

Predicting the effect of fishing on indicators of good environmental status in the North Sea: an ensemble modelling approach.

Authors: Christopher Griffiths, Christopher Lynam, Hayley Bannister, James Waggitt, Robert Thorpe, Michael Spence

Abstract

Adaptive management of marine fisheries within the Ecosystem Approach requires information about how indicators of good environmental status will respond to fishing, both now and into the future. Ecosystem models are frequently used to gain this information, however despite sharing a common objective, to project the effect of different management strategies on ecosystem dynamics, these models often produce differing results. Such differences make any decision sensitive to the choice of model, leading to diminished confidence and a restricted uptake of ecosystem models at the management-level. Here, we overcome this issue, using an ensemble modelling approach that synthesises numerous modelling and empirical studies, to predict, with quantifiable uncertainty, how multiple indicators will respond to multiple fisheries management strategies in the North Sea. Specifically, we predict continued improvement of fish communities, with indicators of size-structure and absolute demersal biomass demonstrating healthy recovery rates. These trends are consistent across all fishing scenarios considered, with indicator values peaking under no fishing and recovery rates under MSY and NASH equilibrium being comparable. We are more uncertain about recovery in lower (zooplankton biomass) and higher (biomass of birds and mammals) trophic levels. This uncertainty highlights how deficient current ecosystem models are in resolving these ecological components and provides a clear avenue for future work. This work demonstrates how we can integrate information from a range of studies, both empirical and modelling, to support the Ecosystem Approach to management and inform on the use of fishing strategies to meet environmental objectives and fisheries goals.

Keywords:

ecosystem modelling, indicators, ensemble, fishing scenarios, 1986-2050, fisheries management

Contact author:

Christopher Griffiths, Centre for Environment, Fisheries and Aquaculture Science (Cefas), Lowestoft Laboratory, Pakefield Road, Lowestoft, Suffolk, NR33 0HT, UK. Email –

chris.griffiths@cefas.co.uk

Twitter username: @christophgriff5