Arklow Bank Wind Park 2

Environmental Impact Assessment Report

Volume III, Appendix 11.2: Marine Mammals Technical Report

sse Renewables

Sure Partners Ltd

Arklow Bank Wind Park 2

Marine Mammal Technical Report

Volume III, Appendix 11.2

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Statement of Authority

Experts	Qualifications	Relevant Experience
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APEM: Ross Culloch Document audit	Ph.D. Behavioural Ecology and Ecological Modelling, Durham University. M.Sc. Marine Mammal Science, Bangor University. B.Sc. (Hons) Aquatic Bioscience, University of Glasgow.	Ross is an Associate Director and head of the Marine Mammal Consultancy team at APEM. Ross joined APEM in February 2022 from Marine Scotland Science (now Marine Directorate), bringing a wealth of expertise in the field of marine mammal ecology, conservation and management, and a practical understanding of the legislation and policy relating to marine mammals and the consenting of major marine infrastructure projects. Ross has 20 years of experience working on marine mammals, primarily in relation to conservation and management, and anthropogenic impacts including fisheries interactions, collision risk and underwater noise.

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Glossary

Term	Meaning
Arklow Bank Wind Park 1 (ABWP1)	Arklow Bank Wind Park 1 consists of seven wind turbines, offshore export cable and inter-array cables. ABWP1 has a capacity of 25.2 MW. ABWP1 was constructed in 2003/04 and is owned and operated by Arklow Energy Limited. It remains the first and only operational offshore wind farm in Ireland.
Arklow Bank Wind Park 2 (ABWP2) (the Project)	Arklow Bank Wind Park 2 (ABWP2) (The Project) is the onshore and offshore infrastructure. This EIAR is being prepared for the Offshore Infrastructure. Consents for the Onshore Grid Infrastructure (Planning Reference 310090) and Operations and Maintenance Facility (Planning Reference 211316) has been granted on 26th May 2022 and 20th July 2022, respectively. • Arklow Bank Wind Park 2 Offshore Infrastructure: This includes all elements to be consented in accordance with the Maritime Area Consent. This is the subject of this EIAR and will be referred to as 'the Proposed Development' in the EIAR. • Arklow Bank Wind Park 2 Onshore Grid Infrastructure: This relates to the onshore grid infrastructure for which planning permission has been granted. • Arklow Bank Wind Park 2 Operations and Maintenance Facility (OMF): This includes the onshore and nearshore infrastructure at the OMF, for which planning permission has been granted. • Arklow Bank Wind Park 2 EirGrid Upgrade Works: any non-contestable grid upgrade works, consent to be sought and works to be completed by EirGrid.
Arklow Bank Wind Park 2 – Offshore Infrastructure	"The Proposed Development", Arklow Bank Wind Park 2 Offshore Infrastructure: This includes all elements under the existing Maritime Area Consent.
Array Area	The Array Area is the area within which the Wind Turbine Generators (WTGs), the Offshore Substation Platforms (OSPs), and associated cables (export, inter- array and interconnector cabling) and foundations will be installed.
Availability bias	Where an animal is underwater and therefore not available for detection.

Term	Meaning
Cable Corridor and Working Area	The Cable Corridor and Working Area is the area where the export, inter array and interconnector cabling will be installed. This area will also facilitate vessel jacking operations associated with installation of WTG structures and associated foundations within the Array Area.
Cetacean	The order Cetacea includes whales, dolphins and porpoises and is collectively known as cetaceans.
Coefficient of Variation	The ratio of the standard deviation to the mean.
Confidence Interval	The measure of the degree of uncertainty or certainty in a sampling method.
DEFRA	Department for Environment, Food & Rural Affairs
Demersal	living close to and being significantly affected by the seabed.
EirGrid	State-owned electric power transmission system operator (TSO) in Ireland and Transmission Asset Owner (TAO) for the Project's transmission assets.
EIA	An Environmental Impact Assessment (EIA) is a statutory process by which certain planned Projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the Directive 2011/92/EU on the assessment of the effects of certain public and private Projects on the environment as amended by Directive 2014/52/EU of the European Parliament and of the Council (EIA Directive) and the regulations transposing the EIA Directive (EIA Regulations).
Environmental Impact Assessment Report (EIAR)	An Environmental Impact Assessment Report (EIAR) is a report of the effects, if any, which the proposed project, if carried out, would have on the environment. It is prepared by the developer to inform the EIA process.
Foreshore	The bed and shore, below the line of high water of ordinary or medium tides, of the sea and of every tidal river and tidal estuary and of every channel, creek, and bay of the sea or of any such river or estuary including the subsoil below, and the water column above the bed and shore and extending to the 12 nautical mile limit.
Habitats Directive	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive).

Term	Meaning
Haul-out	A behaviour associated with pinnipeds temporarily leaving the water for reasons such as reproduction and rest.
Lanugo	White natal coat of seal pups.
Maritime Area Consent (MAC)	A consent to occupy a specific part of the maritime area on a non-exclusive basis for the purpose of carrying out a Permitted Maritime Usage strictly in accordance with the conditions attached to the MAC granted on 22 December 2022 with reference number 2022-MAC-002.
Pelagic	Being neither close to the bottom of the seafloor nor near the shore.
Perception bias	Where an animal is at the surface, but the detection is missed.
Pinniped	Fin-footed group of marine mammals which are semi-aquatic. Pinnipeds comprise of the following families: Odobenidae (walrus); Otariidae (eared seals, sea lions, and fur seals); and Phocidae (earless seals). Pinnipeds are more broadly known as “seals
the Proposed Development	ABWP2 Offshore Infrastructure: This includes all elements to be consented in accordance with the Maritime Area Consent.
Small Cetacean Abundance in the North Sea and Adjacent Waters (SCANS)	Large scale surveys aimed at estimating the abundance of porpoises and other cetaceans in order to assess the impacts of by-catch. SCANS (1994) and SCANS II (2005), SCANS III (2017) and SCANS VI (2022) have been completed.
Trackline	The track directly ahead of a survey vessel.

Acronyms

Term	Meaning
ABWP1	Arklow Bank Wind Park 1
ABWP2	Arklow Bank Wind Park 2
ADD	acoustic deterrent device
ASL	above sea level
CI	confidence interval
CMS	Convention on Migratory Species
Co.	County
CV	Coefficient of Variation
DAERA	Department of Agriculture, Environment and Rural Affairs
DAHG	Department of Arts, Heritage and the Gaeltacht
DAS	Digital Aerial Surveys
DCHG	Department of Culture, Heritage and the Gaeltacht
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EEZ	Exclusive Economic Zone
EPS	European protected species
ESAS	European Seabirds at Sea
EU	European Union
GPS	Global Positioning System
GSD	ground sample distance
IAMMWG	Inter-agency Marine Mammal Working Group
IWDG	Irish Whale and Dolphin Group
ISCOPE	Irish Scheme for Cetacean Observation and Public Education
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
MAC	Maritime Area Consent
MERP	Marine Ecosystems Research Programme
MMO	Marine Mammal Observer
MPA	Marine Protected Area
MU	Management Unit
NBDC	National Biodiversity Data Centre
NE	North East
NERC	Natural Environment Research Council
NI	Northern Ireland
NIS	Natura Impact Statement

NPWS	National Parks and Wildlife Service
NRW	Natural Resources Wales
OMF	Operations and Maintenance Facility
OSP	Offshore Substation Platform
PAM	passive acoustic monitoring
PAMO	passive acoustic monitoring operator
PPM	porpoise positive minutes
SAC	Special Area of Conservation
SAM	static acoustic monitoring
SCANS	Small Cetacean Abundance in the North Sea
SCOS	Special Committee on Seals
SMRU	Sea Mammal Research Unit
TAO	Transmission Asset Owner
TSO	Transmission System Operator
TTS	temporary threshold shift
UK	United Kingdom
WTG	Wind Turbine Generator

Units

Unit	Description
cm	centimetre
kg	kilogram
km	kilometre
km^2	kilometre squared
kn	knot
m	metre
MW	megawatt
nm	nautical mile

1. Introduction

This Marine Mammal Technical Report provides a detailed baseline characterisation of the marine mammal ecology for the Arklow Bank Wind Park 2 (ABWP2) Offshore Infrastructure (hereafter referred to as the 'Proposed Development') and surrounding area (defined as the Marine Mammal Study Areas in section 3). Data were collated through a detailed desktop study of the existing resources available for marine mammals within the region, incorporating data from third-party organisations, to gain a historical perspective. Site-specific visual boat-based survey data collected for ABWP1 during post-consent monitoring (2001 to 2009) were used to provide further detail. Additional site-specific survey data from two years of aerial surveys (March 2018 to April 2020) were also available to inform the baseline.

The aim of this Technical Report is to provide a robust baseline characterisation of the marine mammal receptors, against which the potential impacts of the Proposed Development can be assessed.

2. Policy and Legislation

In Ireland, the Wildlife Act (1976) and Wildlife (Amendment) Act (2000) provide protection for all cetaceans and seals and their habitats up to 12 nautical miles (nm) from the Irish coast, including protection from disturbance and wilful interference. In neighbouring Irish and Celtic Sea waters, all species of marine mammal are protected under the Wildlife and Countryside Act (1981) in the UK, and by the Wildlife Act (1990) in the Isle of Man.

Twelve species or subspecies of marine mammal are listed in Annex II of the Habitats Directive (Council Directive 92/43/EEC), as those whose conservation requires the designation of Special Areas of Conservation (SACs). In Ireland, Annex II marine mammal species, for which SACs are designated, are harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*). A summary of the SACs designated within each Marine Mammal Management Unit (MU) Study Area for each marine mammal feature is provided in Figure 11.2.1 and Table 11.2.A.12, and the relevant SACs are referenced within the species accounts (Section 6.2). Consideration of the impacts of the Proposed Development on the Conservation Objectives of relevant SACs will be the content of the Proposed Development Natura Impact Statement.

Under Annex IV of the Habitats Directive, all cetacean species are afforded strict protection wherever they occur within a Member State's territory, both inside and outside designated protected areas. These are termed European Protected Species (EPS).

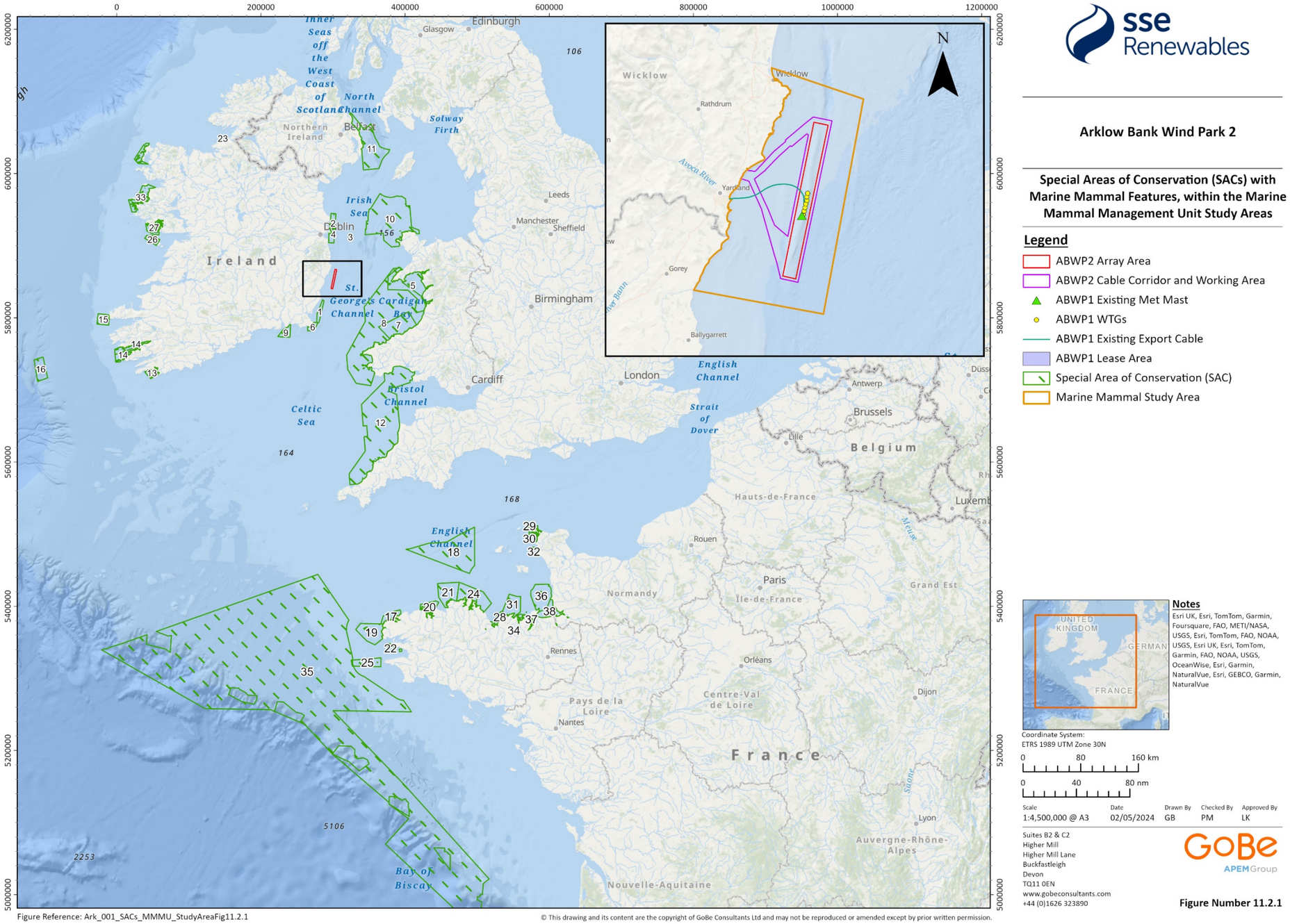


Figure 11.2.1 Special Areas of Conservation (SACs) with marine mammal features, within the Marine Mammal Management Unit Study Area

3. Study Area

Marine mammals are highly mobile and differ in their foraging distances and seasonal distribution; therefore, for the purposes of the marine mammal baseline characterisation, two marine mammal study areas were defined (Figure 11.2.2):

- **Marine Mammal Study Area:** this area encompasses the Array Area and Export Cable Corridors of the Proposed Development plus a 4-kilometre (km) corridor extending around the Array Area and covering the area west of the Array Area to the coast. This combined area is covered by the site-specific digital aerial surveys (DAS) (2018 to 2020).
- **Marine Mammal Management Unit (MU) Study Area:** as marine mammals are highly mobile, the baseline characterisation will also consider marine mammal ecology, behaviour, abundance, and distribution within the appropriate species MU for cetaceans (IAMMWG, 2023). The marine mammal MU Study Area will enable consideration of the scale of movement and population structure for each species. For pinnipeds, this area is defined by survey regions presented in Morris and Duck (2019) and consideration of the seal management units from neighbouring UK waters.

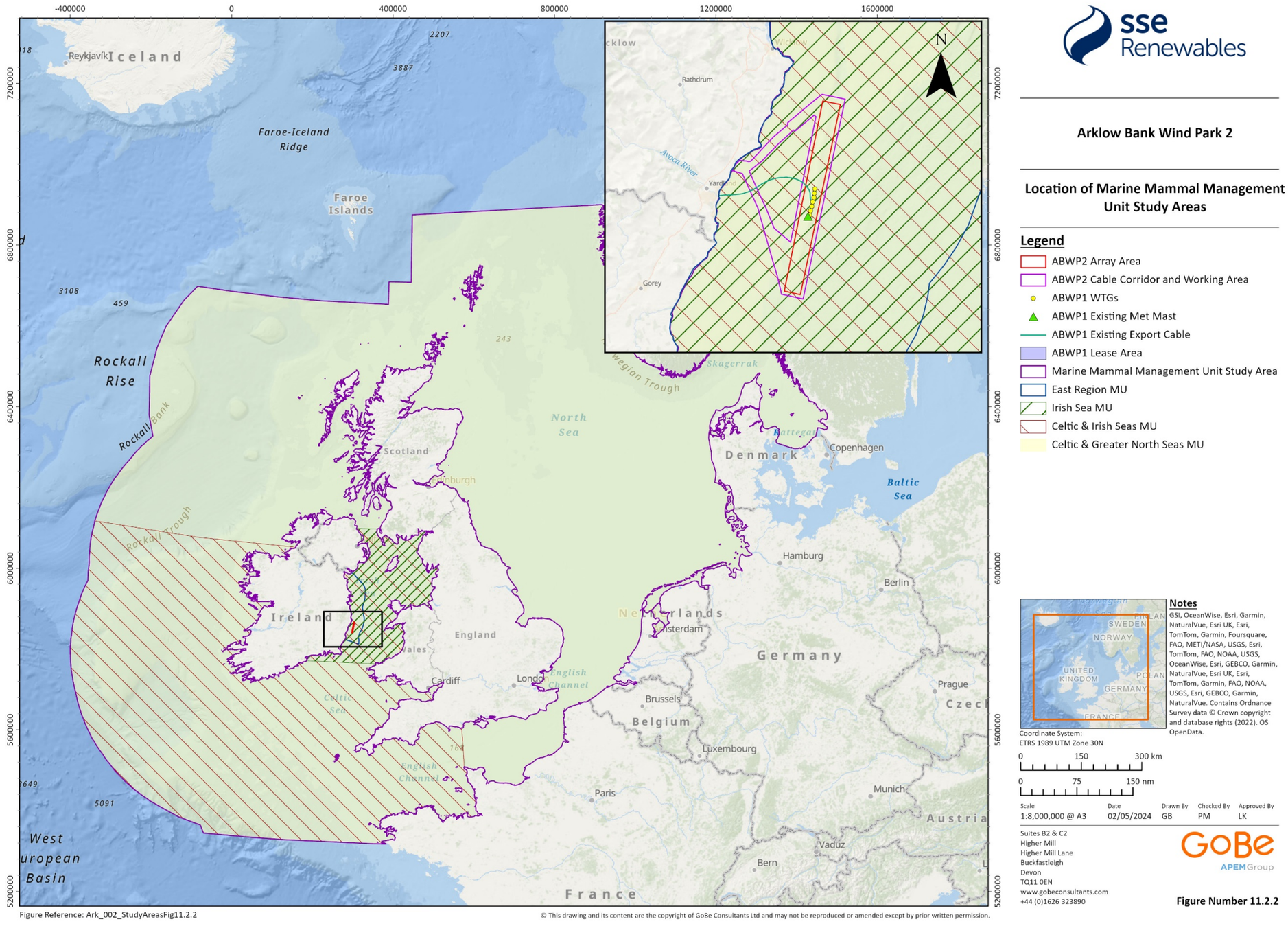


Figure Reference: Ark_002_StudyAreasFig11.2.2

Figure 11.2.2 Location of Marine Mammal Study Area and Marine Mammal Management Unit Study Area for the Proposed Development

4. Consultation

Consultation was undertaken with the National Parks and Wildlife Service (NPWS) and Irish Whale and Dolphin Group (IWDG), in 2019 and 2020, to seek agreement on marine mammal baseline data sources and data collection methodologies to inform site characterisation. Further scoping consultation was undertaken in 2023 and responses from IWDG were received. A summary of the key issues is presented in Table 11.2.1. Additional topics of discussion, e.g. relating to impact assessment, are included in Volume II, Chapter 11: Marine Mammals, in the Environmental Impact Assessment Report (EIAR).

Table 11.2.1 Summary of key points relevant to marine mammals raised during consultation

Date	Consultee and type of response	Issues raised
January 2019	IWDG	Discussion on: • Sources of information including regional monitoring data; • Site-specific survey methods (historical data and aerial surveys); • Mitigation measures to be applied during construction; • Requirement for site-specific noise modelling for piling; and • Return of humpback whales (*Megaptera novaeangliae*) to Irish coastal waters.
January 2019	NPWS	Discussion on: • Sources of data for baseline assessment; • Site-specific noise modelling to be undertaken; • Irish guidance on injury/disturbance to marine mammals recommends consideration of onset of temporary threshold shift (TTS); and • Potential for use of Acoustic Deterrent Devices (ADDs) deployed as part of mitigation strategy.
January 2019	Seal Rescue Ireland	Discussion on: • Site-specific surveys and baseline data; and • Characteristics of seals and location of haul out sites.
August 2020	Department of Culture,	Comments on the Proposed Development marine mammal risk assessment for the geotechnical surveys (relevant to this EIAR):

Date	Consultee and type of response	Issues raised
	Heritage and the Gaeltacht (DCHG)	• Inclusion of the most recent aerial survey data for seals in Ireland; and • Inclusion of TTS in the subsea noise assessment.
October 2020	IWDG – Scoping response	Comments on the previous Scoping Report (submitted 2020): • Inclusion of relevant legislation and guidance including Convention on Migratory Species (CMS) guidance; • Underwater noise during operation and approach; • Study area and scope for baseline data to allow assessment of subsea noise impact; • Static Acoustic Monitoring (SAM) to develop a noise profile of the site before, during and after construction; • The use of Passive Acoustic Monitoring (PAM) as part of mitigation strategy; • Concern regarding assigning unidentified 'seal species' as grey seal and 'small cetacean species' as harbour porpoise; • Predictive noise modelling for piles should be carried out with and without the use of noise abatement systems; and • Mitigation measures should include PAM and a minimum of two PAM Operators (PAMOs).
December 2020	IWDG – meeting	Discussion on Scoping Response, including: • Effect of operational noise, including from vessel traffic; • Baseline data sources and approach to analysis; • 24-hour mitigation, including use of ADDs; • Noise abatement systems; and • Monitoring.
August 2023	IWDG – Scoping response	Comments on the Proposed Development Scoping Report (submitted 2023): • Establishment of baseline underwater noise levels;

Date	Consultee and type of response	Issues raised
		• Department of Arts, Heritage and the Gaeltacht ((DAHG), 2014) guidance is currently under review and updated guidance will likely take a significantly different form; and • Underwater noise during operation and potential overlap of TTS ranges from other turbines.

