AQUACULTURE SUSTAINABILITY AND HUMAN IMPACT ON GLOBAL NUTRIENT CYCLES

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In 2006 fish contributed 110 million tons of meat to the human food supply (Figure 1). Aquaculture provided 47% of this fish and is currently the fastest growing segment of the food production system, expanding at 7% per year. Expectations are that this growth will continue at a similar rate for the foreseeable future. Although current aquafeed production, about 15 million t, is a small portion of the animal feed industry (currently over 600 million t) it will likely become a larger portion in the future. Estimates of demand for aquafeed in 2030 are as high as 80 million t (Figure 2). A number of concerns about the impact of aquaculture on the environment have been raised by NGOs and two items of specific concern to those involved with aquafeed are (1) the feeding of fish to fish and (2) the pollution caused by feeding compounded feeds to fish in open systems. In addition, the question of sustainability is of concern to producers, retailers, consumers and the general public.

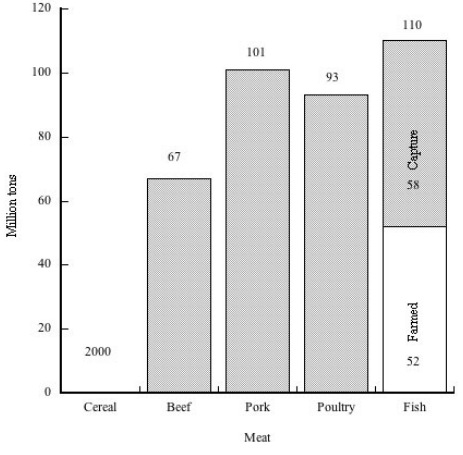

Figure 1. Contribution of various meats to the human food supply

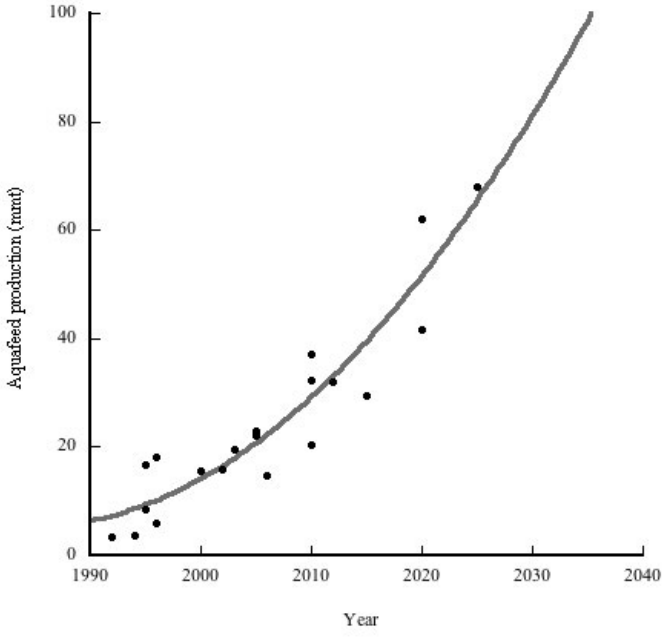

Figure 2. Reported (up to 2006) and estimated world aquafeed production

The aquafeed industry along with a majority of researchers in this area claim that the industry is working towards sustainability. Using the 1987 UN Brundtland Report definition of sustainability "meeting the needs of the present without compromising the ability of future generations to meet their own needs" I will present an examination of this claim. Examining the industry response to concerns (1) and (2) above and looking at the source and ultimate fate of the nutrients contained in aquafeeds suggests that we are proceeding down the wrong path to achieve sustainability.

Aquaculture should be viewed as one of many components of a global food production system that share a single nutrient pool. Sustainability is maintained when nutrients can be moved between components and re-used, but conversely when nutrients are lost or so diluted as to not be reclaimable (e.g. if they are discharged into the world's oceans), then sustainability is not maintained. This

situation may be most critical for phosphorus which may be the first limiting nutrient for industrial food production in the very near future.

Wherever possible, feed ingredients should be derived from materials such as animal processing waste that are not used for human consumption. Single cell proteins produced from natural gas and other microbial proteins grown on agricultural byproducts also have potential as replacements for fishmeal. Finally, rearing systems and processes that can improve sustainability are available (Figure 3), but most require additional research so they can be optimized and become economically viable.

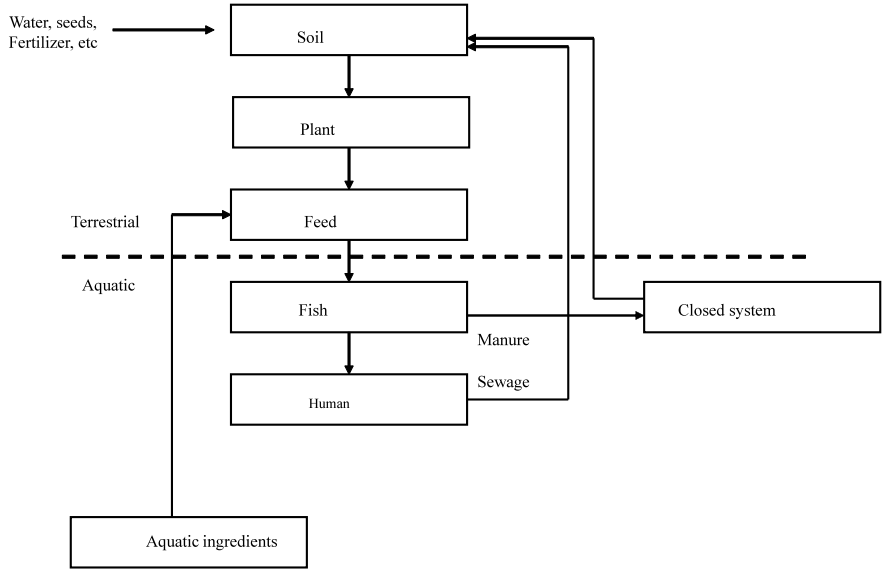

Figure 3. Nutrient flow in a sustainable aquaculture system.

References

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FAO,2005. State of the World Fisheries, 2004