The Sizewell C Project

6.3 Volume 2 Main Development Site

Chapter 22 Marine Ecology and Fisheries

Appendix 22E - Sizewell Marine Mammals Characterisation

Revision: 1.0

Applicable Regulation: Regulation 5(2)(a)

PINS Reference Number: EN010012

May 2020

Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Sizewell marine mammals characterisation

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Please note that the red line boundary used in the figures within this document was amended after this document was finalised, and therefore does not reflect the boundaries in respect of which development consent has been sought in this application. However, the amendment to the red line boundary does not have any impact on the findings set out in this document and all other information remains correct.

Executive summary

This report provides a synthesis of information on the distribution and abundance of marine mammal species that may be found in the proposed development area. This information is required to characterise the mammal component of the proposed development marine ecosystem, as a basis for predicting the potential impacts of the proposed Sizewell C New Nuclear Build (NNB). We also provide a summary of the diets of the key mammal species, which will be used during the impact assessment process to identify any potential indirect food-web effects of the proposed development.

Information has been gathered from a range of sources including published literature, EU and UK research council outputs, information from industry and EDF's commissioned survey work in the Greater Sizewell Bay (the BEEMS static acoustic monitoring). These sources show that seven species of marine mammal have been recorded in the southern North Sea and a further two in the central and northern North Sea. Of these nine species, three can be considered 'commonly encountered' in the southern North Sea – the harbour porpoise *Phocoena phocoena*, the common/harbour seal *Phoca vitulia* and the grey seal *Halichoerus grypus* – while the others are considered unlikely to occur in the proposed development area and can be classed as 'irregular visitors' or 'passing migrants' (the white beaked, bottlenose and short beaked common dolphins *Lagenorhynchus albirostris*, *Tursiops truncatus* and *Delphinus delphis*) or 'rarely encountered' (minke whale *Balaenoptera acutorostrata*, Atlantic white sided and Risso's dolphins *Lagenorhynchus acutus* and *Grampus griseus*). The three common species are considered to be the key marine mammal species in the proposed development area and will be considered in the impact assessments.

Harbour porpoise are seen throughout the North Sea and, on the basis of the two Small Cetacean Abundance in the North Sea (SCANS) surveys in the mid-1990s and mid-2000s, their distribution may have shifted from the northern to southern North Sea over that decade. The latest survey conducted in 2016 indicates that their distribution has expanded from the North Sea into the Channel. They have been recorded in the Greater Sizewell Bay development area and the available evidence suggests some preference for offshore waters, beyond the Sizewell-Dunwich Bank, over the winter period, though lack of data prevents firm conclusions on either seasonal movements or depth preferences.

The common/harbour seal is more widespread around the west of the UK than the North Sea, but it is found around all coasts. There are aggregations to the north of the proposed development, in The Wash and less so at Blakeney Point (north Norfolk), and to the south in the Thames Estuary. Common seals do not appear to heavily utilise the coast around the proposed development itself; they do move through the area but apparently not regularly. There is evidence that populations in the region are growing, though they were blighted by a phocine distemper virus in 2002 and it is currently unclear whether this increase for some colonies represents overall population expansion or a return to pre-virus levels.

Most UK grey seals are found in Scotland, though in the southern North Sea there are populations in Lincolnshire (Donna Nook), East Anglia (Blakeney Point) and the Thames Estuary. Grey seals are more wide-ranging than common seals, with movements for food and hauling out reaching up to 300 km, so transits between the northerly and southerly sites are possible and would include passage along the stretch of coast adjacent to the proposed development. Available evidence suggests that, like the common seal, usage of the waters surrounding the proposed development is quite low. Grey seals are, like the common seal, increasing in number in the East Anglian region and in the North Sea in general.

The three species - the harbour porpoise, common seal and grey seal - appear to prefer certain types of prey, with sandeels and gadoids (e.g. cod, haddock, whiting) and clupeids (e.g. herring, sprat) taken by all three, and flatfish (e.g. Dover sole, plaice and flounder) taken by both common and grey seals. However, overall, they all appear to be opportunistic predators, with their diets likely reflecting the key fish species in the local area at different times of year.

All three species are protected under UK and international agreements, the Main Development Site is adjacent to the Southern North Sea cSAC (designated for harbour porpoise), whilst the nearest spatial protection area for seals is The Wash and North Norfolk coast SAC (designated for the common seal). Documented presence in the proposed development area, together with southern distribution shifts (harbour

porpoise) or local/regional population increases (common and harbour seals) suggest all three species should be assessed during the environmental impact assessment and shifts in distribution should be taken into account when considering future baselines for assessing the effects of operational activities on these key species.

1 Purpose of the report

EDF Energy proposes to construct a new nuclear power station (new nuclear build, or NNB) at a site adjacent to the Sizewell A and B power stations at Sizewell on the Suffolk coast. The application process for this proposed power station development, termed Sizewell C (hereafter the 'proposed development'), requires EDF to evaluate the impacts of the proposed station development on the marine ecosystem of the Greater Sizewell Bay.

To support this process, EDF have commissioned Cefas to conduct a programme of scientific studies on the marine ecosystem of the bay. This includes gathering baseline information and predicting the impacts of the proposed development on the key marine ecosystem components. As marine mammals are a core component of the marine ecosystem and could potentially be exposed to impacts during the construction, operation or decommissioning of the station, they will be included in the proposed development environmental impact assessment.

This report summarises the available information on marine mammal species occurring in the area, forming a baseline against which potential NNB impacts will be assessed. We examine the spatio-temporal distributions of the marine mammal species which are, or are likely to be, commonly encountered around the proposed development, as well as summarising irregular visitors and those less likely to be found in the area. We also review dietary information for the key species, which will be utilised to help assess any potential indirect food web effects of the proposed development NNB. The proposed development is adjacent to the Southern North Sea cSAC (designated for harbour porpoise), this report provides supporting information for the required Habitats Regulations Assessment (HRA).

Edition 2 of this report was produced in response to the Marine Technical Forum (MTF) comments specifically on designated areas and conservation objectives in Section 4.4. The report also includes additional publications and data that have been produced since the first edition.

2 Data and information sources

Information has been collated from a variety of marine mammal data sources. There have been several UK wide marine mammal studies and publications over the last 20 years, including:

- The SCANS, SCANS II and SCANS III surveys[1];
- The Special Committee on Seals (SCOS) reports[2];
- A Wildfowl and Wetlands Trust Consulting report (WWT, 2009); and;
- The Atlas of Cetacean Distribution in North-west European Waters (Reid *et al.,* 2006).

Other databases and non-mammal specific reports have provided sightings and UK wide information (e.g. NBN Gateway[3] and Charting Progress 2[4] (UK Marine Monitoring and Assessment Strategy, 2010) to further inform this characterisation. More region-specific information has also been used including:

- Static acoustic monitoring for harbour porpoise and dolphins off the proposed development using static acoustic devices (BEEMS Technical Report TR271);
- The Marine Aggregate Regional Environmental Assessment for the Outer Thames Region[5] (MAREA) published by the Thames Estuary Dredging Association in 2010 (TEDA, 2010);

[1] http://biology.st-andrews.ac.uk/scans2/index.html
[2] http://www.smru.st-andrews.ac.uk/pageset.aspx?psr=411
[3] http://data.nbn.org.uk/
[4] http://chartingprogress.defra.gov.uk/seals
[5] http://www.marine-aggregate-rea.info/teda

- Wind farm EIAs for the Galloper (Galloper Wind Farm Limited (GWFL), 2011) and Anglian Zone (East Anglia Offshore Wind Limited (EAOW), 2011); and,
- Thames Estuary harbour seal tagging study by the Zoological Society of London (ZSL) (Barker *et al.*, 2014).

3 Species likely to be found around the proposed development

Marine mammals that may be in the proposed development area include both cetaceans (the collective name for whales, dolphins and porpoises) and pinnipeds (seals).

Approximately 35 species of marine mammal have been known to occur in the waters of northwest Europe. Some are quite commonly encountered (e.g. white beaked dolphin, minke whale and grey seal), while others are more rarely encountered (e.g. false killer whale, blue whale and ringed seal). While other regions of the UK are diverse in terms of marine mammals, the southern North Sea has a relatively low species diversity and abundance.

According to the data sources, a total of seven species of marine mammal have been observed in the southern North Sea area (Reid *et al.,* 2003; TEDA, 2010; EAOW, 2011; GWFL, 2011 and SMRU, 2013). The most commonly encountered species reported is the harbour porpoise (*Phocoena phocoena*). Other species that have been observed are the grey seal (*Halichoerus grypus*), the common/harbour seal (*Phoca vitulina*) and the white beaked dolphin (*Lagenorhynchus albirostris*). There have been occasional sightings of the bottlenose dolphin (*Tursiops truncatus*) and the short beaked common dolphin (*Delphinus delphis*) and, surprisingly, one sighting of the Risso's dolphin (*Grampus griseus*) during the EIA baseline studies for the Galloper wind farm. Risso's dolphin are more commonly found in deeper waters in the west and north of the UK. Other species that are found in the North Sea include the minke whale (*Balaenoptera acutorostrata*) and the Atlantic white sided dolphin (*Lagenorhynchus acutus*), however these species tend to be observed further north in the central and northern North Sea. The data reviewed suggested that the harbour porpoise and the common and grey seal can be classed as 'commonly encountered' in the area, while the bottlenose, common and white beaked dolphin can be classed as 'irregular visitors' or 'passing migrants'. The minke whale, Atlantic white sided and the Risso's dolphin can be classed as 'rarely encountered' in the area. Thus, whilst all nine species will be described, only three are considered to be key species in the proposed development marine ecosystem based on their common occurrence:

- harbour porpoise (*Phocoena phocoena*)
- grey seal (*Halichoerus grypus*)
- common/harbour seal (*Phoca vitulina*)

The other species (bottlenose dolphin, common dolphin and white beaked dolphin) have occasionally been recorded, but the southern North Sea, and more locally the Suffolk coast, does not appear to be an important area for these species, with only a handful of sightings over a 25-year period. The white beaked dolphin tends to be reported further north, or in offshore locations between the UK and the Netherlands (see Reid *et al.,* 2003). None of the data sources recorded minke whales or Atlantic white sided dolphins in the region. However, it should be noted that all data sources contained sightings that were not identified to species level, therefore it is possible other species were present in the region. A summary of the protection given to the species recorded in the southern North Sea can be seen in Table 1.

Table 1. International and national legislation under which southern North Sea marine mammals are afforded protection.

	Berne Convention (Appendix)	Bonn Convention (Appendix)	Habitats Directive (Annex) - SAC	ASCOBANS	OSPAR (Annex)	CITES (Appendix)	Conservation of Habitats and Species Regs. (Schedule)	Offshore Marine Conservation Regs. (Schedule)	Wildlife and Countryside Act (Schedule)	Countryside and Rights of Way Act (Section 74)	Conservation of Seals Act	UK BAP
Harbour porpoise	II	II	II and IV	Yes	V	II	2	1	5 and 6	Yes	-	Yes
White beaked dolphin	II	II	IV	Yes	-	II	2	1	5	Yes	-	Yes
Bottlenose dolphin	II	II	II and IV	Yes	-	II	2	1	5 and 6	Yes	-	Yes
Common dolphin	II	II	IV	Yes	-	II	2	1	5 and 6	Yes	-	Yes
Risso's dolphin[6]	II	II	IV	Yes	-	II	2	1	5	Yes	-	Yes
Minke whale	III	-	IV	-	-	I	2	1	5	Yes	-	Yes
Atlantic white-sided dolphin	II	II	IV	Yes	-	II	2	1	5	Yes	-	Yes
Grey seal	III	-[7]	II and V	-	-	-	4	3	-	-	Yes	
Common seal	III	-	II and V	-	-	-	4	3	-	-	Yes	

[6] The Risso's dolphin is not considered to be a common species in the southern North Sea, preferring deeper waters, usually to the west and north of the UK. However, Risso's dolphins have been included in Table 1 as they were observed during the Galloper wind farm EIA survey in 2011.
[7] Only common seals of the Baltic and Wadden Sea and grey seals of the Baltic Sea are included in the Bonn Convention.

4 Key species

4.1 The harbour porpoise

The harbour porpoise is the most common cetacean observed in the North Sea and can be found in temperate waters throughout the north Pacific and Atlantic Oceans. It is the smallest cetacean in European waters, growing up to 1.6 m in length and usually found in small groups of one to three individuals (Reid *et al.,* 2003). In North Sea waters, the harbour porpoise is thought to reach sexual maturity at four to five years of age (Lockyer, 2003). The breeding/mating period is thought to be between June and August, with a 10 to 11-month gestation period. Parturition generally occurs between May and September, with a peak in June (Sorensen and Kinze, 1994; Lockyer, 2003; Lockyer and Kinze, 2003; Wier *et al.,* 2007).

4.1.1 Distribution and abundance within the North Sea

In terms of harbour porpoise populations within the North Sea, Walton (1997) looked at the mitochondrial DNA (mtDNA) of 291 stranded, and 36 incidentally caught porpoises from the UK and adjacent waters. While there was evidence of historic interconnections between all porpoise sampled, significant differences were found between (predominantly) female porpoises from the northern and southern North Sea (and between the North Sea and the Celtic Sea). Walton (1997) suggested that male porpoises were more likely to migrate, whereas females were more likely to stay within an area and form genetically distinct units. There are certain issues with the analysis; for example, the origin of any stranded animals used in the analysis will be unknown. In addition, there are concerns with the use of mtDNA, rather than nuclear DNA; as nuclear DNA gives a better distinction of genetic information (Palme *et al.*, 2008). However, given the historic interconnections and potential migration of male porpoise, it would seem prudent to treat the population of porpoises within the North Sea (and around the UK) as a whole.

