MachairWind Offshore Windfarm

Appendix F – Marine Mammals and Turtles Baseline

ScottishPower Renewables | MachairWind Offshore Windfarm

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GLOSSARY OF ACRONYMS

Term	Description
CGNS	Celtic Great North Sea
CI	Confidence Intervals
CODA	Cetacean Offshore Distribution and Abundance in the European Atlantic
CV	Coefficient of Variation
CWSH	Coastal West Scotland and Hebrides
DAS	Digital Aerial Surveys
EIAR	Environmental Impact Assessment Report
HWDT	Hebrides Whale Dolphin Trust
IAMMWG	Inter-Agency Marine Mammal Working Group
JCP	Joint Cetacean Protocol
MMO	Marine Mammal Observer
MU	Management Unit
NAMMCO	North Atlantic Marine Mammal Commission
OAA	Option Agreement Area
OfTDA	Offshore Transmission Development Area
OnTDA	Onshore Transmission Development Area
OW	Oceanic Waters
PAM	Passive Acoustic Monitoring
SCANS	Small cetacean in the European Atlantic and the North Sea
SCOS	Special Committee on Seals
WDA	Windfarm Development Area
WTG	Wind Turbine Generator
UK	United Kingdom

GLOSSARY OF TERMS

Term	Description
The Applicant	The legal entity submitting consent applications for the MachairWind Offshore Windfarm, namely MachairWind Limited.
Inter-array cables (IAC)	Armoured cable containing electrical and fibre optic cores which link the wind turbine generators to each other and to the offshore substation platform(s).
MachairWind Offshore Windfarm	An offshore windfarm capable of exporting around 2 GW of renewable energy to the National Electricity Transmission System. MachairWind Offshore Windfarm comprises three Development Areas. The Windfarm Development Area is located on the west coast of Scotland to the northwest of Islay and west of Colonsay and the working assumption is that the MachairWind Offshore Windfarm will connect to a location within South Ayrshire. Work is ongoing to define the Offshore Transmission Development Area and Onshore Transmission Development Area. Separate consent and licence applications will be submitted for each Development Area.
Offshore Substation Platform (OSP)	An offshore platform with a fixed foundation located within the Offshore Transmission Development Area which houses electrical equipment such as transformers, switchgear, protection and control systems, and enables the windfarm's renewable electricity to be collected via inter-array cables and exported to the National Electricity Transmission System via offshore export cables.
Offshore Transmission Development Area (OfTDA)	The application boundary which extends seaward of Mean High Water Springs and within which the following will be consented (infrastructure includes but is not limited to): offshore export cable(s), OSP(s), OSP link cables (if required) and external cable protection. The OfTDA is subject to a Marine Licence(s) application under the Marine (Scotland) Act 2010.
Onshore Transmission Development Area (OnTDA)	The planning application boundary extending landward of Mean Low Water Springs and within which the following will be consented (infrastructure includes but is not limited to): landfall(s), onshore export cables, temporary construction compounds, and environmental mitigation areas. The OnTDA will be subject to a planning application under the Town and Country Planning (Scotland) Act 1997.
Operational life	The operational life is the expected length of time from final commissioning of the windfarm development area until the cessation of commercial operations.
Option Agreement Area (OAA)	The seabed area awarded to ScottishPower Renewables in January 2022 through the Scotwind leasing round. Project-specific surveys have been based on either the OAA or Windfarm Development Area (WDA) boundary, with an appropriate buffer implemented in each case.
The Project	MachairWind Offshore Windfarm.
ScotWind	A Crown Estate Scotland seabed leasing round for offshore wind projects in which the process enabled developers to apply for seabed rights to plan and build windfarms in Scottish waters.
Wind Turbine Generator (WTG)	A wind turbine generator which converts wind energy into electrical energy. Each wind turbine generator is a complex system composed of a high number of components. Typically, the main components include the rotor assembly (composed of three blades and a hub); the nacelle (containing a generator, shaft and gearbox, power electronic converter and transformer); and the tower (containing lifting equipment and the switchgear).

Term	Description
Windfarm Development Area (WDA)	The application boundary within which consent will be sought for the WDA Infrastructure. The WDA is subject to a Section 36 consent and Marine Licence(s) application which is being applied for separately from the OfTDA and OnTDA.
WDA infrastructure	The offshore generation infrastructure located within the WDA including but not limited to: WTGs, fixed foundations, IACs, and external cable and scour protection.

1. MARINE MAMMALS AND TURTLES BASELINE

1. This appendix, prepared by Royal HaskoningDHV; should be read in conjunction with the Windfarm Development Area (WDA) Scoping Report, **Chapter 10 Marine Mammals** and **Appendix G Marine Mammals and Turtles Approach to Assessment**. This appendix details the existing environment for marine mammals and turtles and sets out the marine mammal and turtle species which the Applicant proposes to scope in and out of the Environmental Impact Assessment (EIA).

2. Within the WDA, the Hebrides, and west coast of Scotland, 17 different marine mammal species have been identified (Paxton et al., 2016; Gilles et al., 2023; Waggitt et al., 2019; Special Committee on Seals (SCOS), 2023, Hebrides Whale Dolphin Trust (HWDT), 2023; Hague et al., 2020):

- Toothed whales:
  - Harbour porpoise; *(Phocoena phocoena);*
  - Bottlenose dolphin *(Tursiops truncates)*;
  - Short-beaked common dolphin *(Delphinus delphis);*
  - Striped dolphin *(Stenella coeruleoalba)*;
  - White-beaked dolphin *(Lagenorhynchus genus);*
  - Atlantic white-sided dolphin *(Lagenorhynchus acutus)*;
  - Risso's dolphin (*Grampus griseus);*
  - Long-finned pilot whale *(Globicephala melaena);*
  - Killer whale *(Orcinus orca);*
  - Cuvier's beaked whale *(Ziphius cavirostris);* and
  - Northern bottlenose whale *(Hyperoodon ampullatus).*
- Baleen whales:
  - Minke whale (*Balaenoptera acutorstrata);*
  - Fin whale *(Balaenoptera physalus);*
  - Sei whale (*Balaenoptera borealis);* and
  - Humpback whale *(Megaptera novaeangliae).*
- Pinnipeds:
  - Grey seal *(Halichoerus grypus)*; and
  - Harbour seal *(Phoca vitulina)*.

3. An initial review of these species is provided in the following sections. Each sub section summarises whether the species are scoped in or out of further assessment. For some species, there may be limited information available to inform a quantitative assessment and therefore a qualitative assessment would be undertaken instead. This will be confirmed for each species where this is expected to be the case. It should be noted that any species scoped out of further assessment would still be mitigated for under the standard mitigation requirements for underwater noise, and therefore would be protected from auditory injury from any piling, unexploded ordnance clearance, or geophysical surveys, whether fully assessed or not.

1.1. SITE-SPECIFIC SURVEYS

1.1.1. The Project's Digital Aerial Survey Data

4. The Project's Digital Aerial Survey (DAS) was conducted for marine mammals and seabirds using digital aerial still imagery.

5. The aerial surveys captured images at 1.5 cm ground speed distance along 13 transect lines spaced approximately 3.2 km apart. The surveys incorporated a 4 km buffer around the OAA from April to September 2021, increasing to a 6 km buffer from October 2021 to January 2022, and further increased to a 10 km buffer for the remaining surveys (from February 2022 to September 2023) (**Figure 10.1** of **Chapter 10 Marine Mammals**). The buffer around the OAA was extended due to the need to collect ornithology data over these areas, and the data was banked in case it was required at a later date to assess for any potential impacts to birds. For marine mammals, the current Project DAS results for the OAA, plus a 4 km buffer, will be used to calculate density estimates where relevant (see **Chapter 10 Marine Mammals** of this Scoping Report).

6. Imagery was captured in raw format and post-processed to ensure optimal quality for the subsequent stage of image analysis, to extract information on marine fauna or other notable occurrences. Data analysis follows a two-stage process in which images are reviewed (10%) then the detected objects are identified to species or species group level. The images undergo Quality Control.

7. Density and abundance estimates are calculated using the raw counts divided by the number of images collected to give the mean number of animals per image (i). Population estimates (N) for each survey month were subsequently generated by multiplying the mean number of animals per image by the total number of images required to cover the Survey Area (A): N = i A.

8. Non-parametric bootstrap methods were used for variance estimation. A variability statistic was generated by re-sampling 999 times with replacement from the raw count data. The statistic was evaluated from each of these 999 bootstrap samples and upper and lower 95% Confidence Intervals (CI) of these 999 values were taken as the variability of the statistic over the population (Efron and Tibshirani, 1993).

9. A measure of precision was calculated using a Poisson estimator, suitable for a pseudo-Poisson over-dispersed distribution. This produced a coefficient of variation (CV) based on the relationship of the standard error to the mean.

10. The DAS method has been designed to optimise the data collection for all bird and marine mammal species using a grid-based survey design at 1.5 cm resolution to achieve a minimum of 10% coverage and analysis using a twin-engine aircraft.

11. The number of unidentified individuals in a group is proportioned to the specific species that are contained within that group based on the relative abundance of the positively identified species in that month's survey. For example, in the case of harbour porpoise, the count consists of:

- Positively identified harbour porpoise + proportion of group level identified porpoise/dolphin species;
- Instances can occur when there are no positively identified species in months where group level identified individuals have been recorded. A hierarchical approach as follows was applied to such cases with the preferable method being the first or the second, where possible:
    - Use the proportion from the same month, same year;
    - Use the proportion from the same month, different year;
    - Use the proportion from the same season, same year;
    - Use the proportion from the same season, different year;

- Use the proportion from the same month, wider area (i.e. using proportion from the 4 km buffer as a proxy for the site);
- Use the proportion from the same season, wider area (i.e. using proportion from the 4 km buffer as a proxy for the WDA).

12. **Table 1.1** clarifies which marine mammals were attributed to which species group.

Table 1.1 Marine mammals species in unidentified groups (APEM, 2024)

<table>
<tr><th>Species</th><th>Group Level 1</th><th>Group Level 2</th><th>Group Level 3</th><th>Group Level 4</th></tr>
<tr><td>Grey seal</td><td colspan="2">Seal species</td><td rowspan="6"></td><td rowspan="7">Unidentified marine mammal species</td></tr>
<tr><td>Risso’s dolphin</td><td rowspan="4">Dolphin species</td><td rowspan="4">Dolphin / porpoise species</td></tr>
<tr><td>Common dolphin</td></tr>
<tr><td>Bottlenose dolphin</td></tr>
<tr><td>White-beaked dolphin</td></tr>
<tr><td>Harbour porpoise</td><td colspan="2"></td></tr>
<tr><td>Common minke whale</td><td colspan="3"></td></tr>
</table>

13. **Table 1.2** presents the marine mammal data from the Project’s DAS within the OAA plus 4 km buffer from April 2021 to September 2023.

14. Project DAS data from the OAA plus 4 km buffer of each marine mammal species, or marine mammal species group (**Table 1.2**), has been used to calculate abundance and density estimates. Upper and lower confidence intervals as well as CV were also calculated for these density and abundance estimates. The density of animals at the site (and hence the population size), the standard deviation, 95% CI and CV are then estimated using a non-parametric bootstrap method with replacement (Canty and Ripley, 2010).

15. For species such as marine mammals that dive, making them difficult to survey given the amount of time they spend underwater, an availability bias or correction factor must be applied. Applying these availability bias or correction factors transfers a relative abundance or density estimate to an absolute estimate.

16. To account for unidentified species recorded, (any marine mammal species that could not be attributed to a species level), the abundance estimates presented for these unidentified marine mammals (for example porpoise/dolphin species and seal species) in **Sections 1.3.1.2; 1.3.2.2; 1.3.3.2; 1.3.6.2; 1.5.1.2** and **1.7.1.2** have been apportioned to include an attribution of unidentified individuals into the monthly abundance estimates and densities. This is based upon an apportionment of the group level identified individuals between those species within that group that were identified to species level within each individual monthly abundance estimate as described in **paragraph 11.**

Table 1.2 Marine mammal data from the Project's Digital Aerial Survey for the Option Agreement Area plus a 4 km buffer

Survey date	Grey seal	Seal species	Harbour porpoise	Dolphin / porpoise	Common dolphin	Bottlenose dolphin	Risso's dolphin	Unidentified dolphin species	Minke whale	Marine mammal species
Apr-21	5	1	6	7	20	0	0	2	0	0
May-21	8	3	5	4	23	0	0	0	1	1
Jun-21	0	5	8	5	0	0	0	5	0	0
Jul-21	16	6	23	5	4	0	0	0	4	1
Aug-21	5	0	10	4	23	0	0	0	6	0
Sep-21	1	1	2	3	6	0	0	0	0	0
Oct-21	0	2	2	0	12	3	0	2	0	2
Nov-21	2	0	5	2	4	0	0	0	0	0
Jan-22	3	1	6	6	94	0	0	7	0	0
Feb-22	0	0	5	8	6	0	0	0	0	2
Mar-22	7	4	42	0	14	0	0	0	2	1
Apr-22	1	1	8	2	2	0	0	0	4	1
May-22	6	3	12	3	8	0	0	0	2	1
Jun-22	5	1	6	3	27	0	0	0	2	0
Jul-22	18	3	20	0	20	0	0	0	4	0
Aug-22	4	4	0	3	11	0	0	0	1	0
Sep-22	5	4	1	3	6	0	0	1	0	0
Oct-22	1	0	4	1	8	0	0	0	0	0
Nov-22	1	3	12	5	78	0	0	0	1	2

Survey date	Grey seal	Seal species	Harbour porpoise	Dolphin / porpoise	Common dolphin	Bottlenose dolphin	Risso's dolphin	Unidentified dolphin species	Minke whale	Marine mammal species
Dec-22 (S20)	1	2	0	1	12	0	2	0	0	1
Dec-22 (S21)	1	0	1	1	5	0	0	0	0	0
Jan-23	2	2	5	4	64	0	0	0	0	0
Feb-23	5	9	21	32	265	0	0	0	0	0
Mar-23	3	2	2	0	60	0	0	0	0	0
Apr-23	5	13	13	2	4	0	0	0	2	0
May-23	6	8	8	2	59	0	0	0	0	1
Jun-23	14	10	10	0	178	0	0	0	5	0
Jul-23	11	5	5	7	140	0	0	0	8	0
Aug-23	20	12	12	2	45	0	0	0	1	0
Sep-23	9	11	11	7	111	0	0	0	1	0
Total	**165**	**116**	**265**	**122**	**1,309**	**3**	**2**	**17**	**44**	**13**

1.1.2. Third-Party Digital Aerial Survey Data

17. In addition to the Project's DAS described above, APEM were contracted by a third-party to carry out a DAS survey campaign over a portion of the OAA prior to the announcement of exclusivity agreements with Crown Estate Scotland. This campaign was undertaken from October 2020 to December 2021 and the associated data was acquired by the Applicant to provide a better understanding of marine mammal presence for the baseline, surveying the area shown on **Figure 10.2** of **Chapter 10 Marine Mammals**. The survey was a grid-based design with 16 transects spaced 2 km apart, generating 12% coverage.

18. Marine mammal data from the Third-Party DAS is provided in **Table 1.3**.

Table 1.3 Marine mammal data from the Third-Party Digital Aerial Survey

Survey month	Grey seal	Unidentified seal	Common dolphin	Bottlenose dolphin	Risso's dolphin	Unidentified dolphin	Harbour porpoise	Dolphin or porpoise species	Minke whale	Marine mammal species	Total
Oct-20	0	3	9	0	0	2	0	6	0	0	20
Nov-20	0	5	0	0	0	6	1	4	0	0	16
Dec-20	0	0	11	1	0	8	1	11	0	0	32
Jan-21	0	0	0	0	0	8	0	11	0	0	19
Feb-21	0	4	15	0	0	0	7	25	0	0	51
Mar-21	3	1	59	0	0	0	17	9	0	0	89
Apr-21	1	6	36	0	0	0	6	4	0	0	53
May-21	26	24	89	0	1	0	68	9	6	1	224
Jun-21	8	0	43	0	0	0	6	3	0	0	60
Jul-21	11	1	1	0	1	0	32	0	9	0	55
Aug-21	0	6	6	0	0	0	4	2	1	1	20
Sep-21	4	0	52	0	0	7	1	4	7	0	75
Oct-21	1	1	3	0	0	0	2	2	0	0	9
Nov-21	2	1	162	0	0	1	12	3	0	1	182
Dec-21	3	0	21	0	0	0	1	1	0	0	26
Total	**59**	**52**	**507**	**1**	**2**	**32**	**158**	**94**	**23**	**3**	**931**

1.2. MARINE MAMMAL SIGHTINGS DURING PROJECT SITE INVESTIGATION SURVEYS

19. During the geophysical site investigation surveys undertaken from August to November 2023, Marine Mammal Observers (MMO) and Passive Acoustic Monitoring (PAM) surveyed the OAA.

20. Dedicated marine mammal observations were conducted from the bridge (15 m bridge height plus observer's eye height above sea level) during daylight hours. During hours of darkness or poor visibility, PAM was undertaken as a suitable alternative to marine mammal observation. Overall, the MMOs undertook 415 hours and 18 minutes of visual monitoring, and the PAM operators undertook 164 hours and 26 minutes of acoustic monitoring. **Table 1.4** presents details of the MMO and PAM detection during the survey.

Table 1.4 Summary of marine mammal sightings and acoustic detections

Survey month	Common dolphin	Bottlenose dolphin	Long-finned pilot whale	Unidentified dolphin	Minke whale	Grey seal	Unidentified Seal
Aug-23	66	-	-	1	-	-	-
Sep-23	103	-	-	32	-	1	17
Oct-23	160	3	3	31	1	-	1
Nov-23	21	-	-	4	-	-	-
Total	**350**	**3**	**3**	**68**	**1**	**1**	**18**

1.3. BASELINE REVIEW FOR COMMON TOOTHED WHALES

1.3.1. Harbour Porpoise

1.3.1.1. Desk-Based Review

21. Harbour porpoise are the most common cetacean in United Kingdom (UK) waters, they are resident all year and are found in relatively inshore waters throughout the northern hemisphere. Harbour porpoise are widespread throughout coastal regions of the Hebrides and the number of harbour porpoises in Hebridean waters is amongst the highest in Europe (HWDT, 2023a).

22. The Inter-Agency Marine Mammal Working Group (IAMMWG) have defined three Management Units (MU) for harbour porpoises (Error! Reference source not found.). The estimate of harbour porpoise a bundance in the West Scotland (WS) MU is 24,305 (CV = 0.18; 95%; CI = 17,121 – 34,505) (IAMMWG, 2023). This is the reference population for harbour porpoise for use in the EIA. Small cetaceans in the European Atlantic and the North Sea (SCANS)-IV reported an estimated abundance of 24,699 individuals (95% Confidence level = 14,626 - 38,996), although only partial coverage of this MU was achieved in the SCANS-IV survey.

