

Socio-economic impacts of ocean acidification and warming on Barents Sea Cod

Martina H. Stiasny, Martin Hänsel, Catriona Clemmesen, Flemming Dahlke, Felix H. Mittermayer, Martin Quaas, Thorsten Reusch, Daniela Storch, Rudi Voss

Climate change, specifically ocean warming (OW) and ocean acidification (OA), poses a considerable threat to the Arctic. This ecosystem is likely to be negatively affected due to changes in sea ice cover, the higher solubility of carbon dioxide in cold waters and indirectly through particularly short food chains. Socio-ecological links are at the same time particularly important, with many people relying on marine ecosystem services for their livelihoods through e.g. fishing, tourism, or aquaculture. The Atlantic cod (*Gadus morhua*) is one of the most important species ecologically and economically in this area. Over the last years evidence has been accumulating that other fish species or indeed other cod stocks are affected by climate change in a variety of parameters. However, often quantifiable effects on the populations are still missing. Here, we use experimental and time-series data to scale physiological processes up to the population level by incorporating these effects into the stock-recruitment function. Using an ecological-economic optimization model, we investigate the effect of rising CO₂ and temperature levels on ecological (stock size), economic (profits), consumer-related (harvest) and social (fishing effort) indicators, ranging from present day conditions up to future climate change scenarios. We show that ocean acidification demands adaptation in fisheries management in order to secure the provisioning of cod stocks' ecosystem services under anticipated climate change.

Keywords: Atlantic cod, ocean acidification, climate change, early life stages, recruitment

Contact author:

Martina Stiasny, GEOMAR Helmholtz Centre for Ocean Research Kiel, Evolutionary Ecology of Marine Fishes, Düsternbrooker Weg 20, 24105 Kiel, Germany & Department of Economics, University of Kiel, Sustainable Fisheries, Wilhelm-Seelig Platz 1, 24118 Kiel, Germany; e-mail: mstiasny@geomar.de