Bellrock Offshore Wind Farm

Wind Farm Development Area

Environmental Impact Assessment Report - Volume IV

Appendix 9.1: Marine Mammals Technical Report

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Glossary of Terminology

Term	Definition
95% confidence interval	A measure of uncertainty in the mean value. If the analysis was repeated, 95% of the time the mean population estimate would fall within this range. The smaller the CI range the more confident we can be that the mean estimate is an accurate reflection of the true population size.
Applicant	Bellrock Offshore Wind Farm Limited, the legal entity submitting Section 36 Consent and Marine Licence applications for the Bellrock Wind Farm Development Area.
Bellrock Offshore Wind Farm (or the Bellrock Project)	An offshore wind farm capable of exporting up to 1.8 GW of renewable energy to the National Electricity Transmission System. The Wind Farm Development Area is located 120 km east of Stonehaven, and will connect to the National Electricity Transmission System at the proposed SSEN Transmission Hurlie substation, west of Stonehaven in Aberdeenshire. The Bellrock Offshore Wind Farm comprises of the following Development Areas: ▪ Wind Farm Development Area; ▪ Offshore Transmission Development Area; and ▪ Onshore Transmission Development Area.
Coefficient of Variation CV (%)	The coefficient of variation is a standard measure that describes the dispersion of data points around the mean. The lower the CV the more precise the estimate. It is calculated as the SD/mean.
Confidence limit	The upper and lower values that define the range of the 95% confidence interval.
Density estimate (animals/km^2)	The average number of animals per square km surveyed.
Development Area	For consenting purposes, the area for which separate consents and/or Marine Licences will be sought by the Applicant, comprising: ▪ Wind Farm Development Area; ▪ Offshore Transmission Development Area; and ▪ Onshore Transmission Development Area.
Offshore Development Area	The area comprising: ▪ The Wind Farm Development Area; and ▪ The Offshore Transmission Development Area.
Population estimate (number)	The mean number of animals estimated within the survey area.
Relative abundance	In the case of diving birds and mammals, this is the estimated population size based on animals recorded on or above the sea surface and does not account for any that may be diving and thus submerged at the time of survey.
SSEN Transmission Hurlie substation	The onshore substation to be developed by SSEN Transmission, which will receive renewable electricity from the Bellrock Project onshore substation and allow supply of renewable electricity from the wind farm to the National Electricity Transmission System.
Standard deviation of population estimate	The amount of variation or dispersion of a set of values.

Term	Definition
Wind Farm Infrastructure	Infrastructure located within the Wind Farm Development Area including wind turbine generators; floating substructures, station keeping systems and associated scour protection; inter-array cables and associated cable protection; and subsea cable hubs; and ancillary infrastructure including buoys (including activities associated with the Wind Farm Infrastructure construction, operation and maintenance, and decommissioning).

Glossary of Abbreviations

Term	Definition
AMSL	Above Mean Sea Level
BEIS	Department of Business, Energy and Industrial Strategy
CES	Coastal East Scotland
CGNS	Celtic and Greater North Sea
CI	Confidence Interval
CIS	Celtic and Irish Sea
CL	Confidence Limit
CODA	Cetacean Offshore Distribution and Abundance
CV	Coefficient Variable
DECC	Department of Energy and Climate Change
ECOMMAS	East Coast Marine Mammal Acoustic Study
EIA	Environmental impact assessment
GNS	Greater North Sea
GPS	Global Positioning System
HWDT	Hebridean Whale and Dolphin Trust
IAMMWG	Inter-Agency Marine Mammal Working Group
ICES	International Council For The Exploration Of The Sea
IFAW	International Fund For Animal Welfare
IUCN	International Union for Conservation of Nature
JCP	Joint Cetacean Protocol
JNCC	Joint Nature Conservation Committee
MCRI	Marine Conservation Research International
MU	Management Unit
NAMMCO	North Atlantic Marine Mammal Commission
NASS	North Atlantic Sightings Survey
ncMPA	Nature Conservation Marine Protected Area
NE	Northeast

Term	**Definition**
NOAA	National Oceanic And Atmospheric Administration
NS	North Sea
ORCA	Organisation Cetacea
PAH,	Polycyclic aromatic hydrocarbons
PAM	Passive Acoustic Monitoring
PCB	Polychlorinated Biphenyls
POP	Persistent Organise Pollutants
RoI	Republic Of Ireland
SAC	Special Area Of Conservation
SCANS	Small Cetaceans In European Atlantic Waters And The North Sea
SCOS	Scottish Committee On Seals
SE	Southeast
SMRU	Sea Mammal Research Unit
SMU	Seal Monitoring Unit
SWF	Sea Watch Foundation
UK	United Kingdom
USA	United States of America
WFDA	Wind Farm Development Area
WGMME	Working Group on Marine Mammal Ecology
WS	West Scotland

1 Introduction

1. This Marine Mammals Technical Report is an Appendix to **Chapter 9: Marine Mammals (Volume II)** of the Bellrock Wind Farm Development Area (WFDA) Environmental impact assessment (EIA) Report. It provides further supporting marine mammal background information and survey data to define the baseline for the assessments in **Chapter 9: Marine Mammals (Volume II)**.

2. The following marine mammal species are scoped into the assessment:

- Cetaceans:
  - Harbour porpoise *Phocoena phocoena*;
  - Bottlenose dolphin *Tursiops truncatus*;
  - Common dolphin *Delphinus delphis*;
  - White-beaked dolphin *Lagenorhynchus albirostris*;
  - Killer whale *Orcinus orca*;
  - Minke whale *Balaenoptera acutorostrata*;
  - Fin whale *Balaenoptera physalus*; and
  - Humpback Whale *Megaptera novaeangliae*.
- Pinnipeds:
  - Grey seal *Halichoerus grypus*; and
  - Harbour seal *Phoca vitulina*.

3. These species were determined from the site-specific aerial surveys (**Section 3.1**) and other data sources and have also been agreed through the **Bellrock WFDA Scoping Opinion (Appendix 1.2 (Volume IV)**.

2 Study Areas

4. The study areas for the marine mammal assessment have been defined on the basis that marine mammals are highly mobile and transitory in nature. Therefore, it is necessary to examine species occurrence, not only within the Bellrock WFDA, but also throughout the wider environment. The assessments in **Chapter 9: Marine Mammals (Volume II)** are, therefore, based on species-specific study areas. Further details of defining the study areas for the species of interest are provided in **Sections 2.1** and **2.2** below.

2.1 Cetaceans

5. Management Units (MU) provide an indication of the spatial scales at which effects of plans and projects alone, and in-combination, need to be assessed for the key cetacean species in United Kingdom (UK) waters, with consistency across the UK (Inter-Agency Marine Mammal Working Group (IAMMWG, 2023). The study areas, MUs and reference populations have been determined based on the most relevant information and scale at which potential effects from the Wind Farm Infrastructure alone, and together with other plans and projects could occur.

6. The MUs are defined geographical areas in which individuals of a particular species are found and management of human activity is applied (IAMMWG, 2023). For this reason, delineation of cetacean MUs is, as far as is practical, aligned with the International Council for the Exploration of the Sea (ICES) Subarea and/or Divisions that are used for implementation of fisheries management measures as recommended by the ICES Working Group of Marine Mammal Ecology.

7. For each cetacean species, the study areas have been defined based on the relevant MUs as outlined in **Table 2.1** and illustrated in **Plate 2.1** to **Plate 2.4** (IAMMWG, 2023) (Leonard and Øien, 2020), which provide relevant spatial scale for assessment of environmental impacts.

Table 2.1: Relevant Management Units for Cetaceans

Species	Management Unit/s Relevant for the Bellrock WFDA	Source	Plate Reference
Harbour porpoise	North Sea (NS) MU	IAMMWG (2023)	**Plate 2.1**
Bottlenose dolphin	Greater North Sea (GNS) and Coastal East Scotland (CES) MUs	IAMMWG (2023) and Cheney et al. (2024)	**Plate 2.2**
Common dolphin	Celtic and Greater North Seas (CGNS) MU	IAMMWG (2023)	**Plate 2.3**
White-beaked dolphin	CGNS MU	IAMMWG (2023)	**Plate 2.3**
Killer whale	Eastern North Atlantic	Leonard and Øien (2020)	**N/A**
Minke whale	CGNS MU	IAMMWG (2023)	**Plate 2.3**

Species	Management Unit/s Relevant for the Bellrock WFDA	Source	Plate Reference
Fin whale	Combined survey area based on all SCANS-IV blocks, ObSERVE, and the Norwegian mosaic survey (2024-2018)	Leonard and Øien (2020); Gilles et al. (2023)	**Plate 2.4** and **Plate 3.2**
Humpback Whale	Eastern North Atlantic	Leonard and Øien (2020)	N/A

Plate 2.1: Harbour Porpoise MU

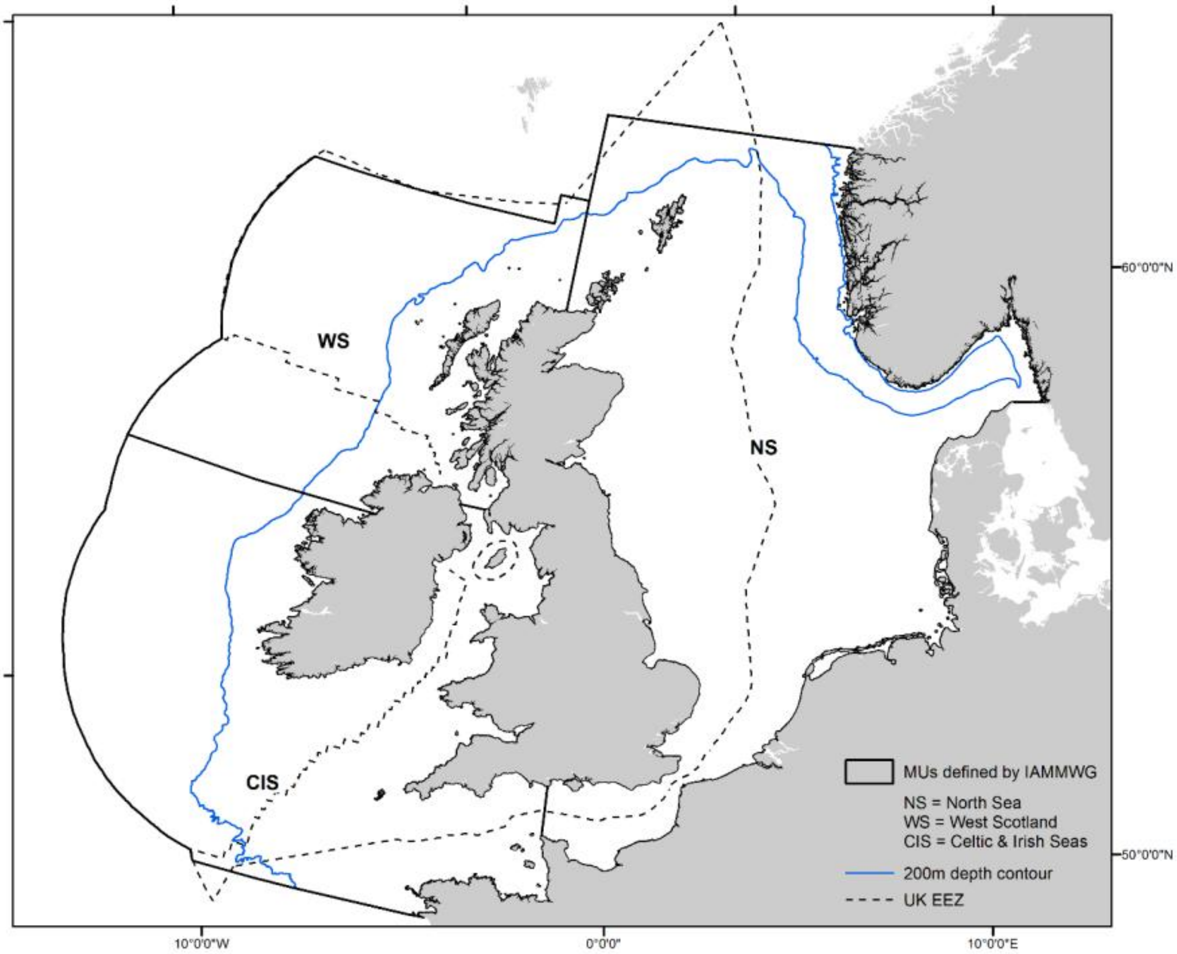


Plate 2.2: Bottlenose Dolphin MU

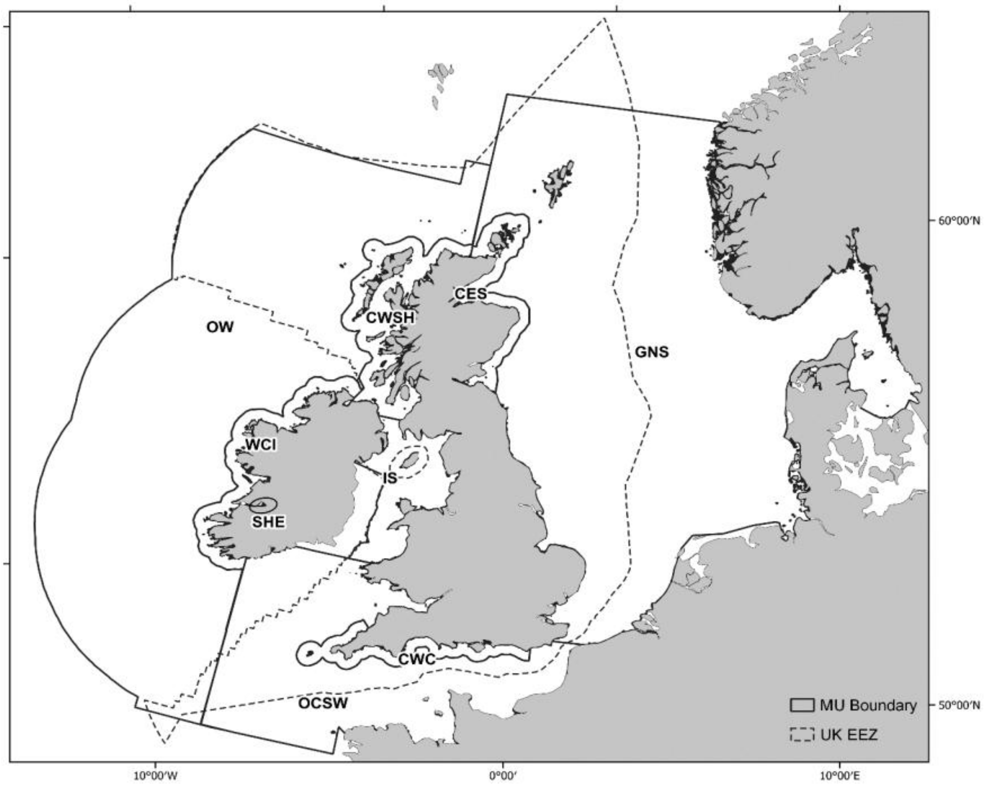


Plate 2.3: Common Dolphin, White-Beaked Dolphin and Minke Whale MU

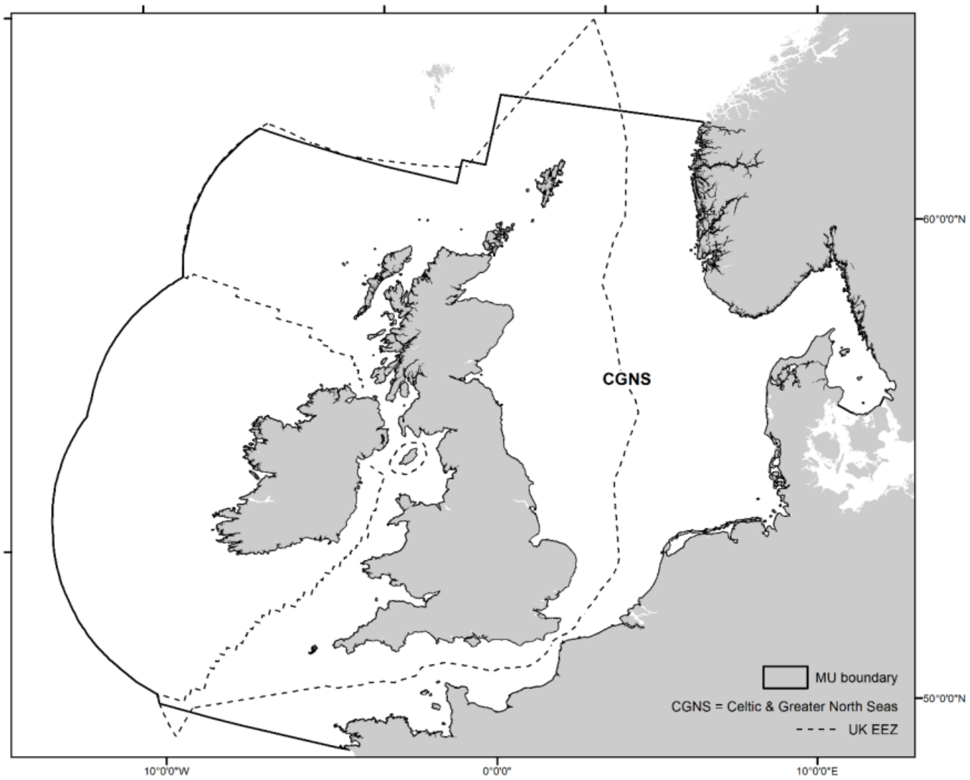
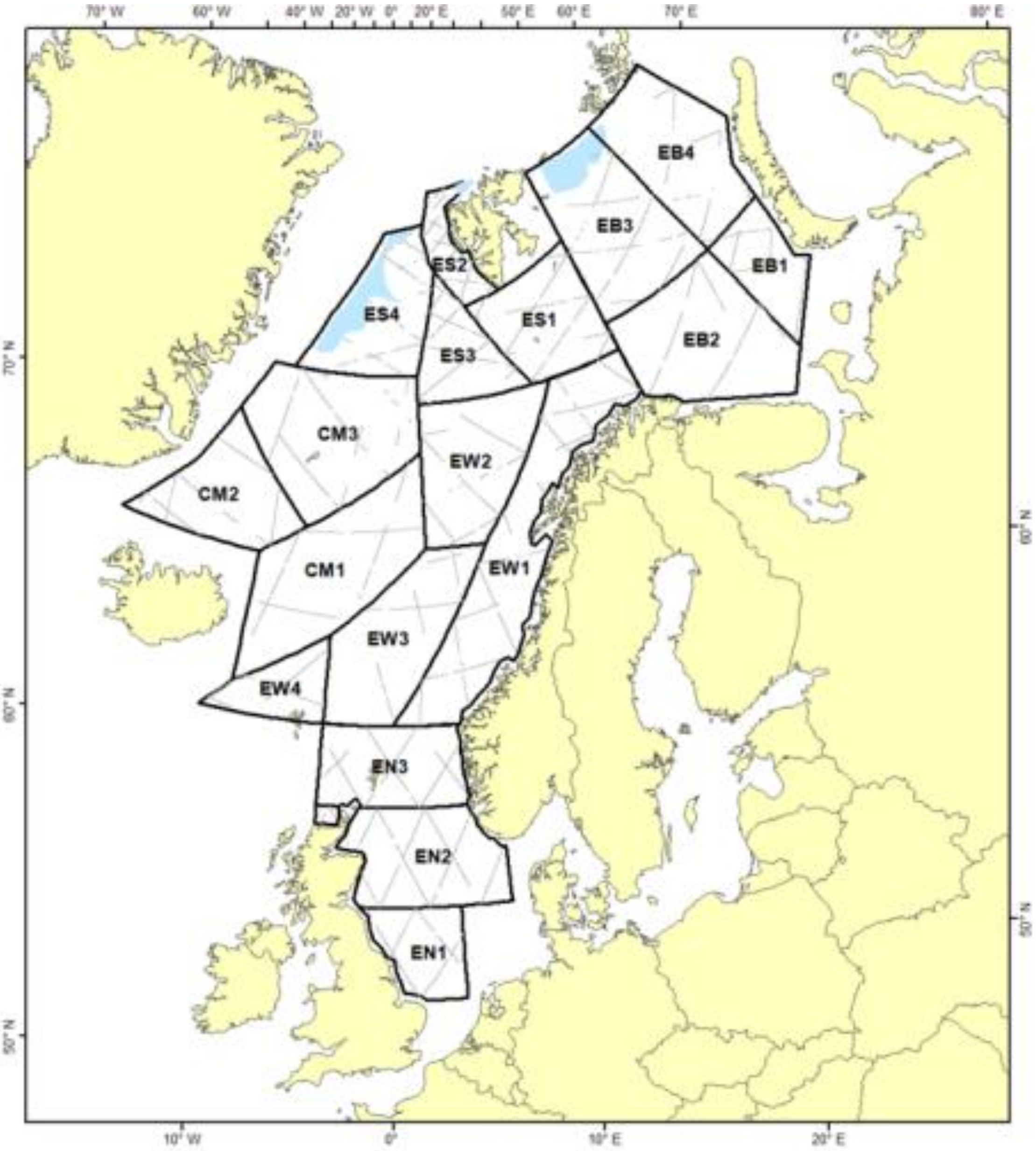


Plate 2.4: Combined MUs (Excluding the Blocks from SCANS-IV and ObSERVE) for Fin Whale [1]



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[1] Blue areas represent ice coverage.

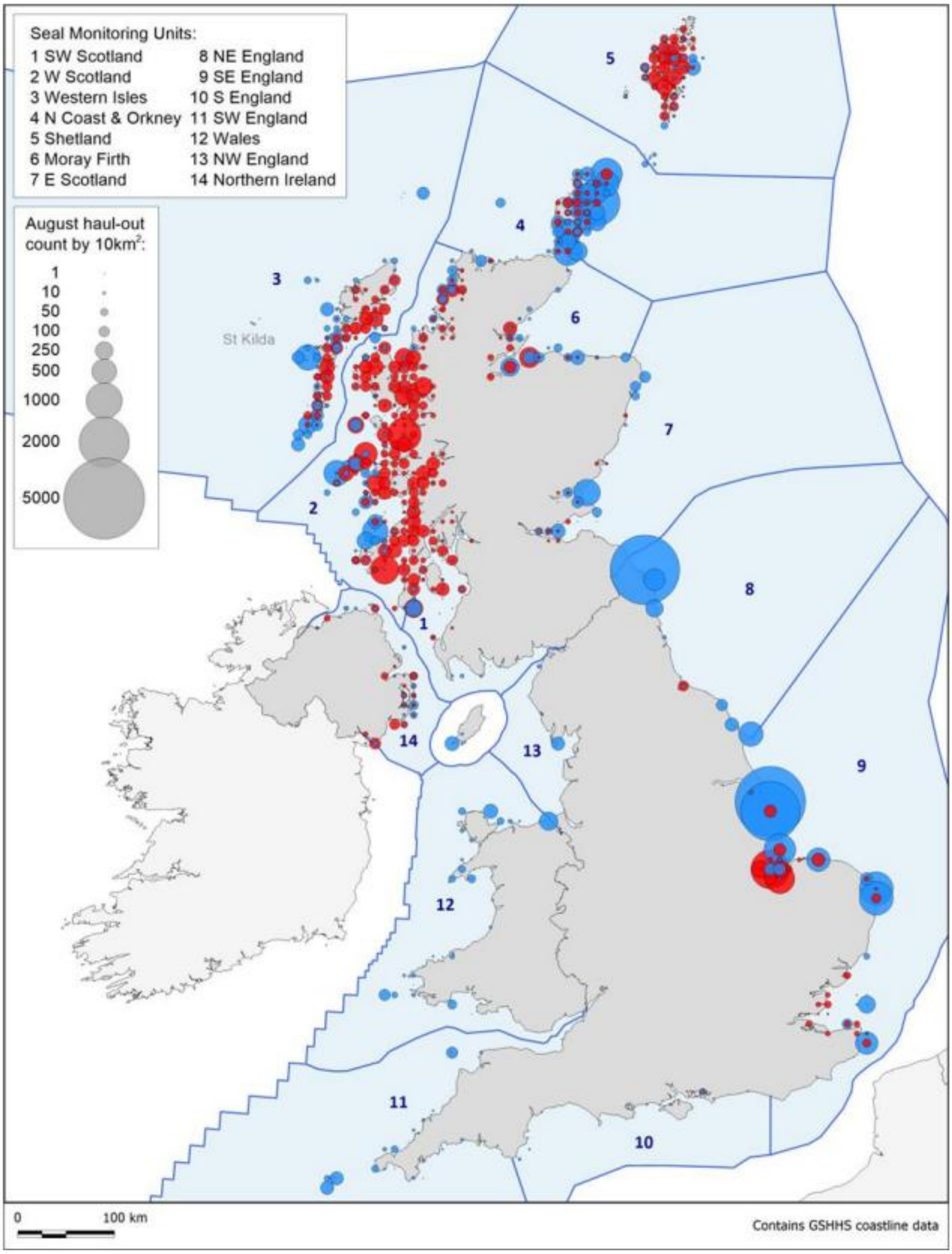
2.2 Pinnipeds

8. Both UK seal species, grey seal and harbour seal, are present in the North Sea in relatively high numbers, due to nearby key breeding sites for both species (Scottish Committee on Seals (SCOS), 2022).

9. Based on the movements of grey and harbour seal, and potential connectivity with the Bellrock WFDA, the relevant MUs (see **Plate 2.5** (SCOS, 2024) and **Figure 9.1.1**) are:

- Grey seal:
    - Moray Firth;
    - East Scotland; and
    - Northeast England.
- Harbour seal:
    - East Scotland.

Plate 2.5: The 14 Seal Monitoring Units (SMUs) for Harbour (Red) and Grey (Blue) Seals Shown on a 10km^2 Grid Scale



3 Data Sources

3.1 Site-specific Surveys

3.1.1 Surveys Overview

10. In order to provide site-specific and up to date information to inform the impact assessment, a site-specific digital aerial survey campaign was conducted by HiDef Aerial Surveying Limited (HiDef) on behalf of Bellrock Offshore Wind Farm Limited (the Applicant), for both seabirds and marine mammals. The survey design consisted of 2.5 km spaced transects within the Bellrock WFDA plus a 4 km buffer, together referred to as the ‘survey area’. The total survey area was 658 km^2.

11. HiDef designed the survey methodology[2] to provide a site-specific monthly snapshot of seabird and marine mammal abundances and distributions to inform the baseline of the Bellrock WFDA EIA Report (see **Table 6.1** and **Figure 9.1.2**).

12. A total of 15 strip transects were flown extending roughly northeast to southwest, perpendicular to the depth contours along the coast. Such a design ensures that each transect samples a similar range of habitats (primarily relating to water depth) and will reduce the variation in bird and mammal abundance estimates between transects.

13. Surveys were undertaken using an aircraft equipped with four bespoke HiDef cameras with sensors set to a resolution of 2 cm ground sample distance. Each camera sampled a strip of 125 m width, separated from the next camera by approximately 25 m, thus providing a combined sampled width of 500 m within a 575 m overall strip.

14. The surveys were flown along the transect pattern at a height of approximately 550 m above mean sea level (AMSL). Flying at this height ensures that there is no risk of flushing species that are easily disturbed by aircraft noise. Thaxter et al. (2010) recommends a minimum flight altitude of 460 – 500 m AMSL. Hammond et al. (2013) also highlight that an aerial survey flown at an altitude of at least 183 m is not likely to result in a responsive reaction from any marine mammal.

3.1.2 Survey Findings

15. **Table 3.1** shows the raw counts of marine mammals recorded within the survey area from March 2022 to February 2024. As the raw count only presents a relative abundance and not total abundances, it will be a supplement with other data available to determine species abundance.

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[2] Consultation with NatureScot and MD-LOT (MS-LOT at the time) was undertaken in February/March 2022 on Method Statements for the site-specific digital aerial surveys. Advice was given on the focal species and alignment of survey approaches with those for adjacent lease option awards to facilitate future cumulative effects assessment (CEA). Comments from NatureScot and MD-LOT have been considered in the methodology for the offshore aerial survey.

16. Five species have been identified to species level. Harbour porpoise is present in the highest numbers, with sightings recorded every month. Grey seal and other unidentified seal species were also noted, though less consistently. Numbers of white-beaked dolphin, minke whale and killer whale were spotted less frequently, with the majority of months showing no sightings. The survey data also included dolphin species and cetacean species, with cetacean species being a catch for those species which could not be confirmed as a dolphin. These species have not been apportioned.

17. From the raw counts (**Table 3.1**) of each marine mammal species, or marine mammal species group, abundance and density estimates were calculated. Upper and lower confidence limits (CL) as well as coefficient variables (CV) were also calculated for these density and abundance estimates. The density of animals in the survey area (and hence the abundance), the standard deviation, 95% confidence interval (CI) and CV are then estimated using a non-parametric bootstrap method with replacement (Canty and Ripley, 2021).

18. For species such as marine mammals that dive and therefore spend a considerable amount of time underwater, an availability bias, or correction factor, must be applied in order to account for those individuals that it is not possible to detect as they are underwater at the time of the survey.

19. Without these availability biases or correction factors any abundance or density estimate would be relative only, rather than being an absolute estimate. As correction factors are only applicable at the species level, harbour porpoise was the only species to which this was applied.

20. In wildlife surveys, a proportion of marine mammals that spend any time underwater, especially while feeding, will not be detectable at the surface. This ‘availability bias’ leads to an under-estimate of their abundance during surveys. For species that make long dives underwater, this bias might be significant (for example, sperm whale).

21. Due to a lack of diving rate data for many species, availability bias corrections were only conducted on harbour porpoise. When considering population estimates calculated for other diving species, it should be noted that population estimates for the survey area are likely to be slightly underestimated, although not in a material sense.

