NORTH FALLS

Offshore Wind Farm

ENVIRONMENTAL STATEMENT

Appendix 12.2 Marine Mammal Baseline Information

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NORTH FALLS
Offshore Wind Farm

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Glossary of Acronyms

ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas
CCW	Countryside Council for Wales
CGNS	Celtic and Greater North Seas
CITES	Convention on International Trade in Endangered Species
CI	Confidence Interval
CL	Confidence Limits
CroW	The Countryside and Rights of Way
CV	Coefficient of Variation
DECC	Department for Energy and Climate Change
EPS	European Protected Species
ETG	Expert Topic Group
FCS	Favourable Conservation Status
IAMMWG	Inter-Agency Marine Mammal Working Group
IWC	International Whaling Commission
JCP	Joint Cetacean Protocol
JNCC	Joint Nature Conservation Committee
KDE	Kernel Density Estimation
km	Kilometre
m	Metre
MMMP	Marine Mammal Mitigation Plan
MMO	Marine Management Organisation
MPS	Marine Policy Statement
MSFD	Marine Strategy Framework Directive
MU	Management Unit
NE	North-east
nm	Nautical mile
NNR	National Nature Reserve
NS	North Sea
OWF	Offshore Wind Farm
SAC	Special Area of Conservation
SCANS	Small Cetaceans in European Atlantic waters and the North Sea
SCOS	Special Committee on Seals
SE	South-east
UK	United Kingdom
UXO	Unexploded Ordnance
ZSL	Zoological Society London

Glossary of Terminology

Array area	The offshore wind farm area, within which the wind turbine generators, array cables, platform interconnector cable, offshore substation platform(s) and / or offshore converter platform will be located.
Array cables	Cables which link the wind turbine generators with each other, the offshore substation platform(s) and / or the offshore converter platform.
Decibel (dB)	A customary scale commonly used (in various ways) for reporting levels of sound. A difference of 10 dB corresponds to a factor of 10 in sound power. The actual sound measurement is compared to a fixed reference level and the "decibel" value is defined to be 10 $\log_{10}$(actual / reference) where (actual / reference) is a power ratio. Because sound power is usually proportional to sound pressure squared, the decibel value for sound pressure is 20 $\log_{10}$(actual pressure / reference pressure). The standard reference for underwater sound is 1 micropascal (µPa). The dB symbol is followed by a second symbol identifying the specific reference value (e.g., re 1 µPa).
Offshore cable corridor	The corridor of seabed from array area to the landfall within which the offshore export cables will be located.
Offshore export cables	The cables which bring electricity from the offshore substation platform(s) to the landfall, as well as auxiliary cables.
Offshore project area	The overall area of the array area and the offshore cable corridor.
Offshore substation platform(s)	Fixed structure(s) located within the array area, containing HVAC electrical equipment to aggregate the power from the wind turbine generators and increase the voltage to a more suitable level for export to shore via offshore export cables.
Offshore converter platform	Should an offshore connection to a HVDC cable be selected, an offshore converter platform would be required. This is a fixed structure located within the array area, containing HVAC and HVDC electrical equipment to aggregate the power from the wind turbine generators, increase the voltage to a more suitable level for export and convert the HVAC power generated by the wind turbine generators into HVDC power for export to shore via a third party HVDC interconnector cable.
Platform interconnector cable	Cable connecting the offshore substation platforms (OSP); or the OSP and offshore converter platform (OCP)
The Applicant	North Falls Offshore Wind Farm Limited (NFOW).
The Project Or 'North Falls'	North Falls Offshore Wind Farm, including all onshore and offshore infrastructure.

1 Marine mammals baseline

1.1 Introduction

1. This appendix provides further supporting marine mammal information and survey data for ES Chapter 12 Marine Mammals (Document Reference: 3.1.14).

1.2 Marine mammal species

2. In the United Kingdom (UK) waters, two groups of marine mammals occur: cetaceans (whales, dolphins and porpoises) and pinnipeds (seals). During the site specific surveys for the North Falls Offshore Wind Farm (NFOW), harbour porpoise *Phocoena phocoena* were the most commonly sighted marine mammal species, with medium and high numbers seen all year round (HiDef, 2021).
3. This finding is supported by other wider scale surveys and reporting for marine mammals in the area, including by Department for Business, Energy & Industrial Strategy (BEIS)[1] (2022), Small Cetaceans in European Atlantic waters and the North Sea (SCANS) surveys (Hammond *et al.,* 2021; Gilles *et al*., 2023) and Joint Cetacean Protocol (JCP) data resources (Paxton *et al.,* 2016).
4. While a number of cetacean species have been recorded within the southern areas of the North Sea (NS), only harbour porpoise occur regularly throughout the year, while minke whale *Balaenoptera acutorostrata* could occur in the area, particularly during the summer periods and white-beaked dolphin *Lagenorhynchus albirostris* are less frequent (BEIS, 2022; Hammond *et al.,* 2021; Gilles *et al*., 2023; Paxton *et al.,* 2016).
5. Both UK seal species, grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina* are present in the area in relatively high numbers, due to nearby key breeding areas for both species (BEIS, 2022).
6. Recent public sightings reported to the SeaWatch Foundation in the east of England (at the time of writing; July 2022 to October 2023) were predominantly harbour porpoise (n=112), common dolphin *Delphinus delphis* (n=69), bottlenose dolphin (n=9), dolphin species (n=17), humpback whale *Megaptera novaeangliae* (n=1), minke whale *Balaenoptera acutorostrata* (n=5), grey seal (n=21), common seal *Phoca vitulina* (n=1), basking shark *Cetorhinus maximus* (n=1) (SeaWatch Foundation, 2021). Of these, only harbour porpoise and grey seal have been sighted near the offshore project area in significant number (SeaWatch Foundation, 2023).
7. Other marine mammal species, including Atlantic white-sided dolphin, bottlenose dolphin, killer whale *Orcinus orca*, sperm whale *Physeter macrocephalus*, long-finned pilot whale *Globicephala melas*, Risso's dolphin

[1] BEIS is now known as the Department for Energy Security and Net Zero (DESNZ) which was established as of the 8th February 2023.

Grampus griseus, striped dolphin *Stenella coeruleoalba* and other seal species are occasional or rare visitors to the southern NS (e.g., Reid *et al.,* 2003; Hammond *et al.,* 2013, 2017, 2021; Gilles *et al.,* 2023; BEIS, 2022; Special Committee on Seals (SCOS), 2022).

8. Site characterisation has been undertaken using site specific data for the offshore project area as well as existing data from other offshore wind farms (OWF) in the area and other available information for the region.

9. Based on the site-specific surveys and other data sources, the key species of interest and therefore the focus of the assessments will be on the following species:

- Harbour porpoise;
- Minke whale;
- Grey seal; and
- Harbour seal.

1.2.1 Scoping out of white-beaked dolphin

10. White-beaked dolphin are widely distributed within the central NS, however, very few sightings are recorded along the east coast of England or south of the Humber Estuary, with a small number of sightings in offshore shallow waters near the North Norfolk Sandbanks and Dogger Bank areas (Gilles *et al.,* 2012; BEIS, 2022). The occurrence of white-beaked dolphin in the southern NS is relatively low (Reid *et al.,* 2003; Hammond *et al.,* 2013; 2021).

11. A review of the strandings data in the NS were collated and assessed by the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) (IJsseldijk *et al.,* 2018) in order to determine temporal and spatial trends in the distributions of white-beaked dolphin in the south-western NS. 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 south-east (SE) coasts of the UK, with an increase in the north-east (NE) area (Ijsseldijk *et al.,* 2018).

12. Data on the distribution of marine mammals in UK areas of the NS were collected opportunistically during aerial surveys for birds conducted by Wildfowl and Wetlands Trust (WWT) Consulting from 2001-2008 (WWT, 2009). A number of unknown dolphin species were also recorded, with local clusters present NE off Flamborough Head. White-beaked dolphin were also recorded in small numbers in the NE, again off Flamborough Head (WWT, 2009).

13. The results of the JCP Phase III Report (Paxton *et al.,* 2016) identified that for white-beaked dolphin, densities are low across much of the UK waters, with higher densities shown to be in the Hebrides and the northern NS. The density of white-beaked dolphin within the southern NS (and near to the offshore project area) is very low, with less than 0.1 individuals per km^2 (Both high and low 97.5% Confidence Interval (CI) of 0-0.1 per km^2) (Paxton *et al.,* 2016).

14. The SCANS-IV survey shows a similar distribution pattern, with no white-beaked dolphin identified within the southern NS survey block NS-B, and low

but increasing densities with the more northerly NS survey blocks (blocks NS-E and NS-F) (Gilles *et al.,* 2023).

15. For white-beaked dolphin, the distribution maps (developed by Waggitt *et al.,* 2019) show a clear pattern of higher density in the northern NS, 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 1.1; Waggitt *et al.,* 2019). The offshore project area is located to the very southern NS area, with very low white-beaked densities, and there appears to be no significant difference in their seasonal distributions within this area.

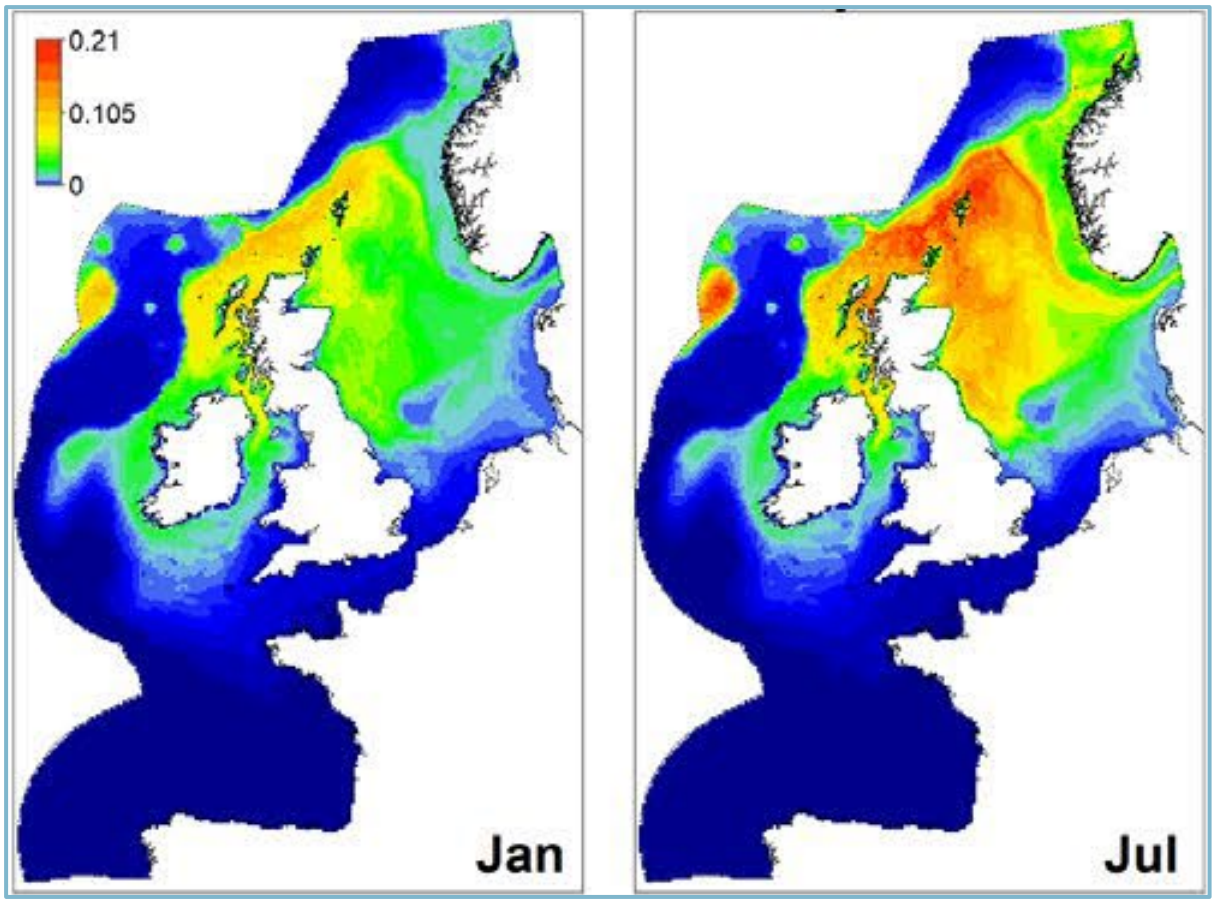


Plate 1.1 Spatial variation in predicted densities (individuals per km of white-beaked dolphin in January and July in the NE Atlantic). Values are provided at 10km resolution. Source: Waggitt *et al.,* 2019

16. During the site specific aerial surveys of North Falls, no white-beaked dolphin were recorded. White-beaked dolphin were also not sighted within the site-specific aerial surveys for the nearby Five Estuaries Offshore Wind Farm (herein 'Five Estuaries') (Five Estuaries Wind Farm Ltd, 2021).

17. Due to the limited presence of white-beaked dolphin in the southern NS and within the vicinity of the offshore project area, this species has been scoped out of assessment.

1.3 Study area

18. Management Units (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 (Inter-Agency Marine Mammal Working Group (IAMMWG), 2023). The study area, MUs and reference populations have been determined based on the most relevant information and scale at which potential impacts from North Falls alone and in-combination with other plans and projects could occur.

19. For each species of marine mammal, the following study areas have been defined based on the relevant MUs, current knowledge and understanding of the biology of each species (as shown on Figure 1.1):

    - Harbour porpoise: NS MU;
    - Minke whale: Celtic and Greater North Seas (CGNS) MU;
    - Grey seal: SE England and the NE England MUs; and
    - Harbour seal: SE England MU.

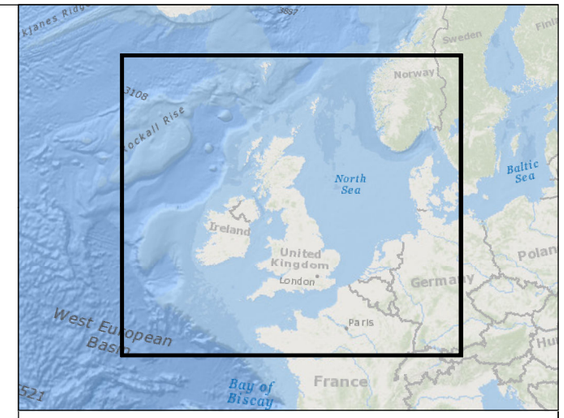
20. There is the potential for seals from haul-out sites to move along the coast and offshore to forage in and around the proposed offshore project areas. Key haul-out sites for both seal species within the vicinity of the North Falls Site are:

    - Hamford Water located 8km from the nearest part of the offshore project area (including offshore cable area and landfall locations);
    - Buxey Sand North located 11km from the nearest part of North Falls (including offshore cable area and landfall locations);
    - Kentish Knock located 16km from the nearest part of the offshore project area (including offshore cable area and landfall locations);
    - Long Sand and Sunk and Knock John sites located 25km from the nearest part of the offshore project area (including offshore cable area and landfall locations); and
    - Margate Sands and Pan Sand Ridge sites located 43km from the nearest part of the offshore project area (including offshore cable area and landfall locations).

