Partners in UK offshore wind

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Environmental Statement

Volume 4, Annex 5.1: Offshore ornithology baseline characterisation

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Glossary

Term	Meaning
Bootstrapping	Bootstrapping is a statistical procedure that resamples a single dataset to create many simulated samples.
Confidence interval	A confidence interval displays the probability that a parameter will fall between a pair of values around the mean.
Design-based abundance estimates	An estimated total abundance of birds within a given area. The design-based method is based on the premise that the portion of the study area that is surveyed is representative of the remainder of the study area.
MRSea	Statistical package to model spatial count data and predict spatial abundances. Package has been developed by the Centre for Research into Ecological and Environmental Modelling (CREEM) specifically for dealing with data collected for offshore wind farm projects.

Acronyms

Term	Meaning
ASSI	Areas of Special Scientific Interest
BDMPS	Biologically Defined Minimum Population Scales
CRM	Collision Risk Modelling
CV	1) Coefficient of Variation (statistics) 2) Cross-Validation (statistics)
EIA	Environmental Impact Assessment
EWG	Expert Working Group
GPS	Global Positioning System
HRA	Habitats Regulations Assessment
ISAA	Information to Support the Appropriate Assessment
JNCC	Joint Nature Conservation Committee
MNR	Marine Nature Reserve
MMEA	Manx Marine Environmental Assessment2
MMO	Marine Management Organisation
MRSea	Marine Renewable Strategic environmental assessment
NERC	Natural Environment and Rural Communities
NRW	Natural Resource Wales
PEIR	Preliminary Environmental Information Report
RSPB	Royal Society for the Protection of Birds
SALSA	Spatially Adaptive Local Smoothing Algorithm (statistics)
SD	Standard Deviation (statistics)
SMP	Seabird Monitoring Programme (database)
SNCB	Statutory Nature Conservation Body

Term	Meaning
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TWT	The Wildlife Trust
VORs	Valued Ornithological Receptors

Units

Unit	Description
°C	Degrees Centigrade
%	Percentage
km	Kilometres
km^2	Square kilometres (area)
m	Metres

1 Offshore ornithology baseline characterisation

1.1 Introduction

1.1.1 Background

1.1.1.1 Energie Baden-Württemberg AG and bp Alternative Energy Investments Limited (hereafter referred to as the Applicant) are progressing with development of the Morgan Offshore Wind Project: Generation Assets (hereafter referred to as the Morgan Generation Assets).

1.1.1.2 The Morgan Generation Assets is located in the east Irish Sea, approximately 22.3 km (12 nm) from the Isle of Man and 37.2 km (20.1 nm) from the northwest coast of England (when measured from Mean High Water Springs). The Morgan Array Area is 280 km^2 in size.

1.1.1.3 For this technical report, the overarching term ‘seabird’ is used to refer to species that depend on the marine environment for survival at some point in their life cycle. Therefore, in addition to the true seabirds, seaducks, divers and grebes are also included because of their additional reliance on marine areas, especially in the non-breeding season.

1.1.1.4 This technical report provides a detailed baseline characterisation of offshore ornithology associated with the Morgan Generation Assets. This technical report includes site specific data, where available, collected by the Applicant for their offshore wind portfolio in the east Irish Sea.

1.1.1.5 This technical report details the findings of the desktop review carried out for the Morgan Generation Assets as well as the site-specific digital aerial surveys carried out in the Morgan Offshore Ornithology Array Area study area. This technical report describes the methods used to characterise the baseline conditions (i.e. abundance and distribution of seabirds and other bird groups found in the offshore environment) and presents the results of the desk-based studies and the site-specific digital aerial surveys undertaken to date at the Morgan Array Area, which comprise digital aerial surveys carried out monthly between April 2021 and March 2023 inclusive.

1.1.1.6 An overview of the baseline, together with the impact assessment, cumulative and transboundary impact assessment are provided in the Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement. Details of the offshore ornithology study area, legislation and guidance, consultation, data sources and methodology for data collection are also included within Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement.

1.1.1.7 It is recommended that this baseline characterisation report is read in-conjunction with Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement.

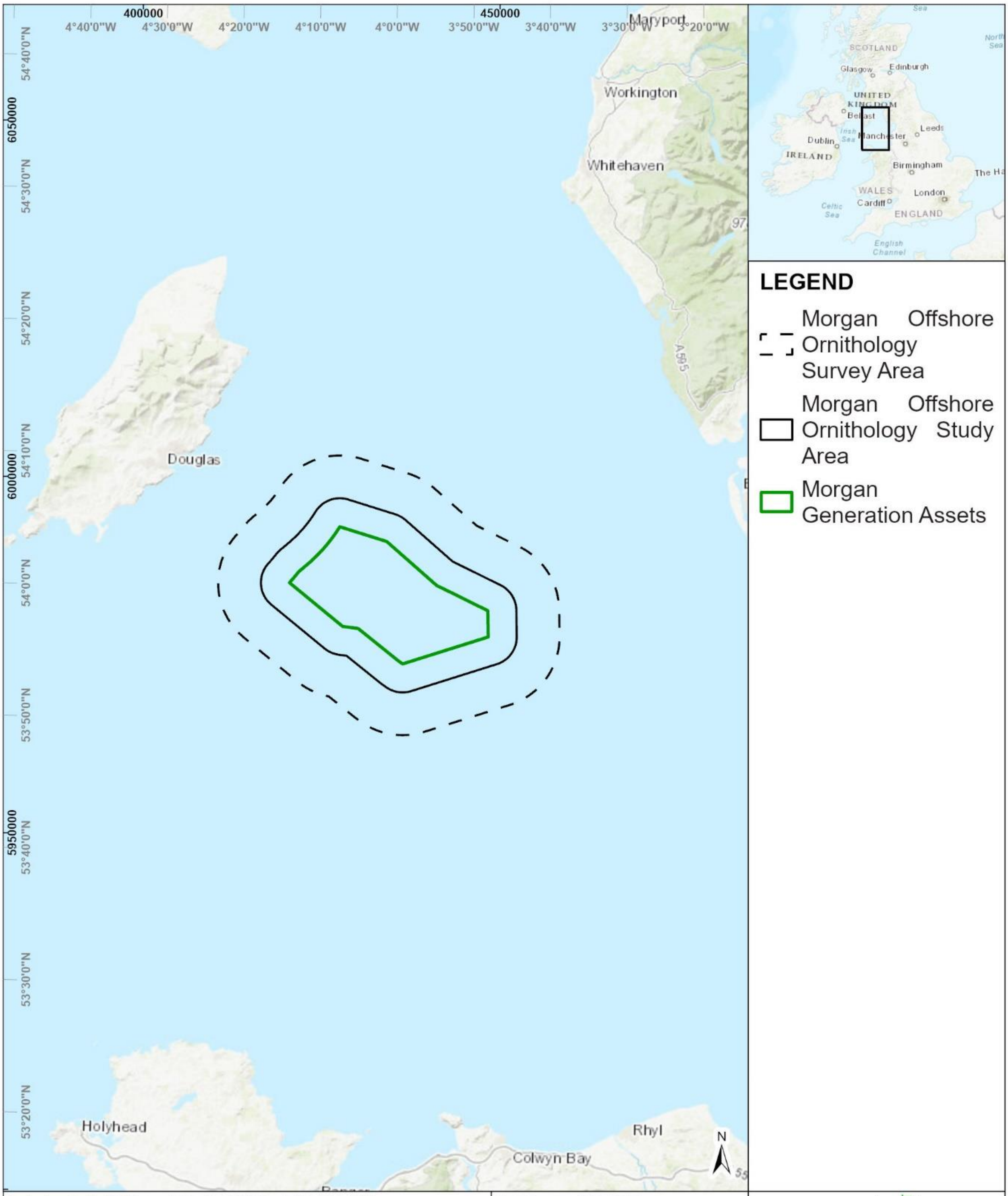
1.1.1.8 This report presents an outline of the study methodology, together with baseline results from the site-specific aerial surveys which were designed to best inform the ornithological baseline characterisation of the Morgan Array Area. This report therefore:

- Collates all ornithological data gathered to date for the Morgan Generation Assets application and provides a baseline description of the ornithological interests within the Morgan Array Area

- Establishes the ornithological importance of the Morgan Generation Assets for breeding, wintering and migratory birds by analysing aerial survey data, and other data sources from the wider area.

1.1.1.9 In relation to nature conservation importance, three key potential legislative impact pathways on the seabird assemblage during the construction, operation and maintenance, and decommissioning of the Morgan Generation Assets have been identified:

- The potential for the project to adversely affect seabirds of highest conservation concern, listed on Annex 1 of the EU Birds Directive (2009/147/EC, the codified version - updated to incorporate the original Directive and all amendments of Council Directive (79/409/EEC)) which was transposed into UK legislation through The Conservation of Habitats and Species Regulations 2017 (2017 No. 1012) (as amended) and The Conservation of Offshore Marine Habitats and Species Regulations 2017 (2017 No. 1013) (as amended) and subsequently retained in UK law through The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (2019 No. 579), and/or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended)
- The potential for the project to adversely affect qualifying ornithological features of nearby designated sites; UK national site network sites (Special Protection Areas (SPAs)), sites of national value (Sites of Special Scientific Interest (SSSIs), Marine Nature Reserves (MNRs)), and internationally designated sites (Ramsar)
- The potential for the project to adversely affect other species in internationally-, nationally- or regionally-important numbers in winter, during migration, or whilst commuting locally between foraging areas (which may include the Morgan Array Area) and breeding colonies.



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri, HERE, Garmin, FAO, USGS, NGA

Data Sources: RPS, NIRAS

Project Name:
MORGAN OFFSHORE WIND PROJECT

0 2.5 5 10 nm
0 5 10 20 km

Drawing Number:
RPSE-MG-TEM-010-01

Drawing Title:
Morgan Generation Assets Study Areas

Geodetic Information:
Datum: ETRS 1989
Projection: ETRS 1989 UTM Zone 30N
Scale@160mmx220mm: 1:900,000

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01	27/09/23	First Issue	HAZ	HAZ

Figure 1.1: Morgan Generation Assets study areas.

1.1.2 Consultation

Overview

1.1.2.1 A summary of the key matters raised during consultation activities undertaken to date specific to offshore ornithology and the use of population viability analysis, is presented in Table 1.1 below, together with how these comments have been considered in the production of this technical report as part of the Environmental Statement and Information to Support the Appropriate Assessment (ISAA) (Document Reference E1).

Evidence plan process

1.1.2.2 The purpose of the Evidence Plan process is to agree the information the Morgan Generation Assets needs to supply to the Secretary of State, as part of the Development Consent Order (DCO) application for the Morgan Generation Assets. The Evidence Plan seeks to ensure compliance with Habitats Regulations Assessment (HRA). The development and monitoring of the Evidence Plan and its subsequent progress is being undertaken by the Steering Group. The Steering Group comprised of the Planning Inspectorate, the Applicant, Natural Resource Wales (NRW), Natural England, Joint Nature Conservation Committee (JNCC) and the Marine Management Organisation (MMO) as the key regulatory and Statutory Nature Conservation Bodies (SNCBs). To inform the Environmental Impact Assessment (EIA) and HRA process during the pre-application stage of the Morgan Generation Assets, Expert Working Groups (EWGs) were also set up to discuss and agree topic specific issues with the relevant stakeholders. Consultation was undertaken via the Offshore Ornithology EWG, with meetings held in February 2022, July 2022, November 2022, February 2023, June 2023, October 2023 and December 2023.

1.1.2.3 The responses provided and changes suggested by the stakeholders through the EWG are summarised in Table 1.1, together with changes implemented in this technical report.

Section 42 Consultation

1.1.2.4 A number of comments were received during the S42 consultation following submission of the Preliminary Environmental Information Report (PEIR) chapter. All the responses provided, and changes suggested by the stakeholders are presented in the Consultation report (Document Reference E3) together with changes implemented in the technical reports underpinning the Environmental Statement.

1.1.2.5 A summary of the key responses with changes implemented in this technical report of the Environmental Statement are presented in Table 1.1.

Table 1.1: Consultation responses relevant to the Technical Appendix.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
February 2022	**Offshore Ornithology EWG 1** – Natural England, JNCC, The Wildlife Trust (TWT), MMO, and the Royal Society for the Protection of Birds (RSPB).	Agreement on broad approach to digital aerial surveys. Agree with the broad approach to aerial survey, as we understand it, with regards to the use of digital aerial surveys, a grid-based sampling design, monthly surveys, and the use of a 10km buffer in every direction for Morgan.	The buffer for the Morgan aerial survey reaches 10 km all the way round the Morgan Array Area.
June 2022	**Scoping Opinion** The Planning Inspectorate	It is noted that the approach to obtaining density and spatial abundance estimates will be discussed within the Evidence Plan process. The Inspectorate advises that given the fundamental importance of this discussion to the outcomes of the EIA process, the Applicant should seek to agree the modelling parameters used and the methodology applied with the relevant consultees, giving careful consideration to the sharing of information through the Evidence Plan process.	The modelling approach to obtaining density and spatial abundance estimates has been discussed with the EWG as part of the Evidence Plan process. The methodology is detailed in section 1.2 of this technical report.
		The Inspectorate advises that the breeding, non-breeding, and migratory seasons (where applicable) are defined for each relevant bird species assessed. Effort should be made to agree the definitions of each season with the relevant consultees including where the use of seasonal peaks is part of the modelling methodology.	Seasonal definitions are based on Furness (2015) and the approach has been agreed with the EWG through the evidence plan process.
July 2022	**Offshore Ornithology EWG 2 –** Natural England, JNCC and RSPB.	Agreement on the approach to baseline characterisation as set out in the baseline characterisation technical paper.	The approach to baseline characterisation is presented in this technical report and summarised in section 5.4 of Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
	Scoping Opinion Natural England	We note the PEIR for the Morgan Generation Assets will only present data analysis of 12 months of the digital and aerial surveys for both birds and marine mammals, with the full 24 months being presented in the Environmental Statement. Natural England highlight the risk that the additional data analysis could have potential to change the conclusions of the Environmental Statement from those set out in the PEIR, which could cause potential delays to the project. More generally, Natural England advises that 24 months of survey effort is the minimum expected evidence standard for bird and marine mammal data.	The assessments and analyses presented in the Environmental Statement and associated technical reports utilises 24 months of site-specific data.
		Tracking studies should also be used where available to evidence connectivity, or lack thereof, they should also be used to aid screening where possible.	Tracking data available from the Seabird Tracking Database (Birdlife International, 2022) have been reviewed and summarized for each species in this technical report (section 1.5).
		Natural England does not hold local information on local sites, local landscape character, priority habitats and species or protected species. Local environmental data should be obtained from the appropriate local bodies. This may include the local environmental records centre, the local wildlife trust, local geo-conservation group or other recording society.	A desk study for the baseline characterisation has been provided in this technical report (section 1.5).
		The Environmental Statement should thoroughly assess the impact of the proposals on habitats and/or species listed as 'Habitats and Species of Principal Importance' within the England Biodiversity List, published under the requirements of S41 of the Natural Environment and Rural Communities (NERC) Act 2006. Section 40 of the NERC Act 2006 places a general duty on all public authorities, including local planning authorities, to conserve and enhance biodiversity. Further information on this duty is available here https://www.gov.uk/guidance/biodiversity-duty-public-authority-duty-to-have-regard-to- conserving-biodiversity.	Conservation values for Valued Ornithological Receptors is defined in this technical report (section 1.6).

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
July – August 2022	the Offshore Ornithology EWG 2.	Advise that model-or design-based estimates of abundance and density of divers and scoters are presented to determine whether or not a displacement assessment should be carried out for red-throated diver and seaducks.	Density estimates of all species encountered during the digital aerial surveys are presented in this technical report (section 1.5).
	JNCC and Natural England – collision technical paper provided and agreed as part of the Offshore Ornithology EWG 2.	Advise the use of a migration-free breeding season.	Collision risk is reported for each season. Seasons were defined according to the breeding, non-breeding and migratory periods using seasonal divisions proposed for Biologically Defined Minimum Population Scales (BDMPS) by Furness (2015).
	JNCC and Natural England – baseline characterisation paper provided and agreed as part of the Offshore Ornithology EWG 2.	Advise that the applicant also provides records of all species detected from aerial surveys.	All species recorded during the digital aerial surveys are presented in this technical report (Appendix A).
		Advise that red-throated diver density data contained within Bradbury *et al.* (2014) are extracted to generate maps and abundance estimates for red-throated diver in the Morgan Array Area plus a 10 km buffer zone to complement the spatial coverage of the digital aerial surveys.	Characterisation of the baseline for red-throated diver associated with the Morgan Generation Assets is provided in this technical report (section 1.5). The Morgan Generation Assets are beyond the zone of influence generally considered for impacts on red-throated diver (10 km) for relevant populations (Liverpool Bay SPA).
		Recommend that the apportioning of unidentified species and availability bias correction should be carried out the order of apportioning then availability correction to ensure that all unidentified species (once apportioned) are corrected for availability bias.	The approach to apportioning of unidentified species and availability bias is presented in section 1.2.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
		Advise that Marine Renewable Strategic environmental assessment (MRSea) is used to predict spatial density and abundance for the array area plus 10 km buffer for each of the most abundant species (black-legged kittiwake, northern gannet, common guillemot, razorbill and Manx shearwater).	Model-based estimates have been produced for each buffer zone (2 km, 4 km and 10 km) in the offshore ornithology baseline characterisation (Volume 6, Annex 10.1: Offshore ornithology baseline characterisation of the Environmental Statement).
February 2023	**Offshore Ornithology EWG 3 –** Natural England, JNCC and RSPB.	Query on why some auk ID rates were lower in some months than expected.	Auk ID rates have been improved and agreement reached with the EWG.
June 2023	**S42 – Consultation log** Isle of Man Department of Infrastructure	**Data Sources** The TSC would draw the applicant's attention to the Manx Marine Environmental Assessment2 (MMEA) which provides a useful overview of the Island's marine environment and should be taken into account as part of both the transboundary and possibly also the cumulative impacts assessment as part of this application. More detail will be provided below in respect of specific areas of the MMEA that should be reviewed.	Relevant ornithological receptors associated with the Isle of Man have been given consideration throughout the EIA.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
		Table 10.17 of the Offshore Ornithology PEIR relates Conservation Value, in terms of the sensitivity of a receptor, to its connection to a specific SPA and notes a receptor as of low sensitivity where no SPA has been designated. We point out that there has been no European level assessment for the designation of sites on the IoM, at this stage, and some key seabird sites have not yet been designated nationally as Areas of Special Scientific Interest (ASSI), though having byelaw and species protections. There is therefore potential for linking effects to a particular site, which is not an SPA and thereby considered to be a low value receptor, where this may not be the case. However, bearing in mind the ‘Negligible’ to ‘low’ predicted impacts, this may not affect the results. If an assessment of Isle of Man site implications is provided under transboundary effects, within the Environmental Statement, then this may pick up any issues that might otherwise be missed due to this issue.	The definition of value has been updated to include other conservation metrics including the Isle of Man BoCC.
		Annex 10.1: Offshore ornithology baseline characterisation – Isle of Man MNRs are shown on the map, and Ballaugh Curraghs Ramsar site, but none of the Areas of Special Scientific Interest, though the Central Ayres is designated for little tern and Maughold Head for its coastal cliff birds, and there are key sites in Manx National Heritage ownership which are of national importance.	Relevant conservation designations on the Isle of Man have been considered in this technical report.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
		Non-SPA colonies: section 1.3.1.7 states 'Additional non-SPA colonies located within individual foraging ranges from the Morgan Array Area are listed in Appendix A' – The IoM colonies will be the closest colonies for many species but none of these is mentioned in Appendix A. Although not all have been assessed and designated with national ASSI status, the colonies are well known and on protected MNH land, including the Calf of Man, Spanish Head and Sugarloaf colonies containing a recovering Manx shearwater colony and kittiwakes, guillemots and razorbills. Unfortunately puffins are now extremely rare but a few are thought to still nest at Maughold Head, Peel Head or Spanish Head and they are red listed on the IoM BoCC.	All colonies within foraging range of the Morgan Generation Assets will be incorporated into relevant sections of the EIA and HRA.
	S42 – Consultation log Natural England	Natural England has concerns regarding the generation and use of model-based abundance estimates. There is a need for presentation of more detailed methods, including corrections for the apportionment of unidentified birds and availability bias and the generation of birds in flight densities for use in Collision Risk Modelling (CRM).	The approach to calculating model-based abundance estimates is presented in section 1.2.
		Vol 2, Ch 10. Table 10.7 Raw counts are only provided as summed totals. Provide species-specific raw counts for each individual survey.	Species-specific raw counts are available in Appendix A of this technical report.
		Vol.2, Ch.10, Table 10.8 In addition to SPAs, the list of designated sites in Table 10.8 should include all relevant Ramsar sites and SSSIs, and their qualifying features. Please include any relevant Ramsar sites and SSSIs (and relevant qualifying features) with connectivity to Morgan.	All designated sites relevant to the Morgan Generation Assets are identified in section 1.4 of this technical report.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
		Vol.2, Ch.10, Table 10.4/10.8.1.8 During the EWG2 (July to August 2022), SNCBs advised that red-throated diver density data contained within Bradbury et al. (2014) could be used to generate density abundance estimates for red-throated diver in the Morgan Array Areas plus a 10 km buffer zone in lieu of sufficient DAS data. We note that these maps and density data do not appear to have been included in Volume 4, Annex 10.1: Offshore ornithology baseline characterisation, as is stated on page 10. If insufficient data is collected by baseline surveys, and this is not thought to be representative of red-throated diver site utilisation, pre-existing data could be used. Further discussion of this approach would be welcomed at future EWGs. Natural England requests that design-based estimates of abundance and density of divers and scoters are presented.	The 24 month aerial survey programme is considered to provide representative data and will therefore be used in assessments for red-throated diver, where required.
		Vol.2, Ch.10, Table 10.4 Vol.4, Ann.10.1 1.3.3.18 Vol.4, Ann. 10.2, Table A 2 Natural England note that no MRSea model was run for razorbill, presumably due to a lack of raw data. However, Annex 10.2, Appendix A, Table A 2 suggests razorbill abundance was modelled. Natural England requests clarification on whether MRSea was run for razorbill (and puffin and Manx shearwater). Further, we request it is clarified throughout the documents where model based and design-based estimates (or a mixture of both) have been utilised for the assessments.	MRSea analyses have been run for all species where there were sufficient data to provide robust models.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
		Vol. 2, Ch. 10, Table 10.7 Vol.4, Ann.10.1 Natural England is concerned about the very high proportion of unidentified auks. Apportioning of these records based on the relative proportions of identified guillemot and razorbill, as undertaken in paragraphs 1.2.3.18 - 1.2.3.22 of Annex 10.1, is not without potential issues. Unaccounted for bias may exist e.g. by one species being easier to identify than another, or varying impacts of environmental conditions on ID rates. Consequently, we also have concerns regarding the reliability of spatial modelling for these species. Natural England reiterate our recommendation to carry out some scenario testing to investigate the potential impact of low ID rates and determine if spatial modelling and apportioning is appropriate. We would welcome further discussion on this issue via future EWG meetings. Further, we request that a full monthly breakdown of records relating to razorbill and guillemot is presented to facilitate scrutiny of seasonal variation in ID rates.	Auk ID rates have been improved and agreement reached with the EWG.
		Ch 10, 10.4.4.15 & Table 10.12 Natural England are not convinced that the method used to calculate regional breeding populations is appropriate. Natural England propose discussing the approach to calculation of regional breeding populations through the EWG to reach agreement with relevant stakeholders and ensure consistency across relevant projects.	The methodology for calculating regional breeding populations has been discussed during EWG meetings and the approach is discussed in Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
		Vol.4, Ann.10.1 Although the general approach appears sound, Natural England consider there is a lack of detail relating to the methods applied throughout the MRSea modelling process and subsequent treatment of data. In particular it is not clear: • How densities of flying birds only have been calculated from MRSea for use in CRM • How mean monthly flying bird densities and CIs have been generated • How corrections for unidentified birds (i.e., apportioning) and availability bias have been applied to the MRSea estimates and CIs. Clarity is needed to give reassurance that modelling and subsequent data treatment has been carried out appropriately. Natural England recommend that worked examples are included to fully detail the assessment process for both collision (e.g. gulls) and displacement (e.g. auks). Clarify and specify throughout the documentation where modelled and design- based data (or both) have been used.	The approach to calculating model-based abundance estimates is presented in section 1.2.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
		Vol.4, Ann.10.1, 1.2.3.26, Vol.6, Ann. 10.2 Natural England note that there appears to be an inconsistency in the availability bias correction factors applied to auks. Natural England also highlight that Manx shearwater is a surface diving species and data are available detailing foraging & diving behaviour. It may also be appropriate to consider availability bias for that species. Clarify which correction factors have been used in calculations and ensure consistency across method descriptions (and application). Discuss the calculation and application of an availability bias correction factor for Manx shearwater at future EWG meetings.	The approach to calculating model-based abundance estimates is presented in section 1.2.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
	S42 – Consultation log Natural Resource Wales	183. Offshore Ornithology. Key issues. Key offshore ornithology issues. Our key issues regarding the PEIR documents for offshore ornithology are: • Concerns regarding the numbers of guillemot/razorbill recorded, the potential issues related to this and apportionment of these birds to species and how these have been applied in model-based abundance estimates • Availability bias correction factors that have been used and how these have been applied in model-based abundance estimates • How model-based abundance estimates of birds in flight only have been generated for use in collision risk modelling (CRM). The need to provide the bootstrapped abundance data used for the CRM and the log files generated by the stochastic collision risk modelling (sCRM) • The need for consideration of migrant seabird species (e.g. skuas, terns) in collision risk assessments • Projects and data included in cumulative (and hence in-combination) assessments • The approach to apportionment of impacts, including: – NRW (A) does not agree with the use of stable age structures for age-class apportioning or the removal of sabbaticals from impacts – NRW (A) does not agree with updating the colony figures from those in Furness (2015) in apportioning impacts to designated sites outside the breeding season and the approach used does not follow the advice provided previously during the EWG.	Please see responses to previous comments. Immature proportions have been calculated from site-specific surveys and updates to Furness (2015) have not been undertaken.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
		184. Offshore Ornithology. Key issues. Lack of assessment of SSSIs and features. There is a lack of assessment of SSSIs and features where there is potential for connectivity – for example, the Pen y Gogarth/Great Orme’s Head SSSI is designated for breeding kittiwake, guillemot and razorbill and the Morgan generation assets project is located within foraging range of all of these features from this site. Therefore, quantitative assessments of collision risk for kittiwake and displacement for guillemot and razorbill should be undertaken for this site.	All designated sites relevant to the Morgan Generation Assets are identified in section 1.4 of this technical report and considered where relevant in Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement.
		186. Offshore Ornithology. Detailed comments. Baseline Characterisation. Morgan Array Area and Buffers. Apportionment of unidentified birds. From Table 10.7 of Chapter 10 the second most frequently recorded species/species group during the 12 months of digital aerial survey data presented for the Morgan generation assets survey area and buffer was guillemot/razorbill, with a total of 2,138 raw counts. Whilst NRW (A) welcome that unidentified species have been apportioned to individual species that make up the respective groups via the approach set out in paragraphs 1.2.3.18-1.2.3.22 of Annex 10.1, we have concerns regarding the high proportions of records identified as guillemot/razorbill and the implications this may have for the appropriateness of modelling abundances for these species and of apportioning these records to the individual species based on proportions of identified guillemots and razorbills.	Auk ID rates have been improved and agreement reached with the EWG.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
		186. Offshore Ornithology. Detailed comments. Baseline Characterisation. Morgan Array Area and Buffers. Apportionment of unidentified birds. From Table 10.7 of Chapter 10 the second most frequently recorded species/species group during the 12 months of digital aerial survey data presented for the Morgan generation assets survey area and buffer was guillemot/razorbill, with a total of 2,138 raw counts. Whilst NRW (A) welcome that unidentified species have been apportioned to individual species that make up the respective groups via the approach set out in paragraphs 1.2.3.18-1.2.3.22 of Annex 10.1, we have concerns regarding the high proportions of records identified as guillemot/razorbill and the implications this may have for the appropriateness of modelling abundances for these species and of apportioning these records to the individual species based on proportions of identified guillemots and razorbills.	The standard approach to the attribution of unidentified birds has been followed.
		188. Offshore Ornithology. Detailed comments. Baseline Characterisation. Morgan Array Area and Buffers. Apportionment of unidentified birds. NRW (A) advise that a breakdown of monthly records of positively identified guillemot and razorbill alongside the number of records per month of guillemot/razorbill (and any other relevant species groups) is provided. Consideration should also be given to issues with bias regarding apportioning to species of guillemot/razorbill records given the very high number of records of this group.	Auk ID rates have been improved and agreement reached with the EWG. Monthly raw data will be provided.
		189. Offshore Ornithology. Detailed comments. Baseline Characterisation. Morgan Array Area and Buffers. Apportionment of unidentified birds. As detailed in paragraphs 192-194, Section 1.5.2.1.3 below, it is unclear how apportionment of unidentified birds has been applied to the abundance estimates generated from MRSea modelling.	The approach to calculating model-based abundance estimates is presented in section 1.2.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
		190. Offshore Ornithology. Detailed comments. Baseline Characterisation. Morgan Array Area and Buffers. Availability Bias. NRW (A) welcome that correction factors have be applied to data for birds on the water for guillemot, razorbill and puffin to account for birds not visible during survey as diving underwater based on that recommended by JNCC (2013) in submissions during the examination phase of the East Anglia One offshore wind farm project. However, there is some inconsistency in the correction factors applied between the information presented in the baseline characterisation annex (Annex 10.1) and the displacement annex (Annex 10.2): • Paragraph 1.2.3.26 of Annex 10.1 states: 'The correction factors applied to sitting common guillemot, razorbill, and puffin were based on JNCC (2013), which assumed that 24.3% of common guillemot, 17.4% of razorbill, and 14.2% of puffin are underwater when digital aerial imagery is captured, leading to correction factors of 1.311, 1.211, and 1.165 respectively.' • Tables A.1-A.3 of Appendix A of Annex 10.2 suggests the following correction factors were used for availability bias: 0.2405 for guillemot, 0.1818 for razorbill, 0.1416 for puffin.	See response to previous comments.
		191. Offshore Ornithology. Detailed comments. Baseline Characterisation. Morgan Array Area and Buffers. Availability Bias. Therefore, clarification is required as to the correction factors that have actually been used. Additionally, as detailed in section 1.5.1.3 below, it is unclear how availability bias correction has been applied to the abundance estimates generated from MRSea modelling.	See response to previous comments.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
		192. Offshore Ornithology. Detailed comments. Baseline Characterisation. Morgan Array Area and Buffers. Abundance estimates. MRSea abundance estimates for all birds (flying and sitting on the water) have currently been generated for 4 species (guillemot, Manx shearwater, kittiwake, gannet) for survey months where more than 50 birds were recorded. This list of species will need to be revisited and potentially updated once the full 24 months of survey data are included. Whilst the MRSea approach as set out in paragraphs 1.2.3.11-1.2.3.14 of Annex 10.1 looks broadly appropriate, clarification is required on the following: • How densities of flying birds only have been generated from MRSea for use in CRM, including how the mean monthly in-flight densities and confidence intervals have been generated. For example, has this been done by apportioning the MRSea estimates for all birds to birds in flight and on the water based on the ratios recorded of birds on the water and birds in flight? • How corrections for unidentified birds and for availability bias have been applied to the MRSea estimates and confidence intervals. For example, have guillemot/razorbill records been modelled using MRSea and then the resulting abundances of guillemot/razorbill apportioned to the individual species based on ratios – noting that it would not be possible to apportion the distributions of the unidentified birds to species and this approach assumes no spatial bias in guillemot and razorbill.	See response to previous comments.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
		193. Offshore Ornithology. Detailed comments. Baseline Characterisation. Morgan Array Area and Buffers. Abundance estimates. NRW (A) recommend that a worked example of the approach for a species assessed by MRSea for collision (e.g. kittiwake) and for a species assessed for displacement (e.g. guillemot) be included that details how unidentified birds and availability bias have been corrected for and how estimates of birds in flight have been made from all birds estimates.	See response to previous comments.
		194. Offshore Ornithology. Detailed comments. Baseline Characterisation. Morgan Array Area and Buffers. Abundance estimates. NRW (A) welcome that the design-based abundance estimates for birds in flight, on the water and combined for the site and site plus various buffers have been presented in Annex 10.1. However, no coefficient of variation (CVs) for any estimates have been presented anywhere in the PEIR documents. NRW (A) request that the CVs are provided.	Confidence metrics are provided in Appendix C and Appendix D of this technical report.
		195. Offshore Ornithology. Detailed comments. Baseline Characterisation. Designated Sites. In addition to SPAs, the list of designated sites in Table 10.8 of Chapter 10 should include relevant Ramsar sites (e.g. the Dee Estuary is also designated as a Ramsar site and non-breeding waterbirds are features) and SSSIs (e.g. the Pen y Gogarth/Great Ormes Head SSSI, which is designated for breeding kittiwake, guillemot and razorbill and the Morgan site is located within mean-maximum foraging range of these species from this SSSI). Additionally, Figure 1.2 of Annex 10.1 (boundaries of protected sites designated for seabirds and coastal birds within 100km of the Morgan Array Area) does not include any Welsh SSSIs with seabird features, e.g. Pen y Gogarth/Great Orme's Head SSSI, Creigiau Rhiwledyn/Little Orme's Head SSSI, Traeth Lafan SSSI, Cemlyn Bay SSSI, The Skerries SSSI, Ynys Feurig SSSI. This should be rectified.	All designated sites relevant to the Morgan Generation Assets are identified in section 1.4 of this technical report.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
		196. Offshore Ornithology. Detailed comments. Baseline Characterisation. Designated Sites. In addition to the Welsh SPAs already listed in Table 10.8 of Chapter 10, we note that the Glannau Aberdaron ac Ynys Enlli/Aberdaron Coast and Bardsey Island SPA designated for breeding Manx shearwater is also located within foraging range of this species from the Morgan generation assets site and, as such, advise that this should be included in Table 10.8.	All designated sites relevant to the Morgan Generation Assets are identified in section 1.4 of this technical report.
		197. Offshore Ornithology. Detailed comments. Baseline Characterisation. Designated Sites. For Table 10.8 of Chapter 10, it should be noted that for the Sgomer, Sgogwm a Moroedd Penfro/Skomer, Skokholm and seas off Pembrokeshire SPA, puffin is a qualifying feature in its own right along with Manx shearwater, European storm petrel, lesser black-backed gull and a breeding seabird assemblage (including razorbill, guillemot, kittiwake, puffin, lesser black-backed gull, Manx shearwater, storm petrel).	All designated sites relevant to the Morgan Generation Assets are identified in section 1.4 of this technical report.
		198. Offshore Ornithology. Detailed comments. Baseline Characterisation. Designated Sites. Whilst SPAs/Ramsar's are assessed within the HRA related reports, where there is potential connectivity (e.g. within foraging range etc.) and potential impact pathway of seabird features of SSSIs that are not already assessed in the HRA reports as they are also features of SPAs/Ramsar's, these SSSIs and features need to be assessed within the ES. For example, the Pen y Gogarth/Great Orme's Head SSSI is designated for breeding kittiwake, guillemot and razorbill and the Morgan project is located within foraging range of all three of these species. Hence quantitative assessments of displacement for guillemot and razorbill and collision for kittiwake should be undertaken for this site.	All designated sites relevant to the Morgan Generation Assets are identified in section 1.4 of this technical report.

Date	Consultee and type of response	Topics and comments	Response to comment raised and/or where considered in this chapter
		199. Offshore Ornithology. Detailed comments. Baseline Characterisation. Reference Populations. Breeding Season. NRW (A) are uncertain of the appropriateness of the approach that has been taken to calculate the regional breeding season reference populations and we have been unable to replicate the numbers presented in Table 10.11 of Chapter 10 (particularly those for the proportions of immatures and juveniles quoted as within information presented in Furness [2015]). We strongly suggest that approaches to calculating regional breeding reference populations be explored collaboratively through the Offshore ornithology EWG.	See previous comments.
		200. Offshore Ornithology. Detailed comments. Baseline Characterisation. Reference Populations. Non-breeding season(s). NRW (A) agree with the use of the non-breeding season(s) BDMPS sizes from Furness (2015) presented in Table 10.12 of Chapter 10, Table 1.3 of Annex 10.2, Table 1.4 of Annex 10.3.	Furness (2015) has been used to identify regional populations in non-breeding seasons.
October 2023	**Offshore Ornithology EWG 6** – Natural England, JNCC and TWT	Further discussions on the calculation of regional breeding populations.	The methodology for calculating regional breeding populations has been discussed during EWG meetings and the approach is discussed in Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement.

1.2 Methodology

1.2.1 Desktop review of data sources

1.2.1.1 Evidence sources and existing datasets have been reviewed to define the seabird baseline and support the findings of the site-specific digital aerial surveys. Both scientific and grey literature were reviewed, and the subsequent data sources relevant to the Morgan Generation Assets identified. Peer-reviewed scientific literature examining seabird distribution and abundance in UK waters was included and grey literature was searched for unpublished reports documenting seabird distribution and abundance. This included survey data collected as part of offshore renewables developments (searched through The Crown Estate's Marine Data Exchange website (www.marinedataexchange.co.uk)), and survey data from surveillance monitoring undertaken by the SNCBs.

1.2.1.2 The data that have been collected and used to inform this baseline characterisation annex are summarised in Table 1.2. This includes a description of the data sources, the spatiotemporal coverage of the dataset across the project area, and any key limitations and assumptions.

Table 1.2: Summary of key desktop datasets and reports.

Source/reference	Description	Data source	Date	Site coverage
HiDef Aerial Surveying Limited (2023)	Report commissioned by Natural England to inform Natural England, NRW and the JNCC in adjusting the conservation objectives within the Joint Conservation Advice package. Digital video aerial surveys conducted between 2015 and 2020 to provide updated density and abundance estimates for red-throated diver (*Gavia stellata)*, common scoter (*Melanitta nigra)* and the waterbird assemblage within the Liverpool Bay/Bae Lerpwl SPA.	Digital aerial data	January to March in 2015, 2018, 2019 and 2020.	Liverpool Bay/Bae Lerpwl SPA area as designated in 2010 (excluding 2017 extension).
Cleasby *et al*. (2020)	Identifying important at-sea areas for seabirds using species distribution models and hotspot mapping for four seabird species: kittiwake (*Rissa tridactyla*), guillemot (*Uria aalge*), razorbill (*Alca torda*) and shag (*Gulosus aristotelis*) .	Tracking data	May to July, (2010 to 2014)	Some overlap with the Morgan Generation Assets study area and survey area and provides information on birds in the wider context of the site.

Source/reference	Description	Data source	Date	Site coverage
Waggitt *et al*. (2020)	Distribution maps of cetacean and seabird populations in the northeast Atlantic.	Aerial and vessel survey data	1980 to 2018	Northeast Atlantic wide coverage and complete overlap with the Morgan Generation Assets study area.
Wakefield *et al.* (2017)	Breeding density, fine-scale tracking, and large-scale modelling reveal the regional distribution of four seabird species.	Tagging data	2010 to 2014	Some degree of overlap of predicted density in the Morgan Generation Assets study area and survey area.
Bradbury *et al.* (2014)	SeaMaST provides evidence on the use of sea areas by seabirds and inshore waterbirds in English territorial waters, mapping their relative sensitivity to offshore wind farm developments.	Boat and aerial surveys	1979 to 2012	Overlap with the Morgan Generation Assets study area.
JNCC (2023)	Population and productivity data for breeding seabirds around the UK	Bird counts and productivity data at breeding colonies	1986 to 2023	Count data at breeding colonies that may have connectivity with the Morgan Generation Assets study area.
Lawson *et al.* (2016)	Results from eight seasons of aerial observer surveys of the Liverpool Bay region, used to inform the extension to the Liverpool Bay/Bae Lerpwl SPA.	Aerial surveys	2001 to 2011	Coverage limited to inshore areas.
BirdLife International (2022)	Interface to view seabird tracking database	Seabird tracking data	Various dates	Some overlap of seabird tracks with the Morgan Generation Assets study area.
Clewley *et al.* (2021)	Assessing movements of Lesser Black-backed Gulls *(Larus fuscus)* using Global Positioning System (GPS) tracking devices in relation to the Walney Extension and Burbo Bank	Tagging data	Tagging data collected across four breeding seasons between 2016 and 2019	Birds made limited use of the marine environment.

Source/reference	Description	Data source	Date	Site coverage
	Extension Offshore Wind Farms			
Dean *et al.* (2010)	Behavioural mapping of a pelagic seabird: combining multiple sensors and a hidden Markov model reveals the distribution of at-sea behaviour	Tagging data	2009, 2010, 2011 breeding seasons	No usage of Morgan Generation Assets Study Area.
Furness (2015)	Non-breeding season populations of seabirds in UK waters.	Population data. Literature review	Uses data up to 2013	Provides non-breeding season populations for all of UK waters. Also provides seasonal extents for multiple species.
Guilford *et al.* (2008)	GPS tracking of the foraging movements of Manx Shearwaters (*Puffinus puffinus)* breeding on Skomer Island, Wales	Tagging data	Breeding seasons between 2004 and 2006	Limited usage of Morgan Generation Assets Study Area.
Kober *et al.* (2010)	An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs	Population data. Literature review	1980 to 2004	Provides seasonal extents and distribution for multiple species covering UK waters.
JNCC *et al.* (2021)	Seabird Population Trends and Causes of Change: 1986–2019 Report	Population demographic data	1986 to 2019	Provides information on seabird population trends for all of the UK.
Wade *et al.* (2016)	Provides vulnerabilities of seabird species to impacts associated with offshore wind farms incorporating data uncertainty	Literature review	N/A	Vulnerability ratings applicable to seabird species that may occur at the Morgan Generation Assets.
Woodward *et al.* (2019)	Desk-based revision of seabird foraging ranges used for HRA screening	Data on foraging range. Literature review	Incorporates information up to 2019	Provides foraging range data for seabird species in UK waters.
Woodward *et al.* (2020)	Population estimates of birds in Great Britain and the United Kingdom	Population data	Typically 2013 to 2017 for breeding estimates and 2012/13 to 2016/17 for wintering estimates	Covers all bird species in the UK.

1.2.2 Site-specific digital aerial survey

Survey summary methodology and survey area

1.2.2.1 Digital aerial surveys for seabirds have been undertaken by APEM in the Morgan Offshore Ornithology Array Area study area. Digital aerial surveys commenced in April 2021 and were completed in March 2023.

1.2.2.2 The digital aerial survey method was designed to optimise the data collection for ornithological and marine mammals by using a grid-based collection method with 30% of the sea surface collected and 12% analysed conforming and/or exceeding with current industry best-practice. Previous studies have been undertaken which suggest that baseline surveys should collect a minimum of 10% coverage (Bundesamt für Seeschifffahrt und Hydrographie, 2013). It is important to note that this study was in relation to transect-based surveys, and it has been suggested that due to the high number of replicates achieved from grid-based surveys this method requires less coverage compared to transect-based surveys (Coppack *et al.,* 2017; Weidauer *et al.,* 2016). Due to the lack of historic data within the survey area, the survey design process relied on similar projects which have been previously agreed by SNCBs as suitable for baseline characterisation. Two examples include: Norfolk Boreas which analysed an 8% grid and Gwynt y Môr which analysed a 12% grid. From analysis done so far on the aerial survey data for the Morgan Generation Assets, calculations from effort data demonstrate for the Morgan Offshore Ornithology Array Area study area, the mean area processed was 12.9% (±0.04 %) (figures in parentheses are standard errors). These values are higher than the 10 % previous minimum coverage suggested by literature (Bundesamt für Seeschifffahrt und Hydrographie, 2013) and coverage accepted by previous projects. The approach to baseline characterization using digital aerial surveys was agreed with the SNCBs.

Survey summary methodology

1.2.2.3 APEM’s bespoke camera system was fitted into a twin-engine aircraft, and custom flight planning software allowed each flight line to be accurately mapped for use before and during the flight. The camera system captured abutting still imagery along 18 survey lines which were spaced approximately 2 km apart. The aircraft collected the data at an altitude of approximately 396 m, and a speed of approximately 120 km.

1.2.2.4 The images were reviewed by appropriately experienced/qualified analysts to enumerate birds to species level, where possible. Internal quality assurance was undertaken to check for missed targets and to ensure the correct species were identified. Birds identified from the images were ‘snagged’ (i.e. located within the images) and categorised to the lowest taxonomic level possible. Images were always viewed by a minimum of two members of staff as part of a comprehensive internal quality assurance process.

1.2.2.5 The direction of birds in flight were recorded from all digital still images. This was undertaken by measuring the axis of bill to tail, within bespoke image analysis software, taking the bearing relative to the bird’s head. This bearing was linked to the geo-referenced image and thus provided an accurate representation of bird orientation at time of image capture. These data can be used to explore the predominant flight direction of each species during a digital aerial survey or during a season by the creation of circular statistic outputs termed ‘rose diagrams’.

1.2.2.6 All digital aerial surveys were undertaken in weather conditions that did not compromise the ability to provide data on the identification, distribution and abundance of bird species and marine megafauna within the survey area. Favourable conditions for surveying are defined by APEM as a cloud base of >396 m, visibility of >5 km, wind speed of <30 km and a sea state of no more than Beaufort force 4 (moderate). For health and safety reasons, no digital aerial surveys were to be undertaken in icing conditions.

1.2.2.7 Measures were taken to minimise glint and glare (strong reflected light off the sea), that makes finding and identifying bird species and marine megafauna more difficult. On days with minimal cloud, digital aerial surveys were avoided for two hours around midday. This reduced the risk of collecting images that are difficult to analyse.

1.2.2.8 The dates, start and end times for each digital aerial survey are provided in Table 1.3 with the corresponding weather conditions reported in Table 1.4.

Table 1.3: Date and start/end times (Coordinated Universal Time) for each flight for the April 2021 to March 2023 digital aerial surveys.

Survey No.	Date	Flight No.	UTC start time (HH:MM)	UTC end time (HH:MM)
01	17/04/2021	1	08:14	13:03
02	05/05/2021	1	09:05	13:50
03	03/06/2021	1	10:00	15:49
04	05/07/2021	1	12:31	16:59
05	24/08/2021	1	09:03	12:33
		2	13:52	15:47
06	08/09/2021	1	08:12	12:33
		2	14:57	17:49
07	10/10/2021	1	09:52	14:31
08	04/11/2021	1	10:50	15:33
09	02/12/2021	1	09:54	14:26
10	11/01/2022	1	09:25	14:17
11	27/02/2022	1	09:28	14:14
12	12/03/2022	1	12:05	16:09
13	01/04/2022	1	08:40	12:31
14	07/05/2022	1	10:54	15:39
15	02/06/2022	1	08:10	12:52
16	02/07/2022	1	08:39	13:27
17	06/08/2022	1	08:37	13:35
18	04/09/2022	1	10:35	15:30
19	02/10/2022	1	09:26	14:09
20	12/11/2022	1	10:25	14:57
		2	13:09	15:01
21	17/12/2022	1	10:43	13:25

Survey No.	Date	Flight No.	UTC start time (HH:MM)	UTC end time (HH:MM)
		2	10:47	13:34
22	20/01/2023	1	09:52	14:46
23	05/02/2023	1	09:22	14:35
24	04/03/2023	1	09:49	14:05
	04/03/2023	2	14:50	17:30
	05/03/2023	3	10:07	11:49

Table 1.4: Weather conditions during all digital aerial surveys from April 2021 to March 2023.

[1] = Calm (Glassy), 1 = Calm (Rippled), 2 = Smooth, 3 = Slightly Moderate, 4 = Moderate

[2] = Clear, 1 = Slightly Turbid, 2 = Moderately Turbid, 3 = Highly Turbid

[3] = Clear, 1 to 10 = Few, 11 to 50 = Scattered, 51 to 95 = Broken, 96 to 100 = Overcast

Survey No.	Date	Visibility (km)	Sea state[1]	Glint/ glare (%)	Turbidity[2]	Cloud (%)[3]	Air temp (ºC)	Wind speed (km)/direction
01	17/04/2021	10+	1	-	0	0 to 95	6	5/N
02	05/05/2021	10+	0	-	1	30 to 60	4	10 to 16/N
03	03/06/2021	10+	1	0	1	50 to 60	10 to 11	9 to 22/S to WSW
04	05/07/2021	10+	2	5	1	20 to 40	12	18/SW
05	24/08/2021	10+	2	0 to 25	2	25	15	10/SE
06	08/09/2021	10+	1 to 2	0 to 30	0 to 1	50 to 80	23 to 25	20 to 25/SE
07	10/10/2021	10+	1	0 to 15	0 to 1	25 to 96	12	15/NW
08	04/11/2021	15+	3	0 to 15	2	75 to 80	6	14 to 17/N
09	02/12/2021	10+	1 to 2	0 to 10	2	10 to 40	4 to 5	15/NW
10	11/01/2021	15+	3	0 to 10	3	30 to 99	6 to 7	8 to 16/SW to W
11	27/02/2022	10+	2	0 to 30	1	0	4 to 5	17 to 32/SSE
12	12/03/2022	10+	1 to 2	0	1 to 2	20	5 to 7	7 to 18/S
13	01/04/2022	30+	1 to 2	0	0 to 1	0	1	14 to 21/NE
14	07/05/2022	10+	1	20 to 40	2	25 to 50	9	3 to 8/N
15	02/06/2022	10+	1	0 to 30	0	40 to 90	11 to 12	4 to 7/SSE
16	01/08/2022	15	1	3 to 5	2	40 to 60	13	10 to 12/SW - WSW
17	06/08/2022	20+	3	3 to 12	2 to 3	30 to 35	11 to 12	9 to 12/WSW - WNW
18	02/07/2022	10+	2	0 to 40	1	75	10	16/W
19	04/09/2022	10+	1	5	1	10 to 20	14 to 17	8 to 15/SSE - S
20	02/10/2022	10+	1 to2	5 to 10	1 to 2	10 to 50	11	14 to 15/W
21	12/11/2022	10+	1 to 3	5 to 15	2	30 to 50	10 to 11	7 to15/E - SE

Survey No.	Date	Visibility (km)	Sea state[1]	Glint/ glare (%)	Turbidity[2]	Cloud (%)[3]	Air temp (ºC)	Wind speed (km)/direction
22	17/12/2022	20+	2	0 to 5	1	20	1	15/W
23	20/01/2023	25	1	0	1	20 to 70	0	4 to 6/NW
24	05/02/2023	15	2	0 to 10	2	85 to 95	4 to 6	11 to 23/S
	04/03/2023	10+	1	0	1	90	1 to 2	4 to 12/N - NE
	05/03/2023	10+	1	0	1	80	4	15/NNW

1.2.3 Data processing and analysis

Abundance estimates

1.2.3.1 As previously stated, digital aerial surveys encompassed the Morgan Array Area and extended up to 10 km. Abundance estimates from the raw survey data are required in order to establish a baseline for assessments of effects. Natural England (2022a) outlines that a buffer of 10 km is required for baseline characterisation surveys where species sensitive to the impacts associated with an offshore wind farm may be present and therefore a 10 km buffer was used for the Morgan Generation Assets. Abundance estimates have therefore been produced for a number of areas, including the Morgan Array Area itself, with those relevant to specific aspects of the ornithological impact assessment presented in relevant appendices.

1.2.3.2 Abundances were generated either through a complex model based approach or though parametric bootstrapping, both of which are detailed further below.

Model-based approach

1.2.3.3 All available digital stills high resolution data collected between April 2021 and March 2023 were utilised in the initial model building stage. The Marine Renewable Strategic environmental assessment (MRSea) package was used to predict numbers across the Morgan Offshore Ornithology Array Area study area alongside 95% confidence intervals derived from 1,000 bootstraps to provide a range of uncertainty predicted by the model.

1.2.3.4 MRSea is a modelling package executable in the R environment (R Core Team, 2021) based on the generalised additive model framework , fitting splines through 1- and 2-dimensional data. MRSea was specifically developed to provide a robust tool for estimating the impact of infrastructural developments on bird populations. The advantage of using MRSea over design-based approaches is two-fold: MRSea can handle missing segments and transects better than design-based approaches by using a 2-dimensional Spatially Adaptive Local Smoothing Algorithm (SALSA) (Scott-Hayward *et al.*, 2014). Other environmental covariates (e.g. bathymetric data) can be implemented in the model to further enhance the precision of the abundance and density estimates.

1.2.3.5 To prepare data for each species model, for each survey the transects were grouped into segments of ~1 km and counts of bird from each species assigned to the mid-point of the nearest segment. Values of environmental covariates were then extracted and attributed to the midpoint of each segment.

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

1.2.3.7 In the first (1-dimensional) stage, the basic model was expanded to include environmental covariates (water depth, distance to coast and bathymetric slope) and x and y coordinate positions as both linear and smoothed explanatory variables. To reduce autocorrelation, the transects within each survey were used as a blocking structure in the model. In the second (2-dimensional) stage, the x-y coordinates were fitted to the best model from stage 1 using SALSA, and with ‘Survey date’ as an interaction term, allowing for different density surfaces to be estimated for each digital aerial survey. For the model to run properly, a minimum number of birds is required in each month, and it was determined that a minimum of 50 was required to produce sensible outputs. This means that for some species in some months, no distribution maps were generated.

1.2.3.8 Both the flexibility and selection of 1-dimensional variables and identification of best models in the first stage, and the spatial flexibility in the second stage was determined using tenfold Cross Validation (CV).

1.2.3.9 All bird behaviours (flying and sitting) were included in this analysis. Therefore, an assumption is made that flying and sitting birds do not differ in their distributions within the Morgan Offshore Ornithology Array Area survey area. Because a staged approach was used, the model also made certain assumptions about the data in the second stage. The most important assumption was that the effects of environmental covariates was common to all months of data. Note that this does not imply that the relative distribution of birds is the same across all months, because the density landscape is altered for each month in stage 2 by the 2-dimensional model by using month as an interaction term.

1.2.3.10 The final model for each species was used to predict the numbers and densities of birds across an environmental grid within the Morgan Offshore Ornithology Array Area study area, which spanned the Morgan Array Area with associated 2 km and 4 km boundaries, as well as the entire digital aerial survey area. Each grid cell in the environmental grid contained an area of 0.1276 km^2, which was the smallest resolution available from the bathymetric data. Results are presented in the form of density maps and monthly tables (population size with confidence interval), the latter of which were compared to design-based estimates to further validate the MRSea models.

1.2.3.11 It was only possible to run MRSea for five species (Table 1.5), because the spatial model can run into issues when data is too sparse. It was found that when there were at least 50 observations in a single survey, models tended to perform well. Design-based abundance estimates have been produced for all species observed between April 2021 and March 2023 (inclusive).

Table 1.5: Number of sightings within the survey area per month for species modelled using MRSea.

Month	Guillemot	Manx shearwater	Black-legged kittiwake	Northern gannet	Razorbill
17/04/2021	1,145	64	140	38	25
05/05/2021	275	9	43	28	7
03/06/2021	173	92	23	13	14
05/07/2021	249	141	7	34	0

Month	Guillemot	Manx shearwater	Black-legged kittiwake	Northern gannet	Razorbill
24/08/2021	382	209	50	79	0
08/09/2021	644	62	41	61	14
10/10/2021	754	0	175	27	30
04/11/2021	182	0	57	5	37
02/12/2021	593	0	408	9	272
11/01/2021	433	0	243	5	95
27/02/2022	261	1	106	12	23
12/03/2022	730	0	253	14	51
01/04/2022	603	0	221	23	0
07/05/2022	121	11	18	14	1
02/06/2022	381	116	37	10	6
02/07/2022	257	66	15	17	0
06/08/2022	1,189	573	22	38	0
04/09/2022	1,491	735	142	69	6
02/10/2022	87	0	24	25	59
12/11/2022	188	0	250	13	94
17/12/2022	293	0	173	3	328
02/01/2023	407	0	58	0	90
05/02/2023	320	0	87	0	65
04/03/2023	705	0	217	13	43

Apportioning of unidentified species

1.2.3.12 For the majority of the digital aerial surveys, there was a proportion of seabirds that were recorded, but not identified to species level. In the case of ‘unidentified’ seabirds within similar species groups, seabirds are apportioned to the individual species that make up that group. For example, in the case of unidentified guillemot/razorbill, they were apportioned to razorbill and guillemot recorded during the digital aerial surveys and apportioning was based on the proportion of seabirds identified to species level within the same survey.

1.2.3.13 There was a total of five broader groups that needed to be apportioned to known species. Explained verbally, the basic idea is that the known (relative) species estimates for each survey month need to increase by proportionally assigning the numbers of the unknown species groups to each of the relevant known species. In formula form, for each known species i and month j, this additional proportion can be written as: ∑(Proportion)ij = ∑(Unknown)ij/∑(Known)ij.

1.2.3.14 The elegance of this analysis lies in the fact that each species will have a single proportional increase assigned to it for each survey month across all unapportioned groups that it belongs to. These proportions can simply be summed to get the total proportional increase. For example, both guillemot and razorbill numbers are increased by apportioning ‘auk/shearwater species’, ‘auk species’ and ‘guillemot/razorbill’ to them. Because guillemot and razorbill belong to the exact same unknown groups, their proportional increase from the apportioning analysis will be the same.

1.2.3.15 For example, a month with 1,200 ‘guillemot/razorbill’, 200 of which are unknown, 900 identified guillemot, and 100 identified razorbill. Applying the formula leads to a proportion of: 200 (unknown)/(900 guillemot + 100 razorbill) = 0.20. Thus, both razorbill and guillemot need to be increased by 0.20 (or multiplied by 1.20), which leads to an absolute estimate of 900*1.20=1,080 guillemot and 100*1.2=120 razorbill. The 200 unknown birds have thus been apportioned proportionally to razorbill and guillemot.

1.2.3.16 If the same month had a total of 1,700 auks, comprising the 1,200 birds mentioned above, plus 300 individuals of an unknown species (i.e. guillemot, razorbill, or puffin) and 200 puffin, applying the formula again this leads to a proportion of: 300 (unknown)/(900 guillemot + 100 razorbill + 200 puffin) = 0.25.

1.2.3.17 Following the original formula, the proportions from ‘guillemot/razorbill’ and ‘auk species’ can now be summed, leading to a proportional increase of 0.20+0.25=0.45 (or multiply by 1.45) for guillemot and razorbill, and 0+0.25 for puffin. This results in 900*1.45=1305 guillemot, 100*1.45=145 razorbill, and 200*1.25=250 puffin. Both ‘guillemot/razorbill’ and ‘auk species’ have now been apportioned, as 1,305+145+250=1,700.

1.2.3.18 This process is repeated for each of the five unknown groups to apportion unidentified birds to species level.

Correction factors to account for availability bias

1.2.3.19 There is an assumption that all seabirds, above the water, are detected during the aerial survey. However, some seabirds (e.g. auks) are not always visible as they spend time foraging beneath the water surface. To account for this, the proportion of time spent on the sea surface needs to be measured and estimates corrected accordingly (Thaxter and Burton, 2009). This is known as availability bias, which can be accounted for by applying a correction factor based on known times spent under water. To calculate the absolute estimate from the relative estimates, the numbers of seabirds observed in the digital aerial surveys are divided by the proportion of time that a bird is expected to be visible at the surface.

1.2.3.20 Availability bias is not known for every species, but is negligible for gulls and terns, as these species spend little time under water. For gannet, although there is no availability bias, there is good information on their foraging patterns. From the available literature (Garthe *et al.*, 2000, 2003, 2007, 2014; Grémillet *et al.*, 2006), gannet dive on average 2.71 to 4.63 times per hour spent flying, with a mean time spend under water ranging from 6.0 to 10.9 seconds among studies. Therefore, gannet are likely to spend <1% of their foraging time submerged, meaning availability bias is limited for this species. As such, it was not considered necessary to adjust the relative numbers of gannet for availability bias in this report.

1.2.3.21 The correction factors applied to sitting guillemot, razorbill, and puffin were based on JNCC (2013), which assumed that 24.3% of guillemot, 17.4% of razorbill, and 14.2% of puffin are underwater when digital aerial imagery is captured, leading to correction factors of 1.311, 1.211 and 1.165 respectively. Availability bias correction factors were only applied to estimates of abundance of birds sitting on the sea surface and were not applied to seabirds in flight.

1.2.3.22 Availability bias is corrected for by applying the above correction factors to sitting auks (excluding other behaviours) using the following formula: (Absolute birds) = (Relative birds * pr(sitting)/pr(visible)) + (Relative birds * (1-pr(sitting))).

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

Model outputs

1.2.3.24 For each species, a prediction surface of birds/km^2 was created over Morgan Offshore Ornithology Array Area survey area). This surface was subsetted to the Morgan Array Area, Morgan Array Area + 2 km buffer, Morgan Array Area + 4 km buffer and Morgan Array Area + 8 km buffer to provide abundance metrics and distribution surfaces for all areas. Within each spatial subset total abundance and mean density were calculated with correction factors applied for apportioning of unknown birds, availability bias (for auks), and results then split into behaviour classifications (flying, sitting and combined).

Design-based approach

1.2.3.25 Design-based estimates for bird numbers and densities in each month were generated and compared to the MRSea estimates to provide additional validation of the MRSea outputs. Furthermore, design-based estimates were produced for all species recorded during the digital aerial surveys.

1.2.3.26 Design-based estimates and confidence intervals were produced using a non-parametric bootstrapping procedure with 1,000 iterations in the R environment (R Core Team, 2021). Each iteration resampled the full dataset with replacement to create a new dataset that was the same length as the original. In each iteration, the data was subsetted three times to cover each of the four area boundaries (Morgan Array Area +2 km, +4 km, and +10 km (Morgan Offshore Ornithology Array Area study area)). In each iteration, the number of birds and area covered by the digital aerial surveys were summed for each boundary area and month. From this, the estimated relative bird population for each boundary area could be calculated using the following formula: Relative population estimate = (Birds observed)/(Area covered by digital aerial survey) * (Total area of boundary).