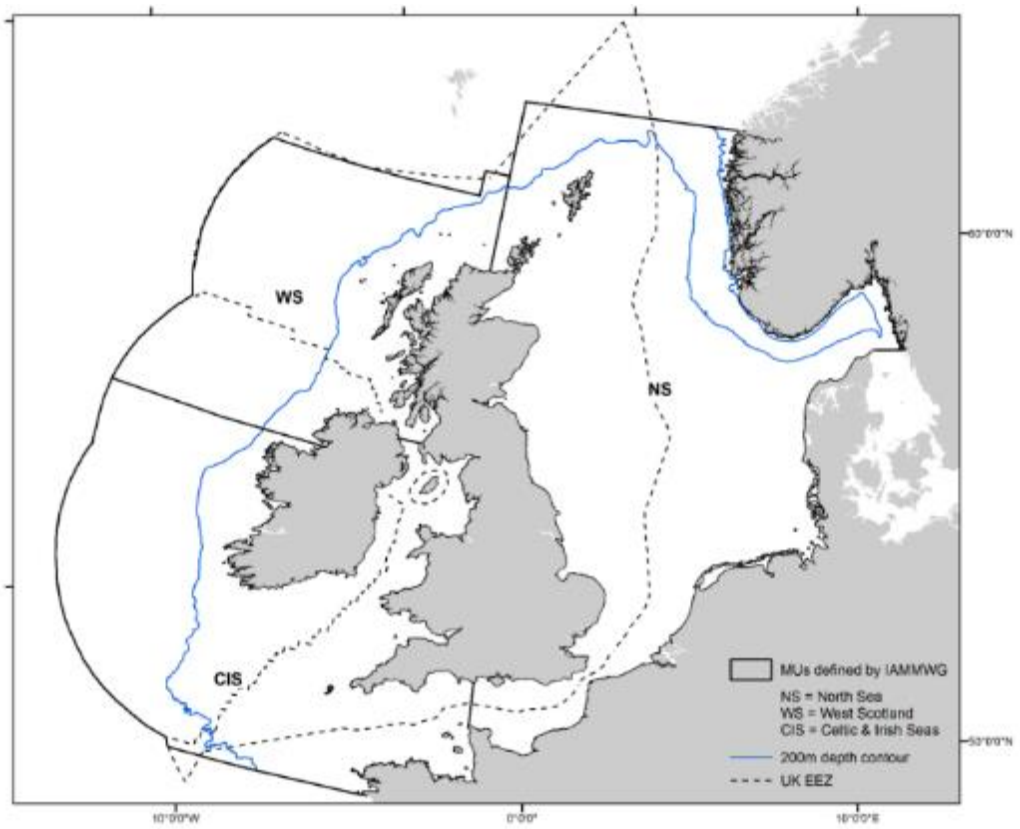

Figure 1.1 Harbour porpoise Management Units – species is largely confined to the continental shelf (i.e. waters less than 200 m depth) (IAMMWG, 2023)

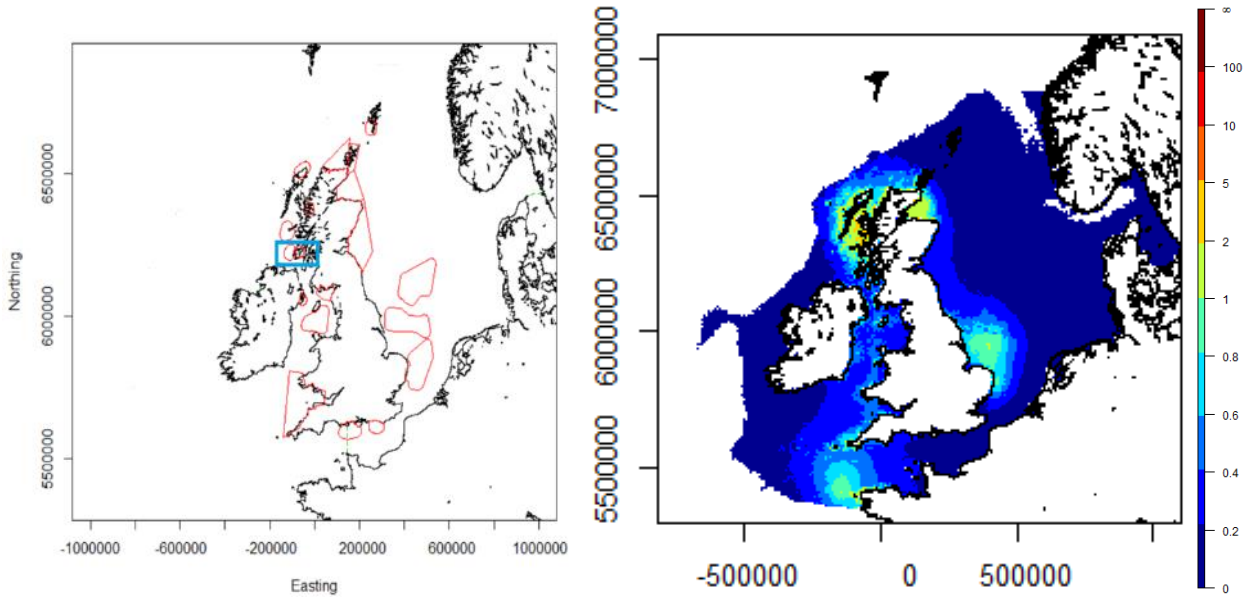

Figure 1.2 JCP Phase III each developer area in red (relevant areas to the Project in blue box); Right = harbour porpoise density (/km^2) for summer 2010 (Paxton et al. (2016).

23. The Joint Cetacean Protocol (JCP) Phase III Report (Paxton et al., 2016) shows there is potential for density estimates ranging from 0.4 to 2.0 harbour porpoise per km^2 within the vicinity of the Project. Based on the JCP Phase III data. Hague et al. (2020) estimated there to be density estimates ranging from 0.29 to 0.62 individuals per km^2 in the Islay area, and 0.35 to 0.87 individuals per km^2 in the Sound of Islay area, with the highest densities in winter (**Figure 1.2**).

24. Distribution and abundance maps were developed by Waggitt et al. (2019) for cetacean species around Europe. For harbour porpoise, the distribution maps show a clear pattern of medium harbour porpoise density in the Hebrides, and the coasts of WS in the winter, with higher densities in the summer, (**Figure 1.3**; Waggitt et al., 2019). Interrogation of these data[1], including all 10 km 'grids' that overlap with the specified area, reveals a maximum density estimate of 0.505 individuals per km^2 (average of all overlapping 10 km 'grids') for the WDA.

25. Average Waggitt et al. (2019) densities across the area of the SCANS-IV block CS-F have also been calculated to show the density of harbour porpoise across a wider area in comparison and results in a maximum density of 0.503 harbour porpoise per km^2 for the Project.

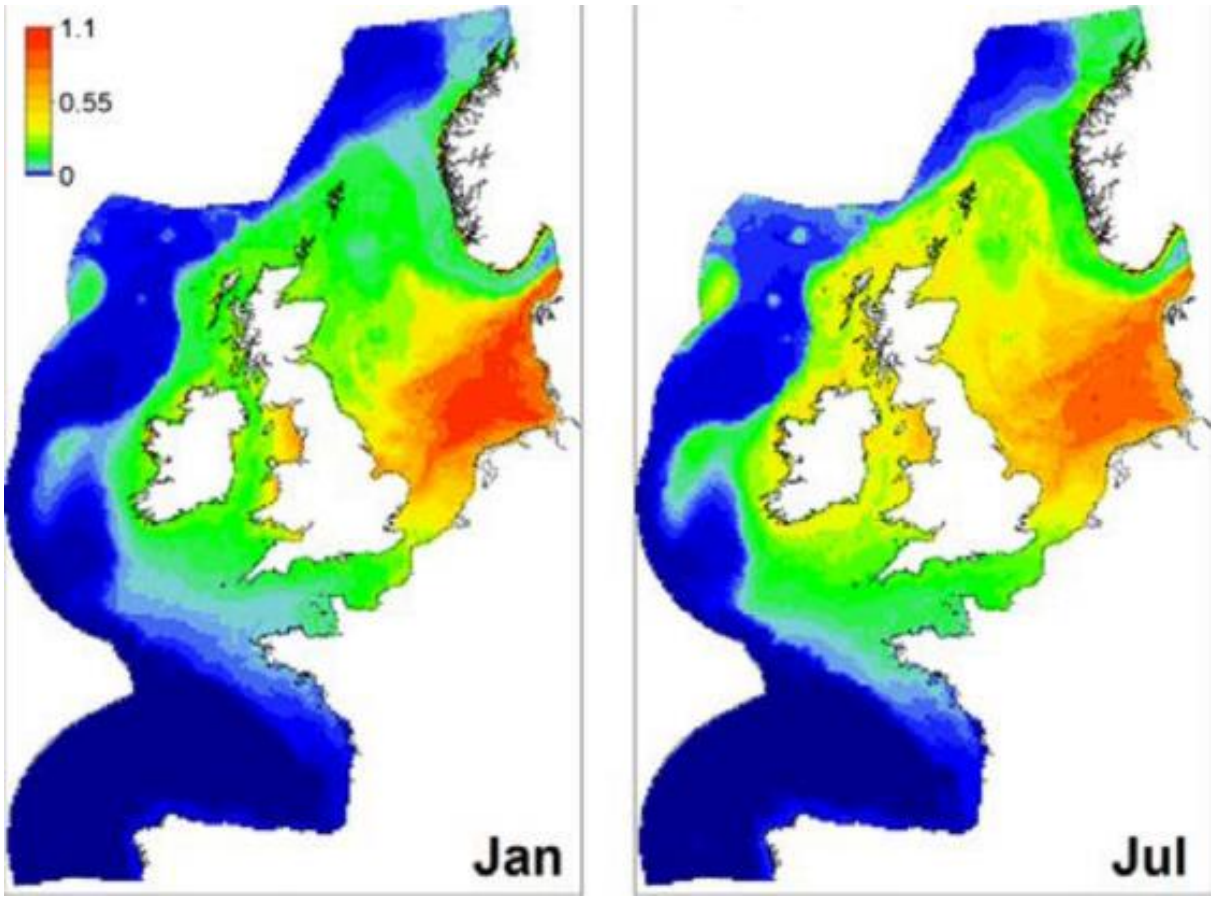

Figure 1.3 Spatial Variation in Predicted Densities (Individuals (per km^2) of Harbour Porpoise in January and July in the North-East Atlantic). Values are Provided at 10 km Resolution. Source: Waggitt et al., 2019

[1] Available from: https:// doi.org/10.5061/dryad.mw6m905sz

26. Within the impact assessments for harbour porpoise, in addition to the site-specific density estimates for harbour porpoise, density estimates from the SCANS-IV surveys (Gilles et al., 2023) will also be used to provide context for the wider area. The Project is in SCANS-IV survey block CS-F, and close to block CS-G (**Figure 1.4**).

- Survey Block CS-F
  - Abundance = 3,064 individuals (95% CI = 688-5,906);
  - Density = 0.2010/km^2 (CV=0.425).
- Survey Block CS-G
  - Abundance = 301 individuals (95% CI = 2-937);
  - Density = 0.0150/km^2 (CV=0.725).

Figure 1.4 SCANs IV survey design MachairWind in survey block CS-F (Gilles et al., 2023)

1.3.1.2. Site-Specific Density Estimates

27. Harbour porpoise were recorded in 28 of the 30 monthly surveys. The results from the Project's DAS provide a peak total number of 165 individuals and an average density of 0.031 harbour porpoise per km^2.

28. The correction factors described in Voet et al. (2017) (which are based on those described in Teilmann et al. (2013)), were applied to the total abundance (surfacing and submerged individuals). These are provided in **Table 1.5**.

Table 1.5 Seasonal harbour porpoise densities with correction factor

Season	Correction Factor
Spring (Mar-May)	0.571
Summer (Jun-Aug)	0.547
Autumn (Sep-Nov)	0.455
Winter (Dec-Feb)	0.472

29. The correction factors presented in **Table 1.5** have been used for the monthly density estimates derived from the DAS surveys for harbour porpoise for each season, to account for those that would be under the surface, and therefore unavailable to count. These densities have also been apportioned to take account of the individuals that could not be identified to species level.

30. The highest density estimate was recorded in spring with 0.253 harbour porpoise per km^2 (**Table** 1.6).

Table 1.6 Seasonal density estimate of harbour porpoise in the Project's Option Agreement Area plus 4 km buffer

Season	Density estimate (APEM, corrected)
Spring (Mar-May)	0.131
Summer (Jun-Aug)	0.125
Autumn (Sep-Nov)	0.074
Winter (Dec-Feb)	0.091

1.3.1.3. Summary of Abundance and Density Estimates for Harbour Porpoise

31. Due to the relatively high number of harbour porpoise present, this species has been scoped in for further assessment.

32. **Table 1.7** provides an initial summary of the density estimate and population estimates of harbour porpoise that will inform the EIA. This will be updated during the EIA process where new information becomes available. For harbour porpoise, the SCANS-IV estimate will be used rather than the most precautionary as it is the most recent desk-based source, and as requested by NatureScot during the Scoping Workshop.

Table 1.7 Summary of reference population and density estimates to inform the assessments on harbour porpoise

Species	Density	Density data source	Reference population	Reference population data source
Harbour porpoise	0.29-0.87/km^2	Paxton et al. (2016)	**United Kingdom (UK): 24,305 (West Scotland (WS) Management Unit (MU))** **Total: 28,936 (WS MU)**	Inter-Agency Marine Mammal Working Group (IAMMWG) (2023)
	0.505/km^2	(Maximum density) Waggitt et al. (2019)		
	0.503/km^2	Waggitt et al. (2019) densities over Small Cetacean in the European Atlantic and the North Sea (SCANS)-IV CS-F block		
	0.2010/km^2	**Gilles et al. (2023)**		
	0.131/km^2 Spring average	Project Digital Aerial Survey (DAS) (harbour porpoise and apportioned dolphin/porpoise data)		
Key	Density estimates taken forward for assessment are shown in **green**			

1.3.2. Bottlenose Dolphin

1.3.2.1. Desk-Based Review

33. In the Inner Hebrides, bottlenose dolphin is resident all year, usually travelling in small pods of 3 to 10 individuals and is most often sighted in the coastal regions in the Inner Hebrides, around the small isles (Brown, 2018).

34. The IAMMWG have defined seven MUs for bottlenose dolphin (**Figure 1.5**). The Project is within both the Coastal West Scotland and Hebrides (CWSH) MU and the Oceanic Waters (OW) MU. The estimate of bottlenose dolphin abundance in the CWSH MU is 45 (CI = 33 – 66), (IAMMWG, 2023) and for OW is 1,299 (CI = 597 – 2,826) (IAMMWG, 2023). Any potential impacts will be assessed against both MUs, separately, as any individuals could be from either of the MU populations.

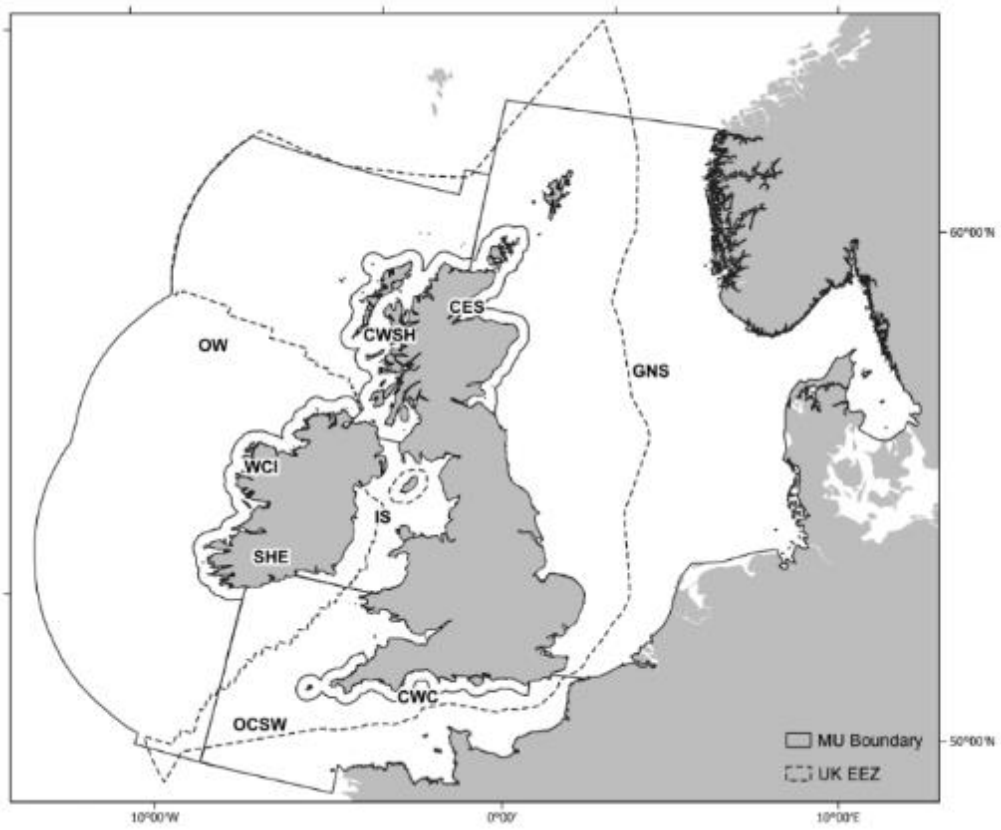

Figure 1.5 Bottlenose dolphin Management Units (IAMMWG, 2023)

35. The JCP Phase III Report (Paxton et al., 2016) estimates there is the potential for a bottlenose dolphin density estimate that ranges from 0 to 0.1 bottlenose dolphin per km^2 within the vicinity of the WDA.

36. Distribution and abundance maps were developed by Waggitt et al. (2019) for cetacean species around Europe. For bottlenose dolphin, the distribution maps show a clear pattern of a low density in the Hebrides, and the coasts of WS in the winter, with higher densities in January, (**Figure 1.6**, Waggitt et al., 2019). Interrogation of this data[2], including all 10 km 'grids' that overlap with the specified area, reveals an average annual density estimate of 0.002 individuals per km^2 (average of all overlapping 10 km 'grids') for the WDA.

[2] Available from: https:// doi.org/10.5061/dryad.mw6m905sz

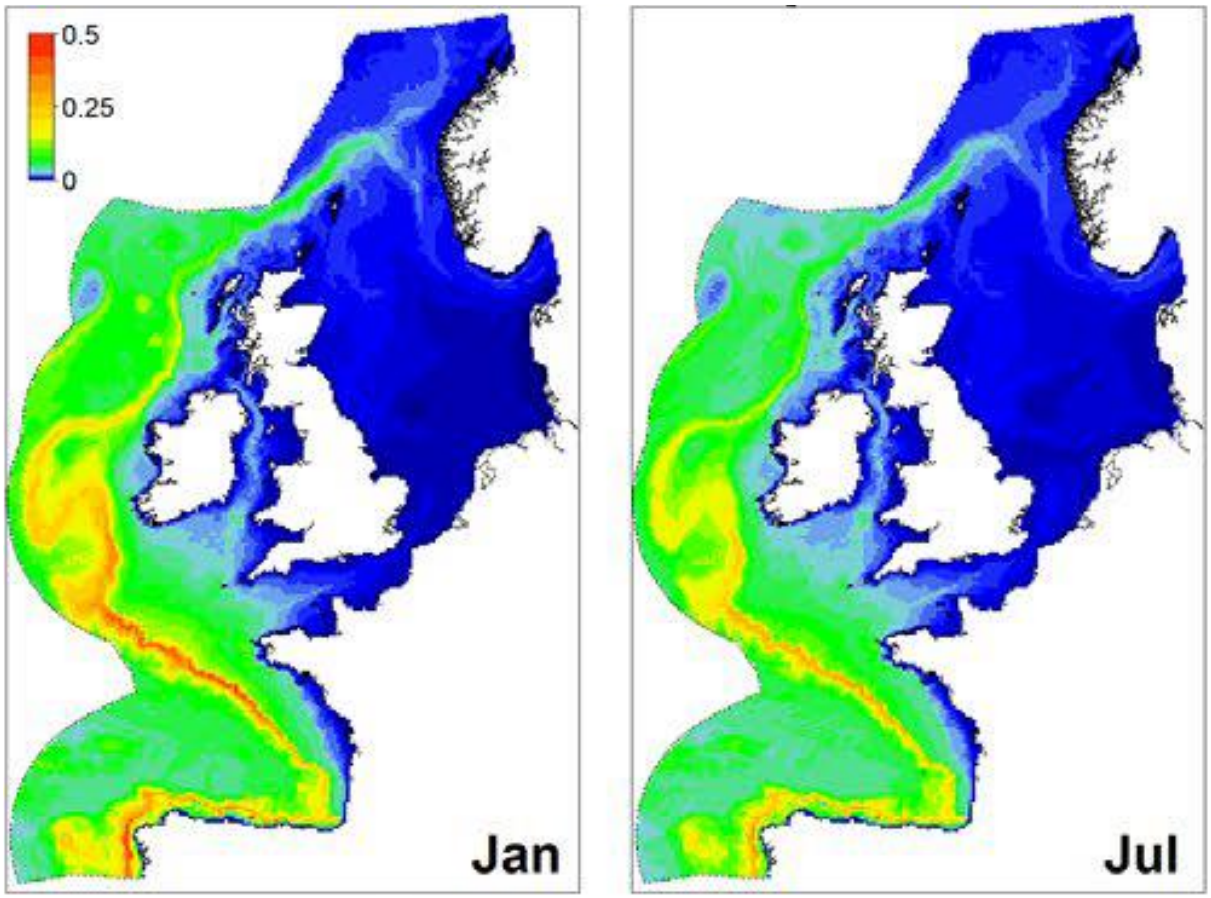

Figure 1.6 Spatial Variation in Predicted Densities (Individuals (per km²) of Bottlenose Dolphin in January and July in the North-East Atlantic). Values are Provided at 10 km Resolution. Source: Waggitt et al., 2019.

