

### Key message

The abundance of harbour porpoise, white-beaked dolphin and minke whale in the North Sea is stable. An earlier shift south in the distribution of harbour porpoise has been maintained.

The abundance of coastal bottlenose dolphins on the east coast of Scotland has increased and their distributional range has expanded southwards.

### Background

The North-East Atlantic Ocean is an important area for cetaceans. As top predators they can be sentinels of environmental status and food web integrity. They occur all around Scotland, but the greatest diversity is found off the continental shelf waters to the north and west. This assessment considers information on the abundance and distribution of the dominant (i.e. most abundant) species (for example minke whale (Figure 1) and white-beaked dolphin (Figure 2)) based on three systematic large-scale surveys carried out in European waters in 1994, 2005 and 2016 (SCANS, SCANS-II, and SCANS-III, (Hammond *et al.*, 2017)), with the current assessment period being 2005 to 2016. These visual surveys were carried out using dedicated survey vessels following a planned



Figure 1: Minke whale © Mònica Arso Civil



Figure 2: White-beaked dolphin © Ben Burville



Figure 3: Bottlenose dolphin © Mònica Arso Civil



Killer whale © Ryan Milne

survey route and statistically robust survey design, employing trained observers from duplicated observation platforms on the vessels. These ship-based surveys were supplemented with visual aerial surveys, which also followed planned routes using trained observers.

As cetaceans are highly mobile species, it is not possible to assess changes in the dominant species at a Scottish Marine Region scale, except for the coastal populations of bottlenose dolphin (Figure 3). The changes in abundance are therefore reported at a scale appropriate to such mobile animals, i.e. the European Continental Shelf which incorporates Scottish Waters.

Cetaceans are subject to a range of human pressures. Some of these pressures have been shown to have negative impacts at the individual

level, ranging from increased stress and higher energetic costs, to sub-lethal effects on reproduction and immune function, and ultimately mortality. In more serious cases, effects may manifest at the population level.

## Results

### Abundance and distribution of offshore cetaceans

The abundance estimates for the dominant cetacean species in the European Continental Shelf seas and offshore waters covered by the CODA in 2007 and SCANS II and ObSERVE surveys in 2016, are given in Table 1. In most cases the abundance of the main species has remained similar or increased. However, the power to detect any significant changes was only possible for three species in the North Sea; **harbour porpoise, minke whale and white-beaked dolphin**. The time span covered by the three SCANS surveys and reasonable precision means that the data have high power to detect changes of 2-5% per year. For **minke whale** this is a 0.5% change due to the additional data available from the Norwegian surveys (Bøthun *et al.*, 2009; Solvan *et al.*, 2015).

Estimates for the European continental shelf obtained from the SCANS surveys in 2005/7 and 2016 and offshore waters covered by the CODA in 2007 and SCANS II and ObSERVE

Table 1: Abundance of cetacean species occurring in European continental shelf seas and offshore waters.

Source: SMRU / SCANS. \* Coefficients of variation; \*\* Beaked whales - Northern bottlenose whale, Sowerby's beaked whale and Cuvier's beaked whale and those not identified to species.

Species	Year	Abundance	CV*	95% CL low	95% CL high
Harbour porpoise	2005/07	519,864	0.21	345,987	781,125
	2016	493,205	0.15	370,878	655,879
White-beaked dolphin	2005/07	37,689	0.36	19,014	74,708
	2016	39,535	0.27	23,558	66,348
White-sided dolphin	2005/07	-	-	-	-
	2016	17,431	0.64	5,528	54,962
Bottlenose dolphin	2005/07	35,936	0.24	22,756	56,749
	2016	115,027	0.17	83,125	159,173
Common dolphin	2005/07	173,219	0.27	103,386	290,221
	2016	481,306	0.26	292,818	791,123
Striped dolphin	2005/07	63,210	0.90	13,913	287,170
	2016	372,340	0.33	198,634	697,953
Common & striped (incl unid)	2005/07	305,460	0.36	153,994	605,904
	2016	1,031,395	0.17	734,129	1,449,030
Risso's dolphin	2005/07	-	-	-	-
	2016	16,214	0.38	7,959	33,030
Pilot whale	2005/07	123,732	0.35	63,551	240,904
	2016	33,190	0.28	19,296	57,089
Sperm whale	2005/07	2,569	0.26	1,556	4,241
	2016	13,518	0.41	6,298	29,017
Beaked whales (all spp)**	2005/07	12,869	0.31	7,107	23,302
	2016	14,536	0.41	6,723	31,427
Minke whale	2005/07	22,014	0.37	10,863	44,611
	2016	21,158	0.27	12,494	35,829
Fin whale	2005/07	19,354	0.24	12,171	30,776
	2016	18,240	0.32	9,885	33,657

surveys in 2016 are given. Abundance estimates were not calculable for species with low encounter rates such as killer whale (see Figures I (i) and (ii) in Read More section) and others were combined (for example beaked whales) to provide an abundance estimate for that species group.