1.2.3.27 Variation around the population estimates was derived from the 1,000 iterations of the non-parametric bootstrap. Upper and lower estimates of the 95% confidence intervals were calculated from the variability in the 1,000 values generated.

1.2.3.28 As per the model-based approach, apportioning of unidentified species and correction factors to account for availability bias were applied to the design-based estimates.

1.2.4 Regional abundance and distribution

1.2.4.1 Density maps associated with Waggitt *et al.* (2020) and Bradbury *et al.* (2014) have been used to produce maps showing the spatial variation in densities across seasons in the Irish Sea. The spatial coverage of both datasets overlapped with the Morgan Generation Assets.

1.2.4.2 Waggitt *et al.* (2020) produced monthly distribution maps for 12 seabird species at a 10 km spatial resolution in the north-east Atlantic. Bradbury *et al.* (2014) analysed offshore boat and aerial observer surveys spanning from 1979 to 2012 to produce predicted bird densities across a grid covering English territorial waters at a resolution of 3×3 km.

1.2.4.3 The variation in distribution and abundance of each species is discussed on a regional basis in the respective species accounts in section 1.5.

1.3 Baseline characterisation

1.3.1 Study area

1.3.1.1 To characterise the baseline environment of the Morgan Generation Assets, a number of study areas have been defined. These include:

- The Morgan Offshore Ornithology survey area. This comprises the Morgan Array Area plus a 10 km buffer. This area provides a wider context in terms of the distribution and abundance of seabird species that may be of importance in the assessment of impacts associated with the Morgan Generation Assets
- The Morgan Offshore Ornithology study area. This comprises the Morgan Array Area plus a 4 km buffer. This area is used for the identification of Valued Ornithological Receptors within this annex.

1.3.1.2 In addition, it is important to consider a wider, regional offshore ornithology study area which generally coincides with the Irish Sea, Western English Channel and Celtic Seas and Minches and West Scotland as defined by the regional seas identified by JNCC for implementing UK nature conservation strategy (JNCC, 1997). This study area encompasses a wide area to capture the areas utilised by various seabird populations that may utilise the Morgan Offshore Ornithology Array Area study area throughout the annual cycle. Consideration of this study area provides a wider context incorporating species-specific foraging ranges, migration routes and wintering areas. In addition, a number of areas in the Irish Sea that are considered important for birds are also discussed as part of the wider baseline characterisation (i.e. the Irish Sea Front).

1.3.2 Recent seabird population trends

Overview

1.3.2.1 Increasing sea temperatures have had impacts on seabird populations in the UK, mainly through indirect effects via the food chain, on which they rely. Sea-surface temperatures in the northeast Atlantic and UK coastal waters have been rising since the 1980s by around 0.2 to 0.9°C per decade, with the most rapid rises occurring in the south of the North Sea and the English Channel (Holliday *et al.*, 2008).

1.3.2.2 In the Celtic Seas in which the Irish Sea is located, a high proportion of surface feeding seabird species (including terns, gulls, skuas, storm-petrels, shearwaters and fulmar) have failed to meet targets associated with abundance trends in recent years and experienced frequent, widespread breeding failures (Mitchell *et al.,* 2020). Such trends are associated with reductions in prey availability which are linked to climate change. Species that are able to exploit prey throughout the water column (e.g. auks, cormorants, gannet and Manx shearwater) appear to have been impacted to a lesser extent.

1.3.2.3 Climate change can influence seabirds in a number of ways either through changes in over-winter survival and breeding productivity which may be influenced by higher sea surface temperatures or due to changes in the life history of important prey species termed trophic mismatch (Mitchell *et al.,* 2020). Studies have shown such effects for species such as kittiwake, fulmar, puffin and Arctic tern. However, there is limited evidence that changes in sea surface temperature has had any effect on the breeding success of kittiwake at colonies in the Celtic Seas region (Mitchell *et al.,* 2020) with this thought to be due to kittiwake being reliant on different prey species than kittiwake on the east coast of the UK.

1.3.2.4 Winter storms can make it difficult for seabirds to forage at sea and consequently result in reduced survival. At times, this impact can be dramatic and some storms have resulted in large-scale mortality events or 'wrecks', when large numbers of dead or emaciated seabirds have been washed up on the shore (e.g. puffins in spring 2013). Frederiksen *et al.* (2008) demonstrated that mortality during storms has had a significant negative effect upon the numbers of European shags breeding at a colony in southeast Scotland.

1.3.2.5 An increase in frequency of extreme weather events, as predicted by climate-change models, could lead to population declines and an increasing probability of extinction of vulnerable species from exposed areas (Frederiksen *et al.*, 2008). Increased storminess and sea level rise may also reduce available breeding habitat for shoreline-nesting species (e.g. terns).

Seabird Monitoring Programme Data Trends

1.3.2.6 Seabird population trends have been used by UK Government as a ‘sustainable development strategy indicator’. JNCC publishes annual updates on seabird population trends. The latest trends in species relevant to the Morgan Generation Assets are summarised in Table 1.6 (JNCC, 2021), where information is available.

1.3.2.7 The nearest large seabird colonies to the Morgan Generation Assets form part of the Ribble and Alt Estuaries SPA and Morecambe Bay and Duddon Estuary SPA. Seabird species at these SPAs include large gull (lesser black-backed gull and herring gull) and tern species (common tern, Sandwich tern and little tern), although not all of these species occur at both SPAs.

1.3.2.8 Populations of large gulls at the Morecambe Bay and Duddon Estuaries SPA have decreased significantly since designation of the SPA with the decline thought to be due to predation. At the Ribble and Alt Estuaries SPA, although the population of lesser black-backed gull is currently higher than when the SPA was designated, the population has decreased since 2014. Populations of tern species at both SPAs have also decreased significantly since designation, although breeding colonies of terns will often move to different locations due to local conditions (e.g. disturbance, predators, etc.).

Table 1.6: Summary of seabird population trends.

Species	Population change (%)		
	1969 to 70 to 1985 to 88	1985 to 88 to 1998 to 2002	2000 to 2019
Fulmar	+77	-3	-33
Gannet	+39	+391	+34
Cormorant	+9	+10	+16
Shag	+21	-27	-40
Arctic skua	+226	-37	-70
Great skua	+148	+26	n/a
Kittiwake	+24	-25	-29
Black-headed gull	+5	0	+26
Mediterranean gull	n/a	+10,900	+327
Common gull	+25	+36	n/a
Lesser black-backed gull	+29	+40	n/a
Herring gull	-48	-13	n/a
Great black-backed gull	-7	-4	-23
Little tern	+58	-23	-28
Sandwich tern	+33	-15	+5
Common tern	+9	-9	-3
Roseate tern	-66	-83	+125
Arctic tern	+50	-31	-5
Guillemot	+77	+31	+60
Razorbill	+16	+21	+37
Black guillemot	n/a	+3	n/a
Puffin	+15	+19	n/a

1.3.3 Seasonal definitions and population importance

1.3.3.1 Seasonal definitions outline different periods of the annual cycle for a species. There are four seasons that can be applied to different periods within the annual cycle however, these seasons are not applicable for some species, with different combinations used depending on the biology and life history of a species:

- Breeding: when birds are attending colonies, nesting and provisioning young
- Post-breeding: when birds are migrating to wintering areas or dispersing from colonies
- Non-breeding: when birds are over-wintering in an area

- Pre-breeding: when birds are migrating to breeding grounds.

1.3.3.2 Seasonal definitions are required in the first instance to determine the importance of populations estimated within the Morgan Generation Assets. Seasonal extents have been defined using a range of sources including Furness (2015) and Kober *et al.* (2010). Seasonal definitions for species relevant to the Morgan Generation Assets are presented in Table 1.7.

1.3.3.3 The seasonal definitions presented in Table 1.7 are considered appropriate for the purpose of identifying population importance within this appendix however, it is important to understand that seasonal extents are not fixed and will vary depending on the population under consideration. For example, the extent of the breeding season may vary between a breeding colony located in south England and one located in north Scotland or further north meaning birds that breed at north colonies may pass through a sea area at the same time as that area is being utilised by birds from a local breeding colony. Further to this different population age cohorts exhibit different behaviours with increasing proportions of different immature age classes arriving at natal waters as the breeding season progresses and potentially occupying different sea areas. These factors will be fully explored, where necessary in the Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement and the Information to Support the Appropriate Assessment (ISAA) Part 2 – SAC assessments (Document Reference E1.2). For the purposes of this report the seasonal definitions presented in Furness (2015) are included in Table 1.7 with both the ‘full’ breeding season and the migration-free breeding season included. For the purposes of this report, months that appear in different seasons (e.g. March for great black-backed gull). For some species one or more seasons are not relevant to the assessments required for the Morgan Generation Assets (e.g. breeding season for common scoter). These are identified using ‘N/A’ in Table 1.7. Where a season is not relevant to a species the relevant cell in Table 1.7 is greyed out.

1.3.3.4 Regional, national and international populations are shown in Table 1.8 and have been defined for every species recorded within the Morgan Generation Assets. These have been derived using a number of sources that are outlined here and referenced in footnotes below Table 1.8. Where possible, these populations have been calculated using data contemporaneous with the aerial surveys undertaken for the Morgan Generation Assets.

1.3.3.5 For the purposes of the analyses required in this technical report, namely to identify the population importance of species recorded during site-specific baseline characterisation surveys, regional populations for the breeding season are estimated by summing the most recent population counts for all breeding colonies in the mean-maximum foraging range plus one standard deviation for each species. This provides the breeding adult population which is then multiplied by the immature proportion for each species as provided in Furness (2015) to provide the immature population associated with the total breeding adult population. The breeding adult and immature populations are then summed to provide the regional population for the breeding season. This approach makes the assumption that all immatures associated with each breeding colony will be present within the foraging range defined for each species. Regional populations composed of breeding adults only and the population including immatures are presented in Table 1.8. The approach to calculating regional breeding populations for other purposes are discussed where relevant in Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement.

1.3.3.6 European storm petrel is not included in Furness (2015) and therefore the regional breeding population for this species is composed of breeding adults only.

1.3.3.7 Regional populations for other seasons are defined using the BDMPS relevant to each species. The BDMPS is defined as the smallest geographical range and population scale that can be supported by evidence relating to the life history of a species including seasonal distribution and migratory movements. Relevant BDMPS populations are calculated for all seasons defined for a species, with those in the breeding season based on the number of birds within foraging range of the Morgan Generation Assets and those in the post-breeding, non-breeding and pre-breeding seasons obtained from Furness (2015) or other relevant sources.

1.3.3.8 In the breeding season, regional populations have been calculated utilising data from the Seabird Monitoring Programme (SMP) database (JNCC *et al.*, 2023). Breeding data within the mean-maximum foraging range plus one standard deviation has been extracted from the online SMP database from 2018 to 2023. These data are considered contemporaneous with the baseline surveys undertaken for the Morgan Generation Assets. Population data for some colonies may not have been collected during this timeframe. In order to not significantly under-estimate the regional breeding population a check of all SPA colonies within the relevant foraging range has been undertaken to ensure all of these colonies are accounted for within the regional breeding population estimated for each species. In these cases the most recent population estimate was used. In addition to breeding adult birds, the number of immature birds present in the regional BDMPS has been estimated using the ratio of immatures to adults provided in the relevant species accounts in Furness (2015). This total population is presented separately to the total number of breeding adults present in the regional BDMPS.

1.3.3.9 Calculation of the total regional breeding population was explored collaboratively with the Offshore Ornithology EWG due to their being little quantitative evidence to support the calculation of the number of immatures and non-breeding birds present in relevant sea areas during the breeding season. The EWG proposed that the sum of the adult and immature population estimates for all colonies that sit within the relevant species BDMPS from Furness (2015) should be used in order to estimate the total regional breeding population. The EWG noted that there are potential inaccuracies associated with this approach. Additionally, this approach makes broad assumptions about immature populations and therefore increases the total regional breeding population figure. As a more precautionary approach therefore, the number of immature birds present in the regional BDMPS has been estimated using the ratio of immatures per breeding adult provided in the relevant species accounts in Furness (2015). This approach assumes that all immatures associated with each breeding colony will be present within the foraging range defined for each species. The Applicant acknowledges there are also potential inaccuracies with this approach as it may under- or over-estimate the true count of immature birds. This is because the approach does not account for immature birds from other breeding colonies outside of foraging range that may interact with the relevant sea area which could under-estimate the number of immature birds present. However, it also assumes that all immature birds associated with breeding colonies within foraging range will be present in the relevant sea area whereas in reality many of these immature birds will be located outside of UK waters or in other areas of UK waters. However as stated, taking this approach will result in a more precautionary assessment in-line with Natural England guidance due to making use of a much smaller total regional breeding population against which the impacts have been assessed.

1.3.3.10 The regional, national and international population levels presented in Table 1.8 are divided by 100 in order to provide the 1% thresholds against which population estimates calculated for each species in the Morgan Generation Assets plus a 4 km buffer are assessed. In the breeding season, for the purposes of this report, the regional population representing breeding adult birds only is used on a precautionary basis. This is used as part of an initial screening exercise to identify those species for which further assessment is required. Originally developed for the Ramsar Convention (Kuijken, 2006), the 1% threshold level signifying importance has been used extensively for site designation (Kuijken, 2006) and in assessing potential impacts of proposed developments (Skov *et al.*, 2007) and its use here is considered appropriate. Where possible, thresholds are taken from temporally appropriate population levels, with particular attention given in this assessment to breeding, post-breeding, non-breeding and pre-breeding populations. Where a population threshold is less than 50 birds, the threshold is increased to 50 birds following the approach taken to defining population importance as part of the Wetland Bird Survey (BTO, 2023). The thresholds used are provided in the species accounts below within the text discussing population importance, and where presentation allows, on the graphs presenting the abundance of each species.

Table 1.7: Seasonal definitions used to identify population importance.

1 Not available, assumed to be the same as common and Arctic tern

2 Not available, assumed to be the same as European storm petrel.

Species	Source	Breeding (full)	Breeding (migration-free)	Post-breeding	Non-breeding	Pre-breeding	Notes
Common scoter	Lawson *et al.* (2016)	No breeding season has been defined due to the no connectivity between the project and breeding areas.			Oct to Mar		Non-breeding season based on extent of surveys undertaken to support the designation of the Liverpool Bay SPA in Lawson *et al.* (2016).
Kittiwake	Furness (2015)	Mar to Aug	May to Jul	Aug to Dec		Jan to Apr	Breeding (full) used
Black-headed gull	Kober *et al.* (2010)	Apr to Aug			Sep to Mar		
Little gull	Kober *et al.* (2010)	No breeding season has been defined due to the no connectivity between the project and breeding areas.			Aug to Apr		
Mediterranean gull	Black-headed gull used as surrogate	Apr to Aug			Sep to Mar		
Common gull	Kober *et al.* (2010)	Apr to Aug			Sep to Mar		
Great black-backed gull	Furness (2015)	Mar to Aug	May to Jul		Sep to Mar		Breeding (full) used
Herring gull	Furness (2015)	Mar to Aug	May to Jul		Sep to Feb		Breeding (full) used
Lesser black-backed gull	Furness (2015)	Apr to Aug	May to Jul	Aug to Oct	Nov to Feb	Mar to Apr	Breeding (full) used
Sandwich tern	Furness (2015)	Apr to Aug	Jun	Jul to Sep		Mar to May	Apr to Jul used for breeding season

Species	Source	Breeding (full)	Breeding (migration-free)	Post-breeding	Non-breeding	Pre-breeding	Notes
Little tern	Furness (2015)	May to Aug	Jun	Jul to Sep		Apr to May	May to Jul used for breeding season
Roseate tern	Kober *et al.* (2010)	May to Aug		Jul to Sep[1]		Apr to May[1]	
Common tern	Furness (2015)	May to Aug	Jun to Jul	Jul to Sep		Apr to May	May to Jul used for breeding season
Arctic tern	Furness (2015)	May to Aug	Jun	Jul to Sep		Apr to May	May to Jul used for breeding season
Great skua	Furness (2015)	May to Aug	May to Jul	Aug to Oct	Nov to Feb	Mar to Apr	Breeding (migration-free) used due to no connectivity with breeding colonies.
Arctic skua	Furness (2015)	May to Jul	Jun to Jul	Aug to Oct		Apr to May	Breeding (migration-free) used due to no connectivity with breeding colonies.
Guillemot	Furness (2015)	Mar to Jul	Mar to Jun		Aug to Feb		Breeding (full) used
Razorbill	Furness (2015)	Apr to Jul	Apr to Jun	Aug to Oct	Nov to Dec	Jan to Mar	Breeding (full) used
Puffin	Furness (2015)	Apr to Aug	May to Jun		Aug to Mar		Breeding (full) used
Red-throated diver	Lawson *et al.* (2016)	No breeding season has been defined due to the no connectivity between the project and breeding areas.		Sept to Nov	Oct to Mar	Feb to Apr	Non-breeding season based on extent of surveys undertaken to support the designation of the Liverpool Bay SPA in Lawson *et al.* (2016).
European storm petrel	Kober *et al.* (2010)	Jun to Oct		Nov to Dec		Jan to May	
Leach's petrel	Kober *et al.* (2010)	Jun to Oct		Nov to Dec[2]		Jan to May[2]	

Species	Source	Breeding (full)	Breeding (migration-free)	Post-breeding	Non-breeding	Pre-breeding	Notes
Fulmar	Furness (2015)	Jan to Aug	Apr to Aug	Sep to Oct	Nov	Dec to Mar	Breeding (migration-free) used
Manx shearwater	Furness (2015)	Apr to Aug	Jun to Jul	Aug to Oct		Mar to May	Breeding (full) used
Gannet	Furness (2015)	Mar to Sep	Apr to Aug	Sep to Nov		Dec to Mar	Breeding (full) used
Cormorant	Furness (2015)	Apr to Aug	May to Jul		Sep to Mar		Breeding (full) used
Shag	Furness (2015)	Feb to Aug	Mar to Jul		Sep to Jan		Breeding (full) used

Table 1.8: Regional, national and international population importance levels for species included in this report. All population estimates are for individual birds. The 1% threshold for each population is obtained by dividing the respective population by 100.

1 Based on data from the Seabird Monitoring Programme database or Mitchell *et al.* (2004) (Leach's petrel)

2 National breeding populations are sourced from Woodward *et al*. (2020) unless otherwise stated and represent the UK estimate

3 Sourced from Wetlands International (2023), Mitchell et al. (2004), del Hoyo et al. (1996) or Birdlife International (2023).

4 National wintering populations are sourced from Woodward *et al*. (2020) or Furness (2015) unless otherwise stated and represent the UK estimate

5 Lawson *et al.* (2016) – Population for the Liverpool Bay/Lerpwl Bae Area of Search

6 Post-breeding and pre-breeding populations from Wildfowl and Wetlands Trust Consulting and MacArthur Green (2014)

7 Population for Rockabill, Ireland (Eaton *et al.,* 2022)

Species	**Breeding**				**Post-breeding (individuals)**		**Non-breeding (individuals)**		**Pre-breeding (individuals)**	
	Regional BDMPS[1] (adults only) (breeding pairs)	**Regional BDMPS (adults and immature birds) (individuals)**	**National[2] (breeding pairs)**	**International[3] (breeding pairs)**	**Regional**	**National**	**Regional**	**National[4]**	**Regional**	**National**
Common scoter	0	0	52	535,000				135,000		
Kittiwake	34,579	130,017	205,000	3,050,000	911,586	1,741,523			691,526	1,319,342
Black-headed gull	0	0	140,000	1,250,000 to 1,700,000				2,200,000		
Little gull	0	0	N/A	48,000 to 90,000			333[5]			
Mediterranean gull	0	0	1,200	95,000 to 145,000				4,000		
Common gull	0	0	48,500	700,000 to 1,000,000				710,000		
Great black-backed gull	221	999	15,000	120,000 to 155,000			17,742	143,521		
Herring gull	5,810	24,286	130,000	370,000 to 390,000			173,299	639,810		

Species	Breeding				Post-breeding (individuals)		Non-breeding (individuals)		Pre-breeding (individuals)	
	Regional BDMPS[1] (adults only) (breeding pairs)	Regional BDMPS (adults and immature birds) (individuals)	National[2] (breeding pairs)	International[3] (breeding pairs)	Regional	National	Regional	National[4]	Regional	National
Lesser black-backed gull	26,133	87,807	110,000	240,000 to 250,000	163,304	372,311	41,159	80,473	163,305	360,787
Sandwich tern	589	1,920	14,000	85,000 to 100,000	10,761	48,812			10,761	48,812
Little tern	0	0	1,450	10,500 to 13,000	1,602	5,126			1,602	5,126
Roseate tern	0	0	100	3,750 to 4,600	3,230[7]				3,230	
Common tern	0	0	11,000	550,000 to 900,000	64,659	209,570			64,659	209,570
Arctic tern	0	0	53,500	1,300,000 to 2,200,000	17,696	235,328			17,696	235,328
Great skua	256	1,239	9,650	19,500 to 22,500	16,336	35,892	1,398	1,541	25,090	33,575
Arctic skua	0	0	785	39,900 to 56,200	5,287	11,714			5,111	6,338
Guillemot	21,876	76,129	950,000	2,300,000 to 2,850,000			1,139,220	2,756,526		
Razorbill	2,255	7,891	165,000	415,000 to 1,000,000	606,914	1,198,788	341,422	560,044	606,914	1,198,788
Puffin	50,381	183,387	580,000	5,500,000 to 6,000,000			304,557	536,514		
Red-throated diver	0	0	1,250	105,000 to 170,000	4,373	17,650	1,657	21,500	4,373	15,371
European storm petrel[6]	10,538	N/A	25,500	438,000 to 514,000	180,000	200,000			90,000	100,000
Leach's petrel	6,815	N/A	48,000	3,000,000 to 3,700,000	450,000	500,000			180,000	200,000
Fulmar	71,427	231,423	350,000	3,380,000 to 3,500,000	828,194	1,785,696	556,367	1,125,103	828,194	1,785,696

Species	Breeding				Post-breeding (individuals)		Non-breeding (individuals)		Pre-breeding (individuals)	
	Regional BDMPS[1] (adults only) (breeding pairs)	Regional BDMPS (adults and immature birds) (individuals)	National[2] (breeding pairs)	International[3] (breeding pairs)	Regional	National	Regional	National[4]	Regional	National
Manx shearwater	606,168	2,230,698	300,000	342,000 to 393,000	1,580,895	1,589,402			1,580,895	1,589,402
Gannet	179,996	651,586	295,000	800,000	545,954	1,002,252			661,888	910,273
Cormorant	0	0	8,900	43,000 to 55,000			9,602	33,123		
Shag	0	0	17,500	76,300 to 78,500			13,075	96,287		

1.4 Designated sites

1.4.1.1 Breeding seabirds are central-place foragers, with the nest or colony forming the central location. Foraging range varies widely between species and is determined by environmental conditions, dietary needs, flight physiology and ability to transport food.

1.4.1.2 The foraging range of each species was used to infer potential connectivity between the Morgan Generation Assets and important colonies or designated sites. For the purposes of the identification of designated sites in this report, the mean-maximum foraging range plus one standard deviation as reported by Woodward *et al.* (2019) has been used with these shown in Table 1.9 for each species unless a different foraging range is recommended with any differences consistent with the foraging ranges advised by JNCC as part of the EWG. The use of this foraging range metric, where available, is in line with guidance from Natural England (Natural England, 2022b). A detailed assessment of connectivity with the sites that form part of the UK National Site Network (and the potential for Likely Significant Effect) is provided in the Morgan Generation Assets HRA Phase 1 screening report (Document Reference E1.4). Additional data from site-specific tracking studies (e.g. Wakefield *et al.,* 2013; Dean *et al.,* 2013) have also been used to refine the results obtained when applying the more generic foraging ranges presented in Woodward *et al.* (2019). Some species have very large foraging ranges and therefore for the purposes of this report any designated sites to the east of Cape Wrath, Scotland in north Scottish waters and the North Sea has been excluded as it is considered that any birds present at these sites are highly unlikely to utilise the area in which the Morgan Generation Assets to a significant degree.

Table 1.9: Foraging ranges used to identify designated sites and important colonies that may have connectivity with the Morgan Generation Assets.

Species	Mean max foraging range + SD (km)
Kittiwake	156.1±144.5
Black-headed gull	18.5 (Mean-max only)
Mediterranean gull	20 (Mean-max only)
Common gull	50 (Mean-max only)
Great black-backed gull	73 (Mean-max only)
Herring gull	58.8±26.8
Lesser black-backed gull	127±109
Sandwich tern	34.3±23.2
Little tern	5 (Mean-max only)
Roseate tern	12.6±10.6
Common tern	18.0±8.9
Arctic tern	25.7±14.8
Great skua	443.3±487.9
Arctic skua	2±0.7 (Mean)
Guillemot	55.5±39.7 (Use of mean max+1SD discounting Fair Isle values, as presented in Woodward *et al.* (2019))

Species	Mean max foraging range + SD (km)
Razorbill	73.8±48.4 (Use of mean max+1SD discounting Fair Isle values, as presented in Woodward *et al.* (2019))
Puffin	137.1±128.3 (excl. Fair Isle data = 119.6±131.2)
European storm petrel	336 (Mean-max only)
Leach's petrel	657 (Mean)
Fulmar	542.3±657.9
Manx shearwater	1,346.8±1,018.7
Gannet	315.2±194.2 (for colonies without site specific maximum values. However, for Grassholm SPA and St Kilda SPA where site specific evidence exceeds this value (509.4 km), 516.7 km and 709 km are used respectively.)
Cormorant	25.6±8.3
Shag	13.2±10.5

1.4.1.3 Foraging ranges of seabirds are species-specific and range from a few km from the colonies (e.g. little tern) to over 1,000 km (e.g. Manx shearwater) during the breeding season. Several seabirds from the Irish Sea colonies and from colonies further afield have the potential to use the Morgan Array Area during the breeding season.

1.4.1.4 There are several protected sites designated for marine and coastal waterbirds with connectivity to the Morgan Generation Assets. Nature conservation designations with relevance to birds comprise SPAs within the National site network in the UK and the Natura 2000 network of European sites in the Republic of Ireland, Ramsar sites, and national (e.g. SSSI), ASSIs, MNRs and regional designations. To ensure a proportionate approach, the presence of each species at SSSIs has only been identified for SSSIs between Bardsey Island and the Solway Firth.

1.4.1.5 There are no current or proposed designated sites within the Morgan Array Area. There are, however, several designated sites along the west British coastline and east and north coastlines of Ireland and Northern Ireland that support qualifying species that have been recorded during the site-specific digital aerial surveys for the Morgan Generation Assets. These are shown in Figure 1.2. The list of SPAs within range of the Morgan Generation Assets is shown in Table 1.10 with other designated sites in Table 1.11.

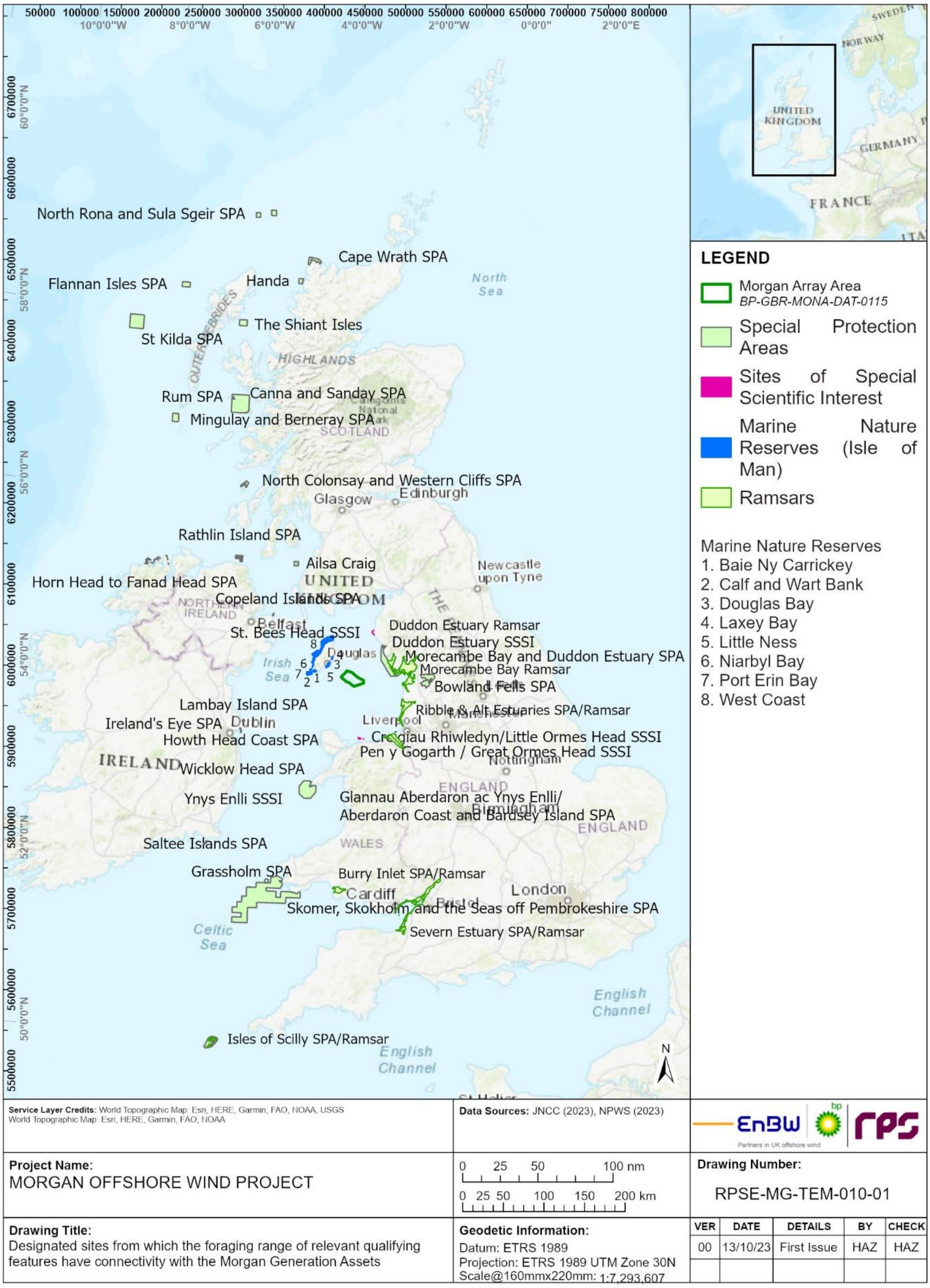

Figure 1.2: Designated sites from which the foraging range of relevant qualifying features has connectivity with the Morgan Generation Assets.

Table 1.10: SPA colonies (qualifying as an individual species and/or assemblage of species) within individual species range (mean-max foraging range + SD) from the Morgan Array Area.

SPA colonies	Storm petrel	Puffin	Leach's petrel	Great skua	Fulmar	Gannet	Herring gull	Kittiwake	Lesser black-backed gull	Manx shearwater
United Kingdom										
Ailsa Craig	x	x	x	x	x	✓	x	✓	✓	x
Bowland Fells	x	x	x	x	x	x	x	x	✓	x
Cape Wrath	x	x	x	x	✓	x	x	x	x	x
Copeland Islands	x	x	x	x	x	x	x	x	x	✓
Flannan Islands	x	x	✓	x	✓	x	x	x	x	x
Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island	x	x	x	x	x	x	x	x	x	✓
Grassholm	x	x	x	x	x	✓	x	x	x	x
Handa	x	x	x	✓	✓	x	x	x	x	x
Isles of Scilly	x	x	x	x	✓	x	x	x	x	✓
Mingulay and Berneray	x	x	x	x	✓	x	x	x	x	x

SPA colonies	Storm petrel	Puffin	Leach's petrel	Great skua	Fulmar	Gannet	Herring gull	Kittiwake	Lesser black-backed gull	Manx shearwater
Morecambe Bay and Duddon Estuary	x	x	x	x	x	x	✓	x	✓	x
North Colonsay and Western Cliffs	x	x	x	x	x	x	x	✓	x	x
North Rona and Sula Sgeir	x	x	✓	x	✓	x	x	x	x	x
Rathlin Island	x	✓	x	x	✓	x	x	✓	✓	x
Ribble and Alt Estuaries	x	x	x	x	x	x	x	x	✓	x
Rum	x	x	x	x	x	x	x	x	x	✓
Skomer, Skokholm and the Seas off Pembrokeshire /Sgomer, Sgogwm a Moroedd. Penfro	✓	✓	x	x	x	x	x	✓	x	✓
St Kilda	x	x	✓	✓	✓	✓	x	x	x	✓
The Shiant Isles	x	x	x	x	✓	x	x	x	x	x
Treshnish Isles	✓	x	x	x	x	x	x	x	x	x
Ireland										

SPA colonies	Storm petrel	Puffin	Leach’s petrel	Great skua	Fulmar	Gannet	Herring gull	Kittiwake	Lesser black-backed gull	Manx shearwater
Beara Peninsula	x	x	x	x	✓	x	x	x	x	x
Blasket Islands	x	x	x	x	✓	x	x	x	x	✓
Clare Island	x	x	x	x	✓	x	x	x	x	x
Cliffs of Moher	x	x	x	x	✓	x	x	x	x	x
Cruagh Island	x	x	x	x	x	x	x	x	x	✓
Deenish Island and Scariff Island	x	x	x	x	✓	x	x	x	x	✓
Dingle Peninsula	x	x	x	x	✓	x	x	x	x	x
Duvillaun Islands	x	x	x	x	✓	x	x	x	x	x
Helvick Head to Ballyquin	x	x	x	x	x	x	x	✓	x	x
High Island, Inishshark and Davillaun	x	x	x	x	✓	x	x	x	x	x
Horn Head to Fanad Head	x	x	x	x	✓	x	x	✓	x	x
Howth Head Coast	x	x	x	x	x	x	x	✓	x	x
Ireland's Eye	x	x	x	x	x	✓	x	✓	✓	x
Iveragh Peninsula	x	x	x	x	✓	x	x	x	x	x

SPA colonies	Storm petrel	Puffin	Leach's petrel	Great skua	Fulmar	Gannet	Herring gull	Kittiwake	Lesser black-backed gull	Manx shearwater
Kerry Head	x	x	x	x	✓	x	x	x	x	x
Lambay Island	x	✓	x	x	✓	x	x	✓	✓	x
Poulaphouca Reservoir	x	x	x	x	x	x	x	x	✓	x
Puffin Island, Kerry	x	x	x	x	✓	x	x	x	x	✓
Saltee Islands	x	✓	x	x	✓	✓	x	✓	x	x
Skelligs	x	x	x	x	✓	✓	x	x	x	✓
Stags of Broad Haven	x	x	x	x	x	x	x	x	x	x
Tory Island	x	x	x	x	✓	x	x	x	x	x
Wicklow Head	x	x	x	x	x	x	x	✓	x	x

Table 1.11: Other designated sites within individual species range (mean-max foraging range + SD) from the Morgan Array Area.

Designated site	Kittiwake	Herring gull	Guillemot	Razorbill	Puffin	Fulmar	Lesser black-backed gull	Storm petrel	Manx shearwater	Cormorant	Shag	Gannet
Morecambe Bay Ramsar	x	✓	x	x	x	x	✓	x	x	x	x	x
Isles of Scilly Ramsar	x	x	x	x	x	x		✓	x	x	x	x
St Bee’s Head SSSI	✓	✓	✓	✓	✓	x	x	x	x	x	x	x
Duddon Estuary SSSI	x	x	x	x	x	x	✓	x	x	x	x	x
Pen y Gogarth/ Great Ormes Head SSSI	✓	x	✓	✓	x	x	x	x	x	x	x	x
Creigiau Rhiwledyn/ Little Ormes Head SSSI	✓	x	✓	✓	x	x	x	x	x	x	x	x
Ynys Enlli SSSI	✓	x	x	x	x	x	x	✓	✓	x	x	x
Baie ny Carrickey MNR	✓	x	✓	✓	✓	x	x	x	x	x	x	x
Calf and Wart Bank MNR	x	x	x	x	✓	x	x	x	✓	x	x	x

Designated site	Kittiwake	Herring gull	Guillemot	Razorbill	Puffin	Fulmar	Lesser black-backed gull	Storm petrel	Manx shearwater	Cormorant	Shag	Gannet
Douglas Bay MNR	x	x	x	x	x	x	x	x	x	✓	✓	x
Laxey Bay MNR	x	x	x	x	x	x	x	x	x	x	✓	✓
Little Ness MNR	x	x	x	x	x	✓	x	x	x	x	x	x
Niarbyl Bay MNR	x	x	x	x	x	✓	✓	x	x	x	x	x
Port Erin Bay MNR	x	✓	x	x	x	✓	x	x	x	x	x	x
West Coast MNR	x	x	x	x	x	x	x	x	x	x	x	✓

1.5 Species accounts

Overview

1.5.1.1 Species that may occur within the Morgan Array Area study area have been identified using site-specific aerial surveys undertaken between April 2021 and March 2023 and regional survey data. Species accounts are therefore presented for all species recorded during these surveys. In addition, information pertaining to other species, the distribution and abundance of which may not be adequately captured by traditional baseline surveys, has been reviewed and is discussed within relevant species accounts below. The species accounts for these species present aerial survey data from the Morgan Generation Assets plus a 4 km buffer. For species included in this section, population estimates for the Morgan Generation Assets plus a 4 km buffer are used as a screening tool to identify those species which require further assessment within Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement. Species identified for further assessment are summarised in section 1.6.

1.5.1.2 The occurrence of each species in the wider Irish Sea has also been considered using relevant data sources including Waggitt *et al.* (2020) and Bradbury *et al.* (2014) (see section 1.2.4).

1.5.1.3 Each species account also includes an overview of species conservation status and sensitivity to impacts associated with offshore wind developments. All designated sites identified in Section 1.4 at which the relevant species is a qualifying feature either in its own right or as part of an assemblage have been identified. Behavioural information recorded during baseline surveys relating to flight direction, is also presented within individual species accounts for those species where flight direction was recorded for at least 100 individuals across all surveys. Age class data is also reported for all species where age class was identified for at least 50 individuals across all surveys.

1.5.1.4 A Valued Ornithological Receptor (VOR) was identified where the numbers present at the Morgan Generation Assets plus a 4 km buffer breached the 1% threshold of the regional population in any season. It is considered that any impacts on species occurring in numbers of less than 1% of the relevant regional population will not be significant. This process is not however, applied as a definitive threshold with expert judgement also used to identify species for which this threshold may not be applicable and therefore ensure that species are not erroneously omitted from further assessment. Each species account section then uses criteria associated with a species conservation status and the importance of populations estimated within the Morgan Generation Assets and a 4 km buffer to identify the relevant conservation value for a VOR (Table 1.12). These selection criteria were informed by the Chartered Institute of Ecology and Environmental Management's (CIEEM) (2019) guidance and adapted to relevance for the avifauna present within the Morgan Generation Assets.

1.5.1.5 The conservation status definitions presented in Table 1.12 take into account relevant conservation metrics in England, Wales and the Isle of Man.

1.5.1.6 The following species accounts present abundance data for the Morgan Generation Assets plus a 4 km buffer to determine the population importance of each species at the Morgan Generation Assets. Raw data from all surveys for the Morgan Generation Assets survey area is presented in Appendix A and densities and population estimates for other project areas are presented, where relevant, in other technical appendices.

Table 1.12: Definition of terms relating to the conservation value of ornithological receptors.

1. As transposed into UK legislation through The Conservation of Habitats and Species Regulations 2017 (2017 No. 1012) (as amended) and The Conservation of Offshore Marine Habitats and Species Regulations 2017 (2017 No. 1013) (as amended) and subsequently retained in UK law through The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (2019 No. 579)

Conservation value	Definition
Negligible	<u>Conservation status</u> All species of lowest conservation status (e.g. Green-listed species listed on the Birds of Conservation Concern 5 or Birds of Conservation Concern Isle of Man).
	<u>Importance</u> Not recorded during baseline and regional surveys of the Morgan Generation Assets.
Local	<u>Conservation status</u> Any other species of conservation status (e.g. Amber-listed species listed on the Birds of Conservation Concern 5 or Birds of Conservation Concern Isle of Man) not covered in the categories below.
	<u>Importance</u> A species which is present at the Morgan Generation Assets in numbers lower than 1% of the regional population.
Regional	<u>Conservation status</u> • Species listed on the Birds of Conservation Concern 5 or Birds of Conservation Concern Isle of Man Red list • Species that are the subject of a specific action plan within the UK or are listed as Species of Principal Importance in England (Section 41 of the NERC Act 2006) or as Species of Principal Importance in Wales (Section 7 of the Environment (Wales) Act 2016).
	<u>Importance</u> A species which is present at the Morgan Generation Assets in numbers greater than 1% of the regional population.
National	<u>Conservation status</u> • Species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) not already covered by international criteria • Species listed on Annex 1 of the EU Birds Directive [1]; • Bird species that form part of an SSSI/ASSI that may potentially interact with the Morgan Generation Assets at some stage of their life cycle • At least 50% of the UK breeding or non-breeding population found in ten or fewer sites • An impact on an ecologically sensitive species (<300 breeding pairs or <900 wintering individuals in the UK).
	<u>Importance</u> A species which is present at the Morgan Generation Assets in numbers greater than 1% of the national population.
International	<u>Conservation status</u> • Bird species that form part of a cited interest of an SPA or Ramsar site that may potentially interact with the Morgan Generation Assets at some stage of their life cycle including those listed as assemblage features • At least 20% of the European breeding or non-breeding population is found in the UK.

Conservation value	Definition
	Importance A species which is present at the Morgan Generation Assets in numbers greater than 1% of the international population.

Common scoter *Melanitta nigra*

Status overview

1.5.1.7 Common scoter is not listed under Annex I of the EU Birds Directive (2009/147/EEC) but is included on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The species is also currently red-listed on the UK Birds of Conservation Concern (Stanbury *et al.*, 2021).

1.5.1.8 The majority of the UK wintering population of common scoter is concentrated in a few large flocks off the mouths of major estuaries around the UK coast. The most recent appraisal of the UK wintering population estimated 135,000 birds in UK waters (Woodward *et al.,* 2020).

1.5.1.9 The UK breeding population of common scoter has declined by more than 50% in recent years, and was estimated 52 pairs in 2020, with all in Scotland (Eaton *et al.*, 2022).

1.5.1.10 Common scoter is listed as a qualifying interest species in the non-breeding season at eleven SPAs in the UK with three of these (Ribble and Alt Estuaries SPA, Liverpool Bay SPA and the Solway Frith SPA) in the Irish Sea. There is however, no direct overlap between the Morgan Generation Assets and these SPAs or any connectivity with the Morgan Generation Assets.

1.5.1.11 Wade *et al.* (2016) assessed common scoter as being at low risk of collision with turbines. However, the species is considered to be at very high risk of displacement and high risk of habitat loss due to a limited flexibility in habitat use. Maclean *et al.* (2009) assessed common scoter as being of moderate risk to barrier effects.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.12 Common scoters were not recorded in the Morgan Generation Assets study area during the 24-month baseline aerial survey programme of the Morgan Generation Assets.

Regional survey data

1.5.1.13 The Morgan Generation Assets is located in the Irish Sea, areas within which are of importance for common scoter. The closest of these areas to the Morgan Generation Assets are incorporated into the designation of the Liverpool Bay SPA. The areas of highest density occur off the English coast at Blackpool, Lancashire and off the Welsh coast between Colwyn Bay and the Dee Estuary. However, these areas do not overlap with the Morgan Generation Assets. The wider Liverpool Bay Area of Search used to define the boundary of the Liverpool Bay SPA in Lawson *et al.* (2016) does not overlap with the Morgan Generation Assets however, those areas closest to the Morgan Generation Assets support negligible densities, if any, of common scoter (Figure B.1).

More recent surveys have shown a similar pattern of distribution (HiDef Aerial Surveying Limited, 2023).

Conclusion

1.5.1.14 Due to the species inclusion on Schedule 1 of the Wildlife and Countryside Act 1981, common scoter is considered to be of National conservation status. Common scoter was not recorded during aerial surveys of the Morgan Generation Assets study area and regional surveys suggest limited, if any, birds will be present. The species is therefore considered to have a negligible population importance and therefore it is considered highly unlikely that impacts associated with the Morgan Generation Assets will occur on common scoter.

1.5.1.15 Common scoter is therefore not considered for further assessment in relation to impacts associated with the Morgan Generation Assets.

Kittiwake *Rissa tridactyla*

Status overview

1.5.1.16 Kittiwake is currently red-listed on the UK Birds of Conservation Concern (Stanbury *et al.*, 2021). The species is not listed under Annex I of the EU Birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended).

1.5.1.17 Kittiwake is one of the commonest seabirds in the UK, breeding in large colonies on coastal cliff habitat. The most recent appraisal of the UK breeding population estimates 205,000 breeding pairs (Woodward *et al.* 2020), although an update to this figure is expected once the results of the most recent national seabird census is published. The largest populations of kittiwake in the UK occur on the east coast with the closest UK SPA to the Morgan Generation Assets the Ailsa Craig SPA located off the north coast of Ayrshire, Scotland. Kittiwakes mostly prey on small fish such as sandeels, crustaceans and fishery discards (Coulson, 2011).

1.5.1.18 The Morgan Generation Assets are within the foraging range of kittiwake from four UK SPAs and six Irish SPAs (Table 1.13). At the time of designation these SPAs supported 29,766 breeding pairs representing over 7% of the Britain and Ireland breeding population as recorded during Seabird 2000 (Mitchell *et al.*, 2004). The most recent counts, where available, indicate that at the majority of colonies, the kittiwake breeding population has subsequently decreased however, increases have been observed at the Rathlin Island SPA and at the Ireland’s Eye SPA.

1.5.1.19 Wade *et al.* (2016) assessed kittiwake as being at low risk of displacement from wind farms and habitat loss due to the ability of the species to utilise alternative habitats. Kittiwake is however considered to be at high risk of collision with turbines due to the relatively high proportion of birds at turbine height. Maclean *et al.* (2009) assessed gulls as being at low risk of barrier effects at offshore wind farms.

Table 1.13: Designated sites at which kittiwake is a qualifying feature with which there is connectivity with the Morgan Generation Assets.

1 Populations from Natura 2000 data forms unless otherwise stated.

2 Stroud *et al.* (2016)

Designated site	Distance to the Morgan Generation Assets (km)	Population at designation [1] (breeding pairs) (JNCC, 2022)	Most recent population estimates (Seabird Monitoring Programme database) (breeding pairs) (year)
UK			
Ailsa Craig SPA	142	3,100	490 (2021)
North Colonsay and Western Cliffs SPA	258	4,512	4,124 (2018 to 2023)
Rathlin Island SPA	186	6,822	13,767 (2021)
Skomer, Skokholm and the Seas off Pembrokshire/ Sgomer, Sgogwm A Moroedd Penfro SPA	252	1,959 [2]	1,544 (2022)
St Bee’s Head SSSI	53	-	572 (2022)
Pen y Gogarth/Great Ormes Head SSSI	63	-	564 (2023)
Creigiau Rhiwledyn/Little Ormes Head SSSI	66	-	28 (2023)
Ynys Enlli SSSI	138	-	62 (2023)
Isle of Man			
Baie ny Carrickey MNR	33	-	Unknown
Ireland			
Horn Head to Fanad Head SPA	255	3,853	Unknown
Howth Head Coast SPA	140	2,329	Unknown
Ireland's Eye SPA	139	941	1,610 (2015)
Lambay Island SPA	130	4,091	3,320 (2015)
Saltee Islands SPA	261	2,125	845 (2013)
Wicklow Head SPA	165	956	Unknown

Seasonal abundance and distribution

Site-specific surveys

1.5.1.20 Kittiwakes were recorded within the Morgan Generation Assets study area in all of the 24 months of the baseline aerial survey programme. Peak numbers occurred in December 2021 (Table 1.14; Figure 1.3).

1.5.1.21 The species was most abundant in the post- and pre-breeding seasons of both survey years, especially December and at the start of the breeding season (March and April). The predicted abundance varied greatly for the rest of the breeding season (April to August) but was generally low between May to August and consistently much lower than post- and pre-breeding season months (Figure 1.3).

1.5.1.22 The MRSea modelling for kittiwake is considered to have provided generally good predictions. Kittiwakes were broadly distributed across the study area in most surveys, but the model performed sufficiently well. Predicted confidence intervals are relatively tight, supporting confidence in predictions (Figure 1.4).

1.5.1.23 MRSea outputs were generated for 15 of the 24 months of survey, with these primarily being months outside of the breeding season. The outputs suggest that there is an easterly bias in the distribution of kittiwake across the Morgan Generation Assets study area (Figure 1.4).

1.5.1.24 The peak population in the post-breeding season (August to December) occurred in December 2022. This did not surpass the 1% threshold for regional importance (9,116 birds). In the pre-breeding season (January to April), the peak population was recorded in March 2022. This also did not surpass the 1% threshold of regional importance (6,915 birds). The population recorded in the March 2022 survey also represented the peak population in the breeding season. This surpassed the 1% threshold of regional importance with the population estimated in April 2022 and March 2023 (when using model-based abundance estimates) also surpassing the regional importance threshold.

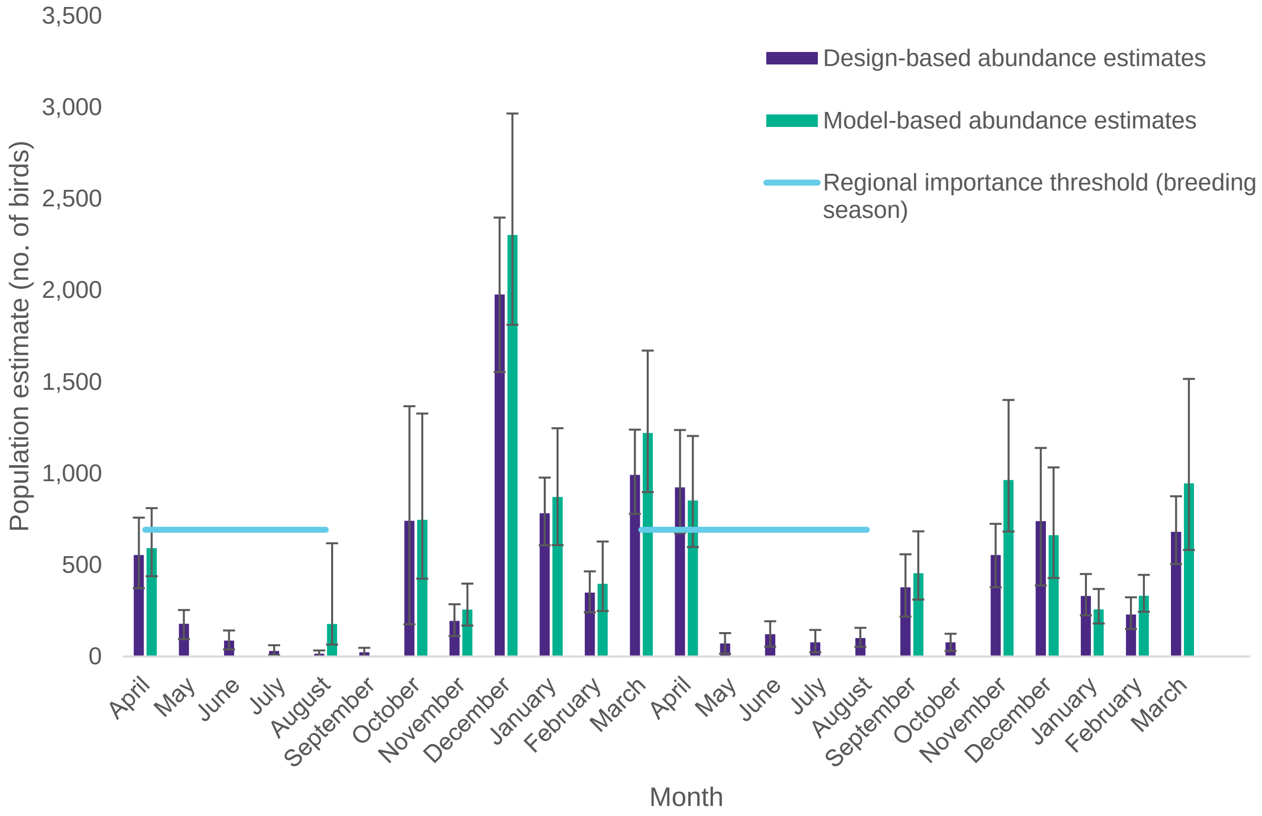

Figure 1.3: Abundance of kittiwake in the Morgan Generation Assets study area during site-specific aerial surveys (with 95% confidence intervals). The regional importance threshold for the breeding season is also shown.

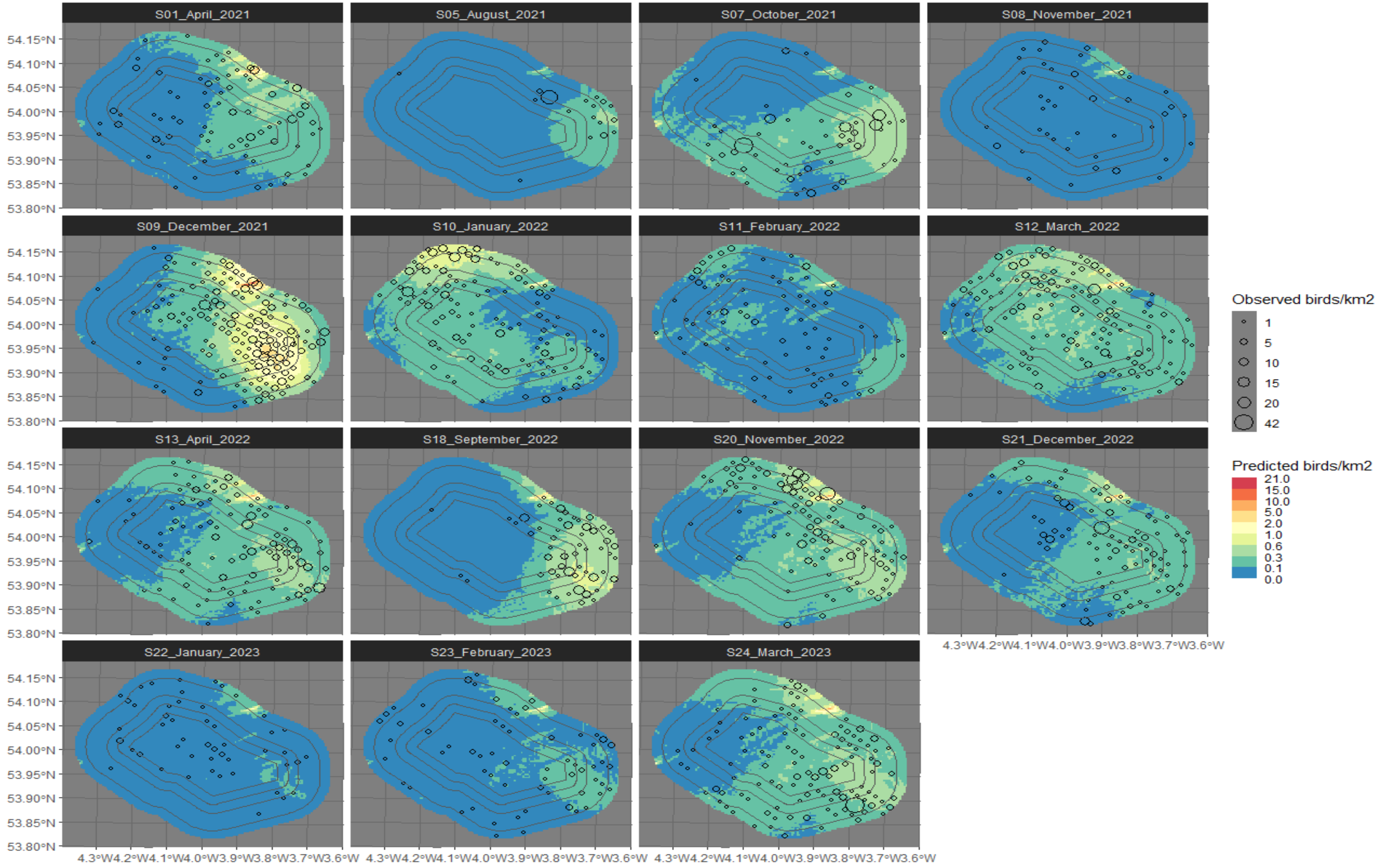

Figure 1.4: Predicted and observed kittiwake density across the Morgan Generation Assets study area (figures also show the array area, 2 and 8 km buffers). Only modelled surveys (surveys with > 50 birds observed) are shown.

Table 1.14: Design-based and model-based (all behaviour) population estimates with lower and upper (95%) confidence limits for each month surveyed from April 2021 to March 2023 for the Morgan Generation Assets study area for kittiwake.

Year	Month	Model-based population estimates			Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit	Mean	Lower confidence limit	Upper confidence limit
1	Apr	592	438	810	554	373	758
1	May	-	-	-	179	94	254
1	Jun	-	-	-	87	38	142
1	Jul	-	-	-	30	7	61
1	Aug	177	65	618	15	0	33
1	Sep	-	-	-	23	0	47
1	Oct	746	425	1,326	740	176	1,366
1	Nov	257	169	398	194	111	285
1	Dec	2,302	1,811	2,965	1,977	1,553	2,397
1	Jan	871	608	1,246	782	607	977
1	Feb	396	249	628	349	241	465
1	Mar	1,220	897	1,670	992	779	1,239
2	Apr	852	598	1,204	924	674	1,237
2	May	-	-	-	71	15	128
2	Jun	-	-	-	121	53	192
2	Jul	-	-	-	77	23	145
2	Aug	-	-	-	101	52	156
2	Sep	454	311	683	378	218	558
2	Oct	-	-	-	77	30	124

Year	Month	Model-based population estimates			Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit	Mean	Lower confidence limit	Upper confidence limit
2	Nov	964	682	1,401	554	378	724
2	Dec	662	429	1,032	739	388	1,139
2	Jan	257	180	369	331	224	450
2	Feb	331	244	446	229	150	323
2	Mar	945	582	1,516	681	505	875

Regional survey data

1.5.1.25 Between March and July, kittiwakes are dispersed widely around the coast of Britain, with the highest densities located in inshore areas along the North Sea coast of the UK (Waggitt *et al.,* 2020). In the Irish Sea, densities are highest in March, likely reflecting the movement of birds to colonies further north. From April until August, densities of kittiwake in the Irish Sea, and especially the area in which the Morgan Generation Assets are located, remain low. From September the importance of the Irish Sea begins to increase however, overall, densities during this period are lower, especially between November and January when the majority of kittiwake have left UK waters (Figure B.2 and Figure B.3).

Telemetry data

1.5.1.26 There is evidence that kittiwake (equipped with geolocators) from the Skomer Island colony (Wales) use the Morgan Array Area and adjacent waters (BirdLife International, 2022). Tracked individuals from the Puffin Island colony (Anglesey, Wales) have also shown use of the Morgan Array Area. This latter data set has been used by Wakefield *et al.* (2017) to examine regional distribution whilst Cleasby *et al.* (2020) used it to identify important areas for seabirds at sea around the UK coastline.

Behaviour and age class

1.5.1.27 A total of 2,062 individuals were aged during the site-specific aerial surveys. Of these, 1,907 were identified as adults, 150 as immatures and five as juveniles. Juvenile birds were observed in September 2021. Immature birds were observed throughout the year (Figure 1.5).

1.5.1.28 Analysis of flight directions across the seasonal extents for the breeding season (full UK breeding season and migration-free breeding season) showed prevailing flight directions were similar albeit with far fewer birds in the migration-free breeding season. The prevailing flight directions were northwest, north, east and southeast. In the post-breeding and pre-breeding seasons, prevailing flight directions were similar with the majority of birds observed flying in west, northwest, north and southeast directions, with a high proportion also observed flying south in the pre-breeding season (Figure 1.6).

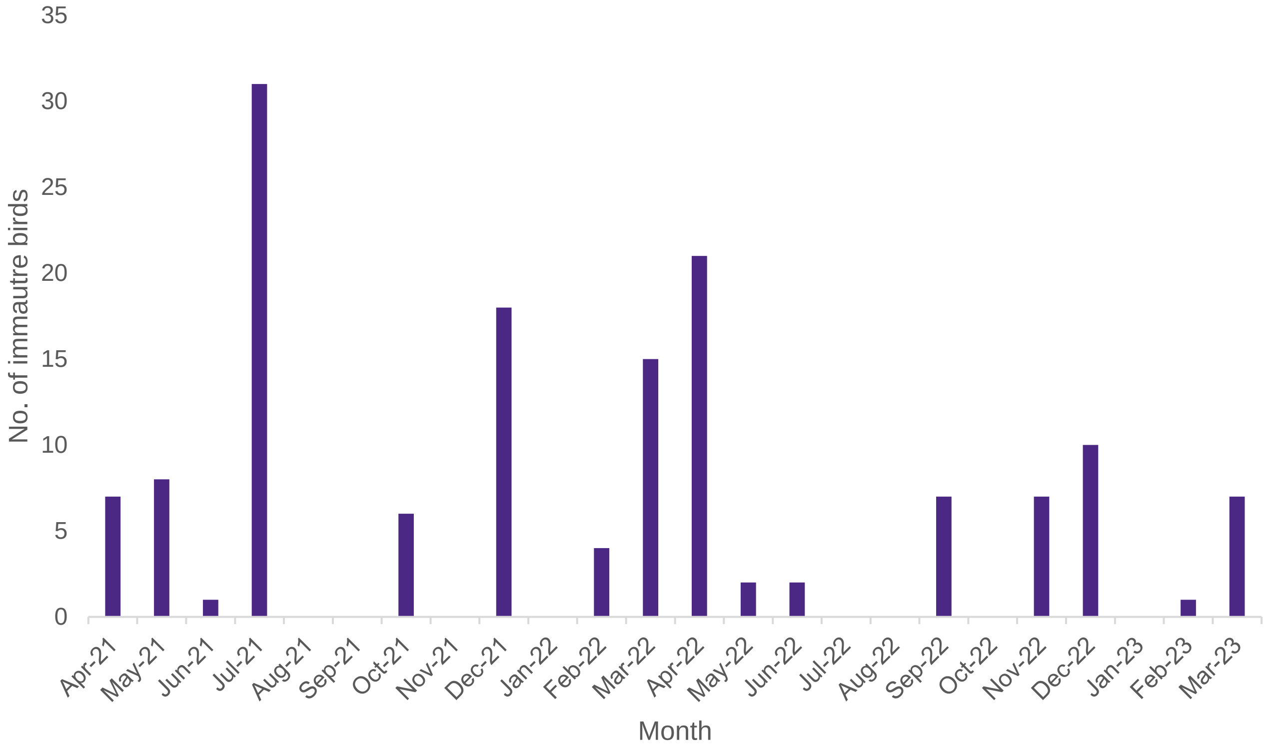

Figure 1.5: Number of immature kittiwakes recorded during each site-specific aerial survey.