5. Methodology

5.1 Desk-based study

Section 6 presents a baseline review of the current environment and population trends of known marine mammals within the site-specific spatial scale – Marine Mammal Study Area – and at the wider spatial scale – the species-specific, Marine Mammal MU Study Areas (shown together in Figure 11.2.2). The approach taken is to consider cetaceans at a population level, using MUs (IAMMWG, 2023). The cetacean MU boundaries are based on the best understanding of the structure of biological populations and ecological differentiation within such populations, also considering political boundaries and the management of human activities rather than distinct cetacean populations. A MU may be smaller than what is believed to be a 'population' to reflect spatial differences in human activities and their management (IAMMWG, 2015; 2022). For some species, these MUs can cover large areas, as is the case for minke whale *(Balaenoptera acutorostrata)*, which has an MU comprising the Celtic Sea and Greater North Sea. Alternatively, for the harbour porpoise, MUs are broken down into smaller areas, which include the North Sea, west Scotland coastal waters, and the Celtic and Irish Seas, which reflects the much higher density of this species in Irish and UK waters.

In considering broadscale information on cetacean occurrence, distribution, and abundance, the cetacean baseline considers the 'Small Cetaceans in European Atlantic waters and the North Sea' surveys (SCANS; Hammond *et al*., 2021; Lacey *et al.,* 2022; Gilles *et al.,* 2023). SCANS surveys provide large scale cetacean abundance and density estimates across the European Atlantic using aerial and boat-based surveys. These surveys were carried out during the summer months in 1994 (SCANS-I), 2005/07 (SCANS-II), 2016 (SCANS III; Hammond *et al.,* 2017; 2021; Lacey *et al.,* 2022), and the most recent survey, SCANS-IV, was completed in 2022 (Gilles *et al.,* 2023).

The Marine Mammal Study Area sits within SCANS-IV block CS-D and SCANS-III block E, both of which were surveyed by air. Although these blocks are commonly used, they have no biological

significance; rather, they are logistical considerations with respect to carrying out the surveys. Nonetheless, for each block, a density estimate is calculated for those cetacean species that have been recorded in sufficient numbers, which can be used to give a broadscale density estimate relating to the Marine Mammal Study Area and the surrounding area.

In 2014, the ObSERVE Programme was established to provide aerial and acoustic surveys to study protected offshore species and habitats across Ireland's exclusive economic zone (EEZ). Surveys were conducted from 2015 to 2017 (Rogan *et al.,* 2018a). The acoustic studies were conducted off West Ireland, off the continental shelf; therefore, they are not considered in this report. The aerial surveys were carried out over four survey seasons: season one, summer (2015); season two, winter (2015-2016); season three, summer (2016); and season four, winter (2016-2017). Regional sightings predicted distribution and species density estimates that are available for transect surveys carried out in survey stratum 5 in the Irish Sea, within which the Marine Mammal Study Area falls. When there were sufficient data collected (60 sightings required for a species/species group), two approaches to estimate abundance and density were used: a design-based method and a model-based method. The former is based on distance-sampling approaches to estimate species abundance and the latter uses modelling approaches to estimate species abundance and to quantify the influence of environmental parameters on the abundance estimate. The analysis methodology was designed to achieve the most robust absolute abundance and density estimates possible, by correcting for biases where sufficient data were collected. For some cetacean species, density and abundance estimates are not available, or may not be available as a model-based estimate as there were too few sightings from which to make any statistical inference.

The data from the ObSERVE surveys were used to inform the National Biodiversity Data Centre's (NBDC) biodiversity maps, alongside data from the IWDG, Joint Nature Conservation Committee (JNCC) European Seabirds at Sea (ESAS), and SIAR Environment surveys (NBDC, 2023).

To model relative density of cetacean species in the Irish Sea, Evans and Waggitt (2023) incorporated data from 1990 to 2020 from the SeaWatch Foundation database and the NERC/DEFRA-funded Marine Ecosystems Research Programme (MERP), which includes SCANS-III and ObSERVE survey data. The collated data were from a range of survey sources and methods, including DAS, visual aerial surveys, and vessel surveys. The data cover Welsh waters and adjacent areas of the Republic of Ireland, Northern Ireland, Isle of Man, northwest and southwest England, and are therefore relevant to the Proposed Development, as the distribution maps provide a broad temporal and spatial scale assessment of relative density and distribution of cetacean species. They do not, however, represent absolute densities or provide temporal or spatial fine-scale distributions.

For seals, populations were assessed against haul-out counts conducted during aerial surveys in 2003 (Cronin *et al., 20*04), 2011/2012 (Duck and Morris, 2013), and 2017/2018 (Morris and Duck, 2019). Telemetry tracking data have been used to model the occurrence and relative abundance of seals at sea (Carter *et al.,* 2022). These are habitat preference models, which use data obtained

from high-resolution Global Positioning System (GPS) telemetry tags from 114 grey seals and 239 harbour seals that were tagged at 26 sites in the UK and Ireland between 2005 and 2019 to match telemetry data to habitat variables, such as water depth, seabed topography, sea surface temperature in order to understand the species-environment relationships that drive seal distribution. Abundance data were then used in the model to predict the spatial variation in density of at-sea populations. Results are presented as predicted at-sea distributions on a 5 x 5 km grid for UK and Irish waters. Other reports focusing on the wider Ireland and UK population abundance estimates of seals (SCOS 2021; 2022) were used alongside Carter *et al.* (2022) to provide broad-scale information on seal ecology and regional population estimates within the Marine Mammal Study Area.

In addition to large-scale abundance and distribution studies, more localised and site-specific data are also required to understand the potential importance of the Marine Mammal Study Area to marine mammals. This has been informed by pre-existing data from the area, such as IWDG surveys and/or public sighting reports (Berrow *et al.,* 2008; Berrow *et al.,* 2011; IWDG, 2023). Berrow *et al.* (2008) derived relative density estimates from boat-based single platform surveys conducted by IWDG in 2008. The surveys covered five sites: North County (Co.) Dublin, Dublin Bay, Cork Coast, Roaring Water Bay, and Galway Bay. Relative density estimates were calculated by assuming that the probability of detecting an animal on the trackline is 1 (i.e. g(0)=1) (as they were carried out in sea state 2 or less) (Berrow *et al.,* 2008). However, they are likely to be an underestimate, as it is well documented that harbour porpoises make aversive movements in response to vessels (i.e., availability bias – where the animal is present but is not detected), and detection bias (likelihood of sighting an animal decreases with increasing distance from the trackline (i.e. vessel)) will also be a factor reducing the probability. Nonetheless, since all of these surveys were carried out using the same method and vessel, the relative densities can be used to identify high density areas compared to low density areas within the region (Berrow *et al.,* 2008).

Single line platform surveys were carried out in two survey blocks in the north and south Irish Sea, using visual and acoustic methods to record cetacean species distribution, relative abundance, and absolute abundance where possible (Berrow *et al.,* 2011). The Marine Mammal Study Area lies within the northern half of the survey block in the south Irish Sea. There were insufficient sightings to derive abundance and density estimates for the south Irish Sea survey block. Therefore, this source has only been used to inform species occurrence and distribution.

A summary of the key data sources used to characterise the marine mammal baseline is provided in Table 11.2.2.

Table 11.2.2 Key data sources used for the marine mammal baseline characterisation

Data	Date and Coverage	Description	Source
Marine mammals in Irish waters atlas	2005 to 2011 Irish territorial waters and Ireland's Exclusive Economic Zone (EEZ).	Distribution and relative abundance of marine mammals in Irish offshore waters.	Wall *et al*., 2013
Biodiversity maps for Ireland	1860 to present Waters around the Irish coast.	Marine mammal sightings and stranding records from dedicated surveys and from incidental observations.	National Biodiversity Data Centre, 2023
ObSERVE aerial data	Summer/ Winter 2015 Summer/ Winter 2016 Offshore waters within and beyond Ireland's continental shelf. The Marine Mammal Study Area is within stratum 5.	Occurrence, distribution and abundance of cetaceans and seabirds in Irish waters based on visual aerial survey data.	Rogan *et al*., 2018a
Marine mammal surveys	2008 to 2011 Sites along Irish coast and Irish EEZ waters.	Various surveys carried out by the IWDG using boat-based visual and aerial sampling techniques.	Berrow *et al.,* 2008; 2013
Harbour seal and grey seal maps	2005 to 2019 UK and Republic of Ireland waters.	Updated at-sea distribution maps (mean and upper/lower confidence intervals (CI)) on a 5x5 km grid based on telemetry data from UK tagged seals and habitat preference modelling. The estimated density surface gives the	Carter *et al.,* 2022

Data	Date and Coverage	Description	Source
		percentage of the British Isles at-sea population (excluding hauled-out animals) estimated to be present in each grid cell at any one time during the main foraging season.	
Thermal imagery surveys	2003, 2011 to 2012, and 2017 to 2018 Coastline of Republic of Ireland.	Pinniped population surveys across the Republic of Ireland via aerial survey during the harbour seal moulting period.	Cronin *et al.,* 2004; Duck and Morris, 2013; Morris and Duck, 2019
Inshore surveys for cetaceans	July and August 2011 Two inshore survey blocks in the north and south Irish Sea.	Visual and acoustic surveys for cetaceans carried out in two survey blocks in the north (block A) and south Irish Sea (block B); the northern half of block B was in proximity to the Proposed Development.	Berrow *et al.,* 2011
Irish Cetacean Review	2000 to 2009 Irish coastline and Irish EEZ	A review of all cetacean sighting and stranding records made by the IWDG through the Irish Scheme for Cetacean Observation and Public Education (ISCOPE)	Berrow *et al.,* 2010
Small cetacean abundance in the North Sea (SCANS-III)	June and July 2016 All European Atlantic waters. The Marine Mammal Study Area is within block E.	Combination of vessel and aerial surveys in 2016 (SCANS-III) to provide design-based abundance estimates (Hammond *et al.,* 2017; 2021) and density surface modelling for cetaceans (Lacey *et al.,* 2022).	Hammond *et al.,* 2017, 2021; Lacey *et al.,* 2022
SCANS-IV	June to August 2022 All European Atlantic waters.	Combination of vessel and aerial surveys in 2022 (SCANS-IV) to provide design-based abundance estimates for cetaceans (Gilles *et al.,* 2023).	Gilles *et al.,* 2023

Data	Date and Coverage	Description	Source
	The Marine Mammal Study Area is within block CS-D.		
Special Committee on Seals (SCOS) series	1996 to 2022 UK waters.	Scientific advice to government on matters relating to the management of UK seal populations. There have been numerous reports collated that identify conservation and management issues, including ecology, behaviour, population trends and estimates, important areas and the status of both grey and harbour seals in the UK.	SCOS, 2021; 2022
Modelled distribution and abundance of cetaceans and seabirds in Wales and surrounding waters	1990 to 2020 Territorial seas of Wales and adjacent areas of the Republic of Ireland, Northern Ireland, Isle of Man, northwest and southwest England, including all of the Irish Sea, Bristol Channel, and adjacent Celtic Sea.	Data published as part of this study were collated from a range of different survey sources including DAS, visual aerial surveys, and vessel surveys. They therefore incorporate various methodologies and observation methods. Distribution maps provide a general illustration of relative densities and broad-scale distribution over several decades. They do not represent absolute densities or fine-scale distributions.	Evans and Waggitt, 2023

5.2 Site-specific surveys

Site-specific surveys were commissioned to support the marine mammal baseline for the ABWP1 planning application. These were boat-based visual surveys (2000-2009) and a PAM campaign (2002). Additional surveys, in the form of DAS, were undertaken from 2018 to 2020 to gather more recent data as part of site characterisation for the Proposed Development EIAR. All of these are reported below.

5.2.1 Boat-based visual surveys (2000-2009)

Visual boat-based surveys, undertaken as part of the marine mammal monitoring programme for the ABWP1 Foreshore Lease application and following award of the Foreshore Lease, focused on three survey areas. The survey areas comprised the Lease Area (termed "the Bank Study Area"), a 5 km wide survey area surrounding the Bank termed "the Box Study Area" and a survey area encompassing the ABWP1 cable route leading from the western edge of the Box Study Area to the shore, termed "the Cable Study Area". The survey dates are summarised in Table 11.2.3.

The surveys were conducted following an adaptation of the standard JNCC ESAS methodology using line transects (Webb and Durinck, 1992). Further details on the methodology can be found in the monitoring reports (Cork Ecology, 2010; 2009; 2007; Fulmar Ecological Services, 2006; Coveney Wildlife Consulting Ltd., 2005; 2004; 2003; 2002).

Table 11.2.3 Summary of site-specific boat-based visual survey data

Survey year	Development phase	Date	Extent of survey	Survey contractor
1	Pre-construction	July 2000 to June 2001	The Bank and Box Study Areas	Coveney Wildlife Consulting Ltd
2	Pre-construction	July 2001 to June 2002	The Bank and Box Study Areas	Coveney Wildlife Consulting Ltd
3	Pre-construction	July 2002 to June 2003	The Bank and Box Study Areas	Coveney Wildlife Consulting Ltd
4	Construction	July 2003 to June 2004 (construction August to October 2003)	The Bank and Box Study Areas	Coveney Wildlife Consulting Ltd
5	Post-construction	July 2004 to June 2005 (commissioned 2004)	The Bank and Box Study Areas	Coveney Wildlife Consulting Ltd

Survey year	Development phase	Date	Extent of survey	Survey contractor
6	Post-construction	July 2005 to June 2006	The Bank and Box Study Areas	Fulmar Ecological Services
7	Post-construction	July 2006 to June 2007	The Bank and Box Study Areas	Cork Ecology
8	Post-construction	July 2007 to June 2008	The Bank and Box Study Areas	Cork Ecology
9	Post-construction	July 2008 to June 2009	The Bank and Box Study Areas	Cork Ecology

5.2.1 Passive acoustic monitoring surveys (2002)

Static Passive Acoustic Monitoring (PAM) of harbour porpoise was conducted in 2002 using an acoustic data logger deployed to the northwest of the ABWP1 development area. The total number of days of deployment was 25, with data collected between 1 August 2002 and 1 September 2002.

5.2.2 Digital aerial surveys (2018 to 2020)

Aerial surveys of seabirds and marine mammals to inform baseline characterisation for the Proposed Development commenced in March 2018 and continued monthly until February 2020, with an additional month in April 2020, added to cover a missed survey in April 2019. The surveys were conducted by HiDef Aerial Surveying Limited ('HiDef') from an aircraft equipped with four HiDef Gen II cameras with sensors to set a resolution of 2 cm ground sample distance (GSD). The transects were flown at a height of approximately 550 m above sea level (ASL) and the aircraft operational speed was 220 km per hour (equivalent to 120 kn).

A total of 20 transects were spaced 2 km apart across the Aerial Survey Area, which encompassed the Array Area, and a wider 4 km buffer area, extending further to the west in order to sample the inshore area up to the Wicklow coastline.

HiDef identified animals first to a species group and then to species level, where possible. For seals, HiDef noted that identification to species level was more difficult as it was not always possible to distinguish between species, particularly where an individual was submerged (HiDef, 2020a). Seasonal densities of harbour porpoise were estimated from the count data. It was not possible to estimate absolute densities of grey seal, harbour seal, bottlenose dolphin and common dolphin, due to a low number of sightings across the months (HiDef, 2020b). HiDef (2020b) contains more information on the methods, assumptions and, analytical approaches used by HiDef.

5.2.1 Site investigation surveys (2019 to 2023)

Site investigation surveys were carried out during site investigation work for the Proposed Development in 2019, 2020, 2022, and 2023. As part of the mitigation protocol, a marine mammal observer (MMO) was on board. Marine mammal sighting records were supplied to NPWS on completion of the activities, in reports by IWDG (2019) and Gavin & Doherty Geosolutions Ltd (2020; 2023a, b).

5.2.2 Assumptions and limitations

5.2.2.1 Boat-based visual surveys

The site-specific boat-based surveys were designed for recording both seabirds and marine mammals. Therefore, observers were not dedicated MMOs as they were also recording seabirds, with an adapted ESAS methodology. Consequently, it is possible that some marine mammals were missed during surveys, however, it is not possible to quantify this.

There is a possibility that there have been changes in the abundance and distribution of marine mammals in the vicinity of the Proposed Development given that the age of the boat-based data (collected on a monthly basis between July 2000 and June 2009). However, more recent DAS have been conducted to ensure robust site-specific data is available to inform the baseline.

5.2.2.2 Digital aerial surveys and boat-based surveys – weather conditions

Poor weather conditions can limit the ability to carry out surveys by aeroplane or on the sea. During April 2019, the DAS had to be flown in early May and subsequent surveys were spaced monthly until July when one survey was carried out at the start of July and the next survey at the end of July. In addition, the missed April survey was subsequently carried out in April 2020.

5.2.2.3 Digital aerial surveys and boat-based surveys – bias

During DAS and boat-based surveys, animals are only available for detection when they are at or just below the surface, resulting in availability bias (where an animal is underwater and therefore not available for detection). Detection bias (where an animal is on the surface but the detection is missed) can also be a limiting factor during data collection, as animals may be more difficult to see with increasing distance from the survey vessel and observers may be looking in a different direction at time of surfacing. However, the high-definition video aerial surveys capture all animals on the surface and the detection is therefore not influenced by the ability of an observer to detect an animal at the time of surfacing/in the field.

Availability bias of harbour porpoise was corrected for by HiDef using an estimate of the probability that an animal is on the surface at any randomly chosen instant (HiDef, 2020b). The resulting correction factor was then used to estimate the total number of animals that may be present within the survey area. The aerial survey data provided a count of the numbers of each species (or species group) within the transects; however, there were no site-specific data on availability bias from these monthly surveys. In the absence of data for Irish Sea porpoises, to

estimate absolute abundance, HiDef used published correction factors from a North Sea tagging study by Teilmann *et al.* (2013) (HiDef, 2020b).

Availability bias is likely to be influenced by extrinsic factors that combine to produce a situation that is unique to each survey: factors such as light conditions, water clarity (turbidity), and animal behaviour can influence whether an animal will be detected on or near the surface. Therefore, species correction factors derived from one aerial survey are unlikely to be a true representation of availability bias for a different aerial survey in a different location, due to the potential spatial and temporal differences in environmental conditions.

With this in mind, HiDef explored a range of correction factors from different aerial surveys to apply a conservative estimate to the data. HiDef were able to provide an estimate of absolute density (subject to the limitations described above) for harbour porpoise only.

5.2.2.4 Digital aerial surveys and boat-based surveys – survey timings

Both DAS data and boat-based data represent a snapshot over a short time period each month. Therefore, it was not possible for HiDef to explore if changes in digital aerial sighting rates were influenced by environmental conditions. Differences in sighting rates between months may be due to seasonal changes, but environmental conditions also have the potential to influence these results.

6. Baseline Environment

6.1 Introduction

Twenty-five species of cetacean have been recorded in Irish waters (Berrow *et al*., 2010; NBDC 2023; O'Brien *et al*., 2009; IWDG, 2023; Rogan *et al.,* 2018a) – a result of the complex of marine habitats to be found around Ireland's coastal and offshore zones. The greatest species diversity is found off the west and south-west coasts of Ireland, where the deep waters of the continental shelf meet shallower bays, bringing an upwelling of prey resource, and providing habitat for larger and smaller species alike.

The range of species present within the Marine Mammal Study Area and their abundance has been assessed using data sources presented in the desk-based study and site-specific survey data. Using the data available, the assessment confirmed the likely presence of harbour porpoise, short-beaked common dolphin (*Delphinus delphis*)*,* bottlenose dolphin, Risso's dolphin (*Grampus griseus*), minke whale, grey seal, and harbour seal within the vicinity of the Proposed Development. Therefore, the baseline environment presents relevant information on the ecology, distribution and occurrence, abundance and density, and seasonality of the key species listed above.

Using available data from the desk-based study and site-specific surveys, it was concluded that the following species occur infrequently within the vicinity of the Marine Mammal Study Area: Atlantic white-sided dolphin (*Leucopleurus acutus*), striped dolphin (*Stenella coeruleoalba*), Cuvier's beaked whale (*Ziphius cavirostris*), fin whale (*Balaenoptera physalus*), humpback whale, killer whale (*Orcinus orca*), long-finned pilot whale (*Globicephala melas*)*,* northern bottlenose whale (*Hyperoodon ampullatus*), pygmy sperm whale (*Kogia breviceps*), Sowerby's beaked whale (*Mesoplodon bidens*) and sperm whale (*Physeter macrocephalus*) (Berrow *et al.,* 2010; Gilles *et al.,* 2023; Hammond *et al.,* 2021; IWDG, 2023; NBDC, 2023; O'Brien *et al.,* 2009; Reid *et al.,* 2003).

Two species of pinniped, harbour seal and grey seal, occur in the Irish Sea, with the harbour seal being more abundant on the west coast of Ireland. Both species have established terrestrial colonies (or haul-outs) along all coastlines of Ireland to rest ashore, breed, moult, and engage in social activity (Cronin *et al.,* 2004; Ó Cadhla *et al.,* 2007). During this time, seals are particularly vulnerable to anthropogenic disturbance. There is little spatial overlap between major haul-out aggregations of harbour and grey seals across Ireland (Morris and Duck, 2019). Telemetry data and habitat preference modelling indicate both species regularly occur within the Marine Mammal Study Area (Carter *et al.,* 2022; Figure 11.2.3; Figure 11.2.4).

Rare sightings of the following pinniped species have been recorded on the west coast of Ireland but have not yet been recorded in the Irish Sea: walrus (*Odobenus rosmarus*); hooded seal (*Cystophora cristata*); bearded seal (*Erignathus barbatus*); and ringed seal (*Pusa hispida*) (IWDG, 2023). As these are largely found in Arctic waters, and Irish and UK waters are not considered part of their natural home ranges, they have not been covered further in this report.

The site-specific DAS identified both species of seal, as well as harbour porpoise, bottlenose dolphin and common dolphin over the 24-month campaign (HiDef, 2020a). Harbour porpoise was the most frequently recorded species.

