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Environmental impacts of a demersal freeze trawler on a fishing trip basis

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Summary

Life Cycle Assessment (LCA) quantifies the environmental impact of products, often using annual average data. Fisheries often show high spatial and temporal variability within a year and annual values may be too coarse to identify causes and improvement options on an appropriate level. Using LCA methodology, we analysed two years of data of a demersal freeze trawler targeting cod, haddock, saithe and shrimp mainly in the Norwegian and Barents Seas. The product was a kg of landed fish or shrimp from one fishing trip, frozen at sea. We quantified standard LCA impacts and biotic indicators (e.g. impacts on target and bycatch stocks) showing large variation between fishing trips. Fuel use was the main driver of emission-based impacts. Shrimp trawling was more fuel intensive than fish trawling per kg landed, due to lower catch rates. Bycatch (defined as catch of species other than the main target species) was low due to use of a species-selective grid in shrimp trawling. Fish trawling required less fuel, but landed varying amounts of bycatch. Quantifying environmental impacts of seafood products on a fine scale could help fishing companies, managers and certifiers to better understand the effect of decision-making on the environmental performance of seafood products.

Introduction

Life Cycle Assessment (LCA) quantifies the resource use and environmental impacts of products and has been applied to seafood production systems for around a decade (Parker 2012). LCA typically includes a number of emission-based impact categories such as greenhouse gas emissions, acidification and eutrophication. When studying fisheries, however, a number of direct and indirect biotic impacts occur that also need consideration. Recently a number of approaches to quantify these impacts in relation to seafood products have been presented (Emanuelsson *et al.* 2014, Hornborg *et al.* 2013a, Hornborg *et al.* 2013b). In this study, we investigated the variability in environmental performance within a year, i.e. between fishing trips, explored the drivers behind found patterns and identified ways to improve the environmental performance. We added the biotic impact categories to the standard set of LCA categories to evaluate whether there are trade-offs between different types of impact.

Methods

We used two years of high resolution data on fuel and production of a demersal freeze trawler targeting mainly cod, haddock, saithe and shrimp in the Norwegian Sea and Barents Sea. The standard LCA impact categories included were the ones recommended by the International Reference Life Cycle Data System, ILCD (EC 2014). A novel approach to quantify biological impacts of fishing in LCA depending on data availability is presented and used. Fish and shrimp landings were categorized as either target species, (with defined MSY reference points), threatened bycatch species (no management plans or biological reference points, but with a threat status on the Norwegian IUCN Red List) or as data-limited landings.

The distribution of landings in each of these categories were quantified for each fishing trip, as was the seafloor area swept.

Results and Discussion

The variability in resource use was found to be larger within a year than between the two years studied. The main explanatory factor for the variable fuel efficiency of fishing trips was the catch rate (landings per hour trawled). Fishing trips targeting shrimps were more fuel intensive than those targeting fish, mainly due to a lower catch rate. This also suggested that there is a tradeoff between biotic and abiotic impacts, as no bycatch was landed in shrimp targeting trips. The steaming distance to and from port was less important for fuel efficiency than the steaming between fishing locations within a trip.

The landings classified as main target species were generally harvested in line with the MSY framework (based on ICES advice), and proportions of threatened species landed were generally low. Proportions of data-limited landings were larger, mainly due to saithe not yet having defined MSY reference points.

Both fuel use and biological indicators varied considerably within a year. Although there are many reasons for this, including weather, climate and migration patterns of the target species, there is scope for improvement through management both on the company level and through fisheries management, by taking this variability into account. Since fuel use per landing is important both for environmental and economic performance, it should be closer monitored and considered as part of the management system. Quantifying a number of environmental impacts of fisheries on a fine scale in relation to a product could be used to follow up environmental performance over time, helping fishing companies to optimize their sourcing as well as managers and certifiers to better understand the effect of their decision-making on the environmental performance of the seafood products.

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