Figure 1.6: Flight directions of kittiwake as recorded during site-specific aerial surveys.

Conclusion

1.5.1.29 Kittiwake is considered to have an international conservation status due to the Morgan Generation Assets being within the foraging range of kittiwake from multiple SPAs at which the species is designated as a breeding feature. Population estimates of kittiwake within the Morgan Generation Assets study area during the breeding season exceeded the 1% importance threshold of the regional population. Kittiwake is therefore identified as a VOR and is considered for further assessment as a receptor with an international conservation value.

Black-headed gull *Chroicocephalus ridibundus*

Status overview

1.5.1.30 Black-headed gull is not listed under Annex I of the EU Birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). Black-headed gull is amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.*, 2021).

1.5.1.31 Black-headed gulls are common and widespread in the UK and occur both inland and on the coast, although they are rarely found far offshore. In summer, birds breed at inland and coastal colonies, with 127,907 pairs recorded in Britain during Seabird 2000 (Mitchell *et al.*, 2004). The UK wintering population of black-headed gull has been estimated at nearly 2,200,000 individuals (Burton *et al.*, 2012).

1.5.1.32 The Morgan Generation Assets are not in the foraging range from any SPA at which black-headed gull is a qualifying feature.

1.5.1.33 Wade *et al.* (2016) assessed black-headed gull as being at low risk of displacement from wind farms and habitat loss due to the species ability to use a wide range of habitats. The species was assessed as being at high risk of collision with turbines due to the relatively high proportion of birds at turbine height. Maclean *et al.* (2009) assessed gulls as being at low risk of barrier effects with offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.34 Black-headed gulls were not recorded in the Morgan Generation Assets study area during the 24-month baseline aerial survey programme of the Morgan Generation Assets.

Regional survey data

1.5.1.35 Black-headed gull have a coastal distribution within the Irish Sea during the summer with relatively low densities occurring along the English, Welsh and Scottish coasts. In the winter the distribution extends further offshore but remains of relatively low importance. The area in which the Morgan Generation Assets are located is of limited importance for the species in both the summer and winter (Figure B.4).

Conclusion

1.5.1.36 Black-headed gull is considered to have a Local conservation status due to the species being Amber-listed on the Birds of Conservation Concern (Stanbury *et al.,* 2021). Black-headed gull was not recorded during aerial surveys of the Morgan Generation Assets study area and regional surveys suggest limited, if any, birds will be present. The species is therefore considered to have a negligible population importance and therefore it is considered highly unlikely that impacts associated with the Morgan Generation Assets will occur on black-headed gull.

1.5.1.37 Black-headed gull is therefore not considered for further assessment in relation to impacts associated with the Morgan Generation Assets.

Little gull *Hydrocoloeus minutus*

Status overview

1.5.1.38 Little gull is listed on Annex I of the EU Birds Directive and Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). It is currently green-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.39 Little gull occurs on passage in UK waters with the species fairly common in the North Sea during the non-breeding season. In the Irish Sea, the species forms part of the non-breeding waterbird assemblage included as part of the designation of the Liverpool Bay SPA. The most important area for the species in the Irish Sea is offshore of Blackpool, Lancashire (Lawson *et al.,* 2016). This corresponds with the distribution of the species in the non-breeding season as presented in Bradbury *et al.* (2014). None of the areas supporting relatively high densities overlap with the Morgan Generation Assets.

1.5.1.40 The Morgan Generation Assets are not in the foraging range or directly overlapping with any SPA at which little gull is a qualifying feature.

1.5.1.41 Bradbury *et al.* (2014) assessed little gull as being at moderate risk of collision with turbines due to the moderate proportion of birds at turbine height. Little gull is considered to have a very low vulnerability to disturbance and a moderate ability of the species to use alternative habitats. Maclean *et al.* (2009) assessed gulls as being at low risk of barrier effects from offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.42 Little gulls were recorded within the Morgan Generation Assets study area in three of the 24 months of the baseline aerial survey programme. The highest population occurred in January 2023 (159 birds) with birds also occurring in April 2021 (8 birds) and January 2022 (15 birds). Throughout the three surveys, birds were primarily located in the south half of the Morgan Generation Assets survey area.

1.5.1.43 All of the little gulls recorded during aerial surveys were recorded during the non-breeding season defined for the species. There was no obvious trend in the distribution of little gull across the Morgan Generation Assets survey area due to the limited number of birds recorded.

1.5.1.44 In the non-breeding season, the peak population estimated in the January 2023 survey surpassed the threshold for regional importance (50 birds). The threshold for regional importance was not surpassed in any other month.

Regional survey data

1.5.1.45 The Morgan Generation Assets is located in the Irish Sea, areas within which are of importance for little gull. The closest of these areas to the Morgan Generation Assets are incorporated into the designation of the Liverpool Bay SPA. The areas of highest density occur offshore and were incorporated into the updated boundary of the SPA which was designated in 2017. However, these areas do not overlap with the Morgan

Generation Assets. The wider Liverpool Bay Area of Search used to define the boundary of the Liverpool Bay SPA in Lawson *et al.* (2016) does not overlap with the Morgan Generation Assets however, those areas closest to the Morgan Generation Assets support negligible densities, if any, of little gull. More recent surveys have shown the distribution of little gull to be slightly further south although still not overlapping with the Morgan Generation Assets (HiDef Aerial Surveying Limited, 2023).

Conclusion

1.5.1.46 Little gull is listed on Annex 1 of the Birds Directive and as such is considered to have a national conservation status. The species was recorded in three of the 24 aerial surveys undertaken across the Morgan Generation Assets study area with all of these being in the non-breeding season defined for the species. In one of these months (January 2023) the population present was of regional importance and therefore the species is identified as a VOR with a national conservation value and is considered for further assessment for impacts associated with the Morgan Generation Assets.

Mediterranean gull *Ichthyaetus melanocephalus*

Status overview

1.5.1.47 Mediterranean gull is listed on Annex I of the Birds Directive and Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The species is currently amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.48 Mediterranean gull breeds, predominantly, along the south and east coasts of England. The breeding population of the species has undergone a significant increase in recent years. A total of 113 breeding pairs were recorded in Britain and Ireland during Seabird 2000 Mitchell *et al.* (2004) with the most recent estimate in 2020 being 2,118 to 2,187 pairs (Eaton *et al.,* 2022).

1.5.1.49 The Morgan Generation Assets are not in the foraging range from any SPA at which Mediterranean gull is a qualifying feature.

1.5.1.50 Bradbury *et al.* (2014) assessed Mediterranean gull as being at low risk of collision with turbines due to the low proportion of birds at turbine height. Mediterranean gull is considered to have a low vulnerability to disturbance and a moderate ability of the species to use alternative habitats. Maclean *et al.* (2009) assessed gulls as being at low risk of barrier effects from offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.51 Mediterranean gulls were recorded within the Morgan Generation Assets study area in only one of the 24 months of the baseline aerial survey programme with this being in the January 2023 survey. One bird was observed in the south part of the Morgan Generation Assets survey area during the January 2023 survey translating into a population estimate of eight birds. This population does not surpass the threshold for any level of importance.

Conclusion

1.5.1.52 Mediterranean gull is considered to have a national conservation status due to its inclusion of Annex I of the EU Birds Directive and Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). Mediterranean gulls were recorded in only one of the 24 surveys undertaken across the Morgan Generation Assets study area. the estimated population did not surpass the thresholds of importance for any population level.

1.5.1.53 Mediterranean gull is therefore not considered for further assessment in relation to impacts associated with the Morgan Generation Assets.

Common gull *Larus canus*

Status overview

1.5.1.54 Common gull is not listed under Annex I of the Birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The species is currently amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.55 Common gulls are common and widespread in the UK in lowland, urban and coastal areas in winter, and at breeding colonies in coastal and inland locations in summer. Seabird 2000 recorded 48,163 pairs of common gulls breeding in Britain (Mitchell *et al.*, 2004). Common gulls typically feed on farmland, playing fields, estuaries and in coastal waters, and are comparatively uncommon offshore (Forrester *et al.*, 2007; Stone *et al.*, 1995). The UK wintering population of common gull has been estimated at over 700,000 individuals (Burton *et al.*, 2012).

1.5.1.56 The Morgan Generation Assets are not in the foraging range from any SPA at which common gull is a qualifying feature.

1.5.1.57 Wade *et al.* (2016) assessed common gull as being at low risk of displacement from wind farms and habitat loss due to the species ability to use a wide range of habitats. However, the species is assessed as being at very high risk from collision with turbines due to the relatively high proportion of birds at turbine height. Maclean *et al.* (2009) assessed gulls as being at low risk of barrier effects at offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.58 Common gulls were recorded within the Morgan Generation Assets study area in eight of the 24 months of the baseline aerial survey programme. The highest population occurred in December 2022 (Table 1.15; Figure 1.7).

1.5.1.59 Of the eight surveys in which the species was recorded, seven were during the non-breeding season, predominantly between November and January. The only records of birds in the breeding season came during the April 2022 survey (Figure 1.7). Due to the small number of birds recorded there were no obvious trends in the distribution of birds across the Morgan Generation Assets survey area.

1.5.1.60 The peak population in the non-breeding season (September to March) occurred in December 2022. No estimate of the regional population relevant to the regional BDMPS in which the Morgan Generation Assets is available and therefore, in the non-breeding season, this species is assessed for national importance only. The estimated population did not surpass the threshold for national importance. In the breeding season (April to August), the peak population was recorded in April 2021. There are no breeding populations of common gull within the foraging range of the Morgan Generation Assets and therefore this population is likely birds moving to breeding colonies.

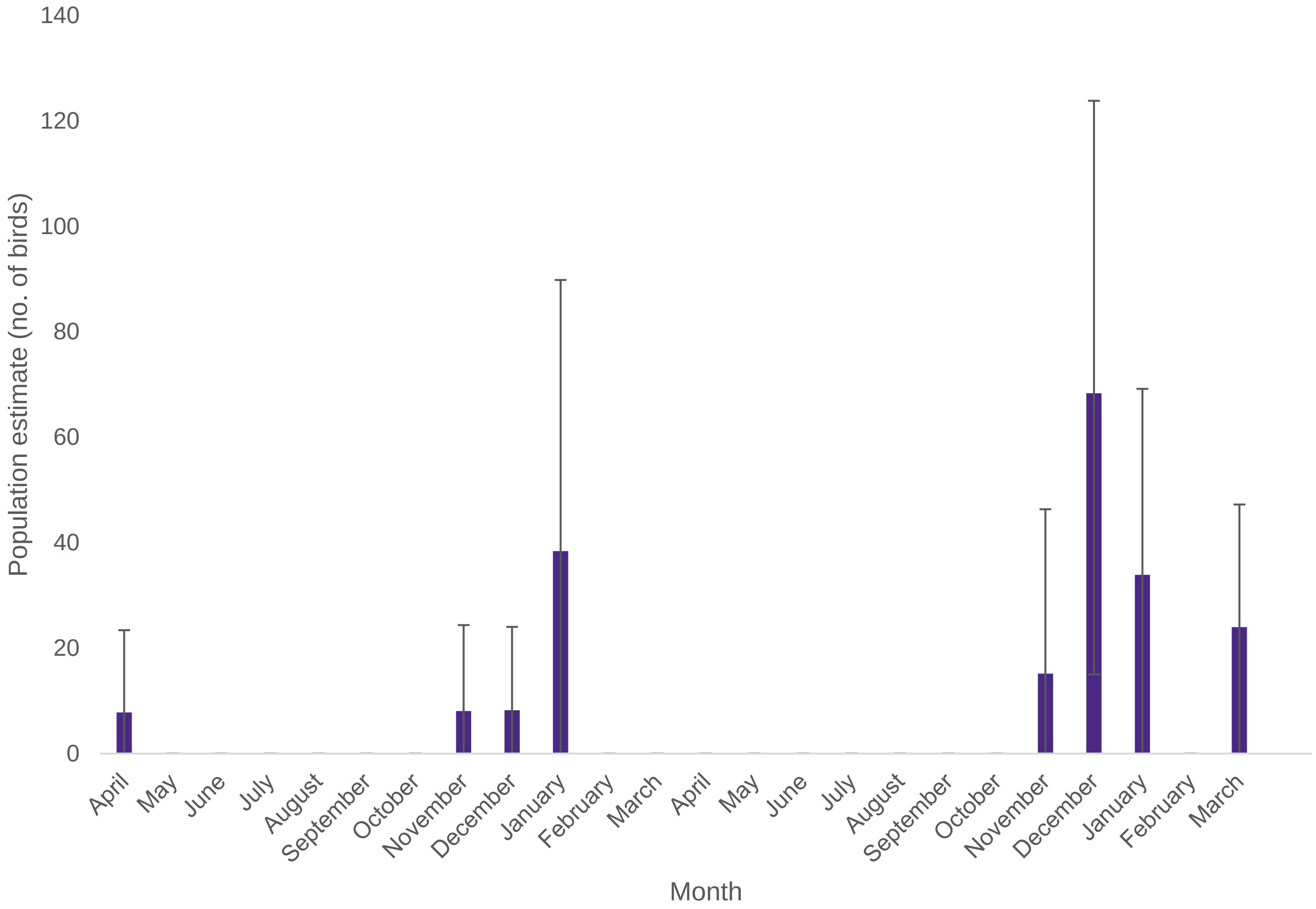

Figure 1.7: Abundance of common gull in the Morgan Generation Assets study area during site-specific aerial surveys (with 95% confidence intervals).

Table 1.15: Design-based and model-based (all behaviour) population estimates with lower and upper (95%) confidence limits for each month surveyed from April 2021 to March 2023 for the Morgan Generation Assets study area for common gull.

Year	Month	Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit
1	April	8	0	23
1	May	0	0	0
1	June	0	0	0
1	July	0	0	0
1	August	0	0	0
1	September	0	0	0

Year	Month	Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit
1	October	0	0	0
1	November	8	0	24
1	December	8	0	24
1	January	38	0	90
1	February	0	0	0
1	March	0	0	0
2	April	0	0	0
2	May	0	0	0
2	June	0	0	0
2	July	0	0	0
2	August	0	0	0
2	September	0	0	0
2	October	0	0	0
2	November	15	0	46
2	December	68	15	124
2	January	34	0	69
2	February	0	0	0
2	March	24	0	47

Regional survey data

1.5.1.61 Common gull have a coastal distribution within the Irish Sea during the summer with relatively low densities occurring along the English, Welsh and Scottish coasts reflecting the limited abundance of the species in the Irish Sea during this period with birds having moved to breeding areas further north. In the winter the distribution extends further offshore but remains of relatively low importance. The area in which the Morgan Generation Assets are located is of limited importance for the species in both the summer and winter (Figure B.5).

Conclusion

1.5.1.62 Common gull is considered to have a local conservation status due to the species being amber-listed on the Birds of Conservation Concern (Stanbury *et al.*, 2021). Common gulls were recorded in eight of the 24 surveys undertaken across the Morgan Generation Assets study area however, the estimated populations did not surpass the thresholds of importance for any population level.

1.5.1.63 Common gull is therefore not considered for further assessment in relation to impacts associated with the Morgan Generation Assets.

Great black-backed gull *Larus marinus*

Status overview

1.5.1.64 Great black-backed gull is not listed under Annex I of the Birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The species is currently amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.65 Great black-backed gull is a common resident species in the UK, occurring in coastal areas. Seabird 2000 recorded 17,394 pairs in Britain, with largest numbers on west coasts (Mitchell *et al.*, 2004). Great black-backed gulls are omnivorous, foraging at sea, on estuaries, beaches and less commonly at rubbish dumps (Forrester *et al.*, 2007).

1.5.1.66 Great black-backed gull is a relatively common breeding species in Great Britain. During the pre-breeding and breeding season their distribution tends to be limited to coastal areas. During the winter they are a much more widely dispersed species and often travel long distances in pursuit of discards from fishing vessels (Stone *et al.*, 1995). The UK wintering population of great black-backed gull has been estimated at over 76,000 individuals (Burton *et al.*, 2012).

1.5.1.67 The Morgan Generation Assets are not in the foraging range from any SPA at which great black-backed gull is a qualifying feature.

1.5.1.68 Wade *et al.* (2016) assessed great black-backed gull as being at low risk of displacement from wind farms and very low risk of habitat loss due to the species ability to use a wide range of habitats. The species is considered to be at very high risk of collision with turbines due to the relatively high proportion of birds at turbine height. Maclean *et al.* (2009) assessed gulls as being at low risk of barrier effects at offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.69 Great black-backed gulls were recorded within the Morgan Generation Assets study area in 10 of the 24 months of the baseline aerial survey programme (Table 1.16; Figure 1.8). Peak numbers occurred in January 2022.

1.5.1.70 The majority of birds were recorded in the non-breeding season defined for the species (September to March). In the breeding season birds were recorded in both August and March surveys (Figure 1.8). The populations of birds recorded during the non-breeding season were generally higher than those recorded in the breeding season. Birds were generally recorded in the south and east regions of the Morgan Generation Assets survey area.

1.5.1.71 The peak population in the non-breeding season (September to March) occurred in January 2022. This population surpassed the 1% threshold for regional importance (177 birds). No other populations estimated in the non-breeding season surpassed this threshold. In the breeding season (March to August), the peak population was recorded in March 2022. This surpassed the 1% threshold of regional importance (50 birds). No other populations estimated in the breeding season surpassed this threshold. The Morgan Generation Assets are within foraging range of great black-backed gull from a limited number of breeding colonies (221 breeding pairs) however, as the peak population was recorded in March it is possible that this represents migrating birds rather than breeding birds.

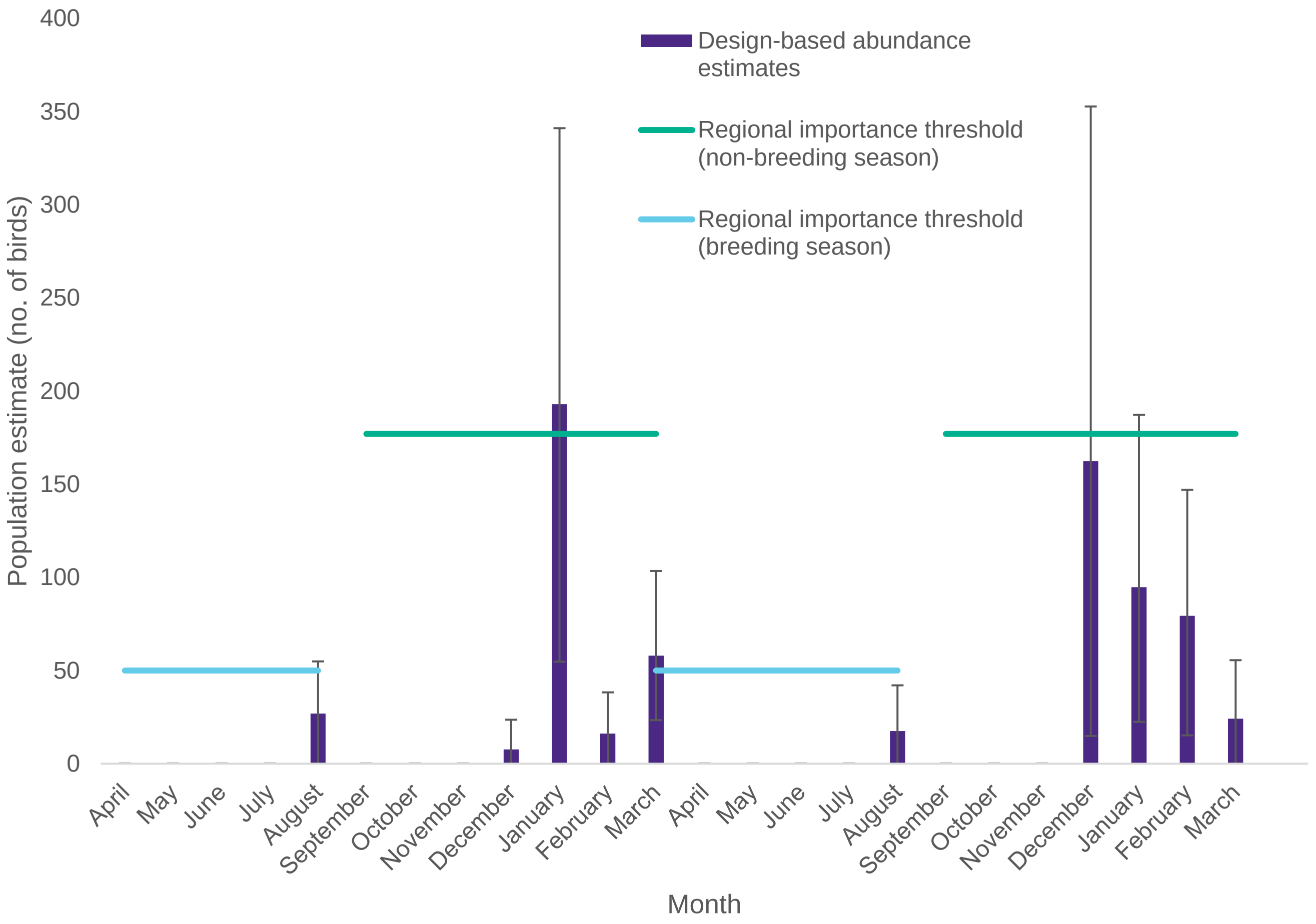

Figure 1.8: **Abundance of great black-backed gull in the Morgan Generation Assets study area during site-specific aerial surveys (with 95% confidence intervals). The regional importance thresholds for the breeding and non-breeding seasons are also shown.**

Table 1.16: **Design-based and model-based (all behaviour) population estimates with lower and upper (95%) confidence limits for each month surveyed from April 2021 to March 2023 for the Morgan Generation Assets study area for great black-backed gull.**

Year	Month	Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit
1	April	0	0	0
1	May	0	0	0
1	June	0	0	0
1	July	0	0	0
1	August	27	0	55

Year	Month	Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit
1	September	0	0	0
1	October	0	0	0
1	November	0	0	0
1	December	8	0	24
1	January	193	55	341
1	February	16	0	38
1	March	58	23	103
2	April	0	0	0
2	May	0	0	0
2	June	0	0	0
2	July	0	0	0
2	August	18	0	42
2	September	0	0	0
2	October	0	0	0
2	November	0	0	0
2	December	162	15	353
2	January	95	22	187
2	February	79	15	147
2	March	24	0	56

Regional survey data

1.5.1.72 The Irish Sea is predominantly of limited importance for great black-backed gull in the breeding season with a small area of moderate densities offshore of Morecambe Bay (Bradbury *et al.,* 2014). In the non-breeding season relatively low densities occur throughout. In both seasons the area in which the Morgan Generation Assets are located is of low importance (Figure B.6).

Age class

1.5.1.73 A total of 132 individuals were aged during the site-specific aerial surveys. Of these, 123 were identified as adults and only eight as immature birds of one or more (calendar) years and one juvenile. Immature and juvenile birds were recorded in surveys between August and March.

Conclusion

1.5.1.74 Great black-backed gull is currently amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021) meaning the species has a local conservation status in the context of the Morgan Generation Assets. Populations of the species estimated in both the breeding and non-breeding seasons surpassed the threshold for regional importance. Great black-backed gull is therefore identified as a VOR and is considered for further assessment as a receptor with a regional conservation value.

Herring gull *Larus argentatus*

Status overview

1.5.1.75 Herring gull is not listed under Annex I of the birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The species is currently red-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.76 Herring gulls are resident, common and widespread, breeding in colonies in coastal and inland locations. Seabird 2000 recorded 142,942 pairs in Britain (Mitchell *et al.*, 2004). There is a general movement south in winter months (Forrester *et al.*, 2007) with the UK wintering population estimated at over 740,000 individuals (Burton *et al.*, 2012). Herring gulls exploit a wide range of food sources, including scraps and offal from trawlers, as well as on land at refuse dumps and farmland (Forrester *et al.*, 2007).

1.5.1.77 The Morgan Generation Assets are within the foraging range of herring gull from the Morecambe Bay and Duddon Estuary SPA which is 31 km to the east. At designation the SPA supported 10,000 breeding pairs of herring gull however, the population has decreased to 776 breeding pairs (2018 to 2023) reflecting the national decline in this species at coastal colonies with the added influence of predation at this SPA. The Morgan Generation Assets are also within foraging range of herring gull from the St Bee's Head SSSI and Port Erin Bay MNR.

1.5.1.78 Wade *et al.* (2016) has assessed herring gull as being low risk from displacement from wind farms and very low risk of habitat loss due to the species ability to use a wide range of habitats. The species is considered to be at very high risk of collision with turbines due to the relatively high proportion of birds at turbine height. Maclean *et al.* (2009) assessed gulls as being at low risk of barrier effects at offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.79 Herring gulls were recorded within the Morgan Generation Assets study area in 14 of the 24 months of the baseline aerial survey programme. The highest populations were estimated in the non-breeding season defined for the species with the peak population occurring in January 2022. Small populations were recorded in breeding season months (less than 20 birds) with the exception of March 2023 when a population of 207 birds was estimated although this may reflect pre-breeding movements of birds (Figure 1.9; Table 1.17). There was no obvious trend in the distribution of herring gull across the Morgan Generation Assets survey area.

1.5.1.80 The peak population in the non-breeding season (September to February) occurred in January 2022. This population did not surpass the 1% threshold for regional importance (1,733 birds). In the breeding season (March to August), the peak population was recorded in March 2023. This population surpassed the 1% threshold of regional importance (116 birds) however, this may represent movements of birds back to breeding colonies and no local breeders. No other populations estimated in the breeding season surpassed this threshold.

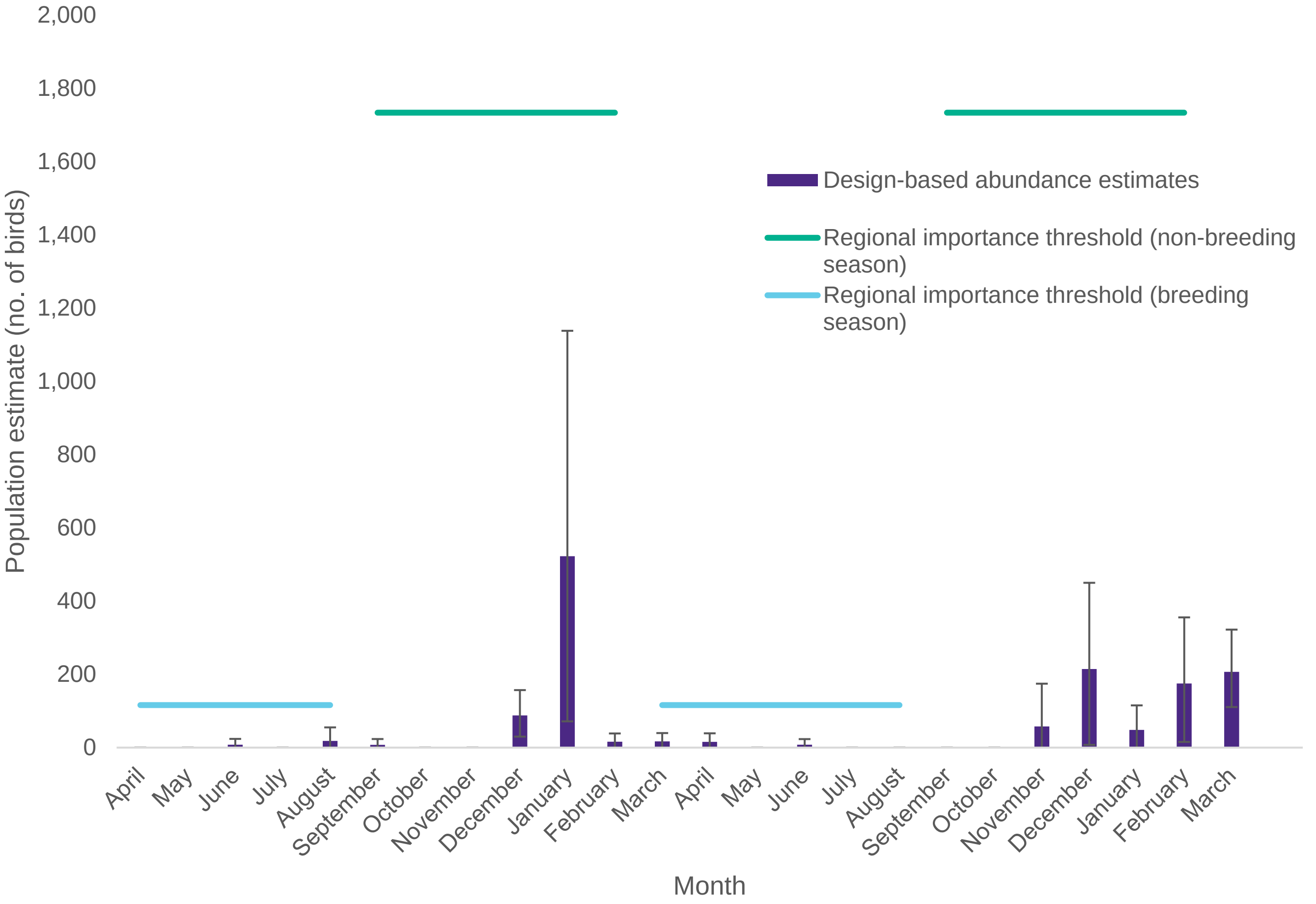

Figure 1.9: **Abundance of herring gull in the Morgan Generation Assets study area during site-specific aerial surveys (with 95% confidence intervals). The regional importance thresholds for the breeding and non-breeding seasons are also shown.**

Table 1.17: **Design-based and model-based (all behaviour) population estimates with lower and upper (95%) confidence limits for each month surveyed from April 2021 to March 2023 for the Morgan Generation Assets study area for herring gull.**

Year	Month	Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit
1	April	0	0	0
1	May	0	0	0
1	June	8	0	24
1	July	0	0	0
1	August	18	0	55
1	September	8	0	23
1	October	0	0	0
1	November	0	0	0

Year	Month	Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit
1	December	88	30	157
1	January	523	72	1,138
1	February	16	0	39
1	March	17	0	40
2	April	16	0	39
2	May	0	0	0
2	June	8	0	23
2	July	0	0	0
2	August	0	0	0
2	September	0	0	0
2	October	0	0	0
2	November	58	0	174
2	December	214	8	450
2	January	48	0	115
2	February	175	15	355
2	March	207	111	322

Regional survey data

1.5.1.81 In the full UK breeding season (March to August) as defined by Furness (2015), the area in which the Morgan Generation Assets is located does not support high densities of herring gull (Waggitt *et al.,* 2020). However, areas to the east associated with inshore areas around Morecambe Bay and to the north around the coast of the Isle of Man do support high densities of the species, reflecting the coastal nature of the species. In the non-breeding season, densities are much lower with the Morgan Generation Assets study area being of similar relative importance as in the breeding season (Figure B.7 and Figure B.8).

Telemetry data

1.5.1.82 Tracking data is available for herring gulls from the Morecambe Bay and Duddon Estuary SPA. The Morgan Generation Assets is within the foraging range of herring gulls when applying generic foraging ranges (Woodward *et al.,* 2020). However, site-specific tracking data shows limited usage of the marine environment by herring gulls from the colony and no connectivity with the Morgan Generation Assets (Thaxter *et al.,* 2017).

Behaviour and age class

1.5.1.83 A total of 211 individuals were aged during the site-specific aerial surveys. Of these, 91 were identified as adults, 106 as immature birds of one or more (calendar) years and 14 juveniles. Immature birds were observed throughout the year with juvenile birds observed in September and October 2021 and March 2023.

1.5.1.84 Flight direction was recorded for a limited number of birds in the migration-free breeding season and therefore only data from the full breeding season is shown in Figure 1.10. The prevailing flight direction was north, with a high proportion of birds also observed flying southeast. In the non-breeding season, the prevailing flight directions were northwest and west (Figure 1.10).

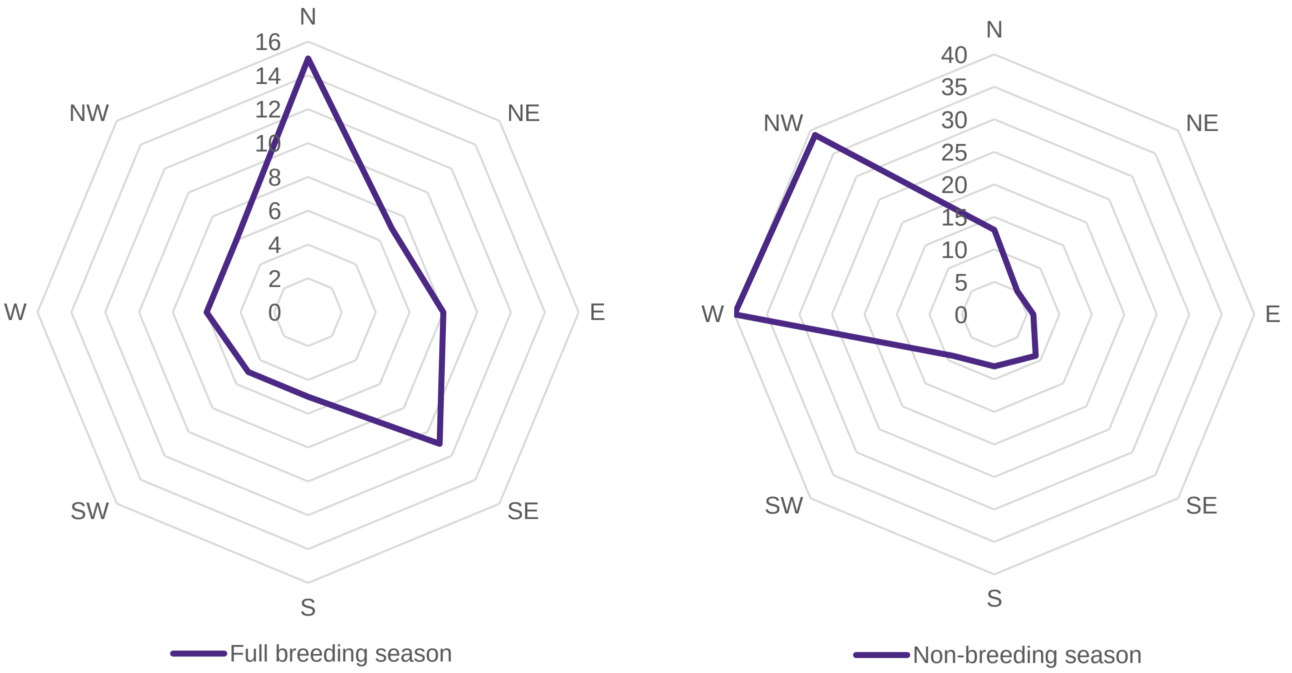

Figure 1.10: Flight directions of herring gull as recorded during site-specific aerial surveys.

Conclusion

1.5.1.85 Herring gull is considered to have an international conservation status due to the Morgan Generation Assets being within the foraging range of herring gull from the Morecambe Bay and Duddon Estuary SPA at which the species is designated as a breeding feature. Population estimates of herring gull within the Morgan Generation Assets study area during the breeding season exceeded the 1% importance threshold of the regional population. Herring gull is therefore identified as a VOR and is considered for further assessment as a receptor with an international conservation value.

Lesser black-backed gull *Larus fuscus*

Status overview

1.5.1.86 Lesser black-backed gull is not listed under Annex I of the Birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The species is currently amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.87 Lesser black-backed gulls are common and widespread in the UK in summer, and breed in colonies in coastal and inland locations. Seabird 2000 recorded 111,835 pairs in Britain (Mitchell *et al.*, 2004). In winter, many birds leave north areas between November and March, although some remain all year, particularly in the southwest

(Forrester *et al.*, 2007). The UK wintering population of lesser black-backed gull has been estimated at 130,000 individuals (Woodward *et al.,* 2020). Lesser black-backed gulls take a wide variety of prey and scavenged food, both at sea, and on farmland and refuse sites (Forrester *et al.*, 2007).

1.5.1.88 The Morgan Generation Assets are within the foraging range of lesser black-backed gull from five UK SPAs and one Irish SPA (Table 1.18). At the time of designation these SPAs supported 25,905 breeding pairs representing over 28% of the Britain and Ireland breeding population as recorded during Seabird 2000 (Mitchell *et al.*, 2004). The most recent counts, where available, indicate that that some colonies have increased whilst others have decreased. The Morgan Generation Assets are also within the foraging range of lesser black-backed gull from the Niarbyl Bay MNR.

1.5.1.89 Wade *et al.* (2016) assessed lesser black-backed gull as being at low risk of displacement from wind farms and very low risk of habitat loss due to the species ability to use a wide range of habitats. However, the species is assessed as being at very high risk of collision with turbines due to the relatively high proportion of birds at turbine height. Maclean *et al.* (2009) assessed gulls as being at low risk of barrier effects at offshore wind farms.

Table 1.18: Designated sites at which lesser black-backed gull is a qualifying feature with which there is connectivity with the Morgan Generation Assets.

1 Populations from Natura 2000 dataforms unless otherwise stated.

2 From citation document Environment and Heritage Service (1999).

Designated site	Distance to the Morgan Generation Assets (km)	Population at designation (JNCC, 2022) (breeding pairs) [1]	Most recent population estimates (Seabird Monitoring Programme database) (breeding pairs) (year)
UK			
Ailsa Craig SPA	142	1,800	189 (2019)
Ribble and Alt Estuaries SPA	51	1,800	4,489 (2021)
Bowland Fells SPA	70	11,470	14,627 (2018)
Rathlin Island SPA	186	155 [2]	519 (2021)
Morecambe Bay and Duddon Estuary SPA	31	9,720	884 (2018-2023)
Duddon Estuary SSSI		-	-
Isle of Man			
Niarbyl Bay MNR		-	-
Ireland			
Lambay Island SPA	130	309	476 (2010)

Seasonal abundance and distribution

Site-specific surveys

1.5.1.90 Lesser black-backed gulls were recorded within the Morgan Generation Assets study area in 11 of the 24 months of the baseline aerial survey programme (Table 1.19; Figure 1.11). The highest populations were estimated in August or September likely reflecting dispersal/migratory movements of birds from breeding colonies. Smaller populations (less than 20 birds) were estimated in all other months.

1.5.1.91 The peak population in the breeding season (April to August) occurred in August 2022. This population did not surpass the 1% threshold for regional importance (523 birds). The August 2022 population also represented the peak population in the post-breeding season (August to October) and also did not surpass the threshold for regional importance (1,633 birds). In the non-breeding season (November to February) the peak population was estimated in January and February 2022. These populations did not surpass the 1% threshold for regional importance (412 birds). The peak population in the pre-breeding season (March to April) occurred in April 2021. This population did not surpass the 1% threshold for regional importance (1,633 birds).

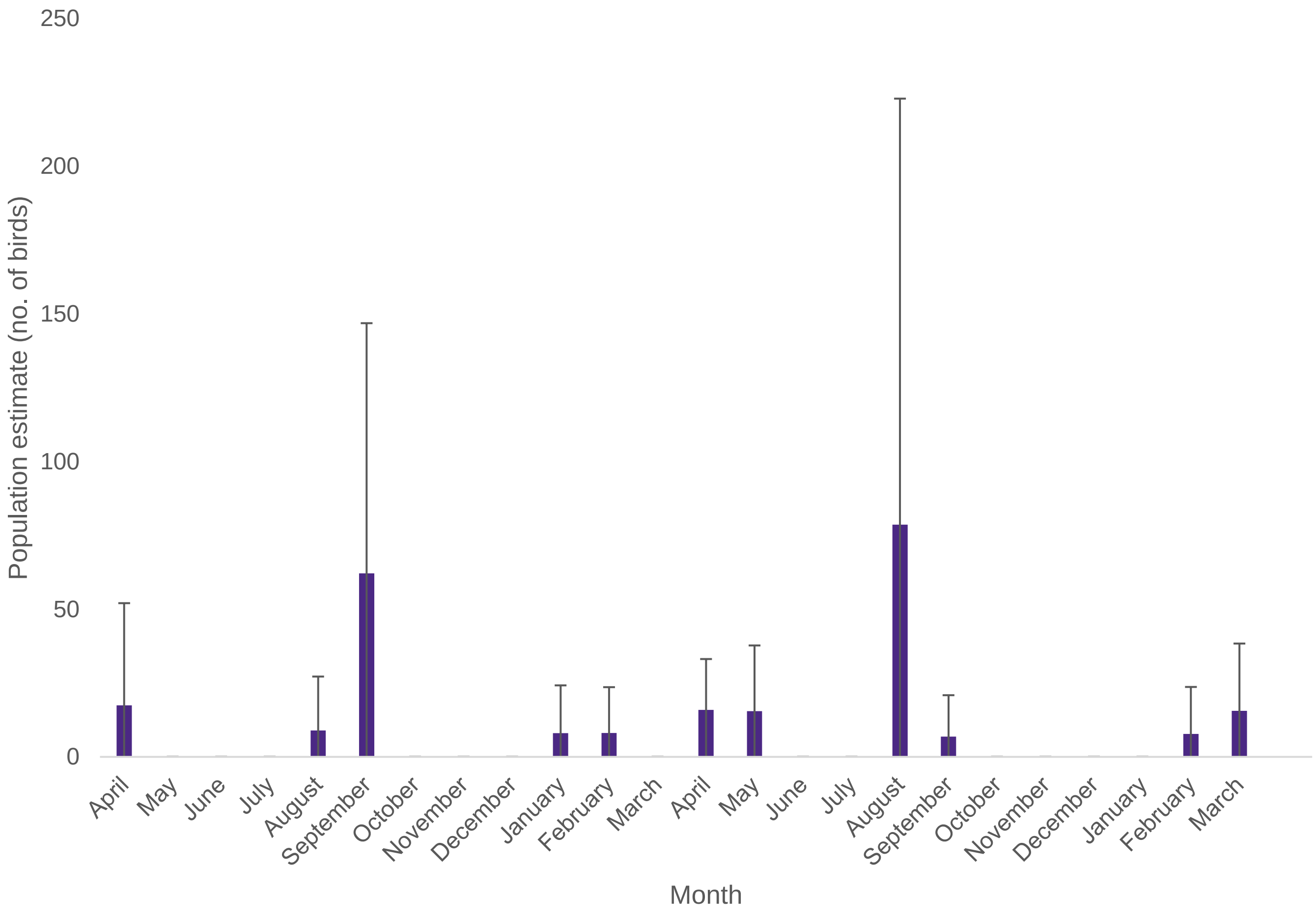

Figure 1.11: Abundance of lesser black-backed gull in the Morgan Generation Assets study area during site-specific aerial surveys (with 95% confidence intervals).

Table 1.19: Design-based and model-based (all behaviour) population estimates with lower and upper (95%) confidence limits for each month surveyed from April 2021 to March 2023 for the Morgan Generation Assets study area for lesser black-backed gull.

Year	Month	Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit
1	April	17	0	52
1	May	0	0	0
1	June	0	0	0
1	July	0	0	0
1	August	9	0	27
1	September	62	0	147
1	October	0	0	0
1	November	0	0	0
1	December	0	0	0
1	January	8	0	24
1	February	8	0	24
1	March	0	0	0
2	April	16	0	33
2	May	15	0	38
2	June	0	0	0
2	July	0	0	0
2	August	79	0	223
2	September	7	0	21
2	October	0	0	0
2	November	0	0	0
2	December	0	0	0
2	January	0	0	0
2	February	8	0	24
2	March	16	0	38

Regional survey data

1.5.1.92 In the full UK breeding season (April to August) as defined by Furness (2015), the area in which the Morgan Generation Assets is located supports moderate densities of lesser black-backed gull with an area of relatively high densities located just to the east associated with breeding colonies in Morecambe Bay and the Ribble and Alt Estuaries (Waggitt *et al.,* 2020). Following the breeding season, the importance of the area in which the Morgan Generation Assets is located reduces and continues to reduce until the start of the breeding season. Densities during the non-breeding season are also much lower than during the breeding season (Figure B.9 and Figure B.10).

Telemetry data

1.5.1.93 Over the 2016 to 2019 breeding seasons, individuals were tracked at the South Walney colony (a large but declining coastal colony within the Morecambe Bay and Duddon Estuary SPA, England) and an urban colony in Barrow-in-Furness (Cumbria, England). The greatest mean foraging range recorded by the study was 14.2±18.4 km which does not overlap with the Morgan Generation Assets. In addition, the majority of individuals tracked from both the South Walney and Barrow colonies made relatively limited use of the marine environment through the 2016 to 2019 breeding seasons (Clewley *et al.*, 2021).

Age class

1.5.1.94 A total of 89 individuals were aged during the site-specific aerial surveys. Of these, 70 were identified as adults, ten as immatures of one or more (calendar) years and nine as juveniles. Juvenile birds were observed in August and September 2021 with immature birds observed during the breeding season.

Conclusion

1.5.1.95 Lesser black-backed gull is considered to have an international conservation status due to the Morgan Generation Assets being within the foraging range of the species from multiple SPAs at which the species is designated as a breeding feature. The species was recorded in 11 of the aerial surveys undertaken across the Morgan Generation Assets study area. The estimated populations did not however, surpass the threshold for regional importance in any month. However, due to the international conservation value of the species, lesser black-backed gull is identified as a VOR and considered for further assessment in relation to impacts associated with the Morgan Generation Assets as a receptor with an International conservation value.

Sandwich tern *Thalasseus sandvicensis*

Status overview

1.5.1.96 Sandwich tern is listed on Annex I of the Birds Directive (2009/147/EEC), and the species is currently amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.97 Sandwich terns are summer visitors to Britain, breeding in coastal colonies. Seabird 2000 recorded 10,536 pairs in Britain (Mitchell *et al.*, 2004). The closest large colonies to the Morgan Generation within Morecambe Bay and the Duddon Estuary. After the breeding season, Sandwich terns migrate south to the west coast of Africa, returning the following spring (Wernham *et al.*, 2002). Sandwich terns feed on a variety of small, surface-feeding fish including sandeels but also cephalopods and crustaceans that they catch by plunge-diving (Brown and Grice, 2005).

1.5.1.98 Wade *et al.* (2016) assessed Sandwich tern as being at low risk of displacement from wind farms (with a low degree of associated uncertainty) and moderate risk of habitat loss due to the species moderate ability to utilise alternative habitats. Sandwich tern is considered to be at low risk of disturbance from vessels although this conclusion has a high degree of associated uncertainty. The species is also assessed as being at high risk of collision with turbines due to the high proportion of time the species spends in flight. Maclean *et al.* (2009) assessed terns as being at very low risk of barrier effects at offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.99 Sandwich terns were not recorded in the Morgan Generation Assets study area during the 24-month baseline aerial survey programme of the Morgan Generation Assets.

Regional survey data

1.5.1.100 Sandwich tern have a coastal distribution within the Irish Sea during the summer with relatively low densities occurring along the English and Welsh coasts extending approximately 15 km offshore. The area in which the Morgan Generation Assets are located is of limited importance for the species (Figure B.11).

Telemetry data

1.5.1.101 Tracking of Sandwich terns from the Duddon Estuary and those colonies that form part of the Anglesey Terns/Morwenoliaid Ynys Môn SPA has shown no connectivity with the Morgan Generation Assets (Wilson *et al.,* 2014).

Conclusion

1.5.1.102 Sandwich tern is considered to have a national conservation status due to the species inclusion on Annex I of the Birds Directive. Sandwich tern was not recorded during baseline aerial surveys of the Morgan Generation Assets study area. However, traditional survey methods are unlikely to capture the movements of migratory birds due to the ephemeral nature of these movements and therefore consideration will be given to potential impacts on this species during migratory periods in Volume 4, Annex 5.4: Offshore ornithology migratory bird CRM technical report of the Environmental Statement and where necessary Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement. Sandwich tern is therefore identified as a VOR with a National conservation value.

Little tern *Sternula albifrons*

Status overview

1.5.1.103 Little tern is listed on both Annex I of the Birds Directive (2009/147/EEC) and Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The species is also amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.*, 2021).

1.5.1.104 Little terns are summer visitors to Britain, breeding in coastal colonies. Seabird 2000 recorded 1,947 pairs in Britain (Mitchell *et al.*, 2004). The closest large colony to the Morgan Generation Assets is located at the Dee Estuary SPA. However, the Morgan Generation Assets are not in the foraging range from any SPA at which little tern is a qualifying feature.

1.5.1.105 Wade *et al.* (2016) assessed little tern as being at low risk of displacement from wind farms and high risk of habitat loss due to the species limited ability to utilise alternative habitats. The species is also assessed as being at moderate risk of collision with turbines due to the high proportion of time the species spends in flight although this level of sensitivity has an associated very high level of uncertainty. Maclean *et al.* (2009) assessed terns as being at very low risk of barrier effects at offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.106 Little terns were not recorded in the Morgan Generation Assets study area during the 24-month baseline aerial survey programme of the Morgan Generation Assets.

Regional survey data

1.5.1.107 Bradbury *et al.* (2014) indicates that densities of common tern are low throughout the Irish Sea in the breeding season, with a small hotspots of moderate densities offshore of the Dee Estuary, Formby and Walney with these hotspots reflecting the locations of breeding colonies (some of which no longer exist) and the limited foraging range of little tern (Woodward *et al.,* 2019) (Figure B.12).

Telemetry data

1.5.1.108 Tracking of little terns at the breeding colony within The Dee Estuary has shown that birds forage offshore to approximately 2 km and along the shore to 3 km away from the colony (Parsons *et al.,* 2015). This would suggest no connectivity between this breeding colony and the Morgan Generation Assets.

Conclusion

1.5.1.109 Little tern is considered to have a national conservation status due to the species inclusion on Annex I of the Birds Directive and Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). Little tern was not recorded during baseline aerial surveys of the Morgan Generation Assets study area. However, traditional survey methods are unlikely to capture the movements of migratory birds due to the ephemeral nature of these movements and therefore consideration will be given to potential impacts on this species during migratory periods in Volume 4, Annex 5.4: Offshore ornithology migratory bird CRM technical report of the Environmental Statement and where necessary Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement. Little tern is therefore identified as a VOR with a National conservation value.

Roseate tern *Sterna dougallii*

Status overview

1.5.1.110 Roseate tern is listed on both Annex I of the Birds Directive (2009/147/EEC) and Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The species is also red-listed on the UK Birds of Conservation Concern (Stanbury *et al.*, 2021). The species is also considered to be ecologically sensitive having fewer than 300 breeding pairs in the UK and over 50% of the population found in 10 or fewer sites.

1.5.1.111 Roseate terns are summer visitors to Britain, breeding on offshore islands. Seabird 2000 recorded 52 pairs in Britain (Mitchell *et al.*, 2004). The closest large colony (i.e. SPAs) to the Morgan Generation Assets is on Rathlin Island off the Northern Irish coast. The Morgan Generation Assets are not in the foraging range from any SPA at which common tern is a qualifying feature. Like other tern species the diet of roseate terns includes sandeels, clupeid and gadoid fish.

1.5.1.112 Wade *et al.* (2016) assessed Roseate tern as being at high risk of collision. Roseate tern is considered to have a low vulnerability to disturbance and displacement and a moderate ability of the species to use alternative habitats. Maclean *et al.* (2009) assessed terns as being at very low risk of barrier effects at offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.113 Roseate terns were not recorded in the Morgan Generation Assets study area during the 24-month baseline aerial survey programme of the Morgan Generation Assets.

Conclusion

1.5.1.114 Roseate tern is considered to have a national conservation status due to the species inclusion on Annex I of the Birds Directive and Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). Roseate tern was not recorded during baseline aerial surveys of the Morgan Generation Assets study area. However, traditional survey methods are unlikely to capture the movements of migratory birds due to the ephemeral nature of these movements and therefore consideration will be given to potential impacts on this species during migratory periods in Volume 4, Annex 5.4: Offshore ornithology migratory bird CRM technical report of the Environmental Statement and where necessary Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement. Roseate tern is therefore identified as a VOR with a National conservation value.

Common tern *Sterna hirundo*

Status overview

1.5.1.115 Common tern is listed on Annex I of the Birds Directive, and the species is currently amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.116 Common terns are summer visitors to Britain, breeding in colonies at coastal sites and also inland. Seabird 2000 recorded 10,308 pairs in Britain (Mitchell *et al.*, 2004). The closest large colonies (i.e. SPAs) to the Morgan Generation Assets are the Ribble and Alt Estuaries SPA, Mersey Narrows and North Wirral Foreshore SPA and the Dee Estuary SPA. In autumn, common terns migrate south to the west coast of Africa, returning the following spring (Wernham *et al.*, 2002). Common terns have a broad diet compared to other terns that includes sandeels, clupeid and gadoid fish (Mitchell *et al.*, 2004).

1.5.1.117 The Morgan Generation Assets are not in the foraging range from any SPA at which common tern is a qualifying feature.

1.5.1.118 Wade *et al.* (2016) assessed common tern as being at low risk of displacement from wind farms (with a low level of associated uncertainty) and moderate risk of habitat loss due to the species moderate ability to utilise alternative habitats. Common tern is considered to be at low risk of disturbance from vessels although this conclusion has a high degree of associated uncertainty. The species was considered to be at moderate risk of collision with turbines due to the high proportion of time the species spends in flight. Maclean *et al.* (2009) assessed terns as being at very low risk of barrier effects at offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.119 Common terns were recorded within the Morgan Generation Assets study area in only one of the 24 months of the baseline aerial survey programme. Six birds were observed in the south part of the Morgan Generation Assets survey area during the May 2021 survey translating into a population estimate of 59 birds.

1.5.1.120 The Morgan Generation Assets is not within the foraging range of common tern from any breeding colonies and therefore importance in the breeding season is assessed against the national population. The population estimated in May 2021 did not surpass the national importance threshold.

Regional survey data

1.5.1.121 Bradbury *et al.* (2014) indicates that densities of common tern are low throughout the Irish Sea in both the breeding and non-breeding seasons. Common terns are present at a number of breeding colonies in the Irish Sea but with a limited foraging range (Woodward *et al.,* 2019) birds may not have been adequately captured by the surveys included in the analyses informing the density surfaces associated with Bradbury *et al.* (2014) (Figure B.13).

Telemetry data

1.5.1.122 Tracking of common terns from the Ribble Estuary, the Dee Estuary and those colonies that form part of the Anglesey Terns/Morwenoliaid Ynys Môn SPA suggest no connectivity with the Morgan Generation Assets (Wilson *et al.,* 2014) and birds from these breeding colonies.

Conclusion

1.5.1.123 Common tern is considered to have a national conservation status due to the species inclusion on Annex I of the Birds Directive. Common terns were recorded in only one of the baseline aerial surveys undertaken across the Morgan Generation Assets study area. However, traditional survey methods are unlikely to capture the movements of migratory birds due to the ephemeral nature of these movements and therefore consideration will be given to potential impacts on this species during migratory periods in Volume 4, Annex 5.4: Offshore ornithology migratory bird CRM technical report of the Environmental Statement and where necessary Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement. Common tern is therefore identified as a VOR with a National conservation value.

Arctic tern *Sterna paradisaea*

Status overview

1.5.1.124 Arctic tern is listed on Annex I of the Birds Directive, and the species is currently amber-listed on the UK Birds of Conservation Concern list (Stanbury *et al.,* 2021).

1.5.1.125 Arctic terns are summer visitors to Britain, breeding in coastal colonies, predominantly in the north. Seabird 2000 recorded 52,621 pairs in Britain (Mitchell *et al.*, 2004). In autumn, Arctic terns migrate down the west coast of Europe and Africa to the Antarctic seas for the winter, returning the following spring (Wernham *et al.*, 2002). The closest large colonies to the Morgan Generation Assets are at Ynys Feurig, Cemlyn Bay and The Skerries which form part of the Anglesey Terns SPA and off the Northern Irish coast at the Copeland Islands SPA and Outer Ards SPA. Sandeels are the major prey species (Mitchell *et al.*, 2004).

1.5.1.126 Wade *et al.* (2016) assessed Arctic tern as being at low risk of displacement from wind farms and moderate risk of habitat loss due to the species moderate ability to utilise alternative habitats. The species was also considered to be at moderate risk of collision with turbines due to the high proportion of time the species spends in flight. Maclean *et al.* (2009) assessed terns as being at very low risk of barrier effects at offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.127 Arctic terns were recorded within the Morgan Generation Assets study area in only one of the 24 months of the baseline aerial survey programme. Three birds were observed in the south part of the Morgan Generation Assets survey area during the August 2022 survey translating into a population estimate of 63 birds.

1.5.1.128 August forms part of the post-breeding season for Arctic tern and the population recorded in August 2022 does not surpass the regional threshold of population importance.

Regional survey data

1.5.1.129 Bradbury *et al.* (2014) indicates that densities of Arctic tern are low throughout the Irish Sea in both the breeding and non-breeding seasons. Arctic terns are present at a number of breeding colonies in the Irish Sea but with a limited foraging range (Woodward *et al.,* 2019) birds may not have been adequately captured by the surveys included in the analyses informing the density surfaces associated with Bradbury *et al.* (2014) (Figure B.14).

Telemetry data

1.5.1.130 Tracking of Arctic tern from those colonies that form part of the Anglesey Terns/Morwenoliaid Ynys Môn SPA suggest no connectivity with the Morgan Generation Assets (Wilson *et al.,* 2014) and birds from these breeding colonies.

Conclusion

1.5.1.131 Arctic tern is considered to have a national conservation status due to the species inclusion on Annex I of the Birds Directive. Arctic terns were recorded in only one of the baseline aerial surveys undertaken across the Morgan Generation Assets study area. However, traditional survey methods are unlikely to capture the movements of migratory birds due to the ephemeral nature of these movements and therefore consideration will be given to potential impacts on this species during migratory periods in Volume 4, Annex 5.4: Offshore ornithology migratory bird CRM technical report of the Environmental Statement and where necessary Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement. Arctic tern is therefore identified as a VOR with a National conservation value.

Great skua *Stercorarius skua*

Status overview

1.5.1.132 Great skua is not listed under Annex I of the Birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). Great skua is currently amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.133 Great skuas breed on Shetland, Orkney and the Western Isles (Balmer *et al.*, 2013), with an estimated population of 9,634 pairs during Seabird 2000 (Mitchell *et al.*, 2004). The UK breeding population of great skua has shown increases of 26% between 1985 to 88 and 1998 to 2002 and 18% between 1998 to 2002 and 2015 (JNCC, 2016). Great skuas breed close to other seabird colonies, in order to scavenge and parasitize food from other seabirds, as well as predating other birds and nests.

1.5.1.134 The Morgan Generation Assets are within the foraging range of great skua from two SPAs (Table 1.20). At the time of designation these SPAs supported 336 breeding pairs representing approximately 3.5% of the Britain and Ireland breeding population as recorded during Seabird 2000 (Mitchell *et al.*, 2004). The most recent counts, where available, indicate variable trends with the population at St Kilda SPA decreasing whilst the population at the Handa SPA has increased.

1.5.1.135 Wade *et al.* (2016) assessed great skua as being at high risk of collision with turbines due to a high proportion of time spent in flight. Risk of displacement and habitat loss resulting from offshore wind farms were considered to be very low and low, respectively due to the species ability to use a wide range of habitats, although the species sensitivity to displacement reported by Wade *et al.* (2016) has an associated high degree of uncertainty. Maclean *et al.* (2009) assessed great skua as being at low risk of barrier effects from offshore wind farms.

Table 1.20: Designated sites at which great skua is a qualifying feature with which there is connectivity with the Morgan Generation Assets.

Designated site	Distance to the Morgan Generation Assets (km)	Population at designation (breeding pairs) (JNCC, 2022)	Most recent population estimates (Seabird Monitoring Programme database) (breeding pairs) (year)
UK			
St Kilda SPA	490	270	94 (2019 to 2022)
Handa SPA	480	66	73 (2022)

Seasonal abundance and distribution

Site-specific surveys

1.5.1.136 Great skuas were recorded within the Morgan Generation Assets study area in only one of the 24 months of the baseline aerial survey programme. One bird was observed on the southwest boundary of the Morgan Array Area during the October 2022 survey translating into a population estimate of eight birds.

1.5.1.137 October forms part of the post-breeding season for great skua and the population recorded in October 2022 does not surpass the regional threshold of population importance.

Regional survey data

1.5.1.138 The density layers for great skua associated with Waggitt *et al.* (2020) show that the Morgan Generation Assets study area supports relatively low to negligible densities through the year (Figure B.15 and Figure B.16).

Conclusion

1.5.1.139 Great skua is considered to have an international conservation status as the Morgan Generation Assets are within the foraging range of the species from two UK SPAs.

Great skuas were recorded in only one of the baseline aerial surveys undertaken across the Morgan Generation Assets study area. However, traditional survey methods are unlikely to capture the movements of migratory birds due to the ephemeral nature of these movements and therefore consideration will be given to potential impacts on this species during migratory periods in Volume 4, Annex 5.4: Offshore ornithology migratory bird CRM technical report of the Environmental Statement and where necessary Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement. Great skua is therefore identified as a VOR with an International conservation value.

Arctic skua *Stercorarius parasiticus*

Status overview

1.5.1.140 Arctic skua is currently red-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021) due to its significant recent decline with the UK breeding population showing declines of 37% between 1985 to 1988 and 1998 to 2002 and 70% between 2000 and 2019 (JNCC, 2021). The species is not listed under Annex I of the Birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended).