-600000 -200000 200000 600000 1000000

6600000 6200000 5800000 5400000

N



Legend

- North Falls Array Area
- Offshore Cable Corridor

IAMMWG MUs

- North Sea MU
- Celtic Sea and Greater North Seas MU

SCOS SMUs

- Northeast England MU (8)
- Southeast England MU (9)

0 50 100 200 nm

0 100 200 400 km

Data Source: © IAMMWG, 2023. © SCOS, 2022. © HaskoningDHV UK Ltd. 2022.
Sources: Esri, GEBCO, NOAA, National Geographic, Garmin,
HERE, Geonames.org, and other contributors.

Drawing Title

Marine Mammal Management Units

Rev	Date	Remarks	Drwn	Chkd
01	27/05/2024	First issue	FC	KF

Drawing Number	Figure Number
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Scale	Plot Size	Datum	Projection
1:6,500,000	A3	WGS84	UTM31N

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1.4 Policy, legislation and guidance

1.4.1 National and regional marine policies

21. As outlined in the ES Chapter 12 Marine Mammals (Document Reference: 3.1.14) there are a number of pieces of legislation, policy and guidance applicable to the assessment of marine mammals. These include:

- The Marine Strategy Framework Directive (MSFD) 2008/56/EC (EC, 2008) as implemented in the UK by the Marine Strategy Regulations 2010;
- The Marine Policy Statement (MPS) (HM Government, 2011); and
- The East Inshore and East Offshore Marine Plans (HM Government, 2014).
- The South East Marine Plan (HM Government, 2021).
- Overarching National Policy Statement for Energy (EN-1) (paragraph 5.4.22)
- National Policy Statement for Renewable Energy Infrastructure (EN-3) (paragraph 2.8.127 – 135)

1.4.1.1 The Marine Strategy Framework Directive

22. Annex I of the MSFD states that to ensure that good environmental status is met, the following must be considered:

- Biological diversity should be maintained;
- The quality and occurrence of habitats, as well as the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions;
- All elements of the marine food web, to the extent that they are known, occur at normal abundance and diversity levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity;
- Concentrations of contaminants are at levels not giving rise to pollution effects;
- Properties and quantities of marine litter do not cause harm to the coastal and marine environment; and
- Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.

23. These are implemented in the UK by the Marine Strategy Regulations 2010:

- Marine Strategy Part One: UK updated assessment and Good Environmental Status (Defra, 2019);
- Marine Strategy Part Two: UK updated monitoring programmes (Defra, 2022); and
- Marine Strategy Part Three: UK Programme of Measures (Defra, 2021).

1.4.1.2 The Marine Policy Statement

24. The MPS (HM Government, 2011) provides a high-level approach to marine planning and the general principles for decision making. It sets out the framework for environmental, social and economic considerations that need to be taken into account in marine planning. The high-level objective of 'Living within environmental limits' covers the points relevant to marine mammals, this requires that:

- Biodiversity is protected, conserved and where appropriate recovered and loss has been halted.
- Healthy marine and coastal habitats occur across their natural range and are able to support strong, biodiverse biological communities and the functioning of healthy, resilient and adaptable marine ecosystems.
- Our oceans support viable populations of representative, rare, vulnerable, and valued species.

1.4.1.3 The East Inshore and East Offshore Marine Plans

25. Within both the East Inshore and East Offshore Marine Plans (HM Government, 2014), a set of objectives have been set out to ensure biodiversity protections and are of relevance to marine mammals as they cover policies and commitments on the wider ecosystem, as set out within the MPS and the MSFD.

- Objective 6: "*To have a healthy, resilient and adaptable marine ecosystem in the East Marine Plan areas*"; and
- Objective 7: "*To protect, conserve and, where appropriate, recover biodiversity that is in or dependent upon the East marine plan areas*".

1.4.1.4 The South East Inshore Marine Plan

26. Within the South East Inshore Marine Plan (HM Government, 2021), a set of objectives have been set out which reflect engagement with stakeholders throughout the planning process and reflects government priorities applied at the local level. These are of relevance to marine mammals as they cover policies and commitments on the wider ecosystem.

- Objective 11: "*Biodiversity is protected, conserved and, where appropriate, recovered, and loss has been halted*".
- Objective 12: "*Healthy marine and coastal habitats occur across their natural range and are able to support strong, biodiverse biological communities and the functioning of healthy, resilient and adaptable marine ecosystems*".
- Objective 13: "*Our oceans support viable populations of representative, rare, vulnerable, and valued species*".

1.4.2 Other national and international legislation for marine mammals

27. Table 1.1 provides an overview of national and international legislation in relation to marine mammals.

Table 1.1 Summary table for national and international legislations relevant for marine mammals

Legislation	Level of Protection	Species Included	Details
ASCOBANS	International	Odontocetes	Formulated in 1992, this agreement has been signed by eight European countries bordering the Baltic and North Seas (including the English Channel) and includes the UK. Under the Agreement, provision is made for the protection of specific areas, monitoring, research, information exchange, pollution control and increasing public awareness of small cetaceans.
The Berne Convention 1979	International	All cetaceans, grey seal and harbour seal	The Convention conveys special protection to those species that are vulnerable or endangered. Appendix II (strictly protected fauna): 19 species of cetacean. Appendix III (protected fauna): all remaining cetaceans, grey and harbour seal. Although an international convention, it is implemented within the UK through the Wildlife and Countryside Act 1981 (with any aspects not implemented via that route brought in by the Habitats Directive).
The Bonn Convention 1979	International	All cetaceans	Protects migratory wild animals across all, or part of their natural range, through international co-operation, and relates particularly to those species in danger of extinction. One of the measures identified is the adoption of legally binding agreements, including ASCOBANS.
Oslo and Paris Convention for the Protection of the Marine Environment 1992 (OSPAR)	International	Bowhead whale *Balaena mysticetus*, northern right whale *Eubalaena glacialis*, blue whale *Balaenoptera musculus*, and harbour porpoise	OSPAR has established a list of threatened and / or declining species in the NE Atlantic. These species have been targeted as part of further work on the conservation and protection of marine biodiversity under Annex V of the OSPAR Convention. The list seeks to complement, but not duplicate, the work under the EC Habitats and Birds directives and measures under the Berne Convention and the Bonn Convention.
International Convention for the Regulation of Whaling 1956	International	All cetacean species	This Convention established the International Whaling Commission (IWC) who regulates the direct exploitation and conservation of large whales (in particular sperm and large baleen whales) as a resource and the impact of human activities on cetaceans. The regulation considered scientific matters related to small cetaceans, in particular the enforcing a moratorium on commercial whaling which came into force in 1986.
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) 1975	International	All cetacean species	Prohibits the international trade in species listed in Annex 1 (including sperm whales, northern right whales, and baleen whales) and allows for the controlled trade of all other cetacean species.
The Conservation of Habitats and Species Regulations 2017 and The Conservation of Offshore Marine	National	All cetaceans, grey and harbour seal	'The Habitats Regulations 2017'. Provisions of The Habitats Regulations are described further in ES Chapter 12 Marine Mammals (Document Reference: 3.1.14). It should be noted that the

Legislation	Level of Protection	Species Included	Details
Habitats and Species Regulations 2017			Habitats Regulations apply within the territorial seas and to marine areas within UK jurisdiction, beyond 12 nautical miles (nm).
The Wildlife and Countryside Act 1981 (as amended)	National	All cetaceans	Schedule five: all cetaceans are fully protected within UK territorial waters. This protects them from killing or injury, sale, destruction of a particular habitat (which they use for protection or shelter) and disturbance. Schedule six: Short-beaked common dolphin, bottlenose dolphin and harbour porpoise; prevents these species being used as a decoy to attract other animals. This schedule also prohibits the use of vehicles to take or drive them, prevents nets, traps or electrical devices from being set in such a way that would injure them and prevents the use of nets or sounds to trap or snare them.
The Countryside and Rights of Way Act (CroW) 2000	National	All cetaceans	Under the CroW Act 2000, it is an offence to intentionally or recklessly disturb any wild animal included under Schedule 5 of the Wildlife and Countryside Act.
Conservation of Seals Act 1970	International	Grey and harbour seal	As of 1st March 2021, a person commits an offence if they intentionally or recklessly kill, injure or take a seal. The legislative changes in England and Wales, amends the Conservation of Seals Act 1970, prohibiting the intentional or reckless killing, injuring or taking of seals and removing the provision to grant licences for the purposes of protection, promotion or development of commercial fisheries or aquaculture activities. These changes were enacted to ensure compliance with the US Marine Mammal Protection Act Import Provision Rule.

1.4.3 European Protected Species guidance

28. All cetacean species are listed as European Protected Species (EPS) under Annex IV of the Habitats Directive and are therefore protected from the deliberate killing (or injury), capture and disturbance throughout their range. Within the UK, The Habitats Directive is enacted through The Conservation of Habitats and Species Regulations 2017 and the Conservation of Offshore Marine Habitats and Species Regulations 2017. Under these Regulations, it is an offence if cetaceans are deliberately disturbed in such a way as to:

- deliberately capture, injure or kill any EPS;
- deliberately disturb them; or
- damage or destroy a breeding site or resting place.

29. The Joint Nature Conservation Committee (JNCC), Natural England and the Countryside Council for Wales (CCW)[2] (JNCC *et al.,* 2010a) produced draft guidance concerning the Regulations on the deliberate disturbance of marine EPS, which provides an interpretation of the regulations in greater detail, including for pile driving operations (JNCC, 2010a), seismic surveys (JNCC, 2017) and the use of explosives (JNCC, 2010b[3]).

30. The draft guidance provides the following interpretations of deliberate injury and disturbance offences under both the Habitats Regulations and Offshore Regulations (now the Habitats Regulations, 2017), as detailed in the paragraphs below:

"*Deliberate actions are to be understood as actions by a person who knows, in light of the relevant legislation that applies to the species involved, and the general information delivered to the public, that his action will most likely lead to an offence against a species, but intends this offence or, if not, consciously accepts the foreseeable results of his action;*

Certain activities that produce loud sounds in areas where EPS could be present have the potential to result in an injury offence, unless appropriate mitigation measures are implemented to prevent the exposure of animals to sound levels capable of causing injury".

31. For the purposes of marine users, the draft guidance states that a disturbance which can cause offence should be interpreted as:

"*Disturbance which is significant in that it is likely to be detrimental to the animals of an EPS or significantly affect their local abundance or distribution*".

32. The draft guidelines further states that a disturbance offence is more likely where an activity causes persistent noise in an area for long periods of time and

[2] Now part of Natural Resources Wales

[3] The DRAFT JNCC guidelines for minimising the risk of injury to marine mammals from unexploded ordnance clearance in the marine environment (October 2023) were issued for consultation in 2023. It is anticipated that the publication of the guidelines will occur after submission of this DCO application but the latest guidance will be applied at the time that and UXO clearance is required.

highlights that sporadic “trivial disturbance” should not be considered as a disturbance offence under Article 12.

33. Any action that could increase the risk of a long-term decline of the population, increase the risk of a reduction of the range of the species, and / or increase the risk of a reduction of the size of the habitat of the species can be regarded as a disturbance under the Regulations. For a disturbance to be considered non-trivial, the disturbance to marine EPS would need to be likely to at least increase the risk of a certain negative impact on the species at Favourable Conservation Status (FCS).

34. JNCC *et al.* (2010a) state that:

“*In any population with a positive rate of growth, or a population remaining stable at what is assumed to be the environmental carrying capacity, a certain number of animals can potentially be removed as a consequence of anthropogenic activities (e.g., through killing, injury or permanent loss of reproductive ability), in addition to natural mortality, without causing the population to decrease in numbers, or preventing recovery, if the population is depleted. Beyond a certain threshold however, there could be a detrimental effect on the population*”.

35. Further discussion on the use of thresholds for significance and the permanent or temporary nature of any disturbance is considered by defining the magnitude of effect in the assessment. Consideration of any potential essential habitat or geographical structuring of EPS is provided in the existing environment section.

1.4.3.1 Marine wildlife licence requirements

36. A marine wildlife licence is required if the risk of injury or disturbance to cetacean species is assessed as likely under the Habitats Regulations 2017. If a licence is required, an application must be submitted, the assessment of which comprises three tests, namely:

- Whether the activity falls within one of the purposes specified in Regulation 55 of the Habitats Regulations. Only the purpose of *“preserving public health or public safety or other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment*” is of relevance to marine mammals in this context;
- That there are no satisfactory alternatives to the activity proposed (that would not incur the risk of offence); and
- That the licensing of the activity will not result in a negative impact on the species’/ population’s FCS.

37. A marine wildlife licence would consider all cetacean species at potential risk of injury or disturbance. There is no legislation that requires seals to be included under a marine wildlife licence; disturbance is not an offence under the Conservation of Seals Act 1970, and in the case of injury to seals, the Marine Management Organisation (MMO) is only able to grant licences under very specific circumstances as listed under Section 10(1) of the Conservation of Seals Act 1970, which would not apply in the case that a marine wildlife licence was required for the construction of North Falls.

38. Under the definitions of ‘deliberate disturbance’ in the Habitats Regulations, chronic exposure and / or displacement of animals could be regarded as a disturbance offence. Therefore, if these risks cannot be avoided, then the Applicant is likely to be required to apply for a marine wildlife licence from the MMO in order to be exempt from the offence.

39. If required, the marine wildlife licence application will be submitted post-consent. At that point in time, the project design envelope will have been further refined through detailed design and procurement activities and further detail will be available on the techniques selected for the construction of the Wind Farm, as well as the mitigation measures that will be in place following the development of the Marine Mammal Mitigation Protocol (MMMP) for piling and Unexploded Ordnance (UXO) clearance.

1.5 Existing environment

1.5.1 Site specific surveys

40. In order to provide site specific and up to date information on which to base the impact assessment, a site-specific aerial survey was conducted for both marine mammals and seabirds. HiDef Aerial Surveying Limited (‘HiDef’) collected high resolution aerial digital still imagery for marine megafauna (combined with ornithology surveys) over the array areas (as they were at the time of survey commencement), including a 4km buffer (referred to as the previous survey area; Plate 1.2).

