

Benthic ecology and environment

What is the issue?

Climatic processes influence the abundance and species composition of seabed communities, directly affecting the availability of food for bottom-feeding fish.

There is little information available on how benthic environments may be affected by climate change, particularly as variability is more associated with very long-term geological responses over 1000s of years.

Any alteration in the seabed communities linked to climate change could alter rates and timing of processes such as nutrient cycling, larval supply to plankton and organic waste assimilation (Frid and Moore, 2008).

What has happened and how confident?

Benthic sessile organisms have been demonstrated to tolerate, in most cases, moderate changes over reasonable adaptive time-scales. However, they are very vulnerable to abrupt and extreme events and after such events, the re-colonization of the benthos can take several tens of years, or even centuries, particularly for species having less successful sexual reproduction (Hoepffner, 2006).

(ICES, 2008a) reports that the strongest evidence of responses in benthic taxa that would be expected as a result of climate change was:

- a. cases (in relatively shallow waters as seen in the Wadden Sea and nearshore German Bight) where anomalously cold winter conditions led to die-offs of species commonly associated with relatively warmer waters, or outbreaks of species commonly associated with relatively colder water (Beukema, 1990; Reiss *et al.*, 2006).
- b. cases of benthic species being reported as expanding in areas outside their historical ranges that are characteristic of areas to the south or more coastal than the areas into which they are spreading.

Both of these observations are consistent with climate sensitivity in the benthos, but with possibly a non-linear response. This situation could make the benthic biota a particularly high risk community for impacts of climate change, as changes are likely to be abrupt rather than incremental over time.

For the benthic environment itself, the basic knowledge of natural sedimentary changes on time-scales of decades is generally insufficient to allow changes to be confidently identified and their significance assessed. Away from the coast, there are few conclusive observations of changes in sediments of any kind, and none which can be definitively attributed to climate change.

What might happen?

To date, changes have been manifest through species composition but not major shifts or changes in gross productivity, which is likely to remain the case in the short to medium term. As benthic communities are broadly similar around the world, the system is not likely to become vastly different i.e. polychaetes, molluscs and echinoderms will still dominate the macrofauna, but there remains the possibility that ecological processes will be severely altered (Frid and Moore, 2008).

The understanding that cold-water corals, such as *Lophelia pertusa* are more widespread and diverse than expected is relatively recent. They are present over a wide bathymetric and hydrographical part of the Atlantic European continental margin (Dullo *et al.*, 2008). Roberts *et al.* (2006) suggested that these cold-water corals could be particularly vulnerable to future ocean acidification.

The natural drivers of potential future change in the benthic environment itself include: relative sea-level rise; wave climate; water salinity and temperature; air temperature; changes in tidal range. Identification of possible future benthic environment impacts with attribution to climatic drivers will remain difficult.

Are there any OSPAR regional differences?

See 'What might happen?' section above.

Changes to benthic environments are difficult to assess but are more likely to occur at a broader scale in the shallower OSPAR Regions II (Greater North Sea) and III (Celtic Seas) with impacts in Regions I (Arctic Waters), IV (Bay of Biscay/Iberian Coast) and V (Wider Atlantic) limited to the shelf areas.

↪ [Go to the full QSR assessment report on impacts of climate change \(publication number 463/2009\)](#)

References

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