

Environmental Management and the Use of Sentinel Species

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1	Introduction	410
1.1	Sharing the Waters	410
2	Coastal Zone Management	412
3	Aquaculture Niche	414
4	Nature of Aquaculture Contributions	416
4.1	Cage Culture—General	416
4.2	Infectious Diseases in Relation to the Environment	418
4.2.1	Infectious Agents	419
4.2.2	Reservoirs and Vectors	421
5	Problems in Assessing Impacts	424
6	Use of Sentinel Species as Non-Specific Biological Indicators of Environmental Quality	425
6.1	Indirect Approach	425
6.1.1	Wild Biota	426
6.1.2	Captive Biota	426
6.2	Direct Approach	427
6.2.1	Early Physiological Indicators	427
6.2.2	Histone-like Proteins (HLPs)	427
6.2.3	Heat Shock Proteins (HSPs) or Molecular Chaperones	428
7	Concluding Remarks	430
	References	431

Abstract To be successful, environmental management must be comprehensive and take into account the activities of all participants who share that environment. In this chapter aquaculture is discussed as an activity in the marine coastal zone that not only shares the waters, but also has a particular need to maintain the quality of those waters. Emphasis is placed upon the need for an effective system of integrated coastal zone management.

Environmental management problems stemming from aquaculture can be minimized by selection of the areas most suitable for culture, applying the best technology and maintaining operations at levels within the assimilative capacity of the area. The contributions of aquaculture to nutrification and pollution are presented and the need to

understand their impacts is discussed. Treatment of infectious diseases among the farmed species as an integral part of a comprehensive environmental quality program is advocated. A central problem in environmental management is the lack of proven indicators of environmental quality. As the condition of the biota reflects the environmental conditions under which they live, it is considered possible to measure environmental quality by using captive and wild biota as sentinel species. These measurements can be made indirectly on whole animal or plant responses or directly through measurements of stress as revealed either by changes in blood constituents or on changing concentrations of stress proteins such as anti-microbial histone-like proteins of the skin, or from the array of heat shock proteins now better understood as stress proteins or molecular chaperones.

Keywords Aquaculture niche and environmental contributions · Coastal Zone Management · Molecular chaperones · Sentinel species · Stress proteins

1

Introduction

Although aquaculture is a significant and legitimate competitor worldwide for space in coastal and freshwater areas, it must still demonstrate that it will not jeopardize other uses of coastal, brackish or freshwater zones by causing unacceptable changes to the environment. Obviously, as aquaculturists are among the first to suffer the consequences of environmental deterioration, their concern for the environment should be equal to or greater than that of all parties wishing to preserve it for other purposes; the emphasis must be on the need for all parties to share the waters responsibly.

1.1

Sharing the Waters

Aquaculture is now being pursued in many areas where it did not previously exist. In the marine environment the areas in which these ventures are being located are largely the relatively narrow coastal zones, often areas which contain other significant activities and interests ranging from fishing to recreational uses, industrial, conservation, waste disposal and military purposes to name a few. Very few areas are wholly pristine or can be occupied exclusively by a single user and thus compromises and cooperation will be required. The major and minor uses and participants can be grouped under four general headings (Fig. 1) [1] to make consideration of these various separate interests more apparent.

Additionally, the environmental condition of the coastal zones in many areas is increasingly becoming a matter of concern, as illustrated in summary form by two reports from the Organization for Economic Cooperation and Development (OECD) [2, 3] which state that the coastal zone in most of its member countries and, in fact, in virtually all countries “is under severe