For **harbour porpoise** in the North Sea, a region that is considered for assessment purposes as a population unit, the results show no evidence for any trend in abundance since the mid-1990s (Figure 4). However, the species distribution has expanded in a southerly direction, particularly into the English Channel, presumably from the North and Celtic Seas.

**Offshore bottlenose dolphin** distribution has not changed and was also similar for **common dolphin, long-finned pilot whale, beaked whales, sperm whale, and fin whale**.

No trends in abundance were evident for **white-beaked dolphin** and **minke whale** in the North Sea (Figure 4). There was some evidence that minke whale distribution in the North Sea had shifted to the south between 1994 and 2005 but since then there has been no change.

Maps showing the encounter rates as a proxy for cetacean distribution for the 12 main species and the killer whale are given in Read More section (Figures a – m).

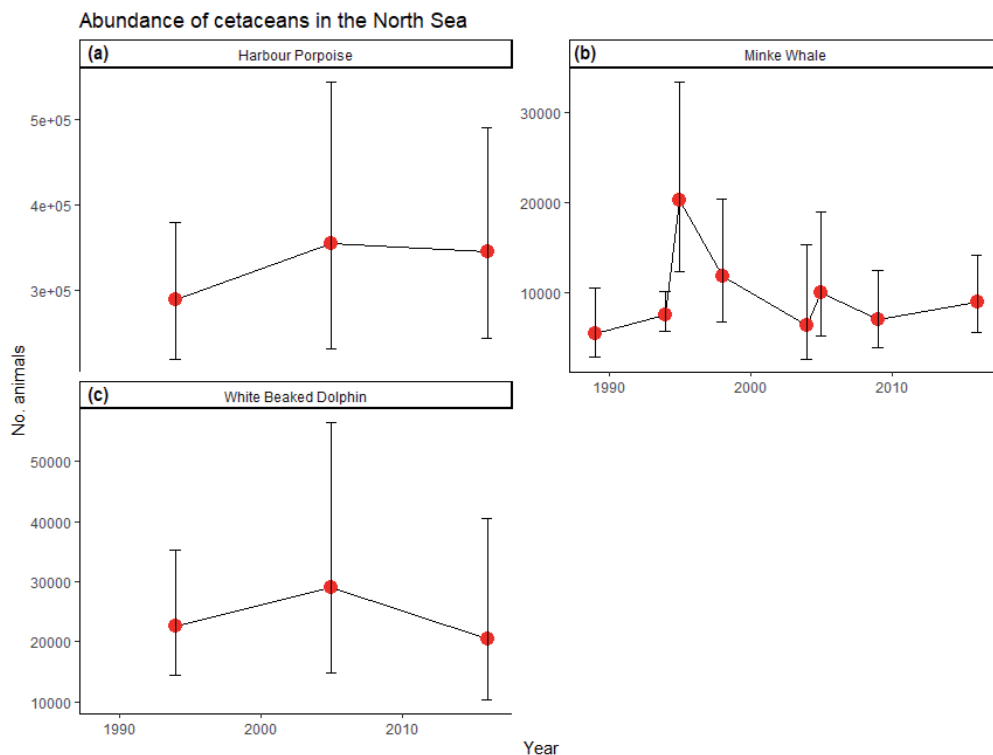


Figure 4:

Time series of three or more abundance estimates.

(a) (top left) harbour porpoise in the North Sea - estimated rate of annual change = 0.8% (95%CI: -6.8; 9.0%),  $p = 0.18$ .

(b) (top right) white-beaked dolphin in the North Sea - estimated rate of annual change = -0.5% (95%CI: -18; 22%),  $p = 0.36$ .

(c) (bottom left) minke whale in the North Sea - estimated rate of annual change = -0.25% (95%CI: -4.8; 4.6%),  $p = 0.90$ . Error bars are log-normal 95% confidence intervals.

## Abundance and distribution of coastal bottlenose dolphins

The estimated abundance of bottlenose dolphins on the east coast of Scotland between 2009 and 2015 was variable but increased from 165 (95% CI 156-175) animals in 2009 to 209 (95% CI 189-230) in 2015 (Arso Civil *et al.*, 2019) (Figure 5). More information is in the extended section.