Harbour porpoise are found throughout the North Sea. Reid *et al.,* (2003) compiled sightings over a 25-year period and showed a wide-ranging distribution around all of the UK and adjacent seas, with the least sightings in the English Channel and southern-most part of the North Sea (Figure 1A). Wildfowl and Wetlands Trust Consulting (WWT, 2009, Figure 1B) compiled aerial sightings from 2001 to 2008, which focussed on the coastline around the UK. Porpoise were found all around the UK, though their surveys recorded a concentration of animals from Norfolk to Kent, with a dense cluster of sightings off Southwold, to the north of Greater Sizewell Bay; a survey including this area in 2005 recorded 242 animals.

SCANS undertook large scale abundance surveys across the UK and adjacent waters in 1994, estimating approximately 250,000 harbour porpoises in the North Sea, with a majority in the central and northern North Sea. SCANS II repeated and extended the surveys undertaken in 1994 in 2005 and estimated a slight decline in animals (231,000), but more notably observed a shift in porpoise distribution from the northern North Sea to the southern North Sea (Figure 2). Reasons for this change are unclear, but it could be due to a change in prey abundance (SCANS II Newsletter, Issue 8[8]). SCANS III again repeating the surveys from 1994 and 2005, in 2016 and provided new and revised estimates for harbour porpoise in the North Sea (289,000 in 1994, 355,000 in 2005 and 345,000 in 2016) (Hammond *et al.*, 2017). It also provided new information on the distribution of harbour porpoise that shows that the distribution has expanded from the North Sea into the Channel (Hammond *et al.*, 2017) (Figure 3). This southerly shift in distribution is also supported by Peschko *et al.* (2016), which states that the shift could be due to changes in prey abundance or less favourable conditions in other parts of the North Sea.

[8] http://biology.st-andrews.ac.uk/scans2/inner-furtherInfo.html

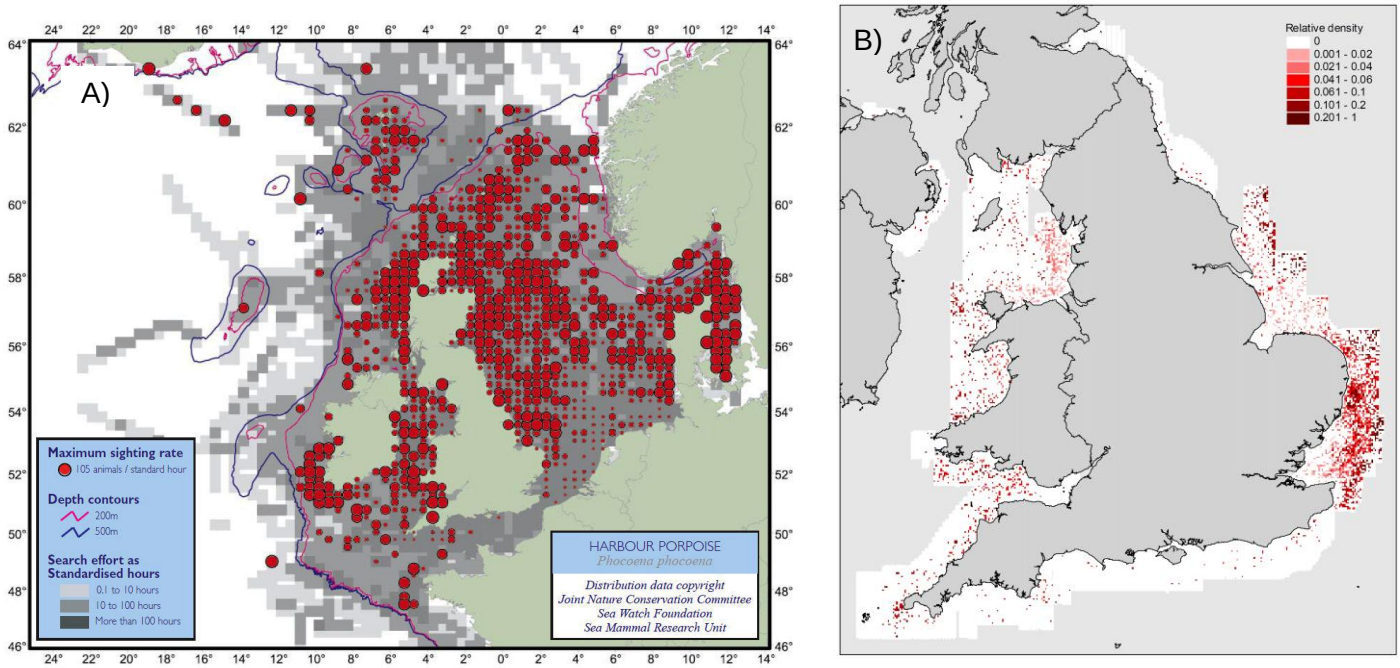

Figure 1. Harbour porpoise distribution around (A) the UK (Reid *et al.*, 2003) and (B) England and Wales (WWT consulting, 2009).

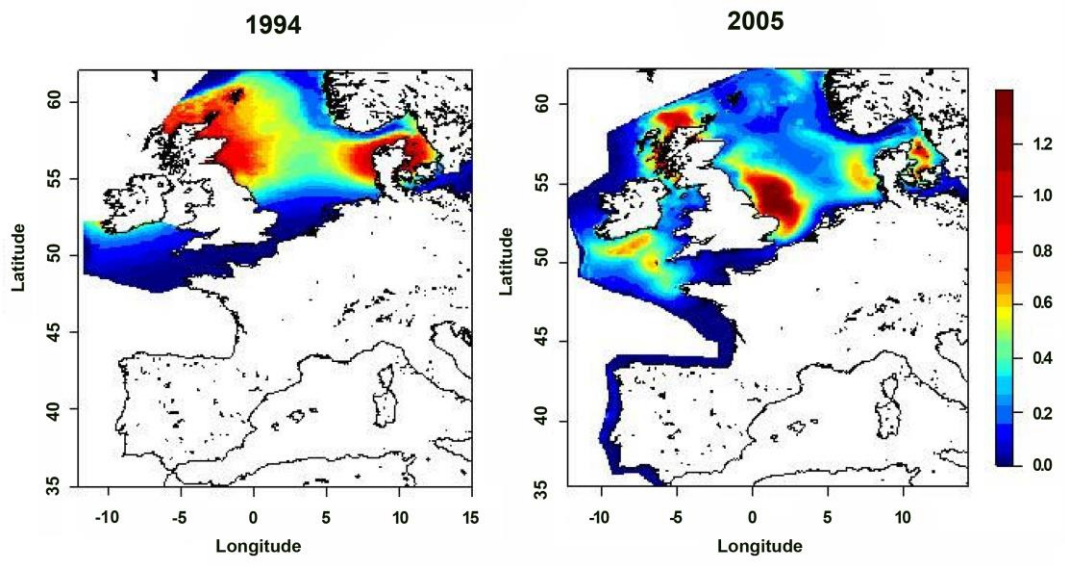

Figure 2. Density surface modelling of the SCANS I and II data collected during July 1994 and 2005, respectively. The maps are based on visual sightings. The colours indicate the absolute density in animals/km² (from Hammond, 2006).

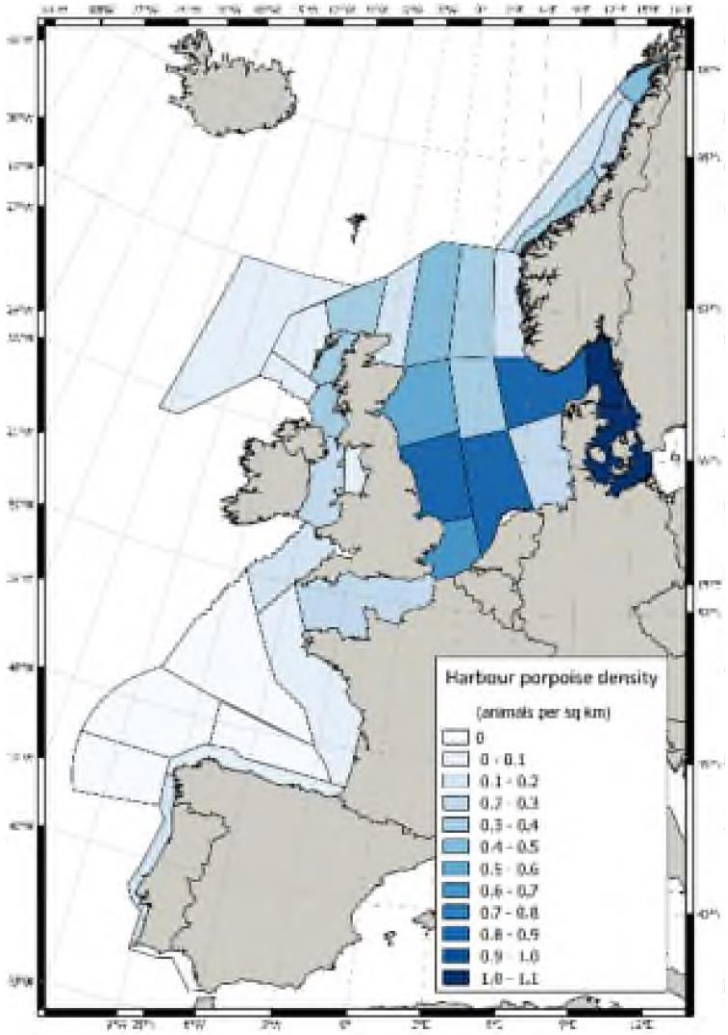

Figure 3. Estimated harbour porpoise density of the SCANS III data collected summer 2016. The maps are based on visual sightings in each survey block (from Hammond *et al.*, 2017).

4.1.2 Distribution and abundance around the proposed development

More locally to the proposed development, the Thames REA (TEDA, 2010) investigated porpoise distribution in the outer Thames region. The proposed development is located to the north of the study site (Figure 4); while survey effort did not reach to the coast, porpoise were recorded near the proposed development site. During the TEDA surveys, the majority of porpoise sightings were recorded over the winter period. This increase in sightings suggests that there could be a seasonal increase in use of the outer Thames Estuary at this time, possibly in relation to increases in food abundance, such as spawning herring (see BEEMS Technical Report TR345).

During the SCANS (1995) survey no porpoise were recorded in the survey region that includes the proposed development (n.b. this is not to say that no porpoise were present but highlights the general low abundances in this region). In 2005, 40,927 porpoise were recorded in the same area (SCANS II Newsletter, Issue 7), demonstrating the north-south shift in distribution described in section 4.1.1. Data from SCANS III (Figure 3) indicates summer harbour porpoise densities in the wider sea area off the southern East Anglian coast are 0.6 - 0.7 animals / km^2.

Under the BEEMS programme a static acoustic monitoring technique was used to investigate the presence of cetaceans in the proposed development area. The acoustic loggers (C-PODS) were deployed over 18 months, from September 2011 to March 2013 (BEEMS Technical Report 271). C-PODS were initially deployed at six stations, with further stations added at later dates (Figure 5). Loss rates were high due to local conditions and suspected human interference, some loggers suffered from technical problems and data recovery rates impaired analysis options (Table 2). However, sufficient data were collected to provide some qualitative information on cetacean activity in the area. Porpoises were detected on 64 % of monitoring days (414 days of a total of 745 days). Porpoise detections were consistently highest between October-March and lowest during the summer period. Detection rates were also higher during the night than the day and the data indicated that porpoise preferred more offshore waters. Marine mammal observations during recent winter geotechnical surveys in the Greater Sizewell Bay, support this apparent offshore presence, with sightings only on the edge and outside of the Sizewell-Dunwich sandbank to the southeast of the proposed development[9] (Figure 6). The surveys also suggest the porpoise are fairly rare visitors, at least during winter, with sightings on only 12 % (5 out of 40) of the February-March survey days; see Fugro EMU Ltd, 2015). The local TEDA (2010) and EDF/BEEMS studies, together with the more national reviews, show that harbour porpoise are present year-round in the area local to the proposed development and, potentially, that the wider area of the southern North Sea has become more important for this species. The Southern North Sea is a candidate SAC and is designated solely for the purpose of aiding the management of the Annex II species harbour porpoise (*Phocoena phocoena)*. The site includes the area of open sea adjacent to the eastern boundary of the Main Development Site.

[9] Note that the geotechnical surveys were focussed specifically on the area of the proposed infrastructure construction and marine mammal surveys were limited to the immediate vicinity of these locations, up to 1 km from the survey vessel. Thus, the wider area was not covered and sightings around the proposed infrastructure do not infer aggregation of the animals around these locations.