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Table 3.1: Summary of Marine Mammal Species Counted in the HiDef Digital Aerial Surveys Between March 2022 and February 2024 within the Survey Area

Survey Year	Survey Month	Harbour Porpoise	White-beaked Dolphin	Minke Whale	Killer Whale	Grey Seal	Seal Species	Dolphin Species	Cetacean Species
2022	March	2	-	-	-	-	-	-	-
	April	3	-	-	-	-	-	-	-
	May	7	-	-	-	-	3	-	-
	June	42	-	1	-	-	-	-	1
	July	21	3	-	-	-	-	-	-
	August	20	-	-	-	-	-	-	-
	September	-	-	-	-	-	-	1	-
	October	2	-	1	-	-	-	-	-
	November	-	-	-	-	-	1	-	-
	December	-	-	-	-	-	1	-	-
2023	January	1	-	-	-	-	1	-	-
	February	2	-	-	-	-	-	-	-
	March	1	-	-	-	1	1	-	-
	April	-	-	-	-	-	-	-	-
	May	1	-	-	-	-	-	-	-
	June	6	-	-	1	-	-	-	-

Survey Year	**Survey Month**	**Harbour Porpoise**	**White-beaked Dolphin**	**Minke Whale**	**Killer Whale**	**Grey Seal**	**Seal Species**	**Dolphin Species**	**Cetacean Species**
	July	4	-	-	-	-	-	-	-
	August	1	-	-	-	-	-	-	-
	September	6	-	-	-	-	1	-	-
	October	-	-	-	-	-	-	-	-
	November	-	-	-	-	-	-	-	-
	December	-	-	-	-	-	-	-	-
2024	January	2	-	-	-	-	-	-	-
	February	5	-	-	-	-	1	-	-
Total		**126**	**3**	**2**	**1**	**1**	**9**	**1**	**1**

3.1.2.1 Abundance and Density Estimates

22. In order to provide a precise or appropriate abundance and density estimate, a sufficiently large sample size of raw counts needs to be available (Hammond et al. 2021). As per **Table 3.1**, harbour porpoise was the only species with sufficiently large raw counts over the two-year survey period, for which such estimations would be appropriate. For all other species, a lack of sufficient sightings data over the two-year survey period did not allow for a representative or appropriate density and abundance to be estimated. For these species, alternative density data sources are available as discussed in **Section 6**.

3.1.2.1.1 Harbour Porpoise Density Estimates

23. A total of 126 harbour porpoises were counted during the survey period (**Table 3.1**) providing enough data to estimate the density of animals/km^2 for the survey area. A correction factor has been used to account for seasonal differences (**Table 3.2**; Voet et al. 2017) and to consider the probability of harbour porpoise being within the upper 2 m of the water column (**Table 3.3**; Teilmann et al. 2013).

Table 3.2: Correction Factors used for Harbour Porpoise

Season	Correction Factor
Spring (March – May)	0.571
Summer (June – August)	0.547
Autumn (September – November)	0.455
Winter (December – February)	0.472

24. The depth above which harbour porpoise can be detected has been estimated to be 2 m (Teilmann et al. 2013) when correcting for availability bias during visual aerial surveys of harbour porpoise. The correction factors applied for harbour porpoise are dependent on the month and time of day (**Table 3.3**).

Table 3.3: Correction Factors Used to Account for the Availability Bias for Harbour Porpoise for Different Months and Times of Day

Month	Position/Time of Day			
	Surface		0 – 2 m Below Surface	
	09:00 – 15:00	15:00 – 21:00	09:00 – 15:00	15:00 – 21:00
January	0.0490	0.0476	0.4381	0.418614
February	0.0398	0.0384	0.3748	0.355348
March	0.0543	0.0529	0.4637	0.444271
April	0.0646	0.0632	0.5708	0.551331

Month	**Position/Time of Day**			
	Surface		**0 – 2 m Below Surface**	
	09:00 – 15:00	**15:00 – 21:00**	**09:00 – 15:00**	**15:00 – 21:00**
May	0.0563	0.0549	0.5262	0.506735
June	0.0518	0.0503	0.5093	0.489809
July	0.0493	0.0479	0.5116	0.492099
August	0.0530	0.0516	0.4508	0.431293
September	0.0420	0.0406	0.4468	0.427348
October	0.0413	0.0399	0.4422	0.42276
November	0.0406	0.0392	0.4439	0.424431
December	0.0429	0.0415	0.4790	0.459555

25. After applying the correction factors from **Table 3.2** and **Table 3.3**, the final monthly absolute density estimates for harbour porpoise for the survey area are presented in **Table 3.4**.

26. To present the most precautionary seasonal averages for summer and winter (each presenting half a year), the maximum density from each survey month has been used for the estimations (**Table 3.4**). The highest density was estimated for the summer (April to September), and the lowest density was estimated for the winter (October to March). The average annual density estimate has been determined based on the full 24 survey months aerial surveys.

Table 3.4 Unapportioned Harbour Porpoise Absolute Density Estimates for Each Month

Year	**Month**	**Absolute Density Estimates (Corrected and Unapportioned) for the Survey Area**
2022	March	0.15
	April	0.17
	May	0.48
	June	3.23
	July	1.70
	August	1.48
	September	0.00
	October	0.20

Year	Month	Absolute Density Estimates (Corrected and Unapportioned) for the Survey Area
	November	0.00
	December	0.00
2023	January	0.06
	February	0.20
	March	0.05
	April	0.00
	May	0.10
	June	0.47
	July	0.33
	August	0.05
	September	0.58
	October	0.00
	November	0.00
	December	0.00
2024	January	0.17
	February	0.47
Average maximum density for summer period (April – September)		**1.273**
Average maximum density for winter period (October – March)		**0.165**
Annual maximum average density		**0.719**
Notes: [1] Corrected for availability bias, with summer, winter and annual density estimates for the survey area.		

3.2 Key Desk-based Sources

3.2.1 SCANS Surveys

27. A series of large-scale surveys for Small Cetaceans in European Atlantic waters and the North Sea (SCANS) was initiated in summer 1994 in the North Sea and adjacent waters (SCANS 1995; Hammond et al. 2002).

28. SCANS-II was undertaken in summer 2005 in all shelf waters (SCANS-II 2008; Hammond et al. 2013) and 2007 in offshore waters (Cetacean Offshore Distribution and Abundance in the European Atlantic (CODA), 2009).

29. SCANS-III was conducted in summer 2016 with the aim to survey all European Atlantic waters. However, the final surveyed area excluded offshore waters off Portugal and also excluded waters to the south and west of Ireland which were surveyed by the Irish ObSERVE 2 project (Hammond et al. 2021). The Bellrock WFDA lies within the boundaries of block R.

30. In October 2023, the SCANS-IV report was released with data collected during the summer 2022 (Gilles et al. 2023), with the aim to inform the upcoming Marine Strategy Framework Directive in European Atlantic Waters in 2024. This survey included the offshore waters off Portugal which had not been previously surveyed as part of SCANS, but excluded waters south and west of Ireland, which were surveyed by the ObSERVE 2, and coastal Norwegian waters north of Vestfjorden. Some of the block boundaries have changed since SCANS-III but have not affected the block in which the Bellrock WFDA lies (block NS-D).

31. With reference to **Plate 3.1** (Hammond et al. 2021) for SCANS-III and **Plate 3.2** (Gilles et al. 202**3),** for SCANS-IV, pink lettered blocks were surveyed by air and blue numbered blocks were surveyed by ship. Blocks coloured green to the south, west and north of Ireland were surveyed by the Irish ObSERVE project. SCANS-III blocks FC and FW coloured yellow were surveyed by the Faroe Islands as part of the North Atlantic Sightings Survey (NASS) in 2015. The cross-hatched area is where SCANS-IV blocks BB-3 and BB-A overlapped.

Plate 3.1: Area Covered by SCANS-III and Adjacent Surveys

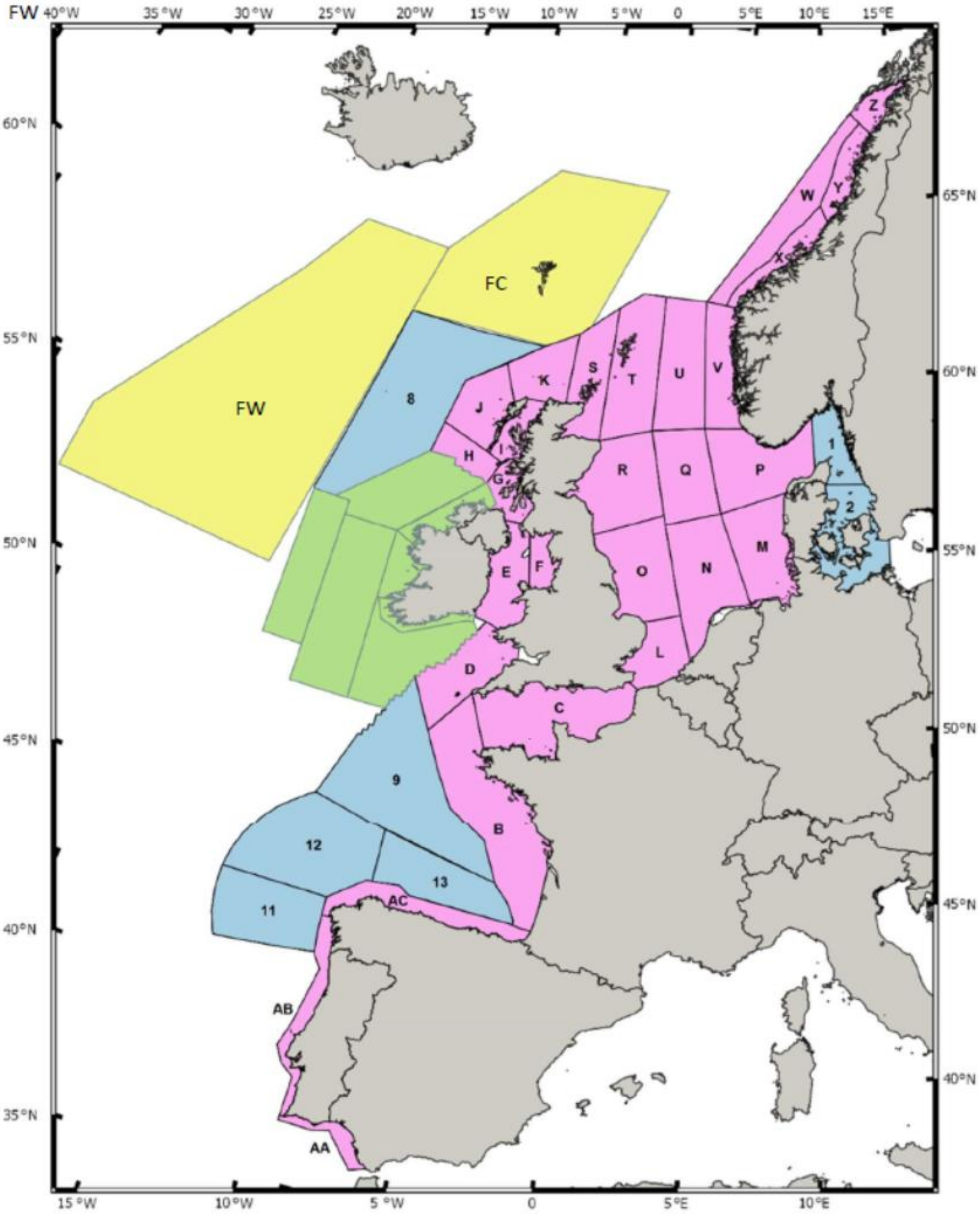
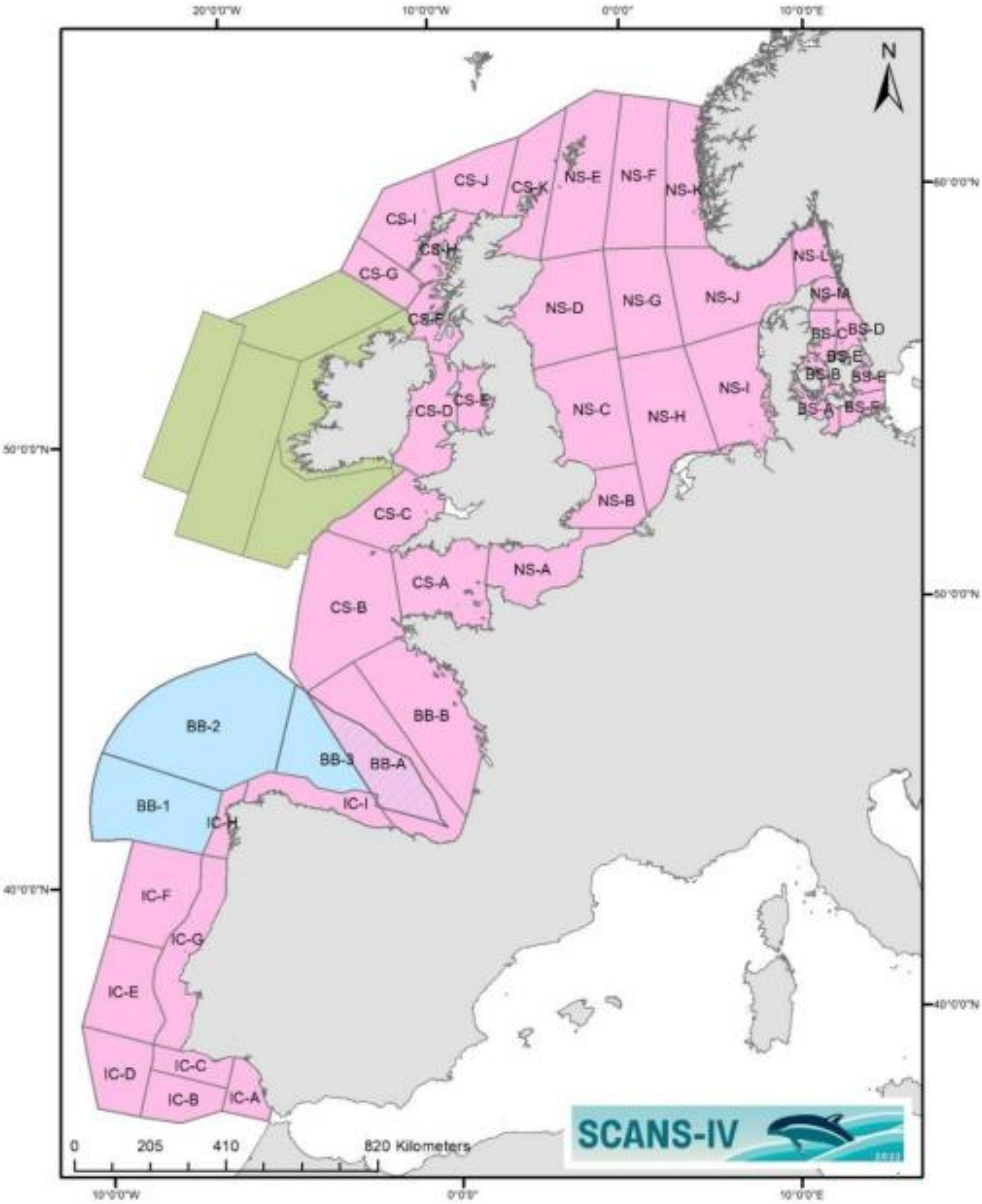


Plate 3.2: Area Covered by SCANS-IV and Adjacent Surveys



3.2.2 Other Surveys and Data Sources

32. **Table 3.5** outlines additional available survey data that informs the baseline for marine mammals.

Table 3.5: Data Sources and Surveys Relevant

Data Source	Date	Data Contents
Revised Phase III data analysis of Joint Cetacean Protocol (JCP) data resources (Paxton et al. 2016)	Data from a range of sources, analysed and reported on in 2015 and 2016.	Density mapping for the most common cetacean species in UK waters.
Joint Cetacean Data Protocol (online data resource)	Various	Sightings and survey data from a large number of surveys within UK waters.
Distribution maps of cetacean and seabird populations in the Northeast Atlantic (Waggitt et al. 2019)	Data from a range of sources, analysed and reported on in 2019.	Density mapping for the most common cetacean species in European and Northeast Atlantic waters for each month.
Scientific Advice on Matters Related to the Management of Seal Populations (SCOS, 2021; 2022)	August surveys undertaken in years 2021 and 2022.	Updated data and information on grey seal and harbour in the UK. Includes the most recent haul-out counts and population estimates for each seal MU in the UK.
Seal telemetry data (e.g. Sharples et al. 2008 & 2012; Carter et al. 2017 & 2022; Jones et al. 2017; Russel & McConnel, 2014; Vincent et al. 2017; Russel et al. 2016; Matthiopoulos et al. 2004)	Various	Provides the results of seal tagging studies in the UK and Europe, to provide an indication of seal movements.
Updated Seal Usage Maps: The Estimated at-sea Distribution of Grey and Harbour Seals (Carter et al. 2022)	Data from a range of sources, analysed and reported on in 2022.	Provides grey seal and harbour seal density estimates for UK waters, and for each seal designated Special Area of Conservation (SAC).
Updated Habitat-Based At-Sea Distribution Maps for Grey and Harbour Seals in Scotland (Carter et al. 2025)	New tracking data alongside data from Carter et al. (2022); as well as updated Scotland population numbers	Provides grey seal and harbour seal density estimates for Scottish waters based on haul-out sites in Scotland
Sea Watch Foundation (SWF) volunteer sightings off eastern England and East Scotland (SWF, 2025)	Public sightings database (currently available data from October 2023 until October 2024).	Public sightings database, records of marine mammals at locations around the UK.
MU for cetaceans in UK waters (IAMMWG, 2023)	Data from a range of sources, analysed and reported on in 2022.	MU areas and abundance estimates for the most comment cetacean species in the UK.
Estimates of cetacean abundance in European Atlantic waters in summer 2016 (SCANS-III) and summer 2022 (SCANS-IV) aerial and shipboard surveys (Hammond et al. 2016; Gilles et al. 2023)	Data from aerial and shipboard surveys in the summer of 2016 and 2022.	Density mapping and abundances for the most common cetacean species in UK waters.

Data Source	Date	Data Contents
Gilles et al. 2016	2005–2013	Seasonal habitat models for harbour porpoise
North Atlantic Marine Mammal Commission (NAMMCO website)	Various	Sightings and survey data, along with abundances and data mapping for the North Atlantic area.
East Coast Marine Mammal Acoustic Survey (ECOMMAS) (Marine Directorate, 2019)	Various	Cetacean distribution and noise modelling data.
Organisation Cetacea (ORCA) citizen science surveys (ORCA, 2025)	Various	Cetacean distribution and sightings from a global context.
Hebridean Whale and Dolphin Trust (HWDT, 2025).	Various	Cetacean sightings throughout Scotland's West coast. Citizen science sightings from shoreline and boat surveys.
Site condition monitoring of bottlenose dolphins within the Moray Firth SAC (Arso et al. 2019; Cheney et al. 2024).	2009 – 2022	Sightings and survey data from a large number of surveys within the Moray Firth SAC and surrounding areas.

4 Baseline Environment

33. The study areas for marine mammals have been defined on the basis that marine mammals are highly mobile and transitory in nature. It is, therefore, necessary to examine species occurrence not only within the Bellrock WFDA, but also over the wider area. Baseline data from developments and research projects in the wider North Sea have been evaluated to determine species in the wider area of the Bellrock WFDA.

4.1 Harbour Porpoise

4.1.1 Abundance

34. Harbour porpoise within the eastern North Atlantic are generally considered to be part of a continuous biological population that extends from the French coastline of the Bay of Biscay to northern Norway and Iceland (Tolley and Rosel, 2006), (Fontaine et al. 2007), (Fontaine et al. 2014) and (IAMMWG, 2023). However, for conservation and management purposes, it is necessary to consider this population within smaller MUs. MUs provide an indication of the spatial scales at which effects of plans and projects alone, and in-combination, need to be assessed for the key cetacean species in UK waters, with consistency across the UK (IAMMWG, 2023).

35. IAMMWG defined three MUs for harbour porpoise: NS MU; West Scotland (WS) MU; and the Celtic and Irish Sea (CIS) MU. The Bellrock WFDA is located within the NS MU (**Plate 2.1**) with an estimated population of 346,601 (CV = 0.09) individuals. A more recent abundance estimate has been published in the SCANS-IV survey, indicating that there are 338,918 harbour porpoise in the North Sea assessment unit (Gilles et al. 2023). The UK portion of the MU is 159,632 (CV = 0.12), which is a more proportional estimate population for the UK (IAMMWG, 2023).

36. As outlined in **Section 3.1**, harbour porpoise was the most commonly sighted marine mammal species during the site-specific surveys, with a total of 126 individuals recorded during the 24-month survey period. Harbour porpoise were recorded in 17 of the 24 months and across the entire survey area (see **Table 3.1**).

37. Within the North Sea, harbour porpoise are the most common marine mammal species. Heinänen and Skov (2015) identified that within the North Sea, water depth and hydrodynamic variables are the most important factors in harbour porpoise densities in species areas, in both winter and summer seasons. The seabed sediments also play an important role in determining areas of high harbour porpoise density, as well as the number of vessels present in the area.

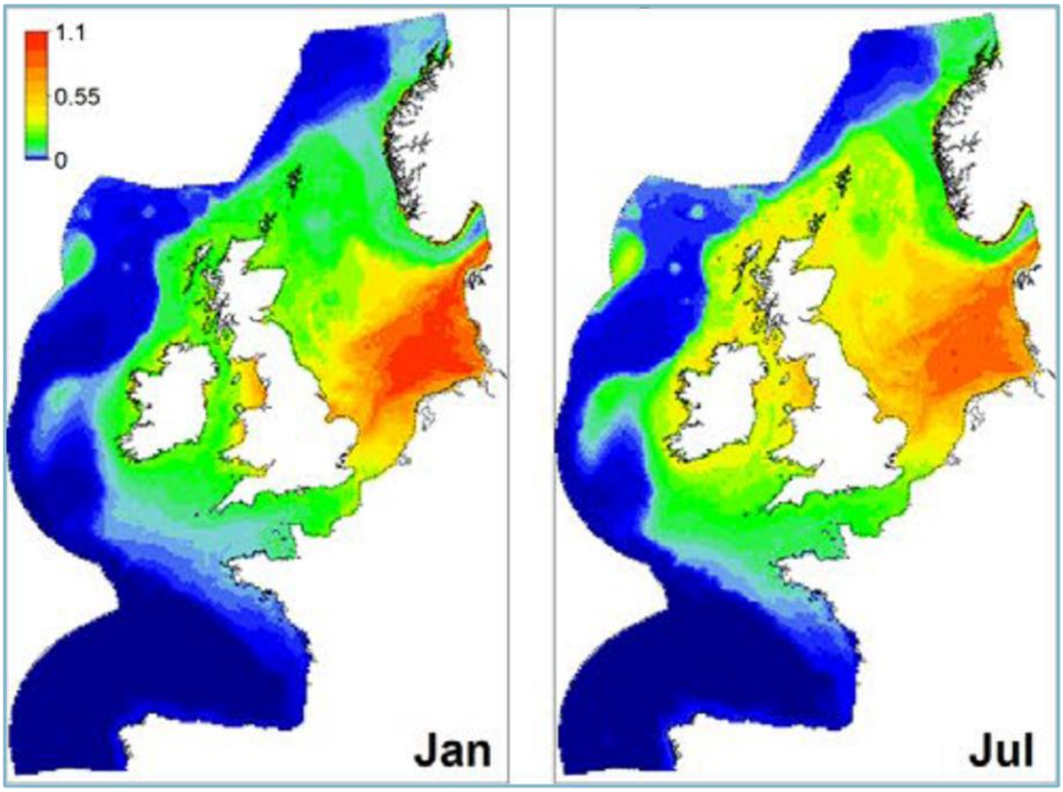
4.1.2 Density

38. Harbour porpoise were detected at all East Coast Marine Mammal Acoustic Study (ECOMMAS) passive acoustic monitoring (PAM) sites along the east coast of Scotland in all survey years between 2013 and 2019. Detection rates were generally lower at the most coastal sites, and where there is overlap with known bottlenose dolphin ranges (Hague et al. 2020).

39. The JCP Phase III Report (Paxton et al. 2016) identified high harbour porpoise density distributions during summer in the southern North Sea, which falls just south of the Bellrock WFDA. Similar observations were made by Gilles et al. (2016), where modelled habitat-prediction maps indicated that in spring there were higher density areas in the southern and southeastern part of the North Sea. During the summer season, the predicted density distribution of harbour porpoise dispersed east over the central North Sea. Compared to summer, during autumn, densities overall decreased, likely due to survey efforts, or a shift of harbour porpoise distribution. There are growing suggestions that the distribution of harbour porpoise within their range in the North Sea is shifting southwards (International Fund for Animal Welfare (IFAW) and Marine Conservation Research International (MCRI, 2012), (Hammond et al. 2013), (Hammond et al. 2021), (Isseldijk et al. 2020).

40. For cetacean species around Europe within the northeast Atlantic, Waggitt et al. (2019) developed distribution and abundance maps. For harbour porpoise, the distribution maps show a clear pattern of high harbour porpoise density in the southern North Sea, and the coasts of southeast England, for both January and July, although not as high, the density is still relatively high around the Bellrock WFDA (**Plate 4.1** (Waggitt et al. 2019)). The distribution maps are limited in that they should only be used to show general, broad-scale distributions of species. According to Waggitt et al. (2019), these densities should not be used for fine-scale distributions.

Plate 4.1: Spatial Variation in Predicted Densities (Individuals per km of Harbour Porpoise in January and July in the Northeast Atlantic)[3]



41. Although there is some overlap in the data used, Gilles et al. (2016) have identified different harbour porpoise hotspots in the southern North Sea (see **Plate 4.2** (Gilles et al. 2016)), but the maps are focused on a much more regional scale compared to those of Waggit0t et al. (2019). However, both studies highlight that the southern North Sea is an important area for harbour porpoise and that abundances shift with seasons.

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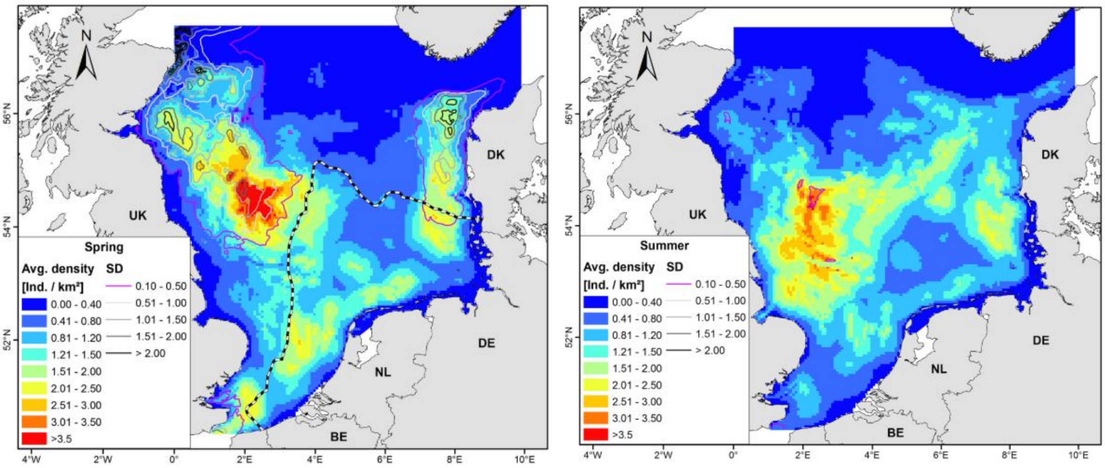
[3] Values are provided at 10 km resolution.

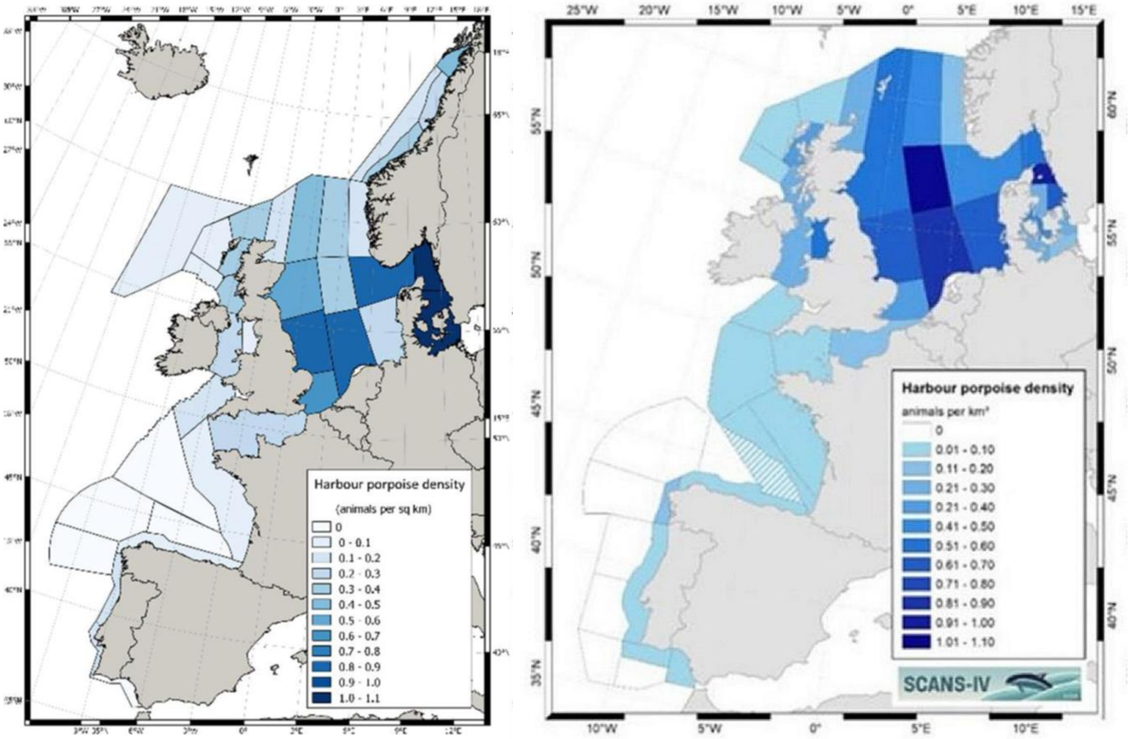
Plate 4.2: Predicted Harbor Porpoise Densities in the North Sea in Spring (March to May) [Left Panel] and Summer (June–August) [Right Panel]



42. In line with previous findings, the distribution of estimated density over the SCANS-III (Hammond et al. 2021) and SCANS-IV (Gilles et al. 2023) survey area indicate that the occurrence of harbour porpoise is greater in southern areas of the North Sea when compared to northern areas of the North Sea (**Plate 4.3** (Hammond et al. 2021; Gilles et al. 2023)).

43. Since SCANS-III, the density of harbour porpoises in SCANS-IV has remained the same with 0.599 animals/km^2 (CV = 0.29 in block R) and 0.599 animals/km^2 (CV = 0.367 in block NS-D). The estimated abundances are similar between the 2017 and 2022 survey, 38,646 (95% Confidence Limit (CL) = 20,584 – 66,524) and 38,577 individuals (95% CL = 18,017 – 76,361; block NS-D), respectively. These findings do not contribute to the existing suggestion of a southward shift mentioned above but are still lower abundance and densities than the southern areas.