37. Results from the SCANS-IV survey (the most recent available and undertaken in summer 2022; Gilles et al., 2023) provides estimated density and abundances of bottlenose dolphin for the wider area. The Project's OAA is in SCANS-IV survey block CS-F, and close to block CS-G (**Figure 1.4**).

- Survey Block CS-F
  - Abundance = 647 individuals (95% CI = 13-2,198);
  - Density = 0.0425/km² (CV=0.4777).
- Survey Block CS-G
  - Abundance = 1,069 individuals (95% CI = 13-2,778);
  - Density = 0.0532/km² (CV=0.742).

1.3.2.2. Site-Specific Density Estimates for Bottlenose Dolphin

38. During the Project's DAS, there was only one recording of bottlenose dolphin, where the individual was recorded in October 2021, resulting in a density estimate of 0.03 bottlenose dolphin per km², which accounts for species apportioning. Due to the low number of bottlenose dolphin sightings, this estimate has not been corrected to account for availability bias.

1.3.2.3. Summary of Abundance and Density Estimates for Bottlenose Dolphin

39. Due to the regular presence of bottlenose dolphin in the WDA, this species has been scoped in for assessment.

40. **Table 1.8** provides an initial summary of the density estimate and population estimates of bottlenose dolphin that will inform the EIA. This will be updated during the EIA process, where new information becomes available. A full review of all desk-based data sources presented in **Chapter 10 Marine Mammals** will be undertaken, and the most precautionary density estimate (and reference population) will be taken forward for assessment.

Table 1.8 Summary of reference population and density estimates to inform the assessments on bottlenose dolphin

Species	Density (km^2)	Density data source	Reference population	Reference population data source
Bottlenose dolphin	0-0.1	Paxton et al. (2016)	**United Kingdom (UK): 45 (Coastal West Scotland and the Hebrides (CWSH) Management Unit (MU))** **UK: 1,299 (Oceanic Waters (OW) MU)** **Total: 70,249 (Oceanic Waters (OW) MU)**	Inter-Agency Marine Mammal Working Group (IAMMWG) (2023)
	0.002	Waggitt et al. (2019)		
	0.0532	**Gilles et al. (2023)**		
	0.03	Project Digital Aerial Survey (DAS) (bottlenose dolphin only)		
Key	Density estimates taken forward for assessment are shown in **green**			

1.3.3. Common Dolphin

1.3.3.1. Desk-Based Review

41. The abundance of common dolphins in the Inner Hebrides increased from 0.05 individuals per 100 km^2 in 2003 to 1.1 individuals per 100 km^2 in 2017 (or 0.0005/km^2 and 0.011/km^2 respectively) and re sighted throughout the year (HWDT, 2023b).

42. The IAMMWG have defined one MU for common dolphin; the Celtic Great North Sea (CGNS) MU (**Figure 1.7**). The estimate of common dolphin abundance in the CGNS MU is 57,417 (CV: 0.32, CI = 30,850 – 106,863) (IAMMWG, 2023). This is the reference population for common dolphin for use in the EIA.

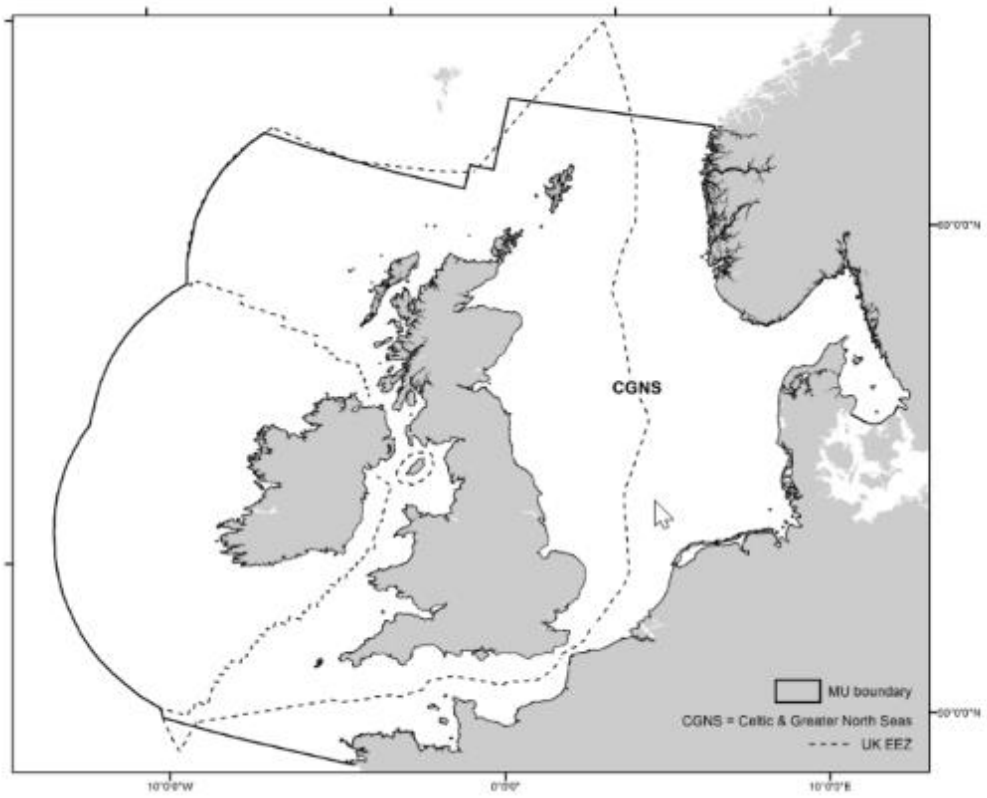

Figure 1.7 Management Unit for common dolphin, white-beaked dolphin, Atlantic white-sided dolphin, Risso's dolphin and minke whale (IAMMWG, 2023)

43. The JCP Phase III Report (Paxton et al., 2016) estimates that there is between 0 and 0.5 common dolphin per km^2 within the vicinity of the WDA. SMFS (2020) estimated there to be density estimates ranging up to 0.09 individuals per km^2 in the Islay area, and up to 0.03 individuals per km^2 in the Sound of Islay area, with the highest densities in the autumn.

44. The distribution maps for common dolphin (developed by Waggitt et al., 2019) show a clear pattern of higher density to the western coastal areas of the UK, extending south to the Bay of Biscay (**Figure 1.8**; Waggitt et al., 2019). The distribution maps indicate a 'corridor' of increased common dolphin density travelling from the west of Scotland, southwards around the west coast of Northern Ireland and the Republic of Ireland.

45. Interrogation of this data[3], including all 10 km 'grids' that overlap with the specified area, reveals a maximum annual density estimate of 0.021 individuals per km^2 (average of all overlapping 10 km 'grids') for the WDA.

[3] Available from: https:// doi.org/10.5061/dryad.mw6m905sz

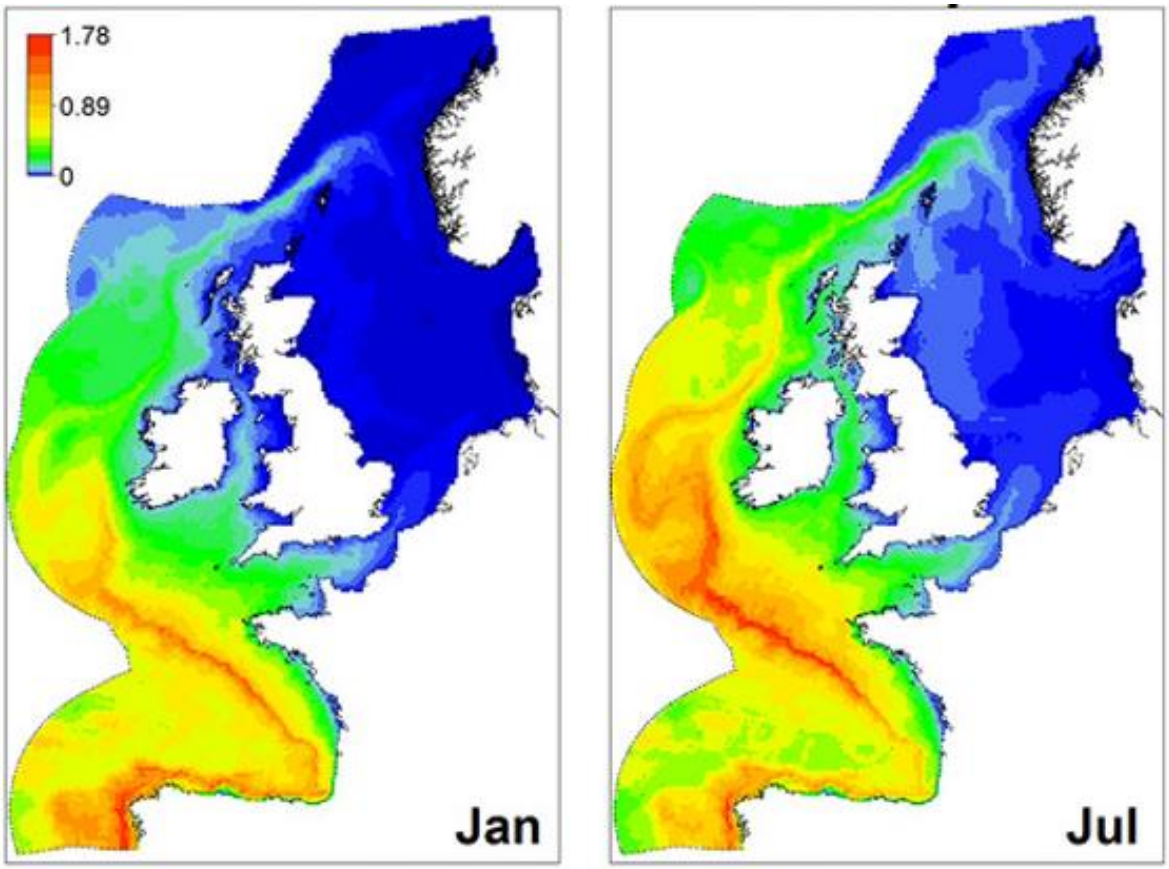

Figure 1.8 Spatial Variation in Predicted Densities (Individuals (per km2) of Common Dolphin in January and July in the North-East Atlantic). Values are Provided at 10 km Resolution. Source: Waggitt et al., 2019.

46. Results from the SCANS-IV survey (Gilles et al., 2023) provides estimated density and abundances for the relevant survey blocks, for common dolphin, of:

- Survey Block CS-F
  - Abundance = 829 individuals (95% CI = 14-3,244);
  - Density = 0.0544/km^2 (CV=1.028).
- Survey Block CS-G
  - Abundance = 1,515 individuals (95% CI = 280-3,281);
  - Density = 0.0754/km^2 (CV=0.496).

1.3.3.2. Site-Specific Density Estimates for Common Dolphin

47. In total, common dolphin were recorded in 29 of the 30 site-specific DAS. A peak estimate of 1,301 individuals was recorded, resulting in an average density estimate of 0.25 individuals per km^2. A correction factor of 0.675 was applied to account for any diving animals (De Boer et al., 2008), which results in an average annual density estimate of 0.368 common dolphin per km^2 in the Project's OAA.

48. **Table 1.9** presents the estimated seasonal densities of common dolphin calculated and apportioned by APEM, as well as densities estimated using the correction factor (De Boer et al., 2008). The winter season proposes the highest estimated density, 0.627 common dolphin per km^2 in the Project's OAA.

Table 1.9 Seasonal common dolphin densities with correction factor in the Project's Option Agreement Area

Season	Density estimate (APEM)	Density estimated with correction factor added
Spring (Mar-May)	0.136	0.201
Summer (Jun-Aug)	0.284	0.421
Autumn (Sep-Nov)	0.181	0.268
Winter (Dec-Feb)	0.423	0.627

1.3.3.3. Summary of Abundance and Density Estimates for Common Dolphin

49. Due to the high number of common dolphin present in the area, as confirmed by the Project's DAS, this species has been scoped in for further assessment.

50. **Table 1.10** provides an initial summary of the density estimate and population estimates of common dolphin that will inform the EIA. This will be updated during the EIA process, where new information becomes available. A full review of all desk-based data sources presented in **Chapter 10 Marine Mammals** will be undertaken, and the most precautionary density estimate (and reference population) will be taken forward for assessment.

Table 1.10 Summary of reference population and density estimates to inform the assessments on common dolphin

Species	Density (km^2)	Density data source	Reference population	Reference population data source
Common dolphin	0.011	Hebrides Whale Dolphin Trust (HWDT) (2023b)	**United Kingdom (UK): 57,417 (Celtic Great North Sea (CGNS) Management Unit (MU))** **Total: 102,656 (CGNS MU)**	(IAMMWG, 2023)
	0.03 - 0.09	Paxton et al. (2016)		
	0.021	Waggitt et al. (2019)		
	0.0754	Gilles et al. (2023)		
	0.627 winter average	**Project Digital Aerial Survey (DAS) (common dolphin only)**		
Key	Density estimates taken forward for assessment are shown in **green**			

1.3.4. White-Beaked Dolphin

1.3.4.1. Desk-Based Review

51. White-beaked dolphins are regularly recorded in the Hebrides, mainly in the open waters around the Outer Hebrides (HWDT, 2023c). The HWDT have recorded a decline in white-beaked dolphin numbers, whereas common dolphin has increased. This could potentially mean that two species are in competition for prey or habitat.

52. The IAMMWG have defined one MU for white-beaked dolphin; the CGNS MU (**Figure 1.7**). The estimate of white-beaked dolphin abundance in the CGNS MU is 34,025 (CV: 0.28, CI = 20,026 – 57,807) (IAMMWG, 2023). This is the reference population for white-beaked dolphin for use in the EIA.

53. The JCP Phase III Report (Paxton et al., 2016) estimates there to be a density estimate of up to 0.1 white-beaked dolphin per km^2 in the vicinity of the WDA.

54. For white-beaked dolphin, the distribution maps (developed by Waggitt *et al.,* 2019) show a clear pattern of higher density in the Inner and Outer Hebrides, with decreasing densities southwards of Scotland along the west coast of England. There is also a clear seasonal difference in the densities of white-beaked dolphin, with higher densities in July, particularly to the north of their range (**Figure** 1.9; Waggitt et al., 2019). Interrogation of this data[4], including all 10 km 'grids' that overlap with the specified area, reveals a maximum density estimate of 0.124 individuals per km^2 (average of all overlapping 10 km 'grids') for the WDA.

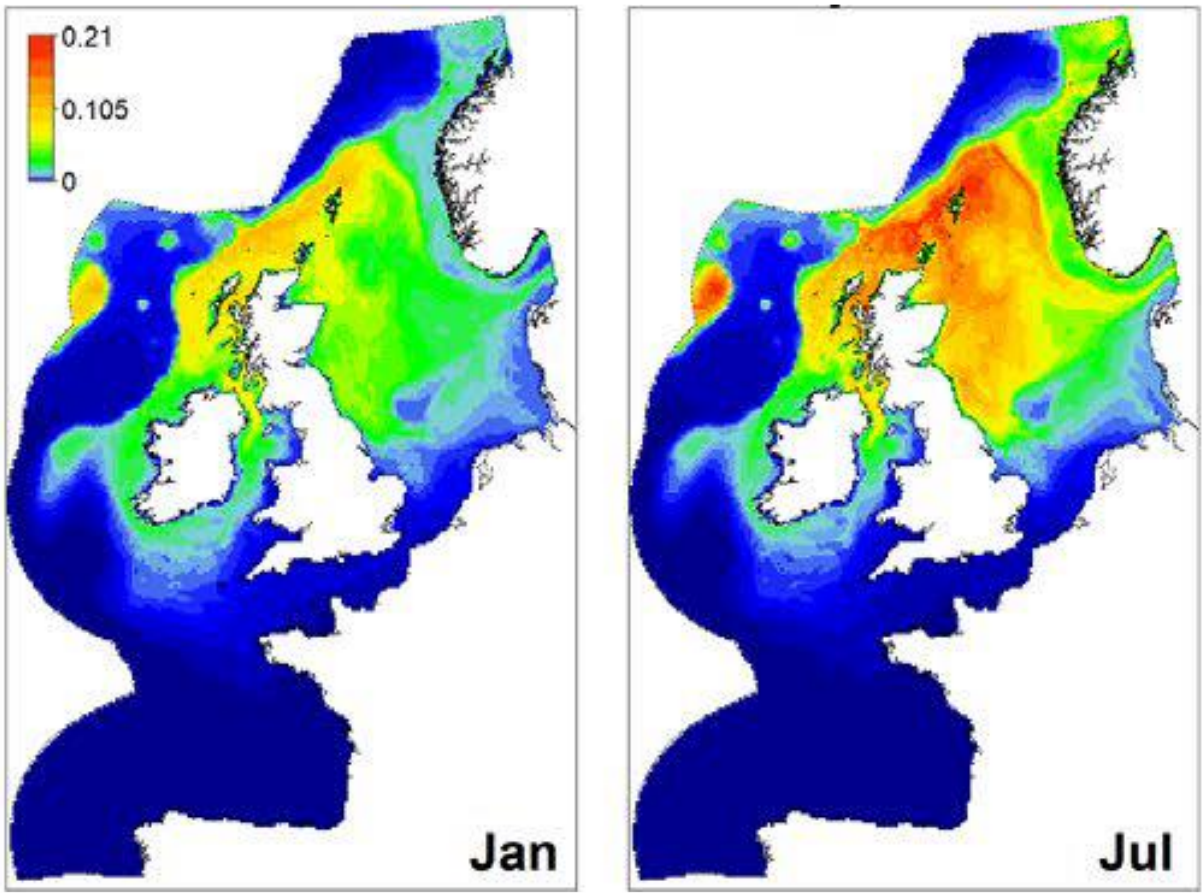

Figure 1.9 Spatial Variation in Predicted Densities (Individuals (per km2) of White-beaked Dolphin in January and July in the NE Atlantic). Values are Provided at 10 km Resolution. Source: Waggitt et al., 2019

55. For the SCANS-IV survey, there are no abundance or density estimates for white-beaked dolphin in survey block CS-F, however there is a density estimate for block CS-G (Gilles et al., 2023) which estimates:

- Abundance = 5,113 individuals (95% CI = 67-15,405);
- Density = 0.2543/km^2 (CV=0.815).

1.3.4.2. Site-Specific Density Estimates for White-Beaked Dolphin

56. No white-beaked dolphin was recorded in the Project's DAS.

[4] Available from: https:// doi.org/10.5061/dryad.mw6m905sz

1.3.4.3. Summary of Abundance and Density Estimates for White-Beaked dolphin

57. While white-beaked dolphin has not been recorded in the Project's DAS, the desk-based review shows that there is potential for white-beaked dolphin presence in the area, and therefore they are scoped in for assessment.

58. **Table 1.11** provides an initial summary of the density estimate and population estimates of white-beaked dolphin that will inform the EIA. This will be updated during the EIA process, where new information becomes available. A full review of all desk-based data sources presented in **Chapter 10 Marine Mammals** will be undertaken, and the most precautionary density estimate (and reference population) will be taken forward for assessment.

Table 1.11 Summary of reference population and density estimates to inform the assessments on white-beaked dolphin

Species	Density (km^2)	Density data source	Reference population	Reference population data source
White-beaked dolphin	0 - 0.1	Paxton et al. (2016)	**United Kingdom (UK): 34,025 (Celtic Great North Sea (CGNS) Management Unit (MU))** **Total: 43,951 (CGNS MU)**	Inter-Agency Marine Mammal Working Group (IAMMWG) (2023)
	0.124	Waggitt et al. (2019)		
	0.2543	**Gilles et al. (2023)**		
Key	Density estimates taken forward for assessment are shown in **green**			

1.3.5. Atlantic White-Sided Dolphin

1.3.5.1. Desk-Based Review

59. The Atlantic white-sided dolphin is usually located in continental shelf regions west of the Outer Hebrides, and although they tend to move closer to the coast during summer months, they are rarely seen within the Continental Shelf in the Hebrides (HWDT, 2023d).

60. The IAMMWG have defined one MU for white-sided dolphin; the CGNS MU (**Figure 1.7**). The estimate of white-sided dolphin abundance in the CGNS MU is 12,293 (CV: 0.64, CI = 3,891 – 38,841) (IAMMWG, 2023). This is the reference population for Atlantic white-sided dolphin for use in the EIA.

