Evaluating Sustainable Seafood Production in Asia using Life Cycle Assessment

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Introduction

Per capita supply from global aquaculture has grown from 0.7 kg to 7.8 kg since the 1970s. Asia accounts for the largest portion of this expansion with highly diverse production systems, ranging from extensive to super-intensive. Globally, 37 percent of present production of fish and fishery products is traded internationally; the major importers being Japan, the U.S.A. and Spain. Feed resources are also sourced from international markets. Impacts from Asian aquaculture may, therefore, extend to soybean plantations in South America or reduction fisheries off the U.S. (figure 1). The need for a full production system approach is therefore needed to evaluate the overall environmental impacts and guide the industry towards a long-term sustainable venture. In doing so, Life Cycle Assessment (LCA) has become a more frequently implemented tool for identifying best practice and overall environmental performance of aquaculture production. LCA includes the whole production chain and can produce quantitative results for several impact categories (figure 2). The LCA framework does, however, have its limitations and needs to be reinforced by other analytical tools to capture a wider range of sustainability concerns. The SEAT project (www.seatglobal.eu) therefore aims to include a range of complementary tools to give a holistic measurement of sustainability. This will help guide the aquaculture industry towards best practices allowing for a long-term net addition to the global food pool.

The SEAT (Sustaining Ethical Aquaculture Trade) project is funded under the EU 7th Framework and will focus on improving the sustainability of four major aquatic products farmed in four Asian countries which have developed export markets to Europe.

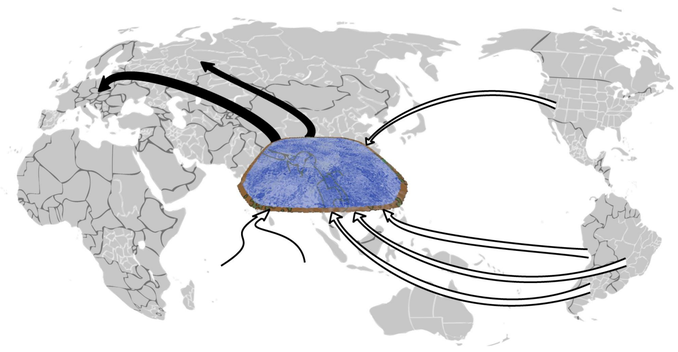

Figure 1: Aquaculture has become a highly globalized industry over the last decades, with approximately 37 percent of the produced seafood entering global markets and feed inputs sourced from around the world

Methods

The overall aim of the SEAT project is to evaluate the overall sustainability of farmed Tilapia *(Tilapia spp*.), Striped catfish (*Pangasius spp.*), Whiteleg shrimp (*Litopaneus vannamei*) and freshwater prawns *(Macrobrachium spp*.) imported to Europe from Asia. The production systems that are analysed include micro, small and medium enterprises in China, Vietnam, Thailand and Bangladesh. In an attempt to embrace the wide context of sustainability throughout the production chain, Life Cycle Assessment (LCA) is being applied to evaluate a wide set of impact categories. This will in turn be supplemented by supporting research on social and economic dynamics, food safety and public health concerns, contamination risks, ethical concerns, the global value chain and policy development. The ambition is to guide consumers to sustainable purchasing decisions. Communication of the outcome of the SEAT project with consumers will be done through the Ethical Aquatic Food Index (EAFI), a qualitative holistic measure of overall sustainability of aquaculture.

During the coming four years data will be collected in field trips in cooperation with local partners. Representative common farming practices will be chosen. The value chain will be described up to marketable product on European shelves. Impact categories will include global warming, eutrophication, acidification, toxicity and biotic resource use.