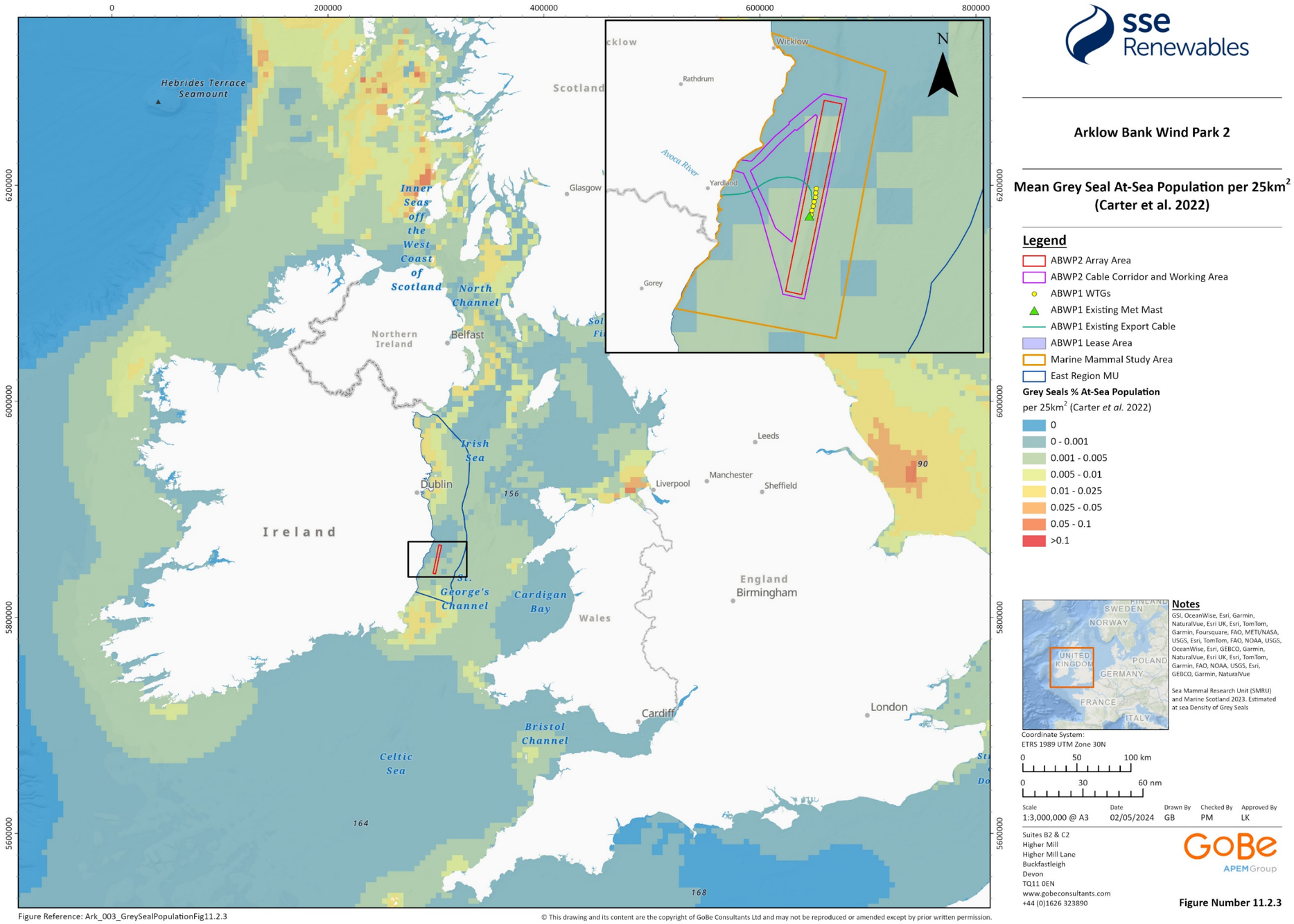
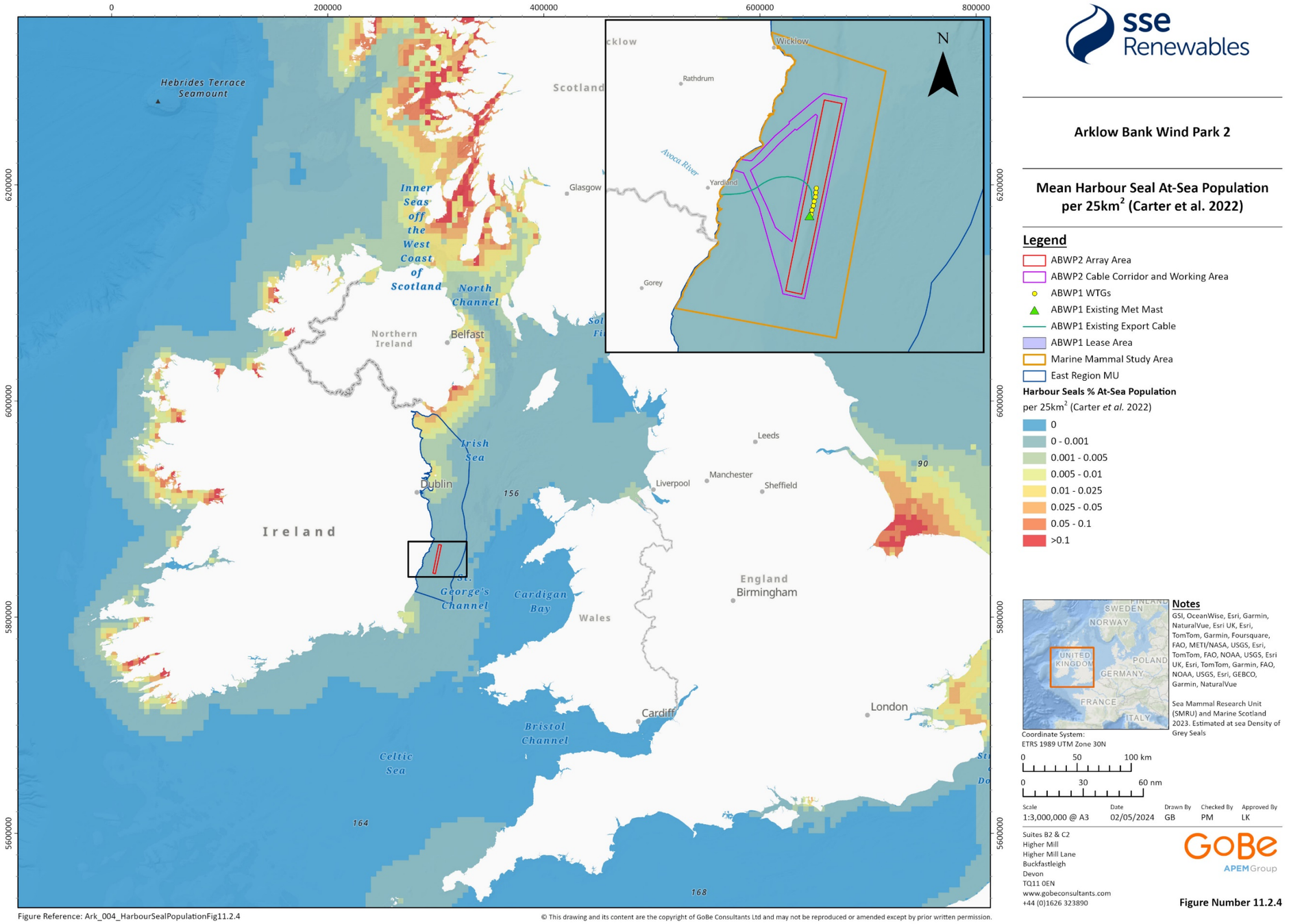


Figure Reference: Ark_003_GreySealPopulationFig11.2.3

Figure 11.2.3 **Grey seal (*Halichoerus grypus*) mean at-sea distribution in waters around the UK and Ireland, from telemetry data (after Carter *et al.*, 2022).**



sse Renewables

Arklow Bank Wind Park 2

Mean Harbour Seal At-Sea Population per 25km^2 (Carter et al. 2022)

Legend

- ABWP2 Array Area
- ABWP2 Cable Corridor and Working Area
- ABWP1 WTGs
- ABWP1 Existing Met Mast
- ABWP1 Existing Export Cable
- ABWP1 Lease Area
- Marine Mammal Study Area
- East Region MU

Harbour Seals % At-Sea Population
per 25km^2 (Carter *et al.* 2022)

- 0
- 0 - 0.001
- 0.001 - 0.005
- 0.005 - 0.01
- 0.01 - 0.025
- 0.025 - 0.05
- 0.05 - 0.1
- >0.1

Notes

GSI, OceanWise, Esri, Garmin, NaturalVue, Esri UK, Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS, Esri, TomTom, FAO, NOAA, USGS, Esri UK, Esri, TomTom, Garmin, FAO, NOAA, USGS, Esri, GEBCO, Garmin, NaturalVue

Sea Mammal Research Unit (SMRU) and Marine Scotland 2023. Estimated at sea Density of Grey Seals

Coordinate System:
ETRS 1989 UTM Zone 30N

0 50 100 km

0 30 60 nm

Scale	Date	Drawn By	Checked By	Approved By
1:3,000,000 @ A3	02/05/2024	GB	PM	LK

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Figure Number 11.2.4

Figure Reference: Ark_004_HarbourSealPopulationFig11.2.4

Figure 11.2.4 Harbour seal (*Phoca vitulina*) mean at-sea distribution in waters around the UK and Ireland, from telemetry data (after Carter *et al.*, 2022)

6.2 Species accounts

Key species of marine mammal are defined as those that have been identified in the desk-based study and site-specific survey data as commonly recorded and / or where they are a designated feature of a SAC within the respective MU-scale Marine Mammal Study Area. The following sections provide more detailed baseline information for each of the key species identified within the Marine Mammal Study Area. These are:

- harbour porpoise;
- bottlenose dolphin;
- Risso's dolphin;
- common dolphin;
- minke whale;
- grey seal; and
- harbour seal.

6.2.1 Harbour porpoise

6.2.1.1 Ecology

Harbour porpoise have a varied diet, largely consisting of whiting (*Merlangius merlangus*), herring (*Clupea harengus*), and small cod (*Trisopterus* spp) (Hernandez-Milian *et al.,* 2011). Their high metabolic rate requires them to eat up to 10% of their body weight in food per day (Booth, 2019). Harbour porpoises give birth to one calf every year between May and August (with peaks in June and July), and mating occurs between April and September, with a gestation period of 10-11 months (Blanchet *et al.,* 2008).

6.2.1.2 Distribution and occurrence

Harbour porpoise are the most widespread and frequently recorded species off the east coast of the Republic of Ireland, sighted throughout the year with an increased presence in July and August (Ó Cadhla *et al*., 2004; Berrow *et al*., 2010; Wall *et al*., 2013; Kavanagh *et al., 20*17; Rogan *et al*. 2018a). The ObSERVE data from the aerial surveys highlighted the importance of the Irish Sea for harbour porpoise in the context of the waters around Ireland, as sightings were frequently recorded along the east coast of Ireland, particularly during the summer months (Rogan *et al.,* 2018a). Records from the NBDC further supports this pattern (NBDC, 2023). These peaks tend to coincide with key life-history periods, as outlined in Section 6.2.1.1. Modelled density outputs

indicated eastern Ireland, particularly the coastal area from Co. Dublin south to Co. Waterford, is likely to be an important area for harbour porpoise (Evans and Waggitt, 2023).

Acoustic records for harbour porpoise in Dublin Bay found that porpoises were detected on all days and within most one-hour periods (81% of possible hours had porpoise detections) over a 46-day recording period (Berrow *et al.,* 2008). The mean porpoise positive minutes (PPM) per hour in Dublin Bay were on average 14.7 with peaks in August (15.6) and September (13.5) and lower values in July (8.9).

Acoustic monitoring of harbour porpoise conducted for ABWP1 in August 2002 found that harbour porpoises were present on 16 out of the 25 deployment days giving an estimated 64% occupancy in this area. Compared to inshore waters to the north in Dublin Bay, the occurrence of harbour porpoise at Arklow Bank is lower.

Harbour porpoises were recorded in all years during the historic site-specific boat-based surveys (Cork Ecology, 2009, 2008 and 2007; Coveney Wildlife Consulting Ltd., 2005). Sightings were noted throughout the 'Bank' and 'Box' survey areas during the surveys, and there were also sightings further inshore along the cable route.

The recent site-specific DAS also found that harbour porpoises were distributed throughout the Marine Mammal Study Area, including the area between the Array Area and the coast (HiDEF, 2020a). Sightings were noted in most survey months. In addition, harbour porpoise were the most abundant species recorded during the geophysical survey campaigns of the Proposed Development in 2019 and 2020 with a total of 24 sightings recorded in 2019 and a total of 51 sightings recorded in 2020 (IWDG, 2019; Gavin & Doherty Geosolutions Ltd, 2020). They were also recorded during the geotechnical survey campaign of the Proposed Development in 2023, where one sighting of three individuals was recorded (Gavin & Doherty Geosolutions Ltd, 2023b). These data suggest that harbour porpoises occur regularly throughout the Study Area.

6.2.1.3 Density/abundance

In most of the eastern North Atlantic, the harbour porpoise is generally considered to behave as a 'continuous' biological population that extends from the French coasts of the Bay of Biscay, northwards to the arctic waters of Norway and Iceland (IAMMWG, 2015). The Inter-Agency Marine Mammal Working Group (IAMMWG), for practical management purposes, however, has identified three MUs for harbour porpoise. The Marine Mammal Study Area is within the Celtic and Irish Seas MU for harbour porpoise (see Figure 11.2.5). The total harbour porpoise abundance for the Celtic and Irish Seas MU is estimated as 62,517 animals (95% CI: 48,324 to 80,877) (IAMMWG, 2023).

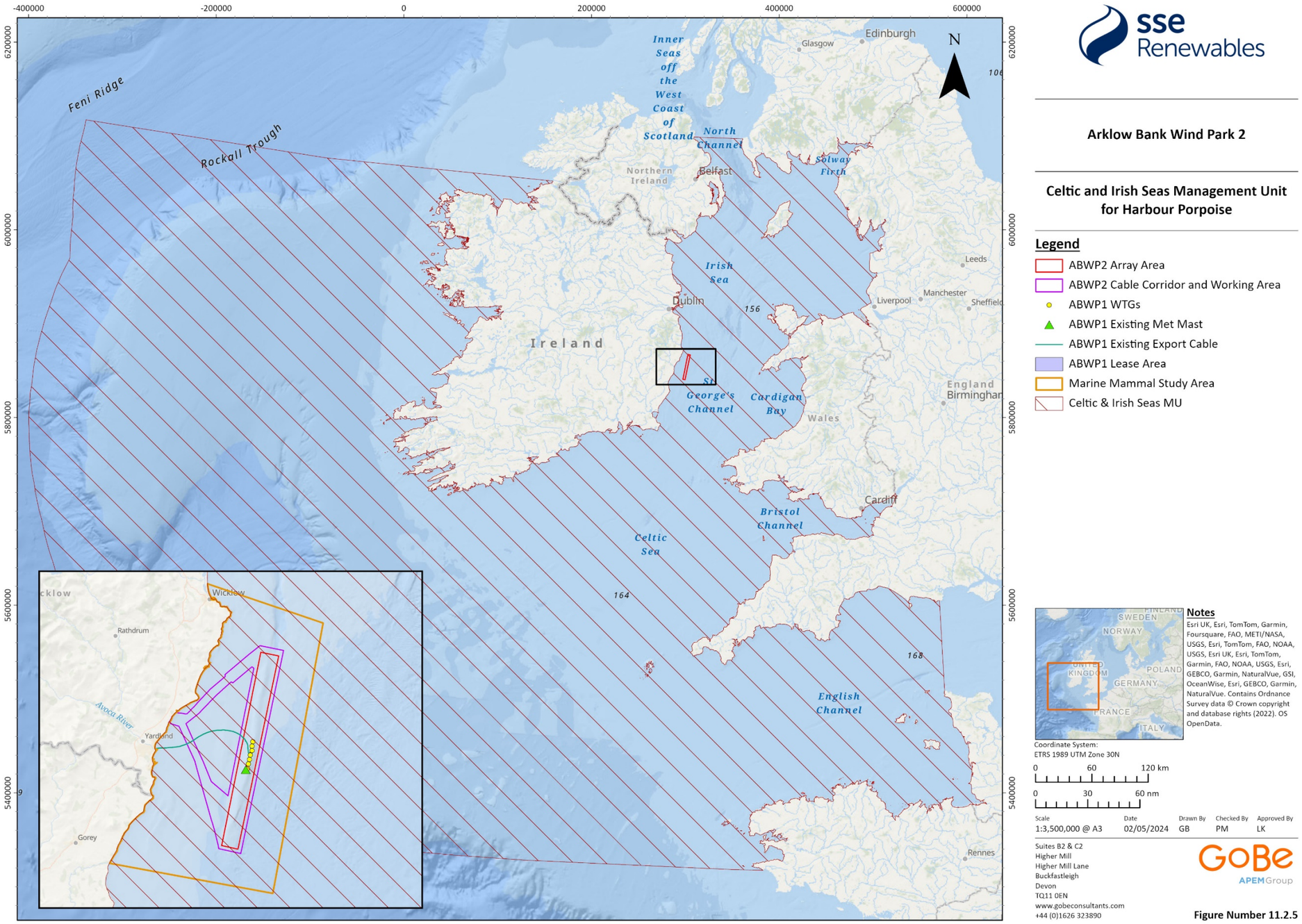

Figure Reference: Ark_005_CelticIrishSeas_HarbourPorpoiseMUFig11.2.5

Arklow Bank Wind Park 2

Celtic and Irish Seas Management Unit for Harbour Porpoise

Legend

- ABWP2 Array Area
- ABWP2 Cable Corridor and Working Area
- ABWP1 WTGs
- ABWP1 Existing Met Mast
- ABWP1 Existing Export Cable
- ABWP1 Lease Area
- Marine Mammal Study Area
- Celtic & Irish Seas MU

Notes

Esri UK, Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS, Esri, TomTom, FAO, NOAA, USGS, Esri UK, Esri, TomTom, Garmin, FAO, NOAA, USGS, Esri, GEBCO, Garmin, NaturalVue, GSI, OceanWise, Esri, GEBCO, Garmin, NaturalVue. Contains Ordnance Survey data © Crown copyright and database rights (2022). OS OpenData.

Coordinate System:
ETRS 1989 UTM Zone 30N

0 60 120 km

0 30 60 nm

Scale	Date	Drawn By	Checked By	Approved By
1:3,500,000 @ A3	02/05/2024	GB	PM	LK

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Figure Number 11.2.5

Figure 11.2.5 The Celtic and Irish Seas Management Unit for harbour porpoise (after IAMMWG, 2015)

Analyses of the ObSERVE data found that the western Irish Sea and Celtic Sea had consistently the highest summer densities/abundance of harbour porpoise compared to other regions surveyed around Ireland (Rogan *et al.,* 2018a; Table 11.2.4). Corrected design-based estimates of abundance for harbour porpoise gave a maximum of 11,625 harbour porpoise in stratum 5 (95% CI: 8,725.8 to 15,486.0) (Rogan *et al.,* 2018a). Corrected model-based estimates of abundance for harbour porpoise gave a maximum of 10,466 harbour porpoise in stratum 5 (95% CI: 7,928.1 to 13,816.3) (Rogan *et al.,* 2018a). SCANS-III estimates the abundance of harbour porpoise as 8,320 animals (CV=0.28; 95% CI: 4,643 to 14,354) for block E (Hammond *et al.,* 2021) whilst SCANS-IV estimates the abundance of harbour porpoise as 9,773 animals for block CS-D (CV=0.316; 95% CI: 4,764 to 18,125) (Gilles *et al.,* 2023).

Encounter rate from the inshore cetacean surveys by IWDG suggests that the northern part of the Irish Sea is likely to support higher numbers of harbour porpoise compared to the south Irish Sea. The northern inshore survey block, which encompasses Dublin Bay and waters to the north, recorded an encounter rate of 0.47 animals per km of route surveyed, whilst the southern inshore survey block, which encompasses the Arklow Bank and waters to the south recorded an encounter rate of 0.13 animals per km of route surveyed (Berrow *et al.,* 2011).

There were no density or abundance estimates available for the historic site-specific boat-based surveys, however the mean encounter rate was generally low, with an average of 0.12 animals per km of route surveyed (Cork Ecology, 2009). To put this in context, the IWDG harbour porpoise surveys carried out in Dublin Bay recorded a total of 69 animals over a total distance of 289.4 km (Berrow *et al.,* 2008) and therefore the encounter rate was 0.24 animals per km of route surveyed. Similarly, the estimated encounter rate for north Co. Dublin from the IWDG surveys was 0.38 animals per km of route surveyed (Berrow *et al.,* 2008). Therefore, the encounter rate for the historic site-specific boat-based surveys was lower in comparison to the coastal waters off Co. Dublin but was similar to the IWDG southern inshore survey of 0.13 animals per km of route surveyed (Berrow *et al.,* 2011).

Density estimates for harbour porpoise are summarised in Table 11.2.4, below and suggest that the likelihood of occurrence of harbour porpoise within the Marine Mammal Study Area is high. Large scale ObSERVE and SCANS surveys were used to calculate density estimates of harbour porpoise which range from 0.239 animals per km^2 to 1.046 animals per km^2. Corrected design-based and modelled density estimates are presented from Rogan *et al.* (2018a). Densities from localised and site-specific surveys are presented from HiDef, Lacey *et al.* (2022), and Berrow *et al.* (2008). Densities were calculated as 0.38 animals per km^2 from the site-specific DAS data and corrected for availability bias (Table 11.2.4). Density estimates modelled by Lacey *et al.* (2022) also provide grid-cell specific densities within the Marine Mammal Study Area (Figure 11.2.6).

