

Environmental Life Cycle Assessment of seafood products from capture fisheries

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Abstract

Seafood demand is expected to increase rapidly over the coming decades. Production of wild fish in the ocean is limited and many important stocks are already considered to be over-exploited. In addition to the direct impact on targeted stocks, fishing also leads to other types of environmental impact such as seafloor impact caused by demersal fishing gear, discard of undersized fish, air emissions from fuel combustion, and water emissions of active substances from anti-fouling paints. To make seafood production and consumption more sustainable in the future, a first step is to quantify the resource use and environmental impact along the entire production chain from the sea to the table. Life Cycle Assessment (LCA) methodology offers a structured way to do this. This research uses and develops the LCA method that was used and developed for application to wild-caught seafood. Two fisheries were studied in detail: 1) the Swedish cod fishery in the Baltic Sea using gillnets and trawls, and the fishery on the Swedish west coast targeting Norway lobster with conventional trawls, species-selective trawls, and creels. In the first case, the product was a frozen cod block and in the second case it was boiled Norway lobsters. Both products were followed from the fishery, through seafood auction, wholesaler and retailer, to the consumer. The case studies both lead to the conclusion that the fishery is the dominant phase in terms of environmental impact and that there are pronounced differences between fishing methods with regard to resource use and environmental impact. Gillnet (cod) and creel (Norway lobster) fisheries caused considerably lower environmental impact than the other methods did. Transport from retailer to consumer turned out to be the most important transport activity in terms of environmental impact according to both studies. In the Norway lobster LCA, the environmental consequences of the 2004 introduction of a new technical regulation — the mandatory use of species-selective trawls on Swedish national waters — was also evaluated. Selective trawling clearly leads to lower resource use and environmental impact than did conventional trawling due to reduced discards of undersized fish and a higher proportion of Norway lobster in the landed catches. Two methodological studies were also undertaken, one concerning emissions from fuel combustion in Swedish cod fisheries and the other concerning the seafloor impact of fishing activities. The emission study indicated that emissions per gram of fuel were higher in gillnet fishing than in trawling due to low engine load, but that the higher fuel consumption in trawling leads to higher emissions per kilogram of landed fish. The difference between allocating based on mass or economic value was demonstrated in the study with regard to catch composition, highly different cod fisheries along the Swedish coast. Considerable improvement potential was also identified in fuel scenarios. In the seafloor study, Swedish demersal fishing effort in the Kattegat was subject to geographical information system (GIS) analysis and overlaid by a marine habitat map. Results indicated that fishing activities were highly concentrated in certain parts of the area. Almost the entire areas of the muddy and deep rocky habitats were affected by the Swedish fishery, while the other habitats were less affected. The biological effects of this impact were assessed using a database of marine habitat sensitivity to various kinds of disturbance, and the results indicated that all habitats except muddy ones were probably in a fully or close to fully recovered condition, while almost half of the muddy seafloor habitats were kept in a permanently altered condition due to regular fishing impact. Large potentials for reducing the environmental impact of seafood production have been identified, especially in the fishing phase, in terms of both technical and structural measures. In the later parts of the life cycle, improvement options mainly concern choosing the right products, maintaining quality and minimizing product loss. A review of the nine seafood LCAs performed to date found that LCA is a potential very useful tool in planning and evaluating changes in fisheries management and in guiding seafood purchase including consumers, to make more sustainable choices.

Key words: cod, creel, discard, environmental impact, fishery, management, Norway lobster, LCA, seafloor seafood products, trawling