61. The JCP Phase III Report (Paxton et al., 2016) estimates there is up to 0.01 Atlantic white-sided dolphin per km^2 in the vicinity of the WDA.

62. The distribution maps for Atlantic white-sided dolphin (**Figure 1.10**), developed by Waggitt et al., 2019) show a clear pattern of higher density in the offshore regions with almost no distribution in the coastal regions in January, however there is a slight increase in the Inner Hebrides in the July map.

63. Interrogation of this data[5], including all 10 km 'grids' that overlap with the specified area, reveals an average annual density estimate of 0.021 individuals per km^2 (average of all overlapping 10 km 'grids') for the WDA.

[5] Available from: https:// doi.org/10.5061/dryad.mw6m905sz

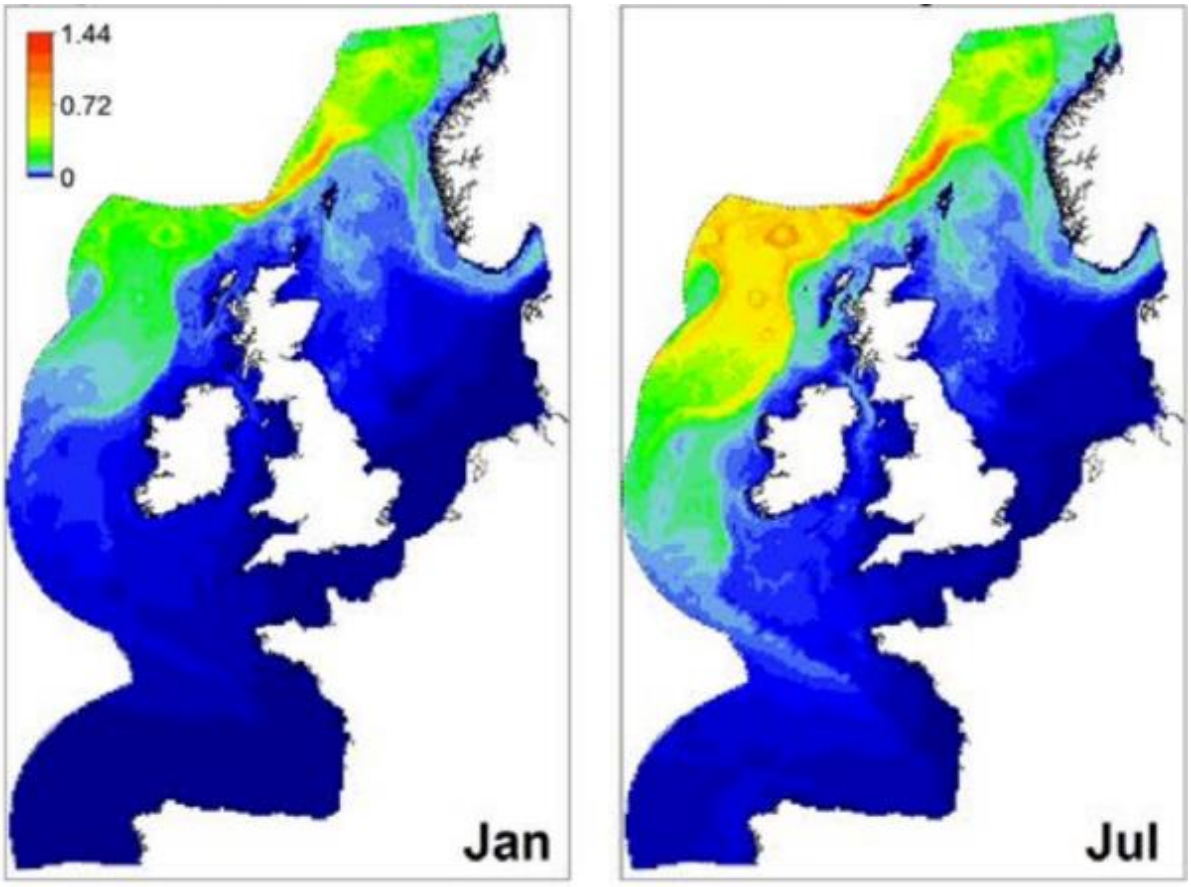

Figure 1.10 Spatial Variation in Predicted Densities (Individuals (per km2) of Atlantic white-sided Dolphin in January and July in the NE Atlantic). Values are Provided at 10 km Resolution. Source: Waggitt et al., 2019

64. For the SCANS-IV survey, there are no abundance or density estimates for Atlantic white-sided dolphin in survey block CS-F, however there is a density estimate for block CS-G and CS-H (Gilles et al., 2023) which estimates:

65. For survey block CS-G

- Abundance = 451 individuals (95% CI = 7-1,464);
- Density = 0.0224/km^2 (CV=0.971).

66. For survey block CS-H

- Abundance = 390 individuals (95% CI = 8-1,130);
- Density = 0.0279/km^2 (CV=0.775).

1.3.5.2. Site-Specific Density Estimates for Atlantic White-Sided Dolphin

67. While Atlantic white-sided dolphin has not been recorded in the Project's DAS, the desk-based review shows that there is potential for their presence in the area, and therefore they have been scoped in for assessment.

68. **Table 1.12** provides an initial summary of the density estimate and population estimates of Atlantic white-sided dolphin that will inform the EIA. This will be updated as part of the EIA process where new information becomes available, such as updated site-specific density estimates. A full review of all desk-based data sources presented in **Chapter 10 Marine Mammals** will be undertaken, and the most precautionary density estimate (and reference population) will be taken forward for assessment.

Table 1.12 Summary of reference population and density estimates to inform the assessments on Atlantic white-sided dolphin

Species	Density (km²)	Density data source	Reference population	Reference population data source
Atlantic white-sided dolphin	0.01	Paxton et al. (2016)	**United Kingdom (UK): 12,293 (Celtic Great North Sea (CGNS) Management Unit (MU))** **Total: 18,128 (CGNS MU)**	Inter-Agency Marine Mammal Working Group (IAMMWG) (2023)
	0.021	Waggitt et al. (2019)		
	0.0224 (Small Cetacean in the European Atlantic and the North Sea (SCANS) Survey block CS-G)	**Giles et al. (2023)**		
	0.0279 (SCANS Survey block CS-H)			
Key	Density estimates taken forward for assessment are shown in **green**			

1.3.6. Risso's Dolphin

1.3.6.1. Desk-Based Review

69. Risso's are widely distributed around the Hebrides, inhabiting deep waters but occasionally can be sighted near the coast. Risso's dolphin are present all year round, mainly in the Outer Hebrides but there have been frequent sightings in the Kintyre peninsula, around Coll, Tiree, Mull and Skye (Brown, 2018).

70. The IAMMWG have defined one MU for Risso's dolphin; the CGNS MU (**Figure 1.7**). The estimate of Risso's dolphin abundance in the CGNS MU is 8,687 (CV: 0.63, CI = 2,810– 26,852) (IAMMWG 2023). This is the reference population for Risso's dolphin that will be used in the EIA.

71. The JCP Phase III Report (Paxton et al., 2016) estimates there is up to 0.01 Risso's dolphin per km² within the vicinity of the WDA.

72. The distribution maps for Risso's dolphin (developed by Waggitt *et al.,* 2019) show a clear pattern of higher density to the western areas of the UK, where density increases in the summer months in the inner Hebrides (**Figure 1.11**; Waggitt et al*.,* 2019). The distribution maps indicate a 'corridor' of increased Risso's dolphin density travelling northwards around the west coast of the Northern Ireland and the Republic of Ireland to the western and northern areas of Scotland.

73. Interrogation of this data[6], including all 10 km 'grids' that overlap with the specified area, reveals a maximum density estimate of 0.003 individuals per km² (average of all overlapping 10 km 'grids') for the WDA.

74. Average Waggitt et al. (2019) densities across the area of the SCANS-IV block CS-F have also been calculated to show the density of Risso's dolphin across a wider area in comparison and results in an annual density of 0.002 Risso's dolphin per km² for the Project.

[6] Available from: https:// doi.org/10.5061/dryad.mw6m905sz

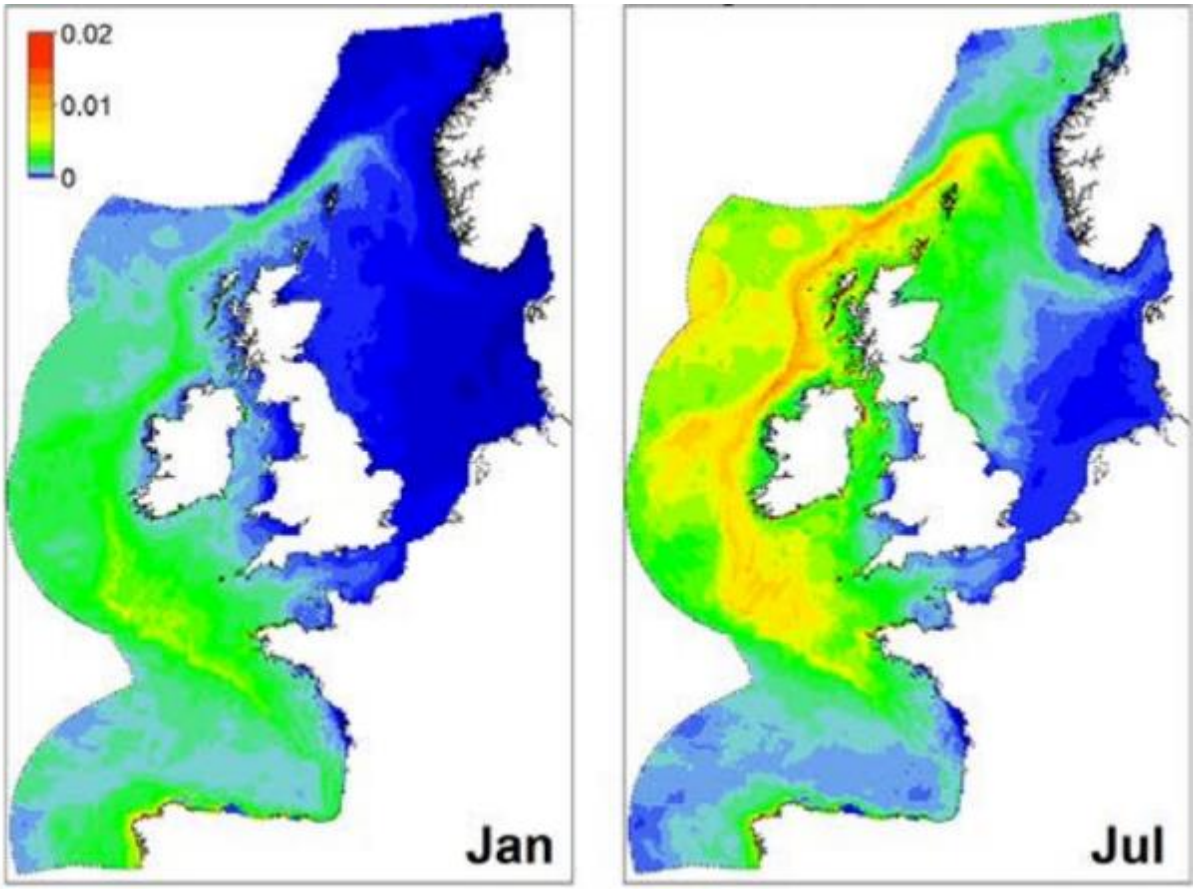

Figure 1.11 Spatial Variation in Predicted Densities (Individuals (per km2) of Risso's Dolphin in January and July in the North-East Atlantic). Values are Provided at 10 km Resolution. Source: Waggitt et al., 2019.

75. For the SCANS-IV survey, there are no abundance or density estimates for Risso's dolphin in survey block CS-G, however there is a density estimate for block CS-F (Gilles et al., 2023) which estimates:

- Abundance = 41 individuals (95% CI = 1-153);
- Density = 0.0027/km^2 (CV=1.006).

1.3.6.2. Site-Specific Density Estimates for Risso's dolphin

76. Two Risso's dolphin were recorded in the Project's December 2022 DAS, resulting in an average density estimate of 0.01 individuals per km^2. Due to the low number of individuals sighted, these density and abundance estimates have not been corrected for availability bias.

1.3.6.3. Summary of Abundance and Density Estimates for Risso's dolphin

77. As Risso's dolphin have been recorded during the Project's and Third-Party DAS surveys, this species has been scoped in for assessment.

78. **Table 1.13** provides an initial summary of the density estimate and population estimates for Risso's dolphin that will inform the EIA. This will be updated as part of the EIA process where a full review of all desk-based data sources presented in **Chapter 10 Marine Mammals** will be undertaken, and the most precautionary density estimate (and reference population) will be taken forward for assessment.

Table 1.13 Summary of reference population and density estimates to inform the assessments on Risso's dolphin

Species	Density (km²)	Density data source	Reference population	Reference population data source
Risso's dolphin	0 - 0.1	Paxton et al. (2016)	**United Kingdom (UK): 8,687 (Celtic Great North Sea (CGNS) Management Unit (MU))** **Total: 12,262 (CGNS MU)**	Inter-Agency Marine Mammal Working Group (IAMMWG) (2023)
	0.003	Waggitt et al. (2019)		
	0.002	Waggitt et al. (2019) densities over Small Cetacean in the European Atlantic and the North Sea (SCANS)-IV CS-F block (annual density)		
	0.0027	Gilles et al. (2023)		
	0.01	**Project Digital Aerial Survey(DAS) (Risso's dolphin only)**		
Key	Density estimates taken forward for assessment are shown in **green**			

1.3.7. Killer Whale

1.3.7.1. Desk-Based Review

79. Killer whales have a cosmopolitan range, where they can be distributed in all oceans across the globe, making them one of the most widespread cetaceans. There is a small group of killer whales that is found in the Hebrides, known as the West Coast Community. The most distinctive animal in the group is John Coe, easily recognisable due to a chunk missing from his dorsal fin, and he has been regularly sighted since 1992 throughout the Hebrides. Killer whales from Shetland, Orkney, Iceland and Norway have also been recorded in the Hebrides (HWDT, 2023e).

80. There is no estimated MU for killer whales from IAMMWG, however the North Atlantic Marine Mammal Commission (NAMMCO), estimate the MU for killer whales in the Northeast Atlantic to be 15,014 (NAMMCO, 2023a), or a MU of <10 for the individuals regularly sighted off Scotland (Beck et al., 2014), where the group has been recorded to be eight individuals (HWDT, 2023e). Any assessments would be undertaken against the West Coast population estimate of eight, as well as the wider Northeast Atlantic population estimate of 15,014.

81. The distribution maps for killer whale (developed by Waggitt et al., 2019) indicate a slightly higher density within the coastal areas of the Hebrides in July compared to January (**Figure 1.12**). Interrogation of this data[7], including all 10 km 'grids' that overlap with the specified area, reveals a maximum density estimate of 0.0008 individuals per km² (average of all overlapping 10 km 'grids') for the WDA.

82. Average Waggitt et al. (2019) densities across the area of the SCANS-IV block CS-F have also been calculated to show the density of killer whale across a wider area in comparison and results in an annual density of 0.0.0005 killer whale per km² for the Project.

[7] Available from: https:// doi.org/10.5061/dryad.mw6m905sz

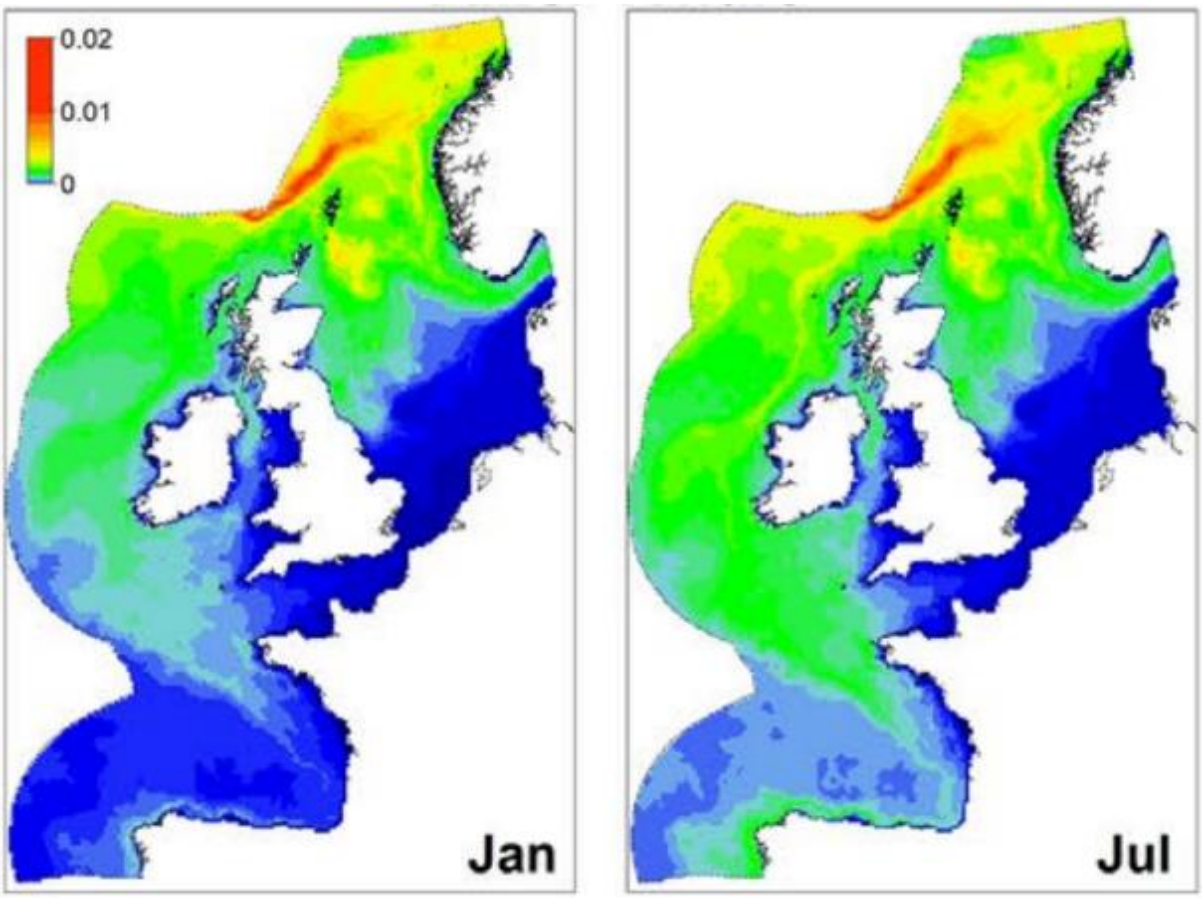

Figure 1.12 Spatial Variation in Predicted Densities (Individuals (per km2) of killer whale in January and July in the North-East Atlantic). Values are Provided at 10 km Resolution. Source: Waggitt et al., 2019.

83. For the SCANS-IV survey, there are no abundance or density estimates for killer whale in either survey block CS-F or CS-G (Gilles et al., 2023).

1.3.7.2. Site-Specific Density Estimates for Killer Whale

84. No killer whales were recorded in the Project's DAS.

1.3.7.3. Summary of Abundance and Density Estimates for Killer Whale

85. While killer whale has not been recorded in the Project's DAS, however, the baseline study shows that there is potential for killer whale presence in the WDA, and due to the known presence of a killer whale pod (the west coast community) in the Hebrides, killer whale has been scoped in for assessment.

86. **Table 1.14** provides an initial summary of the density estimate and population estimates of killer whale that will inform the assessments within the EIA. This will be updated as part of the EIA process where new information becomes available, such as updated site-specific density estimates. A full review of all desk-based data sources presented in **Chapter 10 Marine Mammals** will be undertaken, and the most precautionary density estimate (and reference population) will be taken forward for assessment.

Table 1.14 Summary of reference population and density estimates to inform the assessments on killer whale

Species	Density (km^2)	Density data source	Reference population	Reference population data source
Killer whale	**0.0008**	**Waggitt et al. (2019)**	**15,014 (Northeast Atlantic)** **8 (West Coast community)**	North Atlantic Marine Mammal Commission (NAMMCO) (2023) Hebrides Whale Dolphin Trust (HWDT), 2023e
	0.0005	Waggitt et al. (2019) densities over Small Cetacean in the European Atlantic and the North Sea (SCANS)-IV CS-F block (annual density)		
Key	Density estimates taken forward for assessment are shown in **green**			

1.4. BASELINE REVIEW FOR UNCOMMON TOOTHED CETACEAN SPECIES

1.4.1. Striped Dolphin

1.4.1.1. Desk-Based Review

87. The striped dolphin is wide ranging throughout tropical and temperate waters. Although rare, sightings in UK coastal waters normally occur during the summer months. Off the west coast of Scotland live sightings are rare and records include stranded animals (HWDT, 2023f).

