

A Green Revolution in Cultured Fish and Livestock Diets?

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I am pleased to share my thoughts as member of the Editorial Board of Fisheries and Livestock Production in this inaugural issue. I look forward to articles addressing sustainability, health, safety, and community development in fisheries and livestock production. Although the challenge of sustainably feeding populations growing in numbers and wealth is great, technological advances are meeting the challenge: the rapid growth of aquaculture is taking pressure off ocean stocks, ocean stocks are better managed and understood, and terrestrial livestock systems are responding to animal well-being and human health concerns. In developing nations, the internet is providing information and contacts for private development of animal protein industries, and allowing coordinated management and protection of their valuable fisheries.

Other than the largely unknowable but nonetheless serious impacts of global warming and climate change, among the more pressing issues in fisheries and livestock production is the replacement of fish meal and oil, now comprising a large portion of salmon, trout, bass and other carnivorous cultured fish feeds. Many other animal diets, as well as for most other cultured fishes and shrimps, include substantial quantities of fish meal and oil for the healthful omega 3 lipids and easily digestible protein. An estimated 2.8 mmt fish meal and 1.0 mmt fish oil are currently utilized. This quantity is rendered from much larger quantities of ocean stocks of plankton-feeding fishes such as menhaden, sardines, herrings, etc. Although not a large portion of these are sought for human consumption, they are essential parts of the marine food chain that lead to production of high value predator fishes and other sea life, such as seabirds, including penguins, and mammals. In addition,

biocontrol of harmful algal blooms may be reduced by reduced planktivore populations, as has been suggested for menhaden on the U.S. east coast. The healthful lipids in the fish meal and oil are the result of bioconcentration of these compounds originating with algae. Along with the bioconcentration of these beneficial compounds are minute quantities of other compounds from ocean waters that are undesirable, such as metals and industrial compounds. Thus, objections are raised not only to use of fish meal and oil, but to the inadvertent inclusion in diets of these compounds.

Soybean meal and animal and grain byproducts, such as chicken offal and corn gluten, and byproducts of industries utilizing grains, such as distilleries, are being examined and used as fish meal and oil replacements, but lack the algal-produced omega 3 lipids, such as DHA and EPA. However, by coincidence, an industry is quickly developing to culture algae for biofuels, chemicals, feed supplements, and food supplements with a \$1.4 trillion potential, including \$5 billion in feed supplements (Mitrovich 2011). The current high cost of algal meal and oil should become more competitive by economies of scale, and algal meal has been shown to replace 70% of fish meal in omnivore diets and substantial percentages in more carnivorous species. For aquaculture to grow at the required 10% per year pace to meet current demand, and continue to relieve pressure on ocean overfishing by attaining levels exceeding 100 mmt in 10 years, a full or partial replacement of fish meal and oil is going to be required. Thus, a green revolution may be starting in the diets of fisheries and livestock production. And like that of the earlier revolution, the stakes are high.

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