A1a.7 Marine and other mammals

A1a.7.1 Introduction

The sections below describe the occurrence of cetaceans (porpoises, dolphins, and whales), seals, otters and migratory bats in UK waters. A summary is provided of the current understanding of their distribution, abundance, ecological importance, and the main environmental issues of concern. Where possible, information is provided on any known or likely trends in these characteristics. In addition, the various conservation frameworks in place to facilitate their management and conservation are described.

Reviews of marine mammal distribution, ecology and sensitivities in UK waters have been carried out by the Sea Mammal Research Unit (SMRU), University of St. Andrews, in contribution to previous oil and gas SEAs (e.g. Hammond *et al.* 2001, 2002a, 2003, 2004, 2005, 2006, 2008). Additionally, a collation of background information on marine mammals relevant to the first Offshore Energy SEA was produced by SMRU Limited (Murphy *et al.* 2008). Further reviews of available information on marine mammals and assessments of species' status have taken place as part of several UK initiatives, including Charting Progress (DEFRA 2005), Charting Progress 2 (UKMMAS 2010) and the UK Government reporting for Article 17 of the Habitat Directive (JNCC 2007, 2013) and for the Marine Strategy Framework Directive (DEFRA 2012). The contribution of Evans & Bjørge (2013) to the Marine Climate Change Impacts Partnership has provided up-to-date information on the potential impacts of climate change on marine mammals around the UK.

Large-scale surveillance of cetacean population abundance has been carried out through wide-ranging internationally coordinated ship-based and aerial surveys such as the Small Cetacean Abundance in the European Atlantic and North Seas (SCANS) and Cetaceans Offshore Distribution and Abundance in the European Atlantic (CODA); these surveys have been instrumental in determining total abundance estimates for the more common species. SCANS-I and II took place in the summer of 1994 and 2005; results of these are published in Hammond *et al.* (2002b) and Hammond *et al.* (2013). SCANS-III is being planned in support of the implementation of the MSFD (DEFRA 2014). CODA covered approximately 10,000km of transects along the shelf edge and beyond, in waters of the UK, Ireland, France and Spain (Hammond *et al.* 2009).

Reid *et al.* (2003) compiled cetacean sighting records from a variety of systematic surveys and opportunistic sightings, incorporating some 2,500 days of observation carried out since 1973 to produce an atlas of cetacean distribution in north-west European waters. Many of these sightings came from the European Seabirds at Sea (ESAS) database, the Sea Watch Foundation database and SCANS I. The Atlas has been cited extensively and maps have been regularly reproduced. Since publication new data have been collected by NGOs, academia and industry, including recent baseline surveys and efforts to update the Atlas are ongoing; a Joint Cetacean Protocol has been established to coordinate the data resource and promote standards and methods for integration (e.g. Thomas 2009, Paxton & Thomas 2010, Paxton *et al.* 2010). In Welsh waters, the atlas of marine mammals has recently been updated (Baines & Evans 2012).

Further information on the distribution of large whales (fin, humpback and blue) in deep waters to the west of Britain and Ireland has been provided by acoustic monitoring using US Navy-operated hydrophone arrays mounted to the seabed in this area. Analyses of data collected over a 10 year period from 1996-2005 was presented in Charif & Clark (2009).

Observations of incidental cetacean by-catch by commercial fishing vessels in relation to EU Regulation 812/2004[1] and the Habitat Directive are undertaken by the UK by-catch monitoring scheme and reported annually (Northridge *et al.* 2015).

Inshore bottlenose dolphin populations, for which Special Areas of Conservation (SACs) have been established, have been the focus of continued monitoring efforts to inform SAC condition assessments (Cheney *et al.* 2014, Feingold & Evans 2014a).

Information of UK stranded marine mammals has been routinely collected since 1913. In 1990, the UK Cetacean Strandings Investigation Programme (CSIP) was initiated; CSIP is a long-term monitoring programme to collect, analyse and report strandings around the UK and to carry out systematic *post-mortem* examinations to determine the causes of death, undertake surveillance on the incidence of disease and maintain a national tissue archive for chemical analyses.

Extensive information on the distribution and abundance of grey and harbour seals is drawn from the results of the UK seals monitoring programme, run by SMRU, and reported yearly to the Special Committee on Seals (e.g. SCOS 2014). In addition, information on seals' at-sea movement and behaviour has been obtained from several hundred individuals fitted with satellite tags, many as part of DECC-funded studies (e.g. Jones *et al.* 2015, Russell *et al.* 2013)

Knowledge of the distribution of otters relies on national surveys undertaken at regular intervals (approximately every 7 years) since 1979; the most recent were the 2009-10 survey of England (Crawford 2010), the 2010 survey of Northern Ireland (Preston & Reid 2011), the 2003-04 survey of Scotland (Strachan 2007) and the 2009 survey of Wales (Strachan 2015). Where relevant, information on the ecology of these species is drawn from a wide range of other publicly available reports and peer-reviewed studies.

A1a.7.2 UK context: Cetacean distribution and abundance

Twenty eight cetacean species have been recorded in UK waters from sightings and strandings. Of these, eleven species are known to occur regularly, while seventeen are considered rare or vagrant (UKMMAS 2010). This distinction has formed the basis for reporting conservation status as part of the implementation of the EU Habitat Directive under Article 17 (JNCC 2013). Among the regular species, there are some for which distribution and abundance are reasonably well known: harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), white-beaked dolphin (*Lagenorhyncus albirostris*), minke whale (*Balaenoptera acutorostrata*) and fin whale (*Balaenoptera physalus*). Less data are available for the other six regular species: Atlantic white-sided dolphin (*Lagenorhyncus acutus*), short-beaked common dolphin (*Delphinus delphi*), Risso's dolphin (*Grampus griseus*), killer whale (*Orcinus orca*), long-finned pilot whale (*Globicephala melas*), and sperm whale (*Physeter macrocephalus*). Each of these species is given a separate section below; the uncommon species are grouped under 'beaked whales', 'other odonotocetes' and 'other mysticetes'.

Most cetaceans are wide-ranging and individuals encountered within the UKCS form part of a much larger biological population whose range extends well beyond UK waters. Following advise by SMRU and ICES, management units (MUs) for seven of the more common regularly occurring species have been agreed by the UK Statutory Nature Conservation Bodies (SNCBs) and are described in the relevant sections below. These MUs provide an indication of the spatial scales at which impacts of anthropogenic activities may best be taken into consideration and further guidance on their application is expected (IAMMWG 2015).

[1] Laying down measures concerning incidental catches of cetaceans in fisheries.

A1a.7.2.1 Harbour porpoise

The global distribution of the harbour porpoise (*Phocoena phocoena*) is restricted to the Northern Hemisphere, primarily within temperate and sub-arctic (primarily 5-14ºC) seas. In the eastern Atlantic, it is common and widely distributed on the continental shelf (mainly at depths of 20-200m) from the Barents Sea and Iceland in the north, to the waters off the African coast of Senegal and east across the North Sea to the Baltic Sea (Reid *et al.* 2003). The harbour porpoise is the most common cetacean in UK waters; it is wide-ranging and abundant throughout the UK shelf seas, both coastally and offshore. It is also the smallest and most inconspicuous cetacean within UK waters with sighting rate strongly affected by sea state. Typically, it occurs in small groups of 1-3 animals; larger aggregations have been reported, probably where many smaller groups are concentrated in the same area rather than coordinated schools (Reid *et al.* 2003). The mating/calving periods for the harbour porpoise ranges from May to August in the north east Atlantic (Learmonth 2006, Learmonth *et al.* 2014).

In coastal waters, they are often encountered close to islands and headlands with strong tidal currents (e.g. Pierpoint 2008). Sightings become increasingly rare close to the continental shelf edge, with relatively few records in deeper waters beyond the shelf edge. Individuals across the UKCS are part of the north east Atlantic population which is mainly considered to be a single 'continuous' population, even though some degree of genetic differentiation has been observed (Andersen *et al.* 1997, 2001, Tolley *et al.* 2001, Fontaine *et al.* 2007). However, for management and conservation purposes, three distinct UK Management Units have been proposed (Figure A1a.7.1) and abundance estimates have been calculated for the UK portion of each (IAMMWG 2015); the North Sea (NS) with 110,433 individuals (95% CI 80,866 – 150,811), West Scotland (WS) with 19,291 individuals (95% CI 7,771-47,888) and the Celtic & Irish Seas with 47,229 individuals (95% CI 25,611-87,094).

Several studies have looked at spatial patterns in the distribution of this species across UKCS at varying spatial and temporal scales. Notably, a large southerly shift in distribution was reported across the North Sea during the 10 years between 1994 and 2005 when the two SCANS surveys took place (Hammond *et al.* 2013), shown in Figure A1a.7.2. Density surface modelling from SCANS-I in 1994 suggested high densities of animals north of Scotland and in the western central and northern North Sea but that animals were almost absent from the southern North Sea. Repeat surveys for SCANS-II in 2005 showed considerable differences; densities in the central North Sea and Moray Firth were lower and considerably so around Orkney and Shetland, while high densities were observed throughout much of the UK southern North Sea. In addition, elevated densities were observed in the Celtic Sea, where very few individuals were observed in 1994. The southerly shift in distribution in the North Sea was also reported from land-based observations (Evans *et al.* 2015). Despite this distribution shift, abundance was comparable between 1994 and 2005 and the population has been assessed (as part of 3rd Report by UK under article 17 on the implementation of the Habitat Directive) to be in favourable condition with a total abundance in UK waters of 177,567 animals (CV=0.15) (JNCC 2011).

Figure A1a.7.1: Harbour porpoise management units

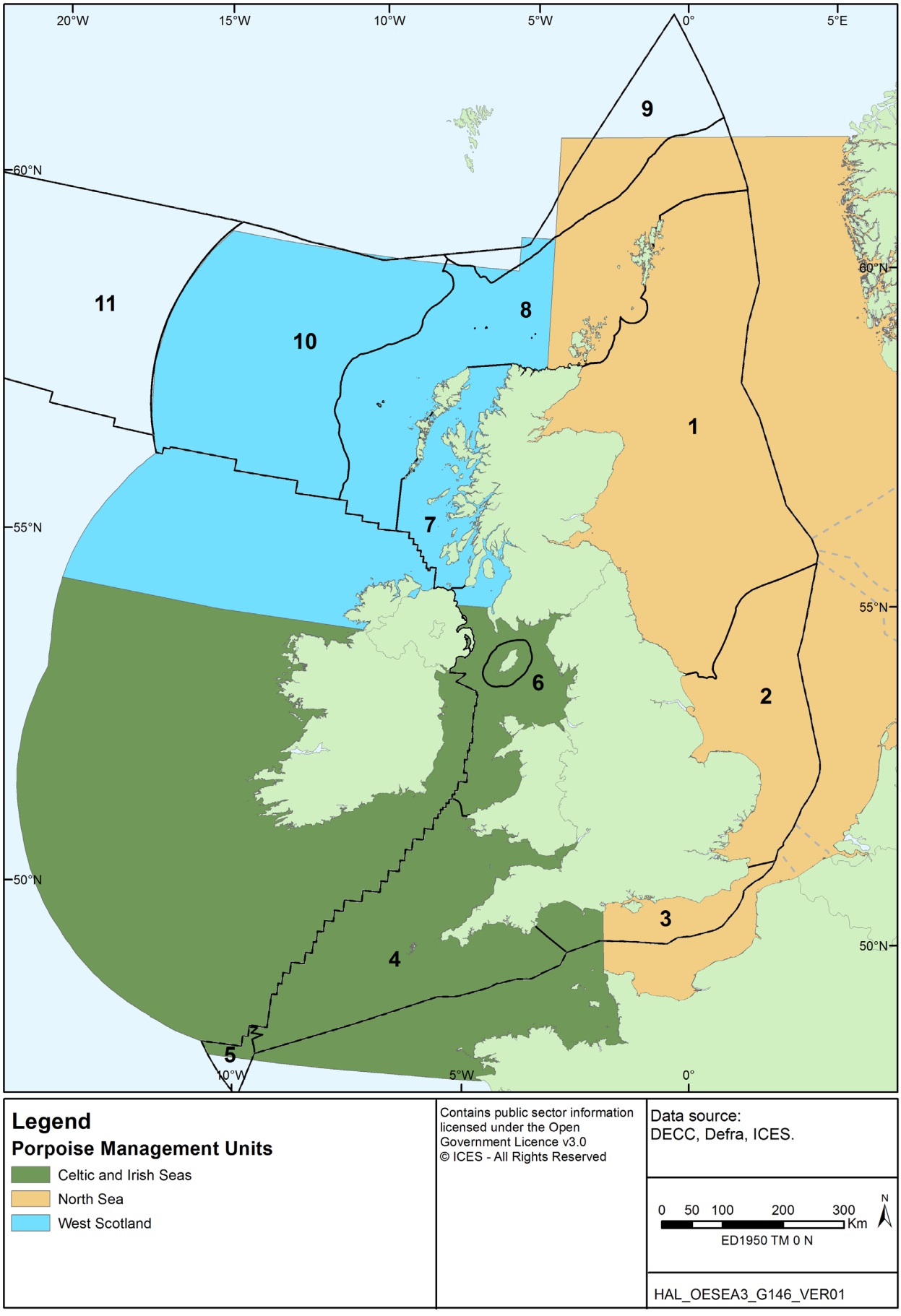
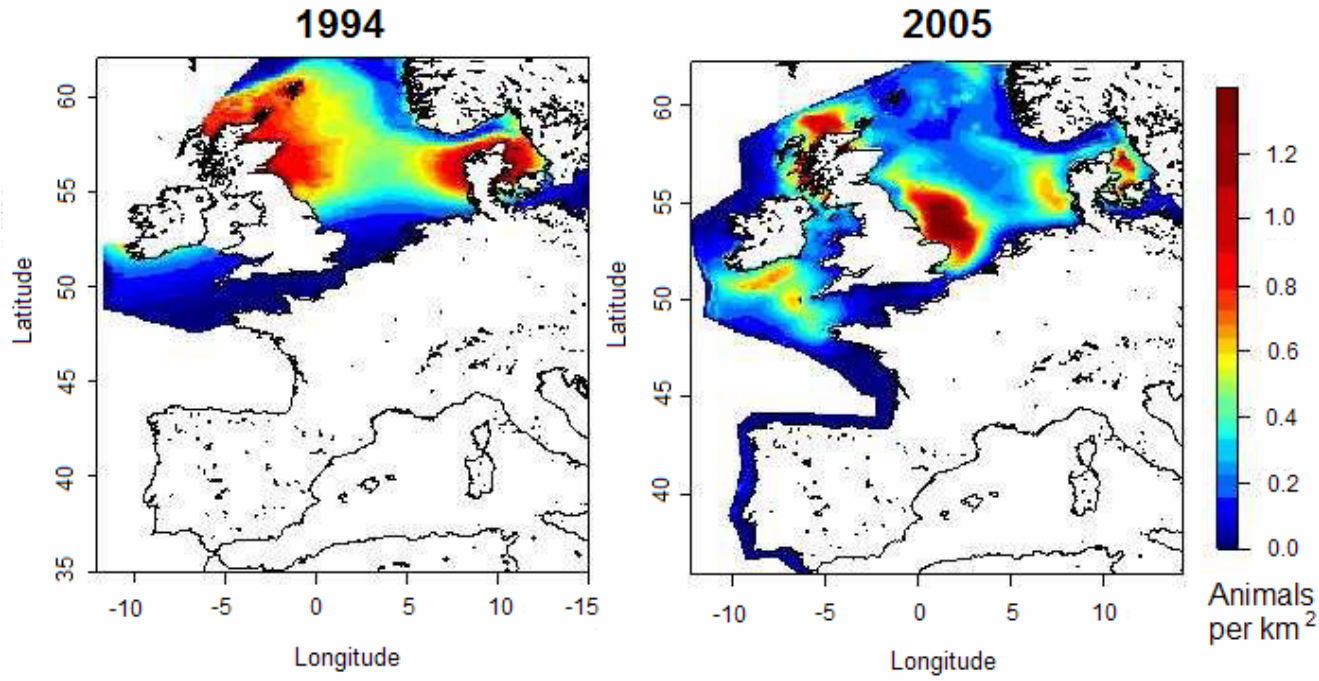


Figure A1a.7.2: Predicted density surface for harbour porpoise in 1994 and 2005

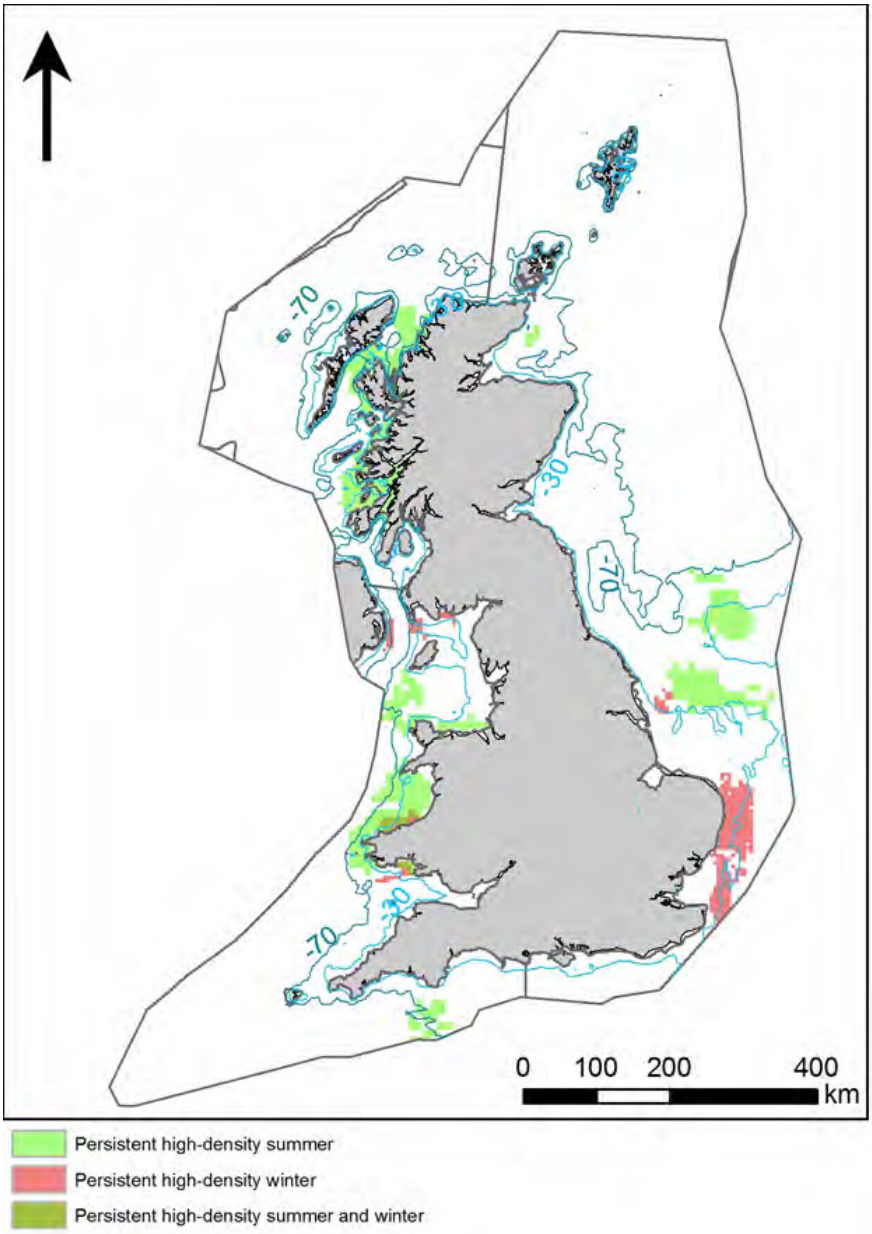


Notes: Density values are predictions based on the observed distributions and their relationships with habitat variables (longitude and latitude, distance from coast, depth or aspect of seabed slope if selected). Source: SCANS-II (2008)

Discrete and persistent areas of relatively high porpoise density have been identified by Heinänen & Skov (2015) following detailed analysis of the most complete dataset available for the UKCS (18 years of survey data in the Joint Cetacean Protocol). They used statistical distribution models within each MU to address the inherent challenge of highly variable survey coverage across space and time and the results, given in (see Figure A1a.7.3) are a set of discrete areas mainly within Irish Sea and Welsh coastal waters, shelf waters of the North Sea and along the north-west Scottish coast; some are persistent throughout the year, while others are valid in the winter or in the summer only. Despite the large quantity of data, effort coverage is very patchy both in time and space and differences in survey coverage may still influence the models. Especially in areas of repeated surveys (e.g. areas subjected to baseline studies for offshore windfarm development), the authors warn that effort-related bias may result in predicted mean densities being largely a function of survey effort (Heinänen & Skov 2015).

The models identified several oceanographic variables and ship traffic as factors influencing the distribution of this species. The response to water depth in the Celtic and Irish Sea regions showed a preference for shallower areas, while the responses in the North Sea region showed two peaks during summer; one at 40m and one at 200m depth. In the North Sea, surface salinity was influential in reflecting avoidance of estuarine water masses while the stability of the water column in terms of temperature differences was the most important determinant of porpoise density during summer. This response displayed similar patterns to water depth, with two peaks: one at the interface between mixed and stratified waters (tidal mixing front), and another peak at high values of stratification (typically found in deeper areas). In the Celtic/Irish Sea, eddy activity and current speed were also important predictors. The coarseness of surface sediments seemed to play a major role for the presence and density of porpoises in all three management units. The model results also indicated a negative relationship between the number of ships and the distribution of harbour porpoises in the Celtic/Irish Sea and the North Sea, but not in north-west Scottish waters.

Figure A1a.7.3: Map showing selected persistent high-density areas of harbour porpoise with survey effort from three or more years, as derived from statistical modelling by Heinänen & Skov (2015)



A1a.7.2.2 Bottlenose dolphin

The bottlenose dolphin (*Tursiops truncatus*) has a worldwide distribution across tropical and temperate seas of both hemispheres. They can be found in coastal and continental shelf waters but in most regions inshore and offshore 'sub-populations' tend to be distinct (e.g. Oudejans *et al.* 2015); the UKCS is no exception to this. In UK waters, inshore individuals are frequently reported off north-east and south-west Scotland, in the Irish Sea, and in the western English Channel. These form four seemingly resident inshore coastal groups and separate Management Units have been agreed (IAMMWG 2015) as shown in Figure A1a.7.4 with abundance estimates for each MU reported in Table A1a.7.1.

Figure A1a.7.4: Bottlenose dolphin management units

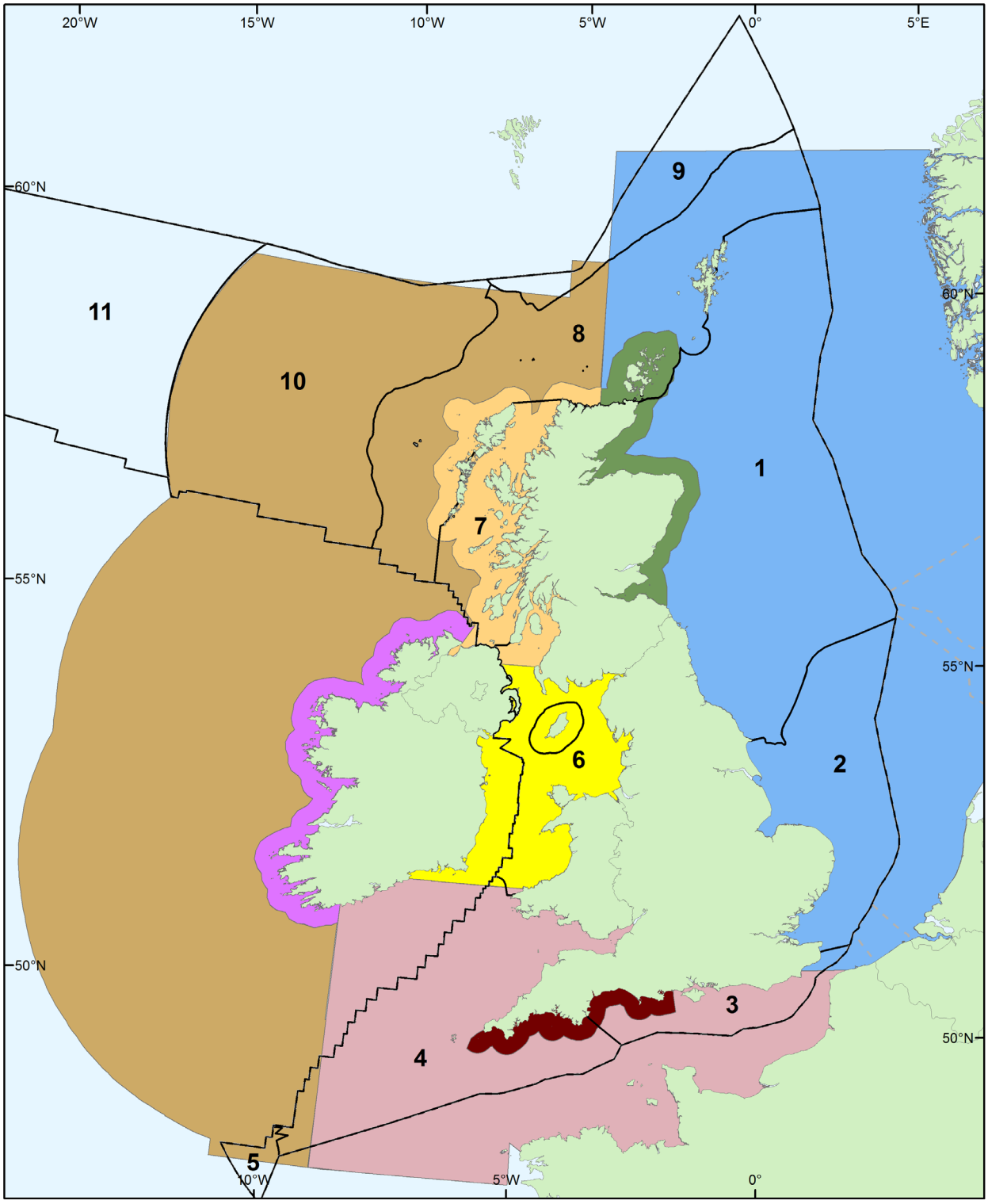


Table A1a.7.1: Estimates of abundance of bottlenose dolphin in defined Management Units (MUs)

MU	Abundance of animals in MU	95% Confidence Interval for MU	Abundance of animals in UK portion of MU	95% Confidence Interval for UK portion of MU
CWSH	45	33-66	same	same
CES	195	162-253	same	same
GNS	0	0	same	same
OCSW	4,856	1,638-14,398	3,014	1,017-8,936
CWC	100		100	
IS	397	362-414	same	same
OW	11,923	7,935-17,915	3,202	1,869-5,486

Source: IAMMWG 2015

The Coastal East Scotland MU ranges from Orkney to the Forth of Firth with the highest frequency of sightings within the inner Moray Firth; the Coastal West Scotland and Hebrides MU includes animals sighted regularly around the inner Hebrides (Mandleberg 2006), as well as more occasional reports from the Outer Hebrides and the northern entrance to the Minch; the Irish Sea MU shows high sighting frequency especially in Cardigan Bay; the Coastal West Channel MU supports animals sighted year round from Cornwall along the Western Channel within 12nm of the coast, while animals outwith this coastal area, are part of the Offshore Channel and SW England MU, ranging from Wales to the East Channel. In coastal waters, bottlenose dolphins favour river estuaries, headlands and sandbanks, mainly where there is uneven bottom relief and/or strong tidal currents (e.g. Wilson *et al.* 1997, Ingram & Rogan 2002). More detailed information for each of these MUs can be found in the regional sections below.