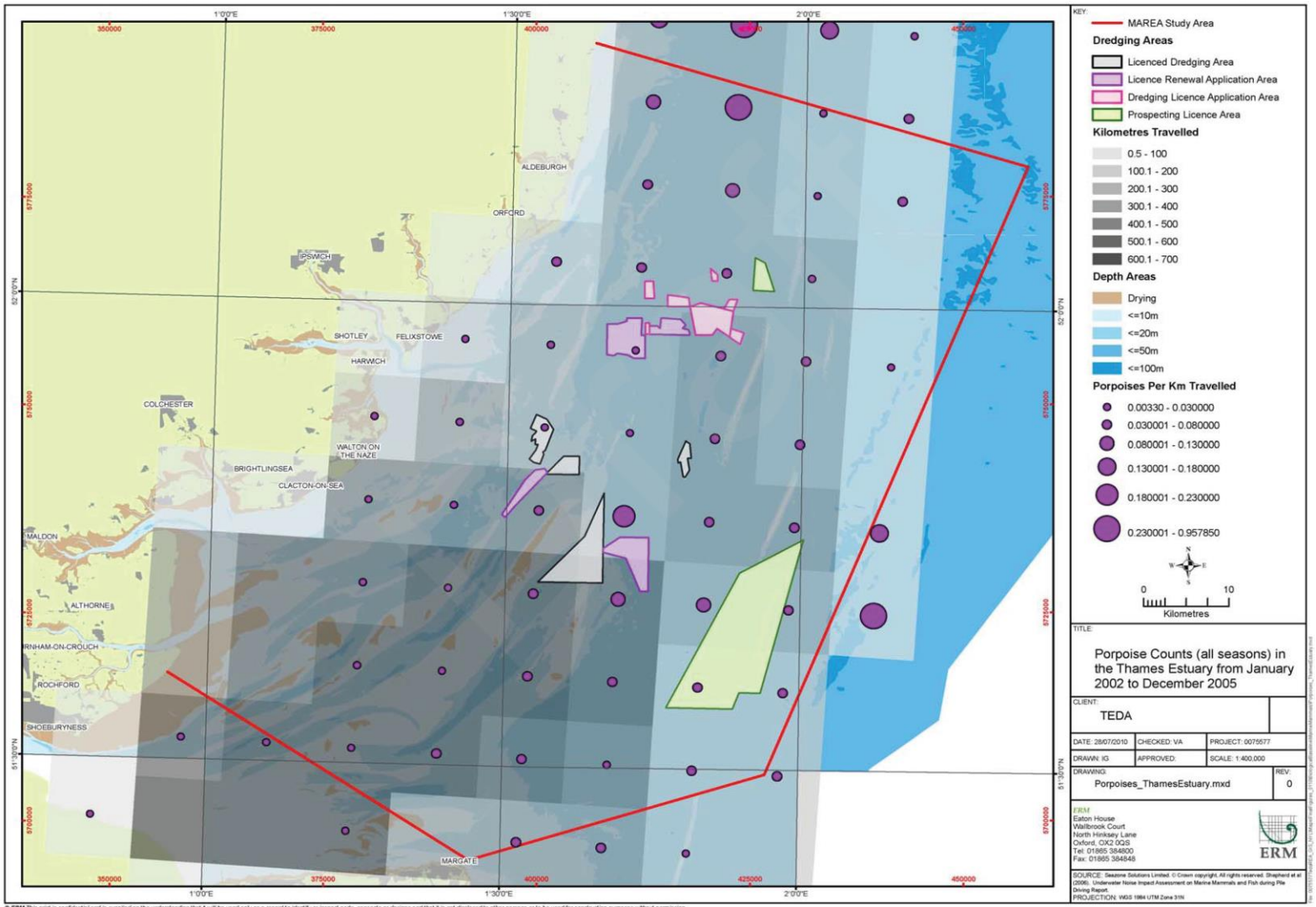

Figure 4. Porpoise distribution and abundance in the outer Thames Estuary (TEDA, 2010).

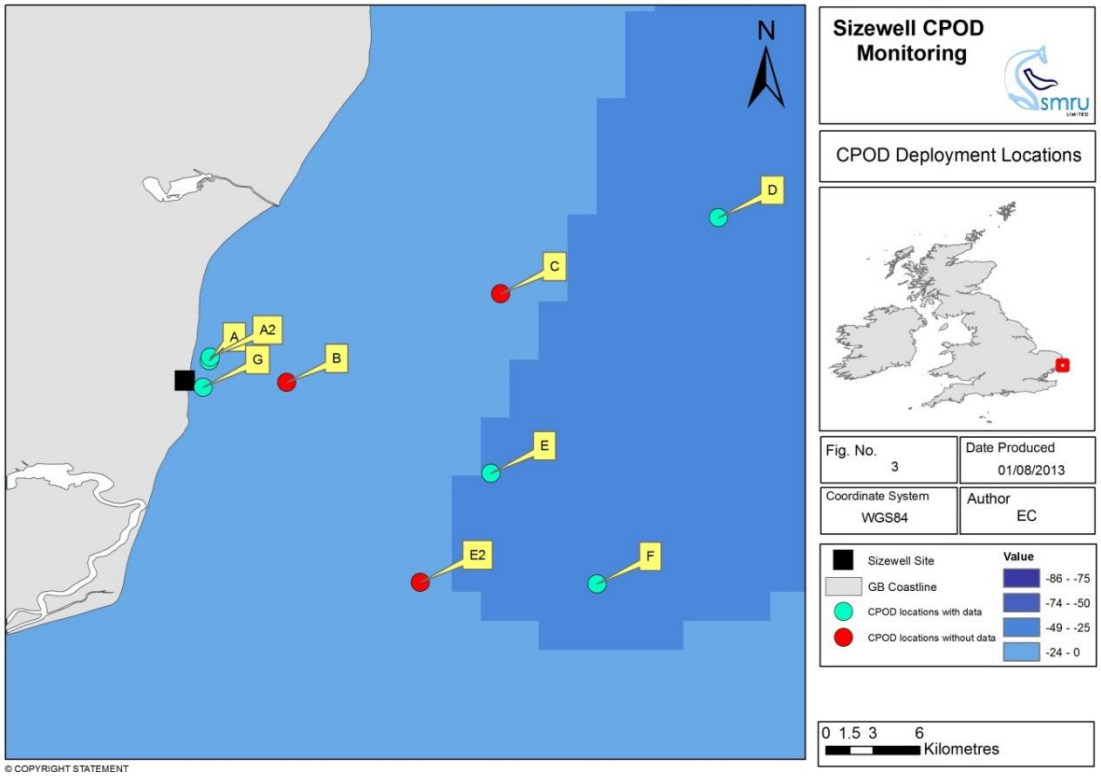

Figure 5. Location of the BEEMS cetacean monitoring sites. Green circles indicate sites where data were obtained and red circles where no data were recovered (due to unit loss). Sites A – F were deployed initially, with the remaining sites added during later deploy. Value = depth (BEEMS Technical Report TR271).

Table 2. Data series recovered during the BEEMS cetacean noise monitoring. Cells are shaded where no C-PODs were deployed (grey) or no data were recovered (brown). 1st deployment = Sep 2011, 2nd = Mar 2012, 3rd = Jun 2012, 4th = Nov 2012. Adapted from BEEMS Technical Report TR271.

Site	Group[10]	Deployment			
		1	2	3	4
A	Inshore	09/11-01/12			
B	Inshore				
C	Offshore				
D	Offshore		03/12-6/12		
E	Offshore	09/11-01/12	03/12-04/12		
F	Offshore		03/12-05/12		
A2	Inshore		03/12-06/12	06/12-11/12	11/12-03/13
E2	Offshore				
G	Inshore				11/12-03/13

[10] The data were classified as either offshore and onshore for the purposes of the analysis.

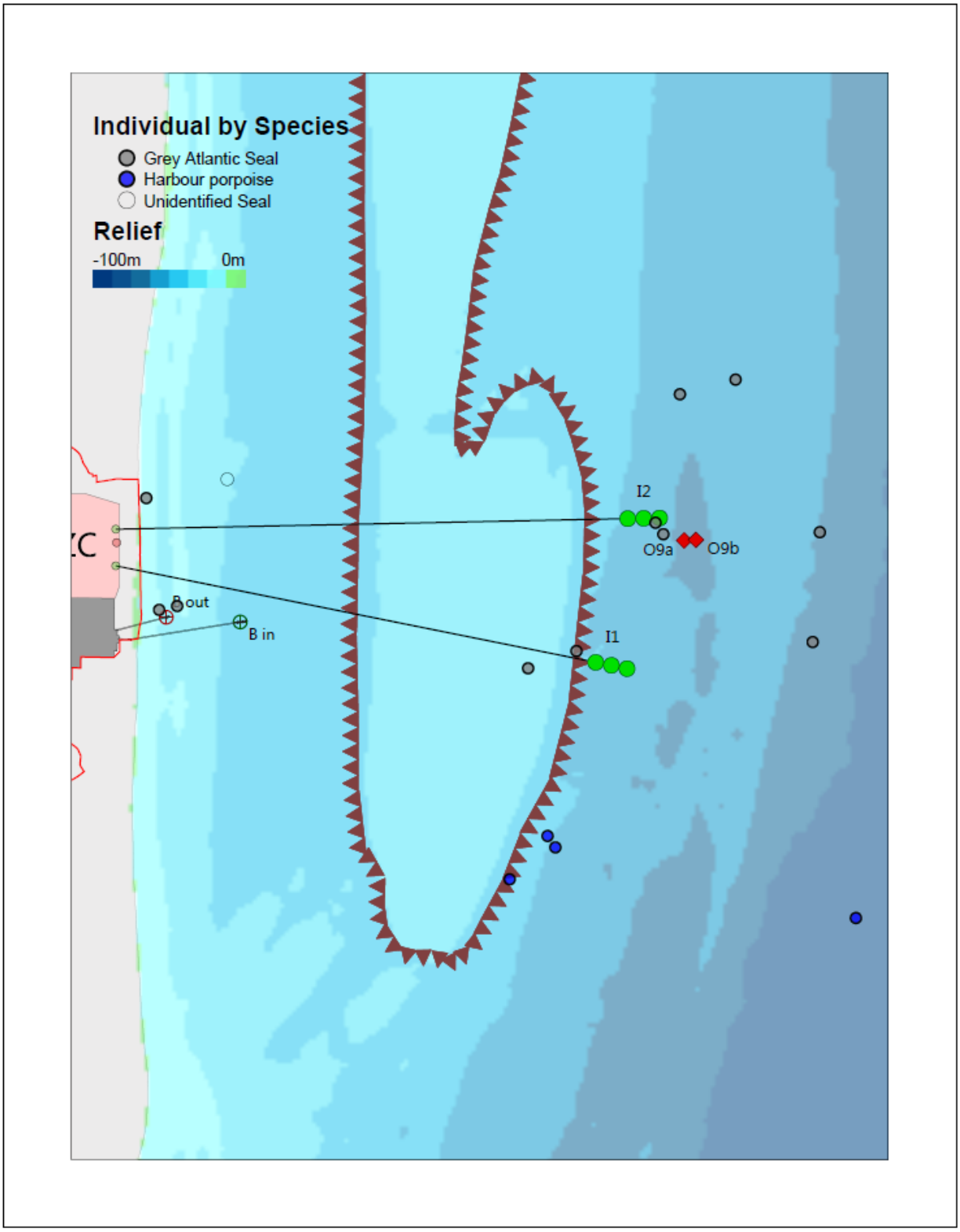

Figure 6. Sightings of harbour porpoise and grey seals during the February-March 2015 Fugro EMU geotechnical survey of the proposed Sizewell C cooling water infrastructure. The inshore Sizewell B and offshore proposed Sizewell C (green circles) cooling water infrastructure is shown for reference. The serrated line denotes the Sizewell-Dunwich sandbank. Note that sightings were limited to up to 1 km of the

survey vessel and so the absence of sightings in the north of the area should not be considered to evince an absence of mammals in this area. Data taken from Fugro EMU (2015).

4.2 The common (harbour) seal

Common seals can weigh up to 100 kg and measure up to 1.8 m in length, with males being slightly larger than females. They can live up to 30 years and the European (eastern Atlantic) population is one of five subspecies. Common seal females reach maturity at three to four years, while males reach maturity approximately a year later (Harkonen and Heide-Jorgensen, 1990). Common seals give birth to a single pup in June and July and the pups are able to swim almost immediately (SCOS, 2012). Mating takes place immediately after lactation (Thompson, 1988).


CC BY_SA 2.5. Andres Trepte. http://en.wikipedia.org/wiki/Harbour_porpoise#mediaviewer/File:Phocoena_phocoena.2.jpg

4.2.1 Distribution and abundance within the North Sea

The common seal has a circumpolar distribution around the Northern Hemisphere. The eastern Atlantic subspecies is found from northern France in the south, to Svalbard and the Baltic in the north and east respectively. In the UK, populations are predominately located around the west coast of Scotland, the Hebrides and the Northern Isles (approximately 80 % of the UK population). However, smaller concentrations of common seals may also be found along the east coast, in the Moray Firth, Firth of Tay, The Wash and the Thames Estuary (SCOS, 2012 and Figure 8).

SCOS is responsible for long term monitoring of the common and grey seal populations in the UK. The estimate of the UK population between 2007 and 2011 was approximately 36,500, with 80 % in Scotland, 15 % in England and 5 % in Northern Ireland. SCOS reports from 2008 to 2011 documented general declines in common seal populations in several regions of Scotland (the Scottish population reducing from 29,532 in 1996/1997 to 21,291 between 2007 and 2011), though they also recorded small increases within the English populations (3,240 in 1997 to 4,023 in 2011), despite two outbreaks of phocine distemper virus in 1988 and 2002. The most recent estimate of the UK population (2008 – 2016) is approximately 43,500.

The temporal trends are slightly more complex than the national figures suggest: Scottish populations have reduced overall since the mid-1990s, driven primarily by general decreases at North Sea sites such as Orkney, Shetland, the Moray Firth and its surrounding coast, but there is a suggestion that the longer term Moray Firth decline may have been halted and there have been some increases on the Scottish west coast (SCOS, 2012; see their Table 3). The small overall English increases mask subtle local differences among the survey regions (see Figure 7), where counts have variously risen and fallen among the 1997, 2005 and 2011 surveys. Clear overall rises are seen at some sites (e.g. The Wash and what have been classed by SCOS as ‘other east coast sites’), whilst more modest increases at other sites have been observed (e.g. Blakeney Point and Scroby Sands in North Norfolk), with declines elsewhere (Donna Nook in Lincolnshire). In the latest advice (2017) it states that there have been general declines in counts of harbour seals in several regions around Scotland but the declines are not universal with some populations either stable or increasing (NERC, 2017).

The UK population of common seals constitutes approximately 30 % of the eastern Atlantic subspecies (SCOS, 2012). Due to the decreases in overall abundance, the UK population may further decline in importance unless English populations rise substantially.