1.5.1.141 Arctic skua is a passage migrant in spring and autumn in the Irish Sea, and a scarce UK breeding species, restricted to Shetland, Orkney, north Scotland and the Western Isles (Forrester *et al.*, 2007). Seabird 2000 estimated the Scottish breeding population at 2,136 pairs (Mitchell *et al.*, 2004).

1.5.1.142 The Morgan Generation Assets are not in the foraging range from any SPA at which Arctic skua is a qualifying feature.

1.5.1.143 Wade *et al.* (2016) assessed Arctic skua as being at high risk of collision with turbines due to a high proportion of time spent in flight. Risk of displacement and habitat loss resulting from offshore wind farms were ranked as very low and low, respectively due to the species ability to utilise a wide range of habitats, although the species sensitivity to displacement reported by Wade *et al.* (2016) has an associated very high degree of uncertainty. Maclean *et al.* (2009) assessed Arctic skua as being at low risk of barrier effects from offshore wind farms.

Seasonal abundance and distribution

Site-specific survey

1.5.1.144 Arctic skuas were recorded within the Morgan Generation Assets study area in only one of the 24 months of the baseline aerial survey programme. One bird was observed in the southwest part of the Morgan Generation Assets study area during the September 2022 survey translating into a population estimate of seven birds.

1.5.1.145 September forms part of the post-breeding season for Arctic skua and the population recorded in September 2022 does not surpass the regional threshold of population importance.

Regional survey data

1.5.1.146 The Irish Sea is of limited importance for Arctic skua throughout the year (Bradbury *et al.,* 2014) reflecting the absence of breeding colonies within the vicinity of the Irish Sea. In the non-breeding season, the movements of this species may not have been adequately captured by the surveys informing the analyses applied in Bradbury *et al.* (2014) (Figure B.17).

Conclusion

1.5.1.147 Arctic skua is considered to have a regional conservation status due to the species being Red-listed on the Birds of Conservation Concern (Stanbury *et al.,* 2021). Arctic skuas were recorded in only one of the baseline aerial surveys undertaken across the Morgan Generation Assets study area. However, traditional survey methods are unlikely to capture the movements of migratory birds due to the ephemeral nature of these movements and therefore consideration will be given to potential impacts on this species during migratory periods in Volume 4, Annex 5.4: Offshore ornithology migratory bird CRM technical report of the Environmental Statement and where necessary Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement. Great skua is therefore identified as a VOR with a Regional conservation value.

Guillemot *Uria aalge*

Status overview

1.5.1.148 Guillemot is not listed under Annex I of the Birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The species is currently amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.149 Guillemot is one of the most abundant seabird species in Britain, breeding in large colonies on suitable coastal cliff habitat. Seabird 2000 recorded 1,322,830 individuals at breeding colonies in Britain (Mitchell *et al.*, 2004). The Morgan Generation Assets are however, not in the foraging range from any SPA at which guillemot is a qualifying feature.

1.5.1.150 The Morgan Generation Assets are not in the foraging range from any SPA at which guillemot is a qualifying feature. The closest breeding colonies, which are located in the Irish Sea, form part of the St Bee’s Head SSSI, Pen y Gogarth/Great Ormes Head SSSI, Creigiau Rhiwledyn/Little Ormes Head SSSI and Baie ny Carrickey MNR.

1.5.1.151 Wade *et al.* (2016) assessed guillemot as being at high risk of displacement from wind farms and moderate risk from habitat loss due to the limited ability of the species to utilise alternative habitats. The species is considered to be at very low risk of collision with turbines due to a very low proportion of birds flying at turbine height. Maclean *et al.* (2009) assessed auks as being at high risk of barrier effects at offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.152 Guillemots were recorded within the Morgan Generation Assets study area in all of the baseline aerial surveys. Populations were generally highest outside of the breeding season with was estimated. The species was generally most abundant in the non-breeding season of both survey years, although the lowest populations estimated occurred in the November 2021 survey. The peak population occurred in August (when estimating populations using design-based methods) or September 2022 (when using model-based methods) (Figure 1.12; Table 1.21).

1.5.1.153 The MRSea modelling for guillemot is considered to have provided generally good predictions. Guillemots were abundant across all surveys and were distributed across the study area, with some persistent areas of aggregation over surveys which the model picked up (Figure 1.13). Predicted confidence intervals are relatively tight, supporting confidence in predictions.

1.5.1.154 MRSea outputs were generated for all surveys. In the breeding season of both survey years guillemot are distributed through the Morgan Generation Assets survey area. In the early part of the non-breeding season (August to December in 2021 and August and September in 2022) there appears to be an easterly bias in the modelled distribution of guillemot (Figure 1.13).

1.5.1.155 The peak population in the breeding season (March to July) occurred in April 2021. This population, and all others estimated in the breeding season surpassed the threshold for regional importance. In the non-breeding season (August to February) the peak population was estimated in August 2022 (design-based abundance estimates) or September 2022 (model-based abundance estimates). These populations did not surpass the threshold for regional importance.

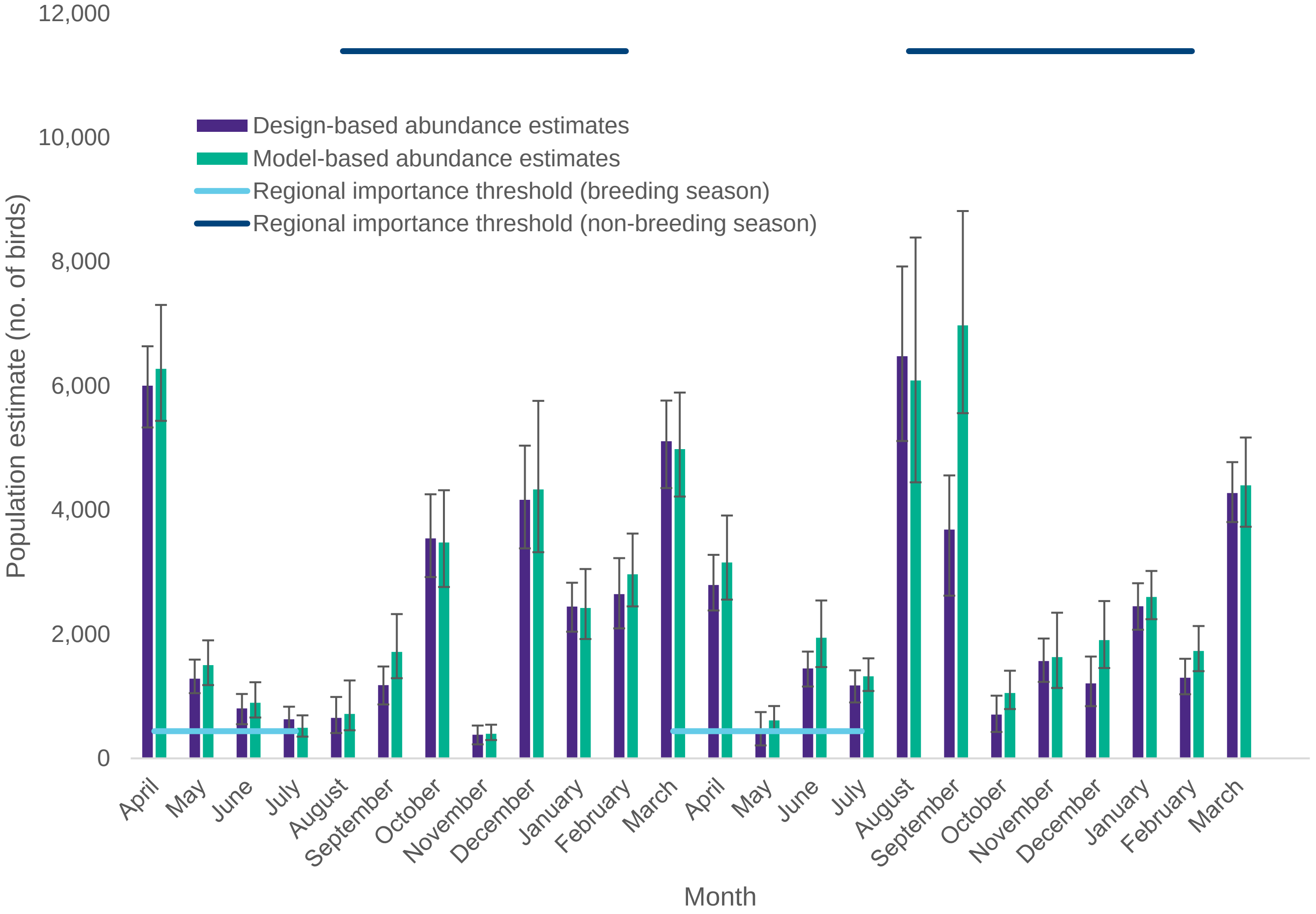

Figure 1.12: Abundance of guillemot in the Morgan Generation Assets study area during site-specific aerial surveys (with 95% confidence intervals). The regional importance thresholds for the breeding and non-breeding seasons are also shown.

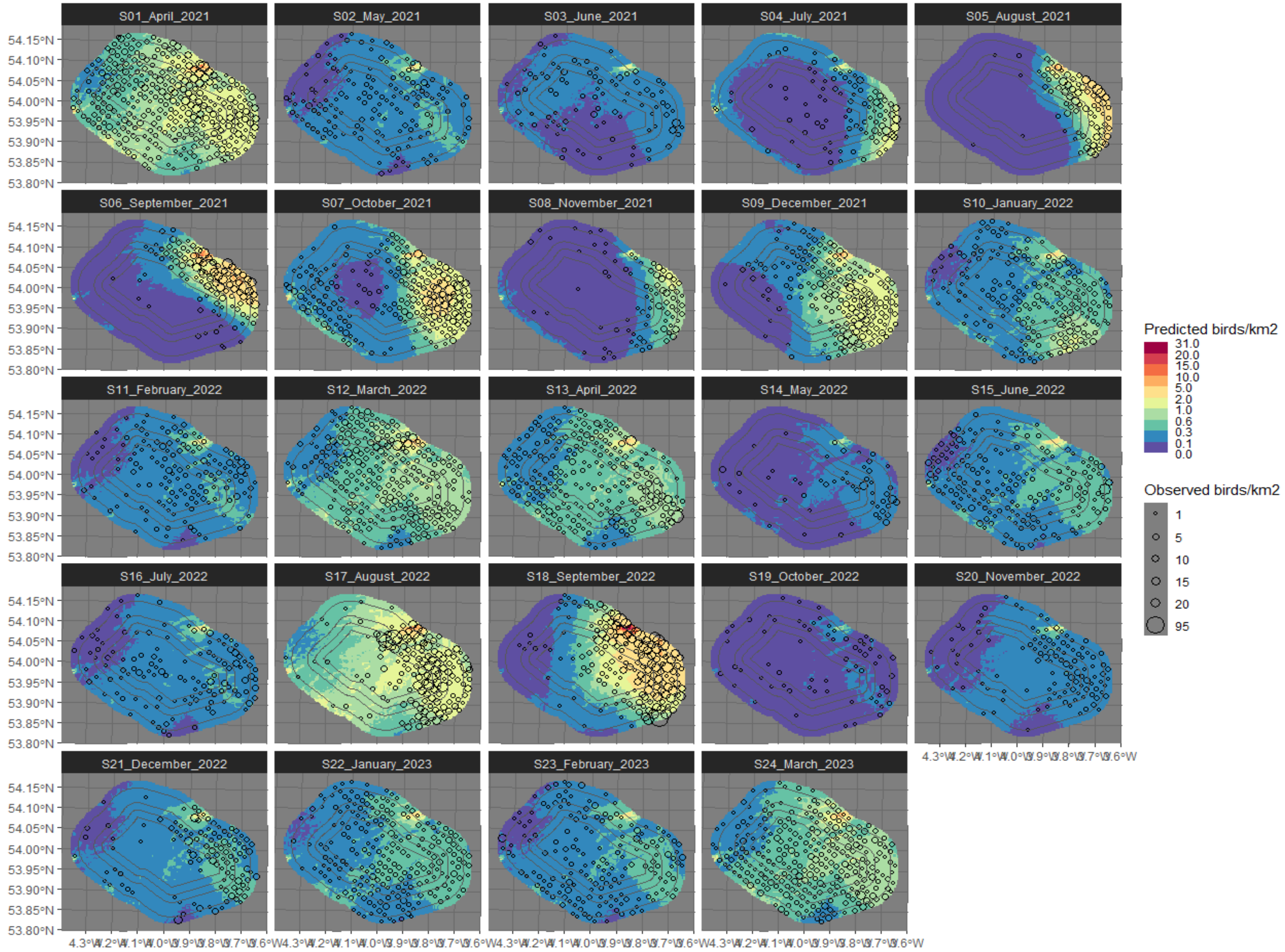

Figure 1.13: Predicted and observed guillemot density across the Morgan Generation Assets study area (figures also show the array area, 2 and 8 km buffers).

Table 1.21: Design-based and model-based (all behaviour) population estimates with lower and upper (95%) confidence limits for each month surveyed from April 2021 to March 2023 for the Morgan Generation Assets study area for guillemot.

Year	Month	Model-based population estimates			Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit	Mean	Lower confidence limit	Upper confidence limit
1	April	6,275	5,437	7,304	6,004	5,330	6,638
1	May	1,501	1,181	1,901	1,285	1,050	1,591
1	June	896	658	1,226	804	550	1,037
1	July	491	350	693	629	435	832
1	August	716	453	1,255	653	408	989
1	September	1,716	1,291	2,324	1,180	868	1,480
1	October	3,477	2,761	4,319	3,545	2,920	4,254
1	November	395	295	542	380	225	529
1	December	4,333	3,321	5,759	4,165	3,383	5,038
1	January	2,422	1,923	3,050	2,444	2,040	2,829
1	February	2,965	2,448	3,621	2,644	2,094	3,226
1	March	4,981	4,217	5,892	5,108	4,354	5,763
2	April	3,155	2,557	3,912	2,793	2,382	3,278
2	May	612	439	843	452	209	746
2	June	1,944	1,471	2,543	1,448	1,157	1,720
2	July	1,322	1,085	1,611	1,174	901	1,418
2	August	6,087	4,447	8,390	6,477	5,111	7,924
2	September	6,974	5,560	8,816	3,686	2,621	4,558
2	October	1,054	794	1,412	706	425	1,010

Year	Month	Model-based population estimates			Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit	Mean	Lower confidence limit	Upper confidence limit
2	November	1,631	1,134	2,346	1,568	1,232	1,930
2	December	1,906	1,456	2,534	1,208	841	1,640
2	January	2,599	2,242	3,019	2,449	2,072	2,821
2	February	1,731	1,405	2,132	1,298	1,033	1,604
2	March	4,399	3,731	5,168	4,275	3,806	4,772

Regional survey data

1.5.1.156 In the full UK breeding season (March to July) as defined by Furness (2015), the area in which the Morgan Generation Assets is located does not support high densities of guillemot (Waggitt *et al.,* 2020). The nearest areas supporting high densities of the species are located on the east coast of Ireland associated with the breeding colonies around Dublin. In the non-breeding season, the relative importance of the Morgan Generation Assets study area increases as the season progresses (Figure B.18 and Figure B.19).

Telemetry data

1.5.1.157 GPS tracking of 15 individuals from the Puffin Island (Anglesey, Wales) and seven individuals from Middle Mouse (Isle of Anglesey, Wales) revealed that tracked birds made use of the nearshore waters. Some tracks however extended further offshore in the Liverpool Bay (BirdLife International, 2022). Across the Irish Sea, GPS tracking of four individuals at Lambay Island (Ireland) showed that the birds remained in the west part of the Irish Sea, and there was no overlap of tracks with the Morgan Array Area. Some of the tracking data has been used by Wakefield *et al.* (2017) and Cleasby *et al.* (2020) in an analysis of distribution of seabirds at sea around the UK coastline.

Behaviour and age class

1.5.1.158 Seventy-four guillemot were aged during site-specific aerial surveys. Of these birds 42 were identified as juveniles in the July and August 2021 and July 2022 surveys consistent with the timing of fledging of juvenile birds from breeding colonies.

1.5.1.159 Analysis of flight directions across the seasonal extents for the breeding season (full UK breeding season and migration-free breeding season) showed limited difference in the number of birds for which flight direction was recorded and therefore only the full breeding season is shown in Figure 1.14. The highest number of birds were recorded flying east however, birds were observed flying in all directions with no overall prevailing flight direction. In the non-breeding season, the prevailing flight directions all had an east component (northeast, east and southeast).

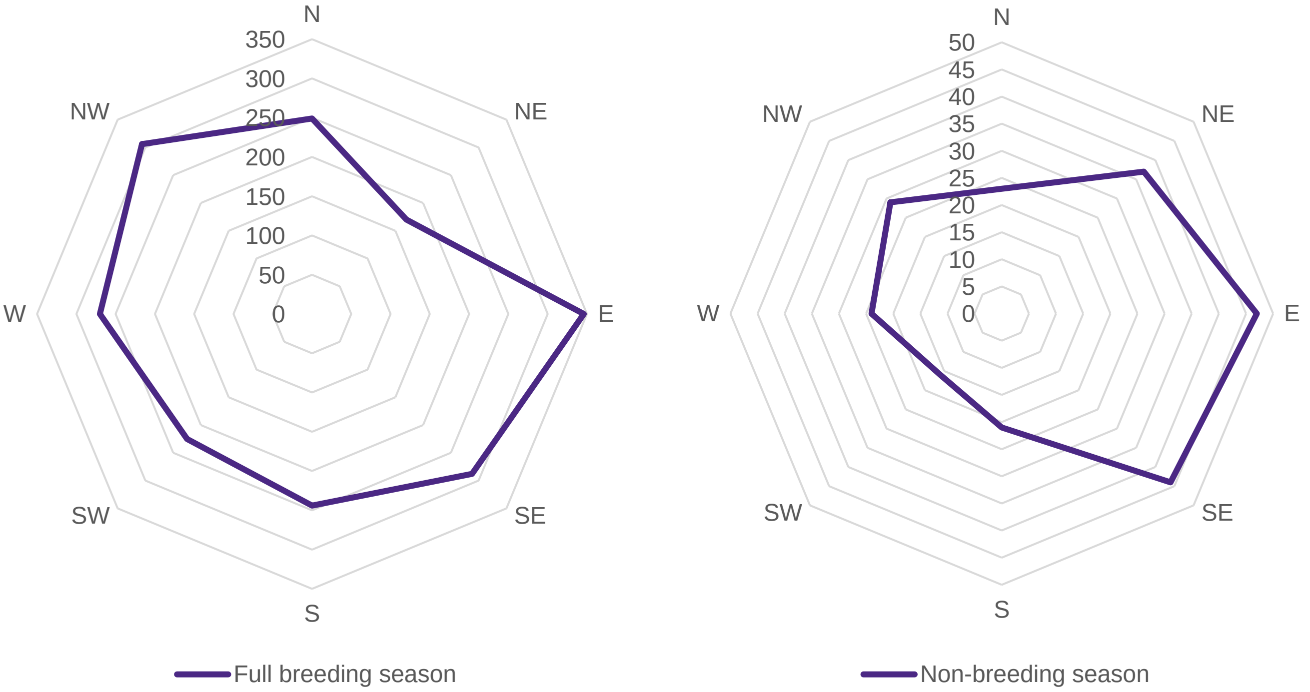

Figure 1.14: Flight directions of guillemot as recorded during site-specific aerial surveys.

Conclusion

1.5.1.160 Guillemot is considered to have a local conservation status due to the species being Amber-listed on the Birds of Conservation Concern (Stanbury *et al.,* 2021). Population estimates of guillemot within the Morgan Generation Assets study area during the breeding season exceeded the 1% importance threshold of the regional population in all months. Guillemot is therefore identified as a VOR and is considered for further assessment as a receptor with a regional conservation value.

Razorbill *Alca torda*

Status overview

1.5.1.161 Razorbill is not listed under Annex I of the Birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The species is currently amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.162 Razorbill is one of the most common seabirds in Britain, breeding in large colonies with other seabirds on suitable coastal cliffs. Seabird 2000 recorded 164,557 individuals at breeding colonies around Britain (Mitchell *et al.*, 2004).

1.5.1.163 The Morgan Generation Assets are however, not in the foraging range from any SPA at which razorbill is a qualifying feature. The closest breeding colonies, which are located in the Irish Sea, form part of the St Bee's Head SSSI, Pen y Gogarth/Great Ormes Head SSSI, Creigiau Rhiwledyn/Little Ormes Head SSSI and Baie ny Carrickey MNR.

1.5.1.164 Wade *et al.* (2016) assessed razorbill as being at high risk of displacement from wind farms and moderate risk of habitat loss due to the limited ability of the species to utilise alternative habitats. The species is considered to be at very low risk of collision with turbines due to a low proportion of birds flying at turbine height. Maclean *et al.* (2009) assessed auks as being at high risk of barrier effects at offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.165 Razorbills were recorded within the Morgan Generation Assets study area in 19 of the 24 months of the baseline aerial survey programme. The highest populations were recorded outside of the breeding season, with very few birds observed between April and August in both years. The peak populations in both years occurred in the December surveys (Figure 1.15; Table 1.22).

1.5.1.166 The MRSea modelling for razorbill is considered to have provided generally good predictions. Razorbills were distributed across the study area, with some persistent areas of aggregation over surveys which the model picked up. Predicted confidence intervals are relatively tight for most surveys but do show greater uncertainty in one or two surveys.

1.5.1.167 MRSea outputs were generated for eight of the 24 surveys with all of these in the non-breeding season. The outputs suggest that there is an east bias in the distribution of razorbill across the Morgan Generation Assets study area (Figure 1.16).

1.5.1.168 The peak population in the breeding season (April to July) occurred in June 2021. This population, and the population estimated in April 2021 surpassed the threshold for regional importance but not the threshold for national importance. In the post-breeding season (August to October) the peak population occurred in October 2022 and did not surpass the threshold for regional importance. In the non-breeding season (November to December) the peak population was estimated in December 2021 (design-based abundance estimates) or December 2022 (model-based abundance estimates). These populations did not surpass the threshold for regional importance. In the pre-breeding season (January to March) the peak population occurred in January 2023 and did not surpass the threshold for regional importance.

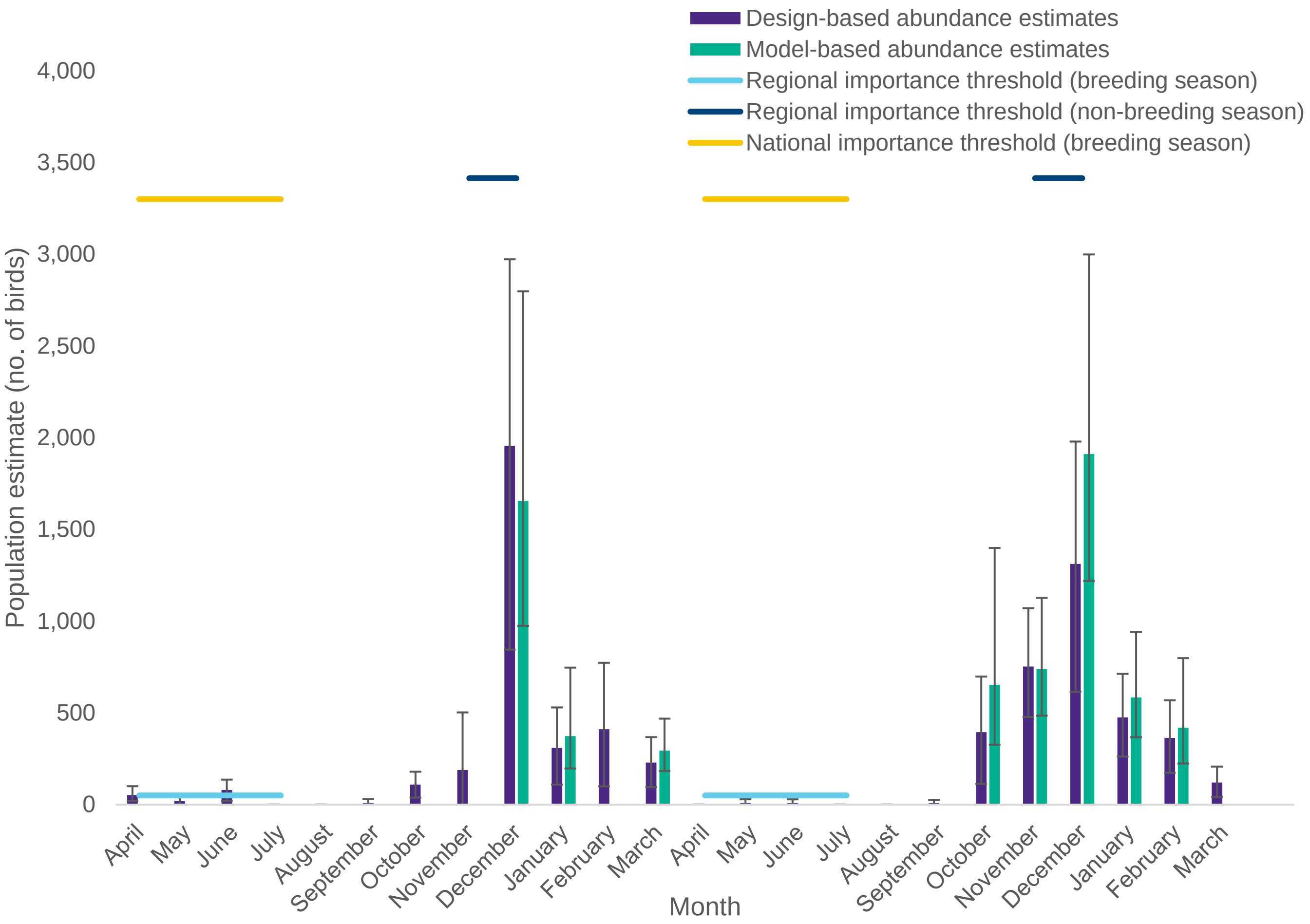

Figure 1.15: Abundance of razorbill in the Morgan Generation Assets study area during site-specific aerial surveys (with 95% confidence intervals). The regional importance thresholds for the breeding and non-breeding seasons are also shown.

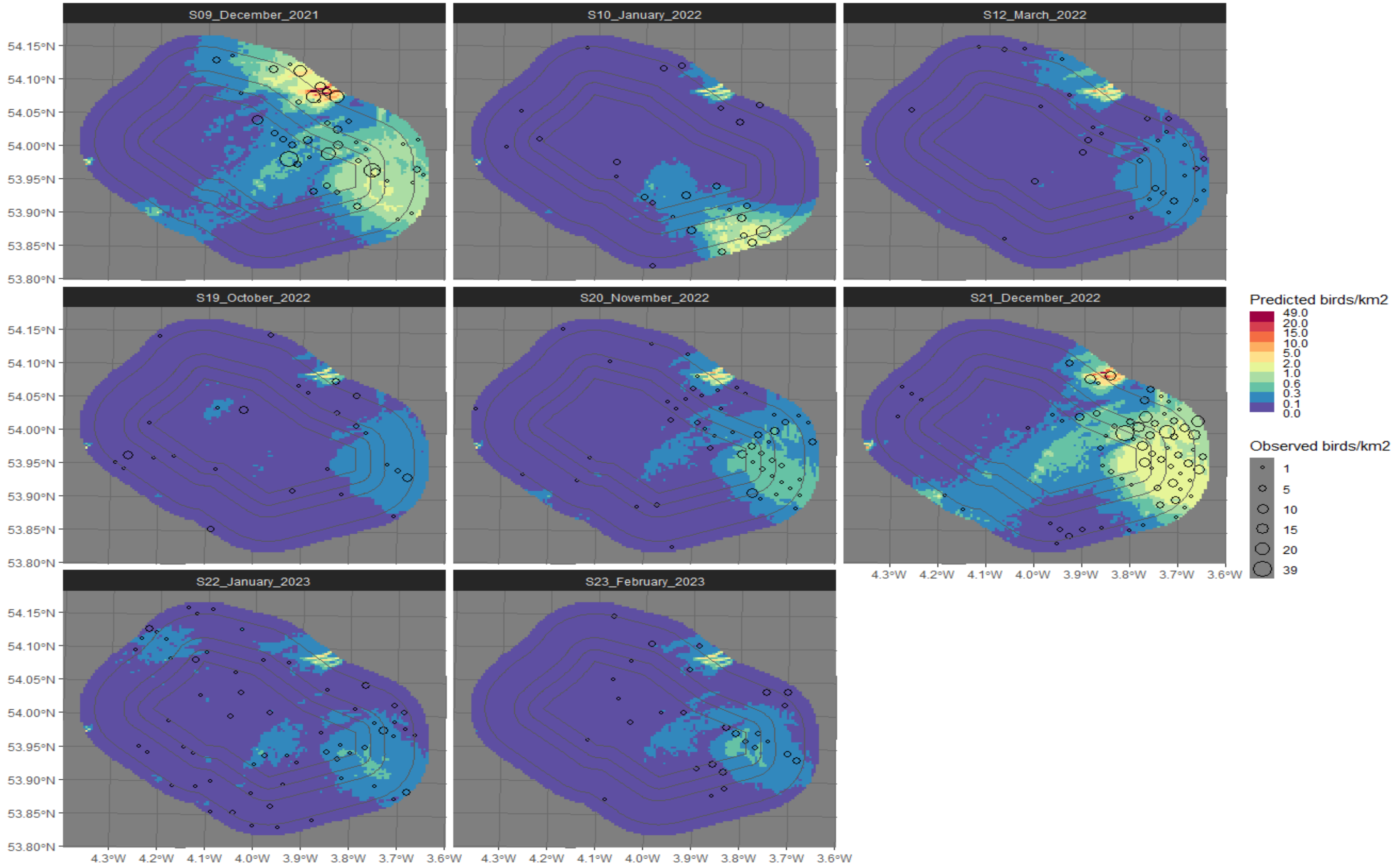

Figure 1.16: Predicted and observed razorbill density across the Morgan Generation Assets study area (figures also show the array area, 2 and 8 km buffers). Only modelled surveys (surveys with > 50 birds observed) are shown.

Table 1.22: Design-based and model-based (all behaviour) population estimates with lower and upper (95%) confidence limits for each month surveyed from April 2021 to March 2023 for the Morgan Generation Assets study area for razorbill.

Year	Month	Model-based population estimates			Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit	Mean	Lower confidence limit	Upper confidence limit
1	April	-	-	-	52	19	100
1	May	-	-	-	21	0	51
1	June	-	-	-	80	20	136
1	July	0	0	0	0	0	0
1	August	0	0	0	0	0	0
1	September	-	-	-	10	0	30
1	October	-	-	-	109	38	179
1	November	-	-	-	189	0	502
1	December	1,655	974	2,797	1,956	845	2,973
1	January	374	197	747	309	109	530
1	February	-	-	-	411	99	773
1	March	294	183	468	229	96	368
2	April	0	0	0	0	0	0
2	May	-	-	-	10	0	29
2	June	-	-	-	9	0	28
2	July	0	0	0	0	0	0
2	August	0	0	0	0	0	0
2	September	-	-	-	8	0	26
2	Octtober	653	326	1,399	395	113	698

Year	Month	Model-based population estimates			Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit	Mean	Lower confidence limit	Upper confidence limit
2	November	739	485	1,127	753	477	1,071
2	December	1,911	1,220	2,999	1,311	615	1,979
2	January	584	367	942	475	262	713
2	February	419	224	798	363	173	569
2	March	-	-	-	120	41	207

Regional survey data

1.5.1.169 In the full UK breeding season (April to July) as defined by Furness (2015), the area in which the Morgan Generation Assets is located does not support high densities of razorbill (Waggitt *et al.,* 2020). The nearest areas supporting high densities of the species are located on the east coast of Ireland associated with the breeding colonies around Dublin and on the north coast of Northern Ireland, again associated with breeding colonies. In the non-breeding season, the relative importance of the Morgan Generation Assets study area increases as the season progresses until March. Densities during this period are however much lower than in the breeding season (Figure B.20 and Figure B.21).

Telemetry data

1.5.1.170 Thirty-four individuals from the nearest colony to the Morgan Array Area, Puffin Island (Anglesey, Wales), were GPS tracked between 2011 and 2013 (BirdLife International, 2022). The data presented in the Seabird Tracking Database (BirdLife International, 2022) showed some tracks to overlap with the Morgan Array Area during the breeding season. GPS tracking has also been carried out at other colonies within the species' breeding home range of the Morgan Array Area: five individuals at Lambay Island (Ireland) and 21 individuals at Bardsey (Wales). The tracks however revealed no connectivity between these colonies and the Morgan Array Area.

Behaviour

1.5.1.171 Analysis of flight directions across the seasonal extents for the breeding season (full UK breeding season and migration-free breeding season) showed limited difference in the number of birds for which flight direction was recorded and therefore only the full breeding season is shown in Figure 1.17. The prevailing flight direction was northwest. There were too few records in the post-breeding and pre-breeding seasons to reveal any trend and therefore Figure 1.17 presents data for the non-breeding season only. In the non-breeding season, the prevailing flight directions were west and northwest (Figure 1.17).

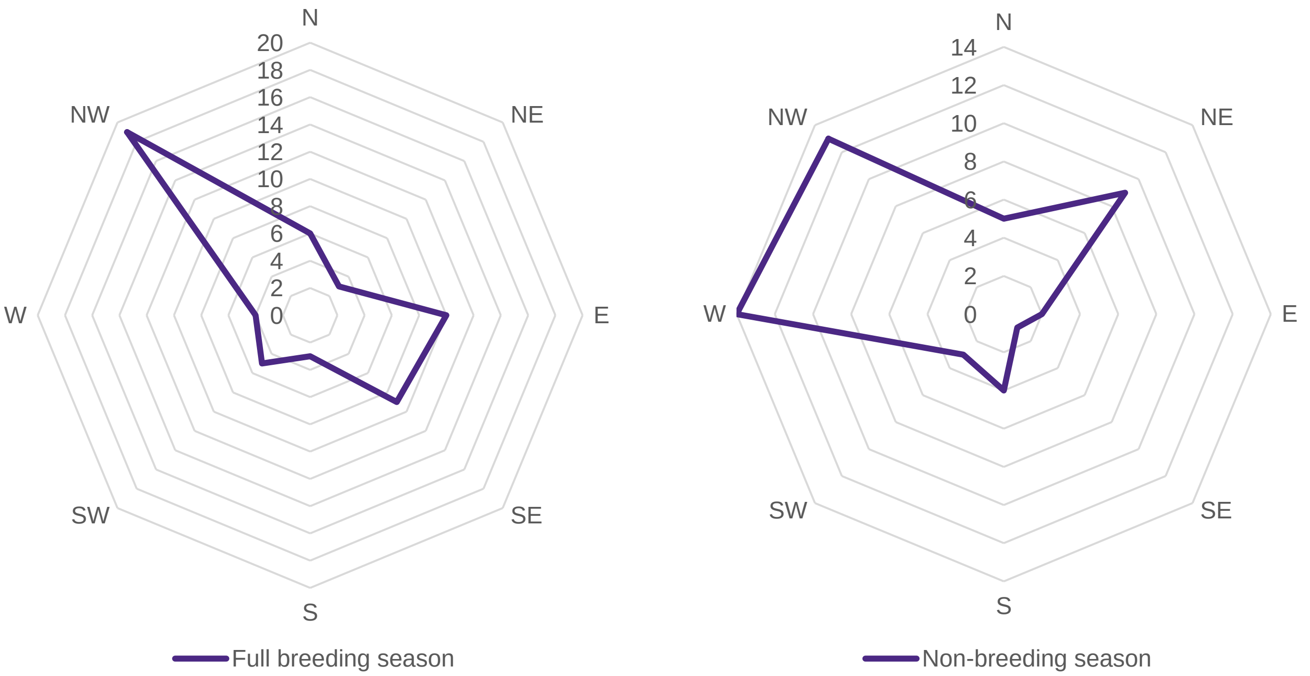

Figure 1.17: Flight directions of razorbill as recorded during site-specific aerial surveys.

Conclusion

1.5.1.172 Razorbill is considered to have a local conservation status due to the species being amber-listed on the Birds of Conservation Concern (Stanbury *et al.,* 2021). Population estimates of razorbill within the Morgan Generation Assets study area during the breeding season exceeded the 1% importance threshold of the regional population in two months. Razorbill is therefore identified as a VOR and is considered for further assessment as a receptor with a regional conservation value.

Puffin *Fratercula arctica*

Status overview

1.5.1.173 Puffin is not listed under Annex I of the Birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The species is however currently red-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.174 Puffins are one of the most abundant seabird species in Britain, breeding in coastal colonies. Seabird 2000 recorded 579,500 pairs at breeding colonies around Britain (Mitchell *et al.*, 2004). Lesser sandeel is the commonest prey item for puffins, but they also eat sprat, herring and a wide range of young gadoid fish (Harris, 1984).

1.5.1.175 The Morgan Generation Assets are within the foraging range of puffin from two UK SPAs and two Irish SPAs (Table 1.23). At the time of designation these SPAs supported 13,985 breeding pairs representing over 2% of the Britain and Ireland breeding population as recorded during Seabird 2000 (Mitchell *et al.*, 2004). The most recent counts, where available, indicate that the population at the Skomer, Skokholm and the seas off Pembrokeshire/Sgomer, Sgogwm a moroedd Benfro SPA has undergone a significant increase, although these counts were collected using different census methods and may therefore not be directly comparable, albeit they still show a significant increase. The Morgan Generation Assets are also within the foraging range of puffin from the St Bee's Head SSSI, Baie ny Carrickey MNR and Calf of Man and Wart Bank MNR.

1.5.1.176 Wade *et al.* (2016) assessed puffin as being at moderate risk of displacement and habitat loss due to offshore wind farms because of the limited ability of the species to utilise alternative habitats. The species is considered to be at very low risk of collision with turbines due to a very low proportion of birds flying at turbine height. Maclean *et al.* (2009) assessed auks as being at high risk of barrier effects at offshore wind farms.

Table 1.23: Designated sites at which puffin is a qualifying feature with which there is connectivity with the Morgan Generation Assets.

Designated site	Distance to the Morgan Generation Assets (km)	Population at designation (JNCC, 2022) (breeding pairs/individuals)	Most recent population estimates (Seabird Monitoring Programme database) (breeding pairs/individuals) (year)
UK			
Skomer, Skokholm and the seas off Pembrokeshire/Sgomer, Sgogwm a moroedd Benfro SPA	252	9,500	47,920 (2018 to 2022)
Rathlin Island SPA	186	2,398	408 (2021)
St Bee's Head SSSI	53	-	8 (2022)
Isle of Man			
Baie ny Carrickey MNR	33	-	Unknown
Calf of Man and Wart Bank MNR	37	-	Unknown
Ireland			
Lambay Island SPA	130	265	144 (2015)
Saltee Islands SPA	261	1,822	Unknown

Seasonal abundance and distribution

Site-specific surveys

1.5.1.177 Puffins were recorded within the Morgan Generation Assets study area in 4 of the 24 months of the baseline aerial survey programme. Birds were recorded in April (19 birds) and May 2021 918 birds), September 2022 (eight birds) and January 2023 (10 birds). Due to the limited numbers of birds recorded there is no obvious trend in the distribution of the species across the Morgan Generation Assets survey area.

1.5.1.178 The peak population in the non-breeding season (August to March) occurred in January 2023. This population did not surpass the 1% threshold for regional importance (3,046 birds). In the breeding season (April to August), the peak population was recorded in May 2021. This population did not surpass the 1% threshold of regional importance (1,008 birds).

Table 1.24: Design-based and model-based (all behaviour) population estimates with lower and upper (95%) confidence limits for each month surveyed from April 2021 to March 2023 for the Morgan Generation Assets study area for puffin.

Year	Month	Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit
1	April	18	0	44
1	May	19	0	46
1	June	0	0	0
1	July	0	0	0
1	August	0	0	0
1	September	0	0	0
1	October	0	0	0
1	November	0	0	0
1	December	0	0	0
1	January	0	0	0
1	February	0	0	0
1	March	0	0	0
2	April	0	0	0
2	May	0	0	0
2	June	0	0	0
2	July	0	0	0
2	August	0	0	0
2	September	8	0	24
2	October	0	0	0
2	November	0	0	0
2	December	0	0	0
2	January	10	0	28
2	February	0	0	0
2	March	0	0	0

Regional survey data

1.5.1.179 In the full UK breeding season (April to August) as defined by Furness (2015), the area in which the Morgan Generation Assets is located does not support high densities of puffin (Waggitt *et al.*, 2020) and there are no areas of high density within the Irish Sea. In the non-breeding season, the relative importance of the Morgan Generation Assets remains low (Figure B.22 and Figure B.23).

Telemetry data

1.5.1.180 Tracking data for puffins tagged on Skomer Island for the breeding season only shows no connectivity between birds from the colony and the Morgan Generation Assets (Fayet *et al.,* 2021). Outside of the breeding season, puffins range extensively throughout western UK waters, including the Morgan Generation Assets, Irish waters, out into the Atlantic and to the eastern and western coasts of Greenland (Darby *et al.,* 2022; Birdlife International, 2022).

Conclusion

1.5.1.181 Puffin is considered to have an international conservation status due to the Morgan Generation Assets being within the foraging range of the species from multiple SPAs at which the species is designated as a breeding feature. Puffins were recorded in only four of the baseline aerial surveys undertaken across the Morgan Generation Assets study area with none of the estimated populations exceeding the relevant thresholds for regional importance. However, due to the international conservation value of the species, puffin is identified as a VOR with an International conservation value and considered for further assessment in relation to impacts associated with the Morgan Generation Assets.

Red-throated diver *Gavia stellata*

Status overview

1.5.1.182 Red-throated diver is listed on Annex I of the Birds Directive (2009/147/EEC) and Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The species is currently green-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.183 An estimated 1,250 pairs of red-throated diver breed in Britain, with the majority of pairs found in the north and west of Scotland (Woodward *et al.,* 2020). The wintering population around Britain has been estimated at 17,000 individuals (O'Brien *et al.*, 2008). Wintering red-throated divers show a preference for sheltered shallow waters and sandy bays along North Sea coasts, and several important areas off the east coast of England have recently been identified, of relevance to the Morgan Generation Assets, Liverpool Bay. Numbers may however fluctuate widely in response to weather and other factors affecting the supply of prey species such as sandeels, crustaceans and small fish (Lack, 1986).

1.5.1.184 Wade *et al.* (2016) assessed red-throated divers as being at very high risk of displacement from offshore wind farms, and there is published evidence from some offshore wind farm studies to support this (e.g. Petersen, 2005; Barton *et al.*, 2008). Red-throated diver has also been assessed as being at high risk of barrier effects (Maclean *et al.*, 2009) and habitat loss due to a limited flexibility in habitat use, and at moderate risk of collision with turbines due to limited flight manoeuvrability (Wade *et al.*, 2016).

Seasonal abundance and distribution

Site-specific surveys

1.5.1.185 Red-throated divers were not recorded in the Morgan Generation Assets study area during the 24-month baseline aerial survey programme of the Morgan Generation Assets. Red-throated diver were also not recorded in the Morgan Generation Assets Survey Area during the 24-month baseline aerial survey programme of the Morgan Generation Assets

Regional survey data

1.5.1.186 The Morgan Generation Assets is located in the Irish Sea, areas within which are of importance for red-throated diver. The closest of these areas to the Morgan Generation Assets are incorporated into the designation of the Liverpool Bay SPA. The areas of highest density occur off the North Wales coast, especially offshore of Colwyn Bay and Llandulas, in the mouth of the Menai Strait, the Dee Estuary and off the coast at Formby (Lawson *et al.,* 2016). However, these areas do not overlap with the Morgan Generation Assets. The wider Liverpool Bay Area of Search used to define the boundary of the Liverpool Bay SPA in Lawson *et al.* (2016) does not overlap with the Morgan Generation Assets however, those areas closest to the Morgan Generation Assets support negligible densities, if any, of red-throated diver (Figure B.24). More recent surveys have shown a similar pattern of distribution (HiDef Aerial Surveying Limited, 2023).

Conclusion

1.5.1.187 Due to the species inclusion on Annex I of the Birds Directive and Schedule 1 of the Wildlife and Countryside Act 1981, red-throated diver is considered to be of national conservation status. Red-throated divers were not recorded during aerial surveys of the Morgan Generation Assets study area and regional surveys suggest limited, if any, birds will be present. The species is therefore considered to have a negligible population importance and therefore it is considered highly unlikely that impacts associated with the Morgan Generation Assets will occur on red-throated diver.

1.5.1.188 Red-throated diver is therefore not considered for further assessment in relation to impacts associated with the Morgan Generation Assets.

European storm petrel *Hydrobates pelagicus*

Status overview

1.5.1.189 Storm petrel is listed on Annex I of the Birds Directive, and the species is currently amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.190 Storm-petrels breed at a small number of colonies around the UK, primarily on Shetland, Orkney, the Western Isles and the west coast of Scotland, as well as on islands off the Welsh coast, Isles of Scilly and the Channel Islands. Seabird 2000 estimated the UK breeding population to be 25,710 pairs. After the breeding season, birds migrate south and spend the winter off the coast of south Africa.

1.5.1.191 The Morgan Generation Assets are within the foraging range of European storm petrel from two UK SPAs (Table 1.25). At the time of designation these SPAs supported 29,766 breeding pairs representing nearly 12% of the Britain and Ireland breeding population as recorded during Seabird 2000 (Mitchell *et al.*, 2004). The most recent counts for the Treshnish Isles SPA indicates that the population of the species has increased (Ward, 2021).

1.5.1.192 Wade *et al.* (2016) assessed storm petrel as being at very low risk of displacement from wind farms and habitat loss due to a high flexibility in habitat use. The species is also considered to be at low risk of collision with turbines due to a limited proportion of birds at turbine height. However, the sensitivities presented in Wade *et al.* (2016) for displacement and collision both have very high degrees of uncertainty associated with them. Although the species has not assessed in terms of barrier effects in Maclean *et* *al.* (2009) however, the species is not considered likely to be exposed due to their notable wide ranging pelagic nature.

Table 1.25: Designated sites at which storm petrel is a qualifying feature with which there is connectivity with the Morgan Generation Assets.

Designated site	Distance to the Morgan Generation Assets (km)	Population at designation (JNCC, 2022) (breeding pairs)	Most recent population estimates (Seabird Monitoring Programme database) (breeding pairs) (year)
UK			
Treshnish Isles SPA	304	5,040	10,261
Skomer, Skokholm and the Seas off Pembrokeshire SPA	252	3,500	Unknown
Ynys Enlli	138	-	Unknown

Seasonal abundance and distribution

Site-specific surveys

1.5.1.193 European storm petrels were not recorded in the Morgan Generation Assets study area during the 24-month baseline aerial survey programme of the Morgan Generation Assets.

Regional survey data

1.5.1.194 Consistent with the site-specific surveys the density layers associated with Waggitt *et al.* (2020) show that densities of European storm petrel in the area occupied by the Morgan Generation Assets study area are negligible throughout the year (Figure B.25 and Figure B.26).

Conclusion

1.5.1.195 European storm petrel is listed on Annex 1 of the Birds Directive meaning the species has a national conservation status. The species was not recorded during aerial surveys of the Morgan Generation Assets study area. However, traditional survey methods are unlikely to capture the movements of migratory birds due to the ephemeral nature of these movements and therefore consideration will be given to potential impacts on this species during migratory periods in Volume 4, Annex 5.4: Offshore ornithology migratory bird CRM technical report of the Environmental Statement and where necessary Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement. European storm petrel is therefore identified as a VOR with a National conservation value.

Leach's petrel *Oceanodroma leucorhoa*

Status overview

1.5.1.196 Leach's petrel is listed on Annex I of the Birds Directive and Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), and the species is currently red-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.197 Leach's petrels breed at a small number of colonies around the UK, primarily on Shetland, Orkney and the Western Isles. Seabird 2000 estimated the UK breeding population to be 48,047 pairs, however there are no breeding colonies on the west mainland coast of Britain (Mitchell *et al.*, 2004; Balmer *et al.*, 2013). After the breeding season, birds migrate south and spend the winter off the coast of west Africa.

1.5.1.198 The Morgan Generation Assets are within the foraging range of Leach's petrel from four UK SPAs and one Irish SPA (Table 1.25). At the time of designation these SPAs supported 6,815 breeding pairs representing over 14% of the Britain and Ireland breeding population as recorded during Seabird 2000 (Mitchell *et al.*, 2004).

1.5.1.199 Wade *et al.* (2016) assessed Leach's petrel as being at very low risk of displacement from wind farms and habitat loss due to a high flexibility in habitat use. The species is also considered to be at low risk of collision with turbines due to a limited proportion of birds at turbine height. However, the sensitivities presented in Wade *et al.* (2016) for displacement and collision both have very high or high degrees of uncertainty associated with them. Although the species has not assessed in terms of barrier effects in Maclean *et al.* (2009) however, the species is not considered likely to be exposed due to their notable wide ranging pelagic nature.

Table 1.26: Designated sites at which Leach's petrel is a qualifying feature with which there is connectivity with the Morgan Generation Assets.

Designated site	Distance to the Morgan Generation Assets (km)	Population at designation (JNCC, 2022) (breeding pairs)
UK		
Flannan Isles SPA	511	1,000
North Rona and Sula Sgeir SPA	568	500
St Kilda SPA	490	5,000
Sule Skerry and Sule Stack SPA	549	5
Ireland		
Stags of Broad Haven SPA	366	310

Seasonal abundance and distribution

Site-specific surveys

1.5.1.200 Leach's petrels were not recorded in the Morgan Generation Assets study area during the 24-month baseline aerial survey programme of the Morgan Generation Assets.

Conclusion

1.5.1.201 Leach’s petrel is listed on Annex 1 of the Birds Directive and Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) meaning the species has a national conservation status. The species was not recorded during aerial surveys of the Morgan Generation Assets study area. However, traditional survey methods are unlikely to capture the movements of migratory birds due to the ephemeral nature of these movements and therefore consideration will be given to potential impacts on this species during migratory periods in Volume 4, Annex 5.4: Offshore ornithology migratory bird CRM technical report of the Environmental Statement and where necessary Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement. Leach’s petrel is therefore identified as a VOR with a National conservation value.

Fulmar *Fulmarus glacialis*

Status overview

1.5.1.202 Fulmar is not listed under Annex I of the Birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). Fulmar is however currently amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.203 Fulmar numbers and distribution around the UK have increased considerably since the mid-19th century (Pennington *et al.*, 2004). The species is one of the most common seabirds in Britain, with an estimated breeding population of 499,081 pairs (Mitchell *et al.*, 2004), although since Seabird 2000 when the UK breeding population was last estimated, the population is predicted to have decreased by 33% (JNCC, 2021). The largest breeding colonies are located off the north and west coasts of Scotland with birds often present at these colonies outside of the breeding season.

1.5.1.204 Fulmars forage at sea over a wide area in search of small fish (sandeels), crustaceans and squid. They also scavenge extensively around fishing vessels, with offal and fish discards from trawlers now forming a major part of their diet (Phillips *et al.*, 2009).

1.5.1.205 Fulmar is a qualifying feature at nine SPAs on the west coast of the UK and 17 SPAs in Ireland (Table 1.27). At the time of designation these SPAs supported 126,001 breeding pairs representing over 23% of the Britain and Ireland breeding population as recorded during Seabird 2000 (Mitchell *et al.*, 2004). The most recent counts, where available, indicate that the population at the majority of these SPAs has declined. The Morgan Generation Assets are also within the foraging range of fulmar from the St Bee’s Head SSSI, Little Ness MNR, Niarbyl Bay MNR and Port Erin Bay MNR.

1.5.1.206 Wade *et al.* (2016) assessed fulmar as being at very low risk of displacement from wind farms although this is associated with a high degree of uncertainty. A similar conclusion was also drawn for collision with turbines due to a limited proportion of flights occurring at turbine height. Fulmar is considered to be at very low risk of habitat loss (Wade *et al.*, 2016) and low risk of barrier effects (Maclean *et al.*, 2009).

Table 1.27: Designated sites at which fulmar is a qualifying feature with which there is connectivity with the Morgan Generation Assets.

1 Heaney and St Pierre (2015)

Designated site	Distance to the Morgan Generation Assets (km)	Population at designation (JNCC, 2022) (breeding pairs)	Most recent population estimates (Seabird Monitoring Programme database) (breeding pairs) (year)
UK			
North Rona and Sula Sgeir SPA	568	11,500	2,210
Flannan Isles SPA	511	4,730	3,066
St Kilda SPA	490	62,800	29,186
The Shiant Isles SPA	442	6,820	1,506
Mingulay and Berneray SPA	370	10,450	6,255
Cape Wrath SPA	502	2,300	732
Handa SPA	480	3,500	685
Rathlin Island SPA	186	1,482	1,045
Isles of Scilly SPA	465	286 [1]	37
St Bee's Head SSSI	53	-	-
Isle of Man			
Little Ness MNR		-	Unknown
Niarbyl Bay MNR		-	Unknown
Port Erin Bay MNR		-	Unknown
Ireland			
Beara Peninsula SPA	462	575	Unknown
Blasket Islands SPA	471	3,000	Unknown
Clare Island SPA	377	4,029	667
Cliffs of Moher SPA	362	3,566	4,801
Deenish Island and Scariff Island SPA	476	385	Unknown
Dingle Peninsula SPA	441	1,016	625
Duvillaun Islands SPA	387	638	Unknown
High Island, Inishshark and Davillaun SPA	391	830	1,561
Horn Head to Fanad Head SPA	255	1,974	Unknown
Iveragh Peninsula SPA	444	766	Unknown
Kerry Head SPA	406	421	Unknown

Designated site	Distance to the Morgan Generation Assets (km)	Population at designation (JNCC, 2022) (breeding pairs)	Most recent population estimates (Seabird Monitoring Programme database) (breeding pairs) (year)
Lambay Island SPA	130	635	375
Puffin Island SPA	481	447	670
Saltee Islands SPA	261	525	Unknown
Skelligs SPA	490	806	795
Tory Island SPA	292	641	507
West Donegal Coast SPA	291	1,879	Unknown

Seasonal abundance and distribution

Site-specific surveys

1.5.1.207 Fulmars were recorded within the Morgan Generation Assets study area in 14 of the 24 months of the baseline aerial survey programme. The highest populations were estimated outside of the migration-free breeding season including in January 2022, when the peak population occurred, and between November 2022 and March 2023 (Figure 1.18; Table 1.28). The distribution of the species within the Morgan Generation Assets survey area was generally focussed in north and west areas.

1.5.1.208 The peak population in the migration-free breeding season (April to August) occurred in April 2021. This population did not surpass the 1% threshold for regional importance (1,429 birds). In the post-breeding season (September to October), the species was only recorded in September 2021 with this population not surpassing the threshold for regional importance (8,282 birds). In the non-breeding season, (November), fulmar was recorded in November 2022 only with the estimated population also not surpassing the threshold for regional importance (5,564 birds). The peak population across all surveys occurred in the pre-breeding season in January 2022. The estimated population did not however, surpass the threshold for regional importance (8,282 birds).

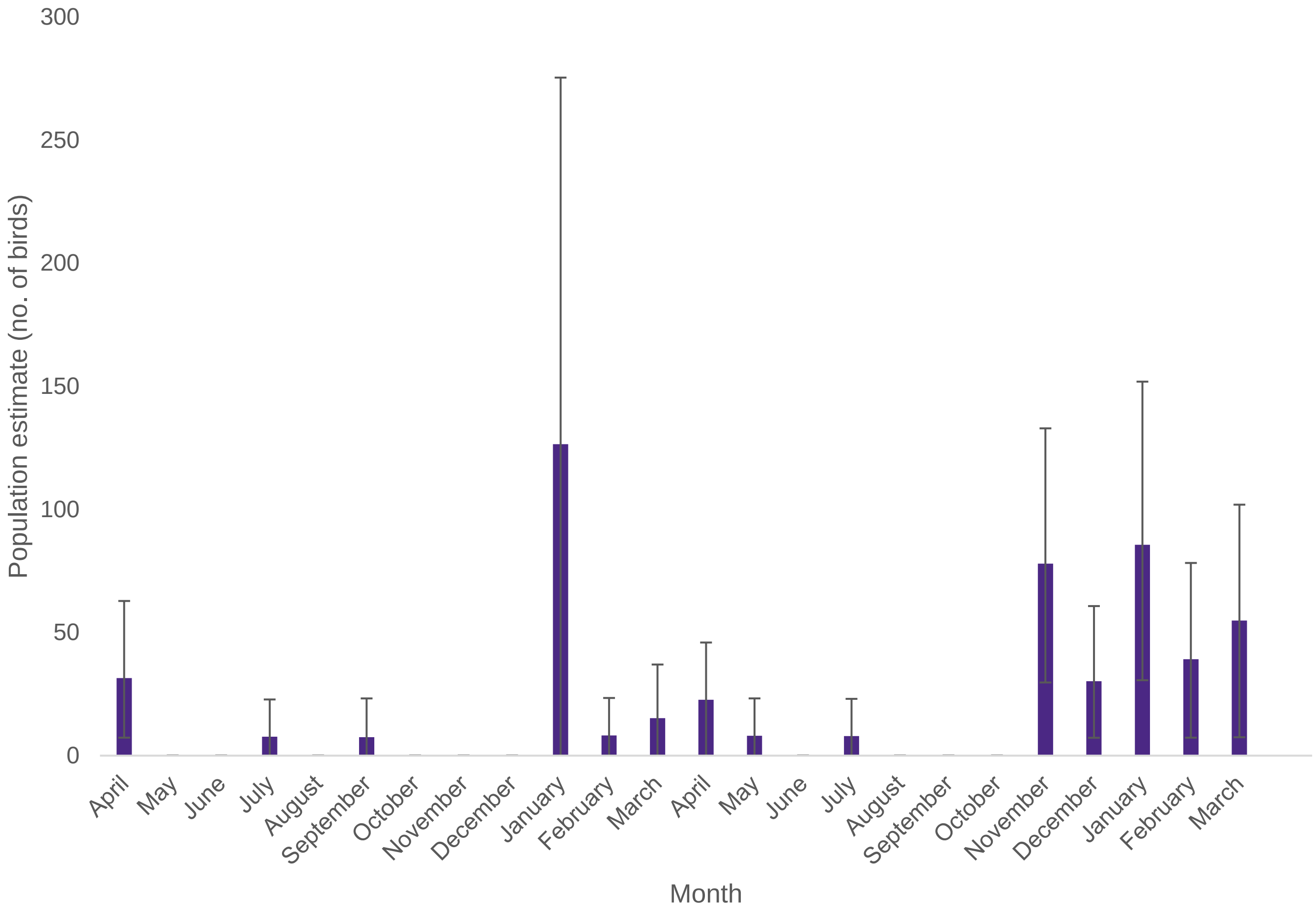

Figure 1.18: Abundance of fulmar in the Morgan Generation Assets study area during site-specific aerial surveys (with 95% confidence intervals).

Table 1.28: Design-based and model-based (all behaviour) population estimates with lower and upper (95%) confidence limits for each month surveyed from April 2021 to March 2023 for the Morgan Generation Assets study area for fulmar.

Year	Month	Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit
1	April	32	7	63
1	May	0	0	0
1	June	0	0	0
1	July	8	0	23
1	August	0	0	0
1	September	8	0	23
1	October	0	0	0
1	November	0	0	0
1	December	0	0	0
1	January	127	0	275
1	February	8	0	23
1	March	15	0	37
2	April	23	0	46
2	May	8	0	23
2	June	0	0	0
2	July	8	0	23
2	August	0	0	0
2	September	0	0	0
2	October	0	0	0
2	November	78	30	133
2	December	30	7	61
2	January	86	31	152
2	February	39	7	78
2	March	55	7	102

Regional survey data

1.5.1.209 Fulmar have a protracted breeding season with Furness (2015) defining the full UK breeding season as January to August. During this period the Morgan Generation Assets study area is of low importance to the species. This continues through the non-breeding season when densities are also lower (Figure B.27 and Figure B.28).

Conclusion

1.5.1.210 Fulmar is considered to have an international conservation status due to the Morgan Generation Assets being within the foraging range of the species from multiple SPAs at which the species is designated as a breeding feature. Fulmars were recorded in fourteen of the baseline aerial surveys undertaken across the Morgan Generation Assets study area. The populations estimated in these surveys did not surpass the relevant thresholds for regional importance in any season. However, due to the International conservation value of the species, fulmar is identified as a VOR and considered for further assessment in relation to impacts associated with the Morgan Generation Assets as a receptor with an International conservation value.

Manx shearwater *Puffinus puffinus*

Status overview

1.5.1.211 Manx shearwater is not listed under Annex I of the Birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). Manx shearwater is currently amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.212 Manx shearwater is a summer visitor to UK waters, occurring at breeding colonies between March and September. Seabird 2000 estimated the British breeding population at 295,089 breeding pairs, with large colonies on the west coast of Scotland and off southwest Wales (e.g. Rum, Skomer and Skokholm) (Mitchell *et al.*, 2004). However, it is evident that the British population of Manx shearwater is now higher with 455,156 breeding pairs estimated on Skomer Island, Wales in 2018 alone (JNCC *et al.,* 2023). The most recent count of breeding Manx shearwater at the Calf of Man, Isle of Man undertaken in 2014 was 424 breeding pairs.

1.5.1.213 Manx shearwater is a qualifying feature at six SPAs on the west coast of the UK and five SPAs in Ireland (Table 1.29). At the time of designation these SPAs supported 265,385 breeding pairs representing nearly 80% of the Britain and Ireland breeding population as recorded during Seabird 2000 (Mitchell *et al.*, 2004). The most recent counts, where available, indicate that the population at the majority of these SPAs has increased. The Morgan Generation Assets are also within the foraging range of Manx shearwater from the Ynys Enlli SSSI and Calf of Man and Wart Bank MNR.

1.5.1.214 Manx shearwaters spend most of their lives at sea, only coming ashore to breed. They typically eat small squid, fish, including sandeels and free-swimming crustaceans, which they catch by shallow plunge-diving or surface feeding (Forrester *et al.*, 2007).

