# Considerations for Selecting Fish Production Facilities

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Extensive and intensive fish production facilities have been differentiated by the degree of man's involvement to control production (Stickney 1979). Extensive systems — natural aquatic systems in which fishery managers manipulate one or more factors to exert some positive influence on favorable species — produce relatively few kilograms of fish per hectare when compared to intensive systems. Intensive production systems — closely managed by aquaculturists to maximize production of selected species by exclusion of competition and sources of mortality — may annually produce harvestable fish in the range of 3,000 to $10^6$ kg/ha.

Intensive culture systems include ponds, cages, tanks, raceways, semiclosed recirculating systems and closed recirculating systems, but not all production facilities are suitable at any given location. A system that is optimum for one site may be most inappropriate for another site because of relative cost of land, water, and energy (Parker 1976). For example, in the urban environment land costs are usually high; thus, pond culture systems that require large tracts of land might be cost prohibitive. Raceways require large volumes of continuously flowing water of high quality and are cost prohibitive in areas where water is limited or highly contaminated with industrial, agricultural, or municipal pollutants. Recirculating systems not only require input to maintain water quality but also require intensive management and operator expertise. Complex water reuse systems can have only limited success in underdeveloped nations where electrical service may be erratic and operator expertise is in short supply.

In the past, aquaculture has been more of an art than a science. Based on the combined research of fish culturists, engineers, economists, chemists, physiologists, nutritionists, and others, aquacultural practices are now being analyzed and defined to provide data bases necessary to make performance projections and establish aquaculture as a science. An indication of our nationwide interest in aquaculture was provided by the National Research Council's 1978 report, which considered the constraints and opportunities for aquaculture in the United States. Recent contributions to the body of knowledge such as Wheaton's (1977) engineering text, Boyd's (1979) water quality text, and papers presented previously in this symposium provide guidance for future developments in the aquaculture area.

The economic potential of the aquacultural industry has generated investments that in some cases have failed because not all factors were carefully considered. Components of the system were not appropriate for the site. Considerations necessary before selecting a particular type of intensive fish production facility include, but are not restricted to, availability of the following: (1) species, (2) land, (3) water, (4) energy, (5) equipment, (6) labor, (7) technical expertise, (8) diagnostic services, (9) maintenance services, (10) emergency backup systems, (11) feeds, (12) markets, (13) storage, (14) processing, (15) transportation, (16) investment capital, and (17) economics.

In this last session of the Bio-Engineering Symposium, operational and design characteristics of several different fish production facilities reflecting state-of-the-art will be presented. Each system, regardless of size, complexity, or expense, was selected to meet design criteria at a given site. They include systems designed for underveloped nations, for backyard aquaculture, for commercial ventures with marine cages, for waste heat utilization in electric power plant effluents, and for the production of salmonids, cyprinids, and aquatic macrophytes. Evaluate these systems for the seventeen points listed above to assess their application potential in other sites. Remember, that as aquaculturists we must first consider the species' requirements, and, secondly, regardless of the design, if a system is not economical, it will not be practical.

## References

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