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## Project Erebus Environmental Statement Technical Report – Marine Mammal and Turtle Baseline Characterisation

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## 1 Glossary of Terms, Acronyms and Abbreviations

| Term    | Description                                                                                     |
|---------|-------------------------------------------------------------------------------------------------|
| BEIS    | Department of Business, Energy and Industrial Strategy                                          |
| BERR    | Department for Business, Enterprise and Regulatory Reform                                       |
| CCW     | Countryside Council for Wales                                                                   |
| CI      | Confidence Interval                                                                             |
| CMR     | Capture-Mark-Recapture                                                                          |
| CODA    | Cetacean Offshore Distribution and Abundance in the European Atlantic                           |
| CV      | Coefficient of Variation                                                                        |
| DBE     | Design Based Estimate                                                                           |
| DECC    | Department of Energy and Climate Change                                                         |
| DNA     | Deoxyribonucleic Acid                                                                           |
| EC      | European Commission                                                                             |
| ECC     | Export Cable Corridor                                                                           |
| EIRPHOT | Wales' grey seal photo-identification database                                                  |
| EPS     | European Protected Species                                                                      |
| GPS     | Global Positioning System                                                                       |
| IAMMWG  | Inter-Agency Marine Mammal Working Group                                                        |
| IDW     | Inverse Distance Weighted                                                                       |
| IUCN    | International Union for Conservation of Nature                                                  |
| JCP     | Joint Cetacean Protocol                                                                         |
| JNCC    | Joint Nature Conservation Committee                                                             |
| MBE     | Model Based Estimate                                                                            |
| MCZ     | Marine Conservation Zone                                                                        |
| MERP    | Marine Ecosystems Research Programme                                                            |
| MMSS    | Marine Mammal Scientific Support                                                                |
| MPA     | Marine Protected Area                                                                           |
| MU      | Management Unit                                                                                 |
| NRW     | Natural Resources Wales                                                                         |
| OSPAR   | Oslo/Paris convention (for the Protection of the Marine Environment of the North-East Atlantic) |
| RoI     | Republic of Ireland                                                                             |

|       |                                                         |
|-------|---------------------------------------------------------|
| RMU   | Regional Management Unit                                |
| SAC   | Special Area of Conservation                            |
| SCANS | Small Cetaceans in the European Atlantic and North Seas |
| SCOS  | Special Committee on Seals                              |
| SMRU  | Sea Mammal Research Unit                                |
| SRDL  | Satellite Relay Data Logger                             |
| SPOT  | Smart Position and Temperature                          |
| SWF   | Sea Watch Foundation                                    |
| WWT   | Wildfowl and Wetlands Trust                             |

## 2 Introduction

### 2.1 Purpose

The purpose of this document is to provide a characterisation of the baseline environment to understand the range of species, and the abundance and density of marine mammals and turtles that could potentially be impacted by Erebus, the Project. The baseline data have been compiled through a combination of a literature reviews and data obtained from site-specific surveys.

### 2.2 Species

The Irish sea consists of a multitude of marine mammal species, ranging from pinniped species such as harbour and grey seals, to small odontocetes and larger mysticete species including minke whales (Wall et al. 2013). The six key marine mammal species outlined in this report (based on the frequency of their sightings in relation to the Project site location during site-specific surveys (HiDef Aerial Surveying Ltd 2020) and during studies conducted in the wider region e.g. SCANS III and ObSERVE (Rogan et al. 2018, Hammond et al. 2021) include the common dolphin (*Delphinus delphis*), harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), Risso's dolphin (*Grampus griseus*), minke whale (*Balaenoptera acutorostrata*) and grey seal (*Halichoerus grypus*). In addition, this report covers the presence of the leatherback turtle (*Dermochelys coriacea*).

### 2.3 Study Area

The marine mammal study area varies depending on the species, considering individual species ecology and behaviour. For all species, the study area covers the Project array area and offshore Export Cable Corridor (ECC) and is extended over an appropriate area considering the scale of movement and population structure for each species. For each species, the area considered in the assessment is largely defined by the appropriate species Management Unit (MU). The study area for marine mammals and turtles has been defined at two spatial scales: the MU scale for species specific population units and the site-specific survey areas for an indication of the local densities of each species. Details of the MU size and extent are provided in Table 1.

At the MU scale, the Project is located within the following species specific MUs:

- Common dolphin: Celtic and Greater North Seas MU;
- Harbour porpoise: Celtic and Irish Seas MU;

- Bottlenose dolphin: Offshore Channel and SW England MU;
- Risso's dolphin: Celtic and Greater North Seas MU;
- Minke whale: Celtic and Greater North Seas MU;
- Grey seals: 2 options available:
  - OSPAR Region III: Celtic Seas (interim MU, proposed by NRW 2020),
  - Within the Wales MU and adjacent to the Southwest England MU (SCOS 2020);
- Leatherback turtle: Northwest Atlantic regional MU (RMU) (IUCN 2019)

The site-specific survey area encompasses the Project array area plus 4 km buffer in order to provide more temporal and spatial fine scale local data (Figure 2.1).

**Table 1 Relevant marine mammal and turtle MUs and their estimated abundances.**

| Species                   | MU                                        | Abundance                     | Source                                                                      |
|---------------------------|-------------------------------------------|-------------------------------|-----------------------------------------------------------------------------|
| <b>Common dolphin</b>     | Celtic and Greater North Seas             | 102,656<br>(58,932 – 178,822) | IAMMWG (2021) based on Hammond et al. (2017) and Rogan et al. (2018)        |
| <b>Harbour porpoise</b>   | Celtic and Irish Sea                      | 62,517<br>(48,324 – 80,877)   | IAMMWG (2021) based on Hammond et al. (2017) and Rogan et al. (2018)        |
| <b>Bottlenose dolphin</b> | Offshore Channel and Southwest England MU | 10,947<br>(6,727 – 17,814)    | IAMMWG (2021) based on Hammond et al. (2017) and Rogan et al. (2018)        |
| <b>Risso's dolphin</b>    | Celtic and Greater North Seas             | 12,262<br>(5,227 – 28,764)    | IAMMWG (2021) based on Hammond et al. (2017) and Rogan et al. (2018)        |
| <b>Minke whale</b>        | Celtic and Greater North Seas             | 20,118<br>(14,061 – 28,786)   | IAMMWG (2021) based on Hammond et al. (2017) and Rogan et al. (2018)        |
| <b>Grey seal</b>          | OSPAR Region III: Celtic Seas             | 66,100                        | Based on scaled at-sea density estimates obtained from Carter et al. (2020) |
|                           | Wales and Southwest England MUs           | 6,090                         | Based on scaled haul-out counts from SCOS (2021)                            |
| <b>Leatherback turtle</b> | Northwest Atlantic RMU                    | 23,010                        | IUCN (2019)                                                                 |

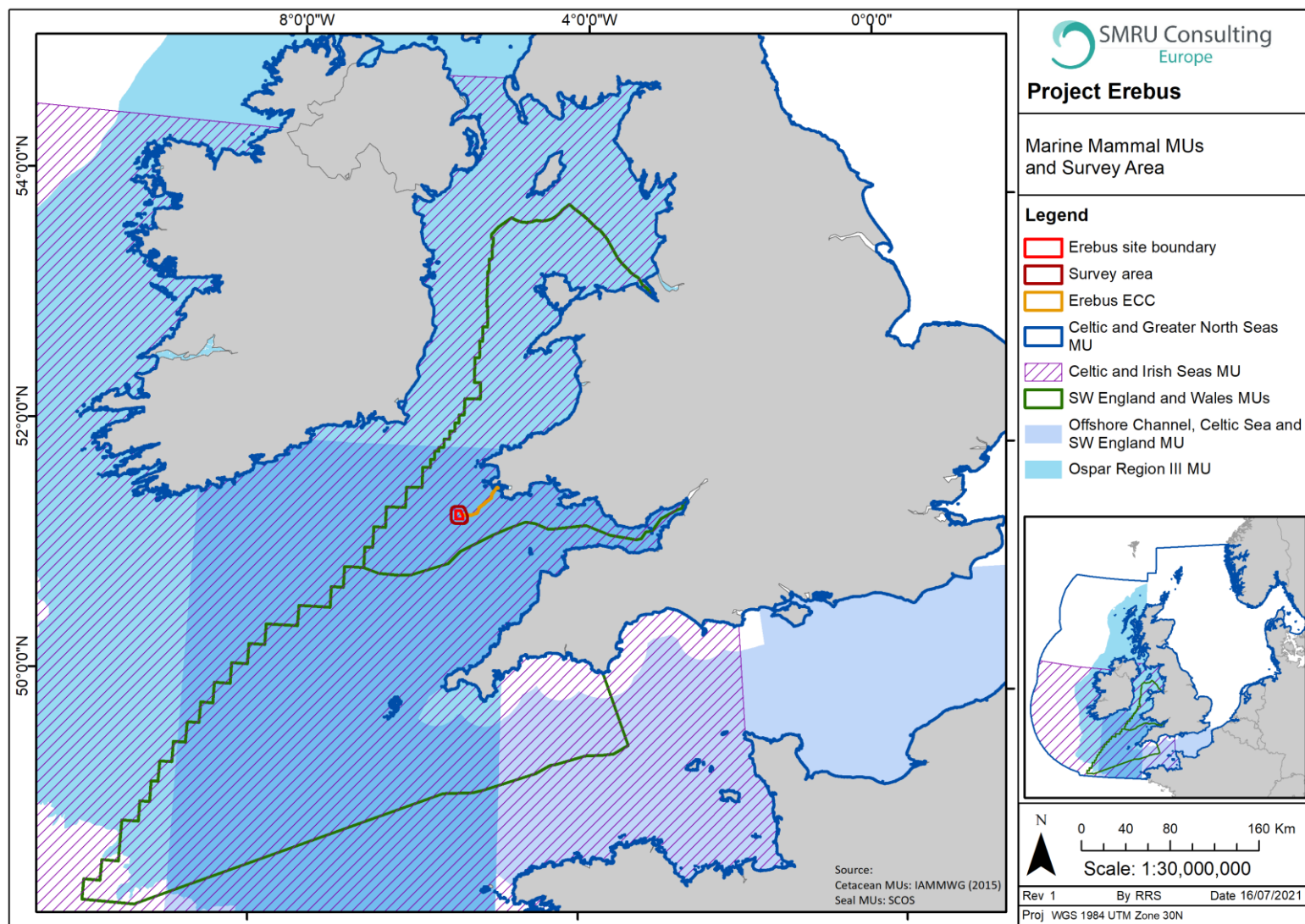


Figure 2.1 Marine mammal management units and marine mammal survey area relevant to the Project array area.

## 2.4 Conservation status

The Joint Nature Conservation Committee (JNCC) provides the UK report on the conservation status of species. The latest assessments were conducted in 2019 and were submitted to the European Commission as part of the 2019 UK Reporting under Article 17 of the EU Habitats Directive. Overall, most species included in this baseline characterisation have an unknown conservation status, apart from grey seals which have a Favourable status (Table 2).

**Table 2 Conservation status of the key species outlined in this report.**

| Species                                                                    | Range | Population | Habitat | Future prospects | Conservation Status | Overall trend | Reference    |
|----------------------------------------------------------------------------|-------|------------|---------|------------------|---------------------|---------------|--------------|
| <b>Common dolphin</b>                                                      | FV    | XX         | XX      | XX               | XX                  | XX            | JNCC (2019c) |
| <b>Harbour porpoise</b>                                                    | FV    | XX         | XX      | FV               | XX                  | XX            | JNCC (2019d) |
| <b>Bottlenose dolphin</b>                                                  | FV    | XX         | XX      | XX               | XX                  | XX            | JNCC (2019b) |
| <b>Risso's Dolphin</b>                                                     | FV    | XX         | XX      | XX               | XX                  | XX            | JNCC (2019f) |
| <b>Minke whale</b>                                                         | FV    | XX         | XX      | XX               | XX                  | XX            | JNCC (2019g) |
| <b>Grey seal</b>                                                           | FV    | FV         | FV      | FV               | FV                  | +             | JNCC (2019e) |
| <b>Leatherback turtle</b>                                                  | XX    | XX         | XX      | XX               | XX                  | XX            | JNCC (2019a) |
| FV = Favourable, U1 = Unfavourable-Inadequate, XX = Unknown, + = Improving |       |            |         |                  |                     |               |              |

## 2.5 Protected areas

In order to conserve biodiversity, by maintaining or restoring Annex II species to a Favourable Conservation Status, the Habitats Directive requires the designation of Special Areas of Conservation (SACs) for the harbour porpoise, bottlenose dolphins and the grey seal. There are many protected areas for marine mammals within their respective MUs (Table 1, Table 3, Figure 2.2 and Figure 2.3). There are 15 harbour porpoise SACs within the Celtic and Irish Seas MU, 21 grey seal SACs in the OSPAR Region III: Celtic Seas MU, two minke whale Marine Protected Areas (MPAs) in the Celtic and Greater North Seas MU and 1 Risso's dolphin MPA in UK waters. Given that the MUs vary in size, not all of these protected areas are located within Welsh waters; there are six MPAs located either wholly or partially in Welsh waters within the relevant MUs (Table 3, Figure 2.2 and Figure 2.3).

**Table 3 Marine mammal protected areas within the relevant MU for each species.**

| Protected Area                                         | Location               |
|--------------------------------------------------------|------------------------|
| <b>Harbour porpoise</b>                                |                        |
| North Anglesey Marine/ Gogledd Mon Forol SAC           | Welsh waters           |
| West Wales Marine / Gorllewin Cymru Forol SAC          | Welsh waters           |
| Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC | Welsh & English waters |
| North Channel SAC                                      | Northern Irish waters  |
| Rockabill to Dalkey Island SAC                         | RoI waters             |
| Blasket Islands SAC                                    | RoI waters             |
| Roaringwater Bay and Islands SAC                       | RoI waters             |
| Mers Celtiques – Talus du golfe de Gascogne SAC        | French waters          |
| Ouesant-Molene SAC                                     | French waters          |
| Nord Bretagne DH SAC                                   | French waters          |
| Chaussee de Sein SAC                                   | French waters          |
| Abers-Cote des Legendes SAC                            | French waters          |
| Baie de Morlaix SAC                                    | French waters          |
| Tregor Gaelo SAC                                       | French waters          |
| Cote de Granitrose-Sept-Iles SAC                       | French waters          |
| <b>Grey seal</b>                                       |                        |
| Pen Llyn a'r Sarnau/ Llyn Peninsula and the Sarnau SAC | Welsh waters           |
| Cardigan Bay/ Bae Ceredigion SAC                       | Welsh waters           |
| Pembrokeshire Marine/ Sir Benfro Forol SAC             | Welsh waters           |
| Lundy SAC                                              | English waters         |
| Isles of Scilly SAC                                    | English waters         |
| Lambay Island SAC                                      | RoI waters             |
| Saltee Islands SAC                                     | RoI waters             |
| Roaringwater Bay and Islands SAC                       | RoI waters             |
| Blasket Islands SAC                                    | RoI waters             |
| Slyne Head Islands SAC                                 | RoI waters             |
| Inishbofin and Inishshark SAC                          | RoI waters             |
| Duvillaun Islands SAC                                  | RoI waters             |
| Inshkea Islands SAC                                    | RoI waters             |
| Slieve Tooney/Tormore Island/Loughros Beg Bay SAC      | Northern Irish waters  |
| Horn Head and Rinclevan SAC                            | Northern Irish waters  |
| The Maidens SAC                                        | Northern Irish waters  |
| Monarch Islands SAC                                    | Scottish waters        |
| Treshnish Isles SAC                                    | Scottish waters        |
| North Rona SAC                                         | Scottish waters        |
| Ouesant-Molene SAC                                     | French waters          |
| Chaussee de Sein SAC                                   | French waters          |
| <b>Minke whale</b>                                     |                        |
| Sea of the Hebrides MPA                                | Scottish waters        |
| Southern Trench MPA                                    | Scottish waters        |
| <b>Risso's dolphin</b>                                 |                        |
| North-east Lewis MPA                                   | Scottish waters        |

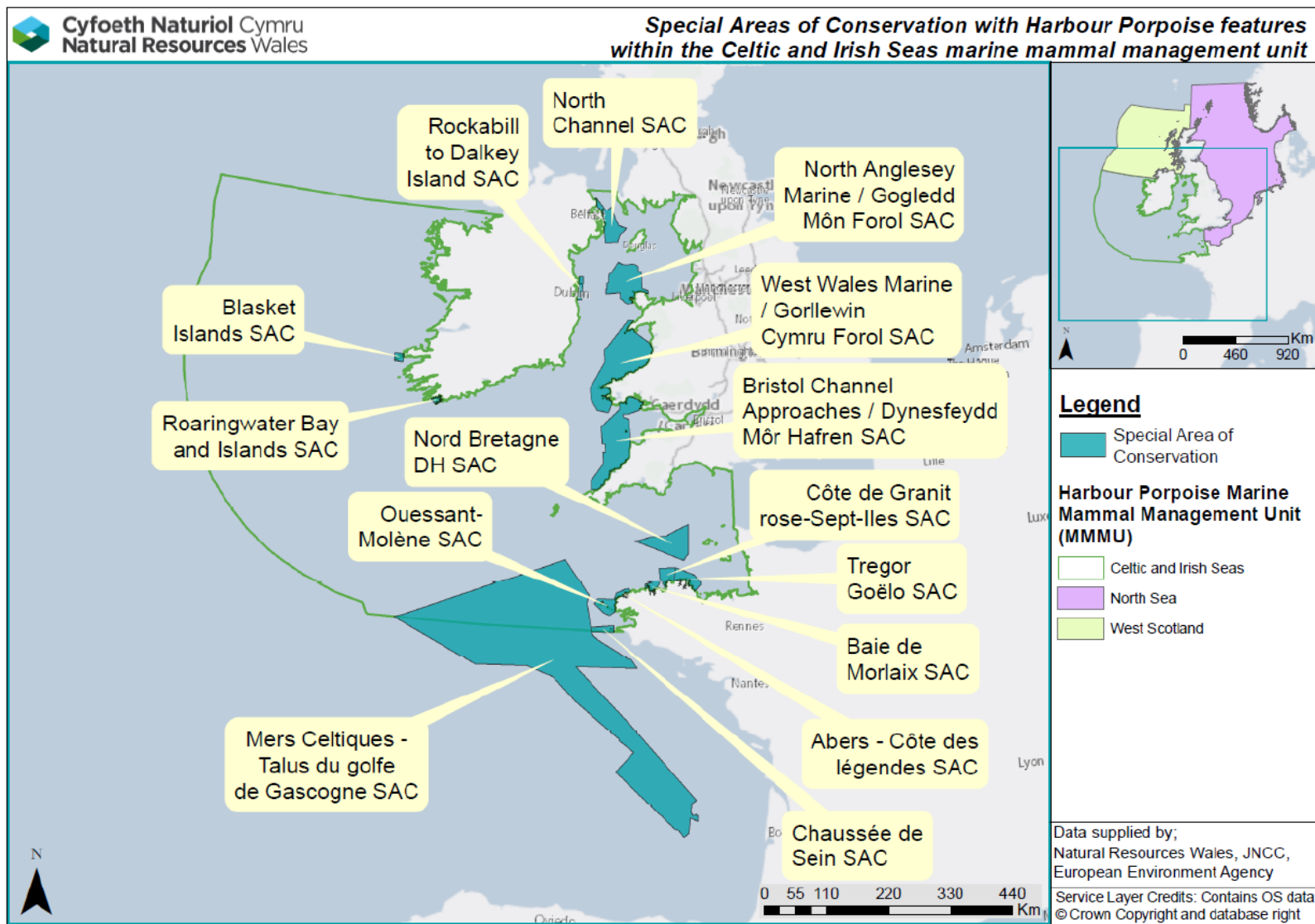


Figure 2.2 The Celtic and Irish Seas harbour porpoise MU and SACs within it (NRW 2020).



Figure 2.3 The OSPAR Region III interim marine mammal MU for grey seal and SACs within it (NRW 2020).

### 3 Data Sources

Table 4 and the following sections provide detail on the key data sources used to characterise the baseline study area for marine mammals and turtles in relation to the Project. This section details the survey and analysis methodology implemented in each study and the potential limitations associated with these. The actual results of the surveys in terms of the species presence are detailed in subsequent species-specific sections.

**Table 4 Data sources examined to inform the baseline characterisation for marine mammals and turtles.**

| Data Source                                                           | Date                                       | Summary                                        | Coverage                                                          |
|-----------------------------------------------------------------------|--------------------------------------------|------------------------------------------------|-------------------------------------------------------------------|
| Site-specific surveys (HiDef Aerial Surveying Ltd 2020)               | Oct 2019–Sep 2021                          | Aerial surveys                                 | The Project site and 4 km buffer                                  |
| Valorous site-specific surveys                                        | Mar-May 2021                               | Aerial surveys                                 | Project Valorous and 4 km buffer                                  |
| SCANS III (Hammond et al. 2017)                                       | Jun & Jul 2016                             | Aerial and vessel visual surveys               | All European Atlantic waters. The Project site located in block D |
| SCANS II (Hammond et al. 2013)                                        | Jun & Jul 2005                             | Aerial and vessel visual surveys               | All European Atlantic waters. The Project site located in block P |
| ObSERVE (Rogan et al. 2018)                                           | Summer/ Winter 2015<br>Summer/ Winter 2016 | Visual aerial surveys                          | Offshore waters within and beyond Ireland's continental shelf     |
| Welsh Marine Atlas (Baines and Evans 2012)                            | 1990–2009                                  | Aerial, vessel and land-based visual surveys   | The coastline of Wales                                            |
| Bottlenose dolphin monitoring in Cardigan Bay (Lohrengel et al. 2018) | 2011-2016                                  | Line transect surveys and photo-ID surveys     | Cardigan Bay SAC and wider Cardigan Bay                           |
| JCP Phase III (Paxton et al. 2016)                                    | 1994-2010                                  | Aerial, vessel and land-based surveys          | UK waters                                                         |
| Harbour porpoise densities (Heinänen and Skov 2015)                   | 1994-2011                                  | Vessel and aerial surveys                      | UK waters                                                         |
| MERP maps (Waggitt et al. 2020)                                       | 1980-2018                                  | Collation of data from JCP (aerial and vessel) | European Atlantic Waters                                          |

| Data Source                                                           | Date                                          | Summary                                           | Coverage                                |
|-----------------------------------------------------------------------|-----------------------------------------------|---------------------------------------------------|-----------------------------------------|
| Seal at-sea density (Carter et al. 2020)                              | 2005-2019                                     | Density surface based on telemetry and count data | UK waters, Republic of Ireland          |
| Seal at-sea usage (Russell et al. 2017)                               | Telemetry data: 1991-2005<br>Count data: 2015 | Density surface based on telemetry and count data | UK, Republic of Ireland and France      |
| Seal pup counts (Wilkie and Zbijewska 2020)                           | 1989 - 2019                                   | Seal pup count data                               | Skomer Marine Conservation Zone (MCZ)   |
| Seal pup counts (Bull et al. 2017b)                                   | 1983-2015                                     | Grey seal pup count data                          | Skomer, Wales                           |
| Seal pup counts (Bull et al. 2017a)                                   | 1993-2015                                     | Grey seal pup count data                          | Marloes peninsula, Wales                |
| Seal pup production (Lock et al. 2017)                                | 1992-2015                                     | Grey seal pup production                          | Skomer MCZ and Marloes peninsula, Wales |
| Seal pup production (Morgan et al. 2018)                              | 2015-2016                                     | Grey seal pup production                          | Ynys Dewi / Ramsey Island, Wales        |
| Seal status (NRW 2018)                                                | 2017                                          | Grey seal indicative condition assessment         | Pembrokeshire Marine SAC                |
| TURTLE database (Pierpoint and Penrose 2002)                          | 2000-2020                                     | Live and dead stranding data and at-sea sightings | UK waters, Republic of Ireland          |
| INTERREG Irish Sea Leatherback Turtle Project (Houghton et al. 2006a) | 2003-2005                                     | Aerial surveys and telemetry data                 | Irish Sea                               |
| Sea Trust                                                             | Apr-Oct 2005-2021                             | Vessel based surveys (no effort)                  | Wider Pembrokeshire area                |

### 3.1 Site-specific survey

In October 2019, HiDef (HiDef Aerial Surveying Limited) was commissioned to undertake high-resolution digital video aerial surveys for marine megafauna, ornithological over the proposed Project offshore wind development site (HiDef Aerial Surveying Ltd 2020). A total of 24 months of data was undertaken (Table 5). These surveys were designed to place transects 1 km apart across the Project site, including a 4 km buffer around the site, comprising a total survey area of 200.11 km<sup>2</sup> (Figure 3.1). All surveys were conducted in sea state 1-5 (Table 5), with most of the effort being conducted in sea state 2 and 3.

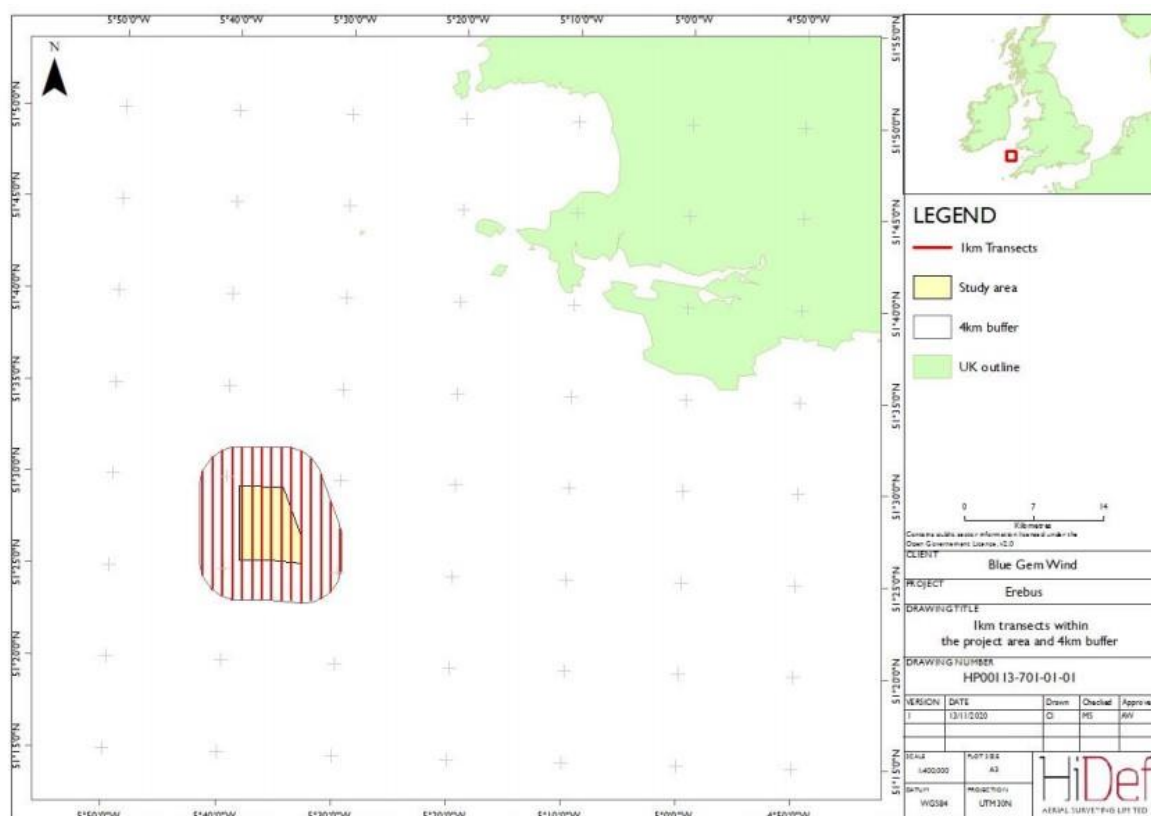


**Figure 3.1 HiDef survey design of the proposed Project offshore wind development site with a 4 km buffer and 1 km spaced transects (HiDef Aerial Surveying Ltd 2020).**

These surveys were conducted using an aircraft equipped with four HiDef Gen II cameras which included sensors set to a resolution of 2 cm Ground Sample Distance. Each of these cameras sampled 125 m wide strips, separated from the next camera by approximately 25 m, providing a combined sampled width of 500 m within a 575 m overall strip. To ensure that sufficient footage was available for a design-based or model-based analysis, only footage from two out of the four cameras was analysed, with the remaining footage remaining available for analysis at a later stage if needed. Data analysis for these surveys involves a two-stage process including a review of video footage with a 20% random sample used for audit, following this, the detected individuals were identified to species and/or species group level, also with 20% selected at random for auditing. For both stages in this process, the audits require 90% agreement to be achieved.

**Table 5 Survey effort across the 24 surveys of the Project offshore wind development site from October 2019 to September 2021 (HiDef Aerial Surveying Ltd 2020, 2021).**

| Survey | Month    | Total length of transects analysed (km) | Area covered (km <sup>2</sup> ) | % effort records at each Sea State |     |   |   |   |
|--------|----------|-----------------------------------------|---------------------------------|------------------------------------|-----|---|---|---|
|        |          |                                         |                                 | 1                                  | 2   | 3 | 4 | 5 |
| 1      | Oct 2019 | 203.37                                  | 50.84                           | -                                  | 100 | - | - | - |
| 2      | Nov 2019 | 203.46                                  | 50.87                           | -                                  | 100 | - | - | - |



| Survey | Month        | Total length of transects analysed (km) | Area covered (km <sup>2</sup> ) | % effort records at each Sea State |     |     |    |    |
|--------|--------------|-----------------------------------------|---------------------------------|------------------------------------|-----|-----|----|----|
|        |              |                                         |                                 | 1                                  | 2   | 3   | 4  | 5  |
| 3      | Dec 2019     | 203.27                                  | 50.82                           | -                                  | 59  | 6   | 35 | -  |
| 4      | Jan 2020     | 202.87                                  | 50.72                           | -                                  | 100 | -   | -  | -  |
| 5      | Feb 2020     | 197.05                                  | 49.26                           | 2                                  | 15  | 75  | 9  | -  |
| 6      | Mar 2020     | 203.27                                  | 50.82                           | -                                  | -   | 36  | 64 | -  |
| 7      | Apr 2020     | 203.23                                  | 50.81                           | -                                  | 60  | 35  | 5  | -  |
| 8      | Jun 2020 (a) | 203.29                                  | 20.82                           | -                                  | 26  | 72  | 2  | -  |
| 9      | Jun 2020 (b) | 203.62                                  | 50.90                           | -                                  | -   | 100 | -  | -  |
| 10     | Jul 2020     | 203.02                                  | 50.76                           | -                                  | 87  | 13  | -  | -  |
| 11     | Aug 2020     | 203.82                                  | 50.96                           | -                                  | -   | 95  | 5  | -  |
| 12     | Sep 2020     | 203.33                                  | 50.83                           | -                                  | 6   | 90  | 4  | -  |
| 13     | Oct 2020     | 203.55                                  | 50.96                           | -                                  | 68  | 32  | -  | -  |
| 14     | Nov 2020     | 204.17                                  | 51.04                           | -                                  | 98  | 2   | -  | -  |
| 15     | Dec 2020     | 203.23                                  | 50.81                           | -                                  | -   | 25  | 75 | -  |
| 16     | Jan 2021     | 203.83                                  | 50.96                           | -                                  | -   | 22  | 78 | -  |
| 17     | Feb 2021     | 203.59                                  | 50.90                           | 86                                 | 14  | -   | -  | -  |
| 18     | Mar 2021     | 203.39                                  | 50.85                           | -                                  | -   | 36  | 64 | -  |
| 19     | Apr 2021     | 203.58                                  | 50.89                           | -                                  | -   | 1   | 39 | 60 |
| 20     | May 2021     | 203.87                                  | 50.97                           | -                                  | 34  | 66  | -  | -  |
| 21     | Jun 2021     | 203.49                                  | 50.87                           | -                                  | 12  | 77  | 11 | -  |
| 22     | Jul 2021     | 203.48                                  | 50.87                           | 2                                  | -   | -   | 98 | -  |
| 23     | Aug 2021     | 203.60                                  | 50.90                           | 96                                 | 4   | -   | -  | -  |
| 24     | Sep 2021     | 203.69                                  | 50.92                           | 90                                 | 10  | -   | -  | -  |

### 3.2 Project Valorous surveys

Site-specific digital aerial surveys are currently being conducted by APEM Ltd at the adjacent Project Valorous site. Given the proximity of the Valorous site to the Project, the baseline data are considered to be relevant. The survey area covered the Valorous Proposed Development Area plus 4 km buffer and consisted of 26 survey lines spaced approximately 1 km between-track. The aircraft flew at approximately 460 m at a speed of 102 knots resulting in images with a 1.6 cm GSD (APEM Ltd 2021). At the time of drafting this report, only March - May 2021 data were processed and available to include here.

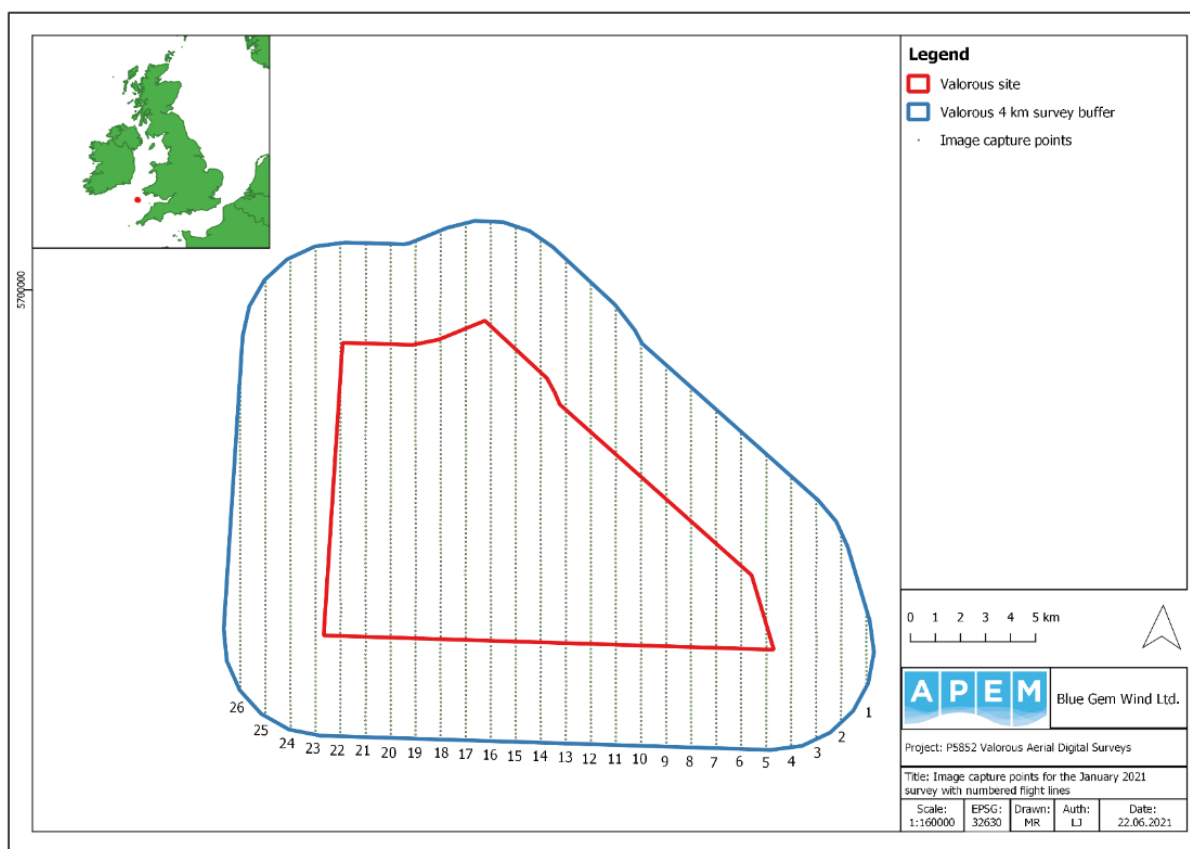


Figure 3.2 Location of the Valorous survey area with numbered flight lines and image capture points (APEM Ltd 2021).

### 3.3 Welsh Marine Atlas

The Welsh Marine Atlas (Baines and Evans 2012) includes 16 groups/survey projects which covered the Welsh coastline to contribute to the database which forms the base of the Atlas. A total of 216,031 km of effort from both vessel and aerial surveys are included, as well as 13,399 hours of land-based effort which span a 20-year period from 1990-2009. These data were used to encompass the region under investigation including the Irish Sea, St. George's Channel and the greater part of the Bristol Channel. The resulting database utilised for this project comprised 32,986 cetacean sightings totalling 99,085 individuals of 12 species. Additionally, the Welsh stranding's database was reviewed and contained records of 1,724 individual cetaceans of 15 species. Grey seal data for the purpose of this document were sourced from Countryside Council for Wales (CCW) with 2,586 at-sea sightings, comprising 3,424 individuals.

In cases where gaps were present within the study area due to little or no data available for a species, interpolation was used in place of predictive modelling. Two methods were considered, and both are

presented in the atlas as both are commonly used in spatial analysis. First, inverse distance weighted (IDW) interpolation which is a deterministic method, and second, kriging, a geostatistical method (Baines and Evans 2012). IDW interpolation is typically used when the input points are dense enough to capture the extent of variation needed for the analysis. Kriging however, is a more sophisticated statistical interpolation method in which spatial correlation is used to explain variation in a surface (Baines and Evans 2012).

### **3.4 SCANS Surveys**

The SCANS surveys consist of SCANS I, II and III which were conducted in 1994, 2005 and 2016. These are large-scale surveys which have been specifically designed to generate comprehensive estimates of abundance for marine mammal species within European Atlantic waters. Each of these surveys provides equal coverage probability within survey blocks such that each point within a block has the same probability of being surveyed. As a result, an unbiased abundance estimation is generated when extrapolating sample densities to block-wide density estimates.

Both aerial and boat-based survey methodologies were designed to correct for availability and detection bias and allow the estimation of absolute abundance (Hammond et al. 2021). The aerial surveys involved a single aircraft method using circle-back (or race-track) methods whereas the boat-based surveys involved a double platform 'primary' and 'secondary' tracker methodology. The Project is located in the SCANS III survey block D which covers an area of 48,590 km<sup>2</sup>, of which 1,744.0 km was surveyed on primary search effort.

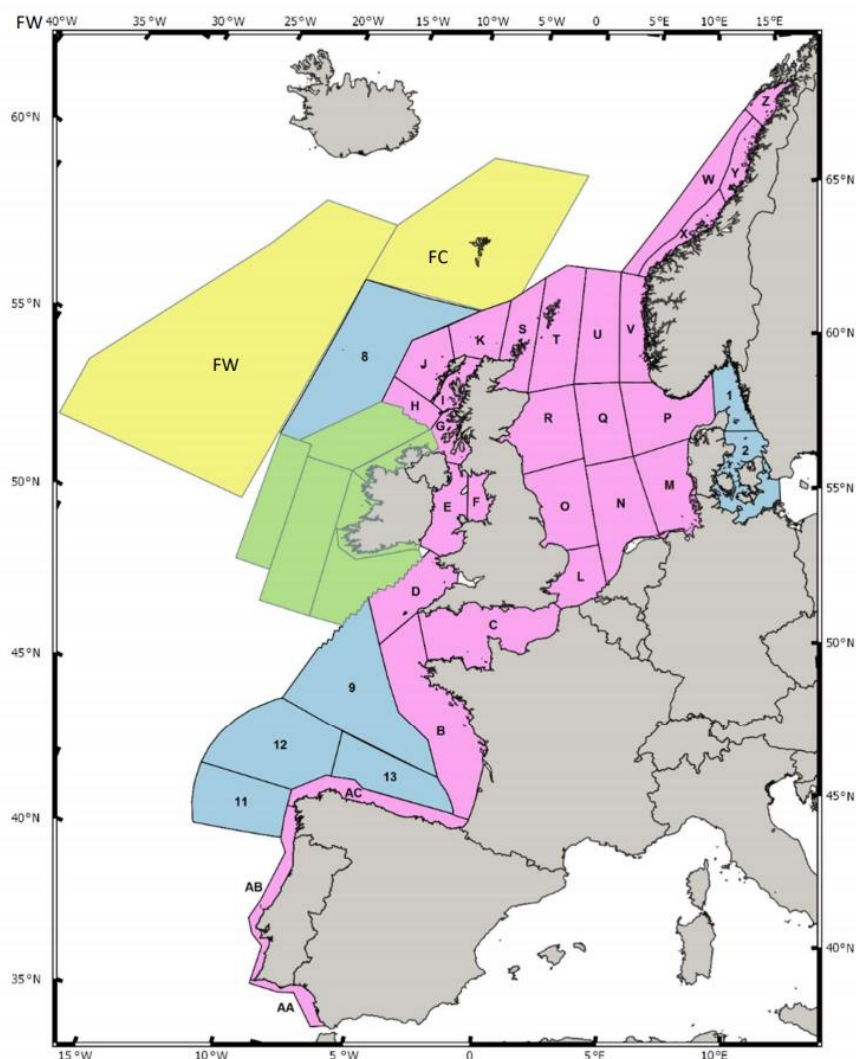


**Figure 3.3 Area covered by SCANS-III and adjacent surveys. SCANS-III: pink lettered blocks were surveyed by air; blue numbered blocks were surveyed by ship (Hammond et al. 2021). The Project is located within block D.**

In order to generate an estimation of abundance for marine mammal species sighted during the surveys, only data collected during “good” and “moderate”<sup>1</sup> sighting conditions were included. The effective strip width was estimated for good and moderate conditions respectively. It is assumed in Distance sampling, that all animals on the survey trackline and within the detection range are detected. However, for marine mammals, this assumption is often violated because a) animals are underwater and cannot be detected (availability bias) and b) observers may miss animals due to weather conditions or human error (perception bias). If these violations are not accounted for, then the detection function can result in negatively biased abundance estimates. The probability of detecting an animal on the trackline was estimated and therefore absolute abundance and density estimates were able to be calculated. Total densities were estimated by dividing the abundance estimates by the area of the associated stratum. Both coefficients of variation (CVs) and 95% confidence intervals (CIs) were estimated through the use of bootstrapping within each stratum.

<sup>1</sup> Sighting conditions were subjectively classified by observers as “good”, “moderate” or “poor” based primarily on sea conditions, water turbidity and glare (Hammond et al. 2021).

While the SCANS surveys provide sightings, density and abundance estimates at a wide spatial scale, the surveys are conducted during a single month, every 11 years and therefore do not provide any fine scale temporal or spatial information on species abundance and distribution. Since they are only conducted during the summer months, there are therefore not representative for other seasons in the year. This can be an issue for marine mammal species with seasonal distributions, and there is the potential to overestimate average annual abundances for such species using the SCANS density estimates alone.

### 3.5 ObSERVE surveys

From 2015-2016, offshore aerial surveys were conducted during the summer and winter months in Ireland, collecting data on the distributions and abundances of marine mammal species present within the survey area (Figure 3.4). In 2016, additional inshore/coastal surveys were conducted in both the winter and summer months (Rogan et al. 2018).

The survey design included a study area consisting of offshore waters around Ireland, both within and beyond Ireland's continental shelf. This study area was initially divided into five strata in 2015, with a further three inshore strata added in 2016. Two zigzag transects were flown within each stratum, with observations recorded and conducted following a standardised protocol designed for aerial surveys. In the case of cetacean sightings, the protocol used was designed using a line-transect methodology, with observer effort restriction to approximately 500 m either side of the aircraft. Two randomly placed transect lines were generated for each stratum. The line-transect positions and start points were changed each year to provide two independent datasets per season per stratum, also providing a more representative coverage of the survey area. In 2015, the total distance flown was 16,802 km within a survey area measuring 297,480 km<sup>2</sup> and in 2016 the distance flown totalled at 20,295 km within a survey area measuring 339,377 km<sup>2</sup>.

During all four surveys, four observers were on board the aircraft, with two on each side of the aircraft. The aircraft's position was recorded every two seconds through the use of an on-board GPS. Observers recorded all sightings of marine fauna, as well as Beaufort sea state, cloud cover, glare extent and severity, the corresponding declination angle of the aircraft to the animal sighted, species, sighting time, group size, presence of calves and behaviours observed.

Across all the survey periods, a total of 1,844 cetacean sightings were recorded, comprising 19 species from an estimated 8,633 individuals. When there was sufficient data collected (60 sightings required for a species/species group) two approaches to estimate abundance were utilised including a design-based method and a model-based method. A number of other marine megafauna species were recorded during the surveys including sharks, large fish species and turtles.

The surveys were designed to *"inform the assessment of risk to protected species and their habitats from a range of human activities (e.g., through man-made disturbance or operational interactions)"* (Rogan et al. 2018), and as such, the analysis methodology was designed to achieve the best absolute abundance and density estimates possible, by correcting for biases in Distance sampling methodology. The probability of detecting an animal on the trackline ( $g(0)$ ) was corrected for using the moderate sightings condition  $g(0)$  estimates calculated from the SCANS III surveys (0.279 for porpoise, 0.414 for dolphin species and 0.302 for minke whales), and therefore absolute abundance and density estimates were able to be calculated.

Whilst the strata covered during the ObSERVE surveys does not directly overlap with the Project site, sightings and density estimates from Stratum 4 and Stratum 5 will be taken into consideration in this technical report due to the proximity to the Project, with the southeast area of Stratum 4 and the northeast area of Stratum 5 being approximately 50 km from the Project site at the closest point. Therefore, due to the mobile nature of marine mammals and turtles, there is potential for connectivity

between animals observed in Irish waters and those that may be observed in Welsh waters in the vicinity of the Project site.