With regard to offshore individuals, bottlenose dolphins are encountered along the shelf edge to the north and west of Scotland and beyond, including the Faroe-Shetland Channel and Rockall Trough and Bank. Here, they are often observed in mixed schools with long-finned pilot whales; these individuals are most likely part of a migratory wide-ranging offshore group (covered by the Oceanic Water MU). A few sightings have occurred beyond 12nm in the North Sea but although there is no conclusive evidence, it is thought that they may belong to the Coastal East Scotland MU; a Greater North Sea MU has been established for completeness but abundance is given as zero. Data obtained during the SCANS surveys indicated that the western Celtic Sea is a relatively important area for bottlenose dolphins, with large numbers recorded off the south and west of Ireland and along the shelf edge southwards towards the French coast.

Group size is commonly 2-25, although it may occasionally number tens or low hundreds of animals; larger schools tend to occur in deeper waters (Reid *et al.* 2003).

A1a.7.2.3 White-beaked dolphin

White-beaked dolphins (*Lagenorhynchus albirostris*) are restricted to the cold temperate sub-polar waters of the north Atlantic. In the eastern Atlantic their range extends from the northern Bay of Biscay to Iceland and to northern Norway. They are the second most commonly occurring cetacean in UK shelf waters, regularly encountered in coastal and offshore waters while very rare in deeper waters beyond the shelf edge (Figure A1a.7.5). Their distribution is generally restricted to the northern half of UK waters, with greatest abundance in the central and northern North Sea, Orkney and Shetland and north-west Scotland. Analysis of summer sightings on shelf waters around the UK from 1983-1998 showed the vast majority of white-beaked dolphins to occur in waters below 13°C in temperature (MacLeod *et al.* 2008). Less

numerous, but regular sightings occur into the southern and eastern North Sea in German, Dutch and Belgian waters (Jansen *et al.* 2010) but are very rare in the Channel and Irish and Celtic Seas. In UK waters, sightings occur throughout the year, but are slightly more frequent from July to October. Long-term stranding data from 1907-2003 show a seasonal peak in strandings of white-beaked dolphins from June to September, with the majority occurring around the Scottish coast and along the east coast of England (Canning *et al.* 2008).

A single MU has been deemed appropriate for the management and conservation of this species; this is called the Celtic & Greater North Seas (CGNS) MU, comprising all UK waters and extending to the seaward boundary used by the European Commission for Habitats Directive reporting (see Figure A1a.7.5, IAMMWG 2015). The abundance of white-beaked dolphin in the MU was estimated[2] at 15,895 animals (95% CI=9,107-27,743), of which 11,694 (95% CI=6,578-20,790) were estimated to be in the UK EEZ.

Group size is typically less than 10, although schools of up to 50 are not uncommon and larger aggregations of 100-500 animals have been reported in northern parts of their range (Reid *et al.* 2003).

A1a.7.2.4 Atlantic white-sided dolphin

Atlantic white-sided dolphins (*Lagenorhynchus acutus*) are confined to the north Atlantic. They share most of their range with the white-beaked dolphin, but in the north-east Atlantic they are primarily an offshore, oceanic species. At sea, the two species can be difficult to distinguish and they are often recorded simply as *Lagenorhynchus* spp. They are regularly sighted in the waters north and west of Scotland, with greatest numbers observed along the shelf break and over deeper waters further offshore, including the Faroe-Shetland Channel to the north (Pollock *et al.* 2000, Macleod *et al.* 2003, Stone 2015a). While they have been observed throughout the year, greatest numbers are observed from May to November (Reid *et al.* 2003). The species is infrequently recorded in nearshore waters of Orkney and Shetland, often in large groups, and primarily during summer. They are also occasionally observed in offshore waters of the central and northern North Sea from July to September. In shelf waters, Atlantic white-sided dolphins have been reported as forming mixed schools with white-beaked dolphin. Over deeper waters, they are regularly recorded in association with long-finned pilot whales (*Globicephala melas*), and occasionally larger baleen whales.

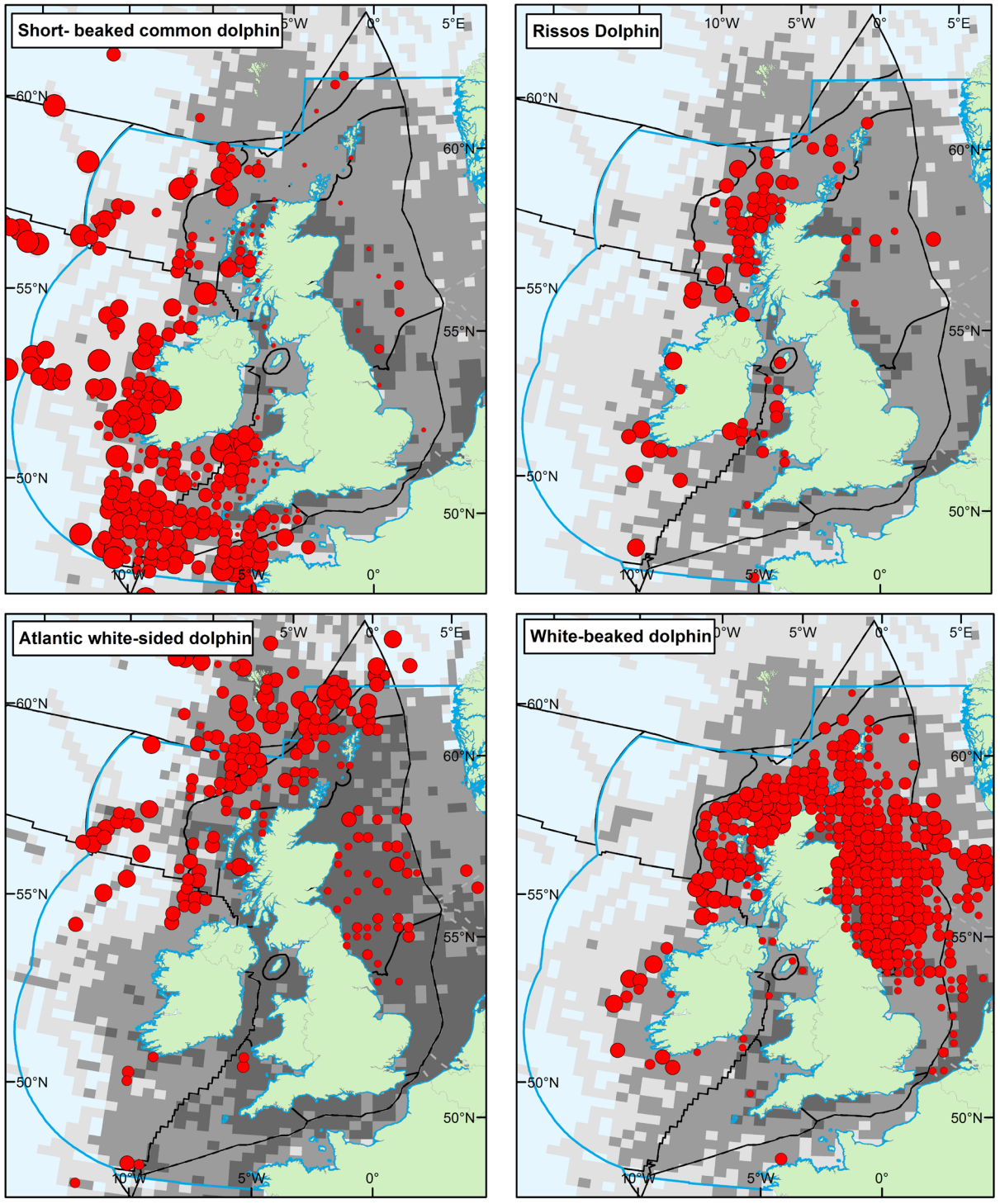
The single CGNS MU (see Figure A1a.7.5), has been deemed appropriate for the management and conservation of this species (IAMMWG 2015). The abundance of white-sided dolphins across the entire CGNS MU was estimated at 69,293 (95% CI= 34,339-139,828) with the UK component estimated at 46,249 animals (95% CI =26,993-79,243).

A1a.7.2.5 Short-beaked common dolphin

The common dolphin (*Delphinus delphis*) has a worldwide distribution and inhabits both oceanic and shelf-edge waters of tropical, subtropical and temperate seas of the Atlantic and Indo-Pacific. Large variability in morphological characters and pigmentation patterns has resulted in two distinct species being proposed (Rosel *et al.* 1994); *Delphinus delphis* is now referred to as short-beaked common dolphin, to distinguish it from the long-beaked common dolphin *Delphinus capensis*; only the short-beaked form has been recorded in the north Atlantic.

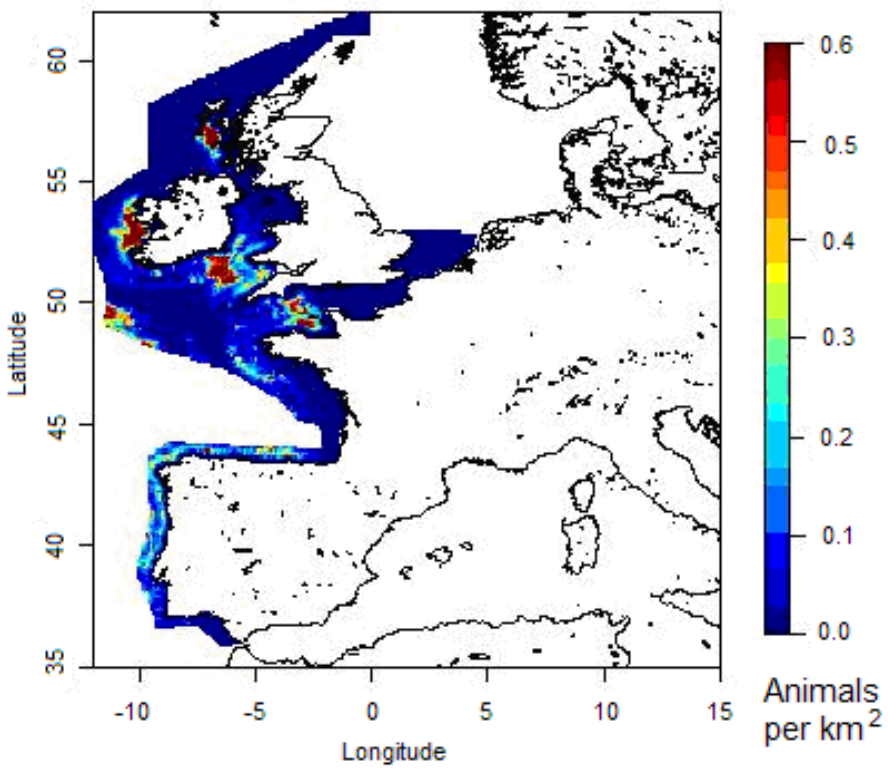
[2] The estimate was derived from the SCANS-II abundance estimates for continental shelf waters (Hammond *et al.* 2013) which represent the core range for this species.

Figure A1a.7.5: The Celtic and Greater North Seas Management Unit and the distribution of sightings for short-beaked common dolphin, Risso's dolphin, Atlantic white-sided dolphin and white-beaked dolphin



At least during summer, it is widely distributed throughout the north-east Atlantic, from coastal waters to the mid-Atlantic ridge, from the Azores and the Strait of Gibraltar to Norway, with the majority of sightings having been reported in waters south of 60°N (Murphy *et al.* 2013). Analysis of summer sightings on shelf waters around the UK and adjacent waters showed the vast majority of common dolphins to occur in waters above 14°C in temperature (MacLeod *et al.* 2008, Cañadas *et al.* 2009). Strong seasonal shifts in their distribution have been noted, with winter inshore movements onto the Celtic Shelf and into the western English Channel and St. George's Channel resulting in pronounced concentrations (Northridge *et al.* 2004). During the summer, coinciding with the mating/calving period (May to September), the majority of sightings are more widely dispersed along and off the continental shelf slope and in deep waters to the south-west of the UK (Murphy *et al.* 2005; Murphy & Rogan 2006), off the west coast of Ireland and to the west and north-west of Scotland (Figure A1a.7.5). Density surface modelling of common dolphins in summer 2005 based on the SCANS-II survey showed well defined areas of higher density south of the Outer Hebrides, west of Ireland, in the Celtic Sea offshore of southeast Ireland, in the western Channel approximately between Devon and northern France, and to a lesser extent along the coast of north Cornwall (Figure A1a.7.6). They have been occasionally sighted further north and east on the shelf, in the northern North Sea and waters surrounding Orkney and Shetland, but only rarely in the southern North Sea and eastern English Channel (Reid *et al.* 2003).

Figure A1a.7.6: Predicted density surface for short-beaked common dolphins in 2005



Notes: Density values are predictions based on the observed distributions and their relationships with habitat variables (longitude and latitude, plus distance from coast, depth or aspect of seabed slope if selected). Source: SCANS-II (2008)

The single CGNS MU was deemed appropriate for the management and conservation of this species (IAMMWG 2015). The abundance of common dolphins across the entire CGNS MU was estimated at 56,556 (95% CI= 33,014-96,920) with the UK component estimated at 13,607 animals (95% CI =8,720-21,234).

Common dolphins are found in a wide range of group sizes from small schools to large concentrations of 1000 to 5000 individuals (e.g. Murphy 2004); average group size reported in Reid *et al.* (2003) was 14 individuals. In the south-west, they occasionally form mixed schools with striped dolphins (*Stenella coeruleoabla*).

A1a.7.2.6 Risso's dolphin

Risso's dolphins (*Grampus griseus*) are widely distributed in tropical and temperate seas of both northern and southern hemispheres. They occur in small numbers along the Atlantic European seaboard from Shetland south to north-west France, the southern Bay of Biscay, around the Iberian Peninsula and into the Mediterranean Sea (Hammond *et al.* 2008). A map of sightings rates is given in Figure A1a.7.5. The majority of Risso's dolphin sightings in UK waters have been reported around the Hebrides, most frequently around the coast of the Outer Hebrides, especially Lewis (Paxton *et al.* 2014). Marine mammal observations during seismic surveys have recorded Risso's dolphins mainly over the continental shelf edge to the west and north of Shetland, extending into deep waters (Stone 2015a). The species is uncommon but regularly sighted in nearshore waters around Shetland and Orkney, in the southern Irish Sea and off south-west Ireland. It is rare in the North Sea and all but the western end of the Channel. They are typically observed in small groups of 5-25 individuals, most frequently from June to September. In the north Atlantic, Risso's dolphins have occasionally been observed in association with other cetaceans, including long-finned pilot whales, white-beaked dolphins, white-sided dolphins and bottlenose dolphins (Reid *et al.* 2003).

The single CGNS MU was deemed appropriate for the management and conservation of this species; there are currently no estimates of Risso's dolphin abundance in UK waters or the wider north-east Atlantic (IAMMWG 2015).

A1a.7.2.7 Killer whale

The killer whale (*Orcinus orca*) has a worldwide distribution in tropical, temperate and polar seas in both hemispheres; their abundance is greatest at higher latitudes. Killer whales are widely distributed on the Atlantic seaboard of northern Europe, mainly around Iceland, western Norway and northern Scotland. They have been observed throughout the northern North Sea, including the east coast of Scotland, the Firth of Forth and as far south as the Farne Islands. Sightings are fairly frequent in coastal waters of Shetland and Orkney, and also around the Hebrides, and have been increasing in frequency in recent years. Very few sightings have been recorded in shelf seas to the south-west of the UK (Figure A1a.7.7). Many coastal observations are in the vicinity of seal colonies (Weir 2002).

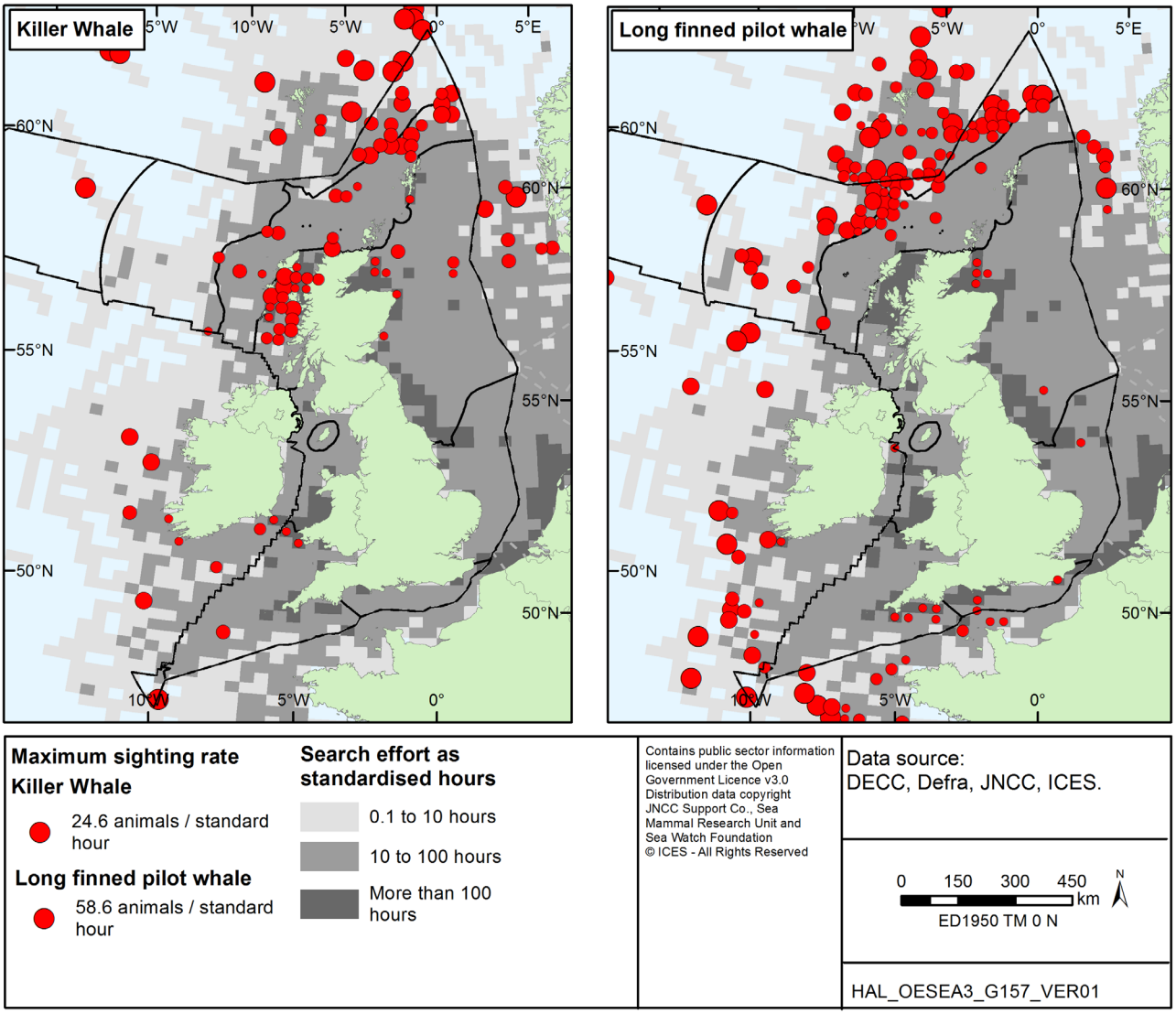
Offshore observations are often in the vicinity of fishing vessels, particularly larger boats targeting pelagic species, with greatest sightings occurring north and east of Shetland (Luque *et al.* 2006, Foote *et al.* 2007). They have been reported in most months of the year, with the greatest frequency between April and September. They are also sighted further offshore along the shelf slope and deeper waters north and west of Scotland. Photo-ID studies have shown individual killer whales identified off Scotland during the summer to travel to Iceland and spend the winter on herring overwintering grounds there; this seasonal movement pattern appears to be consistent for some years even though the numbers of individuals repeatedly moving between these locations may be small (Samarra & Foote 2015).

No overall population estimates exist for killer whales in the north-east Atlantic or UK waters. Sightings in UK waters are most commonly of single animals or groups of less than 8 individuals; however, larger groups of approximately 100 have been observed (Pollock *et al.* 2000, Reid *et al.* 2003).

A1a.7.2.8 Long-finned pilot whale

The long-finned pilot whale (*Globicephala melas*) has a worldwide distribution in temperate and sub-polar seas of both hemispheres; it is common and widely distributed in deep north Atlantic waters, and also occasionally occurs in coastal areas. In UK and Irish waters, long-finned pilot whales occur mainly along the continental shelf slope, particularly around the 1,000m isobath (Hammond *et al.* 2008). They are frequently encountered along the shelf slope north and west of Scotland, and also in the western Celtic Sea where sightings are frequent along the shelf edge and southwards towards the French coast. They are also occasionally reported in coastal waters, primarily around Orkney, Shetland and to the west of the Outer Hebrides. Sightings have occurred in all months of the year, with no clear peak in occurrence.

Figure A1a.7.7: Distribution of killer whale and long-finned pilot whale sightings



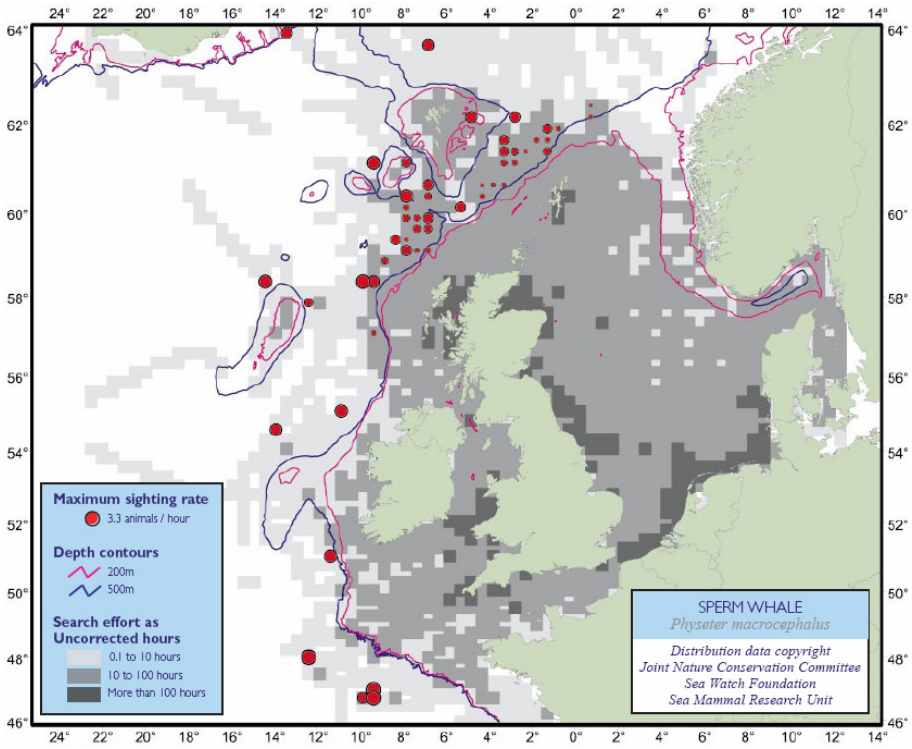
The population of pilot whales in UK waters has been estimated to be somewhere between 20,091 and 76,158 individuals (JNCC 2013); no single survey has measured abundance across the whole UK range so this first estimate has been extrapolated from data collected during the CODA survey in summer 2007, assuming that the area covered is representative of the entire range. They are typically encountered in groups of up to 20 individuals, but may form larger aggregations, including mixed schools with bottlenose dolphins (Reid *et al.* 2003).