Table 11.2.4 A summary of harbour porpoise density estimates (animals per km^2)

Source	Area	Temporal	Density (animals per km^2)
HiDef site-specific DAS	Project aerial survey area	2018 to 2020	0.38

Source	Area	Temporal	Density (animals per km^2)
SCANS-IV block CS-D (Gilles *et al.,* 2023)	Western Irish Sea	Summer 2022	0.2803 (CV: 0.316)
SCANS-III (Lacey *et al.,* 2022)	Marine Mammal Study Area	Summer 2016	Grid-cell specific
SCANS-III block E (Hammond *et al.,* 2017 ; 2021)	Western Irish Sea	Summer 2016	0.239 (CV: 0.28)
ObSERVE stratum 5 corrected design-based estimate (Rogan *et al.,* 2018a)	western Irish Sea and Celtic Sea	Summer 2015	0.696 (CV: 35.1)
ObSERVE stratum 5 corrected design-based estimate (Rogan *et al.,* 2018a)	western Irish Sea and Celtic Sea	Winter 2015-16	0.867 (CV: 46.6)
ObSERVE stratum 5 corrected design-based estimate (Rogan *et al.,* 2018a)	western Irish Sea and Celtic Sea	Summer 2016	1.046 (CV: 28.2)
ObSERVE stratum 5 corrected design-based estimate (Rogan *et al.,* 2018a)	western Irish Sea and Celtic Sea	Winter 2016-17	0.924 (CV: 29.5)
ObSERVE stratum 5 corrected model-based estimate (Rogan *et al.,* 2018a)	western Irish Sea and Celtic Sea	Summer 2015	0.675 (CV: 35.7)
ObSERVE stratum 5 corrected model-based estimate (Rogan *et al.,* 2018a)	western Irish Sea and Celtic Sea	Summer 2016	0.942 (CV: 21.8)
IWDG boat-based surveys (Berrow *et al.,* 2008)	Dublin Bay	Summer 2008	1.19
IWDG boat-based surveys (Berrow *et al.,* 2008)	North County Dublin	Summer 2008	2.03

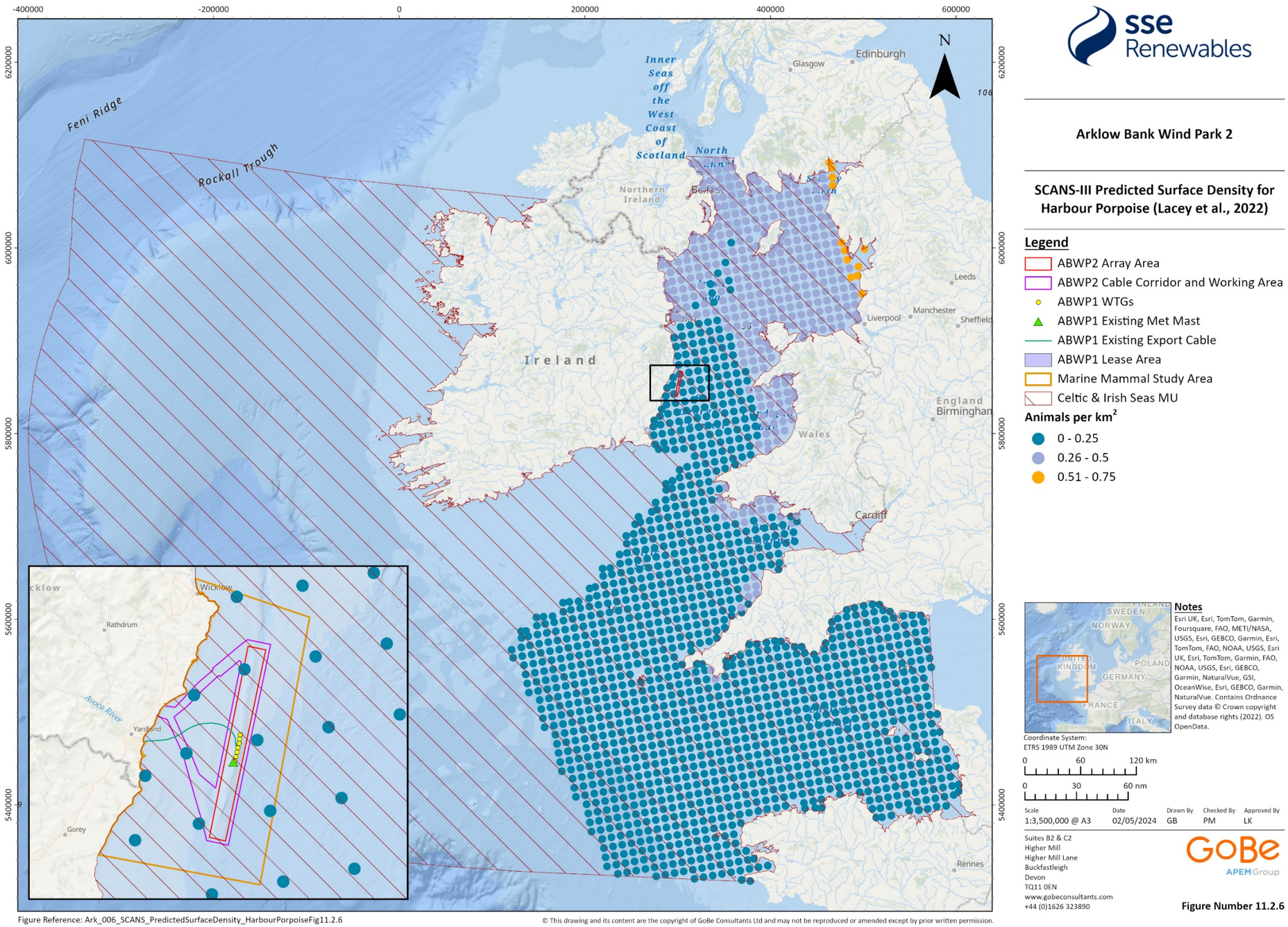

Figure 11.2.6 Density estimates for harbour porpoise in the Marine Mammal Management Unit Study Area and Marine Mammal Study Area, from SCANS-III data (after Lacey *et al.*, 2022)

6.2.1.4 Seasonality

During the ObSERVE surveys, adult harbour porpoises were sighted with calves in many coastal areas around Ireland, including within the western Irish Sea (Rogan *et al.,* 2018a). Berrow *et al.* (2011) estimated that, of all individuals recorded, the proportion of calves recorded in inshore waters of the Irish Sea during July and August was 6%, which was similar to previous surveys in the same area (Berrow *et al.,* 2008). Therefore, inshore waters may be important as nursery habitats during summer months.

During the historic site-specific boat-based surveys, raw data showed that harbour porpoises were recorded in higher numbers during summer and autumn compared to the rest of the year (Cork Ecology, 2009, 2008 and 2007; Coveney Wildlife Consulting Ltd., 2005). These data suggest that harbour porpoise could be moving into inshore waters during the breeding season (summer) and mother-and-calf pairs may inhabit inshore waters during late summer and early autumn when calves are very young.

Similarly, the site-specific DAS data found that the highest counts of harbour porpoises were recorded during the August/September surveys in 2018 and June/July surveys in 2019, therefore supporting the findings from the historic site-specific boat-based surveys.

6.2.1.5 Conservation status

Harbour porpoise currently have a 'favourable' conservation status in Ireland under Article 17 of the EU Habitats Directive, with a stable population trend (NPWS, 2019). They are listed as Least Concern on the IUCN Red List. The current conservation status and short-term trends for harbour porpoise within UK waters are unknown, due to insufficient data for the species (JNCC, 2019a).

As an Annex II species of the Habitats Directive, the designation of SACs is required as a component of their conservation. There are 36 SACs designated for harbour porpoise within the Marine Mammal MU Study Area, the closest of which is Blackwater Bank SAC, 19.8 km from the Array Area, followed by Lambay Island SAC, which is 62.9 km from the Array Area. The full list of SACs is presented in Table 11.2.A.12 and Figure 11.2.1. Sites are ordered with increasing distance from the Array Area; site numbering in Table 11.2.A.12 corresponds with site numbering in Figure 11.2.1.

6.2.2 Bottlenose dolphin

6.2.2.1 Ecology

Two different ecotypes of bottlenose dolphin occur commonly across Irish and UK waters: coastal ecotype and offshore ecotype (Berrow *et al.,* 2013; Wall *et al.,* 2013; Hague *et al.,* 2020). The coastal ecotype makes up resident populations in the Shannon Estuary, Republic of Ireland (Rogan *et al.,* 2018b), Cardigan Bay, Wales, and the Moray Firth, East Scotland year-round (Hague *et al.,* 2020). They have a varied diet consisting of whiting, blue whiting (*Micromesistius poutassou*), pollock (*Pollachius*), saithe (*Pollachius virens*), haddock (*Melanogrammus aeglefinus*), poor cod, European hake (*Merluccius merluccius*), horse mackerel (*Trachurus trachurus*), flatfish (*Pleuronectiformes*), pelagic squid (*Loligo spp.*), and octopus (*Octopus spp.*) (Hernandez-Milian *et*

al., 2011; 2015). Female bottlenose dolphins reach sexual maturity from 6-13 years old (Robinson *et al.,* 2017) and males from their tenth year (Harrison and Ridgway, 1971). Peak season for births in the Irish Sea is observed between May and November (Berrow *et al*., 2010). The gestation period lasts for 12 months and females' average calving intervals are around three to five years (Harrison and Ridgway, 1971; Robinson *et al.,* 2017).

6.2.2.2 Distribution and occurrence

In Ireland, there are thought to be at least three distinct populations of bottlenose dolphin, as determined by genetic studies (Mirimin *et al.,* 2011). One of these populations is highly mobile and the same individuals have been recorded off all Irish coasts (O'Brien *et al.,* 2009). Comparison of images within bottlenose dolphin photographic identification (hereafter 'photo-ID'[1]) catalogues confirmed movement of individuals through prospective corridors linking designated SACs in the Moray Firth, Cardigan Bay and Shannon Estuary (Robinson *et al.,* 2012). There is increasing evidence (from sightings and genetic analysis) to suggest that an offshore ecotype of bottlenose dolphin exists in Irish waters (Mirimin *et al.,* 2011; Berrow *et al.,* 2013). Due to dedicated studies on coastal populations of bottlenose dolphin, there is greater knowledge on the coastal ecotype than the offshore ecotype (Hague *et al.,* 2020). Most coastal sightings around Ireland fall within 10 km from shore (O'Brien *et al.,* 2010; Robinson *et al.,* 2012). Although they have been observed throughout Irish waters year-round, their presence is much less pronounced in the western Irish Sea (Ó Cadhla *et al.,* 2004; Berrow *et al.,* 2010; Wall *et al.,* 2013; Kavanagh *et al.,* 2017; Rogan *et al.*, 2018a).

During the ObSERVE aerial surveys, bottlenose dolphins were the most frequently sighted cetacean species in Irish EEZ waters, with more than twice as many sightings during winter compared to summer (Rogan *et al.,* 2018a). Bottlenose dolphins were recorded in oceanic, neritic and coastal waters, however, there were very few sightings in the western Irish Sea (stratum 5) compared to other regions within the Irish EEZ. This suggests that the west and southwest of Ireland are likely to be more important in terms of the distribution of this species. This is supported by findings of the historic site-specific boat-based surveys, as no bottlenose dolphin were recorded. Bottlenose dolphins were recorded once (November 2019) during the site-specific DAS. Seasonal differences in distribution suggest that bottlenose dolphins disperse into the Irish Sea during the winter, between October and March (Rogan *et al.,* 2018a).

6.2.2.3 Density/abundance

The IAMMWG has identified seven MUs for bottlenose dolphin. The Marine Mammal Study Area is within the Irish Sea MU for bottlenose dolphin (see Figure 11.2.7), and the abundance estimate for this species within this MU is 293 animals (95% CI: 108 to 793) (IAMMWG, 2023).

[1] A method of monitoring using photographs of features, such as dorsal fin shape or scarring, that allows for identification of individual animals.

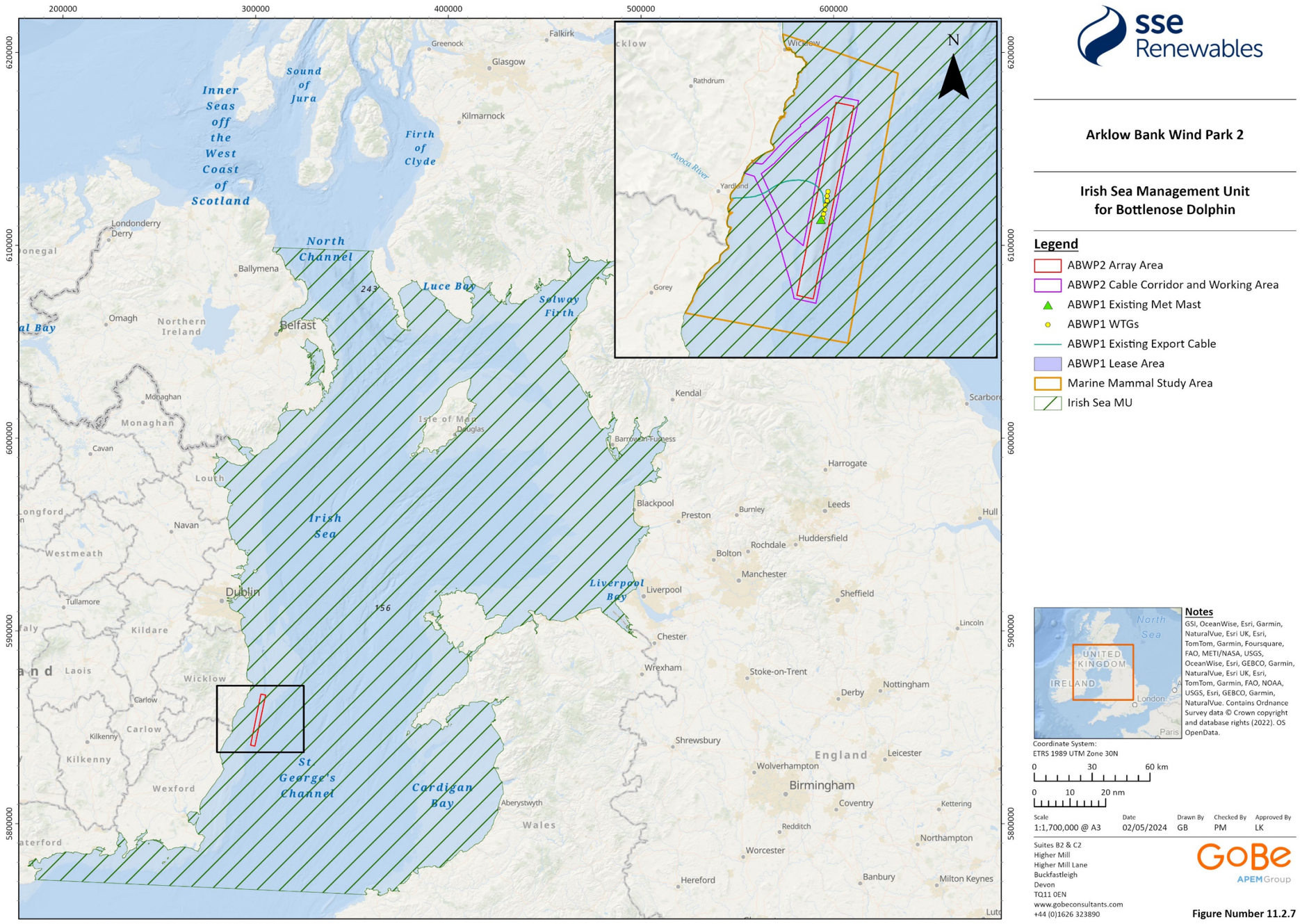

Figure Reference: Ark_007_IrishSea_BottlenoseDolphinMUFig11.2.7

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Arklow Bank Wind Park 2

Irish Sea Management Unit for Bottlenose Dolphin

Legend

- ABWP2 Array Area
- ABWP2 Cable Corridor and Working Area
- ABWP1 Existing Met Mast
- ABWP1 WTGs
- ABWP1 Existing Export Cable
- ABWP1 Lease Area
- Marine Mammal Study Area
- Irish Sea MU

Notes

GSI, OceanWise, Esri, Garmin, NaturalVue, Esri UK, Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS, OceanWise, Esri, GEBCO, Garmin, NaturalVue, Esri UK, Esri, TomTom, Garmin, FAO, NOAA, USGS, Esri, GEBCO, Garmin, NaturalVue. Contains Ordnance Survey data © Crown copyright and database rights (2022). OS OpenData.

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0 30 60 km

0 10 20 nm

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Figure Number 11.2.7

Figure 11.2.7 The Irish Sea Management Unit for bottlenose dolphin (after IAMMWG, 2015)

During the ObSERVE surveys, only one sighting of a group of five bottlenose dolphin was made in stratum 5 during winter 2016, with an abundance estimate of 401 animals (95% CI: 76 to 2,105) (Rogan *et al.,* 2018a).

Data from SCANS-III surveys also recorded low numbers of bottlenose dolphins within the Irish Sea (block E), with most sightings in the north of the Irish Sea. The abundance estimate for block E is 288 (CV=0.57; 95% CI: 0 to 664), with a mean group size of 1.5 individuals (Hammond *et al.,* 2021). Population estimates from a highly studied population at Cardigan Bay in West Wales, however, suggest that the above may be an underestimation. The abundance estimate from the Cardigan Bay / Bae Ceredigion SAC, which is a population linked to the Pen Llŷn a'r Sarnau / Lleyn Peninsula SAC in 2016 was 147 individuals (95% CI: 127 to 194; NRW, 2018).

SCANS-IV recorded higher numbers of bottlenose dolphins within the Irish Sea (block CS-D) than the previous survey, with an abundance estimate of 8,199 animals (CV: 0.353; 95% CI: 3,595 to 15,158) and a mean group size of 2.74 individuals (Gilles *et al.,* 2023). It is important to highlight the significant difference between the SCANS-III and SCANS-IV abundance estimates of bottlenose dolphins in the Irish Sea. The MU population is derived from the lower SCANS-III abundance estimates, resulting in a population size of 293 (IAMMWG, 2023), however, the SCANS-IV abundance estimate for the Irish Sea (blocks CS-D and CS-E) is 8,326 animals (Gilles *et al.,* 2023).

Bottlenose dolphin were not observed during the inshore cetacean surveys in the southern Irish Sea (Berrow *et al.,* 2011), therefore abundance and density estimates could not be derived from this source.

Bottlenose dolphin were not recorded during the historic site-specific boat-based surveys and only once (November 2019) during the site-specific DAS and therefore density and abundance estimates were not available from these datasets (noting, however, that a number of marine mammals could only be identified as 'cetacean species') (HiDEF, 2020a).

Density estimates for bottlenose dolphin are summarised in Table 11.2.5 below and suggest that the likelihood of occurrence of bottlenose dolphin within the Marine Mammal Study Area is low. Density estimates are available from limited sources due to either no sightings being recorded or too few sightings to calculate density. Large scale ObSERVE and SCANS surveys we used to calculate density estimates ranging from 0.008 to 0.2352 animals per km^2. Design-based and model-based density estimates are presented from Rogan *et al.* (2018a). Modelled densities by Lacey *et al.* (2022) provide grid-cell specific densities within the Marine Mammal Study Area (Figure 11.2.8).

Table 11.2.5 A summary of bottlenose dolphin density estimates (animals per km^2) and coefficient of variation (CV), if calculated for the relevant study/survey.

Source	Area	Temporal	Density (animals per km^2)
SCANS-IV block CS-D (Gilles *et al.,* 2023)	Western Irish Sea	Summer 2022	0.2352 (CV: 0.353)

Source	Area	Temporal	Density (animals per km^2)
SCANS-III (Lacey *et al.,* 2022)	Marine Mammal Study Area	Summer 2016	Grid-cell specific
SCANS-III block E (Hammond *et al.,* 2017; 2021)	Western Irish Sea	Summer 2016	0.008 (CV: 0.57)
ObSERVE stratum 5 design-based estimate (Rogan *et al.,* 2018a)	western Irish Sea and Celtic Sea	Summer 2016	0.0106 (CV: 117.94)
ObSERVE stratum 5 design-based estimate (Rogan *et al.,* 2018a)	western Irish Sea and Celtic Sea	Winter 2016-17	0.036 (CV: 93.55)
ObSERVE stratum 5 model-based estimate (Rogan *et al.,* 2018a)	western Irish Sea and Celtic Sea	Winter 2016-17	0.0201 (CV: 82.55)

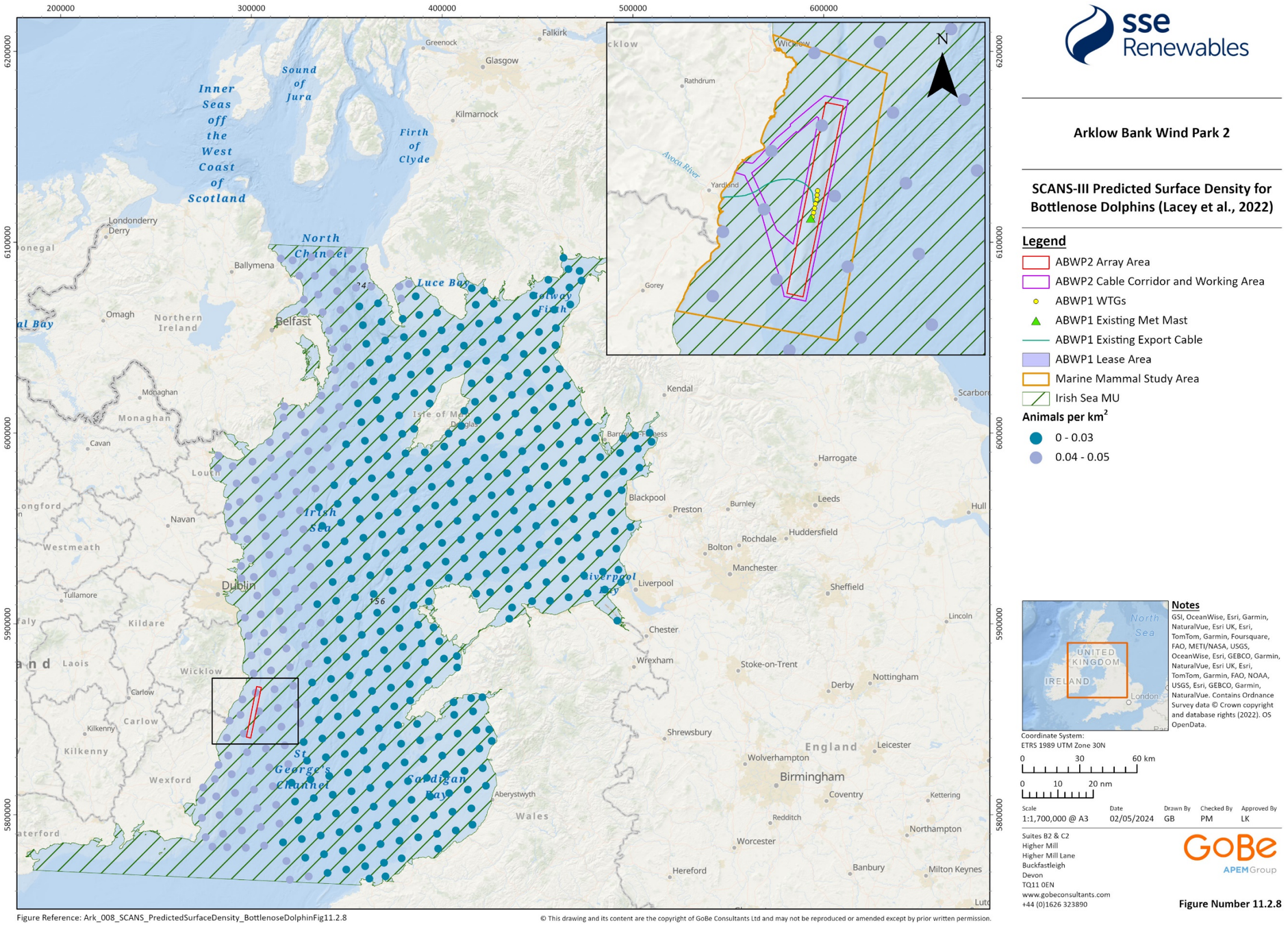

Figure Reference: Ark_008_SCANS_PredictedSurfaceDensity_BottlenoseDolphinFig11.2.8

sse Renewables

Arklow Bank Wind Park 2

SCANS-III Predicted Surface Density for Bottlenose Dolphins (Lacey et al., 2022)

Legend

- ABWP2 Array Area
- ABWP2 Cable Corridor and Working Area
- ABWP1 WTGs
- ABWP1 Existing Met Mast
- ABWP1 Existing Export Cable
- ABWP1 Lease Area
- Marine Mammal Study Area
- Irish Sea MU

Animals per km²

- 0 - 0.03
- 0.04 - 0.05

Notes

GSI, OceanWise, Esri, Garmin, NaturalVue, Esri UK, Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS, OceanWise, Esri, GEBCO, Garmin, NaturalVue, Esri UK, Esri, TomTom, Garmin, FAO, NOAA, USGS, Esri, GEBCO, Garmin, NaturalVue. Contains Ordnance Survey data © Crown copyright and database rights (2022). OS OpenData.