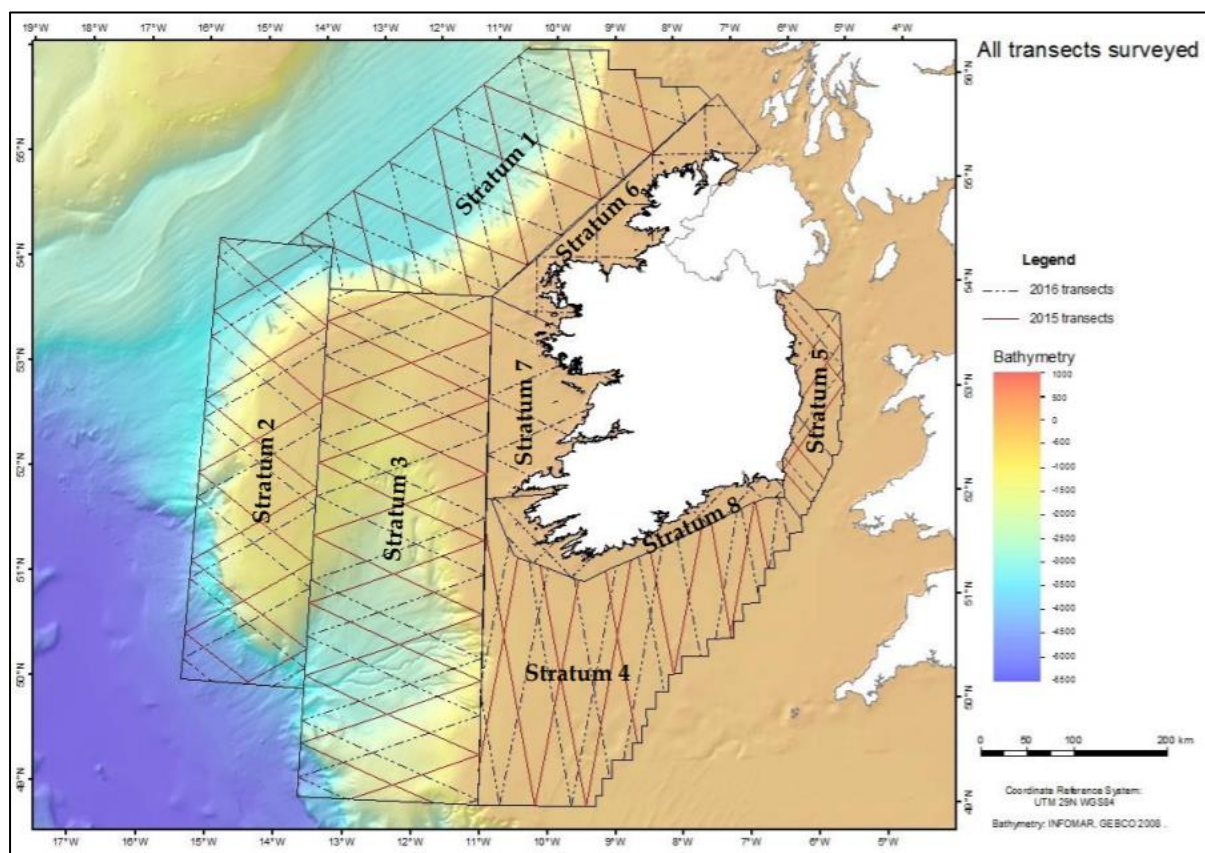


Figure 3.4 Map of the survey area for the ObSERVE surveys in 2015 and 2016 (Rogan et al. 2018).

### 3.6 Bottlenose dolphin surveys

There are two major coastal populations of bottlenose dolphins in UK waters, which includes the semi-resident population of bottlenose dolphins found in Cardigan Bay. Bottlenose dolphins are the primary species of the Cardigan Bay SAC and also a feature of the Pen Llŷn a'r Sarnau SAC in northern Cardigan Bay, designated under the EC Habitats Directive. Due to this, there is a requirement to both monitor and report on the condition of species within the SAC through providing information on the distribution and abundance, population dynamics, life history and health of species such as bottlenose dolphins.

The Sea Watch Foundation (SWF) reported on monitoring work of bottlenose dolphins conducted between 2014-2016 on behalf of Natural Resources Wales (NRW) (Lohrengel et al. 2018). The primary objective of this was to monitor the bottlenose dolphin population of both the Cardigan Bay SAC and the wider Cardigan Bay area. Both line transect and non-line transect surveys were conducted in Cardigan Bay from 2014 to 2016, however coverage of the survey area in 2014 was not complete and as such, no population estimate is available. This work by Lohrengel et al. (2018) built on earlier surveys carried out by SWF since 2001 in the Cardigan Bay SAC and since 2005 in northern Cardigan Bay. Opportunistic observations from wildlife tourism boats were also used to supplement both life history and behavioural information for bottlenose dolphins in the area. Photo-Id methods were also included in this study, utilising a photo-Id catalogue of bottlenose dolphins within the area that held images of a minimum of 379 bottlenose dolphins. Analyses were completed using Capture-Mark-

Recapture (CMR) methods, which also took into consideration an overall average of 64% of marked dolphins in the Cardigan Bay SAC, and 66% in the wider Cardigan Bay.

### **3.7 Joint Cetacean Protocol**

The Joint Cetacean Protocol (JCP) was set up by JNCC with the aim of delivering information on the abundance, distribution and population trends of cetacean species which occur in the North Sea and its adjacent sea regions. The JCP builds on the cetacean sightings datasets currently available through providing cetacean summary information including species-specific estimates of cetacean density, distribution, and population trends. The JCP is often used to assist with reporting on cetacean conservation status to Directives including the EC Habitats and Species Directive and Marine Strategy Framework Directive. Currently, phases I, II and III of the JCP have been completed.

#### **3.7.1 JCP Phase III**

The JCP Phase III analysis included datasets from 38 sources, totalling over 1.05 million km of survey effort between 1994 and 2010 from a variety of platforms (Paxton et al. 2016). The JCP Phase III analysis was conducted to combine these data sources to estimate spatial and temporal patterns of abundance for seven species of cetaceans (harbour porpoise, minke whales, bottlenose dolphins, common dolphins, Risso's dolphins, white-beaked dolphins and white-sided dolphins). The JCP Phase III analysis provided abundance estimates for specific areas of interest for offshore development, including the Atlantic Array (Bristol Channel and adjacent Irish Sea) with an area of 19,649 km<sup>2</sup> (Figure 3.5).

For some surveys, availability bias was corrected for, however this was not possible for all survey sources, and as such, the resulting abundance and density estimates are not absolute.

There are several other limitations of this dataset. The data analysed by Paxton et al. (2016) was collected from 1994 to 2010 and, as such records are between 11 and 26 years old. Therefore, they do not provide a recent density estimate against which to assess impacts for any future EIAs. The authors state that the JCP database provides relatively poor spatial and temporal coverage, that the results should be considered indicative rather than an accurate representation of species distribution, and that due to the patchy distribution of data, the estimates are less reliable than those obtained from SCANS surveys. In addition, the authors categorically state that the JCP Phase III outputs cannot be used to provide baseline data for impact monitoring of short-term change or to infer abundance at a finer scale than 1,000 km<sup>2</sup> because of issues relating to standardizing the data (such as corrections for undetected animals and potential biases) from so many different platforms/ methodologies and the strong assumptions that had to be made when calculating detection probability.

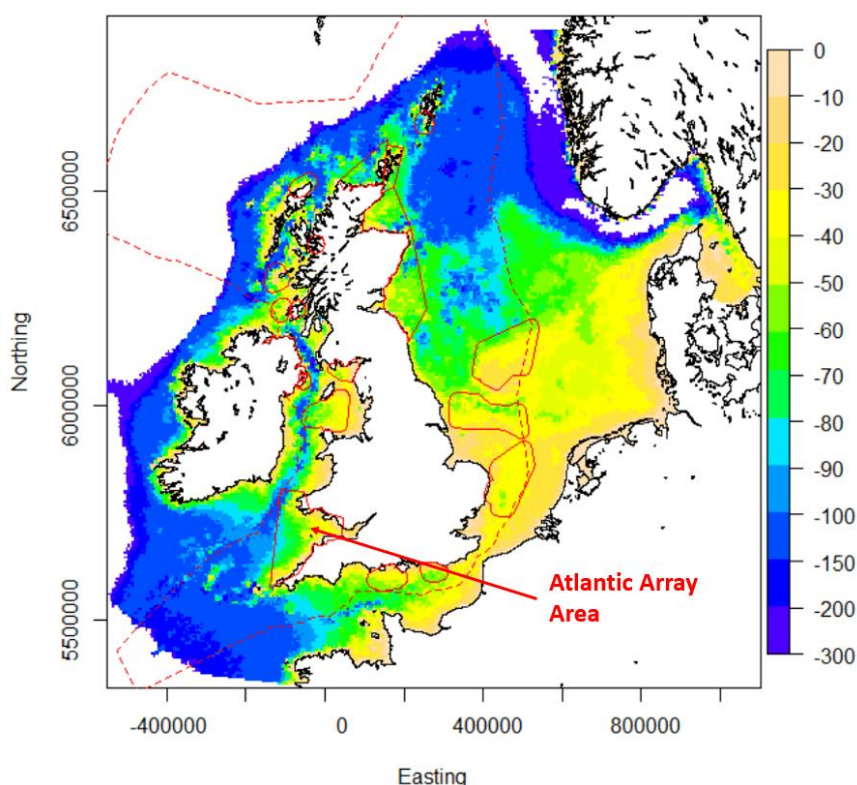


Figure 3.5 The core JCP Phase III region showing (red) areas of interest for offshore development where estimates of abundance are of special commercial interest (red dashed line = British exclusive economic zone, colour = depth in m) (Paxton et al. 2016).

### 3.7.2 Data Tool

The JCP Phase III Data Analysis Product has been provided by JNCC to extract abundance estimates averaged for summer 2007-2010 and scaled to the SCANS III estimates for user specified areas<sup>2</sup>. In order to extract data in relation to the Project, the user specified area was defined as approximately 26 km buffer around the survey area (Figure 3.6).

<sup>2</sup> Joint Cetacean Protocol Phase III Data Analysis Product available here:  
<https://hub.jncc.gov.uk/assets/01adfabd-e75f-48ba-9643-2d594983201e>

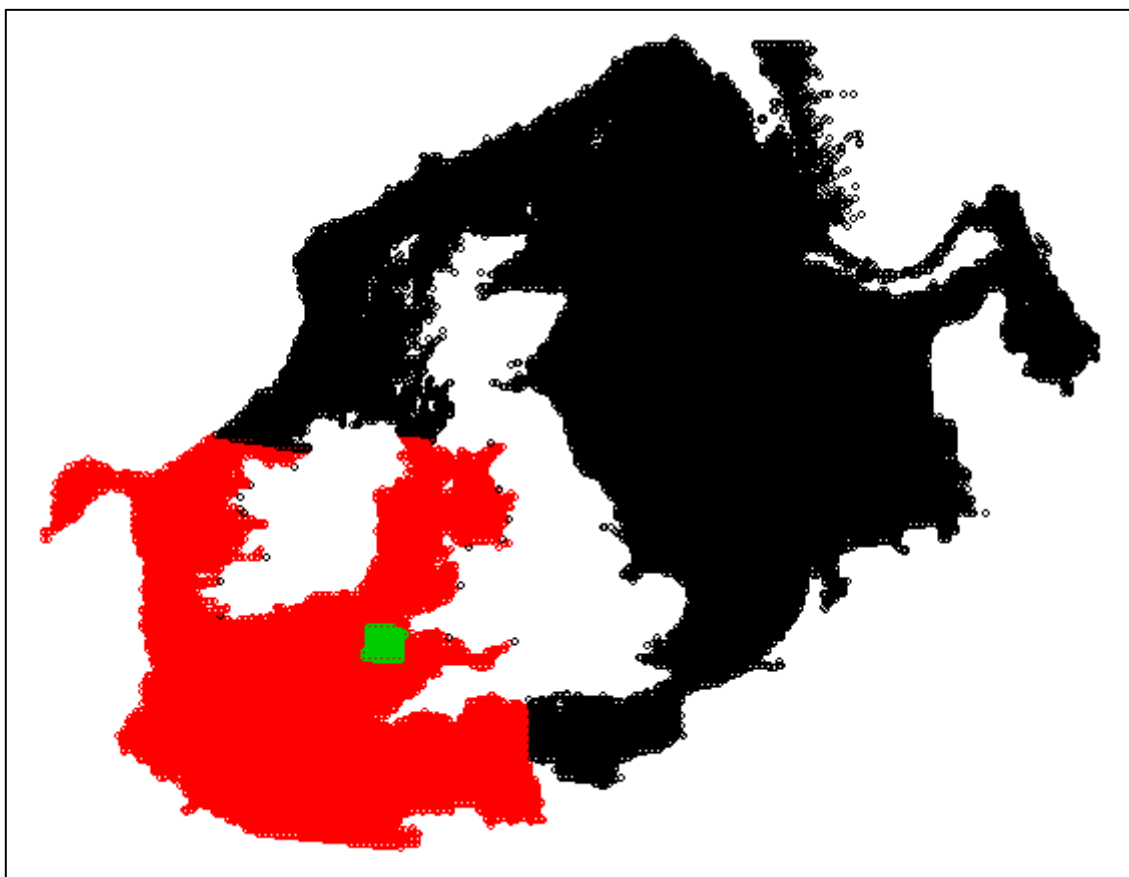


Figure 3.6 User specified area (green), Celtic and Irish Seas MU (red) and full extent of JCP Phase III dataset (black) used to extract abundance and density estimates.

### 3.7.3 Heinenen & Skov

Heinänen and Skov (2015) conducted a detailed analysis of 18 years of survey data on harbour porpoise around the UK between 1994 and 2011 held in the JCP database. The goal of this analysis was to try to identify “discrete and persistent areas of high density” that might be considered important for harbour porpoise with the ultimate goal of determining SACs for the species. The analysis grouped data into three subsets: 1994-1999, 2000-2005 and 2006-2011 to account for patchy survey effort and analysed summer (April-September) and winter (October-March) data separately to explore whether distribution patterns were different between seasons and to examine the degree of persistence between the subsets. The authors note that “due to the uneven survey effort over the modelled period, the uncertainty in modelled distributions vary to a large extent”. In addition, the authors stated that “model uncertainties are particularly high during winter”. The uncertainties in the modelled distributions were taken into account when designating the draft SACs so that only areas with high confidence were retained (IAMMWG 2015b).

### 3.7.4 MERP surveys

The aim of the Marine Ecosystems Research Programme (MERP) project was to produce species distribution maps of cetaceans and seabirds at basin and monthly scales for the purposes of conservation and marine management. A total of 2.68 million km of survey data in the Northeast Atlantic between 1980 and 2018 were collated and standardized. Only aerial and vessel survey data were included where there were dedicated observers and where data on effort, survey area and

transect design were available. The area covered by Waggitt et al. (2020) comprised an area spanning between Norway and Iberia on a north-south axis, and Rockall to the Skagerrak on an east-west axis.

Waggitt et al. (2020) predicted monthly and 10 km<sup>2</sup> densities for each species (animals/km<sup>2</sup>) and estimated the probability of encountering animals using a binomial model (presence-absence model) and estimated the density of animals if encountered using a Poisson model (count model). The product of these two components were used to present final density estimations (Barry and Welsh 2002). The outputs of this modelling were monthly predicted density surfaces for 12 cetacean species at a 10 km resolution. There is no indication of whether the more recent sightings data are weighted more heavily than older data, which limits interpretation of how predictive the maps are to current distribution patterns. Therefore, while the density estimates obtained from these maps are representative of relative density compared to other sites around the UK, they are not considered to be suitable density estimates for use in quantitative impact assessment and are provided in this baseline characterisation for illustrative purposes only.

The authors list three key limitations of the data analysis and the resulting distribution maps which require the maps to be interpreted carefully. Firstly, the influence of small or sub-populations on the model is limited, secondly, the model does not account for large changes in populations within the study period and thirdly, although seasonal movement were detected, there were also many instances of seasonal changes in densities without changes in overall distribution. The authors state that because of these limitations, the maps *“should not be used as a representation of absolute densities and fine-scale distributions”* and recommend that instead, they are used as a *“general illustration of relative densities and broad-scale distribution over several decades”*.

### 3.8 Seal haul-out surveys

Grey seals are counted on all August harbour seal surveys, although these data do not necessarily provide a reliable index of population size. Grey seals aggregate in the autumn to breed at traditional colonies, therefore their distribution during the breeding season can be very different to their distribution at other times of the year. The Sea Mammal Research Unit's (SMRU's) main surveys of grey seals are designed to estimate the numbers of pups born at the main breeding colonies around Scotland. Breeding grey seals are surveyed biennially between mid-September and late November using large-format vertical photography from a fixed-wing aircraft. The SMRU grey seal pup counts round the UK are augmented by surveys conducted by SNH, The National Trust, Lincolnshire Wildlife Trust and Friends of Horsey Seals.

Grey seal haul-out surveys have also been conducted by NRW within Pembrokeshire, Wales, focussed on seal pups on the Skomer Island MCZ (Skomer Island and Marloes peninsula). Surveys were conducted primarily via land-based observations with boats used on occasion to access beaches and caves.

### 3.9 Seal telemetry

SMRU has deployed telemetry tags on grey seals and harbour seals in the UK since 1988 and 2001, respectively. These tags transmit data on seal locations with the tag duration (number of days) varying between individual deployments. There are two types of telemetry tag which differ by their data transmission methods. Data transmission can be through the Argos satellite system (Argos tags) or mobile phone network (phone tags). Both types of transmission result in location fixes, but data from phone tags comprise better quality and more frequent locations. The telemetry data were used to illustrate the distribution of seals at sea and to investigate the degree of connectivity between the Project and seal haul-out sites and SACs.

### 3.10 Seal distribution

The seal at-sea usage maps were created in order to predict the at-sea density of seals in order to inform impact assessments and marine spatial planning. The original SMRU seal density maps were produced as a deliverable of Scottish Government Marine Mammal Scientific Support Research Programme (MMSS/001/01) and were published in Jones et al. (2015). These have since been revised to include new seal telemetry and haul-out count data and modifications have been made to the modelling process (Russell et al. 2017). The analysis uses telemetry data from 270 grey seals and 330 harbour seals tagged in the UK between 1991 – 2015, and haul-out count data from 1996 - 2015 to produce UK-wide maps of estimated at-sea density with associated uncertainty. The combined at-sea usage and haul-out data were scaled to the population size estimate from 2015.

A key limitation of the at-sea usage maps is that there was a lot of “null usage” in the data, where only a subset of all available haul-out sites were visited by a tagged animal. For haul-out sites where no animal had been tagged, or where no tagged animal had visited, it had to be assumed that usage declined monotonically with distance from the haul-out which meant that potential hotspots around these haul-outs will have been missed.

Given the limitations of the at-sea usage maps, and the fact that the grey seal at-sea usage maps were informed mainly by old, low resolution tracking data, the Department of Business, Energy and Industrial Strategy (BEIS) funded a large-scale deployment of high resolution Global Positioning System (GPS) telemetry tags on grey seals around the UK, and analyses to create up-to-date estimates of the at-sea distribution for both seal species (Carter et al. 2020). Telemetry data from 114 grey seals were included in the analysis (Figure 3.7; left panel). To estimate the at-sea distribution, a habitat modelling approach was used, matching seal telemetry data to habitat variables (such as water depth, seabed topography, sea surface temperature) to understand the species-environment relationships that drive seal distribution. Haul-out count data (Figure 3.7; right panel) were then used to generate predictions of seal distribution at sea from all known haul-out sites in the British Isles. This resulted in predicted distribution maps on a 5 x 5 km grid.

The estimated density surface gives the 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. It is estimated that grey seals spent 77% of their time at sea on average, therefore, using the current best estimate of the grey seal population size in the British Isles (SCOS 2020), the total at-sea population size for the British Isles is estimated to be ~150,700 individuals (Carter et al. 2020).

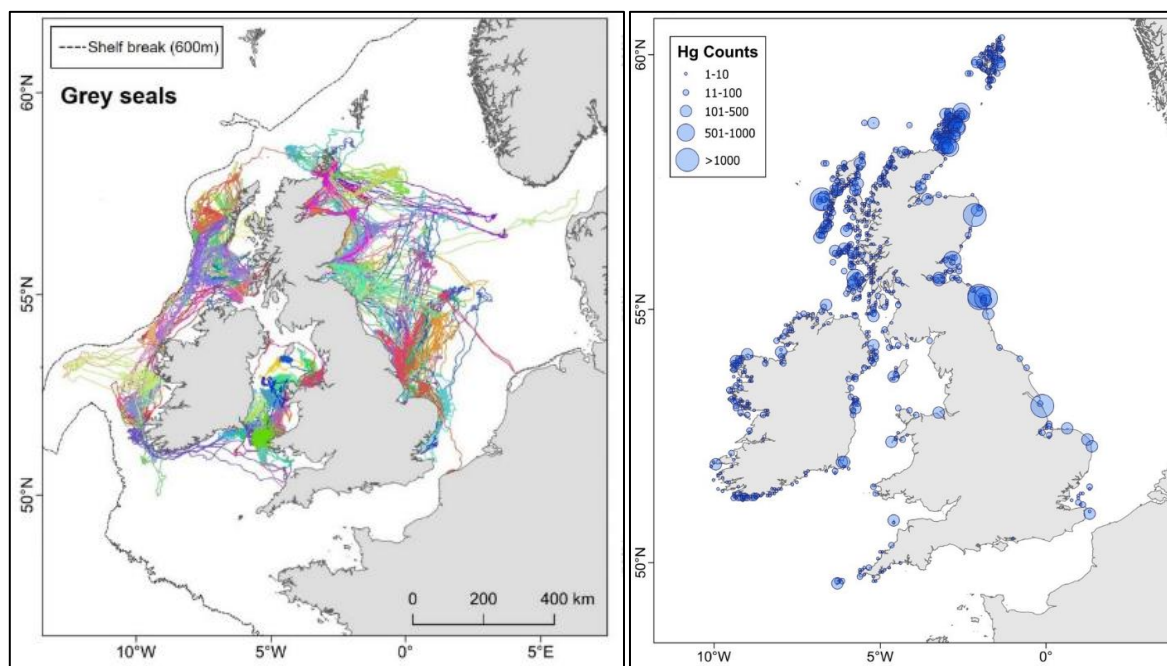


Figure 3.7 From Carter et al. (2020): GPS tracking data for grey seals available for habitat preference models (left) and August count data for grey seals per 5 km x 5 km haul-out cell used in the distribution analysis (right).

### 3.11 Wildfowl and Wetland Trust aerial surveys

Aerial surveys were conducted by Wildfowl and Wetlands Trust (WWT) Consulting from 2001 to 2008 for waterbirds during which data for marine mammals, turtles, sharks and sunfish were also collected opportunistically (WWT Consulting 2009). Data for turtles from these surveys will be considered in this technical report. Initial survey coverage was limited to areas of known concentrations of waterbirds, as the primary focus of the surveys, including Carmarthen Bay, Cardigan Bay, the North Wales coast and around Blackpool and Barrow-in-Furness. With increased offshore wind farm interest, the Department for Business, Enterprise and Regulatory Reform (BERR; formerly Department of Trade and Industry), and BEIS (formerly Department of Energy and Climate Change (DECC)), supported by other Government departments, agencies and industry, commissioned a large-scale survey of strategic areas identified for the second round of offshore wind development. A third and fourth program of surveys was then commissioned for January and March 2007 and October 2007 and August 2008, respectively, which included repeat surveys of many of the areas surveyed previously, as well as new areas particularly around Wales, the southwest, south and southeast.

Surveys utilised a new distance-sampling methodology developed in Denmark by the National Environment Research Institute. All observations were assigned a distance band, to estimate their range from the aircraft. Observations further from the observer were typically more difficult to detect, and therefore recording the distance allows the number of 'missed observations' to be estimated (Buckland et al. 2001). Surveys were run as a series of north-south transects spaced 2 km apart, designed to cover the areas of interest for each project and were generally made during a four-hour period centred on midday GMT to minimise the effects of glare on counts (WWT Consulting 2009).

### 3.12 TURTLE database

Turtle sightings, strandings and instances of bycatch are recorded opportunistically by various individuals and organisations throughout the UK and Ireland. As part of the UK Cetacean Strandings Investigation Programme, records are compiled in the TURTLE database by Marine Environmental Monitoring which is considered the primary source of information to infer distribution relative

abundance and seasonality within UK and RoI waters (Pierpoint and Penrose 2002), dating back to 1910 (Botterell et al. 2020). All data are stringently validated to ensure records are accurate and of the highest quality and confidence before adding to the database. Data also includes records of leatherback capture in driftnets, trawls, set gill nets, purse seines and in longline fisheries (Pierpoint 2000) Annual reports of data submitted to the TURTLE database have been published annually since 2001 (presenting data from 2000 onwards) and efforts are ongoing at the time for this report. Both live and dead standings are recorded for all turtle species.

Detailed analyses of the spatial and temporal occurrence of marine turtle sightings and strandings in the UK and Ireland between 1910 and 2018 have been conducted by Botterell et al. (2020) using data collated in the TURTLE database.

### **3.13 INTERREG Irish Sea Leatherback Turtle Project**

The Irish Sea Leatherback Project was established in April 2003 as a joint venture between the University of Wales Swansea and the University College Cork and was funded by the European Regional Development Fund's INTERREG IIIA initiative (Houghton et al. 2006a). This project comprised aerial surveys of the Irish Sea mapping prey abundance and turtle sightings and satellite tracking of leatherback turtles (partially supported). Shoreline jellyfish surveys were also conducted to examine jellyfish distribution on a spatial and temporal scale to analyse if the distribution of prey correlated with leatherback turtle sightings.

The project also deployed the first satellite relay data logger (SRDL) to a leatherback turtle in the Northeast Atlantic in 2005 (Houghton et al. 2006a). This individual was a female that was able to be tracked for 375 days. A second individual, this time male, was then tagged in 2006 also using an SRDL. This tag stayed attached for 233 days. Both turtles were tagged following entanglement in fishing gear (Doyle et al. 2008).

### **3.14 Sea Trust Wales**

Sea Trust Wales is a marine conservation charity based in Pembrokeshire. Sea Trust began conducting boat surveys to record marine wildlife sightings in 2004. The aim of these surveys are to build local knowledge and to record a comprehensive picture of the cetaceans and other megafauna found in our waters in order to fill knowledge gaps and provide evidence to help in their conservation.

The surveys are conducted on a Lochin marine grp motor cruiser with flybridge and depart from Neyland travelling into the Celtic Deep. The route varies but usually involves travelling towards The Smalls and Grassholm and further out into the Celtic Deep. The route back to Neyland often involves travelling towards either Skomer or Skokholm. Most surveys are usually 8 hours long. Surveys are conducted between May and October under ideal weather conditions. Sea Trust mainly record cetaceans but also there are some sightings of seals, sharks, sunfish, tuna and jellyfish.

The surveys are conducted by trained staff and volunteers. There is one observer and one recorder on the flybridge as well as spotters on either side of the boat. Environmental data is recorded and for each sightings the species, number seen, time, location (latitude and longitude) and distance from the boat are recorded. Surveys are very rarely conducted in sea states higher than 3. Sea state is recorded for each sighting record. The visibility scale used is 1-3 (1=Poor, 2=Moderate, 3=Good).

Sea Trust Wales kindly provided the Project with all sightings data obtained between June 2002 and September 2021 (April-October). A total of seven marine mammal species were recorded (common dolphin, harbour porpoise, Risso's dolphin, bottlenose dolphin, minke whale, fin whale, grey seal, in addition to sightings of unknown seals and unknown dolphins).

## 4 Common dolphin

In UK waters, common dolphins occur primarily in the Celtic Sea, with some reports of this species in the North Sea. Common dolphins are listed as Least Concern on the International Union for Conservation of Nature (IUCN) red list and there are currently no designated or proposed SACs within UK waters. A single MU has been implemented for this species labelled the Celtic and Greater North Sea MU (Table 1).

### 4.1 General – Welsh Marine Atlas

Common dolphins have been recorded in Welsh waters since 1990, with this species having a largely offshore distribution centred upon the Celtic Deep at the southern end of the Irish Sea. This high-density area extends eastwards towards the coast and islands of west Pembrokeshire (Baines and Evans 2012). This species is known to be regular within Welsh waters, with 1,502 sightings logged in the project database, resulting in a count of 19,861 individuals (Baines and Evans 2012).

Baines and Evans (2012) reported on the long-term sighting rates of common dolphins from 1990 - 2009 using vessel counts from vessel survey data (Figure 4.1; left panel). The distribution of this species shown here concludes that common dolphins are present in high abundances in proximity to the Project offshore wind development site. Spatial maps of long-term mean sighting rates of common dolphins from aerial counts retrieved from aerial survey data also report an overlapping distribution with the Project site (Figure 4.1; right panel).

This study also concluded that there is likely to be some seasonal variation occurring in relation to the distribution of common dolphins within the study area. Spatial maps of the long-term (1990 - 2009) quarterly mean sighting rates of common dolphins from vessel surveys indicate that this species have a large summer distribution in the area, moving out of the area from January to March (Figure 4.2). Long-term quarterly mean sightings of common dolphins from aerial surveys show similar results, with peak abundances from July to September, and lowest abundances of common dolphins from January to March (Figure 4.3). However, it is important to note that there is less survey effort carried out during the winter months in comparison to the summer months.

While these data provide an overview of the general distribution of common dolphins in the Irish Sea, they do not provide density estimates.

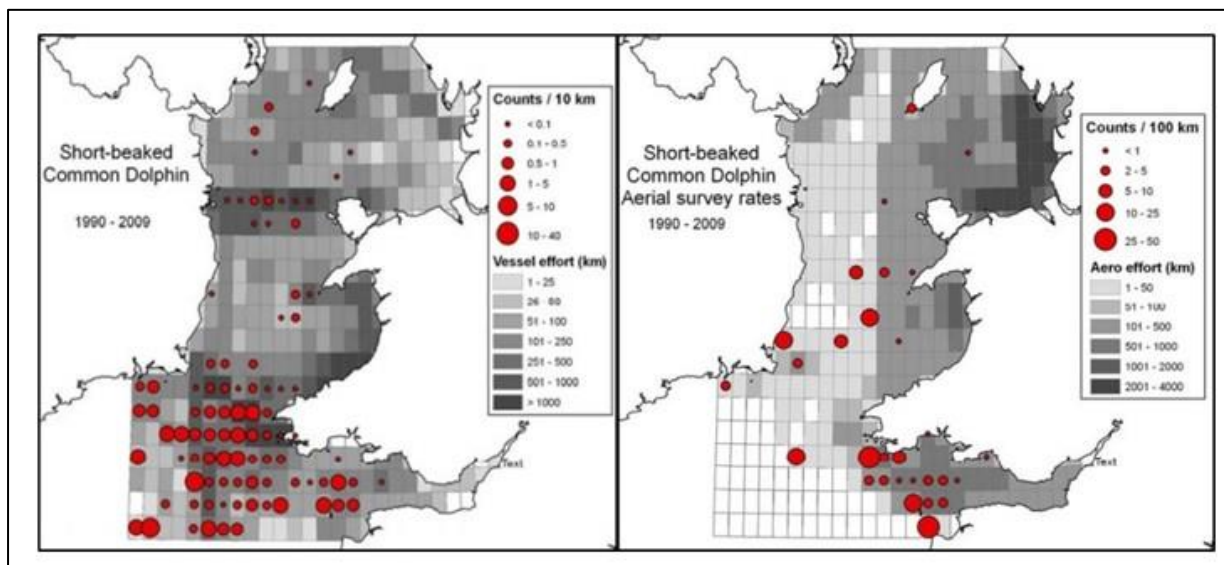


Figure 4.1 Long-term sighting rates (left; vessel counts per 10 km, right; aerial counts per 100 km) of common dolphins from 1990 - 2009 (Baines and Evans 2012).

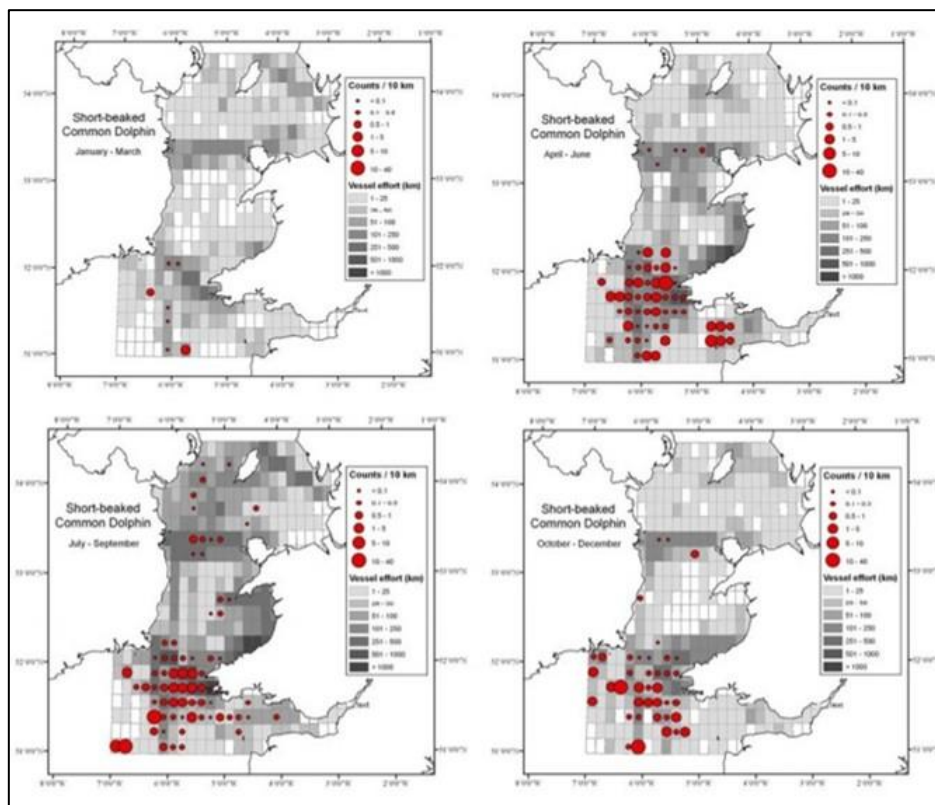


Figure 4.2 Long-term quarterly mean sighting rates of common dolphins from vessel surveys (Baines and Evans 2012).

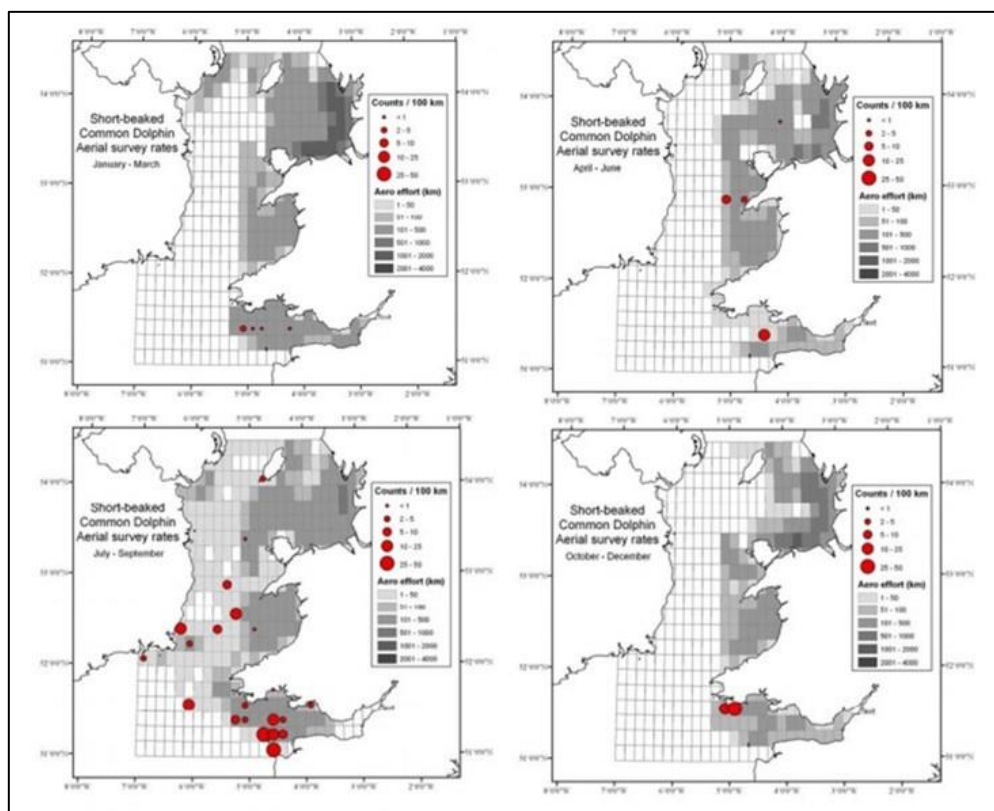


Figure 4.3 Long-term quarterly mean sightings of common dolphins from aerial surveys (Baines and Evans 2012).

## 4.2 Site-specific surveys

During the surveys carried out by HiDef, common dolphins were the most abundant marine mammal. They were found in high densities across the survey area (Figure 4.4), totalling 1,929 sightings across the two years of surveys. Both relative density estimates (dolphins/km<sup>2</sup>) and population estimates were provided for this species for each completed survey (Table 6), as well as spatial maps of this species' distributions at the site during the surveys (Figure 4.5). There does not appear to be evidence of either spatial (Figure 4.5) or seasonal patterns (Figure 4.7) in the sightings.

Common dolphin abundance estimates (within the survey area) fluctuated throughout year 1, with the highest relative density reported during the January 2020 surveys at 5.43 dolphins/km<sup>2</sup> with a coinciding population estimate of 1,086 individuals for this survey. Across the Year 1 survey data, common dolphin densities within the survey area were on average 2.13 dolphins/km<sup>2</sup>, the average relative density in the second year was lower, at 0.91 dolphins/km<sup>2</sup>, resulting in an overall average of 1.52 dolphins/km<sup>2</sup> across the two survey years (Table 6).

These density estimates are relative densities, not absolute densities. This is because while it can be assumed that there is no perception bias in the digital aerial surveys data (ie: no animals are missed by the observers), there is no correction for the availability bias (accounting for the fact that animals may be underwater and not available to be sighted). In order to correct the relative density estimates to obtain absolute density estimates, the proportion of the time the species spends underwater (and is unavailable for detection) needs to be accounted for. There is little such evidence available for common dolphins. The only study that was available to inform this was from Bilgmann et al. (2018) where aerial surveys were flown over the shelf and coastal waters off the western Eyre Peninsula, eastern Great Australian Bight, South Australia. Bilgmann et al. (2018) stated that "*availability bias showed common dolphin schools were visible from the air 94% of the time when percentage was averaged across the 19 focal follows*". Therefore, 6% of the common dolphin schools were not visible

from the air. This can be used to correct the density estimates to obtain an absolute density estimate; which is presented in the final column in Table 6. Taking this into account slightly increases the average common dolphin density estimate across the two years of surveys from 1.52 dolphins/km<sup>2</sup> to 1.61 dolphins/km<sup>2</sup>.

HiDef provide a qualitative measurement of the confidence in the identification as follows:

- 'Definite' – as certain as is reasonably possible;
- 'Probable' – very likely to be this species or species group; or
- 'Possible' – more likely to be this species or species group than anything else.

In the majority of cases for common dolphins the confidence in the identification was high, with 30% of the sightings classified as "definite" and 60% of the sightings classified as "probable". Only a small percentage of the common dolphin sightings were classed as 'possible' (10%). Since it was not possible to identify the factors causing this variability, all detections identified as common dolphin were treated as definite.

Common dolphin sightings occurred in sea states 1-5, with most sightings occurring in sea state 2 (33%) or 3 (46%).

**Table 6 Relative density and abundance estimates of common dolphins within the survey area of the HiDef surveys from October 2019 – September 2020 (HiDef Aerial Surveying Ltd 2020, 2021).**

| Survey                | Date        | Raw count  | Density (#/km <sup>2</sup> ) | Abundance estimate | CV (%) | Lower CI | Upper CI | Corrected density |
|-----------------------|-------------|------------|------------------------------|--------------------|--------|----------|----------|-------------------|
| 1                     | Oct 2019    | 0          | 0                            | 0                  | 0      | 0        | 0        | 0.00              |
| 2                     | Nov 2019    | 40         | 0.72                         | 145                | 41.27  | 39       | 269      | 0.77              |
| 3                     | Dec 2019    | 11         | 0.22                         | 44                 | 61.55  | 0        | 104      | 0.23              |
| 4                     | Jan 2020    | 275        | 5.43                         | 1086               | 19.28  | 682      | 1489     | 5.78              |
| 5                     | Feb 2020    | 36         | 0.73                         | 147                | 39.58  | 45       | 272      | 0.78              |
| 6                     | Mar 2020    | 24         | 0.47                         | 95                 | 37.89  | 28       | 165      | 0.50              |
| 7                     | Apr 2020    | 15         | 0.16                         | 32                 | 94.61  | 0        | 94       | 0.17              |
| 8                     | Jun 2020(a) | 226        | 4.38                         | 876                | 37.01  | 341      | 1592     | 4.66              |
| 9                     | Jun 2020(b) | 142        | 2.78                         | 556                | 47.42  | 140      | 1140     | 2.96              |
| 10                    | Jul 2020    | 251        | 4.83                         | 967                | 25.34  | 515      | 1466     | 5.14              |
| 11                    | Aug 2020    | 68         | 1.3                          | 261                | 30.92  | 110      | 427      | 1.38              |
| 12                    | Sep 2020    | 232        | 4.48                         | 896                | 91.53  | 0        | 2651     | 4.77              |
| <b>Year 1 average</b> |             | <b>110</b> | <b>2.13</b>                  | <b>425.4</b>       | -      | -        | -        | <b>2.26</b>       |
| 13                    | Oct 2020    | 116        | 2.27                         | 454                | 34.49  | 203      | 809      | 2.41              |
| 14                    | Nov 2020    | 3          | 0.06                         | 12                 | 92.70  | 0        | 35       | 0.06              |
| 15                    | Dec 2020    | 9          | 0.1                          | 20                 | 65.80  | 0        | 49       | 0.11              |
| 16                    | Jan 2021    | 13         | 0.25                         | 51                 | 52.56  | 8        | 112      | 0.27              |

| Survey                 | Date     | Raw count    | Density (#/km <sup>2</sup> ) | Abundance estimate | CV (%) | Lower CI | Upper CI | Corrected density |
|------------------------|----------|--------------|------------------------------|--------------------|--------|----------|----------|-------------------|
| 17                     | Feb 2021 | 66           | 1.3                          | 261                | 26.76  | 130      | 404      | 1.38              |
| 18                     | Mar 2021 | 152          | 2.98                         | 597                | 32.26  | 278      | 1025     | 3.17              |
| 19                     | Apr 2021 | 12           | 0.24                         | 48                 | 57.57  | 0        | 109      | 0.26              |
| 20                     | May 2021 | 8            | 0.16                         | 32                 | 75.34  | 0        | 86       | 0.17              |
| 21                     | Jun 2021 | 96           | 1.9                          | 380                | 25.66  | 196      | 574      | 2.02              |
| 22                     | Jul 2021 | 78           | 0.55                         | 111                | 67.82  | 0        | 283      | 0.59              |
| 23                     | Aug 2021 | 1            | 0.02                         | 4                  | 95.39  | 0        | 12       | 0.02              |
| 24                     | Sep 2021 | 55           | 1.08                         | 217                | 58.53  | 0        | 490      | 1.15              |
| <b>Year 2 average</b>  |          | <b>50.75</b> | <b>0.91</b>                  | <b>182.3</b>       | -      | -        | -        | <b>0.97</b>       |
| <b>Overall average</b> |          | <b>80.38</b> | <b>1.52</b>                  | <b>303.8</b>       | -      | -        | -        | <b>1.61</b>       |

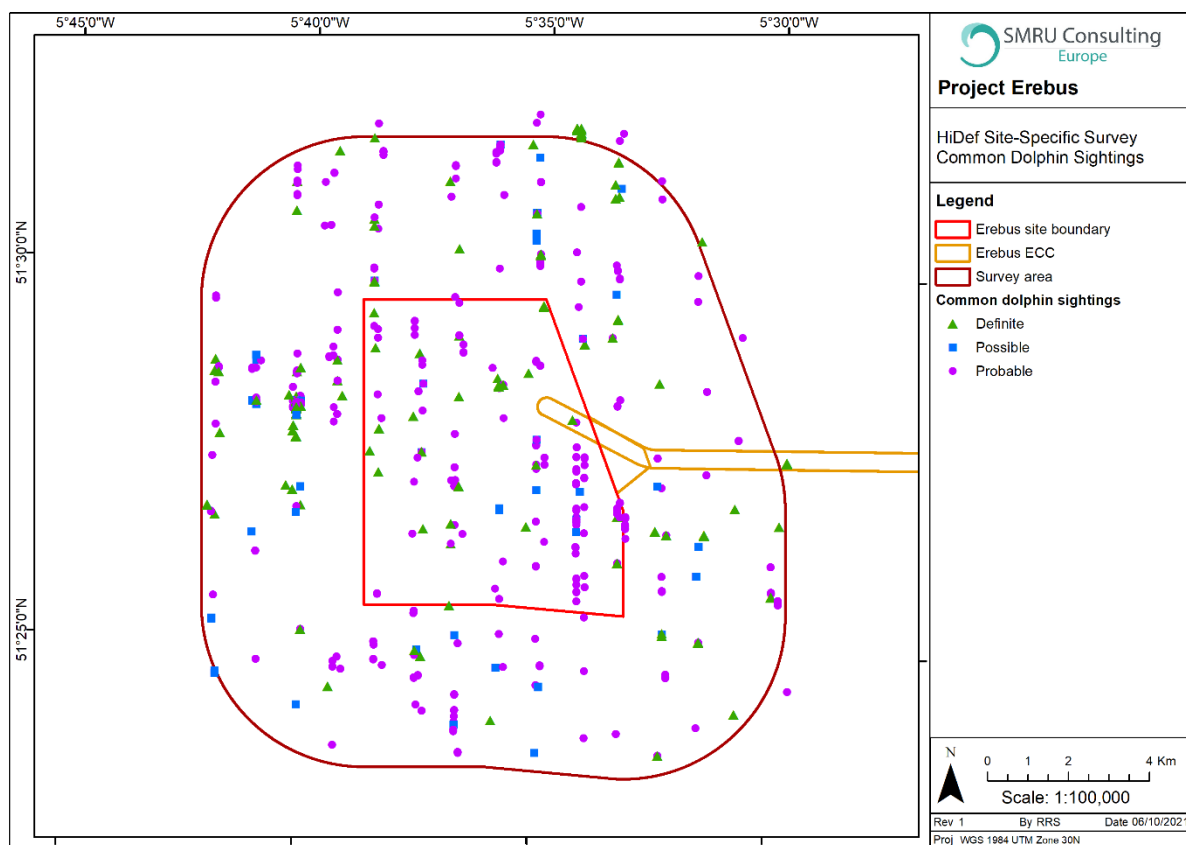


Figure 4.4 Common dolphin sightings recorded during the HiDef surveys.