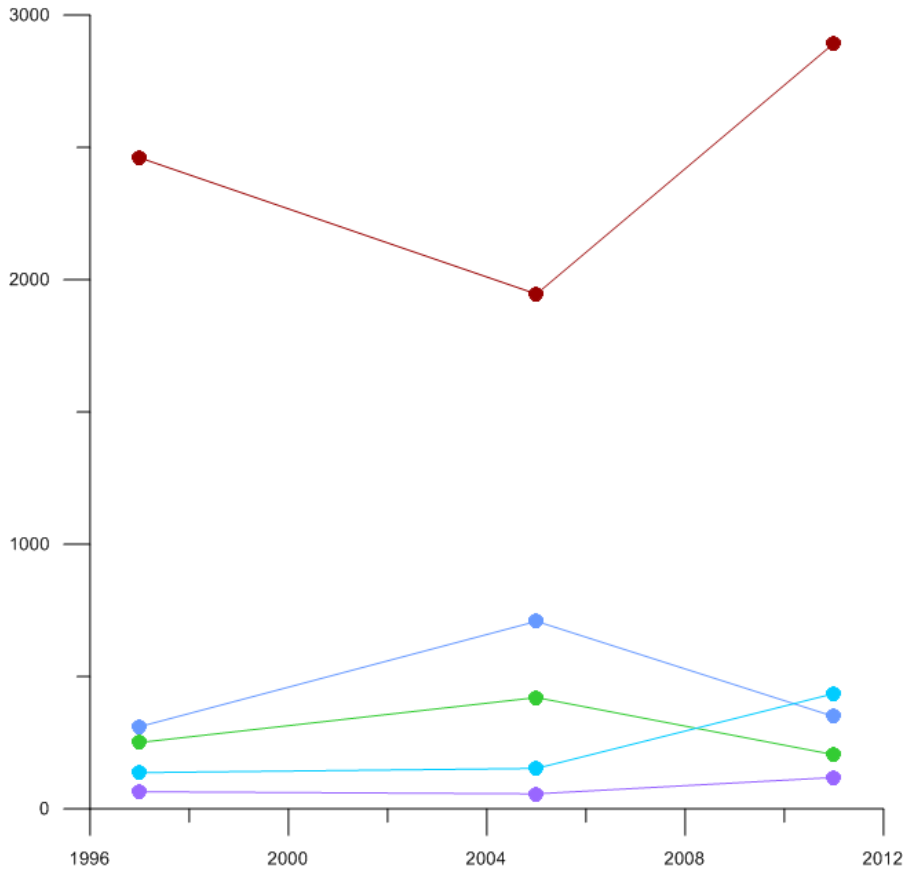

Figure 7. Common seal counts by English east coast regions; surveys in 1997, 2005 and 2011. **The Wash (in red)**, **Blakeney Point (dark blue)**, **Donna Nook (green)**, **Scroby Sands (purple)**, **other east coast sites (light blue)**. Data from SCOS, 2012 (Table 3 of their report) x-axis = year, y-axis = number of seals.

Samples taken from seals across Europe suggest that there is genetic differentiation among different common seal populations, with the Irish/Scottish, English east coast and Wadden Sea populations identified as distinct population units (SCOS, 2012). Thompson *et al., (*1996) further concluded that the Moray Firth population of common seals was discrete as there was little exchange of individuals with other sites, such as those in the Orkney Islands and the Firth of Tay, the animals only travelling a maximum of 75 km between haul out sites (compared to 365 km for grey seals) and only 60 km to forage (compared to 145 km for grey seals). SCOS (2012) have also suggested that common seals appear to have more restricted movements, although this may not be true for all populations, as recent telemetry work has recorded common seals moving between the Netherlands and the English coast and movements have also been observed between spatially close populations, such as between the English east coast sites. Movements may also differ depending on life stage, as pups have been observed to disperse widely from their natal sites (SCOS, 2012).

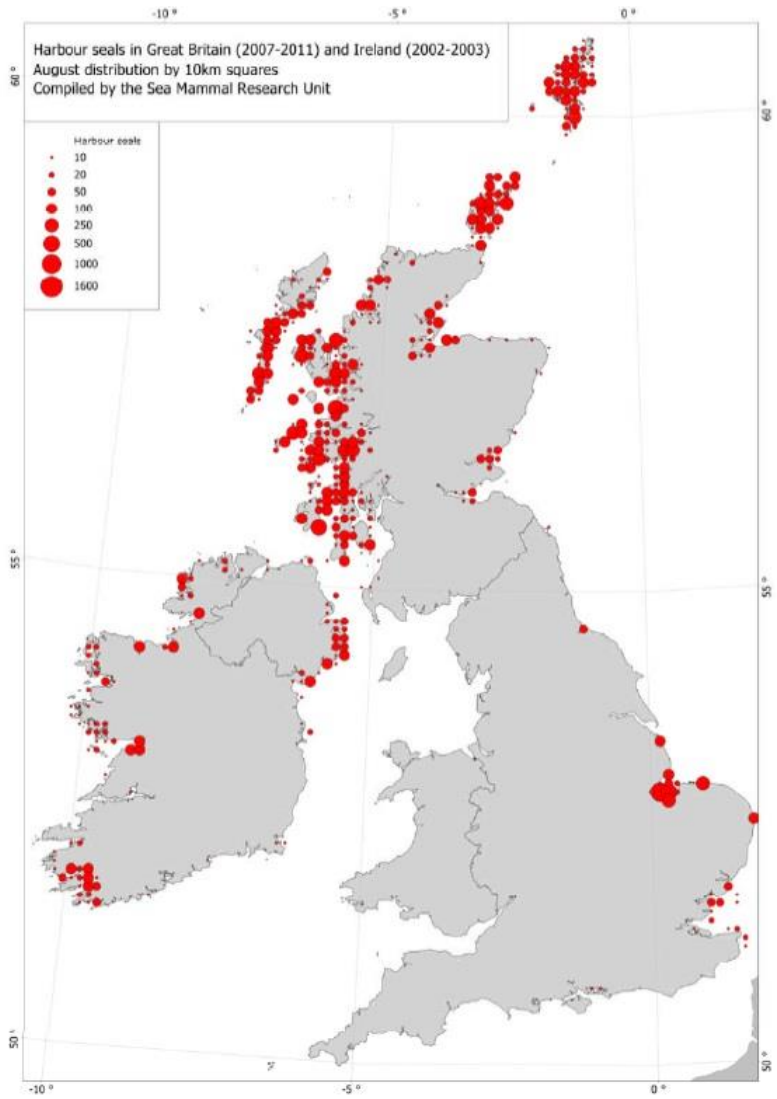

Figure 8. Distribution of common seals around the UK and Ireland (data collected from 2007-2011 in UK and 2002 – 2003 in Ireland, SCOS, 2012).

4.2.2 Distribution and abundance around the proposed development

In the area local to the proposed development, there have been several studies on common seals. The nearest sites of relevance to the proposed development are The Wash and Blakeney Point (north Norfolk) to the north and the Thames Estuary to the south; The Wash has by far the largest population of these sites (see Figure 7). The SCOS is currently developing management units for seal populations, using information on their movements and habitat use. Habitat use, is low to moderate in the proposed development area, particularly compared to The Wash and the Thames (Figure 9).

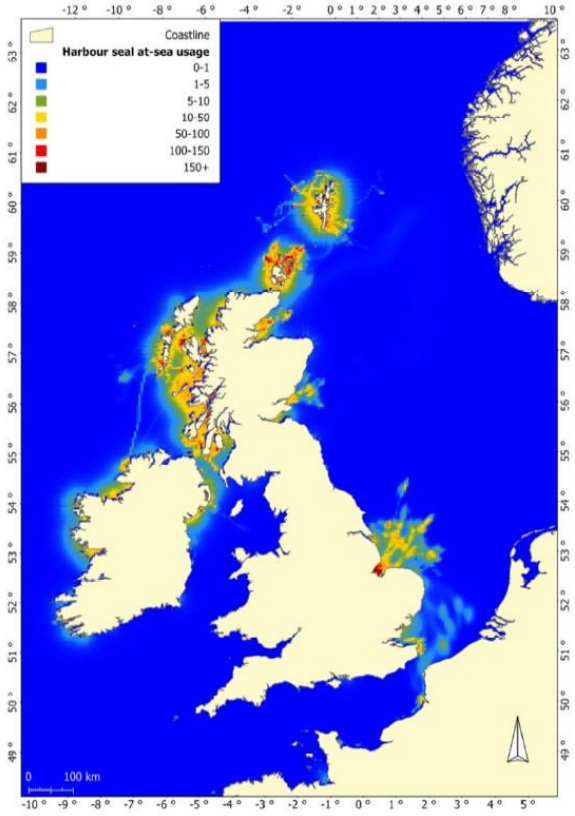

Figure 9. Estimated common seal at sea usage around the UK (SCOS, 2012).

The Galloper and Greater Gabbard wind farm EIA surveys (2011) reported only three common seals within the vicinity of the wind farm site, with SCOS (2009) reporting that the Essex and Kent coastlines only account for approximately 0.3 % of the British population. SCOS (NERC, 2017) report that common seal counts for the East coast of England appear stable, although the 2016 count was approximately 10% higher than in 2015, driven mainly by a doubling of the count from Essex and Kent. Common seals observed in the Thames Estuary do haul out on the sandbanks that are present around the estuary mouth; Sharples *et al.,* (2008) undertook tagging studies of common seals in the estuary and found that, while most stayed in the general haul out area, some did travel up to other sites in north Norfolk and into Lincolnshire (Figure 10A). There is, therefore, some at-sea usage of the area close to the proposed development site (Figure 10B).

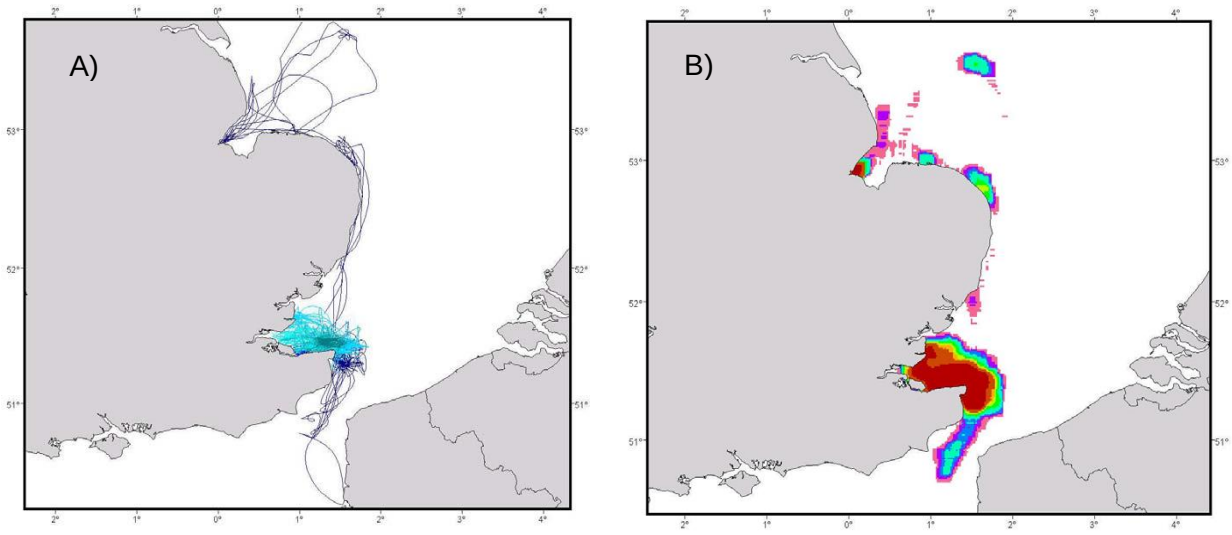

Figure 10. A) Individual filtered tracks of all harbour seals captured in the Thames Estuary. B) Density of 'at sea' surface densities per 100 m^2 from nine tagged seals. (Sharples *et al.*, 2008).

In addition, the Thames Marine Mammal Survey (Kowalik *et al.*, 2008) reported 74 sightings of common seals between 2004-2007. Sightings occurring throughout the year, with abundance seemingly peaking in August to October, common seal sightings accounted for 21 % of all marine mammals observed (Figure 11). In addition, approximately 25 % of all mammals were 'unidentified' seals, so the number of common seals is likely to be greater (it should be noted that sightings are reported by the public, therefore should be seen as non-expert and caution should be applied when using the results).

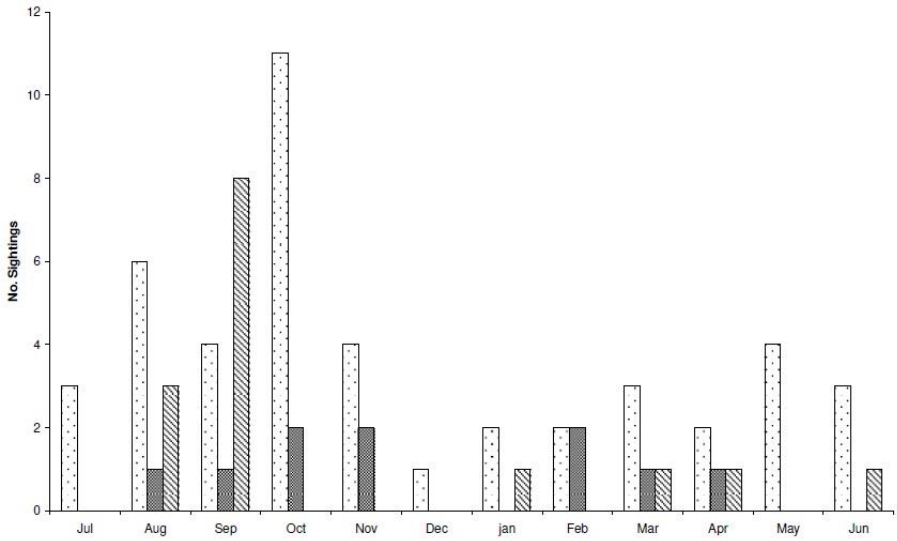

Figure 11. Sightings of common seals recorded in the Thames Estuary between 2004/5 (dotted column), 2005/6 (solid fill column) and 2006/7 (hatched column) from Kowalik *et al.*, 2008.