88. The distribution maps for striped dolphin (developed by Waggitt et al., 2019) show a clear pattern of high densities in the European Atlantic waters, rather than the north Atlantic (**Figure 1.13;** Waggitt et al., 2019). The distribution maps indicate a slight increase of striped dolphin density in the summer months travelling from the Bay of Biscay to the north Atlantic, in the offshore regions, west of Scotland.

89. Interrogation of this data[8], including all 10 km 'grids' that overlap with the specified area, reveals a maximum density estimate of 0.000005 individuals per km^2 (average of all overlapping 10 km 'grids') for the WDA.

[8] Available from: https:// doi.org/10.5061/dryad.mw6m905sz

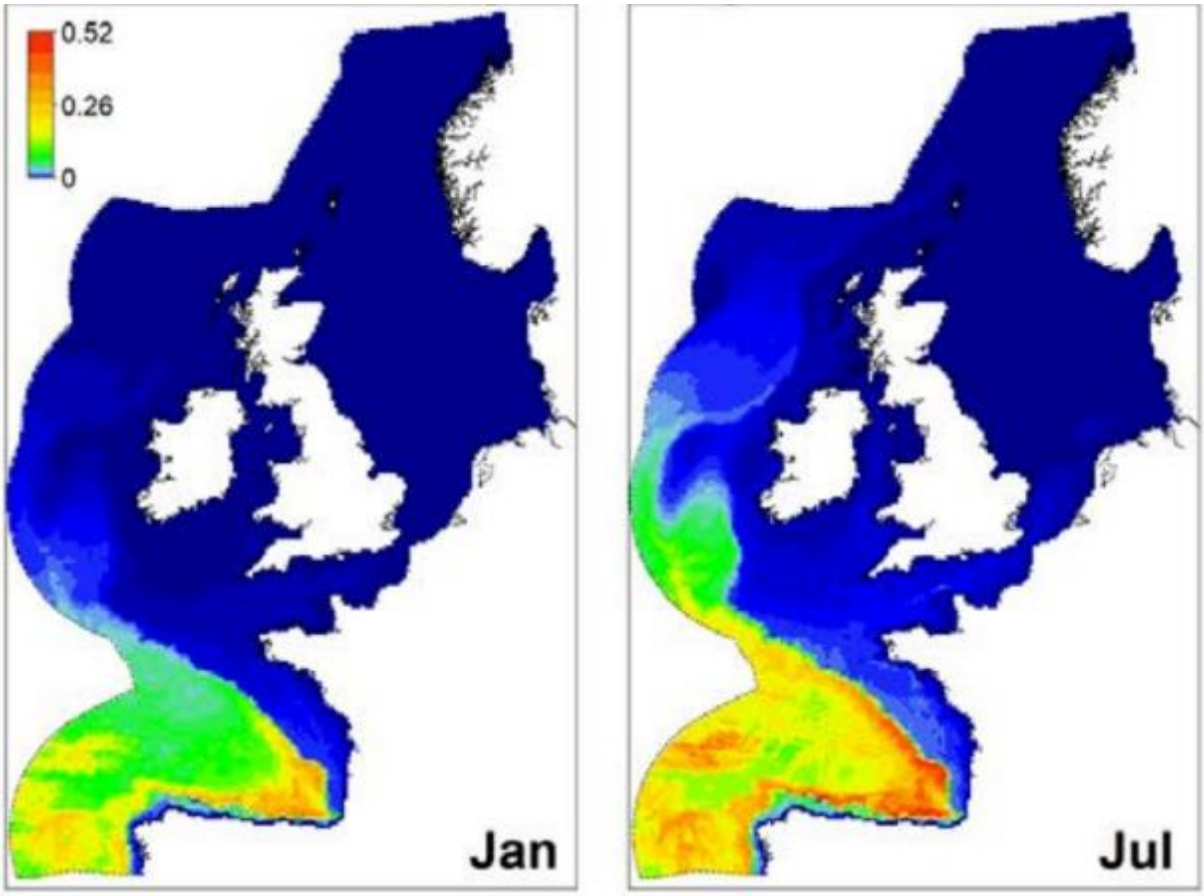

Figure 1.13 Spatial Variation in Predicted Densities Individuals per km of Stripped Dolphin in January and July in the North-East Atlantic. Values are Provided at 10 km Resolution. Source: Waggitt et al., 2019.

90. For the SCANS-IV and SCANS-III survey, there are no abundance or density estimates for striped dolphin in either survey block CS-F or block CS-G (Gilles et al., 2023, Hammond et al., 2017).

1.4.1.2. Site-Specific Density Estimates for Striped Dolphin

91. No striped dolphin were recorded in the Project's DAS.

1.4.1.3. Summary of Abundance and Density Estimates for Striped Dolphin

92. As the baseline study shows striped dolphin abundance to be low around the WDA, this species is proposed to be scoped out of the EIA.

1.4.2. Long-Finned Pilot Whale

1.4.2.1. Desk-Based Review

93. Long-finned pilot whale usually prefer deep water but have been found in coastal regions, most likely due to prey distribution. Therefore, the species is widely distributed in the Hebrides and is also the most common cetacean to strand in the Hebrides (HWDT, 2023g).

94. Sighting surveys in 1987 and 1989 generated an abundance estimate of more than 750,000 long-finned pilot whales in the central and north-eastern North Atlantic (Buckland et al.,1993). A recent analysis of pilot whale abundance estimates for the central and north-eastern North Atlantic in the 28-year period from 1987 to 2015 found no detectable trend (Pike et al., 2018).

95. Sightings data from four surveys conducted from ships and airplanes during 2005-2007 in European waters SCANS-II, Cetacean Offshore Distribution and Abundance in the European Atlantic (CODA), and Trans North Atlantic Sightings Survey) were used to estimate cetacean abundance using double-platform line transect methods. The model-based estimate of abundance in the eastern North Atlantic from the four surveys combined was 152,071 (CV 0.32) long-finned pilot whales (Rogan et al., 2017).

96. The distribution maps for pilot whale show a clear pattern of slightly higher density to the coastal areas of the Hebrides in January compared to July (**Figure 1.14**; Waggit et al. 2019).

97. Interrogation of this data[9], including all 10 km 'grids' that overlap with the specified area, reveals a maximum density estimate of 0.0009 individuals per km^2 (average of all overlapping 10 km 'grids') for the WDA.

98. Average Waggitt et al. (2019) densities across the area of the SCANS-IV block CS-F have also been calculated to show the density of pilot whale across a wider area in comparison and results in an annual density of 0.0001 pilot whale per km^2 for the Project.

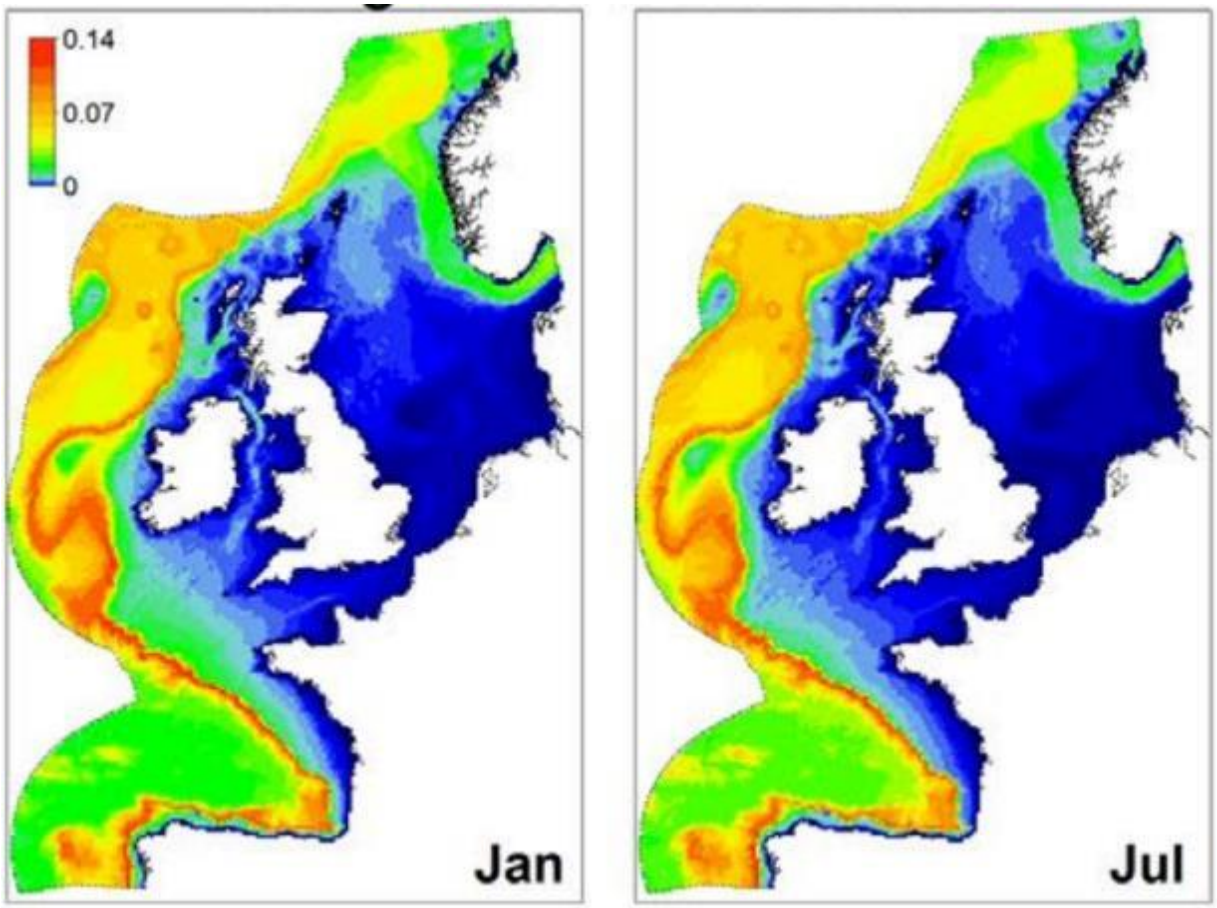

Figure 1.14 Spatial Variation in Predicted Densities Individuals per km of pilot whale in January and July in the North-East Atlantic. Values are Provided at 10 km Resolution. Source: Waggitt et al., 2019.

[9] Available from: https:// doi.org/10.5061/dryad.mw6m905sz

99. For the SCANS-IV survey, there are no abundance or density estimates for long-finned pilot whales in survey block CS-F, however there is a density estimate for block CS-G (Gilles et al., 2023) which estimates:

- Abundance = 655 individuals (95% CI = 101-4,245);
- Density = 0.0326/km^2 (CV=1.010).

1.4.2.2. Site-Specific Density Estimates for Long-Finned Pilot Whale

100. No pilot whales were recorded in the Project's DAS, however, three pilot whales were recorded by MMOs during the geophysical site investigation surveys.

1.4.2.3. Summary of Abundance and Density Estimates for Long-Finned Pilot Whale

101. As long-finned pilot whales have been recorded within the Project's OAA, this species has been scoped into the assessment. A review of density estimates will be further investigated, however, if no density estimate for the WDA can be used, the SCANS-IV density for the adjacent block CS-G will be used. **Table 1.15** summaries long-finned pilot whale densities.

Table 1.15 Summary of reference population and density estimates to inform the assessments on pilot whale

Species	Density (km^2)	Density data source	Reference population	Reference population data source
Long-finned pilot whale	0.0008	Waggitt et al. (2019)	**152,071**	(Rogan et al., 2017)
	0.001	Waggitt et al. (2019) densities over Small Cetacean in the European Atlantic and the North Sea (SCANS)-IV CS-F block (annual density)		
	0.0326	**Gilles et al., 2023, SCANS-IV CS-G**		
Key	Density estimates taken forward for assessment are shown in **green**			

1.4.3. Beaked Whales

1.4.3.1. Desk-Based Review

102. The northern bottlenose whale is a beaked whale species. Very little is known about beaked whales as a species group, as they are very shy, reclusive animals, are deep diving and mostly remain in offshore waters. Northern bottlenose whales occur in small numbers of the western isles of Scotland and are visitors to the coastal areas during July to September (HWDT, 2023h). Some of the data could be strandings rather than sightings data although this would need to be investigated further.

103. Cuvier's beaked whales are widely distributed throughout all major oceans, but they are not found in polar seas and Scotland represents their northern-most limit. Live sightings in the Hebrides are very rare but numerous stranded animals indicate they may be more common than sightings data suggest (HWDT, 2023i). In 2008, there were multiple strandings of Cuvier's beaked whales in the Hebrides, and it was suggested to be due to sonar activity. This suggestion was made by Professor Ian Boyd, the director of Britain's Sea Mammal Research Unit, based at the University of St Andrews in an interview.

104. Beaked whales are elusive deep-diving species. Due to their offshore habitat, along with deep and prolonged dives, this makes abundance estimates for the beaked whale family difficult to determine. In addition, the abundance of beaked whale can also be underestimated when using visual survey methods due to their long diving periods, where the whales are unobservable, together with their inconspicuous behaviour when they surface, which makes them easy to miss (Barlow, 2022).

105. By combining the summer of the 2005 SCANS II survey with the 2007 CODA and Faroese NASS survey, Rogan et al., (2017) provided a combined abundance estimate for all beaked whale species of 29,154 individuals (95% CI: 17,478 – 48,629) in the North-East Atlantic area in 2017. Of these, 12,900 individuals (CV=0.31) were from the SCANS II-CODA area. These estimates are not a true representation as they have not been corrected for diving or missed animals (Rogan et al., 2017).

106. For the SCANS-IV survey, there are no abundance or density estimates for either Cuvier's beaked whale or for Northern bottlenose whale in either survey block CS-F or block CS-G (Gilles et al., 2023). For the northern bottlenose whale, Rogan et al. (2017) provided an abundance of 19,539 (95% CI: 9,92–38,482) for the Northeast Atlantic.

1.4.3.2. Site-Specific Density Estimates for Beaked Whales

107. No beaked whales were recorded in the Project's DAS.

1.4.3.3. Summary of Abundance and Density Estimates for Beaked Whales

108. As the baseline study shows beaked whales' abundance to be low around the WDA area, all beaked whale species is proposed to be scoped out of the EIA.

1.5. BASELINE REVIEW FOR COMMON BALEEN WHALES

1.5.1. Minke Whale

1.5.1.1. Desk-Based Review

109. Minke whale are a seasonal visitor to the region and can be sighted in coastal waters around the Inner Hebrides between April to October.

110. The IAMMWG have defined one MU for minke whale; the CGNS MU (**Figure 1.7**). The estimate of minke whale abundance in the CGNS MU is 10,288 (CV: 0.26, CI = 6,210– 17,042) (IAMMWG, 2023). This is the reference population for minke whale for use in the EIA.

111. The JCP Phase III Report (Paxton et al., 2016) estimates there is between 0.02 and 0.1 minke whale per km^2 within the vicinity of the WDA. SMFS (2020) estimated there to be density estimates of up to 0.05 individuals per km^2 in the Islay area, and up to 0.02 individuals per km^2 in the Sound of Islay area, with the highest densities in summer.

112. For minke whale, the distribution maps (developed by Waggitt et al., 2019) show a clear pattern of higher density in the west coasts of Scotland, in both the Inner and Outer Hebrides, the northeast coast of Ireland with decreasing densities southwards of Scotland along the west coast of England. There is a seasonal difference in the densities of minke whale, with higher densities in July, which is particularly evident in the Inner and Outer Hebrides, (**Figure 1.15**; Waggitt et al., 2019).

113. Interrogation of this data,[10] including all 10 km 'grids' that overlap with the specified area, reveals a maximum density estimate of 0.015 individuals per km^2 (average of all overlapping 10 km 'grids') for the WDA and a maximum summer density of 0.01 individuals per km^2.

[10] Available from: https:// doi.org/10.5061/dryad.mw6m905sz

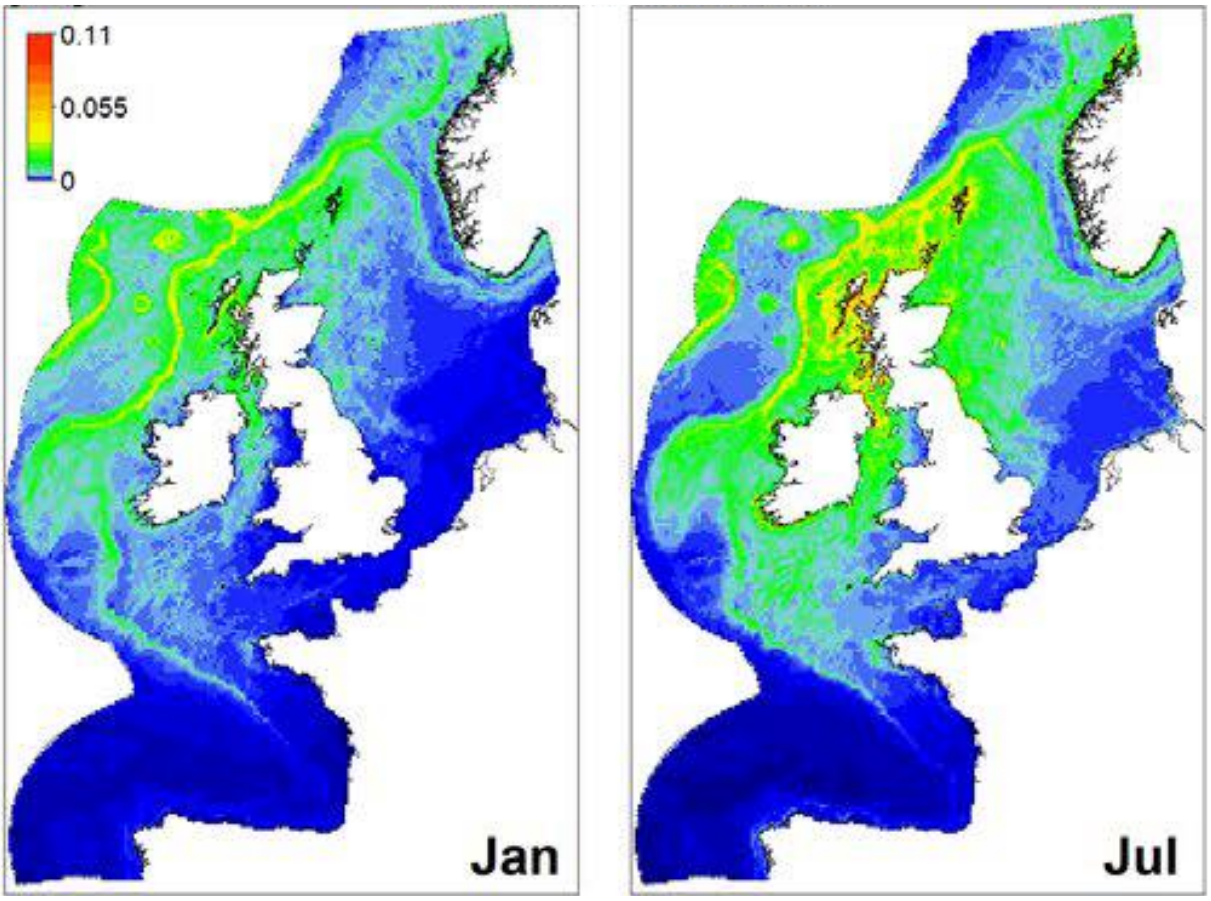

Figure 1.15 Spatial Variation in Predicted Densities, Individuals per km² of Minke Whale in January and July in the North-East Atlantic. Values are Provided at 10 km Resolution. Source: Waggitt et al., 2019

114. For the SCANS-IV survey, there are no abundance or density estimates for minke whales in survey block CS-G, however there is a density estimate for block CS-F (Gilles et al., 2023) which estimates:

- Abundance = 209 individuals (95% CI = 2-954);
- Density = 0.0137/km² (CV=1.091).

