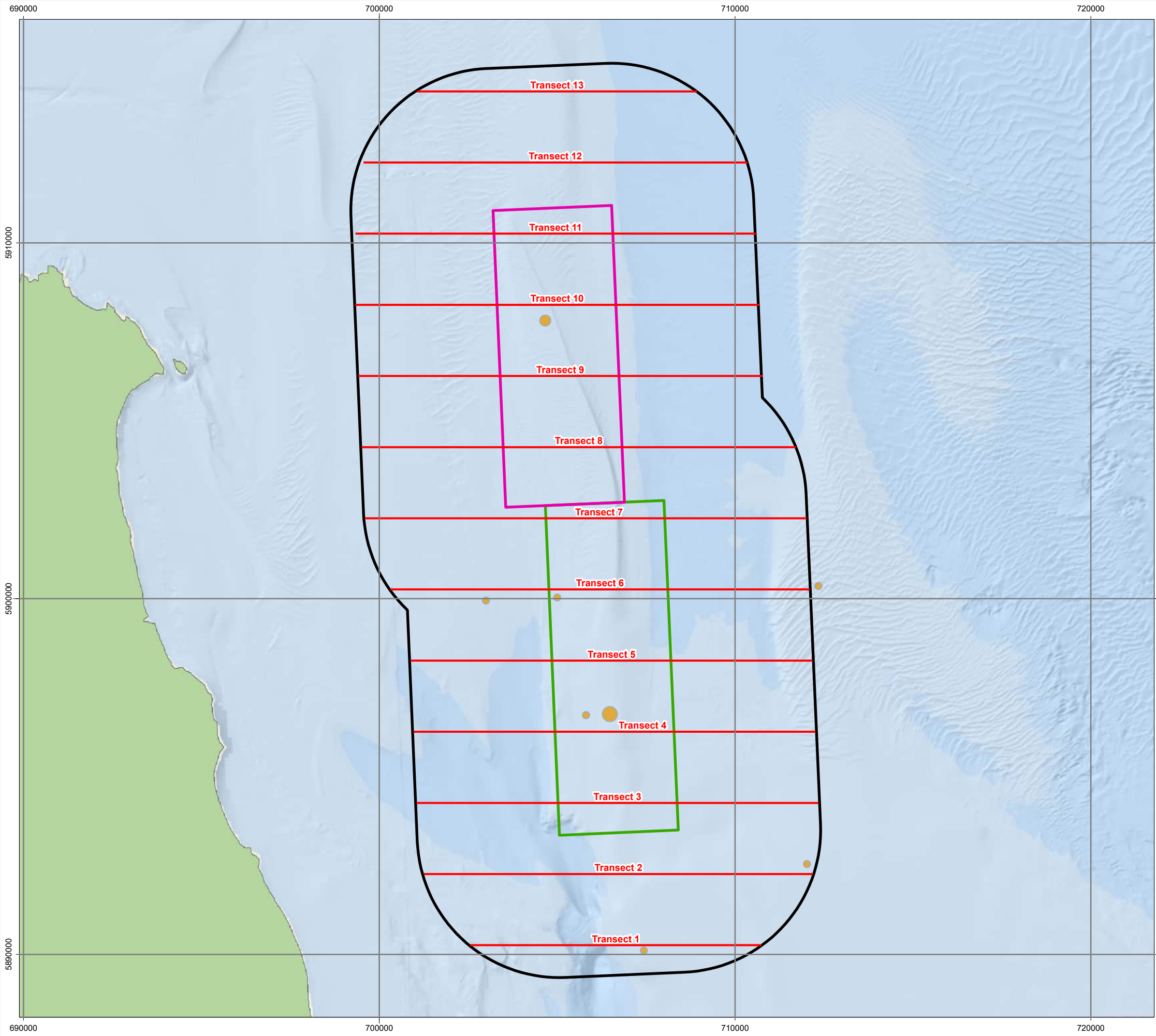
Marine Bird Survey
Puffin Sightings in the Breeding Season on 2016-2017 & 2019-2021 Baseline Surveys

