

32. LCA of locally produced feeds for Peruvian aquaculture

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The research presents and discusses a LCA performed on an aquafeed plants in the Iquitos area, Peru (inventories were collected for two plants but results are presented for the larger one only). The main goal of the analysis is to explore local utilisation of Peruvian anchoveta (*Engraulis ringens*) fishmeal in aquafeeds for both omnivorous and carnivorous cultured species. These results can be useful for the comparative study of seafood supply chains (e.g. Avadí & Fréon, this Conference).

Results from other Anchoveta-SC work on two fishmeal plants (Fréon et al., in prep.) and the Peruvian industrial anchoveta fleet contributed preliminary downstream data for the fishmeal (fishing and reduction stages). One fishmeal plant was fully modelled and one "average" 395 m³ holding capacity fishing vessel (the most representative category of anchoveta-targeting vessels, regarding historical landings) was modelled including rough estimations of the construction and end-of-life phases. Data for other feed ingredients were taken fromecoinvent, and adapted when necessary to fit the sourcing of Amazonian aquafeed ingredients and energy sources (i.e. the grid-disconnected Iquitos electricity supply is based on thermal oil-powered generation). Weighted average of different feed formulations produced was utilised for determining the "typical" feed composition for *Colossoma macropomum* (mostly herbivore, the third more cultured freshwater species in Peru) and *Brycon melanopterus* (omnivore), two important Amazonian species provided by the Iquitos aquafeed industry. This scenario was compared with a theoretical feed plant catering to carnivorous fish (rainbow trout, *Oncorhynchus mykiss*) cultured in the Puno region, by adjusting fishmeal and fish oil use and regional energy mix (Fig. 1 a,b). Moreover, Peruvian formulations were compared with northern hemisphere formulations. Life cycle impact assessments were performed with the ReCiPe method, but additional impact categories were calculated: Cumulative Energy Demand and Biotic Resource Use as appropriation of primary production. Sensitivity analysis was carried out by exploring and contrasting various sources/proportions of key feed ingredients.

As expected, most of the environmental impacts during the life span of the plants are due to the provision of feed ingredients (>65%), especially fishmeal (>35% for trout), corn, wheat and soy meals. An allocation strategy for fishmeal and fish oil is in preparation, but a preliminary gross energy content criterion (71:29) was used for preliminary results. The oil-based Iquitos grid energy determines a high contribution of electricity used (~268 kWh/t feed) to several impact categories. Soy meal used in Peru is mainly imported from Bolivia, and thus a Bolivian soy meal was adapted from an existingecoinvent Brazilian soy meal by adjusting the extent of the natural land transformation impact (provision of stubbed land, based on the characteristics of expansion zones for soy production in both countries (Dros, 2004)). Seasonal flood system rice grown in Iquitos was adapted from US rice, by reducing chemical input and eliminating irrigation. Proxies for wheat and corn where used (US produce), but their important contribution to certain impact categories suggests a full adaptation to local conditions is needed.

It was observed, in line with previous LCA studies of seafood systems, that construction and maintenance of feed plants contributes negligibly to environmental impacts of aquafeed products. It was also demonstrated that increasing use of fishmeal and fish oil, as well as the source of agricultural inputs, contribute to important variations in certain environmental impacts. Comparison between similar feeds for carnivore fish from Peru and Northern countries showed the specificity of South American ingredients: roughly comparable performance of fishmeal and soy meal (except Brazilian). The sourcing of feed ingredients was found to be critical for the contribution of feeds to impacts.

References

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