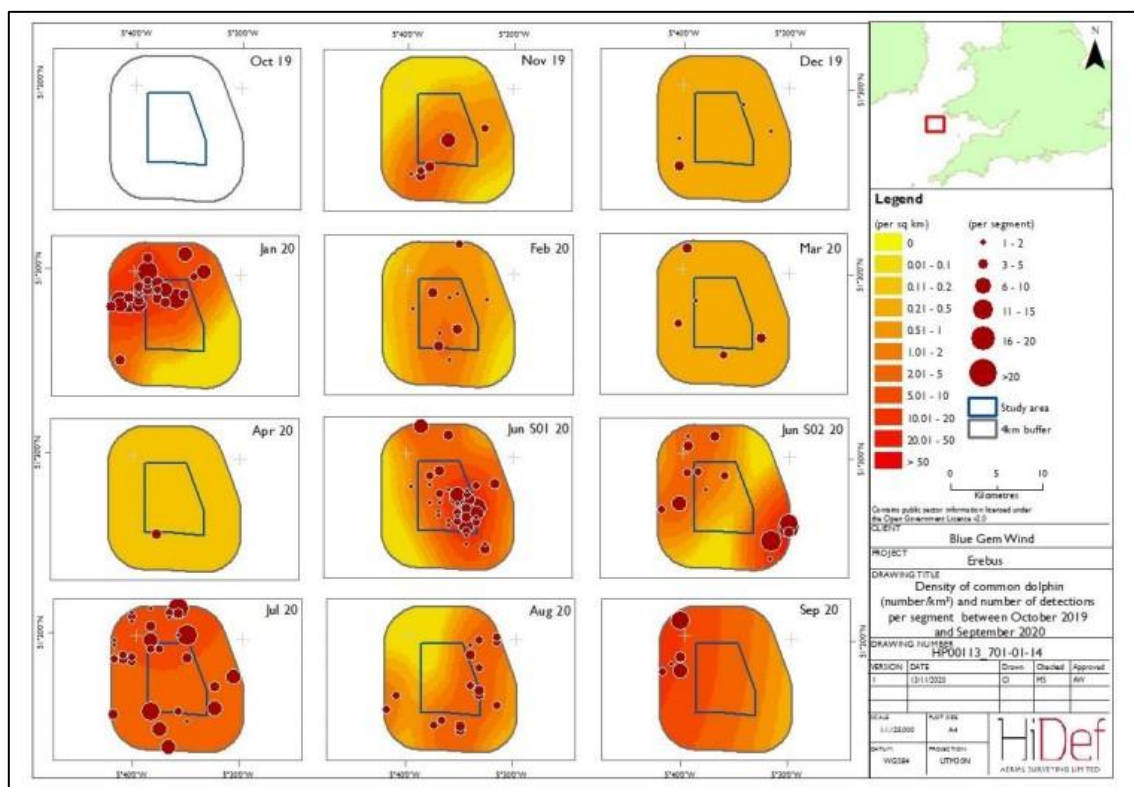


Figure 4.5 Common dolphin densities (dolphins/km<sup>2</sup>) and number of detections per segment across the survey area of the HiDef surveys from October 2019-September 2020 (HiDef Aerial Surveying Ltd 2020).

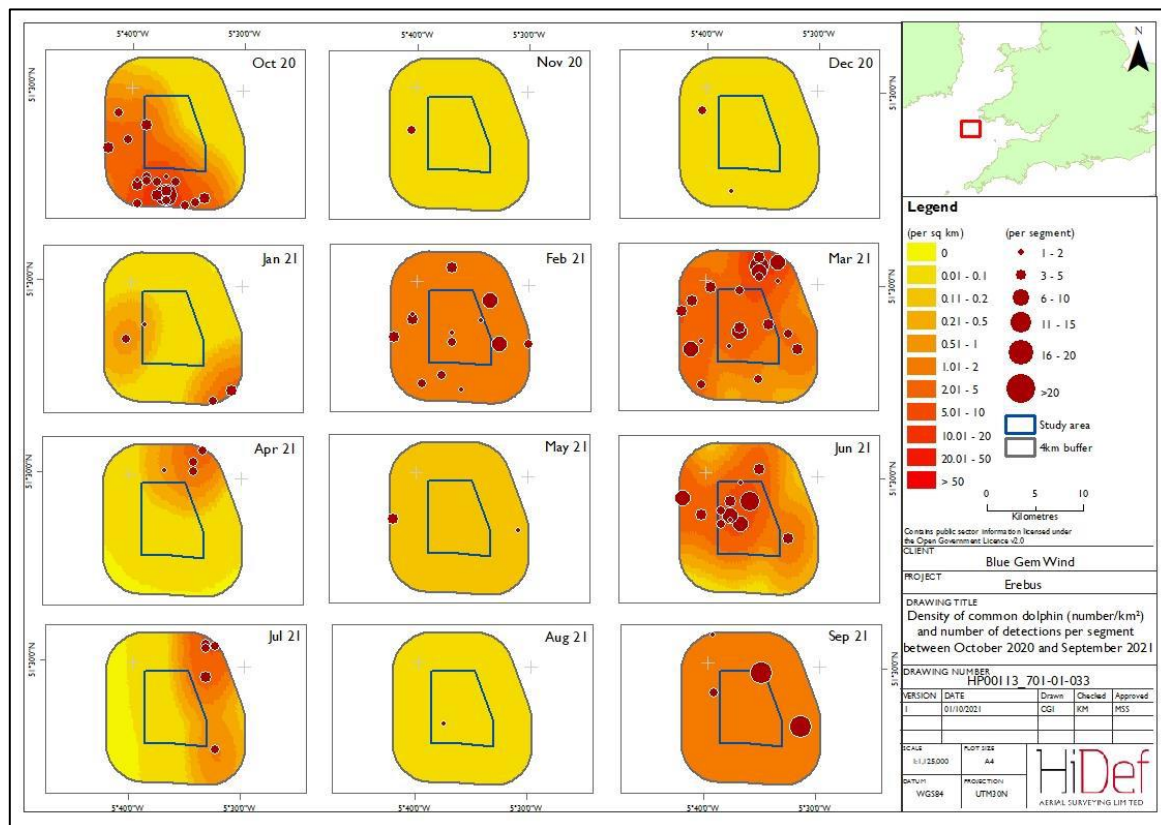


Figure 4.6 Common dolphin densities (dolphins/km<sup>2</sup>) and number of detections per segment across the survey area of the HiDef surveys from October 2020-September 2021 (HiDef Aerial Surveying Ltd 2021).

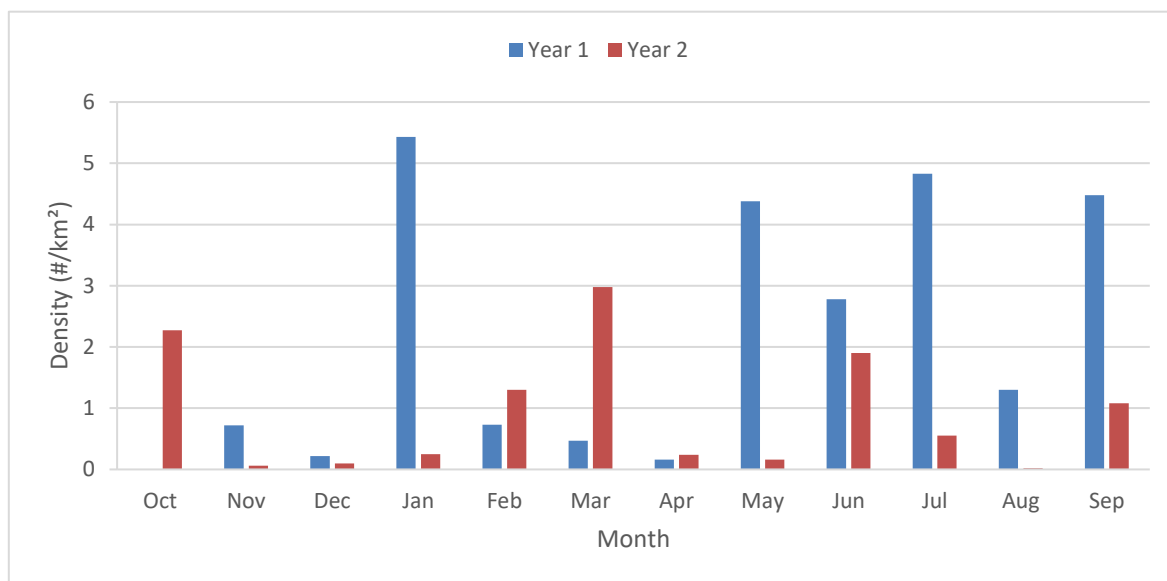


Figure 4.7 Monthly relative density estimates for common dolphins across the two years of site-specific surveys.

### 4.3 Project Valorous surveys

Common dolphins were the most frequently sighted species during the first three APEM surveys at Project Valorous. Of the 182 marine mammal sightings over these three surveys, 103 (57%) were common dolphins. In addition to this, there were 37 sightings of unknown dolphin/porpoise and 33 sightings of unknown dolphin species.

### 4.4 SCANS III

During the SCANS III survey (Hammond et al. 2021), effort was conducted in 2016 in survey block D (which covered the Southern Celtic/Irish Seas and where the Project site is located) using aerial survey techniques. Within survey block D, common dolphins were sighted in the vicinity of the Bristol Channel as well as in more offshore waters (Figure 4.8). Results from this survey concluded that common dolphins in block D had an estimated abundance of 18,187 individuals (95% CI: 4,394 - 33,077). Density estimates for common dolphins within block D were estimated to be 0.3743 dolphins/km<sup>2</sup>.

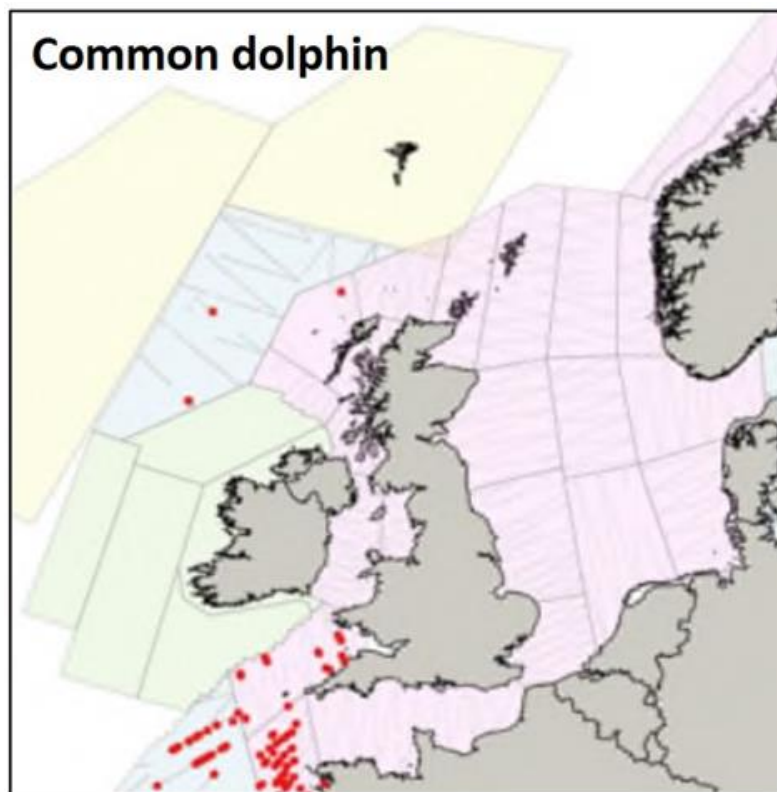


Figure 4.8 Sightings of common dolphins from the SCANS III surveys (Hammond et al. 2021).

#### 4.5 ObSERVE

Common dolphins sighted during the ObSERVE surveys appeared to show both inter-annual and inter-seasonal differences in sightings across the whole ObSERVE survey area, with an increase in common dolphin sightings during the winter months 2015-16 (7.41 dolphin/km<sup>2</sup> across the entire survey area) compared to the summer months for 2015 (3.14 dolphin/km<sup>2</sup>) (Rogan et al. 2018). This species was seen in neritic waters, predominantly to the south and west of Ireland (Figure 4.9).

In Stratum 4, common dolphins were reported at an estimated density of 0.018 dolphins/km<sup>2</sup> and a corrected model-based estimate of 0.044 dolphins/km<sup>2</sup> for summer 2015, which was lower than the respective estimates for winter 2015 at 0.262 dolphins/km<sup>2</sup> and a corrected model-based estimate of 0.637 dolphins/km<sup>2</sup> (Table 7) (Rogan et al. 2018). Within Stratum 4 there was a large inter-annual variation, with common dolphins being sighted in both summer and winter in 2015 but not in either summer or winter of 2016. Common dolphins were not sighted in Stratum 5 during the ObSERVE 2015 - 2016 surveys. In terms of seasonal changes in the abundance of common dolphins, highest abundances appeared to be in winter 2015 (Figure 4.10) in proximity to the Project offshore wind development site.

**Table 7 Common dolphin design-based density (#/km<sup>2</sup>) and abundance estimates for Strata 4 and 5 of the ObSERVE surveys (Rogan et al. 2018).**

|         |             | Corrected design-based estimates |           |          |          | Corrected model-based estimates |           |          |          |
|---------|-------------|----------------------------------|-----------|----------|----------|---------------------------------|-----------|----------|----------|
| Stratum | Season      | Density                          | Abundance | Lower CI | Upper CI | Density                         | Abundance | Lower CI | Upper CI |
| S4      | Summer 2015 | 0.044                            | 2,760     | 1,164    | 6,542    | NA                              |           |          |          |
| S4      | Winter 2015 | 0.637                            | 39,899    | 19,670   | 80,930   | NA                              |           |          |          |
| S4      | Summer 2016 | NA                               |           |          |          |                                 |           |          |          |
| S4      | Winter 2016 | NA                               |           |          |          |                                 |           |          |          |
| S5      | Summer 2015 | NA                               |           |          |          |                                 |           |          |          |
| S5      | Winter 2015 | NA                               |           |          |          |                                 |           |          |          |
| S5      | Summer 2016 | NA                               |           |          |          |                                 |           |          |          |
| S5      | Winter 2016 | NA                               |           |          |          |                                 |           |          |          |

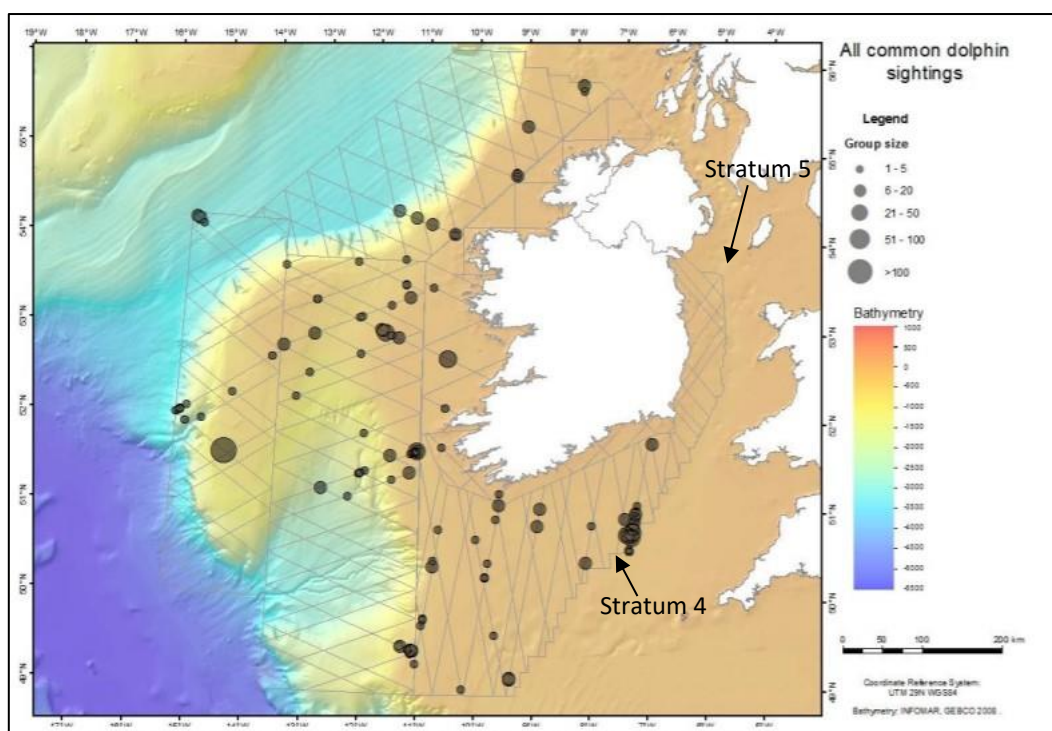


**Figure 4.9 All common dolphin sightings from the ObSERVE surveys from 2015-2016 (Rogan et al. 2018).**

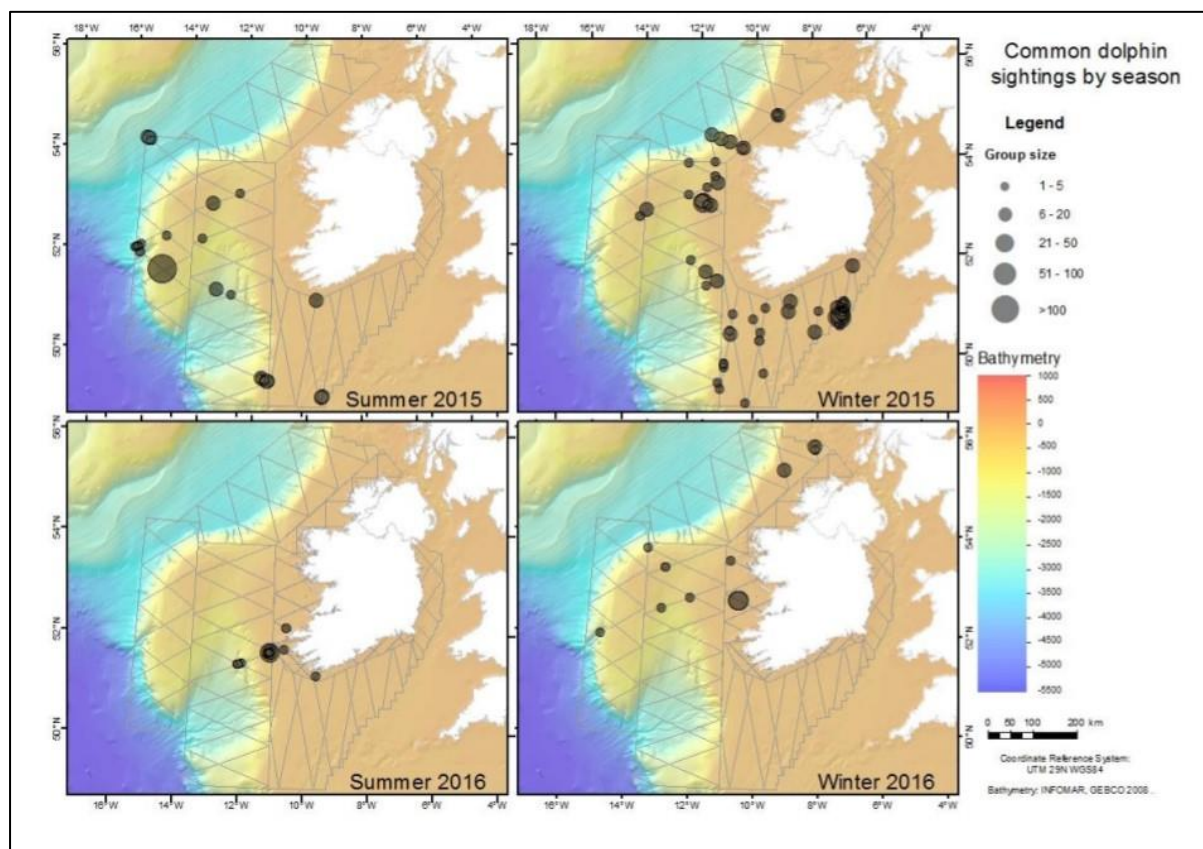


Figure 4.10 Seasonal common dolphin sightings from the ObSERVE surveys from 2015-2016 (Rogan et al. 2018).

## 4.6 JCP

### 4.6.1 JCP Phase III

Paxton et al. (2016) produced predicted common dolphin densities for summer 2010 (Figure 4.11). The upper limit predicted densities reported a high density of common dolphins in proximity to the Project offshore development site (Figure 4.11; bottom right). Data from all years of summer data for common dolphins concluded a moderate density of common dolphins in proximity to the Project site (Figure 4.11; top left). Common dolphins were estimated to have the highest abundances in the Atlantic Array area in Autumn with an abundance of 33,120 individuals (1.69 dolphins/km<sup>2</sup>), and a lowest abundance of 2,430 dolphins during the Winter (0.12 dolphins/km<sup>2</sup>), suggesting that seasonal variation is present for this species within the area (Table 8) (Paxton et al. 2016).

Table 8 JCP Phase III density estimate for common dolphins in 2010 for the Atlantic Array area of commercial interest (Paxton et al. 2016).

| Season | Abundance | 95% CI          | Density (#/km <sup>2</sup> ) |
|--------|-----------|-----------------|------------------------------|
| Winter | 2,430     | 1,260 – 5,840   | 0.12                         |
| Spring | 6,260     | 2,720 – 16,260  | 0.32                         |
| Summer | 7,990     | 4,160 – 25,100  | 0.41                         |
| Autumn | 33,120    | 16,540 – 79,450 | 1.69                         |

|         |        |   |      |
|---------|--------|---|------|
| Average | 12,450 | - | 0.63 |
|---------|--------|---|------|

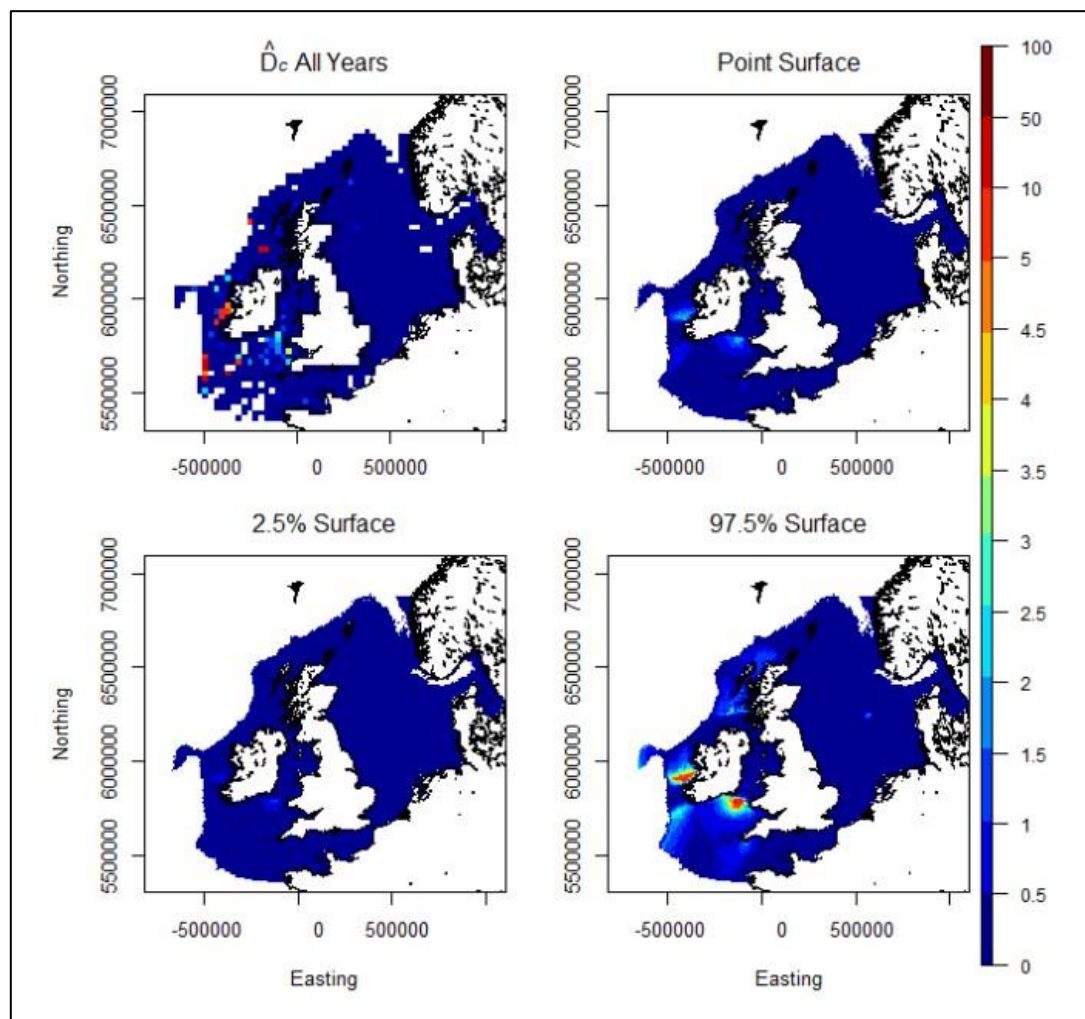


Figure 4.11 Predicted common dolphin densities for summer 2010 (Paxton et al. 2016). Top left; input densities (summer all years), top right; point estimate of cell densities, bottom left; lower (2.5%) confidence limit on cell densities, bottom right; upper (97.5%) confidence limit on cell densities (dolphins/km<sup>2</sup>). Note that the top left plot exaggerates the spatial coverage of the relevant effort.

#### 4.6.2 MERP surveys

Waggitt et al. (2020) produced distribution maps of common dolphins as part of the MERP project. Common dolphins are expected to be present in highest numbers along the continental shelf to the southwest of the UK. Densities in the Southern Irish Sea and southwest of England are relatively high in comparison to densities found in Scotland and the North Sea. The predicted density surfaces for common dolphins concluded a probable increase in density of common dolphins in proximity to the Project site during the summer months (Figure 4.12). However, as mentioned above, these density estimates are representative of relative density compared to other sites in the UK, but they are not considered to be suitable for use in quantitative impact assessments and as such, are provided for illustrative purposes only.

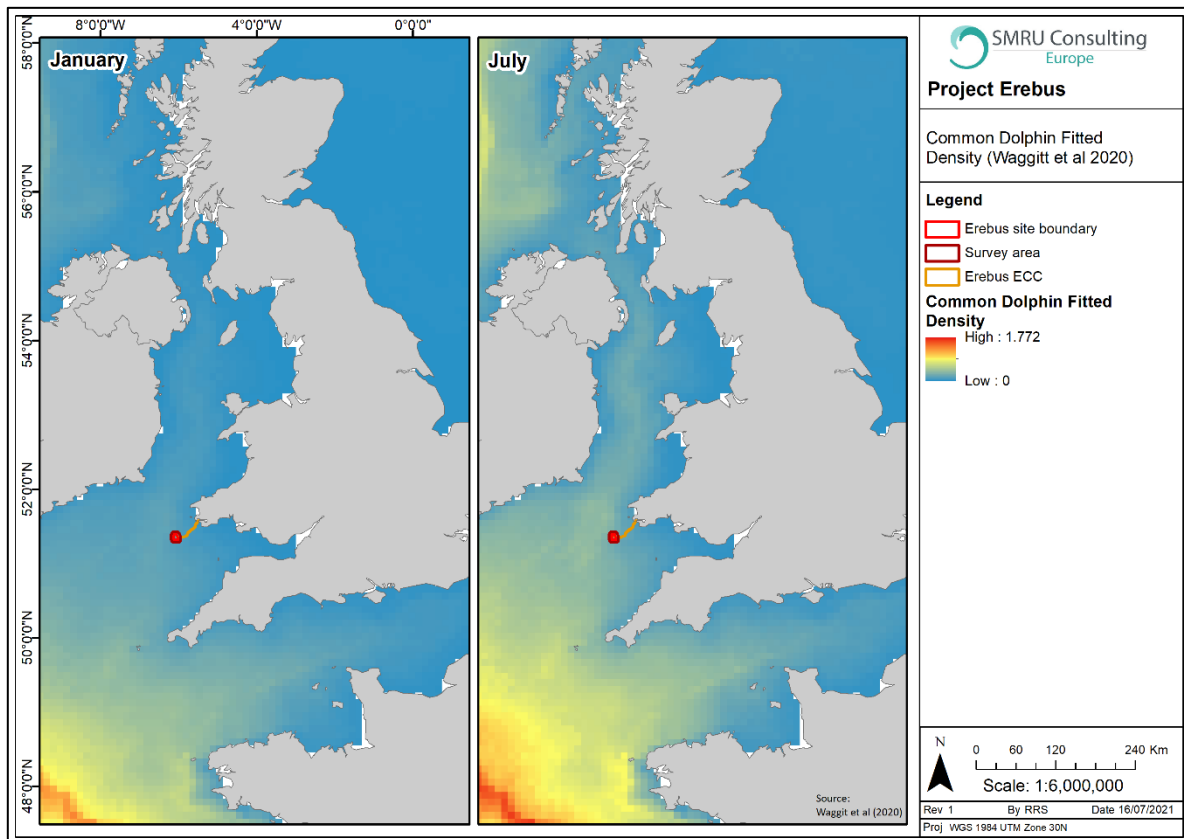


Figure 4.12 Spatial variation in predicted densities (dolphins/km<sup>2</sup>) for common dolphins in January and July in the North-East Atlantic (Waggitt et al. 2020). Values are provided at 10 km resolution.

#### 4.7 Sea Trust Wales

Sightings recorded by Sea Trust Wales were dominated by common dolphins. Of the 19,543 individual marine mammal sightings reported between 2005 and 2021, 97.24% of these were common dolphins (19,003 individuals). Common dolphins were sighted across all survey months (April-October), across the south Pembrokeshire area and both within and near the Project array area (Figure 4.13). No effort data was collected and as such, no density estimate can be calculated using this dataset. The data simply confirm the presence of common dolphins in the area in high numbers.

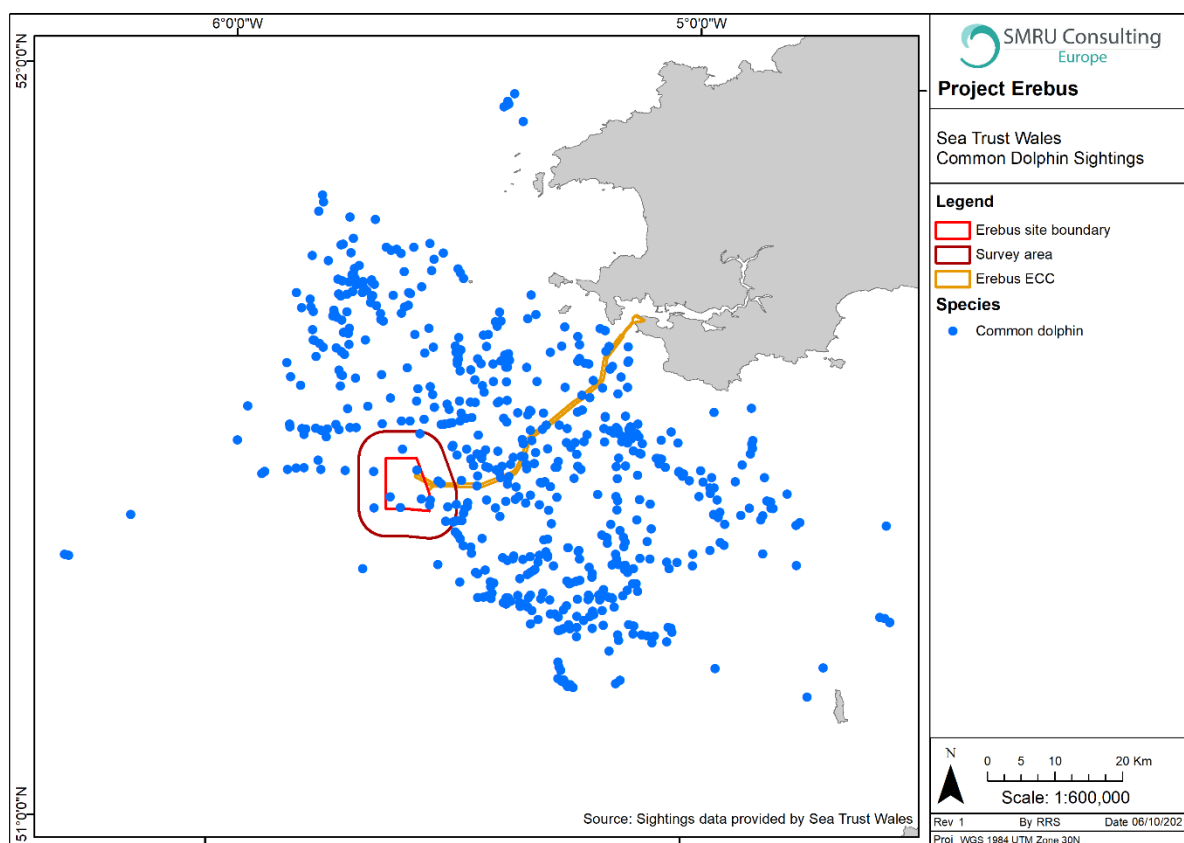


Figure 4.13 Common dolphin sightings recorded by the Sea Trust Wales (April-Oct, 2005-2021).

#### 4.8 Summary

Common dolphins have been found both in the grey and published literature to be present locally within the Project offshore wind development site and as such, are recommended to be included in future scoping work for this site. Density estimates for this species have been summarised (Table 9), with density estimates ranging from 0.044 dolphins/km<sup>2</sup> to 5.43 dolphins/km<sup>2</sup> in areas including the Project site. The ObSERVE density estimates are all taken from the western Irish Sea and are unlikely to be appropriate for the quantitative impact assessment as they do not necessarily represent densities at the Project site or further offshore.

SMRU Consulting recommends that the average corrected density estimate from the HiDef site-specific surveys (1.61 dolphins/km<sup>2</sup>) is taken forward in the quantitative impact assessment as it represents both the most recent and fine scale estimates for the area. It is acknowledged that marine mammal distribution and densities can vary considerably in the small scale between days. Therefore, the average density estimate across the 24 months of surveys is considered to be the most representative of the average number of common dolphins in the area. It would be highly over-precautionary to use the highest density estimate from the 24 months of surveys as this is not representative of the typical density in the area.

As shown in the marine mammal impact assessment chapter, the disturbance contours for pile driving extend far beyond the Survey Area. Therefore, while the density estimate of 1.61 dolphins/km<sup>2</sup> (obtained from the site-specific surveys) is appropriate to use for the portion of the impact contour that is within the Survey Area, it is not appropriate to assume that the density estimate across the whole contour is the same as within the survey area. For the portions of the impact contours that are located outside the survey area, a regional scale density estimate must be assumed. The impact

contours from pile driving are mainly located within SCANS III Block D (0.3743 dolphins/km<sup>2</sup>), with some portions of the contours extending into SCANS III Block E (0.0000 dolphins/km<sup>2</sup>) and ObSERVE Stratum 4 (0.170 dolphins/km<sup>2</sup>). Since the density estimate for SCANS III block D was the highest of these, it was assumed that all areas outside of the site-specific Survey Area should be assumed to have a density of 0.3743 dolphins/km<sup>2</sup>.

**Table 9 Common dolphin density estimates (dbe = design based estimate, mbe = model based estimate).**

| Source                      | Area                                   | Temporal     | Density Estimate (#/km <sup>2</sup> ) |
|-----------------------------|----------------------------------------|--------------|---------------------------------------|
| HiDef site-specific surveys | Project survey area                    | 2019-2020    | 1.61                                  |
| SCANS III block D           | Southern Celtic/Irish Seas             | Summer 2016  | 0.3743                                |
| ObSERVE (Stratum 4, dbe)    | Celtic Sea                             | Summer 2015  | 0.018                                 |
| ObSERVE (Stratum 4, dbe)    | Celtic Sea                             | Summer 2016  | 0                                     |
| ObSERVE (Stratum 4, dbe)    | Celtic sea                             | Winter 2015  | 0.262                                 |
| ObSERVE (Stratum 4, dbe)    | Celtic sea                             | Winter 2016  | 0                                     |
| ObSERVE (Stratum 4, mbe)    | Celtic sea                             | Summer 2015  | 0.044                                 |
| ObSERVE (Stratum 4, mbe)    | Celtic sea                             | Summer 2016  | 0                                     |
| ObSERVE (Stratum 4, mbe)    | Celtic sea                             | Winter 2015  | 0.637                                 |
| ObSERVE (Stratum 4, mbe)    | Celtic sea                             | Winter 2016  | 0                                     |
| Atlantic Array area         | Bristol Channel and adjacent Irish Sea | Winter 2010  | 0.12                                  |
| Atlantic Array area         | Bristol Channel and adjacent Irish Sea | Spring 2010  | 0.32                                  |
| Atlantic Array area         | Bristol Channel and adjacent Irish Sea | Summer 2010  | 0.41                                  |
| Atlantic Array area         | Bristol Channel and adjacent Irish Sea | Autumn 2010  | 1.69                                  |
| Atlantic Array area         | Bristol Channel and adjacent Irish Sea | Average 2010 | 0.63                                  |

## 5 Harbour porpoise

Harbour porpoises are a globally distributed species and can be found throughout the UK, typically in shallow waters (Table 10). There are three MU abundance estimates for harbour porpoise, one presented in IAMMWG (2015a) based on data from SCANS II (Hammond et al. 2006) and CODA (Hammond et al. 2009), revised estimates from the SCANS II and CODA data presented in Hammond et al. (2021) and updated estimates presented in IAMMWG (2021) based on data from SCANS III (Hammond et al. 2021) and ObSERVE (Rogan et al. 2018) (Table 10). While the latest abundance estimate for the Celtic and Irish Sea MU based on SCANS III and ObSERVE data is lower than that estimated based on the SCANS II and CODA data, the latest estimate is considerably more precise with a CV of 0.188 compared to 0.30. This species is listed as least concern on the IUCN red list; however, harbour porpoises are also listed in Annex II of the EU Habitats Directive, requiring the designation of SACs as a component of their conservation. There are currently 15 SACs designated for harbour porpoises within the Celtic and Irish Seas MU (Table 3), with the West Wales Marine SAC and Bristol Channel SAC being of closest proximity to the Project site.

**Table 10 Harbour porpoise management unit abundance estimates.**

| Management unit          | Abundance estimate<br>(IAMMWG 2015a) | Abundance estimate<br>(2015 revised) | Abundance estimate<br>(IAMMWG 2021) |
|--------------------------|--------------------------------------|--------------------------------------|-------------------------------------|
| North Sea                | 227,298 (0.13)                       | 369,560 (0.22)                       | 346,601 (0.09)                      |
| West Scotland            | 21,462 (0.42)                        | 24,435 (0.5)                         | 28,936 (0.16)                       |
| Celtic and Irish<br>Seas | 104,695 (0.32)                       | 98,807 (0.30)                        | 62,517 (0.13)                       |
| <b>Total</b>             | <b>353,455</b>                       | <b>492,802</b>                       | <b>438,054</b>                      |

### 5.1 General – Welsh Marine Atlas

Harbour porpoises have been recorded in Welsh waters since 1990 and are the most widespread and common species in Welsh waters (Baines and Evans 2012). This species is present year-round; however, harbour porpoises are not evenly distributed within the Irish Sea. Hotspots in proximity to the Project site include southern Cardigan Bay, Strumble Head, the west Pembrokeshire islands including Skomer and Ramsey, and in the Bristol Channel off the south coast of Wales (Baines and Evans 2012). Harbour porpoises had the highest number of sightings within the project database for this study, with 13,056 recorded sightings of this species and a total count of 35,700 individuals (Baines and Evans 2012).

Baines and Evans (2012) reported on the long-term (1990 - 2009) mean sightings rates of harbour porpoises from both vessel and aerial surveys (Figure 5.1), concluding an expected widespread distribution of this species throughout the study area, with high densities in the coastal waters of south Wales. This study also concluded that there is likely to be some seasonal variation occurring in relation to the distribution of harbour porpoises within the study area. Spatial maps of the long-term (1990 - 2009) quarterly mean sighting rates of harbour porpoises from vessel surveys indicate that this species has a large summer distribution (July to September) in the area, moving out of the area from January to March (Figure 5.2). Long-term quarterly mean sightings of harbour porpoises from aerial surveys report high abundances year-round, with the lowest abundances seen from April to June in the South Wales coastal areas (Figure 5.3).

While these data provide an overview of the general distribution of harbour porpoises in the Irish Sea, they do not provide density estimates.

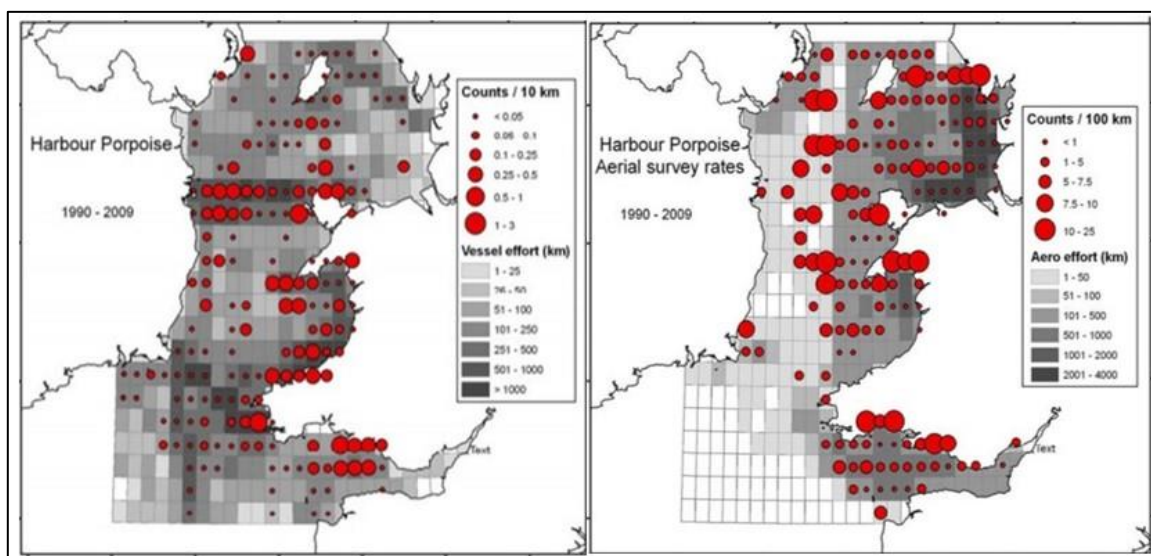


Figure 5.1 Long-term mean sighting rates (left: vessel counts per 10 km, right: aerial counts per 100 km) of harbour porpoises from 1990 – 2009 (Baines and Evans 2012).

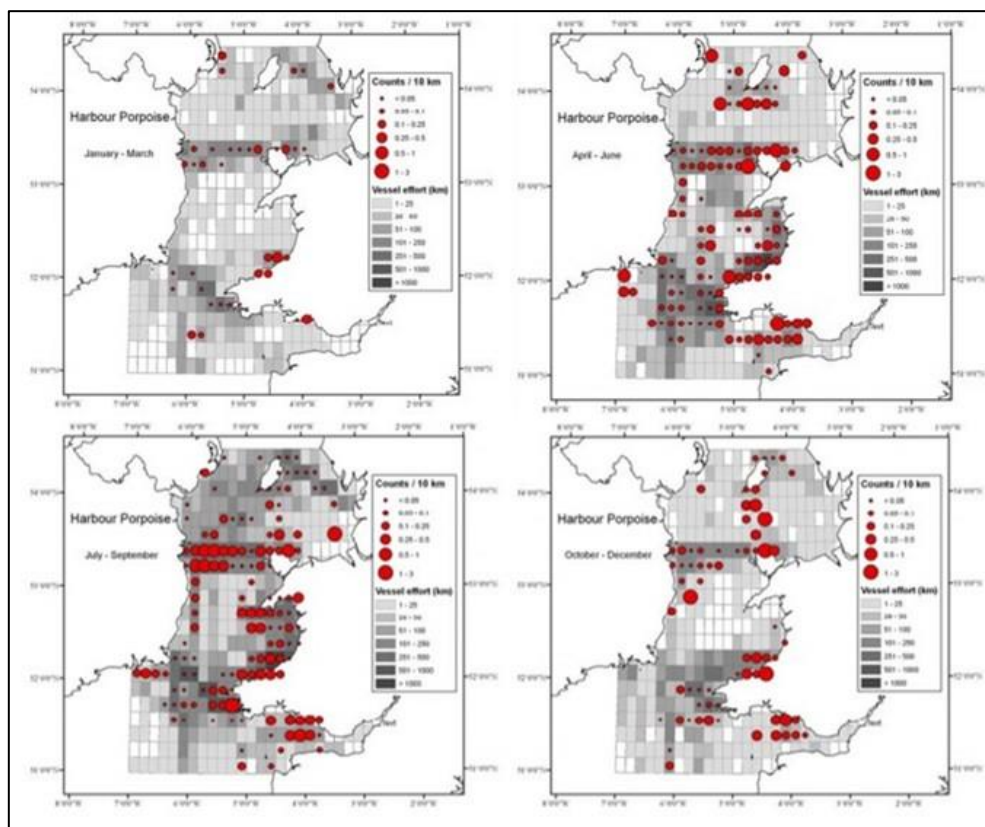


Figure 5.2 Long-term quarterly mean sighting rates of harbour porpoises from vessel surveys (Baines and Evans 2012).

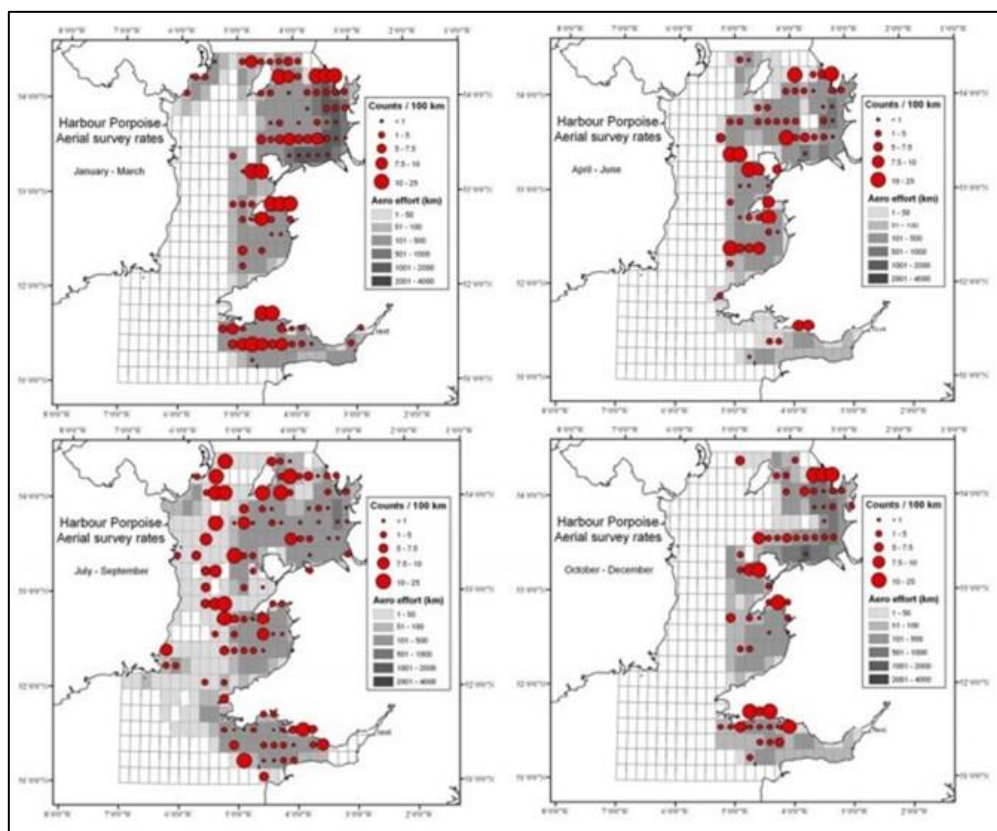


Figure 5.3 Long-term quarterly mean sighting rates of harbour porpoise from aerial surveys (Baines and Evans 2012).

## 5.2 Site-specific surveys

The HiDef surveys conducted on a monthly basis from October 2019 to September 2021 concluded that harbour porpoises were present in low numbers (HiDef Aerial Surveying Ltd 2020, 2021). In total, across the 24 surveys, only 83 sightings of harbour porpoises were reported. For each of the 24 surveys conducted, relative density estimates (porpoise/km<sup>2</sup>) were provided for harbour porpoise (Table 11) as well as figures to visualise the spatial distributions of this species (Figure 5.5). The relative abundance estimate for this species (within the survey area) reached 94 individuals, with a corresponding relative density estimate of 0.47 porpoises/km<sup>2</sup>. The average relative density estimate across the 24 surveys was 0.037 porpoise/km<sup>2</sup>.

