

UK - Climate Change

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Climate change is now known to be affecting the world's oceans. Increased ocean temperatures lead to changes in ocean circulation, melting of ice sheets and increases in sea level (McCarthy et al., 2001). It is widely anticipated that impacts on cetaceans will be mediated primarily via changes in prey distribution and abundance and that the more mobile (or otherwise adaptable) species may be able to respond to this to some extent (Simmonds and Isaac, 2007). However, the extent of this adaptability remains largely unknown and predicting precise consequences of climate change for highly mobile cetaceans is difficult.

During the 20th century there was an observed 0.6°C increase in global temperatures (Meehl et al., 2005). By 2050, global temperatures are predicted to rise between 1.9°C and 11.5°C (Pelley, 2005). With respect to the UK marine environment, seawater temperatures increased in the last quarter of the 20th century, with temperatures in some sea areas increasing by as much as 1°C (Sheppard, 2004). It has been estimated that UK water temperatures could increase by a further 2°C by 2050 (Hulme et al., 2002), or possibly even more in southern UK waters (Hiscock et al., 2004).

Recent warming of the seas around the UK has coincided with a northward shift in the distribution of plankton (Reid et al., 2003) and fish species (Perry et al., 2005). This is also the case for cetacean species such as short-beaked common dolphin (*Delphinus delphis*) and striped dolphin (*Stenella coeruleoalba*), which have recently extended their range further north off western Britain and around into the northern North Sea (Evans et al., 2003; MacLeod et al., 2005).

The white-beaked dolphin (*Lagenorhynchus albirostris*), a species inhabiting cold temperate to arctic waters, has also exhibited a latitudinal shift in its range (Evans et al., 2003; MacLeod et al., 2005) and there are concerns that this species may be displaced from its habitat or become locally extinct in some areas (MacLeod et al., 2005). These shifts in range may not necessarily be directly related to changes in sea temperature, but may reflect changes in the status of fish stocks that are the favoured prey for these species (Evans et al., 2007). This emphasises the difficulties in interpreting regional changes in the status of cetaceans, not only because there are many potential confounding effects (not least being human over-exploitation of fish or squid stocks) but also

because these species may simply be responding to regional variability in resource availability independent of climate change.

As responses to climate change by cetacean species at both the individual and population levels are currently poorly understood, making predictions about future impacts with any degree of certainty is particularly difficult. In UK waters, environmental changes are likely to be reflected mainly in responses to changes in prey distribution and abundance as a result of warmer sea temperatures (Evans et al., 2007).

Researchers have shown that bottlenose dolphin group size in the Moray Firth is affected by the presence of prey, which in turn is affected by water temperature (Lusseau et al., 2004). Potential impacts of climate change on UK cetaceans may involve range shifts. This may mean species such as the short-beaked, common and striped dolphin occur more regularly in northern Britain, displacing the white-beaked and Atlantic white-sided dolphin. Cuvier's beaked whale may become more regular in offshore canyons, and there may be more records of warm-water vagrants to North-west Europe (e.g. Bryde's whale, pygmy sperm whale, rough-toothed dolphin, and Atlantic spotted dolphin). Baleen whales (e.g. humpback whale) that move southwards to warmer waters to winter and breed may increasingly do so within UK waters (Evans et al., 2007).

Cetacean species with exclusive diets may be affected to a greater extent than those with more diverse feeding habits, e.g. climate change effects on cephalopods are likely to have direct impacts on Risso's dolphins (*Grampus griseus*) in UK waters which feed exclusively on squid and octopus.

A pre-requisite to assessing impacts of climate change on cetaceans at a population level is a long-term, wide-ranging, monitoring programme that is able

to discriminate between regional population responses and those occurring on a wider geographical scale. This is presently lacking for all UK cetacean species and is a knowledge gap that must be addressed as a priority.