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Broadening the perspective on fisheries management actions: assessing resource use and environmental impacts from seafood products

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Summary

Sustainable development of fisheries encompasses more than reaching an appropriate fishing mortality for targeted stocks, for example decreasing fuel use, greenhouse gas emissions, seafloor area swept and impacts on threatened species. Life cycle assessment (LCA) is an ISO standardized method to quantify environmental impacts and resource use of products or processes in an integrated perspective. Interest in LCAs of seafood is rapidly growing, and studies of both fisheries and aquaculture production have shown hot spots, improvement options and trade-offs between different types of environmental burdens.
From a product perspective, several European product policies are aiming at sustainable production and consumption based on life cycle assessments. Seafood LCAs have shown that management of fisheries has a major influence on overall resource use and environmental impacts of the seafood product, for example through how fishing quotas and effort are allocated between gear types. Therefore, to fulfil product requirements, current fishing policies should therefore increasingly acknowledge the product perspective, i.e. how the environmental performance of the seafood product is affected by management actions in the fishery. LCA based approaches could constitute a decision support for fisheries management, complementing traditional stock assessments and integrate more aspects of exploitation.

Introduction

Fishing activities are associated to a range of potential impacts on marine ecosystems (Jennings and Kaiser 1998), but also make use of various amounts of fossil fuels and emit greenhouse gases (Vázquez-Rowe *et al.* 2012). Minimizing fuel use is not included in a management context; fuel subsidies to the industry may instead maintain inefficiency (Ziegler and Hornborg 2014). In a changing climate and fossil fuel sparse world, there is an urgent need for improvement.

Life Cycle Assessment (LCA) is an ISO standardized method to quantify environmental impacts and resource use of products in an integrated perspective. Interest in seafood LCAs is rapidly growing, and studies of seafood production have shown hot spots, improvement options and trade-offs between environmental burdens (Vázquez-Rowe *et al*. 2012). Methods for assessing fisheries-specific impacts are however not yet complete, but indicators have been suggested concerning important aspects such as seafloor area swept and impact on threatened species (Nilsson and Ziegler 2007, Hornborg *et al*. 2013). The integrated product perspective seafood LCAs give may offer new insights and a basis for comparison, including decision-support and evaluation for fisheries managers. Seafood LCAs have as an example repeatedly shown that the fishing phase dominates the environmental profile of the product; these results opt for management actions being top priority for the overall sustainability of seafood production. However, even if seafood LCAs have aimed at guiding and evaluating management actions (e.g. Driscoll and Tyedmers 2010; Hornborg *et al*. 2012), this is still at research level and not management practice.

Swedish case studies

The formerly mixed trawl fishery for demersal fish and Norway lobster (*Nephrops norvegicus*) in Sweden has with the depletion of gadoids in the area been transformed into a single-species fishery targeting Norway lobster. The demersal trawls in this fishery, now using a sorting grid to release fish from the catch, do protect sensitive species, but the grid comes with a trade-off; the catch efficiency is lowered, making the fishery more resource intensive practices than the conventional one (Hornborg *et al.* 2012). Meanwhile, the quota allocation to gear type is fixed, hindering an increase in creel fishery for Norway lobster, which has been shown to be a more sustainable alternative to demersal trawling. Instead of quick fixes, a thorough investigation of the broader implications of increased quota allocation to the creel segment is therefore called for, including aspects such as fuel use and seafloor impacts.

The Eastern Baltic cod fishery has gone from management success to crisis; the continuous strive for increased selectivity has caused impaired productivity (Svedäng and Hornborg 2014). In 2013, the stock was still considered to be fished according to a MSY framework, even if the ecological and economic state of the fishery was dire: the size structure of the stock was highly skewed, the quota could not be fished, fishermen were going bankrupt and the processing industry experienced decreased fillet yield and increased handling time. Therefore, broader evaluations should guide decisions on the optimum combination of mesh size and fishing effort. These should include further sustainability metrics such as fuel use, which is of importance both for the environmental and economic performance of the fishery.

Discussion

If sustainable development of fisheries is truly sought for, management considerations encompass more than reaching a sustainable fishing mortality on the targeted stock. There are several take-home messages from the Swedish case studies. These include a call for acknowledging more dimensions of sustainability than single-stock MSY and acknowledging the product perspective in the management of fisheries.

Life cycle approaches to fishing could in this sense form an integrated decision support for managers. Interestingly, from a product perspective, there are several European product policies, such as the Integrated Product Policy (IPP), aiming at sustainable production and consumption with life cycle assessment as the primary decision base. Due to the importance of management decisions to the outcome of the seafood product (Vázquez-Rowe *et al.* 2012), managers of fisheries should increasingly acknowledge their role in the production chain.

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