

MS Offshore Renewables Research: Work Package C2:

**Request for advice on the populations of
cetaceans that might be involved in significant
interactions with marine renewable energy
developments in Scottish marine waters**



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Request for advice on the populations of cetaceans that might
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energy developments in Scottish marine waters.

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Introduction

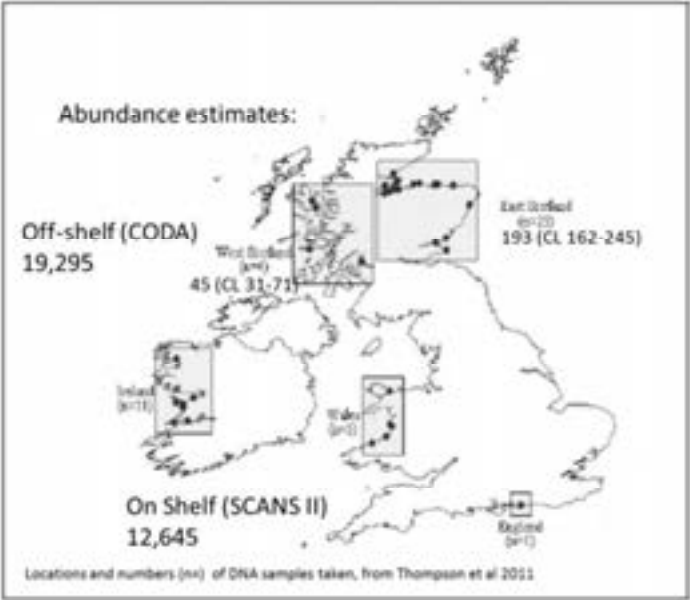
This report aims to provide advice on appropriate biological population units to be used in environmental impact assessments of the potential impacts on cetacean populations of marine renewable energy developments in Scottish waters. The advice takes account of and where appropriate, is consistent with population units already established in related contexts, including Moray Firth SAC population of bottlenose dolphins, population units used for the assessment of the significance of by-catch of harbour porpoise in the ICES area, and population units for minke whale and other cetaceans used by the IWC, ASCOBANS etc. The report focuses on the most regularly present and significant cetacean species in Scottish waters - i.e. bottlenose dolphins, harbour porpoise, minke whales, risso's dolphins, white-beaked dolphins, common dolphins, white-sided dolphins and killer whales - and provides scientific support, as appropriate, for the populations selected. The tabulated species data below provides information on the structure of populations of regularly present and significant cetacean species (see above) in Scottish waters (out to 200 nm) and the geographical scale of biologically meaningful population units of the relevant species where these units extend beyond Scottish waters.

It can be used to provide advice on the relevant population units of these regularly present and significant cetacean species, which can be found in areas of search for renewable developments identified in Marine Scotland Scoping Studies for wind (2011), wave (2012) and tidal stream (2012) energy, and which therefore should be used in SEAs and project EIAs.


Population Structure of Cetaceans in Scottish Waters:

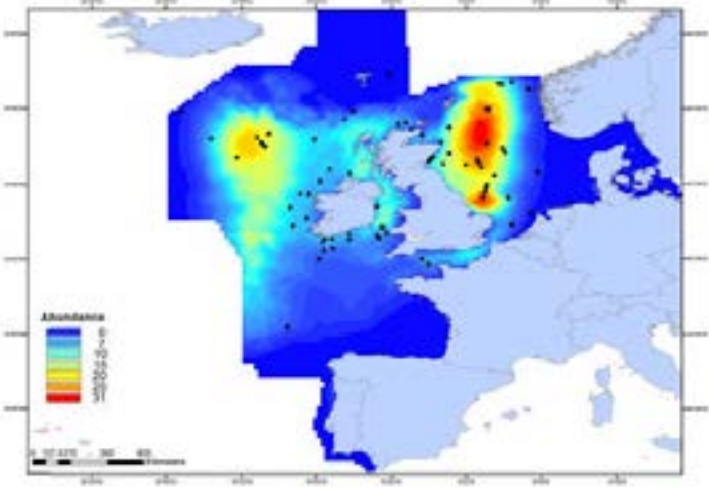
Tabulated Species data

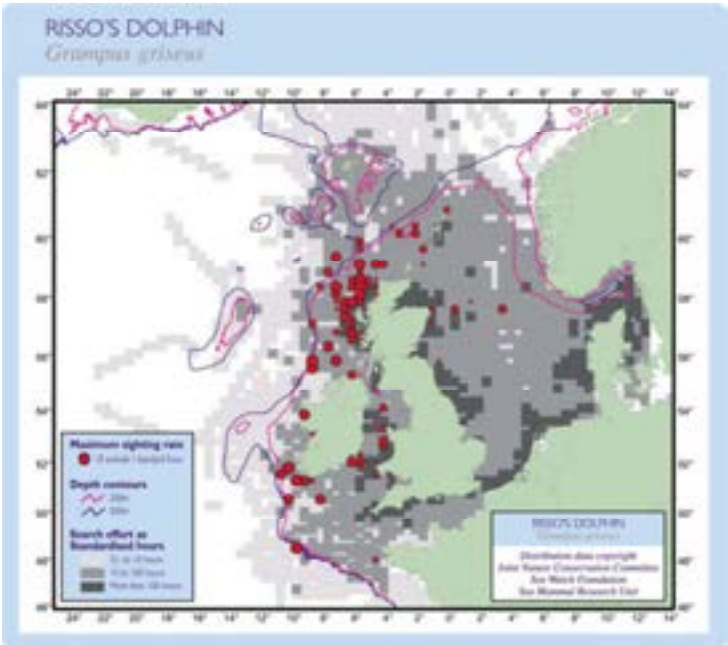
Species	Population or stock distribution	References
<p>Common bottlenose dolphin</p> <p><i>Tursiops truncatus</i></p>	<p>Summary: Two local ‘populations’ – one centred on the Moray Firth – or more accurately now along the Scottish east coast, the other on the West Coast.</p> <p>Both ‘Moray Firth’ and west of Scotland animals do occur outside their ‘normal’ home ranges, but these can be regarded as two discrete stocks.</p> <p>The Moray Forth population is more closely related to Welsh animals than to West coast of Scotland animals (Parsons et al 2002). There are sightings of animals in the central North Sea which may also be from the same population, though none has been photo-identified to our knowledge.</p> <p>“Photo-identification studies indicate that around 200-300 individual [bottlenose] dolphins occur regularly in Scottish coastal waters, with numbers on the east coast being approximately five times higher than those on the west coast [2006 point estimates of 193 vs 45 respectively]. Re-sightings of identifiable individuals demonstrate that the animals recorded during ... surveys in 2006 and 2007 have used these coastal waters since studies began in 1989 on the east coast, and 1995 on the west coast.” Thompson et al 2011. There is some evidence that there may be two or more ‘communities’ of dolphins on the West coast, one centred around the Sound of Barra, and the other in the Inner Hebrides with sightings from Kintyre to Gairloch, and some suggestion of further partitioning of the inshore habitat among two groups of individuals.</p>	<p>Parsons, K. M., L.R. Noble, R. J. Reid, and P.M. Thompson. 2002. Mitochondrial Genetic Diversity and Population Structuring of UK Bottlenose Dolphins (<i>Tursiops truncatus</i>): Is the NE Scotland Population Demographically and Geographically Isolated?’ <i>Biological Conservation</i> 108, no. 2 (December 2002): 175–182.</p> <p>Thompson, P.M., Cheney, B., Ingram, S., Stevick, P., Wilson, B. & Hammond, P.S. (Eds) (2011). Distribution, abundance and population structure of bottlenose dolphins in Scottish waters. Scottish Government and Scottish Natural Heritage funded report. Scottish Natural Heritage Commissioned Report No.354.</p> <p>Hoelzel, A. R., Potter, C. W., & Best, P. B. (1998). Genetic differentiation between parapatric “nearshore” and “offshore” populations of the bottlenose dolphin. <i>Proceedings. Biological sciences / The Royal Society</i>, 265(1402), 1177-83.</p> <p>Mead, J. G., & Potter, C. W. (1995). Recognizing two populations of the bottlenose dolphin (<i>Tursiops truncatus</i>) off the Atlantic coast of north America: morphologic and</p>