1.5.1.215 Wade *et al.* (2016) assessed Manx shearwater as being at very low risk of collision with turbines due to a limited proportion of birds occurring at turbine height although this was associated with a high level of uncertainty. The species is also considered at very low risk of displacement although this also has a high associated level of uncertainty. A similar conclusion was also drawn for habitat loss associated with wind farms due to the high flexibility of Manx shearwater in terms of habitat use. The species is not assessed in terms of barrier effects in Maclean *et al.* (2009) however, the species is not considered likely to be exposed due to their notable wide ranging pelagic nature. Overall, Manx shearwater is assessed as being at low risk from offshore wind developments.

Table 1.29: Designated sites at which Manx shearwater is a qualifying feature with which there is connectivity with the Morgan Generation Assets.

Designated site	Distance to the Morgan Generation Assets (km)	Population at designation (JNCC, 2022) (breeding pairs)	Most recent population estimates (Seabird Monitoring Programme database) (breeding pairs) (year)
UK			
St Kilda SPA	490	5,000	Unknown
Rum SPA	341	61,000	120,000
Glannau Aberdaron ac Ynys Enlli/Aberdaron Coast and Bardsey Island SPA	129	6,930	16,183
Skomer, Skokholm and the Seas off Pembrokeshire SPA	252	150,968	455,156
Isles of Scilly SPA	465	523 [1]	269
Copeland Islands SPA	112	4,800	Unknown
Ynys Enlli SSSI	138	-	Unknown
Isle of Man			
Calf of Man and Wart Bank MNR	37	-	Unknown
Ireland			
Blasket Islands SPA	471	23,500	Unknown
Cruagh Island SPA	399	3,286	Unknown
Deenish Island and Scariff Island SPA	476	2,311	Unknown
Puffin Island SPA	481	6,329	Unknown
Skelligs SPA	490	738	Unknown

[1] Heaney and St Pierre (2015)

Seasonal abundance and distribution

Site-specific surveys

1.5.1.216 Manx shearwaters were recorded within the Morgan Generation Assets study area in 11 of the 24 months of the baseline aerial survey programme. Birds were observed between April and September 2021 and May and September 2022, reflecting the occurrence of the species in UK waters. The peak population in 2021 occurred in July and in September in 2022. No birds were recorded between October and March in both survey years reflecting the seasonal presence of Manx shearwater in UK waters (Figure 1.19; Table 1.30).

1.5.1.217 The MRSea modelling for Manx shearwater is considered to have provided generally OK predictions. The distribution of Manx shearwater was patchy across the survey area in most surveys, with occasional large aggregations of birds which formed outliers and complicated modelling (e.g. observation of 400 birds in one flock). Predicted confidence intervals are therefore larger than for other species, particularly in one or two surveys with count outliers, but are still useable.

1.5.1.218 MRSea outputs were generated for nine of the 24 months of survey, with these primarily being months within the breeding season. The outputs suggest that there is an easterly bias in the distribution of Manx shearwater across the Morgan Generation Assets study area in the majority of surveys (Figure 1.20).

1.5.1.219 The peak population in the breeding season (April to August) occurred in August 2022. This did not surpass the 1% threshold for regional importance (9,116 birds). In the pre-breeding season (January to April), the peak population was recorded in March 2022. This also did not surpass the 1% threshold of regional importance (12,123 birds). The peak population in the post-breeding season occurred in September 2022. This population did not surpass the threshold for regional importance (15,809 birds).

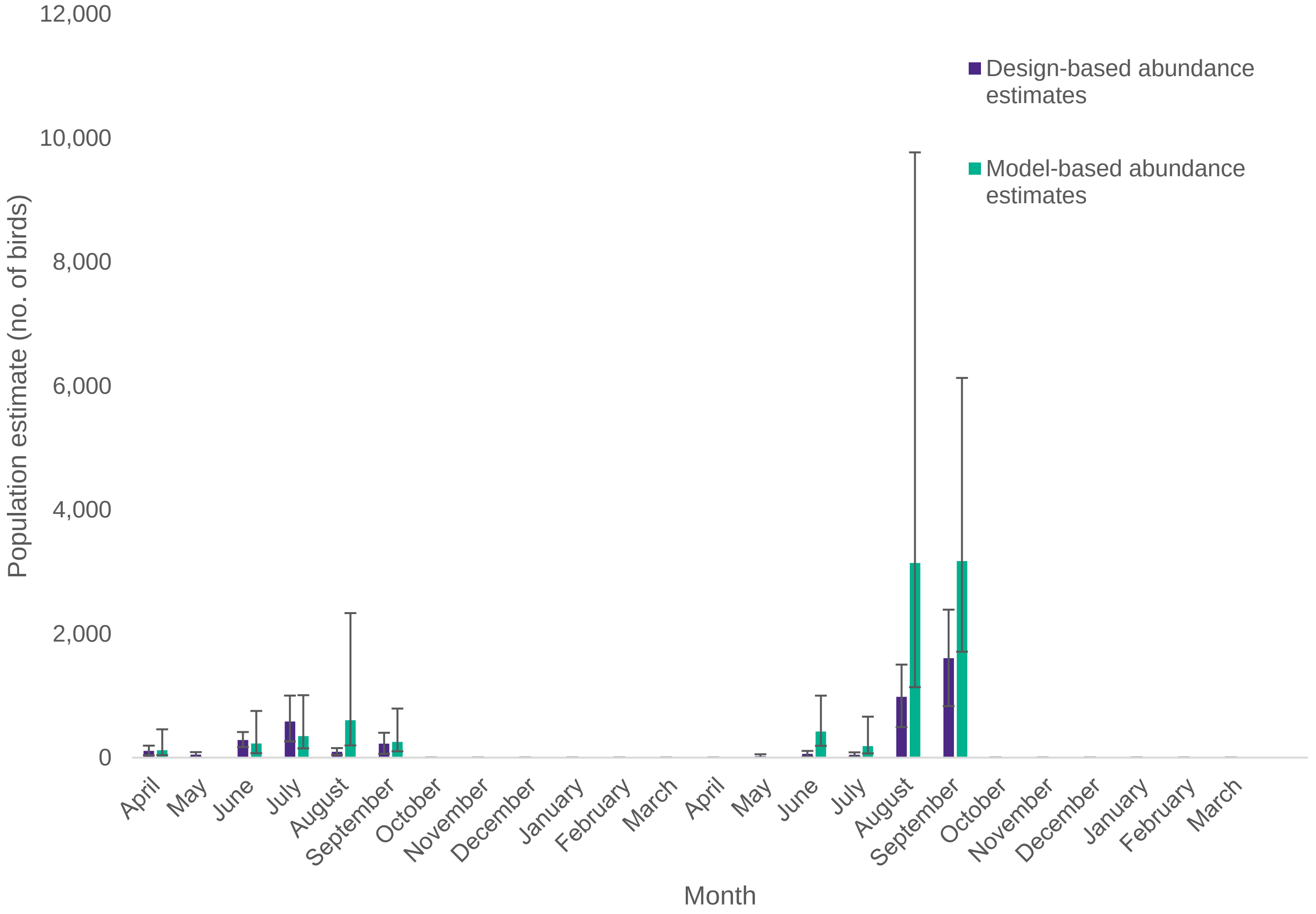

Figure 1.19: Abundance of Manx shearwater in the Morgan Generation Assets study area during site-specific aerial surveys (with 95% confidence intervals).

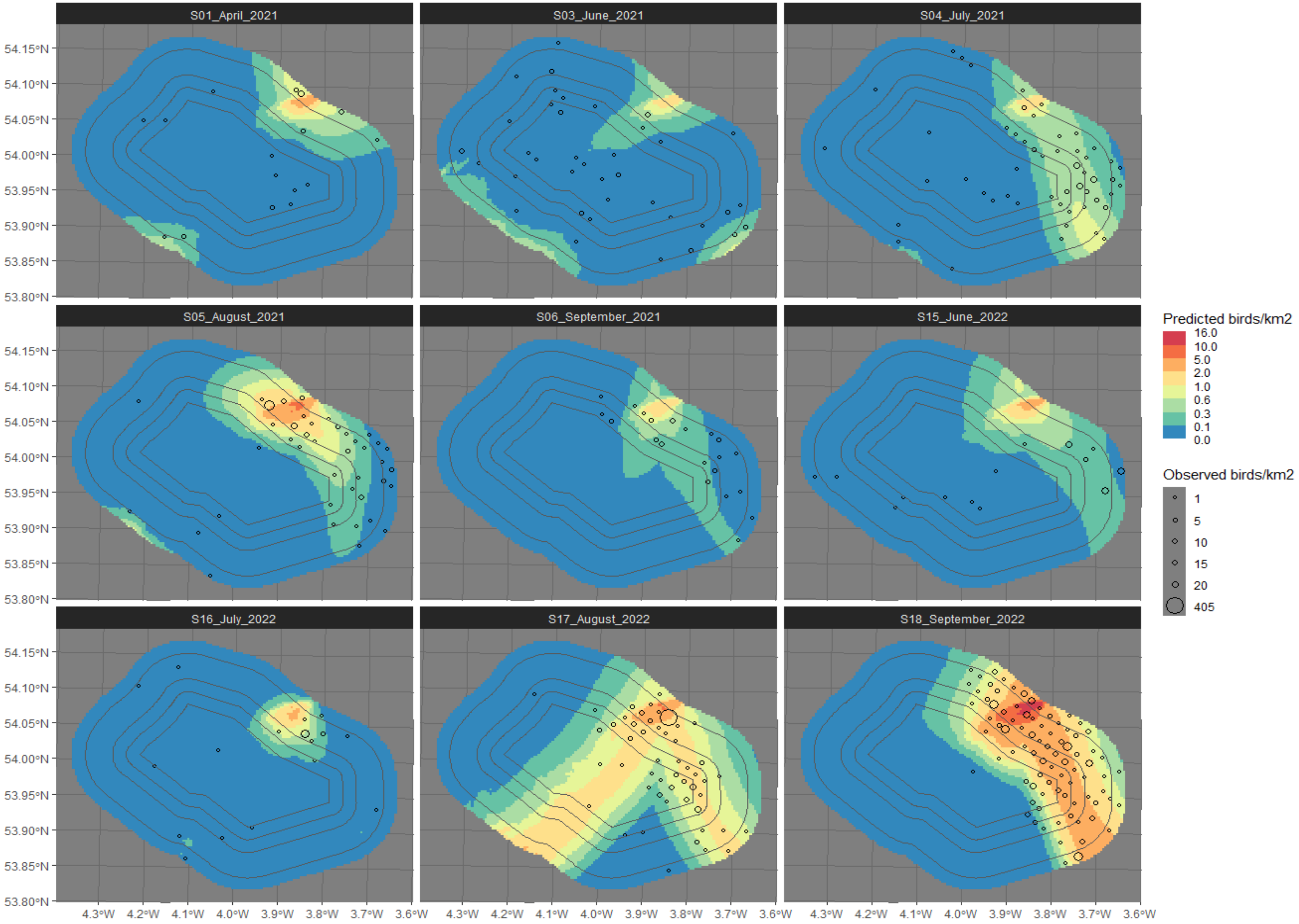

Figure 1.20: Predicted and observed Manx shearwater density across the Morgan Generation Assets study area (figures also show the array area, 2 and 8 km buffers). Only modelled surveys (surveys with > 50 birds observed) are shown.

Table 1.30: Design-based and model-based (all behaviour) population estimates with lower and upper (95%) confidence limits for each month surveyed from April 2021 to March 2023 for the Morgan Generation Assets study area for Manx shearwater.

Year	Month	Model-based population estimates			Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit	Mean	Lower confidence limit	Upper confidence limit
1	April	119	40	457	110	38	194
1	May	-	-	-	49	8	89
1	June	227	72	753	284	171	413
1	July	349	150	1,008	584	263	1,002
1	August	603	197	2,333	95	46	154
1	September	254	102	792	226	61	401
1	October	0	0	0	0	0	0
1	November	0	0	0	0	0	0
1	December	0	0	0	0	0	0
1	January	0	0	0	0	0	0
1	February	0	0	0	0	0	0
1	March	0	0	0	0	0	0
2	April	0	0	0	0	0	0
2	May	-	-	-	23	0	55
2	June	421	190	1,001	61	15	109
2	July	185	68	661	46	15	86
2	August	3,143	1,138	9,771	983	493	1,502
2	September	3,173	1,710	6,130	1,607	832	2,389
2	October	0	0	0	0	0	0

Year	Month	Model-based population estimates			Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit	Mean	Lower confidence limit	Upper confidence limit
2	November	0	0	0	0	0	0
2	December	0	0	0	0	0	0
2	January	0	0	0	0	0	0
2	February	0	0	0	0	0	0
2	March	0	0	0	0	0	0

Regional survey data

1.5.1.220 The density layers for Manx shearwater associated with Waggitt *et al.* (2020) show that the Morgan Generation Assets study area supports relatively low to negligible densities through the year. Higher densities occur further west, closer to Ireland, and are associated with the Irish Sea Front, an area known for its importance for the species (Figure B.29 and Figure B.30).

Telemetry data

1.5.1.221 Tracking of individuals at the Bardsey Colony (Wales) in 2017 showed a widespread utilisation of the Irish Sea during the breeding season, including the Morgan Array Area (BirdLife International, 2022). There has also been tracking work of individuals breeding at Lundy Island in 2009 to 2010 (Dean *et al.*, 2012), with the data used as evidence for the designation of the Irish Sea Front as an SPA. There was however no use of the Morgan Array Area by the Lundy birds. A larger GPS tracking study of 117 individuals captured at the Skomer Island (Wales) and Lighthouse Island in the Copelands group (Northern Ireland) in 2009 to 2011 revealed that birds from the two different colonies foraged in local waters that were exclusive but overlapped in one key area: the Irish Sea Front (Dean *et al.*, 2013). The tracking illustrated little use of the east part of the Irish Sea by the Skomer birds. At the Skomer Island colony, earlier work (2004 to 2006) showed again the utilisation of the west and north sides of the Irish Sea, whilst few movements were observed eastwards (Guilford *et al.*, 2008).

Behaviour

1.5.1.222 Analysis of flight directions across the seasonal extents for the breeding season (full UK breeding season and migration-free breeding season) with no obvious prevailing flight direction (Figure 1.21)Figure 1.21. In the non-breeding season the prevailing flight directions generally had a northerly component (northwest, north and northeast) with a high proportion of birds also observed flying east (Figure 1.21).

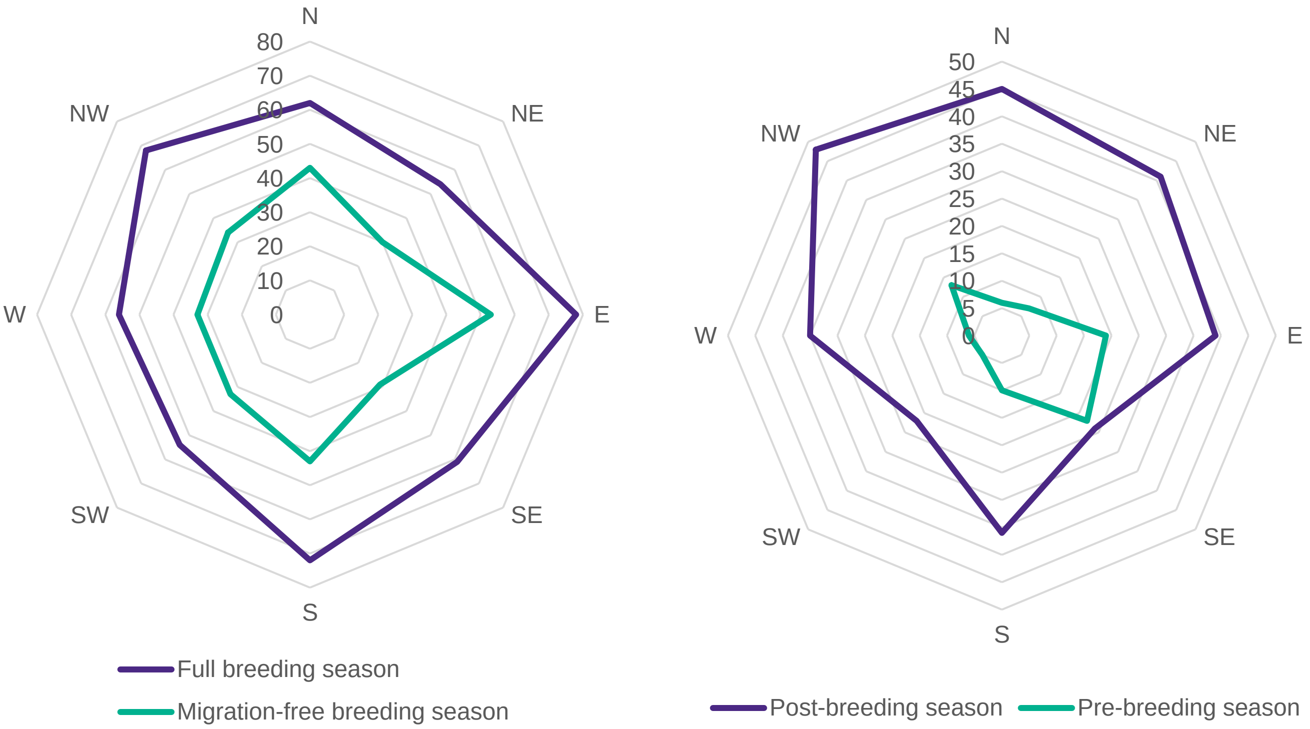

Figure 1.21: Flight directions of Manx shearwater as recorded during site-specific aerial surveys.

Conclusion

1.5.1.223 Manx shearwater is considered to have an international conservation status due to the Morgan Generation Assets being within the foraging range of the species from multiple SPAs at which the species is designated as a breeding feature. Manx shearwaters were recorded in 11 of the baseline aerial surveys undertaken across the Morgan Generation Assets study area. The populations estimated in these surveys did not surpass the relevant thresholds for regional importance in any season. However, due to the International conservation value of the species, Manx shearwater is identified as a VOR and considered for further assessment in relation to impacts associated with the Morgan Generation Assets as a receptor with an International conservation value.

Gannet *Morus bassanus*

Status overview

1.5.1.224 Gannet is not listed under Annex I of the Birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). Gannet is currently amber-listed on the UK Birds of Conservation Concern (Stanbury *et al.,* 2021).

1.5.1.225 The UK breeding population of gannet has been estimated at 295,000 pairs (Woodward *et al.*, 2020). The species breeds at 23 colonies around the UK, the nearest of which to the Morgan Generation Assets being the Ailsa Craig SPA and the Grassholm SPA. The breeding population on Ailsa Craig has fluctuated but in 2014 was at the same level as in 1995 (approximately 33,000 pairs). The breeding population on Grassholm has shown a steady increase from 1986, and although it originally declined reached approximately 36,000 pairs in 2015.

1.5.1.226 Gannet is a qualifying feature at three SPAs on the west coast of the UK and three SPAs in Ireland (Table 1.31). At the time of designation these SPAs supported 259,311 breeding pairs representing nearly 55% of the Britain and Ireland breeding population as estimated for 1998 to 2000 (Mitchell *et al.*, 2004). The most recent counts, where available, indicate that the population at all of these SPAs has increased. The Morgan Generation Assets are also within the foraging range of gannet from the Laxey Bay MNR and West Coast MNR.

1.5.1.227 Wade *et al.* (2016) assessed gannet as being at high risk of collision with turbines due to a moderate proportion of birds at collision height, a moderate flight agility and moderate proportion of time spent in flight. Gannet is also considered to be at high risk of displacement and habitat loss associated with offshore wind farms. Maclean *et al.* (2009) assessed gannet as being at very low risk of barrier effects.

Table 1.31: Designated sites at which gannet is a qualifying feature with which there is connectivity with the Morgan Generation Assets.

Designated site	Distance to the Morgan Generation Assets (km)	Population at designation (JNCC, 2022) (breeding pairs)	Most recent population estimates (Seabird Monitoring Programme database) (breeding pairs) (year)
UK			
St Kilda SPA	490	50,050	60,290
Grassholm SPA	260	33,000	36,011
Ailsa Craig SPA	142	23,000	33,226
Isle of Man			
Laxey Bay MNR	23	-	Unknown
West Coast MNR	40	-	Unknown
Ireland			
Saltee Islands SPA	261	2,446	4,722
Skelligs SPA	490	29,683	35,294
The Bull and The Cow Rocks SPA	486	3,694	6,388

Seasonal abundance and distribution

Site-specific surveys

1.5.1.228 Gannets were recorded within the Morgan Generation Assets study area in 22 of the 24 months of the baseline aerial survey programme. The highest populations occurred in both years towards the end of the breeding season into the post-breeding season with peak number in either August or September of both years. Outside of this period populations were generally lower, and the species was absent in the Morgan Generation Assets study area in the January and February 2023 surveys (Figure 1.22; Table 1.32).

1.5.1.229 The MRSea modelling for gannet is considered to have provided generally good predictions. There were only three surveys where there were more than 50 observations of gannets but in these surveys the model performed sufficiently well. Predicted confidence intervals are relatively tight, supporting confidence in predictions.

1.5.1.230 MRSea outputs were generated for three of the 24 months of survey, with these being months towards the end of the breeding season. The outputs suggest that there is a north and east bias in the distribution of gannet across the Morgan Generation Assets study area (Figure 1.23).

1.5.1.231 The peak population in the post-breeding season (September to November) occurred in September 2021. This population did not surpass the 1% threshold for regional importance (5,460 birds). In the pre-breeding season (December to March), the peak population was recorded in December 2021. This population did not surpass the 1% threshold of regional importance (6,619 birds). The peak population in the breeding season (March to September) was estimated in August 2021. This population did not surpass the 1% threshold of regional importance (3,600 birds).

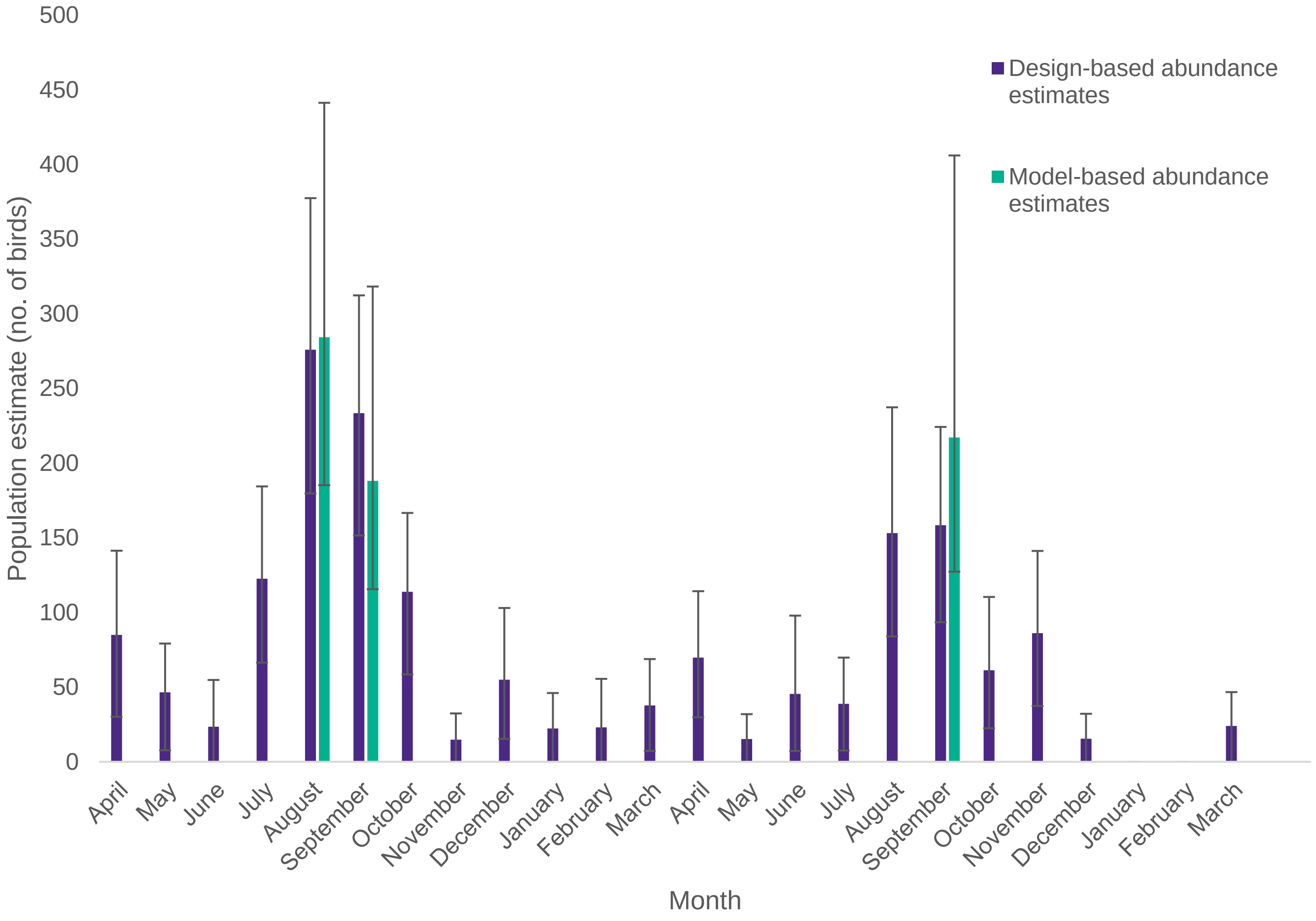

Figure 1.22: Abundance of gannet in the Morgan Generation Assets study area during site-specific aerial surveys (with 95% confidence intervals).

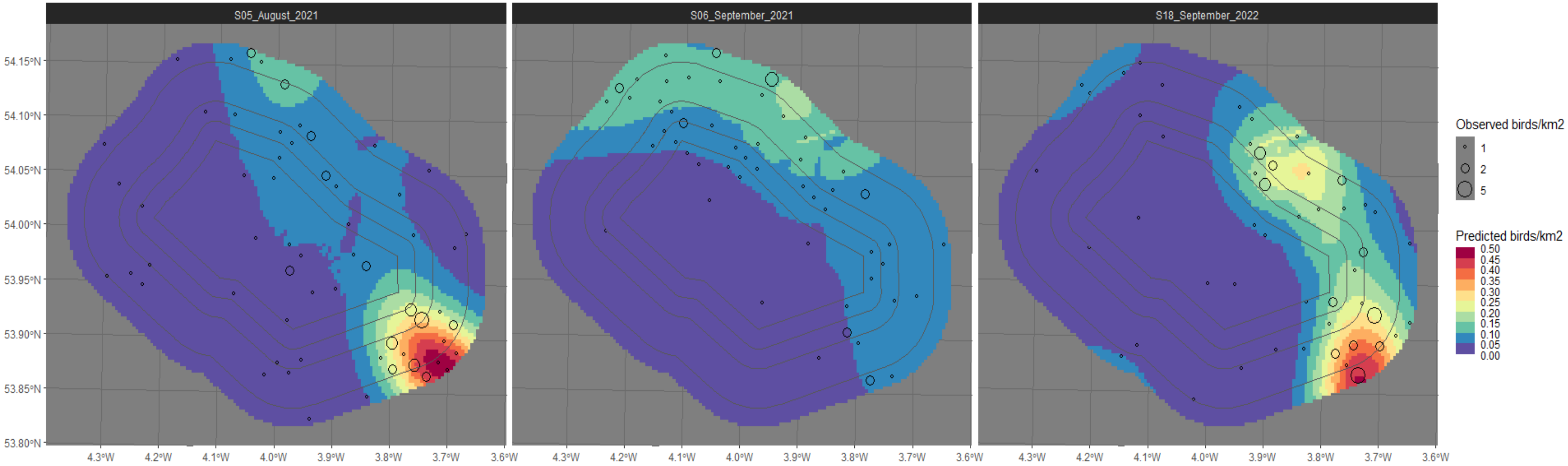

Figure 1.23: Predicted and observed gannet density across the Morgan Generation Assets study area (figures also show the array area, 2 and 8 km buffers). Only modelled surveys (surveys with > 50 birds observed) are shown.

Table 1.32: Design-based and model-based (all behaviour) population estimates with lower and upper (95%) confidence limits for each month surveyed from April 2021 to March 2023 for the Morgan Generation Assets study area for gannet.

Year	Month	Model-based population estimates			Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit	Mean	Lower confidence limit	Upper confidence limit
1	April	-	-	-	85	30	141
1	May	-	-	-	46	8	79
1	June	-	-	-	24	0	55
1	July	-	-	-	123	66	184
1	August	284	185	441	276	180	377
1	September	188	116	318	233	152	312
1	October	-	-	-	114	58	167
1	November	-	-	-	15	0	32
1	December	-	-	-	55	15	103
1	January	-	-	-	22	0	46
1	February	-	-	-	23	0	56
1	March	-	-	-	38	7	69
2	April	-	-	-	70	30	114
2	May	-	-	-	15	0	32
2	June	-	-	-	45	7	98
2	July	-	-	-	39	8	70
2	August	-	-	-	153	84	237
2	September	217	127	406	158	93	224
2	October	-	-	-	61	22	110

Year	Month	Model-based population estimates			Design-based population estimates		
		Mean	Lower confidence limit	Upper confidence limit	Mean	Lower confidence limit	Upper confidence limit
2	November	-	-	-	86	37	141
2	December	-	-	-	15	0	32
2	January	0	0	0	0	0	0
2	February	0	0	0	0	0	0
2	March	-	-	-	24	0	47

Regional survey data

1.5.1.232 The work by Waggitt *et al.* (2020), based on aerial and boat-based survey data collected between 1980 to 2018, indicated that gannet were found in the highest densities to the west of the Morgan Array Area during the breeding (March to September) and the non-breeding seasons (October to February) (Figure B.31 and Figure B.32).

Telemetry data

1.5.1.233 There is a long-term tracking study (2006 to date) of gannet at the Grassholm Colony (Pembrokeshire, Wales) whilst short term studies have been carried out at other colonies in the Irish Sea and the west coast of England (e.g. Ailsa Craig (Scotland), Great Saltee (County Wexford, Ireland) and Irelands Eye (County Dublin, Ireland) (BirdLife International, 2022)). According to Wakefield *et al.* (2013), gannet tracked from colonies around the British Isles forage in largely mutually exclusive areas. In the Irish Sea, Wakefield *et al.* (2013) showed that individuals from the Ailsa Craig colony were the most likely to be connected to the Morgan Array Area however, there was little, if any, overlap between foraging tracks from Ailsa Craig and the Morgan Generation Assets.

Behaviour and age class

1.5.1.234 A total of 564 individuals were aged during the site-specific aerial surveys. Of these, 540 were identified as adults and 24 as immatures of one or more (calendar) years old. Immature birds were recorded between May and September in both survey years.

1.5.1.235 Analysis of flight directions across the seasonal extents for the breeding season (full UK breeding season and migration-free breeding season) showed prevailing flight directions were similar with the majority observed flying in all compass directions between southeast and northwest (Figure 1.24). In the post-breeding season the prevailing flight direction was southeast with south the prevailing direction in the pre-breeding season (Figure 1.24).

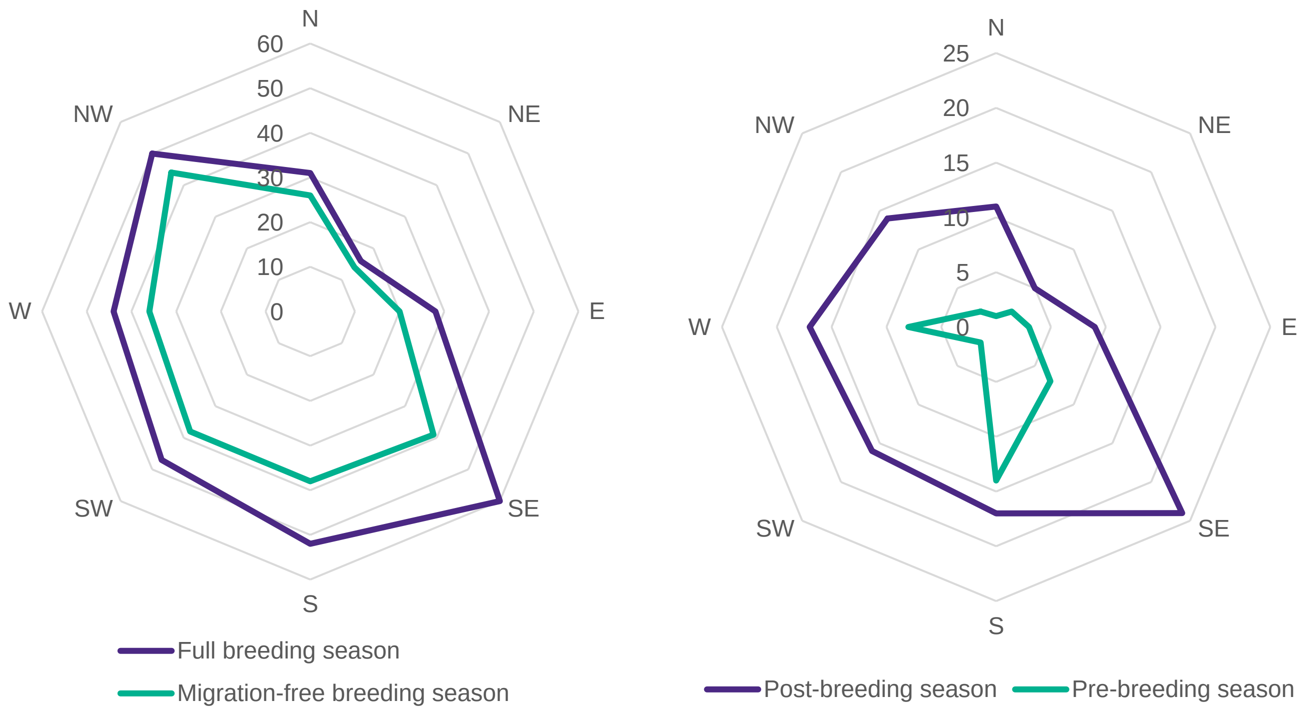

Figure 1.24: Flight directions of gannet as recorded during site-specific aerial surveys.

Conclusion

1.5.1.236 Gannet is considered to have an international conservation status due to the Morgan Generation Assets being within the foraging range of the species from multiple SPAs at which the species is designated as a breeding feature. Gannets were recorded in 22 of the baseline aerial surveys undertaken across the Morgan Generation Assets study area. The populations estimated in these surveys did not surpass the relevant thresholds for regional importance in any season. However, due to the international conservation value of the species, gannet is identified as a VOR and considered for further assessment in relation to impacts associated with the Morgan Generation Assets as a receptor with an International conservation value.

Cormorant *Phalacrocorax carbo*

Status overview

1.5.1.237 Cormorant is not listed under Annex I of the Birds Directive (2009/147/EEC) or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The species is currently green-listed on the UK Birds of Conservation Concern list (Stanbury *et al.*, 2021).

1.5.1.238 The UK population of cormorant is estimated 8,900 pairs with breeding locations found around the coasts of the UK and at inland locations (Woodward *et al.,* 2020; Balmer *et al.,* 2013). The population of the species increases to 64,500 individuals in the breeding season when it is supplemented by birds from the European subspecies *sinensis* (Woodward *et al.,* 2020; Furness, 2015).

1.5.1.239 The Morgan Generation Assets are not in the foraging range from any SPA at which cormorant is a qualifying feature. The Morgan Generation Assets are however within the foraging range of cormorant from the Douglas Bay MNR.

1.5.1.240 Wade *et al.* (2016) assessed cormorant as being at high risk of collision. Cormorant is considered to have a very low vulnerability to disturbance and displacement associated with structures but a high vulnerability to disturbance and displacement associated with vessels and helicopters. The species is considered to have moderate ability of the species to use alternative habitats. Maclean *et al.* (2009) assessed cormorant as being at high risk of barrier effects at offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.241 Cormorant was not recorded in the Morgan Generation Assets study area during the 24-month baseline aerial survey programme of the Morgan Generation Assets.

Regional survey data

1.5.1.242 Cormorant have a coastal distribution within the Irish Sea during both the breeding and non-breeding seasons with relatively low densities occurring along the English and Welsh coasts. The area in which the Morgan Generation Assets are located is of limited importance for the species in both the summer and winter (Figure B.33).

Conclusion

1.5.1.243 Cormorant is considered to have a Negligible conservation status due to the species being green-listed on the Birds of Conservation Concern (Stanbury *et al.,* 2021). Cormorant was not recorded during aerial surveys of the Morgan Generation Assets study area and regional surveys suggest limited, if any, birds will be present. The species is therefore considered to have a negligible population importance and therefore it is considered highly unlikely that impacts associated with the Morgan Generation Assets will occur on cormorant.

1.5.1.244 Cormorant is therefore not considered for further assessment in relation to impacts associated with the Morgan Generation Assets.

Shag *Phalacrocorax aristotelis*

Status overview

1.5.1.245 Shag is listed on Annex I of the Birds Directive (2009/147/EEC) and the species is currently red-listed on the UK Birds of Conservation Concern list (Stanbury *et al.*, 2021).

1.5.1.246 The UK breeding population of shag is estimated at 17,500 breeding pairs with breeding locations found around the coasts of Scotland, Northern Ireland, Wales and the southwest of England (Woodward *et al.,* 2020; Balmer *et al.,* 2013). In the non-breeding season, it is estimated that there are 110,000 individuals in UK waters with birds remaining close to their breeding colonies (Woodward *et al.,* 2020; Furness, 2015).

1.5.1.247 The Morgan Generation Assets are not in the foraging range from any SPA at which shag is a qualifying feature. The Morgan Generation Assets are however within the foraging range of cormorant from the Douglas Bay MNR and Laxey Bay MNR.

1.5.1.248 Wade *et al.* (2016) assessed shag as being at moderate risk of collision. Shag is considered to have a very low vulnerability to disturbance and displacement associated with structures but a high vulnerability to disturbance and displacement associated with vessels and helicopters. The species is considered to have moderate ability of the species to use alternative habitats. Maclean *et al.* (2009) assessed shag as being at high risk of barrier effects at offshore wind farms.

Seasonal abundance and distribution

Site-specific surveys

1.5.1.249 Shag was not recorded in the Morgan Generation Assets study area during the 24-month baseline aerial survey programme of the Morgan Generation Assets.

Regional survey data

1.5.1.250 Consistent with the site-specific surveys the density layers associated with Waggitt *et al.* (2020) show that densities of shag in the area occupied by the Morgan Generation Assets study area are negligible throughout the year (Figure B.34 and Figure B.35).

Telemetry data

1.5.1.251 There is a breeding colony of shag present on Puffin Island, to the southwest of the Morgan Generation Assets. The most recent population for the species on the island was 137 breeding pairs (JNCC *et al.,* 2023). Tracking data from Bird Life International indicates that these birds from this colony forage primarily within Conwy Bay or east along the North Wales coast. There is no connectivity between birds from the colony and the Morgan Generation Assets (BirdLife International, 2022).

Conclusion

1.5.1.252 Shag is considered to have a national conservation status due to the species inclusion on Annex I of the Birds Directive. Shag was not recorded during aerial surveys of the Morgan Generation Assets study area and regional surveys suggest limited, if any, birds will be present. The species is therefore considered to have a negligible population importance and therefore it is considered highly unlikely that impacts associated with the Morgan Generation Assets will occur on shag.

1.5.1.253 Shag is therefore not considered for further assessment in relation to impacts associated with the Morgan Generation Assets.

Other species

1.5.1.254 A number of other species were recorded during surveys of the Morgan Generation Assets survey area. These are identified in Table 1.33.

Table 1.33: Raw counts of other species recorded during baseline aerial surveys of the Morgan Generation Assets survey area.

Species	Survey	Raw count (no. of birds)
Shelduck	January 2023	3
Ringed plover	May 2022	13
Curlew	November 2022	4
Turnstone	May 2021	4
Ruff	August 2021	10
Chaffinch	November 2022	59

1.6 Identification of Valued Ornithological Receptors

1.6.1.1 Table 1.34 outlines the criteria used to determine the conservation value of all species relevant to the Morgan Generation Assets. The following species have been identified for consideration in the assessments to be undertaken for the Morgan Generation Assets:

- Kittiwake
- Little gull
- Great black-backed gull
- Herring gull
- Lesser black-backed gull
- Sandwich tern
- Little tern
- Roseate tern
- Common tern
- Arctic tern
- Great skua
- Arctic skua
- Guillemot
- Razorbill
- Puffin
- European storm petrel
- Leach’s petrel
- Fulmar
- Manx shearwater
- Gannet.

Table 1.34: Summary of the conservation importance and peak populations of all seabird species identified for consideration as part of the Morgan Generation Assets assessment in relation to relevant thresholds.

Species	Conservation status	SPA connectivity	Population importance in the breeding season	Population importance in the post-breeding/pre-breeding season	Population importance in the non-breeding season	Conservation value	Taken forward to impact assessment
Common scoter	Schedule 1	No	Negligible	N/A	Negligible	National	No – species not recorded during baseline aerial surveys
Kittiwake	Red-listed	Yes	Regional	Local	N/A	International	Yes - SPA connectivity. Breeding season population estimates of regional importance.
Black-headed gull	Amber-listed	No	Negligible	N/A	Negligible	Local	No – species not recorded during baseline aerial surveys
Little gull	Annex I and Schedule 1	No	Negligible	N/A	Regional	National	Yes – non-breeding season populations of regional importance
Common gull	Amber-listed	No	Local	N/A	Local	Local	No - peak estimates did not surpass population importance thresholds

Species	Conservation status	SPA connectivity	Population importance in the breeding season	Population importance in the post-breeding/pre-breeding season	Population importance in the non-breeding season	Conservation value	Taken forward to impact assessment
Mediterranean gull	Annex I and Schedule 1	No	Local	N/A	Local	National	No - peak estimates did not surpass population importance thresholds
Great black-backed gull	Amber-listed	No	Regional	N/A	Regional	Regional	Yes – breeding and non-breeding season populations of regional importance
Herring gull	Red-listed	Yes	Regional	N/A	Local	International	Yes - SPA connectivity. Breeding season population estimates of regional importance.
Lesser black-backed gull	Amber-listed	Yes	Local	Local	Local	International	Yes – SPA connectivity
Sandwich tern	Annex I	No	Negligible	Negligible	N/A	National	Yes – migratory species
Little tern	Annex I and Schedule 1	No	Negligible	Negligible	N/A	National	Yes – migratory species
Roseate tern	Annex I and Schedule 1	No	Negligible	Negligible	N/A	National	Yes – migratory species

Species	Conservation status	SPA connectivity	Population importance in the breeding season	Population importance in the post-breeding/pre-breeding season	Population importance in the non-breeding season	Conservation value	Taken forward to impact assessment
Common tern	Annex I	No	Local	Negligible	N/A	National	Yes – migratory species
Arctic tern	Annex I	No	Negligible	Local	N/A	National	Yes – migratory species
Great skua	Amber-listed	Yes	Negligible	Local	N/A	International	Yes – migratory species
Arctic skua	Red-listed	No	Negligible	Local	N/A	Regional	Yes – migratory species
Guillemot	Amber-listed	No	Regional	N/A	Local	Regional	Yes - Breeding season population estimates of regional importance
Razorbill	Amber-listed	No	Regional	N/A	Local	Regional	Yes - Breeding season population estimates of regional importance
Puffin	Red-listed	Yes	Local	N/A	Local	International	Yes – SPA connectivity
Red-throated diver	Annex I and Schedule 1	No	Negligible	Negligible	Negligible	National	No – species not recorded during baseline aerial surveys
European storm petrel	Annex I	Yes	Negligible	Negligible	Negligible	National	Yes – migratory species

Species	Conservation status	SPA connectivity	Population importance in the breeding season	Population importance in the post-breeding/pre-breeding season	Population importance in the non-breeding season	Conservation value	Taken forward to impact assessment
Leach’s petrel	Annex I and Schedule 1	Yes	Negligible	Negligible	Negligible	National	Yes – migratory species
Fulmar	Amber-listed	Yes	Local	Local	Local	International	Yes – SPA connectivity
Manx shearwater	Amber-listed	Yes	Local	Local	N/A	International	Yes – SPA connectivity
Gannet	Amber-listed	Yes	Local	Local	N/A	International	Yes – SPA connectivity
Cormorant	Green-listed	No	Negligible	Negligible	Negligible	Negligible	No – species not recorded during baseline aerial surveys
Shag	Annex I	No	Negligible	Negligible	Negligible	National	No – species not recorded during baseline aerial surveys

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Appendix A: Raw count data

Table A.1: Raw count data for the Morgan Offshore Ornithology survey area between April 2021 and March 2022.

Species	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22
Arctic Skua												
Arctic Tern												
Auk species		8			1	7	3		5	4	1	7
Auk/Shearwater species	22	8	3	3	5	3					4	
Black-backed Gull species	1								2			
Black-headed Gull												
Chaffinch												
Commic Tern			1		1	1						
Commic/Roseate Tern												
Common Gull	1						5	1	7	6		
Common Tern		12										
Cormorant												
Cormorant/Shag												
Curlew												
European Storm Petrel												
Fulmar	6	4	4	2	4	7			1	18	4	8
Fulmar/Gull species												

Species	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22
Gannet	39	64	16	41	84	64	29	7	10	5	12	14
Great Black-backed Gull		2			18	4			1	28	12	11
Great Skua					1		1					
Guillemot	1223	610	188	260	564	749	801	196	636	464	303	781
Guillemot/Razorbill	84	52	14	6	9	65	83	71	303	120	394	269
Gull species	1	8	1		1	1		1		1	1	
Herring Gull	7	4	5		12	4		2	17	75	4	16
Kittiwake	150	114	26	7	60	48	179	64	423	276	120	281
Large Gull species	14				8			1		5		2
Lesser Black-backed Gull	4	2			21	41				1	3	2
Little Gull	1									4		
Manx Shearwater	65	18	94	149	262	73					1	
Mediterranean Gull												
Puffin	2	12		1					1			
Razorbill	28	16	15			16	30	37	292	99	26	54
Ringed Plover												
Ruff					10							
Shearwater species						1						
Shelduck												
Small Gull species	1	4						1	2			
Small Shearwater species												
Tern species	1	4		1		2						

Species	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22
Thrush species								18				
Turnstone		8										
Unidentified Bird species		2		1	3	1	1	2		1	1	
Wader species	1											

Table A.2: Raw count data for the Morgan Offshore Ornithology survey area between April 2021 and March 2022.

Species	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23
Arctic Skua						1						1
Arctic Tern					3							3
Auk species				3	2	3	2	10	6	16	1	87
Auk/Shearwater species		2	2	1	6	9		1				69
Black-backed Gull species			1						2		3	9
Black-headed Gull			1							2	1	4
Chaffinch								59				59
Commic Tern					5							8
Commic/Roseate Tern			1			1						2
Common Gull								2	28	16		72
Common Tern												12
Cormorant					1					1		2
Cormorant/Shag				1								1

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Species	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23
Curlew								4				4
European Storm Petrel						2						2
Fulmar	9	3	1	1			2	28	28	21	12	178
Fulmar/Gull species										6		10
Gannet	30	16	10	17	42	75	33	13	8			642
Great Black-backed Gull		5			2	1			46	12	11	161
Great Skua												2
Guillemot	620	129	396	276	1260	1629	103	198	632	434	346	13534
Guillemot/Razorbill	17	1	11	4	3	30	267	180	310	96	46	2659
Gull species												20
Herring Gull	27	6	1				3	12	68	12	26	367
Kittiwake	231	18	37	15	25	150	30	272	380	59	97	3318
Large Gull species	1				2			1			1	35
Lesser Black-backed Gull	6	3	3		10	1		1			1	101
Little Gull										23		28
Manx Shearwater		11	116	66	576	751						2182
Mediterranean Gull										1		1
Puffin			4			1				1		22
Razorbill		1	6			8	65	99	688	98	69	1696

Species	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23
Ringed Plover		13										13
Ruff												10
Shearwater species												1
Shelduck										3		3
Small Gull species									4	8	3	25
Small Shearwater species			61		78	93						232
Tern species		6										14
Thrush species												18
Turnstone												8
Unidentified Bird species				1		2		1	4	8		28
Wader species		3	2			1						7

Appendix B: Regional distribution maps

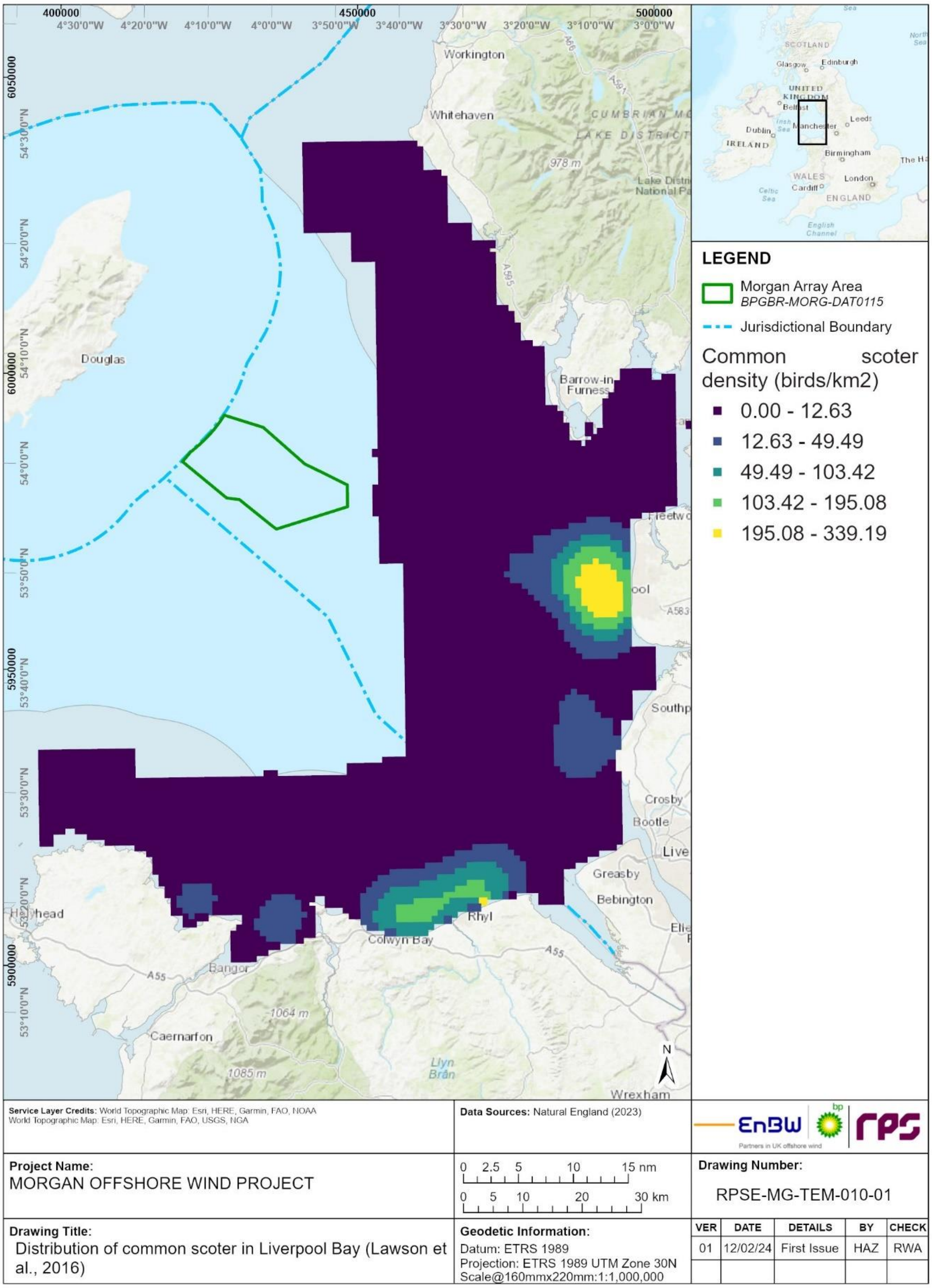
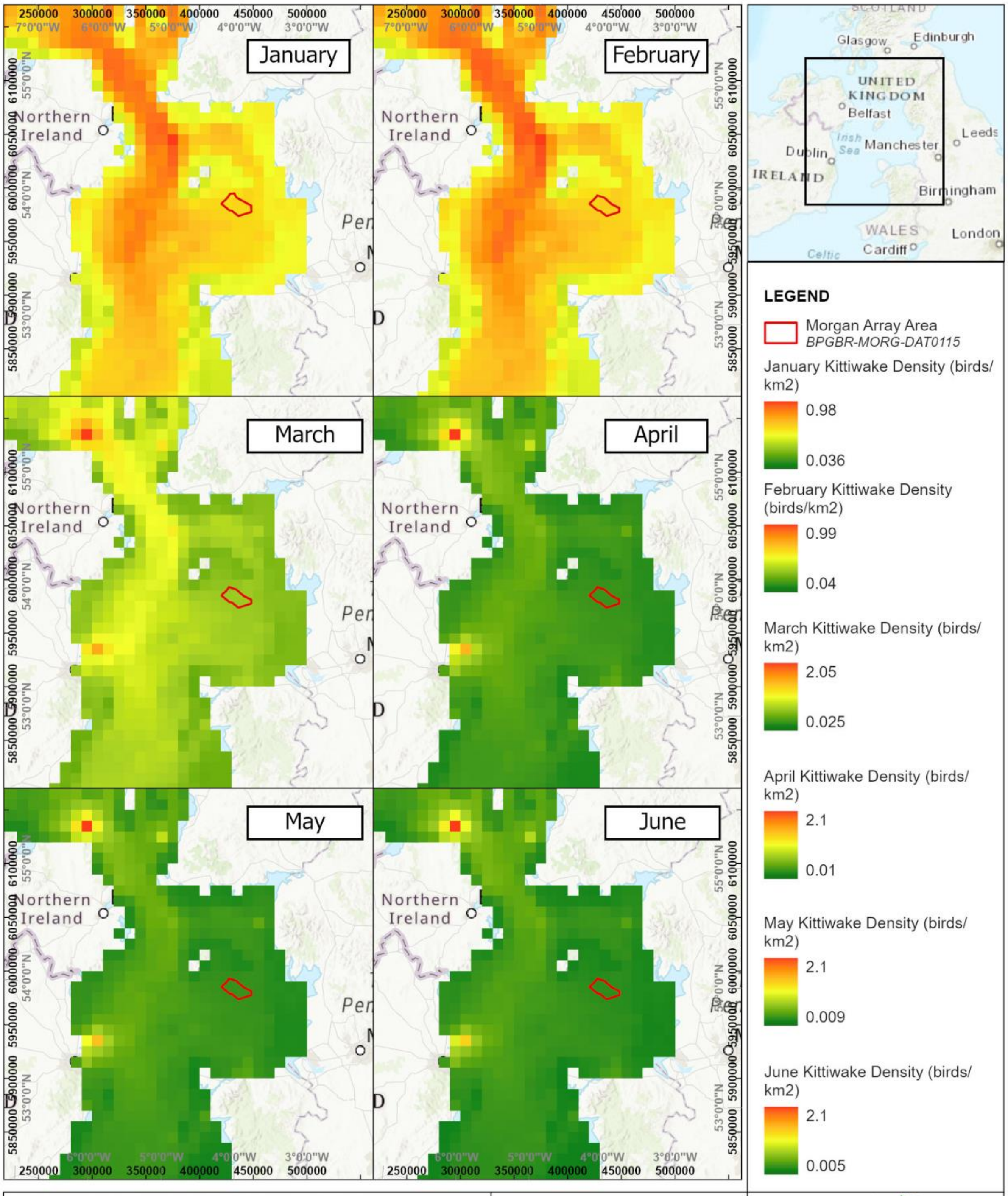


Figure B.1: Regional distribution for common scoter in Liverpool Bay. Density data from Lawson *et al.* (2016).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

EnBW bp rps
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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

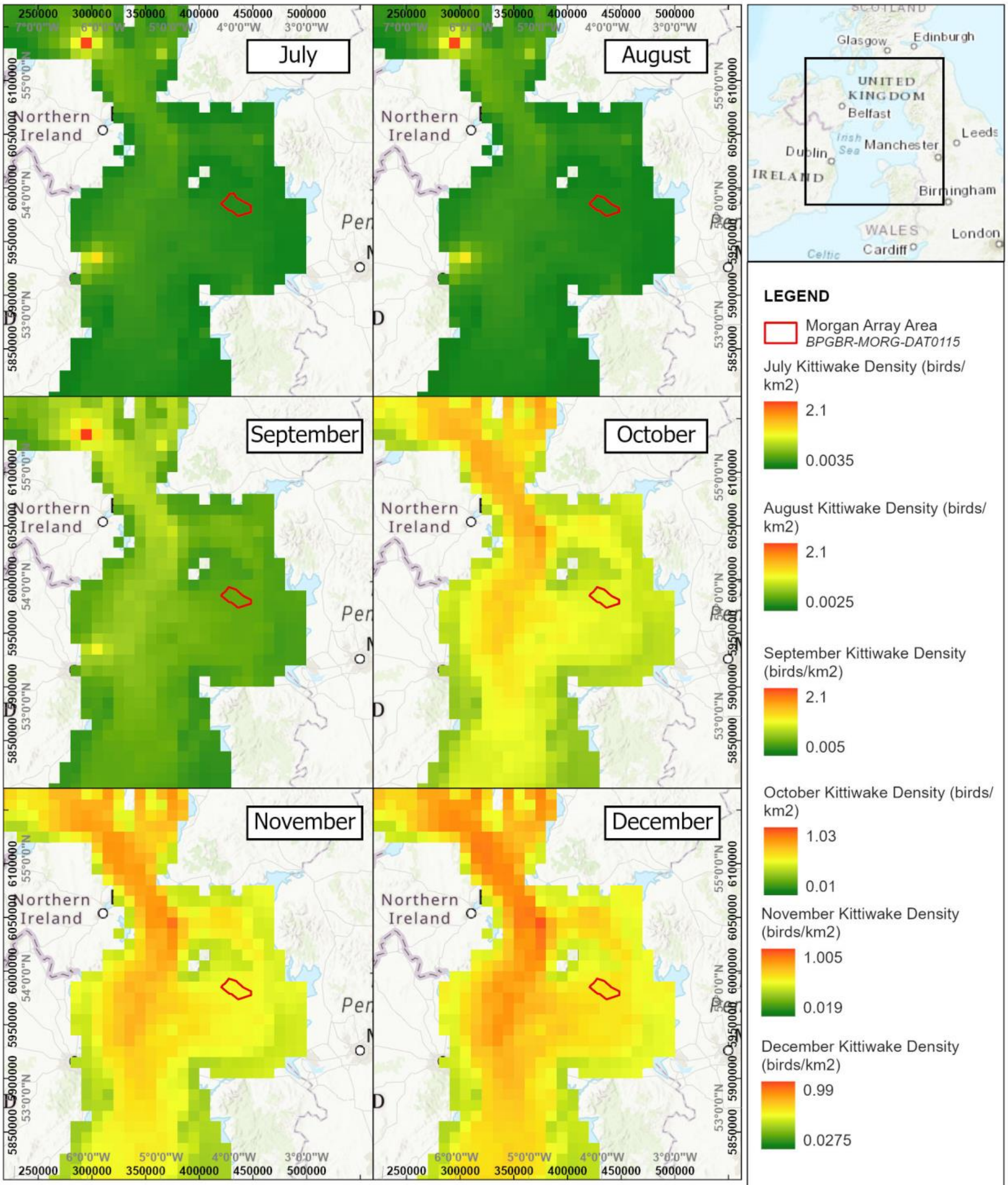
Drawing Number:
NIRA-MG-ORN-A001-02

Drawing Title:
Distribution of Kittiwake in the Irish Sea Between January and June (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.2: Regional distribution for kittiwake between January and June. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

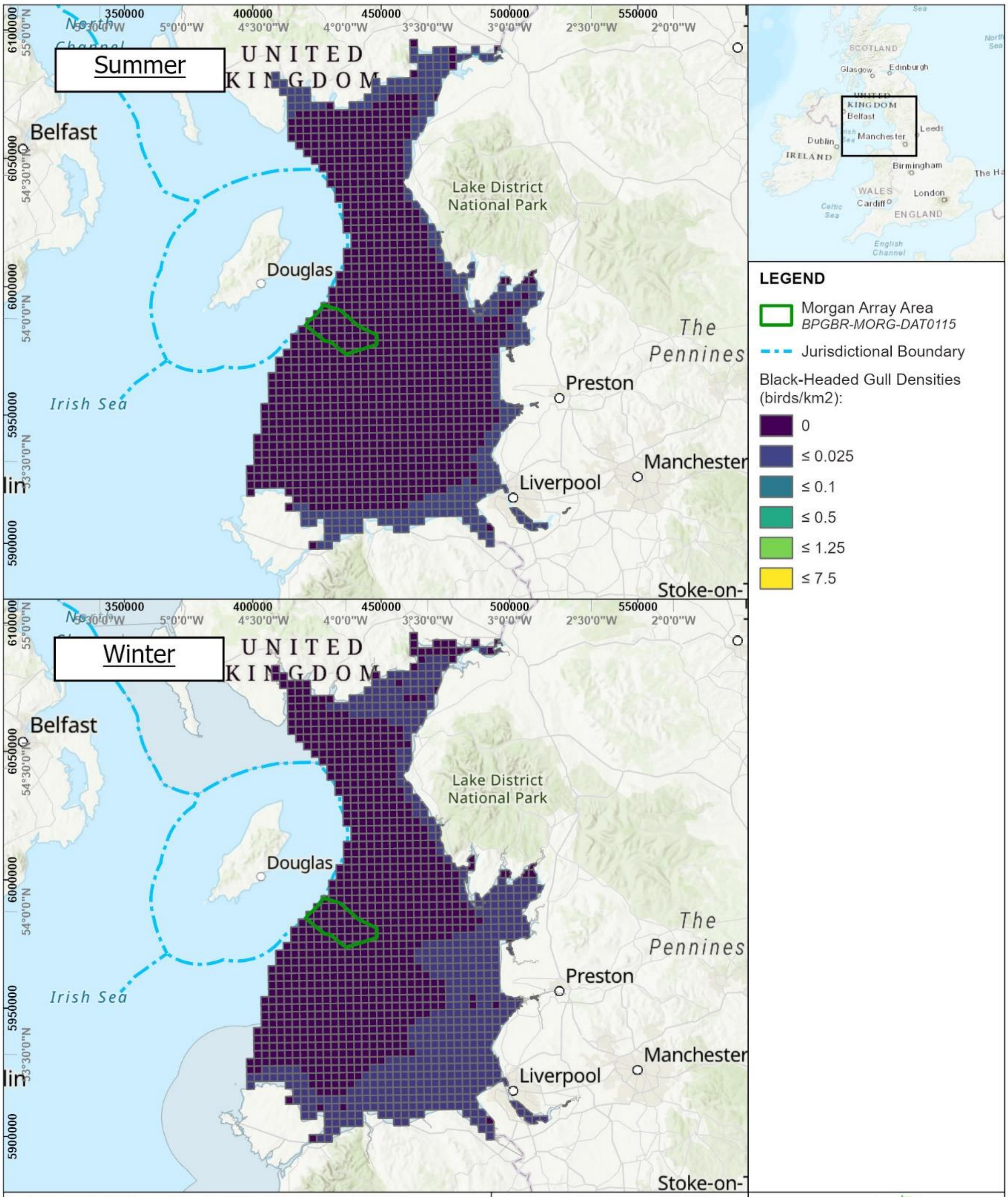
Drawing Number:
NIRA-MG-ORN-A002-02

Drawing Title:
Distribution of Kittiwake in the Irish Sea Between July and December (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.3: Regional distribution for kittiwake between July and December. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri, HERE, Garmin, FAO, NOAA
World Hillshade: Esri, USGS

Data Sources: RPS, Bradbury et al. (2014)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 5 10 20 30 40 nm
0 10 20 40 60 80 km

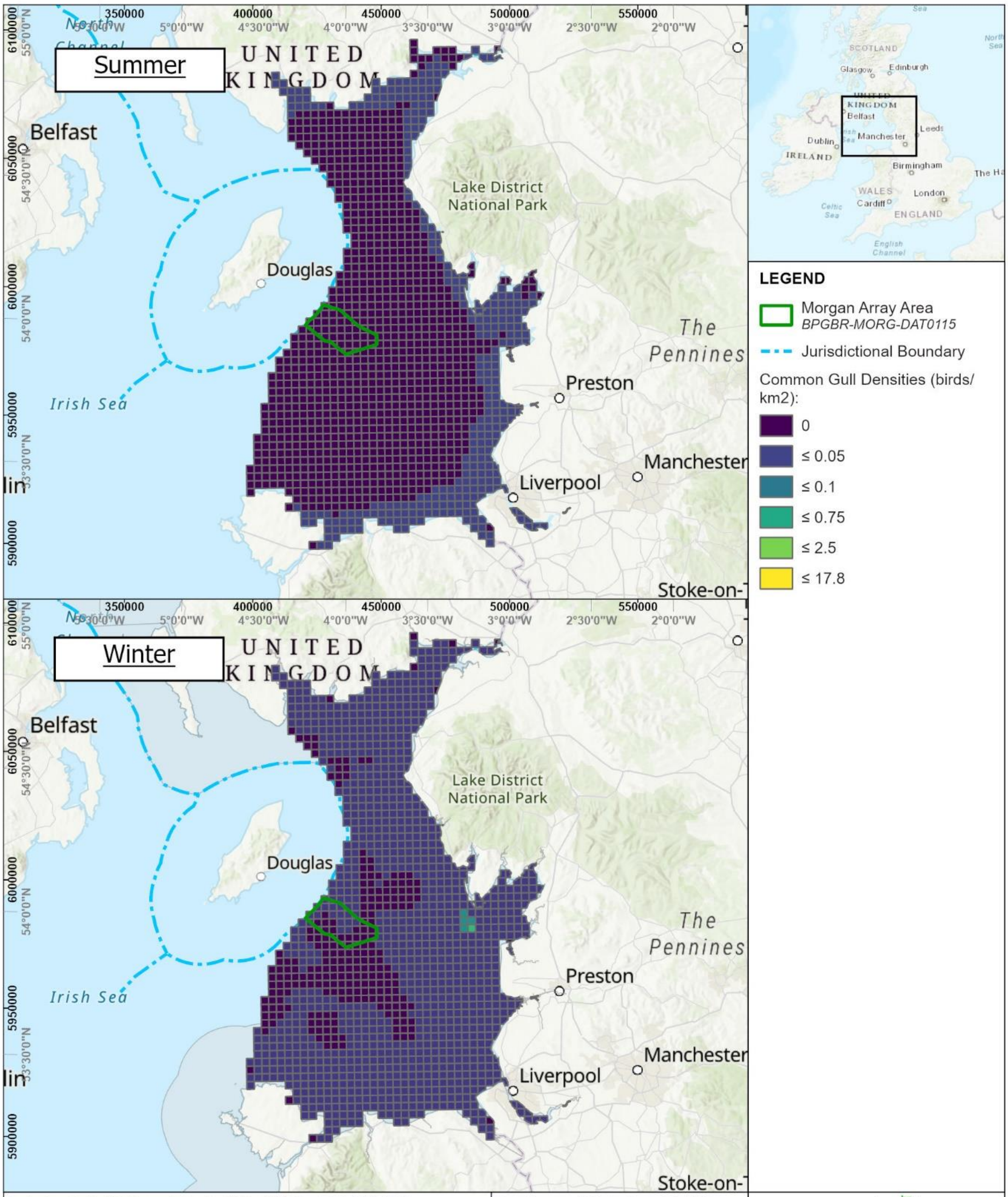
Drawing Number:
NIRA-MG-ORN-B001-02

Drawing Title:
Distribution of Black-Headed Gull in the Irish Sea Between Summer and Winter (Bradbury et al., 2014)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:2,500,000

VER	DATE	DETAILS	BY	CHECK
02	20/10/23	2nd Rev	JOSW	HAZ

Figure B.4: Regional distribution for black-headed gull in summer and winter. Density data from Bradbury *et al.* (2014).