These density estimates are relative densities, not absolute densities. This is because, while it can be assumed that there is no perception bias in the digital aerial surveys data (ie: no animals are missed by the observers), there is no correction for the availability bias (accounting for the fact that animals may be underwater and not available to be sighted). In order to correct the relative density estimates to obtain absolute density estimates, the proportion of the time the species spends underwater (and is unavailable for detection) needs to be accounted for. Unlike common dolphins, there is good telemetry tag data available for harbour porpoise that provides information of the proportion of time spent at different depths in the water column (Teilmann et al. 2013). Assuming that the depth above which animals are available for detection was 2 m, HiDef used the data provided in Teilmann et al. (2013) on the proportion of time spent in the surface 2 m of the water column to correct for the portion of animals below this depth that are assumed to be unavailable for detection. These adjusted density estimates are considered to be absolute densities and are presented in Table 12. The maximum absolute density estimate was 3.13 porpoises/km<sup>2</sup> and the average absolute density estimate across the 24 surveys was 0.4 porpoise/km<sup>2</sup>.

In the majority of cases for harbour porpoise the confidence in the identification was high, with 39% of the sightings classified as “definite” and 45% of the sightings classified as “probable”. Only a small percentage of the harbour porpoise sightings were classed as ‘possible’ (17%). Since it was not possible to identify the factors causing this variability, all detections identified as porpoise were treated as definite.

Harbour porpoise sightings occurred in sea states 1-5, with most sightings occurring in sea state 2 (30%), sea state 3 (15) or sea state 4 (35%).

**Table 11 Relative density and abundance estimates of harbour porpoises within the survey area of the HiDef surveys from October 2019 – September 2020 (HiDef Aerial Surveying Ltd 2020).**

| Survey                 | Date      | Raw count   | Density (#/km <sup>2</sup> ) | Abundance estimate | CV (%) | Lower CI | Upper CI |
|------------------------|-----------|-------------|------------------------------|--------------------|--------|----------|----------|
| 1                      | Oct 2019  | 0           | 0                            | 0                  | 0      | 0        | 0        |
| 2                      | Nov 2019  | 0           | 0                            | 0                  | 0      | 0        | 0        |
| 3                      | Dec 2019  | 1           | 0.02                         | 4                  | 94.98  | 0        | 12       |
| 4                      | Jan 2020  | 8           | 0.16                         | 32                 | 47.91  | 8        | 65       |
| 5                      | Feb 2020  | 0           | 0                            | 0                  | 0      | 0        | 0        |
| 6                      | Mar 2020  | 8           | 0.16                         | 32                 | 40.5   | 8        | 59       |
| 7                      | Apr 2020  | 0           | 0                            | 0                  | 0      | 0        | 0        |
| 8                      | Jun 2020  | 1           | 0.02                         | 4                  | 97.93  | 0        | 12       |
| 9                      | Jun 2020b | 0           | 0                            | 0                  | 0      | 0        | 0        |
| 10                     | Jul 2020  | 0           | 0                            | 0                  | 0      | 0        | 0        |
| 11                     | Aug 2020  | 4           | 0.08                         | 16                 | 66.02  | 0        | 39       |
| 12                     | Sep 2020  | 0           | 0                            | 0                  | 0      | 0        | 0        |
| <b>Year 1 average</b>  |           | <b>1.83</b> | <b>0.037</b>                 | <b>7.33</b>        | -      | -        | -        |
| 13                     | Oct 2020  | 8           | 0.15                         | 31                 | 82.45  | 0        | 87       |
| 14                     | Nov 2020  | 0           | 0                            | 0                  | 0      | 0        | 0        |
| 15                     | Dec 2020  | 2           | 0.02                         | 4                  | 94.74  | 0        | 12       |
| 16                     | Jan 2021  | 0           | 0                            | 0                  | 0      | 0        | 0        |
| 17                     | Feb 2021  | 23          | 0.45                         | 91                 | 24.31  | 50       | 135      |
| 18                     | Mar 2021  | 24          | 0.47                         | 94                 | 49.93  | 27       | 198      |
| 19                     | Apr 2021  | 2           | 0.04                         | 8                  | 96.67  | 0        | 24       |
| 20                     | May 2021  | 0           | 0                            | 0                  | 0      | 0        | 0        |
| 21                     | Jun 2021  | 2           | 0.04                         | 8                  | 93.08  | 0        | 24       |
| 22                     | Jul 2021  | 0           | 0                            | 0                  | 0      | 0        | 0        |
| 23                     | Aug 2021  | 0           | 0                            | 0                  | 0      | 0        | 0        |
| 24                     | Sep 2021  | 0           | 0                            | 0                  | 0      | 0        | 0        |
| <b>Year 2 average</b>  |           | <b>5.08</b> | <b>0.10</b>                  | <b>19.67</b>       | -      | -        | -        |
| <b>Overall average</b> |           | <b>3.46</b> | <b>0.07</b>                  | <b>13.50</b>       | -      | -        | -        |

**Table 12 Adjusted density and abundance estimates of harbour porpoises within the survey area of the HiDef surveys from October 2019 – September 2021 (HiDef Aerial Surveying Ltd 2020, 2021) (taking into account the number of animals that are estimated as being unavailable for detection).**

| Survey                 | Date      | Raw count   | Adjusted<br>(#/km <sup>2</sup> ) | Density | Abundance<br>estimate | Lower CI | Upper CI |
|------------------------|-----------|-------------|----------------------------------|---------|-----------------------|----------|----------|
| 1                      | Oct 2019  | 0           | 0                                |         | 0                     | 0        | 0        |
| 2                      | Nov 2019  | 0           | 0                                |         | 0                     | 0        | 0        |
| 3                      | Dec 2019  | 1           | 0.13                             |         | 26                    | 0        | 77       |
| 4                      | Jan 2020  | 8           | 0.9                              |         | 181                   | 45       | 379      |
| 5                      | Feb 2020  | 0           | 0                                |         | 0                     | 0        | 0        |
| 6                      | Mar 2020  | 8           | 0.82                             |         | 163                   | 41       | 301      |
| 7                      | Apr 2020  | 0           | 0                                |         | 0                     | 0        | 0        |
| 8                      | Jun 2020  | 1           | 0.11                             |         | 21                    | 0        | 64       |
| 9                      | Jun 2020b | 0           | 0                                |         | 0                     | 0        | 0        |
| 10                     | Jul 2020  | 0           | 0                                |         | 0                     | 0        | 0        |
| 11                     | Aug 2020  | 4           | 0.42                             |         | 84                    | 0        | 204      |
| 12                     | Sep 2020  | 0           | 0                                |         | 0                     | 0        | 0        |
| <b>Year 1 average</b>  |           | <b>1.83</b> | <b>0.20</b>                      |         | <b>39.58</b>          | -        | -        |
| 13                     | Oct 2020  | 8           | 1.07                             |         | 221                   | 0        | 590      |
| 14                     | Nov 2020  | 0           | 0                                |         | 0                     | 0        | 0        |
| 15                     | Dec 2020  | 2           | 0.13                             |         | 26                    | 0        | 77       |
| 16                     | Jan 2021  | 0           | 0                                |         | 0                     | 0        | 0        |
| 17                     | Feb 2021  | 23          | 3.13                             |         | 633                   | 341      | 940      |
| 18                     | Mar 2021  | 24          | 2.4                              |         | 485                   | 138      | 1020     |
| 19                     | Apr 2021  | 2           | 0.17                             |         | 34                    | 0        | 103      |
| 20                     | May 2021  | 0           | 0                                |         | 0                     | 0        | 0        |
| 21                     | Jun 2021  | 2           | 0.21                             |         | 43                    | 0        | 128      |
| 22                     | Jul 2021  | 0           | 0                                |         | 0                     | 0        | 0        |
| 23                     | Aug 2021  | 0           | 0                                |         | 0                     | 0        | 0        |
| 24                     | Sep 2021  | 0           | 0                                |         | 0                     | 0        | 0        |
| <b>Year 2 average</b>  |           | <b>5.08</b> | <b>0.59</b>                      |         | <b>120.17</b>         | -        | -        |
| <b>Overall average</b> |           | <b>3.46</b> | <b>0.40</b>                      |         | <b>79.88</b>          | -        | -        |

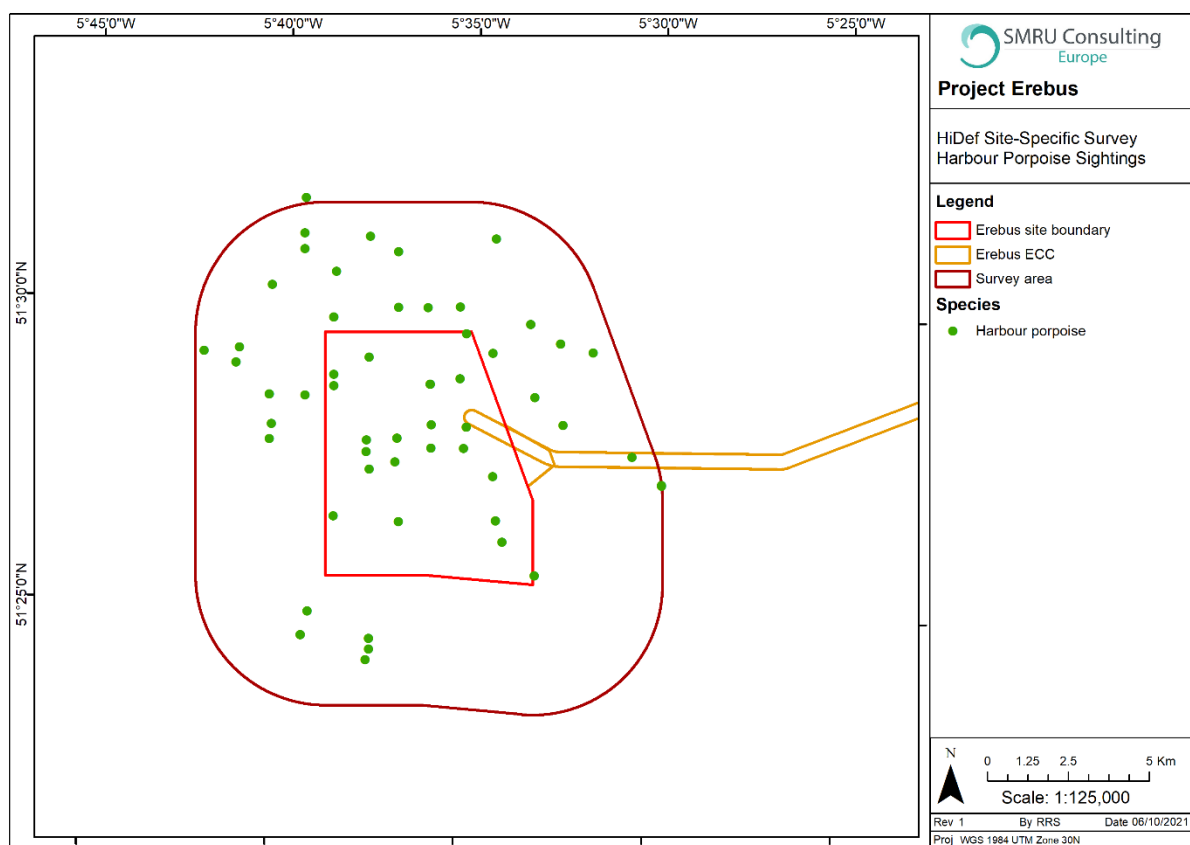


Figure 5.4 Harbour porpoise sightings recorded during the HiDef surveys.



Figure 5.5 Harbour porpoise densities (porpoises/km<sup>2</sup>) and number of detections per segment across the survey area of the HiDef surveys from October 2019 - September 2020 (HiDef Aerial Surveying Ltd 2020).

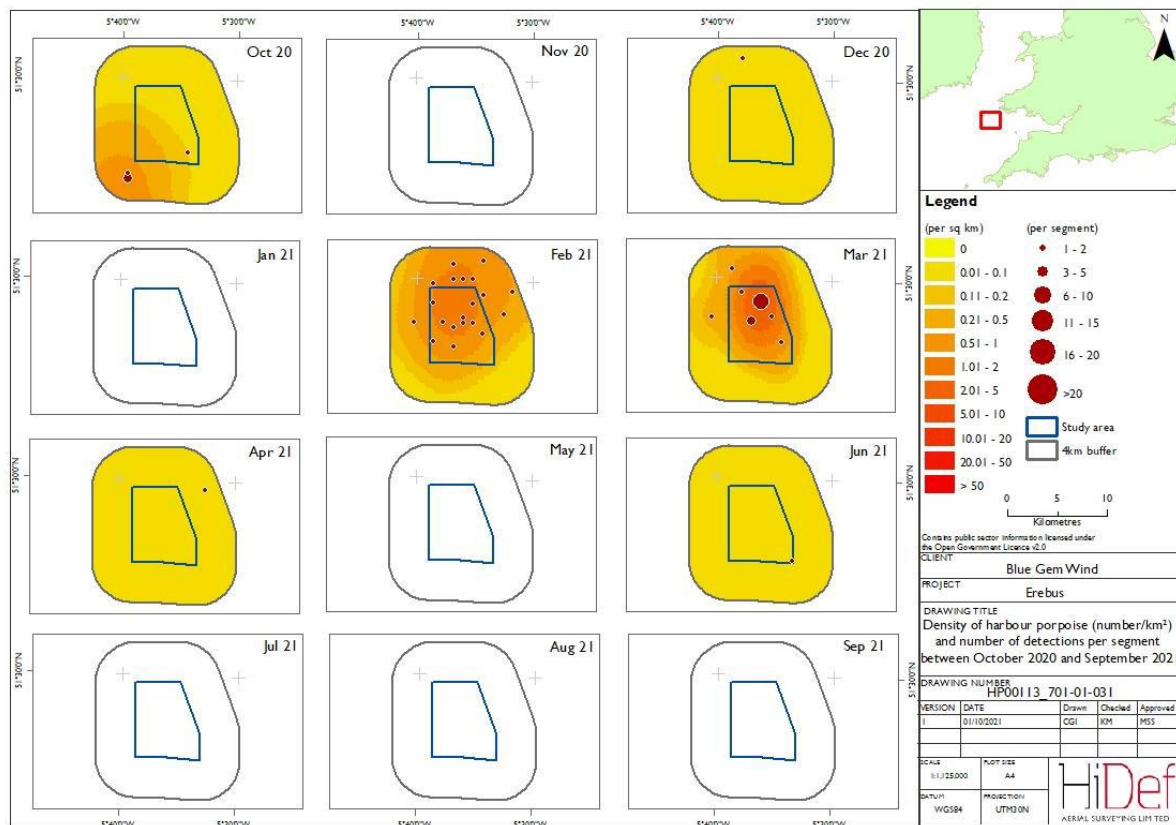


**Figure 5.6 Harbour porpoise densities (porpoises/km<sup>2</sup>) and number of detections per segment across the survey area of the HiDef surveys from October 2020 - September 2021 (HiDef Aerial Surveying Ltd 2021).**

### 5.3 Project Valorous surveys

Harbour porpoise have been recorded in each of the first three APEM surveys conducted at Project Valorous. Of the 182 marine mammal sightings over these three months, 8 porpoise were sighted (4.4% of the total marine mammal sightings). In addition to this, there were 37 sightings of unknown dolphin/porpoise.

### 5.4 SCANS III

During the SCANS III survey (Hammond et al. 2021), effort was conducted in 2016 in survey block D (which covered the Southern Celtic/Irish Seas and where the Project site is located) using aerial survey techniques. Within survey block D, harbour porpoise were sighted in the Bristol Channel as well as in more offshore waters (Figure 5.7). Results from this survey concluded that harbour porpoises in block D had an estimated abundance of 5,734 individuals (95% CI: 1,697 - 12,452). Density estimates for block D were concluded to be 0.118 porpoise/km<sup>2</sup>.

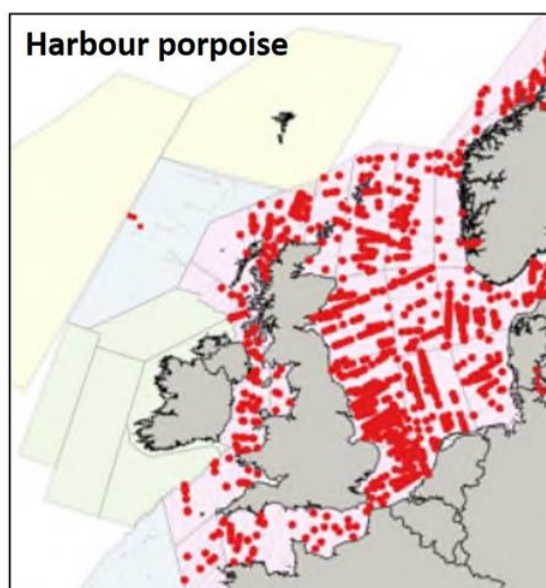


Figure 5.7 Harbour porpoise sightings from the SCANS III survey (Hammond et al. 2017, Hammond et al. 2021) .

## 5.5 ObSERVE

Across both ObSERVE survey years (2015 and 2016), there were a total of 296 harbour porpoise sightings across all of the survey areas (Rogan et al. 2018). These sightings were primarily in neritic waters across the continental shelf and Irish sea (Figure 5.8). In relation to the location of the Project site, no survey stratum directly overlap with the site; however, Stratum 4 and 5 are within the closest proximity (approximately 50 km at the closest point) to the Project site.

The majority of sightings during these surveys were recorded as single individuals, with a mean group size of harbour porpoises in the winter at 1.7 individuals, which was higher than the mean group size of individuals in the summer at 1.3 individuals (Rogan et al. 2018). The ObSERVE surveys also concluded that the estimated abundances for harbour porpoises was higher in the summer surveys (Season 1 and 3) than in the winter surveys (Season 2 and 4). Within survey Stratum 4 and 5, which are in closest proximity to the Project site, the harbour porpoise density estimate was highest in the summer (Figure 5.9). Estimated summer densities reached 0.227 and 0.222 porpoise/km<sup>2</sup> for design-based and model-based density estimates respectively for Stratum 4 (Table 13). Stratum 5 was estimated at 1.046 and 0.942 porpoise/km<sup>2</sup> for design-based and model-based density estimates respectively (Table 13). Harbour porpoises were not sighted in Stratum 4 during the second winter survey (Season 4).

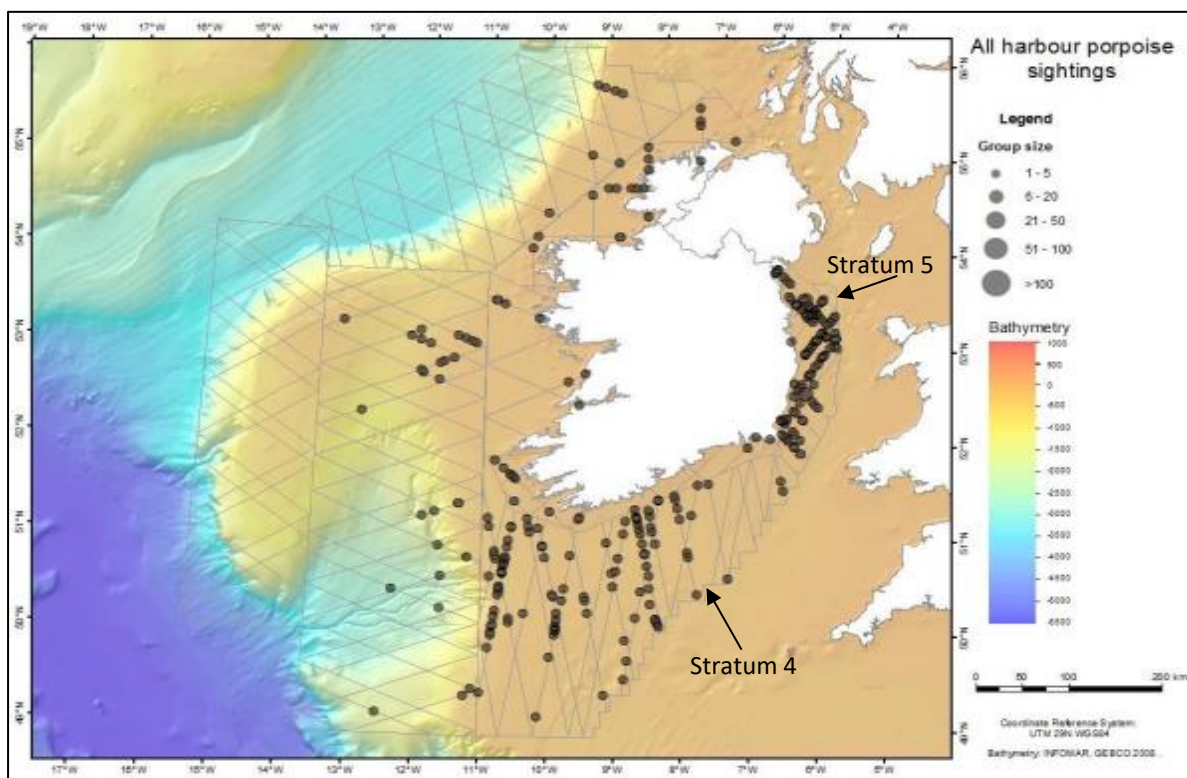


Figure 5.8 All harbour porpoise sightings from the ObSERVE surveys from 2015 - 2016 (Rogan et al. 2018).

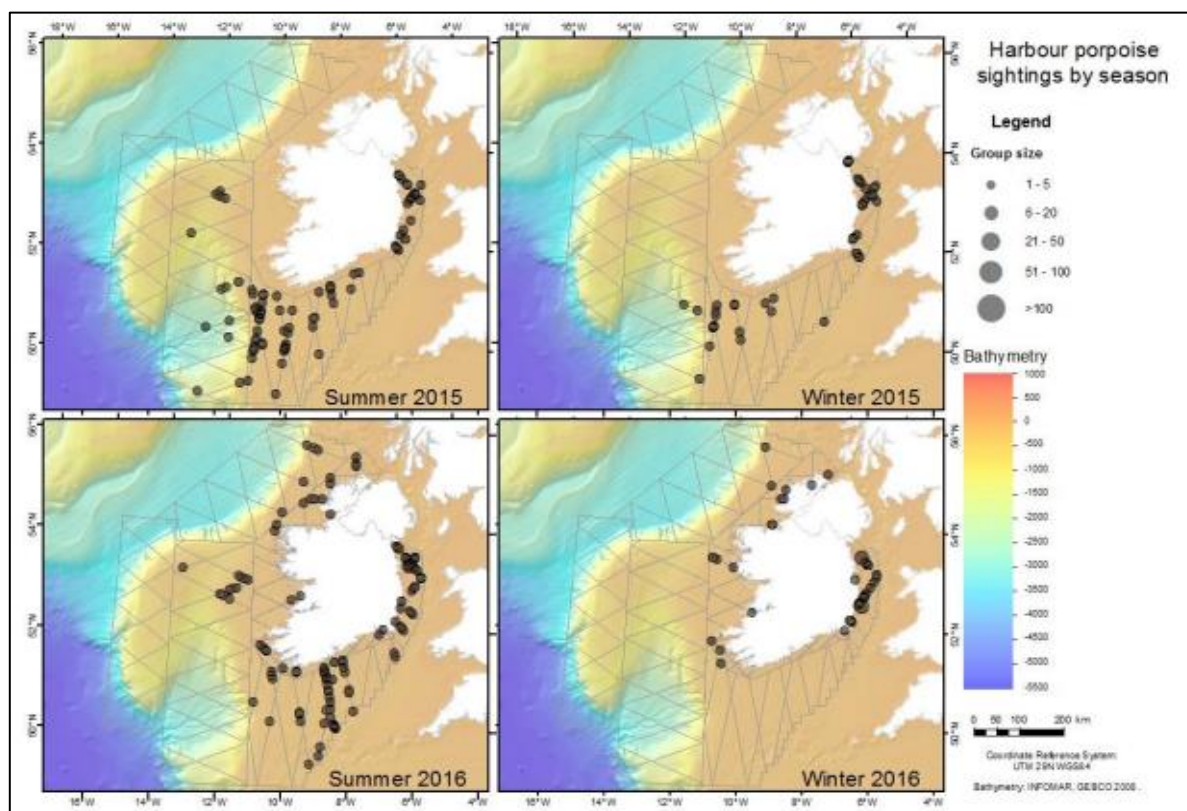


Figure 5.9 Seasonal harbour porpoise sightings from the ObSERVE surveys from 2015 - 2016 (Rogan et al. 2018).

**Table 13 Harbour porpoise design-based and model-based density (#/km<sup>2</sup>) and abundance estimates for Stratum 4 and 5 of the ObSERVE surveys (Rogan et al. 2018).**

| Stratum | Season      | Corrected design-based estimates |           |          |          | Corrected model-based estimates |           |          |          |
|---------|-------------|----------------------------------|-----------|----------|----------|---------------------------------|-----------|----------|----------|
|         |             | Density                          | Abundance | Lower CI | Upper CI | Density                         | Abundance | Lower CI | Upper CI |
| S4      | Summer 2015 | 0.227                            | 14,189    | 10,791   | 18,658   | 0.205                           | 12,810    | 8,114    | 20,223   |
| S4      | Winter 2015 | 0.060                            | 3,752     | 2,345    | 6,002    | NA                              |           |          |          |
| S4      | Summer 2016 | 0.227                            | 14,195    | 9,362    | 21,524   | 0.222                           | 13,921    | 10,045   | 19,291   |
| S4      | Winter 2016 | NA                               |           |          |          |                                 |           |          |          |
| S5      | Summer 2015 | 0.696                            | 7,734     | 5,247    | 11,398   | 0.675                           | 7,495     | 4,789    | 11,729   |
| S5      | Winter 2015 | 0.867                            | 9,636     | 5,633    | 16,482   | NA                              |           |          |          |
| S5      | Summer 2016 | 1.046                            | 11,624    | 8,725    | 15,486   | 0.942                           | 10,466    | 7,923    | 13,816   |
| S5      | Winter 2016 | 0.924                            | 10,263    | 7,555    | 13,942   | NA                              |           |          |          |

## 5.6 JCP

### 5.6.1 JCP Phase III

Paxton et al. (2016) produced predicted harbour porpoise densities for summer 2010 (Figure 5.10). Data from all years of summer data for harbour porpoises concluded relatively low densities of harbour porpoise in proximity to the Project site (Figure 5.10; top left). Density estimates varied between seasons, but not significantly, with density estimates ranging between 0.31 and 0.44 porpoise/km<sup>2</sup> within the Atlantic Array area of commercial interest (Table 8).

**Table 14 JCP Phase III density estimate for harbour porpoise in 2010 for the Atlantic Array area of commercial interest (Paxton et al. 2016).**

| Season         | Abundance    | 95% CI         | Density (#/km <sup>2</sup> ) |
|----------------|--------------|----------------|------------------------------|
| Winter         | 8,500        | 5,100 – 12,800 | 0.43                         |
| Spring         | 7,100        | 4,300 – 12,700 | 0.36                         |
| Summer         | 8,600        | 5,600 – 13,300 | 0.44                         |
| Autumn         | 6,000        | 4,100 – 9,900  | 0.31                         |
| <b>Average</b> | <b>7,550</b> | -              | <b>0.38</b>                  |

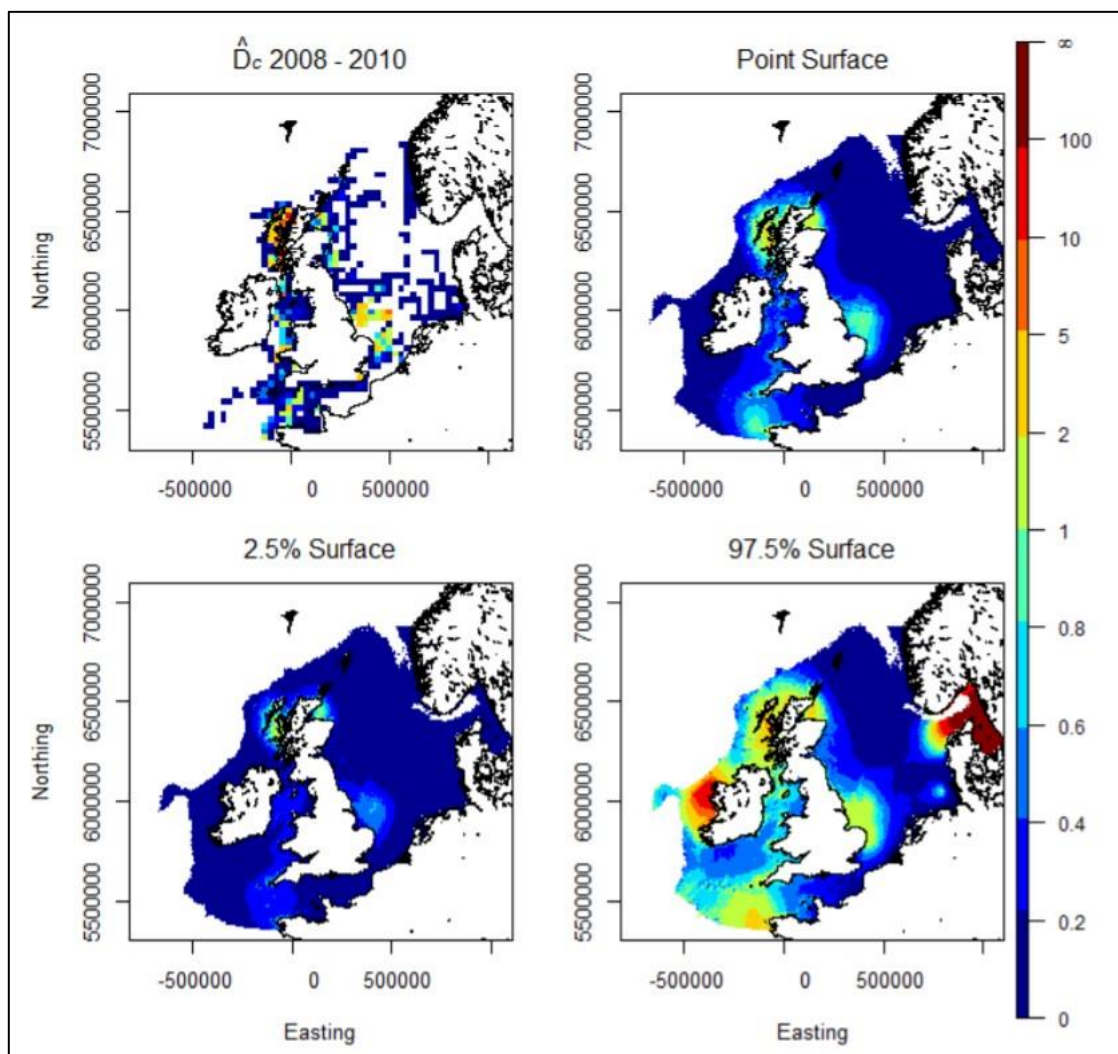


Figure 5.10 Predicted harbour porpoise densities for summer 2010 (Paxton et al. 2016). Top left; input densities (summer all years), top right; point estimate of cell densities, bottom left; lower (2.5%) confidence limit on cell densities, bottom right; upper (97.5%) confidence limit on cell densities (dolphins/km<sup>2</sup>). Note that the top left plot exaggerates the spatial coverage of the relevant effort.

### 5.6.2 JCP III data tool

The JCP data tool estimates that within the user specified area (Figure 3.6), the density of harbour porpoise (averaged for summer 2007-2010 and scaled to the SCANS III estimates) is 0.198 porpoise/km<sup>2</sup> (Table 15). This is lower than the density estimates obtained for the Atlantic Array area of commercial interest by the JCP Phase III analysis (summer 2010 estimate 0.44 porpoise/km<sup>2</sup>); however, this is unsurprising since there is a large amount of inter-annual variation in the JCP dataset (see section 5.6.4 for more detail). As such, the density estimate averaged across 2007 - 2020 is expected to differ to that from 2010 alone.

**Table 15 JCP Data Tool abundance and density estimate of the user specified area.**

|           | Point estimate | lower | Upper |
|-----------|----------------|-------|-------|
| Abundance | 655            | 341   | 812   |
| Density   | 0.198          | 0.103 | 0.246 |

### 5.6.3 MERP surveys

Density maps were produced by Waggitt et al. (2020) as part of the MERP project, however, these maps are for illustrative purposes only as they are not considered to be suitable for quantitative impact assessments. Harbour porpoise density in the Irish Sea and Southwest England was low in comparison to the North Sea. Harbour porpoises were found to have a higher predicted density in the eastern Atlantic during the summer months (July; Figure 5.11; right panel), compared to the winter months (January; Figure 5.11; left panel). However, harbour porpoise predicted densities remain consistently higher in the North Sea region in comparison to the east Atlantic year-round, with relatively moderate predicted densities in proximity to the Project site (Figure 5.11).

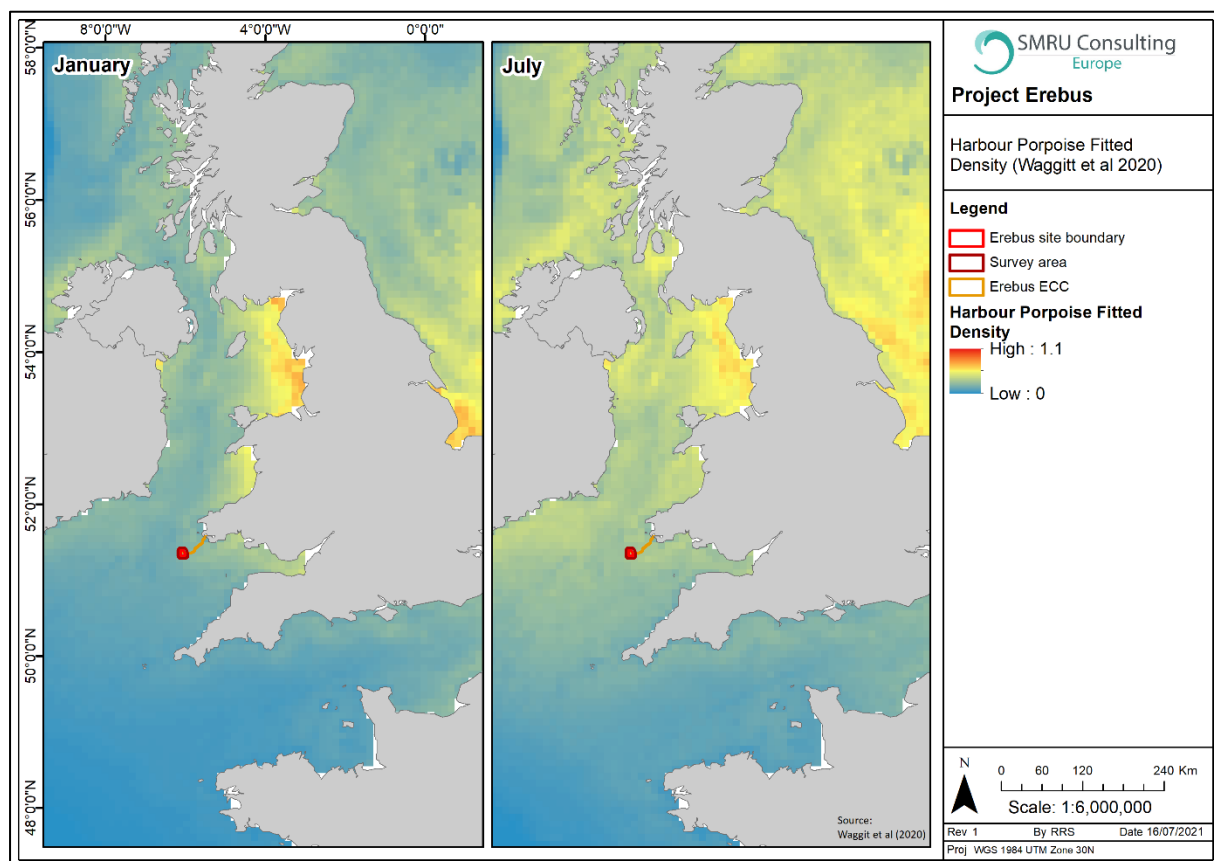


**Figure 5.11 Spatial variation in predicted densities (porpoises/km<sup>2</sup>) for harbour porpoises in January and July in the North-East Atlantic (Waggitt et al. 2020). Values are provided at a 10 km resolution.**

#### 5.6.4 Heinänen & Skov

Discrete and persistent areas of relatively high harbour porpoise densities in the wider UK marine area were identified by Heinänen and Skov (2015) through the use of detailed analyses of 18 year of survey data as part of the JCP. Results from these surveys concluded a higher winter predicted density within the Project site location (Figure 5.12) compared to summer (Figure 5.13), though there was significant inter-annual variation in the winter densities for the area. Harbour porpoises were not predicted to be present in high densities at the Project site location with a result of  $<0.3$  porpoises/km<sup>2</sup> in 2009 for the summer months, a relatively low number in comparison to a predicted density of up to 2.1 - 2.4 porpoises/km<sup>2</sup> at this location in the winter (Heinänen and Skov 2015). This would suggest that seasonal variation may be present at the Project offshore wind development site for harbour porpoise densities.

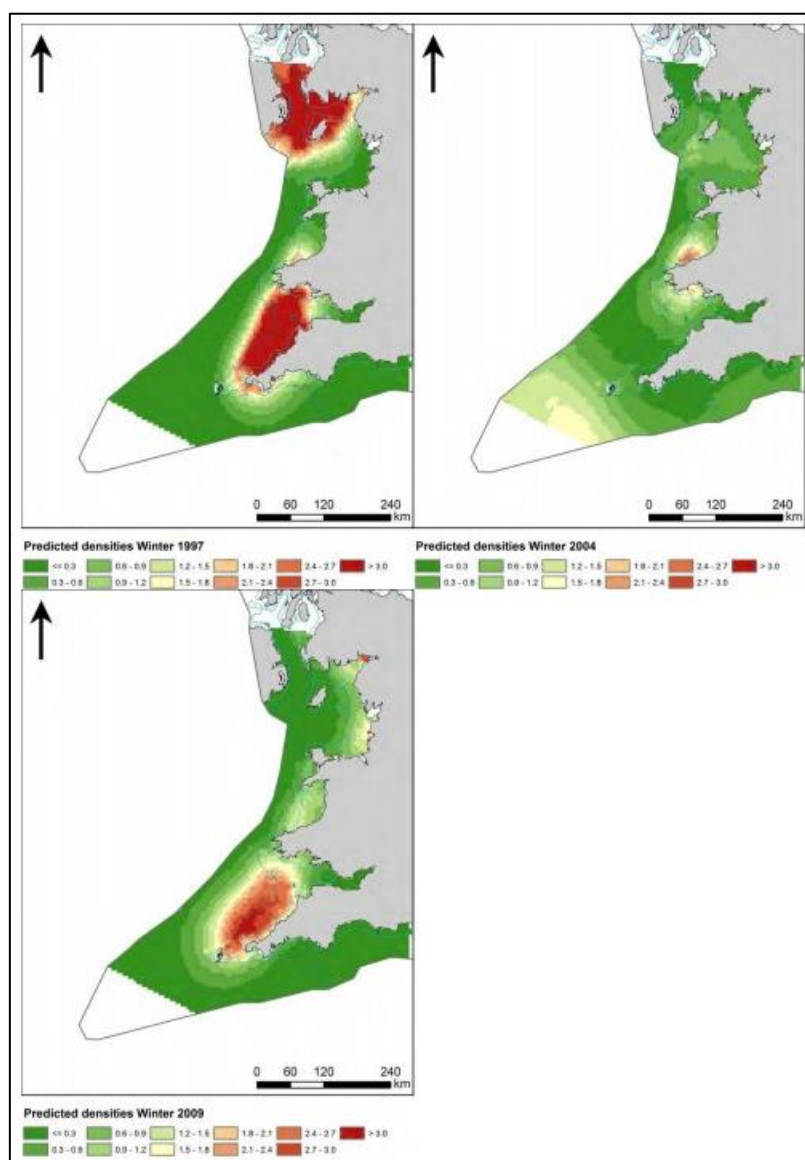


Figure 5.12 Harbour porpoise predicted densities (porpoise/km<sup>2</sup>) during winter for management unit 0 for three different years in each model period (Heinänen and Skov 2015).

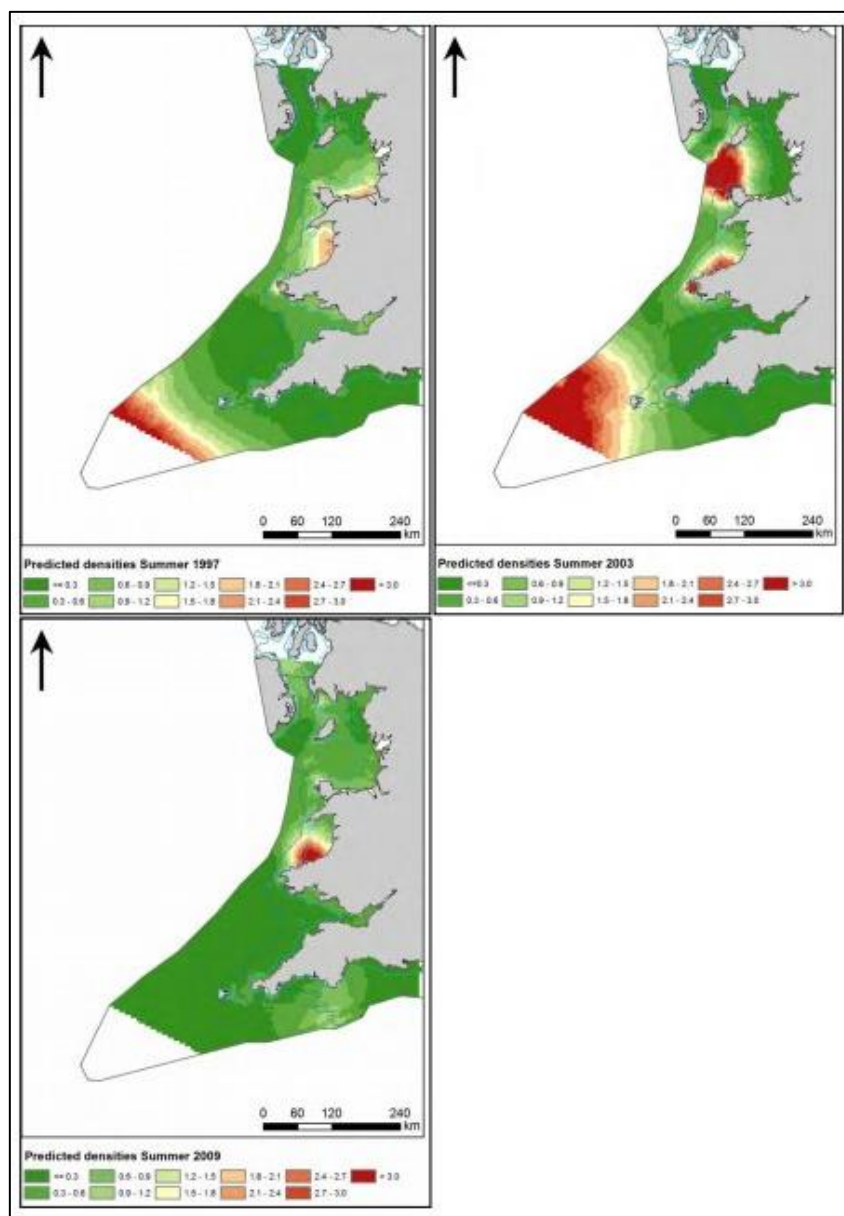


Figure 5.13 Harbour porpoise predicted densities (porpoise/km<sup>2</sup>) during summer for management unit 0 for three different years in each model period (Heinänen and Skov 2015).

## 5.7 Sea Trust Wales

Of the 19,543 individual marine mammal sightings reported between 2005 and 2021, 1.68% of these were harbour porpoise (328 individuals). Harbour porpoise were sighted across all survey months (April to October), across the south Pembrokeshire area (Figure 5.14). No effort data was collected and as such, no density estimate can be calculated using this dataset. The data simply confirm the presence of harbour porpoise in the area, though in low numbers compared to common dolphins.

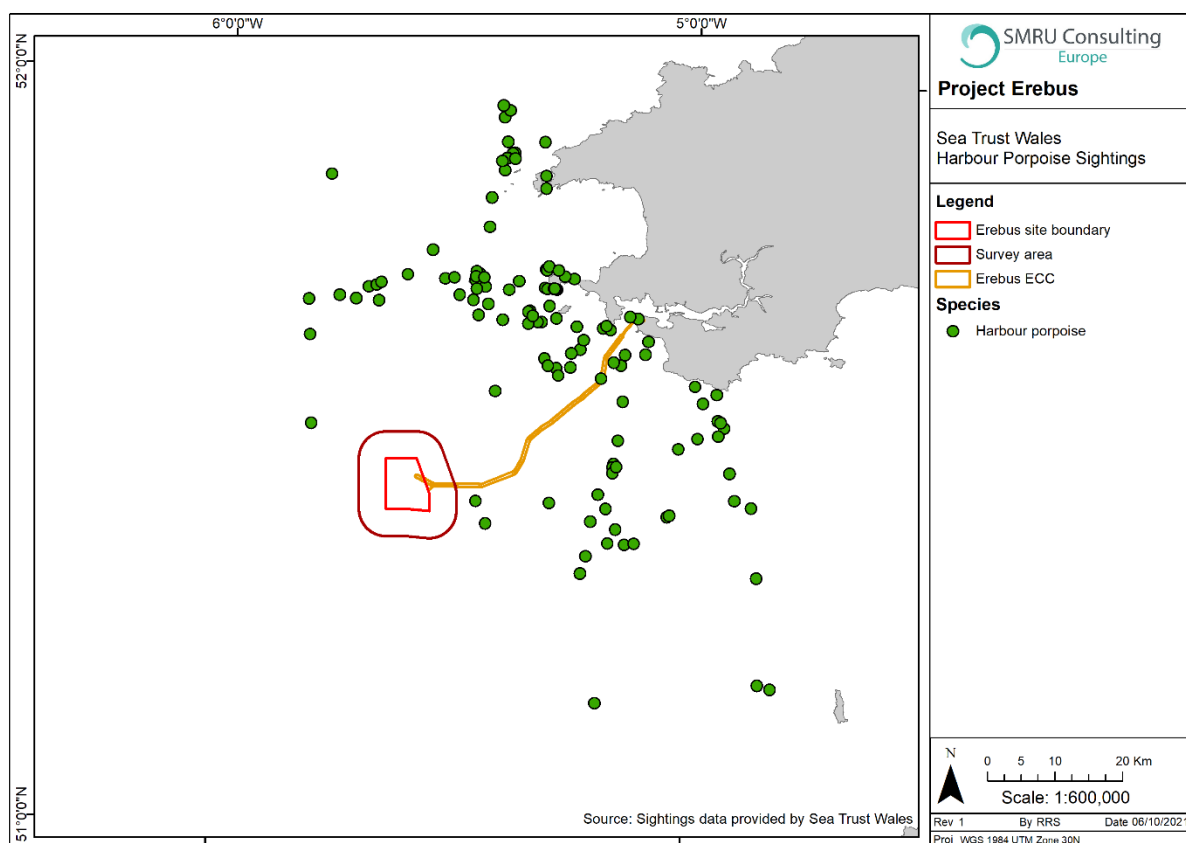


**Figure 5.14 Harbour porpoise sightings recorded by the Sea Trust Wales (April-Oct, 2005-2021).**

## 5.8 Summary

Density estimates obtained for harbour porpoises from the grey and published literature may vary by over an order of magnitude, from 0.016 porpoises/km<sup>2</sup> to >2 porpoises/km<sup>2</sup> (Table 16). Site-specific surveys for the Project conclude an average density of 0.037 porpoises/km<sup>2</sup>. Similar to common dolphins, the densities reported from the ObSERVE surveys are taken from the western Irish Sea and are do not necessarily represent the densities likely to be present at the Project site given the distance of the site from the survey locations. The Heinänen and Skov (2015) analysis suggests that harbour porpoise density in the area differs by season, with higher densities in the winter (though the data are highly variable) and, as such, summer only density estimates (such as SCANS III) may not be the most appropriate.

