Fish

What is the issue?

Demersal and pelagic species in all OSPAR regions have experienced range shifts and changes in abundance over broad spatial areas and on multi-decadal timescales. Since the QSR 2000, it has become apparent that these changes appear to agree more often with the expected climate effect as fishing may have masked this effect over longer time-scales (ICES, 2008a).

What has happened and how confident?

ICES 2008a states that there is 'ample evidence for changes in fish distribution and abundance that are consistent with the expected (i) northward shift or towards deeper regions of the distribution and (ii) increase in abundance in the northern part and decrease in the southern part of the range'.

These changes are most pronounced in the northern seas, i.e. OSPAR Regions I (Arctic Waters) and II (Greater North Sea) and have been observed in both bottom-dwelling and pelagic species as well as in exploited and unexploited species. Whilst other factors such as fishing prevent us from unequivocally attributing these responses to climate it is 'highly likely' that climate effects are contributing to this change. For example, it is reported that stocks of cod in the North Sea are decreasing at a rate that cannot be explained by overfishing alone (Schubert *et al.*, 2006) and also that North Sea cod stock could still support a sustainable fishery under a warmer climate, but only at very much lower levels of fishing mortality (Cook and Heath, 2005).

In 2008, the MCCIP report card stated, with high confidence, that since 1980, the distribution of many warm water North-East Atlantic fish species has shifted northwards to occupy latitudes at which they were once non-existent or rare.

The rate of northward movement of a particular species, the silvery john dory, has been estimated at about 50 km/year (EEA, 2008). Other species have become more common further north, (Brander *et al.,* 2003) suggest that fish such as sea bass (*Dicentrarchus labrax*) and red mullet (*Mullus surmuletus*) have extended their ranges to include western Norway in recent years.

What might happen?

Looking ahead, although we can expect that climate change will have far-reaching impacts on the dynamics of fish populations, knowledge of underlying mechanisms is rather limited, especially in non-commercial species (Pinnegar *et al.,* 2008). Such uncertainties in making projections of fish distribution changes over the next 20–50 years arise from both the uncertainties in projections of ocean climate and uncertainties of fish community responses to those changes (EEA, 2008). Additionally, the overall interactions and cumulative impacts on marine biota of sea-level rise (coastal squeeze with losses of nursery and spawning habitats), increased storminess, changes in the NAO, changing salinity, acidification of coastal waters, and other stressors, such as pollutants, are likely but little known (IPCC, 2007b). In spite of these uncertainties, an assessment of the vulnerability of the North-East Atlantic marine ecoregion concluded that climate change is 'very likely' to produce significant impacts on selected marine fish and shellfish (Baker, 2005).

Farmed fish and shellfish species may become more susceptible to a wider variety of diseases as temperatures increase (Gubbins and Bricknell, 2008). Increasing harmful algal and jellyfish blooms may lead to additional fish kills and closure of some shellfish harvesting area. There will be some opportunities for new farmed species but storms and waves could damage aquaculture sites (Pinnegar *et al.,* 2008).

Are there any OSPAR regional differences?

A regional warming in the marine Arctic of 1–3 °C would be expected to lead to northward displacements of fish populations (Figure 3.2.3.), along with the establishment of discrete populations (e.g., cod near Greenland) and the immigration of southern species (ACIA, 2005). Recent global studies project a large-scale redistribution of global catch potential, with an average of 30–70% increase in high-latitude regions and a drop of up to 40% in the tropics; Exclusive Economic Zone regions with the highest expected increase in catch potential by 2055 include Norway and Greenland (Region I), and the United States (Alaska) and Russia (Asia) (Cheung *et al.*, 2009b).