Service Layer Credits: World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri, HERE, Garmin, FAO, NOAA
World Hillshade: Esri, USGS

Data Sources: RPS, Bradbury et al. (2014)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 5 10 20 30 40 nm
0 10 20 40 60 80 km

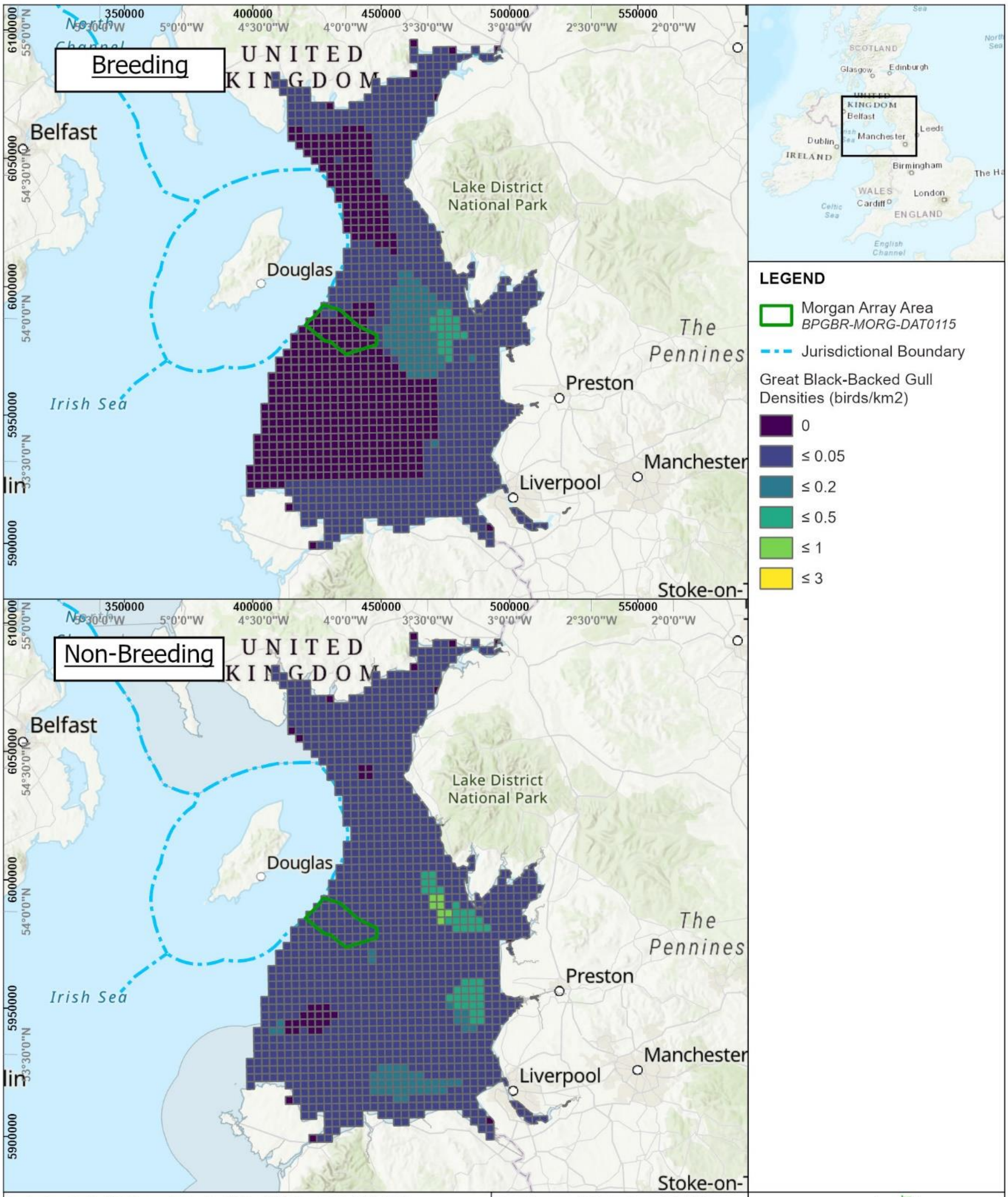
Drawing Number:
NIRA-MG-ORN-B002-02

Drawing Title:
Distribution of Common Gull in the Irish Sea Between Summer and Winter (Bradbury et al., 2014)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:2,500,000

VER	DATE	DETAILS	BY	CHECK
02	20/10/23	2nd Rev	JOSW	HAZ

Figure B.5: Regional distribution for common gull in summer and winter. Density data from Bradbury *et al.* (2014).



Service Layer Credits: World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri, HERE, Garmin, FAO, NOAA
World Hillshade: Esri, USGS

Data Sources: RPS, Bradbury et al. (2014)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 5 10 20 30 40 nm
0 10 20 40 60 80 km

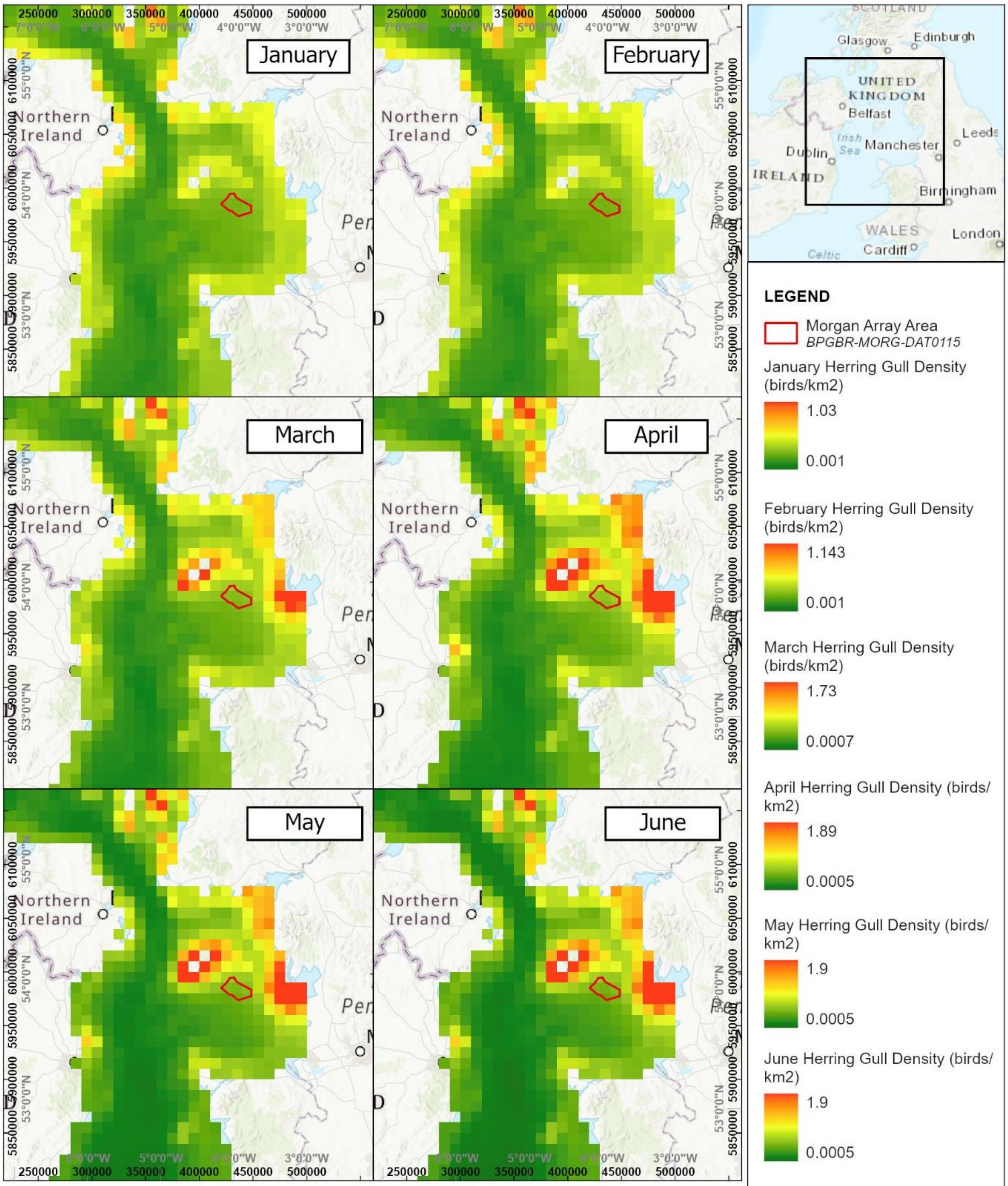
Drawing Number:
NIRA-MG-ORN-B003-02

Drawing Title:
Distribution of Great Black-Backed Gull in the Irish Sea Between Breeding and Non-Breeding Seasons (Bradbury et al., 2014)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:2,500,000

VER	DATE	DETAILS	BY	CHECK
02	20/10/23	2nd Rev	JOSW	HAZ

Figure B.6: Regional distribution for great black-backed gull in summer and winter. Density data from Bradbury *et al.* (2014).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

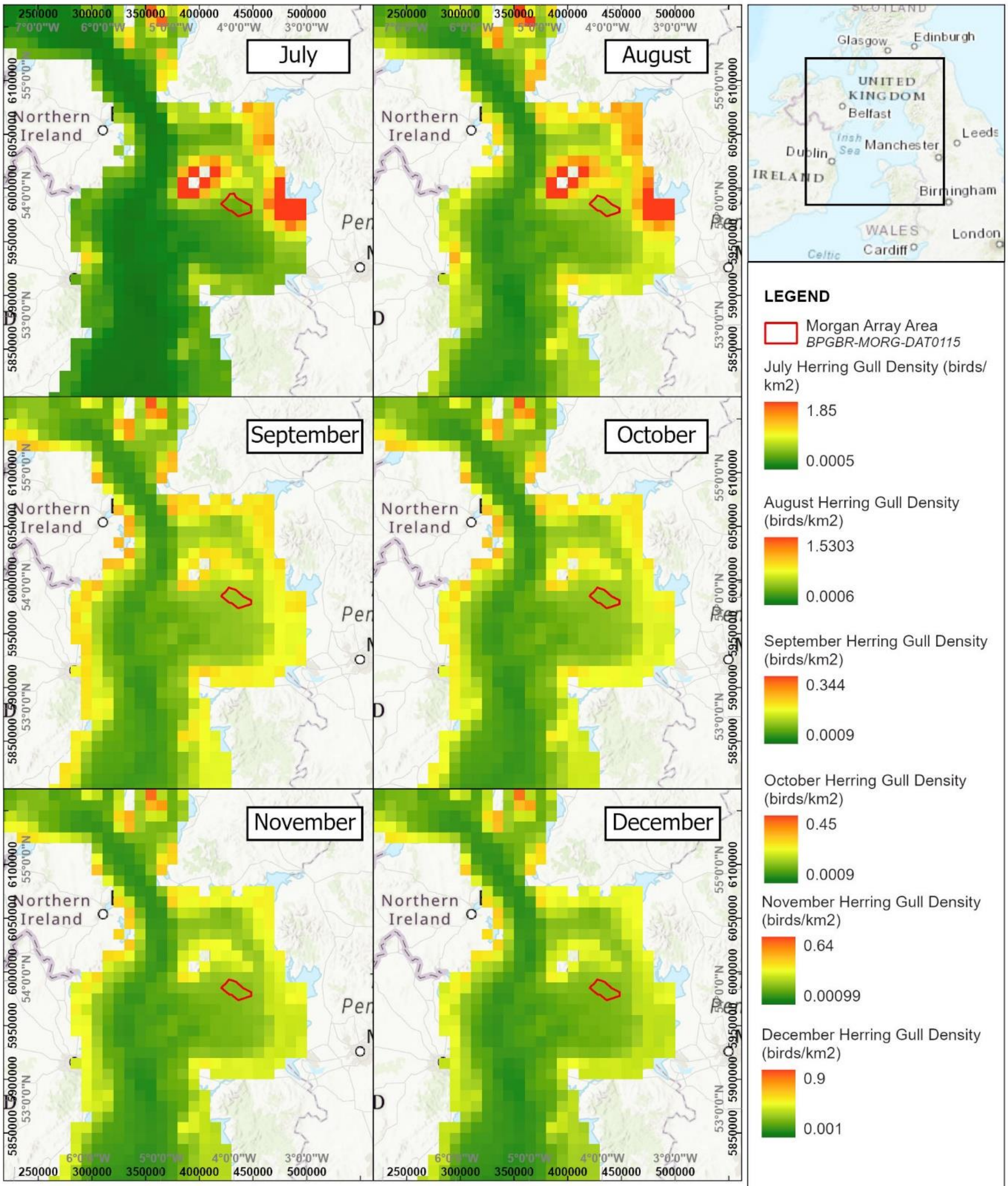
Drawing Number:
NIRA-MG-ORN-A017-02

Drawing Title:
Distribution of Herring Gull in the Irish Sea Between January and June (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.7: Regional distribution for herring gull between January and June. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

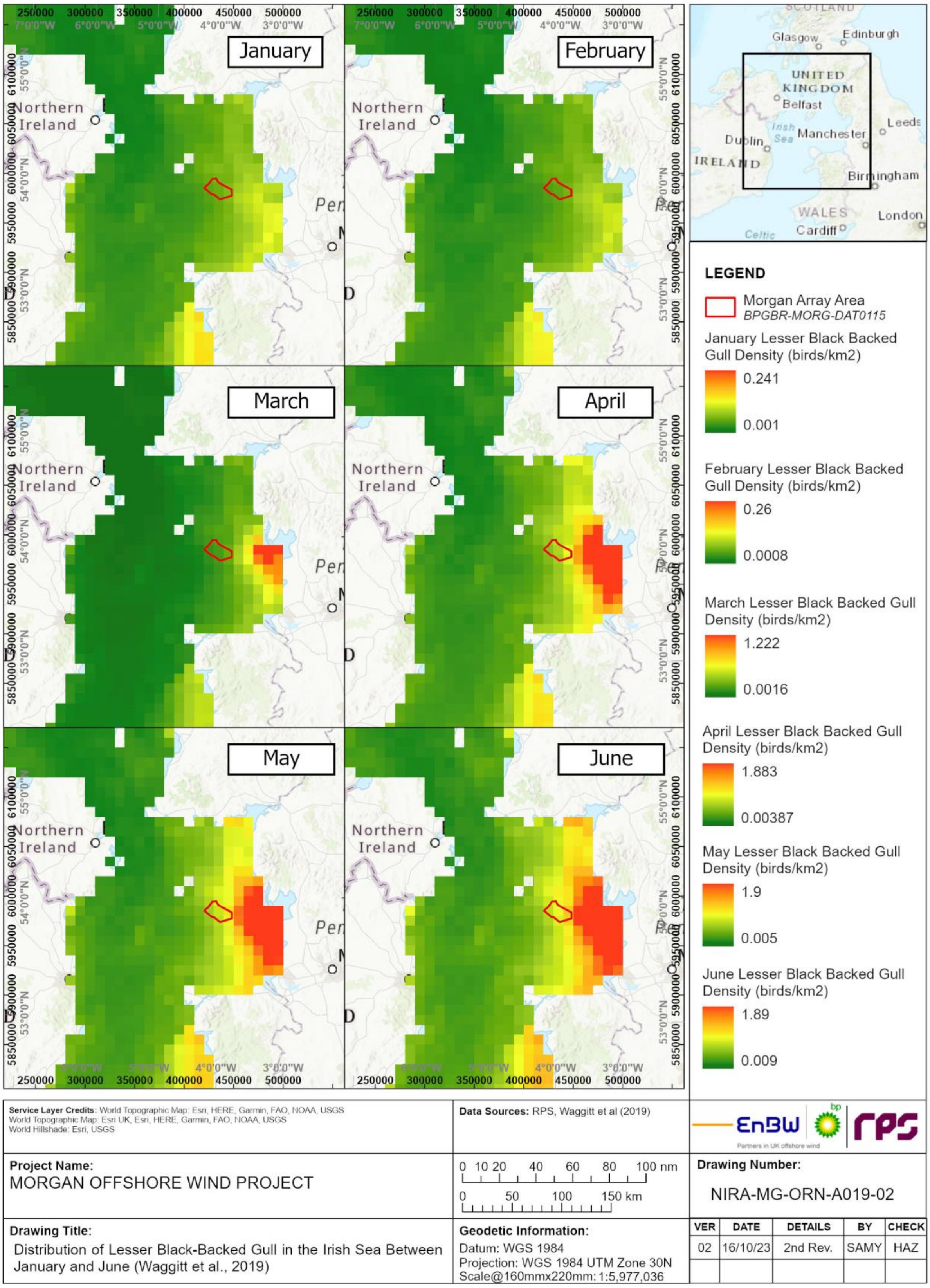
Drawing Number:
NIRA-MG-ORN-A018-02

Drawing Title:
Distribution of Herring Gull in the Irish Sea Between July and December (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.8: Regional distribution for herring gull between July and December. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

Project Name:
MORGAN OFFSHORE WIND PROJECT

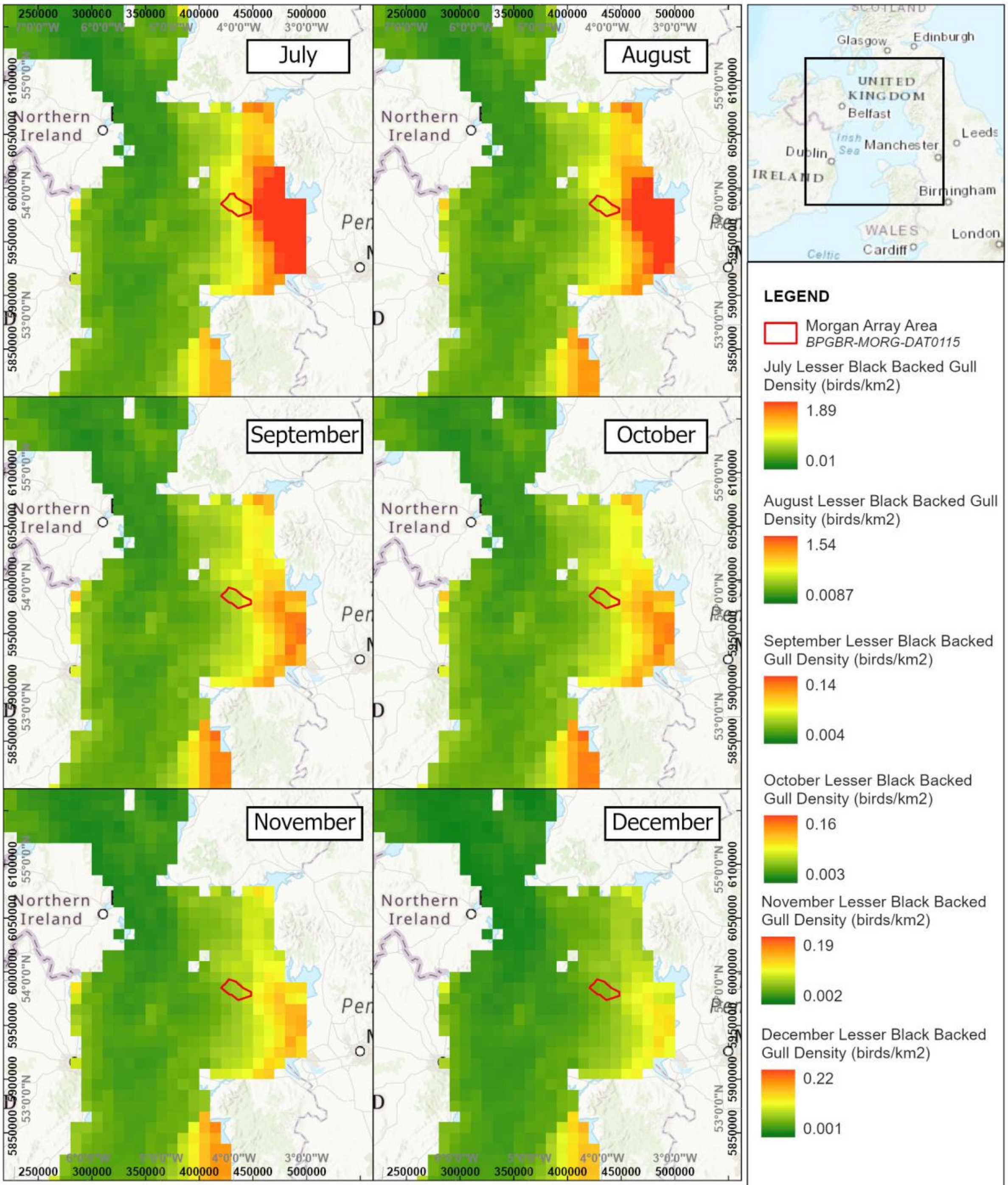
Drawing Number:
NIRA-MG-ORN-A019-02

Drawing Title:
Distribution of Lesser Black-Backed Gull in the Irish Sea Between January and June (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.9: Regional distribution for lesser black-backed gull between January and June. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

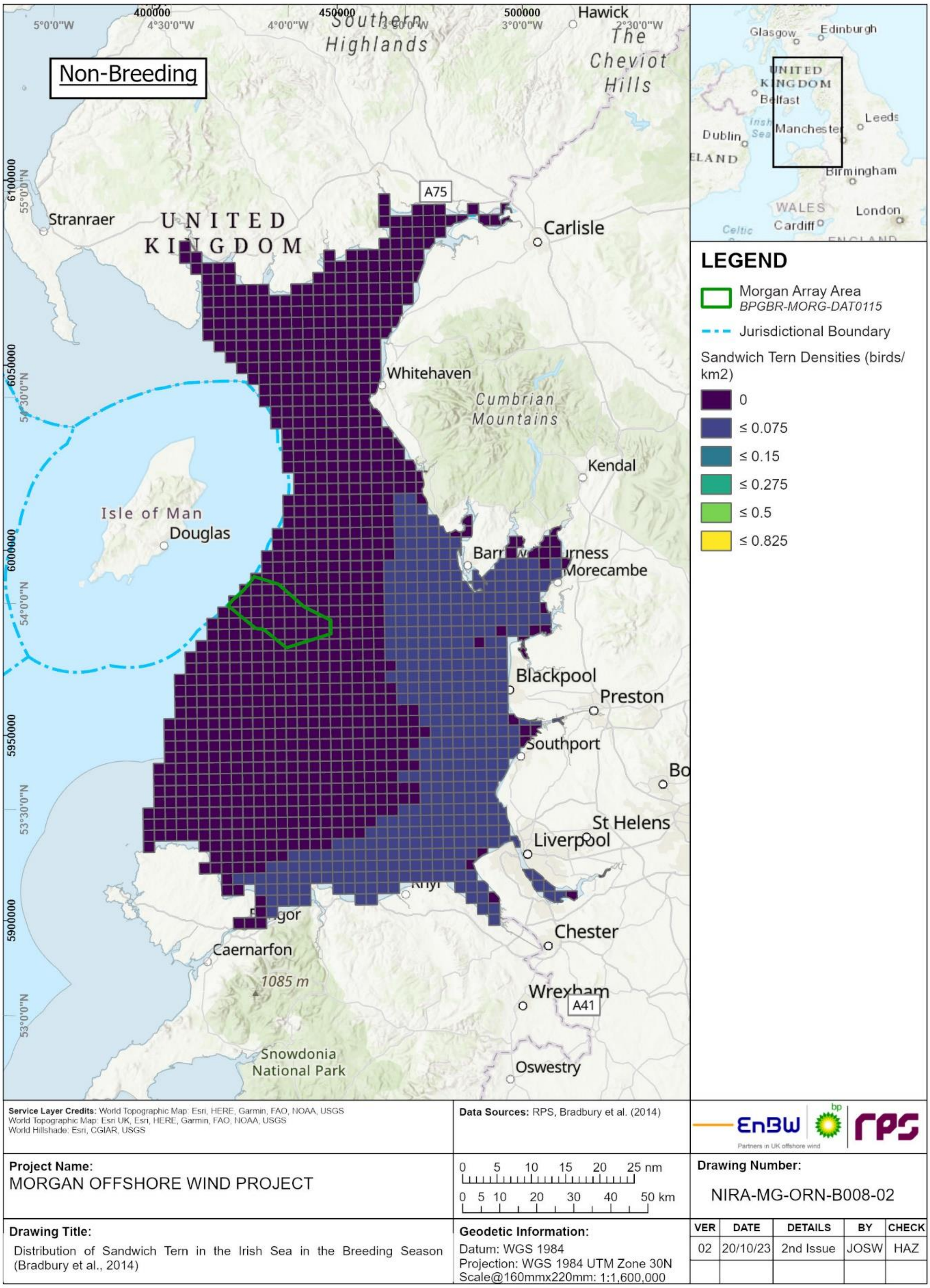
Drawing Number:
NIRA-MG-ORN-A020-02

Drawing Title:
Distribution of Lesser Black-Backed Gull in the Irish Sea Between July and December (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.10: Regional distribution for lesser black-backed gull between July and December. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, CGIAR, USGS

Data Sources: RPS, Bradbury et al. (2014)

Project Name:
MORGAN OFFSHORE WIND PROJECT

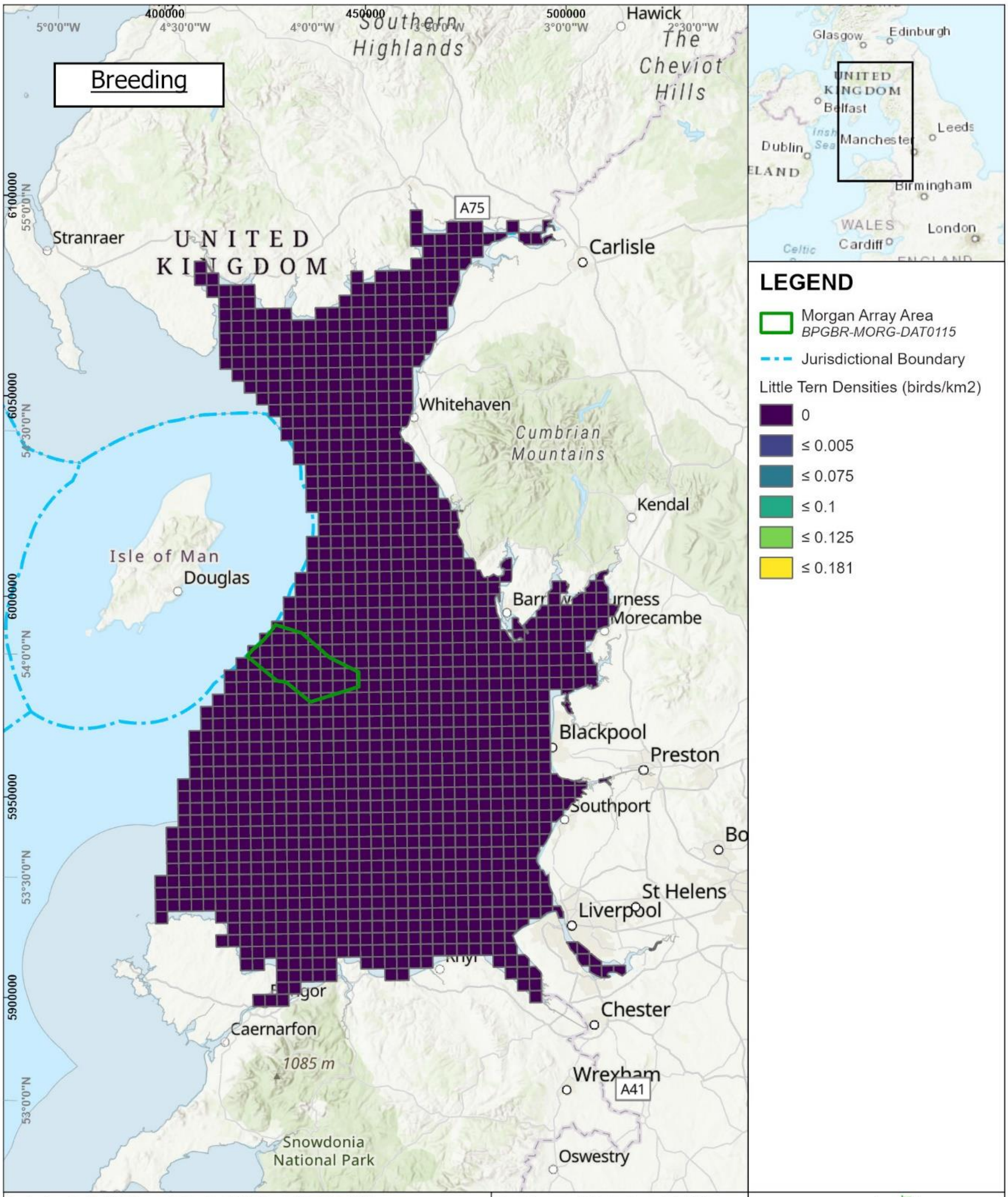
Drawing Number:
NIRA-MG-ORN-B008-02

Drawing Title:
Distribution of Sandwich Tern in the Irish Sea in the Breeding Season (Bradbury et al., 2014)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:1,600,000

VER	DATE	DETAILS	BY	CHECK
02	20/10/23	2nd Issue	JOSW	HAZ

Figure B.11: **Regional distribution for Sandwich tern in summer only. Density data from Bradbury *et al.* (2014).**



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, CGIAR, USGS

Data Sources: RPS, Bradbury et al. (2014)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 5 10 15 20 25 nm
0 5 10 20 30 40 50 km

Drawing Number:
NIRA-MG-ORN-B009-02

Drawing Title:
Distribution of Little Tern in the Irish Sea in the Breeding Season (Bradbury et al., 2014)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:1,600,000

VER	DATE	DETAILS	BY	CHECK
02	20/10/23	2nd Issue	JOSW	HAZ

Figure B.12: Regional distribution for little tern in summer only. Density data from Bradbury *et al.* (2014).

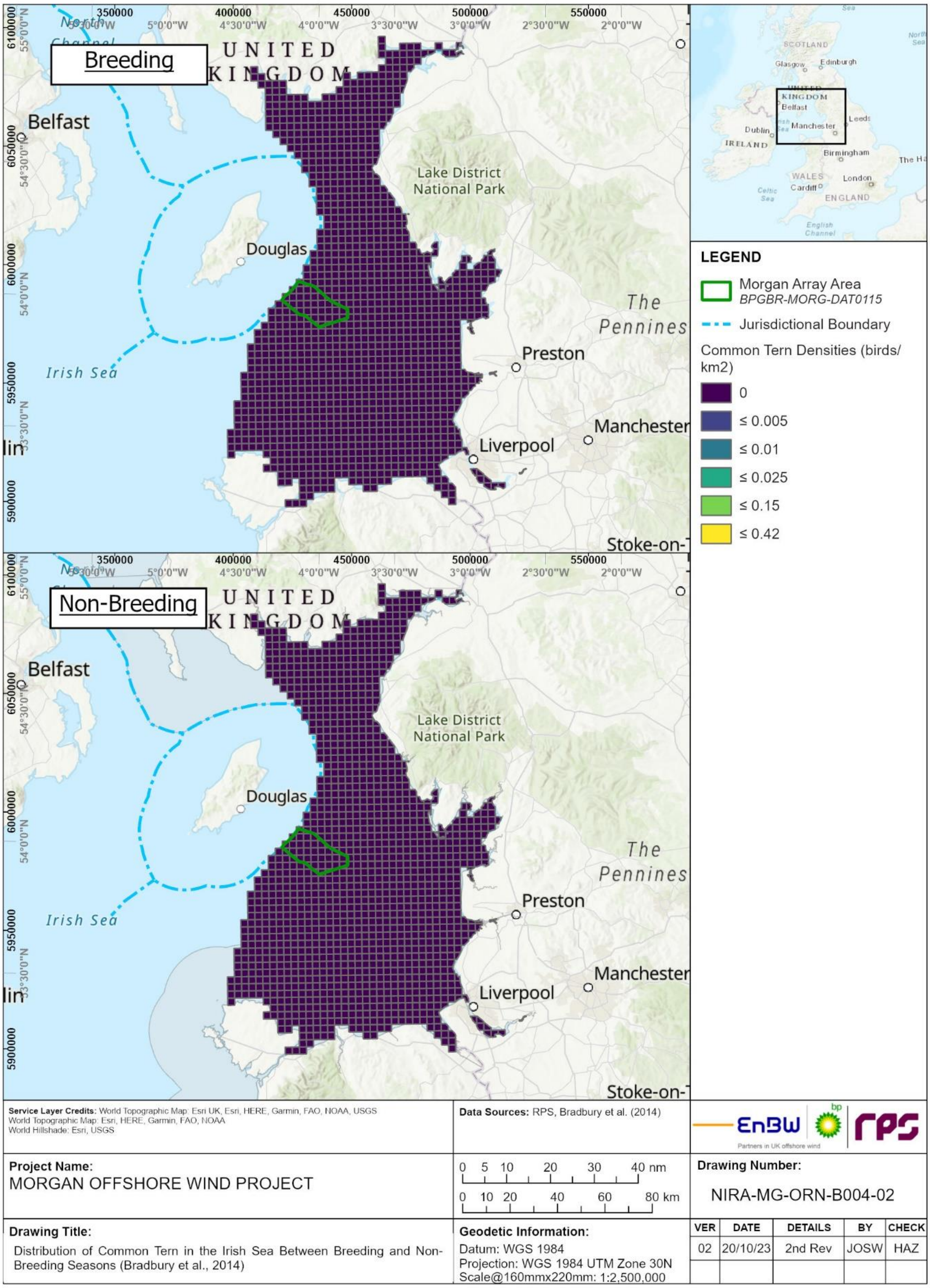
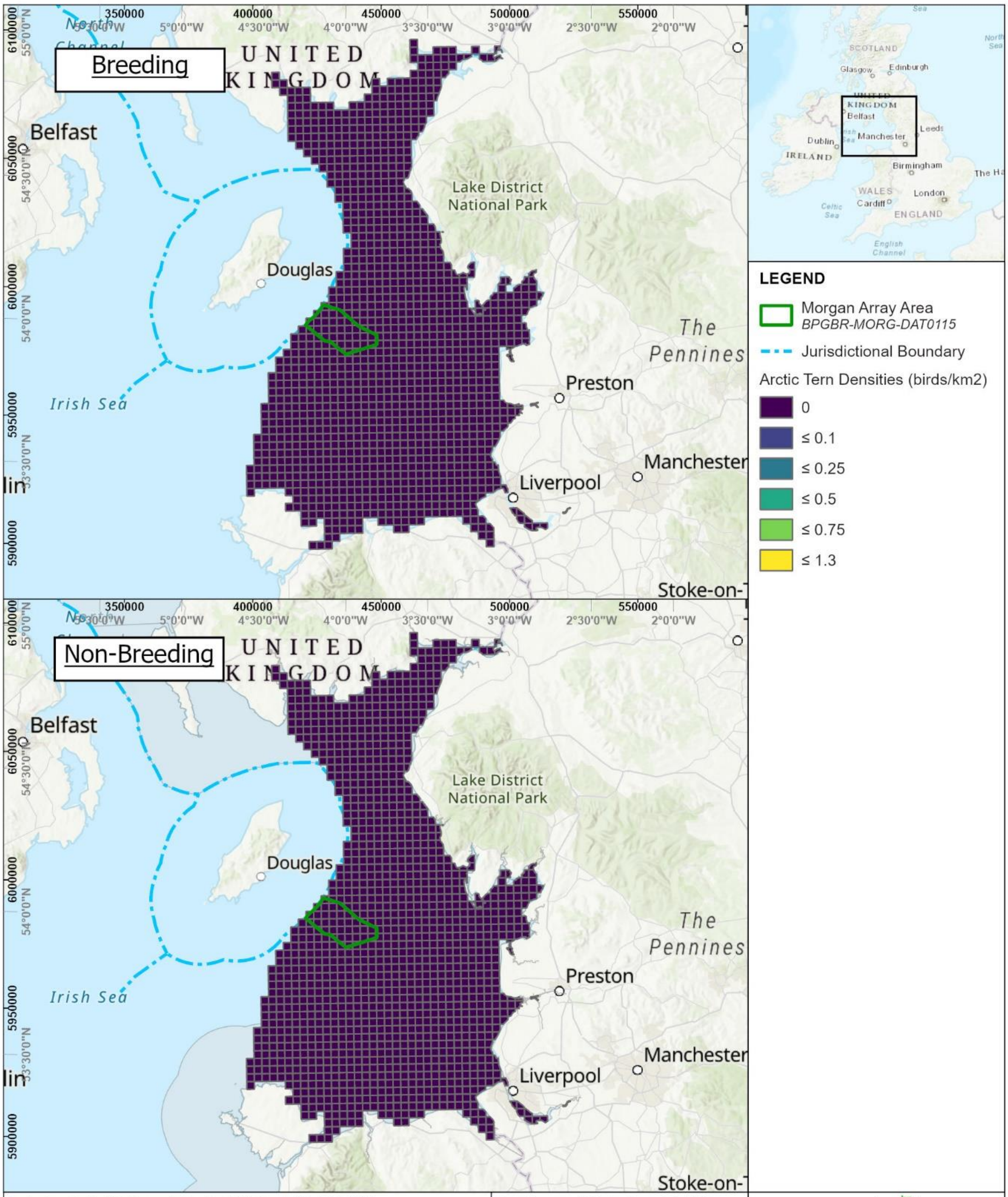


Figure B.13: Regional distribution for common tern in summer and winter. Density data from Bradbury *et al.* (2014).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Bradbury et al. (2014)

Project Name:
MORGAN OFFSHORE WIND PROJECT

0 5 10 20 30 40 nm
0 10 20 40 60 80 km

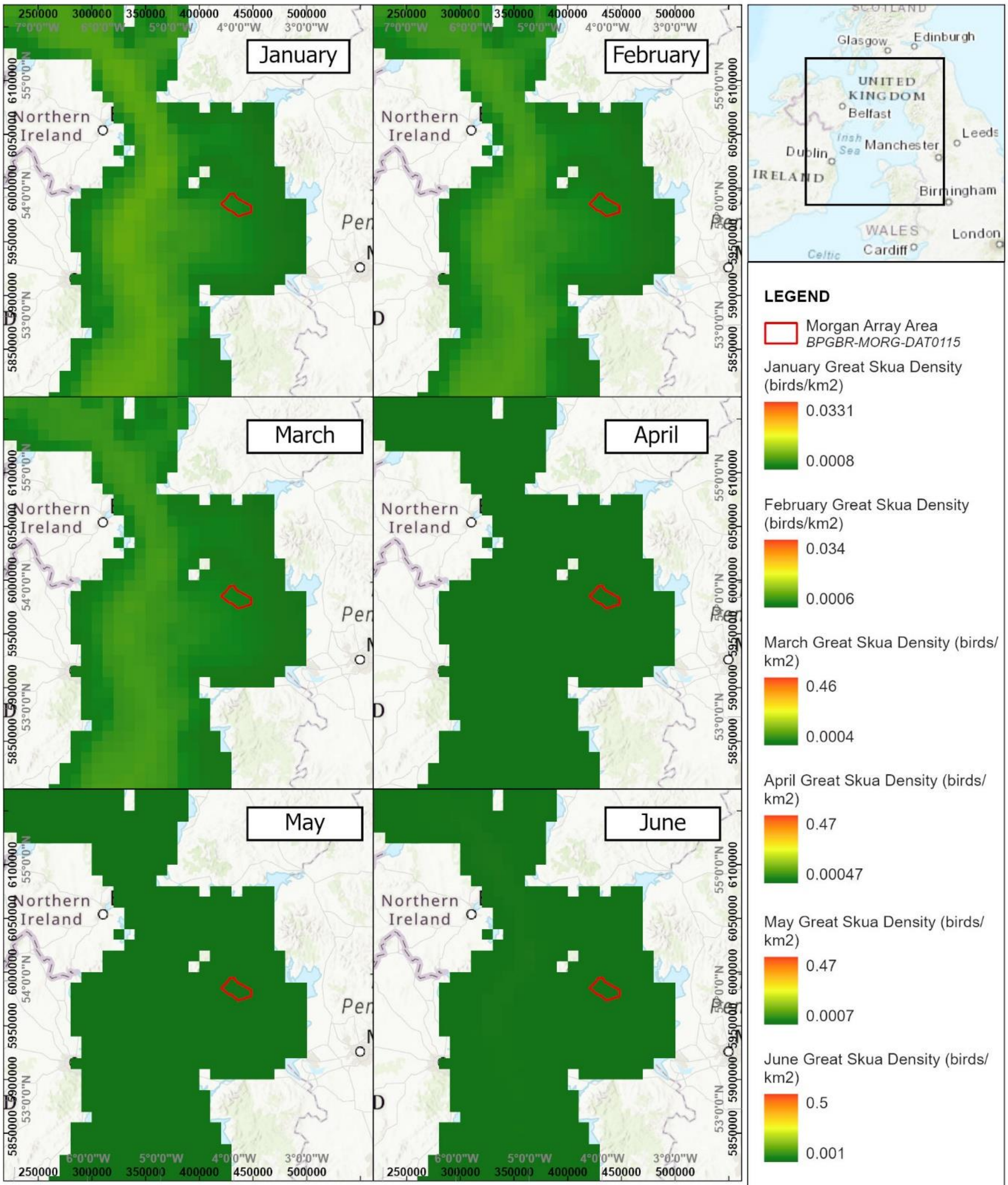
Drawing Number:
NIRA-MG-ORN-B005-02

Drawing Title:
Distribution of Arctic Tern in the Irish Sea Between Breeding and Non-Breeding Seasons (Bradbury et al., 2014)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:2,500,000

VER	DATE	DETAILS	BY	CHECK
02	20/10/23	2nd Rev	JOSW	HAZ

Figure B.14: **Regional distribution for Arctic tern in summer and winter. Density data from Bradbury *et al.* (2014).**



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

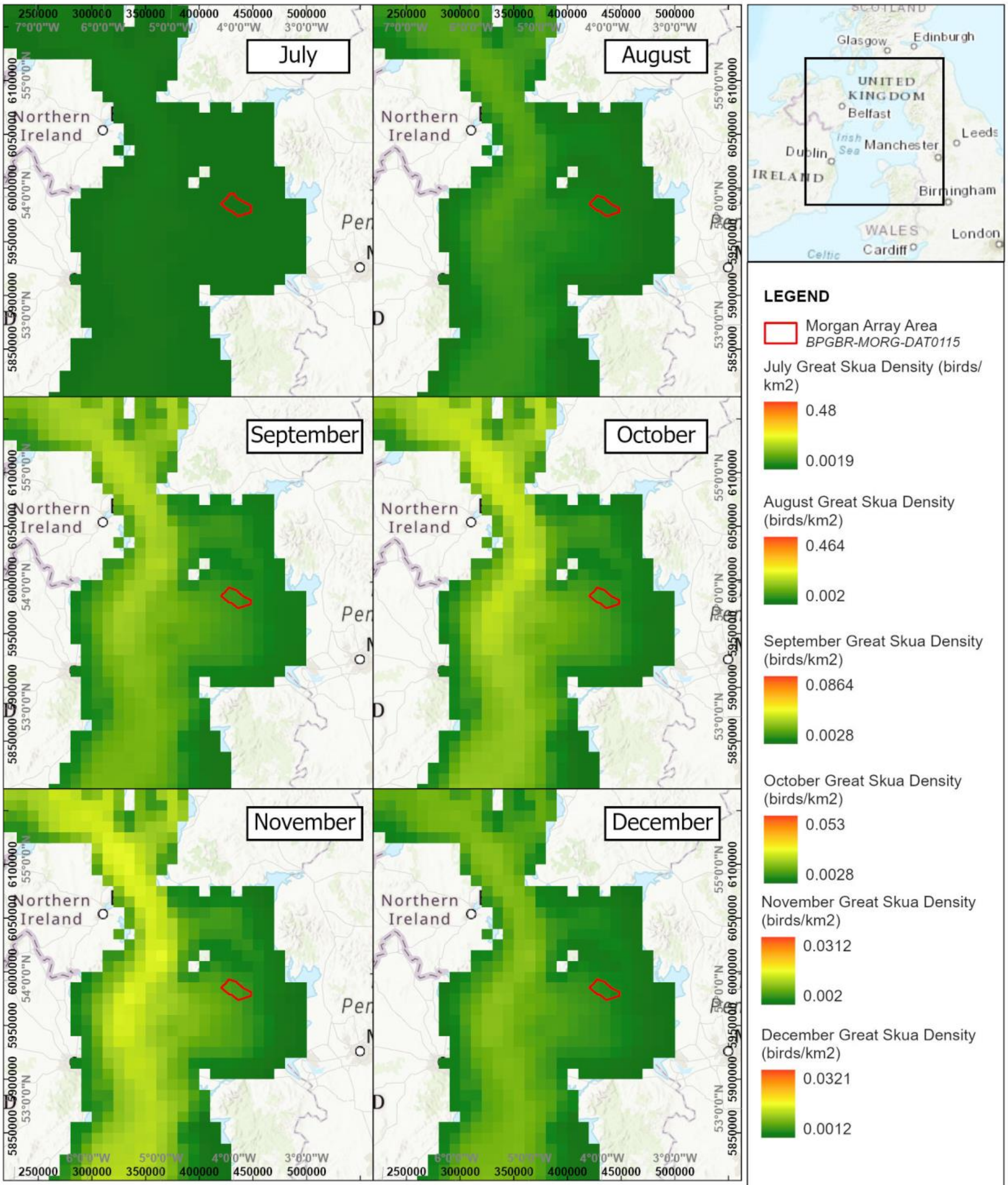
Drawing Number:
NIRA-MG-ORN-A015-02

Drawing Title:
Distribution of Great Skua in the Irish Sea Between January and June (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.15: Regional distribution for great skua between January and June. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

Drawing Number:
NIRA-MG-ORN-A016-02

Drawing Title:
Distribution of Great Skua in the Irish Sea Between July and December (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.16: Regional distribution for great skua between July and December. Density data from Waggitt *et al.* (2020).

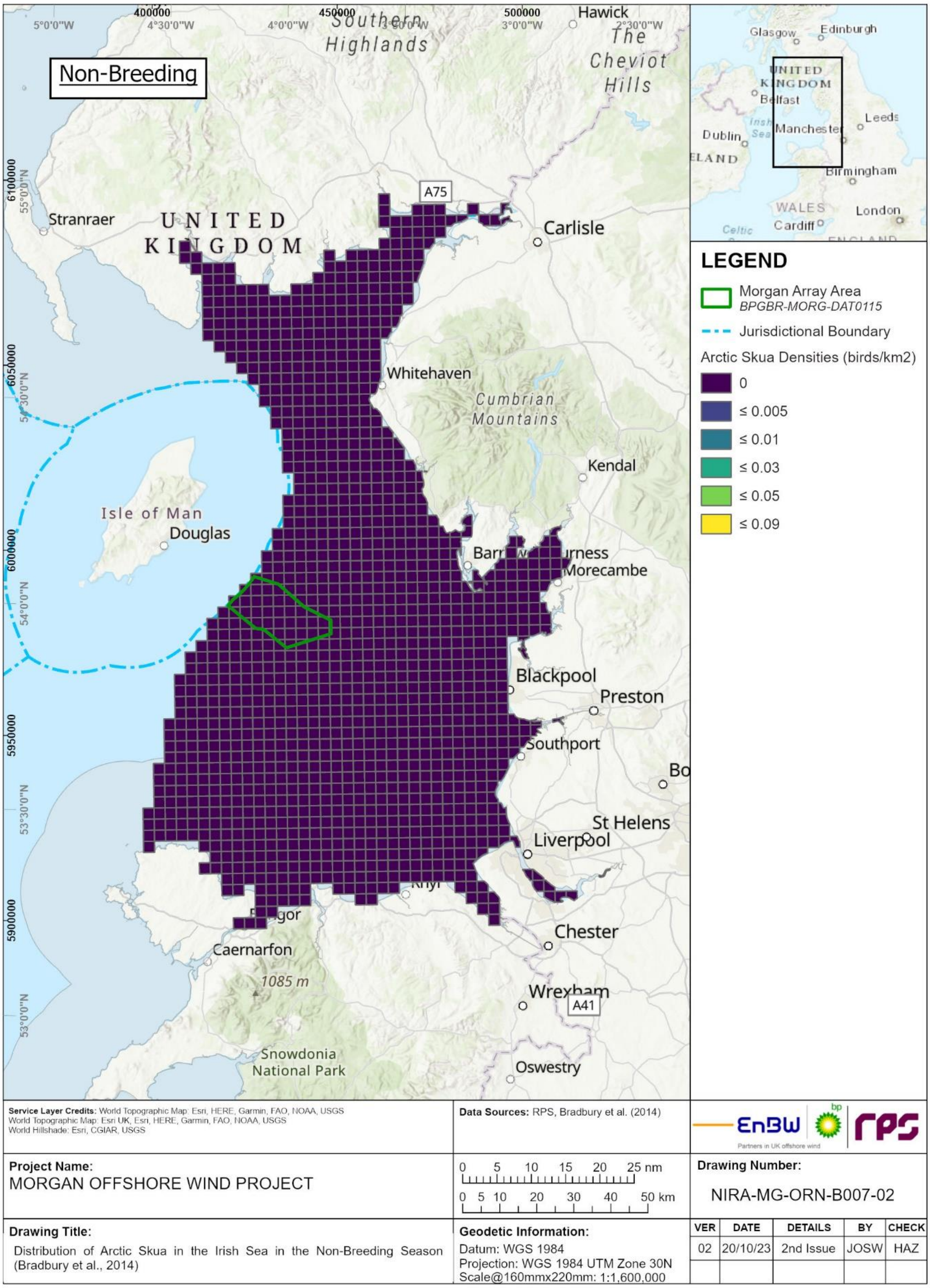
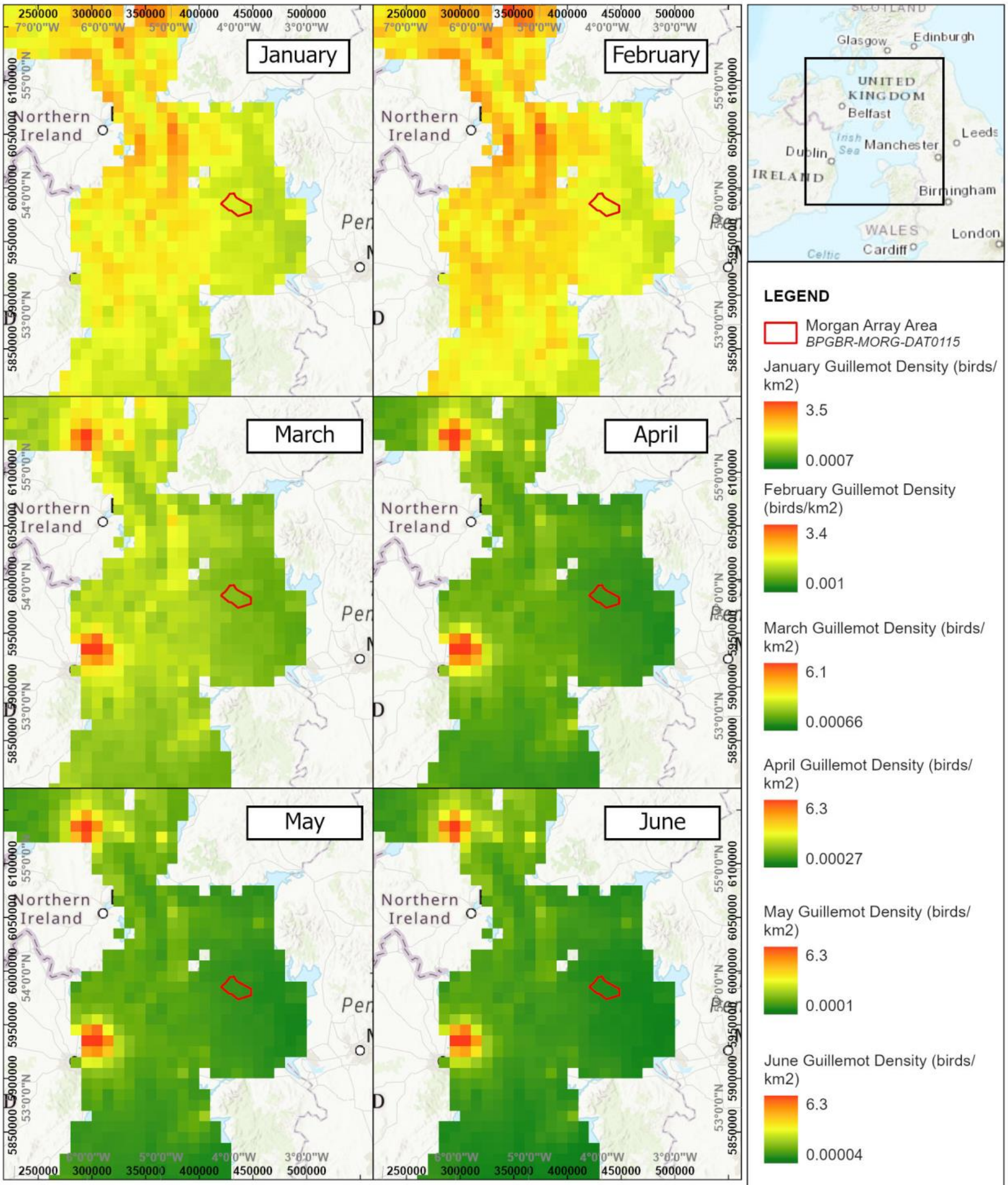


Figure B.17: **Regional distribution for Arctic skua in summer only. Density data from Bradbury *et al.* (2014).**



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

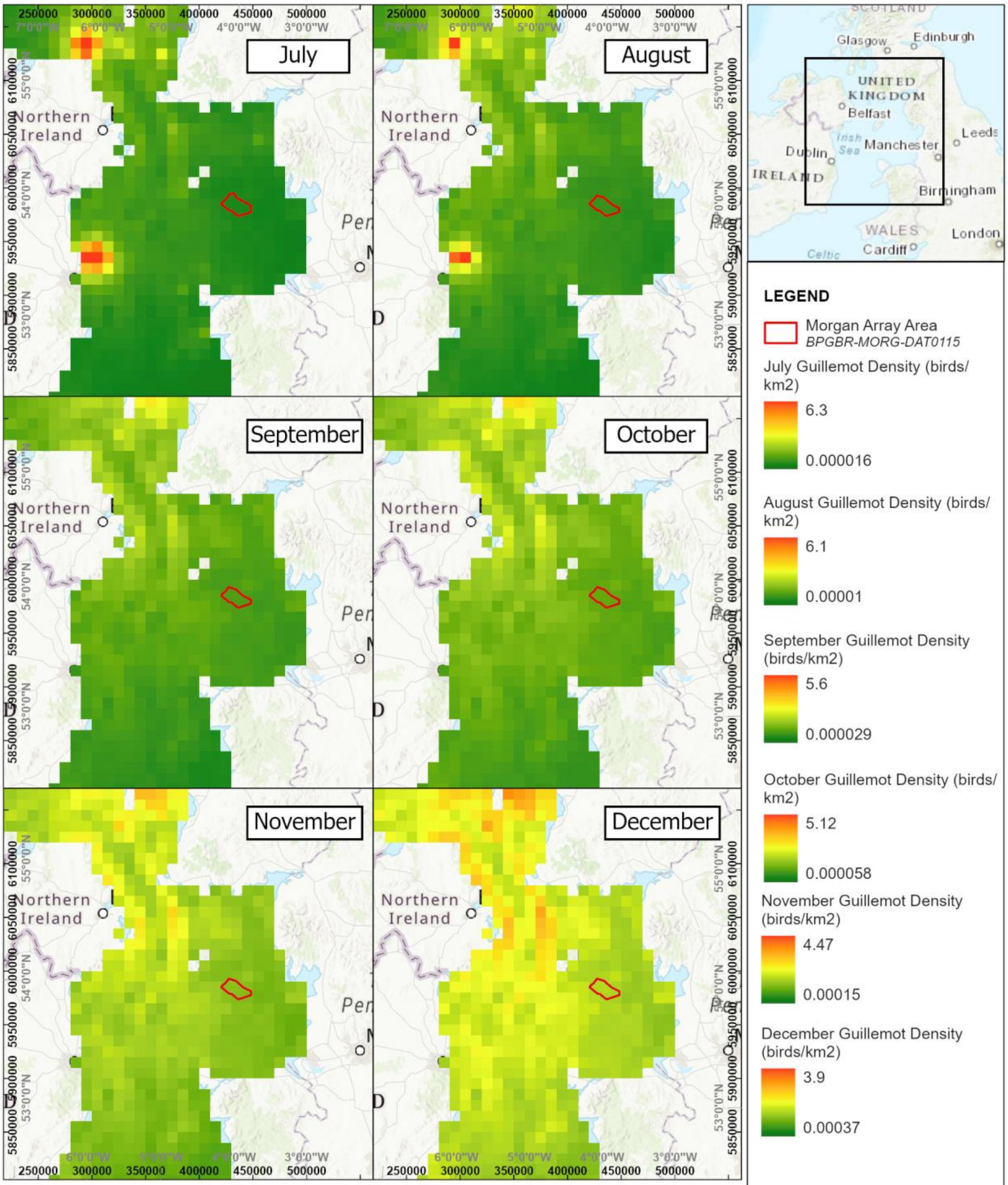
Drawing Number:
NIRA-MG-ORN-A009-02

Drawing Title:
Distribution of Guillemot in the Irish Sea Between January and June (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.18: Regional distribution for guillemot between January and June. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

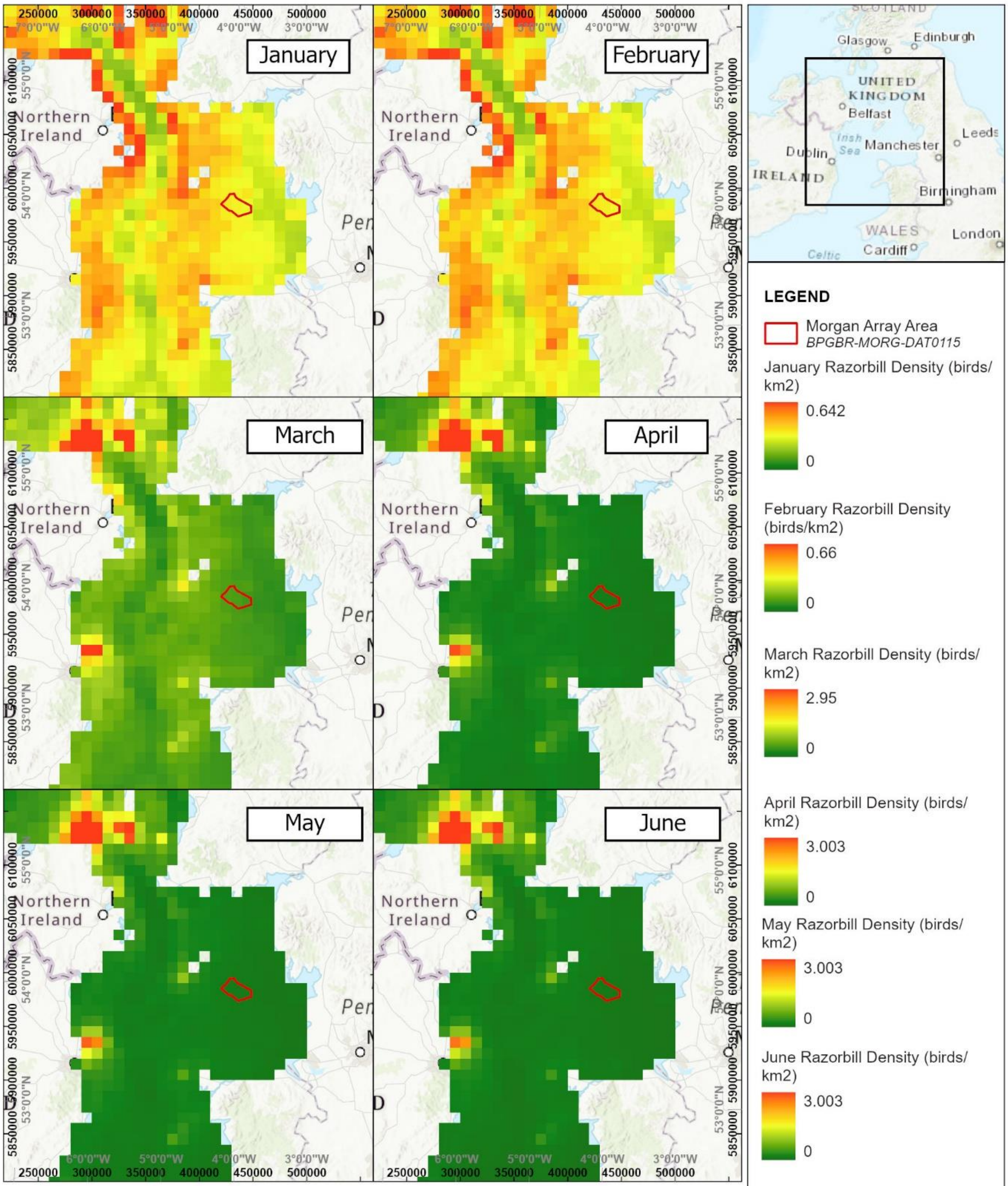
Drawing Number:
NIRA-MG-ORN-A010-02

Drawing Title:
Distribution of Guillemot in the Irish Sea Between July and December (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.19: Regional distribution for guillemot between July and December. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

Project Name:
MORGAN OFFSHORE WIND PROJECT

Drawing Number:
NIRA-MG-ORN-A021-02

Drawing Title:
Distribution of Razorbill in the Irish Sea Between January and June (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.20: Regional distribution for razorbill between January and June. Density data from Waggitt *et al.* (2020).