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Figure Number 11.2.8

Figure 11.2.8 Density estimates for bottlenose dolphin in the Marine Mammal Management Unit Study Area and Marine Mammal Study Area, from SCANS-III data (after Lacey *et al.*, 2022)

6.2.2.4 Seasonality

The seasonal distribution of bottlenose dolphin in Irish waters based on the ObSERVE aerial survey data suggests that this species moves inshore, into shallow coastal waters during warmer months, and into offshore, deeper waters during the winter months (Rogan *et al.,* 2018a). However, this pattern could be as a result of both the coastal and offshore ecotypes using these areas.

6.2.2.5 Conservation status

Bottlenose dolphins currently have a 'favourable' conservation status in Ireland under Article 17 of the EU Habitats Directive, with a stable population trend (NPWS, 2019). They are listed as Least Concern by the International Union for Conservation of Nature (IUCN) Red List. Bottlenose dolphins are classified as a Priority Species under the UK Post-2010 Biodiversity Framework. The current conservation status and short-term trends for bottlenose dolphin within UK waters are unknown, due to insufficient data for the species (JNCC 2019b).

As bottlenose dolphins are also listed under Annex II of the EU Habitats Directive, SACs must be assigned to aid in the protection of this species. There are four SACs designated for bottlenose dolphin within the Marine Mammal MU Study Area, the closest of which is Lleyn Peninsula and the Sarnau / Pen Llŷn a'r Sarnau SAC, 73.3 km from the Array Area, followed by Cardigan Bay / Bae Ceredigion SAC, which is 82.7 km from the Array Area, both of which are in UK waters. The full list of SACs is presented in Table 11.2.A.12 and Figure 11.2.1. Sites are ordered with increasing distance from the Array Area; site numbering in Table 11.2.A.12 corresponds with site numbering in Figure 11.2.1.

6.2.3 Risso's dolphin

6.2.3.1 Ecology

Risso's dolphins predate on cephalopods, primarily squid and octopus (MacLeod *et al.,* 2014). Life history information is relatively limited for Risso's dolphins, but sexual maturity is thought to be reached at 8-10 years old for females and 10-12 years old for males (Baird, 2009). The gestation period is estimated at 13-14 months with a calving interval[2] of 2.4 years. The calving season is unknown for Irish and UK waters, but the presence of young calves in some groups observed during cetacean surveys indicates that calving does occur in Irish waters (Wall *et al.,* 2013).

6.2.3.2 Distribution and occurrence

Risso's dolphin is frequently recorded in Irish waters, in all seasons, and in a variety of habitats. Around the coast of Ireland, sightings of this species are recorded in inshore waters but most are

[2] Time period between new calves borne by a single female.

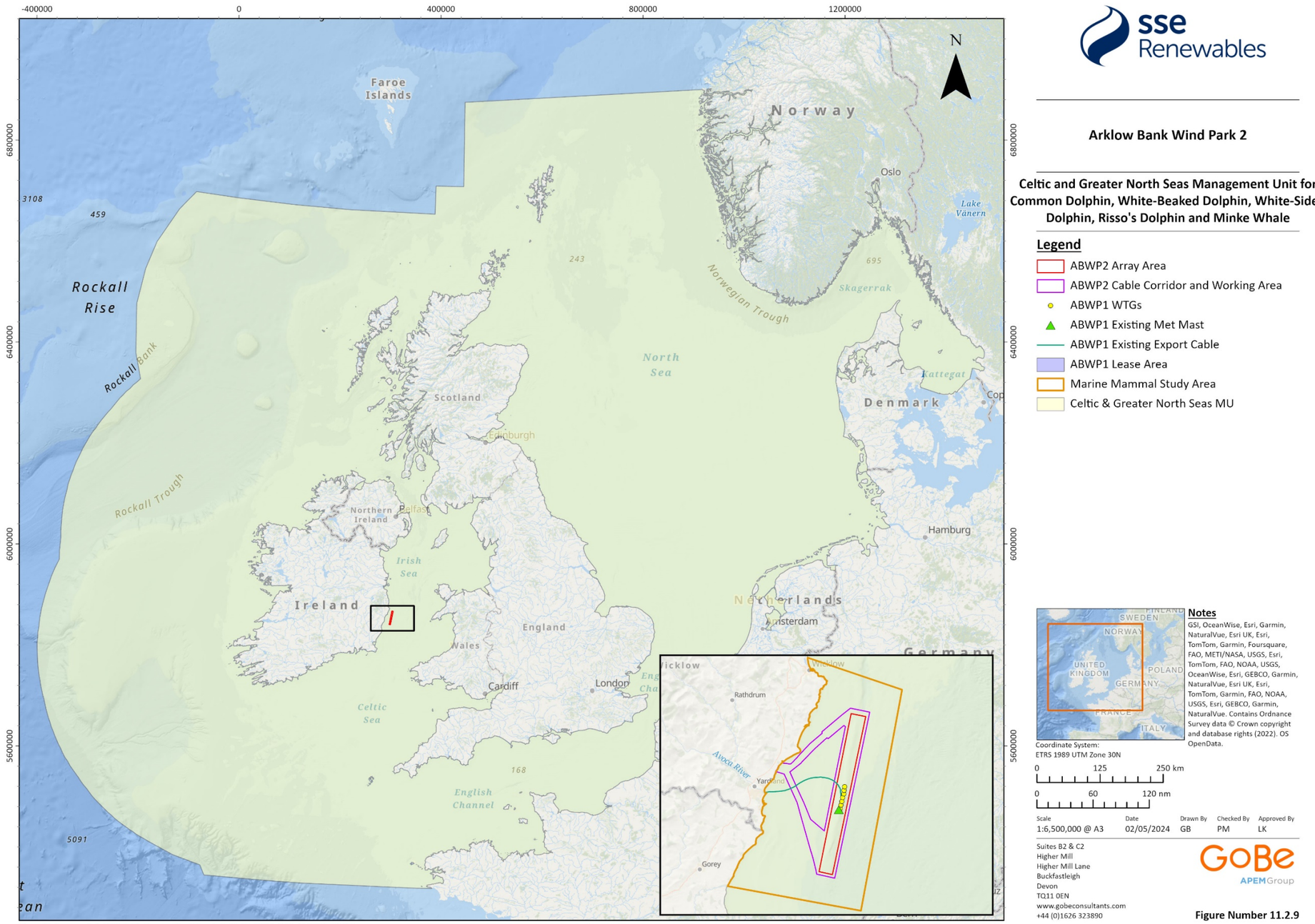
recorded in deeper waters over the continental shelf and slope (Rogan *et al*., 2018a). In Irish waters, Risso's dolphin commonly occur in groups of between one and ten individuals (Rogan *et al.,* 2018a) which may benefit cooperative hunting through repeated associations between individuals, with some individuals staying together for long periods of time (Wells *et al*., 1999; Hartman *et al.,* 2008; Felce, 2013).

Within the Irish Sea, Risso's dolphin is the most commonly recorded dolphin species and there is an indication that presence in the Irish Sea has increased, which is likely a result of the increase in populations of several species of cephalopod (a key prey species, see Section 6.2.3.1) in the British Isles, attributed to climate change (Berrow *et al.,* 2010; Van der Kooij *et al.,* 2016). Coastal sightings are typical for this region, with the coastal waters off Wicklow and Wexford accounting for 41% of all inshore sightings of this species (Berrow *et al.,* 2010). Modelled density outputs also indicate the coastal waters off Wexford, in southeast Ireland contain high densities of Risso's dolphins, as compared to elsewhere in the Irish Sea (Evans and Waggitt, 2023). Calves are often recorded closer to the coast suggesting that calving occurs within the warmer inshore waters. In addition, repeated sightings of the same individuals suggest some degree of site fidelity may occur. For example, photo-ID studies of Risso's dolphins from the eastern Irish Sea showed indications of residency of identified individuals to a particular region (Felce, 2013). It is thought that coastal sightings in the western Irish Sea are likely to represent a frequently sighted community often sighted near the Saltee Islands off County Wexford (Rogan *et al.,* 2018a).

Small numbers of Risso's dolphin, ranging from one to eight individuals, were recorded during the site-specific historic boat-based surveys although none were identified during the site-specific DAS (noting, however, that a number of marine mammals could only be identified as 'cetacean species').

6.2.3.3 Density/abundance

The IAMMWG has identified a single MU as appropriate for a variety of species, including Risso's dolphin: the Celtic and Greater North Seas MU (Figure 11.2.9). The Marine Mammal Study Area is within this MU. The abundance estimate of Risso's dolphins for the Celtic and Greater North Seas MU is 12,262 (95% CI: 5,227 to 28,764) (IAMMWG, 2023).



Arklow Bank Wind Park 2

Celtic and Greater North Seas Management Unit for Common Dolphin, White-Beaked Dolphin, White-Sided Dolphin, Risso's Dolphin and Minke Whale

Legend

- ABWP2 Array Area
- ABWP2 Cable Corridor and Working Area
- ABWP1 WTGs
- ABWP1 Existing Met Mast
- ABWP1 Existing Export Cable
- ABWP1 Lease Area
- Marine Mammal Study Area
- Celtic & Greater North Seas MU

Notes

GSI, OceanWise, Esri, Garmin, NaturalVue, Esri UK, Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS, Esri, TomTom, FAO, NOAA, USGS, OceanWise, Esri, GEBCO, Garmin, NaturalVue, Esri UK, Esri, TomTom, Garmin, FAO, NOAA, USGS, Esri, GEBCO, Garmin, NaturalVue. Contains Ordnance Survey data © Crown copyright and database rights (2022). OS OpenData.

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Figure Number 11.2.9

Figure Reference: Ark_009_CelticGreaterNorthSea_DolphinAndMinkeWhaleMUFig11.2.9

Figure 11.2.9 The Celtic and Greater North Seas Management Unit for common dolphin, white-beaked dolphin, white-sided dolphin, Risso's dolphin and minke whale (after IAMMWG, 2015)

The ObSERVE aerial surveys recorded only one sighting of a single individual in the summer of 2015 within stratum 5, resulting in an abundance of 35 (95% CI: 7 to 188) animals for this region (Rogan *et al.,* 2018a).

Small numbers of Risso's dolphins were noted during the SCANS-III (block E) and SCANS-IV (block CS-D) surveys within the Irish Sea. The estimated abundance within block E was calculated as 1,090 animals (CV=0.69; 95% CI: 0 to 2,843), and a mean group size of 7.5 individuals (Hammond *et al.,* 2021). In block CS-D, the estimated abundance was 75 animals (CV: 1.012; 95% CI: 2 to 259) (Gilles *et al.,* 2023).

One group (six individuals) of Risso's dolphin were recorded in the northern inshore survey block during the inshore cetacean surveys by IWDG in 2011, resulting in an encounter rate of 0.10 animals per km of route surveyed (Berrow *et al.,* 2011). There were no sightings of Risso's dolphin in the southern inshore survey block which encompasses the Marine Mammal Study Area.

Small numbers of Risso's dolphins were also recorded during the historical site-specific boat-based surveys. Eight individuals were sighted in July 2000 and 2002. In May 2005, four individuals were recorded in the north of the survey area and a single animal was recorded in June 2005. In 2005, one Risso's dolphin was seen in August and a group of five were recorded in June 2008. No abundance or density estimates were derived from these data.

There were no Risso's dolphin identified during the site-specific DAS and therefore density and abundance estimates were not available from these datasets (noting, however, that a number of marine mammals could only be identified as 'cetacean species').

Density estimates for Risso's dolphin are summarised in Table 11.2.6 below and suggest that the likelihood of occurrence of Risso's dolphin within the Marine Mammal Study Area is very low. Density estimates are available from limited sources due to either no sightings being recorded or too few sightings to calculate density. Density estimates could not be modelled for Risso's dolphin by Lacey *et al.* (2022) due to insufficient data. Design-based density estimates are presented from Rogan *et al.* (2018a). Large scale ObSERVE and SCANS surveys provided density calculations ranging from ranging from 0.0022 animals per km^2 to 0.031 animals per km^2.

Table 11.2.6 A summary of Risso's dolphin density estimates (animals per km^2)

Source	Area	Temporal	Density (animals per km^2)
SCANS-IV block CS-D (Gilles *et al.,* 2023)	Western Irish Sea	Summer 2022	0.0022 (CV: 1.012)
SCANS-III block E (Hammond *et al.,* 2017; 2021)	Western Irish Sea	Summer 2016	0.031 (CV: 0.69)
ObSERVE stratum 5 design-based estimate (Rogan *et al.,* 2018a)	Western Irish Sea and Celtic Sea	Summer 2015	0.0032 (CV: 96.16)

6.2.3.4 Seasonality

There is reported seasonality in the patterns of occurrence of Risso's dolphin, with animals being sighted more frequently further offshore in continental shelf waters during winter months (October to May) (Reid *et al*., 2003). This is corroborated by sighting records for Irish waters where Risso's dolphin have been reported around the coast of Ireland in all months of the year, although peak sightings occur between May and July suggesting a late spring inshore movement (Berrow *et al.,* 2010). Reid *et al.* (2003) reports that in the Irish Sea (in offshore waters) most sighting records were between July and September, and near-shore records off southwest Ireland were obtained primarily between May and August.

During the historic site-specific boat-based surveys, all sightings of Risso's dolphin were during the months of May, June, and July supporting the evidence above, that this species more commonly occurs inshore in the Irish Sea during the spring/summer months (Cork Ecology, 2009; Coveney Wildlife Consulting Ltd., 2003).

6.2.3.5 Conservation status

Risso's dolphin currently have a 'favourable' conservation status in Ireland under Article 17 of the EU Habitats Directive, with a stable population trend (NPWS, 2019). In 2018, Risso's dolphins were updated from Data Deficient to Least Concern on the IUCN Red List. The current conservation status and short-term trends for Risso's dolphin within UK waters are unknown due to insufficient data (JNCC 2019c). As Risso's dolphin is not an Annex II species under the Habitats Directive, there are no SACs for Risso's dolphin within either study area. A Marine Protected Area (MPA) has been designated in North-east Lewis, Scotland due to the high numbers of Risso's dolphins that occur in these waters year-round. Consequently, it has been suggested that this MPA provides essential foraging grounds, as well as being important for breeding, nursing, and raising young (NatureScot, 2019a). The MPA does not overlap with the Marine Mammal Study Area but is within the MU Study Area.

6.2.4 Short-beaked common dolphin

6.2.4.1 Ecology

Short-beaked common dolphin (hereafter 'common dolphin') prey on a variety of fish and cephalopod species including poor cod, goby (*Caragobius urolepis*), blue whiting, whiting, cephalopods (*Cephalopoda*), Atlantic herring, European sprat (*Sprattus sprattus*), and haddock (Brophy *et al.,* 2009). Recordings from bycaught individuals in the NE Atlantic show that the average age at sexual maturity was 8.2 years for females and 11.9 years for males (Murphy *et al.,* 2005; Murphy *et al.,* 2009; Murphy *et al.,* 2021). Considering common dolphins are reported to live up to 30 years in the Northeast Atlantic and have an extended calving interval period of approximately four years, it is thought females could have up to four to five calves throughout their lifetime (Murphy *et al.,* 2009).

6.2.4.2 Distribution and occurrence

Common dolphins are found throughout the Atlantic seaboard of Europe, in the Western Channel and Irish Sea and often travels in large groups. This species commonly inhabits continental shelf waters and occurs along the shelf edge and in deep water, and is the second most frequently reported cetacean, after harbour porpoise, within Irish waters (Berrow *et al.,* 2010). Common dolphin may occur in both inshore and offshore waters in the western Irish Sea, although the distribution of this species is primarily around the coast of southern and western Ireland (Berrow *et al.,* 2010). Modelled density outputs suggest that densities of common dolphin in the Irish Sea are higher in central regions further from shore (Evans and Waggitt, 2023).

There was one individual common dolphin recorded during the historic site-specific boat-based surveys, in 2002 to 2003 (Coveney Wildlife Consulting Ltd., 2003). During the site-specific DAS undertaken between March 2018 and April 2020, common dolphins were observed on two occasions: a group of three animals in November 2019 and a group of 18 animals in January 2020 (HiDEF, 2020a). In addition, a small number of unidentified cetaceans were reported which may have been common dolphin. It was not possible to estimate abundance and density of common dolphin from the site-specific surveys due to low number of sightings across the months.

6.2.4.3 Density/abundance

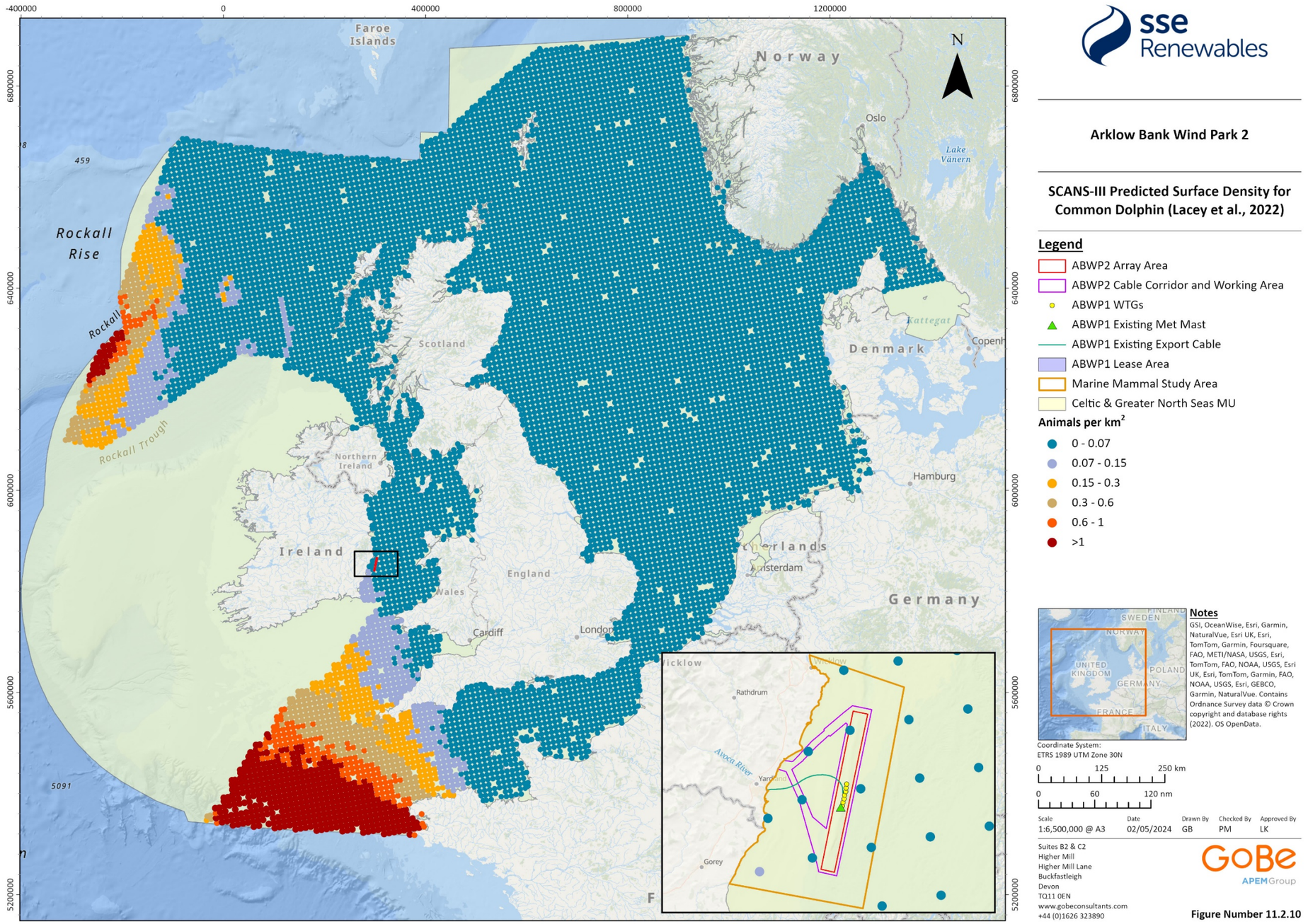
The IAMMWG has identified a single MU as appropriate for a variety of species, including common dolphin: the Celtic and Greater North Seas MU (Figure 11.2.9). The Marine Mammal Study Area is within this MU. The total common dolphin abundance for the Celtic and Greater North Seas MU was estimated as 102,656 (95% CI: 58,932 to 178,822) (IAMMWG, 2023).