DRAWING NUMBER: Figure 60

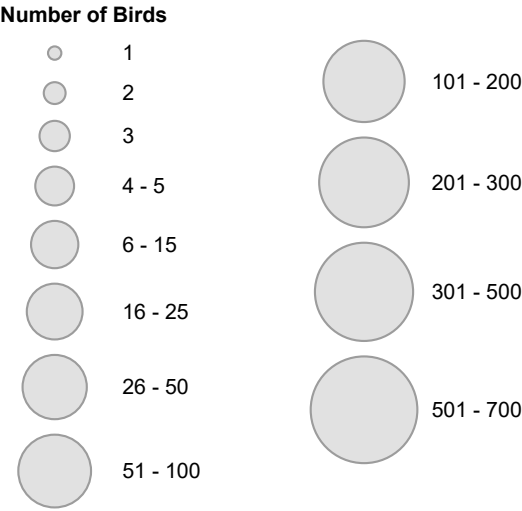
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VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE





- Bray Bank Array Area
- Kish Bank Array Area
- 4km Survey Buffer
- Transect Line and Number
- Bird Sighting 2016 - 2017
- Bird Sighting 2019 - 2021



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PROJECT TITLE

Dublin Array

DRAWING TITLE

Marine Bird Survey
Puffin Sightings in the Non-Breeding Season on 2019-2021 Baseline Surveys

DRAWING NUMBER: Figure 61			PAGE NUMBER: Page 55 of 64		
VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-16	DRAFT	AM	AB	AE
02	2025-01-16	PUBLIC	JK	AE	AE



- 3.4.387 There were only 12 puffins recorded on 2019-2021 baseline surveys in the offshore ornithology study area outside the breeding season between late August and January (Figure 61). Low numbers of puffins were recorded in the array area, with birds also recorded occasionally in the buffer area at this time. No puffins were recorded in the offshore ornithology study area in the non-breeding season on 2016-2017 surveys.
- 3.4.388 Previous 2001-2002 surveys recorded 15 puffins, with a peak count of five birds in June 2002 (Percival *et al.*, 2002). On 2010-2011 surveys, 12 puffins were recorded, with a peak count of six birds in June 2010 (Newton and Trewby, 2011).
- 3.4.389 A total of 27 puffins were recorded off the Irish east coast on the ObSERVE 2016 aerial surveys, with 26 birds seen in summer and one bird recorded on the autumn surveys. The distribution of sightings was consistent with breeding colonies at Ireland's Eye and the Saltee Islands. Surveys found that most observations were over water depths of 30-60 m and concluded that puffins may have been avoiding very nearshore areas and shallow sandbanks in the survey area. The mean density of Atlantic puffins in summer was 0.02 birds/km², and abundance of puffins across the survey area was estimated at 229 (95% CIs 169 - 309) individuals in summer and six (95% CIs 2 - 18) birds in autumn (Jessopp *et al.*, 2018).
- 3.4.390 Flight height was recorded for 23 puffins on baseline surveys in 2016-2017 and 2019-2021, with 100% of all flying birds recorded below 20 m MSL in height i.e. below likely rotor-swept height. A total of 21 puffins were recorded flying below 5 m, with two birds recorded between 5 and 10 m in height.
- 3.4.391 A total of 21 puffins were aged on baseline surveys. There were 10 birds aged as adult, all between April and June, with three immature birds recorded in June and eight juvenile birds recorded in July and August.

3.5 Non seabird species

- 3.5.1 A total of 18 species of non-seabird were recorded on 2016-2017 and 2019-2021 baseline surveys, along with a further three non-seabird species groups where full identification was not possible (Table 8). A brief summary of each of these sightings is presented below.

Mute Swan

- 3.5.2 Seven mute swans were recorded flying north below 5m in height on the December 2016 survey. This species was not recorded on the 2019-2021 baseline surveys.