The Zoological Society of London's 2013 Thames Estuary harbour seal telemetry study (Barker *et al.*, 2014) found 2 out of 10 tagged seals travelled between the estuary and The Wash (most stayed within the estuary and one travelled south as far as France). The tracks were concentrated around the estuary, The Wash and the area around Lowestoft, with few lines recorded around the Greater Sizewell Bay (Figure 12). Wildfowl and Wetland Trust Consulting (2009) undertook aerial marine mammal surveys and, while they were unable to reliably identify animals to species level, seals were recorded close to the proposed development (Figure 13).

In summary, habitat utilisation by common seals is limited off the coast off the proposed development and haul out usage is low. However, common seals do transit along the coastline between the Thames and north Norfolk.

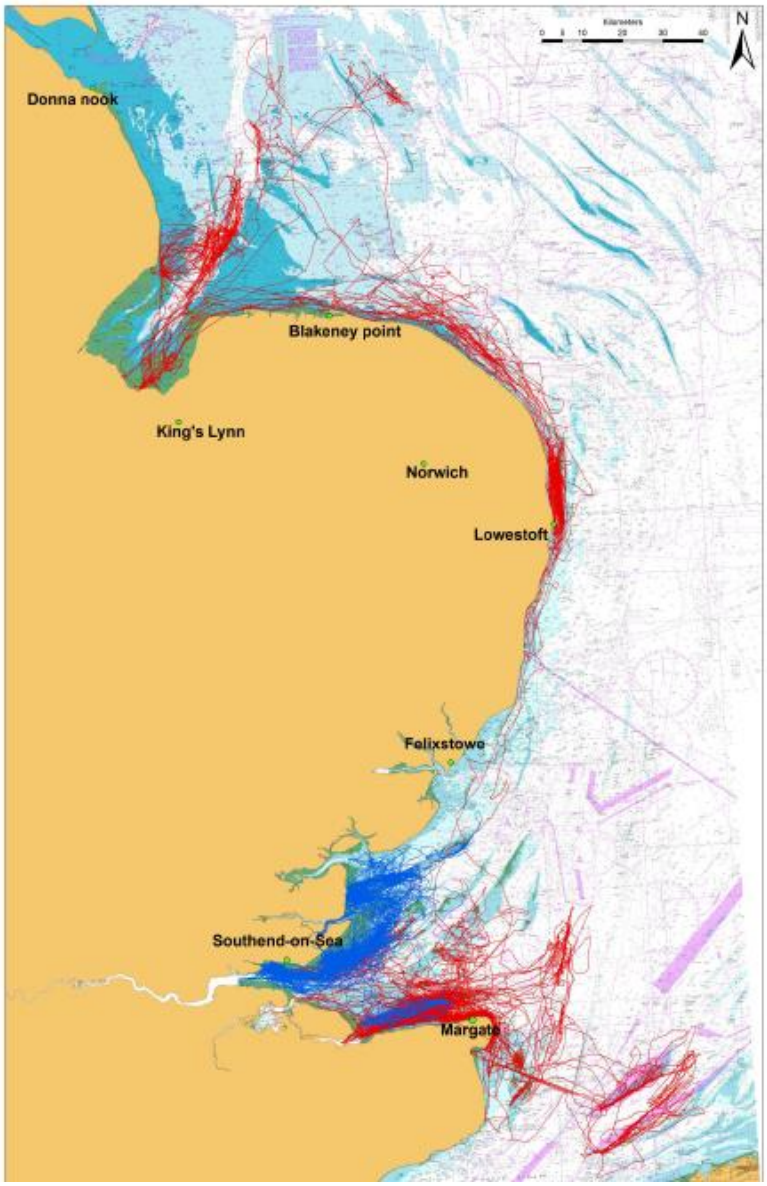

Figure 12. Seal tracks generated from the Zoological Society of London's 2013 Thames Estuary tagging study. Seals were tagged at Margate (red tracks) and Southend-on-Sea (blue tracks). From Barker *et al.* (2014).

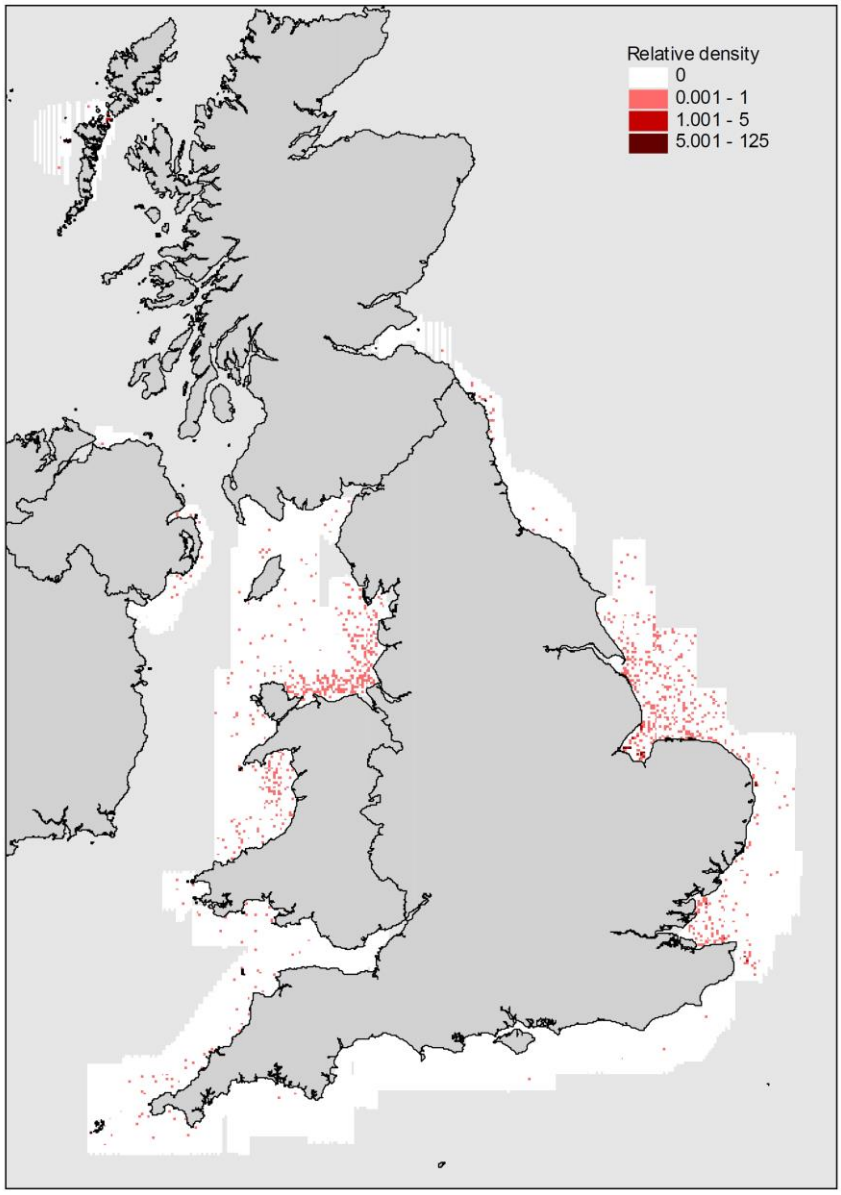

Figure 13. Seal distribution around England and Wales (WWT, 2009).

4.3 The grey seal

Grey seals are larger than common seals, with adult males reaching 300 kg in weight. The females are smaller, reaching up to 200 kg. Like common seals, grey seals can live up to 30 years. Grey seals reach maturity at approximately 10 years of age for males and five years of age for females (SCOS, 2012). Pupping in eastern England generally occurs between early November and mid-December and females give birth to a single pup which suckles for between 17 and 23 days. Pups will remain at the breeding colony for a further two weeks before going to sea.

4.3.1 Distribution and abundance within the North Sea

Grey seals are only found in the North Atlantic, Barents and Baltic Seas. There are two main concentrations of animals, one along the east coast of Canada and the USA (centred on Nova Scotia and the Gulf of St. Lawrence) and the other in northwest Europe (around the UK, SCOS, 2012).

Approximately 88 % of the UK population of grey seals breed in Scotland (SCOS, 2012). UK grey seal populations are estimated by the use of pup production counts. These counts can then be converted to estimates of total population size. The UK contains approximately 38 % of the world population of grey seals (based on pup production) and in 2010, the UK grey seal population was estimated at 111,300 (SCOS, 2012). The latest UK estimate of grey seals in 2016 is 141,000 (NERC, 2017). There has been a steady increase in the grey seal population over the last ten years, increasing at an average of 1 % per annum. This increase has predominantly been within the North Sea populations (these populations are increasing by 4.5 % per annum), with populations in the Western Isles remaining fairly stable over this time and increasing by only approximately 0.5 % in the Orkneys. Southern North Sea colonies in Lincolnshire and East Anglia have increased by more than 15 % over the last ten years (with 30 % increases in pup numbers between 2010 and 2011 at the Lincolnshire site Donna Nook and the Norfolk sites Blakeney and Horsey), possibly as a result of seals from outside these regions recruiting into the breeding population (SCOS, 2012). The community group known as Friends of Horsey Seals[11] was inaugurated in late 2011 to take over the management of the Horsey site and to protect grey seals, particularly during the late autumn and winter, when they give birth and mate. Figure 14 shows the distribution and abundance of grey seals around the UK (from 2000 – 2006, Duck, (2010), taken from unreferenced SMRU work).

[11] http://friendsofhorseyseals.co.uk/ (accessed 15/01/2019)

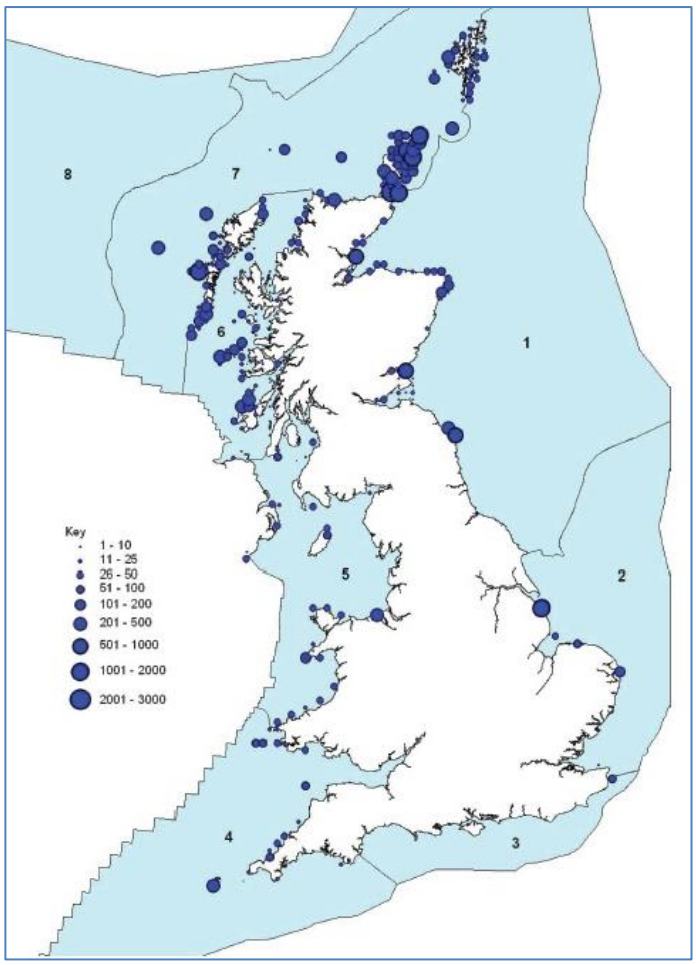

Figure 14. The distribution and abundance of grey seals around the UK (2000 – 2006, Duck, 2010).

Genetic work has shown that there appears to be a degree of reproductive isolation between breeding populations around the UK coast (see references in SCOS, 2012). Male grey seals can be seen to travel widely (see section 4.2.1), it appears that females move little among sites, though females may make finer scale movements away from their birth sites. Work is ongoing to determine female movements using satellite telemetry data and photo ID (SCOS, 2012).

4.3.2 Distribution and abundance around the proposed development

Like the common seal, southern North Sea grey seal populations of relevance to the proposed development are found in The Wash, East Anglia and the Thames Estuary. The SCOS is currently developing management units for seal populations - using information on the species' movements and habitat use – this information shows there is low habitat usage in the proposed development area (see Figure 15).

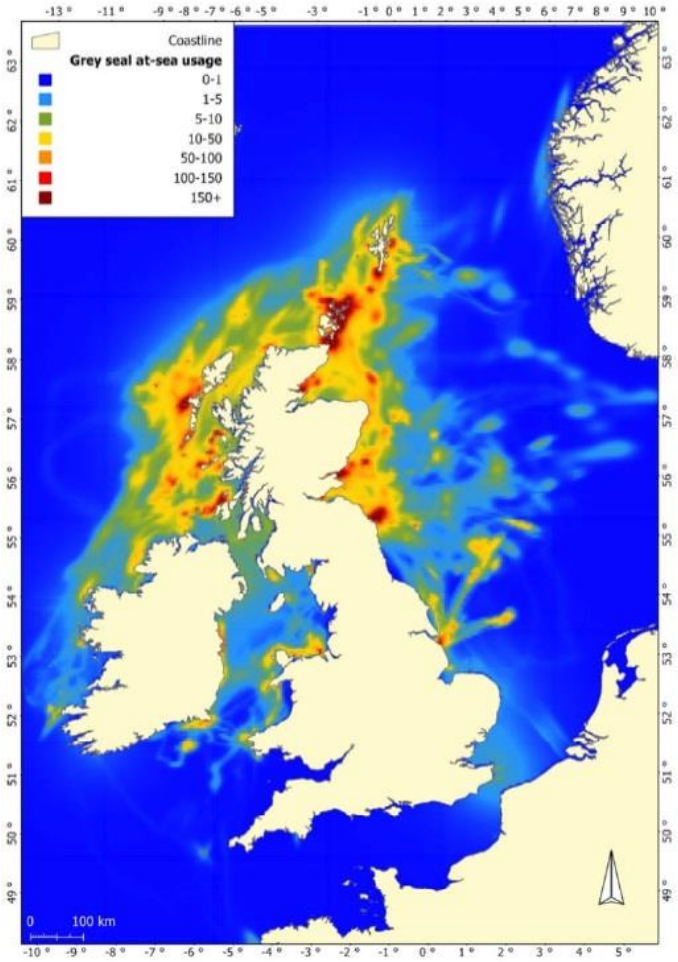

Figure 15. Estimated grey seal at sea usage around the UK (SCOS, 2012).