A1a.7.2.9 Sperm whale

Sperm whales (*Physeter macrocephalus*) have a wide distribution that includes most seas and all oceans. They are widely distributed in deep waters to the north and west of Scotland, both on and beyond the shelf slope. Where records exist, all animals were males, with males migrating to high latitudes to feed. Limited survey effort has shown animals to be numerous in the Faroe-Shetland Channel in May, and also in the Rockall Trough in October (Hammond *et al.* 2006). Acoustic monitoring north-west of the Outer Hebrides in the winter of 1997-1998 detected sperm whales over a wide area of the continental slope, primarily in waters >500m depth (Lewis *et al.* 1998). They have also been observed fairly regularly in the waters around Orkney and Shetland, with sightings and strandings reported in most months (Hammond *et al.* 2003). It can be assumed that these waters represent a migratory route for some portion of the north-east Atlantic population at certain times of the year. A few sightings have also been recorded over deep waters south-west of the UK.

The best estimate of abundance in UK waters is of 673 sperm whales (95% CI: 340 - 1334) (JNCC 2013); this estimate has been extrapolated from the summer 2007 CODA survey when abundance across the entire survey area was estimated at 2,091 (CV = 0.34; 95% CI = 1,077-4,057) (Murphy *et al.* 2008). Group size may number tens of animals, although these are commonly spread over a wide area with only a proportion visible at the surface at one time (Reid *et al.* 2003).

Figure A1a.7.8: Distribution of sperm whale sightings



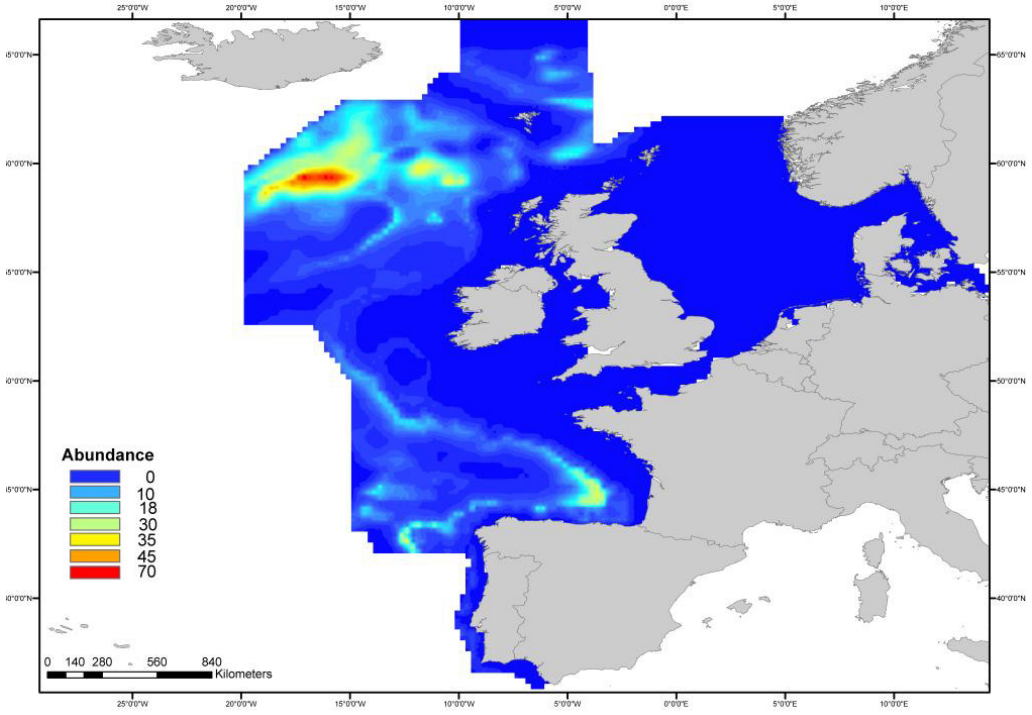
A1a.7.2.10 Beaked whales

The distribution and occurrence of beaked whales in UK waters has been reviewed by Aguilar de Soto *et al.* (2016) as part of the current SEA research programme. They have been recorded in deep waters to the north and west of Scotland, both on and beyond the shelf slope. This area may represent an important part of their habitat, but its true ecological significance is unknown due to the infrequency of encounters and small numbers of animals observed. Almost all sightings of beaked whales are in water ≥1,000m depth; however, rare observations have also been recorded from coastal waters of the Hebrides, Orkney, Shetland and the northern

North Sea. Species recorded include the northern bottlenose whale (*Hyperoodon ampullatus*), Cuvier's beaked whale (*Ziphius cavirostris*), Sowerby's beaked whale (*Mesoplodon bidens*) and unidentified species of the genus *Mesoplodon*.

Among stranding records in the UK and Ireland, 251 records were identified at species level between 1800 and 2002 (MacLeod *et al.* 2003a) consisting of 109 northern bottlenose whales, 70 Sowerby's beaked whales, 63 Cuvier's beaked whales, 7 True's beaked whales (*Mesoplodon mirus*), 1 Gervais' beaked whale (*Mesoplodon europeaus*) and 1 Blainville's beaked whale (*Mesoplodon densirostris*). Analyses of temporal variation in number of strandings was conducted for the three more common species; northern bottlenose whales were more likely to strand in August to October, Cuvier's beaked whales strandings were highest from November to July, while no significant seasonal pattern was found for Sowerby's beaked whales. Population estimates are not available for most beaked whale species occurring in the north-east Atlantic and numbers in UK waters are unknown. The CODA survey estimated beaked whale abundance in the summer of 2007 as 6,992 (CV = 0.25), with the majority sighted north-west of the UK and Ireland and in the Bay of Biscay (Hammond *et al.* 2009). Beaked whales are typically encountered as single individuals or groups of less than 10, although northern bottlenose whales have been observed in larger groups (Reid *et al.* 2003).

Figure A1a.7.9: Distribution of beaked whales (all species combined) predicted from models of the data collected in SCANS-II, CODA and the Faroes block of T-NASS.



Source: de Soto et al. (2016). Scale is predicted abundance of animals in each grid cell of 0.25 x 0.25 degrees.

A1a.7.2.11 Other toothed cetaceans

Other toothed cetaceans infrequently reported in UK waters are the striped dolphin (*Stenella coeruleoalba*), pygmy sperm whale (*Kogia breviceps*), false killer whale (*Pseudorca crassidens*), Fraser's dolphin (*Lagenodelphis hosei*), melon-headed whale (*Peponocephala electra*), narwhal (*Monodon monoceros*) and beluga whale (*Delphinapterus leucha*),

Striped dolphin *Stenella coeruleoalba* is an offshore species found worldwide, mainly in tropical and sub-tropical seas, but also in warm temperate waters. In the northeast Atlantic it is found

mainly in the Bay of Biscay and west of the Iberian peninsula, normally restricted to deep offshore waters of 1,000m or more. UK waters are at the northern limit of this species' distribution; most sightings in British waters are from the southwest approaches with occasional records in deep waters west of Britain and further north (Reid *et al.* 2003; Stone 2015a). In the last twenty years, an increase in sightings and strandings has suggested that this species range is increasing northwards (MacLeod *et al* 2005). They were documented in UK stranding records between 1923 and 1939, but were not reported stranded again until 1975. Following this, they have been reported in almost every year, with increasing frequency (Jepson 2006). Records from the SCANS-II survey were too few too calculate abundance estimates for striped dolphin. However in European waters beyond the continental shelf, striped dolphin best estimate was derived from CODA surveys in the summer of 2007 as 67,414 (CV = 0.38), with the majority sighted towards the south in the Bay of Biscay and off northwest Spain (Hammond *et al.* 2009). Striped dolphins often occur in large groups of hundreds or even thousands, although 6-60 individuals is the most common group size in European waters. In UK and Irish waters, group size is typically less than 10 individuals and they often occur in mixed schools with common dolphins (Reid *et al.* 2003).

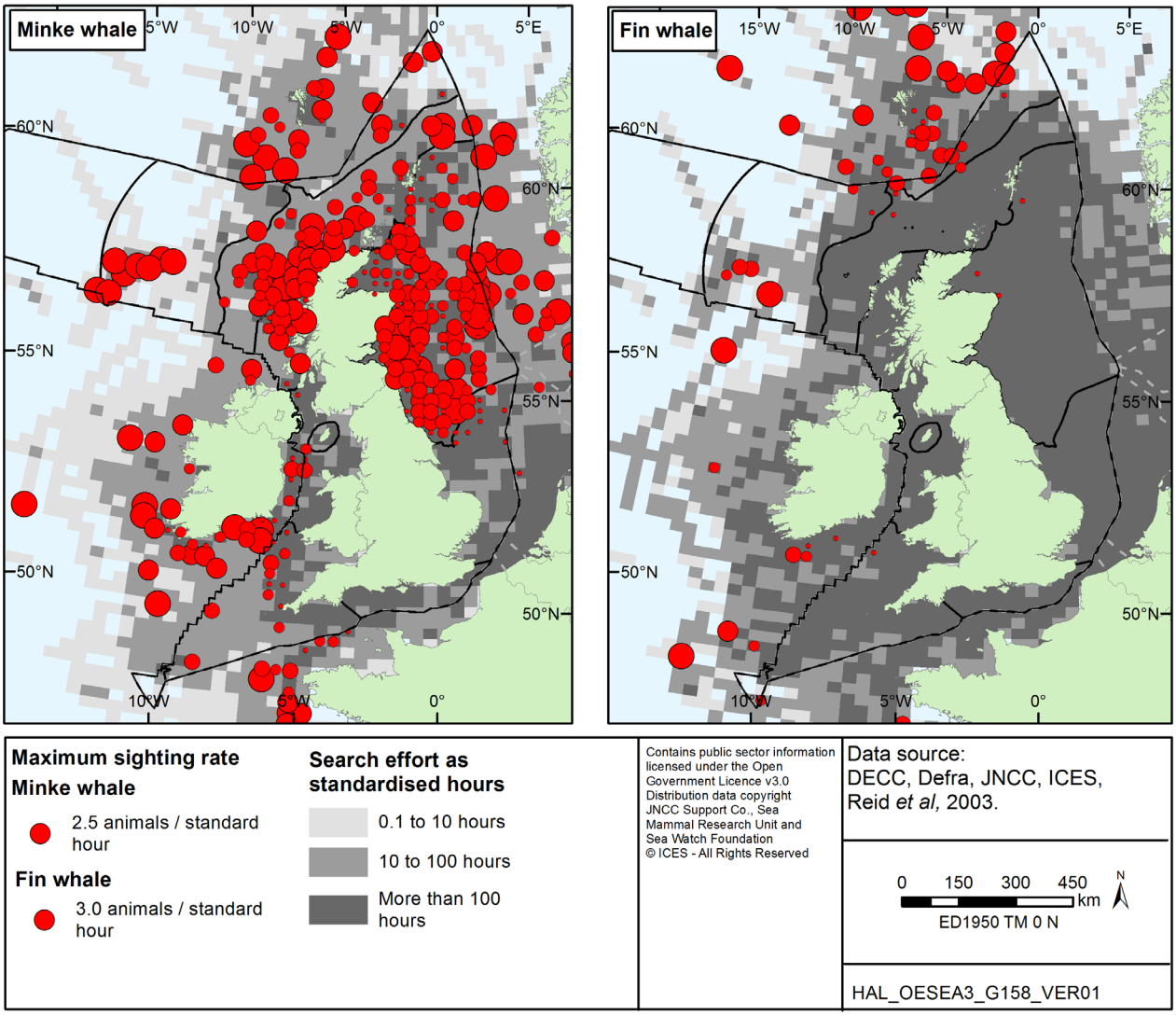
The pygmy sperm whale is distributed worldwide in tropical to temperate seas of both hemispheres, primarily in deep oceanic waters beyond the continental shelf edge. Records in European waters are rare, with sightings restricted to the Bay of Biscay, South West Approaches, western Ireland and occasional records from the North Sea off the east coast of England and Scotland (Reid *et al.* 2003). False killer whales show a similar global distribution; in European waters most reports are from the Bay of Biscay to the Canary Islands. UK records include a few strandings of large groups (approximately 25-150) from 1927-1935 but none since, and a few sightings since 1976 to the south of Cornwall and off western and northeast Scotland (Reid *et al.* 2003). Fraser's dolphins and melon headed whales have worldwide tropical and sub-tropical distributions; the only UK records for these species are of an animal stranded in the Outer Hebrides in 1996 (Jepson, 2006) and of a skull found in Cornwall in 1949 (Reid *et al.* 2003) respectively. The two Arctic species, the beluga whale and the narwhal have been recorded only very rarely in UK waters, mainly in the North.

A1a.7.2.12 Minke whale

Minke whales (*Balaenoptera acutorostrata*) are widely distributed in all the major oceans of the world from tropical to polar seas; they are most abundant in relatively cool waters, and on the continental shelf in waters <200m depth. In the north-east Atlantic they range from Norway to Portugal and into the North Sea (Hammond *et al.* 2008). Within UK waters, minke whales are the most common among the baleen whales and most frequently sighted in the western central-northern North Sea, and west of Scotland around the Hebrides (Fig A1a.7.10).

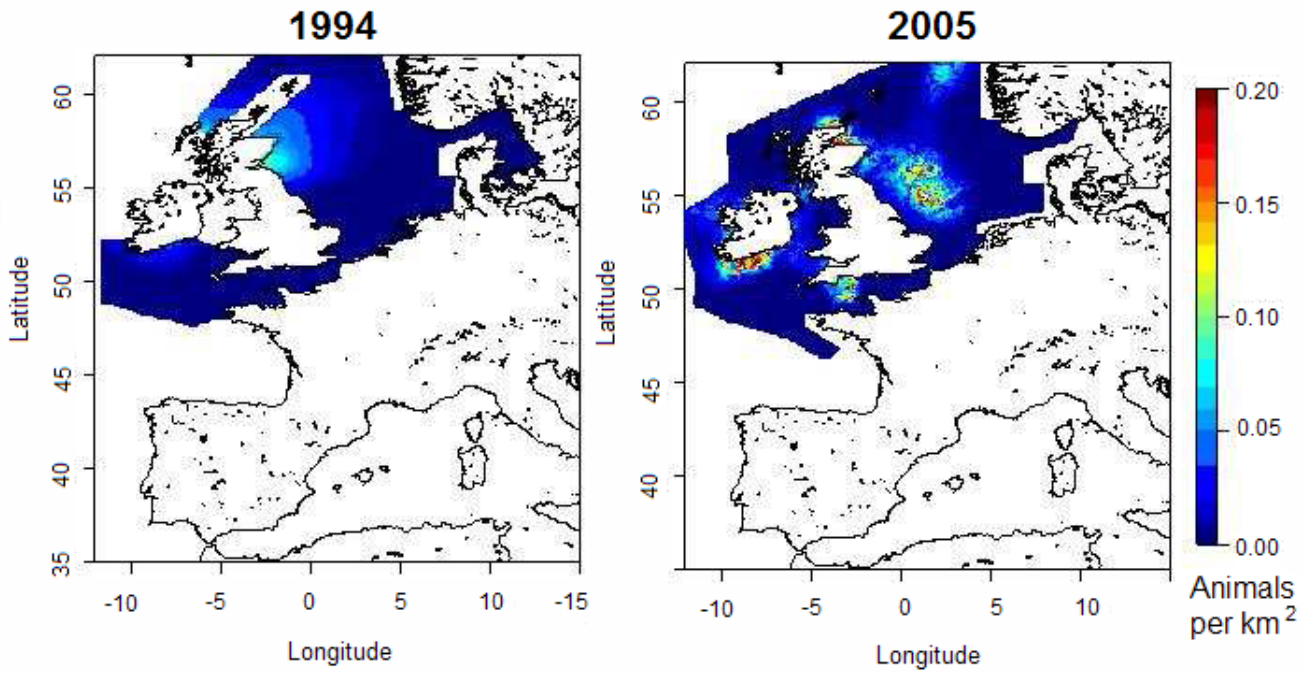
They are primarily a seasonal visitor to UK waters, with whales appearing to move south into the North Sea and western Scotland at the beginning of May and remaining present until October; sightings are rare outside of this period but some individuals are known to remain in coastal waters year-round (Evans 2008). During these summer months, they are widely distributed throughout the region, including coastal and offshore shelf waters, and deeper waters on and beyond the shelf slope. Pollock *et al.* (2000) reported several sightings of minke whales in the Faroe-Shetland Channel.

Figure A1a.7.10: Distribution of minke whale and fin whale sightings



Minke whales are rare in the southernmost North Sea and eastern English Channel; North Sea sightings generally extend no further south than the Dogger Bank. In the western English Channel they are evenly distributed in low numbers along the continental shelf edge, and also present throughout much of the Celtic Sea and western Irish Sea during summer. During the SCANS surveys, minke whale sightings were sufficiently numerous to estimate model-based density surfaces and compare them as shown in Figure Fig A1a.7.11. Although not as evident as for harbour porpoises, there is a suggestion of a southerly shift in distribution in the North Sea, from north-western North Sea to central North Sea between 1994 and 2005.

Figure A1a.7.11: Predicted density surface for minke whale in 1994 and 2005



Notes: Density values are predictions based on the observed distributions and their relationships with habitat variables (longitude and latitude, plus distance from coast, depth or aspect of seabed slope if selected).
Source: SCANS-II (2008)

Some genetic differentiation among individuals has been reported (Andersen *et al.* 2003) but since this does not appear to be caused by geographic structuring within the Northeast Atlantic (Anderwald *et al.* 2011), a single CGNS MU was deemed appropriate for the management and conservation of this species (IAMMWG 2015); this is, in accordance with the approach taken by the International Whaling Commission. The abundance of minke whales across the entire CGNS MU is 23,528 (95% CI= 13,989-39,572), with the UK component estimated at 12,295 animals (95% CI =7,176-21,066). They are usually observed singly or in pairs although may form larger feeding aggregations of 10-15 individuals (Reid *et al.* 2003).

A1a.7.2.13 Fin whale

Fin whales (*Balaenoptera physalus*) have a worldwide distribution, present in all oceans where they range from tropical to polar regions. They are largely pelagic and are rarely seen in nearshore waters. Fin whales occur to the north and west of Scotland along the shelf slope and deeper waters beyond, with most visual observations from the Faroe-Shetland Channel and Rockall Trough (Reid *et al.* 2003, Macleod *et al.* 2003b) as shown in Figure A1a.7.10. They are migratory, and exhibit seasonal movements between lower latitudes in winter and high latitudes in summer; for example Pollock *et al.* (2000) observed fin whales in UK waters between May and October, with a peak in sightings in August. However, Charif & Clark (2009) did not find a clear evidence of large-scale seasonal migratory movements for this species in their analyses of acoustic monitoring of whale calls on the shelf edge and deeper waters north and west of the UK and Ireland. Over the ten year study, fin whale songs were the most frequently detected signals across all regions sampled and in every month of the year, but highest densities were recorded in December and January (Charif & Clark 2009). The current best estimate of population size within UK waters is 741 animals (95% CI: 512- 1072), based on the SCANS-II (2005) and CODA (2007) surveys (JNCC 2013). They are typically encountered singly or in pairs although do form larger pods of up to 20 individuals (Reid *et al.* 2003).

A1a.7.2.14 Other baleen whales

Sei whales (*Balaenoptera borealis*) can be found worldwide in all oceans and adjoining seas; they are primarily an offshore, deep water species. They migrate annually from cool and subpolar waters in summer to temperate and subtropical waters for winter. Sei whales exhibit a similar distribution to fin whales to the north and west of Scotland, with most observations from the Faroe-Shetland Channel and Rockall Trough (Reid *et al.* 2003, Macleod *et al.* 2003b). The majority of sei whale sightings reported in Pollock *et al.* (2000) were in August. They are usually encountered singly or in pairs. During the CODA survey in summer 2007, sei whales were sighted in the waters off north-west Spain, providing an abundance estimate of 366 whales (CV = 0.33, 95% CI = 176-762).

Humpback whales (*Megaptera novaeangliae*) are present worldwide in tropical, temperate and polar seas of both hemispheres, typically favouring waters over and along the continental shelf edge and around oceanic islands (Reid *et al.* 2003). They migrate annually from high latitude, cold water, feeding grounds in summer to low-latitude, warm water, breeding grounds in winter. Most visual sightings over the UKCS come from the Northern Isles, northern Irish Sea, Firth of Clyde, southern Irish Sea, Celtic Sea and the western Channel, mainly between may and September (Reid *et al.* 2003). They have also been reported in deeper waters on and beyond the shelf slope; in these areas visual sightings have been rare but using passive acoustic arrays, Charif & Clark (2009) demonstrated their regular presence between October and April. A north to south progression in the timing of humpback acoustic detections led these authors to suggest that they were most likely *en route* to breeding areas in the West Indies. No returning migration was detected, either because returning whales do no vocalise or because a different route is used. They are usually observed singly or in pairs and groups rarely exceed 4 or 5 individuals when not feeding or breeding (Reid *et al.* 2003). Numbers of humpback whales have been reported to have increased in recent years in Icelandic waters (Pike *et al.* 2005); this may also have led to increased abundance in waters to the west of the UK and Ireland, although a lack of data prevents identification of any potential trends (Hammond *et al.* 2006).

Blue whales (*Balaenoptera musculus*) have a worldwide distribution and are likely to exhibit seasonal migration (Reid *et al.* 2003). They usually occur in deep waters and have been recorded from visual observations and acoustic detections west of Britain and Ireland in the deep waters off the continental shelf (Pollock 2000, Charif & Clark 2009). Sightings are generally rare but blue whales were the second most common species detected by Charif and Clark (2009) with peak detections densities in November and December, declining through late winter early spring to minimal levels in April through June, before increasing again. Movements were in a southward direction through the study area during the fall and winter months.

A1a.7.3 UK context: Seal distribution and abundance

A1a.7.3.1 Grey seals

Grey seals (*Halichoerus grypus*) are found across the north Atlantic, from Nova Scotia and the Gulf of St. Lawrence in the west, to the UK and Baltic Sea in the east. Approximately 38% of the world population occurs in the UK (SCOS 2014). Population size is derived by extrapolation of pup production surveys and demographic parameters; the latest UK population estimate is of 111,600 (95% CI 92,000-137,900) for 2013, similar to the 2012 estimate (SCOS 2014).

Approximately 88% of the UK population breeds in Scotland, largely in the Hebrides and Orkney. Major colonies are also present on Shetland and along the east coast of Scotland including the Isle of May and Fast Castle. Larger colonies in England include the Farne Islands in the north-east, Donna Nook at the mouth of the Humber, and smaller colonies around south-west England and Wales, including Lundy and Pembrokeshire. The distribution of grey seal colonies around the UK is shown in Figure A1a.7.12. Breeding takes place in the autumn with a

clockwise cline in mean birth date around the UK: August-September in SW Britain, September-November in Scotland and November-December in eastern England.

Results of the most recent pup production surveys and trends at the main colonies in the UK are shown in Table A1a.7.2. The best estimate of total pup production in the 2012 breeding season was 56,988 (95%CI 56,317-57,683). Pup production has continued to increase exponentially at colonies in the North Sea; elsewhere, it is stable or increasing. Density-dependence is likely to be acting on pup survival given the stable trend in total population size.

Table A1a.7.2: Grey seal pup production estimates at main colonies surveyed in the UK compared preceding six-year intervals.