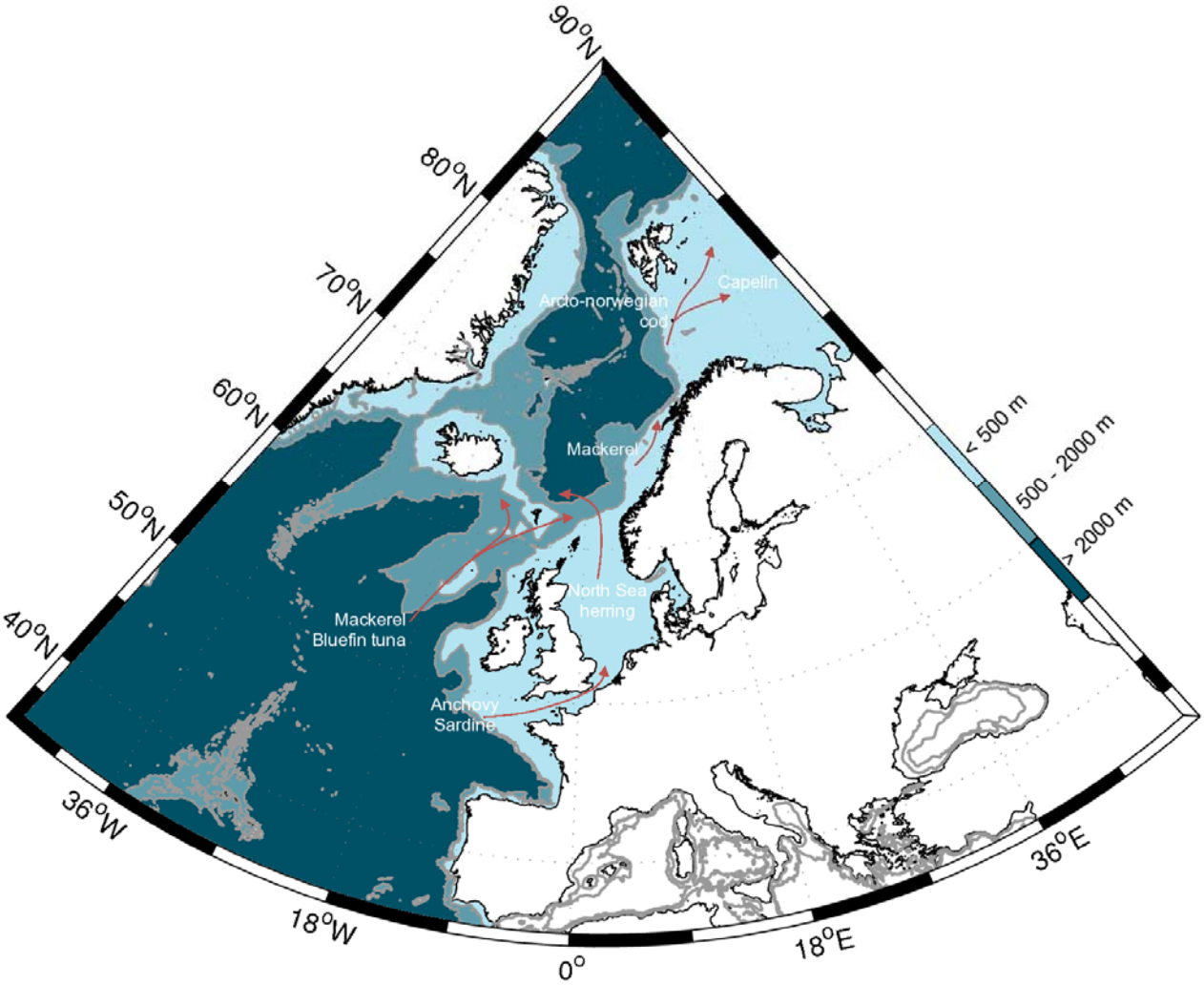

Figure 3.2.3. *Likely extensions of the feeding areas for some of the main commercial fish populations in the North-East Atlantic under climate change. The extent of the movements is for illustrative purposes and not a quantitative estimate of distance moved (modified after (Blindheim et al., 2001) in (ACIA, 2005)).*

➥ *Go to the full QSR assessment report on impacts of climate change (publication number 463/2009)*

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