Brent Goose

- 3.5.3 A total of 43 brent geese were recorded on the early April 2021 baseline survey. A flock of 25 were recorded flying north below 5m in height through the inshore buffer area, with a second flock of 17 birds flying north through the inshore buffer area between 20 and 30 m in height. A single bird was also recorded flying north in the array area between 10 and 20 m in height. This species was not recorded on the 2016-2017 baseline surveys.

Shelduck

- 3.5.4 One shelduck was recorded flying north between 5 and 10 m in height in September 2017. This species was not recorded on the 2019-2021 baseline surveys.

Purple Sandpiper

- 3.5.5 Four purple sandpipers were recorded west and north west below 5m in height on the late May 2020 survey, with three birds seen in the offshore buffer area, and one bird in the array area. This species was not recorded on the 2016-2017 baseline surveys.

Dunlin

- 3.5.6 A flock of seven dunlin were recorded flying south between 5 and 10 m in height on the September 2016 survey. On the 2019-2021 surveys, a flock of eight dunlin were recorded flying west below 5m in height on the edge of the array area on the late May 2020 survey, while three dunlin were recorded flying south east below 5m in height in the offshore buffer area on the June 2020 survey.

Whimbrel

- 3.5.7 One whimbrel was recorded flying west between 20 and 30 m in height on the late April 2021 survey. This species was not recorded on the 2016-2017 baseline surveys.

Curlew

- 3.5.8 Two curlews were recorded flying west between 10 and 20 m in height in the southern half of the array area on the July 2019 survey. This species was not recorded on the 2016-2017 baseline surveys.

Turnstone

- 3.5.9 Three turnstones were recorded flying north east in the inshore buffer area on the late May 2020 survey. This species was not recorded on the 2016-2017 baseline surveys.

Swift

- 3.5.10 On the 2016-2017 surveys, one swift was recorded flying north in June 2017. On the 2019-2021 surveys, one swift was recorded flying south between 10 and 20 m in height in the southern half of the array area on the June 2020 survey, while two were recorded flying west between 5 and 10 m in height in the southern end of the buffer area on the July 2020 survey.

Sand Martin

- 3.5.11 One sand martin was recorded flying north below 5m in height on the late March 2021 survey. This species was not recorded on the 2016-2017 baseline surveys.

Swallow

- 3.5.12 A total of 42 swallows were recorded during the 2019-2021 surveys, with 19 birds in the offshore buffer area on the late August 2019 survey, seven on the early September 2019 survey (five birds in the array area and two birds in the inshore buffer area), two in the inshore buffer area on the late May 2020 survey, 10 in the north end of the buffer and edge of the array area on the August 2020 survey and two on both the early and late April 2021 surveys. All birds were recorded flying below 20 m in height, with 19 birds flying below 5 m, 15 birds flying between 5 and 10 m, and eight birds flying between 10 and 20 m in height. This species was not recorded on the 2016-2017 baseline surveys.

Meadow Pipit

- 3.5.13 A total of 46 meadow pipits were recorded during the 2019-2021 surveys, with two seen in the inshore buffer area on the early September 2019 survey and 44 seen on the late March 2021 survey. All birds were recorded flying below 20 m in height, with eight birds flying below 5 m, 30 birds flying between 5 and 10 m, and eight birds flying between 10 and 20 m in height. This species was not recorded on the 2016-2017 baseline surveys.

Pied Wagtail

- 3.5.14 One pied wagtail was recorded flying south west below 5m in height in the inshore buffer area on the early September 2019 survey. This species was not recorded on the 2016-2017 baseline surveys.

Song Thrush

- 3.5.15 Four song thrushes were recorded flying north west below 5m in height on the December 2020 survey. This species was not recorded on the 2016-2017 baseline surveys.

Goldcrest

- 3.5.16 Three goldcrests were recorded on the late March 2021 survey. One was flying east between 10 and 20 m in height, with one seen flying west between 5 and 10 m in height and one circling between 10 and 20 m in height. This species was not recorded on the 2016-2017 baseline surveys.