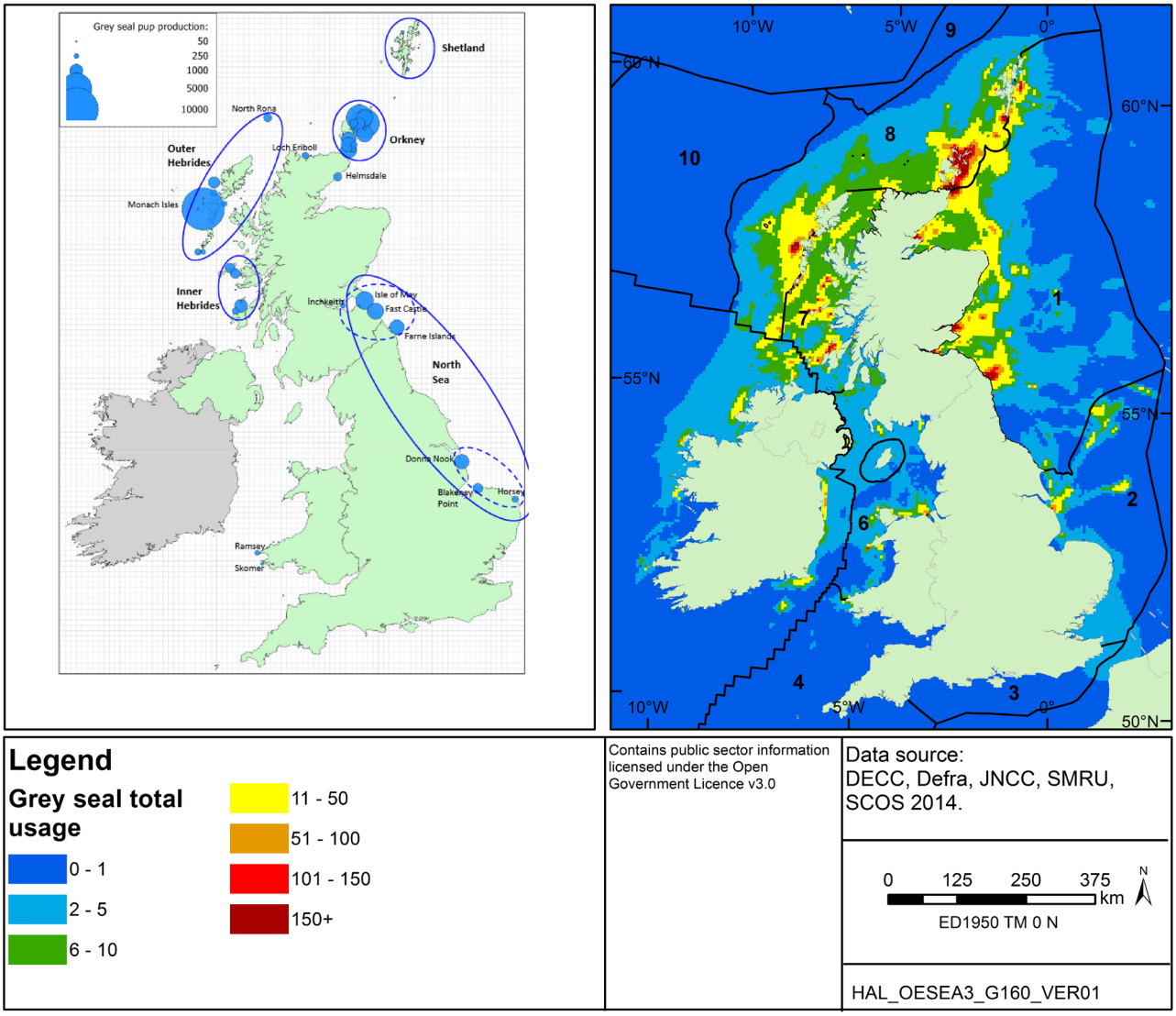
Location	Regional Sea	2012 pup production	Average annual change 2001-2006	Average annual change 2006-2012
Inner Hebrides	7	4,088	+2.8%	+3.1%
Outer Hebrides	7, 8	14,136	+0.1%	+3.3%
Orkney	8	22,926	+0.1%	+3.0%
Firth of Forth	1	5,210	+3.9%	+11.6%
Other Scottish colonies[1] (incl. Shetland and mainland)	1,6,8	3,665	-	-
Farne Islands	1	1,603	+0.7%	+5.1%
Donna Nook[2] + East Anglia	2	3,360	+15.6%	+15.1%
SW England[3]	4	250 est	-	-
Wales[4]	6	1650 est		
Northern Ireland	-6	100 est		
Total UK	-	56,988		

Notes: [1] estimates derived from data collected in different years. [2] Including Blakeney Point and Horsey (east Norfolk) in 2006. [3]Estimate from 1994 count. [4]Estimates from indicator sites in 2004-05, multiplier derived from 1994 synoptic surveys.
Source: SCOS (2014).

Most of the grey seal population will be on land for several weeks from October to December during the pupping and breeding season, and again in February and March during the annual moult. Densities at sea are likely to be lower during this period than at other times of the year. They also haul-out and rest throughout the year between foraging trips to sea. Summer counts are regularly carried out (in combination to harbour seal counts) and provide information on summer distribution even though it is recognised that at this time of the year numbers can be highly variable between days (SCOS 2014, Duck & Morris 2015). Studies at two Scottish colonies have indicated that breeding females tend to faithfully return to their natal breeding colony for most of their lives (Pomeroy *et al.* 2000). Mature females give birth to a single pup which is nursed for about three weeks before it is weaned and moults into its sea-going adult coat.

Considerable data are available on the distribution of adult British grey seals at sea during summer (May-September), courtesy of satellite-relay data loggers. Analyses of these data have produced estimates of modelled at-sea usage by grey seals, as shown in Figure A1a.7.12. Models are based on 234 individual seals tagged over the period 1991-2011; most were adult females (n=123) but also males (n=11) and moulted pups (n=57) were included from most of the important haul-out sites around the UK (see Jones *et al.* 2015 for details).

Figure A1a.7.12: Grey seal breeding colonies (A) and marine usage (B)



Grey seal foraging movements are on two geographical scales: long and distant trips from one haul-out site to another; and local repeated trips to discrete foraging areas (McConnell *et al.* 1999). Foraging areas can be up to 100km offshore and connected to haul-out sites by prominent high-usage corridors (Jones *et al.* 2015). Individual mature grey seals of both sexes are usually faithful to a particular breeding site and may return within 10-100m of previous sites (Pomeroy *et al.* 2000). High inter-annual fidelity to foraging season haul-outs has also been recorded (Vincent *et al.* 2005). Although many seals breed in the same region where they forage, this is not always the case; Russell *et al.* (2013) found that between 21% and 58% of the females studied foraged in a region different from where they bred around the UK, with degree of fidelity varying among regions.

The large distances travelled indicate that grey seals across the North Sea are not ecologically isolated. Some information on the distribution and movements of grey seals comes from using numbered tags attached to the flippers of pups. These indicate that young seals disperse widely in the first few months of life. Pups marked in the UK have, for example, been recaptured or recovered along the North Sea coasts of Norway, France and The Netherlands, mostly during their first year (Wiig 1986).

A1a.7.3.2 Harbour seals

Harbour (or common) seals (*Phoca vitulina*) are one of the most widespread pinniped species and have a practically circumpolar distribution in the Northern Hemisphere. Animals around the UK belong to a European sub-species (*P. vitulina vitulina*) which mainly occur in UK, Icelandic, Norwegian, Swedish, Danish, German and Dutch waters; at the latest count in 2013 approximately 30% of the world population of this sub-species occurs in the UK; this proportion has declined from approx. 40% in 2002 (SCOS 2014).

Around Britain and Ireland, harbour seals haul out on tidally exposed areas of rock, sandbanks or mud. Pupping occurs on land from June to July, while the moult is centred around August and extends into September. Therefore, from June to September harbour seals are ashore more often than at other times of the year. The distribution of seals at haul-out sites around the UK is shown in Figure A1a.7.13. The largest concentrations are found in Scotland, primarily on the West coast, Inner and Outer Hebrides, Orkney and Shetland. Large numbers also occur on the English east coast at The Wash and adjacent coastline. Many other haul-out sites supporting lower numbers are present around the UK coast, the largest of which are found in the Moray Firth, east coast of Northern Ireland, the Firths of Tay and Forth, the greater Thames area and southwest Scotland.

Harbour seals are widespread throughout coastal waters surrounding these colonies, and are abundant in waters surrounding larger colonies. Their distribution at sea is constrained by the need to return periodically to land; they tend to undertake relatively short excursions from their favoured haul-out sites, often less than 50 km, with little evidence of extensive seasonal migrations. Although harbour seals seem to show some fidelity to particular haul-out sites, they occasionally make long-distance movements to other haul-outs, transiting between regions and countries. Duration and distance of foraging trips are largely a function of region and season although sex, size and body condition may also play a role; seals on the east coast of the UK made some of the most wide-ranging trips (e.g. Moray Firth 100.6 km on average) while those from Orkney, Shetland and Outer Hebrides made much shorter trips (between 11-21 km on average) (Sharples *et al.* 2012). Comprehensive analyses of satellite tagging data have produced estimates of modelled at-sea usage by harbour seals, as shown in Figure A1a.7.18. Models are based on 196 tags over the period 2001-2012, with a male to female ratio of 81:95 and an adult to pup ratio of 190:6 from most of the important haul-out sites around the UK (Jones *et al.* 2015). High at-sea usage is consistent with areas with high abundance counts at haul-out sites but clearly harbour seals are not exclusively restricted to coastal waters.

Estimated numbers of harbour seals in the UK are derived from aerial survey counts of hauled out individuals during the moult; these provide minimum population estimates as they are believed to record between 60-70% of actual numbers. Not all areas are counted every year, but the aim is to cover the entire UK coast every 5 years. In response to a sharp decline in numbers observed after the year 2000 in Shetland, Orkney and the Firth of Tay, the survey effort has been increased to once a year in the critical areas; in The Wash yearly surveys have been conducted after the mass deaths from PDV in 1988. Results from the most recent surveys (between 2007-2014) at all sites have been combined to obtain a total of 28,925 harbour seals counted across the UK: 81% in Scotland, 16% in England, 3% in Northern Ireland and no established harbour seal haulout sites in Wales (SCOS 2014; Duck & Morris, 2015).

Minimum population estimates from aerial counts from haul-out sites along the UK coastline over the period 2007-2014 are shown in Table A1a.7.3. Overall counts in Scotland showed a reduction of about 11% since 2000-2006 and of as much as 30% since 1996-1997 estimates, while counts in England have increased since the 2002 epidemic. While total numbers in Scotland continue to show a decrease, there are marked geographical differences, especially at the latest counts in 2014 with the North & East coast of Scotland in decline and the West of

Scotland on the increase; so much so that West Scotland is now by far the most important Management Area for this species (Duck & Morris 2015). Overall, the UK population in 2014 has been estimated at 36,925 (approximate 95% CI 29,900 – 49,700) by scaling the aerial counts by the estimated proportion hauled out (SCOS 2014).

Genetic analyses suggest that there are genetically distinct populations of harbour seals in European waters, with little movement of breeding animals between six distinct units: east coast of England, Ireland-Scotland, Wadden Sea, western Scandinavia, east Baltic and Iceland (Goodman 1998). However, satellite telemetry has shown some movement of animals between these units outside of the breeding season (e.g. SCOS 2014). Such connectivity can also be inferred from the spread of phocine distemper virus (PDV) among European populations in 1988 and 2002.

Figure A1a.7.13: Harbour seals August distribution from counts at haul-out sites (A) and marine usage (B)

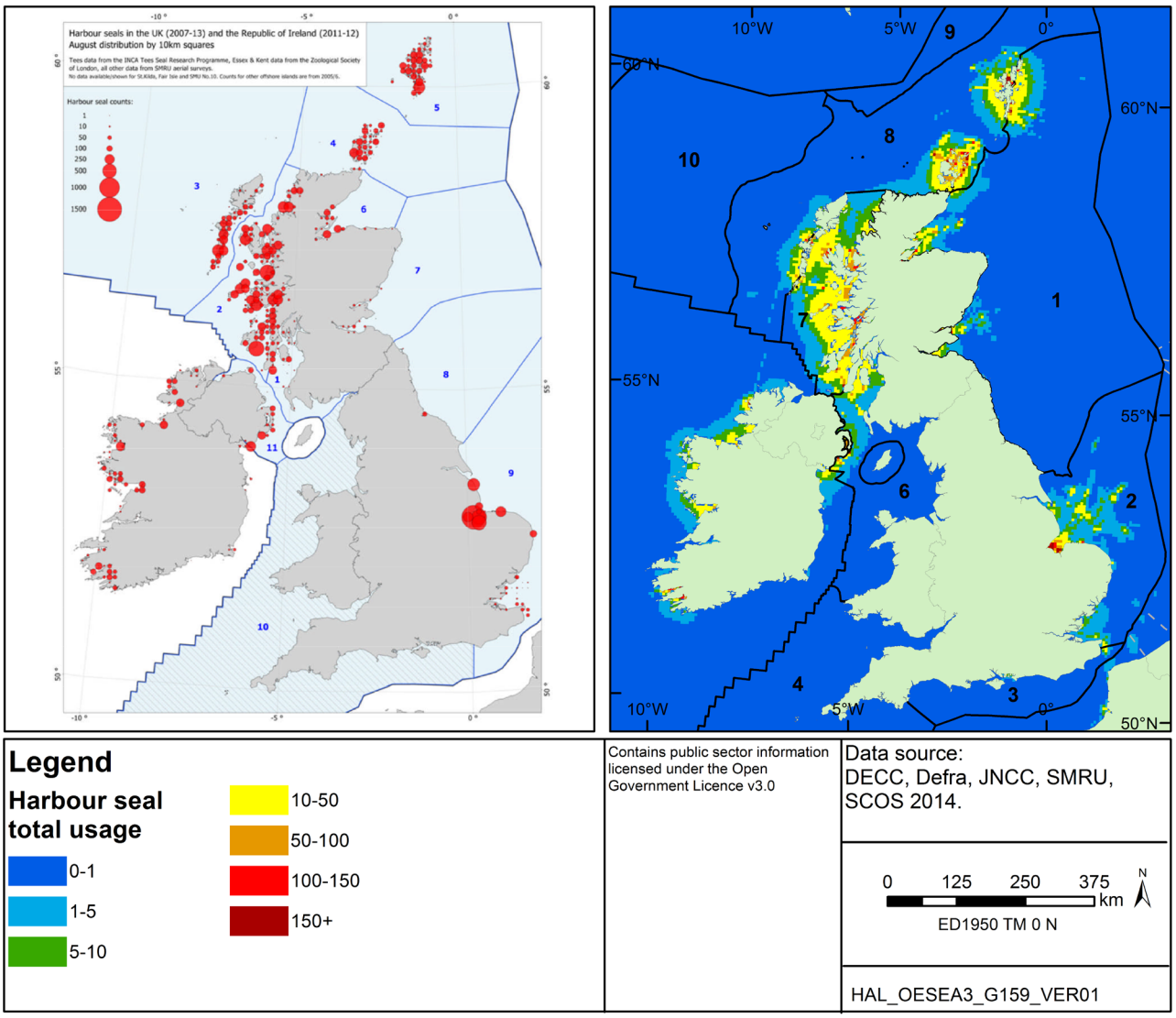


Table A1a.7.3: Most recent harbour seal minimum population estimates for UK seal management units (SMUs), compared with two previous periods

Seal management Unit / Country	Regional Sea	2007-2014	2000-2006	1996-1997
Southwest Scotland	6	834	623	929
West Scotland	7	13,878 [2]	11,668	8,811
Western Isles	7,8	2,739	1,981	2,820
North Coast & Orkney	8	1,938	4,384	8,787
Shetland	1, 8	3,039	3,038	5,994
Moray Firth	1	733[2]	1,028	1,409
East Scotland	1	194[2]	667	764
Total Scotland	-	23,355	23,389	29,514
Northeast England	1	83	62	54
Southeast England	2	4,504	2,964	3,222
West England and Wales [1]	4,6	35 est	20 est	15 est
Total England & Wales	-	4,622	3,046	3,291
Total Northern Ireland	6	948	1,176	-
Total UK	-	28,925	27,611	

Notes: Numbers are counts of hauled-out seals from aerial surveys and provide a minimum population estimate, likely to represent approximately 60-70% of the total population. Data are from SCOS (2014) unless stated differently. [1]No dedicated harbour seal surveys in this SMU and only sparse information available. [2] Data from surveys carried out during summer 2014 (Duck & Morris 2015).

The seal management units currently in use around the UK are shown in Figure A1a.7.13(A). They were originally formulated as a pragmatic approach in response to requirements of legislative drivers and do not aim to define discrete population; they are applied to both species. Given the movement of animals between MUs (Russell *et al.* 2013), especially in the case of grey seals, impacts on animals may have effects at the population level outside the particular MU with which the 'population' is associated (SCOS 2014). For harbour seals, these are broadly similar to OSPAR EcoQO units and supported by recent ICES advice on assessment units for MSFD (ICES 2014); the main difference is that OSPAR has excluded part of the UK coastline where seal presence is minor (West England and Wales and Northeast England). For grey seals, ICES has advised for only two assessment units, one for the North Sea and one to combine western Britain, Ireland and Western France.

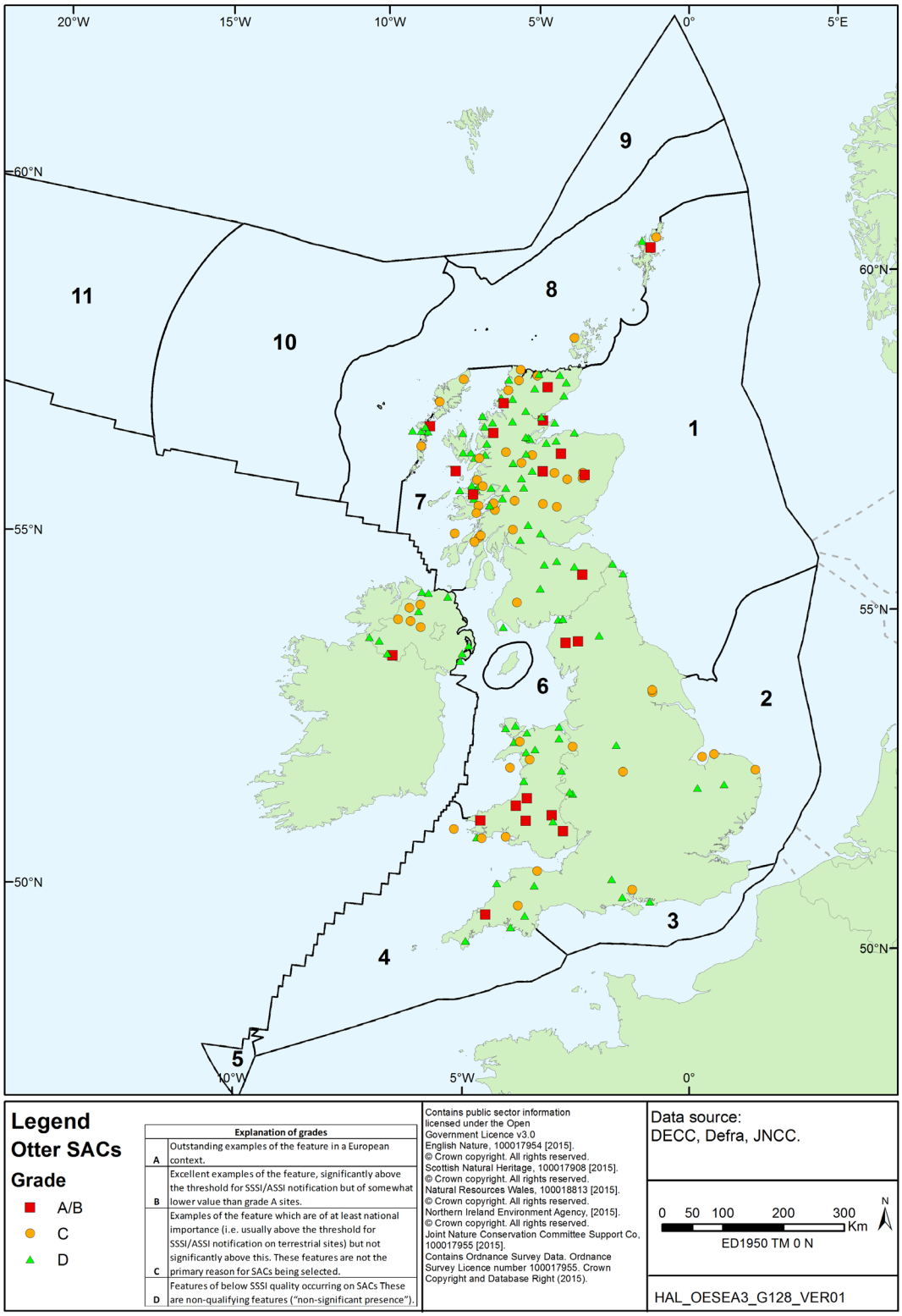
A1a.7.4 UK context: Otter and bats distribution and abundance

A1a.7.4.1 Otter

Otters (*Lutra lutra*) are semi-aquatic mammals which may inhabit rivers, lakes, coastal areas and marshy areas some distance from open water. Coastal populations utilise shallow, inshore marine areas for feeding but also require fresh water for bathing and terrestrial areas for resting and breeding holts. They are commonly seen foraging within a narrow zone close to the shore (<100m) and only rarely cover larger distances, moving between islands (Kruuk 2006). Otters were formerly widespread throughout the UK but in the 1960s-1970s their population experienced a rapid and severe crash, largely as a consequence of widespread use of pesticides, draining of wetlands and river engineering; the impact was most severe in England where they were effectively lost from central and south-eastern counties and to a lesser extent in Wales. Since the 1980s, national surveys have recorded a continued recovery with significant gains across most affected areas; only the south-east and small parts of north-west Midlands remain to be colonised in England, while in Wales otters have been most recently recorded as present across the entire range (JNCC 2013).

Association with coastal habitats by otters occurs most commonly in Scotland where as much as one third of the population has been estimated to be linked to the marine environment, especially in western Scotland, Shetland and the Moray Firth. Other important coastal populations as illustrated by their presence in coastal Special Areas of Conservation include west Wales, and The Wash and north Norfolk coast (Figure A1a.7.14).

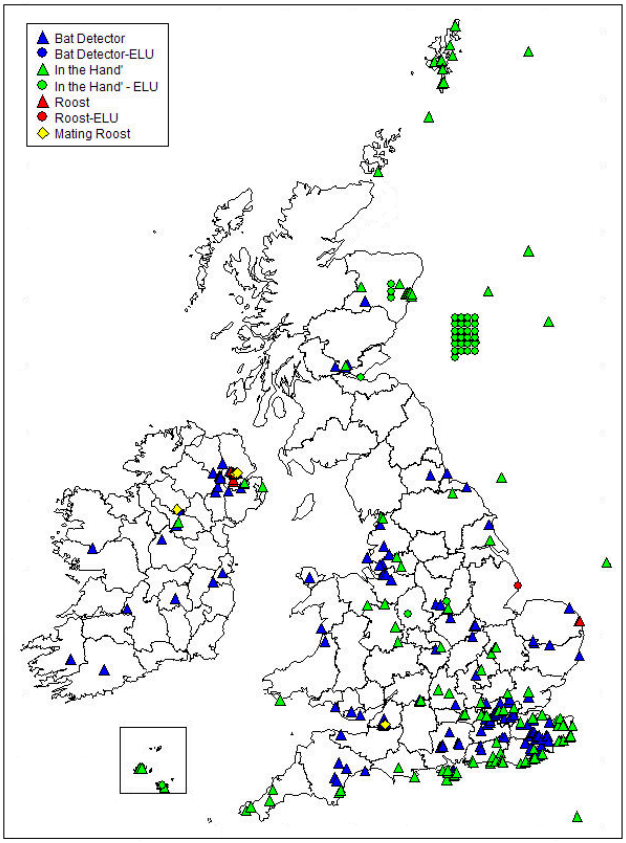
Figure A1a.7.14: Distribution of Special Areas of Conservation where otters are present



A1a.7.4.2 Bat distribution and abundance

There are seventeen species of bat recorded living in Britain and Ireland, some of which are extremely rare. The great majority of these species do not undertake large scale migrations and so do not spend significant time over the sea. The exception to this is Nathusius' pipistrelle (*Pipistrellus nathusii*) which is known to undertake long distance migrations including sea crossings. This species has a widespread distribution from western Europe to western Asia; it migrates seasonally from breeding areas at higher latitudes to overwintering areas with milder climates. Nathusius' pipistrelle is rare but widespread across the UK, with numbers peaking during autumn and again in spring, coinciding with its migration to and from its stronghold in north-eastern continental Europe (Russ *et al.* 2001, Hutterer *et al.* 2005). Offshore observations from oil/gas platforms and boats are uncommon but widely distributed in the western North Sea from east of Shetland to the eastern English Channel; the seasonal pattern of records consistent with the species' seasonal migration. The specific migratory routes and stepping stones used from the Continent to Britain and from Britain to Ireland are not known (Rodrigues *et al.* 2014). At the same time changes in distribution may be taking place as a result of climate change; for example, a few maternity colonies have recently been recorded, primarily in Northern Ireland and more recently in south-eastern England. Overall it is recognised that this species has been under-recorded in the past; abundance trends could not be reliably established as part of the most recent favourable conservation status report (JNCC 2013). The most up-to-date distribution map of records has been prepared by the Bat Conservation Trust (http://www.nathusius.org.uk/Distribution.htm) – see earlier version in Figure A1a.7.15.

Figure A1a.7.15: Records of Nathusius' pipistrelle in the UK and Ireland.



Notes: record spots cover a 10km² area; the coverage is for Great Britain, Ireland and the surrounding islands; ELU = exact location unknown; records located in the sea are from oil rigs and boats. Source: Russ (2004), Russ et al. (2001).

A1a.7.5 Ecological importance

The abundance and availability of fish and other prey, particularly those species mentioned below, is clearly of prime importance in determining the success of marine mammal populations in UK waters and beyond. Changes in the availability of principal prey items can therefore be expected to have considerable effects on marine mammals. It is not possible to predict with any degree of certainty how a change in prey abundance would be likely to affect any of these marine mammal populations (Hammond *et al.* 2008).

A1a.7.5.1 Cetaceans

There is limited information on the feeding ecology of cetaceans in UK waters but continued research efforts are improving our understanding. Information is primarily drawn from analyses of stomach contents of stranded or bycaught individuals, to a lesser degree from stable isotopic analyses of predator and prey tissues and from direct observations.

A1a.7.5.1.1 Harbour porpoise

The harbour porpoise has been described as 'living in the fast lane'; they show rapid growth but attain a smaller size, mature at an earlier age, reproduce more frequently and experience shorter lives than other cetaceans (Read & Hohn 1995). Given their small size, energy balance and fat storage (blubber thickness) are thought to be particularly important in relation to insulation and heat loss (Lockyer 2007). It is a very active species with high metabolic cost of living; it is considered an opportunistic feeder and energy balance is maintained by feeding regularly (2.5-5 kg per day in adults) on a diet largely based on high energy density prey (Lockyer 2007, Spitz *et al.* 2012).

Harbour porpoises feed mainly on fish found on or near to the seabed. Analyses of the stomach contents of 188 harbour porpoises stranded in Scotland, from 1992 to 2003 revealed whiting and sandeels to be the main prey items, together comprising 80% of the diet (Santos *et al.* 2004). Other small gadoids and cephalopods were also important, along with clupeids such as herring and sprat; other preys identified included gobies, mackerel, brown shrimp and several isopods and amphipods. Regional, seasonal and inter-annual differences in diet composition were identified. For example, haddock/saithe/Pollock were more numerous in Shetland diet than in the East Coast while sandeels were least important in the West coast diet. Comparing these results with studies from the 1960s, there is some evidence that the diet has changed from one composed mainly of herring to one dominated by sandeels and whiting, mirroring the decline in North Sea herring abundance (Santos *et al.* 2004).