Marine mammal observations during recent geotechnical surveys in Greater Sizewell Bay signal that grey seals are present in the vicinity of the proposed development beach, the B station outfall and further offshore across and seaward of the Sizewell-Dunwich sandbank in the vicinity of the proposed intake and outfall infrastructure[12]. Observations occurred on a reasonably regular basis, at least in winter/spring [surveys in February and March 2015, seals recorded on almost 40 % (15 out of 40 survey days), one juvenile recorded in early March; see Figure 6 and Fugro EMU Ltd, 2015].

The seal surveys undertaken for the Greater Gabbard and Galloper wind farms only recorded six grey seals in the vicinity of the windfarm site (GWF, 2011). However, the Thames Marine Mammal Sighting Survey (Kowalik *et al.,* 2008) recorded 52 sightings over three years (see Figure 16). This equates to 15 % of all sightings in the area, though because 25 % of seal sightings were 'unidentified', the number of grey seals could have been higher (caution should be applied to interpretation of these results because sightings are made by the public, so are considered non-expert). The WWT (2009) also recorded seals throughout the area (refer to Figure 13), which, because they were not identified to species, could have been either grey or common seals. If the seals observed were indeed grey seals, the species could, like the common seal, be present in the area throughout the year. Overall, a slightly different interpretation is concluded depending on the data source, it would appear that grey seals are present reasonably regularly around the proposed development, at least at particular times of year, but do not utilise the area heavily.

[12] Note that the geotechnical surveys were focussed specifically on the area of the proposed infrastructure construction and marine mammal surveys were limited to the immediate vicinity of these locations, up to 1 km from the survey vessel. Thus, the wider area was not covered and sightings around the proposed infrastructure do not infer aggregation of the animals around these locations.

Despite some drops during individual years in the late 1980s and early to mid-1990s, grey seal pup numbers have increased year-on-year at the Lincolnshire/East Anglian sites, according to SCOS and National Trust data (Figure 17). Although small numbers of seals appeared at Blakeney during in the 1980s, the breeding colony did not appear until 2001; numbers have been increasing swiftly since (see https://www.nationaltrust.org.uk/news/blakeney-point-remains-largest-grey-seal-colony-in-england; accessed 21/03/2018). There is no obvious trend in the Thames Estuary public sightings data from 2004/5 to 2006/7 (Figure 16). The latest Thames Estuary seal study by ZSL in 2014 showed that a total of 449 grey seals were counted, which doubled the previous year's counts.

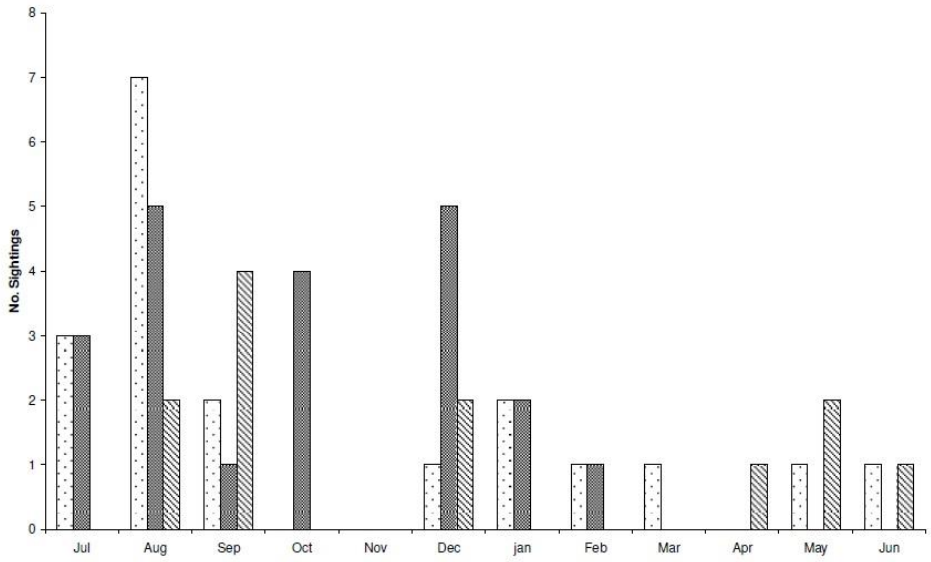

Figure 16. Sightings of grey seals recorded in the Thames Estuary between 2004/5 (dotted column), 2005/6 (solid fill column) and 2006/7 (hatched column). From Kowalik *et al.*, (2008).

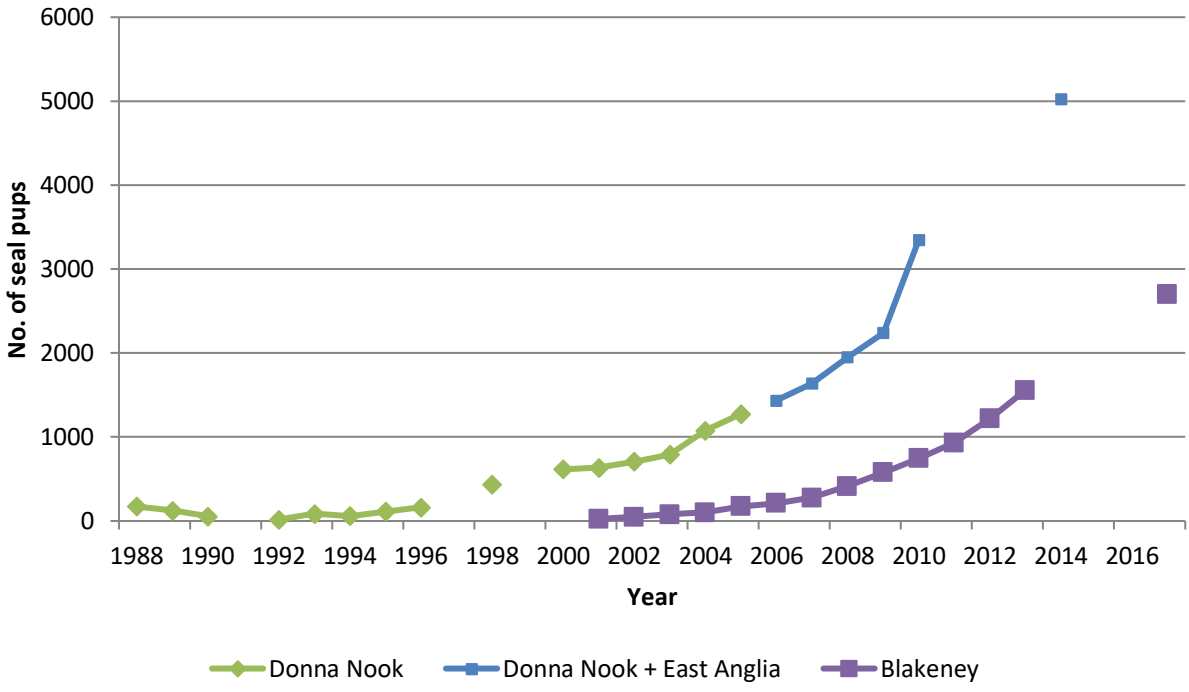

Figure 17. Grey seal pups in Lincolnshire/East Anglian colonies. **Donna Nook in Lincolnshire (green)**, **Donna Nook + 'other East Anglian sites' (blue),** Blakeney **Point in Norfolk (purple)** (years refer to the

winter period, so 2001 represents winter 2001/2002, etc). Donna Nook/Donna Nook+East Anglia data from the special committee on seals (SCOS) reports 1996 to 2011 (see http://www.smru.st-andrews.ac.uk/pageset.aspx?psr=411), Blakeney data from the National Trust's Eastern England blog site ((http://eastofenglandnt.wordpress.com/2014/02/01/successful-breeding-season-for-grey-seals/; accessed 21/10/2014).

4.4 Protection in UK Waters

As for harbour porpoise, common and grey seals are all listed under Annex II of the Habitats Directive, Special Areas of Conservation (SAC) are required to be set up by the UK Government for the protection of these species. The Southern North Sea cSAC was designated in 2017 as it has been recognised as an area of importance for harbour porpoise due to key winter and summer habitat for this species.

Twelve SACs have been set up for the common seal, predominantly in Scotland, The Wash and North Norfolk Coast is the closest SAC for this species situated *circa* 120 km from the proposed development. Sites are designated if they are important both as a haul out site and for moulting and pupping, helping to ensure a favourable conservation status for the common seal in the UK. The nearest SAC to the proposed development that includes common seal as a qualifying feature is The Wash and North Norfolk Coast, in which the species is a primary reason for site designation.

Thirteen SACs have been designated for the grey seal around the UK. Sites are designated if they are important as a breeding colony, which helps to ensure a favourable conservation status for this species in the UK. The nearest SAC to the proposed development that includes grey seal as a qualifying feature is the Humber Estuary, *circa* 220 km to the north.

The relevant European Site's Conservation Objectives provide a framework which should inform any 'Habitats Regulations Assessments' (including an Appropriate Assessment where necessary) that a competent authority may be required to make under the legislation referred to above. In addition, they can be used to inform any measures necessary to conserve or restore the European Site and/or to prevent the deterioration or significant disturbance of its qualifying features as required by the provisions of Articles 6(1) and 6(2) of the Habitats Directive respectively. The relevant European Marine Sites Regulation 33 and Regulation 35 packages detail:

- the international importance of the site, underlying physical processes and the ecological requirements of the habitats and species involved;
- a management scheme which will ensure that the ecological requirements of the site's interest features are met;
- the standards against which the condition of the site's interest features can be determined and undertake compliance monitoring to establish whether they are in favourable condition; and
- any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated.

4.5 Diets of the key species

4.5.1 Harbour porpoise

Harbour porpoises eat a wide variety of fish and cephalopods; the main prey items appearing to vary among regions, seasons, sexes and sizes (review in Santos & Pierce 2003). However, in general, porpoise seem to concentrate on small shoaling demersal and pelagic fish and despite a wide range of prey species being found in their diet, tend to feed on two to four main species (Santos & Pierce 2003). For example, in Scotland this has tended to be whiting *(Merlangius merlangus)* and sandeels (Ammodytidae) (Santos *et al.,* 2004), while in the Baltic, preferred species are herring (*Clupea harengus*), sprat (*Sprattus sprattus*) and cod (*Gadus morhua*) (Koschinski, 2001). Off the Dutch coast, whiting and other gadoids accounted for over 85 % of the diet with sandeels making up less than 5 % of the diet by mass (Santos, 1998). Santos *et al.,* (2004) also noted that sandeels were more important in the diet of porpoise on the east coast of Scotland, during

summer months, whereas, gadoid species (such as whiting) were more important in winter, in the Shetland region.

Given the variation in the diet of the porpoise, they could be considered opportunistic predators, or flexible feeders that they can easily switch to a different prey species if the preferred prey are not sufficiently available. For example, Santos *et al.,* (2004) found that herring and sprat only formed a relatively small proportion of prey in Scottish waters (unlike in the Baltic). The authors suggested that the importance of herring and sprat in the diets had declined since the 1960s, mirroring the decline in overall herring abundance, suggesting the reductions in herring caused the animals to switch prey species. However, the underlying factors determining porpoise diet are not fully understood, as there are large spatio-temporal variations in their diet and studies investigating the distribution and abundance of prey have not been undertaken on a sufficiently fine spatial scale to support definitive conclusions. In addition, porpoise sample sizes are often not large enough to distinguish among factors that could cause a change in diet (Santos & Pierce 2003).

4.5.2 Common seal

The Scottish Government funded a project in 2010 to provide a comprehensive assessment of common seal diet, through the analysis of prey remains in scat. The results show that common seal diet in the North Sea (including Orkney and Shetland) where local harbour seal populations are in decline, is heavily dominated by sandeels which are the primary prey throughout the year (Wilson and Hammond, 2016). This is reflected in other studies, for example, Pierce *et al.,* (1991) and Thompson *et al.,* (1991) observed that the diet of common seals in the Moray Firth tended to be predominantly sandeels in summer and clupeids in winter, although octopus and gadoids (predominately whiting) were also important. Pierce *et al.,* (1991) concluded that the trends they observed were consistent with opportunistic foraging on the most abundant prey.

Similar results were observed in a study in Iceland (Hauksson and Bogason, 1997), where again sandeel were seen to be a more important component in common seal diet in summer, with capelin (*Mallotus villosus*) and herring (*C. harengus*) were more important in winter. However, cod was important in their diet throughout the year and a range of other prey species were found, including redfish (*Sebastes* sp.), saithe (*Pollachius virens*) and catfish (*Anarhichas lupus*). Similar too were results from a study in the Rødsand area of Denmark. Andersen *et al.*, (2007) processed 26 samples over a five-year period and found evidence of 20 different prey species. The diet at Rødsand was predominantly made up of cod, herring, sandeel, flounder (*Platichthys flesus*), plaice (*Pleuronectes platessa*) and dab (*Limanda limanda*), with importance in diet depending on the season.