SCANS-IV estimates the abundance of common dolphins as 949 individuals (CV: 0.814; 95% CI: 32 to 2,990) (Gilles *et al.,* 2023). However, the ObSERVE aerial surveys did not record any common dolphin in stratum 5 (Rogan *et al.,* 2018a). Similarly, there were no sightings of common dolphin There were no sightings of common dolphin recorded in block E (western Irish Sea) during the SCANS-III surveys (Hammond *et al.,* 2021) or during the inshore cetacean surveys in the south Irish Sea (Berrow *et al.,* 2011). Therefore, abundance and density estimates could not be derived from these sources.

Density estimates for common dolphin are summarised in Table 11.2.7 below and suggest that the likelihood of occurrence of common dolphin within the Marine Mammal Study Area is very low. Density estimates are available from limited sources due to either no sightings being recorded or too few sightings to calculate density. Despite common dolphins not being recorded in block E during SCANS-III surveys, Lacey *et al.* (2022) modelled grid-cell specific density estimates within the Marine Mammal Study Area (Figure 11.2.10).

Table 11.2.7 A summary of common dolphin density estimates (animals per km^2)

Source	Area	Temporal	Density (animals per km^2)
SCANS-IV block CS-D (Gilles *et al.,* 2023)	Western Irish Sea	Summer 2022	0.0272 (CV: 0.814)
SCANS-III (Lacey *et al.,* 2022)	Marine Mammal Study Area	Summer 2016	Grid-cell specific



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SCANS-III Predicted Surface Density for Common Dolphin (Lacey et al., 2022)

Legend

- ABWP2 Array Area
- ABWP2 Cable Corridor and Working Area
- ABWP1 WTGs
- ABWP1 Existing Met Mast
- ABWP1 Existing Export Cable
- ABWP1 Lease Area
- Marine Mammal Study Area
- Celtic & Greater North Seas MU

Animals per km²

- 0 - 0.07
- 0.07 - 0.15
- 0.15 - 0.3
- 0.3 - 0.6
- 0.6 - 1
- >1

Notes

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Figure Number 11.2.10

Figure Reference: Ark_010_SCANS_PredictedSurfaceDensity_CommonDolphinFig11.2.10

Figure 11.2.10 Density estimates for common dolphin in the Marine Mammal Management Unit Study Area and Marine Mammal Study Area, from SCANS-III data (after Lacey *et al.*, 2022)

6.2.4.4 Seasonality

The IWDG cetaceans sighting review reports that records from ferries show a notable increase in numbers in the southern Irish Sea in the autumn and a peak in inshore records during the month of August (Berrow *et al.,* 2010), and suggests that there may be an eastward movement along the south coast during autumn and winter.

6.2.4.5 Conservation status

Common dolphins currently have a 'favourable' conservation status in Ireland under Article 17 of the EU Habitats Directive with a stable population trend (NPWS, 2019). They are classed as Least Concern on the IUCN Red List. The current conservation status and short-term trends for common dolphin within UK waters are unknown, due to insufficient data for the species (JNCC, 2019d). As common dolphin is not an Annex II species under the Habitats Directive, there are no SACs for common dolphin within either Study Area. There are also no other MPA designations for common dolphin within either Study Area.

6.2.5 Minke whale

6.2.5.1 Ecology

Minke whales are the most abundant baleen whale within Irish and UK waters and are most commonly sighted in shallow, shelf habitat over the summer months, which are important foraging habitats. Key prey species for minke whales include sandeel (*Ammodytes*), herring, sprat, mackerel (*Scomber scombrus*), poor cod (*Trisopterus minutus*), and goby (Whooley, 2016; Robinson *et al.,* 2023). Some individuals remain in coastal waters year-round; however, most migrate south during winter months to temperate offshore waters for breeding grounds. Individuals from the Northeast Atlantic population of minke whale are thought to reach sexual maturity between three-to-six years old, but some can take up to 13 years to reach physical maturity (Olsen and Sunde, 2002). The gestation period lasts for 10 months, and the calving interval lasts at least one-to-two years (Christiansen *et al.,* 2014).

6.2.5.2 Distribution and occurrence

Minke whale mostly inhabit continental shelf waters, occurring in depths of less than 200 m and can often be seen close to land. In Irish waters, the minke whale is widely distributed but is most commonly seen along the south coast and in localised patches in the central Irish Sea (Reid *et al.,* 2003; Rogan *et al.*, 2018a), with modelled density outputs indicating a similar pattern in distribution (Evans and Waggitt, 2023). There is a distinct seasonal distribution of minke whale with animals moving inshore during the summer months and offshore during winter. A review of all cetacean sighting and stranding records made by the IWDG through ISCOPE suggest that minke whale may also be occasionally present within the Marine Mammal Study Area (Berrow *et al.,* 2010). Most records from the NBDC for the western Irish Sea also show sightings off the coast of Dublin and to the north, and also off southeast Wexford (NBDC, 2023).

Minke whale was the second most frequently recorded species (after harbour porpoise) during inshore boat-based surveys of the Irish Sea (Berrow *et al.,* 2011). Observations of minke whale were made in Dublin Bay and waters to the north. There were no observations of minke whale in the survey area within which the Proposed Development is located (Berrow *et al.,* 2011).

During the historic site-specific boat-based surveys, minke whale was observed to the west of the ABWP1 (i.e. inshore) in Year 4 (Coveney Wildlife Consulting Ltd., 2004). There were no other records of minke whale from the boat-based surveys in later years (Coveney Wildlife Consulting Ltd., 2004).

6.2.5.3 Density/abundance

The IAMMWG has identified a single MU as appropriate for a variety of species, including minke whale: the Celtic and Greater North Seas MU (Figure 11.2.9). The Marine Mammal Study Area is within this MU. The total minke whale abundance for the Celtic and Greater North Seas MU was estimated as 20,118 animals (95% CI: 14,061 to 28,786) (IAMMWG, 2023).

In SCANS-III block E, the total abundance was estimated as 603 animals (CV=0.62; 95% CI: 134 to 1,753) (Hammond *et al.,* 2021) and in SCANS-IV block CS-D, the abundance was estimated as 477 animals (CV=0.632; 95% CI: 85 to 1,425) (Gilles *et al.,* 2023).

Corrected design-based abundance estimates for minke whale from the ObSERVE surveys for stratum 5 (western Irish Sea) was 495 animals (95% CI: 221.5 to 1,105.0) for summer 2015 and 180 animals for summer 2016 (95% CI: 58.6 to 552.9) (Rogan *et al.,* 2018a).

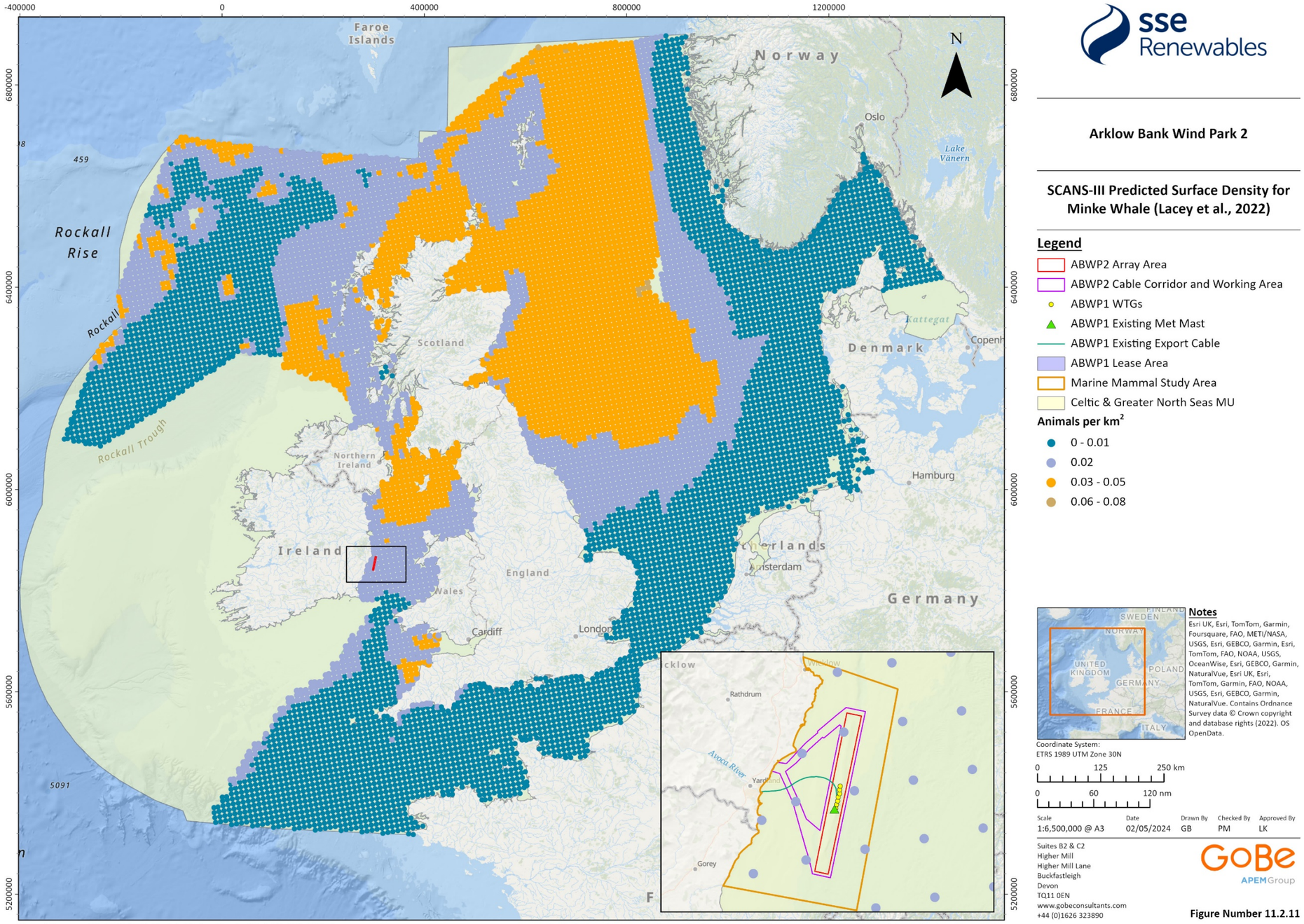
Insufficient sightings of minke whale were recorded during the historic boat-based surveys for abundance and density calculations. There were also no minke whale identified during the site-specific DAS and therefore density and abundance estimates were not available from this dataset (noting, however, that a number of marine mammals could only be identified as 'cetacean species').

Density estimates for minke whale are summarised in Table 11.2.8 below and suggest that the likelihood of occurrence of minke whale within the Marine Mammal Study Area is low. Density estimates are available from limited sources due to either no sightings being recorded or too few sightings to calculate density. Large scale ObSERVE and SCANS-III surveys provided density calculations ranging from 0.0137 animals per km^2 to 0.045 animals per km^2. Corrected design-based density estimates are presented from Rogan *et al.* (2018a). Modelled densities by Lacey *et al.* (2022) provide grid-cell specific estimates within the Marine Mammal Study Area.

Table 11.2.8 A summary of minke whale density estimates (animals per km^2)

Source	Area	Temporal	Density (animals per km^2)
SCANS-IV block CS-D (Gilles *et al.,* 2023)	Western Irish Sea	Summer 2022	0.0137 (CV: 0.632)

Source	Area	Temporal	Density (animals per km^2)
SCANS-III (Lacey *et al.,* 2022)	Marine Mammal Study Area	Summer 2016	Grid-cell specific
SCANS-III block E (Hammond *et al.,* 2017 ; 2021)	Western Irish Sea	Summer 2016	0.017 (CV: 0.62)
ObSERVE stratum 5 corrected design-based estimate (Rogan *et al.,* 2018a)	Western Irish Sea and Celtic Sea	Summer 2015	0.045 (CV: 68.75)
ObSERVE stratum 5 corrected design-based estimate (Rogan *et al.,* 2018a)	Western Irish Sea and Celtic Sea	Summer 2016	0.016 (CV: 106.13)



Arklow Bank Wind Park 2

SCANS-III Predicted Surface Density for Minke Whale (Lacey et al., 2022)

Legend

- ABWP2 Array Area
- ABWP2 Cable Corridor and Working Area
- ABWP1 WTGs
- ABWP1 Existing Met Mast
- ABWP1 Existing Export Cable
- ABWP1 Lease Area
- Marine Mammal Study Area
- Celtic & Greater North Seas MU

Animals per km²

- 0 - 0.01
- 0.02
- 0.03 - 0.05
- 0.06 - 0.08

Notes

Esri UK, Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS, Esri, GEBCO, Garmin, Esri, TomTom, FAO, NOAA, USGS, OceanWise, Esri, GEBCO, Garmin, NaturalVue, Esri UK, Esri, TomTom, Garmin, FAO, NOAA, USGS, Esri, GEBCO, Garmin, NaturalVue. Contains Ordnance Survey data © Crown copyright and database rights (2022). OS OpenData.

Coordinate System:
ETRS 1989 UTM Zone 30N

0 125 250 km

0 60 120 nm

Scale	Date	Drawn By	Checked By	Approved By
1:6,500,000 @ A3	02/05/2024	GB	PM	LK

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Figure Number 11.2.11

Figure Reference: Ark_011_SCANS_PredictedSurfaceDensity_MinkeWhaleFig11.2.11

Figure 11.2.11 Density estimates for minke whale in the Marine Mammal Management Unit Study Area and Marine Mammal Study Area, from SCANS-III data (after Lacey *et al.*, 2022)

6.2.5.4 Seasonality

Little is known about the seasonal movements of minke whales in the Atlantic although data for tagged individuals in the western Atlantic suggests southward movement from feeding areas in Iceland in the autumn months (Reid *et al.,* 2003). There is a distinct seasonal distribution of minke whale with animals moving inshore during the summer months and offshore during winter.

In UK waters, most sightings have been made between May and September. During July and September, feeding aggregations can be observed in inshore areas (Reid *et al.,* 2003). The IWDG cetacean sightings review found that the number of sightings around Irish waters started to increase in April and May, peaking in August, and tapering off in late autumn and early winter (Berrow *et al.,* 2010). This pattern is also reflected in the Irish Sea where animals appear in the eastern Irish Sea from April to June (Berrow *et al.,* 2010). The coastal distribution in summer months and lower or lack of coastal sightings in winter suggests a seasonal offshore to inshore movement. Data from the ObSERVE aerial surveys of Irish waters found a high use of coastal waters during the summer months, particularly in the southwest of Ireland and Irish Sea and the predicted distribution suggests that the Irish Sea appeared to be unsuitable for minke whale in winter (Rogan *et al.,* 2018a).

6.2.5.5 Conservation status

Minke whale currently have a 'favourable' conservation status in Ireland under Article 17 EU Habitats Directive, with a stable population trend (NPWS, 2019). They are listed as Least Concern on the IUCN Red List. The current conservation status and short-term trends for minke whale within UK waters are unknown, due to insufficient data to establish current trends or future prospects for the species (JNCC, 2019e). As minke whale is not an Annex II species under the Habitats Directive, there are no SACs for minke whale within either study area. There are two MPAs in Scotland that have minke whale as a feature: Sea of the Hebrides MPA, and Southern Trench MPA. Habitat modelling suggests that there are above-average densities of minke whale in the waters of both MPAs (NatureScot, 2019b; NatureScot, 2019c). The MPAs do not overlap with the Marine Mammal Study Area but are both within the MU Study Area.

6.2.6 Grey seal

6.2.6.1 Ecology

Grey seals tend to breed on exposed rocky shores, on sandbars or in sea caves with ready access to deep water. Pupping tends to take place between August and November (SCOS, 2021) in the UK and Ireland. Grey seals give birth to a single pup which is weaned over a period of 17 to 23 days (SCOS, 2021), with pups leaving breeding sites for the sea after approximately one month. Following this, the female comes into oestrus and mating occurs, after which adult grey seals return to sea to forage and build up fat reserves. Although population counts are often recorded during the harbour seal moulting period (July-September), grey seals moult between December and April (Bonner, 1990). Grey seals are opportunistic feeders, primarily feeding on pelagic and

epibenthic fish, and molluscs and crustaceans, including cephalopods and shrimp, respectively (Gosch *et al.,* 2014; Wilson and Hammond, 2019).

6.2.6.2 Distribution and occurrence

Grey seals have a wide distribution and regularly travel between haul-out sites and feeding areas up to several hundred kilometres offshore (SCOS, 2021; 2022). They occur around the coast of Ireland although their distribution is concentrated along the Atlantic seaboard with more isolated regional concentrations off the coast of Dublin and Wexford (O'Cadhla *et al.,* 2007). Telemetry data from 19 individuals tagged in 2013/14 from colonies at Raven Point, Co. Wexford, showed that grey seals move north along the coast as far as Dublin Bay, suggesting that they could occur within the Proposed Development Area (Cronin *et al.,* 2016).

Grey seal at-sea distribution maps published by Carter *et al.* (2022) indicate that grey seal occur regularly in the Irish Sea, particularly to the north (north of Dublin Bay) and to the south in county Wexford; although, across Ireland and the UK, the highest mean densities occur in Scotland and along the east coast of England.

Grey seals gather in colonies on land (known as haul-outs) where they breed, rest, moult and engage in social activity (Bonner, 1990). Preferred haul-out locations around the coast of Ireland include uninhabited islands, isolated beaches, rocky skerries and sea caves (O'Cadhla *et al.*, 2007). The closest haul-out to the Proposed Development is on the coast at Arklow. (Duck and Morris, 2013; Morris and Duck, 2019). Grey seals also haul-out at nearby established breeding colonies at Lambay Island to the north of the Proposed Development, and at Wexford Harbour to the south of the Proposed Development (Duck and Morris, 2013; Morris and Duck, 2019). Grey seal breeding surveys conducted from 2009 to 2012 found that, compared to the Atlantic coast, pup production was considerably lower off the mainland coasts of Cork, Wicklow and Wexford compared to counties along the Atlantic coast (O'Cadhla *et al.*, 2013).

Observational data obtained during the Proposed Development geophysical campaigns recorded 17 sightings of grey seal in 2019 and 15 sightings in 2020 (IWDG, 2019; Gavin & Doherty Geosolutions Ltd, 2020). During the Proposed Development geotechnical survey campaign in 2023, there were four sightings of individual grey seals and one sighting of a grey seal and an unidentified seal (Gavin & Doherty Geosolutions Ltd, 2023a). Historic site-specific boat-based surveys recorded grey seal within the Survey Area in most survey years, albeit in low numbers. Similarly, the recent site-specific DAS found small numbers of grey seal or seal species in 8 and 17 of the 25 survey months, respectively, within the Aerial Survey Area; 15 grey seals and 27 seal species were recorded in total, suggesting that this species/species group regularly occur within the Marine Mammal Study Area, albeit in relatively small numbers.

6.2.6.3 Density/abundance

A total of 1,574 grey seal pups were estimated from around the coast of the Republic of Ireland during the 2005 breeding season (O'Cadhla *et al.*, 2007). This equated to a total population estimate of grey seals in Irish Waters of 5,509 to 7,083 animals (O'Cadhla *et al.,* 2007). Using additional data collected in 2007, O'Cadhla and Strong (2007) estimated a total of 5,343 grey seals

across all Irish haul-out sites and therefore suggested that this figure should represent a minimum population estimate. More recently, the University of St. Andrews' Sea Mammal Research Unit (SMRU) carried out an aerial survey of grey and harbour seals around the coast of Ireland in August 2017 and 2018. This survey estimated the total count of 3,698 grey seals, of which 418 occurred at haul-outs in the east region of Ireland (western Irish Sea) (Morris and Duck, 2019). This is a minimum population estimate since it does not account for the proportion of the population that would be at sea during the counts. Up to 25.15% of the population of grey seals are likely to be hauled-out during the August count (SCOS, 2022); thus, extrapolating this would give a total grey seal population for the Irish Sea of 14,704 individuals, and a total population for the western Irish Sea of 1,662 individuals. However, no grey seals were recorded in the portion of the survey region which overlaps with the Proposed Development (Morris and Duck, 2019). For the breeding site at Arklow, the estimated number of grey seals in the colony was in the range 21 to 150 (O'Cadhla and Strong, 2007).

The Marine Mammal Study Area is approximately due south of the Northern Ireland Seal Management Unit, and due west of the Wales Seal Management Unit. The population estimate for the Northern Ireland Seal Management Unit is 600 grey seals and the estimate for Wales Seal Management Unit is 5,200 grey seals (with estimates rounded to the nearest 100; SCOS, 2021).

Relative density estimates were calculated from the recent site-specific DAS data across the Aerial Survey Area and showed that, on average, the density of animals was 0.007 animals per km^2, with the highest density estimate of the eight surveys in which grey seal was positively identified being September 2018 (0.07 animals per km^2). Seventeen of the 26 surveys identified 'seal species' which could not be attributed to either grey or harbour seal, so these have been excluded from density estimates.