	<p>Some animals also occur further offshore and beyond the 200nm limit; we don't know how much mixing there is between the two inshore populations and those animals further offshore, nor do we know how animals sighted in Northern Scotland or the central North Sea relate to other groups.</p> <p>Offshore and inshore populations of Tursiops are known from the western North Atlantic (Mead and Potter 1995, Hoelzel et al. 2010), and there is evidence that some stranded bottlenose dolphins on the west coast of Ireland may belong to an offshore population (Mirimin et al. 2011), suggesting some overlap in distribution there between inshore and offshore groups there at least.</p> <p>The map and data to the right are taken from Thompson et al. 2011, and place the Scottish populations in a broader context.</p>	<p>ecologic considerations. <i>IBI Reports, National Museum of Natural History, Smithsonian Institution</i>, (5), 31-44.</p> <p>Mirimin, L., Miller, R., Dillane, E., Berrow, S. D., Ingram, S., Cross, T. F., & Rogan, E. (2011). Fine-scale population genetic structuring of bottlenose dolphins in Irish coastal waters. <i>Animal Conservation</i>, 14(4), 342-353.</p> 
<p>Harbour porpoise <i>Phocoena phocoena</i></p>	<p>Summary: Probably no discrete local population. There are several overlapping 'populations' in the area. For the UK, essentially a North Sea stock and a Western waters stock.</p> <p>Norwegian and British North Sea animals exhibit some degree of difference (de Luna et al. 2012; Tolley et al. 2006). North Sea and Southwest England also demonstrate genetic differences (Tolley and Rosel 2006, Walton 1997).</p>	<p>De Luna, C. J., Goodman, S. J., Thatcher, O., Jepson, P. D., Andersen, L., Tolley, K., & Hoelzel, A R. (2012). Phenotypic and genetic divergence among harbour porpoise populations associated with habitat regions in the North Sea and adjacent seas. <i>Journal of evolutionary biology</i>, 25(4), 674-681.</p>

<p>Some further subdivision has been proposed but remains unclear.</p> <p>An ASCOBANS-HELCOM workshop (Evans and Teilman 2009) has suggested two populations in the North Sea (North and West as one and South and East as the other), and has further suggested a Northwest Ireland and West Scotland (“NWIS”) as another ‘management unit’. ICES (2012) preferred to keep the entire North Sea as one management unit, but maintained the “NWIS” unit.</p> <p>Few studies have looked at Scottish west coast porpoises from a population genetics perspective, and relatedness of Scottish west coast animals to other groups is unclear. Walton (1997) found no significant difference between North Sea and Western Scottish animals, nor any difference between Western Scottish and Celtic Sea animals, but sample size was small.</p> <p>Most of the population stays within 200nm of shore (Reid et al. 2003).</p> <p>There are open borders between North Sea and Kattegat and North Sea and Norwegian Sea and between the western Channel / Celtic Shelf / Irish Sea and “NWIS” animals. There are also no obvious barriers to porpoises along the North coast of Scotland.</p> <p>It is not helpful to think of managing porpoises in discrete populations. Management ‘stocks’ or units may help from a practical perspective, but degree of fluidity between groups suggests keeping large stock areas is most sensible. Nevertheless, most authors support a distinction between North Sea (including the northern Isles) and the west coast of Scotland</p> <p>Map to the right taken from Evans and Teilmann (2009) and also used by ICES (2012). We concur with ICES suggestions of merging NENS and SWNS management units to form a single North Sea management</p>	<p>Tolley, K.A. and P. E. Rosel (2006). Population structure and historical demography of eastern North Atlantic harbour porpoises inferred through mtDNA sequences. <u>Marine Ecology Progress Series</u> 327: 297-308.</p> <p>Walton, M. 1997. Population structure of harbour porpoises <i>Phocoena phocoena</i> in the seas around the UK and adjacent waters. <i>Proc. R. Soc. Lond. Ser B</i> 264:89-94</p> <p>Evans, P. G. H., & Teilmann, J. (2009). Report of the ASCOBANS/HELCOM Small Cetacean Population Structure Workshop. Ascobans, Bonn, Germany.</p> <p>ICES. (2012). Report of the Working Group on Marine Mammal Ecology (WGMME) International Council for the Exploration of the Sea. ICES WGMME REPORT 2012.</p>
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	<p>unit. The status of the “NWIS” stock or management unit is unclear.</p>	
<p>Minke whale <i>Balaenoptera acutorostrata</i></p>	<p>Summary: No local population - N E Atlantic managed as one stock by IWC</p> <p>Although there is some evidence that some individual minke whales return to the same area in different years (Northridge et al. 2010), these animals range over large distances and the population is treated by the IWC as a single Northeast Atlantic stock.</p> <p>The latest abundance estimate is around 174,000 individuals in the Central and NE Atlantic combined (IWC 2012 Website).</p> <p>There is some evidence of population sub-structure (Anderwald et al. 2011) but this is not at present taken into account in management decisions.</p>	<p>Northridge, S., Cargill, A., Coram, A., Mandleberg, L., Calderan, S. & Reid, R. (2010) Entanglement of minke whales in Scottish waters; an investigation into occurrence, causes and mitigation. <i>Final Report to Scottish Government CR/2007/49</i>, pp. 54pp +Appendices. Sea Mammal Research Unit, University of St Andrews.</p> <p>IWC 2012: Whale Population Estimates The International Whaling Commission's most recent information on estimated abundance: http://iwcoffice.org/conservation/estimate.htm</p> <p>Anderwald, P., Daniélsdóttir, A. K., Haug, T., Larsen, F., Lesage, V., Reid, R. J., Víkingsson, G. a., et al. (2011). Possible cryptic stock structure for minke whales in the North</p>

