

Science 18 June 2010:
Vol. 328, no. 5985, pp. 1523 - 1528
DOI: 10.1126/science.1189930

<http://www.sciencemag.org/cgi/content/abstract/328/5985/1523>

The Impact of Climate Change on the World's Marine Ecosystems

Ove Hoegh-Guldberg^{1,*} and John F. Bruno^{1,2}

Marine ecosystems are centrally important to the biology of the planet, yet a comprehensive understanding of how anthropogenic climate change is affecting them has been poorly developed. Recent studies indicate that rapidly rising greenhouse gas concentrations are driving ocean systems toward conditions not seen for millions of years, with an associated risk of fundamental and irreversible ecological transformation. The impacts of anthropogenic climate change so far include decreased ocean productivity, altered food web dynamics, reduced abundance of habitat-forming species, shifting species distributions, and a greater incidence of disease. Although there is considerable uncertainty about the spatial and temporal details, climate change is clearly and fundamentally altering ocean ecosystems. Further change will continue to create enormous challenges and costs for societies worldwide, particularly those in developing countries.

¹ Ocean and Coasts Program, Global Change Institute, University of Queensland, St. Lucia, QLD 4072, Australia.

² Department of Marine Sciences, University of North Carolina, Chapel Hill, NC 27599, USA.

Conclusions in the report include:

- The average temperature of the upper level of the oceans has increased more than 1 degree Fahrenheit during the past 100 years, and global ocean surface temperatures in January were the second warmest ever recorded for that month.
- Though the increase in acidity is slight, it represents a “major departure” from the geochemical conditions that have existed in the oceans for hundreds of thousands if not millions of years.
- Nutrient-poor “ocean deserts” in the Pacific and Atlantic oceans grew by 15 percent from 1998 to 2006.
- Oxygen concentrations are dropping off the Northwest U.S. coast and the coast of southern Africa, where dead zones appear regularly. There is paleontological evidence that declining oxygen levels in the oceans played a major role in at least four or five mass extinctions.
- Since the early 1980s, the production of phytoplankton, a crucial part of the food chain, has declined 6 percent, with 70 percent of the decline found in the northern parts of the oceans. Scientists also found that phytoplankton are becoming smaller.