An absolute density estimate of 0.08 animals per km^2 for the Proposed Development was derived from the at-sea distribution modelling by Carter *et al.* (2022) (Figure 11.2.3). Absolute density estimates were generated by scaling from percentage of at-sea population to number of individuals using the two population scalars to estimate the total size of the at-sea population:

- the proportion of the overall population hauled-out, and thus available to count during the survey window (within two hours either side of low tide in August); and
- the proportion of time seals spend at-sea on average during the main foraging season as described in Carter *et al.* (2020).

However, there are a number of caveats and limitations associated with conversion of relative to absolute density and should therefore be taken as approximate estimate. Firstly, the density estimates are based on mean predictions, both in terms of relative density and of the size of the at-sea population (Carter *et al.,* 2020). Furthermore, given that the resolution of seal abundance estimates from habitat preference maps was aggregated to 5 km by 5 km grid cells (25 km^2), it was not possible to estimate numbers at a finer scale. This spatial scale is driven by the resolution and uncertainty of the data used in the analytical process (Russell *et al.,* 2017).

Density estimates for grey seal are summarised in Table 11.2.9 below and suggest that the likelihood of occurrence of grey seal within the Marine Mammal Study Area is low.

Table 11.2.9 A summary of grey seal density estimates

Source	Area	Temporal	Density (animals per km^2)
HiDef site-specific DAS (relative density)	Project Aerial Survey Area	2018 to 2020	0.007
Scaled from Carter *et al.* (2020; 2022)	Proposed Development	2005 to 2019	0.08

6.2.6.4 Seasonality

Grey seals haul out to breed between late August to December and subsequently undergo an annual moult between November to April (Kiely *et al.,* 2000). There is a slight overlap in these two key life-history phases between late November and early December (Keily *et al.,* 2000).

At sea, grey seals were found in most months of the year during the historic site-specific boat-based surveys and site-specific DAS. Numbers recorded were low in all months and therefore no seasonal variation was detectable.

6.2.6.5 Conservation status

Grey seals currently have a 'favourable' conservation status in Ireland under Article 17 EU Habitats Directive with an increasing population trend (NPWS, 2019). They are listed as Least Concern on the IUCN Red List.

As an Annex II species of the Habitats Directive, the designation of SACs is required as a component of their conservation. Lambay Island SAC is the only SAC for which grey seals are a designated feature, that falls within the Marine Mammal MU Study Area. Lambay Island SAC is sited 62.9 km from the proposed Array Area. Further information on SACs designated for grey seal and other species can be found in Table 11.2.A.12 and Figure 11.2.1. Sites are ordered with increasing distance from the Array Area; site numbering in Table 11.2.A.12 corresponds with site numbering in Figure 11.2.1.

6.2.7 Harbour seal

6.2.7.1 Ecology

Haul-out sites for harbour seals have tended historically to be found among inshore bays and islands, coves and estuaries (Lockley 1966; Summers *et al.,* 1980), particularly around the hours of lowest tide. The species' natural range in Irish waters include coastal and marine waters up to 200 m depth (Carter *et al.,* 2022). They show high site fidelity, and although some telemetry-tagged individuals have travelled beyond 100 km from their preferred haul-out site, the majority of sea trips remain within 25 km of the coast (Cunningham *et al.,* 2009; Cronin, 2010). Harbour seals breed in small groups, scattered along the coastline. Pups are born in June and July. Having

moulted their white coats *in utero*, they are able to swim within a few hours of birth (Burns, 2002). Females can therefore feed pups from the water; however, they will forage over shorter distances during this period (Thompson *et al.*, 1994). Harbour seals have a generalist diet and feed opportunistically on locally abundant and easily available prey items, which typically consist of small-to-medium-sized fishes (Teilmann and Galatius, 2018).

6.2.7.2 Distribution and occurrence

Harbour seals occur around the coast of Ireland, although are less frequently recorded than grey seal. Areas of particular importance for harbour seal in Irish waters are the southwest of Ireland, the west of Ireland (particularly Galway Bay), and the northwest coast of Ireland (Cronin *et al.,* 2004; Carter *et al.,* 2022; Figure 11.2.4). Within the Irish Sea, harbour seals are most likely to occur off the coast of Northern Ireland, with a smaller cluster off County Dublin (Carter *et al.*, 2022).

Harbour seals favour inshore bays and islands, and coves and estuaries to haul-out, and are known to haul-out at Lambay Island to the north of the Proposed Development and at Wexford Harbour to the south of the Proposed Development (Duck and Morris, 2013; Morris and Duck, 2019). The closest haul-out to the Proposed Development is on the coast at North Bull Island to the south of Dublin Bay and the most recent count for this subregion was up to six individuals in 2017/18 (Morris and Duck, 2019). Larger counts were recorded at Lambay Island SAC (60 individuals in 2017/18) and between Carnsore to Wexford (33 individuals in 2017/18) (Morris and Duck, 2019).

The Proposed Development lies just beyond the typical foraging range for this species (50 km from their haul-out sites) (Carter *et al.,* 2022), although some telemetry tagged individuals have travelled beyond 100 km from their preferred haul-out site (Cunningham *et al.,* 2009; Cronin, 2010).

In the Marine Mammal Study Area, one animal was sighted during the historical site-specific boat-based surveys in 2003, whilst only two harbour seals were identified during the recent site-specific DAS in August 2018, although 27 ‘seal species’ were recorded.

6.2.7.3 Density/abundance

Analyses of aerial survey and ground count data collected in 2003 yielded a minimum count for the Republic of Ireland of 2,955 harbour seals (Cronin *et al.,* 2004). When the proportion of seals that were not hauled out was accounted for, the total population estimate in 2003 was 6,950 (Cosgrove *et al.,* 2016). This has since been updated by land and boat-based surveys undertaken in 2009, 2010 and 2011 by NPWS, which reported a generally stable population, with only slight regional increases and decreases (NPWS, 2012).

The most recent Irish aerial survey counts undertaken in August of 2017 and 2018 recorded a total of 4,007 individuals, of which 131 occurred at haul-outs in the east region of Ireland (western Irish Sea) (Morris and Duck, 2019). This is a minimum population estimate since it does not account for the proportion of the population that would be at sea during the counts. Up to 72% of the population of harbour seals is likely to be hauled-out during the August count (Lonergan *et al.,* 2013); thus, extrapolating this would give a total harbour seal population for the western Irish Sea

of 182 individuals. Similarly, the total count of 4,007 for Irish waters can be extrapolated to a population estimate of 5,565 individuals.

The Marine Mammal Study Area is approximately due south of the Northern Ireland Seal Management Unit, and due west of the Wales Seal Management Unit. The population estimate for the Northern Ireland Seal Management Unit is 1,400 harbour seals and the estimate for Wales Seal Management Unit is <15 harbour seals (SCOS, 2021). For these counts, estimates are rounded to the nearest 100 for Northern Ireland and to the nearest five for Wales (SCOS, 2021).

Harbour seal was identified in just one of the recent site-specific DAS; August 2018 provided a relative density estimate of 0.03 animals per km^2. Across all surveys, this represents a mean of 0.001 animals per km^2. Seventeen of the 26 surveys identified 'seal species' which could not be attributed to either grey or harbour seal, so these have been excluded from density estimates.

An absolute density estimate of 0.0003 animals per km^2 for the Proposed Development was derived from the at-sea distribution modelling by Carter *et al.* (2022) (Figure 11.2.3). Absolute density estimates were generated by scaling from percentage of at-sea population to number of individuals using the two population scalars to estimate the total size of the at-sea population:

- the proportion of the overall population hauled-out, and thus available to count during the survey window (within two hours either side of low tide in August); and
- the proportion of time seals spend at-sea on average during the main foraging season as described in Carter *et al.* (2020).

However, there are a number of caveats and limitations associated with conversion of relative to absolute density and should therefore be taken as approximate estimate. Firstly, the density estimates are based on mean predictions, both in terms of relative density and of the size of the at-sea population (Carter *et al.,* 2020). Furthermore, given that the resolution of seal abundance estimates from habitat preference maps was aggregated to 5 km by 5 km grid cells (25 km^2), it was not possible to estimate numbers at a finer scale. This spatial scale is driven by the resolution and uncertainty of the data used in the analytical process (Russell *et al.,* 2017).

Density estimates for harbour seal are summarised in Table 11.2.10 below and suggest that the likelihood of occurrence of harbour seal within the Marine Mammal Study Area is very low.

Table 11.2.10 A summary of harbour seal density estimates

Source	Area	Temporal	Density (animals per km^2)
HiDef site-specific DAS	Project aerial survey area	2018 to 2020	0.001
Scaled from Carter *et al.* (2020; 2022)	Proposed Development	2005 to 2019	0.0003

6.2.7.4 Seasonality

During the breeding, nursing and moulting seasons (April through to October), harbour seals spend longer periods hauled-out on land, and most foraging trips will be over short distances of approximately 5 km (Thompson *et al.,* 1996; Cronin *et al.,* 2008). Conversely, in winter months harbour seals spend more time in offshore waters compared to coastal waters (Thompson *et al*., 1989) and foraging trips may be more extensive, with animals typically travelling up to 50 km from haul-out sites (Carter *et al.,* 2022), and potentially further, with some studies reporting individuals traveling over 100 km (Cunningham *et al.,* 2009; Cronin, 2010).

Sightings of the two harbour seals at sea during the recent site-specific DAS were in the month of August.

6.2.7.5 Conservation status

Harbour seals currently have a 'favourable' conservation status in Ireland under Article 17 EU Habitats Directive with a stable population trend (NPWS, 2019). They are listed as Least Concern on the IUCN Red List.

As an Annex II species of the Habitats Directive, the designation of SACs is required as a component of their conservation. Lambay Island SAC is the only SAC for which harbour seals are a designated feature, that falls within the Marine Mammal MU Study Area. Lambay Island SAC is sited 62.9 km from the proposed Array Area. Further information on SACs designated for harbour seal and other species can be found in Table 11.2.A.12 and Figure 11.2.1 Sites are ordered with increasing distance from the Array Area; site numbering in Table 11.2.A.12 corresponds with site numbering in Figure 11.2.1.

7. Summary

This Marine Mammal Technical Report has identified seven species of marine mammal that, based on the desk-based review of sources outlined in Table 11.2.2 (which included the site-specific surveys for the Proposed Development), were considered in more detail in the report. Those species identified are summarised in Table 11.2.11. Using abundance and density estimates presented in section 6.2, an assessment has been made on the likelihood of these species occurring within the Marine Mammal Study Area (see Table 11.2.11). These data sources do have their limitations, caveats, and assumptions, some of which have been outlined in Section 5, where key sources have been presented and discussed. Which density estimate(s) are most appropriate to use in the EIAR for marine mammals (volume II, chapter 11: Marine Mammals) will depend, in part on the impacts being assessed, and the range in which those impacts occur. The rationale for which density estimate(s) is used in an assessment, alongside any relevant caveats and limitations, will be clearly outlined in the EIAR chapter, where relevant.

The Marine Mammal Technical Report has not identified any SACs within the Marine Mammal Study Area. The closest SAC to the Proposed Development is Blackwater Bank SAC, which is designated for harbour porpoise and lies 19.8 km from the Array Area (Table 11.2.A.12**)**. There are 38 SACs listed in Table 11.2.A.12 that lie within the respective MUs for each Annex II species. Of these, 36 are designated for the protection of harbour porpoise; although the Celtic and Irish Seas MU covers a significantly greater area (516,892.83 km^2) than the MUs for other Annex II species. This is reflected in the numbers of SACs designated for other species, where four SACs for bottlenose dolphin occur and one SAC for both grey seal and harbour seal within the respective MUs.

Table 11.2.11 Summary of key marine mammal receptors

Key marine mammal receptor	Likelihood of occurrence within the Marine Mammal Study Area
Harbour porpoise	High
Bottlenose dolphin	Low
Risso's dolphin	Very low
Common dolphin	Very low
Minke whale	Low
Grey seal	Low
Harbour seal	Very low

8. References

Baird, R. W. (2009), 'Risso's dolphin: *Grampus griseus*', in W. F. Perrin, B. Würsig and J. G. M. Thewissen (eds.), Encyclopedia of marine mammals (Academic Press).

Berrow, S. D., O'Brien, J., O'Connor, I., McGrath, D. and Wall, D. (2013), 'Marine Mammals and Megafauna in Irish Waters - Behaviour, Distribution and Habitat Use', Marine Research Sub-Programme 2007-2013, Produced by IWDG on behalf of The Marine Institute.

Berrow, S. D., O'Brien, J., Ryan, C., McKeogh, E. and O'Connor, I. (2011), 'Inshore Boat-based Surveys for Cetaceans – Irish Sea', Report to the National Parks and Wildlife Service (Irish Whale and Dolphin Group).

Berrow, S. D., Whooley, P., O'Connell, M. and Wall, D. (2010), 'Irish Cetacean Review (2000-2009)', Irish Whale and Dolphin Group.

Berrow, S. D., Hickey, R., O'Brien, J. O'Connor, I. and McGrath, D. (2008), 'Harbour Porpoise Survey 2008', Report to the National Parks and Wildlife Service (Irish Whale and Dolphin Group).

Blanchet, M., Nance, T., Ast, C., Wahlberg, M., and Acquarone, M. (2008), 'First case of a monitored pregnancy of a harbour porpoise (*Phocoena phocoena*) under human care', Aquatic Mammals, 34/1.

Bonner, W. N. (1990), 'The natural history of seals (New York: Facts on File Inc).

Booth, C. G. (2019), 'Food for thought: Harbor porpoise foraging behavior and diet inform vulnerability to disturbance', Marine Mammal Science, 36/1: 195-208.

Brophy, J. T., Murphy, S. and Rogan, E. (2009), 'The diet and feeding ecology of the short-beaked common dolphin (Delphinus delphis) in the northeast Atlantic', IWC Scientific Committee Document SC/61/SM, 14.

Burns, J. J. (2002), 'Harbor seal and spotted seal', in W. F. Perrin (eds.), Encyclopedia of marine mammals (New York: Academic Press).

Carter, M. I., Boehme, L., Cronin, M. A., Duck, C. D., Grecian, W. J., Hastie, G. D., Jessopp, M., Matthiopoulos, J., McConnell, B. J., Miller, D. L. and Morris, C. D. (2022), 'Sympatric seals, satellite tracking and protected areas: habitat-based distribution estimates for conservation and management', Frontiers in Marine Science.

Carter, M. I. D., Boehme, L., Duck, C. D., Grecian, W. J., Hastie, G. D., McConnell, B. J., Miller, D. L., Morris, C. D., Moss, S. E. W., Thompson, D., Thompson, P. D. and Russell, D. J. F. (2020), 'Habitat-based predictions of at-sea distribution for grey and harbour seals in the

British Isles', Sea Mammal Research Unit, University of St Andrews, Report to BEIS, OESEA-16-76/OESEA-17-78.

Christiansen, F., Víkingsson, G. A., Rasmussen, M. H. and Lusseau, D. (2014), 'Female body condition affects foetal growth in a capital breeding mysticete', Functional Ecology, 28/3: 579-588.

Cork Ecology (2010), 'Arklow Bank Seabird and Marine Mammal Monitoring Programme Year 9 Final Report', A report to Airtricity. May 2010.

Cork Ecology (2009), 'Arklow Bank Seabird and Marine Mammal Monitoring Programme Year 8 Final Report', A report to Airtricity. February 2009.

Cork Ecology (2007), 'Arklow Bank Seabird and Marine Mammal Monitoring Programme Year 7 Final Report', A report to Airtricity. December 2007.

Cosgrove, R., Gosch, M., Reid, D., Sheridan, M., Chopin, N., Jessopp, M., and Cronin, M. (2016), 'Seal bycatch in gillnet and entangling net fisheries in Irish waters', Fisheries Research, 183: 192-199.

Coveney Wildlife Consulting Ltd (2005), 'Interim Report No. 5 on Year 5 of Seabird and Marine Mammal Surveys of the Arklow Bank, July 2004 to June 2005', A report to Airtricity. June 2005.

Coveney Wildlife Consulting Ltd (2004), 'Arklow Bank Seabird and Marine Mammal Survey: Years 1- 4 (July 2000 – June 2004)', A report to Airtricity. November 2004.

Coveney Wildlife Consulting Ltd (2003), 'Arklow Bank Seabird and Marine Mammal Survey: Years 1- 3 (July 2000 – June 2003)', A report to Airtricity. November 2003.

Coveney Wildlife Consulting Ltd (2002), 'Initial Report on Use of the Porpoise Detector (POD) on the Arklow Bank in 2002', unpublished.

Cronin, M. A. (2010), 'The status of the harbour seal (*Phoca vitulina*) in Ireland', NAMMCO Scientific Publications, 8: 129-142.

Cronin, M., Kavanagh, A. and Rogan, E. (2008), 'The Foraging Ecology of the Harbour Seal (*Phoca vitulina vitulina*) in Southwest Ireland', Final Report to the Marine Institute, 1-145.

Cronin, M., Gerritsen, H., Reid, D., Jessopp, M. (2016), 'Spatial overlap of grey seals and fisheries in Irish waters, some new insights using telemetry technology and VMS', PLoS ONE 11/9.

Cronin, M., Duck, C., Ó Cadhla, O., Nairn, R., Strong, D. and O' Keeffe, C. (2004), 'Harbour seal population assessment in the Republic of Ireland: August 2003', Irish Wildlife Manuals,

No. 11, National Parks and Wildlife Service (Dublin, Ireland: Department of Environment, Heritage and Local Government).

Cunningham, L., McConnell, B., Duck, C., Baxter, J., Lonergan, M. and Boyd, I. L. (2009), 'Using satellite telemetry to determine harbour seal movements and haul out patterns', NAMMCO Harbour Seal Working Group document SC/14/HS/18.

Department of Agriculture, Environment, and Rural Affairs and Joint Nature Conservation Committee (2017), 'SAC Selection Assessment: North Channel', (UK: Joint Nature Conservation Committee).

Department of Arts, Heritage and the Gaeltacht (2014), 'Rockabill to Dalkey Island SAC; Site Code 003000; Site Synopsis; Rev 13' https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY003000.pdf [Accessed: August 2023].

Duck, C. and Morris, C. (2013), 'An aerial survey of harbour seals in Ireland: Part 2: Galway Bay to Carlingford Lough. August-September 2012', Unpublished report to the National Parks and Wildlife Service (Dublin: Department of Arts, Heritage and the Gaeltacht).

European Commission (1992) European Union Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive).

Evans, P. G. H. and Waggitt, J. J. (2023), 'Modelled Distribution and Abundance of Cetaceans and Seabirds in Wales and Surrounding Waters', NRW Evidence Report, Report No: 646 (Bangor: Natural Resources Wales).

Felce, T. (2013), 'The Irish Sea Risso's Dolphin Photo-Identification Project', Manx Whale and Dolphin Watch.

Fulmar Ecological Services (2006), 'Seabird and Marine Mammal Monitoring of the Arklow Bank: Interim Report for the period July 2005 to June 2006', Unpublished report for Airtricity Ltd.

Gavin & Doherty Geosolutions Ltd (2023a), 'Arklow Bank 2023 Nearshore GI Marine Mammal Observer Report', Document reference: 23136-GDG-001-02.

Gavin & Doherty Geosolutions Ltd (2023b), 'Arklow Bank 2023 Offshore GI Marine Mammal Observer Report', Document reference: 23140-GDG-001-01.

Gavin & Doherty Geosolutions Ltd (2020), 'Arklow Bank Wind Park (ABWP) Phase 2 Repeat Multibeam Survey (July – August 2020) Marine Mammal Mitigation Report', Document reference: 18086-R-001-01.

Gilles, A., Authier, M., Ramirez-Martinez, N. C., Araújo, H., Blanchard, A., Carlström, J., Eira, C., Dorémus, G., Fernández-Maldonado, C., Geelhoed, S. C. V., Kyhn, L., Laran, S., Nachtsheim, D., Panigada, S., Pigeault, R., Sequeira, M., Sveegaard, S., Taylor, N. L., Owen,

K., Saavedra, C., Vázquez-Bonales, J. A., Unger, B., Hammond, P. S. (2023), 'Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys.'

Gosch, M., Hernandez-Milian, G., Rogan, E., Jessopp, M. and Cronin, M. (2014), 'Grey seal diet analysis in Ireland highlights the importance of using multiple diagnostic features', Aquatic Biology, 20/2: 155-167.

Government of Ireland (1976), The Wildlife Act, 1976.

Government of Ireland (2000), Wildlife (Amendment) Act, 2000.

Hague, E. L., Sinclair, R. R. and Sparling, C. E. (2020), 'Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters', Scottish Marine and Freshwater Science.

Hammond, P. S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M. B., Scheidat, M, Teilmann, J., Vingada, J. and Øien, N. (2021), 'Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys'.

Hammond, P., C. Lacey, A. Gilles, S. Viquerat, P. Börjesson, H. Herr, K. Macleod, V. Ridoux, M. Santos, M. Scheidat, J. Teilmann, J. Vingada, and N. Øien. (2017), 'Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys'.

Hartman, K. L., Visser, F. and Hendriks, A. J. (2008), 'Social structure of Risso's dolphins (*Grampus griseus*) at the Azores: a stratified community based on highly associated social units', Canadian Journal of Zoology, 86/4: 294-306.

Harrison, R. J., and Ridgway, S. H. (1971), 'Gonadal activity in some bottlenose dolphins (*Tursiops truncatus*)', Journal of Zoology, 165/3: 355-366.

Hernandez-Milian, G., Berrow, S., Santos, M. B., Reid, D. and Rogan, E. (2015), 'Insights into the Trophic Ecology of Bottlenose Dolphins (Tursiops truncatus) in Irish Waters', Aquatic Mammals, 41/2.

Hernandez-Milian, G., Santos, M. B. and Rogan, E. (2011), 'Harbour porpoise and bottlenose dolphin in Ireland: diet and interactions with fisheries'. https://www.academia.edu/download/79720303/Harbour_porpoise_and_bottlenose_dolphin_20220128-7182-sjib6z.pdf [Accessed: April 2024].