Starling

3.5.17 A total of 88 starlings were recorded during the 2019-2021 surveys. Four were seen flying west below 5m in height in the inshore buffer area on the October 2019 survey. On the November 2019 survey, 68 starlings were recorded flying west below 5m in height (14 birds in the array area and 54 birds in the offshore buffer area). On the July 2020 survey, 14 starlings were seen flying south west between 20 and 30 m in height in the offshore buffer area, while on the December 2020 survey, two starlings flew south west below 5m in height. This species was not recorded on the 2016-2017 baseline surveys.

Chaffinch

3.5.18 One chaffinch was recorded flying west below 5m in height on the late March 2021 survey. This species was not recorded on the 2016-2017 baseline surveys.

Linnet

3.5.19 A flock of 13 linnets were recorded flying west on the October 2016 survey. This species was not recorded on the 2019-2021 baseline surveys.

Unidentified species groups

3.5.20 In addition, eight unidentified *Calidrid* waders were recorded flying north west below 5m in height in the array area on the early August 2019 survey. An unidentified small wader was recorded flying north between 5 and 10 m in height in the offshore buffer area on the November 2019 survey, while another was recorded flying west below 5m in height on the late April 2021 survey. Four unidentified passerines were also recorded on surveys, with two seen in the offshore buffer area on the early September 2019 survey and two seen on the late March 2021 survey (not mapped).

3.6 Intertidal survey results

3.6.1 For the 2019/20 surveys overall, the majority of waterbird taxa such as gulls, wildfowl, divers, cormorants and shags were recorded on or over the water offshore out to 1.5 km. Of the two vantage points (VP) covered, VP2 is the most relevant to this assessment as it is close to the proposed landfall location, while VP1 is approximately 1.5 km to the south. A summary of the numbers of birds recorded at VP2 over the survey period is presented in Table 121.

3.6.2 As expected, waders such as oystercatchers *Haematopus ostralegus*, ringed plover *Charadrius hiaticula* and greenshank *Tringa nebularia* tended to be observed foraging along the water's edge. The shoreline was less utilised by waterbirds owing to its narrow foreshore and absence of a strand, with the exception of the mouth of the Shanganagh River, which enters the sea approximately 200 m to the north of VP2. Small to medium sized flocks of gulls and waders were regularly recorded foraging in this area throughout the survey season, however no species were recorded in significant numbers.

- 3.6.3 For the 2023/24 surveys overall, the figures show that most waterbird taxa such as gulls, wildfowl, divers, cormorants and shags were recorded on or over the water offshore out to 1 km. As expected, wader species such as Eurasian oystercatcher, common ringed plover and ruddy turnstone tended to be observed foraging along the water's edge. The shoreline was less utilised by waterbirds owing to its narrow foreshore and absence of a strand, except for the mouth of the Shanganagh River, which enters the sea approximately 200 m to the north of VP2. Small to medium sized flocks of gulls and waders were recorded foraging in this area throughout the survey season.
- 3.6.4 The peak counts of waterbird species are presented in Table 122.

Table 121 Peak counts of waterbird species recorded from VP2 on each survey date between November 2019 and October 2020, the number of half-hourly counts in which each species was observed and the proportional frequency of those observations

Species	No of counts with species present	Proportional frequency of observations ⁴	28/11/19	11/12/19	12/12/19	22/01/20	23/01/20	12/02/20	19/03/20	16/9/20	21/10/20
Common Scoter	1	2%	-	14	-	-	-	-	-	-	-
Red-breasted Merganser	12	22%	-	-	-	-	-	2	2	2	2
Red-throated Diver	18	33%	-	2	-	4	-	2	2	-	2
Great Northern Diver	4	7%	-	1	-	-	-	-	1	-	2
Great Crested Grebe	11	20%	-	-	-	-	-	2	-	7	2
Fulmar	3	6%	-	-	-	-	-	-	1	1	-
Gannet	1	2%	-	-	-	-	-	-	-	-	2
Shag	44	81%	4	9	2	7	1	3	3	4	5
Cormorant	18	33%	-	-	-	-	1	1	2	1	2
Grey Heron	3	6%	-	-	1	-	-	2	-	1	-
Osytercatcher	21	39%	10	7	13	11	19	5	11	12	3
Ringed Plover	6	11%	-	-	60	30	6	12	-	-	-
Knot	3	6%	-	22	-	-	-	-	-	-	-
Redshank	1	2%	-	-	-	-	-	-	-	3	-