In the south western North Sea, however, the common seal diet was different, with whiting, Dover sole (*Solea solea*), dragonet (*Callionymus lyra*) and sand gobies (*Pomatoschistus minutus*) making up the majority (63 %) of their diet and a total of 31 different species recorded (Hall *et al.,* 1998). Diet again varied by season and the authors concluded that diet composition appeared to be mainly linked to prey availability and abundance, although the authors also acknowledged that data on seasonal changes in prey distribution and relative abundance are required before this can be determined for certain. A small study of common seals during the months of January to May in the Thames Estuary (n = 6 scats) found flounder, whiting, sprat and sandeel otoliths present in the scats (3, 2, 1 and 1 otoliths, respectively; Barker *et al.*, 2014). Hall *et al.,* (1998) also reviewed studies from other areas of Europe and concluded that common seals are opportunistic foragers, consuming a wide variety of prey species, dependant on the seasonality and local availability. Work undertaken by Iverson *et al.,* (1997) further support this conclusion, where fatty acid profiles in prey showed that common seals depend on a very localised prey source. However, as for harbour porpoise, it seems that while common seals are opportunistic predators and feed on a wide variety of prey species, their diet is dominated by a few key species.

4.5.3 Grey seal

In north eastern Scotland, Hammond *et al.* (1994) investigated the diet of grey seals by collecting and analysing approximately 1000 seal scats. Sandeels comprised by weight almost half the diet. Other important components of their diet were gadoids (in particular cod), flatfish (in particular plaice) and sculpins. As for common seals, the importance of sandeels varied depending on time of year, but no differences were found in the numbers of cod, haddock (*Melanogrammus aeglefinus*) or saithe consumed during the year. Seal scat was again examined from seals in the south western North Sea (Donna Nook in Lincolnshire;

Prime & Hammond, 1990), where only three species (sandeel, cod and Dover sole) accounted for approximately 56 % of the diet, with dab, flounder and plaice contributing another 22 %. As for other studies, the importance of prey species depended on the time of year, though in Prime & Hammond's (1990) study, all species changed in importance, while in the Scottish studies certain species were present in the diet year-round. In the Baltic, herring appears to be the dominant prey followed by species such as common whitefish (*Coregonus lavaretus*), flounder, cyprinids (*Cyprinidae*), sprat, lumpsucker (*Cyclopterus lumpus*), cod and eelpout (*Zoarces viviparus*; Lundström *et al.*, 2007). A more recent study by Hammond and Wilson (2016), has shown that the diet of grey seals in the North Sea was dominated by sandeels (56%) with gadoid prey (particularly cod and saithe) comprising about 20% of the total diet.

Like common seals, grey seals appear to be opportunistic foragers, eating a wide variety of prey types depending on location and season, but the diet predominantly consists of a few key species. Grey seals tend to range more widely than common seals (see section 4.2.1), able to forage several hundred kilometres offshore, with foraging trips lasting between one and 30 days, accordingly some differences in their diets based on differences in fish distributions may be expected.

4.5.4 Comprehensive Impingement Monitoring Programme

Sampling of fish impinged at Sizewell B has been undertaken as part of the Comprehensive Impingement Monitoring Programme (CIMP) since February 2009. A summary of the estimated annual numbers of the most commonly impinged fish, accounting for over 95 % of the cumulative total, is shown in Table 3 (BEEMS Technical Report TR345). The frequency of impingement of fish at Sizewell B is not necessarily representative of the diets of marine mammals off the coast at the proposed development. However, Table 3 provides an indication of the most commonly impinged species within the Sizewell Dunwich Bank. Survey methodology influences species captured and changes in seasonal abundance occur. A full characterisation of the fish communities off the proposed development area is provided in BEEMS Technical Report TR345.

Table 3. A sample of the most abundant fish impinged at Sizewell B as part of the CIMP programme. Cumulative percentages are based on number impinged scaled to account for annual averages. Colour coding illustrates the species captured in different surveys (beam trawl samples, otter trawl samples, glass eel surveys and impingement samples). Adapted from BEEMS Technical Report TR345.

Common name	**Species Latin name**	2 m beam trawl	Otter trawl	Glass eel surveys	CIMP (cumulative individuals)
European sprat	*Sprattus sprattus*				51.8%
Atlantic herring	*Clupea harengus*				63.9%
Whiting	*Merlangius merlangus*				73.4%
European sea bass	*Dicentrarchus labrax*				83.8%
Sand goby	*Pomatoschistus minutus*				89.2%
Dover sole	*Solea solea*				91.1%
Dab	*Limanda limanda*				93.0%
Anchovy	*Engraulis encrasicolus*				94.5%
Thin-lipped grey mullet	*Liza ramada*				95.8%

5 Irregular visitors / passing migrants

None of these species have been recorded in sufficient density or with sufficient frequency to be considered important in the food-web of the proposed development area. Thus, we briefly review their UK distribution for the purposes of completeness only and will not consider them in any further detail in the BEEMS ecological impact assessments (see section 3).

5.1 The bottlenose dolphin

Bottlenose dolphins in the UK are at the most northerly edge of their global distribution. They are large, robust animals, measuring up to four metres in length. Populations are locally common around the UK (Figure 18A & Figure 19), with well-known groups present in the Moray Firth and Cardigan Bay. Bottlenose dolphins have been recorded in certain locations of the UK year-round, but sightings tend to peak between July and October (Wilson *et al.,* 1997; Reid *et al.,* 2003).

Bottlenose dolphins are social animals, often seen around the coastline in groups comprising two to 25 animals, but they can form larger groups further offshore. In coastal waters, bottlenose dolphins tend to favour areas with rapid changes in bottom topography, strong tidal currents and/or relatively deep waters, possibly as a foraging strategy (Wilson *et al.,* 1997; Reid *et al.,* 2003 and Hastie *et al.,* 2004). Bottlenose dolphins have a varied diet, feeding on a wide variety of benthic and pelagic fish, as well as cephalopods and shellfish, with prey type likely dependant on the region where they are foraging (Blanco *et al.,* 2001; Santos *et al.,* 2001 and Spitz *et al.,* 2006).

5.2 The short beaked common dolphin

The short beaked common dolphin is a small dolphin, reaching up to 2.5 m in length. While common dolphins are relatively abundant in northwest Europe and summer sightings in the North Sea do take place (Reid *et al.,* 2003), they are much more common in the waters west and southwest of the UK than in the North Sea (Figure 18B & Figure 19). A survey in north-eastern Scotland recorded common dolphins throughout the year but noted a peak in sightings between September and November (Weir *et al.,* 2001), with other coastal, UK wide, surveys noting a peak between July and October.[13]

Common dolphins are sociable animals and can be found in group sizes that range from six to several hundred animals, or even thousands in some offshore locations. Their diet is varied, predominantly comprising pelagic, schooling fish, though they will also prey on cephalopods (Reid *et al.,* 2003 and Meynier *et al.,* 2008).

[13] http://www.seawatchfoundation.org.uk/

5.3 The white beaked dolphin

The white beaked is a stocky dolphin that can reach up to three metres in length. Their distribution is restricted to temperate and sub-Arctic waters of the North Atlantic and they can be seen all year round. While usually observed in small groups of less than 10 animals, groups of up to 50 can be recorded. Northridge *et al.,* (1995) recorded the highest sighting rates in northern Scotland (Hebrides) and within a strip from the Orkneys down to Flamborough Head in Yorkshire. Sightings are becoming more common in the southern North Sea, with one sighting of four animals in July 2009 as part of the Galloper wind farm survey. However, generally the species seems to stay in more offshore waters (Van der Meij and Camphuysen, 2006). They feed on a variety of both demersal and pelagic prey and include crustaceans and cephalopods in their diet (Reeves *et al.,* 1999; Reid *et al.,* 2003).

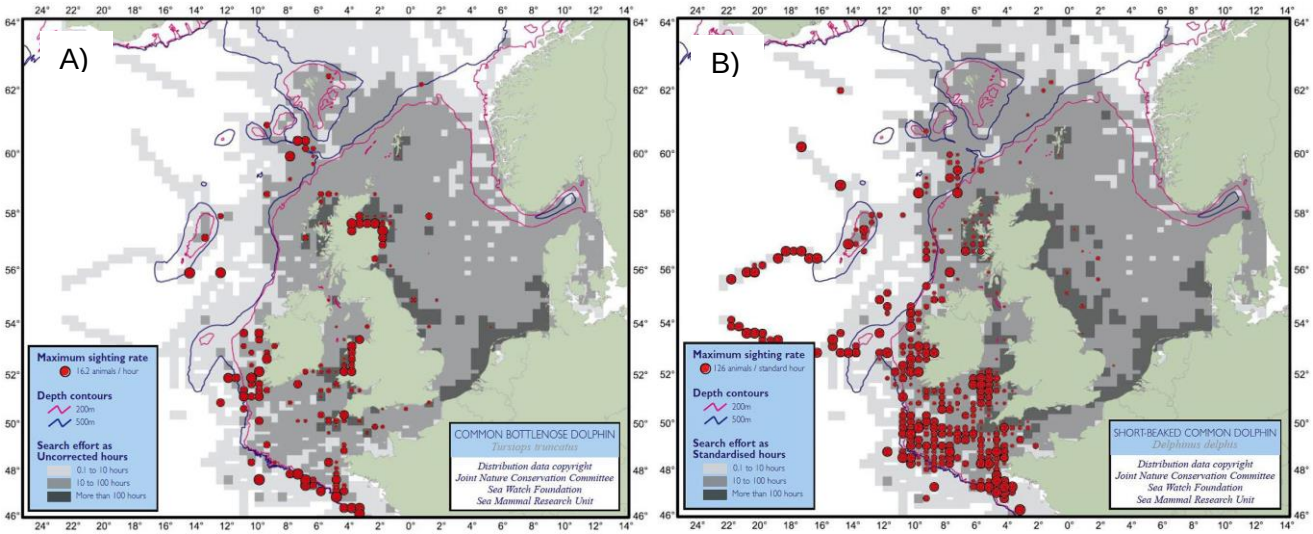

Figure 18. Bottlenose (A) and common (B) dolphin distribution around the UK (Reid *et al.*, 2003).

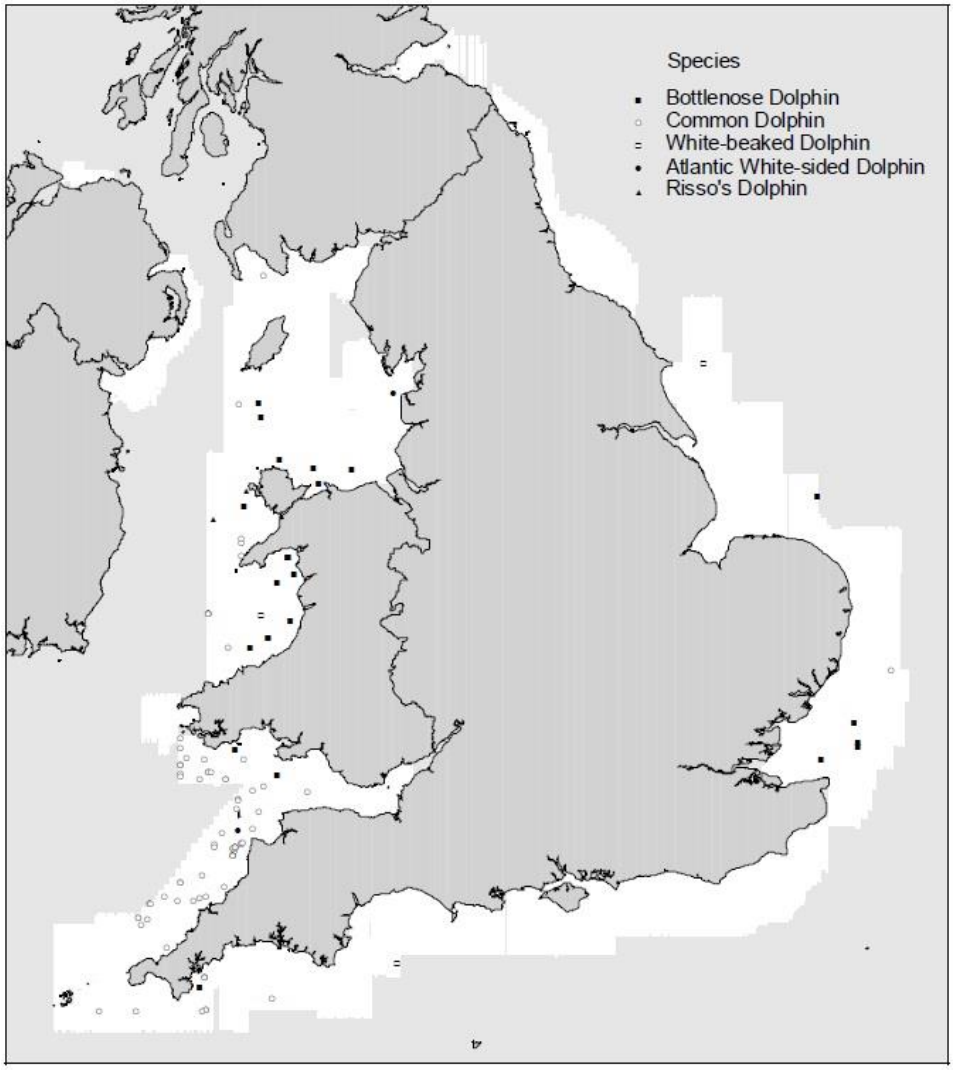

Figure 19. Dolphin sightings during aerial surveys from 2001 – 2008 (WWT, 2009).

