IMPACTS OF CLIMATE CHANGE ON SEABIRDS

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Executive Summary

Many seabirds had very bad breeding seasons in 2004 and 2005, and some species such as kittiwakes have declined strongly in recent years. The problems have been worst in the North Sea, and particularly in Shetland. Climate change is likely to have contributed to these problems, as several studies show that warm winters are bad for seabirds. Seabirds are mostly affected indirectly through their fish prey rather than directly. Fisheries also affect seabirds, and there is some debate between researchers about whether climate or fisheries has the strongest effect. Some seabirds are breeding increasingly late, and this could also be related to climate change. Many UK seabirds are at the southern edge of their range, and in the long term it is likely that some of these species will disappear.

Level of Confidence

Medium

Key sources of Information

The UK Seabird Monitoring Programme (www.jncc.gov.uk/page-1550) monitors trends in seabird population size and breeding success. More detailed data come from e.g. the Isle of May in the Firth of Forth, where the Centre for Ecology & Hydrology carries out research on how seabirds are affected by climate (www.ceh.ac.uk/sections/bpp/coastal.htm).

Supporting Evidence

Climate change can affect seabirds in two major ways, either directly through an increased frequency of bad weather causing e.g. nest flooding, or indirectly through changes in their food supply. The consensus is that indirect effects are likely to be more important for most species. How climate change affects seabirds is therefore to a large extent determined by how sensitive their preferred prey is to changes in temperature, salinity etc., and whether alternative prey is, or will become, available.

Seabirds are very long-lived, and changes in population size tend to be slow. However, some remarkable changes in UK seabirds have occurred recently. Black-legged kittiwake populations in the North Sea have decreased by more than 50% since 1990, and declines have also occurred in e.g. Arctic skuas and shags (Mavor *et al* 2005). In 2004 and 2005, well-publicized widespread breeding failures occurred in many seabird species. It was widely claimed that these failures were caused by climate change, but although this is credible, there is as yet no evidence to back up this assertion, and other causes such as changes in fisheries should not be ruled out.

An increasing number of studies have shown climate effects on UK seabird populations. Both breeding success and individual survival of black-legged kittiwakes in the North Sea was lower following warm winters, and it is likely that this has contributed to the recent population decline, and that further warming will accelerate the decline (Frederiksen *et al* 2004a). Most other studies also indicate that high temperatures, particularly in winter, are bad for seabirds: survival was lower during or after mild winters for Atlantic puffins (Harris *et al* 2005), common guillemots (Votier *et al* 2005) and Northern fulmars (Grosbois *et al* 2005). It is generally assumed that this happens because recruitment to fish stocks is low during warm winters due to either lack of suitable food at the right time or increased predation. In contrast to the situation on land, where most annual events are happening increasingly early, some seabirds now breed later than in the past (Frederiksen *et al* 2004b). This may be related to climate change through a change in the timing of prey occurrence.

Modelling studies predicting how seabirds will respond to climate change in the long term are still at an early stage, but some general predictions can be made. Many of the common breeding seabirds in the UK are at or near the southern edge of their range, and it therefore seems likely that they would be affected by current and future climate change, and that populations may decline and ranges contract northwards. At the same time, very few seabird species currently breeding south of the UK seem likely to take up residence here. A decline in numbers and diversity of breeding seabirds is therefore expected in the longer term.

There is considerable regional variation in how well UK seabird populations are doing. Problems have been worse in the North Sea than in other areas, and particularly bad around Shetland. However, in 2005 the situation was also very bad in NW Scotland. It is likely that this regional variation is linked to differences in the speed of climate change. The relatively shallow North Sea is warming up faster than

the deep Atlantic, and it is here that the most pronounced changes in plankton, fish and seabirds have been observed.

The most important factor other than climate change to affect UK seabird populations is fishery-related changes in food availability. Fisheries can have both positive and negative effects. Industrial fisheries for fishmeal compete directly with seabirds for small, oily 'forage' fish such as sandeels. There is substantial evidence that sandeel fisheries on the Wee Bankie off SE Scotland during the 1990s had negative effects on black-legged kittiwakes in that area (Frederiksen *et al.,* 2004a). On the other hand, discards from fisheries for human consumption have provided an important food source for some seabirds, and recent declines in discards have probably affected these species (Votier *et al.,* 2004). Overfishing of predatory fish such as cod may have had a long-term positive effect on seabirds by allowing forage fish stocks to increase. The recent recovery of herring stocks in the North Sea to levels not seen for 40 years is speculated to have increased predation on sandeels and reduced food availability to seabirds (Furness *et al.,* 2004). Oil spills and other pollution events are also important for some species (Votier *et al.,* 2005).

Because seabirds are very long-lived, it is only possible to document and understand the causes of changes in population size and distribution by continuous monitoring over many years. Trends in population size and breeding success of all UK seabirds are monitored under the Seabird Monitoring Programme (JNCC undated), coordinated by the Joint Nature Conservation Committee, the Royal Society for the Protection of Birds and the Shetland Oil Terminal Environmental Advisory Group. More detailed data on a selection of species come from a small number of sites where intensive long-term studies take place. The most important of these sites is the Isle of May in the Firth of Forth, where breeding success, survival of adult and young birds, foraging behaviour and diet of five key species are followed in great detail by the Centre for Ecology & Hydrology, which also carries out research on how seabirds are affected by climate (CEH undated). Other sites providing important information are Foula in Shetland (University of Glasgow), Eynhallow in Orkney (University of Aberdeen) and Skomer in SW Wales (University of Sheffield/Oxford). A popular account of the study of black-legged kittiwakes, climate and fisheries (Frederiksen *et al.,* 2004a) is available at

www.nerc.ac.uk/publications/documents/pe-aut04/black-legged kittiwakes.pdf (NERC, 2004).

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