115. Paxton et al. (2014) collated survey data across Scotland's waters, from 1994-2012, in order to identify persistently high areas of marine mammal density. For minke whale in the Hebrides, analysis of this data showed a density ranging from 0.2 to 2.0 individuals per km², for all seasons. This data was used to designate the Sea of the Hebrides Nature Conservation Marine Protected Area for minke whale, with persistently high densities. Further information on the Sea of the Hebrides Nature Conservation Marine Protected Area is provided in **Appendix H Nature Conservation Marine Protected Area Screening**.

1.5.1.2. Site-Specific Density Estimates for Minke Whale

116. Minke whale were recorded in 15 of the Project's DASs during the months from March to November, with a total of 57 whales and a maximum density estimate of 0.05 minke whale per km². The average density across the 30 monthly surveys equates to 0.009 minke whale per km². Adding a correction factor of 0.12 (Hedie-Jorgensen et al., 2010), the estimated density is 0.075 minke whale per km².

117. These density and abundance estimates will be further corrected to account for those that would be under the surface, and therefore unavailable to count, and apportioned to take account of the individuals that could not be identified to species level.

1.5.1.3. Summary of Abundance and Density Estimates for Minke Whale

118. Due to the relatively high number of minke whale present in the WDA as recorded in the Project DAS, this species has been scoped in for further assessment.

119. **Table 1.16** provides an initial summary of the density estimate and population estimates of minke whale that will inform the EIA. This will be updated where new information becomes available, such as updating specific density estimates. A full review of all desk-based data sources presented in **Chapter 10 Marine Mammals** will be undertaken, and the most precautionary density estimate (and reference population) will be taken forward for assessment.

Table 1.16 Summary of reference population and density estimates to inform the assessments on minke whale

Species	Density (km^2)	Density data source	Reference population	Reference population data source
Minke whale	0.02-0.05	Paxton et al. (2016)	**United Kingdom (UK): 10,288 (Celtic Great North Sea (CGNS) Management Unit (MU))** **Total: 20,118 (CGNS MU)**	Inter-Agency Marine Mammal Working Group (IAMMWG) (2023)
	0.015	Waggitt et al. (2019)		
	0.0137	Gilles et al. (2023)		
	0.2 – 2.0	Paxton et al. (2014)		
	0.075	**Project Digital Aerial Survey (DAS) (minke whale only)**		
Key	Density estimates taken forward for assessment are shown in **green**			

1.6. BASELINE REVIEW FOR UNCOMMON BALEEN WHALES

1.6.1. Fin Whale

1.6.1.1. Desk-Based Review

120. Fin whale are widely distributed through the world's oceans, where they make seasonal migrations towards the polar regions in the summer months. Sightings in the Hebrides are very rare and occur during the summer months; (April to October). This suggests that the Hebrides could provide foraging grounds for the species (HWDT, 2023j).

121. Abundance estimates from the SCANS IV surveys (summer 2022) have been derived for the North Sea, Irish Sea, and the Atlantic Ocean off France, Spain and Portugal. These provide an abundance estimate of 12,764 (CV 0.19) (Gilles et al., 2023).

122. There are no fin whales recorded in the SCANS survey blocks within the Project, however the total density estimate is 0.0017 fin whales per km^2 for all survey blocks, although it should be noted that this includes a large congregation of fin whale sightings in the southwest blocks, towards the Bay of Biscay.

123. For fin whale, the distribution maps (**Figure 1.16**) (developed by Waggitt et al., 2019) show a clear pattern of higher density in the west coasts of Scotland in the offshore region in July compared to January. Both maps show fin whale distribution to be very rare in the Hebrides.

124. Interrogation of this data,[11] including all 10 km 'grids' that overlap with the specified area, reveals an average annual density estimate of 0.00003 individuals per km^2 (average of all overlapping 10 km 'grids') for the WDA.

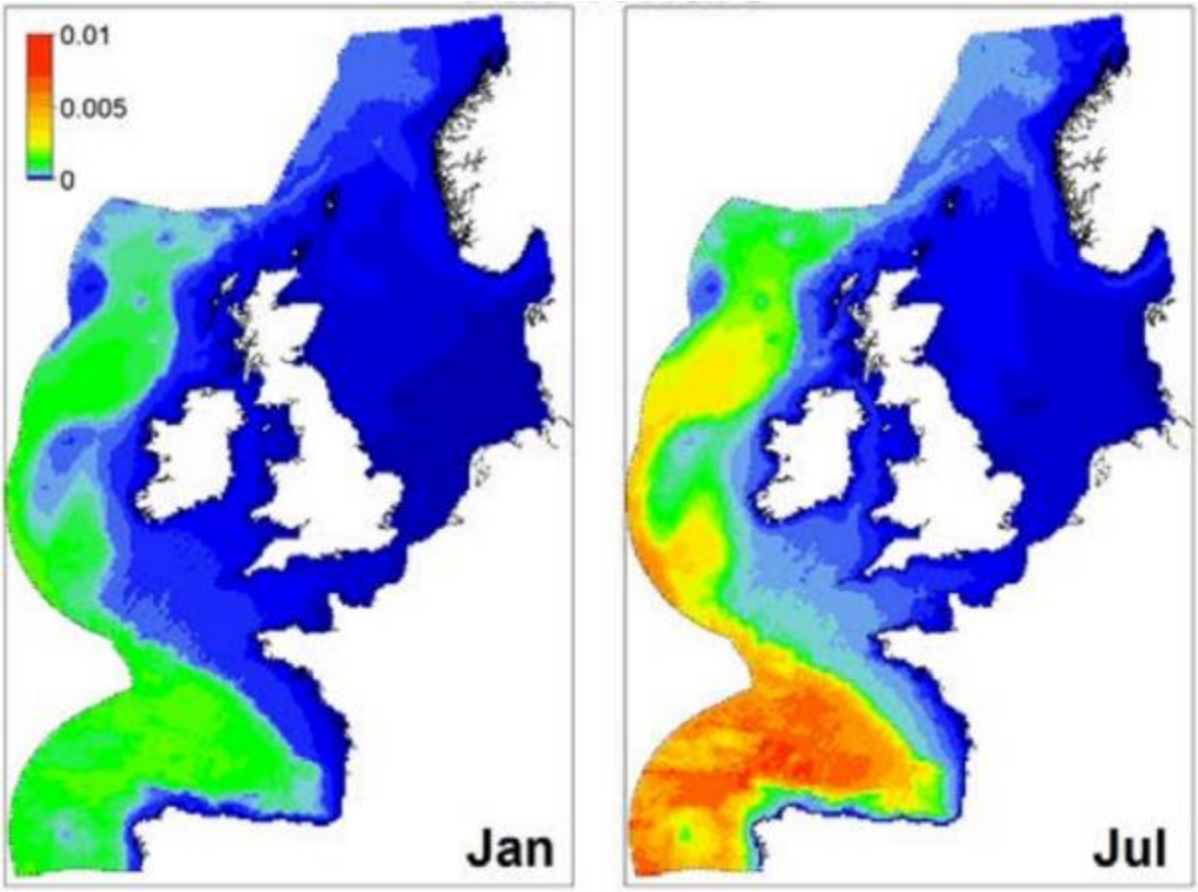

Figure 1.16 Spatial Variation in Predicted Densities, Individuals per km of Fin Whale in January and July in the North-East Atlantic, Values are Provided at 10 km Resolution. Source: Waggitt et al., 2019.

1.6.1.2. Site-Specific Density Estimates for Fin Whale

125. No fin whale were recorded in the Project's DAS.

1.6.1.3. Summary of Abundance and Density Estimates for Fin Whale

126. As the baseline study shows fin whale abundance to be low around the WDA, this species is proposed to be scoped out of the EIA.

1.6.2. Sei Whale

1.6.2.1. Desk-Based Review

127. The distribution of sei whale is poorly understood, along with their migration patterns. Sei whale have been recorded occurring throughout the world's oceans, with exception of the polar regions. In the Hebrides, sei whale are rarely recorded but have been mainly in offshore areas and have been recorded in the months July to October (HWDT, 2023j).

[11] Available from: https:// doi.org/10.5061/dryad.mw6m905sz

128. There is a paucity of documented information on the abundance or populations of sei whale, however the North Atlantic sightings survey in 1989 resulted in an estimated of 10,300 sei whale, (95% CI: 6,150 – 17,260) in waters of Iceland and Faroes (Cattanach et al., 1993), and the latest survey conducted in 2015, resulted in an estimate of 3,767 individuals (95% CI: 1,156 – 12,270) (Pike et al., 2019, NAMMCO, 2019b).

1.6.2.2. Site-Specific Density Estimates for Sei Whale

129. No sei whale were recorded in the Project's DAS.

1.6.2.3. Summary of Abundance and Density Estimates for Sei Whale

130. As the baseline study shows sei whale abundance to be low around the WDA, this species is proposed to be scoped out of the EIA.

1.6.3. Humpback Whale

1.6.3.1. Desk-Based Review

131. Humpback whale are widely distributed throughout the world's oceans. Humpback whales were considered rare in Scottish waters and have occasionally been recorded in the Hebrides, however sightings are becoming more frequent all around the UK coast.

132. The humpback whale population was estimated in 2001 for the British Isles, Norwegian Sea and Barents Sea, with an estimate of 1,450 (CV 0.29); (Øien et al., 2009). The population estimate for Norway, Greenland, Faroes and Jan Mayen was estimated in 2015, with an abundance of 10,031 (CV 0.36) (Pike et al., 2018). For both populations together, the estimate would be around 15,000 humpback whale (CV 0.25) (NAMMCO, 2023c).

1.6.3.2. Site-Specific Density Estimates for Humpback Whale

133. No humpback whale were recorded in the Project's DAS.

1.6.3.3. Summary of Abundance and Density Estimates for Humpback Whale

134. The initial desk-based review of humpback whales indicates there would be a relatively low presence within the WDA. However, more sightings of humpback whale have been recorded along the west coast of Scotland, therefore, humpback whale has been scoped in for further assessment. Due to a lack of information on an appropriate population estimate for Scottish (or UK) waters on which to base an assessment, only qualitative assessments will be undertaken for this species unless a density estimate can be derived e.g. from HWDT data.

1.7. PINNIPEDS

1.7.1. Grey Seal

1.7.1.1. Desk-Based Review

135. Grey seals only occur in the North Atlantic, Barents and Baltic Sea, with their main concentrations on the east coast of Canada and the United States, and in north-west Europe (SCOS, 2023).

136. Approximately 36% of the world's grey seals breed in the UK, and 81% of these, breed at colonies in Scotland with the main concentrations in the Outer Hebrides. Grey seals are wide ranging and can breed and forage in different areas (Russell and McConnell., 2014). Maximum foraging ranges for grey seal has been recorded to be up to 448 km (Carter et al., 2022) and studies from Russell (2016) have showed that grey seals will utilise and travel between different haul-out sites.

137. For seals, it is necessary to consider their movements in the area. Global Positioning System (GPS) tracking data from tagged grey seal indicate there is the potential for presence in the WDA, with individuals from the Inner Hebrides having connection with the Outer Hebrides, and the Republic of Ireland, with limited connection with south-west Scotland, England, or Northern Ireland waters (**Figure 1.17**).

138. In the UK, there are 14 seal MUs (**Figure 1.18**), as well as five regions in the Republic of Ireland. The WDA is within the West Scotland MU, which will be the primary MU used to inform the assessment. It is proposed to also include the Western Isles, south-west Scotland, Northern Ireland, and Republic of Ireland (North and West regions) as a wider population reference to account for grey seal moving in the wider area.

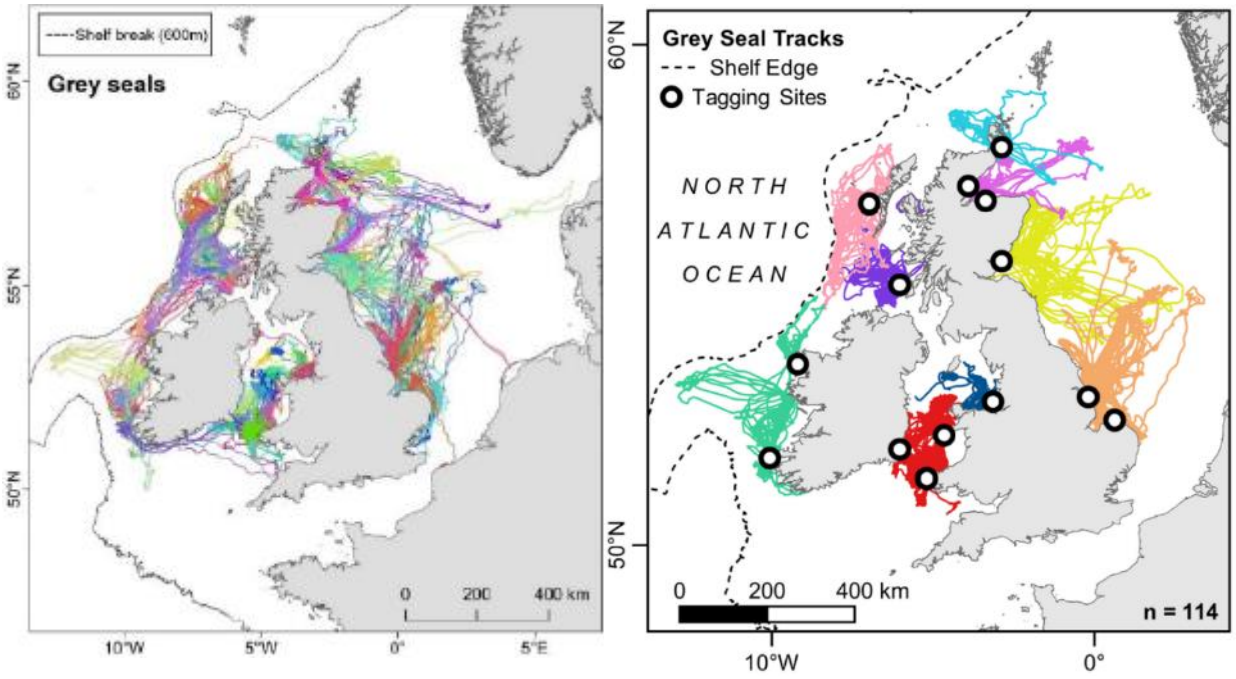

Figure 1.17 GPS tracking data for grey seal, n=114, Carter et al., 2020; Right = GPS tracking data for grey seal, cleaned to remove erroneous location estimates, and trips between regions during the breeding season, n=114, Carter et al., 2022

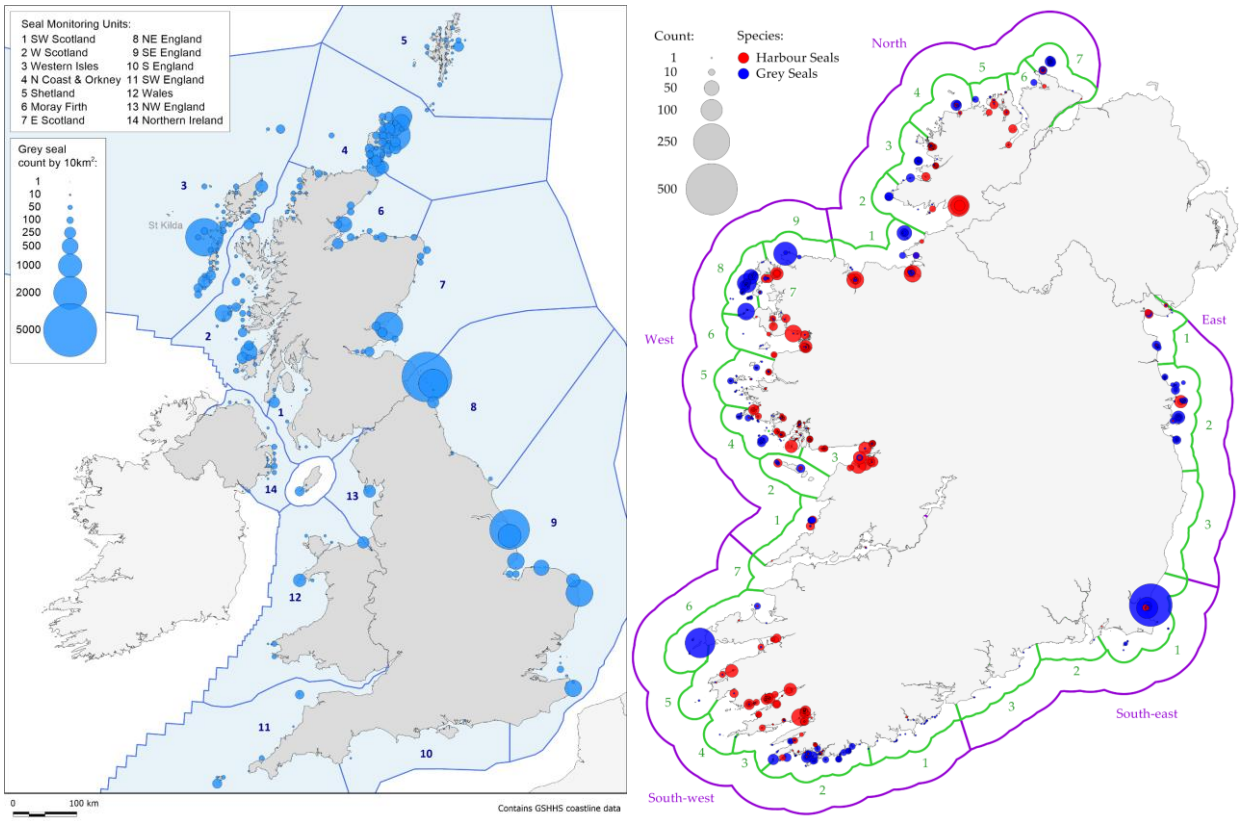

Figure 1.18 Left = Seal Management Units for the UK coast, SCOS, 2023; Republic of Ireland regions, Morris and Duck 2019

139. **Table 1.17** provides the latest grey seal counts within the relevant areas, as well as the corrected population numbers. In order to generate an abundance estimate for seals, it is necessary to take account of those individuals that were not available to count during the August counts, therefore, a correction factor is applied to the counts to generate a population estimate. The correction factor for grey seal is 0.2515 (Russell et al., 2021).

140. When assessing impacts to grey seal in the EIA, it is proposed to assess impacts on the:

- West Scotland MU population; and
- The wider population which includes the West Scotland, Southwest Scotland, Western Isles and Northern Ireland MUs, with the Republic of Ireland North and West regions.

Table 1.17 Grey seal population count estimates

Management Unit (MU) / Region	Grey seal haul-out count	Source of haul-out count data	Correction factor for seals not available to count	Grey seal total population
West Scotland	4,174	Special Committee on Seals (SCOS), 2023	0.2515	**16,596**
Southwest Scotland	517	SCOS, 2023	0.2515	2,056
Western Isles	5,773			22,954
Northern Ireland	549			2,183
Republic of Ireland – North region	749	Morris and Duck, 2019		2,978
Republic of Ireland – West region	1,183			4,704
Total wider reference population	12,945	-		**51,471**
Key	Reference populations taken forward for assessment are shown in **green**			

141. For density estimates of grey seal, Carter et al., (2022) provides habitat-based predictions of at sea distribution for seals around the British Isles. The habitat preference distribution maps provide density estimates per species, on a 5 km by 5 km grid of relative at sea density for seals hauling-out in the British Isles. It is important to note that Carter et al., (2022) provides relative density (i.e. percentage of the total at sea population in each grid at any one time).

142. The grey seal relative density map (**Figure 1.19;** Carter et al., 2022) shows the mean predicted relative density for the WDA is relatively high for the UK and the Republic of Ireland, with areas of increased densities close to the Isle of Jura, Colonsay and Islay, where there are a number of grey seal haul-out sites.

143. The grey seal density estimates for the WDA have been calculated from the seal at-sea usage maps (Carter et al*.,* 2022) based on the 5 km by 5 km grids that overlap with the MachairWind OAA and are corrected against the total UK and the Republic of Ireland population estimates. The total grey seal population in the British Isles is 178,262 (**Table 1.17**; SCOS, 2023). This total population estimate is corrected to determine the total number of individuals that may be at-sea at any time, using a correction factor of 0.8616 for grey seal (Russell et al., 2015). There are therefore approximately 153,591 grey seals at sea at any one time, based on the corrected values and most recent haul-out counts for the UK. This is the at-sea population estimate used with the Carter et al*.* (2022) data to calculate density estimates.