⁴ i.e. the proportion of half-hourly counts on which they were recorded – n=54

Species	No of counts with species present	Proportional frequency of observations ⁴	28/11/19	11/12/19	12/12/19	22/01/20	23/01/20	12/02/20	19/03/20	16/9/20	21/10/20
Greenshank	4	7%	-	-	-	-	-	-	2	2	2
Bar-tailed Godwit	1	2%	-	-	-	-	-	-	-	-	7
Turnstone	14	26%	9	9	-	-	14	10	7	11	-
Little Gull	2	4%	-	2	-	-	-	-	-	-	-
Mediterranean Gull	8	15%	3	1	-	-	-	1	-	2	-
Black-headed Gull	42	78%	120	100	30	25	42	27	3	19	31
Common Gull	7	13%	-	-	-	-	6	3	2	2	2
Kittiwake	2	4%	-	11	-	-	-	-	-	-	-
Lesser black-backed Gull	15	28%	2	5	12	12	7	-	-	-	-
Herring Gull	38	70%	10	18	-	16	27	12	4	26	18
Great black-backed Gull	26	48%	5	4	8	8	11	2	1	3	2
Unidentified gull species	4	7%	-	-	10	17	-	-	-	-	-
Sandwich Tern	3	6%	-	-	-	-	-	-	-	6	-
Common/Arctic Tern	1	2%	-	-	-	-	-	-	-	3	-
Guillemot	8	15%	-	2	-	2	-	-	4	6	1
Razorbill	4	7%	-	-	-	-	-	-	-	3	-
Unidentified auk	1	2%	-	-	-	-	-	-	-	-	6

Species	No of counts with species present	Proportional frequency of observations ⁴	28/11/19	11/12/19	12/12/19	22/01/20	23/01/20	12/02/20	19/03/20	16/9/20	21/10/20
Black guillemot	13	24%	2	2	-	-	-	2	2	2	2

Table 122 Peak counts of waterbird species recorded on each survey date between September 2023 and March 2024, the number of half-hourly counts in which each species was observed and the proportional frequency of those observations (i.e. the proportion of half-hourly counts on which they were recorded – n=164)

Species	No. of Counts in Which Species Observed	Proportional Frequency of Observations	September	October	November	December	January	February	March
Bar-tailed godwit	1	<1%	-	-	-	2	-	-	-
Black guillemot	6	4%	-	-	-	-	-	14	-
Black-headed gull	113	69%	25	8	12	29	20	25	23
Brent goose	3	2%	-	-	-	-	50	-	200
Guillemot	16	10%	-	1	2	1	-	-	2
Common gull	5	3%	-	2	5	1	-	1	-
Ringed plover	28	17%	40	35	25	40	4	14	-
Common tern	1	<1%	2	-	-	-	-	-	-
Curlew	1	<1%	-	-	-	-	-	-	3
Oystercatcher	39	24%	14	25	26	20	30	23	20
Herring gull	150	91%	47	106	27	46	22	71	27

Species	No. of Counts in Which Species Observed	Proportional Frequency of Observations	September	October	November	December	January	February	March
Shag	71	43%	1	2	3	15	4	4	2
Great black-backed gull	109	66%	6	3	3	4	4	3	2
Cormorant	87	53%	4	3	4	6	1	6	1
Grey heron	2	1%	-	1	-	-	-	-	-
Lesser black-backed gull	2	1%	-	-	1	-	-	-	2
Mediterranean gull	36	22%	19	45	2	2	4	28	5
Gannet	5	3%	1	1	-	-	-	-	-
Razorbill	8	5%	1	-	-	3	-	2	-
Red-throated diver	10	6%	-	1	-	3	-	1	-
Turnstone	26	16%	20	5	5	2	1	2	-
Sandwich tern	1	<1%	1	-	-	-	-	-	-