SMRU Consulting recommends that the average absolute density estimate from the HiDef site-specific surveys (0.4 porpoise/km<sup>2</sup>) is taken forward in the quantitative impact assessment as it represents both the most recent and fine scale estimates for the area. It is acknowledged that marine mammal distribution and densities can vary considerably in the small scale between days. Therefore, the average density estimate across the 24 months of surveys is considered to be the most representative of the average number of harbour porpoise in the area. It would be highly over-precautionary to use the highest density estimate from the 24 months of surveys as this is not representative of the typical density in the area.

As shown in the marine mammal impact assessment chapter, the disturbance contours for pile driving extend far beyond the Survey Area. However, other density estimates in the general Bristol Channel and adjacent Irish Sea area are similar (0.31-0.44 porpoise/km<sup>2</sup>) and therefore in this case, the density

estimate of 0.4 porpoise/km<sup>2</sup> is considered to be appropriate to apply to the entire impact range, and not just the site specific Survey Area.

**Table 16 Harbour porpoise density estimates (dbe = design based estimate, mbe = model based estimate).**

| Source                             | Area                                   | Temporal         | Density (#/km <sup>2</sup> ) |
|------------------------------------|----------------------------------------|------------------|------------------------------|
| <b>HiDef site-specific surveys</b> | <b>Project survey area</b>             | <b>2019-2020</b> | <b>0.4</b>                   |
| SCANS III block D                  | Southern Celtic/Irish Seas             | Summer 2016      | 0.118                        |
| ObSERVE (Stratum 4, dbe)           | Celtic Sea                             | Summer 2015      | 0.227                        |
| ObSERVE (Stratum 4, dbe)           | Celtic Sea                             | Summer 2016      | 0.227                        |
| ObSERVE (Stratum 4, dbe)           | Celtic Sea                             | Winter 2015      | 0.060                        |
| ObSERVE (Stratum 4, dbe)           | Celtic Sea                             | Winter 2016      | 0                            |
| ObSERVE (Stratum 4, mbe)           | Celtic Sea                             | Summer 2015      | 0.205                        |
| ObSERVE (Stratum 4, mbe)           | Celtic Sea                             | Summer 2016      | 0.222                        |
| ObSERVE (Stratum 4, mbe)           | Celtic Sea                             | Winter 2015      | 0                            |
| ObSERVE (Stratum 4, mbe)           | Celtic Sea                             | Winter 2016      | 0                            |
| ObSERVE (Stratum 5, dbe)           | East RoI                               | Summer 2015      | 0.696                        |
| ObSERVE (Stratum 5, dbe)           | East RoI                               | Summer 2016      | 1.046                        |
| ObSERVE (Stratum 5, dbe)           | East RoI                               | Winter 2015      | 0.867                        |
| ObSERVE (Stratum 5, dbe)           | East RoI                               | Winter 2016      | 0.924                        |
| ObSERVE (Stratum 5, mbe)           | East RoI                               | Summer 2015      | 0.675                        |
| ObSERVE (Stratum 5, mbe)           | East RoI                               | Summer 2016      | 0.942                        |
| ObSERVE (Stratum 5, mbe)           | East RoI                               | Winter 2015      | 0                            |
| ObSERVE (Stratum 5, mbe)           | East RoI                               | Winter 2016      | 0                            |
| Atlantic Array area                | Bristol Channel and adjacent Irish Sea | Winter 2010      | 0.43                         |
| Atlantic Array area                | Bristol Channel and adjacent Irish Sea | Spring 2010      | 0.36                         |
| Atlantic Array area                | Bristol Channel and adjacent Irish Sea | Summer 2010      | 0.44                         |
| Atlantic Array area                | Bristol Channel and adjacent Irish Sea | Autumn 2010      | 0.31                         |
| Atlantic Array area                | Bristol Channel & adjacent Irish Sea   | Average 2010     | 0.38                         |
| Heinanen & Skov                    | Project area                           | Summer           | <0.3                         |
| Heinanen & Skov                    | Project area                           | Winter           | 2.1 - 2.4                    |
| JCP Data Tool                      | User specified area                    | Summer 2010      | 0.198                        |

## 6 Bottlenose dolphin

Bottlenose dolphins are a worldwide species and are classified as a priority species under the UK Post-2010 Biodiversity Framework, as well as listed as Least Concern on the IUCN red list. Bottlenose dolphins are also listed under Annex II of the EU Habitats Directive and as such, SACs must be assigned to aid in the protection of this species. There are currently two bottlenose dolphin SACs in the Irish

Sea, including the Llyn Peninsula and the Sarnau SAC and the Cardigan Bay SAC. While the Project is not within the Irish Sea MU, given the ranging patterns of bottlenose dolphins it is important to consider the potential for connectivity between the Project site and these SACs.

### 6.1 General – Welsh Marine Atlas

Bottlenose dolphins are frequently recorded in Welsh waters, with a predominantly coastal distribution and lower densities recorded in more offshore areas such as St. Georges Channel (Baines and Evans 2012). High densities of this species have been recorded in areas including Cardigan Bay and Tremadog Bay. Bottlenose dolphins are the second-most frequently recorded marine mammal species by surveys in the area, with a total of 10,236 sightings in the project database for this study and a count of 33,683 individuals (Baines and Evans 2012).

Baines and Evans (2012) reported on the long-term (1990 - 2009) mean sighting rates of bottlenose dolphins from both vessel and aerial surveys (Figure 6.1). Vessel surveys concluded that bottlenose dolphins are reported in small numbers in proximity to the Project site (Figure 6.1; left panel). Aerial surveys also reported small abundances of bottlenose dolphins near the Project site, however it is important to note that survey effort was relatively low in this section of the study area (Figure 6.1; right panel).

Bottlenose dolphins were reported to have some seasonal variation in their distributions across the study area. The long-term (1990 - 2009) quarterly mean sighting rates of bottlenose dolphins from vessel surveys was reported to be at a peak during the summer months, with highest abundances of bottlenose dolphins in proximity to the Project site from April – June (Figure 6.2). In contrast, the long-term (1990 - 2009) quarterly aerial surveys reported relatively low abundances of bottlenose dolphins year-round, with dolphins present in proximity to the Project site from October - December (Figure 6.3). It is important to note that there was a reduced aerial survey effort in the section of the study area in the vicinity of the Project site.

While these data provide an overview of the general distribution of bottlenose dolphins in the Irish Sea, they do not provide density estimates.

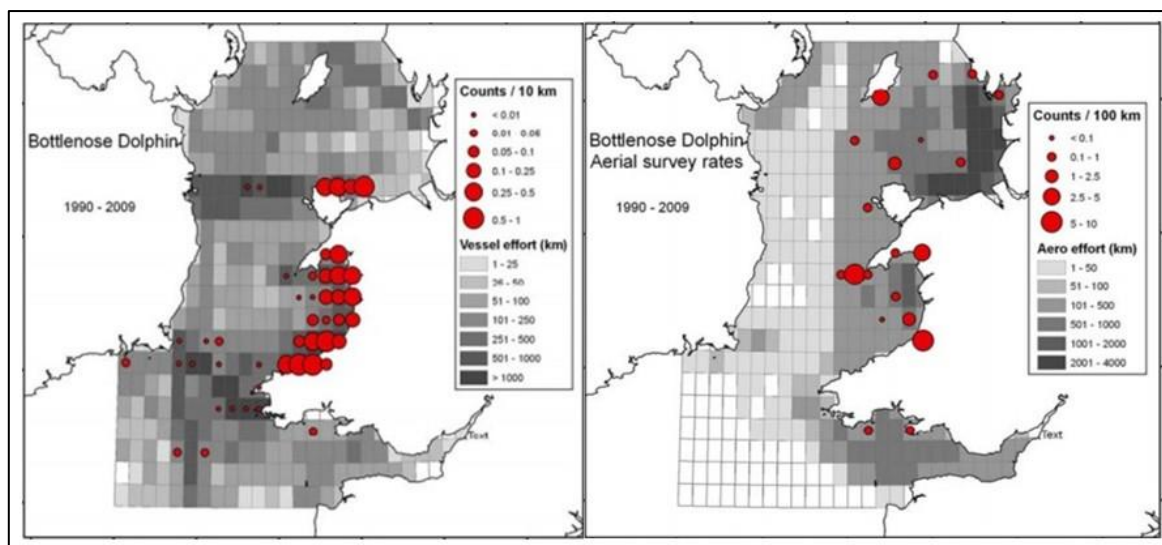


Figure 6.1 Long-term (1990 - 2009) mean sighting rates (left; vessel counts per 10 km, right aerial counts per 100 km) of bottlenose dolphins (Baines and Evans 2012).

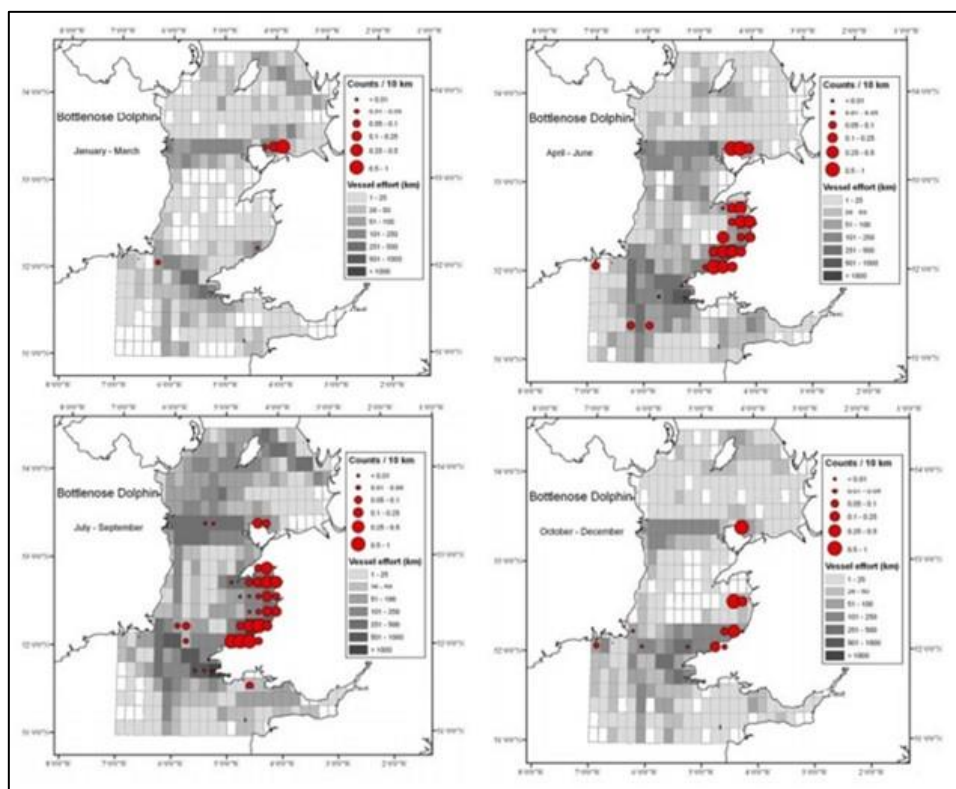


Figure 6.2 Long-term (1990 - 2009) quarterly mean sighting rates of bottlenose dolphins from vessel surveys (Baines and Evans 2012).

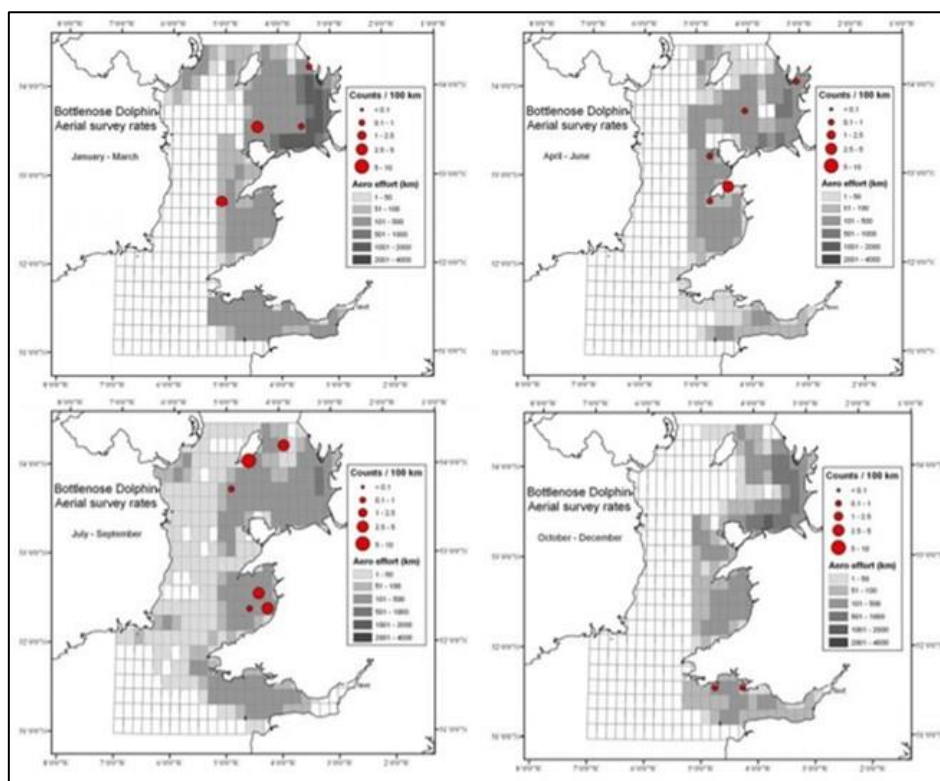


Figure 6.3 Long-term (1990 - 2009) quarterly mean sighting rates of bottlenose dolphins from aerial surveys (Baines and Evans 2012).

## 6.2 Site-specific surveys

During the 24 months of HiDef monthly surveys, bottlenose dolphins were recorded within the survey area, although in very low numbers (HiDef Aerial Surveying Ltd 2020, 2021). In total across the 24 months of surveys, only eight sightings of bottlenose dolphins were recorded (6 probable and 2 definite confidence), with six of these occurring in the March 2020 survey and two in the second June 2020 survey. Relative density estimates (dolphins/km<sup>2</sup>) and relative abundance estimates have been provided. Across the 24 months of surveys, the average relative density estimate was 0.003 dolphins/km<sup>2</sup> (Table 17). There were insufficient sightings to comment on the spatial distribution (Figure 6.4) or seasonal occurrence of bottlenose dolphins.

**Table 17 Density and abundance estimates of bottlenose dolphins within the survey area of the HiDef surveys from October 2019 – September 2021 (HiDef Aerial Surveying Ltd 2020, 2021).**

| Survey                 | Date     | Raw count   | Density (#/km <sup>2</sup> ) | Abundance estimate | CV (%) | Lower CI | Upper CI |
|------------------------|----------|-------------|------------------------------|--------------------|--------|----------|----------|
| 6                      | Mar 2020 | 6           | 0.04                         | 8                  | 68.29  | 0        | 20       |
| 9                      | Jun 2020 | 2           | 0.04                         | 9                  | 93.01  | 0        | 24       |
| All other surveys      |          | 0           | 0                            | 0                  | 0      | 0        | 0        |
| <b>Overall average</b> |          | <b>0.33</b> | <b>0.003</b>                 | <b>0.71</b>        | -      | -        | -        |

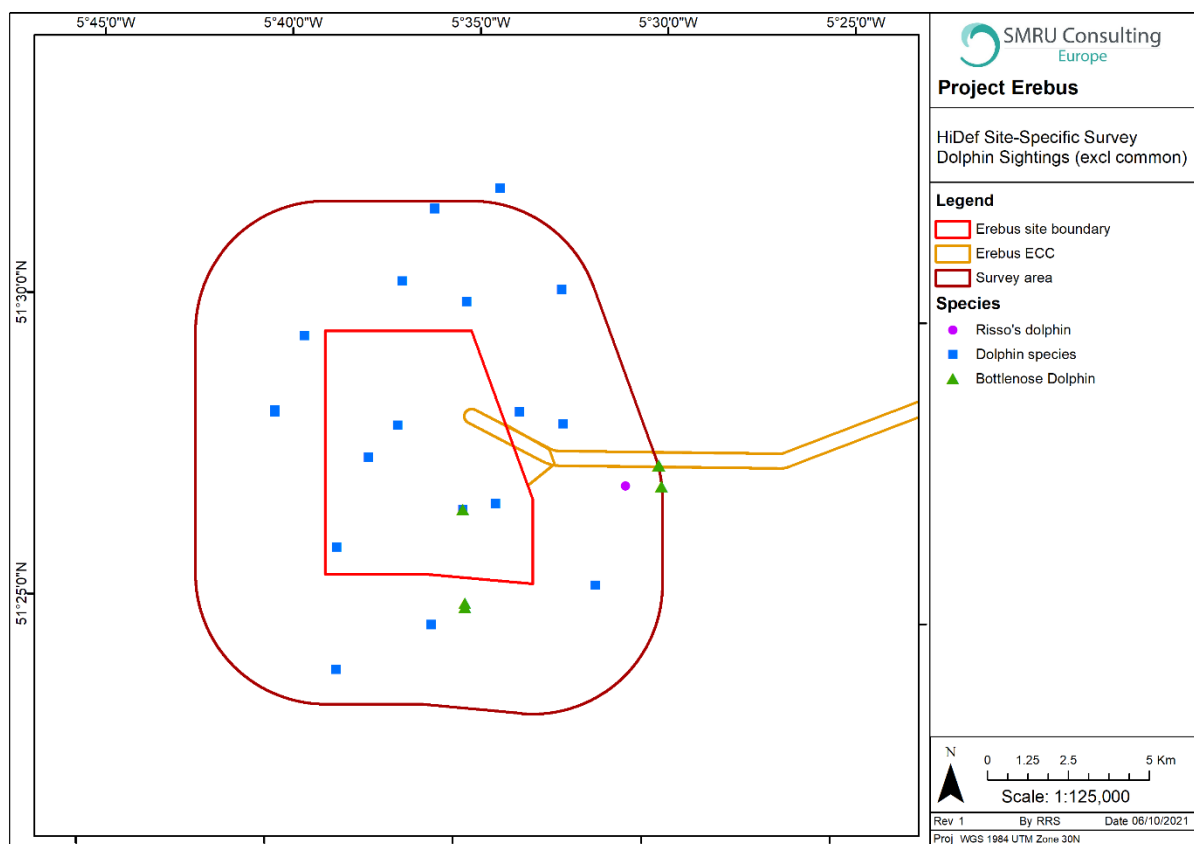


**Figure 6.4 Dolphin sightings (excluding common dolphin) recorded during the HiDef surveys.**

### 6.3 Project Valorous surveys

No bottlenose dolphins were sighted during the first three surveys at Project Valorous. However, there were 37 sightings of unknown dolphin/porpoise and 33 sightings of unknown dolphin species.

### 6.4 Bottlenose dolphin surveys

Lohrengel et al. (2018) carried out a CMR analysis of photo-ID data for both the Cardigan Bay SAC and wider Cardigan Bay based on a closed population model. Bottlenose dolphins within the Cardigan Bay SAC were concluded to have a most recent population estimate of 147 individuals in 2016 (Table 18). For the wider Cardigan Bay, a most recent population estimate of 174 individuals was reported for 2016 (Table 18). Trend analyses conducted also reported a significant decline in abundance of bottlenose dolphins from 2001-2016 for the Cardigan Bay SAC, but no significant decline for more recent years (2007-2016). Photo-ID surveys concluded an average sighting rate of 0.063 sightings/km<sup>2</sup> for bottlenose dolphins in the wider Cardigan Bay area.

**Table 18 Population estimates of bottlenose dolphins from a closed population CMR model in the Cardigan Bay SAC and wider Cardigan Bay from 2001-2016 (Lohrengel et al. 2018).**

| Cardigan Bay SAC |                     |          |          |      | Wider Cardigan Bay  |          |          |      |
|------------------|---------------------|----------|----------|------|---------------------|----------|----------|------|
| Year             | Population estimate | Lower CI | Upper CI | CV   | Population estimate | Lower CI | Upper CI | CV   |
| 2001             | <b>129</b>          | 112      | 177      | 0.27 | NA                  |          |          |      |
| 2002             | <b>124</b>          | 81       | 253      | 0.64 | NA                  |          |          |      |
| 2003             | <b>154</b>          | 143      | 178      | 0.14 | NA                  |          |          |      |
| 2004             | <b>141</b>          | 132      | 166      | 0.17 | NA                  |          |          |      |
| 2005             | <b>205</b>          | 151      | 321      | 0.57 | <b>195</b>          | 162      | 263      | 0.36 |
| 2006             | <b>205</b>          | 169      | 282      | 0.60 | <b>213</b>          | 199      | 256      | 0.20 |
| 2007             | <b>189</b>          | 165      | 245      | 0.28 | <b>225</b>          | 212      | 259      | 0.13 |
| 2008             | <b>239</b>          | 177      | 369      | 0.52 | <b>287</b>          | 245      | 363      | 0.27 |
| 2009             | <b>203</b>          | 161      | 290      | 0.41 | <b>318</b>          | 251      | 440      | 0.39 |
| 2010             | <b>216</b>          | 183      | 278      | 0.29 | <b>241</b>          | 215      | 289      | 0.21 |
| 2011             | <b>168</b>          | 147      | 210      | 0.24 | <b>225</b>          | 201      | 271      | 0.21 |
| 2012             | <b>211</b>          | 175      | 281      | 0.32 | <b>222</b>          | 204      | 260      | 0.17 |
| 2013             | <b>141</b>          | 116      | 194      | 0.35 | <b>191</b>          | 176      | 224      | 0.16 |
| 2014             | <b>107</b>          | 84       | 161      | 0.47 | <b>141</b>          | 117      | 262      | 0.57 |
| 2015             | <b>146</b>          | 119      | 210      | 0.40 | <b>206</b>          | 171      | 278      | 0.28 |
| 2016             | <b>147</b>          | 127      | 194      | 0.29 | <b>174</b>          | 150      | 246      | 0.30 |

Lohrengel et al. (2018) also reported on abundance estimates for bottlenose dolphins within the Cardigan Bay SAC and wider Cardigan Bay (Table 19). For the Cardigan Bay SAC, the most recent abundance estimate for dolphins in this area is 84 individuals in 2016 (Table 19). For the wider Cardigan Bay, the most recent abundance estimate for this species is 289 individuals in 2016 (Table 19). It is important to note for these that abundance estimates from line transect surveys for bottlenose dolphins in the wider Cardigan Bay area are only available from 2011-2016.

**Table 19 Abundance estimates of bottlenose dolphins in the Cardigan Bay SAC and wider Cardigan Bay based on distance sampling from line transect surveys (Lohrengel et al. 2018).**

| Cardigan Bay SAC |                    |          |          |      | Wider Cardigan Bay |          |          |      |
|------------------|--------------------|----------|----------|------|--------------------|----------|----------|------|
| Year             | Abundance estimate | Lower CI | Upper CI | CV   | Abundance estimate | Lower CI | Upper CI | CV   |
| 2001             | 135                | 85       | 214      | 0.24 | NA                 |          |          |      |
| 2003             | 140                | 69       | 284      | 0.37 | NA                 |          |          |      |
| 2005             | 139                | 88       | 218      | 0.23 | NA                 |          |          |      |
| 2006             | 214                | 108      | 422      | 0.36 | NA                 |          |          |      |
| 2007             | 109                | 49       | 239      | 0.42 | NA                 |          |          |      |
| 2011             | 133                | 75       | 235      | 0.30 | 309                | 179      | 353      | 0.28 |
| 2012             | 70                 | 37       | 131      | 0.33 | 330                | 203      | 534      | 0.25 |
| 2013             | 90                 | 45       | 179      | 0.37 | 254                | 151      | 427      | 0.27 |
| 2015             | 64                 | 19       | 220      | 0.65 | 277                | 138      | 555      | 0.36 |
| 2016             | 84                 | 44       | 160      | 0.33 | 289                | 184      | 453      | 0.23 |

In terms of the home ranges for bottlenose dolphins in this area, it has been found that these individuals move outside of this area, mainly northwards towards Anglesey and Liverpool Bay (Lohrengel et al. 2018). However, some known individuals within this population have been sighted in the southernmost part of the Cardigan Bay SAC and further south in Fishguard in both 2015 and 2016 (Lohrengel et al. 2018) which is in increasing proximity to the Project offshore wind development site. Feingold and Evans (2014) also found that a small proportion of bottlenose dolphins exhibited site fidelity with limited home ranges in Cardigan Bay, but a larger proportion of dolphins have wide home ranges, with their distribution extending into North Wales and the Northern Irish Sea. Therefore, it would appear that, while recent surveys support the presence of bottlenose dolphins in Cardigan Bay, a large proportion of this population have a wide habitat range from the southern Cardigan Bay area to the Isle of Man (Duckett 2018).

## 6.5 SCANS III

During the SCANS III survey (Hammond et al. 2021), effort was conducted in 2016 in survey block D (which covered the Southern Celtic/Irish Seas and where the Project is located) using aerial survey techniques. Results from this survey concluded that bottlenose dolphins in block D had an estimated abundance of 2,938 individuals (95% CI: 914 - 5,867). Density estimates for block D were concluded to be 0.0605 dolphins/km<sup>2</sup>.

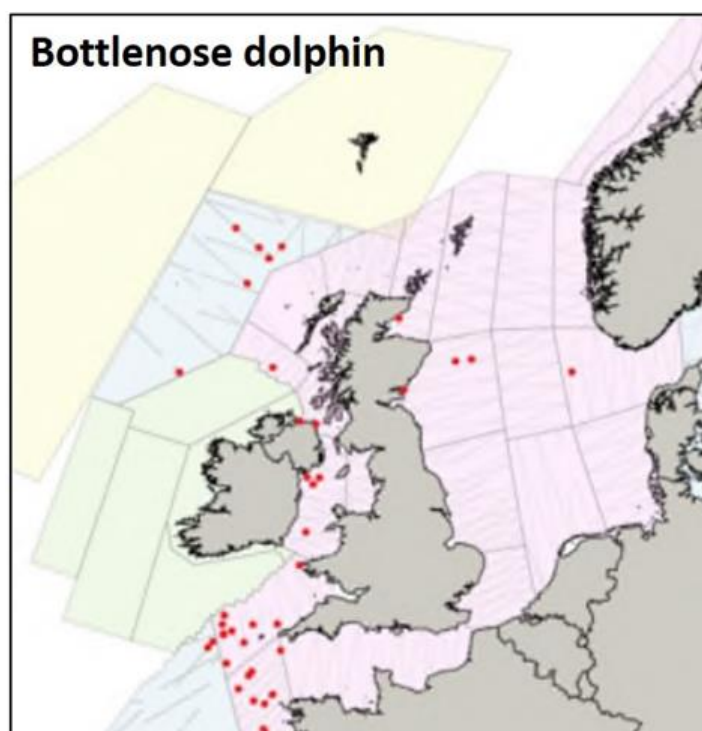


Figure 6.5 Bottlenose dolphin sightings from the SCANS III surveys (Hammond et al. 2021).

## 6.6 ObSERVE

Bottlenose dolphin sightings reported during the ObSERVE surveys were mainly located in the south and west of Ireland (Figure 6.6). Highest abundances of bottlenose dolphin sightings were reported during the winter 2016 surveys (Figure 6.7) and lowest abundance of sightings reported in summer 2015 (Figure 6.7). In Stratum 5, bottlenose dolphins were only sighted in Season 4 (winter 2016), with a resulting design-based estimate of 0.036 dolphins/km<sup>2</sup> and a model-based estimate of 0.020 dolphins/km<sup>2</sup> (Rogan et al. 2018). Model-based estimates for bottlenose dolphins within Stratum 5 for Season 3 were also provided (Table 20). Bottlenose dolphins were sighted in both the summer (Season 1 and 3) and winter (Season 2 and 4) months in Stratum 4 (Table 20).

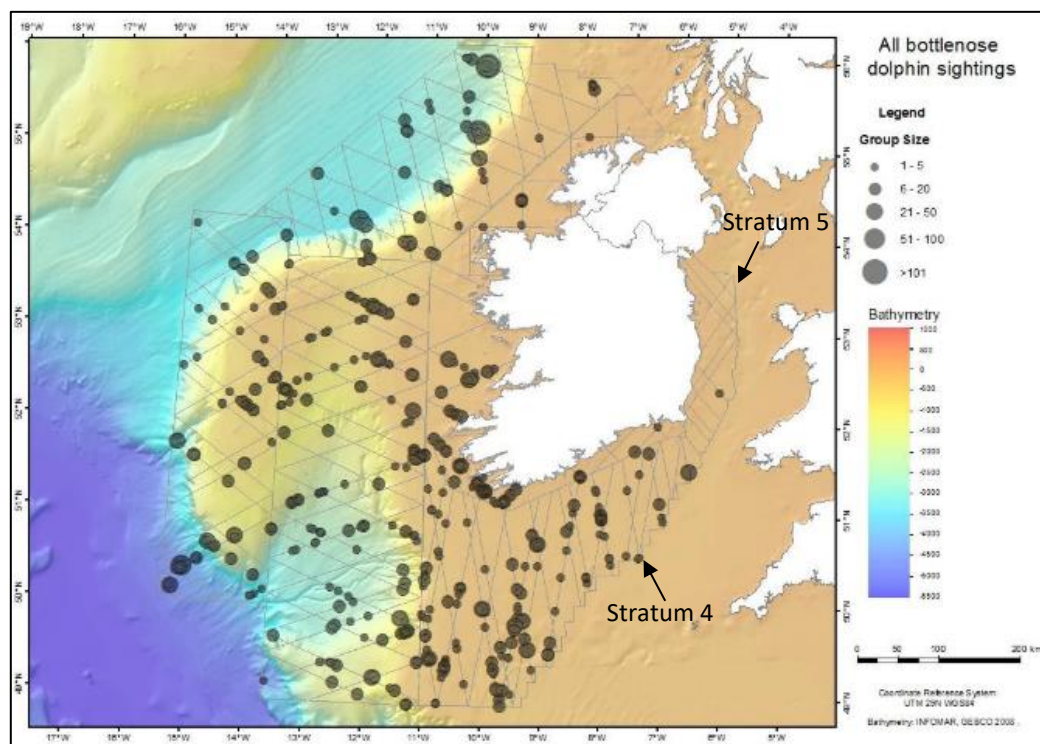


Figure 6.6 All bottlenose dolphin sightings from the ObSERVE surveys from 2015 - 2016 (Rogan et al. 2018).

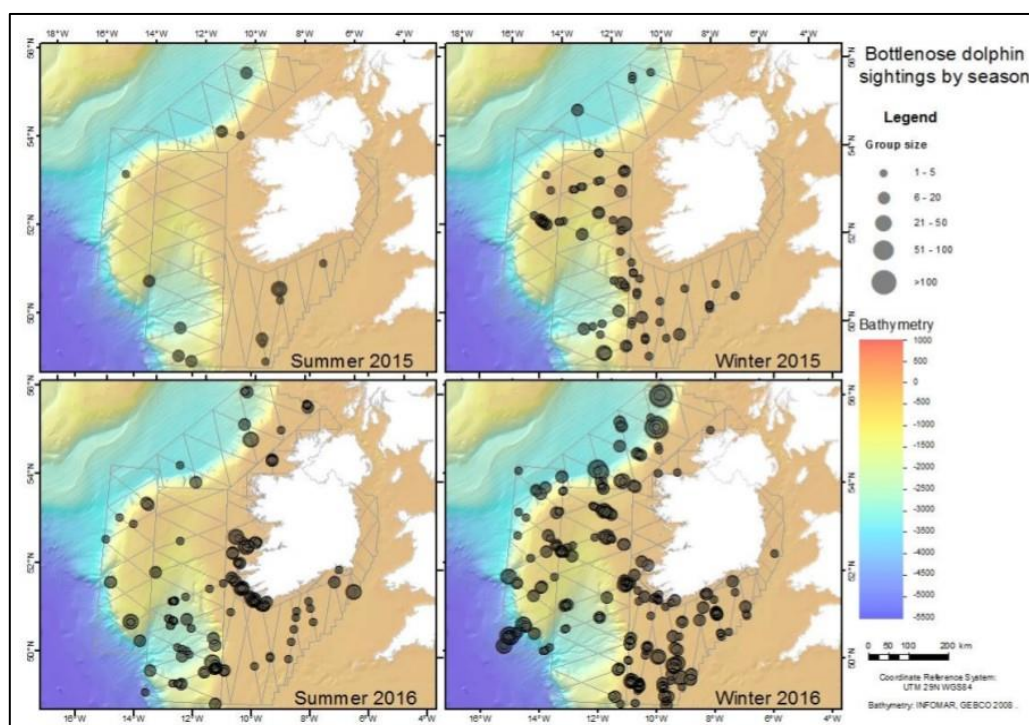


Figure 6.7 Seasonal bottlenose dolphin sightings from the ObSERVE surveys from 2015 - 2016 (Rogan et al. 2018).

**Table 20 Bottlenose dolphin design-based and model-based density (#/km<sup>2</sup>) and abundance estimates for Stratum 4 and 5 of the ObSERVE surveys (Rogan et al. 2018).**

| Stratum | Season      | Design-based estimates |           |          |          | Model-based estimates |           |          |          |
|---------|-------------|------------------------|-----------|----------|----------|-----------------------|-----------|----------|----------|
|         |             | Density                | Abundance | Lower CI | Upper CI | Density               | Abundance | Lower CI | Upper CI |
| S4      | Summer 2015 | 0.062                  | 3,885     | 1,210    | 12,473   | NA                    |           |          |          |
| S4      | Winter 2015 | 0.098                  | 6,217     | 3,565    | 10,842   | 0.0946                | 5,924     | 3926     | 10,646   |
| S4      | Summer 2016 | 0.088                  | 5,549     | 2,241    | 13,739   | 0.1548                | 9,692     | 6999     | 14,511   |
| S4      | Winter 2016 | 0.929                  | 58,647    | 37,881   | 90,798   | 0.9143                | 57,246    | 47,481   | 70,548   |
| S5      | Summer 2015 | NA                     |           |          |          | NA                    |           |          |          |
| S5      | Winter 2015 | NA                     |           |          |          | NA                    |           |          |          |
| S5      | Summer 2016 | NA                     |           |          |          | 0.0106                | 118       | 0        | 1129     |
| S5      | Winter 2016 | 0.036                  | 401       | 76       | 2105     | 0.0201                | 223       | 0        | 828      |

## 6.7 JCP

### 6.7.1 JCP Phase III

Bottlenose dolphin summer densities were modelled for summer 2010 by Paxton et al. (2016), reporting overall a very low summer density of bottlenose dolphins at the Project location (Figure 6.8). Bottlenose dolphins were estimated to have highest abundances within the Atlantic Array area in summer with an abundance of 120 individuals and lowest in Autumn with an abundance of 40 individuals (Table 14) (Paxton et al. 2016), suggesting that bottlenose dolphins within this area may exhibit seasonal variation in abundance.

**Table 21 JCP Phase III density estimate for bottlenose dolphins in 2010 for the Atlantic Array area of commercial interest (Paxton et al. 2016).**

| Season         | Abundance | 95% CI   | Density (#/km <sup>2</sup> ) |
|----------------|-----------|----------|------------------------------|
| Winter         | 70        | 20 – 330 | 0.004                        |
| Spring         | 100       | 30 – 390 | 0.005                        |
| Summer         | 120       | 40 – 490 | 0.006                        |
| Autumn         | 40        | 20 - 170 | 0.002                        |
| <b>Average</b> | <b>83</b> | <b>-</b> | <b>0.004</b>                 |

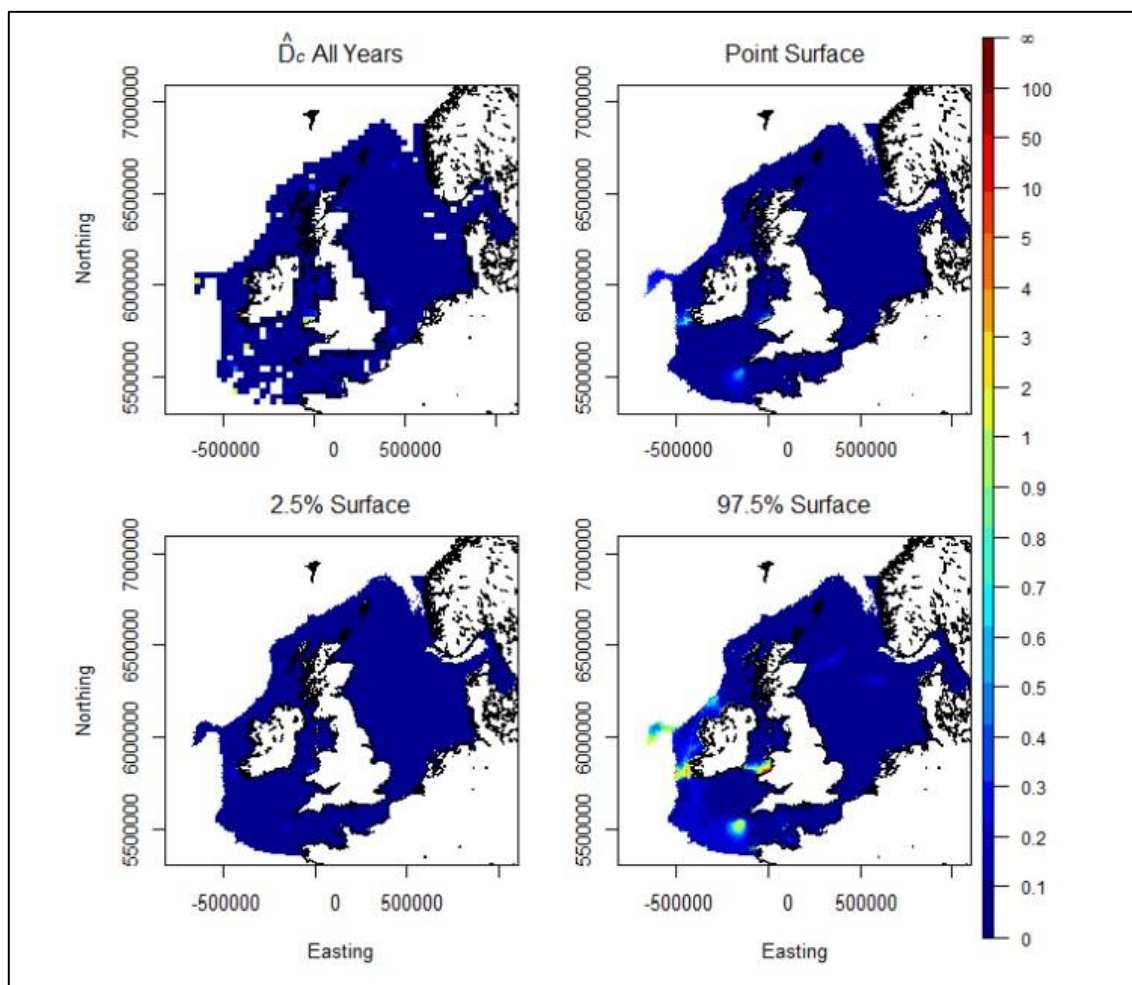


Figure 6.8 Predicted bottlenose dolphin summer densities for summer 2010 (Paxton et al. 2016). Top left; input densities (summer all years), top right; point estimate of cell densities, bottom left; lower (2.5%) confidence limit on cell densities, bottom right; upper (97.5%) confidence limit on cell densities (dolphins/km<sup>2</sup>). Note that the top left plot exaggerates the spatial coverage of relevant effort.

### 6.7.2 MERP surveys

Distribution maps for bottlenose dolphins were produced by Waggitt et al. (2020) as part of the MERP project. The predicted density surfaces for bottlenose dolphins concluded that bottlenose dolphin densities are relatively low in relation to the location of the Project site both in January and July (Figure 6.9). However, these density estimates are for illustrative purposes only, as they are not considered to be suitable for use in quantitative impact assessments.

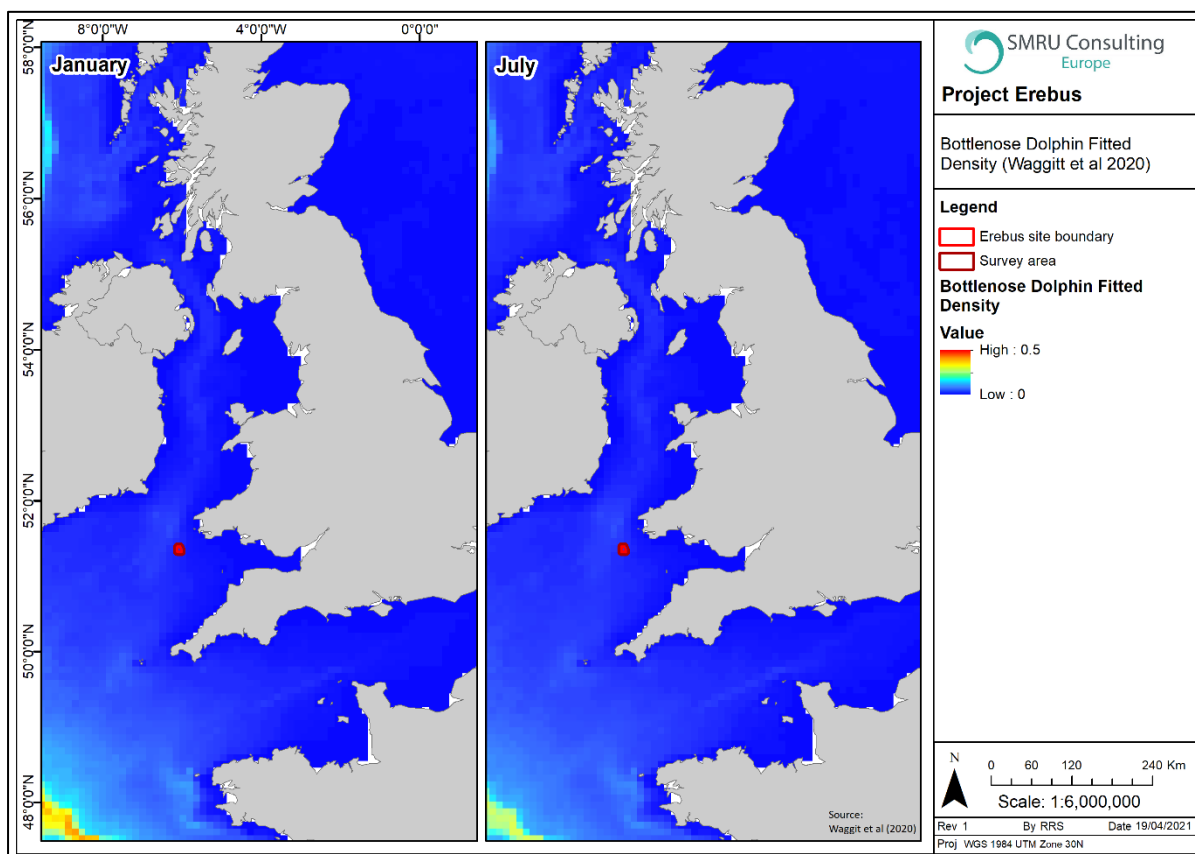


**Figure 6.9 Spatial variation in predicted densities (dolphins/km<sup>2</sup>) for bottlenose dolphins (offshore eco-type) in January and July in the North-East Atlantic (Waggitt et al. 2020). Values are provided at 10 km resolution.**

## 6.8 Sea Trust Wales

With the exception of common dolphins, Sea Trust Wales recorded very few dolphin sightings between 2005 and 2021. Bottlenose dolphins accounted for only 0.18% of the total marine mammal sightings (35 individuals). Bottlenose dolphins were only sighted in July and August and the sightings were approximately 40 km from land (Figure 6.10). No effort data was collected and, as such, no density estimate can be calculated using this dataset. The data simply confirm the presence of bottlenose dolphins in the area, though in very low numbers compared to common dolphins.

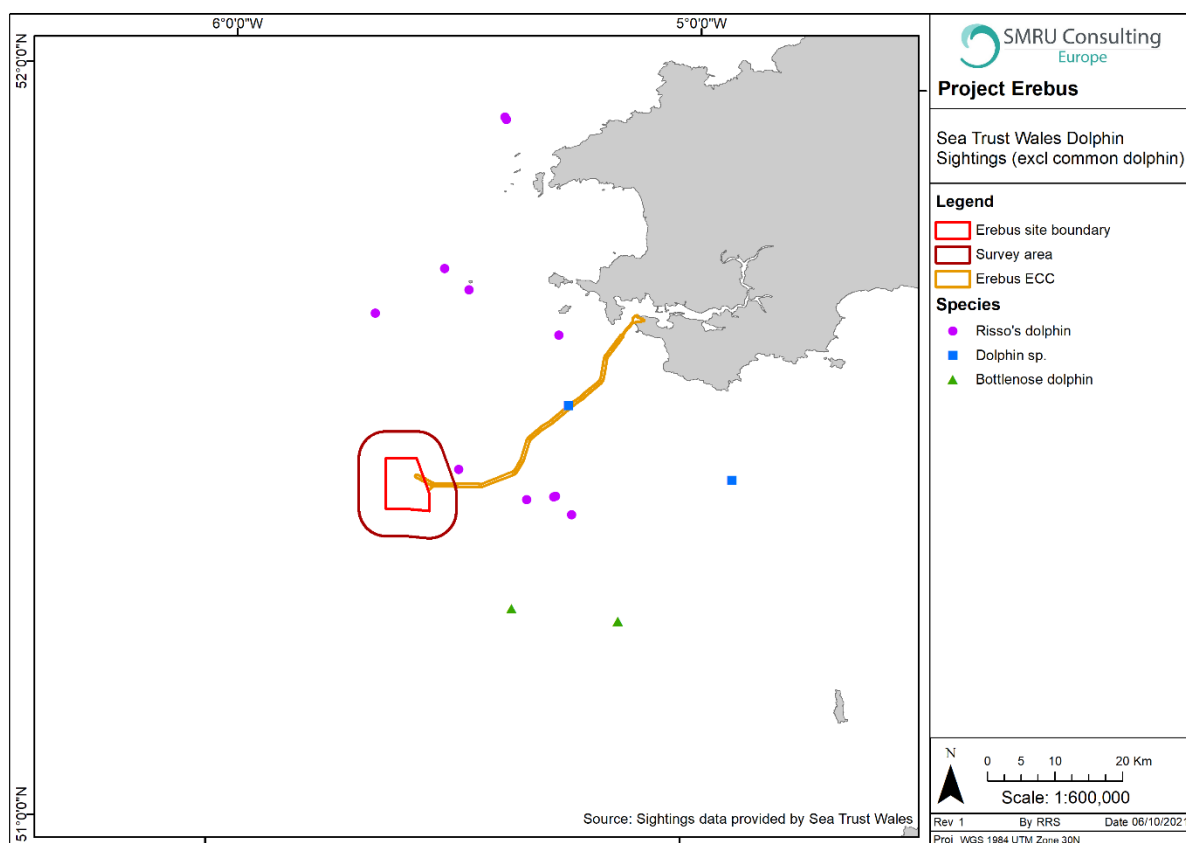


Figure 6.10 Dolphin sightings (excluding common dolphins) recorded by Sea Trust Wales (April-Oct, 2005-2021).

