

CLIMATE CHANGE IMPACTS ON MARINE ECOSYSTEMS IN EUROPE

Carlo Heip*, Manuel Barange, Roberto Danovaro, Marion Gehlen, Anthony Grehan, Filip Meysman, Temel Oguz, Vangelis Papathanassiou, Katja Philippart, Jun She , Paul Tréguer, Rachel Warren, Paul Wassmann, Phil Weaver, Rita Yu, Justus van Beusekom, Philip Boyd, Andrew Cooper, Hein J.W. de Baar, Henk de Haas, Felix Janssen, Wolfgang Ludwig, Leif Toudal Pedersen, Michael Tsimplis, Hans Von Storch, Jan - Bart Calewaert and Niall McDonough

* Royal Netherlands Institute of Sea Research, PO Box 59, 1790 AB Den Burg, the Netherlands
E-mail: carlo.heip@nioz.nl

The marine environment of Europe is vast and extremely diverse. Europe is bordered by the Atlantic Ocean to the west, the Arctic Ocean to the north and the Mediterranean to the south. Europe has the largest coastline relative to its surface of all continents and its economy is highly dependent on the seas and oceans in sectors such as tourism, transport, fisheries, energy, and many more. Changing marine ecosystems has direct consequences for human society.

Climate change affects the oceans. The rapidly and steadily increasing CO₂ concentrations in the atmosphere have warmed up at least the upper 2km of the oceans. The subtle consequences of that are increased stratification, leading to diminishing productivity, and increased hypoxia in the deeper waters, leading to the oceans losing oxygen slowly but steadily, with devastating effects on the deeper water biota. The pH of the oceans is decreasing with still largely unknown consequences. In response to warming waters, species are changing their distributions, in general moving northward everywhere, from the North Sea to the Barents Sea, from the Med to the Black Sea and so on. Fishermen, seals and birds alike will have to follow the movements of their prey.

As the oceans are changing, also the human environment on land is affected. Increasing water temperatures change the atmospheric circulation and affect weather patterns on land. Melting of land ice and thermal expansion are raising sea-levels, threatening coastal habitats as the rate of melting and sea-level rise is increasing. Melting of sea ice in the Arctic Ocean in summer is changing the food web and allows free transfer from the Pacific to the Atlantic and vice versa, for microorganisms and commercial vessels alike.

All these changes have been observed and much evidence is accumulating to scientifically support the conclusion that climate change is impacting our marine ecosystems as much as ecosystems on land. But observations from the oceans and seas are scattered and few sustained data series exist except for a few parameters. Even for temperature and salinity frequent systematic observation on a large scale is less than ten years old. A number of scientific unknowns remain and changes in vast areas in the deeper waters especially are a black knowledge hole. To come to grips with the high variability in many data in order to extract trends more reliably and support policies more adequately much better and more systematic observation is required.