Plate 4.3: Estimated Density in Each Survey Block for Harbour Porpoise From SCANS-III (Left) and SCANS-IV (Right)



44. SCANS-IV conducted a further winter survey from January to March 2024 (Ramirez-Martinez et al. 2025), in the same manner as those conducted for SCANS-III and the SCANS-IV above. Due to resourcing the survey was not able to scan the entirety of NS-D, although it did survey the bottom half and provided density calculations for NS-D. The density of harbour porpoise was noted to be 0.2569 and the estimated abundance for NS-D from this survey is 16,558 (95% CL = 9,239 – 27,021). This is a sharp decline from the previous densities and abundances, but this could be due to only half of NS-D being surveyed and the survey being conducted in winter, which is also shown in the digital aerial surveys for the Bellrock WFDA. Therefore, these numbers have only been provided for information purposes due to the limited data confidence.

45. The Waggitt et al. (2019) dataset has its limitations with regard to fine-scale use. To allow for a more accurate comparison of the species densities across the different data sets, the average for seasonal and annual periods across the area of the SCANS block where the Bellrock WFDA is located have been calculated using the Waggitt et al. (2019) dataset.

46. Therefore, the Waggitt et al. (2019) data was applied across the SCANS-IV block NS-D where the Bellrock WFDA is situated. This method allowed the identification of another possible density estimate for the species (**Table 4.1**).

Table 4.1: Density Overview of Harbour Porpoise Using Waggitt et al. Data over the SCANS-IV Block NS-D

Season	Density (animals/km^2)	Source
Summer	**0.368**	Waggitt et al. 2019
Winter	0.288	
Annual	0.328	

Notes:

The highest density is provided in bold.

47. Having compared all possible densities for harbour porpoise, a worst-case density of 1.273 harbour porpoise/km^2 (summer period within survey area from HiDef survey) was taken forward for the impact assessment in **Chapter 9: Marine Mammals (Volume II)** (see overview in **Table 6.1**).

48. For further information on the HiDef survey's population and density estimates, see **Table B.1** (**Annex B)**.

4.1.3 Diet

49. The distribution and occurrence of harbour porpoise, as well as other marine mammal species, is most likely to be related to the availability and distribution of their prey species. They tend to concentrate their movements in small focal regions (Johnston et al. 2005), which often approximate to particular topographic (Isojunno et al. 2012), (Brookes et al. 2013), (Stalder et al. 2020) and oceanographic features (Weir and O'Brien 2000), (Johnston et al. 2005), (Embling et al. 2009), (Marubini et al. 2009), (Waggitt et al. 2018), (Bouveroux et al. 2020) that are associated with prey aggregations (Sveegaard et al. 2012). Consequently, habitat use is highly correlated with prey density rather than any particular habitat type (e.g. Sveegaard et al. 2012), Ransjin et al. 2021).

50. Harbour porpoise are generalist feeders, and their diet reflects available prey in an area. Therefore, their diet varies geographically, seasonally, and annually, reflecting changes in available food resources. Differences in diet between sexes or age classes may also exist. The diet of the harbour porpoise consists of a wide variety of fish, including pelagic schooling fish, as well as demersal and benthic species, whereby they are especially known to occur near higher densities of Gadoids, Clupeids and sandeels (Börjesson et al. 2003), (Santos and Pierce, 2003), (Santos et al. 2004), (Sveegaard et al. 2012).

51. Harbour porpoise have relatively high daily energy demands and need to capture enough prey to meet its daily energy requirements. They must be near abundant food sources and are driven by the need to feed constantly (Read and Hohn 1995), (Johnston et al. 2005), (Wisniewska et al. 2016). However, it has been estimated that, depending on the conditions, harbour porpoise can rely on stored energy (primarily blubber) for up to three to five days, depending on body condition (Kastelein et al. 1997).

4.2 Bottlenose Dolphin

4.2.1 Abundance

52. Throughout its range, the bottlenose dolphin occurs in a diverse range of habitats, from shallow estuaries and bays, coastal waters, continental shelf edge and deep open offshore ocean waters. However, it is primarily an inshore species, with most sightings within 10 km of land, but they can also occur offshore, often in association with other cetaceans.

53. It has been determined that there are two 'eco-types' of bottlenose dolphin present in Europe, the coastal type and the pelagic (offshore) type, and that these types are genetically and ecologically different from each other (Louis et al. 2014), (Oudejans et al. 2015); Department of Business, Energy and Industrial Strategy (BEIS, 2022). The difference in location sited is that the coastal eco-type tends to occur within 1 km from shore, whereas pelagic eco-types are generally found within 1 – 65 km from the shore (Bearzi et al. 2009).

54. In coastal waters, bottlenose dolphin are often associated with river estuaries (Ingram and Rogan, 2002), steep benthic slopes (Wilson et al. 1997; Ingram and Rogan, 2002), headlands or sandbanks, or where there is uneven bottom relief and/or strong tidal currents (e.g. Lewis and Evans 1993; Wilson et al.1997; Liret et al. 1998; Liret, 2001; Ingram and Rogan 2002), (Reid et al. 2003), (Moreno and Mathews, 2018).

55. With regard to pelagic individuals, they tend to be encountered along the shelf edge to the north and west of Scotland and beyond, including the Faroe-Shetland Channel and Rockall Trough and Bank. These individuals are most likely part of a migratory wide-ranging offshore group (covered by the Oceanic Water MU) (BEIS, 2022).

56. A resident population of bottlenose dolphin is present along the east coast of Scotland, with an estimated 226 individuals (95% CI: 214 – 239; Cheney et al. 2024) and has increased since 2009 (165 individuals in 2009; Arso et al. 2019). In recent decades (1960s to 2000s (Parsons et al. 2002; Nichols et al. 2007)), very few sightings of bottlenose dolphin were recorded further south on the east coast of the UK. However, in recent years an increase in bottlenose dolphins along the coastline of northeast England, as far south as Bridlington Bay, have been reported (Aynsley, 2017; Hacket, 2022; Arso Civil et al. 2025).

57. The most recent study from Cheney et al. (2024) on the Moray Firth SAC bottlenose dolphin population noted a decline in dolphins using the SAC from the previous six years. Although the population has been using the Moray Firth SAC less, as noted above, the population within the East coast of Scotland appears to be steady and slightly increasing.

58. Bottlenose dolphins have been recorded approximately 480 km outside of what would be considered their 'normal' home range (Cheney et al. 2024), with one individual from the Moray Firth population being recorded as far south and east as the Netherlands (Hoekendijk et al. 2021). A most recent photo-ID study showed that up to 75% of the identified animals were matched or associated with the East Coast Scotland bottlenose dolphin population photo-ID records (Arso Civil et al. 2025). Whilst bottlenose dolphin presence has been increasing in northeast England in recent years, they appear to still be a coastal population at present (Hacket, 2022; Arso Civil et al. 2025).

59. Bottlenose dolphin presence was recorded in survey block R during the SCANS-III surveys (Abundance = 1,924, CV = 0.86, Density = 0.03). However, during SCANS-IV there was no recording of bottlenose dolphins being present within block NS-D.

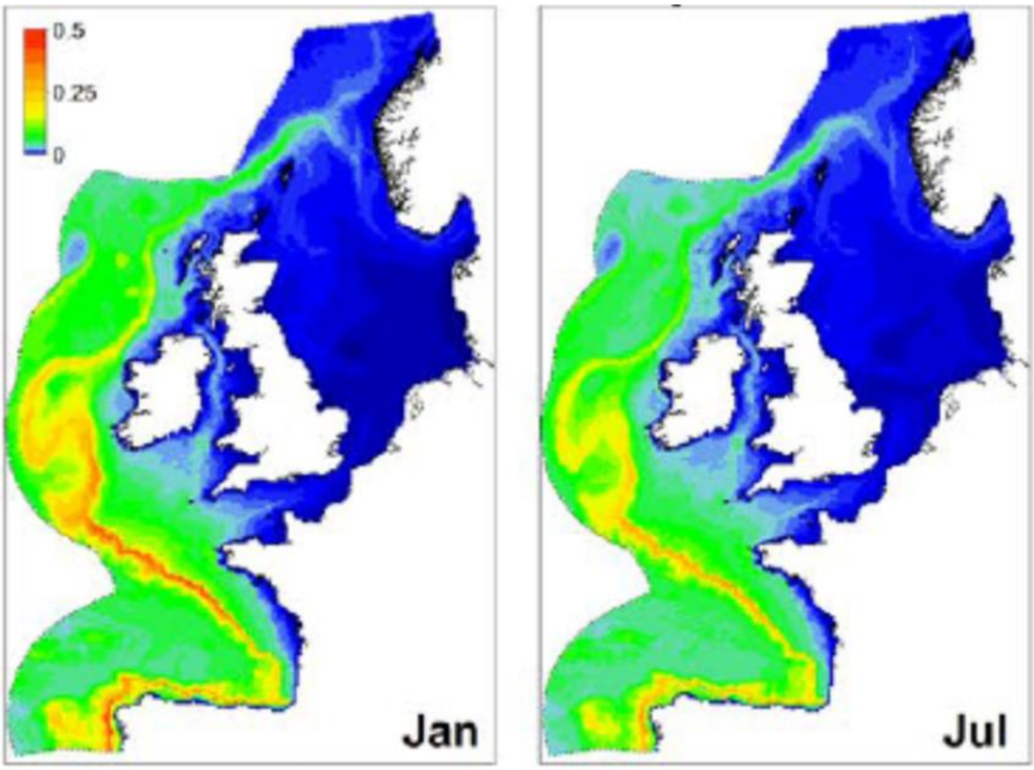
60. The Bellrock WFDA is located within the GNS MU (**Plate 2.2**), with an estimated reference population of is 2,022 (CV = 0.75) individuals (IAMMWG, 2023).

61. As mentioned above observations were made that bottlenose dolphin from the Moray Firth are traveling as far south as Flamborough Head. As such, there is the possibility that individuals from this resident population, which is part of the Coast East Scotland (CES) MU, may be affected by the Wind Farm Infrastructure. The marine mammal assessment in **Chapter 9: Marine Mammals (Volume II)** considers the population of 226 (95% CI: 214 – 239), (Cheney et al. 2024).

4.2.2 Density

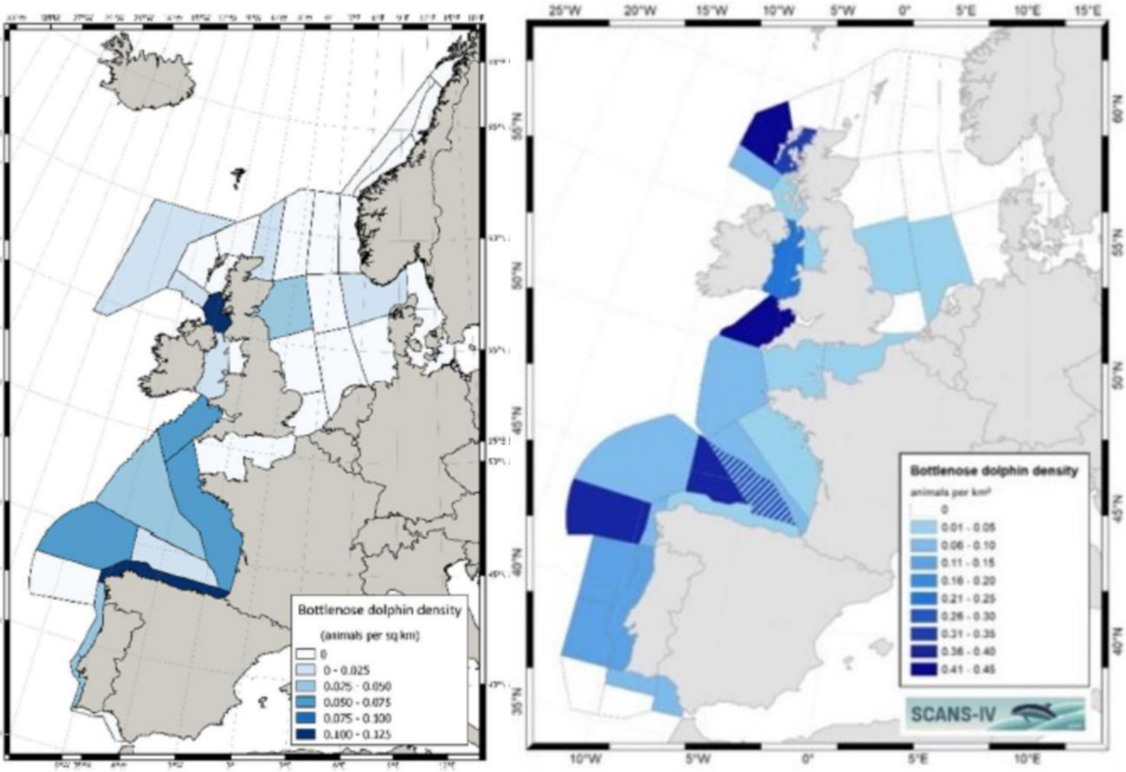
62. The seasonal distribution of the pelagic ecotype of bottlenose dolphin were captured by Waggitt et al. (2019) showing a clear pattern of higher density to the western coastal areas of the UK, extending southwards to the Bay of Biscay (**Plate 4.4** (Waggitt et al. 2019)). The distribution maps indicate a 'corridor' of increased bottlenose dolphin density travelling from west of Scotland, southwards around the west coast of Northern Ireland and the Republic of Ireland, and through the centre of the Bay of Biscay. The distribution maps are limited in that they should only be used to show general, broad-scale distributions of species. According to Waggitt et al. (2019), these densities should not be used for fine-scale distributions.

Plate 4.4: Spatial Variation in Predicted Densities (Individuals per km of the Offshore Ecotype Bottlenose Dolphin in January and July in the Northeast Atlantic)[3]



63. Distribution of estimated density over the SCANS-III and IV survey areas indicate that the occurrence of bottlenose dolphin is much greater in the Celtic and Irish Sea compared to the North Sea (**Plate 4.5** (Hammond et al. 2021), (Gilles et al. 2023)). The SCANS-III estimated a density of 0.0289 animals/km^2 (CV=0.861) and an abundance of 1,924 (95% CL: 0 – 5,048; Hammond et al. 2021), whereas in SCANS-IV no bottlenose dolphins were recorded.

Plate 4.5: Estimated Density in Each Survey Block for Bottlenose from SCANS III (left) and SCANS-IV (right)



64. The Waggitt et al. (2019) dataset has its limitations with regard to fine-scale use. To allow for a more accurate comparison of the species densities across the different data sets, the average for seasonal and annual periods across the area of the SCANS block where the Bellrock WFDA is located have been calculated using the Waggitt et al. (2019) dataset.

65. Therefore, the Waggitt et al. (2019) data was applied across the SCANS-IV block NS-D. This method allowed the identification of another possible density estimate for the species for the relevant populations for the Bellrock WFDA (**Table 4.2**).

Table 4.2: Density Overview for Bottlenose Dolphin using Waggitt et al. Data Over SCANS-IV Block NS-D

Season	Density (animals/km^2)	Source
Summer	**0.0021**	Waggitt et al. 2019
Winter	0.0019	
Annual	0.0020	
Highest density is provided in bold		

66. Having compared all possible densities for bottlenose dolphin, a worst-case density of **0.0298** bottlenose dolphin/km^2 (SCANS-III block R) was taken forward for the impact assessment in **Chapter 9: Marine Mammals (Volume II)** (see overview in **Table 6.1**).

4.2.3 Diet

67. Bottlenose dolphin are opportunistic feeders and take a wide variety of fish and invertebrate species. Benthic and pelagic fish (both solitary and schooling species), including Gadoids, salmonids, flatfish and sandeels. Octopus and other cephalopods have also all been recorded in the diet of bottlenose dolphin (Santos et al. 2001), (Santos et al. 2004), (Reid et al. 2003).

68. Diet analysis suggests that bottlenose dolphin are selective opportunists and although they may have preference for a type of prey, their diet seems to be determined largely by prey availability. Research in Australia has shown that when presented with a choice, they will preferentially feed on certain types of prey, particularly those with a high fat content (Corkeron et al. 1990).

69. Analysis of the stomach contents of ten bottlenose dolphin in Scottish waters, from 1990 to 1999, reveals that the main prey are cod (29.6% by weight), saithe (23.6% by weight), and whiting (23.4% by weight), although other species including salmon (5.8% by weight), haddock (5.4% by weight) and cephalopods (2.5% by weight) were also identified in lower number (Santos et al. 2001).

70. In Irish waters, haddock, saithe and pollock are the dominant prey species ingested, followed by whiting, blue whiting, Atlantic mackerel and horse mackerel; cephalopods are also important (Hernandez-Milian et al. 2015).

4.3 Common Dolphin

4.3.1 Abundance

71. As reviewed in BEIS (2022), during summer common dolphin are widely distributed throughout the northeast Atlantic, from coastal waters to the mid-Atlantic ridge, from the Azores and the Strait of Gibraltar to Norway, with the majority of sightings having been reported in waters south of 60° (Murphy et al. 2013). Analysis of summer sightings on shelf waters around the UK and adjacent waters showed the vast majority of common dolphins to occur in waters above 14 °C in temperature (MacLeod et al. 2008), (Cañadas et al. 2009). Strong seasonal shifts in their distribution have been noted, with winter inshore movements onto the Celtic Shelf and into the western English Channel and St. George's Channel resulting in pronounced concentrations (Northridge et al. 2004).

72. Information on dispersal patterns and site fidelity is scarce, thus the reference population for common dolphin are based on that of the CGNS MU (**Plate 2.3**). They are estimated to have a reference population of 102,656 (CV = 0.29) animals and a UK population of 57,417 (CV = 0.32) (IAMMWG, 2023).

73. There is very little literature on common dolphins in the North Sea, however it is documented that they have a seasonal occurrence in the North Sea in the summer months (Waggitt et al. 2019).

74. ORCA surveys that are carried out by volunteers throughout the year from ferries and cruise ships have recorded 20 sightings of common dolphins with 52 individuals from 2006 to 2017 in the summer months in the North Sea (ORCA, 2025). The SWF data records lists two sightings of common dolphins in the 'North-East Scotland' region with 200 individuals in one sighting and two individuals since 2024. The database showed no recent sightings entries in the regions 'South Grampian and Southeast Scotland' (where the Bellrock WFDA is located), 'Orkney and North Scotland', or 'Yorkshire and Northeast England' (SWF, 2025).

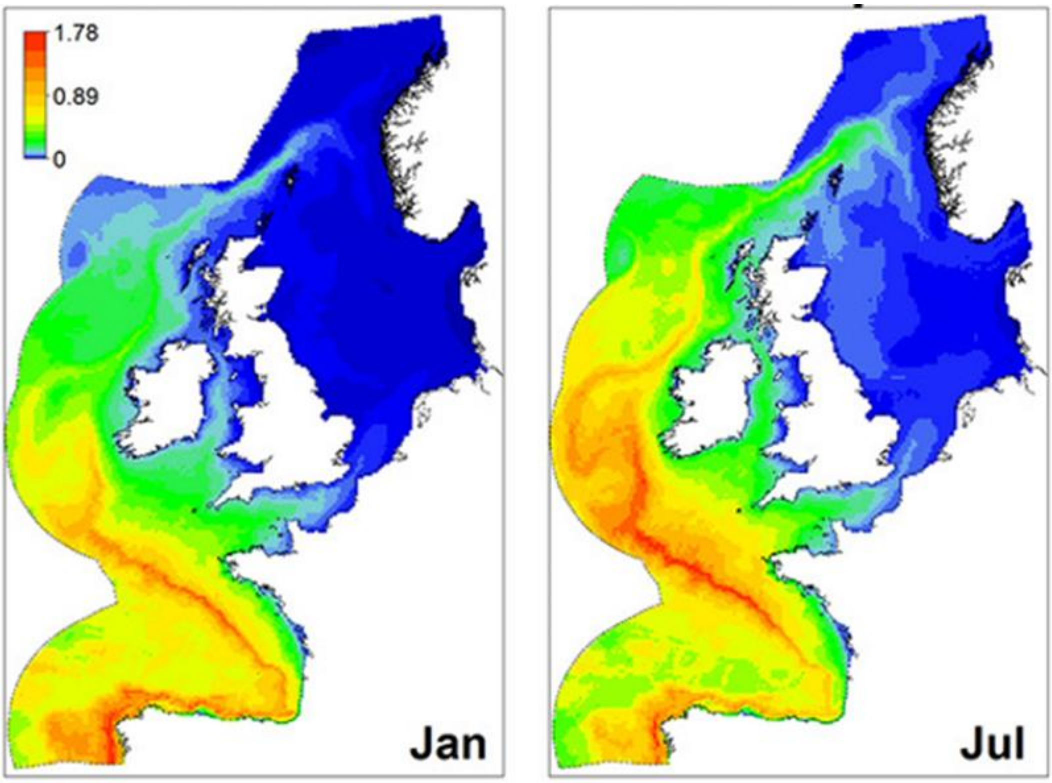
4.3.2 Density

75. The results of the JCP Phase III Report (Paxton et al. 2016) identified that for common dolphin, densities are high across the west of Ireland and the Hebrides but were very low and noted to seldom occur in the North Sea.

76. Distribution maps 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.

77. Densities of common dolphin in the North Sea are very low in comparison. There are indications of a 'corridor' of increased common dolphin density travelling from west of Scotland, southwards around the west coast of Northern Ireland and the Republic of Ireland, and through the centre of the Bay of Biscay, with little occurrence in the North Sea. The distribution maps are limited in that they should only be used to show general, broad-scale distributions of species. According to Waggitt et al. (2019), these densities should not be used for fine-scale distributions (**Plate 4.6** (Waggitt et al. 2019)).

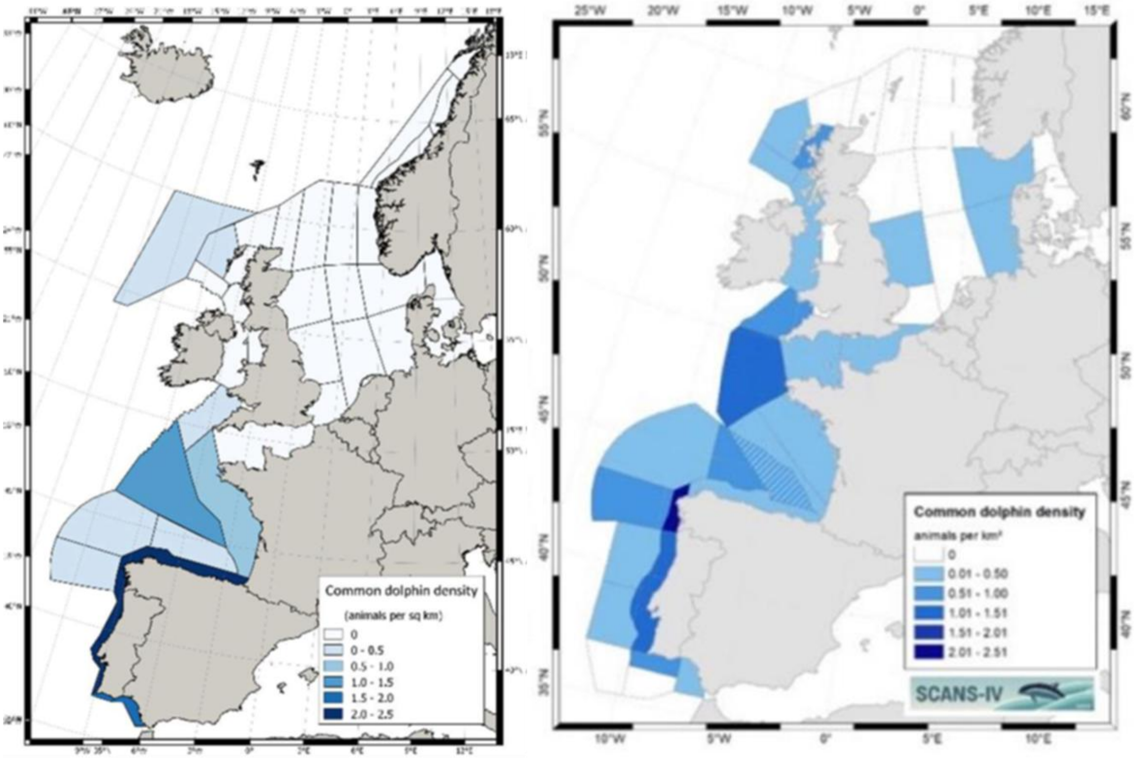
Plate 4.6: Spatial Variation in Predicted Densities Individuals per km of Common Dolphin in January and July in the Northeast Atlantic[3]



78. No common dolphins were observed in block R (in which the Bellrock WFDA is located), nor any other neighbouring blocks within the North Sea (blocks T, Q or O) during the SCANS-III surveys in July (**Plate 4.7** (Hammond et al. 2021), (Gilles et al. 2023)).

79. During SCANS-IV (Gilles et al. 2023), no common dolphin were sighted in block NS-D (**Plate 4.7** (Hammond et al. 2021), (Gilles et al. 2023)), only in the neighbouring block NS-C, which has a density of 0.0032 animals/km^2 (CV = 0.966) with an estimated abundance of 192 animals (95% CL: 6 - 724).

Plate 4.7: Estimated Common Dolphin Density in Each SCANS-III (left) and SCANS-IV (Right) Survey Block



80. The Waggitt et al. (2019) dataset has its limitations with regard to fine-scale use. To allow for a more accurate comparison of the species densities across the different data sets, the average for seasonal and annual periods across the area of the SCANS block where the Bellrock WFDA is located has been calculated using the Waggitt et al. (2019) dataset.

81. Therefore, the Waggitt et al. (2019) data was applied across the SCANS-IV block NS-D. This method allowed the identification of another possible density estimate for the species for the Bellrock WFDA (**Table 4.3**).

Table 4.3: Density overview for Common Dolphin using Waggitt et al. Data over SCANS-IV Block NS-D

Season	Density (Animals/km^2)	Source
Summer	**0.026**	Waggitt et al. 2019
Winter	0.011	
Annual	0.018	
Notes: Highest density is provided in bold.		

82. Having compared all possible densities for common dolphin, a worst-case density of 0.026 common dolphin/km^2 (Waggitt et al. (2019) over SCANS-IV block NS-D) was taken forward for the impact assessment in **Chapter 9: Marine Mammals (Volume II)** (see overview in **Table 6.1**).

4.3.3 Diet

83. Common dolphin are cooperative feeders, working within a pod to capture prey. They have a varied diet of fish including haddock, mackerel *Scomber scombrus*, Atlantic horse mackerel *Trachurus trachurus*, blue whiting *Micromesistius poutassou*, anchovy *Engraulida spp*. and sardine *Sardina pilchardus* (Couperus, 1997), (Silva, 1999), (Meynier, 2004), (Santos et al. 2013), (Marçalo et al. 2018). These species are also exploited by fisheries. Other prey items recorded in common dolphins include cephalopods and crustacean (Brophy et al. 2009).

84. Analysis of 63 common dolphin stomach contents from the Bay of Biscay found that the diet was dominated by fish with mackerel being the preferred fish and cephalopods were recorded as a prey of secondary importance (Pusineri et al. 2007). Stomach content of 71 stranded common dolphins along the French coast between 1999-2002 contained sardine, anchovy, sprat and horse mackerel (Meynier et al. 2008). This study also highlighted the temporal variations in diet composition, which was attributed to prey availability in the region. It further analysed that prey composition and size varied in relation to sex and maturity status of the individual animal. Statistically, common dolphins are more likely to select high energy prey, otherwise it is disregarded, even when highly abundant in the area (Spitz et al. 2010).

4.4 White-beaked Dolphin

4.4.1 Abundance

85. White-beaked dolphin are found in temperate and sub-Arctic seas of the North Atlantic, usually over the continental shelf in waters of 50 – 100 m depth (Reid et al. 2003). In UK waters, sightings occur throughout the year but are slightly more frequent from July to October (Reid et al. 2003).

86. Their distribution is generally restricted to the northern half of UK waters, with greatest abundance in the central and northern North Sea, Orkney and Shetland and northwest Scotland (BEIS, 2022).

87. There is only one MU for white-beaked dolphins, the CGNS MU, and is estimated to hold a population of 43,951 individuals (CV = 0.22) (IAMMWG, 2023) and 34,025 individuals (CV = 0.28) in the UK portion.

88. Results from ORCA surveys carried out yearly have recorded multiple sightings of white-beaked dolphins from 2006 to 2024 in the North Sea. The majority of these sightings have been within summer months but there have been some recordings in the winter (ORCA, 2025).

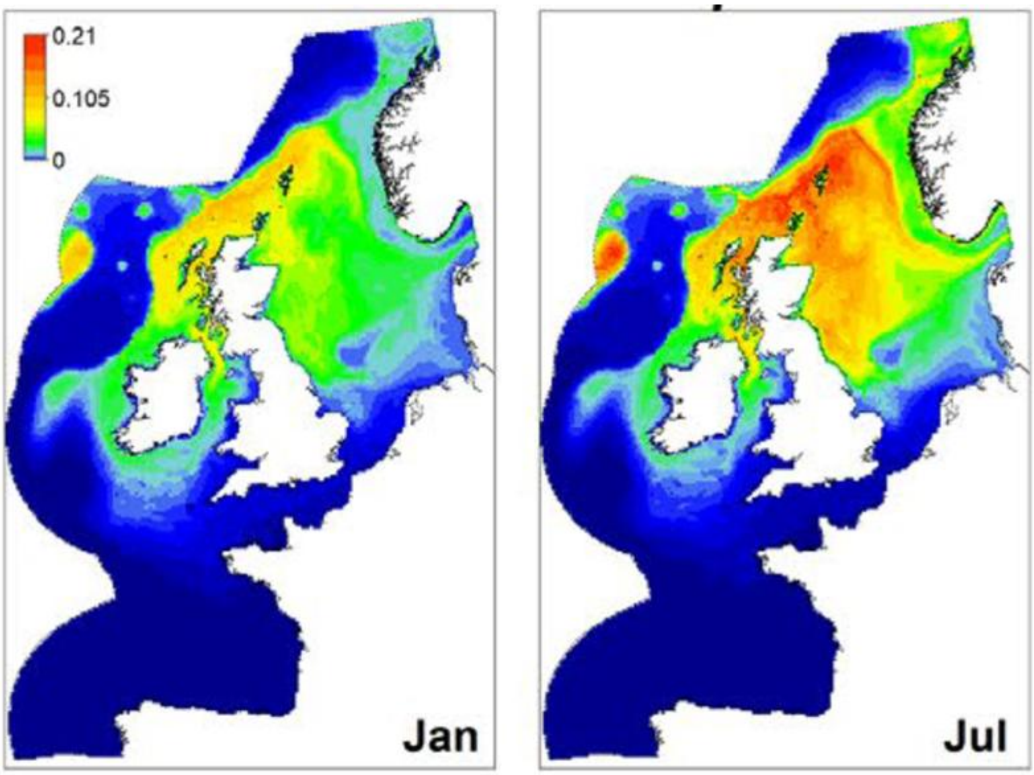
89. The SWF sightings data recorded one sighting of common dolphins in the Orkney and North Scotland region with 15 individuals recorded in January 2025. There were no recent sightings in other nearby areas, and none recorded within the area where the Bellrock WFDA will be situated (SWF, 2025).