	<p>The map on the right is taken from Hammond et al. 2010 and shows the results of a spatial model prediction of minke abundance in the coloured (surveyed) area covered by SCANSII, CODA and TNASS. The line transect survey estimate of abundance for this region was about 38,000 animals (CI: 27-54 000)</p>	<p>Atlantic: Implications for conservation and management. <i>Biological Conservation</i>, 144(10), 2479-2489.</p> <p>Hammond, P. S., Macleod, K., Burt, L., Cañadas, A., Lens, S., Mikkelsen, B., Rogan, E., et al. (2010). Abundance of baleen whales in the European Atlantic. Paper Presented to the IWC SC/63/RMP24.</p> 
<p>Risso's dolphin <i>Grampus griseus</i></p>	<p>Summary: Probably a single UK population, but some discrete groups of animals present, notably off Lewis.</p> <p>Some discrete groups of Risso's are well known around Britain, especially one resident community in the Western Isles, off Lewis. But, sightings actually found throughout western Isles and Minch. There are also sightings around Shetland and a few in North Sea. (Reid et al 2003).</p>	<p>Reid, J.B., Evans, P.G.H. & Northridge, S.P. (2003) Atlas of cetacean distribution in the north-west European waters. pp. 76. Joint Nature Conservation Committee.</p> <p>Gaspari S, Airoidi S, Hoelzel AR. 2007. Risso's dolphins (<i>Grampus griseus</i>) in UK waters are differentiated from a population in the Mediterranean Sea and genetically less</p>

