

The application of pretty good yield ranges to the North Sea multispecies fishery

Robert B Thorpe^{1*} and Simon Jennings^{1,2}

¹ Centre for Environment, Fisheries and Aquaculture Science, Lowestoft, Suffolk, NR33 0HT, United Kingdom

² School of Environmental Sciences, University of East Anglia, Norwich, NR4 7TJ, United Kingdom

* Corresponding author: tel: +44 1502 524555; fax: +44 1502 513865; e-mail: robert.thorpe@cefas.co.uk

Abstract

The concept of Pretty Good Yield (PGY) suggests that a fished population can generate high and sustained fisheries yield across a relatively wide range of population sizes and fishing mortality rates (F). Many fisheries are multispecies and mixed so F ranges leading to PGY will depend on both ecological and technical interactions. We use an ensemble of size-based multispecies models to define F ranges leading to 95% of MSY in the mixed multispecies fishery of the North Sea. The F leading to MSY (F_{MSY}) for each of 21 species' populations was defined at the Nash equilibrium, where yield from any given population could not be improved if its F were changed independently. We then assessed risks to populations and community structure resulting from fishing at different points on these ranges. Results show that reward (total catch weight and value from all fished species' populations) increased marginally when fishing at the upper end of the PGY ranges, but risk of population collapse and not meeting targets for community indicators also increased markedly. Reducing F to rates at the lower end of F PGY ranges will substantially reduce risks of population collapse and increase community resilience, but with small impacts on total fisheries yield or value. While F ranges leading to PGY_{95%} provide managers with some flexibility to manage transition costs when moving to F_{MSY} our results suggest that the greatest collective long-term benefits to fisheries and the environment will be achieved by fishing at rates providing PGY but lower than F_{MSY} .

Keywords: pretty good yield (PGY), maximum sustainable yield (MSY), ensembles, multispecies, mixed fisheries, precautionary, stock impairment