144. Based on the Carter et al. (2022) data, the average density across the WDA is 0.529 grey seal per km^2.

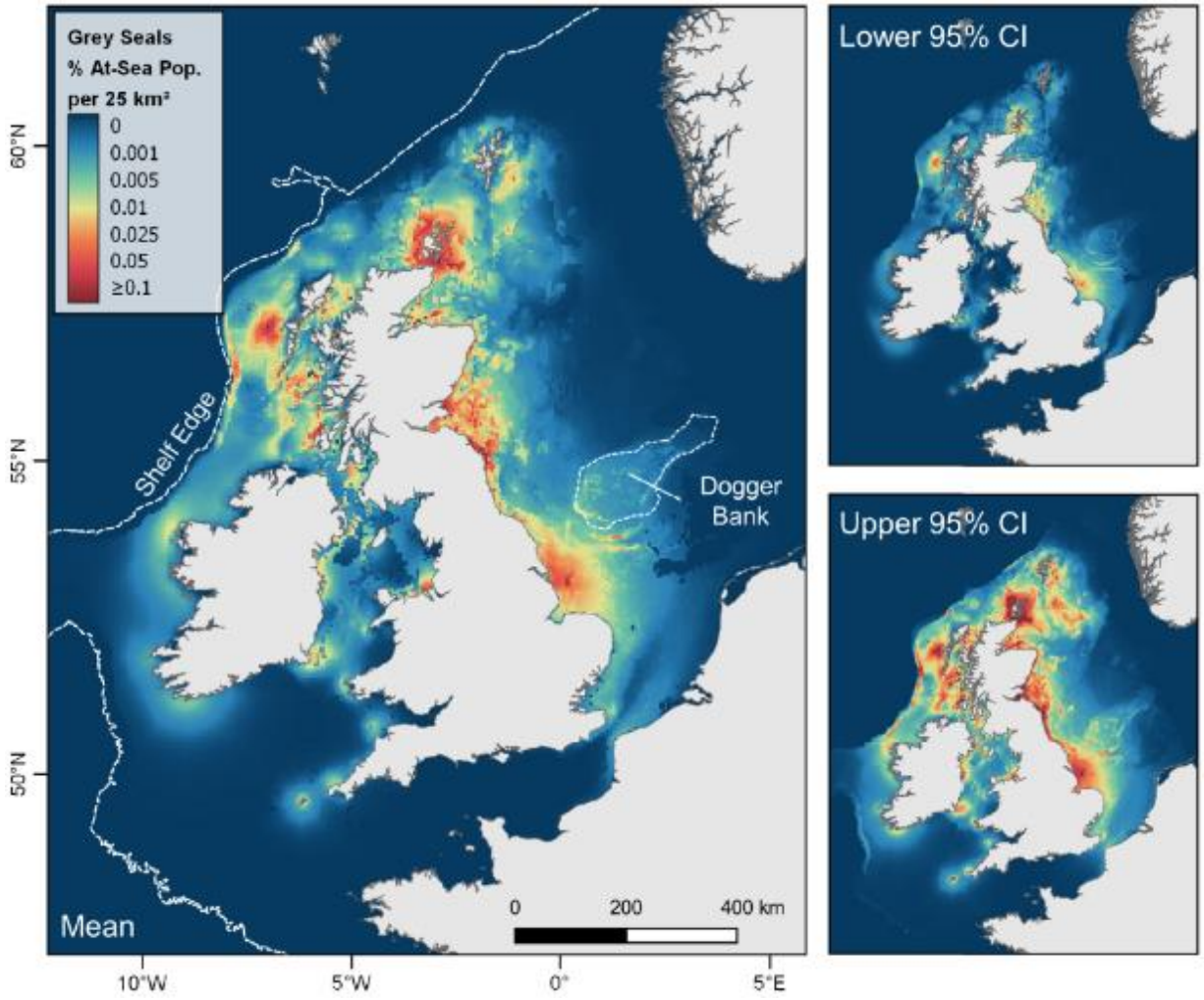

Figure 1.19 At-sea distribution of grey seals; maps show mean percentage of at-sea population estimated to be present in each 5 km x 5 km grid cell at any one time, Carter et al., 2022

1.7.1.2. Site-Specific Density Estimates for Grey Seal

145. During the Project's DAS, grey seal were recorded in 27 of the 30 DAS, with a total of 165 individuals recorded resulting in an average density estimate of 0.036 grey seal per km^2. Adding a correction factor to account for diving species, the average density estimates equate to 0.132 grey seal per km^2 in the Project's OAA. This has also been apportioned to account for unidentified seal species. In total there were 77 unidentified seals recorded in the Project's DAS.

1.7.1.3. Summary of Abundance and Density Estimates for Grey seal

146. Due to the high number of grey seal present in the area, this species has been scoped in for further assessment.

147. **Table 1.18** provides an initial summary of the density estimate and population estimates of grey seal at the WDA. A full review of all desk-based data sources presented in **Chapter 10 Marine Mammals** will be undertaken, and the most precautionary density estimate (and reference population) will be taken forward for assessment.

Table 1.18 Summary of reference population and density estimates to inform the assessments

Species	Density	Density data source	Reference population	Reference population data source
Grey seal	**0.529/km²**	**Carter et al. (2022)**	**WS Management Unit (MU): 16,596** **Wider population: 51,471**	Special Committee on Seals (SCOS) (2023)
	0.132/km²	Project Digital Aerial Survey (DAS) (grey seal and apportioned seal species data)		
Key		Density estimates taken forward for assessment are shown in **green**		

1.7.1.4. Grey Seal Haul-Out Sites

148. There are a number of haul-out sites for grey seal in the Hebrides, and close to the WDA (**Figure** 1.20; SCOS, 2023). The nearest major grey seal sites are on the Islands of Colonsay, Islay, Jura, the west coast of Mull, Tiree and Coll. **Table 1.19** below provides the latest counts for the closest of the haul-out sites, as well as the corrected numbers to account for those not available to count during the Project's DAS. Due to the number and location of the known seal haul out sites, disturbance at seal haul-out sites has been scoped into the EIA.

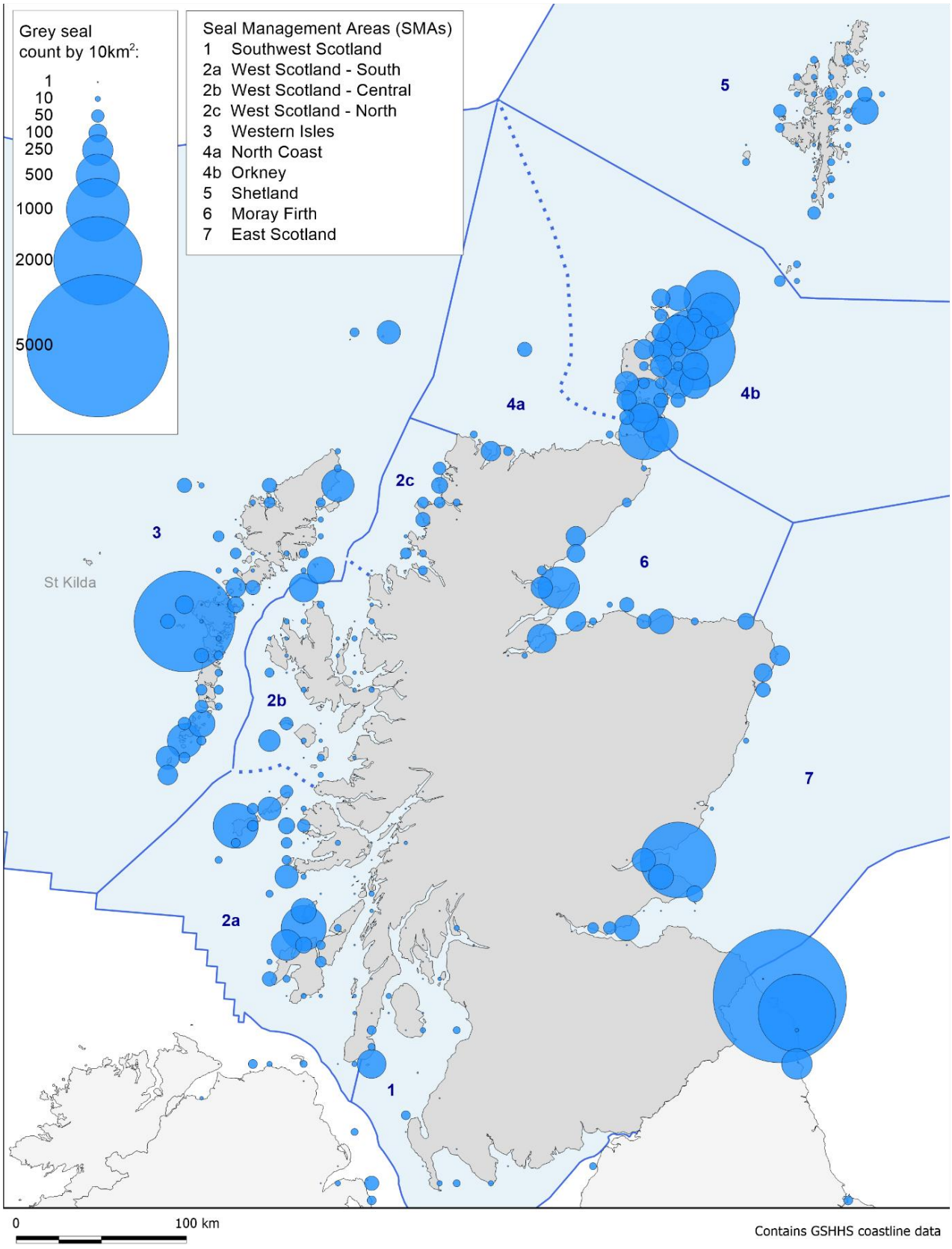

Figure 1.20 Grey seal haul-outs sites, and latest counts, in Scotland (SCOS, 2023)

Table 1.19 Grey seal haul-out sites

Site	Distance to the Windfarm Development Area (WDA) (km)	Grey seal count	Source
Arinthluic	52	2% of grey seal management area's population	Special Committee on Seals (SCOS), 2019
Craighase small Isle and lowland mans	58	Pupping site	
Hough Skerries	53	19% of grey seal management area's population	SCOS, 2019
Friesland bay	50.5	-	
Gunna	48	500+ pup production	SCOS (2019)
Nave Island	14.6	-	-
Oronsay	14.3	50+ pup production in 2012	SCOS, 2019
Oronsay Strand	15.2	-	-
Outer Loch Tarbery	33.4	-	-
Soa, Mull	18.7	20+ pup production (2012)	SCOS, 2019
Treshnish Isles	35	160	-

1.7.2. Harbour Seal

1.7.2.1. Desk-Based Review

149. Harbour seals have a circumpolar distribution in the Northern Hemisphere and are divided into five sub-species. The population in European waters represents one subspecies *Phoca vitulina* (SCOS, 2023). Harbour seals are widespread around the west coast of Scotland and throughout the Hebrides and the Northern Isles.

150. Harbour seal have foraging ranges of up to 273 km (Carter et al., 2022), and the GPS tracking data from tagged harbour seal indicate there is potential for presence in the WDA (**Figure 1.21**). Harbour seal from the WDA have connectivity with the Inner Hebrides, Outer Hebrides, south-west Scotland, Northern Ireland, and north of the Republic of Ireland. There is no connectivity with English waters (**Figure 1.22**). As for grey seal, the West Scotland MU will be the primary MU used to inform the assessment. It is proposed to also include the Western Isles, Southwest Scotland, and Northern Ireland MUs, as well as the Republic of Ireland North Region, as a wider population, to account for harbour seal moving in the wider area.

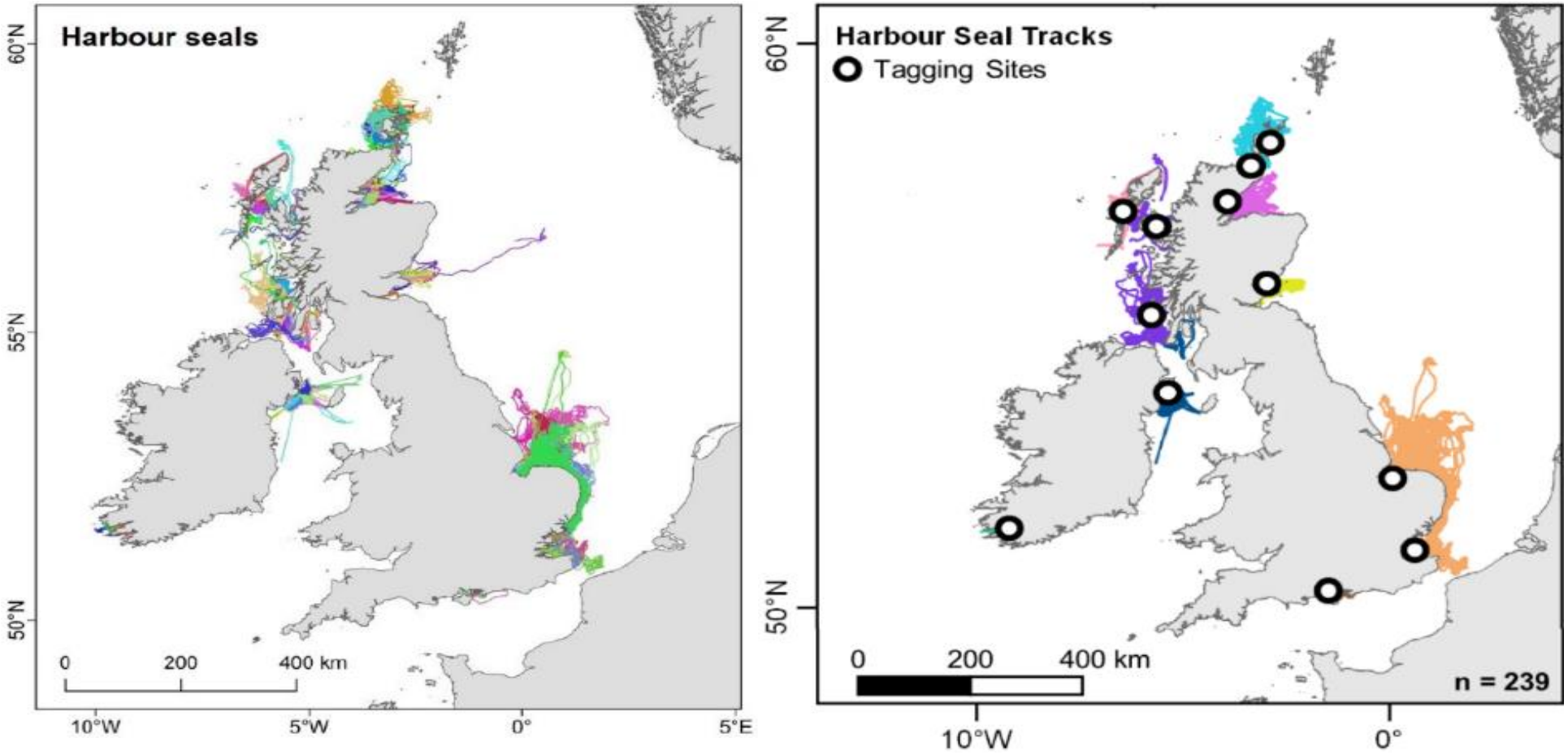

Figure 1.21 GPS tracking data for harbour seal, n=239, Carter et al., 2020; Right = Carter et al., 2022

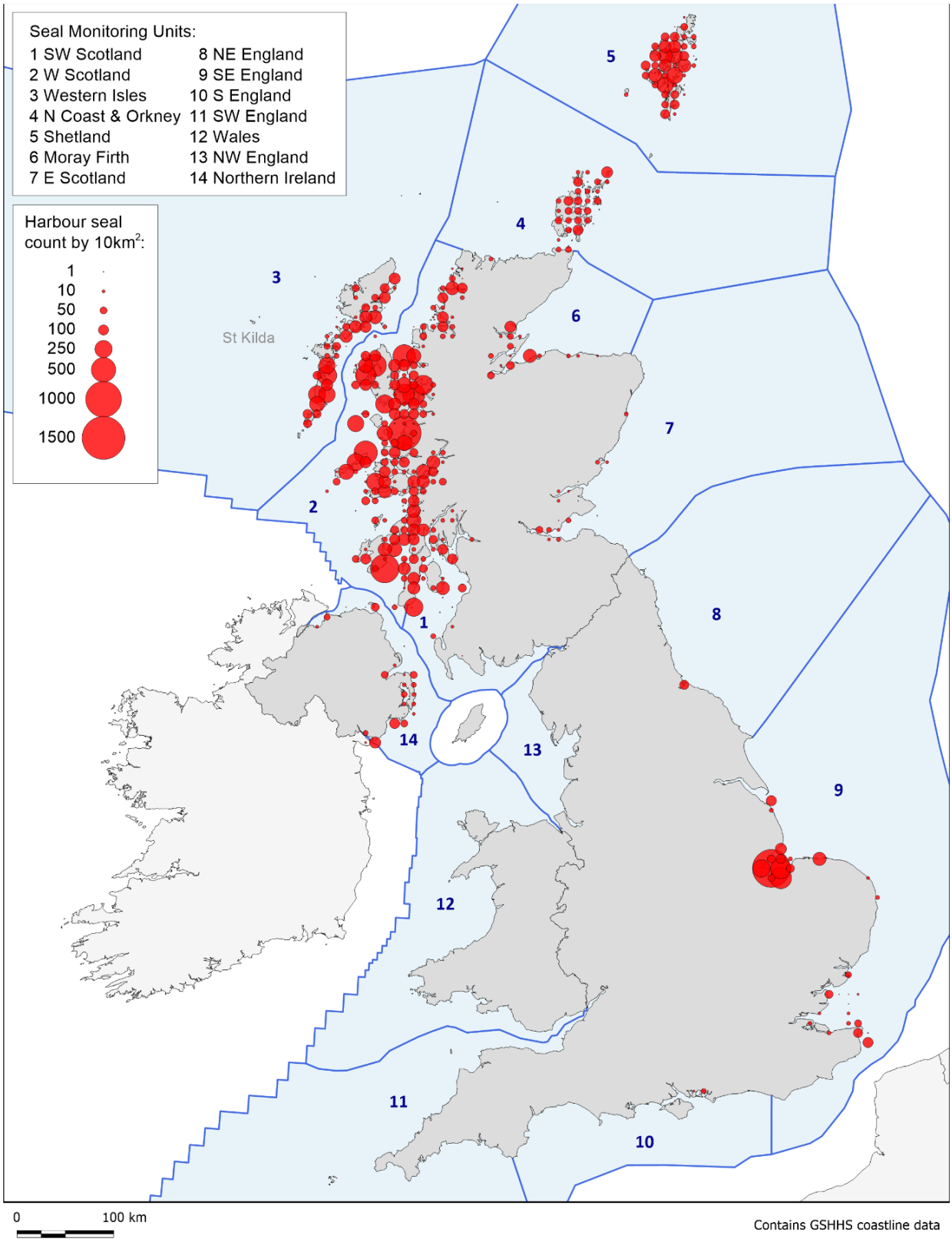

Figure 1.22 Seal management units for the UK coast, SCOS, 2023

151. **Table 1.20** provides the latest harbour seal counts within the relevant areas, as well as the corrected population numbers. In order to generate an abundance, estimate for seals, it is necessary to take account of those individuals that were not available to count during the August counts, therefore, a correction factor is applied to the counts to generate a population estimate. The correction factor for harbour seal is 0.72 (Lonergan et al., 2013).

Table 1.20 Harbour seal population count estimates

Management Unit (MU) / region	Harbour seal haul-out count	Source of haul-out count data	Correction factor for seals not available to count	Harbour seal total population
West Scotland	15,600	Special Committee on Seals (SCOS), 2023	0.72	**21,667**
Western Isles	3,532	SCOS, 2023	0.72	4,906
Southwest Scotland	1,709			2,374
Northern Ireland	818			1,136
Republic of Ireland – North region	1,112	Morris and Duck, 2019		1,544
Total wider reference population	22,771	-	0.72	**31,627**
Key	Reference populations taken forward for assessment are shown in **green**			

152. For density estimates of harbour seal, Carter et al., (2022) provides habitat-based predictions of at sea distribution for seals around the British Isles. The Carter et al., (2022) predicted distribution maps provide estimates per species, on a 5 km by 5 km grid, of relative at sea density for seals hauling-out in the British Isles. It is important to note that Carter et al., (2022) provides relative density (i.e. percentage of the total at sea population in each grid at any one time).