4.4.2 Density

90. The results of the JCP Phase III Report (Paxton et al. 2016) identified that white-beaked dolphin densities are low across much of UK waters, with higher densities shown to be in the Hebrides and the northern North Sea. The density of white-beaked dolphin within the vicinity of the Bellrock WFDA are medium to relatively high.

91. The seasonal distribution maps by Waggitt et al. (2019) indicate higher densities around the Bellrock WFDA in summer compared to observations made by Paxton et al. (2016). Overall, highest densities were in the northern North Sea and around the coasts of Scotland, with decreasing densities southwards of Scotland along the east 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 (**Plate 4.8** (Waggitt et al. 2019)). The distribution maps are limited in that they should only be used to show general, broad-scale distributions of species. According to Waggitt et al. (2019), these densities should not be used for fine-scale distributions.

Plate 4.8: Spatial Variation in Predicted Densities (Individuals per km of White-beaked Dolphin in January and July in the Northeast Atlantic)[3]

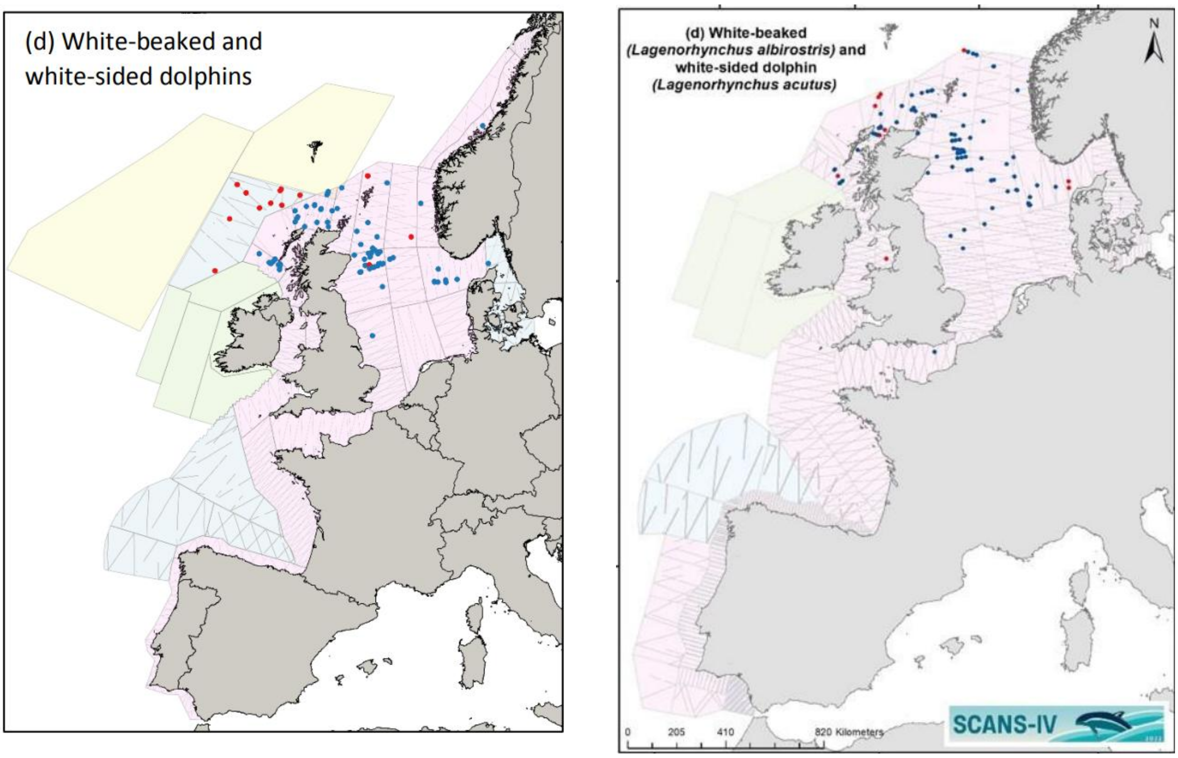


92. The SCANS-III recorded a high number of white-beaked dolphin within the survey block R (Abundance = 15,694, Density = 0.243, CV = 0.48; Hammond et al. 2021). SCANS-IV also recorded the presence of white-beaked dolphins within the survey block NS-D but to a smaller scale (Abundance = 5,149; 95% CL: 961 – 10,586, Density = 0.0799; CV = 0.481; Gilles et al. 2023).

93. A comparison of this data indicated a decrease in the area, it has been observed that the species is increasing in numbers further east and south of the Bellrock WFDA within the southern and eastern North Sea (**Plate 4.9** (Hammond et al. 2021), (Gilles et al. 2023)).

94. The density of white-beaked dolphin was noted to be 0.0049 and the estimated abundance for NS-D from this survey is 314 (95% CL = 0 – 1,012). This is a sharp decline from the previous densities and abundances, but this could be due to only half of NS-D being surveyed and the survey being conducted in winter, which is also shown in the digital aerial surveys for the Bellrock WFDA. Therefore, these numbers have only been provided for information purposes due to the limited data confidence.

Plate 4.9: Distribution of Sightings of White-Beaked (Blue Dot) and White-Sided (Red Dot) Dolphins during SCANS-III [Left] and SCANS-IV [Right]



95. The Waggitt et al. (2019) dataset has its limitations with regard to fine-scale use. To allow for a more accurate comparison of the species densities across the different data sets, the average for seasonal and annual periods across the area of the SCANS block where the Bellrock WFDA is located have been calculated using the Waggitt et al. (2019) dataset.

96. Therefore, the Waggitt et al. (2019) data was applied across the SCANS-IV block NS-D. This method allowed the identification of another possible density estimate for the species for the relevant population of the Bellrock WFDA (**Table 4.4**).

Table 4.4: Density Overview for White-beaked Dolphin Using Waggitt et al. Data Over SCANS-IV Block NS-D

Season	Density (Animals/km^2)	Source
Summer	**0.087**	Waggitt et al. 2019
Winter	0.058	
Annual	0.073	
Highest density is provided in bold		

97. Having compared all possible densities for white-beaked dolphin, the worst-case density of 0.243 white-beaked dolphin/km^2 (SCANS-III block R) was taken forward for the impact assessment in **Chapter 9: Marine Mammals (Volume II)** (see overview in **Table 6.1**).

4.4.3 Diet

98. Dietary analysis for white-beaked dolphin stranded between 1992 and 2003 around the UK (Canning et al. 2008) and between 1968 and 2005 along the Dutch coast (Jansen et al. 2010) found that while a wide variety of prey species were identified, the majority of prey were Gadidae (cod and whiting), haddock and gobies. Canning et al. (2008) further identified that herring *Clupea harengus* and mackerel *Scomber scombrus* were also found in the stomachs and is in line with more dated journals that observed that white-beaked dolphins are associated with herring and mackerel shoals (Harmer, 1927), (Fraser, 1946), (Evans, 1980). Anecdotal evidence from fisherman in Scotland suggests that individuals seen inshore may coincide with mackerel appearing in the same areas (Canning et al. 2008).

4.5 Killer Whale

4.5.1 Abundance

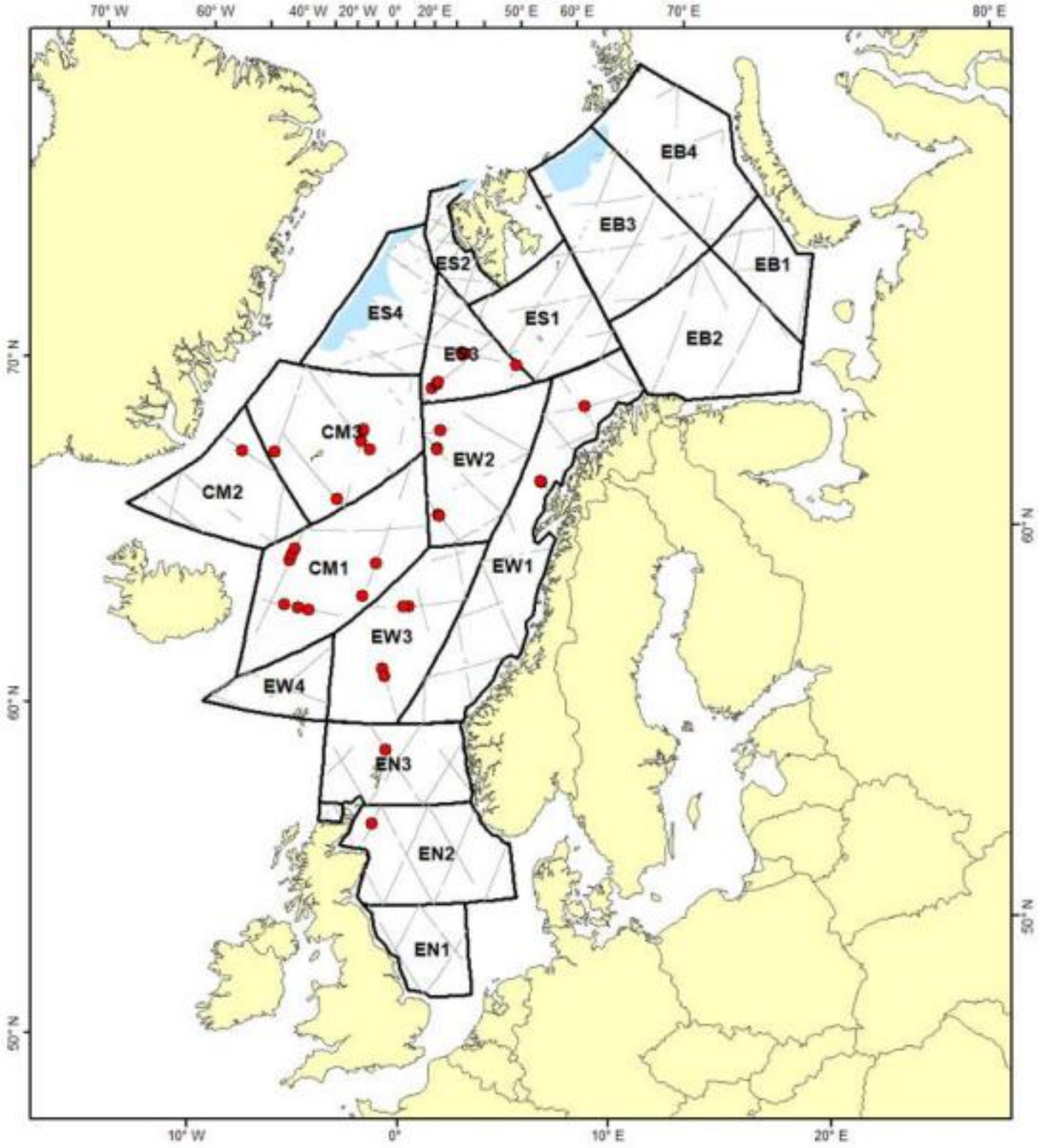
99. Globally, killer whales known to be one of the most widespread cetaceans where they range from warm tropical waters to the freezing polar regions. Killer whales ranging in British waters appear to belong to distinct populations. Killer whales are known to occur off the east coast of the UK continuously distributed toward the Shetland and Faroe Islands, further north from the Bellrock WFDA and are associated with the northeast Atlantic mackerel stock during autumn (Luque et al. 2006), (Foote et al. 2010).

100. Off the Northern Isles and the northeast of Scotland, 50 individuals were regularly sighted within the spring-summer to feed on pinnipeds (Bolt et al. 2009), (Foote et al. 2010), (Beck et al. 2012). An off shoot of this population belong to the herring feeding sub-population off the east coast of Iceland, from where they seasonally migrate (Foote et al. 2010), (Beck et al. 2012), (Samarra and Foote, 2015).

101. Another assemblage of killer whales occurring off the west coast of Scotland, Ireland and Wales was suggested as a population isolated from neighbouring killer whales (Beck et al. 2014). This group, known as the West Coast Community, currently consists of eight individuals. However, only two individuals are regularly sighted, suggesting that the remaining members may no longer be alive. Apart from these two populations in the northern regions of the UK, killer whale sightings (and consequently their abundance) are very rare elsewhere in the UK abundance (Hebridean Whale and Dolphin Trust (HWDT), 2025).

102. The 2001 NASS estimated 15,014 (95% CI: 6,637-33,964) killer whales in the North Atlantic between the Faroe Islands and Canada. In the 2014 – 2018 Norwegian mosaic surveys (covering southern Norway, northern North Sea and Barents Sea; see **Plate 4.10**) (Leonard and Øien, 2020) estimated around 15,056 (CV=0.29, 95% CI: 8,423–26,914) killer whales in the area. Killer whales are thought to be more abundant in the northeast Atlantic and slightly further north than the UK (NAMMCO, 2021).

Plate 4.10: Distribution of Sightings Recorded as Killer Whales During the 2014 – 2018 Sighting Surveys[1]



103. The ORCA surveys recorded six different occasions of killer whales being spotted in east Scotland from 2017 – 2022, with pod sizes ranging from one to four individuals. One sighting of an individual killer whale was reported on the East coast of England in 2018 (ORCA, 2025).

104. The Sea Watch Foundation (SWF) recorded ten separate sightings of killer whale in the Firth of Forth region (southwest of the Bellrock WFDA) since January 2025. There were also 25 separate sightings during this period in the Moray Firth and a further three sightings along the nearshore area from Aberdeen to Peterhead. The sightings included pod sizes of one to eight individuals. There was one sighting of a pod of two whales to the east of the Bellrock WFDA in the centre of the NS in June 2025 (SWF, 2025).

4.5.2 Density

105. The only available density estimate available for killer whales comes from Waggitt et al. (2019), which is limited for the area surrounding the Bellrock WFDA and has a high normalised root mean squared error (0.14) for the species within that study. The data was used and highlighted in **Table 6.1** which shows the density for the entire SCANS-IV NS-D area as 0.001 for the species all year-round. No other density estimate was available for the species within the UK.

106. Given the limited spatial data and the density data available for the UK itself, alongside the limited sightings from the Bellrock WFDA site-specific surveys, killer whale will be assessed qualitatively within **Chapter 9: Marine Mammals (Volume II)**. Although, the density and population are shown in **Table 6.1**, these will not be used within the assessment itself given the lack of evidence available.

4.5.3 Diet

107. Killer whales are extremely intelligent, inquisitive and approachable and they're behaviour varies depending on location and pod. They are one of the marine environment's top predators and the variety of feeding and hunting strategies can change drastically given the location and prey availability. Killer whales prey includes fish (i.e. cod, herring, mackerel and salmon), sharks, octopus, squid, seals, birds and other cetaceans (such as whales). They often hunt cooperatively and in silence, especially when hunting larger prey.

108. The West Coast Community are known to feed on other cetaceans such as harbour porpoises and have even been known to hunt minke whale. The killer whales around Shetland and Orkney tend to have a more varied diet and have been recorded feeding on seals and schooling fish, with reports of feeding on eider ducks (HWDT, 2025).

109. As an apex predator with no natural predators, the highest risk to killer whales comes from higher levels of toxic contamination in their tissue and organs than other species. This is specifically a problem with organochlorines, such as pesticides and industrial chemicals such as polychlorinated biphenyls (PCBs) that can carry into the oceans and accumulate in bodies of all marine animals and become higher in concentration up the food chain (Ross et al. 2000), (Wolkers et al. 2007), (Jepson et al. 2016), (Pedro et al. 2017). In a study by Desforges et al. (2018) PCB levels in different killer whale populations were compared and it was concluded that 10 out of 19 populations have either a moderate or high risk of extinction in the future due to PCB pollution.

110. Due to overfishing and degradation of habitats, killer whales are subject to low prey concentrations at particular locations. Availability of prey species has been shown to have effects on both survival and reproduction of killer whales (Ford et al. 2010). Killer whales are also subject to climate change and pollution which can change ecosystems, i.e. prey availability (HWDT, 2025).

4.6 Minke Whale

4.6.1 Abundance

111. Within UK waters, minke whale are most frequently sighted in the central to northwestern North Sea and west of Scotland around the Hebrides (BEIS, 2022). They are primarily a seasonal visitor to UK waters, with increased sightings from May to October, although some animals may remain in coastal waters year-round (BEIS, 2022), (Reid et al. 2003). Department of Energy and Climate Change (DECC) (2016) supports this, stating that occasional sightings of minke whale are made as far south as Flamborough Head and the north Humberside coastlines between July and October.

112. Few sightings of minke whale have been made further south of these areas and it is thought that they probably enter the North Sea from the north (DECC, 2016). Minke whales appear to move into the North Sea at the beginning of May and are present throughout the summer until October (Northridge et al. 1995).

113. Some genetic differentiation among individuals has been reported (e.g. Andersen et al. 2003), but this does not appear to be caused by geographic structuring within the northeast Atlantic (Anderwald et al. 2011). Minke whale of the North Atlantic are likely to be a single genetic population (Anderwald et al. 2012). Therefore, IAMMWG (2023) considers a single MU is appropriate for minke whale in UK waters which holds an estimated population of 20,118 individuals (CV = 0.18), and 10,288 individuals (CV = 0.26) for the UK portion of the MU.

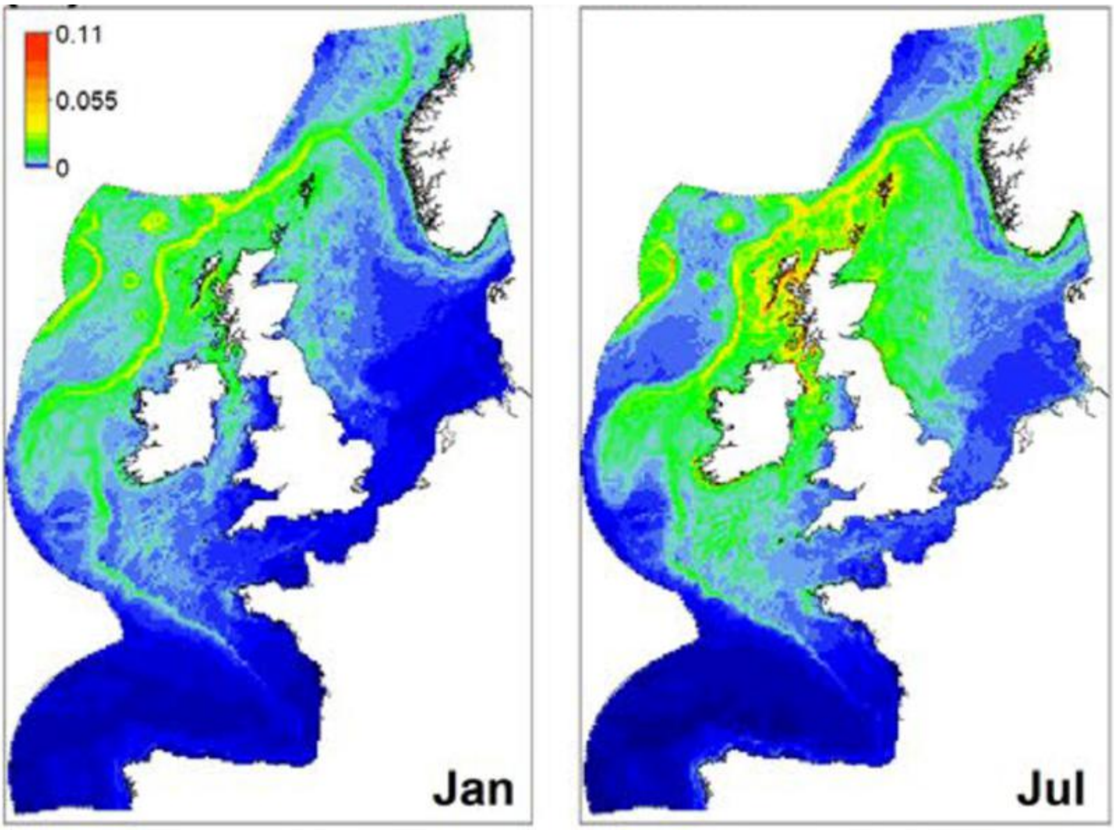
114. The Southern Trench Nature Conservation Marine Protected Area (ncMPA) is located on the east coast of Scotland in the outer Moray Firth and is designated to protect minke whale, burrowed mud, fronts, shelf deeps, Quaternary of Scotland and Submarine Mass Movement. Fronts in the Southern Trench are created by mixing of warm and cold waters, which creates an area of high productivity, attracting a number of predators to the area. Minke whale are attracted by the fish species brought to the area by the fronts, as well as the abundance of sandeels in the soft sands. NatureScot advise that, in order to conserve minke whale, the risk of injury and death should be minimised, access to resources within the site should be maintained, and supporting features should also be conserved.

115. Minke whale are wide-ranging baleen whales which are present in the Moray Firth primarily in the summer months (June – September) (Reid et al. 2003), (Hammond et al. 2021). They often prefer water depths of up to 200 m and are often solitary or found in pairs, though they occasionally form larger groups (up to 15 individuals) while feeding.

4.6.2 Density

116. For minke whale, the distribution maps by Waggitt et al. (2019) indicate higher densities in the northern North Sea, around Scotland and Ireland, including the Celtic Sea area, with decreasing densities southwards of Scotland along the east coast of England (**Plate 4.11** (Waggitt et al. 2020)). The results of the JCP Phase III Report (Paxton et al. 2016) identified that for minke whale densities were highest around the northern coast of the UK, with hotspots in the Hebrides. There is a clear seasonal difference in the densities of minke whale, with higher densities in July, particularly evident in their northern range (**Plate 4.11**). Whilst the density of minke whales in the WFDA in January is nearly absent, it slightly increases in July, but the overall densities are relatively low from the Waggitt et al. (2019) data. The distribution maps are limited in that they should only be used to show general, broad-scale distributions of species. According to Waggitt et al. (2019), these densities should not be used for fine-scale distributions.

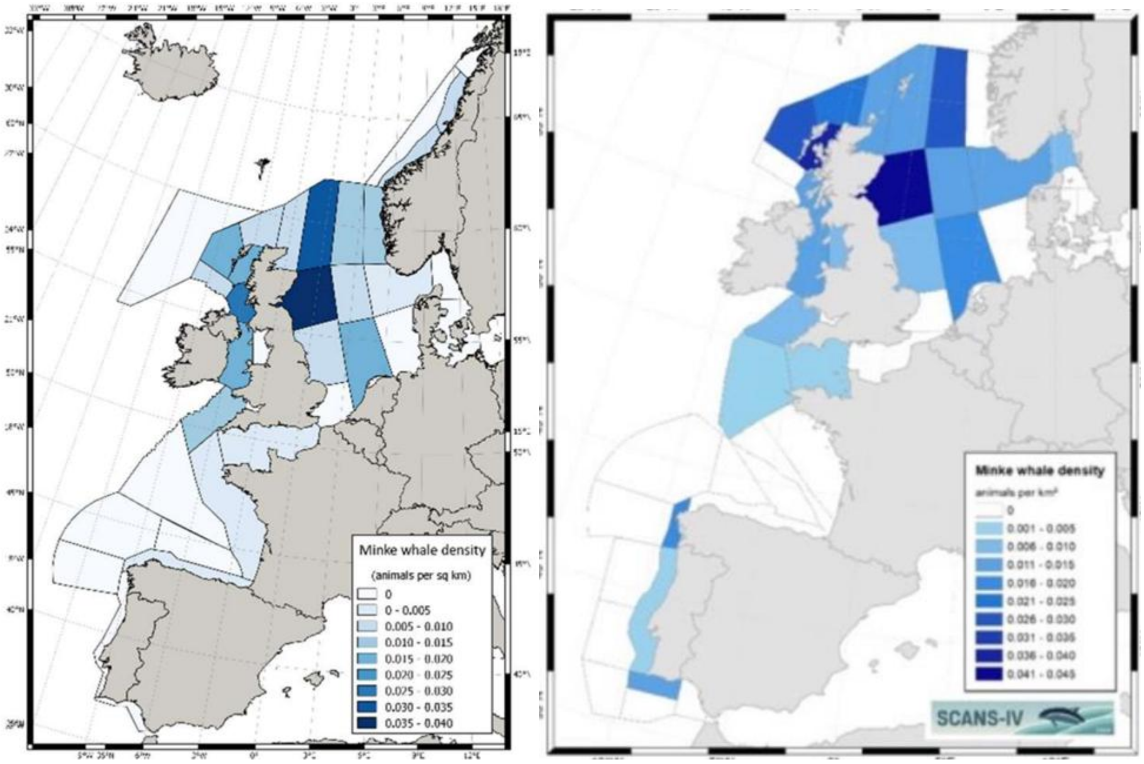
Plate 4.11: Spatial Variation in Predicted Densities (Individuals per km of Minke Whale in January and July in the Northeast Atlantic)[3]



117. During the SCANS-III surveys, minke whales were recorded within block R (in which the Bellrock WFDA is located) and an abundance was estimated to be 2,498 minke whales (95% CL: 604 – 6,791). The density estimate is 0.039 animals/km^2 (CV = 0.61; Hammond et al. 2021; **Plate 4.12** (Hammond et al. 2021; Gilles et al. 2023))

118. Slightly more minke whale were recorded during the SCANS-IV survey, resulting in a higher density of 0.0419 animals/km^2 (CV = 0.594) and a population abundance of 2,702 minke whale (95% CL: 547 – 7,357).

Plate 4.12: Estimated Density in Each Survey Block for Minke Whale from SCANS III (Left) and SCANS-IV (Right)



119. The data for which the Southern Trench ncMPA was designated on shows that minke whale are present in higher numbers in the northern area of the ncMPA, with densities of up to more than ten minke whales per km^2. At closest point to the Bellrock WFDA (of approximately 80 km), this density data shows minke whale presence of less than 0.1/km^2 (Plate 4.12 Paxton et al. 2014).

120. The Waggitt et al. (2019) dataset has its limitations with regard to fine-scale use. To allow for a more accurate comparison of the species densities across the different data sets, the average for seasonal and annual periods across the area of the SCANS block where the Bellrock WFDA is located have been calculated using the Waggitt et al. (2019) dataset.

121. Therefore, the Waggitt et al. (2019) data was applied across the SCANS-IV block NS-D. This method allowed the identification of another possible density estimate for the species for the relevant population for the Bellrock WFDA (**Table 4.5**).

Table 4.5: Density Overview for Minke Whale using Waggitt et al. Data over SCANS-IV Block NS-D

Season	Density (Animals/km^2)	Source
Summer	**0.0091**	Waggitt et al. 2019
Winter	0.0056	
Annual	0.0074	
Notes: Highest density is provided in bold.		

122. Having compared all possible densities for minke whale, the worst-case density of 0.0419 minke whale/km^2 (SCANS-IV; block NS-D) was taken forward for the impact assessment in **Chapter 9: Marine Mammals (Volume II)** (see overview in **Table 6.1**).

4.6.3 Diet

123. Minke whales feed on a variety of fish species, including herring, cod and haddock. Minke whale feed by engulfing large volumes of prey and water, which they then ‘sieve’ out through their baleen plates and swallow their prey whole.

124. A study into the diet of minke whale in the northeastern Atlantic sampled a total of 210 minke whale forestomach contents from 2000 to 2004, with a total of 37 minke whale samples analysed within the northern North Sea. Within this area, minke whale were found to prey upon a number of different species at the population level. However, 84% of individuals were found to prey upon only one species. Sandeels (56% of total prey by biomass) and mackerel (30% of total prey by biomass) were found to be the most dominant prey species for minke whale in the northern North Sea (Windsland et al. 2007).

4.7 Fin Whale

4.7.1 Abundance

125. Within the North Atlantic, the fin whale is the most commonly sighted species of baleen whale, typically found further north of the UK towards Greenland (Pike et al. 2019). The SCANS surveys further identified high densities of fin whale around the Iberian peninsula, the Bay of Biscay (Gilles et al. 2023) and in northwest Scotland (Hammond et al. 2021). Furthermore, occasional sightings in the Celtic Sea are becoming increasingly more regular (Fariñas-Barmejo et al. 2023).

126. Pike et al. (2019) observed an increase in fin whale numbers around the Faroe Islands and south of Iceland in recent years, compared to earlier surveys conducted by NAMMCO. It is speculated that this could be due to a northern incursion of fin whales into the area from the Spanish stock area, where both earlier and recent surveys found fin whales to be abundant (Buckland et al. 2001), (Hammond et al. 2013), (Hammond et al. 2017), (Gilles et al. 2023).

127. While overall abundance over the entire NAMMCO survey area is not directly comparable due to varying coverage between surveys, the numbers reported by Pike et al. (2019) are the highest of any survey in the Central North Atlantic in recent years. This suggests either an increase in abundance in northern areas, a distributional shift, or a combination of both. A distributional shift is plausible, as Víkingsson et al. (2015) demonstrated that fin whales increased both in abundance and altered their distribution patterns within the NAMMCO survey area between 1987 and 2007. This change was associated with an increase in sea surface temperature and height, likely affecting prey availability, particularly in the western part of the NAMMCO area.

128. It appears that this pattern may be continuing, allowing this species to expand its range and numbers in the Central North Atlantic. Surveys in the southeastern part of the North Atlantic (i.e. SCANS and CODA), including the most recent one conducted in 2022, have not shown any corresponding decrease in fin whale numbers further south (Sanpera and Jover 1989), (Buckland et al. 2001), (Hammond et al. 2013), (Hammond et al. 2017), (Gilles et al. 2023). This suggests an overall increase in fin whale abundance in the wider North Atlantic area. Recent estimates of fin whale abundance in the Norwegian survey area to the east and north of Iceland and the Faroes suggest numbers in the low thousands (Øien, 2009), (Leonard and Øien, 2019a;b;c;d).