- 3.6.5 In general, black-headed gull and shag were the most frequently recorded species in the inter-tidal study area from VP2. Oystercatcher was the most regularly recorded species of wader recorded on inter-tidal surveys at VP2.
- 3.6.6 Black-headed gull was recorded on 78% of counts from VP2 throughout the season, making it the second most regularly recorded species at VP2. Birds were recorded in all survey months, with a peak of 120 birds in November 2019 and 100 birds in December 2019. Lower numbers were recorded in other months.
- 3.6.7 Shag was the most regularly recorded species at VP2, present in 81% of counts. The peak count of shags at VP2 was nine birds in December 2019. Two further species were recorded on more than 50% of overall counts; herring gull (recorded on 70% of counts from VP2) and great black-backed gull (recorded on 48% of counts from VP2). The peak counts of herring gull at VP2 were 27 birds in January 2020 and 26 birds in September 2020. The peak counts of great black-backed gull at VP2 were 11 birds in January 2020 and eight birds in December 2019.
- 3.6.8 Oystercatchers were the most regularly recorded species of wader at VP2, with small numbers recorded each month and a peak of 19 birds in January 2020. Ringed Plover were recorded at VP2 between December 2019 and February 2020, with a peak count of 60 birds in December 2019, while turnstone (*Arenaria interpres*) were regularly recorded in low numbers over the period, with a peak of 14 birds in January 2020. Other wader species such as knot (*Calidris canutus*), redshank (*Tringa tetanus*) and greenshank were also recorded occasionally over the survey period in lower numbers.
- 3.6.9 Species that are known to be susceptible to disturbance such as divers and common scoter were only recorded in the Inter-tidal study area in very low numbers over the study period. A peak of four Red-throated divers were recorded from VP2 in January 2020, with two birds seen in December 2019, February 2020, March 2020 and October 2020. Single great northern divers were recorded in December 2019 and March 2020, with two recorded in October 2020. Common scoter were only recorded in December 2019 when 14 birds were seen. The low numbers recorded on surveys indicates that the Inter-tidal study area does not support significant numbers of these species.
- 3.6.10 Overall, no species were recorded in numbers exceeding 1% of the national population, which would be considered significant.
- 3.6.11 Between September 2023 and March 2024, at least 22 waterbird species were recorded from VP2 (Table 122). Gull species and shags and cormorants were the most frequently occurring species groups recorded in the study area. Herring gull was recorded during 91% of counts from VP2 throughout the season, with a peak count of 106 birds in October 2023. In addition, black-headed gulls were recorded on 69% of counts, with a peak count of 29 birds in December 2023, great black-backed gull were recorded on 66% of counts, with a peak count of six birds in September 2023, and cormorants were recorded on 53% of counts, with a peak count of six birds in December 2023 and February 2024.

- 3.6.12 Excluding gulls, the highest peak count for any species was for light-bellied brent goose ($n = 220$). This species was only recorded on surveys in January 2024 ($n = 50$ and $n = 12$) and one count in March 2024 ($n = 220$). These data show that although some peak counts of light-bellied brent goose were relatively high, the frequency of their occurrence within the study area was low. This species was only recorded flying through the study area with no indication that the geese were using the survey area other than flying through it.
- 3.6.13 Overall, as with the 2019-2020 surveys, no species were recorded in numbers exceeding 1% of the national population, which would be considered significant. Further information on the intertidal surveys is presented in the Intertidal Survey Reports (Volume 4, Appendix 4.3.6-8 and Volume 4, Appendix 4.3.6-9).
- 3.6.14 Full details of the species recorded are presented in the Intertidal Ornithology Technical Report.