Elsewhere in British waters, investigations of harbour porpoise diet revealed the diet off southern England to be dominated by whiting, followed by poor cod and scad (Roberts 2005, cited in Hammond *et al.* 2008). Off Wales, whiting was also the dominant prey species consumed, followed by gobies.

The diet of marine mammals stranded on the Dutch, French and Belgian coasts from 1994-2000 was investigated by Das *et al.* (2003) through comparisons of carbon and nitrogen isotope ratios in their muscle compared to that of a wide range of potential prey species in the southern North Sea. The trophic level of harbour porpoises was estimated to be lower than that of white-beaked dolphin and also grey and harbour seals, although variations were observed with sex and age of porpoises. This suggests that harbour porpoise in the southern North Sea consume a greater proportion of zooplankton-feeding fish such as clupeids and sandeels than the other species investigated.

Some evidence for different diets between offshore waters and coastal areas has been suggested by comparing diet composition derived from stomach content and isotope analyses

in porpoises stranded along the Dutch coast between 2006-2008 (Jansen *et al.* 2013); results from stable isotope analyses, which provide long-term diet composition, revealed a greater importance of pelagic schooling species (e.g. mackerel) than was observed in stomach contents.

A1a.7.5.1.2 Other toothed cetaceans

Bottlenose dolphins are considered generalist predators with a broad diet that includes many demersal and pelagic prey species. In Scotland, analyses of stomach contents have shown gadoids to be the main component, along with salmon, other fish species and cephalopods (Santos *et al.* 2001). Observations of feeding behaviour have been reported in a few locations within the inner Moray Firth (Kessock Channel, Chanonry narrows and mouth of the Cromarty Firth) and the waters surrounding Aberdeen harbour (Wilson *et al.* 1997, Hastie *et al.* 2004, Stockin *et al.* 2006). In French shelf waters, the predominant prey species reported in the stomachs of bottlenose dolphins were blue whiting, hake, scad, *Trisopterus* species, horse mackerel and the squid *Loligo vulgaris* (Learmonth *et al.* 2004, cited in Hammond *et al.* 2008; De Pierrepont *et al.* 2005). In Irish waters, haddock, saithe and pollock are the dominant prey species ingested, followed by whiting, blue whiting, Atlantic mackerel and horse mackerel; cephalopods are also important (Hernandez-Milian *et al.* 2015).

The diet of common dolphins includes a variety of fish and squid, with main dominant species varying with season and region (see Hammond *et al.* 2008 and Murphy *et al.* 2013 and references therein). Some studies have described them as opportunistic, others as specialists with a preference for energy-rich species but the most recent large scale analysis was still unable to provide conclusive evidence either way (Santos *et al.* 2013). Fish preys identified in the stomachs of stranded specimens examined from UK and Irish waters revealed horse mackerel, mackerel, Norway pout and sardines to dominate, with other *Trisopterus* spp., whiting, herring, sprat and sandeel also present. Cephalopods prey included mainly *Loligo* spp., *Alloteuthis subulata*, *Ancistroteuthis lichtensteini*, *Todarodes sagittatus*, *T. eblane* and *Sepiola atlantica*, but various other species of squid, octopus and cuttlefish were also consumed. In a limited number of animals bycaught in Scottish waters, whiting was dominant. In the Celtic Sea and western Channel, the common dolphin predominately feeds on horse mackerel, sardines and mackerel. Common dolphins bycaught in Irish and French tuna driftnets on and beyond the continental shelf slope in summer were predominately feeding nocturnally on meso-pelagic fishes such as myctophids and squids. De Pierrepont *et al.* (2005) reported *Trisopterus* spp. and gobies as the main prey species consumed in French Channel waters.

White-beaked dolphins have been recorded taking whiting and other gadoids, sandeels, herring and octopus. Studies of the stomach contents of white-beaked dolphins stranded mainly on the Scottish east coast identified haddock and whiting as the predominant fish species consumed (Canning *et al.* 2008). The diet of Atlantic white-sided dolphin in UK waters is unknown, although a diet consisting of pelagic species such as herring, mackerel, horse mackerel, silvery pout and squid has been reported from elsewhere in the North Atlantic (Reeves *et al.* 1999a, cited in Hammond *et al.* 2004). In the eastern North Atlantic the diet of striped dolphins consists of a variety of mesopelagic and benthic fish, squid and crustaceans; studies of striped dolphins stranded around Scotland from 1992-2003 showed whiting and *Trisopterus* spp. to be the main prey species in the diet (Santos *et al.* 2008).

There has been limited documentation of killer whale diet in UK waters but elsewhere, they are known to have one of the most diverse diets among marine top-predators (Heyning & Dahlheim 1988). In the Northeast Atlantic, herring has long been considered the key prey species (Similä *et al.* 1996) but a recent study in offshore waters between Norway and Iceland has demonstrated a strong association between killer whales and mackerel schools during the

summer months (Nøttestad *et al.* 2014). In Scottish waters, they have been occasionally recorded feeding in the vicinity of pelagic vessels targeting herring and mackerel (Luque *et al.* 2006) and they have been reported predating on seals around major colonies, particularly in Orkney and Shetland (Weir 2002, Bolt *et al* 2009, Samarra & Foote 2015). Deecke *et al.* (2011) described coastal seal-hunting groups and offshore herring-eating groups off Shetland, characterised by different social and vocal behaviour suggesting dietary specialisation.

Risso's dolphins are generally assumed to feed on cephalopods (Hammond *et al.* 2008). This was confirmed by analyses of stomach contents of 11 dolphins stranded between 1992 and 2004 across Scotland (MacLeod *et al.* 2014); 7 cephalopods taxa and 3 fish taxa were identified but cephalopods made up 98% of the total prey (by weight and number). Just one single octopus species, *Eledona cirrhosa* made up 90% of the total; the next most important prey was the common squid *Loligo* sp.

Long-finned pilot whales primarily target cephalopods, with animals in the northwest Atlantic also reported to have consumed small amounts of fish such as saithe, mackerel and blue whiting (Gannon *et al.* 1997). In French Channel waters, cuttlefish (primarily *Sepia* species) were the dominant prey item (De Pierrepont *et al.* 2005); octopods (mainly Octopodidae) were numerically more important in stomach contents from pilot whales stranded in Portugal and Galicia while squids (mainly Ommatostrephidae) were dominant in Scotland (Santos *et al.* 2014) Stable isotope analyses have revealed a similar pattern, with octopus and squids the main prey items identified in Northwest Iberia and Scotland respectively (Monteiro *et al.* 2015).

It is generally assumed that sperm whales in waters adjacent to the UK feed on deepwater squid, as has been reported in animals stranded off the east coast of Scotland (Santos *et al.* 1999). In some parts of the world deepwater fishes have also been reported in sperm whale diet (Hammond *et al.* 2006). Beaked whales also show a strong preference for squid, especially deeper water species (*ca.* 200-1000m) (Hammond *et al.* 2006, MacLeod *et al.* 2003a). In bottlenose whales stranded in UK, Ireland and the Netherlands, prey remains consisted almost exclusively of cephalopod beaks; 90% were *Gonatus* spp, *Teuthowenia* spp and *Taonius pavo*, all oceanic squid species distributed in temperate to sub-polar regions (Fernandez *et al.* 2014).

A1a.7.5.1.3 Baleen whales

Minke whales feed on a variety of fish, including herring, cod, and haddock in Norwegian waters. Stephenson (1951, cited in Hammond *et al.* 2008) reported that most minke whales taken by commercial whaling in the UK waters of the North Sea during 1948 had been feeding on herring, with some mackerel and sandeels also reported. Analysis of stomach contents of ten minke whales stranded in Scotland from 1992-2002 showed sandeels to be the dominant prey item, with sprat, herring, mackerel and Norway pout consumed to a lesser extent (Pierce *et al.* 2004). Animals caught in the North Sea by Norwegian fisheries showed a similar diet composition, along with the addition of whiting (Olsen & Holst 2001). Minke whales off the west coast of Scotland and more specifically around the Isle of Mull have been shown to prefer areas of sandeel habitat in spring and early summer, and shift to pre-spawning herring habitat and to areas with high sprat abundance in late summer (Macleod *et al.* 2004, Anderwald *et al.* 2012). Off Iceland, diet composition of minke whales sampled during 2003-2007 was found to be predominantly composed of fish, with sandeels the single most important prey species and herring, capeling, haddock and cod also common; krill contribution was small (<10%). This recent diet was found to differ markedly from previously available stomach content data (1977-1984) when krill and capelin were dominant and may reflect the response of minke whales to a changed environment (Vikingsson *et al.* 2014).

The feeding habits of fin whales in UK waters are unknown, but elsewhere in the Northeast Atlantic, especially off Iceland, they are reported to have a diet predominated by planktonic

crustaceans (euphausiid shrimps such as *Meganyctiphanes norvegica*) although small schooling fish such as capelin and herring may also be taken (Lockyer 2007). Sei whales in the North Atlantic have also been reported as consuming planktonic crustaceans and small schooling fish, although are regarded as more specialist feeders (Pollock *et al.* 2000).

A1a.7.5.2 Seals

Grey seal foraging destinations at sea are typically localised areas characterized by a gravel/sand seabed sediment, which is the preferred burrowing habitat of their primary prey, sandeels. The distance from a haul-out site of a typical foraging trip indicates that the ecological impact of seal predation may be greater coastally than further offshore.

Grey seals are important marine predators in the UK marine environment. They are generalist feeders, foraging mainly on the sea bed at depths up to 100m, although likely capable to feed at all depths found across the continental shelf (SCOS 2014). Their diet primarily comprises sandeels, gadoids (cod, haddock, whiting, ling) and flatfish (plaice, sole, flounder, dab), in that order of importance, but varies seasonally and from region to region (Hammond & Grellier 2006). Around the Outer Hebrides, Orkney and Shetland, sandeels and gadoids typically dominate during winter, while flatfish and herring increase in importance during summer months. Food requirements depend on the size of the seal and fat content of the prey but an average consumption estimate is 7 kg of cod or 4 kg of sandeels per seal per day. An estimate of annual grey seal prey consumption in the North Sea is approximately 150,000 tonnes, of which almost 50% is sandeels (SCOS 2007). In addition, predation by grey seals on marine mammals has also been reported; Bouveroux *et al.* (2014) provided direct observations of gray seal predation and scavenging on harbour porpoises in the Strait of Dover, off the coast of France. Forensic DNA techniques implicated grey seals in attacks that caused harbour porpoises to strand in the Netherlands (van Bleijswijk *et al.* 2014). Adult males attacking grey seal pups and young harbour seals have also been reported (Thompson *et al.* 2015, van Neer *et al.* 2015).

Harbour seals are also important predators in the UK marine environment. The diet is composed of a wide variety of prey including sandeels, gadoids, herring and sprat, flatfish, octopus and squid. Diet varies seasonally and from region to region; current knowledge of the likely daily ration suggests approximately 3kg of fatty fish or up to 5kg of whitefish per day (SCOS 2007). Based on this, a very approximate estimate of minimum annual consumption of prey by harbour seals hauling out on Orkney, Shetland and the west coast of Scotland (including islands) would be 33,000-64,000 tonnes.

A1a.7.5.3 Otters

In general otters feed on a wide range of prey with a strong bias towards fish; however, they are somewhat opportunistic predators and will take many prey items provided they are of appropriate size. In UK coastal waters, they generally consume bottom-dwelling fish, some crustaceans, and have also been occasionally observed taking small water birds.

The diet of otters in coastal studies in Shetland by Kruuk *et al.* (1987) and Kruuk & Moorhouse (1990) consisted mostly of eelpout (*Zoarces viviparus*) and rockling (*Ciliata* spp.), which are nocturnal species most active at night. In northwest Scotland, Yoxon (2008) observed otters preying primarily on small benthic fish, with the five key prey species being viviparous blenny (*Lipophrys pholis*), five-bearded rockling (*Ciliata mustela*), butterfish (*Pholis gunnellus*), sea scorpion (*Taurulus bubalis*), and saithe (*Pollachius virens*). Britton *et al.* (2006) recorded sea bass (*Dicentrarchus labrax)* and thick lipped mullet *(Chelon labosus)* as prey items of otters in south west England.

Crustaceans are thought to be of secondary importance (Crass 1995), with coastal otters in Shetland feeding mainly on inter-tidal or benthic species (Kruuk & Moorhouse 1990). Watt (1993) recorded that the diet of coastal cubs and sub-adults comprised a significantly greater proportion of crustaceans, mainly shore crab (*Carcinus maenas*), and less fish than that of adults; there was a negative correlation between age and the proportion of crustaceans in the diet. Shore crabs and other hard bodied crustaceans are relatively unprofitable prey for otters as they provide little meat and require a lengthy handling time.

A1a.7.5.4 Bats

All UK resident bat species feed exclusively on insects. Nathusius' pipistrelles mainly feed on flying aquatic insects of small-medium size, primarily Chironomidae (non-biting midges). They feed over lakes, rivers and a variety of adjacent riparian habitats, including broadleaf and mixed woodland, parkland, and occasionally farmland (Russ 2008).

A1a.7.6 Features of Regional Sea 1

The central and northern North Sea has a moderate to high diversity and density of cetaceans, with a general trend of increasing diversity and abundance with increasing latitude. Harbour porpoise and white-beaked dolphin are the most widespread and frequently encountered species, occurring regularly throughout most of the year. Minke whales are regularly recorded as a frequent seasonal visitor. Coastal waters of the Moray Firth and east coast of Scotland support an important population of bottlenose dolphins, while killer whales are sighted with increasing frequency towards the north of the area. Atlantic white-sided dolphin, Risso's dolphin and long-finned pilot whale can be considered occasional visitors, particularly in the north of the area. Large numbers of grey and harbour seals breed in the area, with high densities observed in many coastal waters and some areas further offshore.

Harbour porpoise are frequently sighted throughout the central and northern North Sea, in both coastal and offshore waters. While sighted throughout the year, peak numbers are generally recorded in summer months from June to October. The 1994 SCANS survey showed this area to be one of the most important for harbour porpoise in the North Sea, with high densities predicted throughout the area (Hammond *et al.* 2002b). However, the 2005 SCANS-II surveys showed the main concentration of this species to have shifted southwards into the southern North Sea (Hammond *et al.* 2013). Stone (2015a) reported a similar southerly shift from analysis of harbour porpoise recorded during seismic surveys between 1995 and 2010. Nonetheless, acoustic detections of porpoises were recorded throughout this region with high detection rates recorded in waters off north-east Scotland and the outer Moray Firth (SCANS-II 2008). More recent studies have confirmed a widespread distribution and regular presence of this species across the Moray Firth (Thompson *et al.* 2013), with the Smith Bank and Outer Moray Firth identified as persistent high density areas for porpoise in the summer (Heinänen & Skov 2015). A tendency toward spatio-temporal habitat partitioning between harbour porpoises and bottlenose dolphins has been observed in the Moray Firth (as elsewhere across the UK see Evans *et al.* 2015); the relatively high incidence of lethal attacks by bottlenose dolphins may be linked to this (Ross & Wilson, 1996). From land-based observations, southern and eastern areas of Shetland have the highest densities in the region (Evans *et al.* 2015).

Along with harbour porpoise, white-beaked dolphin are among the most commonly occurring cetacean in the central and northern North Sea, regularly encountered in coastal and offshore waters. While sighted throughout the year, sightings are slightly more frequent from July to October. SCANS I and II surveys gave abundance estimates in the northern North Sea one to two orders of magnitude smaller than for harbour porpoise. Stone (2015a) found this species to be by far the most commonly encountered by marine mammal observers during seismic surveys. Atlantic white-sided dolphins appear to be seasonally present in the North Sea, where

they are most frequently sighted in waters >10km from the coast in the northern and central North Sea from June to September (Reid *et al.* 2003). Common dolphins are regarded as notably rare in the northern North Sea (Reid *et al.* 2003) but regular surveys in the outer Moray Firth have shown sustained summer occurrence since 2006 (Robinson 2010).

Killer whales have been observed throughout the northern North Sea; sightings are fairly frequent in coastal waters of Shetland and Orkney, and they are also occasionally sighted off the east coast of Scotland, in the Firth of Forth and as far south as the Farne Islands. While they have been reported in most months of the year, sightings are most frequent between April and September.

During summer months, minke whales are well distributed (both coastally and offshore) throughout the central and northern North Sea, particularly in the west (Northridge *et al.* 1995). They are frequently sighted in small numbers off the coast of Scotland and north-east England, with sightings extending south to Flamborough Head. Frequent sightings were made during both SCANS I and II (Hammond *et al.* 2002b, Hammond *et al.* 2013). Inshore waters of the southern Moray Firth (primarily between Spey Bay and Fraserburgh (Robinson *et al.* 2009)), are thought to provide a rich feeding ground, especially between June and October (Robinson and Tetley 2007, Paxton 2014); minke whales in this area appear to have a strong preference for water depths between 20 and 50m, steep shelf slopes and sandy-gravel sediment type. As a consequence, this species is a feature of the proposed Southern Trench MPA.

A small, seemingly resident population of bottlenose dolphins (*Tursiops truncatus*) exists off the east coast of Scotland, as represented by the Coastal East Scotland Management Unit (IAMMWG 2015). They typically range from coastal waters of the Moray Firth to the Firth of Forth, with occasional observations from further offshore in the North Sea; the dolphins are most frequently sighted within the inner Moray Firth. Bottlenose dolphin is listed in Annex II of the Habitats Directive[3], and the importance of this population, and the Moray Firth, is reflected in the designation of part of this area as a Special Area of Conservation (SAC).

In the 1980s, the core of the population's known range was focused in the inner Moray Firth, typically within three main areas; the Kessock Channel, Chanonry Narrows, and around the mouth of the Cromarty Firth (Wilson *et al.* 1997, 2004; Hastie *et al.* 2003). While dolphins are seen in these areas throughout the year, an apparent influx of animals is observed from May to September (Thompson *et al.* 2011). Surveys along the southern coast of the Moray Firth from 2001-2005 encountered bottlenose dolphins along the majority of the coastline, primarily in waters <25m depth (Robinson *et al.* 2007). Since the early 1990s, data have shown the population's range to include waters off Aberdeenshire, St Andrew's Bay and the Firth of Forth (Wilson *et al.* 2004). Dolphins are present year round off Aberdeenshire, with a peak in abundance during March to May (Stockin *et al.* 2006). Peak sightings in St Andrews Bay occur in June to August (Hammond *et al.* 2004). Two social units appear to exist within the population: those which are only observed in the inner Moray Firth, and those which are observed throughout the known range (Lusseau *et al.* 2006). For the latter group, individual variability in patterns of movement between the Moray Firth SAC and Tayside and Fife areas is high (Thompson *et al.* 2011, Quick *et al.* 2014). Occasional offshore observations in the North Sea may indicate that these animals are also distributed offshore at least for part of the year (Reid *et al.* 2003; SMRU 2007).

[3] *Council Directive 92/43/EEC on the conservation of natural habitats of wild flora and fauna*

Between 1990 and 2013, annual estimates of the number of dolphins using the SAC in summer ranged between 43-134; inter-annual variability was relatively high and no significant trend over time was detected (Cheney *et al.* 2014). Overall, the east coast population is believed to be stable or increasing (Cheney *et al.* 2012), ranging from a low of 102 (95% HPDI: 66-144) in 1999 to a high of 178 (95% HPDI: 151-204) in 2010. A refined estimate of current size puts the east coast population at 195 individuals (95% HPDI: 162-253)(Cheney *et al.* 2013).

Major grey seal colonies in the northern and central North Sea include the Isle of May, Fast Castle and the Farne Islands. Amongst these sites, approximately 6,800 newborn pups were counted in 2012 (SCOS 2014). Maps of marine usage by grey seals show hotspots of activity around Orkney and Shetland (see Region 8), in the Moray Firth by Helmsdale and along the West Bank, off the northeast coast of Scotland at Rattray Head and outside the Tay estuary and around the Farne Islands; marine usage in these areas is among the highest in UK waters (Matthiopoulos *et al.* 2004, Jones *et al.* 2015).

Harbour seals are widely distributed around most of the coasts of North Scotland, Shetland and Orkney (see Region 8 for further information in these areas) and along the Moray Firth and the east coast of Scotland. There are many important haul-out and breeding sites on these coastlines, several of which contain internationally important numbers; seals are abundant throughout coastal waters surrounding these sites. Models of marine usage by harbour seals show foraging areas off much of the east coast of Scotland, with hotspots of activity east of Shetland, northeast of Orkney, in the Moray Firth and north of St Andrews marine usage in these areas is among the highest in UK waters (Jones *et al.* 2015). Harbour seals in this region were largely unaffected by PDV in 1988 and 2002 but since 2000 numbers have declined sharply in some areas, particularly Shetland (30% decrease between 2000-2009), Orkney (78% decrease between 2000-2013) and the Forth of Tay (93% decrease between 2000-2013). In the Moray Firth there is considerable variability in the August total counts between years; for example, at the latest count in summer 2014 counts at Ardesier, Dornoch Firth and Morrich More SAC and Brora were the lowest ever recorded while counts at Culbin and Loch Fleet were the highest ever recorded. Overall, the 2014 count was the lowest with 733 seals (Duck and Morris 2015). Research into causes of the decline is ongoing: the main drivers of interest are competition for prey with grey seals and increased mortality from harmful algal toxin uptake (SCOS 2014).

A1a.7.7 Features of Regional Sea 2

Compared to the central and northern North Sea, the southern North Sea generally has a relatively low density of marine mammals, with the likely exception of harbour porpoise. While over ten species of cetacean have been recorded in the southern North Sea, only harbour porpoise and white-beaked dolphin can be considered as regularly occurring throughout most of the year, and minke whale as a frequent seasonal visitor. Bottlenose dolphin and Atlantic white-sided dolphin can be considered uncommon visitors. Important numbers of grey and harbour seals are present off the east coast of England, particularly around The Wash where harbour seals forage over a wide area.

In summer 2005 during SCANS II, harbour porpoise were observed in high densities throughout much of the UK southern North Sea, an area from which they were largely absent during the first SCANS survey in 1994 (Hammond *et al.* 2013). This southern shift in distribution may be partly explained by inter-annual variation in spatial distribution of abundance, but corroborating evidence of a systematic change has been found with increasing trends in sightings and strandings along the French, Belgian, Dutch and German waters over the last decade (Camphuysen 2004, Jauniaux *et al.* 2008, Haelters *et al.* 2011, Peschko *et al.* 2016). At the same time, survey effort has markedly increased in this region of the UKCS; with the exception

of SCANS, the whole area south of a line between Flamborough Head and the northern flanks of the Dogger Bank had no effort before 2003 but between 2003-2011 it received a lot of attention on account of baseline surveys related to the offshore wind energy development schemes.

Heinänen & Skov (2015) developed statistical distribution models integrating 18 years of survey data in the Joint Cetacean Protocol with annual and seasonal environmental data (water depth, hydrodynamic variables, sediments, shipping intensity) to support the identification of persistent high-density areas for harbour porpoises. Within the southern North Sea, one large coherent offshore zone of high-density was identified, from the western slopes of the Dogger Bank southwards along the 30m depth contour to an area off Norfolk; once number of years with effort was taken into account (≥ 3 years), the area retained was smaller and split into three more rigorously identifiable areas; these persistent high-density areas were the inner Silver Pit, the north-western edge of Dogger Bank and offshore areas east of Norfolk and east of outer Thames estuary (year round, in summer and in winter respectively).

White-beaked dolphins are widely distributed in offshore areas in the north of Regional Sea 2. Very few sightings recorded along the east coast of England south of the Humber estuary, with a limited number of offshore sightings in the shallowest waters of the North Norfolk Sandbanks and within the Dogger Bank and adjacent areas (Gilles *et al* 2012). Minke whales are not regularly present throughout the southern North Sea, but are well distributed (both coastally and offshore) in the western central and northern North Sea and occasionally, sightings extend south to Flamborough Head and the north Humberside coast mainly from July to October. Relatively high densities of minke whale have been reported along the slopes of the Dogger Bank and adjacent areas during spring and summer surveys (de Boer 2010, Gilles *et al.* 2012, Hammond *et al.* 2013). Given the lack of records further south, including the English Channel, minke whales are thought to enter the North Sea from the north. A few sightings of Atlantic white-sided dolphins have been recorded in the southern North Sea, primarily in the north-west >10km from the coast, north-east of Flamborough Head and around Dogger Bank. Bottlenose dolphins are only occasionally sighted in this region (Reid *et al.* 2003, Evans *et al.* 2015).

A long established colony of breeding grey seals exists at Donna Nook, at the mouth of the Humber (Lincolnshire). Smaller colonies are present further south at Blakeney Point on the north Norfolk coast, and also at Horsey on the east Norfolk coast. Seal pup production at these colonies has continued to increase (*ca*. 15% annual increase) with 3,360 pups estimated from the latest counts in 2012 (SCOS 2014). Breeding grey seals are also recorded at Flamborough Head and The Wash. Small numbers of grey seals occur along the European continental coast of the southern North Sea, the majority of which are recorded in the Dutch Wadden Sea; pup production in this area is also on the increase with 430 in 2012 (SCOS 2014). In addition to coastal areas adjacent to haul-out sites, at sea usage is high offshore in proximity of sandbanks (i.e. Dogger Bank) and along corridors connecting these offshore foraging areas to haul-out sites. To the south of The Wash, models of marine usage by grey seals show a generally low density of activity over offshore areas (Matthiopoulos *et al.* 2004, Jones *et al.* 2015).