129. There has been one sighting of one individual fin whale in the ORCA surveys within east Scotland in November 2019. A further two sightings occurred in ‘East England’ in 2015 and 2017 of one individual each time in the summer months (ORCA, 2025). The SWF recorded four sightings of fin whale since 2024 of one individual each time within the summer months in ‘South Grampian and Southeast Scotland’ area (where the Bellrock WFDA is located. There were no other sightings in nearby areas, apart from one sighting of a “Large whale” in August 2024 in the ‘Orkney and North Scotland’ area, which could potentially be a fin whale (SWF, 2025).

130. The existing abundance estimates for fin whales are not representative of the number of sightings in the Bellrock WFDA. During the summer, fin whales are present in the entire NAMMCO study area, but since they are migratory animals, some animals move south to lower latitudes in winter to find warm breeding grounds for mating and calving (Lydersen et al. 2020). As such, fin whales are a relatively uncommon species in the North Sea and surveys are likely to capture some migrating individuals rather than resident populations. Extensive surveys in the Northeast Atlantic such as ObSERVE, SCANS, and Norwegian mosaic survey (2014-2018), allowed several abundance estimates to be captured for fin whales in different sea regions.

131. The most recent overall abundance estimate for fin whales from the SCANS-IV survey for all survey blocks (see **Plate 3.2**) were 12,764 (95% CL: 8,875 – 18,357) (Gilles et al. 2023). During SCANS-III (Hammond et al. 2021), the estimate was estimate of 27,293 (95% CL: 13,187 - 56,487) is significantly higher than the recent figure, but the difference is due to changes in survey blocks and areas that have no longer been longer included.

132. The ObSERVE surveys in Irish waters recorded a total of 38 fin whale sightings over four seasons (summer 2015 to winter 2016/17) (Rogan et al. 2018). The abundance estimate was 781 (CV=38.56, 95% CI: 374 – 1,628) but was not corrected for animals on the survey line which causes a possible underestimation of counts. Fin whales were seen in all seasons, but sighting numbers varied between the first year and the second year in which the summer and winter season had almost nine times as many sightings. Dring their migration, fin whales are likely to use the Irish waters as a feeding stop and are therefore regularly sighted in autumn and winter. Over five years,

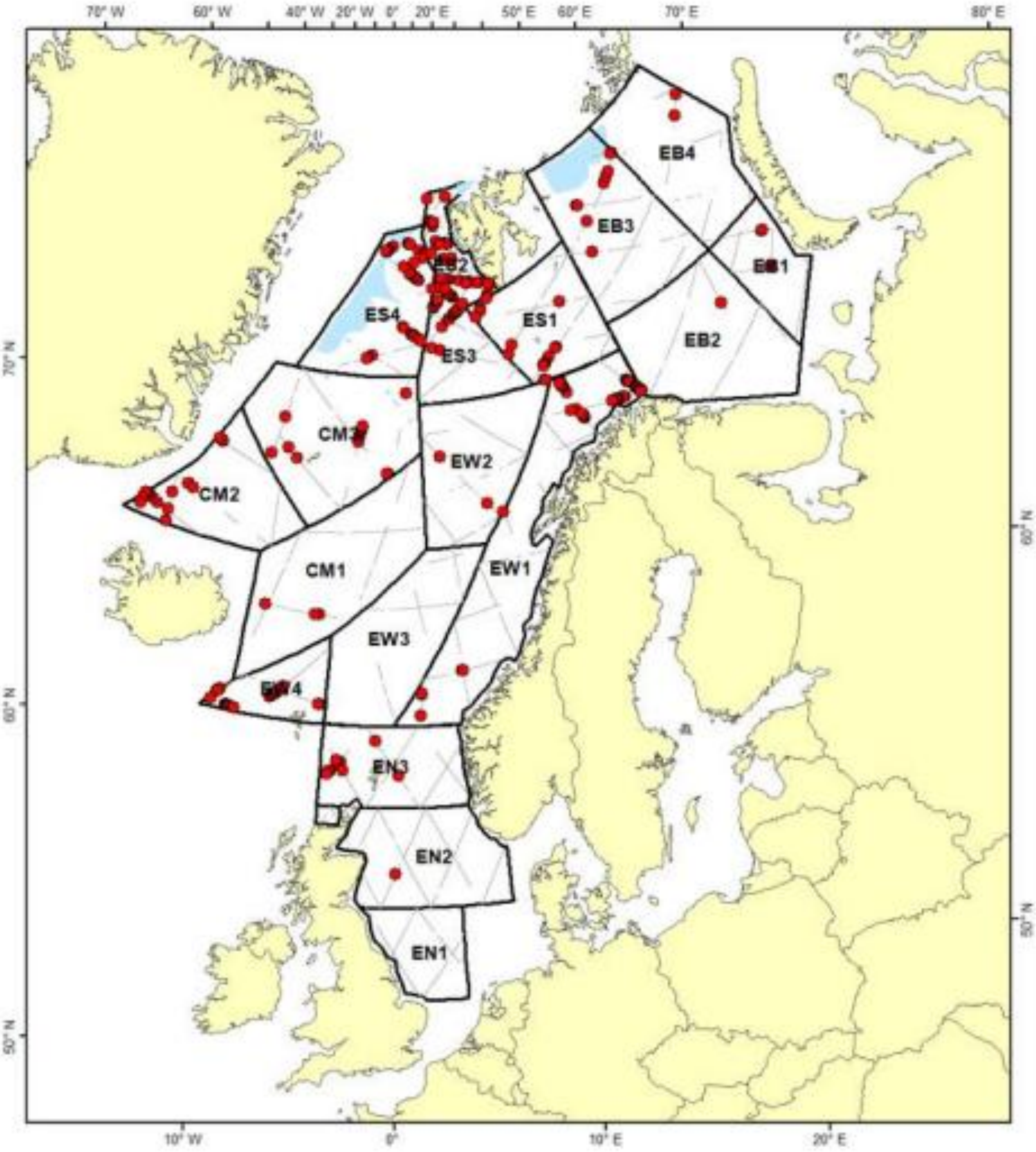
each August, during the Norwegian mosaic survey, a boat-based survey of the Northeast Atlantic, conducted surveys between the southern North Sea and the ice edge of the Barents Sea and Greenland Sea (**Plate 2.4**), presenting abundance estimates for fin whales in these regions. As expected, most sightings are in the arctic sea regions (see **Plate 4.13** (Leonard and Øien, 2020)) during the August surveys, totalling to an abundance estimate of 11,387 (CV=0.17, 95% CI: 8,072– 16,063) (Leonard and Øien, 2020).

133. Since fin whales are migratory, it is suggested that several abundance estimates from southern and northern sea regions are to be summed, capturing the migrating population from north to south. Therefore, the reference population suggested for the assessments in **Chapter 9: Marine Mammals (Volume II)** are derived from SCANS-IV, ObSERVE, and NASS (see **Table 4.6**)

Table 4.6: Reference Population for Fin Whale

Region	Survey Name	Abundance	Source
North Sea, Barents Sea, Greenland Sea	Norwegian mosaic survey	11,387	Leonard and Øien, 2020
Ireland	ObSERVE	781	Rogan et al. 2018
European Atlantic waters	SCANS-IV	12,764	Gilles et al. 2023
Total		**24,932**	

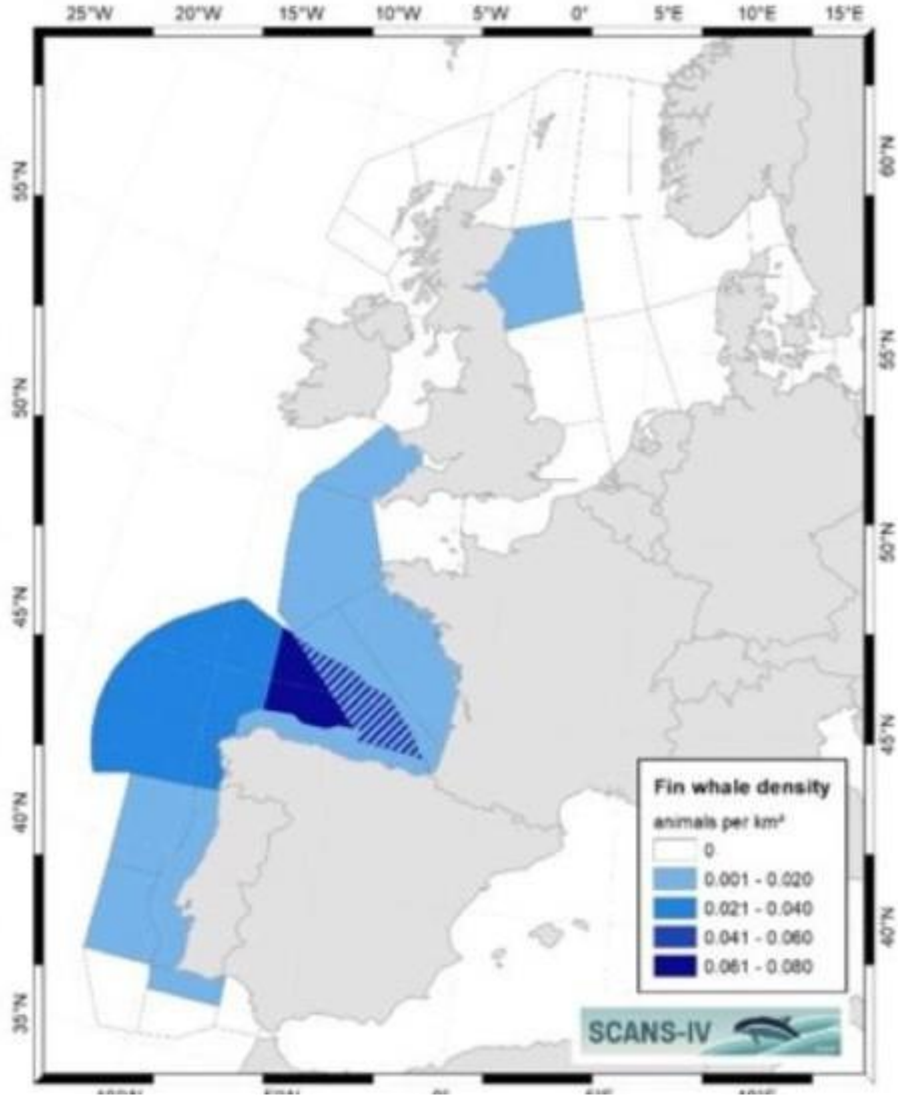
Plate 4.13: Distribution of Sightings Recorded as Fin Whales During the 2014 – 2018 Sighting Surveys[1]



4.7.2 Density

134. During the SCANS-III surveys, no fin whale were sighted in the North Sea, apart from a singular occurrence north of Shetland, and several sightings northwest of Scotland. In the most recent SCANS-IV surveys, fin whale was sighted once in block NS-D (in which the Bellrock WFDA is located), with an estimated density as low as 0.0009 animals/km^2 (CV=0.947). As per **Plate 4.14** (Gilles et al. 2023), densities around the Iberian Peninsula and the Bay of Biscay are much higher.

Plate 4.14: Estimated Fin Whale Density in Each SCANS-IV Survey Block



135. The Waggitt et al. (2019) dataset has its limitations with regard to fine-scale use. To allow for a more accurate comparison of the species densities across the different data sets, the average for seasonal and annual periods across the area of the SCANS block where the Bellrock WFDA is located has been calculated using the Waggitt et al. (2019) dataset.

136. Therefore, the Waggitt et al. (2019) data was applied across the SCANS-IV block NS-D. This method allowed the identification of another possible density estimate for the species for the Bellrock WFDA assessment, although it is important to note that due to a lack of data validity, the fin whales will be assessed qualitatively (**Table 4.7**).

Table 4.7: Density Overview for Fin Whale using Waggitt et al. Data Over SCANS-IV Block NS-D

Season	Density (Animals/km^2)	Source
Summer	**0.000028**	Waggitt et al. 2019
Winter	0.000021	
Annual	0.000025	
Notes: Highest density is provided in bold.		

137. Having compared all possible densities for fin whale, the worst-case density of 0.0009 fin whale/km^2 (SCANS-IV; block NS-D) was taken forward for the impact assessment in **Chapter 9: Marine Mammals (Volume II)** (see overview in **Table 6.1**).

4.7.3 Diet

138. Fin whales are fast swimmers and are often found in social groups of two to seven individuals. In the North Atlantic, they are often seen feeding in large groups that include humpback whales, minke whales, and Atlantic white-sided dolphins (Aguilar and García-Vernet, 2018). The fin whale is a pelagic feeder. Its diet consists mainly of planktonic crustaceans (particularly euphausiids) but will also feed on small schooling fish including herring, capelin, sandeel, blue whiting, mackerel, and squid.

139. During the summer, fin whales feed on krill, small schooling fish (including herring, capelin, and sand lance), and squid by lunging into schools of prey with their mouth open, using their 50 to 100 accordion-like throat pleats to gulp large amounts of food and water. They then filter the food particles from the water, using the 260 to 480 baleen plates (long, flat plates made of fingernail-like material called keratin) that they have in place of teeth on each side of the mouth. Fin whales fast in the winter while they migrate to warmer waters (National Oceanic and Atmospheric Administration (NOAA), 2024).

140. Like other baleen whales, fin whales also skim the water, taking in huge volumes of water. When they close their mouths, the water is pushed out through the baleen, and the prey is caught on the inside of the baleen. A fin whale eats up to two tons of food daily (NOAA, 2024).

4.8 Humpback Whale

4.8.1 Abundance

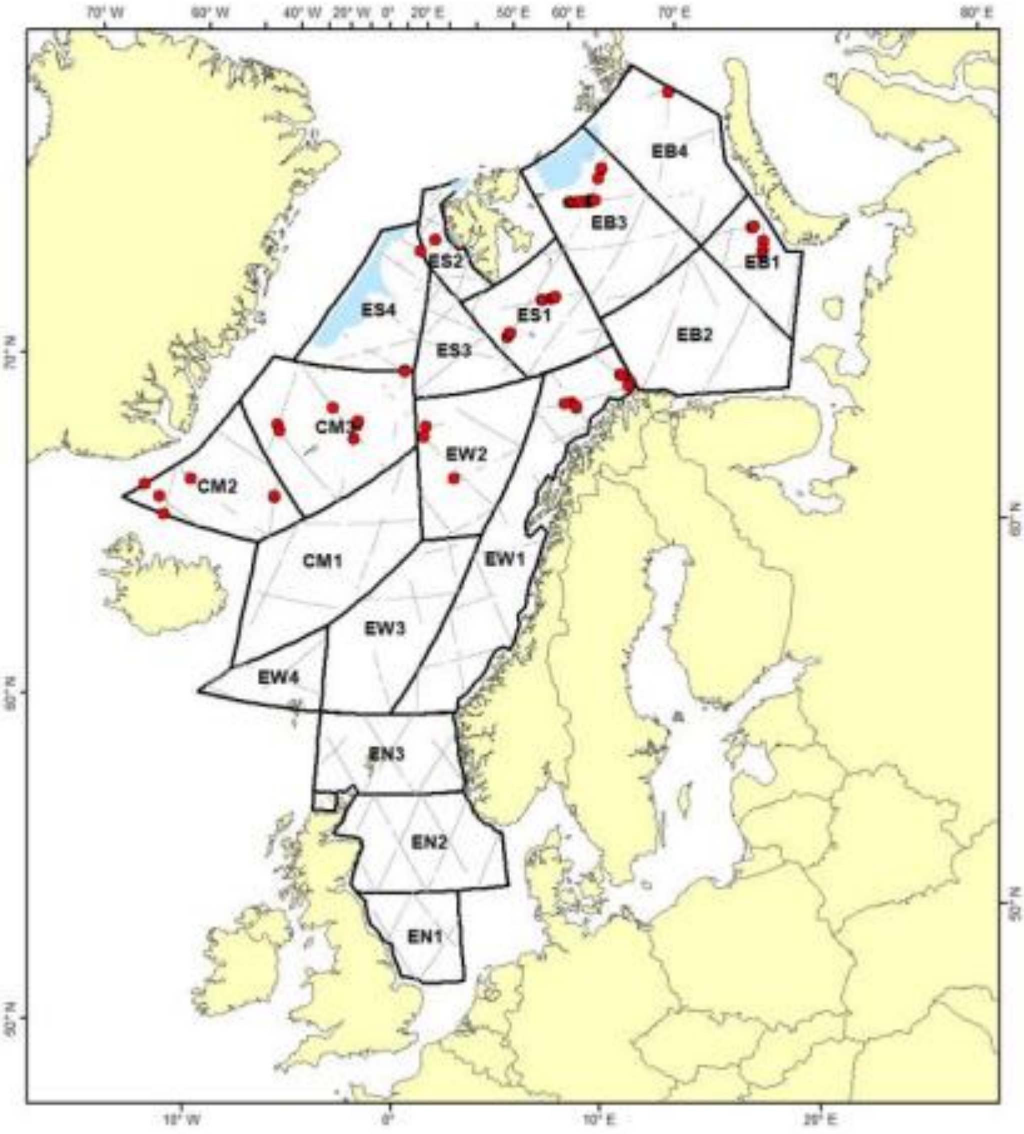
141. Humpback whales migrate widely and can travel up to 15,000 km per year between their tropical breeding/mating area and their high latitude feeding grounds. Within the Northern Hemisphere they have been sighted arriving in February and leaving by the end of April (Stevick et al. 1999). The species are known to migrate along the west side of the UK and Ireland, up to the feeding grounds to the north of the Norwegian Sea, with the feeding grounds being in locations where water masses

mix, which causes upwelling and high productivity. The eastern most feeding ground occurs off Northern Norway, especially around Bear and Jan Mayen Islands (Reilly et al. 2008), (Smith and Pike, 2009).

142. Although humpback whales tend to migrate along the west side of the UK and Ireland, in recent years they have begun being spotted within the English Channel as far east as the Sussex coastline. Sightings also occur around the southwest of England and have become increasingly more common in recent years. There are some theories around this noted change, following potential recovery of the population from the end of commercial whaling, which could result in the species expanding its range to explore new breeding and feeding areas. Another theory suggests that climate change could be forcing the species to travel further in search of suitable feeding waters in relation to changing conditions affecting prey availability (Marine Conservation Society, 2025).

143. There is no data available to determine humpback whale abundance within UK waters. However, population data from the NAMMCO surveys and the Eastern North Atlantic area has estimated an abundance of 9,867 humpback whales for Iceland/Faroes (Pike et al. 2019). The abundance for the entire NAMMCO survey area (**Plate 4.15** (Leonard and Øien, 2020)), which is estimated to be 10,708 (CV=0.38, 95% CI: 4,906–23,370) humpback whales (Leonard and Øien, 2020). There are no other density sources available for the UK, or the Bellrock WFDA. Therefore, humpback whale will be assessed qualitatively given the lack of available data in relation to the Bellrock WFDA.

Plate 4.15 **Distribution of Sightings Recorded as Humpback Whales During the 2014–2018 Sighting Surveys**[1]



144. There have been two humpback whale sightings of one individual each time, within the ‘South Grampian and Southeast Scotland’ area of the SWF recordings since 2024. There has been one further sighting in the neighbouring area (‘northeast Scotland’) of one individual (SWF, 2025). From the ORCA recordings, there were two sightings of humpback whales, both noting one individual each time within east Scotland in 2021 (ORCA, 2025).

4.8.2 Diet

145. As discussed in **Section 4.8.1**, humpback whales are long-distance travellers and make the longest migrations of any mammal (Ford and Reeves, 2008). Although they travel vast distances between breeding and feeding grounds, the species are not fast swimmers compared to other

members of their family. The normally travel 2 – 12 km/h, covering up to 200 km per day during the migration period.

146. The species tend to engage in group feeding behaviour and they have a diverse diet and can exhibit great flexibility and variation in their feeding behaviour. They aim for areas of strong currents and upwelling where prey naturally congregate. In the North Atlantic, the species mainly feed on krill (*euphausiids*) and small schooling fish such as capelin, Atlantic herring, sandeels and mackerel. However, the diet varies by season and feeding ground (Heide-Jørgensen and Laidre 2007), (Heide-Jørgensenet al. 2007), (Magnusdóttir et al. 2014).

147. The species can track the movements of their prey and tend to change their distribution in response to changes in the abundance and distribution of prey species (Virkingsson et al. 2015).

4.9 Grey Seal

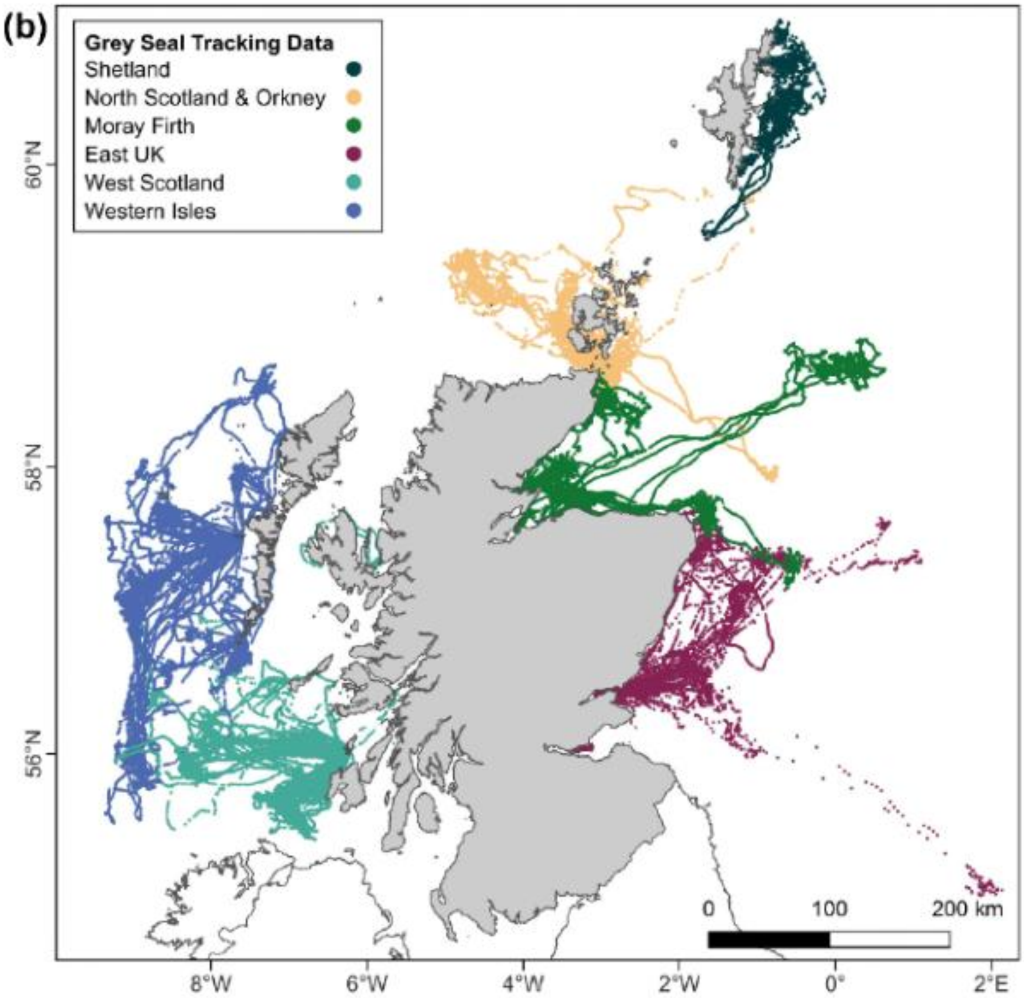
4.9.1 Distribution

148. Grey seals only occur in the North Atlantic, Barents and Baltic Sea with their main concentrations on the east coast of Canada and United States of America and in northwest Europe. Globally there are three centres of grey seal abundance: one in eastern Canada and the Northeast USA; a second around the coast of the UK, especially in Scottish coastal waters; and a third, smaller group in the Baltic Sea. In the UK and Canadian populations, there are clear indications of a slowing down in population growth in recent years (SCOS, 2022).

149. Approximately 35% of the world’s grey seals breed in the UK, with 80% of them breeding at colonies in Scotland, where the main concentrations are in the Outer Hebrides and in Orkney. There are also breeding colonies in Shetland, on the north and east coasts of mainland Britain and in southwest England and Wales. Numbers are generally stable or increasing throughout Scotland (SCOS, 2022).

150. Grey seals are wide ranging and can breed and forage in different areas (Russell et al. 2013). They generally travel between known foraging areas and back to the same haul-out site but will also move to new sites (Russel, 2016). Telemetry studies of grey seal in the UK have identified a highly heterogeneous spatial distribution with a small number of offshore ‘hot spots’ continually utilised (Matthiopoulos et al. 2004), (Russell et al. 2017). **Plate 4.16** (Carter et al. 2025) provides a map of grey seal trips to and from haul outs in Scotland (the tagging data was cleaned to remove data during the grey seal breeding season) including data from seals tagged across the UK, Ireland, and France due to the movement of seals. The underlying data (see Carter et al. 2022) was updated with additional tracking data and is now based on 169 grey seals, compared to an initial 114 in Carter et al. (2022). The tracking data indicates that the tagged grey seals hauled out along the coastal area of Eastern Scotland are using the offshore areas around the Bellrock WFDA. The underlying Carter et al. (2024) data highlights that estimates from the east coast of Scotland should be treated with caution as a lack of recent telemetry data may cause uncertainty in the model.

Plate 4.16: Tracking Data for Grey Seals (n=169) Hauling out in Scotland



151. Grey seal forage in the open sea and they may range widely to forage and frequently travel over 100 km between haul-out sites (SCOS, 2022). Foraging trips can last anywhere between one and 30 days. Tracking of individual grey seal has shown that most foraging probably occurs within 100 km of a haul-out site, although they can feed up to several hundred kilometres offshore (SCOS, 2022). The grey seal maximum foraging range is estimated to be 448 km based on tracking data (Carter et al. 2022).

4.9.2 Haul-out Sites

152. Grey seal will haul-out on beaches, rocky islands during low tide to digest food and rest. In the UK grey seal will spend longer hauled out during their annual moult (between December and April) and during their breeding season (between August and December) (SCOS, 2020).

153. In the north and west of Scotland, pupping occurs mainly between September and late November, whereas eastern England pupping occurs mainly between early November to mid-December. Pups are typically weaned 17 to 23 days after birth, when they moult their white natal coat, and then remain on the breeding colony for up to two or three weeks before going to sea. Mating occurs at

the end of lactation and then adult females depart to sea and provide no further parental care (SCOS, 2020).

154. **Plate 4.17** shows the most recent haul out counts for grey seals in Scotland and **Table 4.8** gives an indication to the distance of these main haul-out sites to the Bellrock WFDA. Some of the haul-outs are shared with harbour seals. Distances are measured in a straight line using QGIS v.3.38.0.