## 6.9 Summary

Bottlenose dolphin density estimates range greatly in the Irish Sea (Table 22). An issue with using large-scale survey estimates (such as SCANS III) for bottlenose dolphins is that uniform density estimates do not take into consideration the habitat preferences for coastal populations of bottlenose dolphins, which have been found to be largely restricted to coastal waters (Quick et al. 2014). As such, a block wide uniform density estimate is not suitable for this species and will not reflect the true expected distribution and predicted impact numbers in the quantitative impact assessment. Due to the large known home ranges of this species, it is reasonable to assume that the density estimate for this species in proximity to the Project site is similar to those in the wider Cardigan Bay area, as presented above (Lohrengel et al. 2018). Therefore, SMRU Consulting recommends that the average sighting rate of 0.063 dolphins/km<sup>2</sup> presented by Lohrengel et al. (2018) (bold text in Table 22; 0.063 dolphins/km<sup>2</sup>) be taken forward to the quantitative impact assessment for the Project. This is considered to be highly precautionary given the much lower density estimates obtained for the general area from the JCP dataset.

**Table 22 Bottlenose dolphin density estimates (dbe = design based estimate, mbe = model based estimate).**

| Source                       | Area                                   | Temporal         | Density (#/km <sup>2</sup> ) |
|------------------------------|----------------------------------------|------------------|------------------------------|
| HiDef site-specific surveys  | Project survey area                    | 2019-2020        | 0.003                        |
| <b>Lohrengel et al. 2018</b> | <b>Wider Cardigan Bay area</b>         | <b>2014-2016</b> | <b>0.063</b>                 |
| SCANS III block D            | Southern Celtic/Irish Seas             | Summer 2016      | 0.0605                       |
| ObSERVE (Stratum 4, dbe)     | Celtic Sea                             | Summer 2015      | 0.062                        |
| ObSERVE (Stratum 4, dbe)     | Celtic Sea                             | Summer 2016      | 0.088                        |
| ObSERVE (Stratum 4, dbe)     | Celtic Sea                             | Winter 2015      | 0.098                        |
| ObSERVE (Stratum 4, dbe)     | Celtic Sea                             | Winter 2016      | 0.929                        |
| ObSERVE (Stratum 4, mbe)     | Celtic Sea                             | Summer 2015      | 0                            |
| ObSERVE (Stratum 4, mbe)     | Celtic Sea                             | Summer 2016      | 0.155                        |
| ObSERVE (Stratum 4, mbe)     | Celtic Sea                             | Winter 2015      | 0.095                        |
| ObSERVE (Stratum 4, mbe)     | Celtic Sea                             | Winter 2016      | 0.914                        |
| ObSERVE (Stratum 5, dbe)     | East RoI                               | Summer 2015      | 0                            |
| ObSERVE (Stratum 5, dbe)     | East RoI                               | Summer 2016      | 0                            |
| ObSERVE (Stratum 5, dbe)     | East RoI                               | Winter 2015      | 0                            |
| ObSERVE (Stratum 5, dbe)     | East RoI                               | Winter 2016      | 0.036                        |
| ObSERVE (Stratum 5, mbe)     | East RoI                               | Summer 2015      | 0                            |
| ObSERVE (Stratum 5, mbe)     | East RoI                               | Summer 2016      | 0.011                        |
| ObSERVE (Stratum 5, mbe)     | East RoI                               | Winter 2015      | 0                            |
| ObSERVE (Stratum 5, mbe)     | East RoI                               | Winter 2016      | 0.020                        |
| Atlantic Array area          | Bristol Channel and adjacent Irish Sea | Winter 2010      | 0.004                        |
| Atlantic Array area          | Bristol Channel and adjacent Irish Sea | Spring 2010      | 0.005                        |
| Atlantic Array area          | Bristol Channel and adjacent Irish Sea | Summer 2010      | 0.006                        |
| Atlantic Array area          | Bristol Channel and adjacent Irish Sea | Autumn 2010      | 0.002                        |
| Atlantic Array area          | Bristol Channel and adjacent Irish Sea | Average 2010     | 0.004                        |

## 7 Risso's dolphin

Risso's dolphins are known to be sporadically distributed within UK waters, with this species commonly recorded around the Hebrides and seasonally within the Celtic and Irish Seas. In 2018, they were updated from Data Deficient to Least Concern on the IUCN red list. A single MU has been implemented for this species, labelled the Celtic and Greater North Seas MU. Due to low numbers of sightings for Risso's dolphins, there are currently no abundance estimates available (Table 1).

### 7.1 General – Welsh Marine Atlas

Risso's dolphins are a relatively common species in Welsh waters, although they have a somewhat localised distribution which forms a wide band running from the southwest to northeast, encompassing areas such as west Pembrokeshire and the southeast coast of Ireland. This population

appears to be consistently present over the last decades, however their numbers have been reported to vary a great deal between years (Baines and Evans 2012). The project database for this study included a total of 616 sightings of Risso's dolphins and a count of 1,515 individuals across the entire study area (Baines and Evans 2012).

Long-term (1990 - 2009) vessel sightings of Risso's dolphins were reported in small numbers in proximity to the Project site (Figure 7.1; left panel). In contrast, long-term (1990 - 2009) aerial sighting of Risso's dolphins concluded no presence of Risso's dolphins in proximity to the Project site (Figure 7.1; right panel). It is important to note that aerial survey effort was relatively low in the section of the study area in which the Project site is located.

In terms of seasonal variation for the distribution of Risso's dolphins in proximity to the Project site, long-term (1990 - 2009) quarterly sighting rates from vessel surveys report the highest abundance of Risso's dolphins in the southern Irish sea in general from July – September, with abundances in proximity to the Project site from April – June (Figure 7.2). Aerial surveys did not report abundances of Risso's dolphins in proximity to the Project site or southern Irish Sea on a seasonal scale (Baines and Evans 2012).

While these data provide an overview of the general distribution of Risso's dolphins in the Irish Sea, they do not provide density estimates.

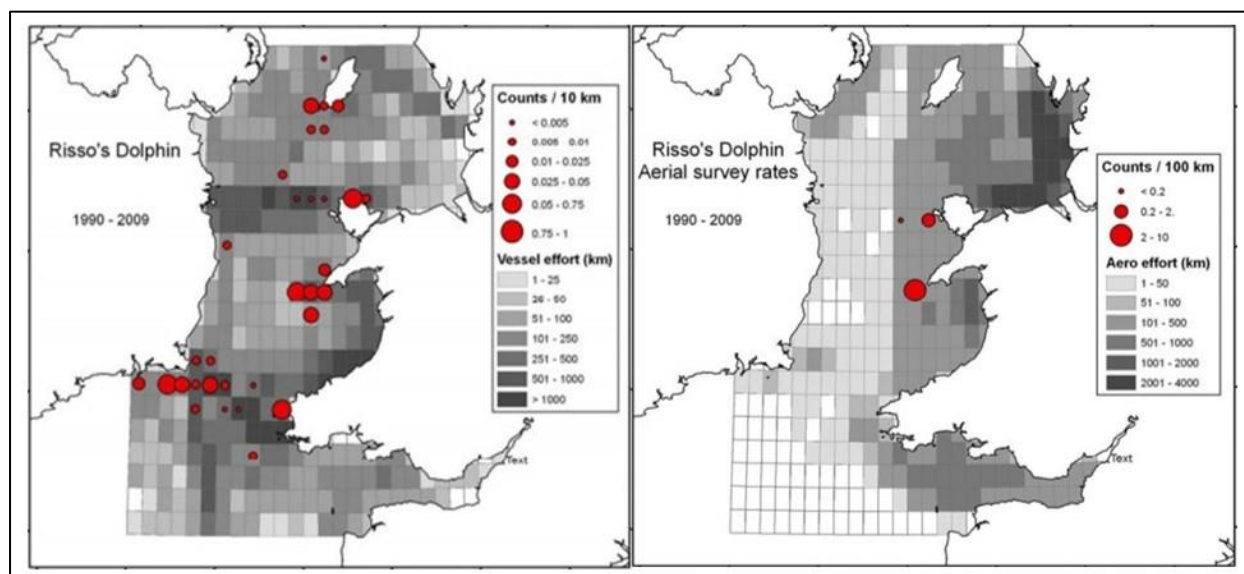


**Figure 7.1 Long-term (1990 - 2009) mean sighting rates (left; vessel counts per 10 km, right; aerial counts per 100 km) of Risso's dolphins (Baines and Evans 2012).**

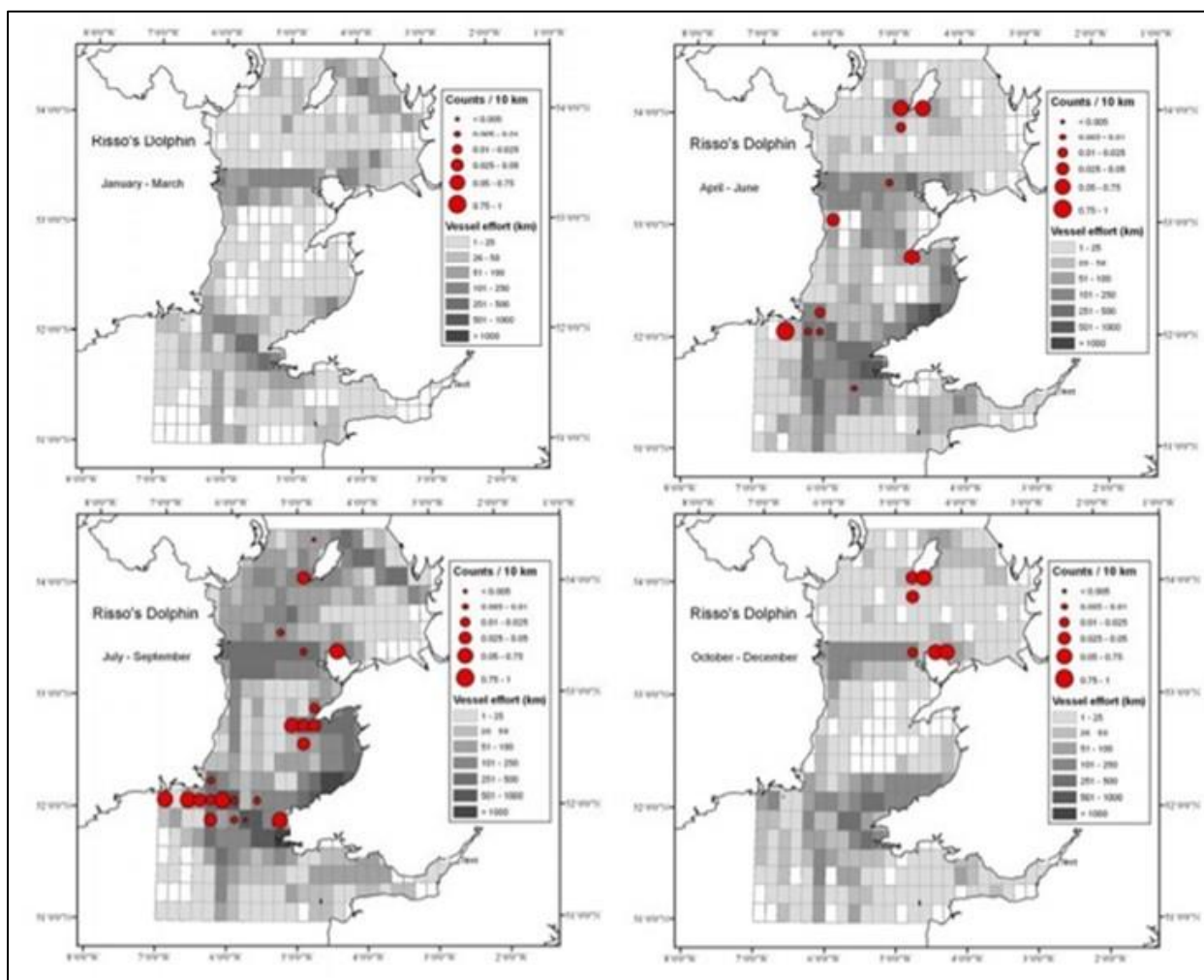


Figure 7.2 Long-term quarterly mean sighting rates of Risso's dolphins from vessel surveys from 1990 - 2009 (Baines and Evans 2012).

## 7.2 Site-specific surveys

Only one sighting of a single Risso's dolphin was reported during the first year for the HiDef surveys at the Project site (HiDef Aerial Surveying Ltd 2020). Based on images provided by HiDef, SMRU Consulting consider there to be insufficient identifiable features visible in the frames to be confident of this species identification. Due to the uncertainty of the species identification, the site-specific survey does not provide confirmation of the definite presence of Risso's dolphin in the Project survey area. Due to this, abundance estimates, density estimates and spatial maps of this species' distribution in the survey area could not be provided.

## 7.3 Project Valorous surveys

No Risso's dolphins were sighted during the first three surveys at Project Valorous. However, there were 37 sightings of unknown dolphin/porpoise and 33 sightings of unknown dolphin species.

## 7.4 SCANS III

During the SCANS III survey (Hammond et al. 2021), effort was conducted in 2016 in survey block D (which covered the Southern Celtic/Irish Seas and where the Project is located) using aerial survey

techniques. Risso's dolphins were not sighted within block D and as such, no density estimates for this species were provided.

## 7.5 ObSERVE

Risso's dolphin sightings during the ObSERVE surveys were generally low across all surveys and strata (Figure 7.3). In Stratum 5, Risso's dolphins were only sighted during Season 1 (Summer 2015), resulting in a design-based density estimate of 0.003 dolphins/km<sup>2</sup> (Table 21) (Rogan et al. 2018), with this sighting located in the south of the stratum (Figure 7.4 and Figure 7.3). In Stratum 4, Risso's dolphins were sighted in Season 2 (winter 2015) and Season 3 (summer 2016), with a summer density estimate at 0.0128 dolphins/km<sup>2</sup> compared to the winter estimate of 0.0006 dolphins/km<sup>2</sup> (Table 21) (Rogan et al. 2018). This would suggest some seasonal variation in relation to the density of Risso's dolphins in the Celtic Sea.

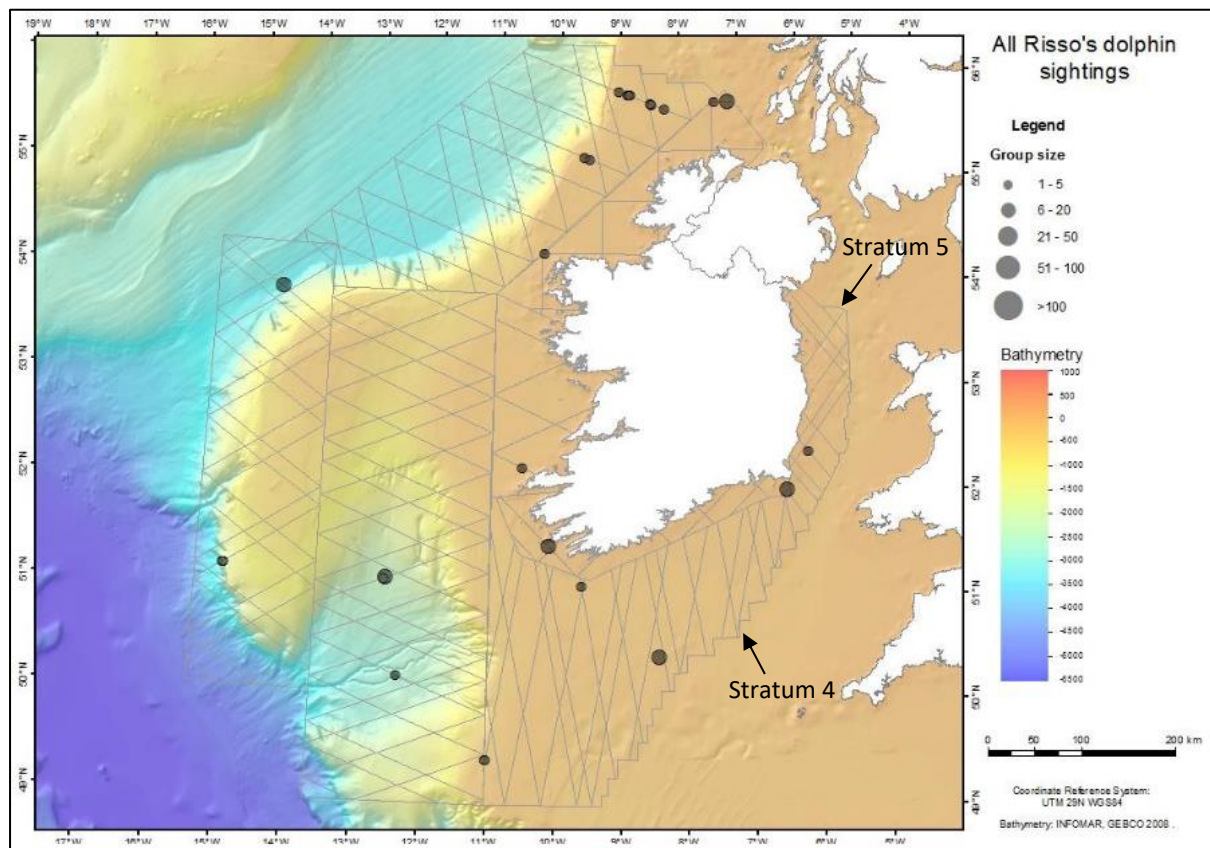


Figure 7.3 All Risso's dolphin sightings from the ObSERVE surveys from 2015-2016 (Rogan et al. 2018).

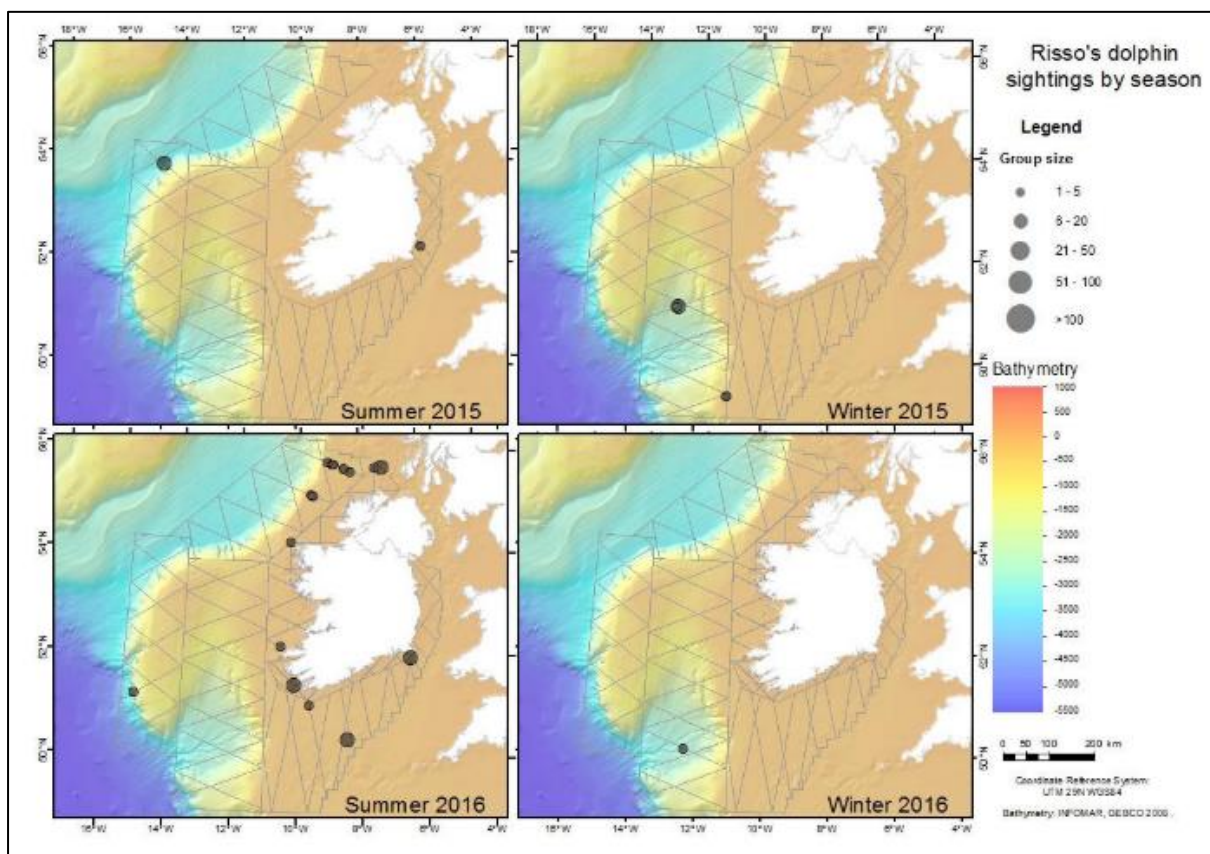


Figure 7.4 Seasonal Risso's dolphin sightings from the ObSERVE surveys from 2015 - 2016 (Rogan et al. 2018).

Table 23 Risso's dolphin design-based estimates for Stratum 4 and 5 of the ObSERVE surveys (Rogan et al. 2018).

| Stratum | Season      | Density (#/km <sup>2</sup> ) | Abundance | Lower CI | Upper CI |
|---------|-------------|------------------------------|-----------|----------|----------|
| S4      | Summer 2015 | NA                           |           |          |          |
| S4      | Winter 2015 | 0.0006                       | 39        | 7        | 215      |
| S4      | Summer 2016 | 0.0128                       | 809       | 163      | 4,012    |
| S4      | Winter 2016 | NA                           |           |          |          |
| S5      | Summer 2015 | 0.0032                       | 35        | 7        | 188      |
| S5      | Winter 2015 | NA                           |           |          |          |
| S5      | Summer 2016 | NA                           |           |          |          |
| S5      | Winter 2016 | NA                           |           |          |          |

## 7.6 JCP

### 7.6.1 JCP Phase III

Paxton et al. (2016) produced predicted Risso's dolphin densities for summer 2010 (Figure 7.5). This report concluded that, in general, Risso's dolphin densities were low, or zero within the Project site location for summer 2010 (Figure 7.5). Similarly, for the Atlantic Array, the estimate of Risso's dolphins

abundance across all seasons (spring, summer, autumn and winter) was 0 individuals (Paxton et al. 2016).

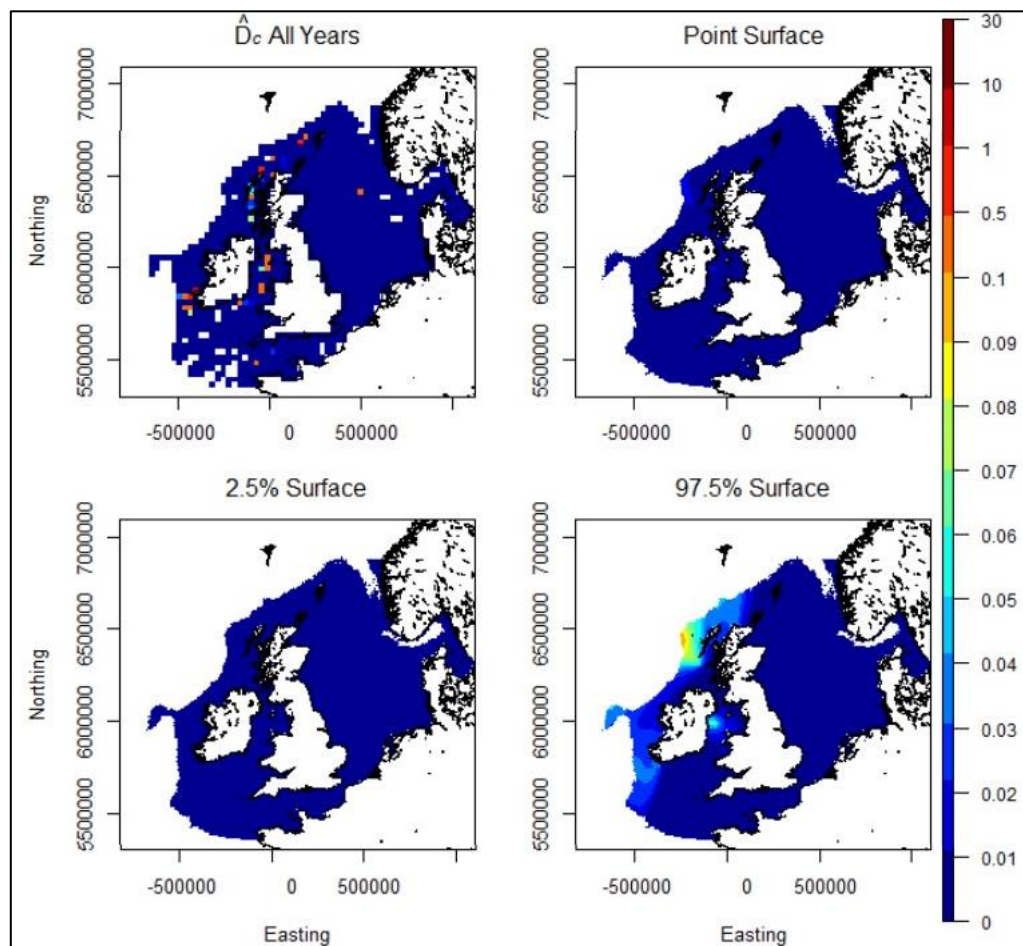


Figure 7.5 Predicted Risso's dolphin densities for summer 2010 (Paxton et al. 2016). Top left; input densities (summer all years), top right; point estimate of cell densities, bottom left; lower (2.5%) confidence limit on cell densities, bottom right; upper (97.5%) confidence limit on cell densities (dolphins/km<sup>2</sup>). Note that the top left plot exaggerates the spatial coverage of the relevant effort.

### 7.6.2 MERP surveys

Waggitt et al. (2020) produced distribution maps of Risso's dolphins as part of the MERP project (Figure 7.6). The predicted densities provided by this study conclude a potential increase in the density of Risso's dolphins southwest England during the summer months (Figure 7.6). However, as mentioned previously, these density estimates are representative of relative density compared to other sites in the UK, but they are not considered to be suitable for use in quantitative impact assessments and as such, are provided for illustrative purposes only.

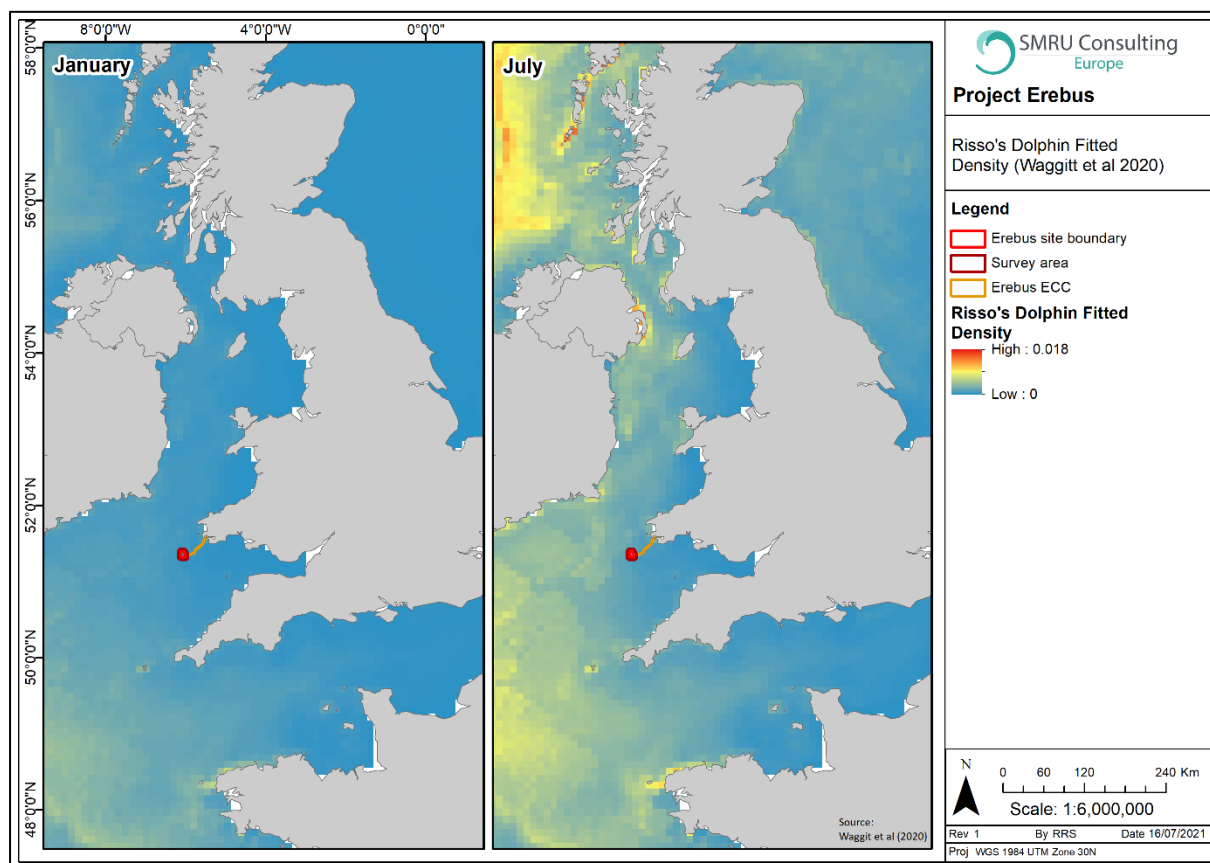


**Figure 7.6 Spatial variation in predicted densities (dolphins/km<sup>2</sup>) for Risso's dolphins in January and July in the North-East Atlantic (Waggitt et al. 2020). Values are provided at 10 km resolution.**

## 7.7 Sea Trust Wales

With the exception of common dolphins, Sea Trust Wales recorded very few dolphin sightings between 2005 and 2021. Risso's dolphins accounted for only 0.43% of the total marine mammal sightings (85 individuals). Risso's dolphins were only sighted between June and September with sightings spread across the general area (Figure 6.10). No effort data was collected and as such, no density estimate can be calculated using this dataset. The data simply confirm the presence of Risso's dolphins in the area, though in very low numbers compared to common dolphins.

## 7.8 Summary

Due to the lack of Risso's dolphin sightings during the site-specific surveys, and the lack of Risso's dolphins predicted to be present in the area from the SCANS III or JCP III data (Table 24), it is recommended that Risso's dolphins are scoped out of quantitative assessment for the Project. However, given that there is a chance that Risso's dolphins may be present rarely in the area, they will be considered briefly and qualitatively in the impact assessment.

**Table 24 Risso's dolphin density estimates.**

| Source                      | Area                                   | Temporal    | Density (#/km <sup>2</sup> ) |
|-----------------------------|----------------------------------------|-------------|------------------------------|
| HiDef site-specific surveys | Project survey area                    | 2019-2020   | 0                            |
| SCANS III block D           | Southern Celtic/Irish Seas             | Summer 2016 | 0                            |
| ObSERVE (Stratum 5, dbe)    | East Rol                               | Summer 2015 | 0.003                        |
| ObSERVE (Stratum 5, dbe)    | East Rol                               | Summer 2016 | 0                            |
| ObSERVE (Stratum 5, dbe)    | East Rol                               | Winter 2015 | 0                            |
| ObSERVE (Stratum 5, dbe)    | East Rol                               | Winter 2016 | 0                            |
| ObSERVE (Stratum 4, dbe)    | Celtic Sea                             | Winter 2015 | 0.0006                       |
| ObSERVE (Stratum 4, dbe)    | Celtic Sea                             | Winter 2016 | 0                            |
| ObSERVE (Stratum 4, dbe)    | Celtic Sea                             | Summer 2015 | 0                            |
| ObSERVE (Stratum 4, dbe)    | Celtic Sea                             | Summer 2016 | 0.0128                       |
| Atlantic Array area         | Bristol Channel and adjacent Irish Sea | Winter 2010 | 0                            |
| Atlantic Array area         | Bristol Channel and adjacent Irish Sea | Spring 2010 | 0                            |
| Atlantic Array area         | Bristol Channel and adjacent Irish Sea | Summer 2010 | 0                            |
| Atlantic Array area         | Bristol Channel and adjacent Irish Sea | Autumn 2010 | 0                            |

## 8 Minke whale

Minke whales are a globally distributed species and listed as Least Concern on the IUCN red list. However, this species is protected as both a European Protected Species (EPS) and as a priority species under the UK Post-2010 Biodiversity framework. Minke whale presence within UK waters is known to be seasonal, with migrations leading to peaks in minke whale abundance during the summer months. Until 2020, no protected areas had been assigned to minke whales in UK waters, however, two protected areas have been recently proposed and designated in Scottish waters (Sea of the Hebrides and Southern Trench MPAs). There is currently a single MU assigned for minke whales labelled the Celtic and Greater North Seas MU (Table 1).

### 8.1 General – Welsh Marine Atlas

Minke whales are known to be a relatively regular species in Welsh waters with a largely offshore distribution. The highest densities of sightings occur in the Celtic Deep region (Baines and Evans 2012). A total of 211 sightings of minke whales were included in the project database for this study, resulting in a count of 274 individuals. Baines and Evans (2012) reported sightings of minke whales in proximity to the Project site from vessel surveys (Figure 8.1). Aerial surveys were concluded to have no reported sightings in proximity to the Project site. Baines and Evans (2012) also reported seasonal variation in the abundance of minke whales (Figure 8.2), with no reported sightings of minke whales from January - March in proximity to the Project site. Sightings peaked from April - June and remained high from July - September (Figure 8.2).

While these data provide an overview of the general distribution of minke whales in the Irish Sea, they do not provide density estimates.

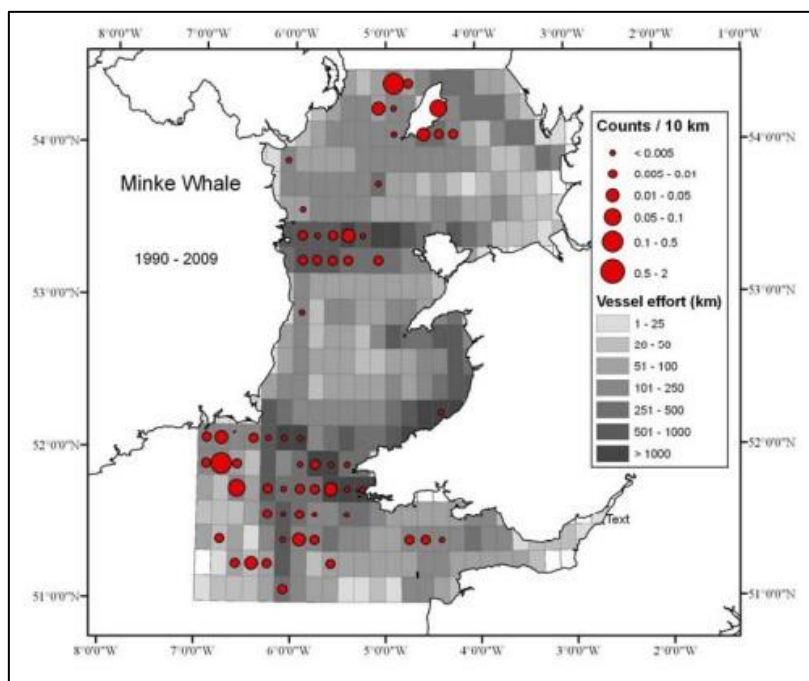


Figure 8.1 Long-term (1990 - 2009) mean sightings rate (vessel counts per 10 km) of minke whales (Baines and Evans 2012).

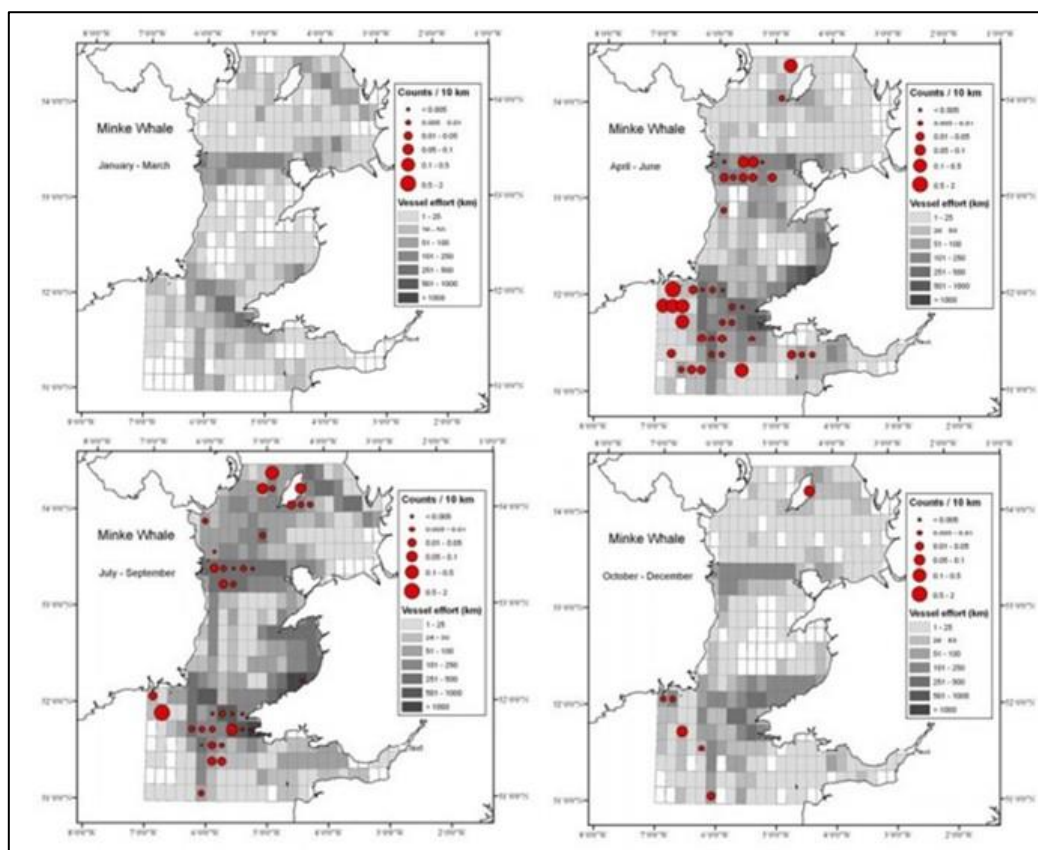


Figure 8.2 Long-term (1990 - 2009) quarterly mean sighting rates of minke whales from vessel surveys (Baines and Evans 2012).

## 8.2 Site-specific surveys

During the 24 months of HiDef monthly surveys from October 2019 to September 2021, minke whales were recorded in one single survey (HiDef Aerial Surveying Ltd 2020, 2021). In total, across all surveys, only three sightings of minke whales were recorded (2x probable and 1x definite, all in sea state 3), with these three sightings reported during the second June 2020 survey (Figure 8.3). Relative density estimates (dolphins/km<sup>2</sup>) and relative abundance estimates have been provided. Across the 24 months of surveys, the average relative density estimate was 0.002 whales/km<sup>2</sup> (Table 25). There were insufficient sightings to comment on the spatial distribution (Figure 8.3).

**Table 25 Density and abundance estimates of minke whale within the survey area of the HiDef surveys from October 2019 – September 2021 (HiDef Aerial Surveying Ltd 2020, 2021).**

| Survey                 | Date     | Raw count   | Density (#/km <sup>2</sup> ) | Abundance estimate | CV (%) | Lower CI | Upper CI |
|------------------------|----------|-------------|------------------------------|--------------------|--------|----------|----------|
| 9                      | Jun 2020 | 3           | 0.04                         | 8                  | 63     | 0        | 20       |
| All other surveys      |          | 0           | 0                            | 0                  | 0      | 0        | 0        |
| <b>Overall average</b> |          | <b>0.13</b> | <b>0.002</b>                 | <b>0.33</b>        | -      | -        | -        |

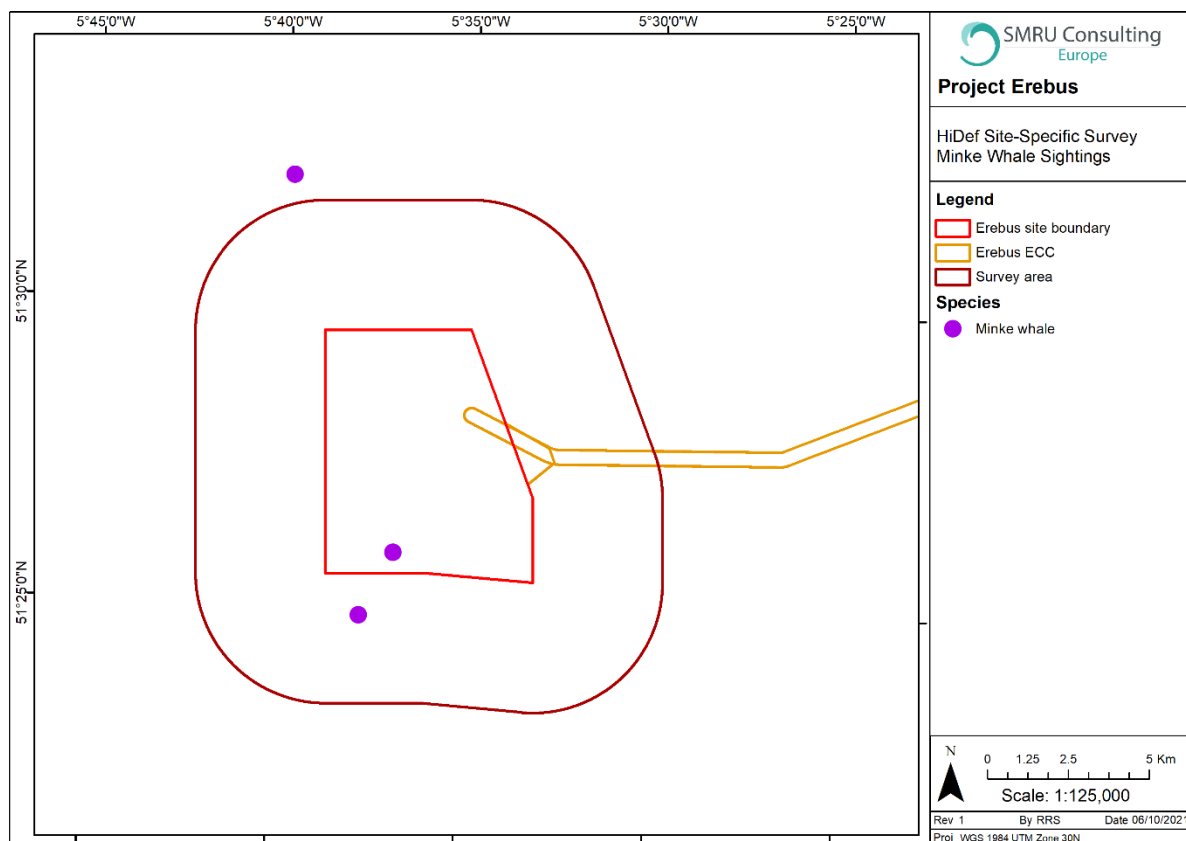


**Figure 8.3 Minke whale sightings recorded during the HiDef surveys.**

## 8.3 Project Valorous surveys

No minke whales were sighted during the first three surveys at Project Valorous.

#### 8.4 SCANS III

During the SCANS III survey (Hammond et al. 2021), effort was conducted in 2016 in survey block D (which covered the Southern Celtic/Irish Seas and where the Project is located) using aerial survey techniques. Minke whales were sighted in the northeast of block D, with no sightings in the more offshore waters (Figure 8.4). Results from this survey concluded that minke whales in block D had an estimated abundance of 543 individuals (95% CI: 0 - 1,559). Density estimates for block D were concluded to be 0.0112 whales/km<sup>2</sup>.

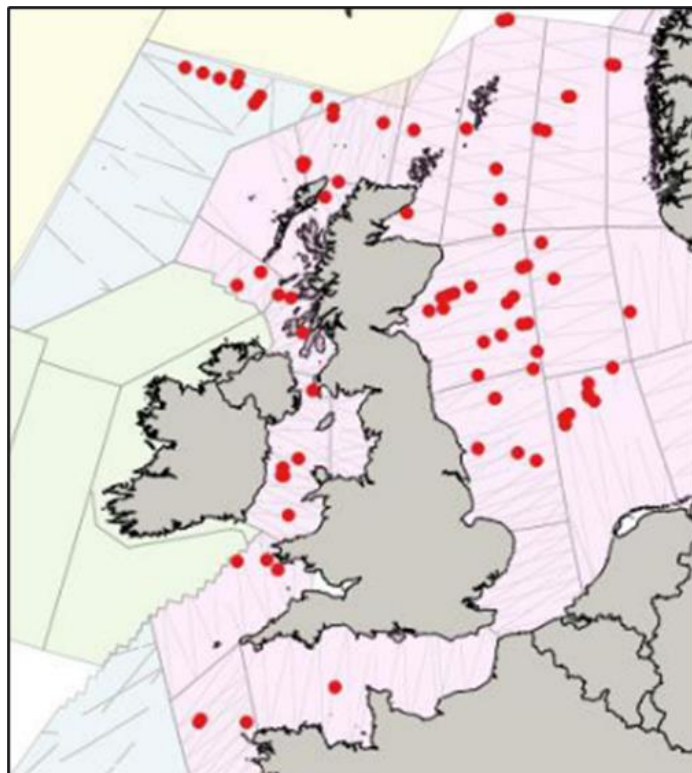


Figure 8.4 Sightings of minke whales from the SCANS III surveys (Hammond et al. 2021) .

#### 8.5 ObSERVE

Minke whales were the most frequently sighted mysticete species during the ObSERVE surveys carried out from 2015 - 2016. Almost all sightings of this species were single individuals, with one sighting of a mother-calf pair of minke whales (Rogan et al. 2018). These sightings occurred in neritic waters, in all strata and in the Irish Sea (Figure 8.5).

These surveys concluded that there was inter-seasonal variation present for minke whales within the survey area, with coastal distributions of these individuals appearing to increase during the summer in comparison to the winter months, suggesting that a seasonal inshore to offshore movement pattern may be occurring for minke whales in the survey area (Figure 8.6). Findings from this study also suggest that the Irish Sea appears to be unfavourable for minke whales in the winter period (Figure 8.6).