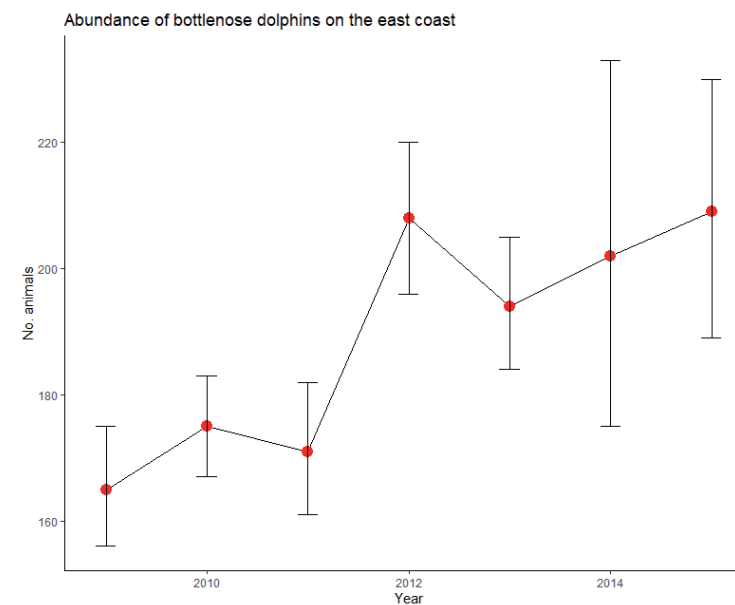


Figure 5:

Abundance of coastal bottlenose dolphins on east coast of Scotland by year.

## Conclusion

### Offshore cetaceans

Scottish offshore waters continue to be important for a range of cetacean species. In the Greater North Sea, only harbour porpoise, white-beaked dolphin and minke whale have more than two estimates of abundance since 1994 and the numbers for these species are stable. For harbour porpoise and minke whale the power to detect trends is good. In general, the recent abundance estimates for the dominant species (Atlantic white-sided dolphin, short-beaked common dolphin, striped dolphin, Risso's dolphin, long-finned pilot whale, sperm whale, beaked whales and fin whale) are mostly either very similar to or larger than earlier estimates.

### Coastal bottlenose dolphins

Coastal bottlenose dolphins on the east coast have shown a marked change in their distribution over the last two decades or so. Their range has expanded, and abundance changed from stable to increasing (Arso Civil *et al.*, 2019). The population is highly mobile within its main distributional range, and overall connectivity within the population is well established. Their range continues to expand as shown by increasing sightings south of the Firth of Forth.

## Knowledge gaps





### Offshore cetaceans





The results from large-scale international surveys have greatly expanded the knowledge of the distribution and abundance of cetaceans in the European Atlantic. However, knowledge gaps remain due to the infrequency of these surveys. For logistical reasons, large-scale surveys such as SCANS have been conducted during summer. Information is therefore lacking on large-scale seasonal changes in distribution.

### Coastal bottlenose dolphins



















The impacts of human activities on these populations are largely unknown, as are the status and population trends for the dolphins on the west coast.

## Status and trend assessment

Region assessed	Coastal bottlenose dolphin		Harbour porpoise		Comment
	Status with confidence	Trend with confidence	Status with confidence	Trend with confidence	
North Sea	 ☆☆☆	 ☆☆☆	 ☆☆☆	 ☆☆☆	Pre-2005 there was a southward shift in the distribution of harbour porpoise from the northern to the southern North Sea. Since 2005 there has been no change in distribution. Therefore, comparing with the abundance of harbour porpoise in the northern North Sea before 2005 with the current estimate would indicate a decrease.
West Coast	No data	No data	No data	No data	

Region assessed	White-beaked dolphin		Minke whale		All other species
	Status with confidence	Trend with confidence	Status with confidence	Trend with confidence	
All SMRs	 ☆☆☆	 ☆☆☆	 ☆☆☆	 ☆☆☆	Status and trend unknown for all other species and SMRs