4 Future receiving environment

- 4.1.1 EIAR guidance from the EPA (2022), states that the environment will change over time, even without the introduction of the proposed project. Therefore, the EIAR must include a description of the likely evolution of the environmental factor in the absence of the project. This predicted changing baseline may be referred to as the likely future receiving environment. These changes to the baseline may be natural changes (due to ecological trends, for example) or may be caused by other actions (nearby projects, for example).
- 4.1.2 The future receiving environment in the absence of the Dublin Array project would be likely to be broadly similar to the current baseline, in the immediate area of the proposed project. Regarding ornithology, if Dublin Array did not proceed, then it is considered likely that breeding seabird populations within foraging range of the project footprint would continue to use the sea area in the breeding season as recorded on baseline surveys. Similarly, numbers and species of birds passing through the area in the non-breeding season or on spring or autumn migration would be similar to what was recorded on baseline surveys. In time, numbers of each species would be likely to change, with some species increasing in numbers and others decreasing in numbers, depending on how these species are impacted by environmental changes caused by climate change.
- 4.1.3 For sensitive species such as kittiwake, where climate change is predicted to lead to a rise in sea temperature, which is likely to impact on the distribution and availability of prey species such as sandeels (RSPB, 2018), numbers breeding at colonies within foraging range would be predicted to decrease. In addition, if fishing activity were to increase in the area in the future, then this could have further impacts on prey availability, resulting in additional pressures on the breeding populations of such species.
- 4.1.4 In addition, birds would be subject to potential impacts of collision, displacement and barrier effects arising from other offshore wind farm projects in the vicinity, as these become operational over time. The degree of any such impacts would depend on how many turbines are installed, the distance from these turbines to the breeding colonies and foraging areas, and also the degree to which species are likely to be affected.

5 Data gaps or uncertainties

5.1 Baseline survey data

- 5.1.1 It was not always possible to conduct monthly surveys during the baseline data collection periods. On the 2019-2021 surveys, the planned surveys between February and April 2020 were not conducted due to unsuitable weather conditions (February and March 2020) and Covid-19 restrictions (April 2020). As a result of missing the April 2020 survey, two surveys were undertaken in May 2020.
- 5.1.2 Similarly, on the 2016-2017 surveys, surveys were not conducted in January 2017 due to bad weather, or in April 2017 due to a lack of vessel availability.

5.2 Reference populations

- 5.2.1 Breeding season regional reference populations within mean maximum foraging range (+1 SD) were estimated primarily using results from the recently published Seabirds Count national seabird census of Ireland and the UK (Burnell *et al.*, 2023). For some smaller colonies, recent counts were not available, so data from the previous Seabird 2000 national census had to be used. In these instances, there is uncertainty about the accuracy of these older counts, however, overall, it was considered that the breeding season reference populations were based on a robust, recently collected dataset.
- 5.2.2 As previously highlighted, for the non-breeding season, there was no equivalent of the BDMPS report (Furness, 2015), for Irish waters, therefore it was necessary to adapt the Furness (2015) approach, in order to estimate suitable regional reference populations for the non-breeding season for use in the EIAR. This approach assumed that birds using the waters off the coast of Ireland are from the Irish east and south coast breeding colonies, in addition to birds from other countries such as the UK. In addition, it was assumed that these populations present in Irish waters in the non-breeding season consist of adults and non-breeding immature birds, with ratio of immature birds to adults birds being derived from Horswill and Robinson (2015) (Table 4).
- 5.2.3 Overall, it was considered that this approach allowed appropriate regional reference populations to be derived that enabled cumulative impacts across several east coast projects to be estimated.