HiDef Aerial Surveying Limited (2020a), 'Digital video aerial surveys of seabirds and marine mammals at Arklow Bank: Two-year survey report March 2018 - February 2020 survey programme (plus April 2020)', DOCUMENT NUMBER: HP00091-703-01.

HiDef Aerial Surveying Limited (2020b), 'Digital video aerial surveys of seabirds and marine mammals at Arklow Bank: Two-year survey report March 2018 - February 2020 survey programme (plus April 2020) – population and density estimates', DOCUMENT NUMBER: HP00091-704-01.

HM Government (1981), Wildlife and Countryside Act (1981).

Inter-agency Marine Mammal Working Group (2023), 'Review of Management Unit boundaries for cetaceans in UK waters', JNCC Report No. 734 (Peterborough: JNCC).

Inter-agency Marine Mammal Working Group (2022), 'Updated abundance estimates for cetacean Management Units in UK waters', JNCC Report No. 680.

Inter-agency Marine Mammal Working Group (2015), 'Management Units for cetaceans in UK waters (January 2015)', JNCC Report No. 547.

Irish Whale and Dolphin Group (2023), 'Sightings'. https://iwdg.ie/browsers/sightings.php [Accessed: July 2023].

Isle of Man Government (2004), The Wildlife Act 1990 (Variation Of Schedules) Order 2004.

IWDG Consulting (2019), 'Arklow Wind Park Survey Marine Mammal Mitigation Report', 12pp.

Joint Nature Conservation Committee (2019a), 'European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018 Conservation status assessment for the species: S1351 - Harbour porpoise (*Phocoena phocoena*) United Kingdom'. https://jncc.gov.uk/jncc-assets/Art17/S1351-UK-Habitats-Directive-Art17-2019.pdf [Accessed: August 2023].

Joint Nature Conservation Committee (2019b), 'European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018 Conservation status assessment for the species: S1349 - Bottlenose dolphin (*Tursiops truncatus*) United Kingdom'. https://jncc.gov.uk/jncc-assets/Art17/S1349-UK-Habitats-Directive-Art17-2019.pdf [Accessed: August 2023].

Joint Nature Conservation Committee (2019c), 'European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018 Conservation status assessment for the species: S1349 - Risso's

dolphin (*Grampus griseus*) United Kingdom', https://jncc.gov.uk/jncc-assets/Art17/S2030-UK-Habitats-Directive-Art17-2019.pdf [Accessed: August 2023].

Joint Nature Conservation Committee (2019d), 'European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018 Conservation status assessment for the species: S1349 - Common dolphin (*Delphinus delphis*) United Kingdom', https://jncc.gov.uk/jncc-assets/Art17/S1350-UK-Habitats-Directive-Art17-2019.pdf [Accessed: August 2023].

Joint Nature Conservation Committee (2019e), 'European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018 Conservation status assessment for the species: S2618 - Minke whale (*Balaenoptera acutorostrata*) United Kingdom', https://jncc.gov.uk/jncc-assets/Art17/S2618-UK-Habitats-Directive-Art17-2019.pdf [Accessed: August 2023].

Joint Nature Conservation Committee and Natural Resource Wales (2015), 'SAC Selection Assessment: North Anglesey Marine / Gogledd Môn Forol' (UK: Joint Nature Conservation Committee).

Joint Nature Conservation Committee (2015), 'SAC Selection Assessment: Bristol Channel Approaches /Dynesfeydd Môr Hafren' (UK: Joint Nature Conservation Committee).

Kavanagh, A. S., Hunt, W., Richardson, N. and Jessopp, M. (2017), 'Cetaceans in Irish offshore waters: Final report of the SFI-KOSMOS Project 2015-2017', MaREI Centre, University College Cork.

Kiely, O., Lidgard, D. C., McKibben, M., Baines, M. E. and Connolly, N. (2000), 'Grey Seals: Status and Monitoring in the Irish and Celtic Seas', Maritime Ireland/Wales INTERREG report No. 3. (Dublin: Marine Institute).

Lacey, C., Gilles, A., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M., Scheidat, M., Teilmann, J., Sveegaard, S., Vingada, J., Viquerat, S., Øien, N. and Hammond, P. (2022), 'Modelled density surfaces of cetaceans in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys'.

Lockley, R. M. (1966), 'The distribution of grey and common seals on the coasts of Ireland', The Irish Naturalists' Journal, 136-143.

Lonergan, M., Duck, C., Moss, S., Morris, C. and Thompson, D. (2013), 'Rescaling of aerial survey data with information from small numbers of telemetry tags to estimate the size of a

declining harbour seal population', Aquatic Conservation: Marine and Freshwater Ecosystems, 23/1: 135-144.

MacLeod, C. D., Santos, M. B., Burns, F., Brownlow, A., and Pierce, G. J. (2014), 'Can habitat modelling for the octopus *Eledone cirrhosa* help identify key areas for Risso's dolphin in Scottish waters?', 725/1: 125–136.

Mirimin, L., Miller, R., Dillane, E., Berrow, S.D., Ingram, S., Cross, T. F. and Rogan, E. (2011), 'Fine-scale population genetic structuring of bottlenose dolphins in Irish coastal waters', Animal Conservation, 14/4: 342-353.

Morris, C. D. and Duck, C. D. (2019), 'Aerial thermal-imaging survey of seals in Ireland, 2017 to 2018', Irish Wildlife Manuals, No. 111 National Parks and Wildlife Service (Ireland: Department of Culture, Heritage and the Gaeltacht).

Murphy, S., Evans, P. G., Pinn, E., and Pierce, G. J. (2021), 'Conservation management of common dolphins: Lessons learned from the North-East Atlantic', Aquatic Conservation: Marine and Freshwater Ecosystems, 31: 137-166.

Murphy, S., Winship, A., Dabin, W., Jepson, P. D., Deaville, R., Reid, R. J., Spurrier, C., Rogan, E., Lopez, A., Gonzalez, A. F., Read, F. L., Addink, M., Silva, M., Ridoux, V., Learmonth, J.A., Pierce, G. J., Northridge, S. P. (2009), 'Importance of biological parameters in assessing the status of *Delphinus delphis*'. Marine Ecology Progress Series, 388: 273–291.

Murphy, S., Collet, A. and Rogan, E. (2005), 'Mating strategy in the male common dolphin *Delphinus delphis*: What gonadal analysis tells us', Journal of Mammalogy, 86: 1247–1258.

NatureScot (2019a), 'Scottish MPA Programme Assessment against the MPA Selection Guidelines: NORTH-EAST LEWIS POSSIBLE MPA', https://www.nature.scot/sites/default/files/2019-06/North-east%20Lewis%20possible%20MPA%20-%20Detailed%20Assessment%20Against%20the%20Guidelines.pdf [Accessed: August 2023].

NatureScot (2019b), 'Scottish MPA Programme Assessment against the MPA Selection Guidelines' https://www.nature.scot/sites/default/files/2019-06/Sea%20of%20the%20Hebrides%20possible%20MPA%20-%20Application%20of%20the%20MPA%20Selection%20Guidelines_0.pdf [Accessed: August 2023].

NatureScot (2019c), 'Scottish MPA Programme Assessment against the MPA Selection Guidelines', https://www.nature.scot/sites/default/files/2019-06/Southern%20Trench%20possible%20MPA%20-%20Application%20of%20the%20MPA%20Selection%20Guidelines.pdf' [Accessed: August 2023].

Natural Resource Wales (2018), 'Cardigan Bay/ Bae Ceredigion Special Area of Conservation: Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017' https://naturalresources.wales/media/687993/eng-cardigan-bay-reg-37-report-2018.pdf [Accessed: August 2023].

National Biodiversity Data Centre (2023), 'Biodiversity Maps: online mapping tool', https://maps.biodiversityireland.ie/Map. [Accessed: July 2023].

National Parks and Wildlife Service (2019), 'The status of EU protected habitats and species in Ireland, Volume 1: Summary Overview', Unpublished NPWS report. https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2019_Vol1_Summary_Article17.pdf [Accessed: August 2023].

National Parks and Wildlife Service (2014), 'Site Name: Lambay Island SAC. Site Code: 000204. Site Synopsis Report', https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY000204.pdf [Accessed: July 2023].

National Parks and Wildlife Service (2012), 'Harbour Seal Pilot Monitoring Project', Unpublished NPWS report. https://www.npws.ie/sites/default/files/publications/pdf/Harbour%20Seal_NPWS%20pilot%20monitoring%20study%202011_Final%20doc.pdf [Accessed: August 2023].

Olsen, E., and Sunde, J. (2002), 'Age determination of minke whales (*Balaenoptera acutorostrata*) using the aspartic acid racemization technique', Sarsia, 87/1: 1-8.

O'Brien, J. and Berrow, S. D. (2016), 'Harbour porpoise surveys in Rockabill to Dalkey Island SAC, 2016', Report to the National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs (Irish Whale and Dolphin Group).

O'Brien, J. M., Berrow, S. D., Ryan, C., McGrath, D., O'Connor, I., Pesante, G., Burrows, G., Massett, N., Klotzer, V. and Whooley, P. (2010), 'A note on long-distance matches of bottlenose dolphins (*Tursiops truncatus*) around the Irish coast using photo-identification', The Journal of Cetacean Research and Management, 11/1: 69-74.

O'Brien, J., Berrow, S., McGrath, D. and Evans, P. (2009), 'Cetaceans in Irish waters: A review of recent research', Biology and Environment: Proceedings of the Royal Irish Academy, 109B, 63–88.

Ó Cadhla, O., Keena, T., Strong, D., Duck, C. and Hiby, L. (2013), 'Monitoring of the breeding population of grey seals in Ireland, 2009 – 2012', Irish Wildlife Manuals, No. 74. National Parks and Wildlife Service (Dublin, Ireland: Department of the Arts, Heritage and the Gaeltacht).

Ó Cadhla, O., Strong, D., O'Keeffe, C., Coleman, M., Cronin, M., Duck, C., Murray, T., Dower, P., Nairn, R., Murphy, P., Smiddy, P., Saich, C., Lyons, D. and Hiby, A. R. (2007) 'An

assessment of the breeding population of grey seals in the Republic of Ireland, 2005', Irish Wildlife Manuals No. 34. National Parks and Wildlife Service (Dublin, Ireland: Department of the Environment, Heritage and Local Government).

Ó Cadhla, O. and Strong, D. (2007), 'Grey seal moult population survey in the Republic of Ireland, 2007,' Unpublished report. https://www.npws.ie/sites/default/files/publications/pdf/OCadhla_&_Strong_2007_Grey_Seal_Moult_Survey.pdf [Accessed: August 2023].

Reid, J. B., Evans, P. G. H., and Northridge, S. P. (2003), 'Atlas of cetacean distribution in northwest European waters', (Peterborough: JNCC).

Robinson, K. P., MacDougall, D. A., Bamford, C. C., Brown, W. J., Dolan, C. J., Hall, R., Haskins, G. N., Russell, G., Sidiropoulos, T., Sim, T. M. and Spinou, E. (2023), 'Ecological habitat partitioning and feeding specialisations of coastal minke whales (Balaenoptera acutorostrata) using a recently designated MPA in northeast Scotland', PloS one, 18/7: e0246617.

Robinson, K. P., Sim, T. M. C., Culloch, R. M., Bean, T. S., Cordoba Aguilar, I., Eisfeld, S. M., Filan, M., Haskins, G. N., Williams, G. and Pierce, G. J. (2017), 'Female reproductive success and calf survival in a North Sea coastal bottlenose dolphin (*Tursiops truncatus*) population', PLoS ONE, 12/9.

Robinson, K. P., O'Brien, J. M., Berrow, S. D., Cheney, B., Costa, M., Eisfeld, S. M., Haberlin, D., Mandleberg, L., O'Donovan, M., Oudejans, M. G. and Ryan, C. (2012), 'Discrete or not so discrete: Long distance movements by coastal bottlenose dolphins in UK and Irish waters', The Journal of Cetacean Research and Management, 12/3: 365-371.

Rogan, E., Breen, P., Mackey, M., Cañadas, A., Scheidat, M., Geelhoed, S. and Jessopp, M. (2018a), 'Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2015- 2017', Department of Communications, Climate Action and Environment and National Parks and Wildlife Service (NPWS) (Dublin, Ireland: Department of Culture, Heritage and the Gaeltacht).

Rogan, E., Garagouni, M., Nykänen, M., Whitaker, A., and Ingram, S. (2018b), 'Bottlenose dolphin survey in the Lower River Shannon SAC 2018', Report to the National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, University College Cork.

Russell, D. J. F., Jones, E. L. and Morris, C. D. (2017), 'Updated Seal Usage Maps: The Estimated at-sea Distribution of Grey and Harbour Seals', Scottish Marine and Freshwater Science, 8/25.

Special Committee on Seals (2022), 'Scientific Advice on Matters Related to the Management of Seal Populations: 2022', NERC: Special Committee on Seals (SCOS) Main Advice Report.

Special Committee on Seals (2021), 'Scientific Advice on Matters Related to the Management of Seal Populations: 2021', NERC: Special Committee on Seals (SCOS) Main Advice Report.

Summers, C. F., Warner, P. J., Nairn, R. G. W., Curry, M. G. and Flynn, J. (1980), 'An assessment of the status of the common seal, *Phoca vitulina* in Ireland', Biological Conservation, 17: 115-123.

Teilmann, J., Christiansen, C.T., Kjellerup, S., Dietz, R., and Nachmann, G. (2013), Geographic, seasonal, and diurnal surface behavior of harbor porpoises, Marine Mammal Science, 29: 60–76.

Teilmann, J. and Galatius, A. (2018), 'Harbour seal, in B. Würsig, J. G. M. Thewissen, and K. M. Kovacs (eds.), Encyclopedia of Marine Mammals Third Edition (London: Academic Press).

Thompson, P. M., McConnell, B. J., Tollit, D. J., Mackay, A., and Racey, P. A. (1996), 'Comparative Distribution, Movements and Diet of Harbour and Grey Seals from Moray Firth', Journal of Applied Ecology, 33/6 :1572-84.

Thompson, P. M., Miller, D., Cooper, R. and Hammond, P. S. (1994), 'Changes in the distribution and activity of female harbour seals during the breeding season: implications for their lactation strategy and mating patterns', Journal of Animal Ecology, 24-30.

Thompson, P. M., Fedak, M. A., McConnell, B. J., and Nicholas, K. S. (1989), 'Seasonal and Sex-Related Variation in the Activity Patterns of Common Seals *Phoca vitulina'*, Journal of Applied Ecology, 26/2: 521-35.

van der Kooij, J., Engelhard, G. H. and Righton, R. (2016), 'Climate change and squid range expansion in the North Sea', Journal of Biogeography, 43/11: 2,285- 2,298.

Wall, D., Murray, C., O'Brien, J. M., Kavanagh, L. (2013), 'Atlas of the Distribution and Relative Abundance of Marine Mammals in Irish Waters: 2005-2011' (Kilrush, Co Clare: IWDG).

Webb, A. and Durinck, J. (1992), 'Counting birds from ship. Manual for aeroplane and ship surveys of waterfowl and seabirds', International Wildfowl Research Bureau Special Publication, 19, 24-37.

Wells, R. S., Boness, D. J., Rathburn, G. B. (1999), 'Behaviour' in J. E. Reynolds (eds.), Biology of Marine Mammals (Smithsonian Institute).

Whooley, P. (2016), 'Minke whale (Balaenoptera acutorostrata)', in Liam Lysaght and Ferdia Marnell (eds.), Atlas of Mammals in Ireland 2010-2015 (Waterford: National Biodiversity Data Centre).

Wilson, L. J., and Hammond, P. S. (2019), 'The diet of harbour and grey seals around Britain: Examining the role of prey as a potential cause of harbour seal declines', Aquatic Conservation: Marine and Freshwater Ecosystems, 29/S1: 71–85.

Annex A: Table of Special Areas of Conservation

Table 11.2.A.12 Special Areas of Conservation (SACs) designated for the protection of marine mammal species within their respective MU Study Areas; listed in order of increasing distance from the Array Area

No.	Site name	Distance from Array Area (km)	Distance from Cable Corridor and Working Area (km)	Marine mammal interest features	Administrative region
1	Blackwater Bank SAC	19.8	47.3	Harbour porpoise	Ireland
2	Lambay Island SAC	62.9	80.5	Harbour porpoise Grey seal Harbour seal	Ireland
		Habitat includes intertidal shoreline, coves and caves, which provides undisturbed haul-outs for grey and harbour seal. Grey seal have an estimated population of 196-252 individuals (NPWS, 2014); harbour seal count data is reported at 38-47 individuals (NPWS, 2014).			
3	Codling Fault Zone	63.3	66.6	Harbour porpoise	Ireland
4	Rockabill to Dalkey Island SAC	70.4	72.5	Harbour porpoise	Ireland
		Habitat includes sandy and muddy seabed, reefs, sandbanks and islands. Harbour porpoise are present year-round within the SAC (DAHG, 2014), and have been observed with calves. Visual surveys in 2016 derived density estimates of 1.37 to 1.87 animals per km^2 (O'Brien and Berrow, 2016).			
5	Lleyn Peninsula and the Sarnau / Pen Llŷn a'r Sarnau SAC	73.3	116.2	Bottlenose dolphin	Wales
		Dolphins present within this SAC are part of the wider Cardigan Bay population, which is managed as a single unit (NRW, 2018).			

No.	Site name	Distance from Array Area (km)	Distance from Cable Corridor and Working Area (km)	Marine mammal interest features	Administrative region
6	Carnsore Point SAC	73.8	70.7	Harbour porpoise	Ireland
7	Cardigan Bay / Bae Ceredigion SAC	82.7	117.0	Bottlenose dolphin	Wales
		Habitat includes reef and sandbanks which support bottlenose dolphin, which show site fidelity to Cardigan Bay. Between 100 and 300 individuals occur regularly in the area; the greatest number of dolphins are recorded between July and October, however some are present year-round. Calving occurs from April to September, and the area serves as in important nursery ground (NRW, 2018).			
8	West Wales Marine / Gorllewin Cymru Forol SAC	93.5	98.6	Harbour porpoise	Wales
		Harbour porpoise are present in high densities during the summer months. The site supports 2,506 individuals (95% CI: 1,410 to 4,455) for at least part of the year (JNCC and NRW, 2015).			
9	Hook Head SAC	113.1	109.9	Harbour porpoise Bottlenose dolphin	Ireland
10	North Anglesey Marine / Gogledd Môn Forol SAC	114.2	119.7	Harbour porpoise	Wales
		Harbour porpoise are present in persistent high densities during the summer months. The site supports approximately 1,084 individuals (95% CI: 557 to 2,111) for at least part of the year (JNCC and NRW, 2015).			
11	North Channel SAC	194.5	197.6	Harbour porpoise	Northern Ireland (NI)

No.	Site name	Distance from Array Area (km)	Distance from Cable Corridor and Working Area (km)	Marine mammal interest features	Administrative region
		High densities of harbour porpoise are present across the entire site in winter months; the area between Mew Island to Islandmagee is also important during the summer months porpoise (DAERA and JNCC, 2017). The population estimate for harbour porpoise is approximately 537 individuals (95% CI: 276 to 1046) for at least part of the year.			
12	Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC	214.7	215.0	Harbour porpoise	Wales/England
		High densities of harbour porpoise are present across the entire site in winter months, and the northern part during the summer months (JNCC, 2015). The site supports approximately 2,100 individuals (95% CI: 805 to 5,661) for at least part of the year (JNCC, 2015).			
13	Roaringwater Bay and Islands SAC	313.8	310.7	Harbour porpoise	Ireland
14	Kenmare River SAC	374.6	371.4	Harbour porpoise	Ireland
15	Blasket Islands SAC	428.5	425.4	Harbour porpoise	Ireland
16	Belgica Mound Province SAC	468.9	465.8	Harbour porpoise Bottlenose dolphin	Ireland
17	Abers - Côte des legends SAC	486.7	487.0	Harbour porpoise	France
18	Nord Bretagne DH SAC	487.8	488.12	Harbour porpoise	France
19	Ouessant-Molène SAC	502.4	502.7	Harbour porpoise	France
20	Baie de Morlaix SAC	505.3	505.6	Harbour porpoise	France

No.	Site name	Distance from Array Area (km)	Distance from Cable Corridor and Working Area (km)	Marine mammal interest features	Administrative region
21	Côte de Granit rose-Sept-Iles SAC	509.5	509.8	Harbour porpoise	France
22	Côtes de Crozon SAC	531.5	531.7	Harbour porpoise	France
23	Bunduff Lough and Machair/Trawalua/Mullaghmore SAC	536.9	540.0	Harbour porpoise	Ireland
24	Tregor Goëlo	541.8	542.1	Harbour porpoise	France
25	Chaussée de Sein SAC	543.2	514.9	Harbour porpoise	France
26	Inishmore Island SAC	552.4	549.3	Harbour porpoise	Ireland
27	Kilkieran Bay and Islands SAC	565.9	562.7	Harbour porpoise	Ireland
28	Baie de Saint-Brieuc – Est SAC	588.8	589.1	Harbour porpoise	France
29	Récifs et landes de la Hague SAC	591.0	591.3	Harbour porpoise	France
30	Anse de Vauville SAC	591.2	591.5	Harbour porpoise	France
31	Cap d'Erquy-Cap Fréhel SAC	594.2	594.5	Harbour porpoise	France
32	Banc et récifs de Surtainville SAC	597.1	597.4	Harbour porpoise	France
33	West Connacht Coast SAC	608.6	605.5	Harbour porpoise	Ireland

No.	Site name	Distance from Array Area (km)	Distance from Cable Corridor and Working Area (km)	Marine mammal interest features	Administrative region
34	Baie de Lancieux, Baie de l'Arguenon, Archipel de Saint Malo et Dinard SAC	612.4	612.7	Harbour porpoise	France
35	Mers Celtiques – Talus du golfe de Gascogne SAC	613.5	610.4	Harbour porpoise	France
36	Chausey SAC	622.2	622.5	Harbour porpoise	France
37	Estuaire de la Rance SAC	629.0	629.3	Harbour porpoise	France
38	Baie du Mont Saint-Michel SAC	641.2	641.5	Harbour porpoise	France