## Status and trend assessment legend

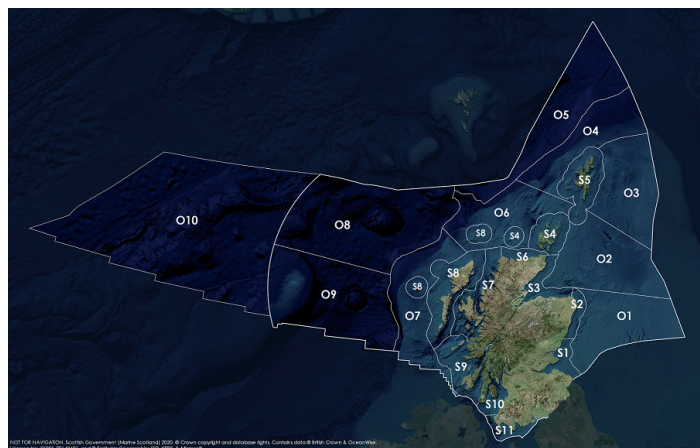
Status assessment (for Clean and safe, Healthy and biologically diverse assessments)		Trend assessment (for Clean and safe, Healthy and biologically diverse and Productive assessments)	
	Many concerns		No / little change
	Some concerns		Increasing
	Few or no concerns		Decreasing
	Few or no concerns, but some local concerns		No trend discernible
	Few or no concerns, but many local concerns		All trends
	Some concerns, but many local concerns	<b>Confidence assessment</b>	
	Lack of evidence / robust assessment criteria	<b>Symbol</b>	<b>Confidence rating</b>
	Lack of regional evidence / robust assessment criteria, but no or few concerns for some local areas		Low
	Lack of regional evidence / robust assessment criteria, but some concerns for some local areas		Medium
	Lack of regional evidence / robust assessment criteria, but many concerns for some local areas		High



## Overall confidence

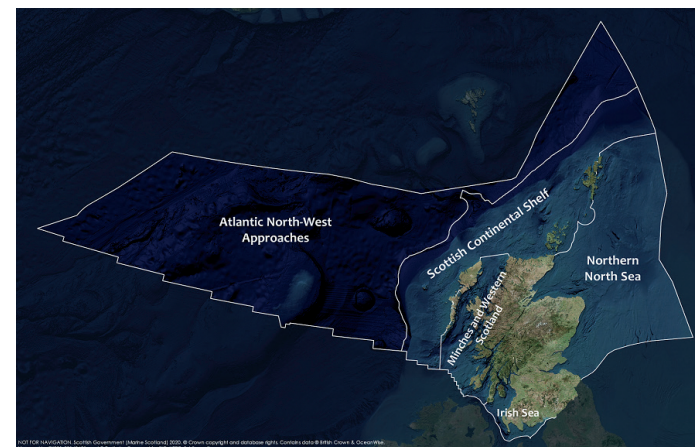


## Assessment regions

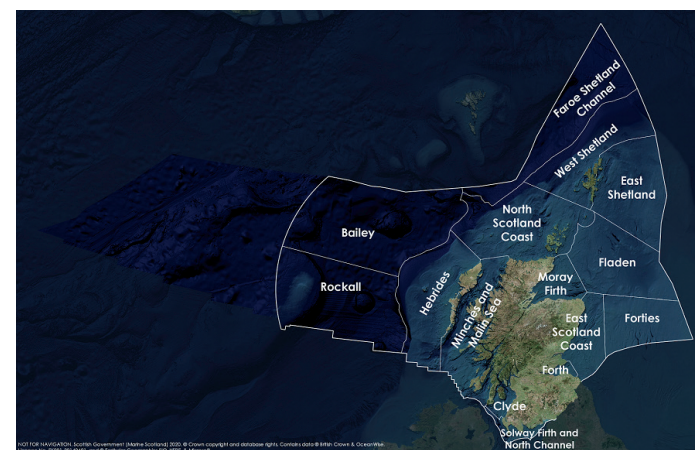


The Scottish Marine Regions (SMRs; S1 – S11) and the Scottish Offshore Marine Regions (OMRs; O1 – O10)

Key: S1, Forth and Tay; S2, North East; S3, Moray Firth; S4 Orkney Islands; S5, Shetland Isles; S6, North Coast; S7, West Highlands; S8, Outer Hebrides; S9, Argyll; S10, Clyde; S11, Solway; O1, Long Forties; O2, Fladen and Moray Firth Offshore; O3, East Shetland Shelf; O4, North and West Shetland Shelf; O5, Faroe-Shetland Channel; O6, North Scotland Shelf; O7, Hebrides Shelf; O8, Bailey; O9, Rockall; O10, Hatton.



Biogeographic, Charting Progress 2 (CP2) Regions. These have been used as the assessment areas for hazardous substances.



Scottish Sea Areas as used in Scotland's Marine Atlas 2011. These are sub divisions of the biogeographic, or Charting Progress 2 (CP2), Regions.