6 Summary

- 6.1.1 In order to ensure that sufficient site specific data is used to support the assessment, as required in the DCCAE Guidance Part 1, baseline data from two periods of data collection (September 2016 to September 2017 and June 2019 to April 2021) have been combined in this assessment. The offshore ornithology study area for the 2019-2021 surveys included a 4km buffer around the array area. The 2016-2017 surveys covered a similar but slightly smaller area, with transect length between 7.4 km and 7.8 km.
- 6.1.2 The methods used for the 2019-2021 baseline surveys complied with the recommended ESAS methodology, (Camphusyen *et al.*, 2004), while methods used for the 2016-2017 surveys were based on ESAS methods and compatible with the more recent dataset.
- 6.1.3 In addition, data from two previous periods of boat-based surveys (September 2001 to September 2002 and June 2010 to June 2011) were also used in this assessment to provide context, while relevant data from other published sources, such as ESAS surveys in the Irish Sea (e.g. Pollock *et al.*, 1997) and more recent visual aerial surveys conducted by UCC (Jessopp *et al.*, 2018) are also summarised and presented in this report. Relevant information on seabird breeding colonies (e.g. Cummins *et al.*, 2019) was also included in this report.
- 6.1.4 Overall, a total of 23 seabird species were regularly recorded (more than 15 birds) on boat-based baseline surveys in the study area between June 2019 and April 2021. This compares to 22 regularly recorded seabird species between September 2016 and September 2017.
- 6.1.5 For more commonly encountered species, those with at least 50 observations of birds on the water, Distance analysis (Thomas *et al.*, 2010) was undertaken, using the package of the same name in the statistical software 'R' (R Core Team, 2008). For the 2016-2017 dataset, it was possible to conduct Distance analysis for six species: Manx shearwater, shag, Herring gull, kittiwake, guillemot and razorbill. For the 2019-2021 dataset, Distance analysis was again possible for these six species, plus an additional two species: gannet and great black-backed gull. In addition, Distance analysis was also conducted on one unidentified species group from the 2019-2021 dataset: guillemot/razorbill.
- 6.1.6 Based on the Distance analysis undertaken, there were eight key species recorded in the study area on baseline surveys; Manx shearwater, gannet, shag, herring gull, great black-backed gull, kittiwake, guillemot and razorbill.
- 6.1.7 Estimated numbers of Manx shearwaters were highest in the breeding season, with a peak in April. Gannet estimated numbers were also highest in the breeding season, with a peak in May, with considerably lower numbers in the non-breeding season. Unlike the previous two species, estimated numbers of shags were highest in the non-breeding season, with a peak in November. Estimated numbers of shags in the breeding season were highest in July and August.

- 6.1.8 Among the large gulls, estimated numbers of herring gulls were highest in the breeding season, with peaks in May and August, while in the non-breeding season estimated numbers were highest in February. Estimated numbers of great black-backed gulls were highest in the breeding season in March and May. Lower estimated numbers were recorded in the non-breeding season, with a peak in December.
- 6.1.9 Estimated numbers of kittiwakes were slightly higher in the breeding season than in the non-breeding season. In the breeding season, numbers peaked in April, while in the non-breeding season, numbers peaked in December.
- 6.1.10 Two species of auks were considered to be key species for the assessments, guillemot and razorbill. Estimated numbers of guillemots were highest in the breeding season, with peaks in April and May. Estimated numbers were lower in the post-breeding moult period (August and September), with a peak in July, and lower again in the non-breeding season, with peaks in November and December. For razorbill, estimated numbers were highest in the post-breeding season, with a peak in September. Estimated numbers were lower in the breeding season with a peak in July, while in the non-breeding season, estimated numbers were lowest, with a peak in March.
- 6.1.11 Between November 2019 and October 2020, there were at least 30 species of waterbird recorded on intertidal bird surveys. Black-headed gull and shag were the most frequently recorded species in the inter-tidal study area, while oystercatcher was the most regularly recorded species of wader recorded (Volume 4, Appendix 4.3.6-8).
- 6.1.12 Between September 2023 and March 2023, at least 22 waterbird species were recorded on intertidal bird surveys. Gull species and shags and cormorants were the most frequently occurring species groups recorded in the study area (Volume 4, Appendix 4.3.6-9).
- 6.1.13 Species that are known to be susceptible to disturbance such as divers and common scoter were only recorded in the Inter-tidal study area in very low numbers over the study periods.
- 6.1.14 Overall, it is concluded that the baseline information presented within this Technical Report is adequate for the purposes of conducting an EIAR assessment.

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