

Estimating climate change impacts on global fish production and additional vulnerabilities to human societies

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Climate change is accelerating and is already affecting marine ecosystems and their services. Coupled climate models and ocean observations indicate that the world's oceans are warming and patterns in atmospheric variability are changing, resulting in changes in oceanic stratification, circulation patterns, sea ice and light supply to the surface ocean.

Biological responses to these effects are visible but uncertain. Primary production is expected to increase globally but with large geographical differences. Ocean warming and changes in currents are expected to continue causing distributional and phenological changes in plankton communities. However, the quantification of direct climate impacts on the production of fish resources at the global scale, and the risks and vulnerabilities of these impacts is hampered by:

- a) difficulties of downscaling Global Climate Models to the scales of biological relevance,
- b) lack of adequate global ecosystem models capable of capturing biological processes up to fish populations at the right scale and resolution,
- c) uncertainties over future global aquatic net primary production (NPP), and the transfer of this production through the food chain,
- d) difficulties is separating the multiple additional stressors affecting fish production, including differential geographical and temporal exploitation patterns and policies,
- e) inadequate methodology to estimate human vulnerabilities to these changes at all scales.

A new research consortium between leading UK research Institutions, supported by the WorldFish Centre, is addressing some of these challenges by investigating how climate change would affect size-based ecosystem production in the future, compared to past and present scenarios. This approach disregards uncertainties regarding future exploitation regulations, and focuses on the added impacts that climate change is likely to cause, and on the subsequent additional risks and vulnerabilities of these effects to human societies.

The project is anchored on outputs from Global Climate Models and from coupled physical/biological ecosystem dynamic models to predict ecosystem functioning in pre-industrial, present, near future (2050) and distant future (2100) scenarios. For each time period we will:

- estimate plankton production in 20 Large Marine Ecosystem units around the world,
- link primary production to fish production through algorithms based on ecosystem metabolic theory,
- develop improved ways of assessing vulnerability of fisheries to future climate change, in the context of other drivers of change, and
- specifically investigate the consequences of the results on the markets for a major fish-based global commodity, such as fishmeal/ oil.

We will present the pioneer multi-disciplinary methodology developed by QUEST_Fish and some preliminary results, as well as discuss some of the advantages of our approach and difficulties encountered.

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Biography

Dr Manuel Barange has been Director of the GLOBEC International Project Office, at the Plymouth Marine Laboratory, UK, since 1999. Previously he was Specialist Scientist and Head of the Surveys and Fish Behaviour Division at Marine and Coastal Management in Cape Town, South Africa. He has published over 60 peer-reviewed papers on zooplankton and fish ecology and life history strategies, physical-biological interactions, fish hydroacoustic assessment and survey design, and global change impacts on marine ecosystems. He is currently a member of the European Commission FP7 Advisory Committee on Environment and of the UK-DEFRA Marine Fisheries Advisory Group. He is a PI of the European Network of Excellence EUR-OCEANS and leads the NERC-funded QUEST_Fish project (Estimating climate change impacts on global fish production). Dr Barange is particularly interested in investigating climate and anthropogenic impacts on marine ecosystems and their services, linking natural and socio-economic approaches in ensuring marine ecosystem sustainability.