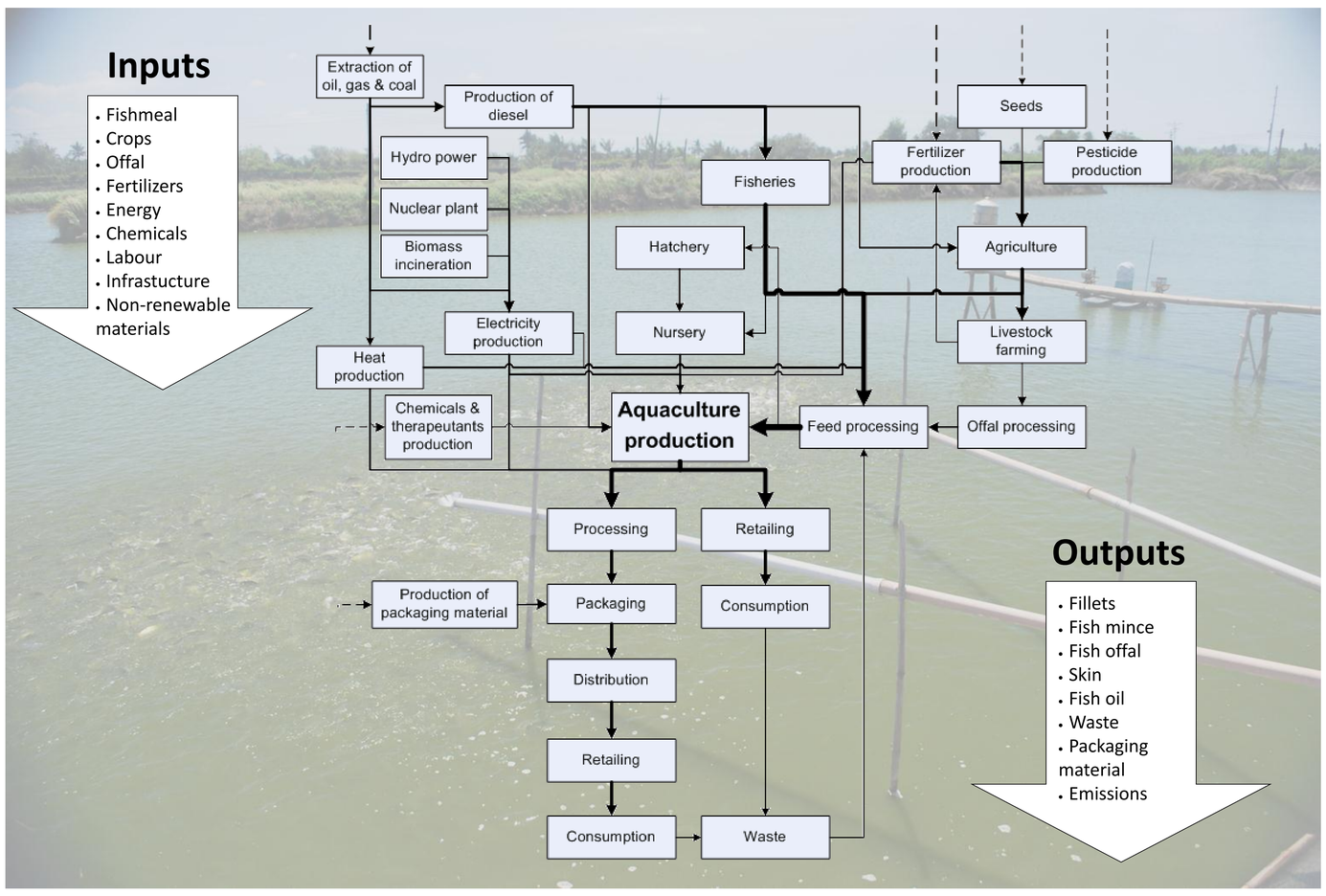

Figure 2: Flowchart of processes commonly involved in aquaculture production

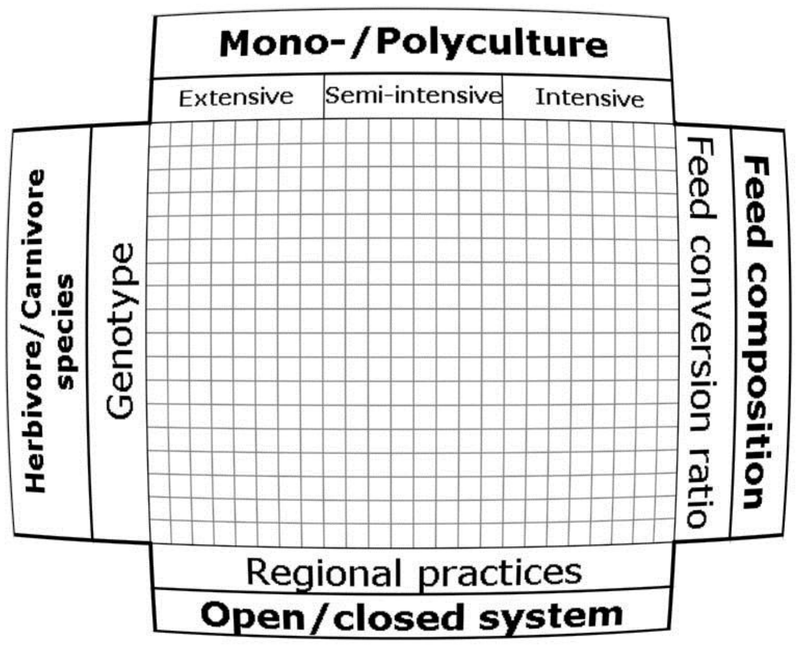

Figure 3: There is a matrix of farming systems depending upon species, region, farming intensity and feed composition. The SEAT project will therefore identify a set of different farms representing average technology as well as best available technology. This will allow for unsustainable trends to be identified and recommendations for best practice to be made.

Discussion

Collapsing fish stocks and increasing public demand for sustainable seafood has led to increased imports of Asian aquatic food products. The SEAT project aims to help consumers towards sustainable choices of seafood through the Ethical Aquatic Food Index (EAFI); which includes both environmental as well as socio-economic areas of concern. The project also aims to identify different farming practices within micro, small and medium enterprises, which vary widely between countries and species (figure 3). This will allow for estimations to be made on the environmental performance of each system and recommendations on best practices. In existing literature, feed is often found to be the main driver of the environmental performance of systems. This is influenced by both food conversion ratio (FCR) and feed composition. All of the four species in this study differ from the salmonid species often seen in western aquaculture as they are omnivorous and therefore have a greater potential for inclusion of crop derived ingredients. This will decrease the dependence on wild fish stocks, while in the meantime increase the FCR due to poorer feed quality. The outcomes of this research may support sustainability policy for both Asian producing countries and importers, supermarkets and consumers in Europe.

Acknowledgements

This work is part of the SEAT project, which is co-funded by the European Commission within the Seventh Framework Programme - Sustainable Development Global Change and Ecosystem (project no. 222889)

Pangasius spp.

Oreochromis niloticus

Penaeus spp.

Macrobrachium spp.