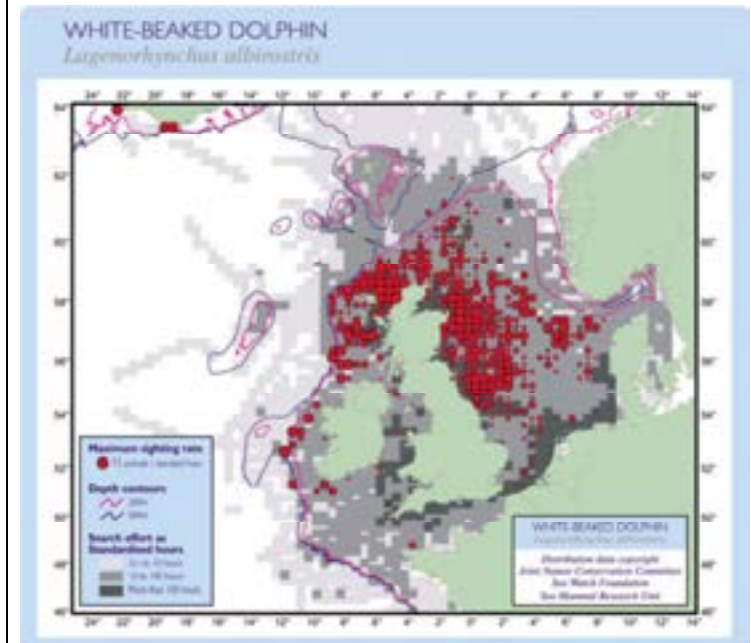
	<p>Results of one population genetics study found limited genetic variability among 18 samples collected from Orkney, the west coast, Wales and southern England, suggesting “that the UK Risso’s dolphin population should be identified as a separate management unit when considering conservation Strategies” Gaspari et al (2007).</p> <p>The map of Risso’s dolphin sightings rates to the right is taken from Reid et al 2003. There is no overall abundance estimate.</p>	<p>diverse. <i>Conserv. Genet.</i> 8: 727-732.</p> 
<p>White-beaked dolphin <i>Lagenorhynchus albirostris</i></p>	<p>Summary: probably a single stock or population around the UK.</p> <p>Sightings data suggest a population centred on Scottish waters (North Sea and West coast), extending further south into the North Sea with a distinct hiatus between Scottish and Norwegian waters. (Northridge et al 1997).</p> <p>A more recent study on white-beaked dolphin genetics also suggests some genetic difference between UK and Norwegian waters (Banguera-Hinestroza et al 2010)</p> <p>ICES’ WGMME recommends treating animals around the British Isles and in the North Sea as a single management unit (ICES 2012 in prep).</p>	<p>Northridge, S., Tasker, M., Webb, A., Camphuysen, K. & Leopold, M. (1997) White-beaked <i>Lagenorhynchus albirostris</i> and Atlantic white-sided Dolphin <i>L. acutus</i> distributions in northwest European and US North Atlantic Waters. <i>Rep. Int. Whal. Comm.</i> 47, 797-805.</p> <p>Banguera-Hinestroza, E, Bjørge, A., Reid, R.J., Jepson, P. and Hoelzel A.R. (2010). The influence of glacial epochs and habitat dependence on the diversity and phylogeography of a coastal dolphin species: <i>Lagenorhynchus albirostris</i>. <i>Conserv. Genetics</i> 11:1823-1836</p>

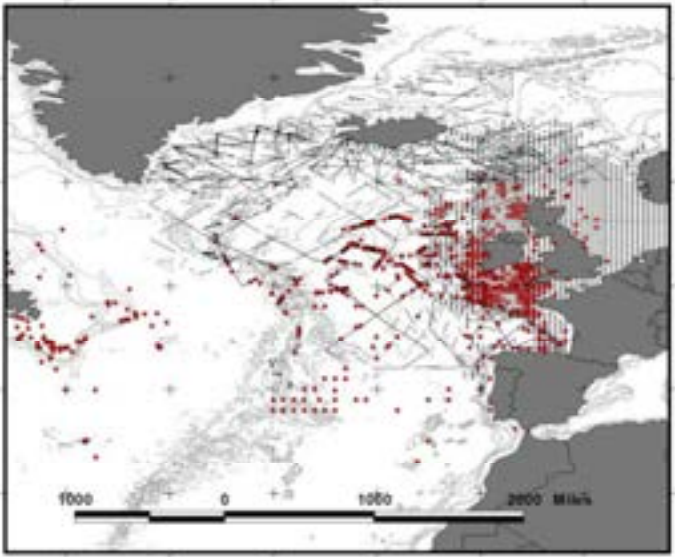
Individuals are likely to be found inside and outside of the 200nm limit, but the bulk of the BI management stock is likely found inside the UK and Irish 200nm limits, and the with the majority of these inside the Scottish 200nm limit. Total abundance on European shelf waters was estimated at around 22,700 animals (Hammond 2008).