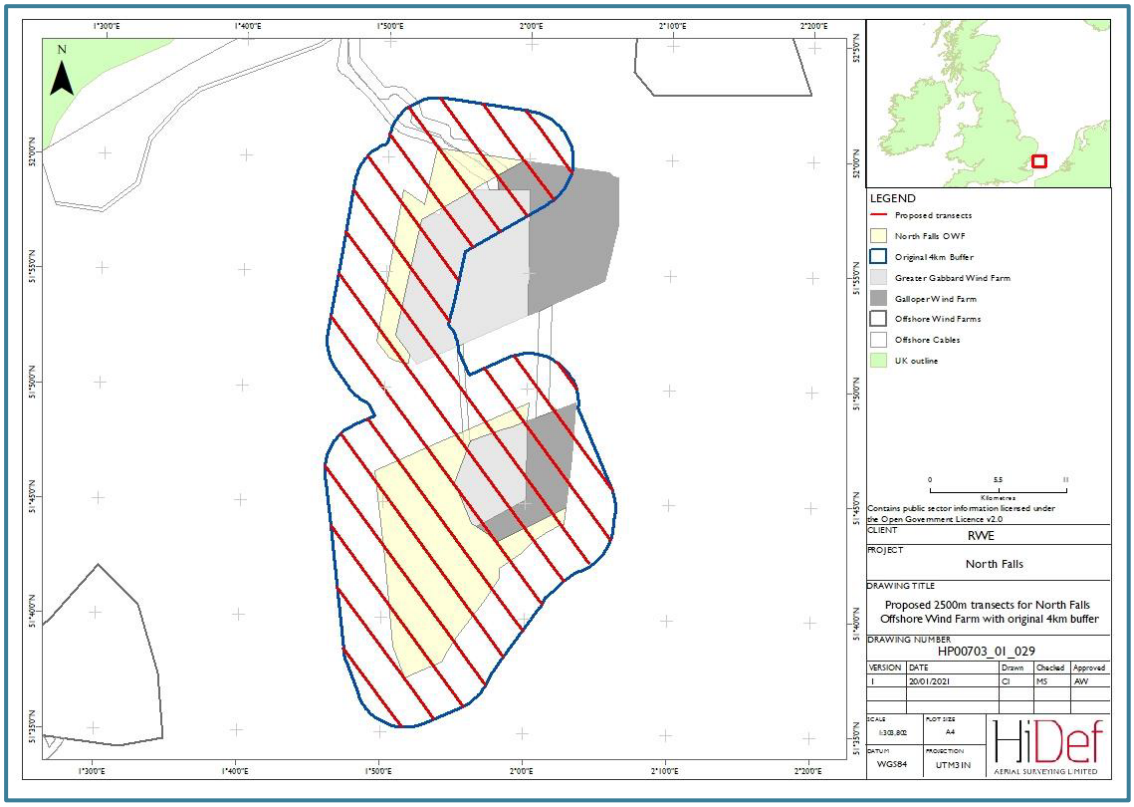

Plate 1.2 North Falls aerial survey area

41. The aerial survey was conducted along a series of strip transects (at 2.5km spacing) across a 772km^2 survey area. The surveys were flown on a monthly basis from March 2019 to February 2021.

42. For the DCO application, the data collected over the full aerial survey area (as shown in Plate 1.2) was clipped for the southern array area only, due to the updated NFOW boundary (referred to as the survey area).

43. Data analysis follows a two-stage process in which video footage is reviewed (with a 20% random sample used for audit) then the detected objects are identified to species or species group level (again with 20% selected at random for audit). The audit of both stages requires 90% agreement to be achieved.

44. Density and abundance estimates are calculated using strip transect analysis and a statistical technique called kernel density estimation (KDE) was used to create density surface maps.

45. The aerial survey method has been designed to optimise the data collection for all bird and marine mammal species using a grid-based survey design at 2cm resolution to achieve a minimum of 10% coverage using a twin-engine aircraft.

46. Table 12.2 shows the numbers of marine mammals recorded during the aerial surveys from March 2019 to February 2021, within the previous survey area. The results indicate that harbour porpoise are present in the highest numbers, grey seal were observed in low numbers as well as just one sighting of a minke whale.

47. From the sightings numbers (as shown below) of each marine mammal species, or marine mammal species group, abundance and density estimates were calculated (for the survey area only). Upper and lower CI as well as coefficient of variation (CV) were also calculated for these density and abundance estimates. The density of animals at the site (and hence the population size), the standard deviation, 95% CI and CV are then estimated using a non-parametric bootstrap method with replacement (Buckland *et al.,* 2001).

48. 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 survey as they are underwater. Without these availability bias, or correction factors, being corrected for, any abundance or density estimate would be relative only, rather than being an absolute estimate. The availability bias is discussed further in Section 12.5.2.2.1. These results have also been apportioned to take into account any individuals that could only be identified to species group level[4].

49. Density maps have also been generated from the site-specific survey data at the projects. To build a density map, the study area is covered with a fine mesh of study points and the density is calculated at each point in the mesh in turn.

[4] E.g., for any individuals identified as seal / small cetacean species, they were distributed between grey seal and harbour porpoise according to the proportions of each species identified in the surveys.

Table 1.2 HiDef surveys species counts for the previous survey area (March 2019 to February 2021).

Survey date	Grey seal	Harbour porpoise	Minke whale	Partially identified seal species	Partially identified seal / small cetacean species	Partially identified cetacean species
March 2019	1	34	0	3	1	1
April 2019	0	16	0	0	0	0
May 2019	0	1	0	0	0	0
June 2019	0	21	0	3	0	0
July 2019	0	13	0	1	0	0
August 2019	1	35	0	3	0	0
September 2019	0	40	1	1	0	0
October 2019	0	9	0	0	0	0
November 2019	1	34	0	1	1	0
December 2019	2	32	0	0	0	0
January 2020	0	20	0	1	1	0
February 2020	1	75	0	2	0	1
March 2020	0	37	0	1	0	0
April 2020	0	40	0	0	1	1
May 2020	1	33	0	0	1	0
June 2020	0	27	0	0	2	1
July 2020	0	23	0	0	2	0
August 2020	2	11	0	0	0	0
September 2020	0	34	0	0	4	0
October 2020	1	25	0	0	1	0

Survey date	Grey seal	Harbour porpoise	Minke whale	Partially identified seal species	Partially identified seal / small cetacean species	Partially identified cetacean species
November 2020	0	55	0	0	3	1
December 2020	0	24	0	3	0	0
January 2021	1	28	0	2	0	0
February 2021	2	35	0	2	0	0
TOTAL	**13**	**702**	**1**	**23**	**17**	**5**

1.5.1.1 Other offshore wind farm surveys

50. In addition to site specific surveys for North Falls, further information has been obtained from Five Estuaries Offshore Wind Farm Limited (VEOWL) who commissioned HiDef to undertake aerial surveys between March 2019 and February 2021. The surveys covered the Five Estuaries wind farm survey area as well as a 4km buffer area. The results indicated harbour porpoise were the most abundant marine mammal species recorded, with peaks seen in November 2019 and May 2020. In November 2019 harbour porpoise reached a density of 8.48 animals/km^2 and 5.2 animals/km^2 in May 2020; outside of these months the estimated density ranged between 0.14 and 3.10 animals/km^2. The only other marine mammal species recorded was grey seal. Over the two survey year period a total of eight grey seals were recorded (Five Estuaries Wind Farm Ltd, 2021).

51. Previous surveys undertaken by the Galloper and Greater Gabbard wind farms, which are in close proximity to North Falls, have been used for further baseline information. Galloper surveys were undertaken between June 2008 and May 2011, the results indicate harbour porpoise sightings were greater between March and May. The total raw count of harbour porpoise was 570 individuals sighted. Other than harbour porpoise, the only other marine mammal sighted were white-beaked dolphin; in June 2009 four individuals were sighted (Galloper Wind Farm Limited, 2011).

52. The Greater Gabbard surveys were undertaken between April 2004 and July 2005, a total of 176 marine mammals were recorded. Marine mammals recorded included two harbour seal; six grey seal; one unidentified seal species; one unidentified dolphin species and 166 harbour porpoise. Similarly, to Five Estuaries and Galloper, harbour porpoise were recorded most frequently in the months of March and April (Greater Gabbard Offshore Winds Ltd, 2005).

1.5.2 Harbour porpoise

1.5.2.1 Distribution

53. Within the southern NS area, harbour porpoise are the most common marine mammal species. During the North Falls baseline surveys (from March 2019 to February 2021) a total of 702 harbour porpoise were recorded. As noted above, given that the survey methodology was likely to result in underestimation of harbour porpoise numbers, an availability bias was applied.

54. Through the North Falls aerial surveys, harbour porpoise were recorded relatively frequently, and was the most commonly sighted marine mammal species within the survey. They were recorded all year round in high numbers with a slight peak in February 2020.

55. Heinänen and Skov (2015) identified one area of persistently high harbour porpoise density in the summer period extending from the western slopes of Dogger Bank south along a 30m depth contour towards an area off the Norfolk coast (but not reaching the offshore project area). Persistently high densities of harbour porpoise in winter were also identified in the southern NS, within an area between Flamborough Head and the outer Thames Estuary, including the offshore project area.

56. The JCP Phase III Report (Paxton *et al.,* 2016) identifies a similar distribution of high harbour porpoise density, with a relatively high density in the southern NS, with an estimated density of 0.6-1.0 individuals per km^2 in the vicinity of the offshore project area (0.2-0.6 per km^2 – 1.0-2.0 per km^2 97.5% CI; Paxton *et al.,* 2016).

57. Seasonal maps produced by Gilles *et al.* (2016) for harbour porpoise density across the central and south-eastern NS, indicated that in spring there were higher density areas in the southern and south-eastern part of the NS (with an estimated density of 0-0.8 individuals per km^2 in the vicinity of the offshore project area). In summer, there was an apparent shift, compared to spring, toward offshore and western areas (with an estimated density of 0.81-2.5 individuals per km^2). In autumn, there were lower densities compared to spring and summer, and the distribution was spatially heterogeneous (with an estimated density of 0.41-1.50 individuals per km^2; Gilles *et al.,* (2016).

58. Distribution and abundance maps were developed by Waggitt *et al.* (2019) for cetacean species around Europe. For harbour porpoise, the distribution maps show a clear pattern of high harbour porpoise density in the southern NS, and the coasts of SE England, for both January and July (Plate 1.3, Waggitt *et al.,* 2019).

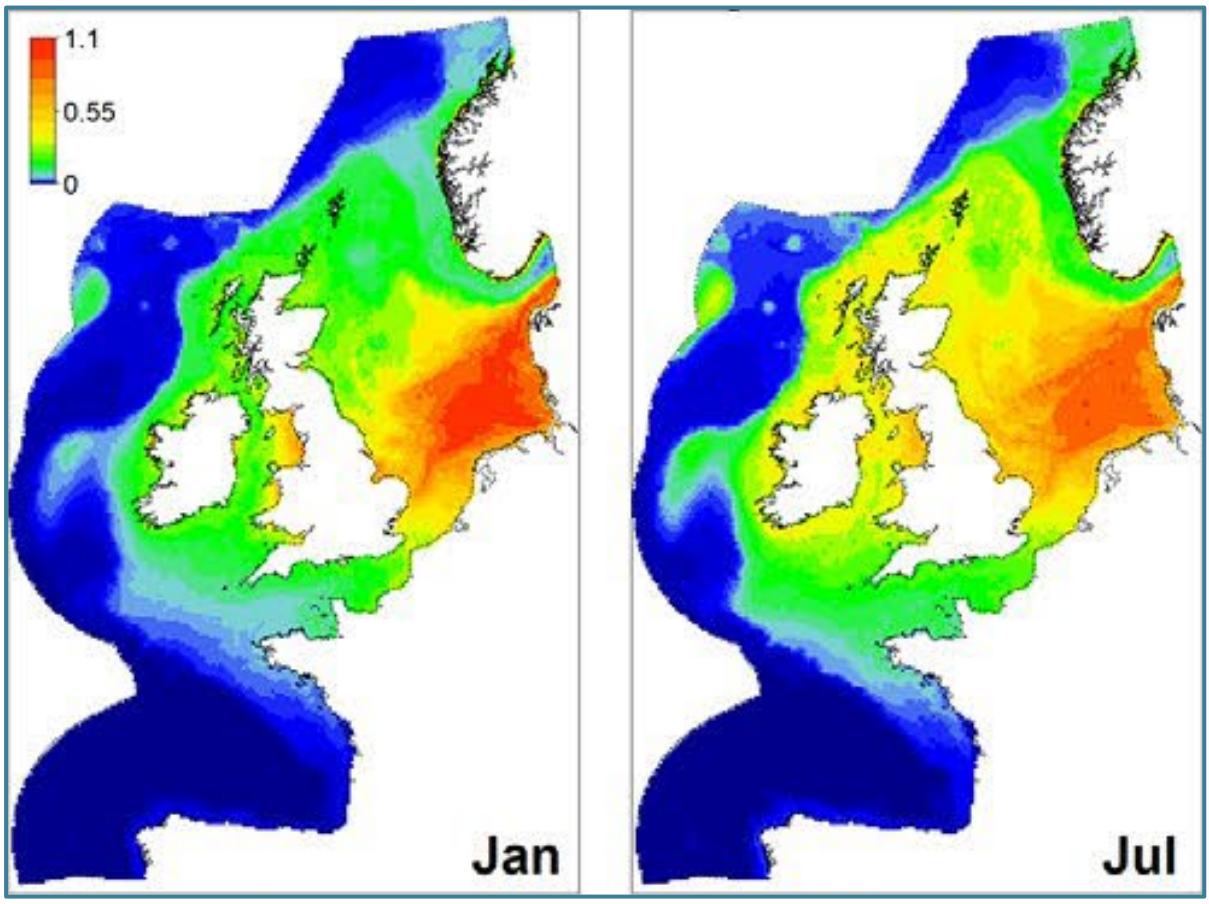

Plate 1.3 Spatial variation in predicted densities (individuals per km of harbour porpoise in January and July in the NE Atlantic). Values are provided at 10km resolution. Source: Waggitt *et al.,* 2019.

1.5.2.2 Site-specific surveys

59. Data from the North Falls site specific surveys were used to generate abundance and density estimates for the sites with a 4km buffer.

