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Aspiring Forenvironmentally Concious Aquafeed: Comparative Life Cycle Assessment (LCA) of Aquafeed Manufacturing using Different Protein Sources

Biniam Samuel Fitwi[1], Stefan Meyer[2], Karoline Reckmann[1], Jan Schroder[2], Carsten Schulz[1]

[1] *University of Kiel, Institute of Animal Breeding and Husbandry, Marine Aquaculture, Germany*
[2] *Gesellschaft für Marine Aquakultur Mbh, Germany*

Abstract

Aquaculture is one of the fastest growing animal production activities in the world and it plays a vital role in many countries by providing economic, social and nutritional opportunities. However, the production of several culture species heavily depend on feed produced from resources of wild fisheries, namely fish meal and oil, that aquafeed manufacturing is a major contributor to several of the impact categories. In reality, the increased focus on growing few high value culture species at large quantities will accelerate the demand for fish meal and oil, a concern that is threatening the global capture of fish currently in decline due to overfishing and environmental changes. Therefore, continued growth of aquaculture production dictates that substitutes must be utilised without compromising fish health and product quality. In response, several investigators have successfully observed that partial or complete substitution of fishmeal by alternate protein sources, such as soybean meal and rapeseed meal, is possible.

In this study, a comprehensive environmental evaluation of the impacts of aquafeed is explored in order to provide decision support in policy discussions regarding aquafeed manufacturing. Thus, the impact of the product itself and the entire production system to produce it is investigated. In our study, we used consequential life cycle assessment (LCA) to model the environmental impact of trout feed manufacturing using different scenarios of fishmeal, soybean meal and rapeseed meal based protein sources for aquafeed formulations. In a cradle to factory-gate assessment of fishmeal-based standard trout feed, the impact categories acidification potential, global warming potential, eutrophication potential and land competition were 8.7 kg SO_2 equiv., 1797 kg of CO_2 equiv., 2.0 kg of PO_4 equiv. and 1065 m^2a, per tonne of aquafeed, respectively. Results indicate that fishmeal-based aquafeed has considerably higher impact on the environment as compared to plant protein based aquafeeds across all the impact categories. These impact results were sensitive to changes in different marginal energy uses. Moreover, the selection of attributional and consequential approaches of LCA result in considerably large differences that system expansion using consequential LCA is most appropriate in evaluating the impacts of aquafeed.

Keywords: Aquaculture, aquafeed, attributional LCA, consequential LCA, Life cycle assessment

Contact Address: Biniam Samuel Fitwi, University of Kiel, Institute of Animal Breeding and Husbandry, Marine Aquaculture, Hafentörn 3, 25761 Büsum, Germany, e-mail: biniam@gma-buesum.de