Plate 4.17: Haul-out Count for Scottish Grey Seals During August Surveys Between 2011-2023

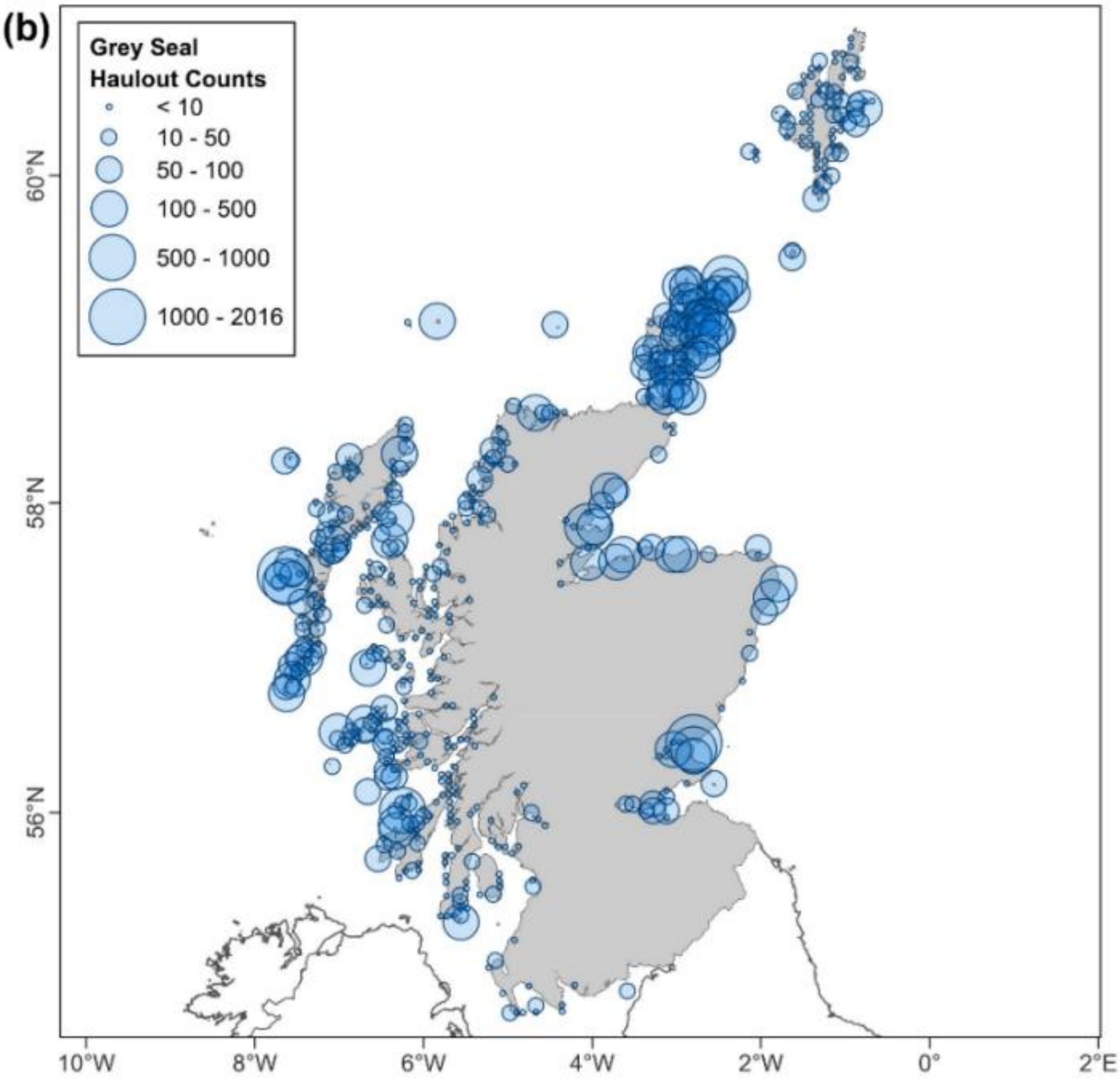


Table 4.8: Protected Seal Haul-out Sites in Scotland

Haul-out Site	Distance to Bellrock WFDA (km)	Species
Ythan River Mouth	119	Grey seals
Fast Castle	156	Grey seals
Craigleith	176	Grey seals
Kinghorn Rocks	199	Harbour/common and grey seals
Inchkeith	201	Grey seals
Inchmickery and Cow and Calves	210	Harbour/common and grey seals
Findhorn	225	Harbour/common and grey seals
Dunbeath-Wick	240	Grey seals
Dunbeath-Helmsdale	244	Grey seals
Ardersier	244	Harbour/common and grey seals
Lothmore	249	Harbour/common and grey seals
Brora	253	Harbour/common and grey seals
Duncansby Head	255	Grey seals
Pentland Skerries	256	Grey seals
Gills Bay	260	Harbour/common and grey seals
Stroma	263	Harbour/common and grey seals
South Ronaldsay East	263	Grey seals
South Ronaldsay West	264	Grey seals
Copinsay	266	Grey seals
Swona	267	Grey seals
Deer Sound	272	Harbour/common and grey seals
Switha	273	Harbour/common and grey seals
Auskerry	275	Grey seals
N Flotta	276	Grey seals
Calf of Flotta	277	Grey seals
North and East Fara	279	Harbour/common and grey seals
Bay of Houseby	280	Harbour/common and grey seals

Haul-out Site	Distance to Bellrock WFDA (km)	Species
Bay of Holland East and Tor Ness	281	Harbour/common and grey seals
Greenli Ness	283	Grey seals
Ve Ness	284	Harbour/common and grey seals
Odness	284	Harbour/common and grey seals
North East Hoy	284	Grey seals
Holm of Houton	286	Harbour/common and grey seals
North end Mill Bay	287	Harbour/common and grey seals
Linga Holm	288	Grey seals
Damsay and Holm of Grimbister	289	Harbour/common and grey seals
Sty Taing	290	Grey seals
Taing Skerry and Grass Holm	290	Harbour/common and grey seals
Holm of Huip	291	Grey seals
Little Linga	292	Grey seals
Gairsay	292	Grey seals
Selwick	292	Harbour/common and grey seals
Little Green Holm	293	Grey seals
Muckle Green Holm	293	Grey seals
Holm of Rendall	293	Harbour/common and grey seals
Holms of Spurness	293	Grey seals
Sweyn Holm	293	Harbour/common and grey seals
South East Egilsay	296	Harbour/common and grey seals
Seal Skerry (Eday)	297	Harbour/common and grey seals
Egilsay North	299	Harbour/common and grey seals
Calf of Eday	299	Grey seals
Solway Firth Outer Sandbank	300	Grey seals
Rusk Holm	301	Grey seals
South North Ronaldsay	302	Harbour/common and grey seals
Costa and Burgar	303	Harbour/common and grey seals

Haul-out Site	Distance to Bellrock WFDA (km)	Species
Eynhallow and Westside	303	Harbour/common and grey seals
South Westray	305	Grey seals
Seal Skerry (N Ronaldsay)	306	Grey seals
Skerry of Wastbist	308	Harbour/common and grey seals
Eilean nan Ron (Tongue)	308	Grey seals
Kyle of Tongue Sandbanks	309	Harbour/common and grey seals
Spo Ness to Ness of Brough	311	Harbour/common and grey seals
Holm of Papa Westray and North Wick	315	Harbour/common and grey seals
Lady Isle	316	Harbour/common and grey seals
Loch Eriboll & Whiten Head	317	Grey seals
Narr Ness	317	Harbour/common and grey seals
Eilean Hoan	325	Harbour/common and grey seals
Iolla Mhor	333	Grey seals
Horse Island	335	Grey seals
Lady's Holm	337	Harbour/common and grey seals
Toab and Scatness	338	Harbour/common and grey seals
Siggar Ness	339	Grey seals
Eilean Chrona	341	Grey seals
Glas-Leac Mor (Summer Isles)	341	Grey seals
Sound of Pladda Skerries	341	Harbour/common and grey seals
Glas-Leac Beag	342	Grey seals
Colsay & Bay of Scousburgh	345	Harbour/common and grey seals
Am Balg	347	Grey seals
Sule Skerry	349	Grey seals
Maywick	353	Harbour/common and grey seals
Little Scares	368	Grey seals
Holm of Beosetter	370	Harbour/common and grey seals
Aa Skerry	371	Harbour/common and grey seals

Haul-out Site	Distance to Bellrock WFDA (km)	Species
Sanda & Sheep Island	374	Harbour/common and grey seals
SW Rum	375	Grey seals
Da Smell Geo	376	Harbour/common and grey seals
Hoo Stack	376	Harbour/common and grey seals
Foula West	377	Grey seals
Gruting Voe North West Head	379	Harbour/common and grey seals
Trodday	380	Grey seals
Cairns of Coll	382	Harbour/common and grey seals
Dale	383	Grey seals
S Oronsay	383	Grey seals
Rumble, East Linga, Grif Skerry	383	Harbour/common and grey seals
Sgeir a' Phuirt	384	Harbour/common and grey seals
Oronsay Strand	385	Grey seals
Sgeir nam Maol	385	Grey seals
Fladda-chuain	387	Harbour/common and grey seals
Isle of West Burrafirth and Tainga Skerries	387	Harbour/common and grey seals
W Canna	388	Harbour/common and grey seals
Papa Stour	390	Grey seals
The Guens, Filla and The Benelips	390	Harbour/common and grey seals
Soa (Mull)	390	Grey seals
Swarta Skerry & Mo Geo	390	Harbour/common and grey seals
Nave Island	393	Grey seals
Sgeir Leathann (Broad Bay)	395	Harbour/common and grey seals
Hyskeir	396	Harbour/common and grey seals
Muckle Skerry (Out Skerries)	396	Harbour/common and grey seals
Soa (Coll)	397	Grey seals
Ve Skerries	397	Harbour/common and grey seals
Gunna	401	Grey seals

Haul-out Site	Distance to Bellrock WFDA (km)	Species
Skerries of Neapaback	402	Harbour/common and grey seals
Sligga Skerry and North End of Bigga	405	Harbour/common and grey seals
Isle of Stenness	406	Harbour/common and grey seals
Tinga Skerry	406	Harbour/common and grey seals
Ronas Voe	411	Grey seals
Little Holm	412	Harbour/common and grey seals
Point of Bugarth	416	Harbour/common and grey seals
Fetlar NW Islands	416	Harbour/common and grey seals
Uyea	418	Grey seals
Hough Skerries	420	Grey seals
Sound of Harris Islands	420	Grey seals
Coppay	433	Grey seals
Shillay (SoH)	437	Grey seals
Askernish Skerries South	442	Harbour/common and grey seals
Gasker	442	Grey seals
Aird Ghrein & Sgeir Liath	446	Harbour/common and grey seals
Sandray	448	Grey seals
Pabbay	450	Grey seals
Berneray	454	Grey seals
Causamul	454	Grey seals
Mingulay	455	Grey seals
Haskeir	461	Grey seals

4.9.3 Abundance and Density Estimates for Grey Seal

4.9.3.1 Seal Density Maps

155. The following sections provide the grey seal at-sea density estimates from habitat distribution maps for Scotland, derived from latest tracking data and updated estimates of seal abundance (Carter et al. 2025).

156. **Plate 4.16** shows the mean percentage of at-sea population estimated to be present in each 5 x 5 km grid square at any one time, in the wider area around the Bellrock WFDA as a percentage of the total UK population.

157. The relative seals at-sea abundance maps have been used to calculate grey seal density estimates for the Bellrock WFDA. The Carter et al. (2025) density maps are an update for the distribution of seals hauled-out in Scotland and are superior to the Carter et al. (2022) mapping, as it includes new tagging studies, including the UK, Ireland, and France.

158. The resultant density of seals at-sea maps (Carter et al. 2025) show the relative density of seals in each 5 x 5 km grid cell. Each grid cell shows the percentage of the overall seal population within the British Isles, which can then be related to the current best population estimate for each species. This ensures that the relative densities can be updated based on overall population level changes.

159. To calculate a density estimate based on the Carter et al. (2025) data, the current at-sea population of each species must be used. A correction factor is also applied to the overall population level to take account of those individuals that are estimated to be on land. **Figure 9.1.4** shows the mean percentage of at-sea population estimated to be present in each 5 x 5 km grid square at any one time (Carter et al. 2025).

160. The total grey seal population in Scotland, at-sea, is approximately 86,797 individuals (Carter et al. 2025). This at-sea estimate is based on the latest (2024) grey seal August counts for Scotland, which has been corrected for both those individuals that were not available to count (0.2515; SCOS-BP 21/02 in SCOS, 2021), and for those individuals that would be at-sea at any one time (0.8616; Russel et al. 2015). This is the population estimate is used in conjunction with the relative density maps from Carter et al. (2025) to calculate the density estimate using 5 x 5 km grids that overlap with the Bellrock WFDA.

161. The mean at-sea density estimate, 0.027 grey seal/km^2, has been calculated based on Carter et al. (2025) and taken forward in the impact assessment in **Chapter 9: Marine Mammals (Volume II)**.

4.9.3.2 Grey Seal Population Counts

162. Grey seal population trends are assessed from the counts of pups born during the autumn breeding season, when females congregate on land to give birth. The pup production estimates are converted to estimates of total population size (1+ aged population) using a mathematical model and projected forward (SCOS, 2024).

163. The most recent surveys of the principal grey seal breeding sites of Scotland, Wales, Northern Ireland and England, resulted in an estimate of 75,947 pups (SCOS, 2024). The most recent counts of grey seal in the August surveys 2016 – 2022, estimated that the minimum count of grey seals in

the British Isles was 44,833, the total wider reference population for Scotland was 20,943 and the total wider reference population for eastern England was 16,138 (SCOS, 2024).

164. These have also been corrected to take account of the number of seals not available to count during the surveys. Approximately 0.2515 grey seals are available to count within the August surveys (i.e. are hauled out). Therefore, this has been used as a correction factor (SCOS-BP 21/02 in SCOS, 2021), to derive total grey seal numbers within each MU, rather than the number counted within each MU. The reference population for grey seal is therefore currently based on the most recent estimates as shown in **Table 4.9**.

Table 4.9: Grey Seal Counts and Population Estimates

Population Area	Grey Seal Haul-out Count	Source of Haul-out Count Data	Correction Factor for Seals Not Available to Count	Grey Seal Total Population
Moray Firth	1,354	SCOS (2024)	0.2515	5,383
East Scotland	1,584			6,298
Northeast England	5,446			21,654
Total				**33,335**

165. Carter et al. (2025) have stated in their most recent publication that the Scotland population is now 86,797 grey seals versus 84,413 grey seals as stated in the SCOS (2022) publication (both figures including the population scalars), but the breakdown of the MU specific changes were not public at the time of the study. However, SCOS (2024) has now been published, and these population estimates will be used for the assessment Bellrock Wind Farm Infrastructure.

4.9.4 Diet and Foraging

166. Grey seals will typically forage in the open sea and return regularly to land to haul-out, although they may frequently travel up to 100 km between haul-out sites. Foraging trips generally occur within 100 km of their haul-out sites, although they can travel up to several hundred kilometres offshore to forage, with distances up to 448 km observed (SCOS, 2020). Grey seal generally travel between known foraging areas and back to the same haul-out site but will occasionally move to a new site. For example, movements have been recorded between haul-out sites on the east coast of England and the Outer Hebrides (SCOS, 2020). Grey seals are generalist feeders, feeding on a wide variety of prey species (SCOS, 2020), (Hammond and Grellier, 2006). This variety leads to the diet varying seasonally and from region to region (SCOS, 2020). Principal prey items are sandeel, whitefish (such as cod, haddock, whiting and ling *Molva molva*) and flatfish (plaice *Pleuronectes platessa*, sole *Solea solea*, flounder, and dab *Limanda limanda*) (Hammond and Grellier, 2006). Amongst these, sandeels are typically the predominant prey species. Food requirements depend on the size of the seal and fat content (oiliness) of the prey, but an average consumption estimate for an adult is 4-7 kg per seal per day depending on the prey species (SCOS, 2020).

4.10 Harbour Seal

4.10.1 Distribution

167. Harbour seals have a circumpolar distribution in the Northern Hemisphere and are divided into five sub-species. The population in European waters represents one sub-species *Phoca vitulina vitulina* and approximately 32% of European harbour seals are found in the UK, of which 85% are found in Scotland (SCOS, 2022). Harbour seals are widespread around the west coast of Scotland and throughout the Hebrides and Northern Isles, whereas on the east coast, their distribution is more restricted with concentrations in the major estuaries of the Thames, The Wash, the Firths of Forth and Tay, and the Moray Firth (SCOS, 2022).

168. Counts of harbour seals in East Scotland, Moray Firth, and Southeast England SMUs in 2021 were substantially lower than in the years leading up to the SCOS (2022) study. North Coast and Orkney and East Scotland SMUs are depleted and still declining, whereas Shetland and Moray Firth SMUs are depleted but stable (SCOS, 2024). Potential causal factors include competition with grey seal for prey and space, grey seal predation, disease, and some aspect of anthropogenic activity. It is likely that more than one factor is contributing to the population decline in harbour seals.

169. SMRU, in collaboration with others (Russell and McConnell, 2014), deployed 344 telemetry tags on harbour seals around the UK between 2001 and 2012. The spatial distributions reported indicated that harbour seals persist in discrete regional populations, display heterogeneous usage, and generally stay within 50 km of the coast. Tagged harbour seals were observed to have a more coastal distribution than grey seals and do not travel as far from haul-outs. Several studies exist that analysed tracking data by tagged individuals through which habitat preferences were deduced.

170. Harbour seals generally make smaller foraging trips than grey seals. Tracking studies have shown that harbour seals travel 50 – 100 km offshore and have been recorded to travel a up to 200 km between haul-out sites (Lowry et al. 2001), (Sharples et al. 2012). The range of these trips varies depending on the location and surrounding marine habitat. The typical and average foraging range for harbour seal is within 40-50 km (SCOS, 2021). Tracking data analysed in Carter et al. (2022) produced a radius based on the maximum geodesic distance of 273 km for harbour seals representing the species' maximum foraging range.

171. An early study by Carter et al. (2020) deployed harbour seal tags (n=239) between 2006 and 2017, confirms the observations made by Russell and McConnell (2014) that harbour seals venture less far offshore than grey seals, and that they do not travel far from their haul-outs (**Plate 4.18**) (Carter et al. 2020). Following this study, Carter et al. (2022) created habitat-based predictions of at-sea distribution for harbour seal around the British Isles, which has again been updated by Carter et al. (2024), although the underlying data is nearly identical. To address a knowledge gap of harbour seals in Shetland, the most recent estimates include newly added satellite tracking data to identify the at-sea usage by seals hauled-out in Scotland. Due to the international movement of seals, the habitat models were based on data from 222 harbour seals tagged across the UK, Ireland, and France. **Plate 4.19** (Carter et al. 2025) highlights again that harbour seals stay close to the coast and that they appear to remain within the region of the haul-out they have been tagged in.

Plate 4.18: GPS Tracking Data for Harbour Seals Available for Habitat Preference Models

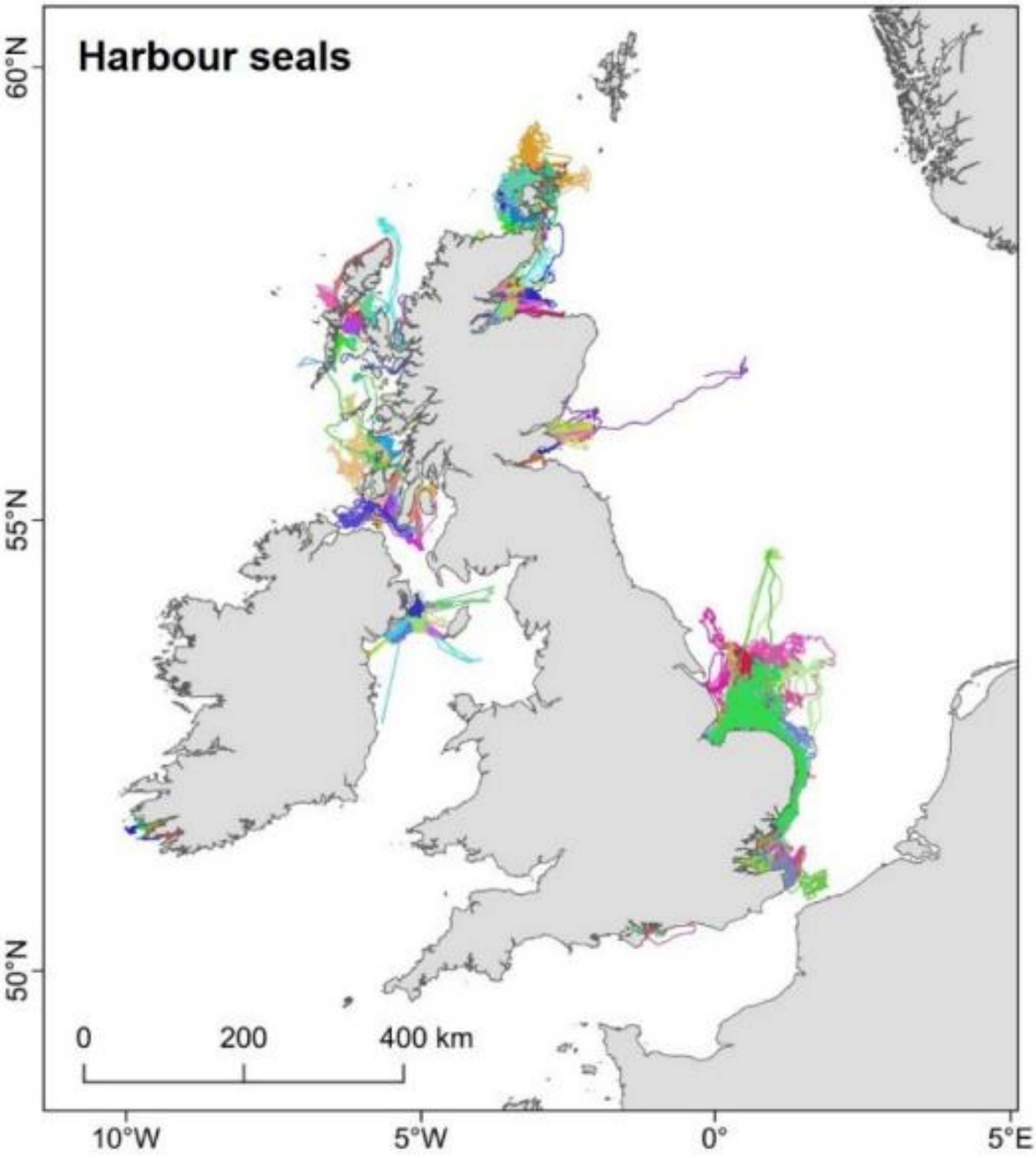
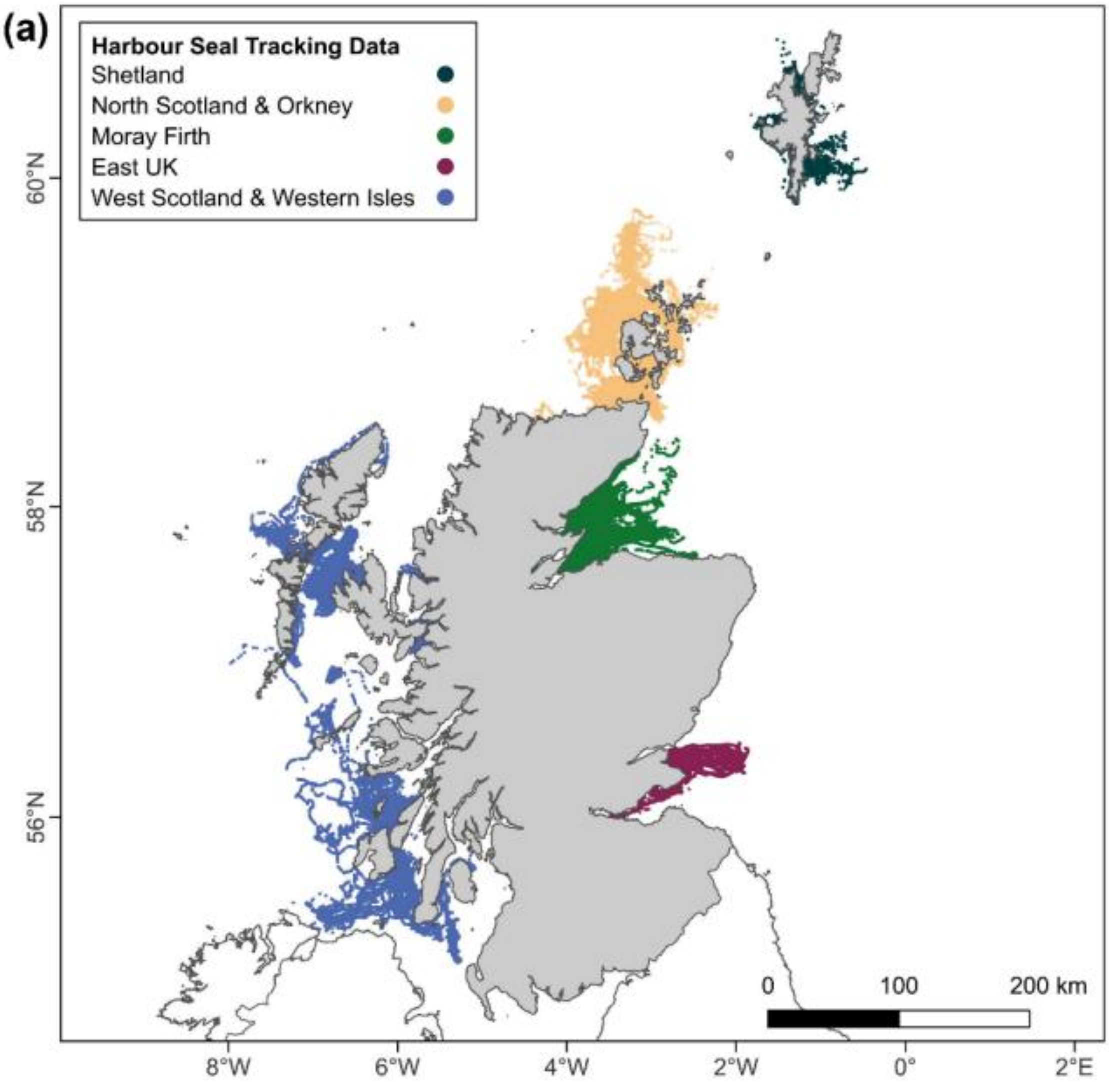


Plate 4.19: Tracking Data for Harbour Seals (N=222) Hauling Out in Scotland



4.10.2 Haul-out Sites

172. Harbour seal come ashore in sheltered waters, typically on sandbanks and in estuaries, but also in rocky areas. They regularly haul-out on land to rest and digest food during low tide. Harbour seals give birth to their pups in June and July and pups can swim almost immediately after birth.

173. In August, when moulting occurs, they spend a higher proportion of their time on land compared to other times of the year (SCOS, 2020). During this period, the females will continue to forage at sea, though they regularly return to their pup which can limit the foraging distance, therefore, at sea distribution may vary during these months (Bailey et al. 2014).

174. **Table 4.10** shows the harbour seal only haul-out sites within 350 km of the Bellrock WFDA **Table 4.8** shows the distance for harbour and grey seal shared haul-out sites in Scotland, but there are no harbour seal haul-out sites within 199 km of the Bellrock WFDA (see **Plate 4.20**).

Plate 4.20: Haul-out Count for Scottish Harbour Seals During August Surveys Between 2011 – 2023

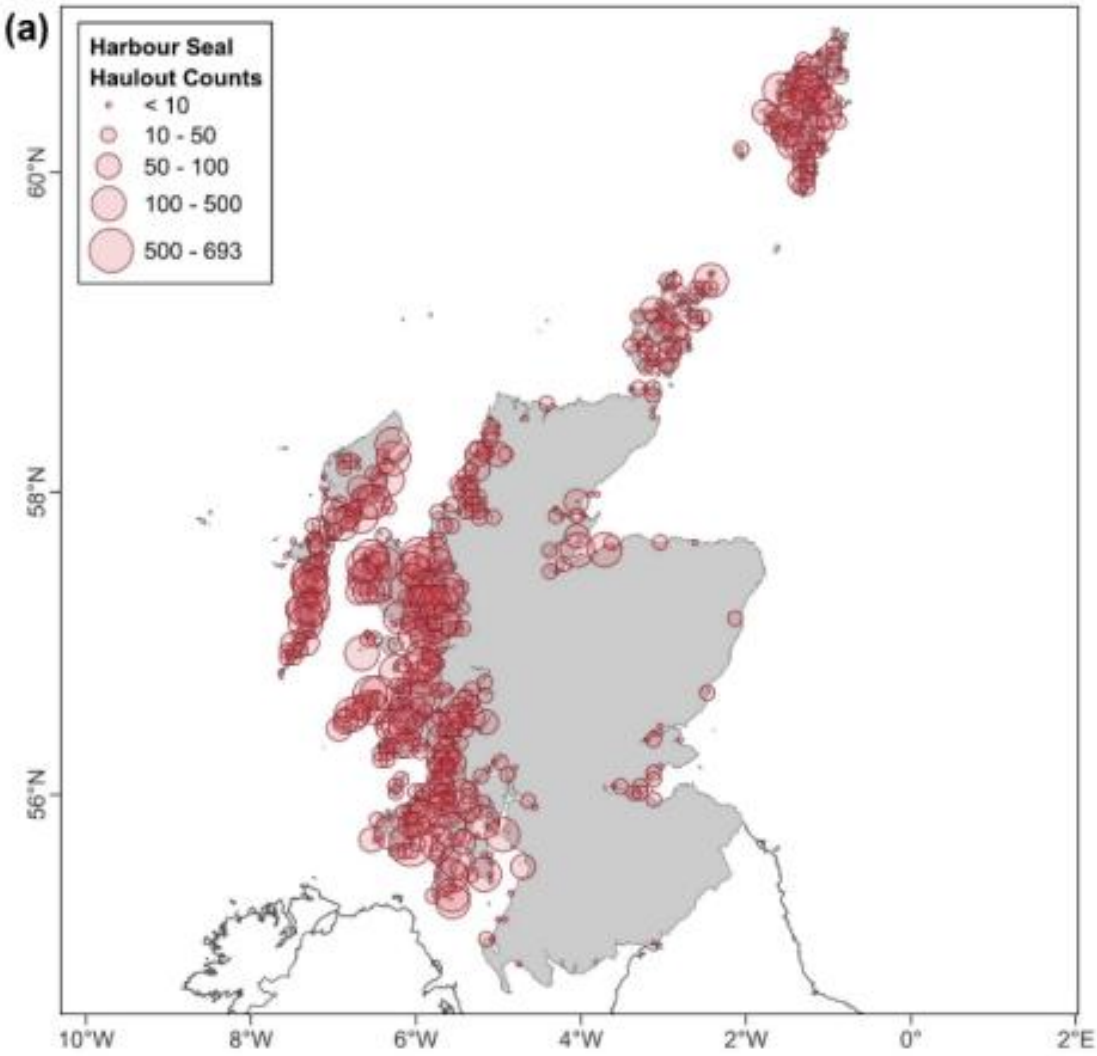


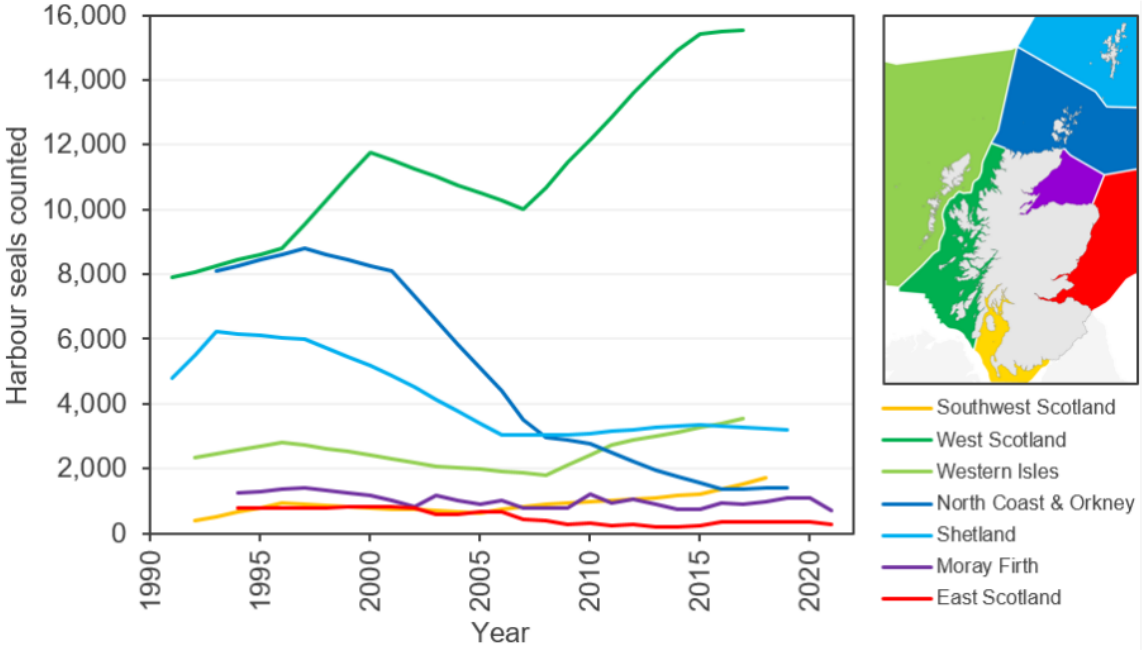
Table 4.10 Protected Harbour Seal Only Haul-out Sites in Scotland

Haul-out Site	Distance to Bellrock WFDA (km)	Species
Beauly	257	Harbour/common seal
Loch Fleet	259	Harbour/common seal
Cromarty Firth	263	Harbour/common seal
NW Water Sound	272	Harbour/common seal
Flotta Oil Terminal	278	Harbour/common seal
Barrel of Butter	282	Harbour/common seal
Cava	282	Harbour/common seal
Helliar Holm North & Elwick	286	Harbour/common seal
Bay of Ireland	294	Harbour/common seal
Holm of Scockness	300	Harbour/common seal
Kishorn Island & Strome Islands	332	Harbour/common seal
Carn nan Sgeir	333	Harbour/common seal
Rubha Creag Iomhair	337	Harbour/common seal
Sgeirean Glasa	338	Harbour/common seal
East End of Sound of Mull	340	Harbour/common seal
Tros Wick	343	Harbour/common seal
Pabay & Ardnish Peninsula	345	Harbour/common seal
Arisaig	347	Harbour/common seal
Channer Wick & Hos Wick	349	Harbour/common seal
E South Shetland	350	Harbour/common seal
Note: For harbour seals 273 km representing the species' maximum foraging range (Carter et al. 2022)		

175. The majority of knowledge on overall harbour seal abundance is from annual aerial surveys in Scottish waters. There have been noted temporal shifts in haul-out distribution detected in some areas of Scotland, potentially due to localised variation (Cordes et al. 2011). The most recent assessment has concluded that the overall trend in Conservation Status was Unfavourable – Inadequate due to declines being observed in some areas and future prospects appear poor for the population (JNCC, 2019).