1.5.2.2.1 Density estimates for harbour porpoise

60. Density estimates of animals/km^2 have been calculated from the raw data counts for harbour porpoise. These have also been corrected for availability bias and apportioned for the proposed array area. These abundance and densities are for the entire survey area, plus 4km buffer.

61. Correction factors were then be applied to the density estimates to account for the presence of individuals below 2m water depth (the depth at which it is no longer possible to detect marine mammals from aerial imagery).

62. The correction factors are based on Teilmann *et al.* (2013), with different correction factors applied for different months, times of day, and for whether individuals would be at the surface or within the top 2m of the water column. More general correction factors have been applied to the species groups that have the potential to be harbour porpoise and are set out below.

63. The correction factors applied for harbour porpoise are dependent on the month, and time of day for which data was collected (see Table 12.3).

Table 1.3 Correction factors used to account for the availability bias for harbour porpoise for different months, and times of day (taken from Teilmann *et al.*, 2013)

Month	Surface		0 – 2m	
	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
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

64. Voet *et al.* (2017) have determined seasonal correction factors for harbour porpoise that can be used to determine abundance and density estimates obtained from aerial digital surveys (Table 12.4). These seasonal correction factors are based on published dive profile data from harbour porpoise tagged in the NS. The Teilmann *et al.* (2013) tagging study indicated significant differences in the percentage of time that each harbour porpoise spent between 0 and 2m water depth with the time of year. Spring and summer had a higher average time spent between 0 and 2m compared autumn and winter. Therefore,

to take this into account, Teilmann *et al.* (2013) suggest that aerial survey data should be corrected for time submerged as well as for seasonal effects.

65. The seasonal correction factors in Table 12.4 has been used to generate harbour porpoise site specific density estimates for the array area and 4km buffer.

Table 1.4 Harbour porpoise seasonal correction factors

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

66. Site specific density estimates for harbour porpoise have then been calculated, based on the density estimate (with availability bias) for harbour porpoise, and including the apportioning of individuals that could not be identified to species level.

67. The maximum density of each month was taken for apportioned and corrected harbour porpoise densities. The average of the winter months (October to March), summer months (April to September), and annual density has then been calculated based on the maximum calculated for each month. Table 12.5 shows the density estimates for harbour porpoise only.

Table 1.5 Maximum harbour porpoise density estimate calculated for each month, corrected for availability bias, with summer, winter and annual density estimates for whole survey area, plus 4km buffer

Month	Maximum density estimate (corrected) for whole survey area (animals/km^2)
January	1.89 (95% CI = 0.8 – 3.27)
February	5.01 (95% CI = 2.89 – 7.06)
March	2.64 (95% CI = 1.24 – 4.19)
April	2 (95% CI = 1.13 – 3.04)
May	0.9 (95% CI = 0.4 – 1.4)
June	1.68 (95% CI = 1.08 – 2.28)
July	1.77 (95% CI = 0.57 – 3.13)
August	1.43 (95% CI = 0.58 - 2.33)
September	2.21 (95% CI = 1.2 – 3.35)
October	3.06 (95% CI = 1.91 – 4.15)
November	3.95 (95% CI = 2.15 - 5.88)
December	2.75 (95% CI = 0.79 – 5.11)
Average winter	**3.217**
Average summer	**1.665**
Average annual	**2.441**

1.5.2.2.2 Density maps for harbour porpoise

68. Density maps were derived from the data collected within the aerial surveys for the previous survey area. These density maps are provided in Plate 1.4 and Plate 1.5.

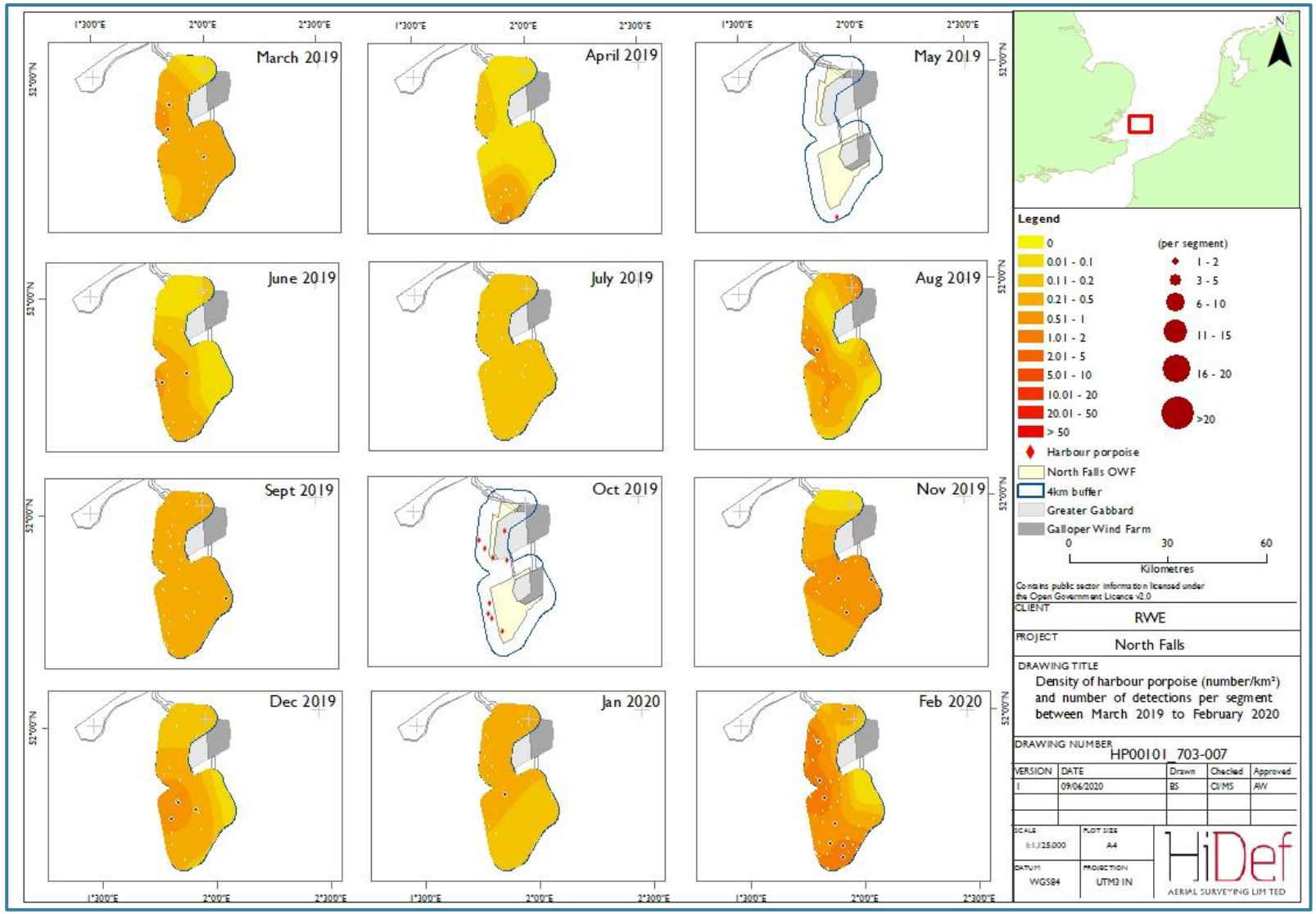

Plate 1.4 Harbour porpoise density maps for March 2019 to February 2020

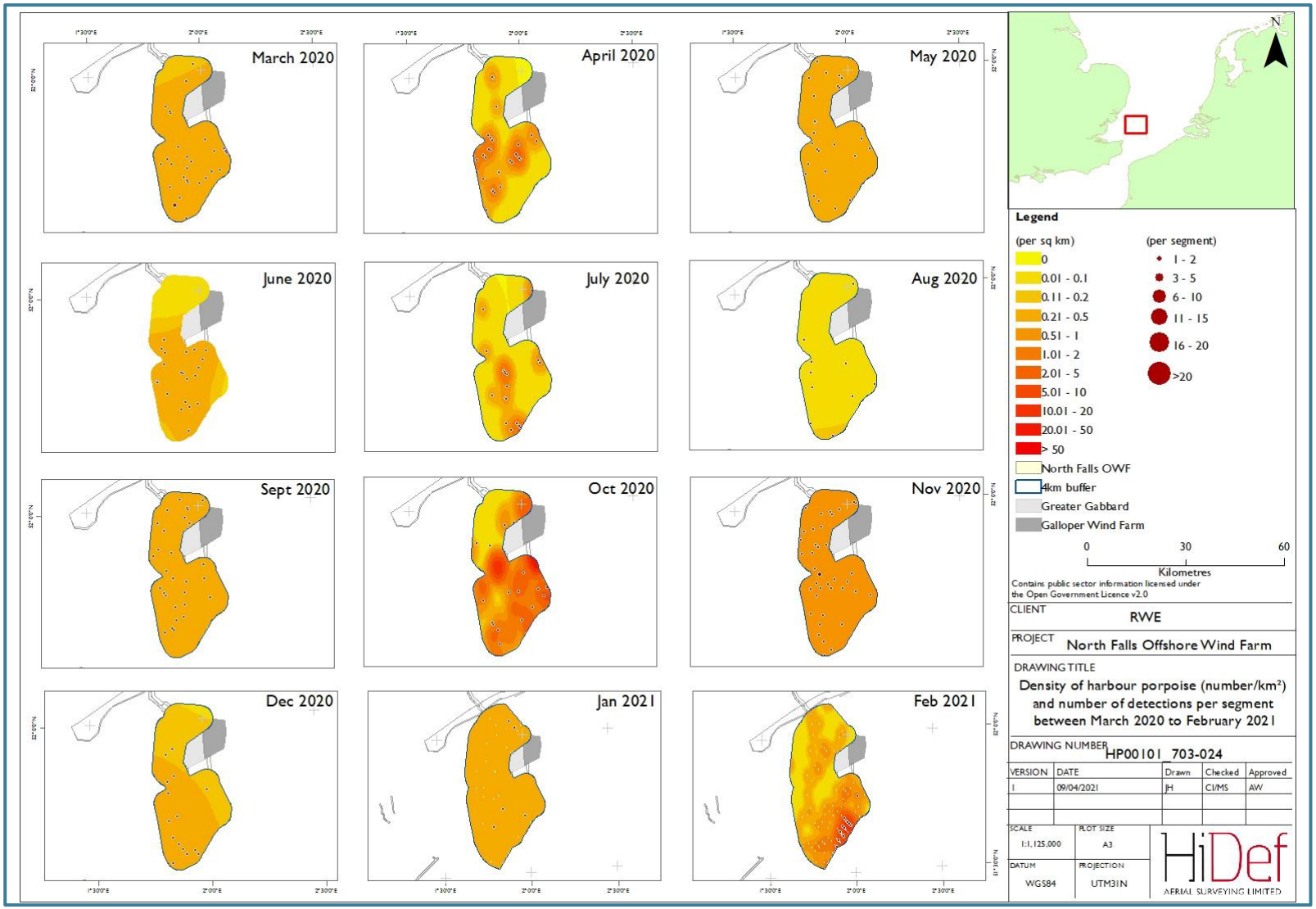

Plate 1.5 Harbour porpoise density maps for March 2020 to February 2021

1.5.2.2.3 Abundance estimates for harbour porpoise

69. The population estimates of harbour porpoise within the survey area have been derived and estimates have been corrected and summarised in the same way as the density estimates above.

70. These population estimates are shown in Table 12.6. As mentioned above, there is a clear seasonal pattern in the abundance of harbour porpoise within the entire survey area, with higher numbers present in the winter months. After being corrected for availability bias, the highest population estimate for harbour porpoise was in February 2020, with 1,878 individuals, while the lowest population estimate was 339 in May 2020.

Table 1.6 Estimated population estimate of harbour porpoise within whole survey area, corrected for availability bias

Month	Maximum population estimate (corrected) for harbour porpoise
January	711 (95% CI = 298 – 1,210)
February	1,878 (95% CI = 1,087 – 2,633)
March	988 (95% CI = 466 – 1,568)
April	739 (95% CI = 431 – 1,131)
May	339 (95% CI = 160 - 529)
June	624 (95% CI = 412 - 846)
July	667 (95% CI = 217 – 1,174)
August	541 (95% CI = 217 - 864)
September	830 (95% CI = 448 – 1,244)
October	1,129 (95% CI = 721 – 1,544)
November	1,460 (95% CI = 810 – 2,201)
December	1,022 (95% CI = 301 – 1,906)
Average winter	**1,198**
Average summer	**623.3**
Average annual	**910.7**

1.5.2.3 Harbour porpoise distribution patterns within North Falls

1.5.2.3.1 Abundance and density estimates for harbour porpoise

71. A series of large-scale surveys for cetaceans in European Atlantic waters was initiated in summer 1994, in the NS and adjacent waters (SCANS, 1995; Hammond *et al.,* 2002) and continued in summer 2005 in all shelf waters (SCANS-II 2008; Hammond *et al.,* 2013). Despite no overall change in population size between the SCANS-I and SCANS-II surveys, large scale changes in the distribution of harbour porpoise were observed between 1994 and 2005, with the main concentration shifting from north eastern UK and Denmark to the southern NS. Such large-scale changes in the distribution of harbour porpoise are likely the result of changes to the availability of principal prey within the NS (SCANS-II, 2008).

72. Results from the SCANS-III survey (undertaken in summer 2016; Hammond *et al*., 2021) also indicate that the occurrence of harbour porpoise is greater in the central and southern areas of the NS compared to the northern NS. In the latest

SCANS IV survey sightings of harbour porpoise were seen throughout the entire channel, which has not been seen in previous years (Gilles *et al*., 2023).

73. In 2022 the Zoological Society of London (ZSL) carried out a visual and acoustic vessel-based survey focused on the presence and distribution of cetaceans within the Thames Estuary. The study observed high encounter rate in the Thames indicating the importance of UK estuaries for harbour porpoises in general (ZSL, 2022).

74. A review of citizen science programs in the NS, found that higher density areas occur off the coast of Aberdeen and the Shetland Islands as well as farther south on routes approaching the Netherlands and Denmark. Analysis of temporal trends in porpoise densities indicated an increase in the NS. The review also indicated that densities were also lower along routes in the English Channel, with densities higher in the NS and off the coast of Cornwall in the Celtic Sea (Nielsen *et al*., 2021).