Across the survey area, estimated abundances for minke whales were higher in the summer months (Seasons 1 and 3), with estimates 3.4 times higher than in the winter months (Seasons 2 and 4) in 2015, and 1.6 times higher in the summer months than the winter months in 2016 - 17 (Rogan et al. 2018). Within Stratum 4, which is in proximity to the Project site, minke whales were sighted in all

surveys except Season 4 (Table 26). In Stratum 5, minke whales were only sighted in the summer surveys. Corrected density estimates were reported for minke whales in this study (Table 26).

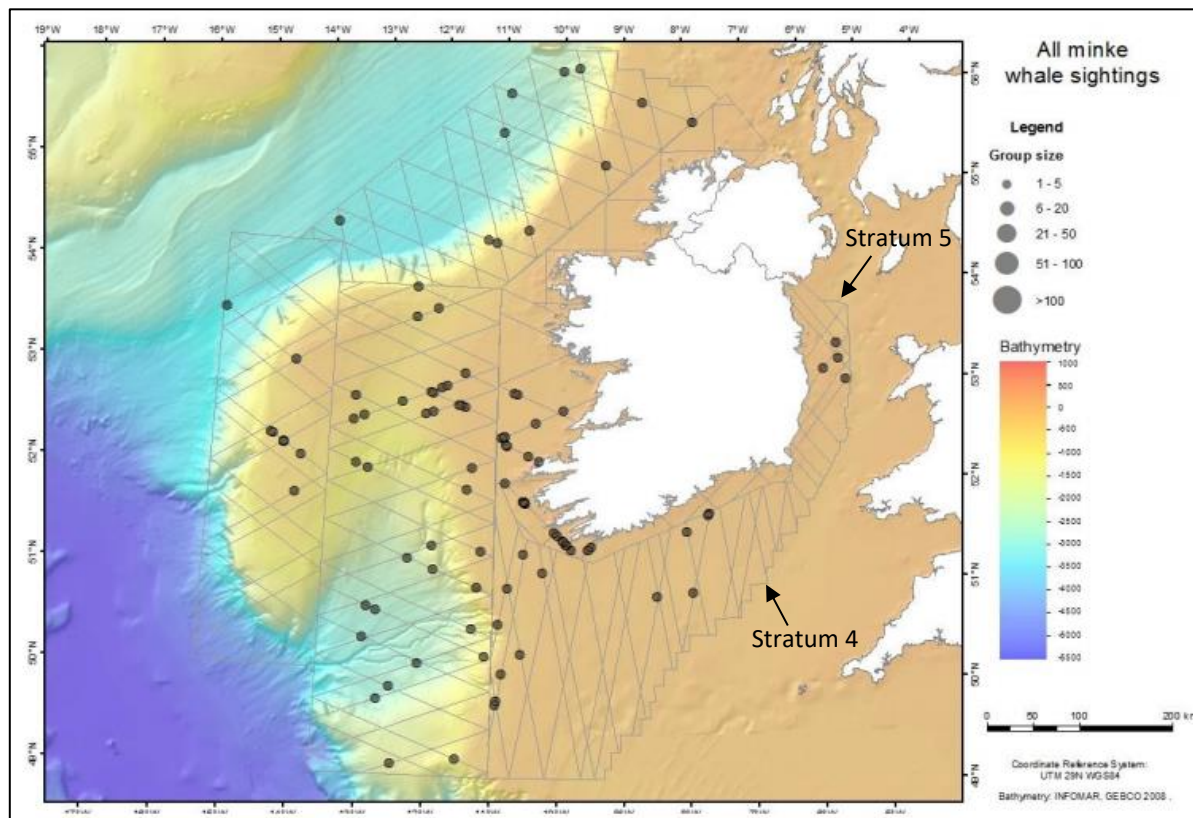


Figure 8.5 All minke whale sightings from the ObSERVE surveys from 2015 - 2016 (Rogan et al. 2018).

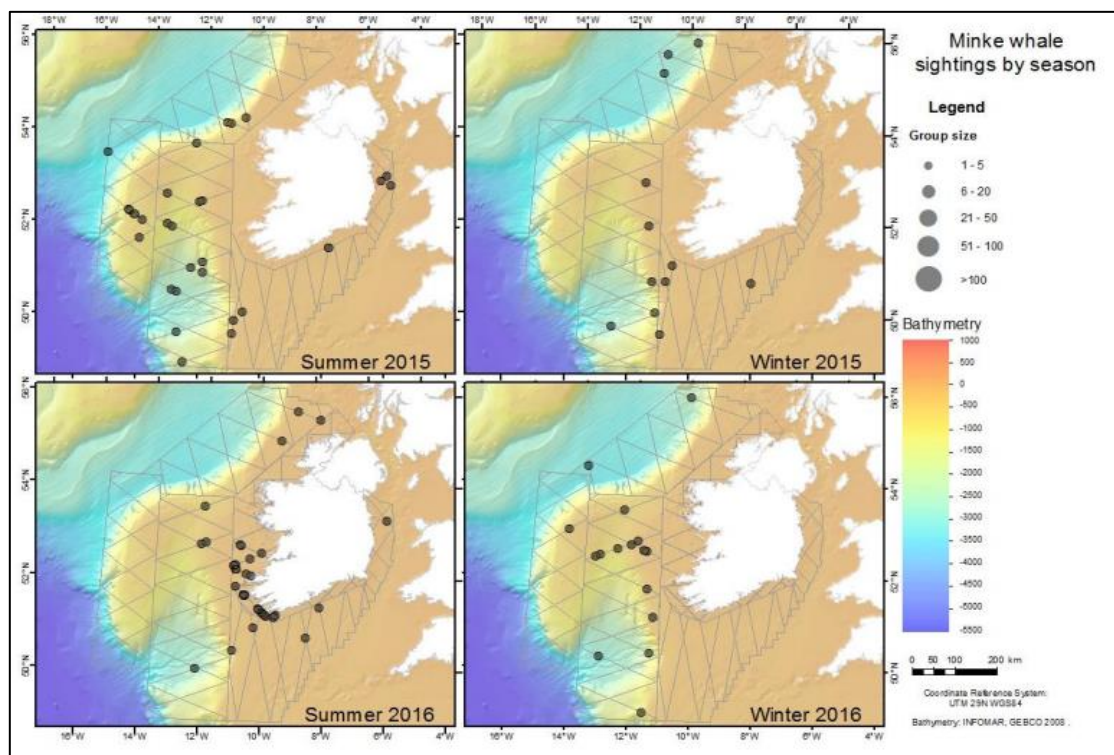


Figure 8.6 Seasonal sightings of minke whales from the ObSERVE surveys from 2015 - 2016 (Rogan et al. 2018).

Table 26 Minke whale groups, mean group size, density and corrected design-based estimates for Stratum 4 and 5 of the ObSERVE surveys (Rogan et al. 2018).

| Stratum | Season      | Density (#/km <sup>2</sup> ) | Abundance | Lower CI | Upper CI |
|---------|-------------|------------------------------|-----------|----------|----------|
| S4      | Summer 2015 | 0.013                        | 835       | 382      | 1827     |
| S4      | Winter 2015 | 0.012                        | 750       | 349      | 1613     |
| S4      | Summer 2016 | 0.012                        | 760       | 359      | 1610     |
| S4      | Winter 2016 | NA                           |           |          |          |
| S5      | Summer 2015 | 0.045                        | 494       | 221      | 1105     |
| S5      | Winter 2015 | NA                           |           |          |          |
| S5      | Summer 2016 | 0.016                        | 180       | 58       | 552      |
| S5      | Winter 2016 | NA                           |           |          |          |

## 8.6 JCP

### 8.6.1 JCP Phase III

Minke whales were reported on in terms of their predicted densities for summer 2010 by Paxton et al. (2016). The upper limit predicted densities for this species concluded a moderately high density of minke whales in proximity to the Project site (Figure 8.7; bottom right). Densities from all years of summer data reported a lower, but still moderate, density of minke whales in proximity to the Project site (Figure 8.7; top left). Minke whales were reported to have the highest estimated abundances within the Atlantic Array in the summer months at 280 individuals, and lowest in the winter at 40

individuals (Table 14), suggesting seasonal variation may be present for this species in the area (Paxton et al. 2016).

**Table 27 JCP Phase III density estimate for minke whales in 2010 for the Atlantic Array area of commercial interest (Paxton et al. 2016).**

| Season         | Abundance  | 95% CI    | Density (#/km <sup>2</sup> ) |
|----------------|------------|-----------|------------------------------|
| Winter         | 40         | 10 – 210  | 0.002                        |
| Spring         | 110        | 10 – 830  | 0.006                        |
| Summer         | 280        | 120 – 950 | 0.014                        |
| Autumn         | 50         | 10 - 200  | 0.003                        |
| <b>Average</b> | <b>120</b> | <b>-</b>  | <b>0.006</b>                 |

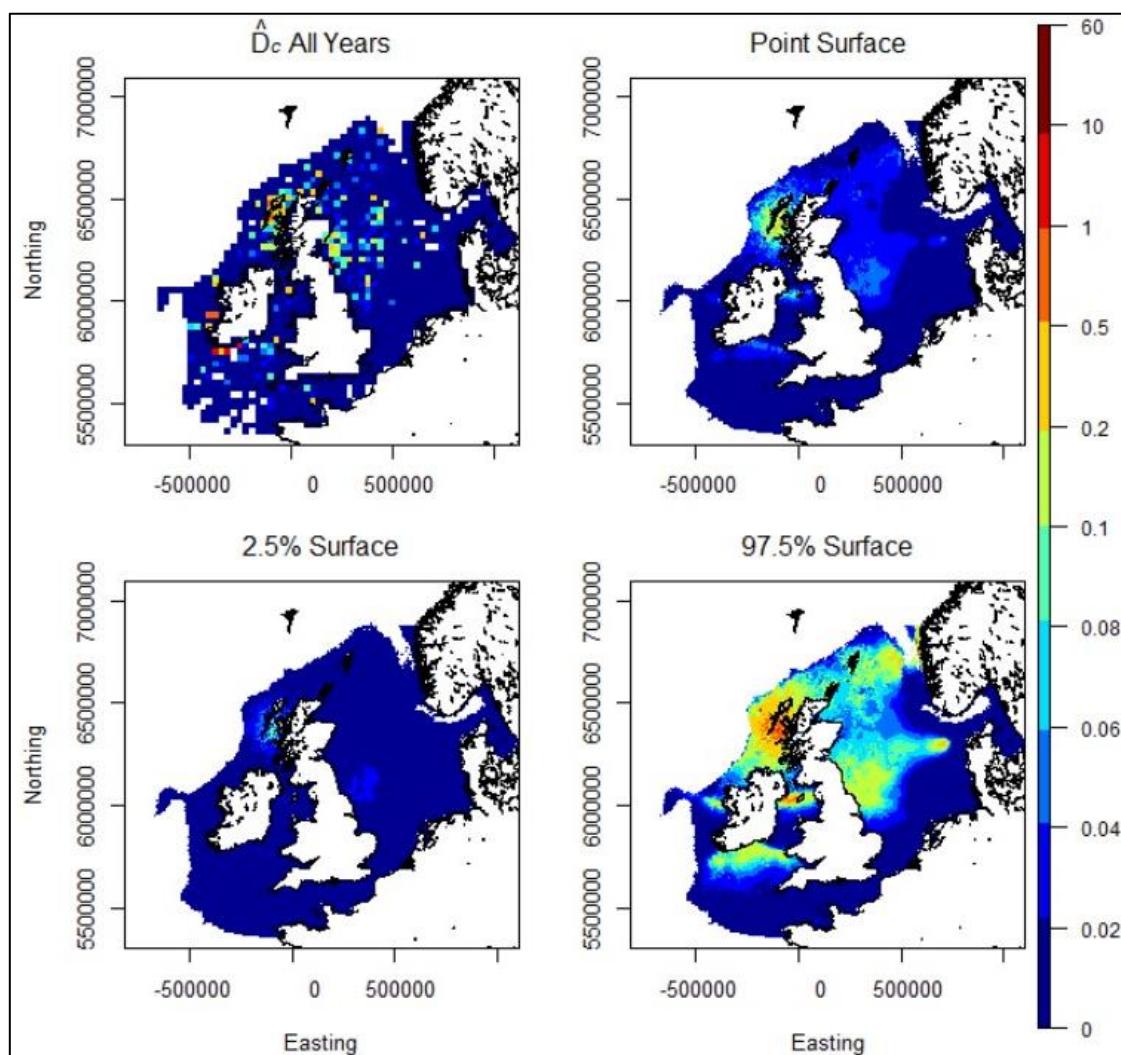
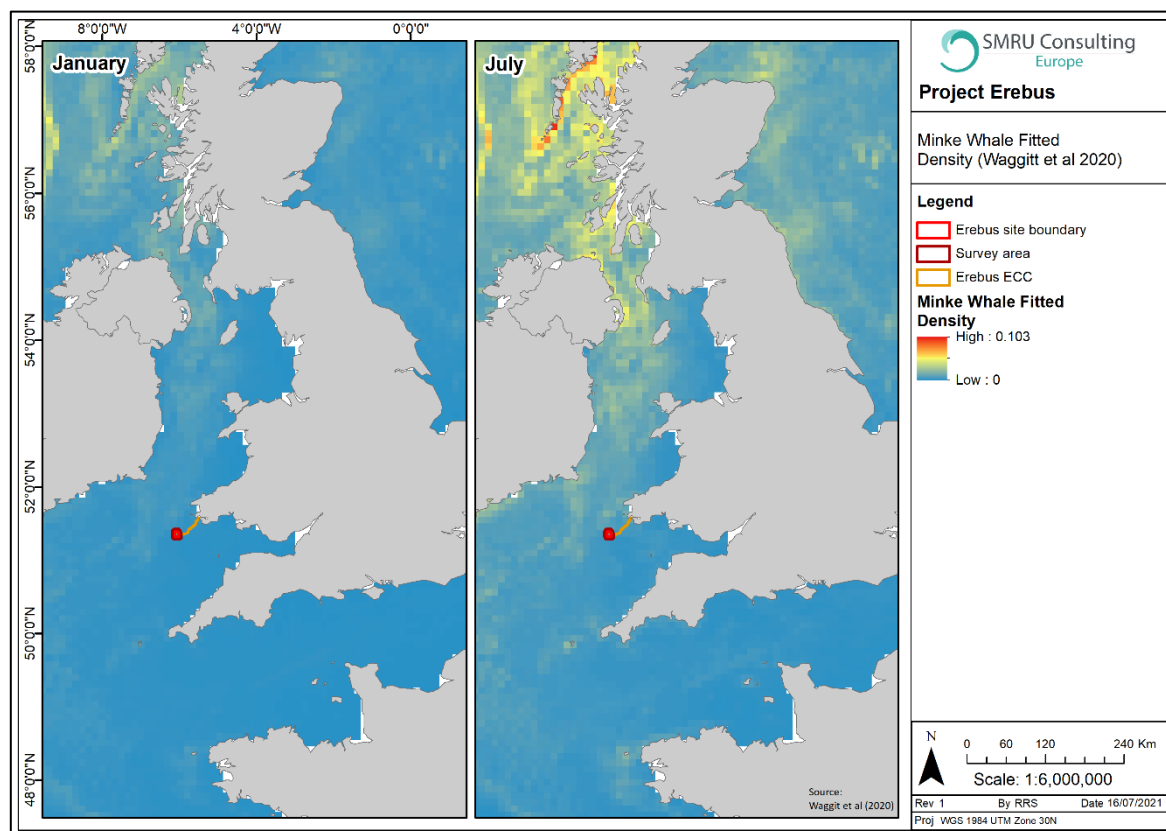


**Figure 8.7 Predicted minke whale densities for summer 2010 (Paxton et al. 2016).** Top left; input densities (summer all years), top right; point estimate of cell densities, bottom left; lower (2.5%) confidence limit on cell densities, bottom right; upper (97.5%) confidence limit on cell densities (whales/km<sup>2</sup>). Note that the top left plot exaggerates the spatial coverage of the relevant effort.

### 8.6.2 MERP surveys

Waggitt et al. (2020) produced distribution maps of minke whales as part of the MERP project (Figure 8.8). The predicted density surfaces for minke whales concluded a slight increase in the density of this species in proximity to the Project site during the summer months (Figure 8.8). However, these are provided for illustrative purposes only as these densities are not considered to be suitable for use in quantitative impact assessments.



### 8.7 Sea Trust Wales

Minke whales were the fourth most commonly sighted species during the Sea Trust Wales surveys between 2005 and 2021. Minke whales accounted for 0.24% of the total marine mammal sightings (46 individuals). Minke whales were only sighted between June and September with sightings spread across the general area (Figure 8.9). No effort data was collected and as such, no density estimate can be calculated using this dataset. The data simply confirm the presence of minke whales in the area.

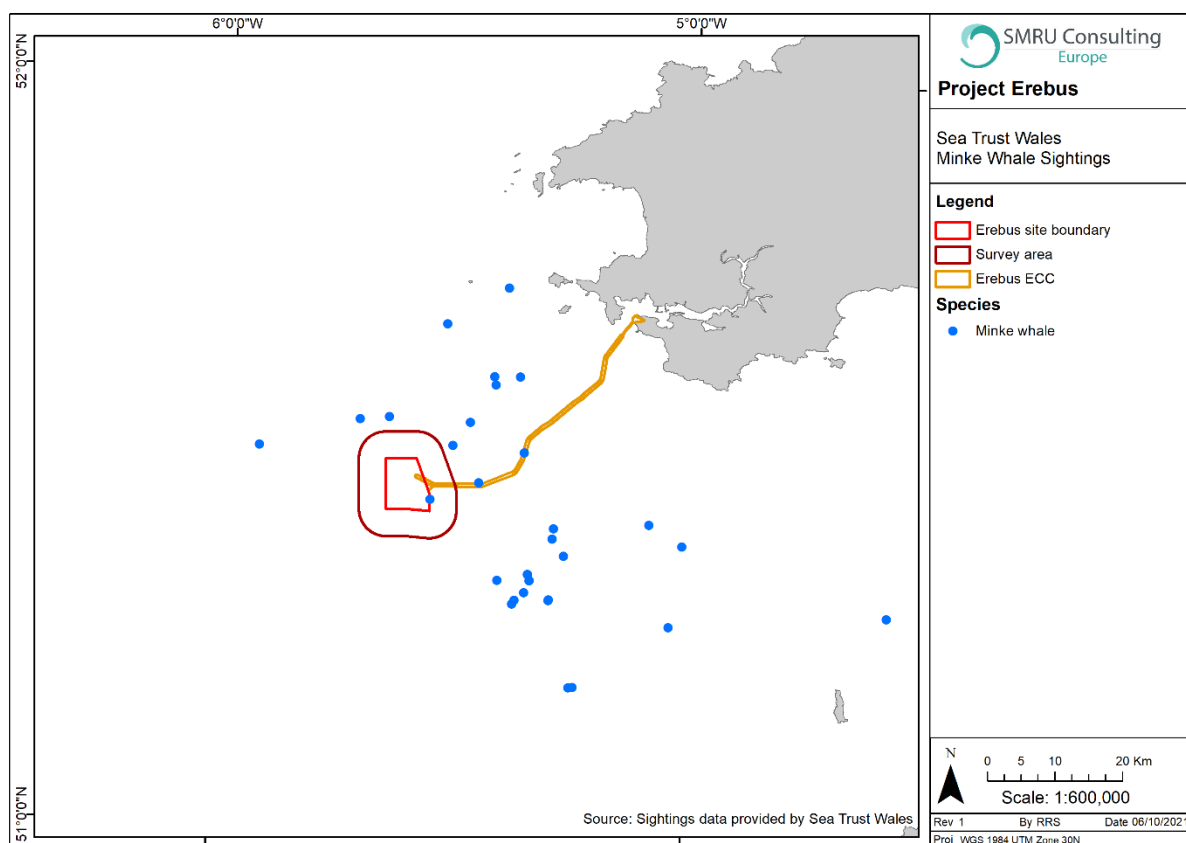


Figure 8.9 Minke whale sightings recorded by the Sea Trust Wales (April-Oct, 2005-2021).

## 8.8 Summary

Minke whales are present in the Irish Sea during the summer months and as such, should be included in the Project impact assessment. SMRU Consulting concludes that the most reliable and recent density estimate for this species is the SCANS III survey at 0.0112 whales/km<sup>2</sup> (bold text in Table 28). The density estimate from ObSERVE Stratum 5 and the Atlantic array area are marginally larger at 0.014 whales/km<sup>2</sup> in both surveys. However, these have not been used as the ObSERVE survey does not directly cover the survey area and the Atlantic array area survey, whilst covering the Project area, is not considered as reliable as those from SCANS III. This is because there are significant limitations to the estimates provided by the JCP Phase III analysis. The authors state that the JCP database provides relatively poor spatial and temporal coverage, that the results should be considered indicative rather than an accurate representation of species distribution, and that due to the patchy distribution of data, the estimates are less reliable than those obtained from SCANS surveys. In addition, the authors categorically state that the JCP Phase III outputs cannot be used to provide baseline data to infer abundance at a finer scale than 1,000 km<sup>2</sup> because of issues relating to standardizing the data (such as corrections for undetected animals and potential biases) from so many different platforms/methodologies and the strong assumptions that had to be made when calculating detection probability. The data included in the analysis are now between 10 and 26 years old and may not be representative of current cetacean distribution and densities.

**Table 28 Minke whale density estimates.**

| Source                      | Area                                   | Temporal           | Density (#/km <sup>2</sup> ) |
|-----------------------------|----------------------------------------|--------------------|------------------------------|
| HiDef site-specific surveys | Project survey area                    | 2019-2020          | 0.002                        |
| <b>SCANS III block D</b>    | <b>Southern Celtic/Irish Seas</b>      | <b>Summer 2016</b> | <b>0.0112</b>                |
| ObSERVE (Stratum 4, dbe)    | Celtic Sea                             | Summer 2015        | 0.004                        |
| ObSERVE (Stratum 4, dbe)    | Celtic Sea                             | Summer 2016        | 0.004                        |
| ObSERVE (Stratum 4, dbe)    | Celtic Sea                             | Winter 2015        | 0.004                        |
| ObSERVE (Stratum 4, dbe)    | Celtic Sea                             | Winter 2016        | 0                            |
| ObSERVE (Stratum 5, dbe)    | East Rol                               | Summer 2015        | 0.014                        |
| ObSERVE (Stratum 5, dbe)    | East Rol                               | Summer 2016        | 0.005                        |
| ObSERVE (Stratum 5, dbe)    | East Rol                               | Winter 2015        | 0                            |
| ObSERVE (Stratum 5, dbe)    | East Rol                               | Winter 2016        | 0                            |
| Atlantic Array area         | Bristol Channel and adjacent Irish Sea | Winter 2010        | 0.002                        |
| Atlantic Array area         | Bristol Channel and adjacent Irish Sea | Spring 2010        | 0.006                        |
| Atlantic Array area         | Bristol Channel and adjacent Irish Sea | Summer 2010        | 0.014                        |
| Atlantic Array area         | Bristol Channel and adjacent Irish Sea | Autumn 2010        | 0.003                        |
| Atlantic Array area         | Bristol Channel & adjacent Irish Sea   | Average 2010       | 0.006                        |

## 9 Grey seal

Grey seals are found in coastal waters in the UK, with pup production estimates showing that this population has been rapidly increasing over the last decade. The latest UK population estimate (from 2016 pup production estimates and projected forward to the population size at the start of the 2019 breeding season) is 149,700 adult grey seals (95% CI: 120,000 – 174,900) (SCOS 2021). Based on NRW photo-ID grey seal data, there is an estimated 2,688 adult female grey seals utilising haul-out sites around the Welsh coastline between 1992 and 2016, with these data showing that adult grey seals found within SACs in this region ranging over the wider Celtic and Irish Seas (Langley et al. 2020). Within the Pembrokeshire Marine SAC (approximately 40km from the Project site), grey seal population status and range are also considered Favourable (NRW 2018).

### 9.1 Management unit

The relevant MU for grey seals is under discussion, and therefore two MUs are presented here and in the quantitative impact assessment:

- OSPAR Region III: Celtic Seas (interim MU, proposed by NRW 2020)
- Within the Wales MU and adjacent to the Southwest England MU (SCOS 2021)

#### 9.1.1 OSPAR Region III MU

NRW (2020) do not agree with the seal MUs provided in IAMMWG (2013) (used in SCOS reporting), as it “does not reflect known seal population movement and distribution or management boundaries”. Therefore, NRW suggest that until the IAMMWG define a more suitable MU for grey seals, the OSPAR Region III Celtic Sea area is an appropriate interim MU. As shown in Figure 2.3, this encompasses the

Celtic Seas (including the Irish Sea, Republic of Ireland waters, Northern Irish waters, Scottish waters, English waters and French waters). Using the grey seal mean habitat preference map, there are estimated to be 50,900 grey seals at-sea within the OSPAR Region III MU at any one time. It is estimated that grey seals spend 77% of their time at sea on average, therefore, accounting for the 23% of grey seals on land, the population estimate of grey seals within the OSPAR Region III MU is approximately 66,100 grey seals.

### 9.1.2 SCOS MUs

Given the limited connectivity between seals in Welsh waters and Scottish waters (see section 9.7), there is reason to consider the OSPAR Region III MU to be too large to appropriately define the relevant grey seal population. Therefore, as an alternative, the SCOS MUs are considered here too. The Project is located within the Wales MU for grey seals, but is adjacent to the Southwest England MU, and therefore it is considered appropriate to combine the two MUs for the purpose of assessment in relation to the Project. Estimates of grey seals counted in August 2016-2019 in the Wales and the Southwest England MUs are provided in SCOS (2021) (900 and 500 respectively); however, the report states that there are no SMRU surveys in the Wales or Southwest England MUs, and that estimates are “*compiled from counts shared by other organisations*” (including NRW) “*or found in various reports & on websites*” (e.g. Westcott and Stringell 2004, Stringell et al. 2014). It is estimated that grey seals spend 23% of their time hauled-out on average and, therefore, accounting for the grey seals at sea, the population estimate for the combined Wales and Southwest England MUs is approximately 6,090 grey seals. However, given the lack of dedicated surveys in these areas, this estimate should be considered with caution due to the limited data used to inform the estimate.

## 9.2 General – Welsh Marine Atlas

Grey seals are the only known pinniped species which breeds in Wales. This species is widely distributed, with highest pup production reported in northwest Pembrokeshire. The project database for this study included 2,580 sightings of grey seals, resulting in a count of 3,428 individuals (Baines and Evans 2012). Both land- and vessel-based counts from 1990 - 2007 were combined to provide a sightings rate for grey seals in sightings per hour (Figure 9.1). However, Baines and Evans (2012) expressed caution when interpreting these figures as it was found that observers on occasion would not record grey seal sightings during surveys which were for cetaceans, potentially resulting in a lower representation of grey seal abundance within the area.

Figure 9.1 concludes that grey seals are present in proximity to the Project site. Further investigation into the seasonal variation of grey seals reported that grey seal sightings peak in proximity to the Project site from April - June, and again from October - December. Lowest sightings of grey seals in proximity to the Project site are reported to be from January - March (Figure 9.2).

While these data provide an overview of the general distribution of grey seals in the Irish Sea, they do not provide density estimates.

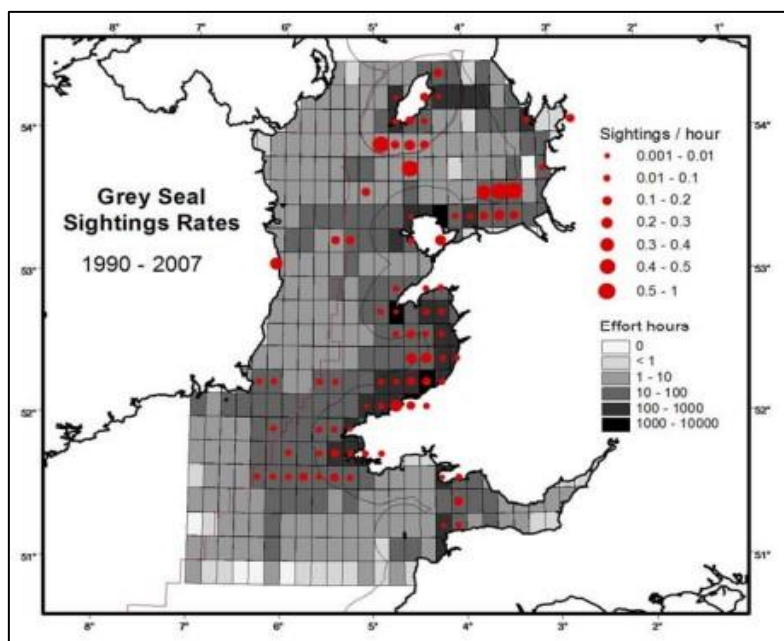


Figure 9.1 Sighting rates (vessel and land-based surveys) of grey seals from 1990-2007 (Baines and Evans 2012).

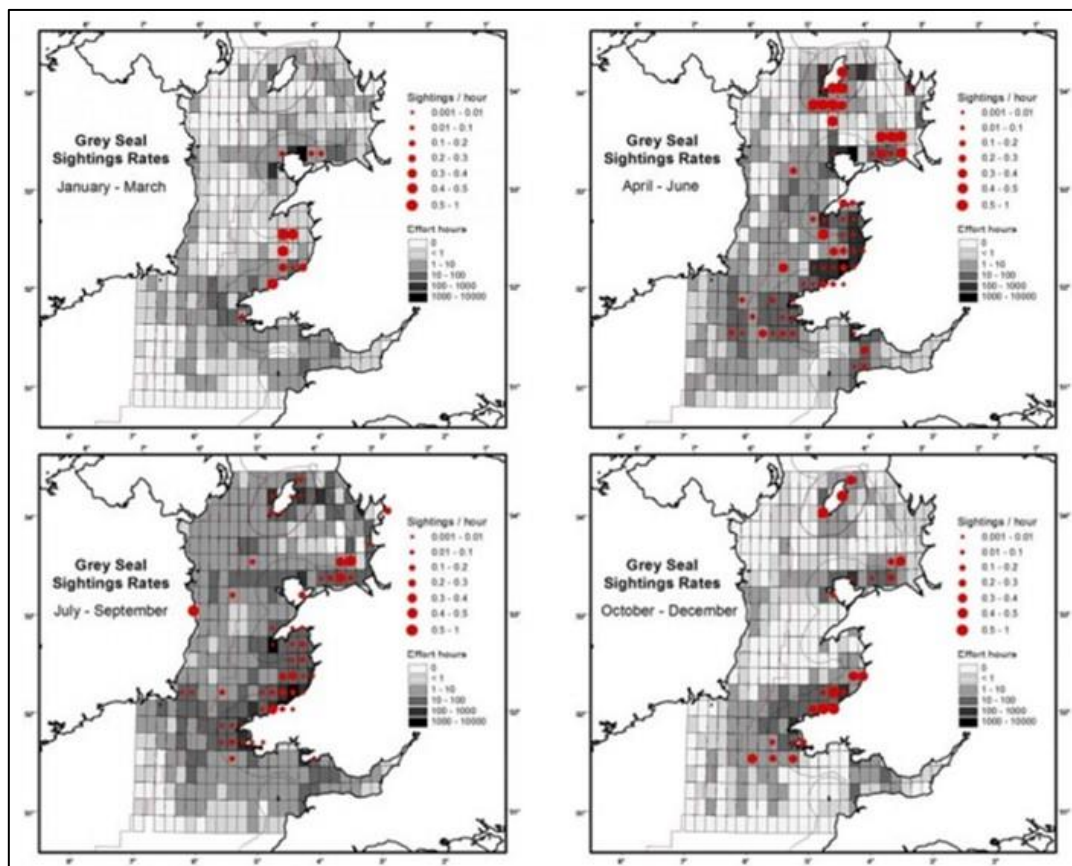


Figure 9.2 Long-term (1990-2007) quarterly mean sighting rates of grey seals from both vessel and land surveys (Baines and Evans 2012).

### 9.3 Site-specific surveys

Grey seals were sighted in the HiDef monthly surveys from October 2019 to September 2021, with this species reported to have been sighted in very low numbers (HiDef Aerial Surveying Ltd 2020, 2021). Across all 24 surveys, only four grey seals were sighted. Relative density estimates (seals/km<sup>2</sup>) and relative abundance estimates have been provided. Across the 24 months of surveys, the average relative density estimate was 0.003 grey seals/km<sup>2</sup> (Table 29). There were insufficient sightings to comment on the spatial distribution (Figure 9.3) or seasonal occurrence of grey seals.

**Table 29 Density and abundance estimates of grey seals within the survey area of the HiDef surveys from October 2019 – September 2021 (HiDef Aerial Surveying Ltd 2020).**

| Survey                 | Date     | Raw count   | Density (#/km <sup>2</sup> ) | Abundance estimate | CV (%) | Lower CI | Upper CI |
|------------------------|----------|-------------|------------------------------|--------------------|--------|----------|----------|
| 2                      | Nov 2019 | 1           | 0.02                         | 4                  | 94.36  | 0        | 12       |
| 17                     | Feb 2021 | 1           | 0.02                         | 4                  | 95     | 0        | 12       |
| 18                     | Mar 2021 | 2           | 0.04                         | 8                  | 93.39  | 0        | 24       |
| All other surveys      |          | 0           | 0                            | 0                  | 0      | 0        | 0        |
| <b>Overall average</b> |          | <b>0.17</b> | <b>0.003</b>                 | <b>0.67</b>        | -      | -        | -        |

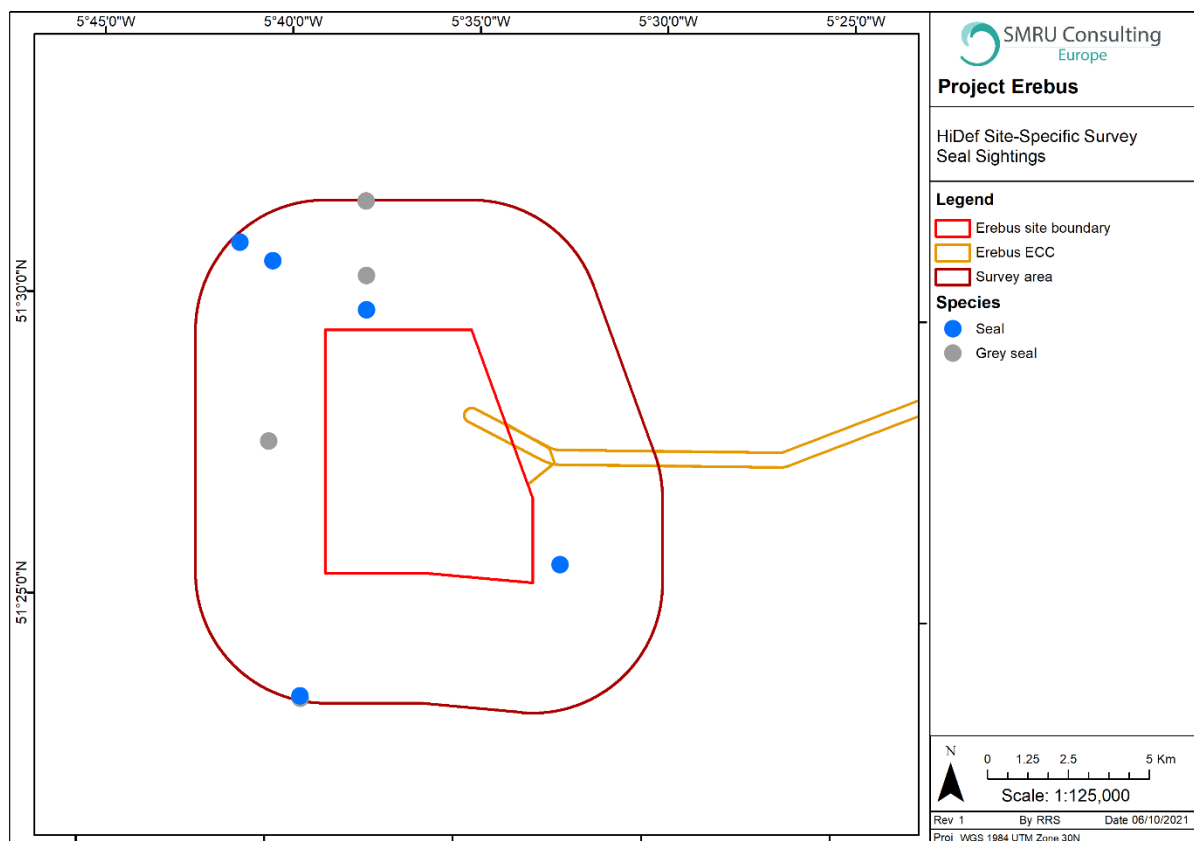


**Figure 9.3 Seal sightings recorded during the HiDef surveys.**

### 9.4 Project Valorous surveys

Only one single grey seal was sighted during the first three surveys at Project Valorous.

## 9.5 Haul-out

In the Welsh region, grey seals are notoriously difficult to count at haul-out site from aerial surveys because, during the pupping season, these individuals tend to haul-out in caves and in cryptic habitats in which certain topographic features completely/partially obscure the habitat from aerial view. Due to this, ground and vessel-based surveys are considered more accurate in terms of providing estimates, but have their own challenges in terms of cost, personnel and resource limitations (Stringell et al. 2014).

NRW partly monitors grey seal haul-out sites around the Welsh coastline through the maintenance of Wales' grey seal photo-identification database (called the EIRPHOT database) of photo-ID data from 246 sites around the Welsh coast and islands (Figure 9.4). A high degree of connectivity has been reported among these areas over the years, with Skomer being connected with all other broad areas within the EIRPHOT database, while Ramsey and Bardsey were connected to all other broad areas excluding the Dee Estuary (Langley et al. 2018). This supports previous findings which demonstrated shorter term (on a scale of weeks and months) movements and connections of grey seals to sites throughout the Celtic and Irish Seas (Langley et al. 2018). Grey seals are also known to show high levels of site fidelity at their breeding sites (Pomeroy et al. 2000), which includes all of the EIRPHOT sites, excluding the Dee Estuary (Langley et al. 2018). In the most recent report, high levels of connectivity was reported between Skomer, Smalls & Grassholm, Llyn Peninsula and other more broad areas (Langley et al. 2020).

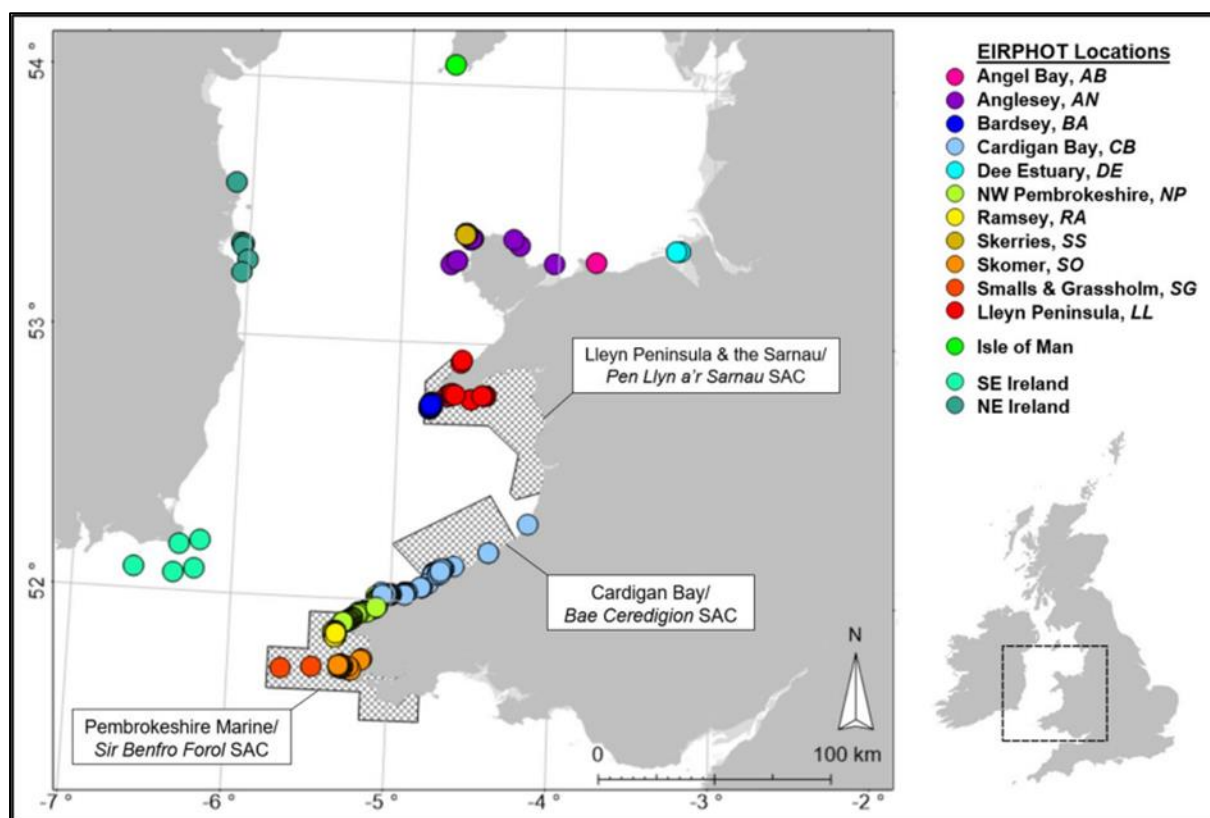


Figure 9.4 Celtic and Irish Sea grey seal haul-out sites covered by the EIRPHOT database (Langley et al. 2020).

## 9.6 Pup count

The latest grey seal pup counts for Wales (from 2016) predicted a population estimate in Welsh waters of 4,700 grey seals at the start of the 2018 breeding season, and pup production estimates for Wales in 2016 represented an average 10.1% increase per annum change in counts since 2014 (SCOS 2020). The main grey seal breeding sites in Wales are Ramsey Island, Skomer MCZ, North Pembrokeshire and North Wales (Figure 9.5), with larger breeding colonies distributed in Scotland and East England (Figure 9.5).

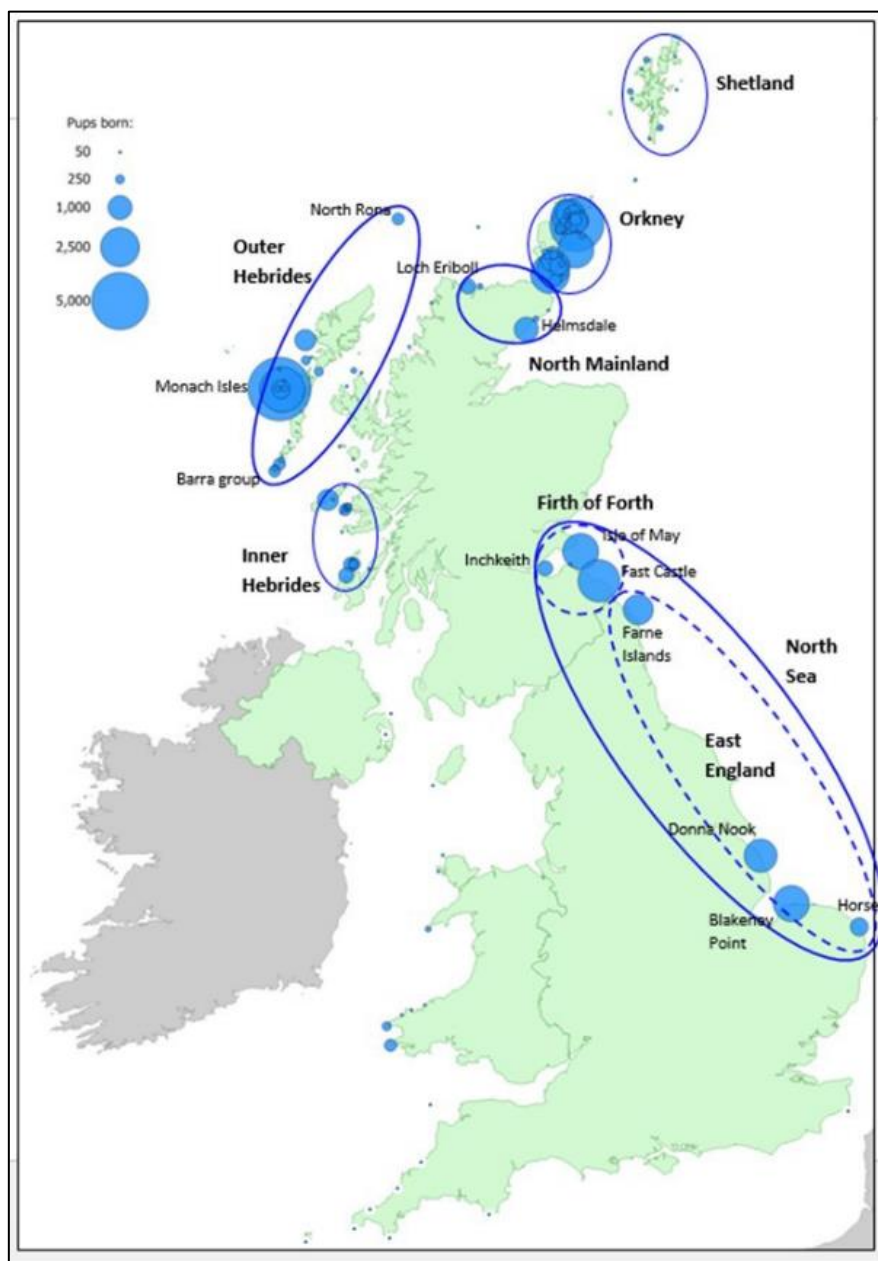


**Figure 9.5 Distribution and size of the main grey seal breeding colonies. Blue ovals indicate groups of regularly monitored colonies within each region (SCOS 2020).**

Wilkie and Zbijewska (2020) provided the latest census on grey seal breeding at Skomer Island, reporting a slightly reduced number of pups born here at 238 in total, compared to 241 pups reported in 2018 (Büche and Stubbings 2019), which was the highest total ever recorded. In total, 408 grey seal pups were born within the Skomer MCZ, 170 of which were born on the Marloes peninsula (Wilkie

and Zbijewska 2020). Due to the proximity of Skomer Island to the Project offshore wind development site, data on pup production in this area is imperative to the assessment of the grey seal population in this area. Data from 1989 – 2019 on pup production in the Skomer MCZ would suggest that pup production within this area is on the rise (Figure 9.6), highlighting the area as an important breeding site for grey seals. This trend has also been noted at other monitored sites and several North Pembrokeshire coastal sites over the past decade (Bull et al. 2017a, Bull et al. 2017b, Lock et al. 2017, Morgan et al. 2018). Within the MCZ, pup production is consistently higher at Skomer Island (59-81%) than Marloes peninsula (19-41%), although the percentage contribution to pup production at Marloes peninsula has been increasing over time (Figure 9.7) (Lock et al. 2017). The census also concluded that, on Skomer Island, the highest percentage (60.7%) of grey seal pups were born in September in 2019, which is consistent with previous census' as far as 2016 (Wilkie and Zbijewska 2020). Overall pup survival within the MCZ was variable from 1992 to 2016, ranging from 67% in 2001 to 91% in 1999 (Lock et al. 2017).