Several harbour seal colonies and haul-out sites are present on the south east coast of England; minimum numbers here are estimated at approximately 4,500 animals (SCOS 2014). The largest colony by far is in The Wash with 3,174 animals; Donna Nook and Blakeney Point are also important (304 and 396 animals respectively in 2013). Colonies are also present at Scroby Sands off the east Norfolk coast and in the greater Thames area. The English east coast population has fluctuated considerably since the late 1980s in response to phocine distemper virus (PDV) epidemics in 1988 and 2002, causing 50% and 22% declines in population size respectively (Thompson *et al.* 2005). Further information on population trends is provided in Section A1a.7.15.2 Tagging studies of harbour seals hauling out at The Wash have

shown animals to forage over a wide area at distances much greater from haul-out sites than many other parts of the UK. Models of marine usage by harbour seals in the southern North Sea show a large area of fairly diffused activity extending from The Wash, with the greatest activity offshore of the Humber. Seals hauling-out in the greater Thames area appear to forage over a smaller area closer to the coast (Sharples *et al.* 2012).

A1a.7.8 Features of Regional Sea 3

The eastern English Channel has a relatively low density and diversity of marine mammals; it is a transition zone between the communities of the southern North Sea and the western Channel/Celtic Sea. Bottlenose dolphins are the most frequently sighted species in coastal waters, followed by harbour porpoise. Further offshore, occasional sightings of long-finned pilot whales or common dolphins have occurred but numbers are much less than in the Western Channel. The area is not particularly important for seals, with no major colonies present and very little activity recorded.

Seasonal movements of bottlenose dolphins in the English Channel have been reported with the majority of sightings reported off the Cornish coast during winter, followed by an eastwards movement during the spring as far as the east Sussex coast (Williams *et al.* 1996, cited in Hammond *et al.* 2008). During summer, highest sightings were reported from Lyme Bay eastwards, and in the autumn the majority of sightings were reported off the Dorset coast, east of the Isle of Wight. Several small resident groups of bottlenose dolphins are present off the northwest coast of Brittany and Normandy (e.g. Kiszka *et al.* 2004). It has been suggested that animals along the French Channel coast form very stable groups that are resident in small areas, whereas those along the southern English coast are wider-ranging (Reid *et al.* 2003).

Harbour porpoises were thought to have been lost from the eastern English Channel by the 1990s (Reid *et al.* 2003) and there were no sightings during the SCANS survey in July 1994; however several sightings were made during the SCANS-II survey in July 2005 and over the last decade as effort has increased, so have encounters. McClellan *et al.* (2014) have analysed presence-only data and modelled a seasonal pattern: harbour porpoises are more likely to be encountered in the southern North Sea during winter and spring, move throughout the Channel in the summer and retract back to the North Sea and the western English Channel by the autumn. Data in the JCP for this area are relatively few and the recent analysis by Heinänen & Skov (2015) could not provide reliable estimates.

The eastern English Channel is not a particularly important area for seals. No major colonies of either grey or harbour seals are present along the coast; only small colonies of both species are present on the east Kent coast. Small numbers of seals from these and other colonies on adjacent coasts can be expected to be present in the area and this is reflected in the maps of marine usage with low levels of activity off the Kent coast (Jones *et al.* 2015). Some activity in this area can be attributed to a number of individual grey seals moving between northern Brittany and the Channel Islands and the English Channel to as far east as the greater Thames area (Matthiopoulos *et al.* 2004), as well as to harbour seals transiting across the Channel between haul-outs in the Thames estuary and France (Sharples *et al.* 2012)

A1a.7.9 Features of Regional Sea 4/5

The region experiences a relatively high density and moderate diversity of marine mammals. Four cetacean species occur frequently in the Regional Sea 4 area: short-beaked common dolphin, minke whale, harbour porpoise and bottlenose dolphin. Long-finned pilot whale and Risso's dolphin are also regularly encountered. Grey seals are present in the area, but in low densities relative to the rest of UK shelf waters. Harbour seals are rarely encountered.

Common dolphins are widespread and abundant in Regional Sea 4, with sightings reported throughout the year. Strong seasonal shifts in their distribution have been noted, with winter movements onto the Celtic Shelf and into the western English Channel (Northridge *et al.* 2004), resulting in a 10-fold increase in density in this area (Brereton *et al.* 2005, cited in Hammond *et al.* 2008). Indeed winter estimates of abundance in the Western Approaches of the English Channel obtained by de Boer *et al.* (2008) were the highest recorded from comparable surveys in the North Atlantic, showing that the Channel is an important winter habitat for this species. During the mating/calving period for this species from May to September the majority of sightings have been reported along and off the continental shelf slope to the southwest of the UK (Murphy *et al.* 2005; Murphy & Rogan 2006). However, large numbers of animals have been observed southwest of Wales (particularly over the 100m isobath) throughout much of the year (Reid *et al.* 2003). The vast majority of common dolphin strandings in the UK occur on the southwest coasts of England and Wales (Deaville *et al.* 2007).

Minke whales are present throughout much of the Celtic Sea and western Channel during summer. Concentrations of sightings have been reported around the Brittany coast and the northern edge of the Bay of Biscay (Reid *et al.* 2003). Minke whales were sighted in this region during both SCANS surveys; density surface modelling based on SCANS-II data predicted high concentrations of minke whales in the western Channel between approximately Devon and northern France (Hammond et al 2002 and Hammond *et al.* 2013).

Harbour porpoise are widespread and numerous across much of the Celtic Sea, with the majority of individuals sighted off the southwest coast of Wales, outer Bristol Channel coast, west of Cornwall. In Addition to the SCANS surveys, several at sea surveys of different duration and geographical extent have confirmed harbour porpoise regular presence across this region; for example in coastal waters off southwest England between south Devon and the Isles of Scilly (Goodwin & Speedie 2008), at Runnelstone Reef in southwest Cornwall (off Lands' End) which is considered of regional importance both during summer and winter months (Jones *et al.* 2014 and references therein) and in the Channel along the route of the ferry 'The Pride of Bilbao' where MacLeod *et al.* (2009) found numbers in summer months to increase between 1996 and 2006. The analyses of sightings data carried out by Heinänen & Skov 2015, identified two areas of persistent high density in this region in the summer: part of the Bristol Channel (Camarthen Bay) and an area in the Western Channel off Start Point. Coastal hotspots across this region have been identified from dedicated shore watches by Evans *et al.* (2015) in the following locations: Swansea Bay and the Gower Peninsula, along the south side of the outer Bristol Channel between Bideford (north Devon) and Minehead (Somerset) and on the South Devon Coast between Babbacombe Bay and Bigbury Bay. The importance of Swansea Bay has been further highlighted by Oakley *et al.* (2016).

Reid *et al.* (2003) reported large aggregations of bottlenose dolphins in the vicinity of the shelf break to the southwest of the UK, particularly off southwest Ireland and southwards towards the French coast. Sightings are lower in offshore shelf waters, although still widespread. In coastal waters, sightings are highest off the Cornish coast during winter, followed by an eastwards movement during the spring into the eastern English Channel (Williams *et al.* 1996, cited in Hammond *et al.* 2008). A northerly shift in distribution of bottlenose dolphins off the Cornish coast across the Bristol Channel into Welsh waters has also been suggested (Wood 1998). Recent analysis of sighting data from dedicated shore watches identified areas around Falmouth Bay and the Lizard Peninsula in Cornwall and Bideford Bay in north Devon as important (Evans *et al.* 2015). Several small resident groups of bottlenose dolphins are present off northern France, although these are not believed to spend significant time in UK waters (Reid *et al.* 2003, Kiszka *et al.* 2004).

In waters to the southwest of the UK, long-finned pilot whales occur mainly along the continental shelf slope, particularly around the 1,000m isobath. In the shelf waters to the southwest of the UK, they are predominately sighted in the western English Channel off the southwest coast of England, during the autumn and early spring (Evans 1980, cited in Hammond *et al.* 2008). The majority of pilot whale strandings reported in the UK are along the southwest coast (Sabin *et al.* 2002). Risso's dolphins are regularly seen in the southern Irish Sea and off southwest Ireland, but are rare across the majority of the Celtic Sea and western Channel. Sightings have been reported on the continental shelf slope.

Several other species of toothed cetacean have been recorded in the Celtic Sea and western Channel area in low numbers: killer whale, white-sided and white-beaked dolphin, striped dolphin. For beaked whales, only a handful of strandings have been recorded in the area, while fin, sei and humpback whales are occasionally seen (Hammond *et al.* 2008).

Several minor grey seal colonies are present along the southwest coast of England, including the Isles of Scilly and Lundy. Two larger colonies are present at Skomer and Ramsey off southwest Wales, just north of the Regional Sea 4 boundary. Latest estimate of pup production for southwest England is for 250 grey seal pups, derived from 1994 counts as colonies in this region are only irregularly included in national monitoring efforts. In the Isles of Scilly, a recent survey estimated pup production between 89 and 134 individuals in 2010 (Sayer *et al.* 2012). Models of marine usage by grey seals show a typically low level of activity across the majority of the Celtic Sea and western Channel. Areas of higher activity are observed in waters surrounding southwest Wales and to a lesser extent the Isles of Scilly (Jones *et al.* 2015). There are no harbour seal colonies in this region but a very small number of individuals (<50) has been increasingly reported for the West England & Wales management unit (SCOS 2014).

A1a.7.10 Features of Regional Sea 6

Effort-related sightings in this region have been collated by Baines and Evans into the Atlas of the Marine Mammal of Wales (Baines & Evans 2012). It combines results from sixteen groups / survey projects providing aerial, vessel and land-based sightings spanning the 20-year period 1990-2009. Eighteen species of cetaceans have been recorded in this region with highest species diversity offshore around the Celtic Deep and close to the Isle of Man. Five species are more commonly encountered: harbour porpoise, bottlenose dolphin, short-beaked common dolphin, Risso's dolphin and minke whale. Grey and harbour seals are also regularly present in certain areas.

Harbour porpoises are widely distributed and sighted throughout much of the Irish Sea during most months of the year. Sightings are fairly frequent along the Welsh coast throughout the year, although peak from summer to autumn; sightings hotspots are off the coast of North Wales (Anglesey, Lleyn Peninsula), west Wales (Pembrokeshire and Cardigan Bay) with smaller areas north of the Isle of Man and on the Northern Irish coast near Strangford Lough.

Bottlenose dolphins are the second most frequently recorded species in the Irish Sea, with a predominantly coastal distribution and particularly high concentrations off west Wales and off the coast of Co. Wexford in southeast Ireland. While effort-related sightings are few in the northern Irish Sea, the species is regularly sighted in summer off the Galloway coast of southwest Scotland and around the Isle of Man (Hammond *et al.* 2005, Baines & Evans 2012). The entire Irish Sea has been chosen as the appropriate Management Unit for this species in this region with an abundance of 397 animals (95% CI 362-141) (IAMMWG 2015).

Off the coast of Wales, bottlenose dolphins are most commonly seen in Cardigan Bay within 10 miles of the coast and particularly within two miles; sightings are greatest in the southern portion

of the bay. However they occur also off the north coast of Wales, particularly north and east of Anglesey (Feingold & Evans 2014b). The importance of Cardigan Bay to this species has long been recognised and two Special Areas of Conservation (SACs) have been designated with this species as an interest feature. Bottlenose dolphin is a primary feature of the Cardigan Bay SAC located in the south of the bay off the coast of Cardigan, New Quay and Aberaeron, and a qualifying feature of the Lleyn Peninsula and the Sarnau SAC in the northern end of the bay and around the Lleyn Peninsula.

Marked seasonal trends have been observed in Cardigan Bay, with high coastal sightings in summer and autumn and low records in winter and early spring; during the winter, a northwards shift in distribution and dispersal into the wider Irish Sea has been observed (Pesante *et al* 2008a, Veneruso and Evans 2012b). Photo ID has confirmed the waters around the Isle of Man to represent the northern range limit of the Cardigan Bay population (Feingold & Evans 2014b). Mean group size of sightings in Cardigan Bay has been recorded as 5.85 individuals (Lott 2004, cited in Pesante *et al.* 2008b) while largest group sizes (50-150 individuals) have been observed in the winter in North Wales and Manx waters. Juveniles have been recorded most frequently in Cardigan Bay, mainly during April to October; around 50% of groups encountered within Cardigan Bay SAC had one or more calves present during the systematic monitoring efforts between 2011 and 2013 ((Feingold & Evans 2014a).

Monitoring efforts have largely concentrated upon the Cardigan Bay SACs with regular line-transect surveys providing abundance estimates yearly between 2001-2007 (Pesante *et al.* 2008a) and again between 2011-2013; in addition between 2011-2013, survey efforts increased in range to cover the wider Cardigan Bay (Feingold & Evans 2014a). Abundance estimates within Cardigan Bay SAC were highest in 2006 with 214 individuals (95%CI 108-422) and lowest in 2012 with 70 (95% CI 37-131). Abundance across the entire bay was estimated at 309 (95%CI 179-353), 390 (95%CI 203-534) and 254 (95%CI 151-427) in 2011, 2012 and 2013 respectively. Photo-identification efforts were maintained with relatively even coverage within the SAC yearly between 2001 and 2013 giving the opportunity to analyse trends in abundance estimates (using mark-recapture analysis) and no apparent trend was found (Feingold & Evans 2014a). Bottlenose dolphin population in Cardigan Bay SAC as well as across the whole bay include transients, occasional visitors as well as resident animals (Pesante 2008b) and rates of emigration and immigration fluctuate between years. Residency within the Cardigan Bay SAC was calculated as between 47-58% but in recent years it has declined to 37-43%, raising concern with regard to the possible reasons (Feingold & Evans 2014a). At present, there is no evidence to infer any negative effect to the population and bottlenose dolphins are currently classified as 'favourable' in both the Cardigan Bay SAC and the Lleyn Peninsula and the Sarnau SAC (JNCC 2007).

Risso's dolphins have a localised distribution in the Irish Sea, in a wide band running SW-NE that encompasses west Pembrokeshire, the western end of the Lleyn Peninsula and Anglesey, the south-east coast of Ireland in the west, and waters around the Isle of Man in the north (Baines & Evans 2012). They have mainly been observed in the region in summer and rarely between December and March (Hammond *et al.* 2005); young animals have been reported off the north coasts of Pembrokeshire and Anglesey and in Manx waters (Baines & Evans 2012). Through photo-identification, seasonal and long-term site-fidelity has been revealed for some individuals in the waters off Bardsey Island, in Cardigan Bay (de Boer *et al.* 2013).

Common dolphins are most prevalent offshore, in the far south of the Irish Sea, over the Celtic Deep during the summer; this relatively high-density area extends eastwards towards the coast and islands of Pembrokeshire. Sightings have occurred further north and in Manx waters but much less frequently. A similar distribution has been observed also for minke whales. They occur mainly in summer in the western side, over the Celtic deep, and very rarely north of the

Isle of Man (Hammond *et al.* 2005) where small numbers appear to follow the spawning herring from the west side of the island to the east during the late summer and early autumn.

In the Irish Sea area, the size of the grey seal population breeding in Wales and Ireland has been estimated at 5,000-7,000 animals (Keily *et al.* 2000). The larger haul-out sites are present around Pembrokeshire, the Lleyn Peninsula, Liverpool Bay, the Firth of Clyde, southeast and east Ireland. Haul-outs are also present in Cardigan Bay, Anglesey, the Solway Firth, northern Isle of Man, east Northern Ireland and the Dumfries and Galloway coast (Hammond *et al.* 2005). A significant portion of the Irish Sea area is clearly important as foraging habitat for grey seals hauling out in Wales and Ireland (Hammond *et al.* 2005). Satellite tagging of 18 adult grey seals at Irish Sea colonies in 2004 and 17 pups in 2009-10 has provided some information of their movements at sea; average foraging trips were 16.9 km and 19.5 km long and maximum trip lengths were 173 and 436 km for adults and pups respectively (SCOS 2014). Tracking data, in combination with counts of animals at haul-out sites in summer, have formed the basis of models predicting marine usage by grey seals (Jones *et al.* 2015); the southern Irish Sea and northern St George's Channel are predicted to be used extensively by grey seals as foraging areas, with the southern part of Liverpool Bay also heavily used. In Welsh waters, Baines & Evans (2012) indicated highest sighting rates of grey seals in the north-east of Wales towards Hilbre Island in the mouth of the River Dee, reflecting the distribution of moulting and feeding haul-out sites; in addition, their presence was observed in both inshore and offshore waters of Cardigan Bay (Feingold & Evans 2013).

There are few harbour seals around the Irish Sea except along the coast of Northern Ireland and in Southwest Scotland (Firth of Clyde); no breeding site is known along the Welsh coast. The number of seals in the area is likely to be around 3,500-4,000 (Hammond *et al.* 2005). Models suggest at-sea activity by harbour seals in the Irish Sea to be mainly in the north: along the Northern Ireland coast, the North Channel and the Firth of Clyde (Jones *et al.* 2015).

A1a.7.11 Features of Regional Sea 7

The Minches and western Scotland support a rich diversity and high density of marine mammals. Harbour porpoise and white-beaked dolphins are widespread and numerous. They are encountered throughout the year, although most frequently during summer months, minke whales are also abundant and Risso's dolphins and common dolphins are frequently sighted. Small numbers of bottlenose dolphins occur around coastal waters. Killer whales are occasionally observed throughout the area, most notably around seal haul-out sites during summer. Both grey and harbour seals are abundant throughout the area.

Harbour porpoise are widely distributed and frequently sighted throughout much of the Minches and western Scotland. While sighted throughout the year, peak numbers are generally recorded in summer months from June to September. Their abundance in this region is above average and this has been reflected in the identification of the coastal areas off north-west Scotland, including Minches and eastern parts of the Sea of Hebrides as a persistent high density area for this species (Heinänen & Skov 2015). Distribution within the region is partly a function of environmental characteristics (e.g. depth, tidal stream speed) and several studies have modelled habitat preferences at different spatial scales and identified hotspots. The regions between Ardnamurchan, Coll and the Small Isles, southeast of Barra, northesast of Skye to Gairloch and west of Pairc Peninsula (Isle of Lewis) to Shiant Islands were highlighted by Marubini *et al.* (2009); the Sound of Jura, the Firth of Lorne, the area between Mull and the

Treshnish Islands, and Sound of Sleat were four clusters of predicted high use in the southern Inner Hebrides identified by Embeling *et al.* (2010), while land-based observations around Gairloch demonstrated regular occurrence in the adjacent coastal waters (Dolman *et al.* 2013).

Individuals within this region are part of the West Scotland Management Unit; abundance for the UK portion of the WSMU has been estimated at 19,291 individuals (95% CI 7,771-47,888) (IAMMWG, 2015) and given the large overlap between this region and the UK waters of the MU this estimate is assumed to only partially overestimate regional abundance.

Along with harbour porpoise, white-beaked dolphins are the most abundantly recorded cetacean across this region; they are widely dispersed with a preference for more offshore waters, especially in the northern part of the Minch and west of the other Hebrides (Reid *et al.* 2003, Paxton *et al.* 2014). Sightings are most frequent from June to October.

Bottlenose dolphins (*Tursiops truncatus*) are primarily sighted in small numbers around the Inner Hebrides; sightings are fairly common around Mull, Islay, Tiree and Skye. They have also been reported from the Outer Hebrides, particularly across the Sound of Barra, and occasionally off the west coast of the Outer Hebrides and in the northern entrance to the Minch (Grellier & Wilson 2003, Mandleberg 2006). Bottlenose dolphins in this region appear to have a relatively larger range with a less predictable and more ephemeral distribution than on the East coast (Thompson *et al.* 2011). Presence is throughout the year and earlier photo-identification efforts had suggested a small, possibly resident population to occur in these waters (Grellier & Wilson 2003, Mandleberg 2006). This was confirmed by further dedicated photo-identification surveys in 2006 and 2007 (Thompson *et al.* 2011). Overall, only few bottlenose dolphins use the coastal waters of western Scotland; the best estimate obtained so far is for 2007 with 45 dolphins (95% PI: 33-66) (Thompson *et al.* 2011). They appear to belong to two discrete parapatric communities, one of which appears to be confined to the waters around the Sound of Barra whereas the other ranges much more widely throughout the Inner Hebrides and mainland coasts (Thompson *et al.* 2011).

Risso's dolphins have been recorded throughout much of the region, although sightings are most frequent around the coast of the Outer Hebrides, particularly the northeast coast of Lewis. They are typically observed in small groups of 5-25 individuals, most frequently from June to September. A persistent area of relatively high density has been identified in the region to the North of Lewis/Harris (Paxton *et al.* 2014). Short-beaked common dolphins are observed throughout the year in coastal waters off southwest Scotland and in the Inner Hebrides as far north as Skye. Sightings are most frequent from May to August. Atlantic white-sided dolphins are primarily an offshore, oceanic species. They are occasionally sighted in the coastal waters of western Scotland, with most sightings in the northern Minch and southern Sea of Hebrides. Sightings are most frequent in July and August.

Killer whales sightings are fairly frequent in the Minches and western Scotland, and have been increasing in frequency in recent years. Repeat observations are recorded around many of the islands of the Inner Hebrides; many observations are in the vicinity of seal colonies. They have been reported in most months of the year, with the greatest frequency between May and September.

Minke whales are seasonally present in the Minches and western Scotland, with whales appearing to move south into the area at the beginning of May and remaining present until October, with a peak between July and September; sightings are rare for the rest of the year. During these summer months, they are widely distributed throughout the region. The observed distribution across the Minches has been modeled by Anderwald *et al.* 2012; important predictors of relative minke whale abundance included both fixed environmental parameters (depth, seafloor topography) and those that vary temporally (sea surface temperature and chlorophyll content), while fine-scale foraging behavior around the Small Isles best explained by the strength and direction of tidal currents. The model that best explained minke whale distribution across the whole of the Hebrides was for June, the only month when predicted

sandeel presence was highly significant. Paxton *et al.* (2014) analysed data available in the Joint Cetacean Protocol for this region and identified contiguous, higher than average density areas in the Sea of the Hebrides and south and west of the Hebrides. This species has been regularly sighted throughout western Scotland by land-based observers (HWDT 2006, Dolman et al 2013).

A few individuals of fin and humpback whales are occasionally sighted in the area during summer months. Small groups of pilot whales are also occasionally recorded during summer.

There are several major colonies of grey seals in this region, mainly along the Outer and Inner Hebrides. Latest pup production estimates exceed 12,000 pups during the 2012 breeding season, almost 40% of the total pup production in Scotland (SCOS 2014). Models of marine-usage show moderate-high activity throughout the Minches, especially between Tiree and Skye, as well as south and west of the Outer Hebrides (Jones *et al.* 2015).

This region is particularly important for harbour seals; the latest minimum population estimate of 16,617 (Western Isles and West of Scotland combined) corresponds to 71% of the total Scottish harbour seals population (or 57% of the total UK population). Twenty years ago, this region accounted for about 40% of the Scottish population, but numbers have been on the increase here, while large reductions have been observed elsewhere in Scotland since 2001 (Duck & Morris 2015). Haul-outs are widely distributed and numerous in this area with seals abundant throughout adjacent coastal waters. Models of marine-usage show moderate-high levels of activity throughout the majority of Regional Sea 7 from Skye south to the North Channel; hotspots of activity occur around Mull, Jura, Isla and adjacent coasts, at the entrance to the North Channel, the Sound of Barra and between Skye and North Uist (Jones *et al.* 2015).

A1a.7.12 Features of Regional Sea 8

The waters north and west of Scotland support a rich diversity of marine mammals. Containing a variety of habitats, the region supports species commonly associated with shallower coastal areas, offshore shelf waters, and those occupying the deeper waters of the shelf edge and slope. Ten cetacean species are known to occur regularly in this area: harbour porpoise, white-beaked dolphin, Atlantic white-sided dolphin, Risso's dolphin, bottlenose dolphin, short-beaked common dolphin, killer whale, long-finned pilot whale, sperm whale and minke whale. Large numbers of grey and harbour seals breed in the area, with high densities observed in many coastal waters and some shelf areas further offshore.

Harbour porpoise and white-beaked dolphins are widespread and numerous throughout shelf waters in this region (<200m depth), especially off Shetland and Orkney; minke whales, Risso's dolphins and killer whales are widely distributed during the summer months. For harbour porpoises, offshore areas north of Shetland were identified as high-density areas by Hein... but survey effort was limited to the period 1994-1999; since then survey effort has been low and from SCANS survey it is thought that porpoise numbers may have decreased in these northern areas. From land-based surveys, areas with moderate count rates and predicted likelihoods of occurrence include the coast of north Caithness and around Scapa Flow in Orkney (Evans *et al.* 2015). As depth increases beyond the shelf edge and along the slope, the most commonly sighted small cetacean is by far the white-sided dolphin; harbour porpoises, white-beaked dolphins are encountered but numbers are much reduced and bottlenose dolphins, common dolphins and Risso's dolphins are also observed found (Reid *et al.* 2003, MacLeod *et al.* 2003a, Stone *et al.* 2015a). Deeper water species such as sperm whales, long-finned pilot whales and fin whales most common in the adjacent Faroe-Shetland channel (see Region 9) are also sighted as do killer whales. Sei whales, blue whales, humpback whales and beaked whales also occur in these deeper waters but to a lesser extent.