75. Within the impact assessments for harbour porpoise, and in addition to the site specific density estimates for harbour porpoise, density estimates from the SCANS-IV surveys (Gilles *et al.,* 2023) will also be used to provide context for the wider area. The offshore project area site is in SCANS-IV survey block NS-B (Plate 1.6; Plate 1.7):

- Abundance = 7,982 harbour porpoise (95% Confidence Limits (CL) = 4,865 – 13,033)
- Density = 0.3096 harbour porpoise/km^2 (CV=0.239)

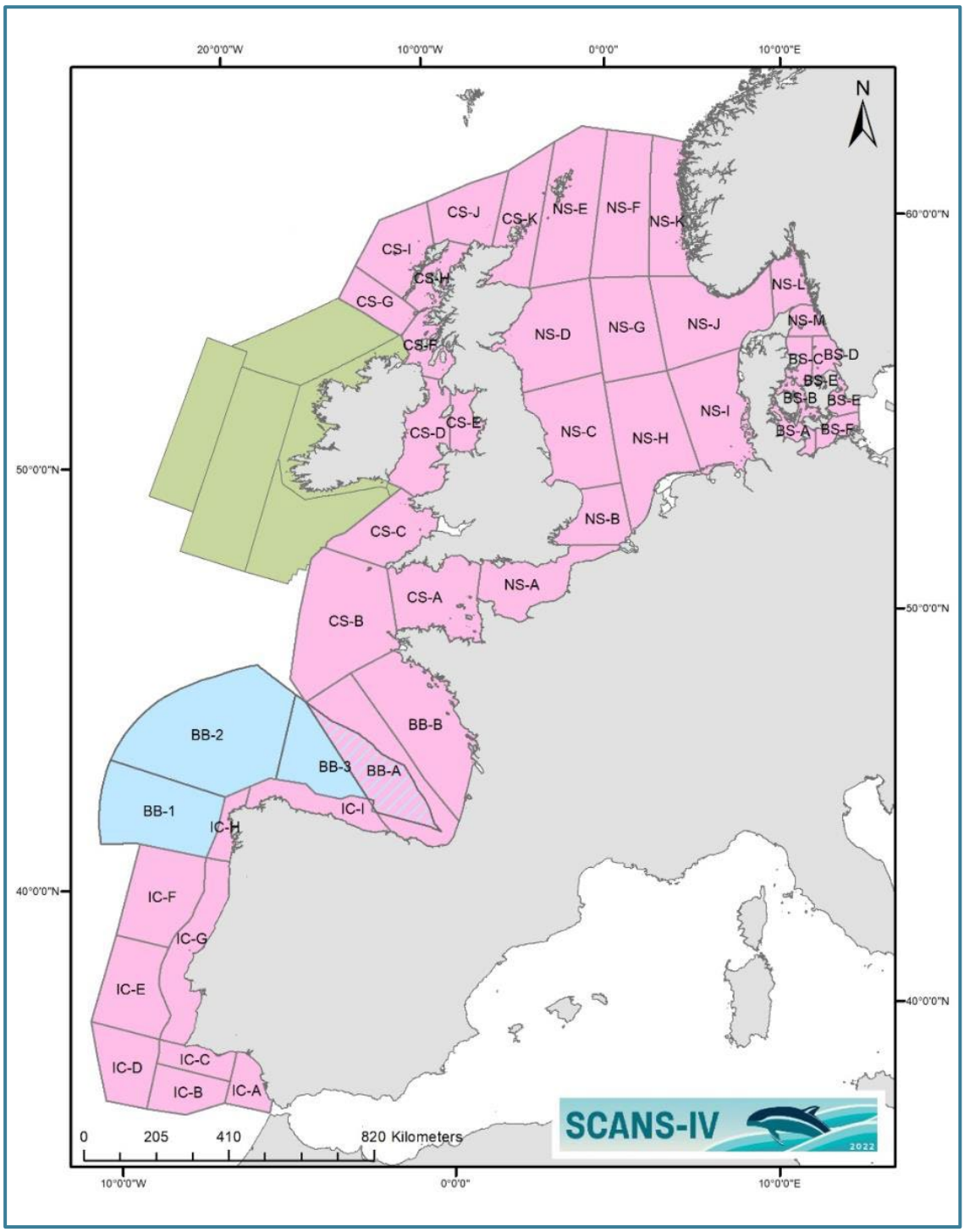

Plate 1.6 Area covered by the SCANS-IV survey, and the locations of the SCANS-IV survey blocks (the offshore project area is within Survey Block NS-B) (Gilles *et al.,* 2023)

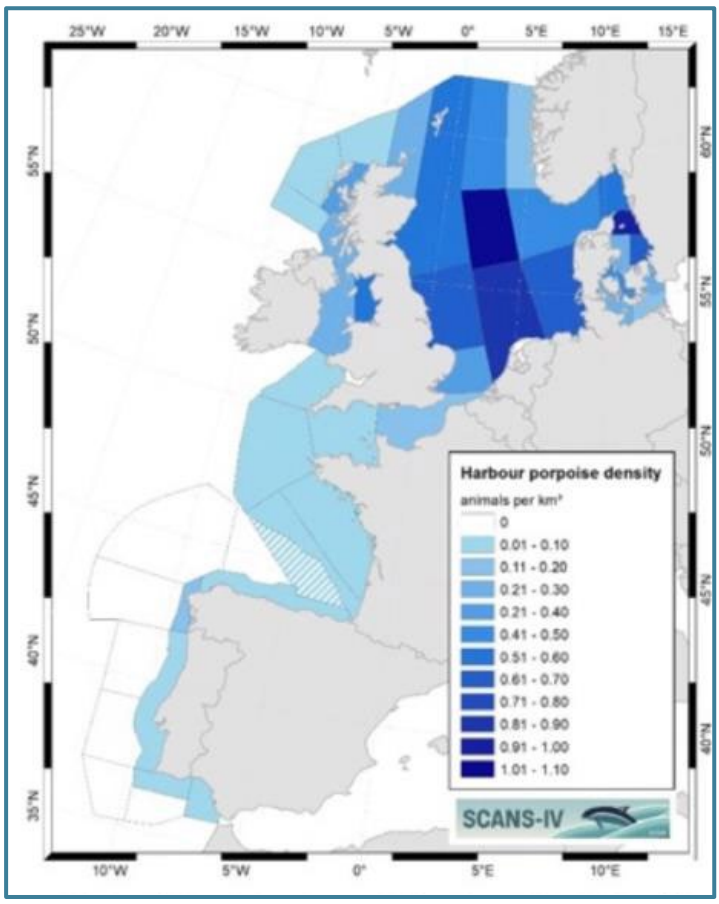

Plate 1.7 Estimated harbour porpoise density in each SCANS-IV survey block (Gilles *et al.,* 2023)

76. Distribution and abundance maps were developed by Waggitt *et al*. (2019), interrogation of this data, including all 10km 'grids' that overlap with the specified area, reveals an average density estimate of:

- 0.393 individuals per km^2 annual density (average of all overlapping 10km 'grids') for the North Falls array area;
- 0.378 individuals per km^2 summer density (average of all overlapping 10km 'grids') for the North Falls array area;
- 0.408 individuals per km^2 winter density (average of all overlapping 10km 'grids') for the North Falls array area.

77. 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, 2014; 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).

78. IAMMWG defined three MUs for harbour porpoise: NS; West Scotland; and the Celtic and Irish Sea. The offshore project area is located in the NS MU (as shown on Figure 1.1).

79. The most recent estimate of harbour porpoise abundance in the NS MU is provided by Gilles *et al*. (2023), with a population estimate of 338,918 (95%; CL = 243,063 – 476,203; Gilles *et al*., 2023). This is the reference population for harbour porpoise, of which any potential impacts will be assessed against.

1.5.2.4 Diet

80. 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. For example, sandeels (*Ammodytidae* species), which are known prey for harbour porpoise, exhibit a strong association with key surface sediments (Gilles *et al.,* 2016; Clarke *et al.,* 1998).

81. 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 and 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, especially Gadoids, Clupeids and sandeels (Berrow and Rogan 1995; Kastelein *et al.,* 1997; Börjesson *et al.,* 2003; Santos and Pierce 2003; Santos *et al.,* 2004).

82. Harbour porpoise tend to concentrate their movements in small focal regions (Johnston *et al.,* 2005), which often approximate to particular topographic and oceanographic features and are associated with prey aggregations (Raum-Suryan and Harvey 1998; Johnston *et al.,* 2005; Keiper *et al*., 2005; Tynan *et al.,* 2005). Consequently, habitat use is highly correlated with prey density rather than any particular habitat type.

83. Harbour porpoise have relatively high daily energy demands and need to capture enough prey to meet its daily energy requirements. It has been estimated that, depending on the conditions, harbour porpoise can rely on stored energy (primarily blubber) for three to five days, depending on body condition (Kastelein *et al.,* 1997).

1.5.3 Minke whale

1.5.3.1 Distribution

84. Minke whales are widely distributed along the Atlantic seaboard of Britain and Ireland and throughout the NS. The JNCC Cetacean Atlas (Reid *et al.,* 2003), indicates that minke whale occur regularly in the NS to the north of Humberside, but are comparatively scarce in the southern NS. Animals are present throughout the year, but most sightings are between May and September (Reid *et al.,* 2003). Department for Energy and Climate Change (DECC) (2016) support this, stating that sightings rarely extend past Dogger Bank, but that occasional sightings of minke whale are made as far south as Flamborough Head and the north Humberside coastlines between July and October (DECC, 2016).

85. Higher densities of minke whale have been recorded along the margins of Dogger Bank and adjacent areas in spring and summer (de Boer, 2010; Gilles *et al.,* 2012; Hammond *et al.,* 2013). Few sightings of minke whale have been made further south of these areas and it is thought that they probably enter the NS from the north (DECC, 2016). Minke whales appear to move into the NS at the beginning of May and are present throughout the summer until October (Northridge *et al.,* 1995).

86. The JCP Phase III Report (Paxton *et al.,* 2016) identified a total of 1,860 minke whale sightings within the UK offshore area. The density of minke whale was predicted to be highest along the northern coast of the UK, from Yorkshire north to the Kintyre Peninsula. The resultant density maps produced in the JCP Phase III Report (Paxton *et al*., 2016) show a minke whale density of less than 0.04 per km^2 for the southern NS (97.5% CI 0-0.02 – 0.08 per km^2) below the Humber Estuary and Flamborough Head.

87. For minke whale, the distribution maps (developed by Waggitt *et al*., 2019) show a clear pattern of higher density in the northern NS, and around the coasts of Scotland, Ireland and within the Celtic and Irish Sea, with decreasing densities southwards of Scotland along the east coast of England. There is a clear seasonal difference in the densities of minke whale, with higher densities in July, which is particularly evident in the north of their range (Plate 1.8; Waggitt *et al*., 2019). In addition, the distribution maps indicate a ‘corridor’ of increased minke whale density travelling from north of Orkney, around the north and west coasts of the UK to Northern Ireland.

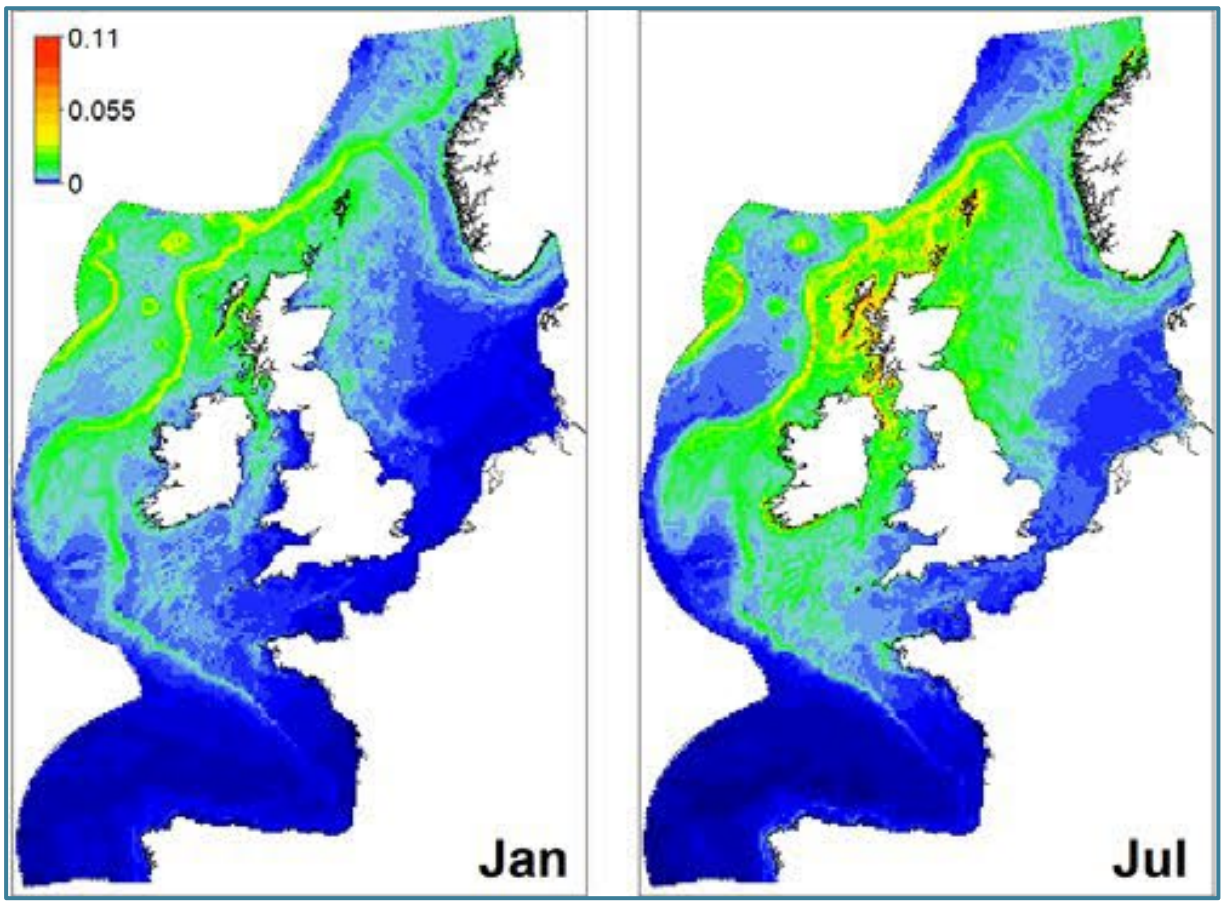

Plate 1.8 Spatial variation in predicted densities (individuals per km of minke whale in January and July in the NE Atlantic). Values are provided at 10km resolution. Source: Waggitt *et al.,* 2019.

1.5.3.2 Site-specific surveys

88. During the North Falls site specific aerial surveys (surveys undertaken between March 2019 and February 2021), a single minke whale was positively identified in September 2019, resulting in a relative density estimate of 0.02 individuals per km^2.