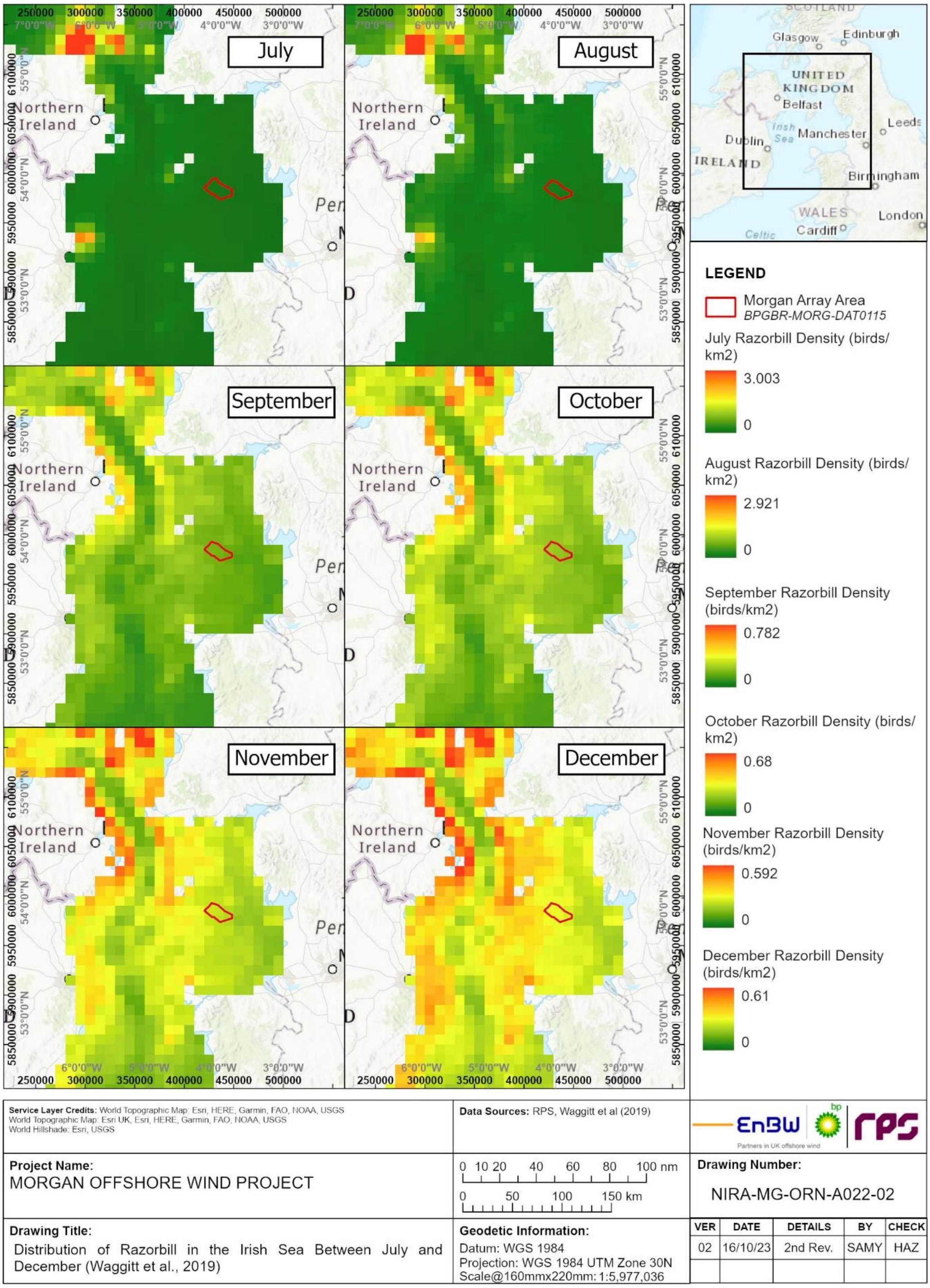
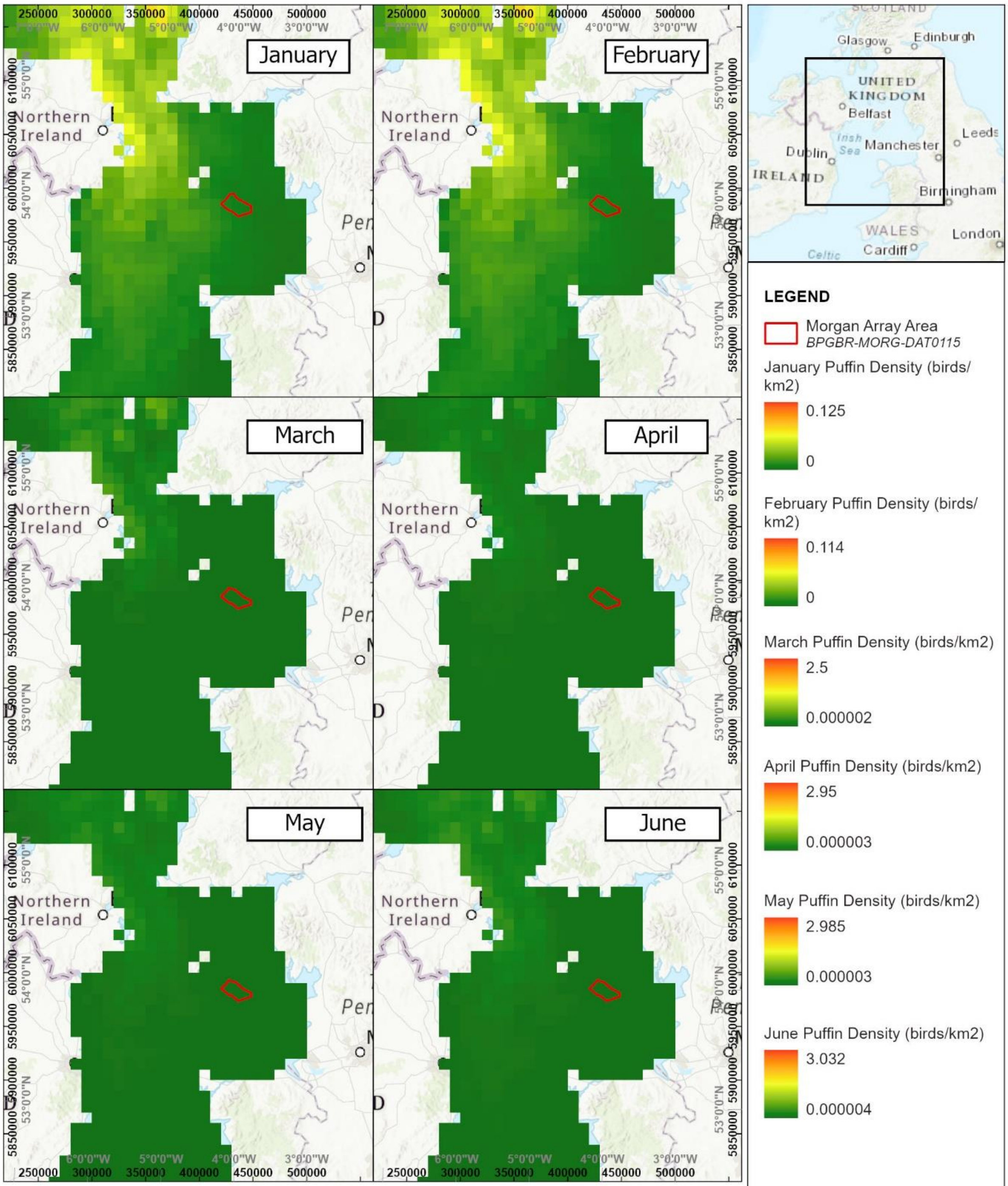


Figure B.21: **Regional distribution for razorbill between July and December. Density data from Waggitt *et al.* (2020).**



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

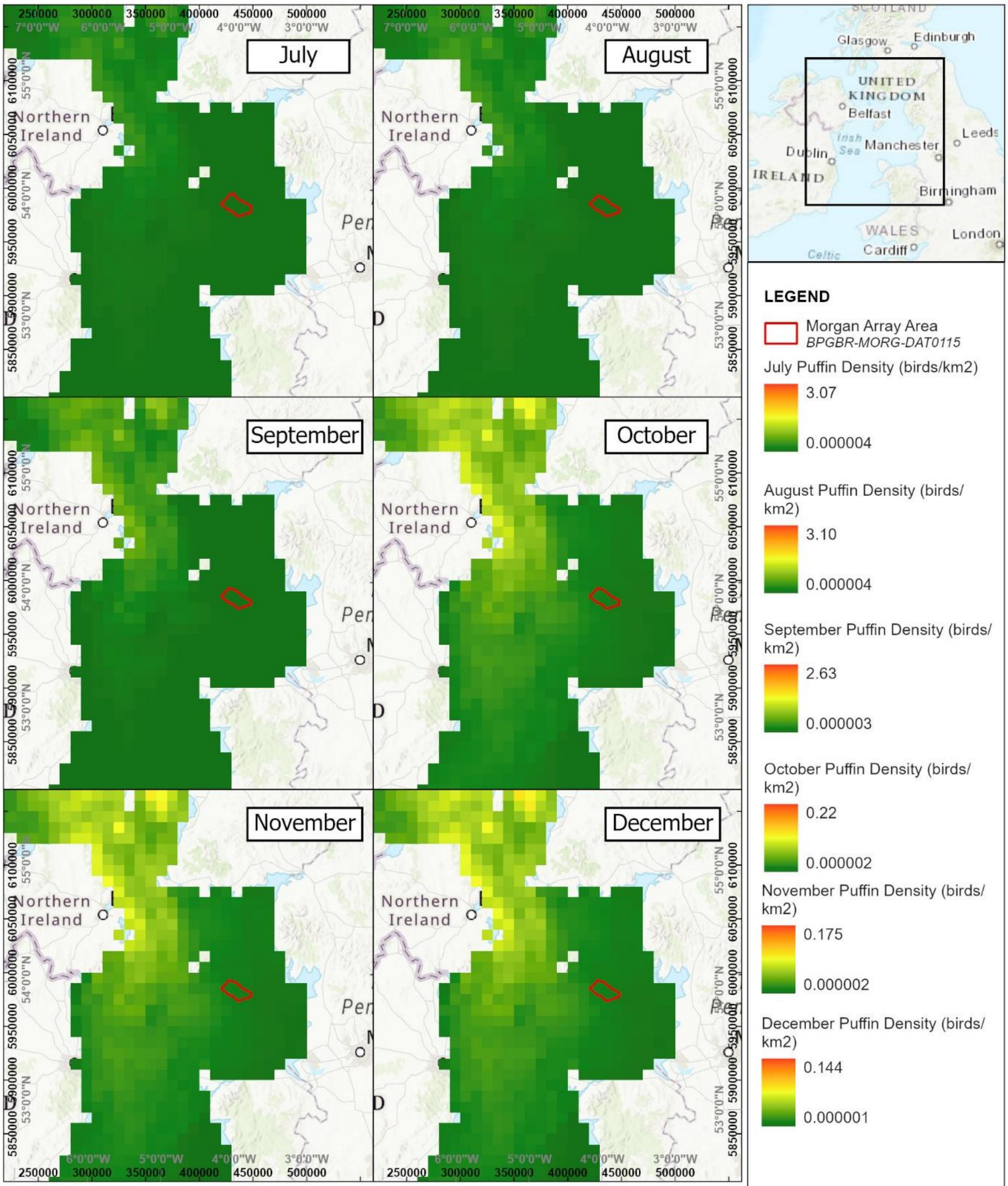
Drawing Number:
NIRA-MG-ORN-A007-02

Drawing Title:
Distribution of Puffin in the Irish Sea Between January and June (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.22: Regional distribution for puffin between January and June. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

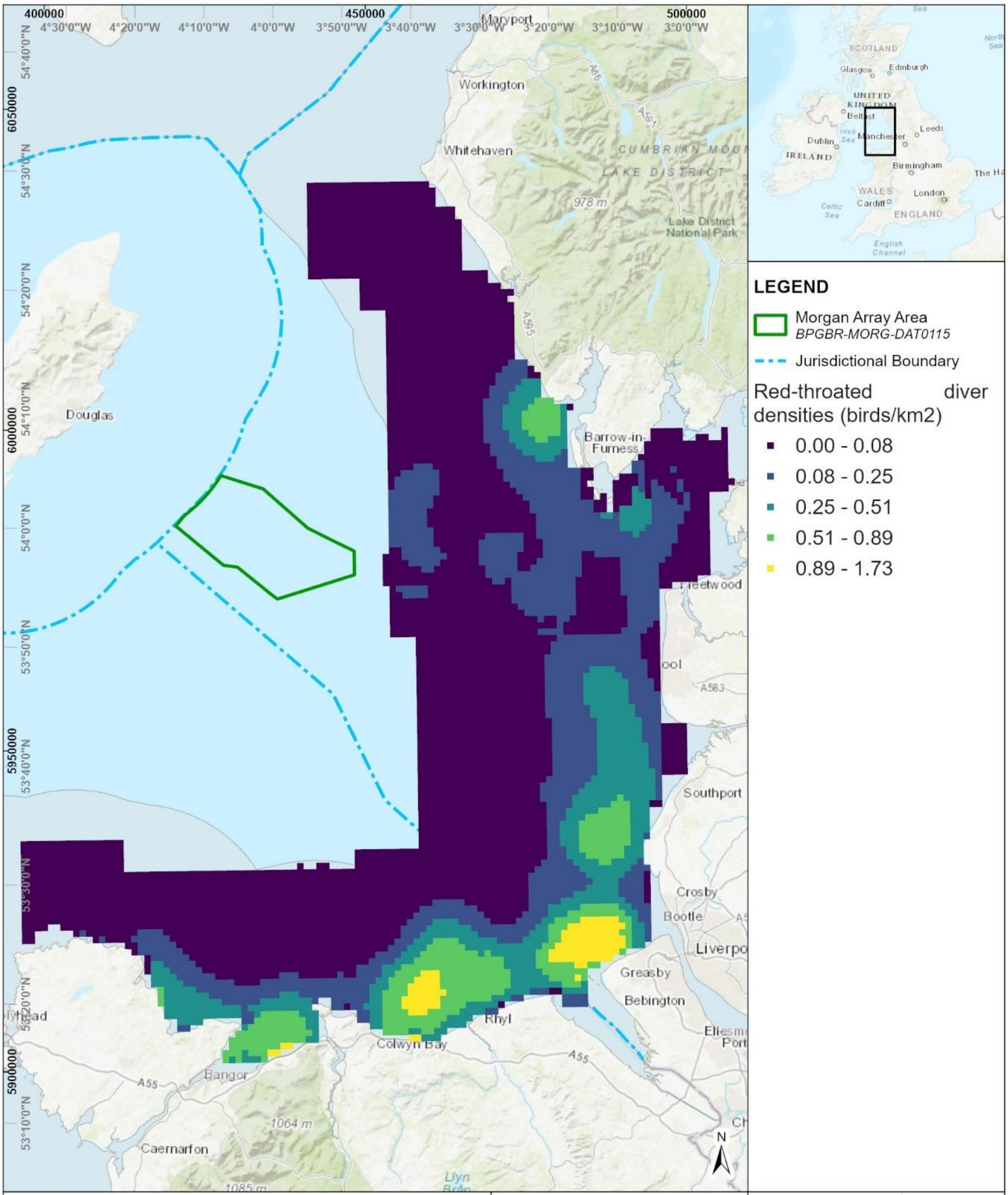
Drawing Number:
NIRA-MG-ORN-A008-02

Drawing Title:
Distribution of Puffin in the Irish Sea Between July and December (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.23: Regional distribution for puffin between July and December. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri, HERE, Garmin, FAO, USGS

Data Sources: Natural England (2023)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 2.5 5 10 15 nm
0 5 10 20 30 km

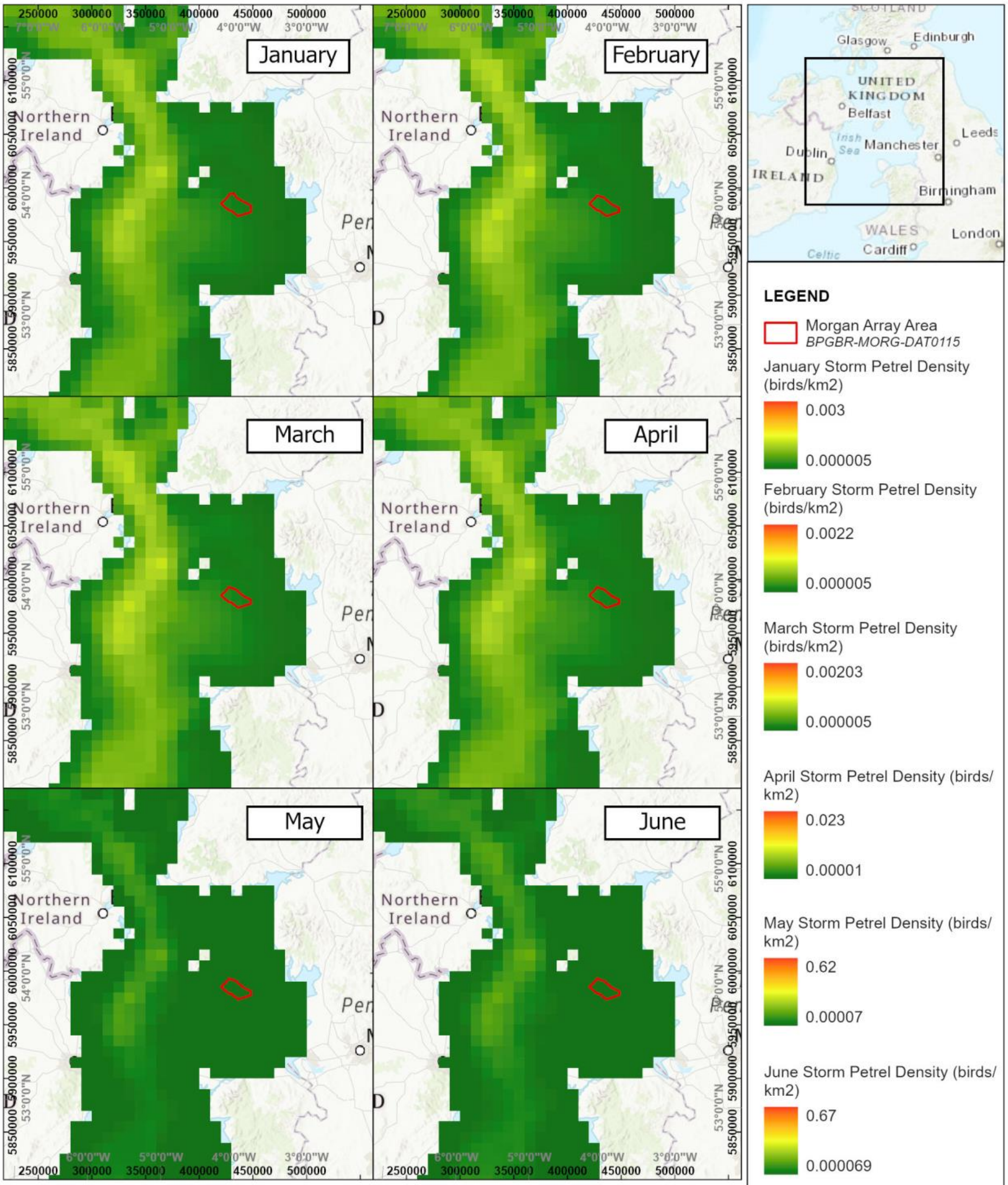
Drawing Number:
RPSE-MG-TEM-010-01

Drawing Title:
Red-throated diver distribution in Liverpool Bay (Lawson et al., 2016)

Geodetic Information:
Datum: ETRS 1989
Projection: ETRS 1989 UTM Zone 30N
Scale@160mmx220mm: 1:1,000,000

VER	DATE	DETAILS	BY	CHECK
01	12/02/24	First Issue	HAZ	RWA

Figure B.24: Regional distribution for red-throated diver in Liverpool Bay. Density data from Lawson *et al.* (2016).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

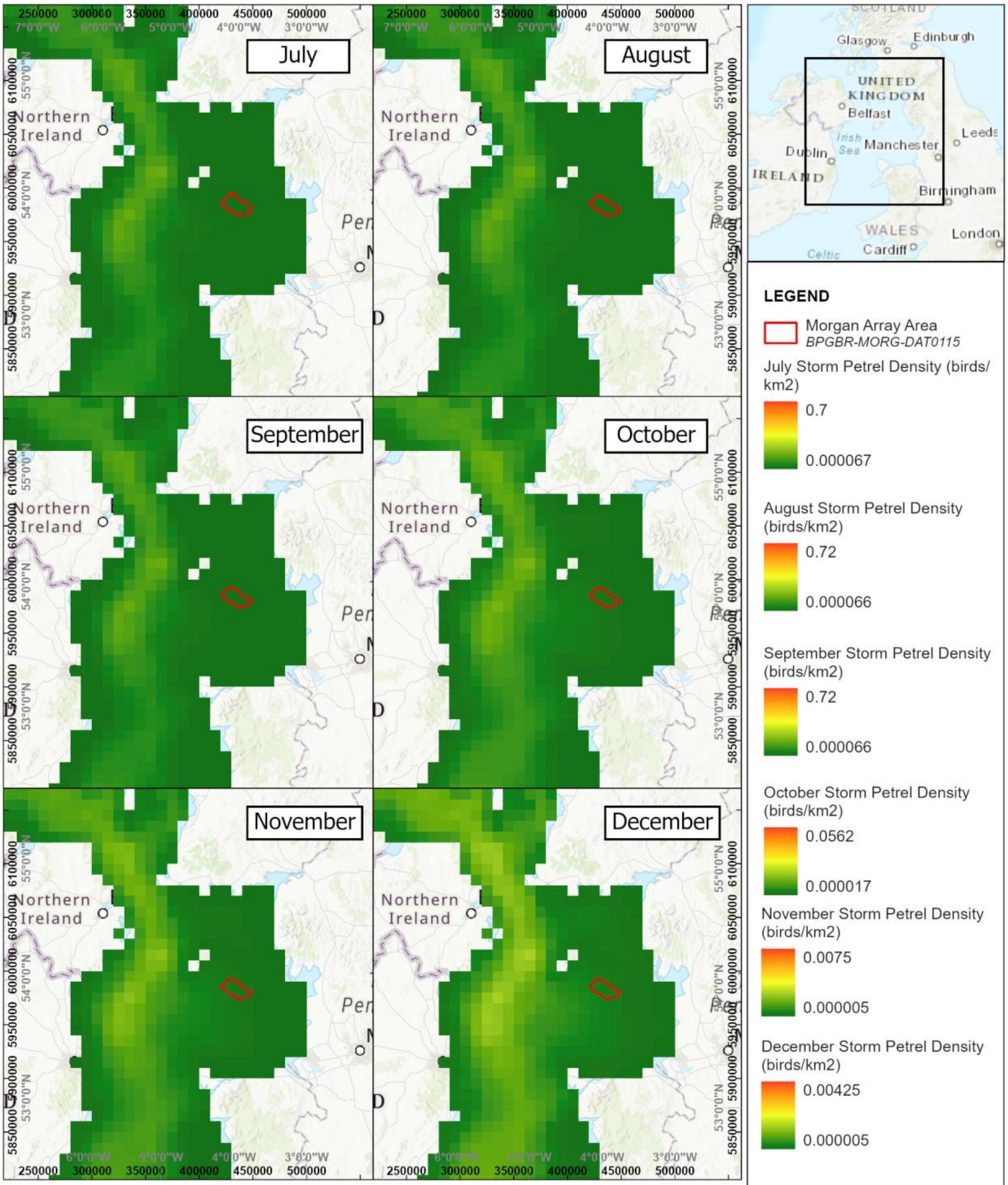
Drawing Number:
NIRA-MG-ORN-A003-02

Drawing Title:
Distribution of Storm Petrel in the Irish Sea Between January and June (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.25: Regional distribution for European storm petrel between January and June. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

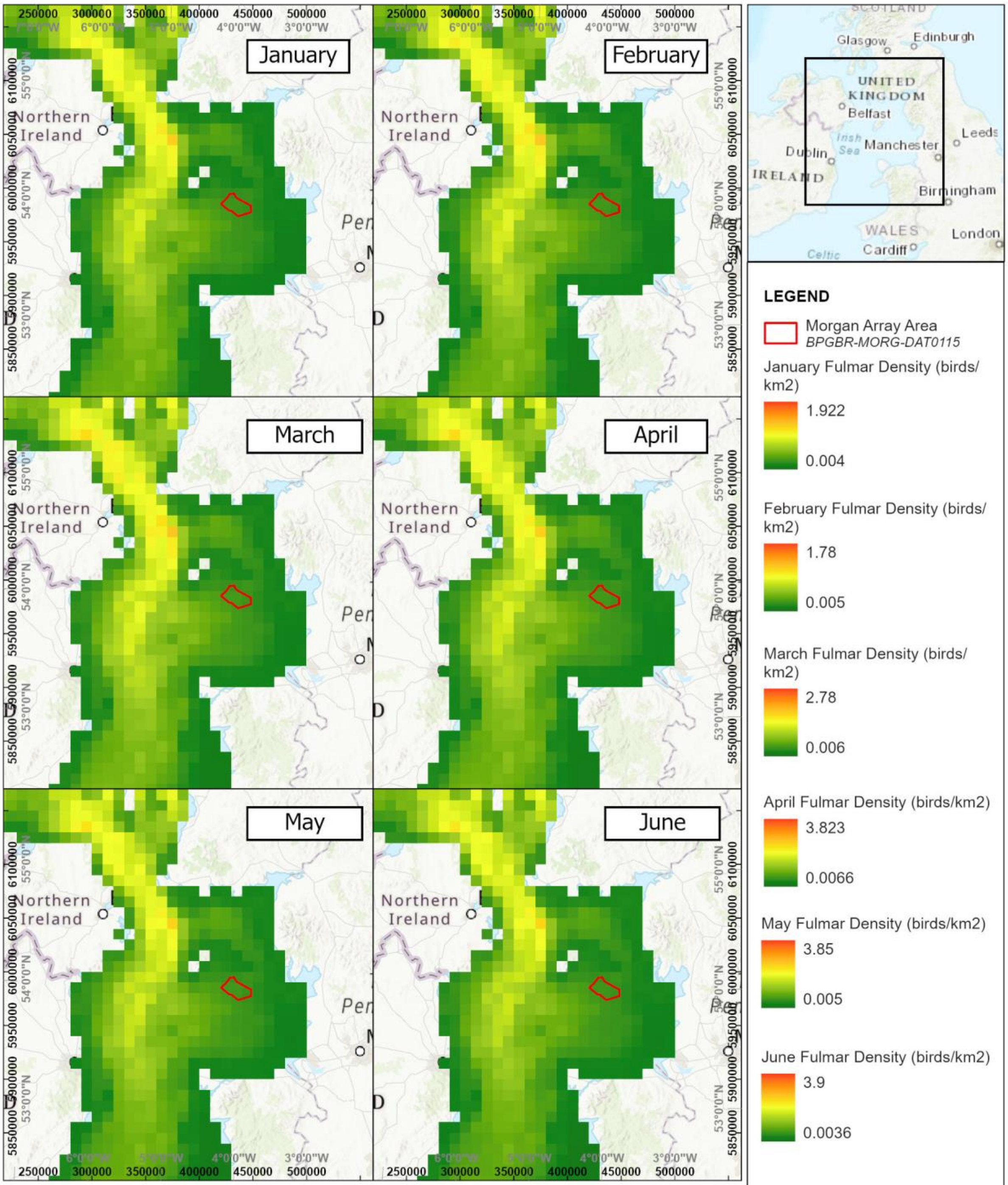
Drawing Number:
NIRA-MG-ORN-A004-02

Drawing Title:
Distribution of Storm Petrel in the Irish Sea Between July and December (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.26: Regional distribution for European storm petrel between July and December. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

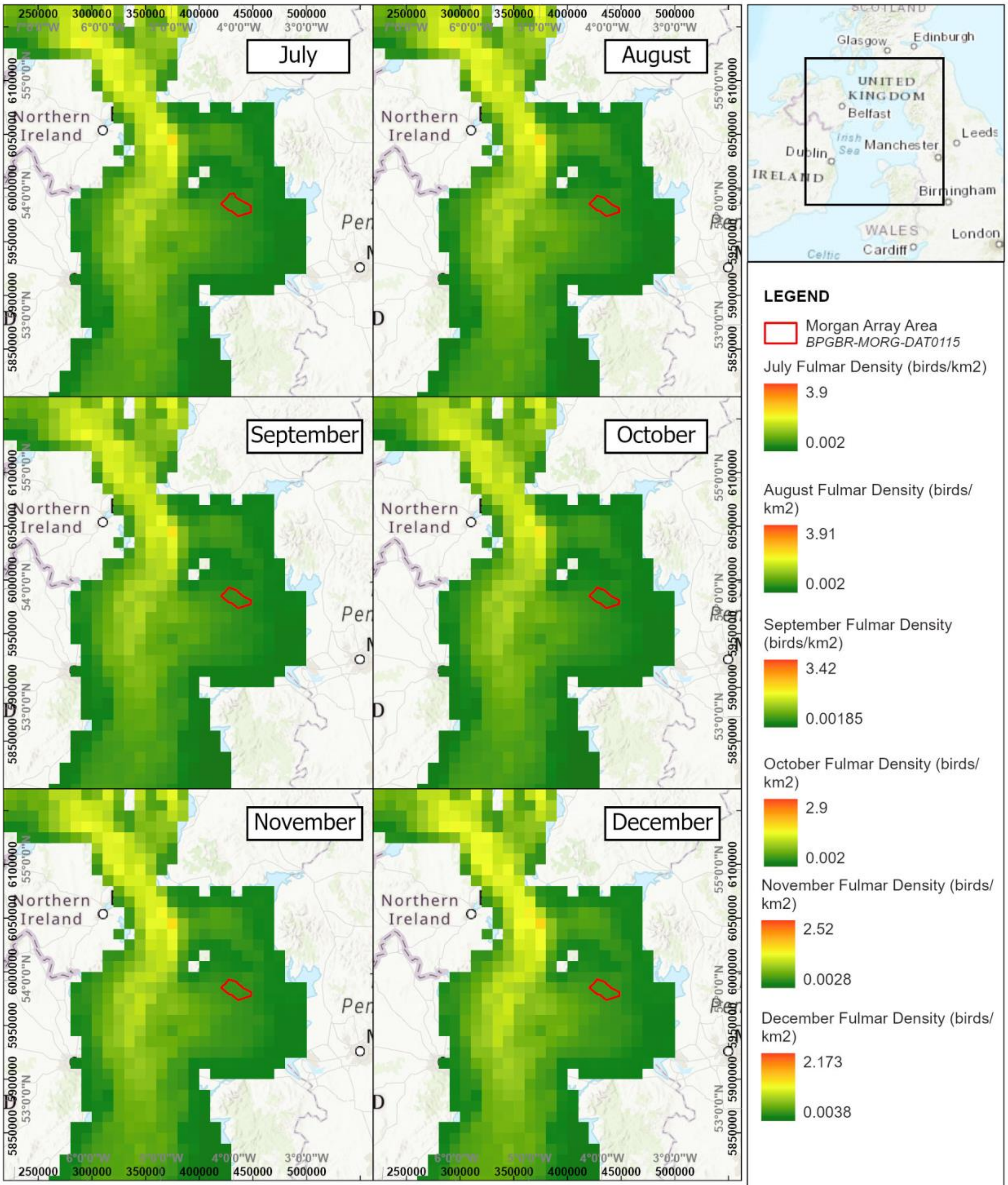
Drawing Number:
NIRA-MG-ORN-A011-02

Drawing Title:
Distribution of Fulmar in the Irish Sea Between January and June (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.27: Regional distribution for fulmar between January and June. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

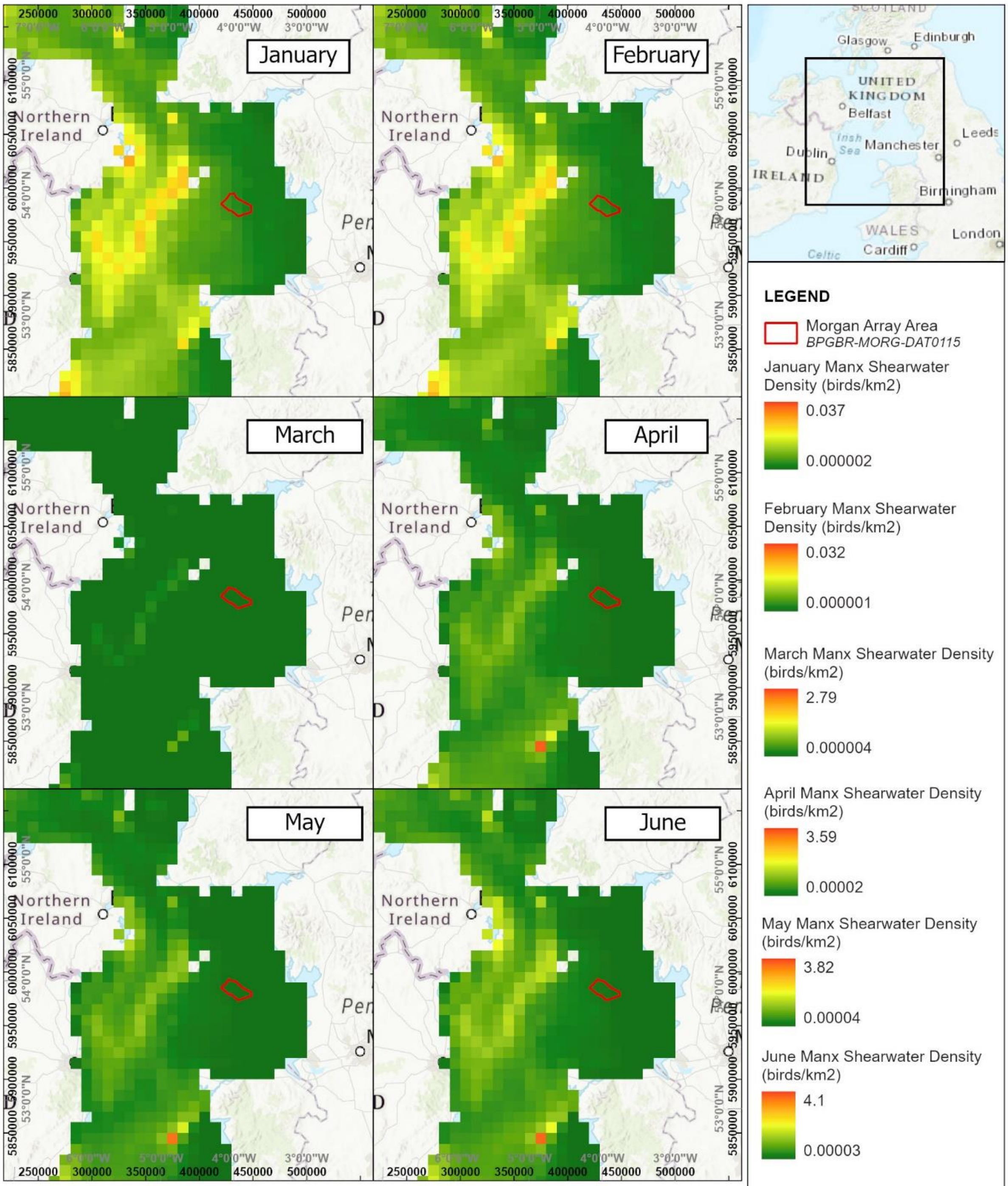
Drawing Number:
NIRA-MG-ORN-A012-02

Drawing Title:
Distribution of Fulmar in the Irish Sea Between July and December (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.28: Regional distribution for fulmar between July and December. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

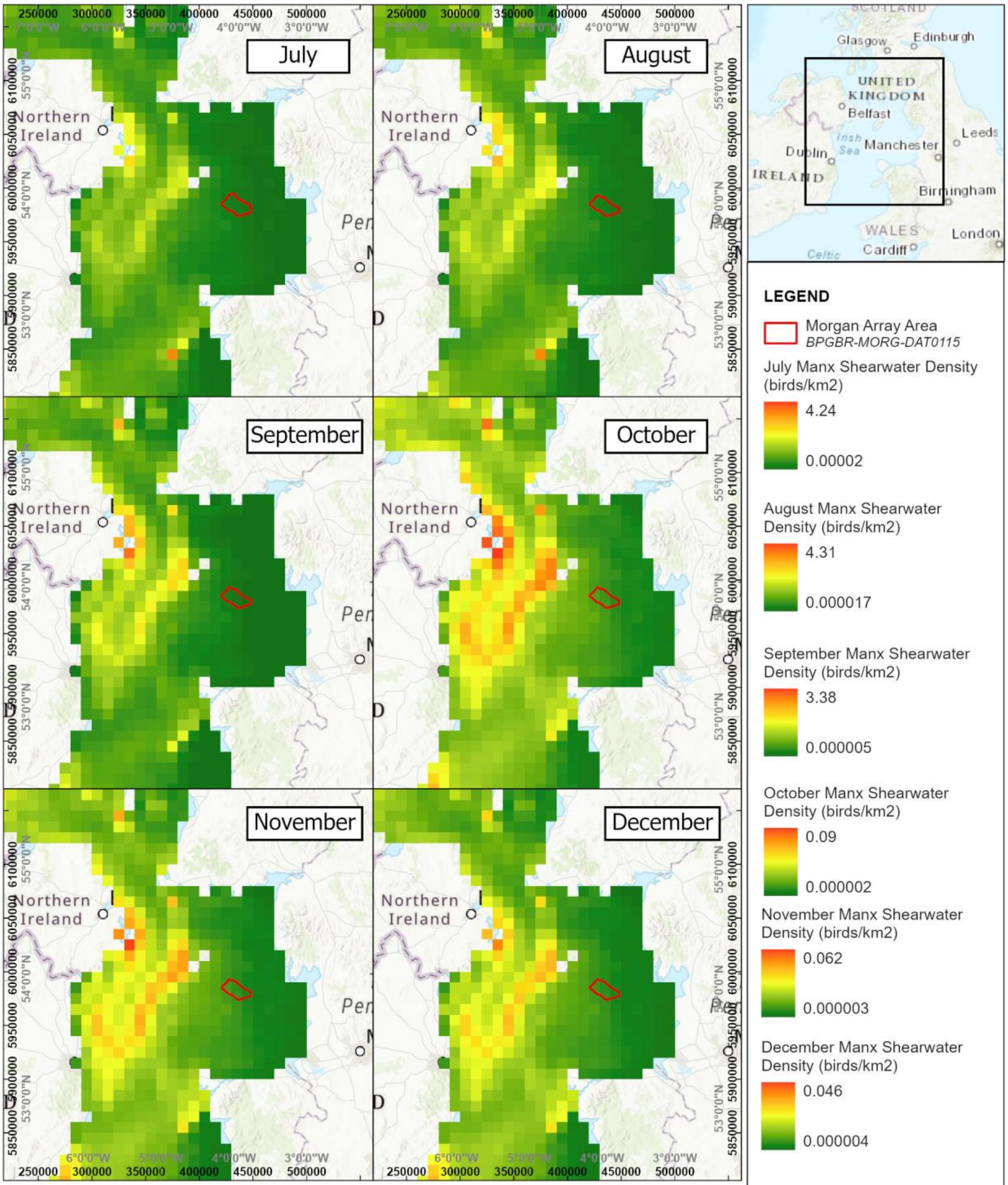
Drawing Number:
NIRA-MG-ORN-A023-02

Drawing Title:
Distribution of Manx Shearwater in the Irish Sea Between January and June (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.29: Regional distribution for Manx shearwater between January and June. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

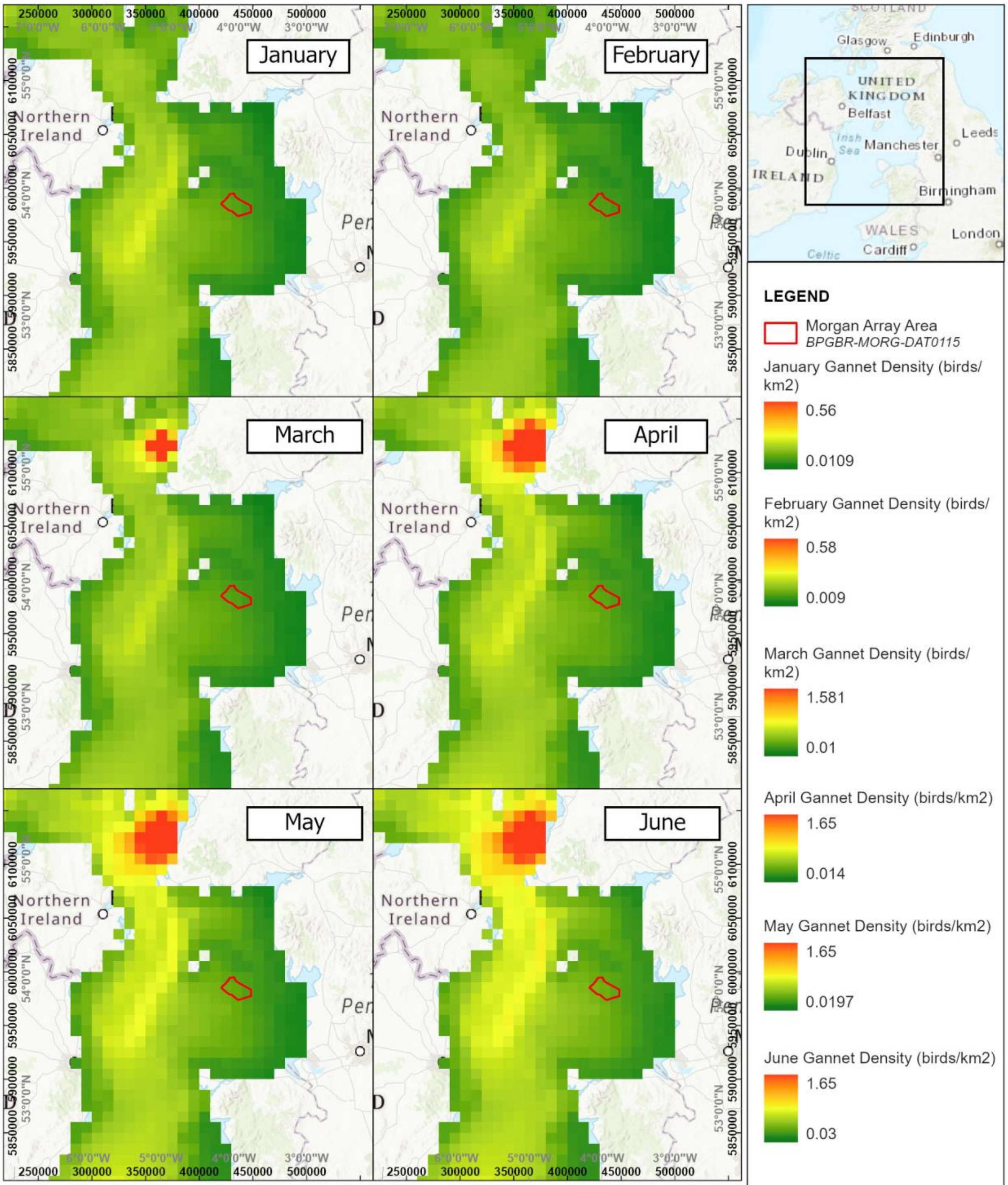
Drawing Number:
NIRA-MG-ORN-A024-02

Drawing Title:
Distribution of Manx Shearwater in the Irish Sea Between July and December (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.30: Regional distribution for Manx shearwater between July and December. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

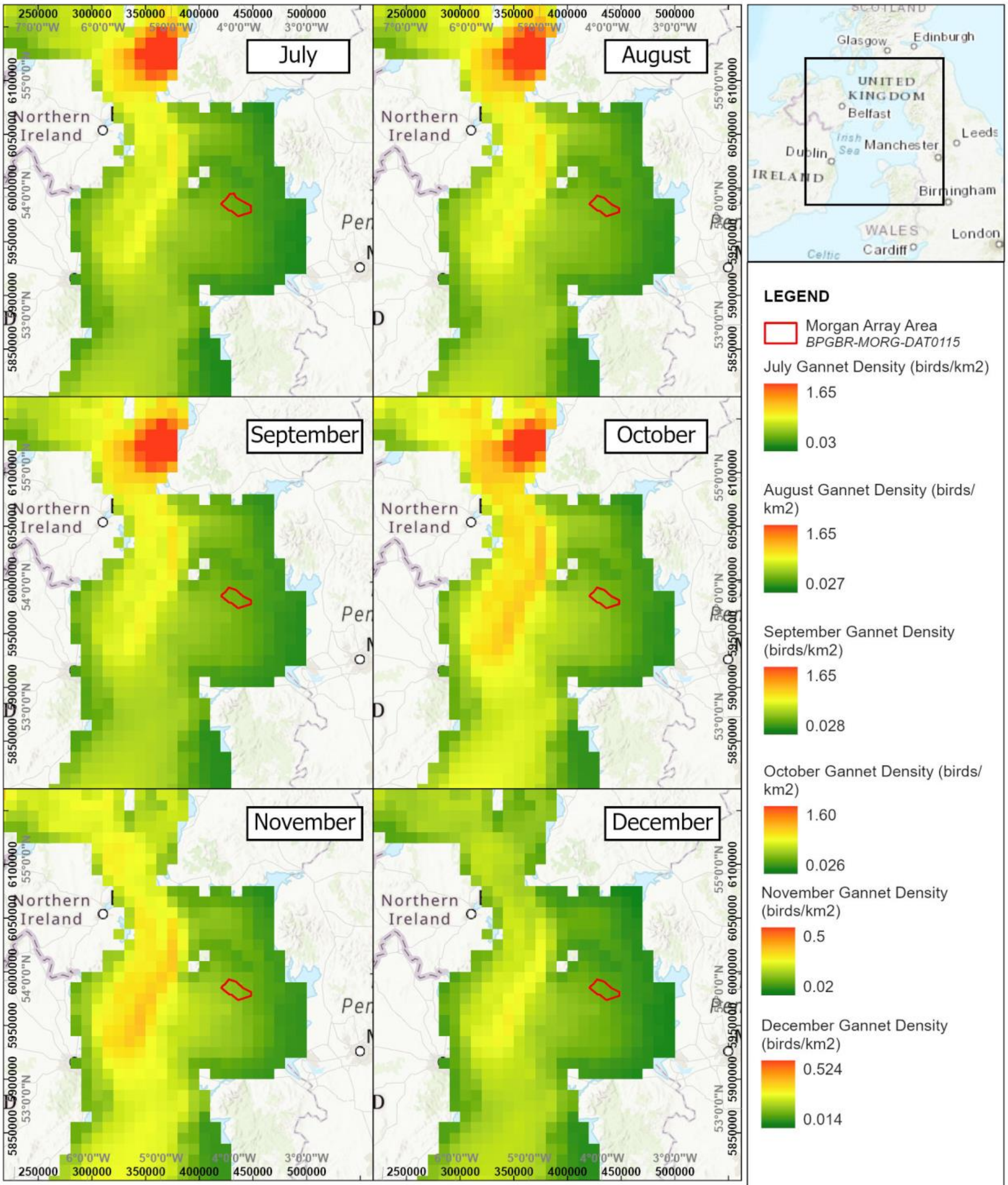
Drawing Number:
NIRA-MG-ORN-A013-02

Drawing Title:
Distribution of Gannet in the Irish Sea Between January and June (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.31: Regional distribution for gannet between January and June. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

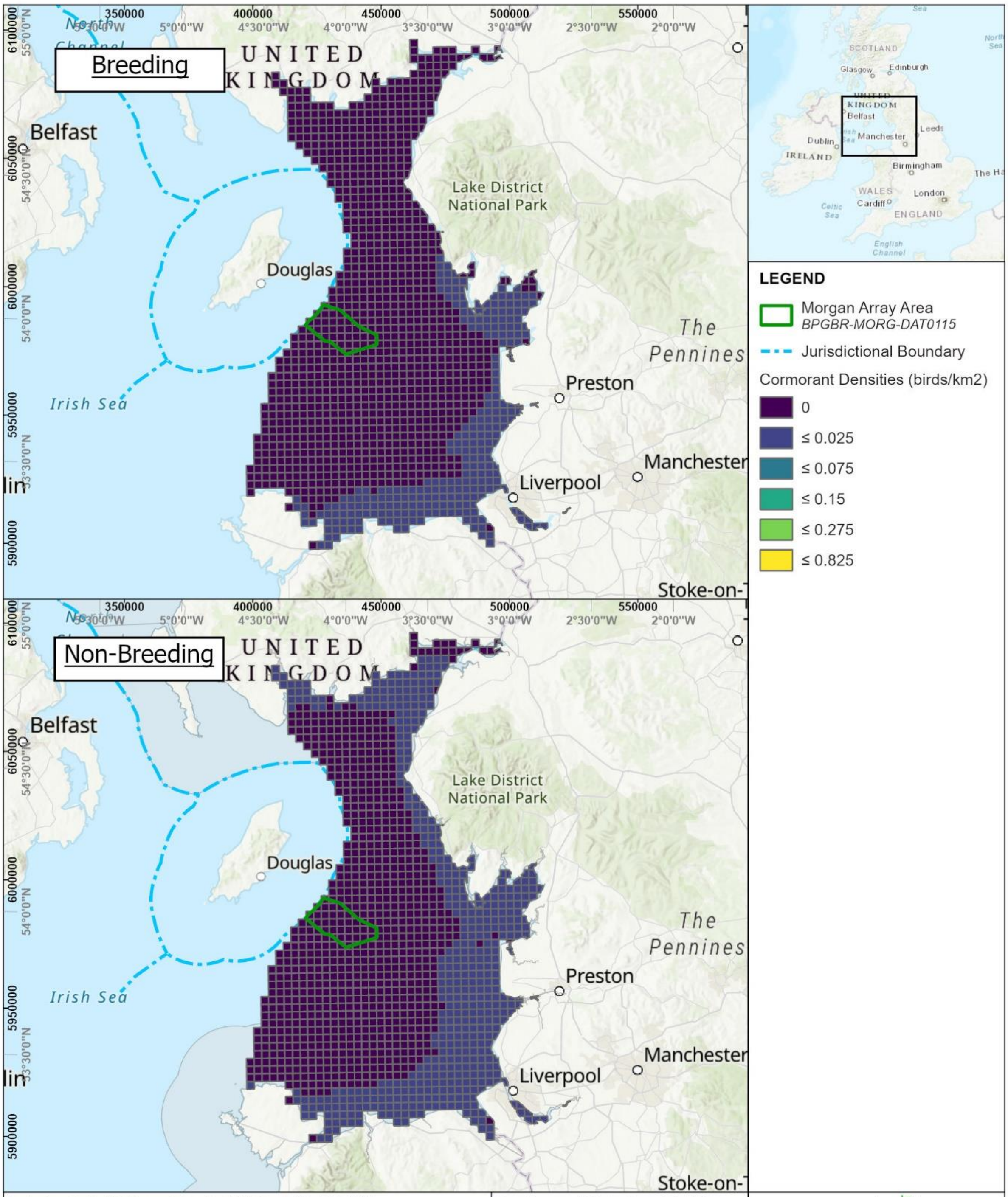
Drawing Number:
NIRA-MG-ORN-A014-02

Drawing Title:
Distribution of Gannet in the Irish Sea Between July and December (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.32: Regional distribution for gannet between July and December. Density data from Waggitt *et al.* (2020).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Bradbury et al. (2014)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 5 10 20 30 40 nm
0 10 20 40 60 80 km

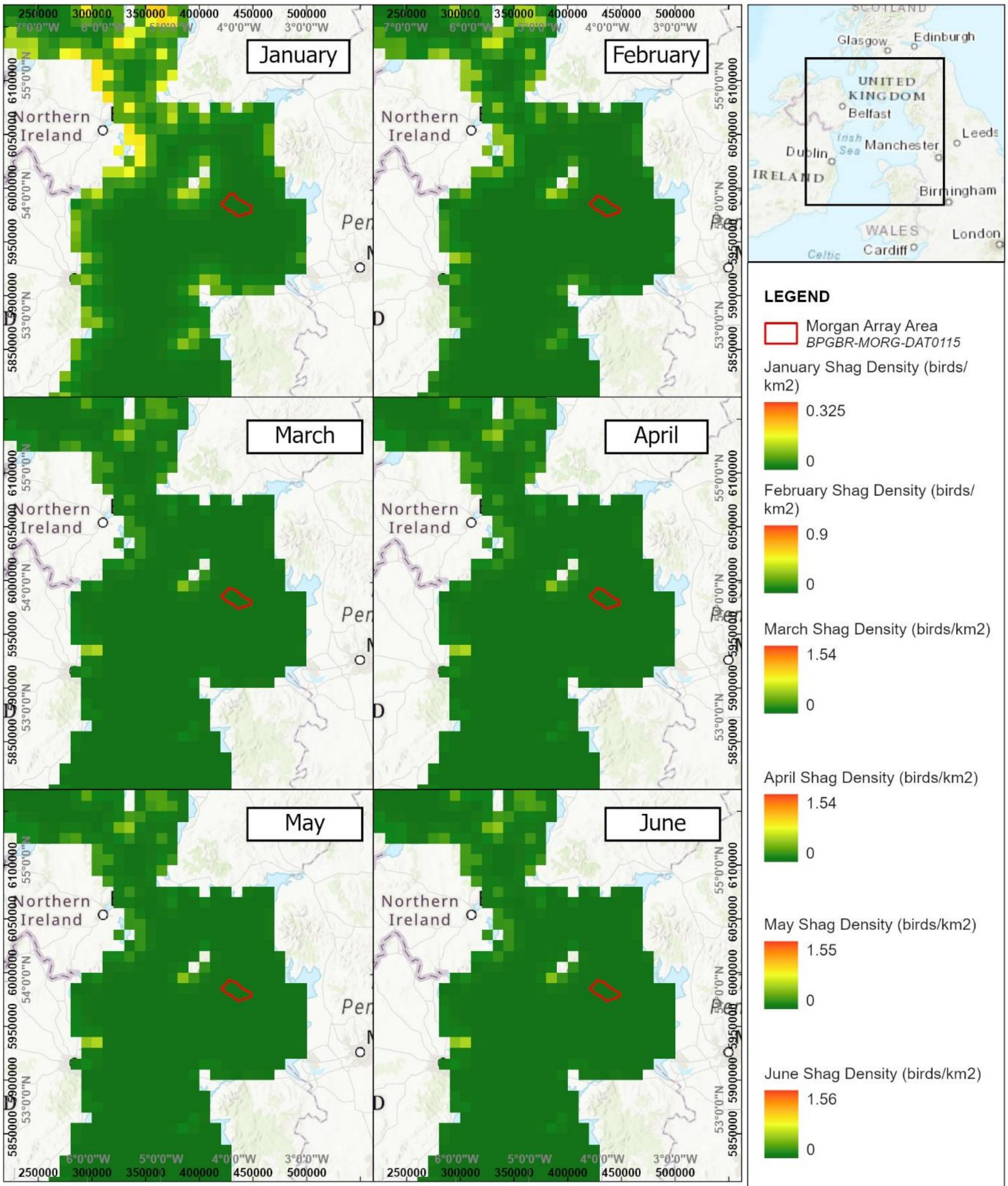
Drawing Number:
NIRA-MG-ORN-B006-02

Drawing Title:
Distribution of Cormorant in the Irish Sea Between Breeding and Non-Breeding Seasons (Bradbury et al., 2014)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:2,500,000

VER	DATE	DETAILS	BY	CHECK
02	20/10/23	2nd Rev	JOSW	HAZ

Figure B.33: Regional distribution for cormorant in summer and winter. Density data from Bradbury *et al.* (2014).



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS
World Hillshade: Esri, USGS

Data Sources: RPS, Waggitt et al (2019)

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Project Name:
MORGAN OFFSHORE WIND PROJECT

0 10 20 40 60 80 100 nm
0 50 100 150 km

Drawing Number:
NIRA-MG-ORN-A005-02

Drawing Title:
Distribution of Shag in the Irish Sea Between January and June (Waggitt et al., 2019)

Geodetic Information:
Datum: WGS 1984
Projection: WGS 1984 UTM Zone 30N
Scale@160mmx220mm: 1:5,977,036

VER	DATE	DETAILS	BY	CHECK
02	16/10/23	2nd Rev.	SAMY	HAZ

Figure B.34: Regional distribution for shag between January and June. Density data from Waggitt *et al.* (2020).