176. The main concentration of harbour seal haul-outs are in west Scotland (including the Inner Hebrides), where 60% of all harbour seals have been counted. The counts for seals in different Seal MUs around Scotland have shown the Moray Firth and east Scotland to have relatively stable numbers of harbour seals since 1991 (**Plate 4.21** (SCOS, 2022)).

Plate 4.21: Harbour Seal Counts in Seal MUs Around Scotland from 1991-2021



4.10.2.1 Seal Density Maps

177. Impact assessments are based on densities as derived from desk-based sources. Carter et al. (2022) provide habitat-based predictions of at-sea distribution for harbour seal around the British Isles. The habitat preference approach predicted estimates per species, on a 5 x 5 km grid of relative at-sea density for seals hauling-out in the British Isles. Similarly, an update for Scottish habitat-based predictions were recently published by Carter et al. (2025). While the map is an update to Carter et al. (2022), the data (as a raster file) does not extend to the Bellrock WFDA and is cut at where the tracking data suggests seals would not be present (see **Plate 4.19**). As such, the updated Carter et al. (2025) data will not be used for harbour seal density estimates and instead, as a precautionary measure, density estimates from the Carter et al. (2022) maps will inform the impact assessment.

178. To calculate a density, estimate to be used in assessments from the Carter et al. (2022) data, the current at-sea population of each species must be used. A correction factor is also applied to the overall population level to take account of those individuals that are estimated to be on land (**Figure 9.1.5** shows the mean percentage of at-sea population estimated to be present in each 5 x 5 km grid square at any one time (Carter et al. 2022)).

179. The total harbour seal population in the British Isles, at-sea, is approximately 40,525 individuals, based on the correction factors for both the number of harbour seals not available to count (0.72;

Lonergan et al. 2013), and for the those at-sea (0.8236; Russell et al. 2015), as well as the most recent haul-out counts for the UK and RoI (total count of 29,178 individuals; SCOS, 2024). The harbour seal density estimates for the Bellrock WFDA have been calculated from the latest seal at sea maps produced by SMRU (Carter et al. 2022), based on the 5 x 5 km grids that overlap with the Bellrock WFDA.

180. The mean at-sea density estimate, 0.000000014 harbour seal/km^2, has been calculated based on Carter et al. (2022) and taken forward in the impact assessment in **Chapter 9: Marine Mammals (Volume II)**.

4.10.2.2 Harbour Seal Population Counts

181. Harbour seal are counted while they are on land during their August moult, giving a minimum estimate of population size (SCOS, 2022). Combining the most recent counts (2022) gives a total of 34,763 counted in the UK and RoI. Scaling this by the estimated proportion hauled out (0.72 (95% CL = 0.54-0.88)) produces an estimated total population for the UK in 2022 of 48,419 harbour seals.

182. Tagging maps (as shown in **Section 4.10.1**) illustrate that it is very unlikely that harbour seal will be present in the Bellrock WFDA. Based on the known foraging ranges and areas to which Scottish harbour seals swim to (considering Carter et al. (2020) tracking data), the East Scotland MU, despite its low population number, is the most suitable to represent the wider reference population and allows for a realistic approach for the harbour seal population.

183. The wider reference population for harbour seal is therefore currently based on the most recent estimates as shown in **Table 4.11**.

Table 4.11: Harbour Seal Counts and Population Estimates

Population Area	Harbour Seal Haul-out Count	Source Of Haul-out Count Data	Correction Factor for Seals Not Available to Count	Harbour Seal Total Population
East Scotland MU	276	SCOS, 2024	0.72	383

4.10.3 Diet and Foraging

184. Harbour seal take a wide variety of prey including sandeels, gadoids, herring, sprat, flatfish and cephalopods. Diet varies seasonally and regionally, prey diversity and diet quality also showed some regional and seasonal variation (SCOS, 2020). It is estimated harbour seals eat 3 – 5 kg per adult seal per day depending on the prey species (SCOS, 2020) and the likely daily ration suggests approximately 3 kg of fatty fish or up to 5 kg of whitefish per day (BEIS, 2022).

185. The range of foraging trips varies depending on the surrounding marine habitat. Telemetry studies indicate that the tracks of tagged harbour seals have a more coastal distribution than grey seals and do not travel as far from haul-outs.

5 Predicted Future Baseline

186. Marine mammals in the North Sea are increasingly vulnerable to the effects of climate change and other anthropogenic pressures, as it is one of the most intensively utilised seas in the world (Matthijsen et al. 2018). OSPAR's Quality Status Report from 2023 reported that the status of seals and small toothed cetaceans (dolphins and harbour porpoise) is not good while the status of other marine mammals remains unknown (OSPAR, 2023). The assessment in the report has noticed limited improvements as compared to previous assessments.

187. Significant change has been documented in many aspects of the UK marine environment in BEIS (2022). These changes include rising sea temperatures, biogeographical shifts in many zooplankton assemblages, with a northward extension of warm-water species and changes in the distribution and abundance of fish species, with southern species becoming more prominent. This is likely due to a variety of factors, including climatic influences, nutrient inputs and anthropogenic factors, such as fishing. These observations are in line with the those of the OSPAR Quality Status Report 2023, whereby the state of marine food webs was deemed to be of great concern.

188. Warming sea surface temperatures, driven by global climate change, are projected to rise by 1.5–3°C by the end of the 21st century, depending on future greenhouse gas emissions (OSPAR, 2017). These temperature increases, combined with shifts in oceanographic conditions, will likely disrupt the abundance and distribution of key prey species such as sandeels and small pelagic fish, which are critical for species like harbour porpoises (MacLeod et al. 2007; OSPAR, 2017).

189. As prey availability declines or shifts to cooler, northern waters, marine mammals may experience distributional shifts, with range contractions likely in southern parts of the North Sea where conditions become less favourable. This trend has already been observed in other regions where prey stress has impacted marine mammal populations, reducing reproductive success and survival rates. This trend also affects distribution, abundance and migration patterns, community structure, and susceptibility to disease and contaminants (Learmonth et al. 2006; Evans and Waggitt, 2020).

190. The changing climate will also impact critical habitats for seals, particularly low-lying haul-out sites and breeding grounds in coastal areas such as the Wadden Sea. Submergence of haul-out sites and habitat degradation may force seals to relocate to alternative areas, although their ability to establish new colonies will be limited in a region characterised by intense human activity and coastal development.

191. Grey seals have been noted to predate on harbour seals, which have shown a declined population in recent years. This predation has potentially demonstrated asymmetric intraguild predation whereby the predation event targets a species with which it competes for a prey resource (Brownlow et al. 2016). Given the changing climate impacting critical habitats, alongside the asymmetric intraguild predation, harbour seals could potentially continue to decline in numbers.

192. Changes in ocean temperatures could also affect species that require a specific range of water temperatures in which they can physically survive (Learmonth et al. 2006; MacLeod et al. 2007; Evans and Waggitt, 2020). Species of marine mammal with a narrow range of temperature

tolerance, such as species of the Phocidae (earless seals such as grey and harbour seal), have been shown to be more susceptible to the effects of climate change (Orgeret et al. 2022).

193. At the same time, the North Sea is undergoing rapid industrialisation, driven by the expansion of offshore renewable energy in the last twenty years and the emergence of carbon capture and storage projects. While oil and gas activities were prospering in the past, they are now experiencing declines in oil production with the lowest production measured since its beginning in 1970 (Taylor et al. 2024). Gas production peaked in the early 2000s and due to resource depletion, production has been in a steady decline since then (University of Aberdeen, 2006).

194. Shipping, already at high levels in the North Sea, is projected to increase further (OSPAR, 2023); (Robbins et al. 2022), exacerbating underwater noise pollution and increasing the risk of ship strikes. In addition, fisheries interactions remain a persistent threat, particularly through bycatch.

195. As fish distributions shift due to climate change, fishing practices may also intensify in new areas, further increasing bycatch risks unless effective mitigation strategies are widely adopted (Ojea et al. 2020).

5.1 Harbour Porpoise

196. The effects of climate change on harbour porpoise populations are still relatively unknown, however, it is expected that there will be impacts to the population through prey depletion and range shifts. Harbour porpoise habitat and population range is determined from their preferred prey availability. Therefore, a change in prey range has the potential to cause a change in the distribution of harbour porpoise (Evans and Bjorge, 2013; Ransijn et al. 2019). Although harbour porpoise feed on a range of prey, sandeels are their preferred item due to their high nutritional value. A decline in sandeel populations was thought to have impacted the distribution of harbour porpoise in the Scottish North Sea (MacLeod et al. 2007). With the recent ban of the sandeel fishing in the UK (European Commission, 2024), this closure might have cascading effects on the marine food web (Marine Directorate, 2023). Consequently, it could enhance food availability for harbour porpoise, reducing starvation and potentially stabilising their population.

197. Data from SCANS I to SCANS IV suggested that the abundance of harbour porpoise in the NS MU (for which there are enough data to assess trends) is stable between surveys (Gilles et al. 2023, IAMMWG, 2021, IAMMWG. et al. 2015). SCANS IV suggests that data for the North Sea is positive but with poor precision, and therefore similar to no trend as there is a potential for small declines in the dataset. However, this leads to a conclusion the harbour porpoise population in the North Sea is stable. A study of the impact of climate change on the species range and distribution in van Weelden et al. (2021) suggested a northward shift and expansion of harbour porpoise range, similar to MacLeod et al. (2009), but no increase in maximum latitude. This shift may lead to range contraction and present a risk for northwest European populations with their preference for sub-polar to temperate water temperature.

198. Climate change may impact on harbour porpoise prey distribution and abundance (see **Chapter 8: Fish and Shellfish Ecology (Volume II)** for effects on prey species). Evans and Bjørge (2013) predicted that rising sea temperatures may enhance stratification, forcing earlier occurrence of the spring phytoplankton bloom and potential cascading effects through the food chain. A study by

Sadykova et al. (2020) predicted a large future distribution shift in sandeel and harbour porpoise habitat overlap (164 km) but a small shift (16 km) in overlap between herring *Clupea harengus* and harbour porpoise.

199. The most recent UK assessment of favourable conservation status shows that the current range of harbour porpoise covers all of the UK's continental shelf and there appears to have been no change in range since 1994 (JNCC, 2019d), (Paxton et al. 2016). The future trend in the range of this species has therefore been assessed as 'overall stable (good)'. Due to insufficient data, the future trend in the population and consequently future prospects of harbour porpoise was assessed as 'unknown'. As a result of the establishment of SACs for this species in UK waters, the future prospects for the supporting habitat was assessed as 'good'. The report on conservation status assessment for the species concluded that, assuming that conservation measures are maintained and further measures are taken should other pressures emerge (or existing pressures change) then the future prospects for harbour porpoise in UK waters (which includes the Bellrock WFDA) should remain 'favourable' (JNCC, 2019d).

200. National monitoring in the Southern North Sea showed that the seasonal pattern of occurrence has changed. For example, harbour porpoise in the southern part of the North Sea show a higher abundance in winter and spring and lower abundances in summer (Camphuysen, 2011); (Scheidat et al. 2012). Recently, this pattern has changed (2012–2017); harbour porpoise abundance increased in summer and abundance and density are now comparable to spring (Geelhoed and Scheidat, 2018; Nachtsheim et al. 2021).

201. In the German sector of the North Sea, harbour porpoise abundance has been in decline in summer between 2002 and 2019, as well as local and seasonal differences in trends. The underlying causes for the observed trends are unknown but it is suggested that cumulative effects of a number of stressors could be the cause. However, it is acknowledged that there is a lack of data on population trends that could be driven by anthropogenic activities (Nachtsheim et al. 2021). Therefore, more research is required to look at harbour porpoise population trends in the wider North Sea as there is little documentation on porpoise population trends in the area of interest.

5.2 Bottlenose Dolphin

202. The observed distribution of bottlenose dolphins in SCANS-III in 2016 was similar to that observed in SCANS-II and Cetacean Offshore Distribution and Abundance in the European Atlantic (CODA) in 2005/07 (Hammond et al. 2009; Hammond et al. 2013; Hammond et al. 2021). The total abundance estimate for SCANS-III in 2016 of 120,500 (CV = 0.165) is considerably greater than that from 2005/07 of 35,900 (CV = 0.21) (Hammond et al. 2021; Working Group on Marine Mammal Ecology (WGMME), 2017). The difference in abundance estimates between 2005/07 and 2016 may reflect bottlenose dolphins responding to spatial variation in prey availability across the wider range (Hammond et al. 2021).

203. In SCANS-III there was an increase in predicted densities of bottlenose dolphin off the southwest coast of Britain and northwest coast of Spain since 2005, indicating that the species may be increasing its range northwards over time in response to climate change, warming seas and prey availability. There has been an increasing range expansion of the bottlenose dolphin from the Moray Firth. With an increase in the number of dolphins using areas along the east coast of

Scotland, such as St Andrews Bay and the Tay estuary, 300 km south of the Moray Firth SAC (Arso Civil et al. 2019). There has also been a recent increase in bottlenose dolphins in the northeast of England (Aynsley, 2017), with one individual from the Moray Firth population being recorded as far south as The Netherlands.

204. However, in more recent studies it has been noted that a slight decline of 4.9% from 2017-2022 for bottlenose dolphins using the Moray Firth SAC. Despite this decline, the number of dolphins using the SAC between 2001 – 2022 shows interannual variability but the numbers appear stable over the long-term. Although the numbers showed a slight drop in bottlenose dolphins using the Moray Firth SAC, it's still noted that the population is increasing on the east coast of Scotland (Cheney et al. 2024). Also, in the SCANS-IV summer survey in 2022, the population in the east coast Scotland are continuing to show signs of an increase and range expansion (Geelhoed et al. 2023; Gilles et al. 2023).

205. The Moray Firth population is a regular visitor to the east coast of England during the summer months; and potentially could be evidence of a new population becoming residents in the area, perhaps an expansion of the Moray Firth dolphins ranges. This shift in bottlenose dolphin distribution is most likely due to a change a prey distribution (Hackett, 2022).

5.3 Common Dolphin

206. Common dolphin occurrence has increased in the Celtic Sea, as well as southwest of UK and in the western part of the English Channel, suggesting that the population range may be expanding further north (see also Macleod et al. 2008; Williamson et al. 2021).

207. SCANS- III predicted high densities of common dolphin in the Celtic Sea in 2016, focused on shelf waters off the southwest of England and northwest coast of Spain, and this species is regularly seen around coastal regions of Cornwall. The estimated density areas have shifted northwards over time, with high numbers expected within the southern North Sea in 2016 compared to 2005 (Hammond et al. 2013; 2021).

208. Between 1994 and 2010 the population in the UK has remained relatively stable. However, there are noted fluctuations on approximately decadal time scales (Paxton et al. 2016).

209. Common dolphins prefer a warm temperate or tropical environment (thermophilic) and are noted as having a flexible diet (Marçalo et al. 2018). Therefore, it may be expected that this species will move into more northerly regions as sea temperatures rise and prey availability changes at the same time (Williamson et al. 2021).

210. In the SCANS-IV survey in the summer of 2022, common dolphin was encountered in the North Sea, therefore showing a more northly distribution compared to previous SCANS surveys (Gilles et al. 2023).

5.4 White-beaked Dolphin

211. Studies have found colder-water adapted species, such as white-beaked dolphin, have been seen less frequently in British waters, potentially due to climate change effects (IAMMWG, 2023; Williamson et al. 2021; Evans and Waggitt, 2020). However, the observed distribution of white-beaked dolphin in 2022 (SCANS-IV) was similar to that observed in SCANS-III in 2016, SCANS-II in 2005 and in SCANS-I in 1994 (Gilles et al. 2023; Hammond et al. 2002, 2013, 2021). The estimate of abundance of white-beaked dolphin in 2022 of 67,138 (CV = 0.33) was higher than previous estimates, with SCANS-III being 36,287 (CV = 0.29) in 2016, SCANS-II was 37,689 (CV = 0.36) in 2005 and SCANS was 23,716 (CV = 0.30) in 1994.

212. SCANS-IV found no evidence of a trend in abundance of white-beaked dolphin in the North Sea since the mid-1990s (Hammond et al. 2021); (Gilles et al. 2023). A review of the strandings data of white-beaked dolphin in the North Sea were collated and assessed by Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (IJsseldijk et al. 2018) in order to determine temporal and spatial trends in the distributions of white-beaked dolphin in the SW North Sea. Strandings data used within the review were from Belgium, Germany, the Netherlands and the UK, from 1991 to 2017. This review indicates that there has been a reduction in the abundance of white-beaked dolphin in the southeast coasts of the UK, with an increase in the northeast area (IJsseldijk et al. 2018). These changes probably reflect changes in prey distribution as a result of climate change.

213. Around northwest Scotland in the period 1992 to 2003, the relative frequency of strandings of white-beaked dolphin (a colder water species) declined, while strandings of common dolphin (a warmer water species) increased. Similarly, sightings surveys in the area also showed that the relative occurrence and abundance of white-beaked dolphins had declined, and common dolphins increased, in comparison to previous studies. These observations were consistent with changes in the local cetacean community, being driven by increases in local water temperature (MacLeod et al. 2005). This study demonstrates that climatic changes have been driving the expansion of species distribution ranges. Although the study focused on northwest Scotland and no equivalent research is known for the North Sea, it can be inferred that future shifts in species distributions may occur.

5.5 Killer Whale

214. During the last decade, killer whales have become more common off East Greenland. However, it is unknown if this shift in distribution and/or abundance is related to a shift of prey, increasing water temperatures, decreasing ice cover or a combination of these factors (Ugarte et al. 2013).

215. Off Norway, shifts in the herring wintering distribution since 2007 have resulted in a possible increase in killer whale abundance during these months. The wintering ground for the Norwegian spring spawning stock of herring, formerly located in inner fjords of the Lofoten region, shifted to more open waters mainly located between 69°N and 73°N (Huse et al. 2010) over the last decade. The displacement of the wintering herring ground to a more open area may have brought this abundant prey resource within the reach of additional killer whale groups, as suggested by new adult individuals identified since 2011 that were not present in the former catalogues. However,

such increase in killer whale abundance on the herring wintering ground is likely to reflect shifts in killer whale distribution from other locations in response to a dynamic prey resource rather than an increase in abundance of killer whales (NAMMCO, 2024).

216. The future of killer whale populations along the east coast of Scotland remains cautiously optimistic, though nuanced by ecological pressures and limited demographic resilience. While sightings in this region are sporadic, they often involve individuals from the Northern Isles community, which exhibits seasonal inshore movement patterns (Deecke et al. 2011). These whales are known to traverse vast North Atlantic ranges, complicating localized population assessments.

217. The SCANS surveys indicated stable or slightly increasing trends in overall marine mammal abundance in European Atlantic waters, including Scottish seas (Hammond et al. 2017; Gilles et al. 2024). Although killer whales were not among the most frequently observed species, their presence within these surveys suggests continued viability in the region, especially where prey availability remains sufficient.

218. However, the long-term outlook is tempered by genetic and social constraints. The West Coast Community, a small and isolated group of killer whales in Scottish waters, has shown no evidence of reproduction and suffers from low genetic diversity (Foote et al. 2010). If similar demographic patterns exist among east coast individuals, population sustainability could also be at risk.

5.6 Minke Whale

219. The abundance estimate of minke whale from SCANS-IV is slightly lower compared to SCANS-III survey and a trend analysis has shown no support for change in abundance in the North Sea since 1989 (Gilles et al. 2023). However, a decade of acoustic observations in the western North Atlantic have shown important distributional changes over the range of baleen whales, mirroring known climatic shifts (Davis et al. 2020).

220. A study by Sun et al. (2022), using predictive distribution modelling for the North Atlantic minke whale, has identified a reduction in future suitable habitats and a poleward shift in response to warming climates, depending on the climate scenarios used in the models. For instance, under the worst-case climate scenario, the North Sea region has been predicted to be a loss of minke whale habitat in the year 2100 (Figure 8 in Sun et al. 2022).

221. Similar results for other baleen species (e.g. blue whale *Balaenoptera musculus* and sperm whale *Physeter macrocephalus*) were highlighted in Peters et al. (2022) that also modelled future suitable habitat these species in New Zealand waters. In line with Sun et al. (2022), the research by Peters et al. (2022) revealed a shift towards higher latitudes (i.e. polewards) in response to several climate scenarios. This higher latitude shift was likely to be driven through changes in prey composition and sea surface temperatures. Similar observations were made in the UK, in which changes in local cetacean communities were observed driven by increases in local water temperature (minke whale was not investigated in this study). Changes are expected to have significant impacts on the local ecosystem (Sun et al. 2022; Peters et al. 2022; McLeod et al. 2005).

5.7 Fin Whale

222. As noted above in **Section 4.7**, Pike et al. (2019) observed an increase in fin whale numbers around the Faroe Islands and south of Iceland in recent years, compared to earlier surveys conducted by NAMMCO. It is speculated that this could be due to a northern incursion of fin whales into the area from the Spanish stock area, where both earlier and recent surveys found fin whales to be abundant (Buckland et al. 2001; Hammond et al. 2013; Hammond et al. 2017; Gilles et al. 2023).

223. The distribution of fin whales is known to be cosmopolitan, whereby they occur worldwide with populations in the Atlantic, Pacific and Southern Oceans (Rice, 1998). The species migrate seasonally, and in relation to the UK this normally is associated with the western side of Ireland and Scotland, keeping to the oceanic shelfs to feeding grounds near the arctic circle. Historically, during the whaling times of the 19th and 20th centuries, fin whales were heavily exploited off the coast of Scotland until the whaling stations in Scotland ceased operations in 1929. Fin whales constituted the largest proportion of catches in this area, with the records suggesting the species were relatively abundant off northwest Scotland and it is considered likely that this area is still important for the species (Macleod et al. 2007).

224. The main impacts to fin whale populations in the North Sea are similar to those of humpback whale and all mysticetes as noted below in **Section 5.8**. This includes disturbance, ship collisions, entanglement, and crucially, changes in food supply (Leopold et al. 2018). The difference between fin and humpback whales is that fin whales appear further from coastal areas and therefore the coastal anthropogenic activities are less of an issues for fin whales.

225. Kahane-Rapport et al. (2022) found that mysticetes (humpback whale, fin whale, blue whale) predominantly feed at depths of between 50 m and 250 m which coincides with the highest measured microplastic concentration in the studied pelagic California Current Ecosystem, predicting whales that feed on fish may be less exposed to microplastic ingestion than those that feed on krill. However, concentrations of persistent organic pollutants (POPs) tend to be lower in mysticetes in comparison with odontocete species due to their foraging preferences for lower trophic levels and generally shorter life spans.

226. Heavily hunted during the industrial whaling period in the first half of the 20th century, fin whales were severely depleted. Globally the species is considered Vulnerable on the IUCN Red List of Threatened species because the remaining population is considered to be such a small fraction of what it was before modern whaling. The species is listed under Appendix I of the Convention on Migratory Species and global population estimates are difficult to obtain due to the species' dispersal over deep open oceans that are difficult to survey with traditional methods. However, it has been estimated that there are around 80,000 fin whales in the North Atlantic (Cooke, 2018)

227. Given the anthropogenic pressures noted above, the mortality and disturbance from these are considered to be less than the historic whaling of the species, coupled with the warming seas from climate change, the numbers of fin whales within Scottish waters is still expected to increase for the predicted future. However, fin whaling has resumed in Greenland and Iceland, where the numbers of whales caught since the year 2,000 is 173 individuals (NAMMCO, 2025).

5.8 Humpback Whale

228. Following a severe decline due to commercial whaling, humpback whale populations in the North Atlantic region have been undergoing steady recovery during the latter part of the twentieth century (Johnson and Wolman, 1984; O'Neil et al. 2019). In the western North Atlantic, entanglement in static fishing gear, namely crab and lobster creels (pots), is currently considered to be the largest source of anthropogenic mortality and injury for this species (Leaper et al. 2022; Ryan et al. 2016). There are reported stranding records of humpback whales in the southern North Sea (Haelters et al. 2010), however sightings of large mysticetes are infrequent. Specifically, no abundance estimate exists for humpback whales in Scottish waters and SCANS and Cetacean Offshore Distribution and Abundance visual surveys did not detect any between 1994 and 2017 (Hammond et al. 2017). However, influxes of humpback whales into the Firth of Forth were reported in 2017 and 2018, during migration (O'Neil et al. 2019).

229. The main impacts on humpback whale populations in the North Sea includes disturbance, ship collisions, entanglement and crucially, changes in food supply (Leopold et al. 2018). Humpback whales occur close to shore and therefore coastal areas with high human activity. Fournet et al. (2018) showed that humpback whales in foraging grounds in the North Pacific and North Atlantic have increased the source levels of their calls as ambient noise levels increased, suggesting increasing ocean noise may lead to masking impacts on the species. Increased disturbance to humpback whale due to increasing marine tourism is also thought to be potentially significant, if not managed carefully (Schaffar et al. 2010).

230. Another threat to humpback whales is entanglement in fishing gear, which is increasing in Northeast Atlantic and European waters (Basran et al. 2019; Ryan et al. 2016). At least 25% of 379 individual humpback whales photographed off Iceland showed evidence of non-lethal entanglements with fishing gear (Basran et al. 2019).

231. Concentrations of POPs tend to be lower in mysticetes in comparison with odontocete species due to their foraging preferences for lower trophic levels and generally shorter life spans. In a study by (Ryan et al. 2013), polychlorinated biphenyl (PCB) and dichlorodiphenyltrichloroethane concentrations in humpback whales sampled in the eastern North Atlantic were found to be lower than threshold toxicity levels for blubber in marine mammals. The non-selective foraging technique of mysticete species such as humpback involves ingesting material surrounding the intended prey in the water could result in exposure to microplastic, with Besseling et al. (2015) reporting the first case of microplastic in intestines of a mysticete from the North Sea.

232. Kahane-Rapport et al. (2022) found that mysticetes (humpback whale, fin whale, blue whale) predominantly feed at depths of between 50 m and 250 m which coincides with the highest measured microplastic concentration in the studied pelagic California Current Ecosystem, predicting whales that feed on fish may be less exposed to microplastic ingestion than those that feed on krill.

5.9 Grey Seal

233. Grey seals were exploited in large scale culls in the 1960s and 1970s in the North Sea, Orkney and Hebrides as population control measure. Since the 1960s regular surveys began, which have shown that there has been a continual increase in the total UK grey seal pup production. Grey seal pup production at colonies in the North Sea increased rapidly with an average 7% annual increase (SCOS, 2022). The majority of the increase in the North Sea has been due to the continued rapid expansion of newer colonies on the mainland coasts in Berwickshire, Lincolnshire, Norfolk and Suffolk. Interestingly, these colonies are all at easily accessible sites on the mainland, where grey seals have probably not bred in significant numbers since before the last ice age (SCOS, 2020).

234. In the UK coast of the North Sea (i.e. East Scotland), pup production is increasing rapidly, suggesting that there is likely immigration from colonies further north. This was previously noted in SCOS reports and the colonies in the North Sea are still being shown to increase rapidly in population size, whereby the species in the area does not appear to be reaching their carrying capacity (SCOS, 2024). Modelling from SCOS (2024), estimates the population growth to be ~1.5% for the entirety of the UK, August pup counts also show a stable population for the Moray Firth and East Scotland, but increasing in eastern England.

235. Approximately 34% of the world's grey seals breed in the UK and 70% of these breed in Scotland (with highest concentrations in the Western Isles and Orkney, with the fastest growing colonies located in the central and southern North Sea. UK grey seal numbers are currently stable or increasing throughout their monitored range, suggesting that their population status is not under threat. Population dynamics depend on a colony,however, pup production at colonies in the North Sea is continuing to increase rapidly and does not show any indications of density dependent restraint on growth. SCOS (2024) stated the East Coast of Scotland SMU is continuing to increase rapidly, but the two SACs in the SMU show different trends in abundance. Production at the Isle of May increased exponentially to 9.9% p.a. since surveys began in 1979 (SCOS, 2022), however, it is now stable or potentially declining (SCOS, 2023). Pup production at Fast Castle, in the Berwickshire and North Northumberland Coast SAC, shows a rapidly increasing pup production and does not show any indication of reaching an asymptote (SCOS, 2024).

236. As top marine predators, grey seal are particularly vulnerable to biotoxins because they possess large fat stores that accumulate POPs. The analysis of POPs in blubber from weaned grey seal pups on the Isle of May detected POP concentrations below the values that could cause severe toxic effect. However, it was highlighted that even low concentrations are likely to cause endocrine disruption with unknown consequence for individual health and survival (Robinson et al. 2019). Most previous research focused on the transfer of contaminants through the trophic levels. Wilman et al. (2023), noted that mercury and polycyclic aromatic hydrocarbons (PAHs) in the lungs of the seals, with results suggesting the airborne influx of mercury and PAHs into the lungs from marine mammals to be plausible. This is of particular importance in juveniles (pups) who at the initial stage of life spend time on land and do not obtain food independently. Other threats to grey seals include entanglement in marine and plastic debris, particularly discarded fishing gear, disturbance and climate change affecting availability of prey.

237. In SCOS (2024), they advised it unlikely that observed high sea surface temperatures in 2023 (with particularly warm sea surface temperatures off the east of the UK from Durham to Aberdeen) will have significant direct impacts on either grey or harbour seals in terms of their physiology or

energetics, but any potential medium or longer term impacts are likely to be due to marine heatwave effects on grey seal prey species. SCOS (2024), highlighted that warmer temperatures are more likely to impact animals in terms of thermoregulation on land during breeding or haul out, rather than when swimming at sea (where a large thermal gradient between internal body temperature (37°C) and the cold sea water means seals remain in the thermoneutral zone).