1.5.3.3 Abundance and density estimate for minke whale

89. For the entire SCANS-IV survey area, minke whale abundance in the summer of 2022 was estimated to be 12,417 with an overall estimated density of 0.0085/km^2 (CV = 0.361; 95% CL = 7,038-26,943; Gilles *et al*., 2023).

90. Distribution and abundance maps were developed by Waggitt *et al*. (2019), interrogation of this data, including all 10km 'grids' that overlap with the specified area, reveals an average density estimate of:

- 0.001 individuals per km^2 annual density (average of all overlapping 10km 'grids') for the North Falls array area;
- 0.001 individuals per km^2 summer density (average of all overlapping 10km 'grids') for the North Falls array area;
- 0.0006 individuals per km^2 winter density (average of all overlapping 10km 'grids') for the North Falls array area.

91. Within the impact assessments for minke whale, density estimates from the SCANS-IV surveys will be used. the offshore project area is located in SCANS-

IV survey block NS-B, however there were no sightings in this block therefore, the adjacent block will be used; block NS-H (Plate 1.9; Gilles *et al.,* 2023):

- Abundance = 1,061 minke whale (95% CL=231-2,771)
- Density = 0.0153 minke whale/km^2 (CV=0.552)

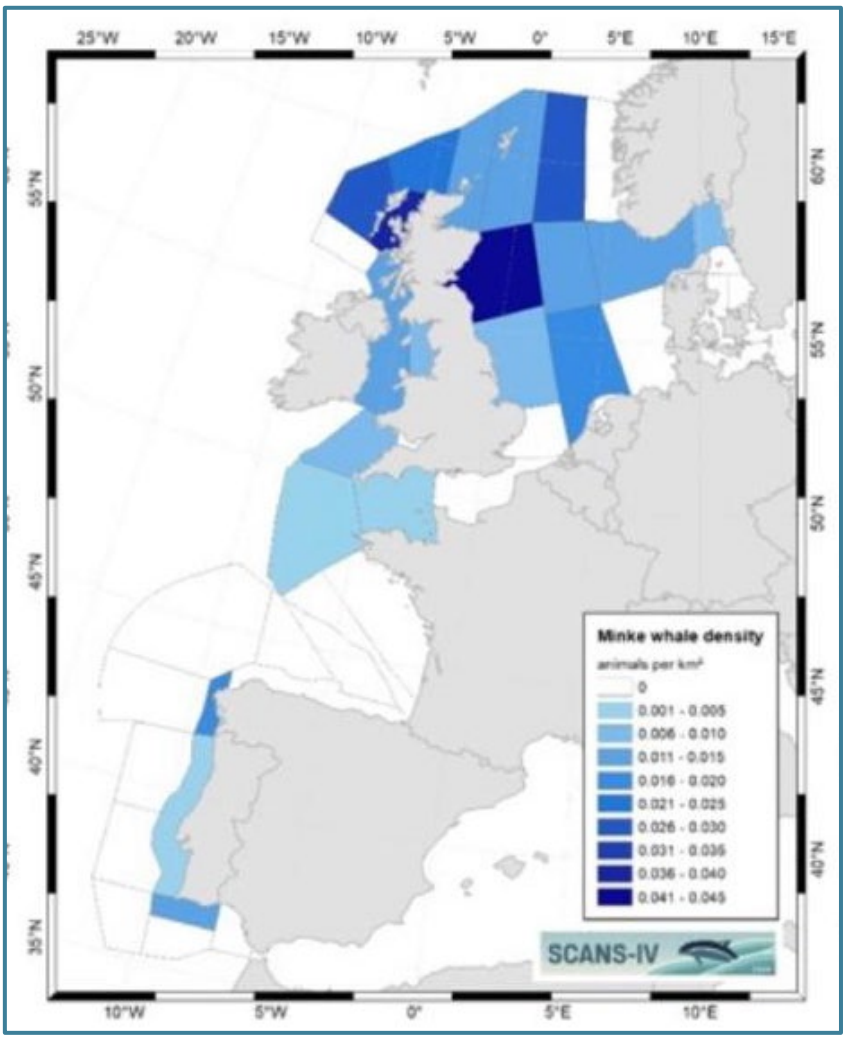

Plate 1.9 Estimated minke whale density in each SCANS-IV survey block (Gilles *et al*., 2023)

92. Genetic evidence suggests that the minke whales 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 whales in European waters.

93. The single MU for minke is the CGNS MU (as shown on Figure 1.1). The reference population for minke whales in the CGNS MU is 20,118 animals (CV = 0.18; 95% CI = 14,061 – 28,786; IAMMWG, 2023). This estimate was derived from using the SCANS-III (Hammond *et al*., 2017). The IAMMWG (2023) note the abundance of minke whales is highly seasonal, with abundance peaking during migration south into waters around the UK for summer.

1.5.3.4 Diet

94. 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 of through their baleen plates and swallow their prey whole.

95. A study into the diet of minke whale in the north-eastern 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 NS. 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 NS (Windsland *et al*., 2007).

1.5.4 Grey seal

1.5.4.1 Distribution

96. 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 north-west Europe (SCOS, 2022).

97. Approximately 35% of the world's grey seals breed in the UK, and 80% of these breed at colonies in Scotland with the main concentrations 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 south-west England and Wales (SCOS, 2022).

98. Grey seals are wide ranging and can breed and forage in different areas (Russell *et al*., 2013). For example, tags deployed on grey seals at Donna Nook and Blakeney Point in May 2015, indicated that they used multiple haul-outs sites; with one hauling out in the Netherlands and one in Northern France (Russell, 2016).

99. Plate 1.10 shows the tagged seal movements along the east coast of England and indicates that grey seal travel between haul-out sites along the east coast of England, as well as to the north of France, Firth of Forth and Dogger Bank, and travel through the offshore project area (Russell, 2016). Carter *et al.* (2022) provide grey seal movement maps for foraging trips only (the tagging data was cleaned to remove data during the harbour seal breeding season). This is shown in Plate 1.11, with grey seal foraging movements being located along the Norfolk, Lincolnshire and Yorkshire coasts, with some movement offshore.

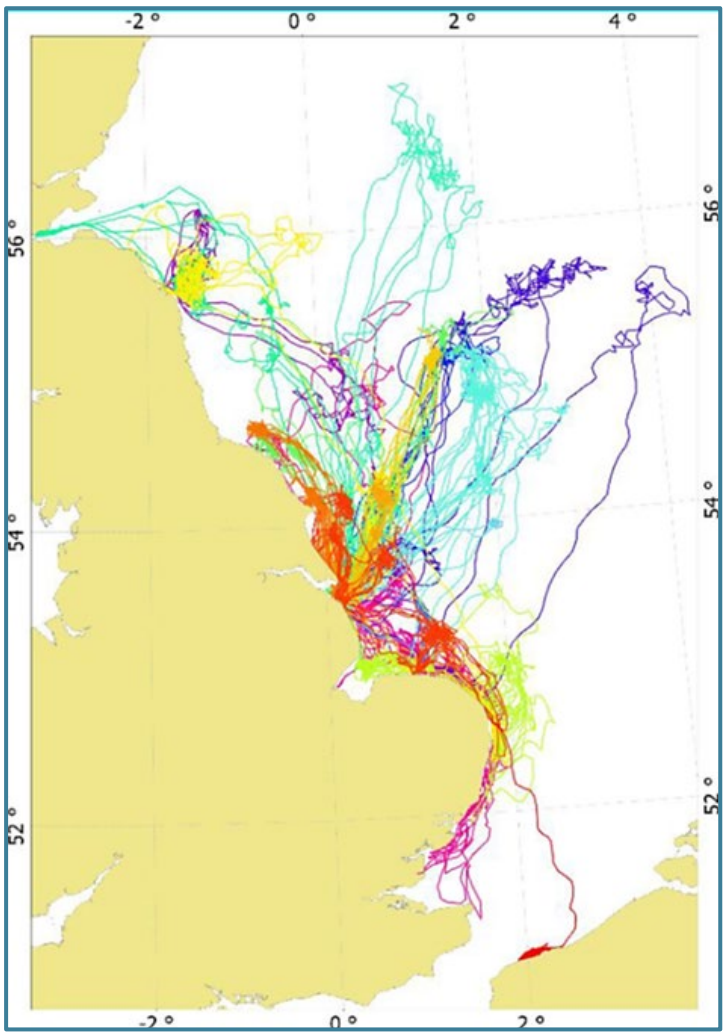

Plate 1.10 Tagged grey seal movements along the East coast of England (Russell, 2016).

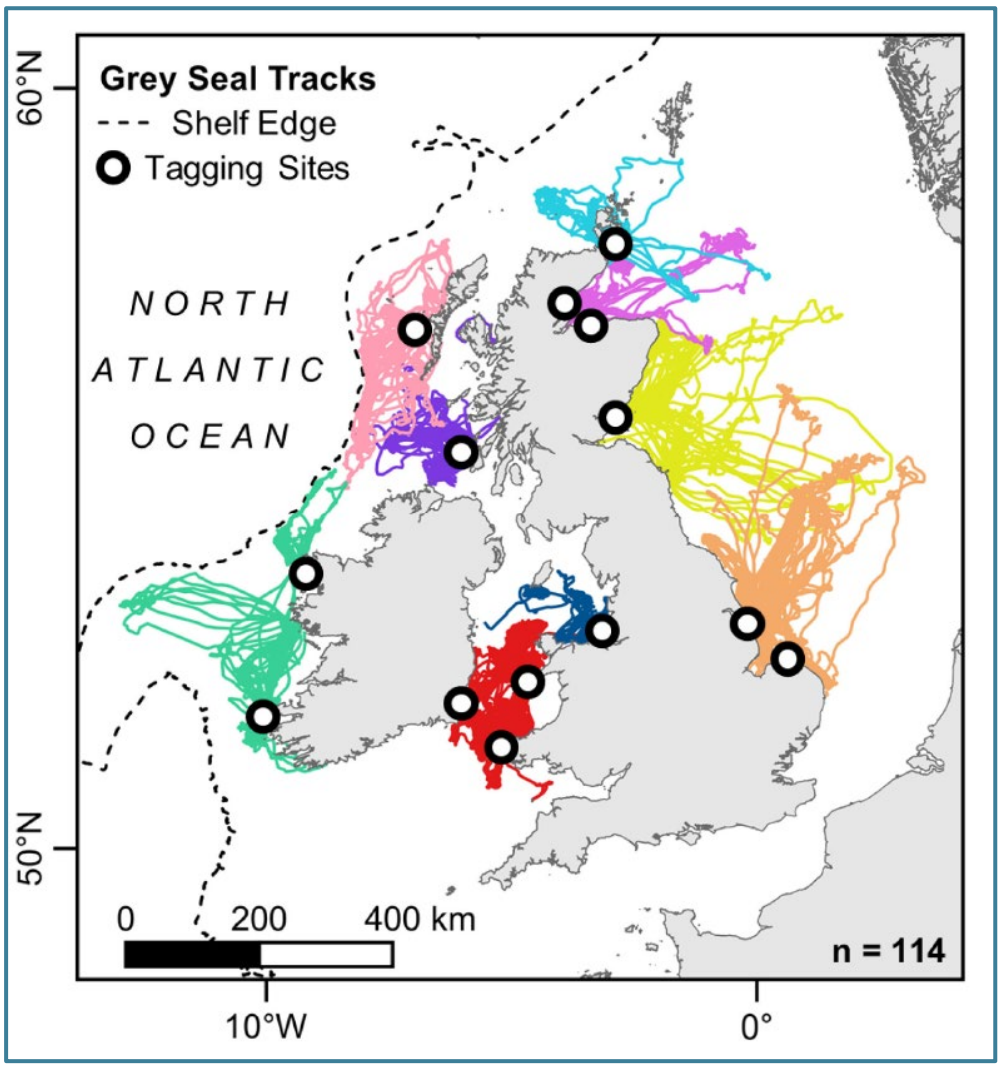

Plate 1.11 Grey seal tagging data 239 harbour seals, colour-coded by habitat preference region (Carter *et al*., 2022)

100. The north Dutch coastline is also an important foraging zone and migration route for grey seal (Brasseur *et al*., 2010).

101. Telemetry tagging studies of grey seals, undertaken from key haul-out sites along the north coast of France show connectivity of grey seals from the east coast of England to the north coasts of France, Belgium, and the Netherlands, (for tagged individuals from 2012; Vincent *et al*., 2017) (Plate 1.12).

102. There is a considerable amount of movement of grey seals that occurs (as observed from telemetry data) among the different areas and regional subunits of the NS, and no evidence to suggest that grey seals on the NS coasts of Denmark, Germany, the Netherlands or France are independent from those in the UK (SCOS, 2019).

