

A Bioeconomic Model of Ocean Acidification Challenges in the Baffin Bay/Davis Straight Shrimp Fishery

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Abstract:

We examine the case of the shrimp fishery in Baffin Bay/Davis Straight for potential effects of Ocean Acidification (OA), including:

1. the overall productivity of the shrimp fishery,
2. the spatial spread of the shrimp fishery,
3. the quality of the shrimp brought to market, and hence price and profitability

As (1) and (2) are certainly also affected by other climate change impacts, especially temperature changes, the isolation of OA impacts requires not only integrated biological and economic analysis of the fishery but also the ecosystem shifts that can be connected to OA relative to other climate change impacts.

We develop a bio-economic model of the fishery including the ecosystem and its productivity. Specifically, we consider the potential shifts in ecosystem productivity from OA and the optimal response of the fishers and fishery managers to these shifts. We then evaluate the potential direct and indirect costs of OA by comparing optimal bio-economic use of the shrimp fishery without ecosystem productivity shifts due to OA and with shifts due to OA.

The demand side includes product differentiation to account for price differentials from different quality levels. The supply side includes costs associated with a stock-dependent harvest and technological and regulatory choices that affect discard and ecosystem health (e.g. trawling).

The biological components of the model incorporate the relationship between catch yield and population (growth dynamics). OA may impact the relationship directly or indirectly as the energy requirements of reproduction and growth shift the characteristics of the shrimp throughout the life cycle.

Keywords: Baffin Bay/Davis Straight Shrimp Fishery; Ocean Acidification; Bio-economic modelling

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