There are several major as well as minor colonies of grey seals distributed across much of the coastline in Region 8, (including Shetland, Orkney and the Outer Hebrides). The highest concentration is to be found in Orkney where pup production was estimated at 22,926 in 2012 and as many as 7,840 individuals were counted at haul-out sites during August 2013 (approx. 42% of the entire Scottish population) (SCOS 2014). Tagging studies show grey seals to utilise much of the coastal waters along with a considerable proportion of the adjacent offshore areas. Models of marine usage show activity throughout most shelf seas of Regional Sea 8, with greatest activity around Orkney, Shetland, North Rona, the north mainland and west and south of the Outer Hebrides; activity in these areas represents some of the highest in UK waters (Jones *et al.* 2015).

Harbour seals are also widely distributed around most of the coasts of Orkney and Shetland and along the north coast of Scotland and outer Hebrides. There are many important haul-out and breeding sites on these coastlines, several of which contain internationally important numbers. Numbers in Orkney and Shetland have suffered a steep decline over the last 15 years and most recent counts during August surveys are for 3,039 in Shetland and 1,865 in Orkney (SCOS 2014). Seals are abundant throughout coastal waters surrounding these colonies and models of marine usage show greatest activity around Orkney (particularly north), Shetland and west and south of the Outer Hebrides (Jones *et al.* 2014); marine usage in these areas is among the highest in UK waters.

A1a.7.13 Features of Regional Sea 9

The Faroe-Shetland Channel supports a rich diversity and high density of marine mammals. Cetaceans known to regularly occur include: Atlantic white-sided dolphin, bottlenose dolphin, killer whale, long-finned pilot whale, and sperm whale. Beaked whales, common dolphins, Risso's dolphins, and fin, sei and minke whales are also recorded to a lesser extent, while other species of baleen whale such as blue and humpback are occasionally observed. Hooded seals occur to a limited extent, particularly in the north; grey and harbour seals are very uncommon.

Atlantic white-sided dolphins are the most numerous cetacean in the area; they have been observed in all months of the year, with the highest abundance from June to November and a large increase in numbers observed in August. Estimated abundance of white-sided dolphins in waters of the Faroe-Shetland Channel north and west of the Northern Isles during summer 1998 was 74,626 (CV = 0.72) (Macleod 2004a, cited in Murphy *et al.* 2008). Bottlenose dolphin sightings appear to be concentrated around the Wyville Thomson and Ymir Ridges, in the southwest of the Faroe-Shetland Channel. Risso's dolphins (*Grampus griseus*) are occasionally recorded in deeper waters off the shelf slope, including the Faroe-Shetland Channel; Pollock *et al.* (2000) recorded all deeper water sightings between July and December.

Long-finned pilot whales are fairly common in the area, particularly around the 1,000m isobath, and were the second most abundant species of cetacean north and west of Scotland observed by Pollock *et al.* (2000). Acoustic monitoring northwest of the Outer Hebrides in the winter of 1997-1998 detected limited pilot whale presence over the continental slope in waters >600m depth (Lewis *et al.* 1998). Average group size appears to increase between June and September.

Sperm whales are widely distributed and frequently observed in the Faroe-Shetland Channel. Sightings are highest over the 1000m isobath, with animals either on or beyond the shelf slope. Acoustic monitoring northwest of the Outer Hebrides in the winter of 1997-1998 detected sperm whales over a wide area of the continental slope, primarily in waters >500m depth (Lewis *et al.* 1998). Sightings in this area have occurred in most months of the year, with a peak in June. Pollock *et al.* (2000) did not record any sperm whales in February and March; survey effort was

limited during these months, although similarly low effort in November and December did record sperm whales. It can be assumed that these waters represent a migratory route for some portion of the northeast Atlantic population at certain times of the year.

Beaked whales, including northern bottlenose whale and *Mesoploddon* spp., have been recorded throughout much of the Faroe-Shetland Channel; this area may represent an important part of their habitat, but its significance is unknown due to the infrequency of encounters and small numbers of animals observed. *Mesoplodon* spp. have been sighted in most months of the year, with a distinct peak in August. Average group size was approximately 3 individuals. Northern bottlenose whales are thought to migrate north from lower latitudes in spring and return south from polar waters in autumn (Benjamin & Christensen 1979, cited in Pollock *et al.* 2000); peak numbers north and west of Scotland were observed in April and August. However, they have been recorded around the Faroe Islands throughout the year, so some individuals may not migrate. Average group size is approximately 2 individuals.

Pollock *et al.* (2000) observed fin whales in the Faroe-Shetland Channel only between May and October, with a peak in sightings in August. However, acoustic investigations have detected fin whale calls in all months of the year, with whale counts and vocal activity greatest from October to April (Charif & Clark 2000).

Grey seals appear to have only a very limited presence in deeper waters off the shelf edge but sightings have taken place in the Faroe-Shetland Channel (Pollock *et al.* 2000, Stone 2015). McConnell *et al.* (1999) observed a female grey seal tagged on the Farne Islands moving north to Orkney, Shetland, then the Faroe Islands before moving south through deep-waters west of Britain. Animals present in the Faroe-Shetland Channel are likely to be undertaking targeted long-distance movements between haul-out sites, with foraging activity highly unlikely.

Harbour seals tagged on Orkney and Shetland have been occasionally recorded in deeper water beyond the shelf edge northwest of Scotland, including the Faroe-Shetland Channel (Hammond *et al.* 2004); however, their presence in this area is very limited in comparison to adjacent coastal and offshore shelf waters. Pollock *et al.* (2000) only recorded one observation of an harbour seal in the Faroe-Shetland Channel. Models of marine usage show very low activity in the Regional Sea 9 area, suggesting that this is not an important foraging area for harbour seal (Jones *et al.* 2015).

Hooded seals tagged at Jan Mayern, east of Greenland, were recorded making post-breeding trips of an average of 7 weeks duration over large areas of the Greenland and Norwegian Seas, around the Faroe Islands, and deeper waters to the north and west of Scotland (Folkow *et al.* 1996). Pollock *et al.* (2000) recorded several observations of hooded seals in the Faroe-Shetland Channel.

A1a.7.14 Features of Regional Sea 10/11

Knowledge of marine mammal occurrence in the deep waters beyond the shelf slope to the west of Scotland is poor relative to other areas in UK waters. However, available information suggests that this is an important area for cetaceans, with a variety of species and high densities recorded.

These waters are beyond the scope of the SCANS surveys, and while other survey effort is moderate in the northeast corner of Regional Sea 10 the majority of the area has historically poor coverage to approximately 12°W and very little west of that. The most recent and extensive information on cetaceans in this area is provided by the CODA survey, providing a snapshot of the distribution in summer 2007 in offshore waters west of the UK, Ireland, France

and northern Spain. Figure A1a.7.16 shows the distribution of survey strata, effort and sightings of three of the most frequently encountered species.

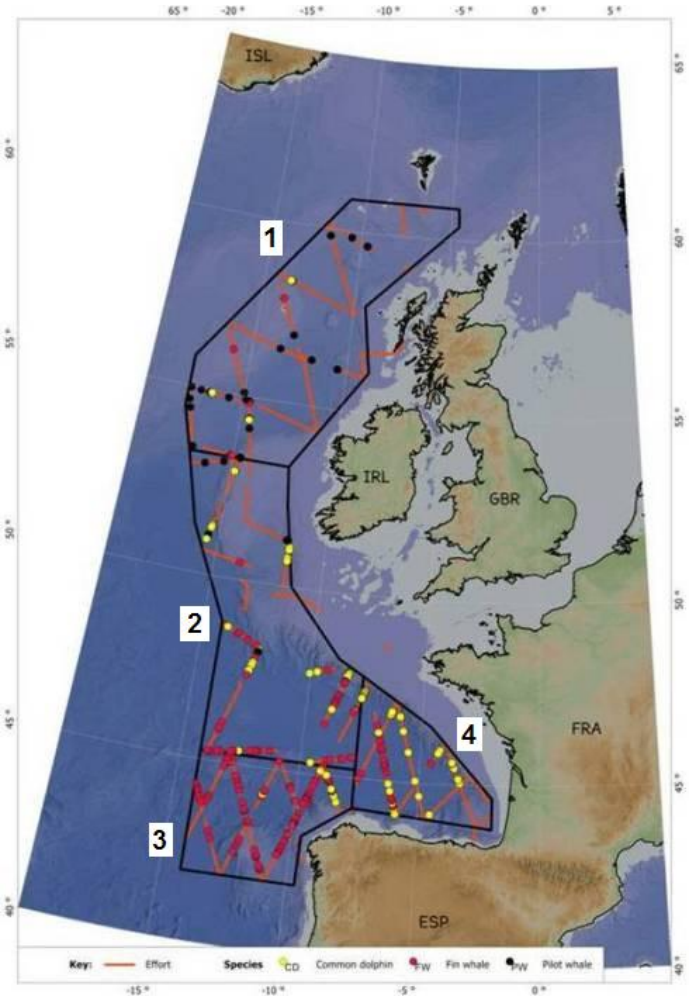
Sightings during the CODA survey amounted to almost 1,500 encounters of seventeen species from all ships combined (Macleod & Hammond 2008). Across the entire survey area, fin whales and common dolphins were the most frequently encountered species. Fin whale observations were greatest in the western Bay of Biscay, while common dolphin observations generally increased towards the south. In waters west of the UK and Ireland, long-finned pilot whales were frequently recorded. Whilst widespread, a greater number of pilot whale encounters were recorded in the Rockall Trough over the southeastern slope of Rockall Bank. Sperm whales were widespread in this area, while many other species were also observed including common dolphin, bottlenose dolphin, Atlantic white-sided dolphin, striped dolphin, beaked whales, minke whale, fin whale and blue whale (Macleod & Hammond 2008). Additionally, acoustic observations from survey vessels detected dolphin click trains throughout the area.

Abundance estimates for summer 2007 derived from the CODA survey for stratum 1 are as follows: bottlenose dolphin 5,709 (CV = 0.35), minke whale 5,547 (CV = 1.03), common dolphin 3,546 (CV = 0.76), beaked whale 3,512 (CV = 0.33), striped dolphin 519 (CV = 1.05), sperm whale 363 (CV = 0.46), fin whale 247 (CV = 0.45) (Murphy *et al.* 2008). Additionally, abundance of large baleen whales (fin, sei and "fin or sei" whales) was estimated as 249 (CV = 0.44).

Previous visual surveys have recorded similar results. Pollock *et al.* (2000) reported long-finned pilot whales to be fairly common in the area, particularly around the 1,000m isobath, while common dolphins and sperm whales were also frequently encountered. A notable difference in occurrence concerns Atlantic white-sided dolphins, which have been reported as widespread and abundant along the continental slope north and west of Scotland (e.g. Pollock *et al.* (2000), Macleod *et al.* 2003b), but which were sighted a relatively low number of times in this area during the CODA survey; abundance was not estimated. However, survey conditions were poor during the CODA survey, particularly in the northern sector (Macleod *et al.* 2008), and therefore sightings are likely to have under-represented the true occurrence of white-sided dolphins during the survey. As mentioned previously, acoustic detections of dolphins were widespread and frequent throughout this area in summer 2007 (Macleod & Hammond 2008). Estimated abundance of white-sided dolphins in waters west of the Outer Hebrides (including an area on and beyond the shelf slope) during summer 1998 was 21,371 (CV = 0.54) (Macleod 2004a, cited in Murphy *et al.* 2008).

Acoustic monitoring of fin, humpback and blue whale calls on the shelf edge and deeper waters north and west of the UK and Ireland showed fin whales to be the most frequently recorded species (Charif & Clark 2009). Fin whale sounds were detected throughout the study area, with peak densities typically occurring in December and January before gradually declining to minimal levels in May and June before increasing again. Patterns of seasonal variation in detection were similar across the study area. Only small seasonal variation in the minimum number of fin whales was detected; there was no evidence of large-scale seasonal migratory movements, although it is noted that acoustic tracking of vocalising individual fin whales is difficult. The highest detection densities occurred in the Rockall Bank area, where the maximum number of fin whales detected simultaneously was twelve.

Figure A1a.7.16: CODA survey sightings of the most frequently encountered species.



Notes: Survey strata (black polygon); ship transects (orange lines); sightings of long-finned pilot whale (black dots), common dolphin (yellow) and fin whale (red). Source: SMRU, St. Andrews, UK.

Blue whales were recorded to a lesser extent in waters north and west of the UK and Ireland. Peak detections occurred between November and December followed by a gradual decline to minimal levels from April to June, before gradually increasing again. This seasonal pattern in detection was similar throughout the study area with the exception of Faroese waters and the central and northern Faroe-Shetland Channel, where detection densities (which were among the lowest recorded) dropped to zero in November and December in most years, when peak levels occurred elsewhere. The maximum number of blue whales detected simultaneously in any one region was nine, recorded in the Rockall Trough area in November 1999. Observations of individually tracked blue whales suggest that most individuals detected during the autumn to winter period are migrating to the south or southwest; the northward migratory route is believed to lie further west in the Atlantic (Charif & Clark 2008).

Humpback whales were the least frequently detected species in waters north and west of the UK and Ireland. Vocalisations were recorded only from mid-October to late March. While recorded throughout the study area, detections were rare south of approximately 52°N. The maximum number of humpback whales detected simultaneously in a region was six, recorded between the Faroe Islands and Iceland in December 1996. Groups of singing humpbacks were tracked moving into the study area from the north and travelling on generally south-westerly courses. No corresponding northward migration was detected (Charif & Clark 2008).

Very few records exist of grey or harbour seal occurrence in deep waters west of the UK beyond the continental shelf. Extensive study of grey and harbour seal distribution at sea has revealed greatest activity to occur in coastal waters around colonies and offshore shelf areas suitable for foraging (Matthiopoulos *et al.* 2004; Sharples *et al.* 2008, Jones *et al.* 2015). Sightings in this region are very rare also for the deeper diving hooded seal

A1a.7.15 Evolution of the baseline

Significant change has been documented in many aspects of the UK marine environment over the past few decades and beyond, likely due to an array of factors including climatic influences, nutrient inputs and anthropogenic factors such as fishing (e.g. Clark & Frid 2001). Some of the most notable and widespread trends observed include rising air and sea temperatures (Berry & Kent 2008, Holliday *et al.* 2008); increased phytoplankton abundance and an increase in the ratio of dinoflagellates to diatoms (e.g. Leterme *et al.* 2006); strong biogeographical shifts in many zooplankton assemblages, with a northward extension of warm-water species associated with a decrease in the number of colder-water species (Beaugrand *et al.* 2002); changes in spatial presence of many epibenthic species, particularly in the southern North Sea (Callaway *et al.* 2007); changes in the distribution and abundance of fish species, with southern species becoming more prominent (Heath *et al.* 2012), and increased abundance of scavenging seabirds (e.g. Camphuysen & Garthe 2000).

Such ecosystem-wide changes are likely to influence marine mammals in a variety of ways. Evans & Bjørge (2013) provide an up-to-date review of the effects of climate change on marine mammals, with specific reference to the UK. They acknowledge that responses, both at individual and population levels, of marine mammals to climate change remain poorly understood, while any predictions are largely speculative and unsubstantiated by unequivocal evidence. Potential impacts which have been suggested to date include range shifts, changes in physical habitat, changes to food webs and increased susceptibility to disease and contaminants.

Range shifts in marine mammals have been reported in the Northeast Atlantic, and these have been linked to increasing sea temperatures. Changes in species distribution, using future climate scenarios, have been predicted based on species habitats and thermal niche modelling: cold water-limited species risk northwards range contractions (e.g. white-beaked dolphin) while warm water-limited species will expand range into the UKCS (e.g. striped dolphin) (Lambert *et al.* 2014). However, the mechanisms causing those changes remain uncertain, and for some species, it is difficult to differentiate between short-term responses to regional resource variability and longer-term ones driven by climate change. While marine mammals are warm-blooded and generally target a wide range of prey, their distributions often fall between particular sea temperature boundaries which reflect the range preferences of their major prey organisms (Evans *et al.* 2008). Increasing temperatures and greater presence of southern fish species in the central and northern North Sea may lead to an increasing occurrence of southern marine mammal species. This could also cause species with affinities for cooler waters to undergo a northward shift in distribution (MacLeod *et al.* 2008). Additionally, prey distribution and abundance can show considerable variation in response to fisheries exploitation; this is likely to have knock-on effects on marine mammals which predate on the exploited fish populations.

A1a.7.15.1 Cetaceans

As data on cetaceans' abundance are typically few and often characterised by considerable uncertainty and both seasonal and spatial gaps, the identification of trends is very difficult. It is even more difficult to establish any causes of potential trends. There are currently no monitoring schemes for any offshore cetacean populations in UK waters that would be capable

of detecting even large changes in population levels (Murphy *et al.* 2008). Systematic SCANS-type surveys provide the best opportunity to monitor cetacean abundance over time but even then, statistical power in assessing trends for most species is very poor if surveys are carried out only once every ten years. For example, the ICES working group on Marine Mammal Ecology (ICES WGMME 2014) reported that the power of decadal SCANS surveys to determine a 30% decline over three generations (corresponding to IUCN definition of 'vulnerable') is 57% for harbour porpoise and <50% for all other species. The frequency of surveys needs to increase if changes are to be detected with a reasonable degree of confidence; every 5 years may be sufficient for harbour porpoise and every 3 years for minke whale, common dolphin and white-beaked dolphins.

Comparison between SCANS I and II surveys has been instrumental in providing evidence for the distributional shift in the North Sea as discussed above, but the ecological reasons for this remain uncertain. There has been some speculation that the apparent shift in harbour porpoise abundance from the northern to southern North Sea may be due to a shortage of sandeels, a known prey item, with some suggestions of a recent increase in starvation observed amongst porpoises stranded in Scotland (MacLeod *et al.* 2007), although it is also argued that there is little evidence to support this (Thompson *et al.* 2007).

There is greater understanding of trends in abundance and distribution for the populations of bottlenose dolphins occurring in Cardigan Bay (and wider Welsh coast) and the Moray Firth (and wider Scottish east coast), which have been the subject of targeted research and monitoring for many years. However, these abundance estimates are still subject to considerable uncertainty and highly variable between some years; continued support for these time-series is required to detect trends with statistical confidence (ICES WGMME 2014).

From acoustic monitoring of fin, humpback and blue whale calls in deeper waters north and west of the UK and Ireland, considerable inter-annual variations were observed in the patterns of detection densities over the period 1996-2005. Further data analyses over a longer time series will be necessary before statistically robust conclusions may be drawn (Charif & Clark 2008).

However, change in population size is only one of the parameters that can be used to monitor the well being of a population. Data on fecundity, disease prevalence and tissue contamination are also regularly collected as part of the UK Cetacean Stranding Investigation Programme (see also sections on Environmental Issues). For example, Murphy *et al.* (2015) estimated reproductive parameters for harbour porpoises and compared them with other populations; they found that in UK waters pregnancy rate (50%) were lower and average age attained at sexual maturity was higher (1.92 yrs) compared to those in the North-west Atlantic (72-90%, 3.2yrs) and Iceland (98%, 3.2yrs).

The latest assessment of conservation status for cetaceans in UK waters was provided as part of the UK Government reporting for Article 17 of the Habitat Directive (JNCC 2013); status was assessed as favourable for all the species were data were sufficient to make an assessment (harbour porpoise, bottlenose dolphin, short-beaked common dolphin, Atlantic white-sided dolphin, white-beaked dolphin, minke whale and fin whale). The data were insufficient for Risso's dolphin, long-finned pilot whale and killer whales.

A1a.7.15.2 Seals

Due to the greater ease with which seals can be studied, data on their distribution and abundance are more complete. The UK seal monitoring programme, run by the Sea Mammal Research Unit (SMRU) at the University of St. Andrews, has been on-going since the early 1960s. While abundance estimates are often subject to considerable uncertainty, data are of

sufficient quality and temporal coverage for larger magnitude changes and trends to be identified and interpreted (SCOS, 2014).

The most recent estimate of grey seal population size provide some evidence that in the UK as a whole numbers are stables after several years of continued increase. Average annual change in pup production for major colonies since 2001 are provided in Table A1a.7.2; with the exception of some central North Sea colonies (including Donna Nook, Blakeney Point and Horsey), where pup production is still increasing exponentially, numbers are stabilising. The overall conservation status for this species is thus favourable (JNCC 2013).

Results from aerial survey counts of harbour seals by UK survey regions are provided in Table A1a.7.3. The negative trend in harbour seal populations previously reported (Lonergan *et al.* 2007) has continued throughout several major colonies in Britain, especially in Orkney (down 78% between 2000 and 2013), Shetland (down 30% between 2000 and 2009) and Firth of Tay (down 93% between 2000 and 2013). Other regions have largely being maintained at stable levels (West coast and Outer Hebrides). Outbreaks of PDV in 1988 and 2002 were responsible for considerable declines in harbour seals on the east coast of England (Thompson *et al.* 2005), but caused only low mortality in Scottish colonies in 1988 and virtually none in 2002 (SCOS 2007). In Southeast England, numbers have increased since and recovered to pre-epidemic levels by 2012; the latest count (2013) was comparable to 2012 (SCOS 2014). The overall assessment of conservation status for the harbour seal is bad (JNCC 2013).

A1a.7.16 Environmental issues

A1a.7.16.1 Underwater noise

Marine mammals are sensitive to noise in the marine environment. Their extensive use of sound for communication, prey capture, predator avoidance and probably navigation, and the possession of large gas-filled organs make them vulnerable to both disturbance and physiological damage from underwater noise of sufficient magnitude. Identifying these effects, and the levels of sound which may induce them, continues to be subject of considerable research; extensive reviews are provided by Richardson *et al.* (1995), Nowacek *et al.* (2007), Southall *et al.* (2007), OSPAR 2009 and Finneran (2015). Additionally, reviews of marine mammals in UK waters in contribution to previous SEAs have addressed the issue of noise (e.g. Hammond *et al.* 2006, 2008).

Many human activities introduce sound into the marine environment, e.g. shipping, ice breaking, oil and gas exploration and development, renewable energy development, sonars and explosions; some of these sounds are extremely intense. Anthropogenic noise is often of low to mid frequency and may propagate well to be detectable at substantial ranges from the source. Recent technological developments have introduced many new sources of noise in offshore waters. Those typically of greatest concern to marine mammals, and marine fauna in general, are those producing the most intense sound pressure levels: seismic exploration, underwater explosions, sonar (particularly naval), pile-driving and some acoustic harassment devices (AHDs). However, less intense noise sources such as shipping are also of concern due to their persistent nature and long-range of audibility. Shipping is the dominant noise source at low frequencies in most locations, and its contribution to increased ambient noise levels has been considerable in recent decades.

Many of the activities assessed in the current SEA introduce noise potentially capable to cause damage and/or disturbance to marine mammals; the reader is referred to Section 5 of the Environmental Report where detailed information on the characteristics of underwater noise and the potential effects on marine mammals are given.

A1a.7.16.2 Contaminants

Marine mammals are exposed to a variety of anthropogenic contaminants, primarily through the consumption of prey. As top predators, they are at particular risk from contaminants which biomagnify through the food chain (i.e. are found at increasing concentrations at higher trophic levels). Most research has focussed on two main groups of contaminants: the persistent organic pollutants (POPs) and the heavy metals. POPs are extremely toxic substances for environment and human health; they are man-made compounds produced by industry for a wide variety of applications (i.e. pesticides, insecticides, flame redardants) or as by-product from industrial or combustion processes (i.e. PAHs). Several of these compounds (i.e. PCBs, DDT) have been banned but since they are highly stable, and resistant to metabolic degradation, they continue to persist in the environment long after their use is interrupted. They accumulate in fatty tissues, and are often found in high concentrations in the blubber and livers of marine mammals. For many compound groups (i.e. perfluorinated compounds, organochlorine pesticides and butyltins) temporal trends are downwards. In contrast, PCBs (controlled since 1980s) earlier downward trends appear to have stalled from 1998 onwards (Law 2014); concentrations in UK-stranded harbour porpoises are still reported to be on average above the threshold level for adverse health effects (Murphy *et al.* 2015). The use of organophosphorus flame retardant (PFRs) compounds is likely to be on the increase, but current levels do not suggest a high level of concern and routine monitoring is not warranted (Papachlimitzou *et al.* 2015). POPs may affect the reproductive, immune and hormonal systems; high concentrations of PCBs in harbour porpoises have been linked to increase susceptibility to disease (Jepson *et al.* 2005, Hall *et al.* 2006, Pierce *et al.* 2008), to parasite burdens (Bull *et al.* 2006) and to reproductive failure (Murphy *et al.* 2015). A negative trend in POP concentration was reported also for common dolphins bycaught in fisheries off the SW coast of the UK from 1992 to 2006; nonetheless 72% of the dolphins analysed (n=43) had blubber PCB concentrations above the toxicity threshold level (Law *et al.* 2013). Geographical differences in contaminant load has been demonstrated by Pierce *et al.* (2008) in the blubber of female common dolphins and harbour porpoises stranded on the Atlantic coast of Europe from 2001-2003. Harbour porpoises stranded on the Scottish coast showed lower concentrations of PCBs than those from the southern North Sea coast, although were still above the threshold for effects on reproduction in a third of animals; the lowest levels of POPs were generally recorded in animals stranded on the Irish and Galician coasts. For common dolphins, those stranded along the French and Galician coasts had significantly higher concentrations of PCBs than those in Ireland. Fish are good metabolisers of PAHs, therefore fish-eating marine mammals commonly exhibit lower levels of PAHs than those feeding primarily on cephalopods, small crustaceans and plankton. Both cetaceans and seals contain enzyme systems which can detoxify PAHs, although this process itself may release new toxic substances within the animal. While short-term acute exposure to PAHs has been shown to cause damaging effects to marine mammals, little is known of the effects of long-term chronic exposure.