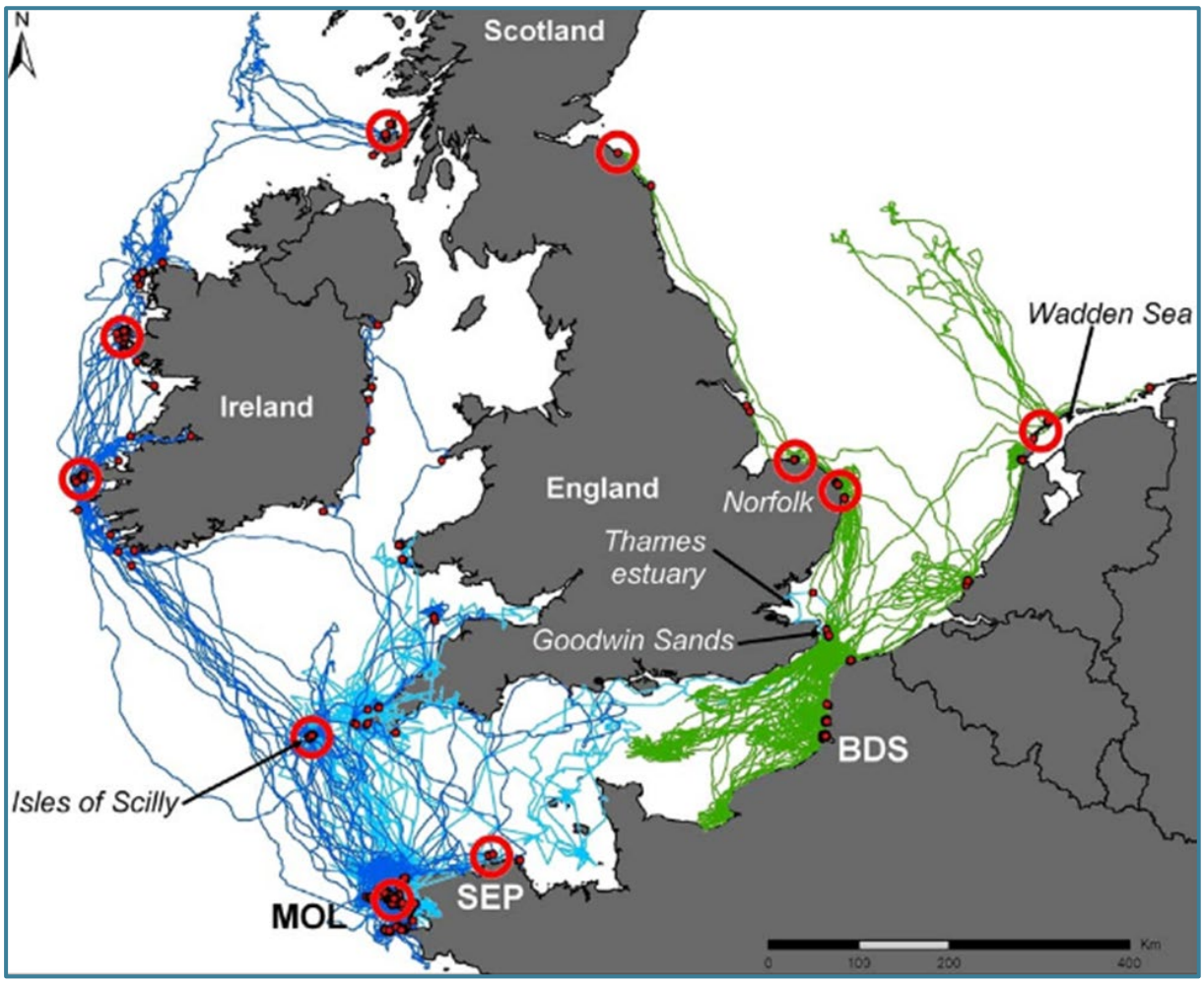

Plate 1.12 Grey seal telemetry tags (shown in green are the results from the tagging of 11 individuals in 2012, from the Baie de Somme (BDS) haul-out site on the north coast of France. Red dots indicate haul-out sites, and red circles indicate breeding locations. Source: Vincent *et al.* (2017).

1.5.4.2 Haul-out sites

103. Compared with other times of the year, grey seals in the UK spend longer hauled out during their annual moult (between December and April) and during their breeding season (SCOS, 2021).

104. In eastern England, pupping occurs mainly between early November and mid-December (SCOS, 2022). 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, 2022).

105. In 2021, the ZSL conducted a seal population survey in the outer Thames Estuary (SCOS, 2021; Cox, 2021). A total of 749 grey seal were counted during the 2021 survey, which results in a population estimate of 3,134 grey seal (95% CI 2,619 – 3,901) (Cox, 2021).

106. A number of seal haul-out sites are located within the outer Thames estuary (Plate 1.13), with seals using sandbanks to haul-out. There are intertidal haul-

out sites and not always available to seals, and therefore are unlikely to be used as pupping sites.

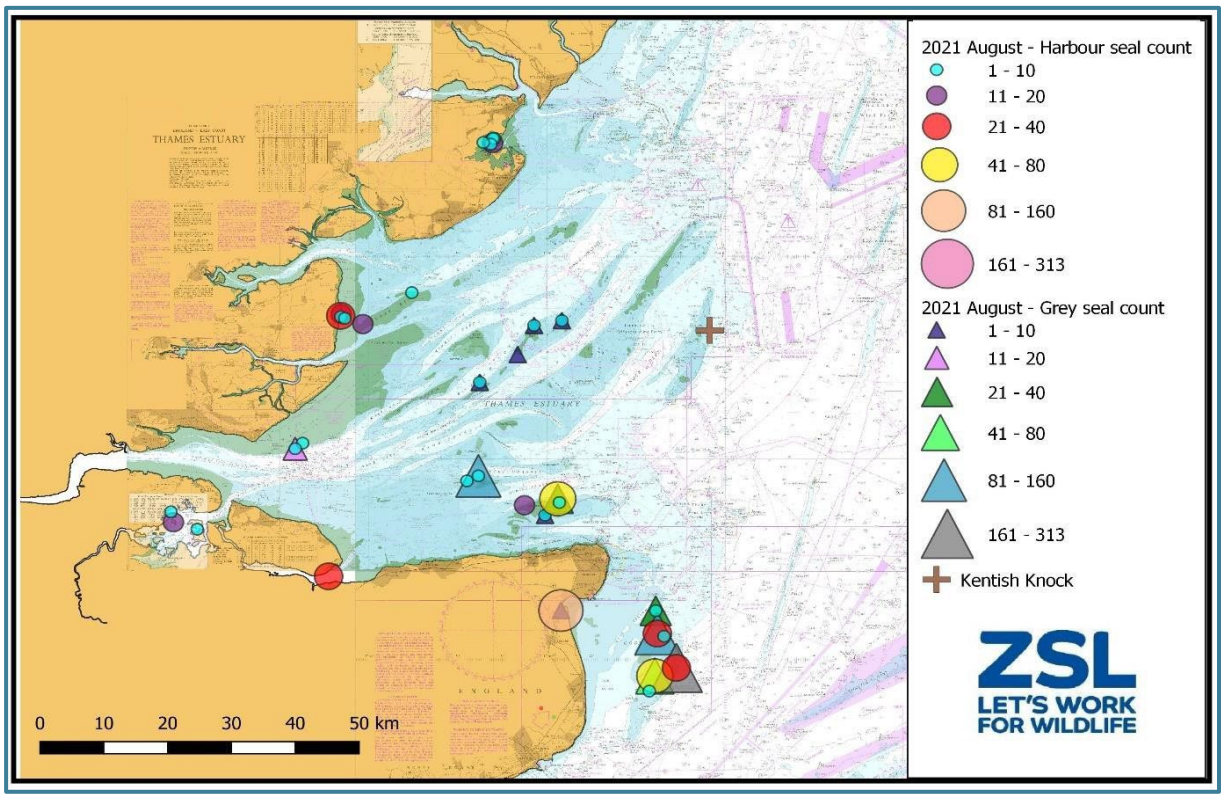

Plate 1.13 Counts of grey seal and harbour seal in the outer Thames Estuary in 2021 (Cox, 2021)

107. The array area is located approximately 40km from the East Anglian coast (at the closest point). Principal grey seal haul-out sites are included in Table 12.7, which shows the approximate distance to the closest point of the offshore project area, and the most recent grey seal count for each location.

Table 1.7 The most recent grey seal count at each of the nearby haul-out sites, and the distance to the offshore project area

Haul-out site	Distance to the offshore project area	Grey seal count
Sunk and Knock John sites	25km from offshore cable corridor 48km from array area	Up to 40 grey seal (2021 count; Cox *et al.,* 2020)
Long Sand	22km from offshore cable corridor 30km from array area	No grey seal in latest count (2021 count; Cox *et al.,* 2020)
Kentish Knock	16km from offshore cable corridor 17km from array area	Approximately 200 seals, not identified to species level (2021 count; Cox *et al.,* 2020)
Margate Sands and Pan Sand Ridge sites	46km from offshore cable corridor 43.5km from array area	Approximately 280 grey seal recorded over two survey dates (or 140 on average per survey day) across the sites (2021 count; Cox *et al*., 2020)
Blakeney Point National Nature Reserve (NNR)	140km from the offshore project area at closest point	493 grey seal (2021 mean grey seal count; SCOS, 2021).

Haul-out site	Distance to the offshore project area	Grey seal count
Horsey Corner	99km from the offshore project area at closest point	380 grey seal (2021 mean grey seal count; SCOS, 2021).
The Wash	170km from the offshore project area at closest point	799 grey seal (2021 mean grey seal count; SCOS, 2021).
Scroby Sands	80km from the offshore project area at closest point	1,377 grey seal (2021 mean grey seal count; SCOS, 2021).
Donna Nook	216km from the offshore project area at closest point	3,897 grey seal (2021 mean grey seal count; SCOS, 2021).

1.5.4.3 Site-specific surveys

108. As noted above, a relatively low number of grey seal were recorded during the site-specific aerial surveys, with a total of 13 individuals recorded through the 24 survey dates, however, in addition a total of 23 partially identified (to species) seals were recorded, as well as 17 seal / small cetacean species, a proportion of which are expected to be grey seal.

109. Throughout the surveys the numbers of grey seal, or individuals that could be grey seal (i.e., seal species and seal / small cetacean species) were relatively similar year-round, with no clear change seasonally. Due to the low number of grey seal sightings, absolute density and abundance estimates were not possible to derive.

1.5.4.4 Abundance and density estimates for grey seal

1.5.4.4.1 Seal density maps

110. The following sections provide the grey seal at-sea density estimates from a grey seal mapping dataset, Carter *et al.* (2022).

111. The relative seals at-sea density maps have been used to calculate grey seal density estimates for the offshore project area. The Carter *et al*. (2022) density maps are an update to the Russell *et al*. (2017) mapping, and include updated tagging studies. These density maps only include tagging studies from the UK.

112. The resultant density of seals at-sea maps (Carter *et al*., 2022) differ from the Russell *et al*. (2017) maps, in that they show the relative density of seals in each 5km by 5km 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. 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, and therefore not included in the density mapping.

113. The total grey seal population in the British Isles, at-sea, is approximately 153,591 individuals, based on the most recent haul-out counts presented in

SCOS (2022), and the relevant grey seal correction factors[5]. This is the population estimate used with the Carter *et al*. (2022) data to calculate density estimates for the offshore project area.

114. The mean at-sea relative density estimates for these areas have been calculated from Carter *et al*. (2022), as the worst-case;

- 0.07 individuals per km^2 for the array area; and
- 0.19 individuals per km^2 for the offshore cable corridor.

1.5.4.4.2 Grey seal population counts

115. 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 (SCOS, 2022). The pup production estimates are converted to estimates of total population size (1+ aged population) using a mathematical model and projected forward (SCOS, 2022).

116. The most recent surveys from 2019 of the principal grey seal breeding sites in Scotland, Wales, Northern Ireland and south-west England, resulted in an estimate of 67,850 pups (95% CI = 50,250-85,400; SCOS 2020). When the pup production estimates are converted to estimates of total population size, there was an estimated 157,300 grey seals in 2019 (approximate 95% CI = 144,600-169,400; SCOS, 2020).

117. Grey seal pup production has increased continually since surveys started in the 1960s the rate of increase is approximately 1.4% per year (SCOS, 2022).

118. In the southern NS, the rates of increase in pup production from 2010 to 2014 by an average 22% per year) suggests that there must be some immigration from colonies further north (SCOS, 2020). The colonies in the southern NS are still increasing in population size, but the rate has been much lower in the last three years, giving an early indication that they may be reaching carrying capacity (SCOS, 2020).

119. The most recent estimated adult population size for the regularly monitored sites at the start of the 2020 breeding season was 140,900 (95% CI 130,600-151,600). When projected forward the model produced total population estimates of 143,100 (95% CI 130,200-157,500) at the start of the 2021 breeding season and 145,400 (95%CI 131,400-160,600) for the start of the 2022 breeding season. The population at the regularly monitored colonies was estimated to have increased 1.6% between 2021 and 2022 (SCOS, 2022).

120. In accordance with the agreed approach for other OWF, and as agreed during the 2nd Expert Topic Group (ETG) meeting on the 18th June 2020, the reference population extent for grey seal will incorporate the SE England MU and NE England MU (IAMMWG, 2013; SCOS, 2022).

[5] The total grey seal population is corrected from the haul-out counts (i.e. to take account of those not available to count during the August surveys) with the SCOS (2022) factor of 0.2515. A second corrected is then applied to generate the at-sea population, using the Russell *et al*. (2015) correction factor of 0.8616.

121. 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; SCOS, 2022), and therefore this has been used as a correction factor, to derive total grey seal numbers within each MU, rather than the number counted within each MU.

122. The reference population for grey seal is therefore currently based on the most recent estimates as shown in Table 12.8.

Table 1.8 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
SE England MU	7,694	SCOS 2022	0.2515	30,592
NE England MU	6,517	SCOS 2022	0.2515	25,913
Total wider reference population	**14,211**	**-**	**0.2515**	**56,505**

123. Assessments will be done in the context of the nearest MU (i.e. the 30,592 grey seal of the SE England MU), in addition to the wider reference population (i.e. both the SE and NE England MUs, with a total population estimate of 56,505). As a worst-case it is assumed that all seals are from the nearest MU, the SE England MU, although the more realistic assessment is based on wider reference population which takes into account the movement of seals.

1.5.4.5 Diet and foraging

124. Grey seals will typically forage in the open sea and return regularly to land to haul-out, although they may frequently travel up to 448km between haul-out sites. Foraging trips generally occur within 448km of their haul-out sites, although grey seal can travel up to several hundred kilometres offshore to forage (Carter *et al*., 2022). 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, 2019).

125. Individual grey seals based at a specific haul-out site often make repeated trips to the same region offshore, but will occasionally move to a new haul-out site and begin foraging in a new region (SCOS, 2019). 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).

126. Grey seals are generalist feeders, feeding on a wide variety of prey species (SCOS, 2019; Hammond and Grellier, 2006). Diet varies seasonally and from region to region (SCOS, 2019).

127. In the NS, principal prey items are sandeel, whitefish (such as cod, haddock, whiting and ling) and flatfish (plaice, sole, flounder, and dab) (Hammond and Grellier, 2006). Amongst these, sandeels are typically the predominant prey species.

128. Food requirements depend on the size of the seal and fat content (oiliness) of the prey, but an average consumption estimate of an adult is 4 to 7kg per seal per day depending on the prey species (SCOS, 2019).

1.5.5 Harbour seal

1.5.5.1 Distribution

129. Harbour seals have a circumpolar distribution in the Northern Hemisphere and are divided into five sub-species. The population in European waters represents one subspecies *Phoca vitulina vitulina* (SCOS, 2022).

130. On the east coast of Britain harbour seal distribution is generally restricted, with concentrations in the major estuaries of the Thames, The Wash, the Firths of Forth and Tay, and the Moray Firth (SCOS, 2022).

131. SMRU, in collaboration with others, has deployed around 344 telemetry tags on harbour seals around the UK between 2001 and 2012. The spatial distributions indicate harbour seals persist in discrete regional populations, display heterogeneous usage, and generally stay within 50km of the coast (Russell and McConnell, 2014). Tagged harbour seals were observed to have a more coastal distribution than grey seals and do not travel as far from haul-outs (Plate 1.14; Russell and McConnell, 2014). Carter *et al.* (2022) provide harbour seal movement maps for foraging trips only (the tagging data was cleaned to remove data during the harbour seal breeding season). This is shown in Plate 1.15, with harbour seal foraging movements being located within the southern NS area only.