153. The harbour seal relative density map (**Figure 1.23**; Carter et al., 2022) shows the mean predicted relative densities for the WDA are relatively high, with areas of increased densities south of the Isles of Islay and Jura, and Loch Linnhe where there are a number of harbour seal haul-out sites.

154. Harbour seal density estimates for the WDA have been calculated from the seal at sea usage maps (Carter et al., 2022) based on the 5 km by 5 km grids that overlap with the array area, corrected against the total UK and the Republic of Ireland population estimates. The total harbour seal population in the British Isles is 48,419 (**Table 1.20**; SCOS, 2023). This total population estimate has been corrected to determine the total number of harbour seal that may be at-sea at any time, using a correction factor of 0.8236 for harbour seal (Russell et al., 2015). There are therefore approximately 39,878 harbour seals, based on the corrected values and most recent haul-out counts for the UK. This is the at-sea population estimate used with the Carter et al. (2022) data to calculate density estimates.

155. Based on the Carter et al. (2022) data, the density for the Project's OAA is 0.068 harbour seal per km^2.

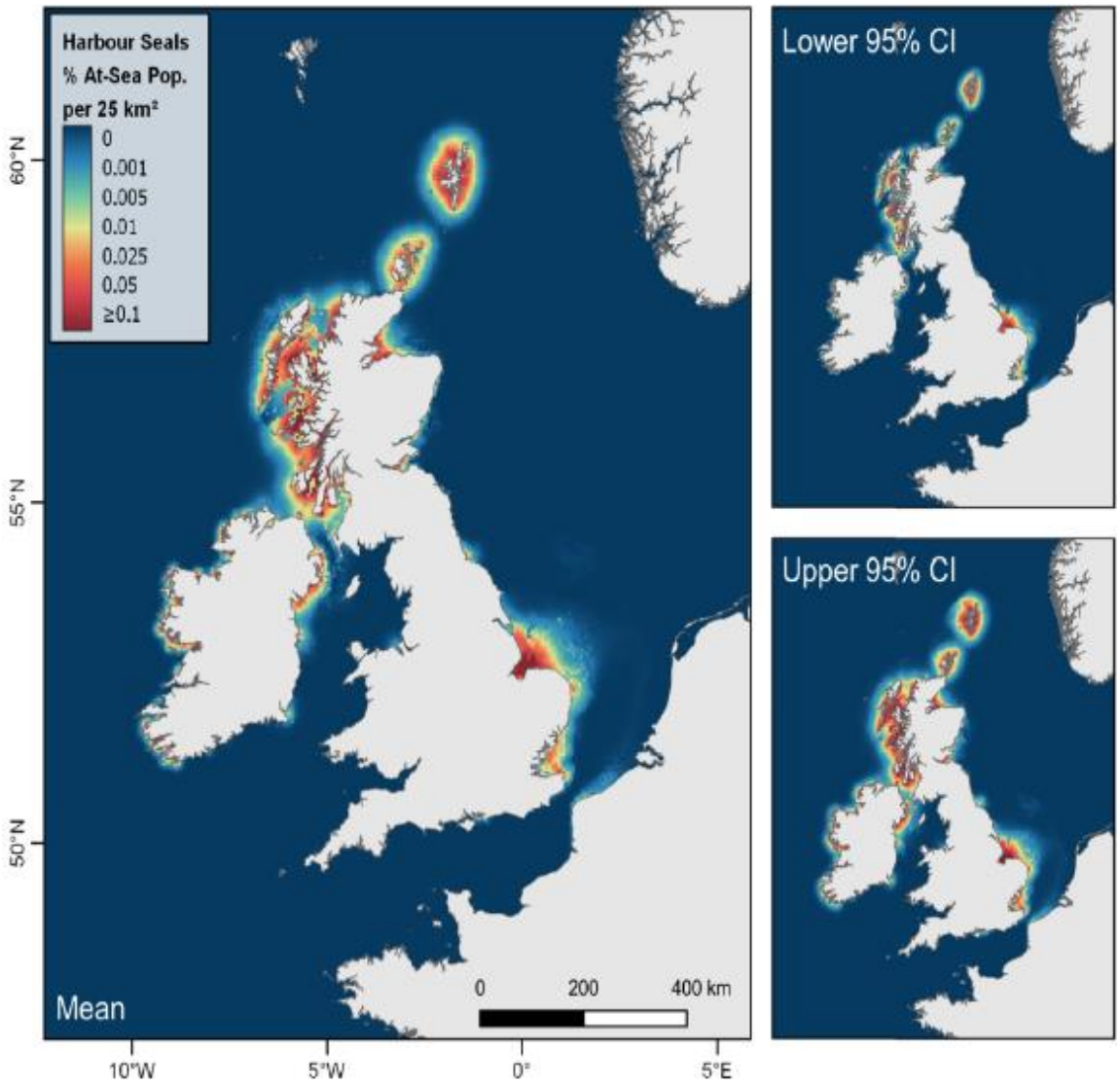

Figure 1.23 At-sea distribution of harbour seals; maps show mean percentage of at-sea population estimated to be present in each 5 km x 5 km grid cell at any one time, Carter et al., 2022

1.7.2.2. Site-Specific Density Estimates for Harbour Seal

156. No harbour seals were recorded in the Project's DAS.

1.7.2.3. Summary of Abundance and Density Estimates for Harbour seal

157. Due to the high number of harbour seal present in the area, this species has been scoped in for further assessment.

158. **Table 1.21** provides an initial summary of the density estimate and population estimates of grey seal at the WDA. A full review of all desk-based data sources presented in **Chapter 10 Marine Mammals** will be undertaken, and the most precautionary density estimate (and reference population) taken forward for assessment.

Table 1.21 Summary of reference population and density estimates to inform the assessments

Species	Density (km^2)	Density data source	Reference population	Reference population data source
Harbour seal	**0.068**	**Carter et al. (2022)**	**WS Management Unit (MU): 21,667** **Wider population: 31,627**	Special Committee on Seals (SCOS) (2023)
Key	Density estimates taken forward for assessment are shown in **green**			

1.7.2.4. Harbour Seal Haul-Out Sites

159. There are a number of haul-out sites for harbour seal in the Hebrides, and close to the WDA (**Figure** 1.24; SCOS, 2023). The nearest major harbour seal haul-out sites are to the south of Islay and Jura, to the east of Mull and on Colonsay. **Table 1.22** below provides the latest counts for the closest of the haul-out sites, as well as the corrected numbers to account for those not available to count during the Project's DAS. Due to the number and location of the known seal haul-out sites, disturbance to seal haul-out sites has been scoped into the EIA.

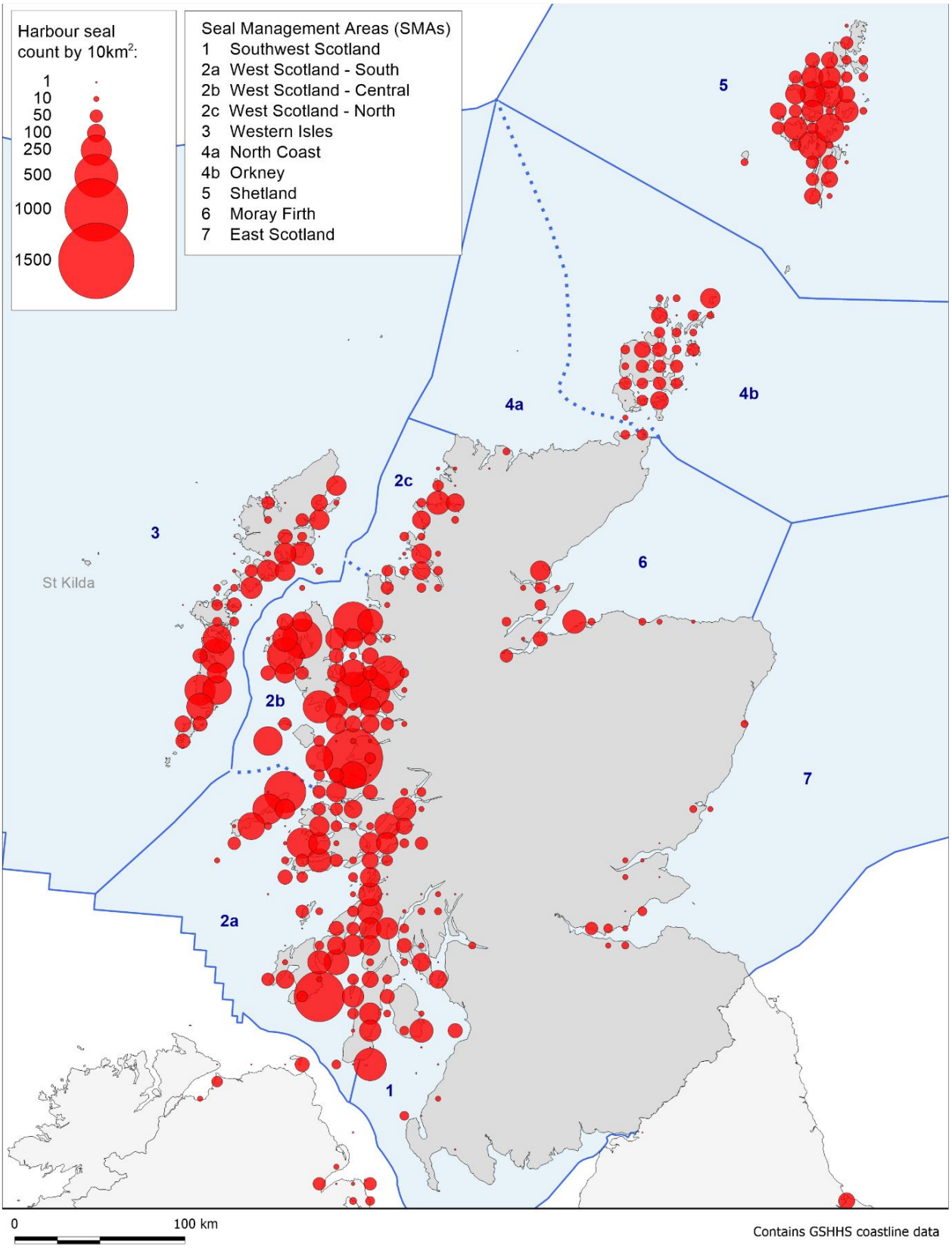

Figure 1.24 Harbour seal haul-outs sites, and latest counts, in Scotland, SCOS, 2023

Table 1.22 Harbour seal haul-out counts

Site	Approximate Distance from Windfarm Development Area (km)	Harbour seal count	Source
Cains of Coll	58	-	-
Craighouse Small Isles & Lowlandman's Bay	52	-	-
Eileanan agus Sgeiran Lios mor	83	238	Special Committee on Seals (SCOS), 2022
Gunna	48	500+ pups	SCOS, 2022
Oronsay Strand	15.2	50+ pup production (2012)	SCOS, 2022
Outer Loch Tarbery	33.4	-	-
Soa, Mull	18.7	20+	-
Soa (Coll)	48	20+	-
South Jura	59	-	-
South-West Islay Skerries	52	706	SCOS, 2022

1.7.3. Protected Seal Haul-Out Sites

160. Seal haul-out sites are coastal locations that seals use to breed, moult and rest. Almost 200 seal haul-out sites have been designated through The Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014 which was amended with additional sites in 2017. These haul-out sites are protected under Section 117 of the Marine (Scotland) Act 2010. The Act is designed to assist in protecting the seals when they are at their most vulnerable, and as such provide additional protection from intentional or reckless harassment.

161. In total there are 26 protected seal haul-out sites (**Table 1.23**) which are in vicinity of the WDA.

162. The protected seal haul-out sites that are in close proximity of the WDA, are listed in the **Table 1.23**.

Table 1.23 List of protected seal haul-out sites and distance from Windfarm Development Area

Haul-Out Site	Approximate Distance from Windfarm Development Area (km)
Arinthluic	52
Cairns of Coll	64
Craighase small Isle & Lowland mans	58
Eilean an Fheoir	47
Friesland bay	50.5
Gunna	48
Hough Skerries	53
Inch Kenneth & Greasgills	43.2
Lady Isle	191
Laggan Bay (Mull)	48.5
Litle Scares	211

Haul-Out Site	Approximate Distance from Windfarm Development Area (km)
Loch na Corrobha Skerries	39
Nave Island	14.6
Oronsay	14.3
Oronsay Strand	15.2
Outer Loch Tarbery	33.4
Rubhan nan sgarbh	130
Sand of Pladda Skernes	133
Sanda & Sheep Island	99
Soa (Coll)	48
Soa (Mull)	18.7
Solway Firth Outer Sandbach	279
South Ulva Islands & little colonsay	40
Vaul & Salum bays	52
Yellow rock	126

1.8. LEATHERBACK TURTLE

1.8.1. Desk-Based Review

163. Leatherback turtle (*Dermochelys coriacea*) is listed as 'Vulnerable' by the International Union for Conservation of Nature (IUCN), (2022) and is the only species of marine reptile to be considered a regular member of the UK marine fauna. Leatherbacks are seasonal visitors to UK waters as they are able to metabolically raise their body temperature above their surrounding environment (Bostrom et al., 2010), which allows them to survive in cooler waters such as the UK. Leatherback turtles migrate to UK waters to feed on jellyfish.

164. Leatherback turtles are a single species globally, with 7 Regional Management Units (RMUs) worldwide, each representing a different subpopulation (**Figure 1.25**) (Wallace et al., 2010). It is the Atlantic, Northwest MU that mostly likely represents leatherback turtles in UK waters.

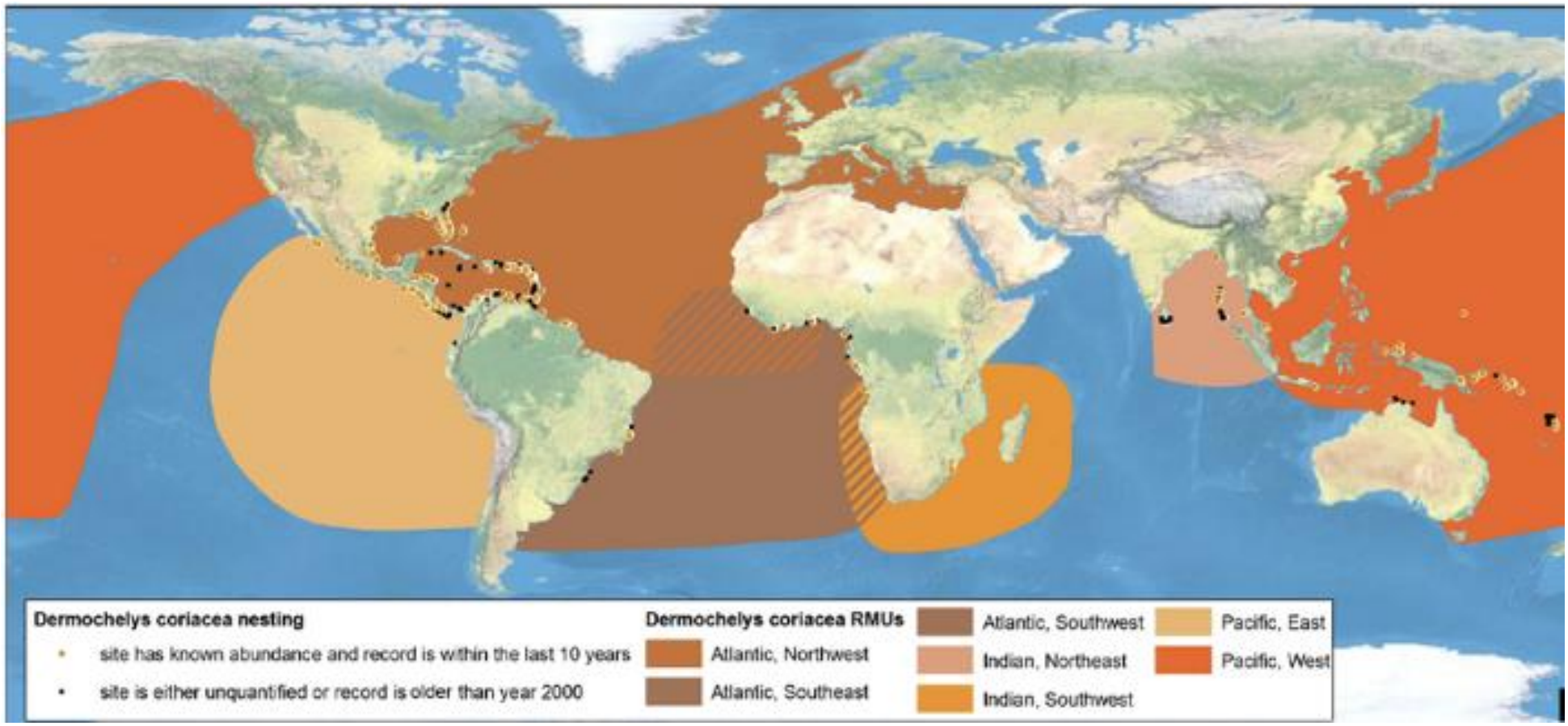

Figure 1.25 Regional management unit for leatherback turtle, Site-Specific Density Estimates for leatherback turtle

165. A single leatherback turtle was detected during the Project DAS in September 2022, which equates to a density estimate of 0.01 turtles per km^2. The current population sizes are not well known in most areas; however, in the North Atlantic the population is estimated to be between 34,000 and 94,000 adults (U.S. Fish and Wildlife Service 2020).

1.9. SUMMARY OF MARINE MAMMALS RECEPTORS SCOPED IN AND OUT

166. **Table 1.24** provides a summary of which marine mammals and turtles are proposed to be scoped in and out of the EIA from the baseline review that has been undertaken as well as advice from NatureScot which is presented in **Chapter 10 Marine Mammals** of the Scoping Report.

167. A summary of the marine mammals and turtle densities and reference populations proposed to be used for the EIA is presented in **Chapter 10 Marine Mammals** of the Scoping Report.

Table 1.24 Proposed summary of marine mammals and turtles scoped in and out of the EIA (blue scoped in, orange scoped out)

Species	Scoped in or out	Justification
Harbour porpoise	Scoped in	Recorded in the Project's Option Agreement Area (OAA) from the Projects Digital Aerial Survey (DAS) (**Section 1.3.1.2**)
Bottlenose dolphin	Scoped in	Recorded in the Project's OAA from the Projects DAS (**Section 1.3.2.2**)
Common dolphin	Scoped in	Recorded in the Project's OAA from the Projects DAS (**Section 1.3.3.2**)
White-beaked dolphin	Scoped in	Scoped in as are regularly recorded in the Project's Study Area (**Section 1.3.4.1**)
Atlantic white-sided dolphin	Scoped in	Scoped in as are regularly recorded in the Project's Study Area (**Section 1.3.5.1**)
Risso's dolphin	Scoped in	Recorded in the Project's OAA from the Projects DAS (**Section 1.3.6.2**)
Killer whale	Scoped in	Scoped in as are regularly recorded in the Project's Study Area and because of the west coast community (**Section 1.3.7.1**)
Striped dolphin	Scoped out	Scoped out as are not regularly recorded in the Project's Study Area (**Section 1.4.1.1**)
Long-finned pilot whale	Scoped in	Recorded in the Project's OAA from the site investigation surveys (**Section 1.4.2.2**)
Northern bottlenose whale	Scoped out	Scoped out as are not regularly recorded in the Project's Study Area (**Section 1.4.3.1**)
Cuvier's beaked whale	Scoped out	Scoped out as are not regularly recorded in the Project's Study Area (**Section 1.4.3.1**)
Minke whale	Scoped in	Recorded in the Project's OAA from the Projects DAS (**Section 1.5.1.2**)
Fin whale	Scoped out	Scoped out as are not regularly recorded in the Project's Study Area (**Section 1.6.1.1**)
Sei whale	Scoped out	Scoped out as are not regularly recorded in the Project's Study Area (**Section 1.6.2.1**)

Species	Scoped in or out	Justification
Humpback whale	Scoped in	Scoped in as recorded sightings have been increasing in the Project's Study Area (**Section 1.6.3.1**)
Grey seal	Scoped in	Recorded in the Project's OAA from the Projects DAS (**Section 1.7.1.2**)
Harbour seal	Scoped in	Scoped in as are regularly recorded in the Project's Study Area (**Section 1.7.2.1**)
Leatherback turtle	Scoped in	Recorded in the Project's OAA from the Projects DAS (**Section 1.8**)

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