Cadmium, lead, zinc and mercury are the heavy metals of greatest concern in marine mammals (Hammond *et al.* 2006). They are frequently present in the highest concentrations in the liver, kidney and bone, with levels varying considerably with the geographic location of the species. Marine mammals are able to produce certain proteins (metallothioneins) which can sequester certain metal ions into less toxic complexes; this enables many species to cope with relatively high dietary exposures to certain metals. Whilst there are few studies that show major impacts of heavy metals, it is possible that they may have combined effects as they often co-occur with the persistent organic contaminants. Higher hepatic metal concentration was reported from harbour porpoises which had died from infectious disease compared to healthy porpoises (died from physical trauma) in strandings along the Southern North Sea and Bay of Biscay (Mahfouz *et al.* 2014). Heavy metal concentrations were determined for common dolphins as part of the 2008 mass stranding investigation: for all adults, levels were found to be lower when compared to samples taken from strandings in 1990-1992 (Jepson & Deaville 2009).

Direct mortality of marine mammals from exposure to oil spills has rarely been reported, and has usually only been observed in major oil spills such as the *Exxon Valdez* in Alaska in 1989 (Hammond *et al.* 2006). Unlike seabirds, they generally rely on blubber for insulation, so are less vulnerable to fouling from oil. Grey seal pups are the most vulnerable to oil fouling, as these rely on their thicker fur for insulation during the first few weeks of their life before developing blubber and moulting into a sea-going coat; they are also restricted to their breeding colony until they are weaned. A direct threat to marine mammals from oil slicks is the exposure to the volatile and aerosolized petroleum-associated compounds that evaporate from the surface of a slick at sea within the first few days. Both seals and cetaceans typically inhale just above the surface of the water, so any animal surfacing in a fresh slick is likely to inhale vapours. Symptoms from acute exposure to volatile hydrocarbons include irritation to the eyes and lungs, lethargy, poor coordination and difficulty with breathing; individuals may then drown as a result of these symptoms (Hammond *et al.* 2006). Sub-lethal and/or chronic effects of this type of exposure have been described in a coastal population of bottlenose dolphins in the Gulf of Mexico, following the Deepwater Horizon explosion in 2010; a higher than normal proportion of dolphins was found to be in poor condition, with teeth loss, pulmonary and haematological abnormalities (Schwacke *et al.* 2013).

The rapid and catastrophic decline of otters across much of the UK and Europe from the 1950s-1970s has been linked with, among other factors, an increase in the levels of certain contaminants, especially organochlorine pesticides (e.g. Jefferies 1989). Sufficient levels of such contaminants in vertebrates cause lethal and sub-lethal detrimental effects; contaminants entered water systems and accumulated in the tissues and organs of otters through the consumption of contaminated prey. The most significant declines in otters were observed in the southeast of England and the Midlands. Coastal otter populations were generally exposed to lower levels of contaminants, and did not experience such catastrophic declines. Recovery has taken place once pesticide practices changed.

A1a.7.16.3 Disease

It is well known that marine mammals harbour large numbers of macroparasites, such as nematodes and cestodes as well as various ectoparasites (Hammond *et al.* 2006). However, these parasites do not usually cause severe harm unless the animals are suffering from an underlying primary disease or are stressed for other reasons. Outbreaks of viral and bacterial disease epidemics have occurred among seals and cetaceans worldwide; these appear to have increased in frequency in recent years, particularly in the U.S. (e.g. Harvell *et al.* 1999). In addition to high profile, large-scale epidemic diseases, marine mammals are also known to suffer from a range of viral and bacterial infectious diseases. A range of organisms has been cultured from healthy and sick marine mammals; many are secondary infections in malnourished and starving animals, particularly juveniles.

In UK and European waters, harbour seals suffered from major epidemics of PDV, a morbillivirus, in 1988 and again in 2002. The greatest mortality was observed on the English east coast, with 50% and 22% population declines respectively (Thompson *et al.* 2005); mortality in most Scottish colonies was low in 1988 and virtually zero in 2002 (SCOS 2007). The main cause of death from PDV is often secondary bacterial infection due to a weakening of the immune system; in the 1988 outbreak, *Bordetella* organisms were isolated from a large proportion of the sick animals but not found in healthy individuals (Munro *et al.* 1992, cited in Hammond *et al.* 2006). While PDV infection has been observed in grey seals, no substantiated fatal cases have been observed; it is believed that grey seals may act as carriers of the virus (Pomeroy *et al.* 2005; Hall *et al.* 2006).

Morbilliviruses (MV) are also observed in cetaceans, including harbour porpoises and dolphins where they are commonly referred to as PMV and DMV respectively. DMV caused mass

mortality in Mediterranean striped dolphins in 1990 and US bottlenose dolphins in 1987. A survey of stranded animals of different cetacean species in Europe indicated that infections with DMV and PMV-like morbilliviruses are not uncommon (Visser *et al.* 1993). Post-mortem investigations of 89 porpoises found dead along the coasts of England and Wales revealed 37 individuals to have died of infectious diseases caused by parasitic, bacterial, fungal and viral pathogens (most frequently pneumonia caused by lungworm and bacterial infections) (Bennet *et al.* 2001). The remaining 49 animals were described as healthy before having suffered some form of physical trauma, most commonly entrapment in fishing gear.

Bottlenose dolphins occurring in the Moray Firth show a high prevalence of skin lesions (Wilson *et al.* 1997). This has been suggested to be caused by environmental conditions impacting skin integrity or increasing physiological stress, potentially making animals more vulnerable to natural infections or anthropogenic factors (Wilson *et al.* 1999).

Anthropogenic pathogens are largely found in marine mammals from effluents of untreated sewage or from facilities which contain domestic animals. For example, up to 11.8% of grey and harbour seals taken into rehabilitation centres on the east coast of England tested positive for *Salmonella* (Baker *et al.* 1995 cited in Hammond *et al.* 2006).

A1a.7.16.4 Bycatch

The accidental capture of marine mammals in fishing gear (bycatch) remains an issue of concern throughout European waters and beyond. In UK waters, the two main species affected by fishing are the harbour porpoise and the short-beaked common dolphin; Region 4 is the main area of concern.

Since 1995 when the UK Bycatch monitoring Scheme was established, the SMRU has been carrying out work towards determining bycatch rates of marine mammals in several fisheries in UK waters in support of the UK Government in meeting obligations under Council Regulation 812/2004 and under the Habitats Directive. Monitoring takes place regularly across a variety of fisheries and coverage has been extended from the North Sea, to West of Scotland and the Southwest, where most of the monitoring effort is currently concentrated. In addition to monitoring and reporting, work is undertaken to improve mitigation measures (Northridge *et al.* 2011).

In the North Sea, the primary gear types that have been associated with marine mammal bycatch are set nets such as gill and tangle nets (Hammond *et al.* 2002a). Harbour porpoises are predominantly bottom feeding, and therefore particularly vulnerable to set bottom nets. The major fishing fleets involved in bottom set gillnetting and tangle netting in the North Sea are from Denmark, the UK and Norway, with lesser effort from Belgium and Germany. The latest advice by ICES has evaluated the total annual bycatch of harbour porpoises in set net fisheries in the North Sea (including Divisions VIId and IIIa) to range between 1235 and 1990 animals (lower and higher 95% CI); using the abundance from SCANS II, these estimates equate to a mortality of 0.54% to 0.88%. This is below the 1.7% limit established by ASCOBANS but caution is required as many caveats apply to the range of by-catch estimates due to effort data reliability and the potential for biases in the observation data (ICES website). By-catch has been decreasing. The smaller UK fleet is estimated to take around 500 porpoises per year (Northridge *et al.* 2011). UK gill and tangle net fisheries operate predominantly in coastal waters, in the central southern North Sea and to the west of Shetland.

Bycatch of other Atlantic white-sided and white-beaked dolphins has also been reported in the North Sea but much more rarely (ICES WGBYC 2015). Some by-catch mortality of bottlenose dolphins associated with illegal salmon nets has been observed in Scotland (Thompson *et al.* 2004).

Bycatch levels in the Celtic Sea and Western Channel area are relatively high in comparison to other areas around the UK, due to the presence of large amounts of gillnetting and high densities of harbour porpoise and common dolphin (Hammond *et al.* 2008). ICES latest estimate for bycaught porpoises from setnets across the Celtic and Irish Sea is for 1137-1472 (lower and higher 95% CI); this corresponds to a mortality of 1.07% to 1.39% with respect to the best estimate of abundance in 2005. Mortality in UK set net fisheries in this region are likely to be in the mid to high hundreds of animals per year (Northridge *et al.* 2011). Common dolphins seemed particularly vulnerable to bycatch in pelagic pair trawls targeting bass in the winter months, when common dolphin densities are at a peak. Total mortalities in UK bass pair teams peaked at over 400 animals in the 2003-2004 winter, but have since declined following strict management measures; as of 2014 this fishery is effectively ended on UK vessels (Northridge *et al* 2015). In the Western Channel, striped dolphins have also been recorded as bycatch (ICES WGBYC 2015).

Since 2005, in accordance with European Council Regulation (EC) 812/2004, it has been mandatory for vessels over 12m involved in specified fixed gear fisheries (bottom-set gillnet or entangling net) in the North Sea to use acoustic devices ("pingers") attached to fishing gears. These are designed to deter cetaceans with a view to reducing bycatch and guidance for their use has been produced by the Marine Monitoring Organisation (https://www.gov.uk/guidance/reduce-dolphin-and-porpoise-by-catch-comply-with-regulations). The regulation also requires the monitoring of by-catch of vessels ≥15m by on board observers in specified fisheries. Since its introduction, a number of weaknesses have been identified; it is not necessarily targeted at the right fisheries or in the right areas and it relies heavily on use of acoustic deterrent devices to mitigate bycatch. Further review of this regulation is expected by end 2015 (ICES WGBYC 2015).

Hall *et al.* (2001) used the SMRU seal tagging database to estimate the minimum level of seal mortality from tags returned from seals found in fishing gear. They estimated that a minimum of around 2% of all seals tagged were subsequently killed in fishing gear, and it is thought that most of this mortality is in gill and tangle nets. The latest UK report estimated a total of 469 seals from net fisheries across the UK, thought to be predominantly grey seals (ICES 2015). While not strictly bycatch, fishery-related mortality of seals occurs due to the shooting of seals which interfere with fishing and aquaculture operations. Since the Marine (Scotland) Act 2010 (Section 6) came into force, the killing of seals has been strictly regulated under license and much effort has been made to develop effective non-lethal measures. In 2014, Marine Scotland granted 53 licenses seals for a maximum of 765 grey seals (across all seal management areas) and 240 common seals (no license granted in East Coast); the actual number of seals reported shot were much lower (164 grey and 41 harbour seals) (Marine Scotland, 2015).

A1a.7.16.5 Collision

Another potential source of mortality to marine mammals, primarily cetaceans, may be through collisions with vessels. In other parts of the world, whales are occasionally reported to be struck and killed, especially by fast-moving ferries. Smaller cetaceans can also be impacted by propeller strikes from smaller vessels. In areas where cetacean numbers are depleted and vessels are numerous, ship-strike mortality can be a serious cause for concern. In the UK certain areas experience very high densities of commercial and recreational shipping traffic, some of which may be frequented by large numbers of marine mammals; despite this, relatively few deaths are recorded as results of collisions (Hammond *et al.* 2008). Between 2000 and 2009, only 11 out of 1100 post-mortems on harbour porpoises and common dolphins identified collision as the cause of death (UKMMAS, 2010). Increase in recreational use of coastal areas, including dolphin watching activities, pose the potential to increase the risk of collision and disturbance; code of conducts have been produced.

Since 2008 several dead seals with corckscrew injuries (>76 animals) (Bexton *et al.* 2012) were found on beaches; at first, in the absence of any evidence of predation, concern was raised of the potential for ship propellers, in particular those using ducted propulsion systems, to cause such injuries (Onoufriou & Thompson, 2014). Most recently however, evidence for predation by adult grey seals as the cause of such spiral-cut injuries has been obtained both on yound harbour seals in Germany and on grey seal pups on the Isle of May (van Neer *et al.* 2015, Thompson *et al.* 2015). It is now considered highly unlikely that the use of duct propeller vessels should pose any increased risk over and above normal shipping activities (SNCBs interim advice 2015).

The installation of wave and tidal energy devices creates a potential collision risk for marine mammals (Wilson *et al.* 2007). Several studies have investigated the use of tidal-stream environments by marine megafauna (see review by Benjamins *et al.* 2015). In many cases, high tidal stream speed has been linked to increased habitat usage; for example harbour porpoises in the Minches and Wales (Marubini *et al.* 2009, Pierpoint 2008) and bottlenose dolphins in the inner Moray Firth (Mendes *et al.* 2002). This result however is far from ubiquitous and higher abundance in low tidal currents has also been observed (Embling *et al.* 2010). Consequently, site specific studies are important when assessing risk at a specific location. For example, the tidal narrows of the Sound of Islay and the Kyle Rhea were surveyed specifically to determine how often harbour porpoises occurred in these areas of immediate interest for tidal-stream development (Wilson *et al.* 2014); while porpoises were seen and detected in both areas, they were an order of magnitude less abundant than in surrounding waters. In addition to area usage, several research projects are being undertaken on the behaviour of marine mammals to gather a better understanding of how they perceive and avoid tidal and wave energy devices. High resolution GPS/GSM tags are the tool of choice for monitoring seal movements but other methodologies are also being developed including hydrophone arrays for Passive Acoustic Monitoring and active sonar (McConnell *et al.* 2013). Sparling *et al.* (2013) observed that while no marine mammal collision at any tidal device had yet been reported, an effective methodology able to detect collision still needs to be demonstrated in the field.

On land, collisions between otters and motor vehicles can be a cause of considerable mortality (e.g. Kruuk & Conroy 1991, Philcox *et al.* 1999). In a study of patterns of otter road mortality in Britain, Philcox *et al.* (1999) identified coastal roads and those running alongside rivers in steep valleys a particular problem; especially coastal roads in the vicinity of freshwater streams. However, investigations of otter mortality in Shetland suggested food shortage to be the most common cause of death; high proportions of recorded deaths attributable to road mortality was believed to be an artefact of sampling methods (Kruuk & Conroy 1991).

Bat mortality has been reported around terrestrial wind turbines worldwide (e.g. Barclay *et al.* 2007, Arnett *et al.* 2008), with mortality most commonly associated with species migrating long distances (Kunz *et al.* 2007). Due to their excellent ability to detect moving objects through echolocation, their relatively high mortality at wind farms is surprising, and possible reasons for this have been the topic of much debate (Kunz *et al.* 2007, Baerwald *et al.* 2008). While direct collisions do occur, recent evidence has suggested barotrauma resulting from exposure to pressure differences in the vicinity of turbine blades to be a significant cause of death (Baerwald *et al.* 2008). Information on interactions between bats and offshore wind turbines is almost completely lacking. Ahlen *et al.* (2007) monitored bat behaviour around offshore wind farms in the Baltic and Kattegat; bats were observed foraging in close proximity to the turbines, feeding on accumulations of flying insects. However, no mention is made of observed collisions between bats and turbines.

A1a.7.16.6 Other issues

Plastic litter has been identified as an increasing anthropogenic pressure in the marine environment (OSPAR, 2009). It is argued that the main problem is with discarded fishing gear which can result in entanglement and death of cetaceans and seals (UKMMAS 2010, OSPAR 2009). Ingested plastics have been identified in the stomachs of several species of marine mammals but there is little or no evidence of a pathological effect (UKMMAS 2010).

A1a.7.17 Conservation frameworks

A wide range of international treaties and conventions, European directives and national legislation apply to the protection and conservation of marine species and habitats in the UK as outlined in Appendix 1j and Appendix 2. Many of these are directly relevant to the protection of marine mammals, otters and bats.

A1a.7.17.1 International

All species of cetacean, the European otter (*L. lutra*) and bats are listed on Annex IV (Animal and Plant Species of Community Interest in Need of Strict Protection) of the EU Habitats Directive[4]. Under Annex IV, the keeping, sale or exchange of such species is banned as well as deliberate capture, killing or disturbance[5]. Grey and harbour seals are listed on Annex V (Animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures). The harbour porpoise, bottlenose dolphin, grey seal, harbour seal and otter are also listed in Annex II of the Habitats Directive. Member countries of the EU are required to consider the establishment of Special Areas of Conservation (SACs) for Annex II species. The purpose of the Habitat Directive is to achieve and maintain the favourable conservation status of the habitat and species it lists; the assessment of conservation status does not only relate to that component of a species population that is within SACs but to the totality of the species throughout its range. This is particularly important with wide ranging and migratory species as marine mammals and cetaceans.

The Marine Strategy Framework Directive covers all marine biodiversity; among the indicative list of characteristics to be used in the assessment of Good Environmental Status (GES) given in Table 1 of Annex III of the Directive, reference is made to 'population dynamics, natural and actual range and status of species of marine mammals'. This has been further interpreted and a set of listed species has been produced for the North-East Atlantic region (OSPAR 2012). The UK has proposed a set of indicators under Descriptor 1 and 4 based on the five most common species of cetacean (harbour porpoise, bottlenose dolphins, common dolphins, white-beaked dolphins, minke whales) as well as on grey and harbour seals (DEFRA 2012).

The OSPAR Convention covers all marine biodiversity of the North-East Atlantic and cetaceans and seals are two of eight marine biodiversity components identified for assessment purposes. In addition, the harbour porpoise, blue whale and northern right whale are listed on the OSPAR list of threatened and/or declining species and habitats in the North-East Atlantic; these species are in need of protection in the North-East Atlantic and are the focus of regular assessments and further priority setting for conservation under Annex V of the OSPAR Convention.

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[4] *Council Directive 92/43/EEC on the conservation of natural habitats of wild flora and fauna*

[5] The definition of disturbance in Scotland is slightly different from elsewhere in the UK. To help avoid or minimise the risk by activities in the marine environment to kill, injure or disturb European Protected Species, guidance has been prepared by JNCC, Natural England and Countryside Council for Wales (2010), relevant to for the marine area in England and Wales and the UK offshore marine area and by Marine Scotland (2014) for Scottish inshore waters.

The UK has been a signatory to the Convention on the Conservation of Migratory Species (The Bonn Convention) since 1985. States are required to enter into agreement to protect migratory species throughout their entire range. ASCOBANS (Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas) was set up under the auspices of The Bonn Convention and came into force in March 1994. Under ASCOBANS, provision is made for protection of specific areas, monitoring, research, information exchange, pollution control and heightening public awareness. Measures cover the monitoring of fisheries interactions and disturbance, resolutions for the reduction of bycatch in fishing operations, and recommendations for the establishment of specific protected areas for cetaceans. Additionally, an agreement on the Conservation of Bats in Europe (EUROBATS) under the auspices of the Bonn Convention is in force, and all European bats are listed under Appendix II of the Convention.

Minke, fin, humpback, blue and northern bottlenose whales, along with otters (*L. lutra*) are all listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). These animals are classified as threatened with extinction; CITES prohibits international trade in specimens of these species for commercial purposes. Additionally, all cetaceans are listed under Appendix II of CITES; these animals are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. However, all cetaceans and otter (*L. lutra*) are listed on Annex A of the EU Wildlife Trade Regulations[6] and are therefore treated by the EU as if they were on CITES Appendix I, thus prohibiting commercial trade (Murphy *et al.* 2008).

The International Union for Conservation of Nature (IUCN)'s Red List of Threatened Species 2008 provides assessments of the conservation status of animals that have been globally evaluated using the IUCN Red List Categories and Criteria, with the aim of determining their relative risk of extinction. Where sufficient information exists, the majority of marine mammal species occurring in UK waters fall into the lowest category of 'least concern'. The Nathusius' pipistrelle bat is also described as 'least concern'. Otters (*L. lutra*) are in the next higher category of 'near threatened'. Of higher extinction risk are the 'threatened' categories: 'vulnerable', 'endangered' and 'critically endangered'. Sperm whale and hooded seal are described as 'vulnerable', while fin, sei, blue and the Northern right whales are listed as 'endangered'. 'Data deficient' species where assessment is precluded by insufficient information include killer whale, long-finned pilot whale, northern bottlenose whale and beaked whales of the genus *Mesoplodon*.

A1a.7.17.2 United Kingdom

In the UK, all species of cetaceans, bats and otter (*L. lutra*) are protected under Schedule 5 of the *Wildlife and Countryside Act 1981*[5] (WCA 1981) and the *Wildlife (Northern Ireland) Order 1985*. Under WCA 1981, it is an offence (subject to exceptions) to intentionally kill, injure, or take, possess, or trade in any wild animal listed under Schedule 5, and prohibits interference with places used for shelter or protection, or intentionally disturbing animals occupying such places. Amendments to the WCA 1981 in Scotland by the *Nature Conservation (Scotland) Act 2004* made it an offence to intentionally or recklessly disturb a cetacean. Additionally, whaling is illegal under the *Fisheries Act 1981*.

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[6] *Council Regulation (EC) 338/97 on the protection of species of wild fauna and flora by regulating trade therein*

[5] The Wildlife and Countryside Act (as amended) implements the Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention) which entered into force in 1982.

The *Conservation (Natural Habitats, &c.) Regulations 1994* (as amended) implements the EU Habitats Directive in the UK. Amendments to the Conservation Regulations in England and Wales, followed by the introduction of the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (implementing the Habitats Directive beyond 12nm), have revised the definition of deliberate disturbance of European Protected Species (those listed on Annex IV of the Habitats Directive). The *Conservation of Habitats and Species Regulations 2010* consolidate all the various amendments made to the *Conservation (Natural Habitats, &c.) Regulations 1994* in England and Wales. In Scottish waters to 12nm, the EU Habitats Directive is transposed through a combination of the *Conservation of Habitats and Species Regulations 2010* and the *Conservation (Natural Habitats, &c.) Regulations 1994*, which was amended specifically for Scotland (2004, 2007, 2008 (twice), 2011 and 2012) to include the 12nm limit. The *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) implement the EU Habitats Directive for all oil and gas activities within the UK Continental Shelf. Under these regulations, any company wishing to carry out a seismic survey must apply for consent, which, if granted, must be carried out in accordance with the Joint Nature Conservation Committee (JNCC) guidelines for minimising acoustic disturbance to marine mammals from seismic surveys (JNCC 2010).

The *Grey Seal (Protection) Act 1914*, provided the first legal protection for any mammal in the UK because of a perception that seal populations were very low and there was a need to protect them. In the UK seals are protected under the *Conservation of Seals Act 1970* (England, and Wales), the *Marine (Scotland) Act 2010* and the *Wildlife (Northern Ireland) Order 1985*. The *Conservation of Seals Act* prohibits taking seals during a close season (01/09 to 31/12 for grey seals and 01/06 to 31/08 for harbour seals) except under licence issued by the Marine Management Organisation (MMO). The Act also allows for specific Conservation Orders to extend the close season to protect vulnerable populations. After consultation with NERC, three such orders were established providing year round protection to grey and harbour seals on the east coast of England and in the Moray Firth and to harbour seals in the Outer Hebrides, Shetland, Orkney and the east coast of Scotland between Stonehaven and Dunbar (effectively protecting all the main concentrations of harbour seals along the east coasts of Scotland and England). The *Marine (Scotland) Act 2010* (Section 6) prohibits the taking of seals except under licence. Licences can be granted for the protection of fisheries, for scientific and welfare reasons and for the protection of aquaculture activities. In addition, in Scotland it is now an offence to disturb seals at designated haulout sites. NERC (through SMRU) provides advice on all licence applications and haulout designations. The *Wildlife (Northern Ireland) Order 1985* provides protection for both grey and harbour seals and prohibits the killing of seals except under licence. In Northern Ireland it is an offence to intentionally or recklessly disturb seals at any haulout site.

UK Biodiversity Action Plan (UK BAP) was first published in response to the Convention on Biological Diversity (Rio de Janeiro, 1992); it included a number of specific plans for listed priority species and habitats including several cetaceans, otters and bats. After devolution, each country developed strategies for biodiversity and the environment while maintaining a shared vision; these are ongoing. Following the publication of the CBD's Strategic Plan for Biodiversity 2011-2010 and its 20 'Aichi Biodiversity Targets', the UK BAP has been succeeded by the UK Post-2010 Biodiversity Framework published in 2012 and supported by an Implementation Plan published in 2013 (see JNCC website for further details http://jncc.defra.gov.uk/page-5155).

A1a.7.17.3 Marine Protected Areas

In the UK, SACs have long been established for the inshore populations of bottlenose dolphins in Wales (Cardigan Bay SAC and Lleyn Peninsula and the Sarnau SAC) and in Scotland (Moray Firth SAC). At the present time (Dec 2015) the Skerries and Causeway Candidate SAC,

proposed in 2012 in Northern Ireland, is the only site with harbour porpoise as a qualifying feature. This is likely to change in the near future as a number of UK sea areas, including three areas in Welsh waters (Natural Resources Wales website, accessed Aug 2015) are currently being considered for designation following recent analyses of both effort related sea- (Heinänen & Skov, 2015) and land-based sightings (Evans *et al.* 2015).

There are currently no exclusively marine SACs for grey or harbour seals in the UK, although a number of terrestrial SACs (with intertidal and/or marine components) have been established for these species around the coast. Numerous SACs have been established for otters throughout the UK, several of which contain marine components.

Through national legislation, areas for species other than those already listed in Annex II of the Habitats Directive may also receive protection; in Scotland, following the 2010 Marine (Scotland) Act, white-beaked dolphins, Risso's dolphins and minke whales have been included on the list of MPA search features (Marine Scotland, 2011) and regions of persistent high-use have been sought (Paxton *et al.* 2014). Two sites are being proposed for minke whales (the Sea of Hebrides MPA, the Southern Trench MPA) and one for Risso's dolphins (North East Lewis MPA).

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