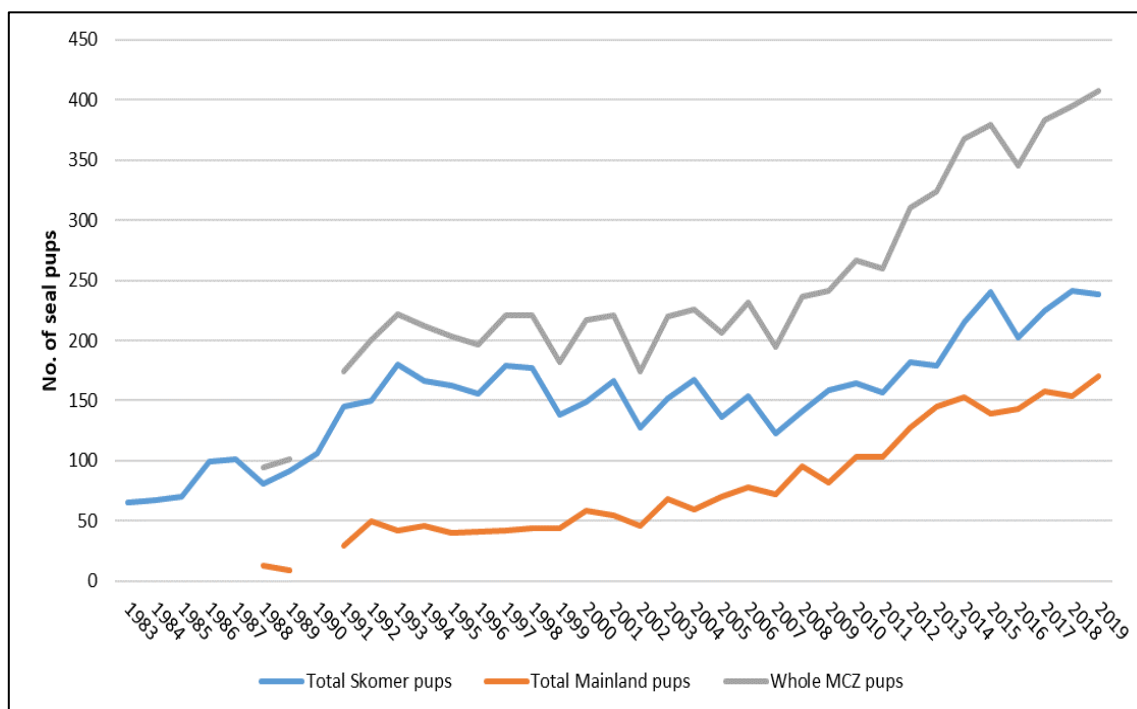


**Figure 9.6 The number of grey seal pups born in the Skomer MCZ between 1989 – 2019 (Wilkie and Zbijewska 2020).**

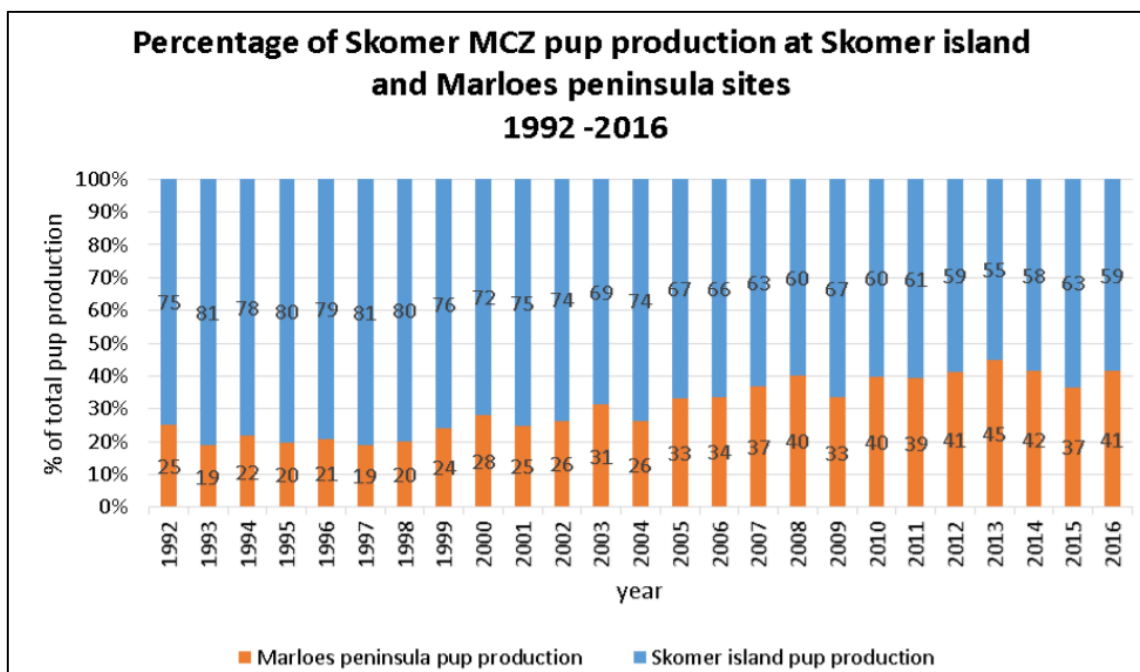


Figure 9.7 Percentage of Skomer MCZ production at Skomer Island and Marloes peninsula (Lock et al. 2017).

Data is also indicating that the onset of the pupping season has been getting earlier over time, but it is currently not known whether the observed change is indicative of a shift in the pupping season or an extension in the period (Bull et al. 2017b, Morgan et al. 2018). This trend has previously been observed in the Farne Islands where a correlation between an increase in the size and density of the breeding colony and the tendency for earlier pupping was observed (Coulson 1981, Bull et al. 2016). The shift in seasonality may, therefore, be in response to increased competition as a result of population growth (Bull et al. 2017b).

## 9.7 Telemetry

In total, 57 grey seals have been tagged in the West England and Wales MU, most of these were tagged in north Wales (Bardsey, River Dee and Anglesey) however there have been tagging studies conducted at Ramsey Island in Pembrokeshire (Table 30). Only 2 of these tagged grey seals have recorded telemetry tracks within the Project array area, one of these was tagged in Ramsey and the other in Anglesey (Figure 9.8). These 2 seals showed connectivity with the Pembrokeshire Marine SAC, the Cardigan Bay SAC and the Llyn Peninsula and the Sarnau SAC.

More generally, the telemetry data show high levels of interconnectivity between the Welsh, eastern RoI and SW England SACs, with individual seals with telemetry data recorded with the Pembrokeshire Marine SAC also recording telemetry tracks within the Llyn Peninsulas and the Sarnau SAC, the Cardigan Bay SAC, the Saltee Islands SAC, the Lundy SAC and the Isles of Scilly Complex SAC (Figure 9.9).

Table 30 Summary information on all grey seals tagged in the West England and Wales MU.

| Date      | Location                                                | Tag type  | Sex          | Age       |
|-----------|---------------------------------------------------------|-----------|--------------|-----------|
| June 2004 | Bardsey x4<br>River Dee (Hilbre Island) x7<br>Ramsey x7 | All Argos | 9x F<br>9x M | All adult |

|              |                                                                 |                    |              |                     |
|--------------|-----------------------------------------------------------------|--------------------|--------------|---------------------|
| Oct 2009     | Anglesey (Skerries) x3<br>Bardsey x2                            | All GPS            | 3x F<br>2x M | All pups            |
| Oct-Nov 2010 | Anglesey (Skerries) x5<br>Ramsey x7                             | All GPS            | 7x F<br>5x M | All pups            |
| Jun-Jul 2017 | River Dee (West Hoyle Bank) x11<br>River Dee (Hilbre Island) x1 | 3x Argos<br>9x GPS | 7x F<br>5x M | 11x adult<br>1x juv |
| May 2018     | Bardsey x10                                                     | 1x Argos<br>9x GPS | 6x F<br>4x M | All adult           |

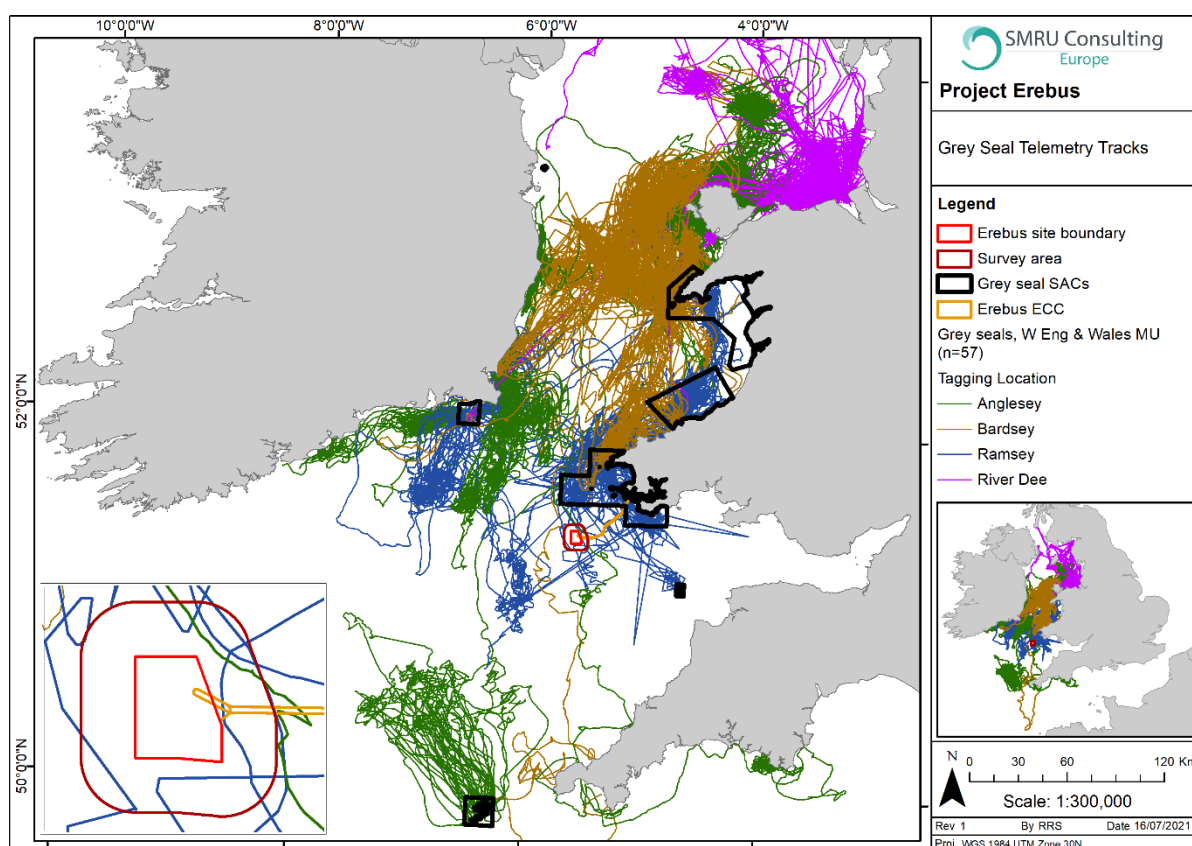


**Figure 9.8** Telemetry data of the 57 grey seals tagged in the West England and Wales MU. Tracks are coloured by tagging location.

Telemetry data from grey seals tagged at haul-out sites in France (Molene archipelago and baie de Somme) have shown that there is connectivity between French haul-out sites and haul-out sites in southwest England and in Wales, with grey seal telemetry tracks being recorded within the Bristol Channel and in the vicinity of the Project site (Figure 9.9) (Vincent et al. 2017). This large scale movement needs to be considered in the transboundary effects assessment for grey seals.

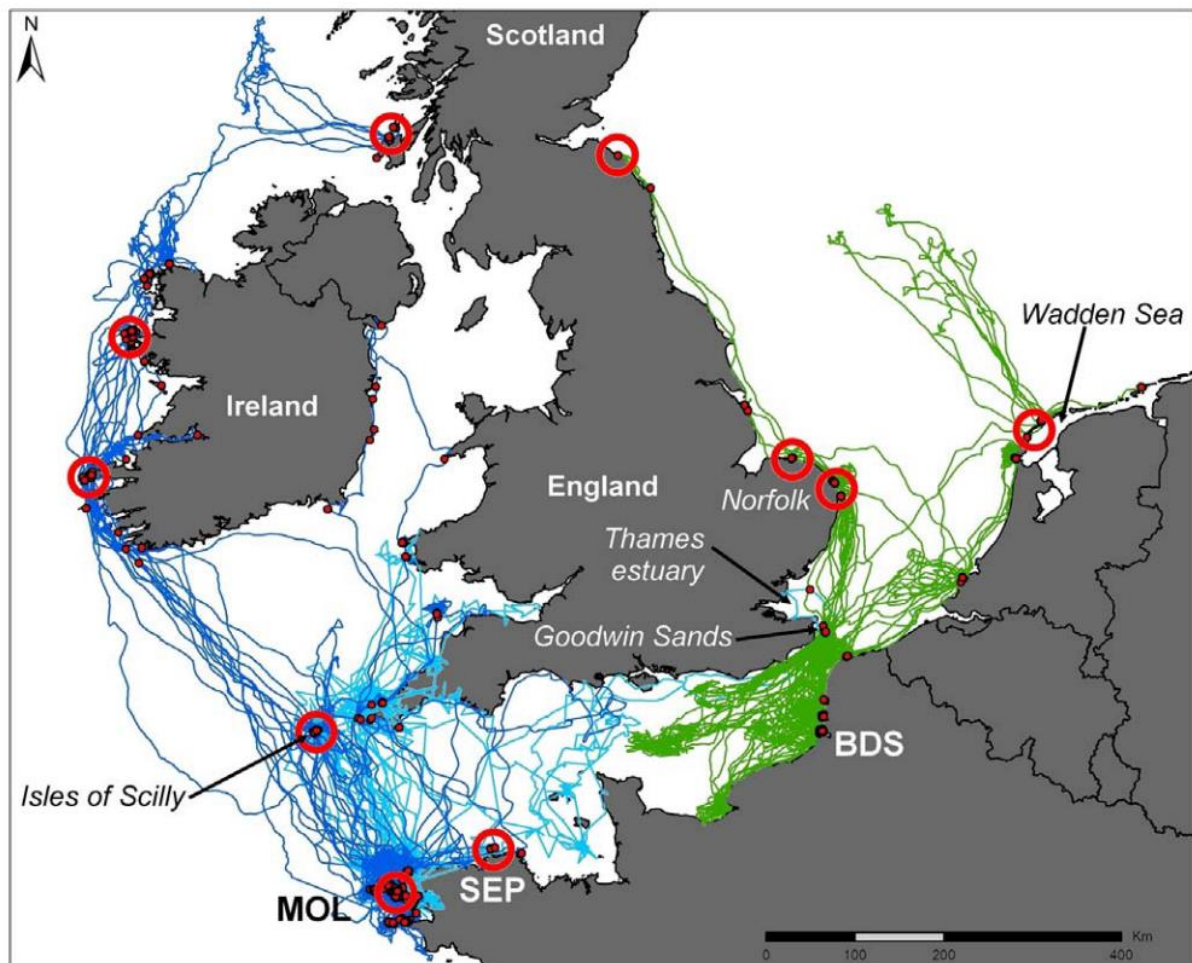


Figure 9.9 Grey seal telemetry tracks for grey seals tagged in France (Vincent et al. 2017). Tracks from MOL (15 individuals tracked by Argos tags from 1999 to 2003, in light blue, and 19 individuals tracked by GPS/GSM tags from 2010 to 2013, in dark blue) and BDS (11 individuals tracked in 2012, in green). Red dots indicate haul-out locations of the seals. Thick, red circles indicate breeding locations, as suggested from the activity budget of the seals.

## 9.8 Habitat preference

The habitat preference maps shows that grey seal at sea densities are lower in the south-west England area in comparison to other parts of the UK such as southeast and northeast England, Orkney and parts of the Hebrides (Figure 9.10). Within a 50 km buffer of the Project array area, there are predicted to be ~280 grey seals at sea at any one time, this equates to an average density of 0.031 grey seals/km<sup>2</sup>. However, usage within this buffer area is not expected to be uniform, and much higher densities are predicted to be present around Skomer Island and within the Pembrokeshire Marine SAC, where at sea density estimates reach up to 0.48 seals/km<sup>2</sup>. Within the Project array area, the estimated density is much lower at ~0.004 seals/km<sup>2</sup>.

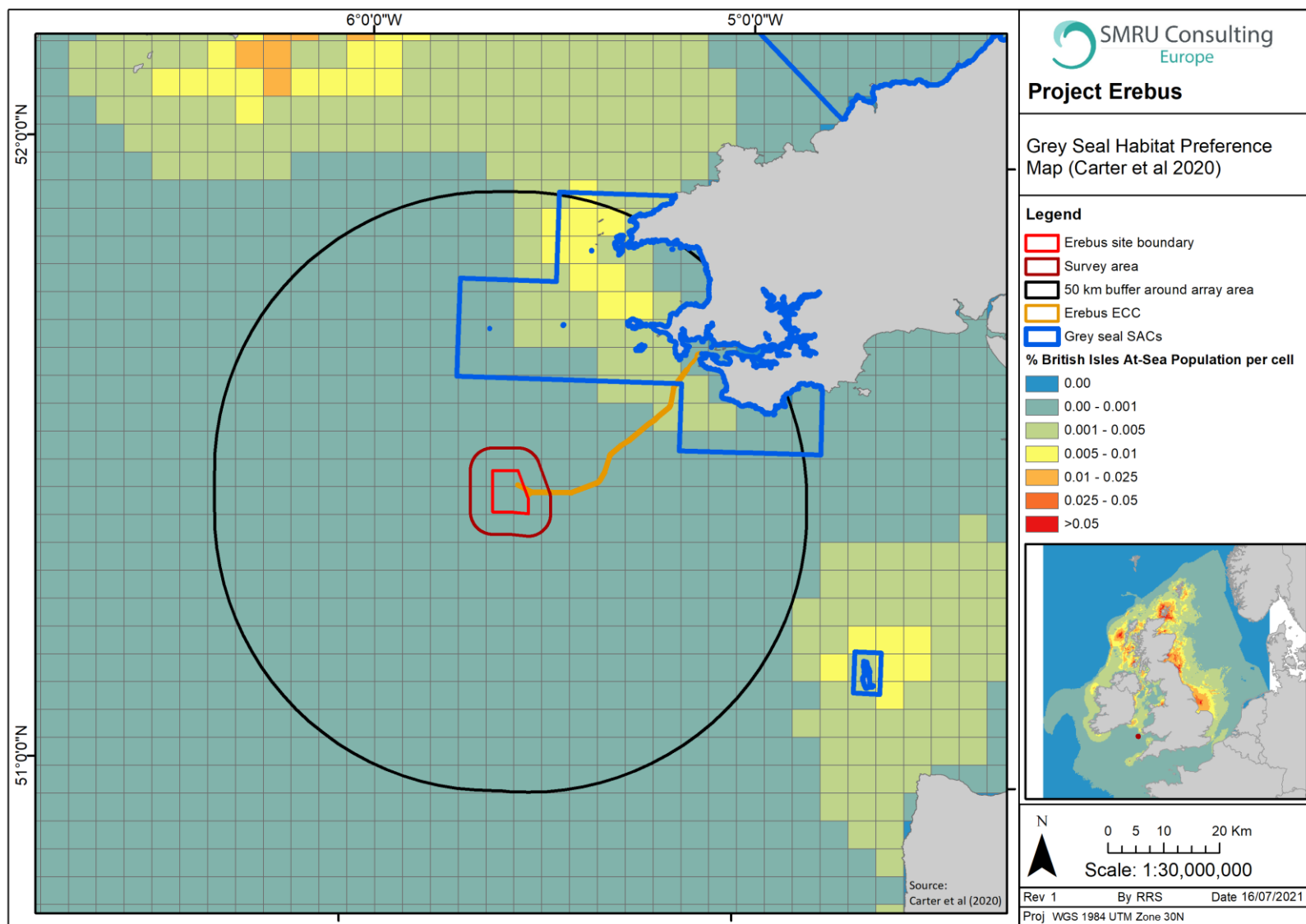


Figure 9.10 Grey seal mean estimated at-sea distribution map (Carter et al. 2020).

## 9.9 Summary

Grey seals have been sighted during the HiDef site-specific surveys (HiDef Aerial Surveying Ltd 2020), and they are known to be present in the area from both at-sea surveys (Baines and Evans 2012), haul-out data (Bull et al. 2017a, Bull et al. 2017b, Langley et al. 2020) and telemetry data (Vincent et al. 2017). Therefore, grey seals should be included in the quantitative impact assessment for the Project. It is recommended that the density estimate taken forward are the grid cell specific estimates based on the habitat preference maps. Given the lack of agreed MUs for grey seals, it is also recommended that two different MUs are considered in the impact assessment: both the OSPAR Region III Celtic Sea MU and the SCOS combined Wales and Southwest England MUs.

## 10 Turtles

Five species of marine turtle have been recorded in the UK, but the majority of these are vagrants and are not sighted regularly. The only species thought to be resident is the leatherback turtle (*Dermochelys coriacea*), listed as 'Critically Endangered' by the IUCN (IUCN 2019). Leatherbacks are a single species globally comprising biologically described RMUs (Wallace et al. 2010), which describe biologically and geographically explicit population segments by integrating information from nesting sites, mitochondrial and nuclear DNA studies, movements and habitat use by all life stages. There are seven RMUs assigned for leatherback turtles, each representing a different subpopulation, with a degree of geographical overlap between some RMUs. The Project array area overlaps with the Northwest Atlantic RMU (Figure 10.1) which contains an estimated 23,010 leatherback turtles (IUCN 2019). The RMU spans an extensive area throughout the northern Atlantic Ocean from nesting areas in the wider Caribbean region to foraging areas extending from the equator to northern temperate latitudes (North Atlantic Leatherback Working Group 2018).

Outside of the nesting season which occurs in tropical and sub-tropical waters, leatherback turtles undertake extensive trans-oceanic migrations during the summer months to northern latitudes, including the waters surrounding the UK and RoI. Evidence suggests leatherback turtles may migrate through the Celtic and Irish Seas whilst on passage between the southwest of Ireland through to Northern Ireland and the west coast of Scotland (Intertek 2016) and, as such, pass through the Study Area. UK waters likely represent the most northerly limit of leatherback turtle migration (DECC 2016).

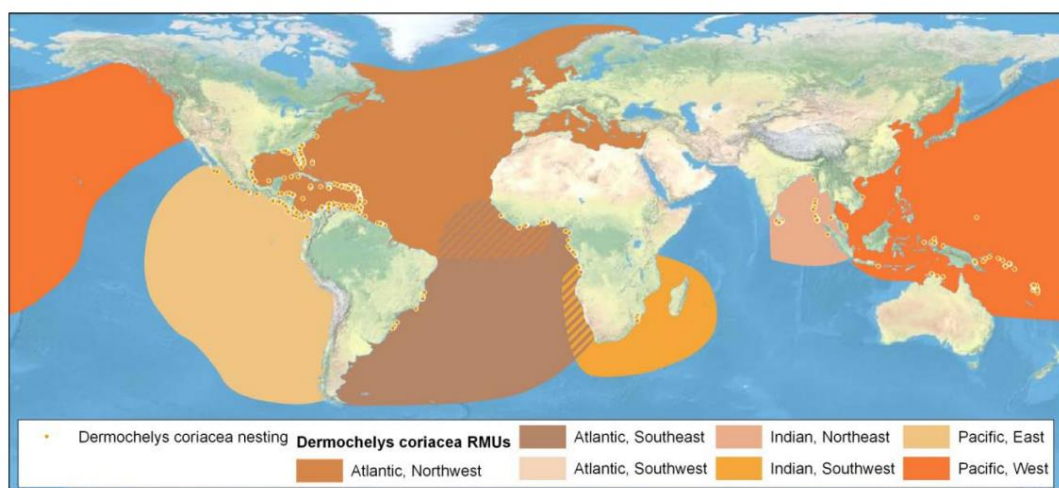


Figure 10.1 Global map of the seven leatherback turtle RMUs and nesting sites (IUCN 2019)

### 10.1 Site-specific surveys

During the site-specific surveys, no turtle sightings were reported (HiDef Aerial Surveying Ltd 2020, 2021). Due to the lack of sightings, this survey provides no information regarding abundance estimates, density estimates or species' distribution in the survey area.

A number of aerial surveys (WWT Consulting 2009, Rogan et al. 2018, HiDef Aerial Surveying Ltd 2020) have previously been used to obtain data on turtle abundance and distribution in waters around the UK and RoI. Nesting turtles are relatively easy to study as they are readily accessible whilst on land and logistically easier to be surveyed, but around the UK turtles are present for foraging and so will spend all of their time at sea, making surveying more challenging. Numerous studies have concluded that aerial surveys at sea are a proven method for collecting turtle abundance and distribution data (Henwood and Epperly 1999, Lauriano et al. 2011) and is effective over large areas (Fuentes et al. 2015). As with marine mammals, aerial surveys for turtles fail to meet the fundamental assumption of line transect sampling that all animals on the transect line will be detected (Buckland et al. 2001, Fuentes et al. 2015). This is because turtles need to surface periodically to breathe and will, therefore, only be intermittently visible from an aerial view (Henwood and Epperly 1999). However, tests have been conducted to determine the approximate depth at which turtles can be detected using aerial surveys under different environmental conditions (Fuentes et al. 2015). These tests involved using a secchi disk constructed to resemble a green turtle placed at various depths under the surface to determine the point at which it was visible from the aerial survey platform at 500 ft under different environmental conditions. The secchi disk was on average visible from 0.5 m to 2.5 m (Fuentes et al. 2015). This indicates that turtles do not have to be directly at the surface in order to be detected during aerial surveys, which increases the potential for observation both before and after surfacing. Therefore, it is considered that the site-specific aerial surveys were an appropriate methodology to inform the turtle baseline.

### 10.2 Project Valorous surveys

No turtles were sighted during the first three surveys at Project Valorous.

### 10.3 ObSERVE

Across both ObSERVE survey years (2015 and 2016), there were a total three sightings of leatherback turtles (Rogan et al. 2018). All sightings occurred within Stratum 4 (Figure 10.2) and occurred during the summer seasons (Figure 10.3). Insufficient sightings were made during the survey to allow for density estimates to be calculated.

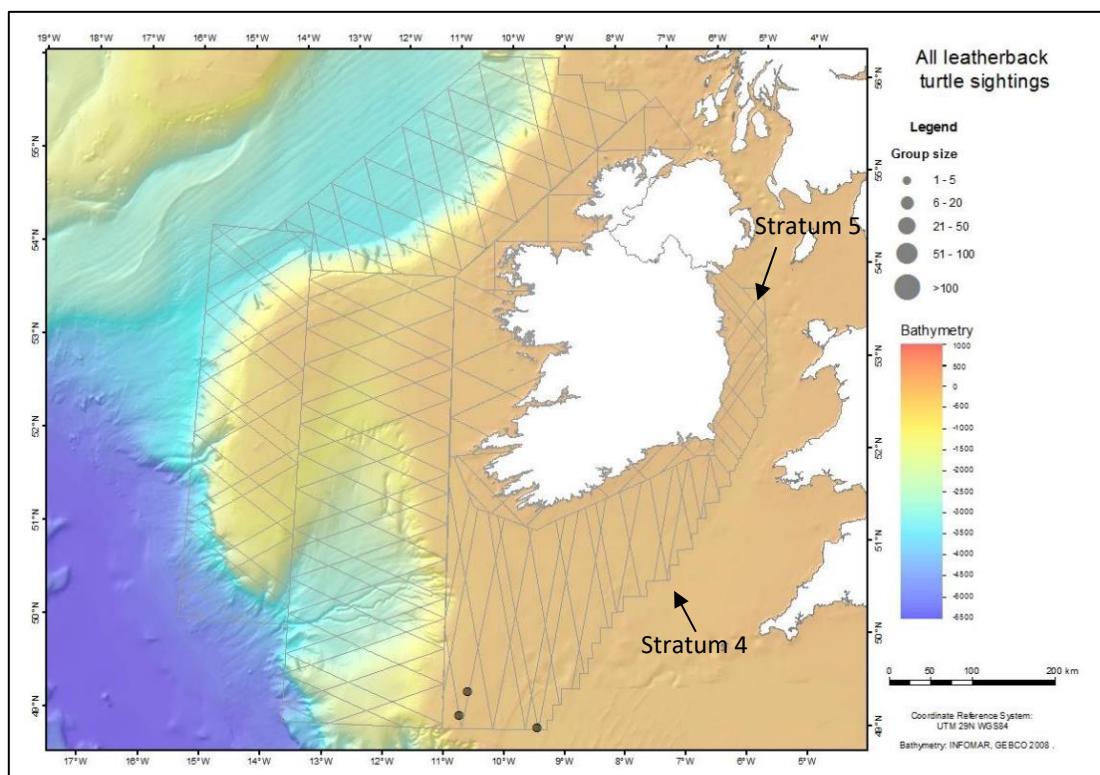


Figure 10.2 All leatherback turtle sightings from the ObSERVE surveys from 2015 – 2016 (Rogan et al. 2018).

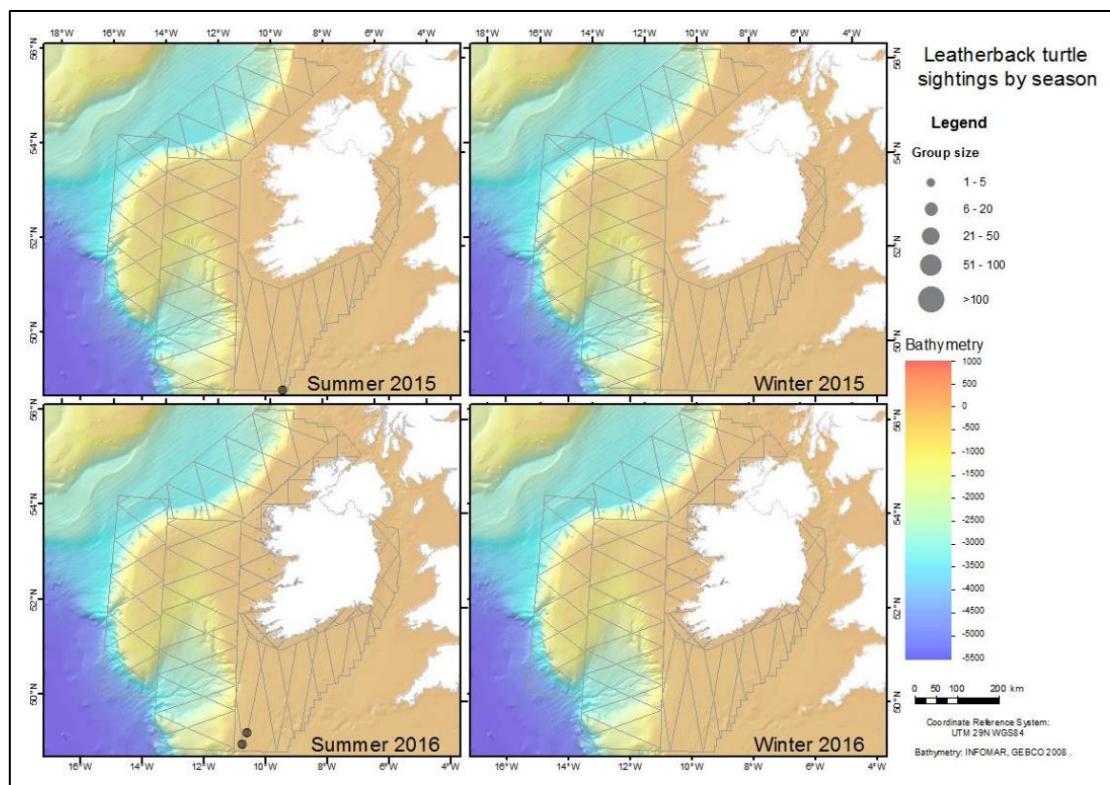


Figure 10.3 Seasonal leatherback turtle sightings from the ObSERVE surveys from 2015 - 2016 (Rogan et al. 2018).

#### 10.4 Wildfowl and Wetland Trust aerial surveys

During aerial surveys, three observations of turtles were made in the vicinity of Carmarthen Bay, one in November 2007 and two in July 2008 (WWT Consulting 2009). However, species identification was not possible and, therefore, data from this survey does not assist with establishing the density of leatherback turtles in proximity to the Project survey area.

#### 10.5 TURTLE database

From 1910-2018, a total of 1,997 sightings, strandings and captures of marine turtle were recorded in the TURTLE database. Of these, 1,683 were of leatherback turtles, with 1,319 sightings, 229 strandings and 135 captures. The number of leatherback turtle records was initially very low, with no records in the 1920s and 30s, but increased from the 1960s up until the 1990s, and then has subsequently declined occurred since (Botterell et al. 2020) (Figure 10.4).

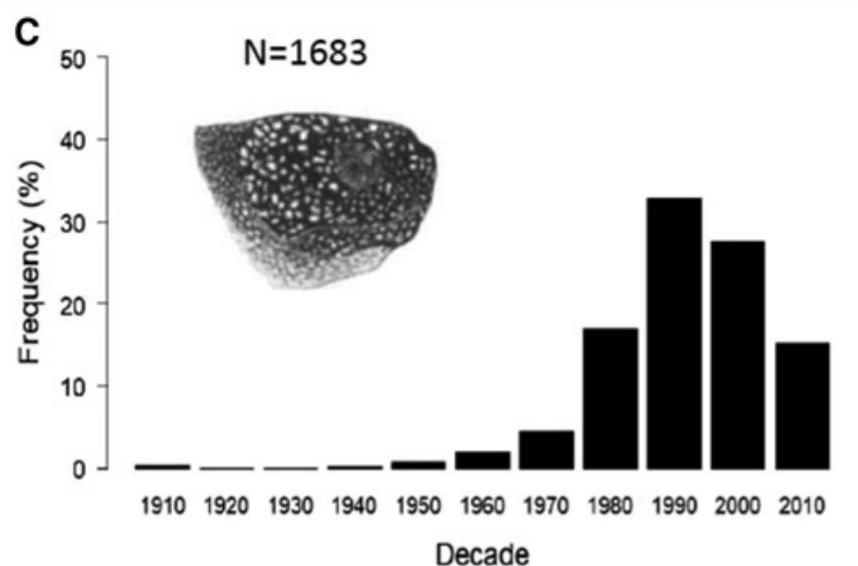


Figure 10.4 Temporal distribution of leatherback turtle strandings and capture records in the UK and Ireland from 1920-2018 (2010-2018 incomplete decade) (Botterell et al. 2020).

All records presented fall within the leatherback turtle RMU. The majority were concentrated in Regional Sea Areas 4 and 6 (DECC 2016), with high numbers of records occurring along the English Channel and along the entirety of Ireland's coastline, including in the Irish Sea (Botterell et al. 2020) (Figure 10.5). Data suggests that leatherback turtles move into British and Irish waters from the south and west, and pass northwards up western coasts and the Irish Sea (Pierpoint 2000).

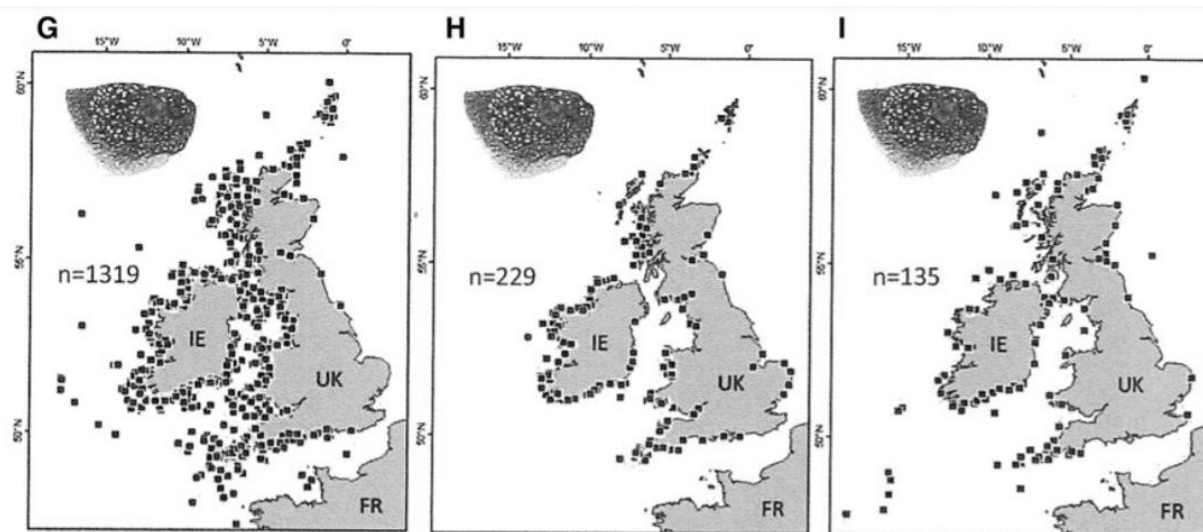


Figure 10.5 The distribution of sightings (G), strandings (H) and capture (I) records for leatherback turtles around the UK and Ireland from 1910-2018.

The highest number of leatherback turtle records occurred from June to October, with the peak occurring in August (Figure 10.6). Records of living leatherback turtles only occurred between May and November. The data also indicates that leatherback turtles may be present all year round, albeit much more infrequently, as dead leatherbacks were recorded throughout the year with the highest frequency in September and October (Botterell et al. 2020).

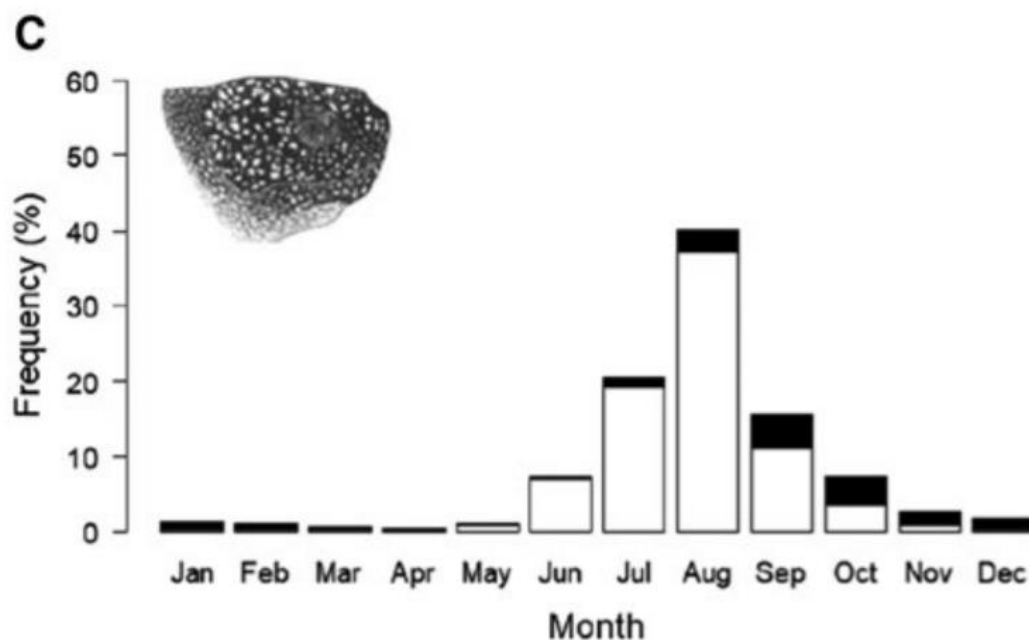


Figure 10.6 Cumulative monthly frequency of leatherback turtle sightings, stranding and capture records from the UK and Ireland 1910–2018; records of live turtles (open bars) and records of dead turtles (filled bars) (Botterell et al. 2020).

## 10.6 INTERREG Irish Sea Leatherback Turtle Project

Within the area of the Irish Sea surveyed during this project, 143 turtle sightings occurred (Figure 10.7). Sighting hotspots occurred around the southwest coast of Wales and the northwest coast of England. The jellyfish aerial surveys conducted alongside the turtle surveys found consistent aggregations of barrel jellyfish (*Rhizostoma octopus*) in distinct coastal hotspots. When examining these in conjunction with previous leatherback turtle sightings it was determined that 22.5% of sightings correlated with these hotspots, with three sightings being made directly within these aggregations (Houghton et al. 2006a), indicating prey availability may affect their distribution within the Irish Sea. To further examine their distribution, an analysis of sightings data grouped by decade was conducted, but this revealed no distinct spatial pattern. It did, however, confirm, that leatherback turtles have been widely sighted throughout the Irish Sea. Leatherback turtles were most frequently sighted from July to September (Houghton et al. 2006b).

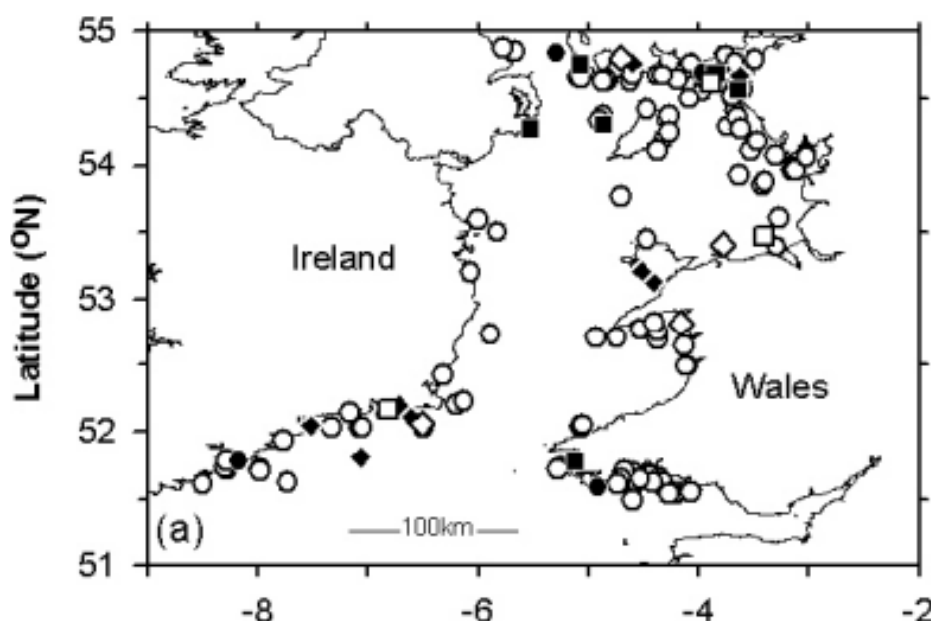


**Figure 10.7** All leatherback sightings (for given section of Irish Sea) from 1950-2005 (n = 143). Data are plotted according to decade: 2000-2005 (open circle); 1990s (closed circle); 1980s (open square); 1970s (closed square); 1960s (open diamond); 1950s (closed diamond) (Houghton et al. 2006a).

The tagging study conducted partially as part of the Irish Sea Leatherback turtle project. The individuals were tracked south from Dingle, Ireland where one individual spent time between Mauritania and Cape Verde before heading northwest and the other remaining in northeast Atlantic waters before heading towards French Guiana (Figure 10.8) (Doyle et al. 2008). Whilst neither turtle was tracked within the Irish Sea in the vicinity of the Project site, the tagging data shows the large-scale migrations and connectivity with other areas within the Northwest Atlantic RMU and supports the large area and population estimate for the RMU.



Figure 10.8 Track of female (black solid and dotted track) and male (red track) leatherback turtles (Doyle et al. 2008).

## 10.7 Summary

There have been no sightings of leatherback turtles during the site-specific surveys, though there is some evidence from various data sources that they are present in low numbers in the Irish Sea and southwest England. It is recommended that leatherback turtles are scoped out of the impact assessment for the Project based on the lack of sightings and on the guidance provided in JNCC et al. (2010): *“Given the apparent low density of leatherbacks within UK waters and their highly migratory nature, the likelihood of occurrence in any area for any lengthy period of time is so low that the risk of animals being disturbed in a way that would impair their ability to survive, reproduce, migrate, rear or nurture their young could be considered negligible. Due to their occurrence in very low numbers in any given area it is also unlikely that there could be a significant effect on their local abundance or distribution as a result of an activity.”* Unlikely as it is to occur, due to the rarity of the species at the Project site, any potential for injury from underwater noise will be mitigated through the use of the MMMP since the guidance for mitigating impacts is also considered to be appropriate for marine turtles (JNCC 2010a, c, b, 2017).

## 11 Summary

The data available for this baseline characterisation have confirmed that common dolphins, harbour porpoise, bottlenose dolphins, minke whales and grey seals are likely to be present in the vicinity of the Project site and should be considered within the quantitative impact assessment. There was little evidence of Risso’s dolphin presence in proximity to the Project site, and the site-specific surveys were not able to conclusively identify this species with confidence; as such, it is recommended that this species is scoped out of quantitative impact assessment (however, given that there is a chance that Risso’s dolphins may be present rarely in the area, they will be considered briefly and qualitatively in the impact assessment). Additionally, since no leatherback turtles were sighted during the site-specific surveys, and based on guidance provided in JNCC et al. (2010), it is recommended that turtles are also scoped out. There are a range of density estimates available from various surveys and data sources as outlined for each species. The most robust and relevant density estimates have been outlined in Table 31 and are the ones recommended to take forward to the quantitative impact assessment.

**Table 31 Species, MU size and density estimate recommended for use in the Project quantitative impact assessment.**

| Species            | MU                                                                                       | MU Size | MU Ref                   | Density (#/km <sup>2</sup> )           | Density Ref                                                            |
|--------------------|------------------------------------------------------------------------------------------|---------|--------------------------|----------------------------------------|------------------------------------------------------------------------|
| Common dolphin     | Celtic and Greater North Seas                                                            | 102,656 | IAMMWG (2021)            | 1.61 within survey area, 0.3743 beyond | HiDef site-specific surveys<br>SCANS III block D (Hammond et al. 2017) |
| Harbour porpoise   | Celtic and Irish Seas                                                                    | 62,517  | IAMMWG (2021)            | 0.4                                    | HiDef site-specific surveys                                            |
| Bottlenose dolphin | Offshore Channel and Southwest England                                                   | 10,947  | IAMMWG (2021)            | 0.063                                  | Wider Cardigan Bay surveys (Lohrengel et al. 2018)                     |
| Risso's dolphin    | Scoped out of quantitative impact assessment - considered briefly and qualitatively only |         |                          |                                        |                                                                        |
| Minke whale        | Celtic and Greater North Seas                                                            | 20,118  | IAMMWG (2021)            | 0.0112                                 | SCANS III block D (Hammond et al. 2017)                                |
| Grey seal          | OSPAR region III                                                                         | 66,100  | NRW (2020)               | Grid cell specific                     | Carter et al. (2020)                                                   |
|                    | Wales and Southwest England MUs combined                                                 | 6,090   | Derived from SCOS (2021) |                                        |                                                                        |
| Leatherback turtle | Scoped out                                                                               |         |                          |                                        |                                                                        |

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