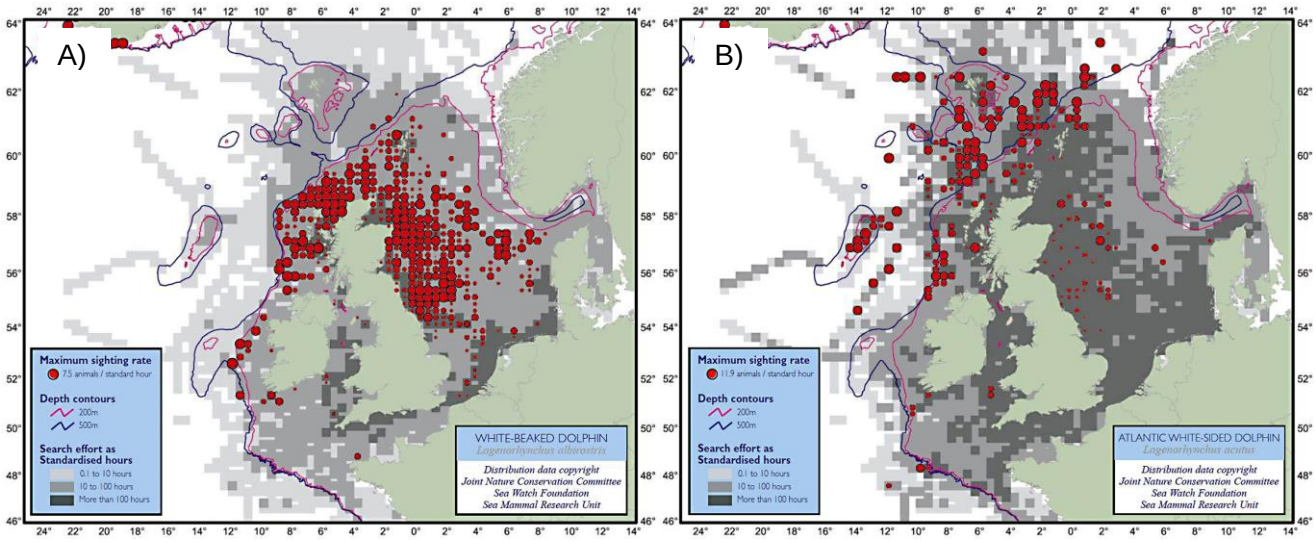

Figure 20. Observations of (A) white beaked and (B) Atlantic white sided dolphin within northwest Europe (Reid *et al.*, 2003).

6 Rare sightings

6.1 The Atlantic white sided dolphin

The Atlantic white sided dolphin can grow up to three metres in length. They can form mixed groups with white beaked dolphins and have a similar distribution (temperate and sub-Arctic waters of the North Atlantic), although there does appear to be some habitat separation (Northridge *et al.,* 1997). There may be a seasonal movement of white sided dolphins in summer into the North Sea, but they are more often observed offshore in deeper waters to the north and northwest of the UK (Northridge *et al.,* 1997). In the northeast Atlantic, sightings of white sided dolphins are less numerous than white beaked dolphins, though white sided dolphins are often seen in much larger groups, with 1,000 animals not uncommon. White sided dolphins eat a wide variety of small pelagic schooling fish as well as cephalopods such as squid (Palka *et al.,* 1997).

6.2 The minke whale

The minke whale is the smallest of the baleen whales, growing up to 8.5 m in length. Minke whales are widely distributed throughout the world, in tropical, temperate and polar seas. In northwest Europe, minke whales are common on the Atlantic coast and within the northern and central North Sea they occur as far south as Flamborough Head in Yorkshire (Figure 21A), where concentrations may occur in late summer/early autumn due to a plankton frontal system (Jones *et al.,* 2004). Minke whales can be seen year-round, with feeding aggregations between July and September (Reid *et al.,* 2003). While feeding minkes can reach group sizes of 10 – 15 individuals, they are usually seen alone or in pairs. Of all the baleen whales, minke have the most diverse diet, feeding on a wide variety of schooling fish and using a range of feeding techniques.

6.3 The Risso's dolphin

The Risso's dolphin is a large robust dolphin, reaching up to 3.5 m in length. Risso's dolphin typically forms small to medium sized groups ranging in size from 2 – 50 animals, but more usually in the UK forms groups of 6 – 12 (Reid *et al.,* 2003). They are wide ranging and can be found in all oceans, but tend to favour continental slope and/or deeper waters offshore (depending on the location they are observed), due mainly to the distribution of their preferred prey - cephalopods such as squid, octopus and cuttlefish. Around the UK they are most commonly seen along the continental slope as well as within the Hebrides (Figure 21B). There are occasional sightings in the northern North Sea, generally between July and August (Reid *et al.,* 2003).

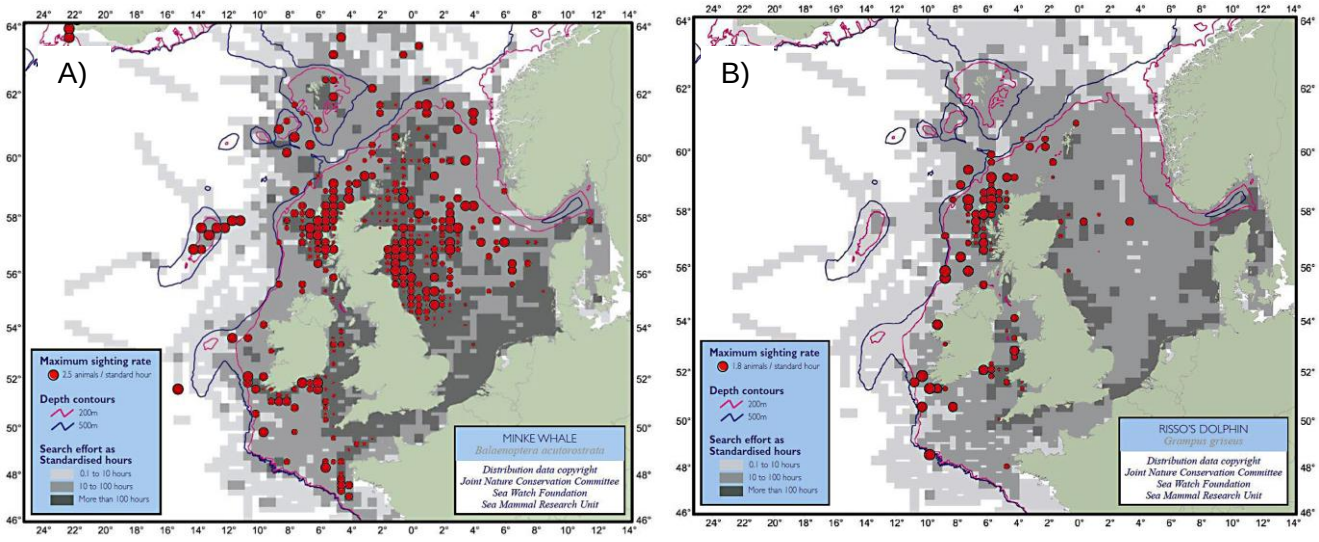

Figure 21. Observations of A) minke whale and B) Risso's dolphin within northwest Europe (Reid *et al.*, 2003).

6.4 Other Sightings

During 2016, four sperm whales were washed up on the coasts of North Norfolk and Lincolnshire. The media has reported that these whales likely belonged to the same pod in the southern Norwegian Sea that became disorientated and were then stranded in the shallow North Sea (http://www.edp24.co.uk/news/environment/could-solar-storms-explain-whale-strandings-on-beaches-in-norfolk-lincolnshire-and-other-north-sea-coasts-1-5181585; accessed 21/03/2018). There is no evidence however, that suggests sperm whales (*Physeter macrocephalus*) are becoming more commonly encountered off the coast of the proposed development.

There has also been reports in the media of a humpback whale individual being sighted off the Norfolk coast multiple years in a row (http://www.bbc.co.uk/news/uk-england-norfolk-34868589; accessed 21/03/2018). Again, there is no evidence to suggest that humpback whales (*Megaptera novaeangliae*) are becoming more commonly encountered off the coast of the proposed development.

7 Synthesis

Information from a range of sources, encompassing published literature, EU research project outputs (the SCANS surveys), UK research council outputs (the NERC Special Committee on Seals, or SOCS) and outputs from industry such as windfarm surveys and EDF Energy commissioned survey work in the Greater Sizewell Bay (the BEEMS static acoustic monitoring) provided a picture of the distribution of marine mammals around the proposed development area. Approximately 35 species of marine mammal have been recorded in northwest European waters, of which seven have been recorded in the southern North Sea and a further two in the central and northern North Sea. Of these nine species, three can be considered 'commonly encountered' in the southern North Sea – the harbour porpoise, the common/harbour seal and the grey seal – while the others are considered unlikely to occur in the proposed development area and can be classed as 'irregular visitors' or 'passing migrants' (the white beaked, bottlenose and short beaked common dolphins) or 'rarely encountered' (minke whale, Atlantic white sided and Risso's dolphins).

The three commonly encountered species, harbour porpoise, common and grey seals, are considered to be the key marine mammal species in the proposed development area. The others are unlikely to feature often enough to be considered a key component of the proposed development marine ecosystem and will not be taken further in the impact assessments.

The harbour porpoise (see section 4.1) is found throughout the North Sea. A somewhat conflicting picture emerges on regional distribution, with Reid *et al.*'s (2003) 25-year analysis indicating low usage of the area around the proposed development, but the Wildfowl and Wetlands Trust's (2009) later review of 2001 - 2008 data showing a concentration around the East Anglian coastline. The EU-funded SCANS projects and Peschko *et al.* (2016) documented a shift in porpoise distribution from the northern to southern North Sea between 1994 and 2016, which may explain this anomaly - harbour porpoise appear to have become more commonly encountered in the southern North Sea (and, it follows, potentially the area surrounding the proposed development). Hence, why the Southern North Sea has been proposed as a cSAC for harbour porpoise. There is some evidence of seasonal changes in distribution in the area around the proposed development, with the Thames Estuary REA (TEDA, 2010) recording more sightings over the winter and the BEEMS C-POD monitoring (BEEMS Technical Report 271) indicating a potential preference for offshore waters over winter. They are certainly present in the region and may be increasing; such possible increases should be considered during the impact assessments.

The common/harbour seal (see section4.2) is found around UK coasts, but is more widespread around the west coast than in the North Sea. The nearest sites of relevance to the proposed development are a concentration of the species around The Wash and a smaller concentration at Blakeney Point in north Norfolk and around the Thames Estuary. The seals are known to haul out onto sandbanks around the mouth of the Thames, but there's little current evidence of heavy utilisation of the proposed development area - they do move through the area, but densities appear to be low (see Figure 10 and Figure 12). Moreover, few were recorded in the nearby Galloper and Greater Gabbard windfarm surveys (EAOW Ltd., 2011; GWFL Ltd., 2011) and they are thought to generally travel less than 100 km between haul out sites or for foraging (see section 4.2.1). Thus, they are likely to be present around the proposed development, but not to the extent that they are found in the northerly Wash and southerly Thames areas. The local temporal picture is one of overall population increase, driven primarily by an increase of *circa* 400 animals between 1997 and 2011 at The Wash (see Figure 7). The increase at Scroby Sands has been much more modest, at only 52 animals, though this does constitute an 80 % increase on 1997 numbers (see SCOS, 2012; their Table 3). Thus, the common seal populations around the proposed development (The Wash, Blakeney, Scroby Sands) seem to have grown and the latest advice (NERC, 2017), state that the numbers are stable. Thus, it's clear that common seals are present around the proposed development and should be considered in the impact assessments, particularly if their population numbers are increasing in the region. However, the baseline information on their natural temporal variability is uncertain and the wider context of the regional increases gives food for thought (the east English populations suffered a phocine distemper virus epidemic in 2002 and numbers have since increased at a slower rate than the nearest mainland European population also affected by the epidemic; see SCOS, 2012).

Most of the UK's grey seals are found in Scotland (section 4.3). There are populations in the southern North Sea - in Lincolnshire, East Anglia and the Thames Estuary – though from the available evidence usage of the areas around the proposed development itself seems to be quite low. Grey seals are capable of longer-range movements than common seals (over 300 km to haul out sites and 145 km to forage, see section 4.2.1), so are theoretically well able to travel between the Norfolk/Thames sites and the proposed development site and possibly even between Donna Nook and the proposed development site. The available evidence suggests grey seals are increasing around the East Anglian region and the North Sea in general. Pup numbers are increasing year-on-year at Blakeney and other East Anglian sites (see Figure 17) and, while the Thames public sightings data show no clear temporal trend, the Zoological Society of London's comparative graph suggests there was an overall increase in numbers between 2002 and 2013[14] (although numbers dropped between 2010 and 2013, they were still larger than in 2002, 2003 and 2008; see graph in Appendix 5 of Barker *et al.*, 2014). Overall, there is sufficient evidence of their presence in the proposed development area to warrant their inclusion in the impact assessments.

All three species – harbour porpoise, common seal and grey seal - appear to be opportunistic predators, presumably switching between fish species as population numbers fluctuate. Despite dietary flexibility, they all appear to concentrate preferentially on a few key prey species: harbour porpoise seem to concentrate on small shoaling fish such as whiting, sandeels, herring and sprat. Sandeels also feature in the diet of the common seal, as do clupeids (e.g. herring) and gadoids (whiting, cod) - common seals in the southwestern North Sea consume whiting, Dover sole, dragonet and sand goby, with flounder, sprat and sandeel also selected. Grey seals have similar diets to common seals, featuring sandeels, gadoids (cod, haddock, saithe), flatfish (Dover sole, flounder, dab and plaice). It is likely the diets of all three species will reflect the key fish species found in each locality.

All three species are protected under UK and international conservation agreements. Special areas of conservation have been designated for each of them. The Southern North Sea cSAC (designated for harbour porpoise) includes the area of open sea adjacent to the eastern boundary of the Main Development Site. The Wash and North Norfolk Coast SAC (designated for common seal), at *circa* 120 km from the proposed development (from Sizewell to Blakeney Spit[15]) is outside of the transit range for the species (100 km, see section 4.2.1.). The nearest SAC to the proposed development that includes grey seal as a qualifying feature is the Humber Estuary, *circa* 220 km (from the proposed development to the mouth of the Humber[12]), which is within the *circa* 300 km transit range for this species.

[14] The numbers should be treated with caution because the 2002, 2003 and 2008 surveys utilised different methods than the 2013 study.

[15] Measured on Google Earth as a traverse around the coastline from the approximate location of the Sizewell C NNB site to the two areas (Blakeney Spit and the mouth of the Humber Estuary).

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