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Sustainable Aquaculture for a Secure future

Title: Environmental Considerations

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Abstract: Water, air, soil, and aquatic organisms can be viewed as overlapping compartments in the pond environment. Substances exchange between these compartments through their closely associated interfaces. Aquaculture, with its intimacy of contact with receiving waters, should include evaluation and mitigation of potential environmental risks. Such action will reduce constraints on development by this emerging industry and protect it from ineffective or unnecessary restrictions. Other water users, such as intensive agriculturists and wastewater managers, have been forced to consider the environmental concerns of society and the restrictions on both the characteristics and the amount of effluent released and the type of treatment required. The aquaculture industry may be in the process of following a similar pathway as it responds to environmental legislation while incorporating its own sense of environmental responsibility and awareness. Aquacultural scientists from industrialized nations, where environmental legislation may be well established, are helping to shape aquacultural practices in countries where legislation and environmental concern may be just emerging. Although regulation to limit the environmental impacts of aquaculture may be defensible, such restrictions have often been unnecessarily burdensome, complex, and purposeless. Surveys of U.S. aquaculturists indicate that aspects of the permitting process and operational regulations are often inappropriate extensions of regulations designed for other forms of agriculture. The aquaculture community may find it necessary to lobby and build influence within the political community, while conducting convincing environmental research, to effect changes in these regulations.

Aquaculture has expanded rapidly throughout the world, doubling production to about 14 million metric tons between 1984 and 1992 (FAA, 1994). As production has increased, aquacultural practices have begun to resemble traditional animal agriculture in terms of increased intensity. Aquaculturists have been able to operate aquatic systems near the water quality limitations of the species cultured. Careful monitoring of dissolved oxygen and ammonia, sometimes coupled

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with mechanical systems to prevent lethal conditions, have allowed production at high levels within the limits of real but allowable risk of crop failure. Traditional agriculture has increased production in much the same way, increasing inputs and stock density to maximize profits per unit area. However, just as traditional agriculture has encountered problems, such as point and non-point discharge of wastes, fertilizers, drugs, and other potentially toxic substances, aquaculture may now face such problems.

Environmental problems associated with aquaculture may lead to legislative constraints beyond those encountered by traditional animal culture. Brackishwater shrimp culture, for instance, has attracted the attention of environmentalists and others concerned about the loss of wetlands, particularly valuable mangrove ecosystems, by improper culture practices. Such concerns, if ignored, may result in aquaculture facing confining legislation or public rejection of the product, as sometimes occurs in other areas of agriculture. Many examples already exist: consumers rejected apples from the Pacific Northwest because of concern over the use of the additive Alar; consumers have demanded "dolphin safe" tuna. Reduced red meat consumption may derive not only from health concerns but also from the perception that beef production is associated with poor rangeland practices and high resource commitments that impact other species.

Recent appreciation for the value of preserving indigenous species must be addressed by aquaculturists. Cultured exotic species, such as tilapia, introduced into receiving waters have endangered native species through competition, disease, or predation. Even where cultured fish are indigenous, loss of genetic diversity in native fish has occurred from hybridization with cultured stocks. When choosing which species to culture, aquaculturists must now take potential impacts on indigenous species into account, along with performance and economical considerations.

Aquaculture need not be environmentally damaging; instead, it can play a prominent role in conserving natural resources while contributing much needed social benefits. Attaining a more sustainable, productive, and environmentally sound food production base throughout the world may not be achievable, in fact, without the incorporation of an expanded aquaculture industry into the agricultural process. By avoiding negative impacts on the environment, aquaculture can solve rather than create environmental problems on a global scale.

This abstract is excerpted from the original paper, which was in: H.S. Egna and C.E. Boyd (Editors), *Dynamics of Pond Aquaculture*. CRC Press, Boca Raton, pp. 163–182. (1997)