Distribution map is from Reid et al 2003. Total SCANS-II abundance estimate is around 23,000 animals, mostly in the waters around Scotland.

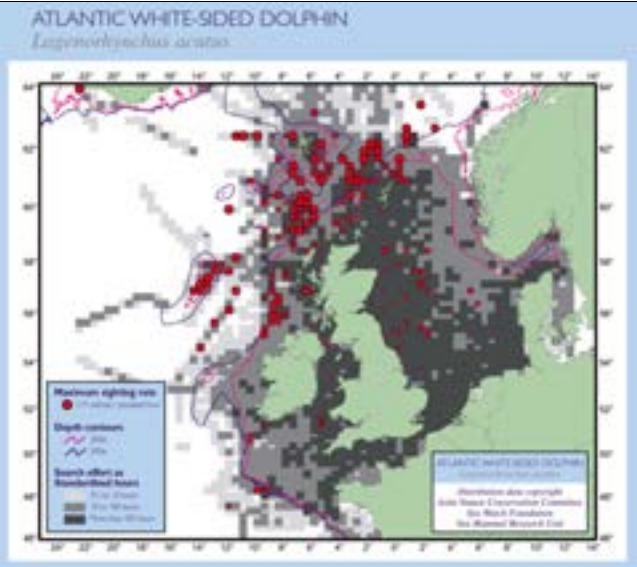
Hammond et al 2008. Cetacean Offshore Distribution in the European Atlantic (CODA) – Final Report.

ICES. (2012). Report of the Working Group on Marine Mammal Ecology (WGMME) International Council for the Exploration of the Sea. ICES WGMME REPORT 2012



<p>Short-beaked common dolphin</p> <p><i>Delphinus delphis</i></p>	<p>Summary: single NE Atlantic stock between Scotland and Portugal.</p> <p>This population is wide ranging from Portugal to Norway and mainly in deeper water; they are more abundant on the shelf in winter, but more common in Scotland in summer. No local populations known.</p> <p>Population structure has been subject of much recent examination by ICES and by ASCOBANS. A more detailed account would be possible, but the essential conclusion is summarised above.</p> <p>Distribution map from ICES (2009). Around 345,000 common dolphins (including sightings characterised as common or striped) estimated by SCANS-II and CODA.</p>	<p>ICES, 2009. Report of the Working Group on Marine Mammal Ecology (WGMME) International Council for the Exploration of the Sea. ICES WGMME REPORT 2009</p> <p>Mirimin L., Westgate A., Rogan E., Rosel P., Read A., Coughlan J. and Cross T. (2009) Population structure of short-beaked common dolphins (<i>Delphinus delphis</i>) in the North Atlantic Ocean as revealed by mitochondrial and nuclear genetic markers. <i>Marine Biology</i> 156, 821-834.</p>  <p>Tracklines and sightings of common dolphins in the NE</p>