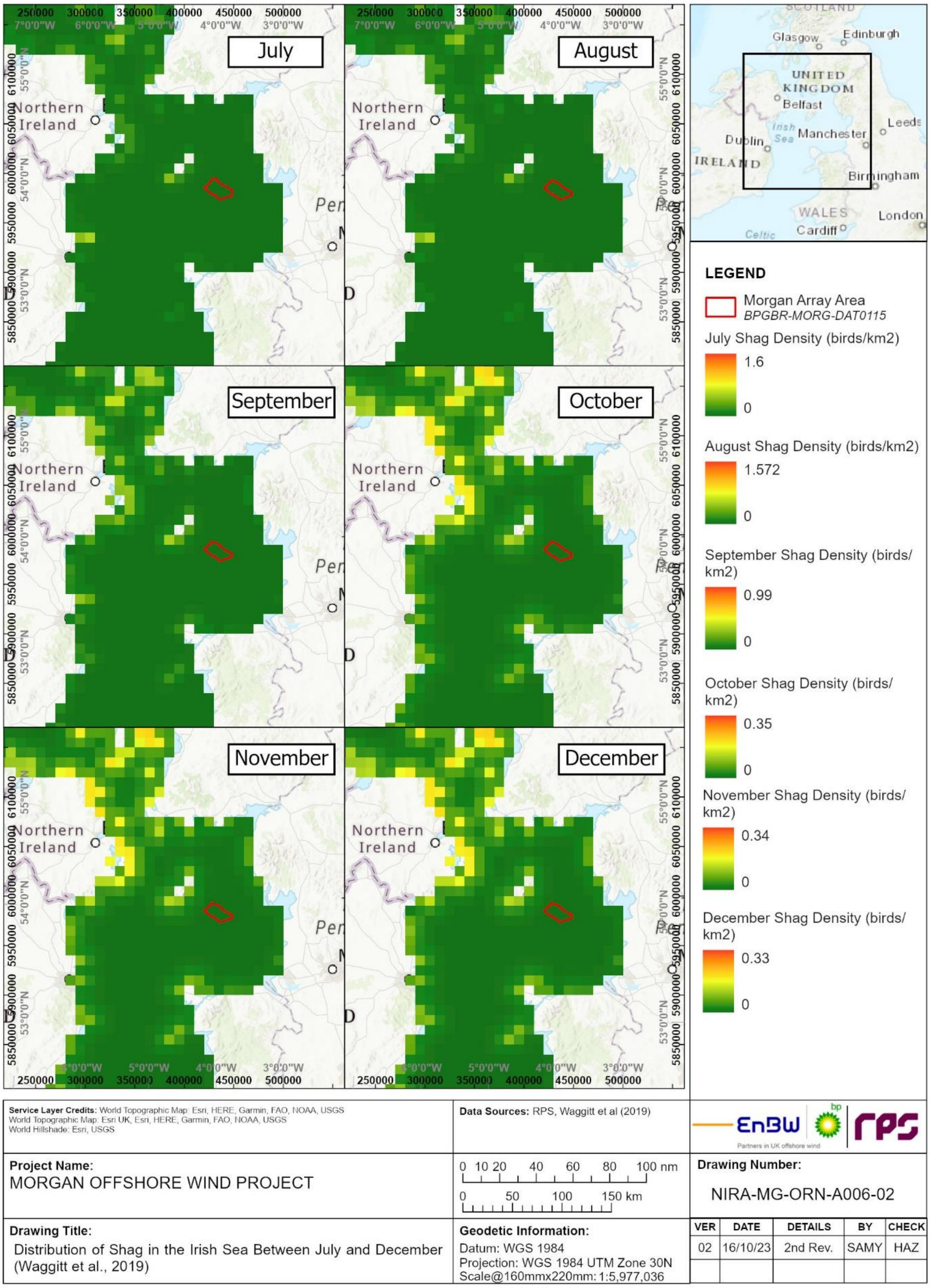

Figure B.35: **Regional distribution for shag between July and December. Density data from Waggitt *et al.* (2020).**

Appendix C: Model-based abundance estimates for the Morgan Array Area + 4 km buffer

C.1 Kittiwake

Table C.1: Kittiwake MRSea estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	592	0.96	385	0.63	207	0.34	151.61	25.63
1	May	-	-	-	-	-	-	-	-
1	June	-	-	-	-	-	-	-	-
1	July	-	-	-	-	-	-	-	-
1	August	177	0.29	35	0.06	142	0.23	459.49	259.08
1	September	-	-	-	-	-	-	-	-
1	October	746	1.22	499	0.81	247	0.40	635.48	85.17
1	November	257	0.42	63	0.10	194	0.32	67.77	26.42
1	December	2302	3.75	429	0.70	1873	3.05	368.48	16.01
1	January	871	1.42	391	0.64	480	0.78	312.40	35.86
1	February	396	0.65	123	0.20	273	0.44	132.79	33.50
1	March	1220	1.99	564	0.92	656	1.07	285.49	23.40
2	April	852	1.39	467	0.76	386	0.63	373.46	43.82
2	May	-	-	-	-	-	-	-	-
2	June	-	-	-	-	-	-	-	-
2	July	-	-	-	-	-	-	-	-

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	August	-	-	-	-	-	-	-	-
2	September	454	0.74	233	0.38	221	0.36	274.42	60.45
2	October	-	-	-	-	-	-	-	-
2	November	964	1.57	281	0.46	682	1.11	476.38	49.43
2	December	662	1.08	237	0.39	425	0.69	409.64	61.84
2	January	257	0.42	146	0.24	111	0.18	109.93	42.77
2	February	331	0.54	186	0.30	145	0.24	118.90	35.92
2	March	945	1.54	379	0.62	566	0.92	603.22	63.84

Table C.2: Kittiwake MRSea estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	409	0.94	266	0.61	143	0.33	151.61	37.09
1	May	-	-	-	-	-	-	-	-
1	June	-	-	-	-	-	-	-	-
1	July	-	-	-	-	-	-	-	-
1	August	108	0.25	22	0.05	86	0.20	459.49	425.54
1	September	0	0	0	0	0	0	0	0
1	October	525	1.21	351	0.81	174	0.40	635.48	120.96
1	November	193	0.44	47	0.11	145	0.33	67.77	35.16

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	December	1621	3.73	302	0.70	1319	3.04	368.48	22.73
1	January	602	1.39	270	0.62	332	0.76	312.40	51.89
1	February	282	0.65	88	0.20	195	0.45	132.79	47.01
1	March	915	2.11	423	0.97	492	1.13	285.49	31.20
2	April	601	1.38	329	0.76	272	0.63	373.46	62.10
2	May	-	-	-	-	-	-	-	-
2	June	-	-	-	-	-	-	-	-
2	July	-	-	-	-	-	-	-	-
2	August	-	-	-	-	-	-	-	-
2	September	258	0.59	133	0.31	125	0.29	274.42	106.36
2	October	-	-	-	-	-	-	-	-
2	November	680	1.57	199	0.46	482	1.11	476.38	70.04
2	December	467	1.08	168	0.39	300	0.69	409.64	87.62
2	January	181	0.42	103	0.24	78	0.18	109.93	60.61
2	February	234	0.54	132	0.30	102	0.23	118.90	50.90
2	March	667	1.54	267	0.62	399	0.92	603.22	90.47

Table C.3: Kittiwake MRSea estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	257	0.92	167	0.60	90	0.32	151.61	59.08
1	May	-	-	-	-	-	-	-	-
1	June	-	-	-	-	-	-	-	-
1	July	-	-	-	-	-	-	-	-
1	August	58	0.21	12	0.04	47	0.17	459.49	789.30
1	September	0	0	0	0	0	0	0	0
1	October	334	1.19	223	0.80	111	0.40	635.48	190.13
1	November	133	0.47	33	0.12	100	0.36	67.77	51.13
1	December	969	3.46	180	0.64	788	2.82	368.48	38.04
1	January	382	1.36	171	0.61	211	0.75	312.40	81.79
1	February	186	0.66	58	0.21	128	0.46	132.79	71.52
1	March	630	2.25	292	1.04	339	1.21	285.49	45.29
2	April	386	1.38	211	0.76	175	0.62	373.46	96.70
2	May	-	-	-	-	-	-	-	-
2	June	-	-	-	-	-	-	-	-
2	July	-	-	-	-	-	-	-	-
2	August	-	-	-	-	-	-	-	-
2	September	121	0.43	62	0.22	59	0.21	274.42	227.59
2	October	-	-	-	-	-	-	-	-
2	November	437	1.56	128	0.46	309	1.10	476.38	109.07

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	December	300	1.07	108	0.38	193	0.69	409.64	136.45
2	January	116	0.42	66	0.24	50	0.18	109.93	94.38
2	February	150	0.54	84	0.30	66	0.23	118.90	79.26
2	March	428	1.53	172	0.61	257	0.92	603.22	140.88

C.2 Guillemot

Table C.4: Guillemot MRSea estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	6275	10.23	6207	10.12	67	0.11	672.46	10.72
1	May	1501	2.45	1489	2.43	13	0.02	316.75	21.10
1	June	896	1.46	889	1.45	8	0.01	179.37	20.01
1	July	491	0.80	488	0.80	3	0.00	443.61	90.28
1	August	716	1.17	716	1.17	0	0.00	1438.92	200.95
1	September	1716	2.80	1716	2.80	0	0.00	663.18	38.65
1	October	3477	5.67	3474	5.66	4	0.01	435.31	12.52
1	November	395	0.64	385	0.63	10	0.02	141.64	35.81
1	December	4333	7.06	4271	6.96	62	0.10	677.38	15.63
1	January	2422	3.95	2401	3.91	21	0.03	269.70	11.14

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	February	2965	4.83	2806	4.57	159	0.26	236.10	7.96
1	March	4981	8.12	4970	8.10	10	0.02	530.71	10.66
2	April	3155	5.14	3135	5.11	20	0.03	590.43	18.71
2	May	612	1.00	584	0.95	27	0.04	189.53	30.99
2	June	1944	3.17	1837	2.99	107	0.17	485.90	25.00
2	July	1322	2.15	1318	2.15	4	0.01	221.09	16.73
2	August	6087	9.92	6087	9.92	0	0.00	1853.98	30.46
2	September	6974	11.37	6974	11.37	0	0.00	1184.59	16.99
2	October	1054	1.72	998	1.63	56	0.09	126.72	12.02
2	November	1631	2.66	1529	2.49	101	0.16	360.83	22.13
2	December	1906	3.11	1881	3.07	25	0.04	407.36	21.37
2	January	2599	4.24	2565	4.18	34	0.06	244.83	9.42
2	February	1731	2.82	1543	2.51	188	0.31	304.75	17.61
2	March	4399	7.17	4356	7.10	43	0.07	518.04	11.78

Table C.5: Guillemot MRSea estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	4471	10.30	4423	10.19	48	0.11	672.46	15.04
1	May	1070	2.46	1061	2.44	9	0.02	316.75	29.61

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	June	616	1.42	611	1.41	5	0.01	179.37	29.12
1	July	262	0.60	260	0.60	2	0.00	443.61	169.59
1	August	325	0.75	325	0.75	0	0.00	1438.92	442.32
1	September	820	1.89	820	1.89	0	0.00	663.18	80.87
1	October	2097	4.83	2095	4.82	2	0.00	435.31	20.76
1	November	167	0.38	163	0.37	4	0.01	141.64	84.84
1	December	3036	6.99	2993	6.89	43	0.10	677.38	22.31
1	January	1656	3.81	1641	3.78	15	0.03	269.70	16.29
1	February	2113	4.87	2000	4.61	113	0.26	236.10	11.18
1	March	3549	8.17	3542	8.16	7	0.02	530.71	14.95
2	April	2248	5.18	2234	5.15	14	0.03	590.43	26.26
2	May	436	1.00	416	0.96	19	0.04	189.53	43.49
2	June	1385	3.19	1309	3.01	76	0.18	485.90	35.08
2	July	942	2.17	939	2.16	3	0.01	221.09	23.48
2	August	4337	9.99	4337	9.99	0	0.00	1853.98	42.75
2	September	4611	10.62	4611	10.62	0	0.00	1184.59	25.69
2	October	751	1.73	711	1.64	40	0.09	126.72	16.87
2	November	1162	2.68	1090	2.51	72	0.17	360.83	31.06
2	December	1358	3.13	1341	3.09	18	0.04	407.36	29.99
2	January	1852	4.26	1828	4.21	24	0.06	244.83	13.22
2	February	1233	2.84	1100	2.53	134	0.31	304.75	24.71

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	March	3135	7.22	3104	7.15	31	0.07	518.04	16.53

Table C.6: Guillemot MRSea estimates for the Morgan Array Area

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	2904	10.37	2873	10.26	31	0.11	672.46	23.16
1	May	695	2.48	689	2.46	6	0.02	316.75	45.60
1	June	384	1.37	380	1.36	3	0.01	179.37	46.77
1	July	130	0.47	129	0.46	1	0.00	443.61	340.63
1	August	132	0.47	132	0.47	0	0.00	1438.92	1088.42
1	September	366	1.31	366	1.31	0	0.00	663.18	181.23
1	October	1036	3.70	1035	3.70	1	0.00	435.31	42.01
1	November	59	0.21	57	0.20	1	0.01	141.64	241.11
1	December	1921	6.86	1894	6.77	27	0.10	677.38	35.26
1	January	1036	3.70	1027	3.67	9	0.03	269.70	26.04
1	February	1372	4.90	1299	4.64	73	0.26	236.10	17.21
1	March	2305	8.23	2300	8.22	5	0.02	530.71	23.03
2	April	1460	5.22	1451	5.18	9	0.03	590.43	40.44
2	May	283	1.01	270	0.97	13	0.05	189.53	66.97
2	June	900	3.21	850	3.04	49	0.18	485.90	54.02

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	July	612	2.19	610	2.18	2	0.01	221.09	36.15
2	August	2817	10.06	2817	10.06	0	0.00	1853.98	65.82
2	September	2710	9.68	2710	9.68	0	0.00	1184.59	43.72
2	October	488	1.74	462	1.65	26	0.09	126.72	25.98
2	November	755	2.70	708	2.53	47	0.17	360.83	47.82
2	December	882	3.15	871	3.11	12	0.04	407.36	46.18
2	January	1203	4.30	1187	4.24	16	0.06	244.83	20.36
2	February	801	2.86	714	2.55	87	0.31	304.75	38.05
2	March	2036	7.27	2016	7.20	20	0.07	518.04	25.45

C.3 Razorbill

Table C.7: Razorbill MRSea estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	-	0	-	0	0	0	-	0
1	May	-	0	-	0	0	0	-	-
1	June	-	0	-	0	0	0	-	0
1	July	0	0	0	0	0	0	0	0
1	August	0	0	0	0	0	0	0	0

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	**D**	**Pop**	**D**	**Pop**	**D**	**SD**	**CV**
1	September	-	-	-	-	-	-	-	-
1	October	-	-	-	-	-	-	-	-
1	November	-	-	-	-	-	-	-	-
1	December	1655	2.70	1599	2.61	56	0.09	832.18	50.29
1	January	374	0.61	364	0.59	10	0.02	299.04	80.02
1	February	-	-	-	-	-	-	-	-
1	March	294	0.48	289	0.47	5	0.01	153.03	52.06
2	April	0	0	0	0	0	0	0	0
2	May	-	-	-	-	-	-	-	-
2	June	-	-	-	-	-	-	-	-
2	July	0	0	0	0	0	0	0	0
2	August	0	0	0	0	0	0	0	0
2	September	-	-	-	-	-	-	-	-
2	October	653	1.06	499	0.81	153	0.25	168.75	25.85
2	November	739	1.20	666	1.09	73	0.12	181.66	24.58
2	December	1911	3.11	1911	3.11	0	0.00	777.49	40.69
2	January	584	0.95	578	0.94	5	0.01	197.08	33.76
2	February	419	0.68	414	0.67	5	0.01	150.73	35.95
2	March	-	-	-	-	-	-	-	-

Table C.8: Razorbill MRSea estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	**D**	**Pop**	**D**	**Pop**	**D**	**SD**	**CV**
1	April	-		-				-	
1	May	-		-				-	-
1	June	-		-				-	
1	July	0	0	0	0	0	0	0	0
1	August	0	0	0	0	0	0	0	0
1	September	-	-	-	-	-	-	-	-
1	October	-	-	-	-	-	-	-	-
1	November	-	-	-	-	-	-	-	-
1	December	1079	2.49	1043	2.40	36	0.08	832.18	77.11
1	January	253	0.58	246	0.57	7	0.02	299.04	118.35
1	February	-	-	-	-	-	-	-	-
1	March	192	0.44	189	0.43	3	0.01	153.03	79.82
2	April	0	0	0	0	0	0	0	0
2	May	0	0	0	0	0	0	0	0
2	June	0	0	0	0	0	0	0	0
2	July	0	0	0	0	0	0	0	0
2	August	0	0	0	0	0	0	0	0
2	September	-	-	-	-	-	-	-	-
2	October	468	1.08	358	0.82	110	0.25	168.75	36.10
2	November	491	1.13	442	1.02	48	0.11	181.66	37.02

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	December	1261	2.90	1261	2.90	0	0.00	777.49	61.66
2	January	403	0.93	399	0.92	4	0.01	197.08	48.92
2	February	302	0.70	298	0.69	4	0.01	150.73	49.89
2	March	-	-	-	-	-	-	-	-

Table C.9: Razorbill MRSea estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	-		-				-	
1	May	-		-				-	-
1	June	-		-				-	
1	July	0	0	0	0	0	0	0	0
1	August	0	0	0	0	0	0	0	0
1	September	0	0	0	0	0	0	0	0
1	October	-	-	-	-	-	-	-	-
1	November	-	-	-	-	-	-	-	-
1	December	649	2.32	628	2.24	22	0.08	832.18	128.13
1	January	171	0.61	167	0.6	4	0.02	299.04	174.63
1	February	-	-	-	-	-	-	-	-
1	March	115	0.41	114	0.41	2	0.01	153.03	132.64

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	April	0	0	0	0	0	0	0	0
2	May	0	0	0	0	0	0	0	0
2	June	0	0	0	0	0	0	0	0
2	July	0	0	0	0	0	0	0	0
2	August	0	0	0	0	0	0	0	0
2	September	0	0	0	0	0	0	0	0
2	October	313	1.12	240	0.86	74	0.26	168.75	53.89
2	November	295	1.05	266	0.95	29	0.1	181.66	61.57
2	December	748	2.67	748	2.67	0	0	777.49	104
2	January	253	0.91	251	0.9	2	0.01	197.08	77.75
2	February	192	0.68	189	0.68	2	0.01	150.73	78.65
2	March	-	-	-	-	-	-	-	-

C.4 Manx shearwater

Table C.10: Manx shearwater MRSea estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	119	0.19	97	0.16	22	0.04	785.08	659.23
1	May	-	-	-	-	-	-	-	-

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	June	227	0.37	37	0.06	190	0.31	2565.86	1128.11
1	July	349	0.57	119	0.19	230	0.37	653.92	187.59
1	August	603	0.98	459	0.75	144	0.23	1483.07	246.07
1	September	254	0.41	164	0.27	90	0.15	21117.18	8300.63
1	October	0	0	0	0	0	0	0	0
1	November	0	0	0	0	0	0	0	0
1	December	0	0	0	0	0	0	0	0
1	January	0	0	0	0	0	0	0	0
1	February	0	0	0	0	0	0	0	0
1	March	0	0	0	0	0	0	0	0
2	April	0	0	0	0	0	0	0	0
2	May	-	-	-	-	-	-	-	-
2	June	421	0.69	262	0.43	160	0.26	365.42	86.70
2	July	185	0.30	25	0.04	159	0.26	443.08	240.05
2	August	3143	5.12	2809	4.58	335	0.55	6698.81	213.11
2	September	3173	5.17	2582	4.21	591	0.96	4423.66	139.41
2	October	0	0	0	0	0	0	0	0
2	November	0	0	0	0	0	0	0	0
2	December	0	0	0	0	0	0	0	0
2	January	0	0	0	0	0	0	0	0
2	February	0	0	0	0	0	0	0	0

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	March	0	0	0	0	0	0	0	0

Table C.11: Manx shearwater MRSea estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	58	0.13	47	0.11	11	0.03	785.08	1343.78
1	May	-	-	-	-	-	-	-	-
1	June	159	0.37	26	0.06	133	0.31	2565.86	1616.78
1	July	162	0.37	55	0.13	107	0.25	653.92	402.43
1	August	235	0.54	179	0.41	56	0.13	1483.07	631.23
1	September	157	0.36	101	0.23	56	0.13	21117.18	13492.66
1	October	0	0	0	0	0	0	0	0
1	November	0	0	0	0	0	0	0	0
1	December	0	0	0	0	0	0	0	0
1	January	0	0	0	0	0	0	0	0
1	February	0	0	0	0	0	0	0	0
1	March	0	0	0	0	0	0	0	0
2	April	0	0	0	0	0	0	0	0
2	May	-	-	-	-	-	-	-	-
2	June	224	0.52	139	0.32	85	0.20	365.42	163.25

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	July	76	0.17	10	0.02	65	0.15	443.08	584.40
2	August	2273	5.23	2031	4.68	242	0.56	6698.81	294.71
2	September	1666	3.84	1355	3.12	310	0.71	4423.66	265.58
2	October	0	0	0	0	0	0	0	0
2	November	0	0	0	0	0	0	0	0
2	December	0	0	0	0	0	0	0	0
2	January	0	0	0	0	0	0	0	0
2	February	0	0	0	0	0	0	0	0
2	March	0	0	0	0	0	0	0	0

Table C.12: Manx shearwater MRSea estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	29	0.10	24	0.08	5	0.02	785.08	2694.69
1	May	-	-	-	-	-	-	-	-
1	June	106	0.38	17	0.06	89	0.32	2565.86	2418.84
1	July	52	0.19	18	0.06	34	0.12	653.92	1256.16
1	August	63	0.22	48	0.17	15	0.05	1483.07	2364.96
1	September	85	0.30	55	0.20	30	0.11	21117.18	24913.42
1	October	0	0	0	0	0	0	0	0

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	November	0	0	0	0	0	0	0	0
1	December	0	0	0	0	0	0	0	0
1	January	0	0	0	0	0	0	0	0
1	February	0	0	0	0	0	0	0	0
1	March	0	0	0	0	0	0	0	0
2	April	0	0	0	0	0	0	0	0
2	May	-	-	-	-	-	-	-	-
2	June	109	0.39	68	0.24	41	0.15	365.42	334.03
2	July	25	0.09	3	0.01	22	0.08	443.08	1743.13
2	August	1497	5.35	1337	4.78	159	0.57	6698.81	447.53
2	September	614	2.19	500	1.78	114	0.41	4423.66	720.52
2	October	0	0	0	0	0	0	0	0
2	November	0	0	0	0	0	0	0	0
2	December	0	0	0	0	0	0	0	0
2	January	0	0	0	0	0	0	0	0
2	February	0	0	0	0	0	0	0	0
2	March	0	0	0	0	0	0	0	0

C.5 Gannet

Table C.13: Gannet MRSea estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	-	-	-	-	-	-	-	-
1	May	-	-	-	-	-	-	-	-
1	June	-	-	-	-	-	-	-	-
1	July	-	-	-	-	-	-	-	-
1	August	284	0.46	173	0.28	112	0.18	103.66	36.47
1	September	188	0.31	83	0.14	105	0.17	57.94	30.79
1	October	-	-	-	-	-	-	-	-
1	November	-	-	-	-	-	-	-	-
1	December	-	-	-	-	-	-	-	-
1	January	-	-	-	-	-	-	-	-
1	February	-	-	-	-	-	-	-	-
1	March	-	-	-	-	-	-	-	-
2	April	-	-	-	-	-	-	-	-
2	May	-	-	-	-	-	-	-	-
2	June	-	-	-	-	-	-	-	-
2	July	-	-	-	-	-	-	-	-
2	August	-	-	-	-	-	-	-	-
2	September	217	0.35	116	0.19	101	0.16	86.13	39.67
2	October	-	-	-	-	-	-	-	-

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	November	-	-	-	-	-	-	-	-
2	December	-	-	-	-	-	-	-	-
2	January	0	0	0	0	0	0	0	0
2	February	0	0	0	0	0	0	0	0
2	March	-	-	-	-	-	-	-	-

Table C.14: Gannet MRSea estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	-	-	-	-	-	-	-	-
1	May	-	-	-	-	-	-	-	-
1	June	-	-	-	-	-	-	-	-
1	July	-	-	-	-	-	-	-	-
1	August	191	0.44	116	0.27	75	0.17	103.66	54.41
1	September	112	0.26	50	0.11	63	0.14	57.94	51.60
1	October	-	-	-	-	-	-	-	-
1	November	-	-	-	-	-	-	-	-
1	December	-	-	-	-	-	-	-	-
1	January	-	-	-	-	-	-	-	-
1	February	-	-	-	-	-	-	-	-

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	March	-	-	-	-	-	-	-	-
2	April	-	-	-	-	-	-	-	-
2	May	-	-	-	-	-	-	-	-
2	June	-	-	-	-	-	-	-	-
2	July	-	-	-	-	-	-	-	-
2	August	-	-	-	-	-	-	-	-
2	September	117	0.27	63	0.14	54	0.13	86.13	73.52
2	October	-	-	-	-	-	-	-	-
2	November	-	-	-	-	-	-	-	-
2	December	-	-	-	-	-	-	-	-
2	January	0	0	0	0	0	0	0	0
2	February	0	0	0	0	0	0	0	0
2	March	-	-	-	-	-	-	-	-

Table C.15: Gannet MRSea estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	-	-	-	-	-	-	-	-
1	May	-	-	-	-	-	-	-	-
1	June	0	0	0	0	0	0	0	0

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	July	-	-	-	-	-	-	-	-
1	August	116	0.41	70	0.25	45	0.16	103.66	89.68
1	September	59	0.21	26	0.09	33	0.12	57.94	97.80
1	October	-	-	-	-	-	-	-	-
1	November	-	-	-	-	-	-	-	-
1	December	-	-	-	-	-	-	-	-
1	January	-	-	-	-	-	-	-	-
1	February	0	0	0	0	0	0	0	0
1	March	-	-	-	-	-	-	-	-
2	April	-	-	-	-	-	-	-	-
2	May	-	-	-	-	-	-	-	-
2	June	-	-	-	-	-	-	-	-
2	July	-	-	-	-	-	-	-	-
2	August	-	-	-	-	-	-	-	-
2	September	53	0.19	28	0.10	25	0.09	86.13	162.37
2	October	0	0	0	0	0	0	0	0
2	November	-	-	-	-	-	-	-	-
2	December	0	0	0	0	0	0	0	0
2	January	0	0	0	0	0	0	0	0
2	February	0	0	0	0	0	0	0	0
2	March	-	-	-	-	-	-	-	-

Appendix D: Design-based abundance estimates for the Morgan Array Area + 4 km buffer

Table D.1: Kittiwake design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	554	0.90	347	0.57	207	0.34	99.61	0.18
1	May	179	0.29	69	0.11	110	0.18	36.96	0.23
1	June	87	0.14	27	0.04	60	0.10	26.83	0.32
1	July	30	0.05	4	0.01	26	0.04	15.30	0.51
1	August	15	0.03	3	0.00	13	0.02	11.01	0.72
1	September	23	0.04	9	0.02	14	0.02	13.63	0.59
1	October	740	1.21	484	0.79	256	0.42	336.13	0.45
1	November	194	0.32	46	0.07	149	0.24	43.46	0.23
1	December	1977	3.22	365	0.59	1612	2.63	215.02	0.11
1	January	782	1.27	348	0.57	433	0.71	99.44	0.13
1	February	349	0.57	113	0.18	236	0.38	57.39	0.17
1	March	992	1.62	480	0.78	512	0.83	117.73	0.12
2	April	924	1.51	512	0.83	412	0.67	149.07	0.16
2	May	71	0.12	20	0.03	51	0.08	30.48	0.43
2	June	121	0.20	46	0.07	75	0.12	36.90	0.30
2	July	77	0.13	15	0.03	62	0.10	32.89	0.43
2	August	101	0.16	20	0.03	81	0.13	27.71	0.27
2	September	378	0.62	199	0.32	179	0.29	91.34	0.24
2	October	77	0.13	33	0.05	43	0.07	24.90	0.32

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	November	554	0.90	175	0.29	379	0.62	88.20	0.16
2	December	739	1.20	253	0.41	486	0.79	207.90	0.28
2	January	331	0.54	190	0.31	140	0.23	54.71	0.18
2	February	229	0.37	130	0.21	99	0.16	41.68	0.19
2	March	681	1.11	281	0.46	400	0.65	92.96	0.14

Table D.2: Kittiwake design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	431	0.99	270	0.62	161	0.37	79.32	0.19
1	May	119	0.28	46	0.11	73	0.17	32.80	0.30
1	June	63	0.14	19	0.04	43	0.10	23.28	0.38
1	July	23	0.05	3	0.01	19	0.04	13.18	0.58
1	August	0	0.00	0	0.00	0	0.00	0.00	
1	September	0	0.00	0	0.00	0	0.00	0.00	
1	October	375	0.86	245	0.56	130	0.30	151.29	0.40
1	November	129	0.30	30	0.07	99	0.23	30.87	0.25
1	December	1504	3.46	277	0.64	1227	2.82	180.72	0.12
1	January	580	1.34	258	0.60	321	0.74	84.71	0.15
1	February	225	0.52	73	0.17	152	0.35	49.91	0.22

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	March	692	1.59	335	0.77	357	0.82	104.38	0.15
2	April	573	1.32	317	0.73	255	0.59	90.69	0.16
2	May	63	0.15	17	0.04	45	0.10	29.35	0.47
2	June	84	0.19	32	0.07	52	0.12	27.66	0.33
2	July	31	0.07	6	0.01	25	0.06	15.84	0.51
2	August	63	0.15	13	0.03	50	0.12	21.57	0.34
2	September	250	0.58	132	0.30	118	0.27	75.19	0.30
2	October	39	0.09	17	0.04	22	0.05	17.96	0.46
2	November	391	0.90	124	0.28	267	0.62	80.51	0.21
2	December	662	1.52	226	0.52	436	1.00	206.80	0.32
2	January	246	0.57	142	0.33	104	0.24	45.82	0.20
2	February	190	0.44	108	0.25	82	0.19	38.29	0.21
2	March	509	1.17	210	0.48	299	0.69	81.89	0.16

Table D.3: Kittiwake design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April							63.29	0.22
1	May							30.83	0.33
1	June							19.36	0.51

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	July							10.66	0.74
1	August							0.00	
1	September							0.00	
1	October							148.57	0.52
1	November							25.82	0.30
1	December							143.56	0.15
1	January							53.88	0.18
1	February							46.54	0.25
1	March							87.73	0.20
2	April							72.51	0.19
2	May							27.59	0.50
2	June							18.51	0.61
2	July							13.44	0.58
2	August							15.59	0.49
2	September							33.63	0.39
2	October							7.81	1.04
2	November							60.41	0.26
2	December							49.48	0.20
2	January							43.23	0.23
2	February							28.91	0.29
2	March							73.70	0.20

Table D.4: Little gull design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	8	0.01	0	0.00	8	0.01	8.13	0.98
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	15	0.02	0	0.00	15	0.02	10.56	0.71
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	159	0.26	69	0.11	90	0.15	48.24	0.33
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.5: Little gull design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	8	0.02	0	0.00	8	0.02	8.07	0.98
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	8	0.02	0	0.00	8	0.02	7.96	1.02
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	142	0.33	62	0.14	80	0.18	47.07	0.36
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.6: Little gull design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	8	0.03	0	0.00	8	0.03	8.04	0.97
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	8	0.03	0	0.00	8	0.03	7.94	1.02
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	85	0.30	37	0.13	48	0.17	33.01	0.42
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.7: Mediterranean gull design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	8	0.01	0	0.00	8	0.01	7.76	1.01
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.8: Mediterranean gull design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	8	0.02	0	0.00	8	0.02	7.74	1.01
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.9: Mediterranean gull design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.10: Common gull design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	8	0.01	0	0.00	8	0.01	8.02	1.04
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	8	0.01	0	0.00	8	0.01	7.81	1.00
1	December	8	0.01	0	0.00	8	0.01	8.08	0.99
1	January	38	0.06	6	0.01	32	0.05	25.33	0.66
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	15	0.02	0	0.00	15	0.02	15.33	1.01
2	December	68	0.11	0	0.00	68	0.11	28.89	0.43
2	January	34	0.06	15	0.02	19	0.03	19.24	0.62
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	24	0.04	4	0.01	20	0.03	12.80	0.55

Table D.11: Common gull design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	15	0.04	3	0.01	13	0.03	11.12	0.72
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	15	0.03	0	0.00	15	0.03	15.33	1.01
2	December	68	0.16	0	0.00	68	0.16	28.91	0.43
2	January	34	0.08	15	0.03	19	0.04	19.22	0.62
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	8	0.02	1	0.00	7	0.02	7.83	1.00

Table D.12: Common gull design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	8	0.03	1	0.00	7	0.02	7.76	1.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	15	0.05	0	0.00	15	0.05	15.35	1.02

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	December	38	0.14	0	0.00	38	0.14	16.53	0.44
2	January	9	0.03	4	0.01	5	0.02	7.75	0.98
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	8	0.03	1	0.00	7	0.02	7.84	0.99

Table D.13: Great black-backed gull design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	27	0.04	3	0.00	24	0.04	13.47	0.59
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	8	0.01	8	0.01	0	0.00	7.70	1.00
1	January	193	0.31	124	0.20	69	0.11	75.13	0.41
1	February	16	0.03	8	0.01	8	0.01	10.86	0.68
1	March	58	0.09	42	0.07	16	0.03	19.76	0.36

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	18	0.03	9	0.01	9	0.01	10.57	0.70
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	162	0.26	113	0.18	49	0.08	97.97	0.60
2	January	95	0.15	79	0.13	16	0.03	45.22	0.48
2	February	79	0.13	43	0.07	36	0.06	35.95	0.46
2	March	24	0.04	21	0.03	3	0.00	17.06	0.72

Table D.14: Great black-backed gull design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	**D**	**Pop**	**D**	**Pop**	**D**	**SD**	**CV**
1	August	9	0.02	1	0.00	8	0.02	7.78	1.05
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	8	0.02	8	0.02	0	0.00	7.67	1.00
1	January	97	0.22	62	0.14	34	0.08	30.07	0.33
1	February	8	0.02	4	0.01	4	0.01	7.62	0.97
1	March	25	0.06	18	0.04	7	0.02	13.03	0.56
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	9	0.02	4	0.01	4	0.01	7.50	0.99
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	163	0.37	113	0.26	49	0.11	98.09	0.60
2	January	95	0.22	79	0.18	16	0.04	45.16	0.48
2	February	40	0.09	22	0.05	18	0.04	16.87	0.43
2	March	8	0.02	7	0.02	1	0.00	7.35	0.95

Table D.15: Great black-backed gull design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	9	0.03	1	0.00	8	0.03	7.75	1.05
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	88	0.32	57	0.20	32	0.11	29.04	0.35
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	17	0.06	12	0.04	5	0.02	11.00	0.69
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	9	0.03	4	0.02	4	0.02	7.48	0.99
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	December	155	0.55	108	0.38	47	0.17	97.86	0.63
2	January	95	0.34	79	0.28	16	0.06	44.92	0.48
2	February	24	0.09	13	0.05	11	0.04	13.01	0.56
2	March	8	0.03	7	0.02	1	0.00	7.36	0.95

Table D.16: Herring gull design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	8	0.01	3	0.01	5	0.01	7.57	1.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	18	0.03	11	0.02	8	0.01	16.21	1.04
1	September	8	0.01	4	0.01	4	0.01	7.64	1.01
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	88	0.14	31	0.05	57	0.09	34.55	0.39
1	January	523	0.85	223	0.36	300	0.49	292.32	0.59
1	February	16	0.03	8	0.01	8	0.01	10.90	0.67
1	March	17	0.03	7	0.01	9	0.02	10.85	0.69

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	April	16	0.03	11	0.02	5	0.01	11.30	0.73
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	8	0.01	0	0.00	8	0.01	7.68	0.98
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	58	0.09	34	0.06	24	0.04	54.41	1.01
2	December	214	0.35	69	0.11	145	0.24	126.24	0.59
2	January	48	0.08	36	0.06	12	0.02	36.09	0.75
2	February	175	0.29	121	0.20	54	0.09	94.16	0.55
2	March	203	0.33	139	0.23	68	0.11	54.56	0.27

Table D.17: Herring gull design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	August	18	0.04	11	0.02	8	0.02	16.19	1.04
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	54	0.12	19	0.04	35	0.08	21.68	0.40
1	January	163	0.37	69	0.16	93	0.21	68.72	0.44
1	February	16	0.04	8	0.02	8	0.02	10.89	0.67
1	March	17	0.04	7	0.02	9	0.02	10.77	0.69
2	April	16	0.04	11	0.02	5	0.01	11.23	0.73
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	58	0.13	34	0.08	24	0.06	54.35	1.01
2	December	207	0.48	67	0.15	140	0.32	126.08	0.61
2	January	48	0.11	36	0.08	12	0.03	36.07	0.75
2	February	16	0.04	11	0.03	5	0.01	11.00	0.69
2	March	159	0.37	107	0.25	52	0.12	49.95	0.32

Table D.18: Herring gull design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	18	0.06	11	0.04	8	0.03	16.15	1.04
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	38	0.14	14	0.05	25	0.09	18.49	0.48
1	January	155	0.55	66	0.24	89	0.32	67.92	0.46
1	February	16	0.06	8	0.03	8	0.03	10.83	0.67
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	16	0.06	11	0.04	5	0.02	11.23	0.73
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	December	124	0.44	40	0.14	84	0.30	102.11	0.82
2	January	48	0.17	36	0.13	12	0.04	35.90	0.75
2	February	8	0.03	6	0.02	3	0.01	7.55	0.95
2	March	103	0.37	69	0.25	34	0.12	39.14	0.39

Table D.19: Lesser black-backed gull design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	17	0.03	4	0.01	13	0.02	7.36	0.96
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	9	0.01	2	0.00	7	0.01	7.53	0.98
1	September	62	0.10	45	0.07	17	0.03	42.25	0.69
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	8	0.01	0	0.00	8	0.01	7.50	0.99
1	February	8	0.01	0	0.00	8	0.01	8.08	1.01
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	April	16	0.03	3	0.00	13	0.02	10.74	0.70
2	May	15	0.03	0	0.00	15	0.03	11.17	0.72
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	79	0.13	31	0.05	47	0.08	60.60	0.90
2	September	7	0.01	0	0.00	7	0.01	6.86	1.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	8	0.01	8	0.01	0	0.00	7.65	1.01
2	March	16	0.03	8	0.01	8	0.01	10.74	0.70

Table D.20: Lesser black-backed gull design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	August	9	0.02	2	0.00	7	0.02	7.52	0.98
1	September	8	0.02	6	0.01	2	0.00	7.65	1.01
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	8	0.02	0	0.00	8	0.02	8.05	1.01
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	16	0.04	3	0.01	13	0.03	10.70	0.70
2	May	15	0.04	0	0.00	15	0.04	11.14	0.72
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	7	0.02	0	0.00	7	0.02	6.81	1.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	8	0.02	8	0.02	0	0.00	7.64	1.01
2	March	16	0.04	8	0.02	8	0.02	10.74	0.70

Table D.21: Lesser black-backed gull design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	8	0.03	6	0.02	2	0.01	7.65	1.01
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	8	0.03	0	0.00	8	0.03	8.03	1.01
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	8	0.03	1	0.00	7	0.02	7.61	0.98
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	7	0.02	0	0.00	7	0.02	6.80	1.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	8	0.03	8	0.03	0	0.00	7.61	1.01
2	March	16	0.06	8	0.03	8	0.03	10.78	0.70

Table D.22: Common tern design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	59	0.10	0	0.00	59	0.10	43.90	0.99
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.23: Common tern design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.24: Common tern design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.25: Arctic tern design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	63	0.10	0	0.00	63	0.10	22.89	0.97
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.26: Arctic tern design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	63	0.14	0	0.00	63	0.14	22.87	0.97
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.27: Arctic tern design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.28: Great skua design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	8	0.01	0	0.00	8	0.01	7.57	0.98
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.29: Great skua design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	8	0.02	0	0.00	8	0.02	7.54	0.98
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.30: Great skua design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	8	0.03	0	0.00	8	0.03	7.54	0.98
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.31: Arctic skua design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	7	0.01	0	0.00	7	0.01	6.84	0.97
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.32: Arctic skua design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.33: Arctic skua design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.34: Guillemot design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	6004	9.78	5944	9.69	60	0.10	233.48	0.06
1	May	1285	2.09	1275	2.08	10	0.02	98.63	0.11
1	June	804	1.31	785	1.28	20	0.03	88.60	0.15
1	July	629	1.02	625	1.02	4	0.01	77.73	0.17
1	August	653	1.06	653	1.06	0	0.00	111.15	0.23
1	September	1180	1.92	1180	1.92	0	0.00	113.79	0.14
1	October	3545	5.78	3541	5.77	3	0.01	238.41	0.10
1	November	380	0.62	371	0.60	9	0.01	47.18	0.21
1	December	4165	6.79	4029	6.57	136	0.22	251.08	0.10
1	January	2444	3.98	2424	3.95	20	0.03	130.89	0.09
1	February	2644	4.31	2516	4.10	128	0.21	101.61	0.11

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	**D**	**Pop**	**D**	**Pop**	**D**	**SD**	**CV**
1	March	5108	8.32	5098	8.31	10	0.02	207.27	0.07
2	April	2793	4.55	2773	4.52	21	0.03	172.81	0.08
2	May	452	0.74	433	0.71	19	0.03	109.94	0.32
2	June	1448	2.36	1371	2.23	77	0.12	108.81	0.10
2	July	1174	1.91	1171	1.91	3	0.01	98.16	0.11
2	August	6477	10.56	6477	10.56	0	0.00	568.61	0.12
2	September	3686	6.01	3686	6.01	0	0.00	367.48	0.13
2	October	706	1.15	675	1.10	32	0.05	44.88	0.21
2	November	1568	2.56	1457	2.37	111	0.18	86.84	0.12
2	December	1208	1.97	1191	1.94	18	0.03	128.65	0.17
2	January	2449	3.99	2415	3.94	35	0.06	123.03	0.08
2	February	1298	2.12	1162	1.89	136	0.22	102.51	0.11
2	March	4275	6.97	4221	6.88	54	0.09	169.65	0.06

Table D.35: Guillemot design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	**D**	**Pop**	**D**	**Pop**	**D**	**SD**	**CV**
1	April	4400	10.13	4356	10.03	44	0.10	209.16	0.07
1	May	885	2.04	879	2.02	7	0.02	84.87	0.14
1	June	566	1.30	552	1.27	14	0.03	77.58	0.19

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	July	381	0.88	378	0.87	2	0.01	62.05	0.22
1	August	219	0.50	219	0.50	0	0.00	58.03	0.36
1	September	461	1.06	461	1.06	0	0.00	65.17	0.20
1	October	2269	5.22	2267	5.22	2	0.00	204.36	0.13
1	November	196	0.45	191	0.44	5	0.01	28.80	0.25
1	December	2360	5.44	2283	5.26	77	0.18	137.09	0.10
1	January	1888	4.35	1873	4.31	16	0.04	116.10	0.10
1	February	2046	4.71	1946	4.48	99	0.23	87.47	0.12
1	March	3475	8.00	3469	7.99	7	0.02	164.77	0.08
2	April	1771	4.08	1758	4.05	13	0.03	134.20	0.10
2	May	348	0.80	334	0.77	15	0.03	105.97	0.40
2	June	902	2.08	855	1.97	48	0.11	84.53	0.12
2	July	903	2.08	900	2.07	2	0.01	87.87	0.13
2	August	4337	9.99	4337	9.99	0	0.00	470.85	0.14
2	September	1678	3.86	1678	3.86	0	0.00	219.55	0.18
2	October	423	0.98	404	0.93	19	0.04	35.49	0.28
2	November	963	2.22	894	2.06	68	0.16	72.30	0.16
2	December	875	2.02	862	1.99	13	0.03	124.50	0.23
2	January	1824	4.20	1799	4.14	26	0.06	108.52	0.09
2	February	813	1.87	728	1.68	85	0.20	73.16	0.13
2	March	3040	7.00	3002	6.91	38	0.09	140.96	0.07

Table D.36: Guillemot design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	3076	10.99	3046	10.88	31	0.11	174.19	0.08
1	May	669	2.39	664	2.37	5	0.02	76.65	0.17
1	June	370	1.32	361	1.29	9	0.03	65.81	0.25
1	July	225	0.80	224	0.80	1	0.00	43.23	0.26
1	August	101	0.36	101	0.36	0	0.00	47.98	0.64
1	September	169	0.60	169	0.60	0	0.00	40.11	0.34
1	October	1437	5.13	1436	5.13	1	0.00	190.26	0.19
1	November	79	0.28	77	0.28	2	0.01	19.40	0.42
1	December	1386	4.95	1341	4.79	45	0.16	108.12	0.13
1	January	1286	4.60	1276	4.56	11	0.04	92.95	0.12
1	February	1537	5.49	1462	5.22	75	0.27	75.60	0.14
1	March	2311	8.26	2307	8.24	5	0.02	135.91	0.10
2	April	891	3.18	885	3.16	7	0.02	88.19	0.13
2	May	174	0.62	167	0.60	7	0.03	41.73	0.32
2	June	548	1.96	519	1.85	29	0.10	61.19	0.15
2	July	630	2.25	628	2.24	2	0.01	71.84	0.15
2	August	1587	5.67	1587	5.67	0	0.00	255.80	0.21
2	September	778	2.78	778	2.78	0	0.00	123.30	0.21
2	October	264	0.94	252	0.90	12	0.04	26.11	0.33

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	November	311	1.11	289	1.03	22	0.08	39.09	0.27
2	December	433	1.55	427	1.52	6	0.02	79.60	0.30
2	January	1158	4.14	1141	4.08	16	0.06	79.64	0.11
2	February	597	2.13	534	1.91	62	0.22	62.64	0.15
2	March	2227	7.96	2200	7.86	28	0.10	122.02	0.08

Table D.37: Razorbill design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	52	0.09	52	0.09	0	0.00	16.90	0.42
1	May	21	0.03	21	0.03	0	0.00	10.93	0.71
1	June	80	0.13	80	0.13	0	0.00	24.04	0.39
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	10	0.02	10	0.02	0	0.00	7.32	1.01
1	October	109	0.18	106	0.17	3	0.00	27.53	0.33
1	November	189	0.31	121	0.20	68	0.11	106.84	0.84
1	December	1956	3.19	1855	3.02	101	0.16	343.24	0.28
1	January	309	0.50	301	0.49	8	0.01	76.34	0.36
1	February	411	0.67	411	0.67	0	0.00	67.76	0.44

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	March	229	0.37	225	0.37	4	0.01	44.45	0.31
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	10	0.02	10	0.02	0	0.00	7.92	1.02
2	June	9	0.01	9	0.01	0	0.00	7.17	1.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	8	0.01	8	0.01	1	0.00	7.30	1.04
2	October	395	0.64	311	0.51	84	0.14	54.24	0.41
2	November	753	1.23	682	1.11	70	0.11	78.73	0.20
2	December	1311	2.14	1308	2.13	3	0.01	241.86	0.28
2	January	475	0.77	471	0.77	4	0.01	79.95	0.25
2	February	363	0.59	359	0.58	4	0.01	76.65	0.28
2	March	120	0.20	116	0.19	4	0.01	33.05	0.38

Table D.38: Razorbill design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	10	0.02	10	0.02	0	0.00	7.75	0.99
1	May	21	0.05	21	0.05	0	0.00	10.88	0.71
1	June	70	0.16	70	0.16	0	0.00	22.74	0.43

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	10	0.02	10	0.02	0	0.00	7.31	1.01
1	October	39	0.09	38	0.09	1	0.00	15.08	0.51
1	November	166	0.38	106	0.24	60	0.14	105.96	0.94
1	December	1317	3.03	1250	2.88	68	0.16	255.53	0.31
1	January	261	0.60	254	0.59	7	0.02	70.82	0.40
1	February	190	0.44	190	0.44	0	0.00	46.01	0.65
1	March	143	0.33	141	0.32	2	0.01	35.44	0.40
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	8	0.02	8	0.02	1	0.00	7.26	1.04
2	October	279	0.64	219	0.51	59	0.14	50.26	0.54
2	November	419	0.96	380	0.87	39	0.09	56.50	0.26
2	December	938	2.16	936	2.16	2	0.01	221.50	0.35
2	January	316	0.73	314	0.72	3	0.01	53.19	0.25
2	February	302	0.70	299	0.69	4	0.01	70.51	0.31
2	March	98	0.23	94	0.22	4	0.01	31.70	0.45

Table D.39: Razorbill design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	**D**	**Pop**	**D**	**Pop**	**D**	**SD**	**CV**
1	April	10	0.04	10	0.04	0	0.00	7.74	0.99
1	May	10	0.04	10	0.04	0	0.00	7.64	1.01
1	June	49	0.18	49	0.18	0	0.00	17.09	0.45
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	39	0.14	38	0.14	1	0.00	15.03	0.51
1	November	154	0.55	98	0.35	55	0.20	105.44	1.01
1	December	917	3.27	869	3.11	47	0.17	203.04	0.35
1	January	226	0.81	220	0.79	6	0.02	68.89	0.45
1	February	189	0.67	189	0.67	0	0.00	45.86	0.65
1	March	70	0.25	69	0.25	1	0.00	29.00	0.66
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	186	0.66	147	0.52	40	0.14	46.49	0.75

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	November	164	0.58	148	0.53	15	0.05	46.08	0.55
2	December	100	0.36	100	0.36	0	0.00	24.86	0.37
2	January	215	0.77	213	0.76	2	0.01	40.49	0.28
2	February	199	0.71	196	0.70	2	0.01	62.03	0.42
2	March	22	0.08	21	0.07	1	0.00	11.02	0.71

Table D.40: Puffin design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	18	0.03	18	0.03	0	0.00	10.91	0.71
1	May	19	0.03	19	0.03	0	0.00	11.18	0.71
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	8	0.01	8	0.01	0	0.00	7.07	1.01
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	10	0.02	10	0.02	0	0.00	7.53	0.96
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.41: Puffin design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	18	0.04	18	0.04	0	0.00	10.83	0.71
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	9	0.02	9	0.02	0	0.00	7.52	0.96
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.42: Puffin design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	0	0.00	0	0.00	0	0.00	0.00	0.00
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	0	0.00	0	0.00	0	0.00	0.00	0.00
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	9	0.03	9	0.03	0	0.00	7.50	0.96
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.43: Fulmar design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	32	0.05	5	0.01	26	0.04	15.80	0.50
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	8	0.01	4	0.01	4	0.01	7.79	1.01
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	8	0.01	6	0.01	1	0.00	7.46	0.99
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	127	0.21	63	0.10	63	0.10	78.01	0.62
1	February	8	0.01	2	0.00	6	0.01	8.08	0.98

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	March	15	0.02	8	0.01	8	0.01	10.71	0.70
2	April	23	0.04	20	0.03	3	0.00	12.94	0.57
2	May	8	0.01	8	0.01	0	0.00	8.09	1.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	8	0.01	8	0.01	0	0.00	7.50	0.95
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	78	0.13	58	0.10	19	0.03	27.09	0.35
2	December	30	0.05	22	0.04	9	0.01	15.06	0.50
2	January	86	0.14	77	0.13	8	0.01	32.34	0.38
2	February	39	0.06	23	0.04	16	0.03	19.97	0.51
2	March	55	0.09	51	0.08	4	0.01	26.55	0.48

Table D.44: Fulmar design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	24	0.05	4	0.01	20	0.05	13.35	0.56
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	126	0.29	63	0.15	63	0.15	77.74	0.62
1	February	8	0.02	2	0.00	6	0.01	8.08	0.98
1	March	8	0.02	4	0.01	4	0.01	7.68	0.97
2	April	15	0.03	13	0.03	2	0.00	10.89	0.72
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	8	0.02	8	0.02	0	0.00	7.49	0.95
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	47	0.11	35	0.08	12	0.03	22.03	0.47
2	December	30	0.07	22	0.05	9	0.02	15.05	0.50
2	January	78	0.18	70	0.16	7	0.02	31.55	0.41
2	February	24	0.05	14	0.03	10	0.02	16.79	0.71
2	March	39	0.09	36	0.08	3	0.01	20.15	0.52

Table D.45: Fulmar design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	16	0.06	3	0.01	13	0.05	10.86	0.69
1	May	0	0.00	0	0.00	0	0.00	0.00	0.00
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	0	0.00	0	0.00	0	0.00	0.00	0.00
1	August	0	0.00	0	0.00	0	0.00	0.00	0.00
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	126	0.45	63	0.22	63	0.22	77.42	0.62
1	February	8	0.03	2	0.01	6	0.02	8.05	0.98
1	March	8	0.03	4	0.01	4	0.01	7.67	0.97
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	0	0.00	0	0.00	0	0.00	0.00	0.00
2	June	0	0.00	0	0.00	0	0.00	0.00	0.00
2	July	8	0.03	8	0.03	0	0.00	7.44	0.95
2	August	0	0.00	0	0.00	0	0.00	0.00	0.00
2	September	0	0.00	0	0.00	0	0.00	0.00	0.00
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	November	15	0.05	11	0.04	4	0.01	10.89	0.71
2	December	8	0.03	5	0.02	2	0.01	7.61	0.99
2	January	62	0.22	56	0.20	6	0.02	29.95	0.49
2	February	8	0.03	5	0.02	3	0.01	7.84	1.01
2	March	32	0.11	29	0.10	2	0.01	18.73	0.59

Table D.46: Manx shearwater design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	110	0.18	90	0.15	20	0.03	39.23	0.36
1	May	49	0.08	33	0.05	16	0.03	22.39	0.46
1	June	284	0.46	45	0.07	239	0.39	61.71	0.22
1	July	584	0.95	188	0.31	396	0.65	201.30	0.35
1	August	95	0.15	75	0.12	20	0.03	28.85	0.31
1	September	226	0.37	149	0.24	77	0.13	92.05	0.41
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	23	0.04	13	0.02	10	0.02	16.47	0.72
2	June	61	0.10	38	0.06	23	0.04	24.67	0.41
2	July	46	0.08	6	0.01	40	0.07	18.71	0.41
2	August	983	1.60	873	1.42	109	0.18	271.27	0.28
2	September	1607	2.62	1294	2.11	312	0.51	409.35	0.26
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.47: Manx shearwater design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	101	0.23	83	0.19	19	0.04	38.72	0.39
1	May	16	0.04	11	0.02	5	0.01	10.93	0.69
1	June	260	0.60	42	0.10	219	0.50	60.11	0.23

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	**D**	**Pop**	**D**	**Pop**	**D**	**SD**	**CV**
1	July	140	0.32	45	0.10	95	0.22	43.56	0.31
1	August	40	0.09	32	0.07	8	0.02	18.11	0.46
1	September	39	0.09	26	0.06	13	0.03	25.62	0.66
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	8	0.02	4	0.01	4	0.01	7.60	0.99
2	June	30	0.07	19	0.04	11	0.03	14.44	0.48
2	July	31	0.07	4	0.01	26	0.06	14.94	0.49
2	August	833	1.92	741	1.71	93	0.21	264.48	0.32
2	September	728	1.68	587	1.35	142	0.33	204.44	0.28
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.48: Manx shearwater design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	78	0.28	64	0.23	14	0.05	34.48	0.45
1	May	16	0.06	11	0.04	5	0.02	10.92	0.69
1	June	161	0.58	26	0.09	136	0.48	49.34	0.31
1	July	69	0.25	22	0.08	47	0.17	24.85	0.36
1	August	8	0.03	6	0.02	2	0.01	8.25	1.04
1	September	0	0.00	0	0.00	0	0.00	0.00	0.00
1	October	0	0.00	0	0.00	0	0.00	0.00	0.00
1	November	0	0.00	0	0.00	0	0.00	0.00	0.00
1	December	0	0.00	0	0.00	0	0.00	0.00	0.00
1	January	0	0.00	0	0.00	0	0.00	0.00	0.00
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	0	0.00	0	0.00	0	0.00	0.00	0.00
2	April	0	0.00	0	0.00	0	0.00	0.00	0.00
2	May	8	0.03	4	0.02	4	0.01	7.57	0.99
2	June	30	0.11	19	0.07	11	0.04	14.39	0.48
2	July	8	0.03	1	0.00	7	0.02	7.61	1.00
2	August	535	1.91	476	1.70	59	0.21	208.25	0.39
2	September	377	1.35	304	1.09	73	0.26	137.05	0.36
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	November	0	0.00	0	0.00	0	0.00	0.00	0.00
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	0	0.00	0	0.00	0	0.00	0.00	0.00

Table D.49: Gannet design-based estimates for the Morgan Array Area + 4 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	85	0.14	65	0.11	20	0.03	29.23	0.34
1	May	46	0.08	28	0.04	19	0.03	19.44	0.42
1	June	24	0.04	10	0.02	13	0.02	17.19	0.73
1	July	123	0.20	48	0.08	75	0.12	30.33	0.25
1	August	276	0.45	167	0.27	108	0.18	52.09	0.19
1	September	233	0.38	102	0.17	131	0.21	41.94	0.18
1	October	114	0.19	75	0.12	39	0.06	28.61	0.25
1	November	15	0.02	2	0.00	13	0.02	10.99	0.75
1	December	55	0.09	22	0.04	33	0.05	23.03	0.42
1	January	22	0.04	13	0.02	9	0.01	12.83	0.57
1	February	23	0.04	4	0.01	19	0.03	17.83	0.77

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	March	38	0.06	19	0.03	19	0.03	16.44	0.44
2	April	70	0.11	40	0.06	30	0.05	22.73	0.33
2	May	15	0.02	9	0.01	7	0.01	10.57	0.69
2	June	45	0.07	5	0.01	41	0.07	26.04	0.57
2	July	39	0.06	16	0.03	23	0.04	16.85	0.44
2	August	153	0.25	61	0.10	92	0.15	40.03	0.26
2	September	158	0.26	86	0.14	73	0.12	34.84	0.22
2	October	61	0.10	26	0.04	36	0.06	23.32	0.38
2	November	86	0.14	46	0.08	40	0.06	28.11	0.33
2	December	15	0.03	0	0.00	15	0.03	10.81	0.70
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	24	0.04	15	0.02	9	0.02	13.37	0.56

Table D.50: Gannet design-based estimates for the Morgan Array Area + 2 km buffer.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	46	0.11	35	0.08	11	0.02	21.19	0.46
1	May	23	0.05	14	0.03	9	0.02	13.19	0.58
1	June	16	0.04	7	0.02	9	0.02	15.59	1.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	**D**	**Pop**	**D**	**Pop**	**D**	**SD**	**CV**
1	July	76	0.18	30	0.07	47	0.11	23.88	0.31
1	August	135	0.31	82	0.19	53	0.12	35.16	0.26
1	September	124	0.29	54	0.12	70	0.16	31.20	0.25
1	October	83	0.19	55	0.13	29	0.07	23.76	0.29
1	November	15	0.03	2	0.00	13	0.03	11.00	0.75
1	December	55	0.13	22	0.05	33	0.08	22.94	0.42
1	January	22	0.05	13	0.03	9	0.02	12.82	0.58
1	February	8	0.02	1	0.00	7	0.02	8.14	1.00
1	March	22	0.05	11	0.03	11	0.03	12.48	0.56
2	April	54	0.12	31	0.07	23	0.05	19.94	0.37
2	May	7	0.02	4	0.01	3	0.01	7.55	1.02
2	June	38	0.09	4	0.01	34	0.08	25.53	0.68
2	July	23	0.05	10	0.02	14	0.03	12.92	0.56
2	August	84	0.19	33	0.08	50	0.12	26.93	0.32
2	September	69	0.16	38	0.09	32	0.07	21.09	0.30
2	October	45	0.10	19	0.04	26	0.06	20.56	0.45
2	November	47	0.11	25	0.06	22	0.05	18.37	0.39
2	December	15	0.04	0	0.00	15	0.04	10.82	0.70
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	24	0.06	15	0.03	9	0.02	13.36	0.56

Table D.51: Gannet design-based estimates for the Morgan Array Area.

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
1	April	15	0.05	12	0.04	3	0.01	10.64	0.71
1	May	15	0.05	9	0.03	6	0.02	10.92	0.72
1	June	0	0.00	0	0.00	0	0.00	0.00	0.00
1	July	38	0.14	15	0.05	23	0.08	17.41	0.46
1	August	101	0.36	61	0.22	40	0.14	30.42	0.30
1	September	55	0.19	24	0.09	31	0.11	20.86	0.38
1	October	76	0.27	50	0.18	26	0.09	22.58	0.30
1	November	7	0.03	1	0.00	6	0.02	7.52	1.07
1	December	15	0.06	6	0.02	9	0.03	10.85	0.70
1	January	15	0.05	9	0.03	6	0.02	10.67	0.72
1	February	0	0.00	0	0.00	0	0.00	0.00	0.00
1	March	22	0.08	11	0.04	11	0.04	12.46	0.56
2	April	39	0.14	22	0.08	17	0.06	16.70	0.43
2	May	7	0.03	4	0.01	3	0.01	7.53	1.02
2	June	38	0.13	4	0.01	34	0.12	25.43	0.67
2	July	16	0.06	6	0.02	9	0.03	10.75	0.69
2	August	76	0.27	30	0.11	46	0.16	25.71	0.34
2	September	35	0.12	19	0.07	16	0.06	15.46	0.44
2	October	0	0.00	0	0.00	0	0.00	0.00	0.00

Year	Month	All behaviours		Sitting only		Flying only		Standard Deviation	Coefficient of Variation
		Pop	D	Pop	D	Pop	D	SD	CV
2	November	31	0.11	17	0.06	14	0.05	15.08	0.49
2	December	0	0.00	0	0.00	0	0.00	0.00	0.00
2	January	0	0.00	0	0.00	0	0.00	0.00	0.00
2	February	0	0.00	0	0.00	0	0.00	0.00	0.00
2	March	8	0.03	5	0.02	3	0.01	7.87	0.98