5.10 Harbour Seal

238. Overall, the UK population of harbour seal has increased since the late 2000s and is close to the previous high observed during the 1990s (SCOS, 2021). However, there are significant differences in the population dynamics between seal MUs, with general declines in counts of harbour seals in several regions around Scotland and more recently in the southeast of England. SCOS (2024), noted the East Scotland SMU has depleted and still declining, with the Moray Firth and Shetland SMUs have also depleted but appear stable.

239. The 2019 decrease follows a period when growth rates had decreased to zero, possibly indicating that the population in the SE England SMU was approaching its carrying capacity. This could represent the first indication of a population decline. Additional surveys in 2020, 2021 and 2022 confirmed this continued decrease (SCOS, 2022).

240. The factors driving the population decline remain uncertain, but the most likely main drivers could be increased competition with grey seals, anthropogenic activities, disease, toxins or interactions therein (SCOS, 2022). This decline is a clear cause for concern and emergency funding for additional surveys has been provided by Defra. A proposed research programme is currently being developed to investigate the causes behind this decline (SCOS, 2022).

241. SCOS (2024), has noted that predicted future trends in harbour seal populations is problematic. The current monitoring programme does not provide a reliable method of projecting trends. Simply projecting recent trends forward would provide little insight in the absence of clearly identified drivers and some information on the likely future status of those drivers. Potential drivers are being investigated under the Scottish Government funded Marine Mammal Scientific Support project and an integrated harbour seal population model is being developed as part of that programme. The current phase of that programme is in the final year and will report on the conclusions from the work in mid-2025 and outcomes will be provided in SCOS 2025.

6 Density and Reference Population Overview

242. **Table 6.1** summarises the densities for each marine mammal discussed in this report. Numbers in blue are taken forward for the impact assessment in **Chapter 9: Marine Mammals (Volume II)**.

Table 6.1: Summary of Marine Mammal Densities and Reference Populations Densities in Bold Taken Forward for Assessment)

Data Source	Average of Season/ Year	Harbour Porpoise	Bottlenose Dolphin	Common Dolphin	White-beaked Dolphin	Killer Whale	Minke Whale	Fin Whale	Humpback Whale	Grey Seal	Harbour Seal
Waggitt et al. (2019) – over SCANS-IV block NS-D	Summer	0.368	0.0021	**0.026**	0.087	0.001	0.0091	0.000028			
	Winter	0.288	0.0019	0.011	0.058	0.001	0.0056	0.000021			
	Annual	0.328	0.0020	0.019	0.073	0.001	0.0074	0.000025			
SCANS-IV block NS-D	Summer	0.599			0.080		**0.0419**	**0.0009**			
SCANS-III block R	Summer	0.599	**0.0298**		**0.243**		0.039				
Site-specific surveys (HiDef aerial surveys)	Summer	**1.273**									
	Winter	0.165									
	Annual	0.719									
Carter et al. (2022)	-										**0.000000014**
Carter et al. (2025)	-									**0.024**	

Data Source	**Average of Season/ Year**	**Harbour Porpoise**	**Bottlenose Dolphin**	**Common Dolphin**	**White-beaked Dolphin**	**Killer Whale**	**Minke Whale**	**Fin Whale**	**Humpback Whale**	**Grey Seal**	**Harbour Seal**
Reference population		346,601 (NS MU) 159,632 (NS MU – UK portion)	2,022 (GNS MU) 226 (CES MU UK portion) 1,885 (GNS MU UK portion)	102,656 (CGNS MU) 57,417 (CGNS MU UK portion)	43,951 (CGNS MU) 34,025 (CGNS MU UK portion)	15,056[4] (Northeast Atlantic, Leonard and Øien, 2020)	20,118 (CGNS MU) 10,288 (CGNS MU UK portion)	24,932 (Combined Regions = North Sea, Barents Sea, Greenland Sea, Ireland, European Atlantic waters)	10,708[4] (Eastern North Atlantic, Leonard and Øien, 2020)	33,336 (Moray Firth, East Scotland and North East England MUs)	383 (East Scotland MU)

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[4] Given the lack of data, this species is considered qualitatively.

7 References

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Annex A – Figures

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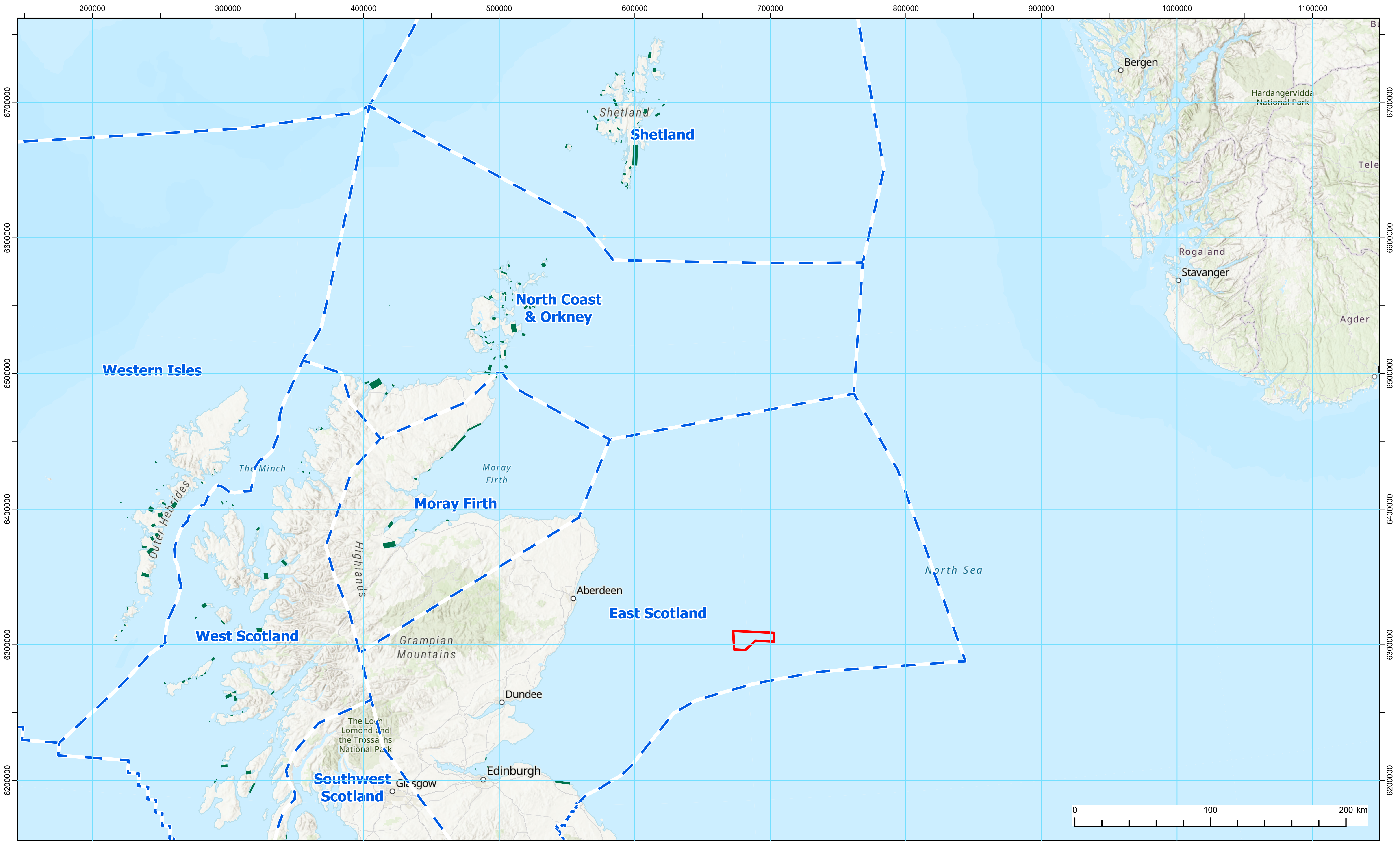

Haskoning
Enhancing Society Together
Bellrock

Legend:
🟥 Bellrock Wind Farm Development Area
▭ Seal Management Areas
🟩 Seal Haul-out Sites

REV	DATE	STATUS	DRW	CHK	APR
1	31/03/2026	Final	DL	SA	BMcG

Coordinate System: WGS 1984 UTM Zone 30N

Source:

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Scale @ A3

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Figure Title:

Seal Management Units and Seal Haul-out Sites

Project:

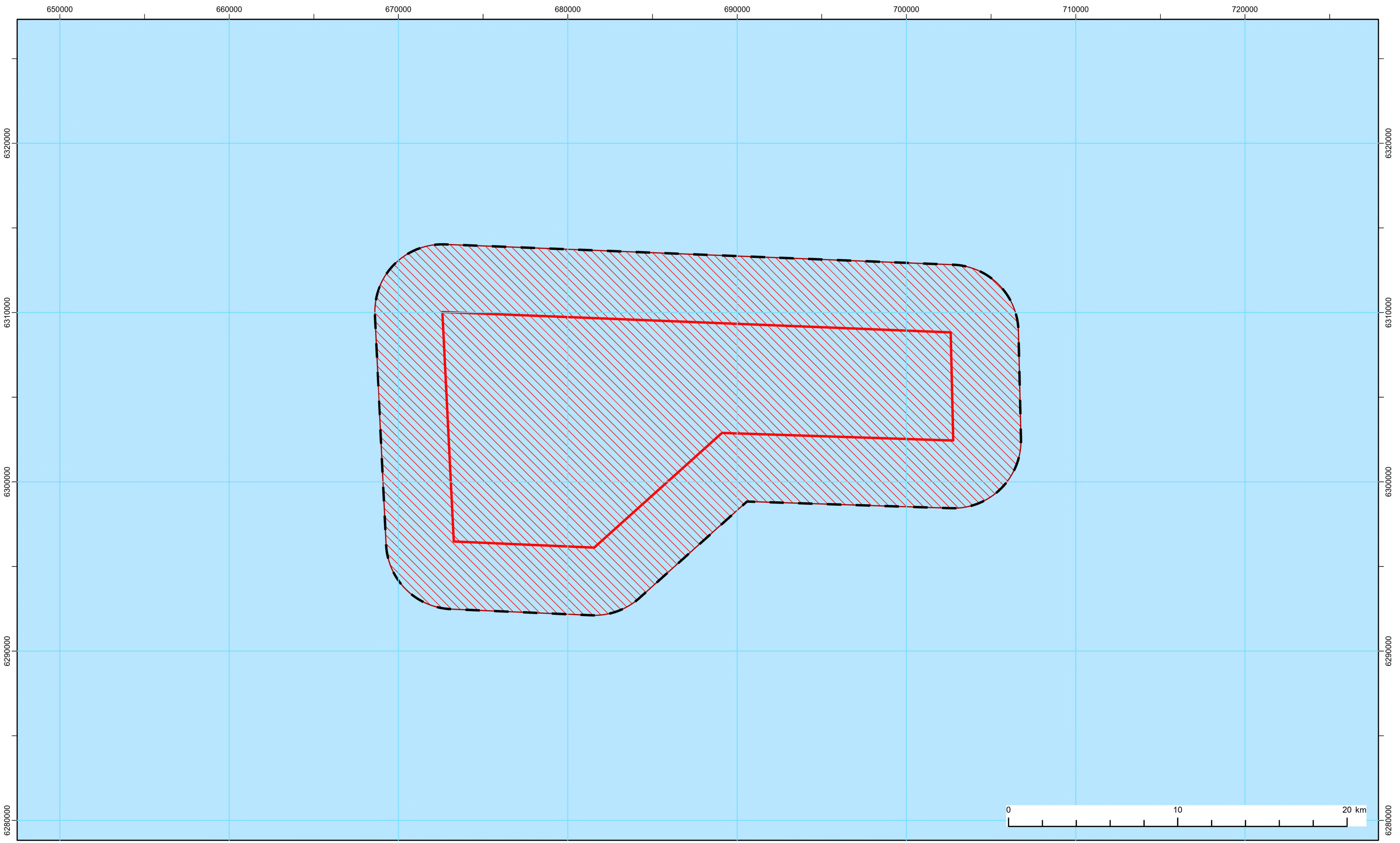
Bellrock Wind Farm
Development Area (WFDA)

Report:

EIA Report
Appendix 9.1: Marine
Mammals Technical Report

Drawing No.: RHDV_BEL_CST_REP_0003_022

Figure 9.1.1



Haskoning
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Bellrock

Legend:
- 🟥 Bellrock Wind Farm Development Area
- ⌐ ¬ Bellrock Wind Farm Development Area 4 km Buffer
- ▨ Bellrock Wind Farm Development Area Aerial Survey

1	31/03/2026	Final	DL	SA	BMcG
REV	DATE	STATUS	DRW	CHK	APR

Coordinate System: WGS 1984 UTM Zone 30N

Source:
Esri, Intermap, NASA, NGA, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, © Haskoning UK Ltd, 2026.

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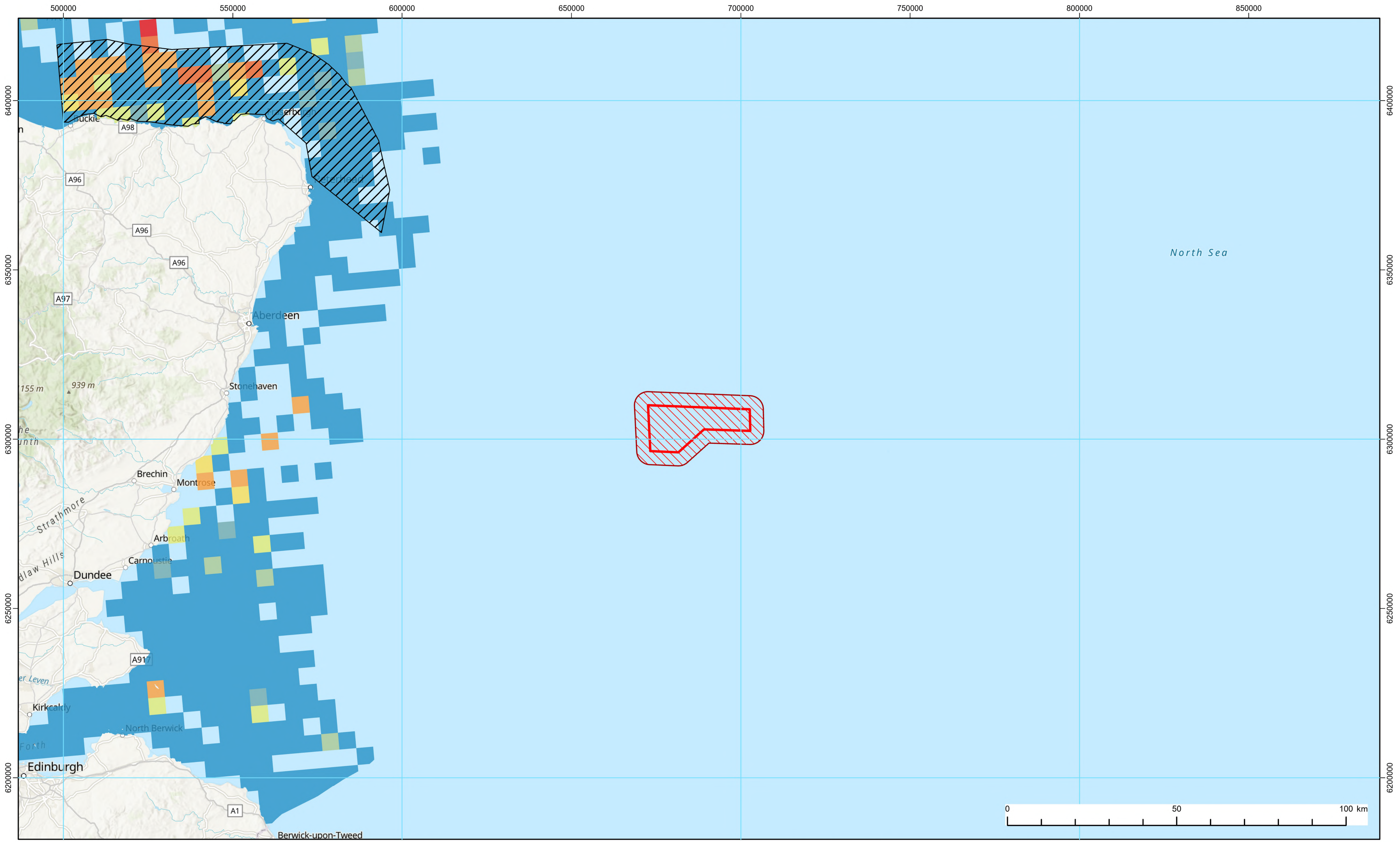
Figure Title:
Bellrock Wind Farm
Development Area Aerial Survey

Project:
Bellrock Wind Farm
Development Area (WFDA)

Report:
EIA Report
Appendix 9.1: Marine
Mammals Technical Report

Drawing No.: RHDV_BEL_CST_REP_0003_023

Figure 9.1.2



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Bellrock

Legend:

▭	Bellrock Wind Farm Development Area	▨	> 0.10 - 0.20
▨	Bellrock WFDA Aerial Survey Area	▨	> 0.20 - 0.50
▨	Southern Trench ncMPA	▨	> 0.50 - 1.00
	Observed adjusted densities of minke whale (all seasons 2000-2012)	▨	> 1.00 - 2.00
	Average Encounter Rate	▨	> 2.00 - 5.00
▨	0.00 - 0.10	▨	> 5.00 - 10.00
		▨	> 10.00 - 124.12

1	31/03/2026	Final	DL	SA	BMcG
REV	DATE	STATUS	DRW	CHK	APR

Coordinate System: WGS 1984 UTM Zone 30N

Source:
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Scale @ A3
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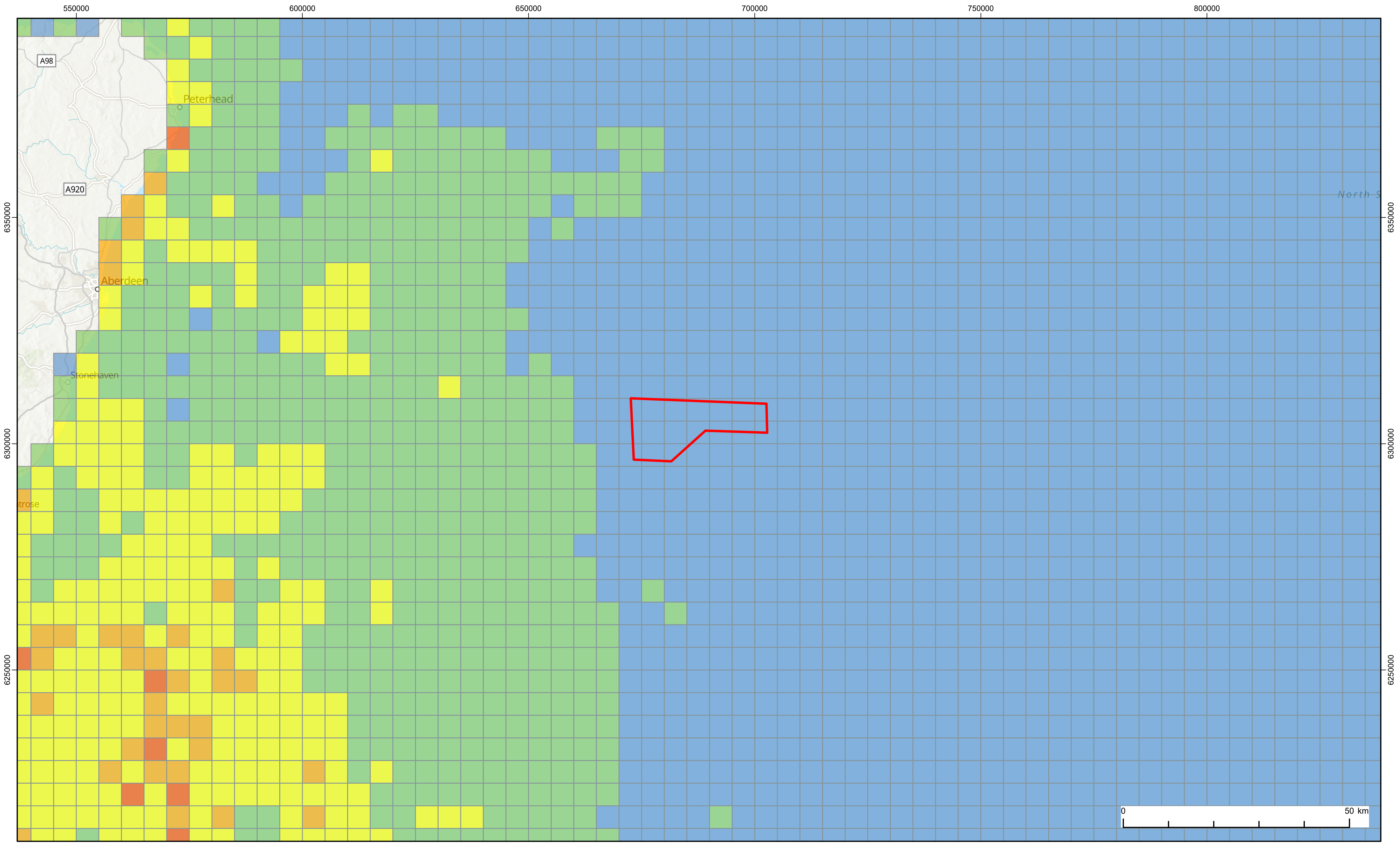
Figure Title:
Adjusted Densities of Minke Whale within the Southern Trench Nature Conservation Marine Protected Area

Project:
Bellrock Wind Farm Development Area (WFDA)

Report:
EIA Report
Appendix 9.1: Marine Mammals Technical Report

Drawing No.: RHDV_BEL_CST_REP_0003_024

Figure 9.1.3



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Bellrock

Legend:

🟥 Bellrock Wind Farm Development Area

Grey Seal Mean At-sea Density per 25 km²

🟦	0.000 - 0.002
🟩	0.002 - 0.010
🟨	0.010 - 0.025
🟧	0.025 - 0.050
🟥	0.050 - 0.100

REV	DATE	STATUS	DRW	CHK	APR
1	31/03/2026	Final	DL	SA	BMcG

Coordinate System: WGS 1984 UTM Zone 30N

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Scale @ A3
1:750,000

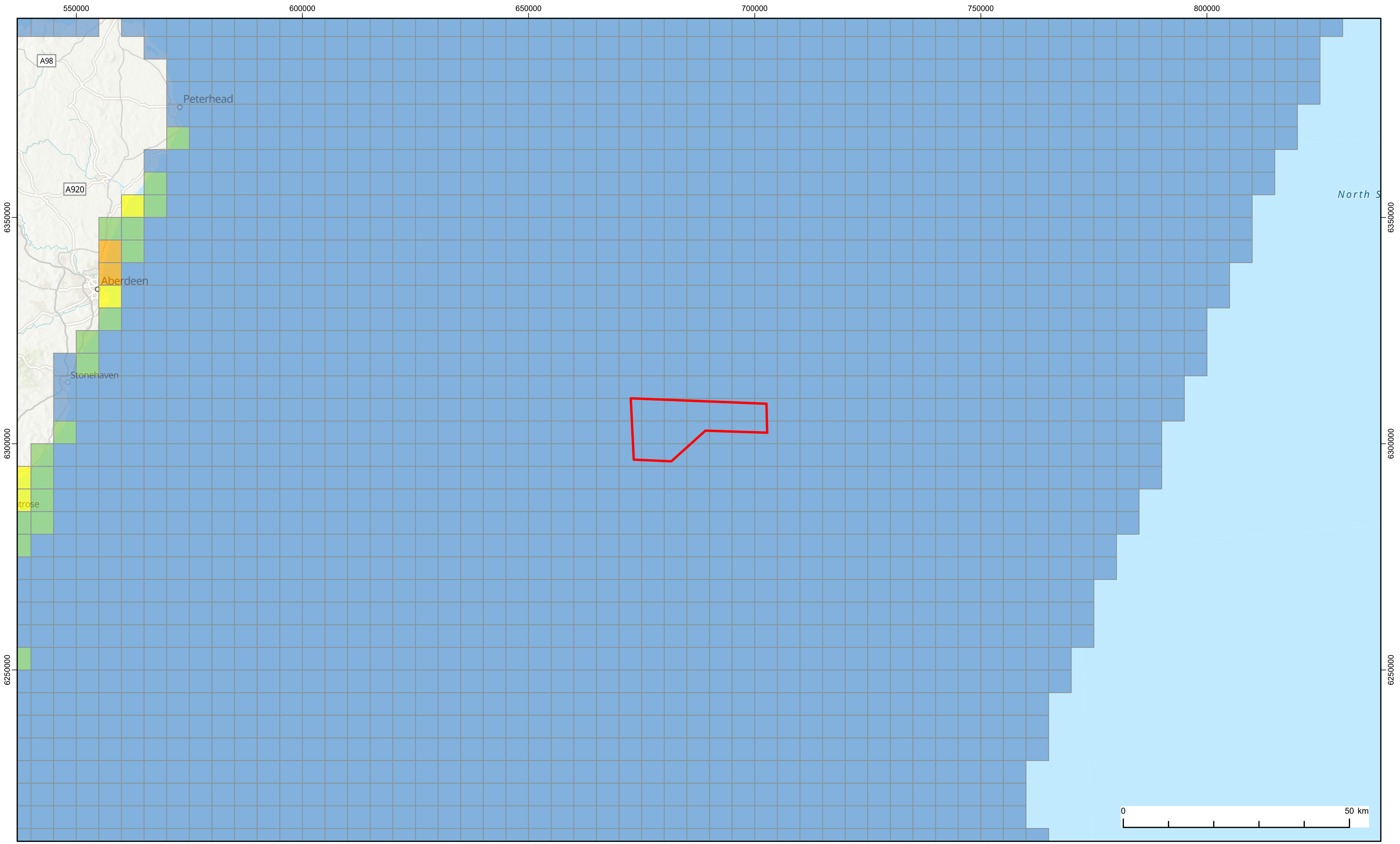
Figure Title:
Grey Seal At-sea Distribution

Project:
Bellrock Wind Farm
Development Area (WFDA)

Report:
EIA Report
Appendix 9.1: Marine
Mammals Technical Report

Drawing No.: RHDV_BEL_CST_REP_0003_025

Figure 9.1.4



Haskoning
Enhancing Society Together

Bellrock

Legend:

🟥 Bellrock Wind Farm Development Area

Harbour Seal Mean At-sea Density per 25 km²

🟦 0.000 - 0.001
🟩 0.001 - 0.005
🟨 0.005 - 0.010
🟧 0.010 - 0.025

REV	DATE	STATUS	DRW	CHK	APR
1	31/03/2026	Final	DL	SA	BMcG

Coordinate System: WGS 1984 UTM Zone 30N

Source:
Esri, CGIAR, N Robinson, NCEAS, USGS, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Carter et al, 2022.
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Scale @ A3
1:750,000

Figure Title:
Harbour Seal At-sea Distribution

Project:
Bellrock Wind Farm
Development Area (WFDA)

Report:
EIA Report
Appendix 9.1: Marine
Mammals Technical Report

Drawing No.: RHDV_BEL_CST_REP_0003_026

Figure 9.1.5

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Annex B – Mammal Survey Report Table

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Table B.1: Relative and Absolute Monthly Unapportioned Density and Population Estimates for Harbour Porpoise in the Bellrock Survey Area Between March 2022 and February 2024, Corrected for Animals Estimated as Unavailable for Detection

Survey Date	Relative Population Estimates						Absolute Population Estimates			
	Density Estimate (n/km^2)	Population Estimate (Number)	Lower 95% Confidence Limit of Population (Number)	Upper 95% Confidence Limit of Population (Number)	Bootstrap Standard Error of Population Estimate (Number)	CV$_{SE}$ (%)	Density Estimate (n/km^2)	Population Estimate (Number)	Lower 95% Confidence Limit of Population (Number)	Upper 95% Confidence Limit of Population (Number)
19 March 2022	0.03	21	0	47	12	59.00	0.15	104	0	234
11 April 2022	0.04	30	0	69	20	65.07	0.17	125	0	288
02 May 2022	0.10	68	29	117	23	33.31	0.48	326	139	561
04 June 2022	0.62	408	170	687	135	32.96	3.23	2127	886	3581
08 July 2022	0.31	204	104	317	55	26.95	1.70	1117	570	1736
17 August 2022	0.29	193	75	337	69	35.53	1.48	983	382	1717
20 September 2022	0.00	0	0	0	0	0.00	0.00	0	0	0
01 October 2022	0.03	20	0	47	12	61.76	0.20	131	0	307
09 November 2022	0.00	0	0	0	0	0.00	0.00	0	0	0
20 December 2022	0.00	0	0	0	0	0.00	0.00	0	0	0
21 January 2023	0.01	10	0	29	9	92.69	0.06	55	0	160
13 February 2023	0.03	20	0	58	19	94.74	0.20	136	0	393
04 March 2023	0.01	10	0	29	9	91.02	0.05	50	0	144

Survey Date	**Relative Population Estimates**						**Absolute Population Estimates**			
	Density Estimate (n/km²)	**Population Estimate (Number)**	**Lower 95% Confidence Limit of Population (Number)**	**Upper 95% Confidence Limit of Population (Number)**	**Bootstrap Standard Error of Population Estimate (Number)**	**CV_{SE} (%)**	**Density Estimate (n/km²)**	**Population Estimate (Number)**	**Lower 95% Confidence Limit of Population (Number)**	**Upper 95% Confidence Limit of Population (Number)**
03 April 2023	0.00	0	0	0	0	0.00	0.00	0	0	0
04 May 2023	0.02	10	0	30	10	91.26	0.10	48	0	144
13 June 2023	0.09	59	0	133	34	57.66	0.47	308	0	693
07 July 2023	0.06	40	0	105	30	74.41	0.33	219	0	575
17 August 2023	0.01	10	0	29	9	93.05	0.05	51	0	148
04 September 2023	0.09	58	0	141	38	64.59	0.58	373	0	906
13 October 2023	0.00	0	0	0	0	0.00	0.00	0	0	0
14 November 2023	0.00	0	0	0	0	0.00	0.00	0	0	0
10 December 2023	0.00	0	0	0	0	0.00	0.00	0	0	0
30 January 2024	0.03	20	0	48	13	62.46	0.17	110	0	264
08 February 2024	0.07	50	20	85	18	34.88	0.47	339	136	577