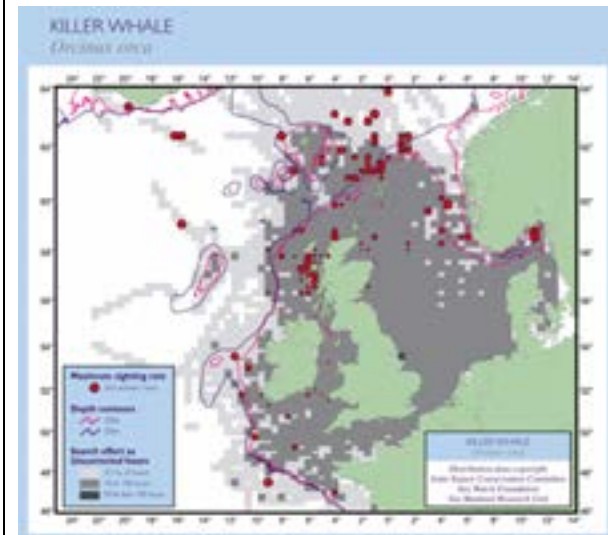
		Atlantic – see ICES 2009 for details.
<p>Atlantic white-sided dolphin</p> <p><i>Lagenorhynchus acutus</i></p>	<p>Summary: Seems to be a single NE Atlantic population.</p> <p>No evidence of local Scottish population. This species is mainly distributed offshore in the northeast Atlantic (Northridge et al 1997)</p> <p>This species is quite abundant throughout its range. There are an estimated 96,000 (CV=54%) off the west coast of Scotland (MacLeod 2004).</p> <p>(The abundance in two strata was estimated as 21,371 (CV = 0.54) to the west of the Outer Hebrides and 74,626 (CV = 0.72) in the Faroe Shetland Channel. (MacLeod 2004))</p> <p>Population genetics work also suggests a single wide-ranging population in the north-eastern Atlantic (Mirimin et al 2010). Some suggestion of slight differences between animals from the North Sea and further west. (Banguera-Hinestroza 2010).</p> <p>Approximately 74,000 around Shetland / Faroes and a further 21,000 west of the Hebrides (Macleod 2004). No overall, UK or Scottish estimate is available.</p>	<p>Mirimin, L., Banguera-Hinestroza, E., Dillane, E., Hoelzel, A. R., Cross, T. F., & Rogan, E. (2010). Insights into genetic diversity, parentage, and group composition of Atlantic white-sided dolphins (<i>Lagenorhynchus acutus</i>) off the west of Ireland based on nuclear and mitochondrial genetic markers. <i>The Journal of heredity</i>, 102(1), 79-87.</p> <p>MacLeod K. 2004. Abundance of Atlantic white-sided dolphin (<i>Lagenorhynchus acutus</i>) during summer off northwest Scotland. <i>J Cetacean Res Manag.</i> 6:33–40.</p> <p>Banguera-Hinestroza, E. with P. Evans, L. Mirimin, R.J. Reid, B. Mikkelsen, B. Couperus, R. Deaville, E. Rogan, and A.R. Hoelzel. 2010 White-sided dolphin (<i>Lagenorhynchus acutus</i>, Gray 1828) in the north Atlantic. Final Report to UNEP /ASCOBANS: 17th ASCOBANS Advisory Committee Meeting AC17/Doc.6-07 Bonn, 4-6 October 2010.</p>

		 <p>ATLANTIC WHITE-SIDED DOLPHIN <i>Lagenorhynchus acutus</i></p> <p>Distribution map from Reid et al 2003.</p> <p>Macleod, K. 2004. The abundance of the Atlantic white-sided dolphin (<i>Lagenorhynchus acutus</i>) during summer off north-west Scotland. <i>Journal of Cetacean Research and Management</i>, 6, 33-40</p>
<p>Killer whale</p> <p><i>Orcinus orca</i></p>	<p>Summary: appears to be a single population around the British Isles.</p> <p>A recent analysis of Killer Whale population genetics found three significantly differentiated populations centred on Iberia, the British Isles and Norway/Iceland, with some overlap between the last two around Shetland (Foote et al 2010).</p> <p>“Line-transect surveys have resulted in estimates of abundance in several regions in the North Atlantic, including ...in Norwegian waters</p>	<p>Foote et al, 2010. Genetic differentiation among North Atlantic killer whale populations. <i>Molecular Ecology</i> 20:629–641.</p> <p>Taylor, B.L., Baird, R., Barlow, J., Dawson, S.M., Ford, J., Mead, J.G., Notarbartolo di Sciara, G., Wade, P. & Pitman, R.L. 2008. Killer whale: IUCN redlist</p>

(Øien 1990), and 6,618 (CV=32%) in Iceland and Faroe Islands waters (Gunnlaugsson and Sigurjónsson 1990; Sigurjónsson *et al.* 1989).” Taylor et al 2008.

Distribution map (sightings rates) from Reid et al (2003). Abundance near UK is unknown. Much of the UK ‘population’ appears to occur in Scottish waters, notably the Hebrides.

<http://www.iucnredlist.org/apps/redlist/details/15421/0>.





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