132. Harbour seals generally make smaller foraging trips than grey seal, typically travelling 40 to 50km from their haul-out sites to foraging areas (SCOS, 2019). The range of these trips varies depending on the location and surrounding marine habitat. Tagging studies undertaken on harbour seal at The Wash (2003 to 2005) have shown that this population travels larger distances for their foraging trips than for other harbour seal populations and repeatedly forage between 75km and 120km offshore (average was 80km), with one seal travelling 220km (Sharples *et al.*, 2012). There is also evidence of the maximum foraging range to be 273km for harbour seals (Wakefield *et al.*, 2009 and Carter, 2022).

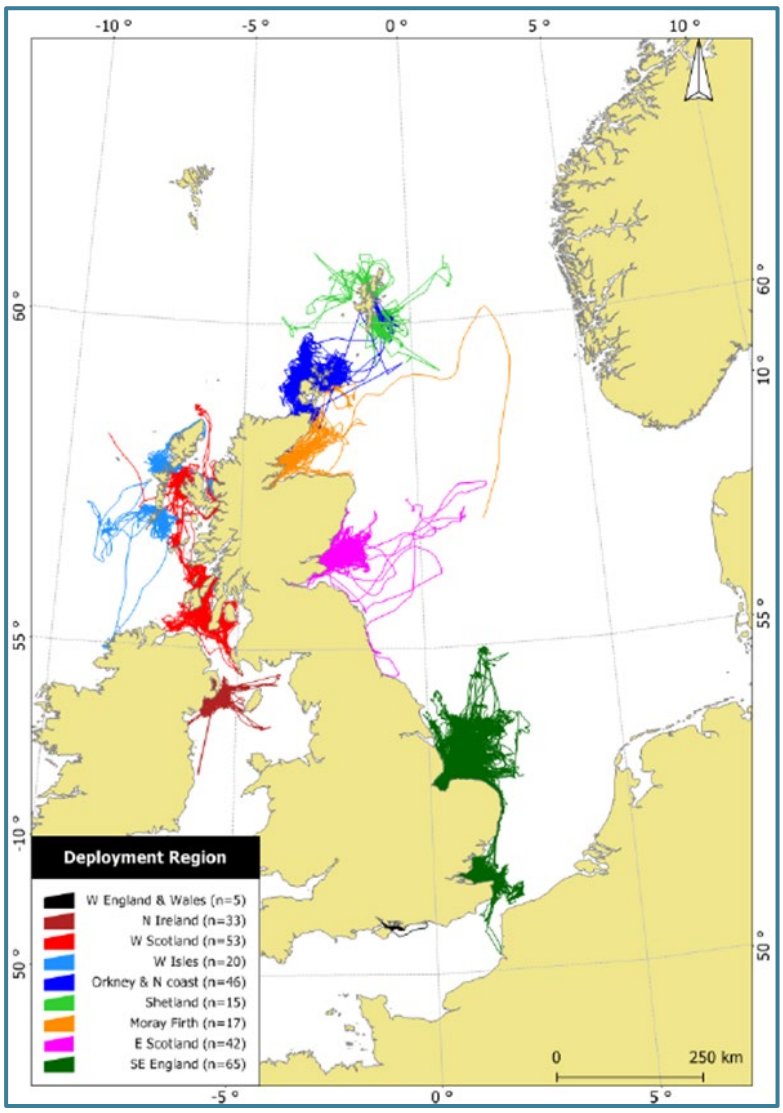

Plate 1.14 Telemetry tracks by deployment region for harbour seals aged one year or over (Russell and McConnell, 2014).

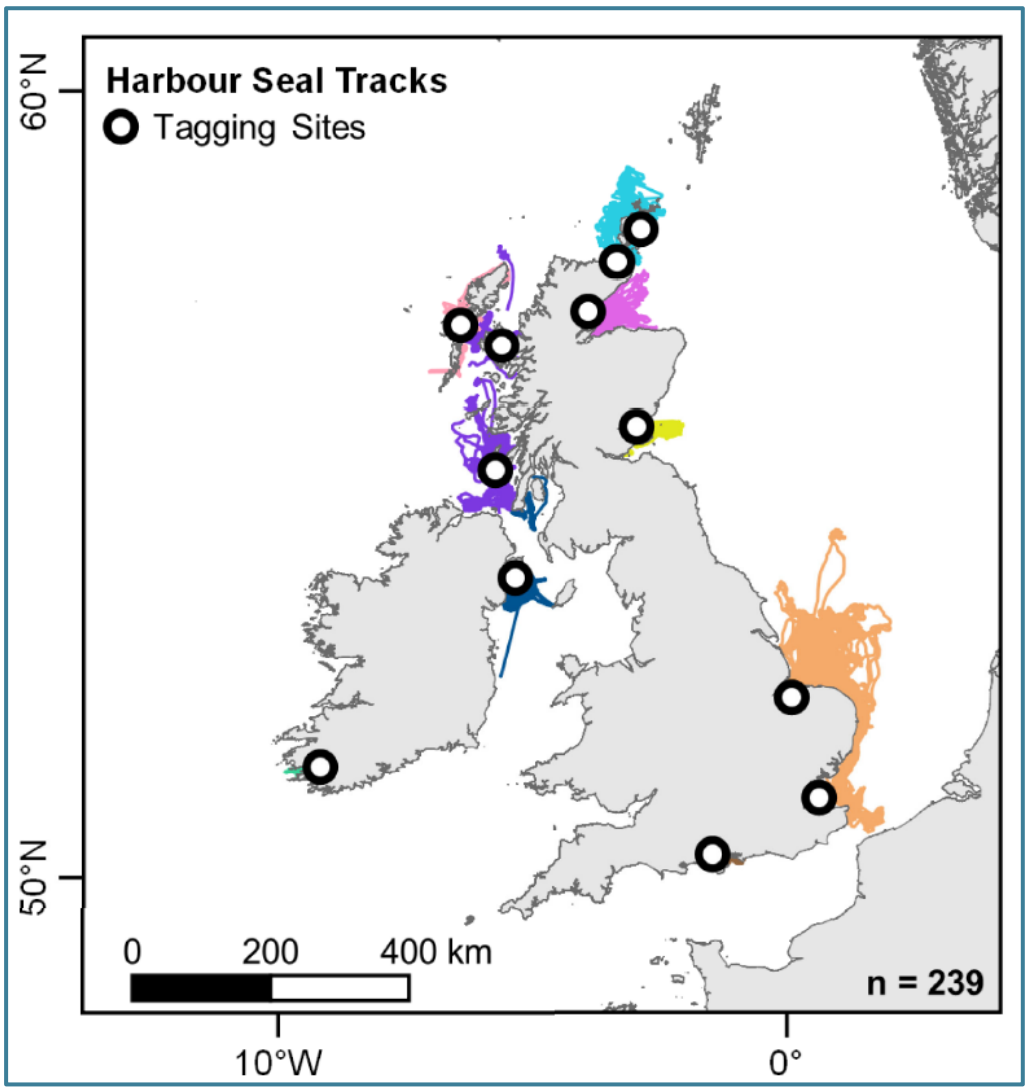

Plate 1.15 Harbour seal tagging data 239 harbour seals, colour-coded by habitat preference region (Carter *et al*., 2022)

1.5.5.2 Haul-out sites

133. Harbour seal come ashore in sheltered waters, typically on sandbanks and in estuaries, but also in rocky areas. Harbour seal regularly haul-out on land in a pattern that is often related to the tidal cycle (SCOS, 2019). Harbour seal give birth to their pups in June and July and pups can swim almost immediately after birth (SCOS, 2019). Harbour seals moult in August and spend a higher proportion of their time on land during the moult than at other times (SCOS, 2019).

134. In the 2021 ZSL seal population survey of the outer Thames Estuary, a total of 498 harbour seal were counted, with a resulting population estimate of 692 harbour seal (95% CI = 566 – 922) (Cox, 2021). A number of seal haul-out sites are located within the outer Thames estuary (Plate 1.13), with seals using sandbanks to haul-out. There are intertidal haul-out sites and not always available to seals, and therefore are unlikely to be used as pupping sites.

135. The array area is located approximately 40km from the East Anglian coast (at the closest point). Principal harbour seal haul-out sites are included in Table 12.9 below, which shows the approximate distance to the closest point of the

offshore project area, and the most recent harbour seal count for each location. These harbour seal haul-out sites are also shown on Plate 1.13.

Table 1.9 The most recent harbour seal count at each of the nearby haul-out sites, and the distance to the offshore project area

Haul-out site	Distance to the offshore project area	Harbour seal count
Hamford Water	8km from offshore cable corridor 41km from the array area	Between 11 and 20 harbour seal (2021 count; Cox *et al.*, 2020)
Buxey Sand North	11km from offshore cable corridor 41km from the array area	Up to 10 harbour seal (2021 count; Cox *et al.*, 2020)
Long Sand	22km from offshore cable corridor 30km from the array area	No harbour seal in latest count (2021 count; Cox *et al.*, 2020)
Kentish Knock	16km from offshore cable corridor 17km from the array area	Approximately 200 seals, not identified to species level (2021 count; Cox *et al.*, 2020)
Sunk and Knock John sites	25km from offshore cable corridor 48km from the array area	Up to 30 harbour seal (2021 count; Cox *et al.*, 2020)
Margate Sands	46km from offshore cable corridor 43.5km from the array area	Approximately 140 harbour seal recorded over two survey dates (or 70 on average per survey day) (2021 count; Cox *et al.*, 2020)
Scroby Sands	80km from the offshore project area at closest point	25 (mean 2021 harbour seal count; SCOS, 2022).
Horsey	99km from the offshore project area at closest point	12 (mean 2021 harbour seal count; SCOS, 2022).
Blakeney Point NNR	140km from the offshore project area at closest point	181 (mean 2021 harbour seal count; SCOS, 2022).
The Wash	170km from the offshore project area at closest point	2,667 (mean 2021 harbour seal count; SCOS, 2022).
Donna Nook	216km from the offshore project area at closest point	122 (2019 harbour seal count; SCOS, 2022).

1.5.5.3 Site-specific surveys

136. No harbour seals were recorded during the site-specific aerial surveys. However, a total of 23 unidentified seal species were recorded, as well as 17 seal / small cetacean species, a proportion of which are expected to be harbour seal.

137. With the exception of a large spike in unidentified seal sightings in February 2020 the number of individuals that could be harbour seal (i.e., seal species and seal / small cetacean species) were relatively similar year-round, with small spikes in sightings number, with an indication of an increase in the winter

periods. Due to there being no harbour seal sightings (and only unidentified seals), absolute density and abundance estimates were not possible to derive.

1.5.5.4 Abundance and density estimates for harbour seal

1.5.5.4.1 Seal density maps

138. Impact assessments will be based on densities as derived from desk-based sources. Carter *et al.* (2022) provides habitat-based predictions of at-sea distribution for harbour seal around the British Isles. The habitat preference approach predicted distribution maps provide estimates per species, on a 5km x 5km grid, of relative at-sea density for seals hauling-out in the British Isles.

139. The harbour seal density estimates for the offshore project area have been calculated from the latest seal at sea maps produced by SMRU (Carter *et al.,* 2022), based on thee 5km x 5km grids that overlap with each area. The total harbour seal population in the British Isles, at-sea, is approximately 39,878 individuals, based on the corrected values[6] and most recent haul-out counts for the UK (SCOS, 2022). This is the population estimate used with the Carter *et al.* (2022) data to calculate density estimates for the offshore project area.

140. The mean at sea density estimates for these areas have been used in the assessment:

- 0.00048 individuals per km^2 for the array area; and
- 0.11 individuals per km^2 for the offshore cable corridor.

1.5.5.4.2 Harbour seal population counts

141. 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 (2016 to 2021) gives a total of 30,900 counted in the UK. Scaling this by the estimated proportion hauled out (0.72 (95% CI = 0.54-0.88)) produces an estimated total population for the UK in 2019 of 42,900 harbour seal (approximate 95% CI = 35,100-57,100; SCOS, 2022).

142. Recent trends in harbour seal populations indicate that the last 10 years have shown significant growth in both SMUs on the east coast of England up to 2018. However, the 2019 count in the SE England MU was approximately 25% lower than the mean of the previous five years. Counts for 2020, 2021 and 2022 confirm that this decline has continued (SCOS, 2022).

143. In accordance with the agreed approach for other OWF, the reference population extent for harbour seal will incorporate the SE England MU (IAMMWG, 2013; SCOS, 2022).

144. These have also been corrected to take account of the number of seals not available to count during the surveys. Approximately 0.72 harbour seals (Lonergan *et al*., 2013) are available to count within the August surveys (i.e., are hauled-out), and therefore this has been used as a correction factor, to

[6] The total harbour seal population is corrected from the haul-out counts (i.e. to take account of those not available to count during the August surveys) with the Lonergan *et al*. (2013) factor of 0.72. A second correction is then applied to generate the at-sea population, using the Russell *et al*. (2015) correction factor of 0.8236.

derive total harbour seal numbers within the MU, rather than the number counted within the MU.

145. The reference population for harbour seal is therefore currently based on the most recent estimates as shown in Table 12.10.

Table 1.10 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
SE England MU	3,505	SCOS 2022	0.72	4,868

146. The total reference population for the assessment is 4,868 harbour seal.

1.5.5.5 Diet and foraging

147. Harbour seal take a wide variety of prey including sandeels, gadoids, herring and sprat, flatfish and cephalopods. Diet varies seasonally and regionally, prey diversity and diet quality also showed some regional and seasonal variation (SCOS, 2022). It is estimated harbour seals eat 3 to 5 kg per adult seal per day depending on the prey species (SCOS, 2022).

148. The range of foraging trips varies depending on the surrounding marine habitat (e.g., 25km on the west of Scotland (Cunningham *et al*., 2009); 30km to 45km in the Moray Firth (Tollit *et al*., 1998; Thompson and Miller 1990). However, data from The Wash (from 2003 to 2005) suggest that harbour seal in this area travel further, and repeatedly forage between 75km and 120km offshore (with one seal travelling 220km; Sharples *et al*., 2008). 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. Between 2005 and 2019 harbour seals were tagged at 26 sites in the UK and Ireland, producing a dataset of 8,579 trips. The data indicated harbour seals maximum foraging range to be 273km (Carter *et al*., 2022).

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