

The 'Blue Revolution' - Aquaculture Must Go Green

by

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SINCE 1950 there's been a 100 percent increase in the per capita demand for fish products (Brown et al. 1998). The United Nations Food and Agriculture Organization predicts that in this century world consumption of aquatic proteins will increase to 150-160 million tons (FAO 2000). Traditional fisheries can provide no more than 100 million tons so the bulk of the increase will need to come from aquaculture—farming the world's waters. But expansion of aquaculture—the so-called "blue revolution"—has raised several concerns about: aquaculture operations becoming energy-intensive animal feedlots producing nutrient pollution comparable to that of small cities; habitat destruction and water diversions that disrupt aquatic ecosystems; aquaculture being a vector for invasive species, diseases, and causing genetic dilution of wild stocks; and about the accelerated use of fish meals in aquaculture feeds, resulting in aquaculture's becoming a consumer, rather than a producer, of animal protein (Pullin et al. 1993; Folke et al. 1998; Goldberg and Triplett 1997; Naylor et al. 1998, 2000).

Aquaculture encompasses a wide diversity of systems, species and management practices which defy rigorous classification. As a result, aquaculture is not a monolithic "industry" or a standard set of practices easy to classify, categorize or regulate. However, most of the well-publicized problems are with shrimp and salmon aquaculture. Concerns about shellfish, grazing and omnivorous fish aquaculture and marine-plant agronomy (algae, aquatic plant, seaweed aquaculture, etc.) are fewer. Indeed, shellfish aquaculture has been shown to provide a vital ecosystem service in the removal of nutrients and sediments from the water (Kaspar et al. 1985; Rice 1999; Newell 2002).

I support the rapid expansion of aquaculture worldwide, but believe that expansion must be accomplished by promoting an alternative aquaculture development model: an "ecological aquaculture" model, which brings not only the technical aspects of ecosystems design and ecological principles to aquaculture, but also incorporates comprehensive planning for the wider social, economic and environmental contexts of aquaculture (Costa-Pierce 1997, 2002; Costa-Pierce and Bridger 2002; Stickney and McVey 2002).

Aquaculture is nothing new, nor is the concept of "ecological" aquaculture. Aquatic animals and plants were farmed using ecologically sophisticated technologies over 3,000 years ago. Aquaculture evolved in societies pressed by the inabilities of natural and cultivated land and water resources to provide enough high quality protein foods for their increasing populations. The integration of agriculture, animal husbandry, and aquaculture on farms in Asia created definable aquaculture ecosystems, which closely resembled natural ecosystems, with their own structure, closely coupled nutrient-recycling pathways and ecological management.

Adopting ecological technologies alone, however—no matter how innovative—is not enough. More appropriate technologies must be implemented; farming practices must be reconfigured; and more comprehensive policies must be enacted for the industry to resurrect its reputation and gain the support of its many detractors. New aquaculture developments must be planned as part of—not separate from—comprehensive management strategies for the restoration and sustainability of coastal ecosystems, coastal fisheries and coastal communities.

The competition between aquaculture and fisheries could be better managed for the benefit of both traditional fishing and aquaculture farming communities. Professor Jim Anderson, a University of Rhode Island fisheries economist, put this lack of comprehensive fisheries planning in context when he considered a typical meeting of fisheries experts. He said, "They debate fisheries management and innovative solutions to the great open-access problems. When they break to eat dinner, it is likely to consist of salmon or shrimp. Yet they seem oblivious to the fact that the seafood they are consuming is farmed. They eat the future of fisheries, but they continue to discuss its past." (Anderson 2002). We need to get beyond the current user conflicts over the future of our coasts and evolve more socially and ecologically responsible aquaculture industries that enhance traditional fisheries, reclaim damaged ecosystems and habitats, and offer to society a more comprehensive vision for the future of the world's working coasts.

Alaska is a textbook case of the need for more comprehensive planning for fisheries, aquaculture, ecosystems and the future of coastal communities. Some time ago, Alaska made salmon aquaculture technically illegal in order to protect its salmon fishery and its pristine marine environments (and with the unstated purpose of protecting its salmon markets?). But in reality, Alaska is a salmon aquaculture powerhouse. The state has salmon hatcheries and nursery net pens in Prince William Sound that have added millions of salmon to the some 10 million salmon harvested each year since the 1990s. Studies have found that these hatchery salmon did not displace the region's wild salmon stocks; rather, the hatchery salmon have added to the size of Alaska's salmon harvest (Wertheimer et al. 2001). As a result, Alaska is awash in salmon, not only from the wild, but also from its aquaculture-enhanced salmon fishery. According to *The Anchorage Daily News*, Alaska fishermen landed almost 175 million salmon in the summer of 2001, yet they received only \$216 million for them—less than half the revenue earned 15 years before. This is occurring when the global production and demands for salmon are exploding. For the first time in 2001, salmonid farms in Chile produced more than their

counterparts in Norway: 501,00 tons vs. 477,000 tons (Fish Farmer Magazine 2002). The world last year consumed an estimated 3.7 billion pounds of salmon—triple the amount of 20 years earlier. The reason for the fishermen's declining revenue is that the salmon farms have won almost all of the new demand. Alaska fishermen contend that wild salmon tastes better than farmed, but consumers don't seem to care. By banning salmon aquaculture Alaska has, in effect, “legislated the typewriter”.

Aquaculture's growth needs to be better planned to not only meet the phenomenal growth in seafood markets, but to serve human needs. To increase its social acceptance, aquaculture needs family and community roots, in addition to corporate ones. Thousands of ecologically and economically sustainable aquaculture family farms and start-up companies need to be developed. The farms will need to practice "input management"; to recycle water, nutrients and materials; and to produce healthy products without discharges. As part of their business plans, the new farms and companies will need to recognize their social and environmental responsibilities; plan for more efficient resource recycling; and enhance—not degrade—natural ecosystems and community social services. In order to accomplish this, we need increased interaction among aquaculture's business, science and education leaders, coastal communities, and the larger aquatic resource management community regarding the principles, practices and policies needed to develop ecologically and socially sustainable aquaculture. Clearly, this will require accelerated funding for applied aquaculture research and increased involvement by state and federal agencies and the public so that we can have the latest science and outreach advances needed to assist the evolution of ecological aquaculture. Governments—worldwide—have dropped the ball here.

Environmental groups have done a service to both society and global aquaculture by pointing out the ecological and social effects of aquaculture. Aquaculture does have an impact on the environment, just as agriculture does. In expanding, aquaculture needs to adopt an ecological development model to become part of the "culture" of a place and region. Increased planning for aquaculture is needed on a scale beyond that of the farm site, in order to: recognize aquaculture's vital support services at the outset of proposed developments; maximize potential job creation and local benefits; and plan better for aquaculture's ecological and social "footprints" in the larger context of a bio-region and the future of coastal fishing communities. In areas where it is relatively new, such as North America, if aquaculture continues to evolve as a corporate and regulatory undertaking—rather than in an environmental and socially responsible manner—it will never reach its potential. The increased diseases, environmental regulations, management difficulties, and resource and social conflicts coming in the crowded 21st Century will slow its progress and its promise. And it is certain that the public worldwide will not accept any new forms of food production that exploit people, cause environmental harm, or produce new sources of aquatic pollution. Expansion of industrial aquaculture in enclosed bays along crowded coasts and rivers in conflict with coastal communities and environmental managers is not the way to conduct the blue revolution.

Only with a new vision for aquaculture development that incorporates increased and more comprehensive planning can we become better stewards of the earth's natural and cultivated aquatic ecosystems. In short, the blue revolution will quickly go bust unless it "greens up."

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