

Prospects for Aquaculture in India

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Cost-benefit analysis indicates considerable scope for aquaculture in India. The technical, environmental and biological factors affecting the choice of the ideal systems and species are discussed. The other aspects considered are the biological risks involved, the size of investment, cash flow pattern and run-in-time for achieving a high rate of return.

AT present, there is a worldwide trend towards the development of fish farming or aquaculture which is aimed mainly at monitoring the environment, so as to control the quality and yield of the desired product. The estimated farmed fish production in the world is about 5×10^8 tonnes/year, of which about 80% is from Asia and the Far East¹. This production represents about 6% of the total annual catch of fish in the world. The production under aquaculture has almost doubled during the last five years. In a few countries like Israel, more than 40% of the annual fish production is from aquaculture².

Scope of aquaculture in India

In a developing country like India, the necessity for encouraging aquaculture on mass scale arises for the following reasons: (i) to produce a high quality animal protein at a reasonable price for supplementing the protein deficient diets; (ii) availability of relatively cheap and abundant unskilled manpower; (iii) production of choicest variety of quality table fish for export; (iv) proper utilization of vast wetlands measuring 1.6 million hectares for generating more food resources; and (v) creating more vocational opportunities for the rural populations.

In India, more than 7.5 million people depend on fishery for their livelihood, while about

25,000 are engaged in ancillary vocations complementary to fisheries. Of the country's available water resource of 1.6 million hectares, only 0.6 hectares are in use for fisheries, while about 0.4 million hectares are readily available for fish farming. Further, about 2 million hectares of brackish water offer immense possibilities for cultivating shrimp, fin-fishes, oysters, mussels and clams.

The technical feasibility of farming different aquatic organisms in Indian waters is highly promising (Table 1), and some of the production figures, especially for Indian carp, mixed culture and green mussels are comparable and even higher than those reported from the developed countries³. Cost benefit analysis also indicates a high rate of return which is 181% in the case of mussel culture⁴ and more than 100% in traditional fish farming in Goa⁵. The techniques developed in India are low cost and practicable. Thus, the success, so far achieved, clearly indicates the possibilities of fish farming on commercial scale.

Factors related to the development of aquaculture in India

Government authorities have been generally slow to recognize that fish farming is a primary producing industry like agriculture or animal husbandry for which legislative, administrative

Table 1 — Annual yield from different aquaculture systems developed in India

SPECIES/WATER	LOCATION/SYSTEM	ANNUAL YIELD kg/ha	REFERENCE
Indian carp/Fresh	Cuttack (Orissa)/Average for 132 ponds	4000	1
Mixed/Fresh	CIFRI, Barrackpore/Fish farm (West Bengal)	8750	1
Mixed/Brackish (Fish and prawn)	Kakinada (Andhra Pradesh)/Fish farm	2250	7
Mixed/Brackish (Fish and prawn)	Goa/Traditional fish farms, paddy fields and salt pans	1060	5
Green mussel/Brackish	Dona Paula (Goa)/Rope culture on floating rafts	4,80,000	4

and financial assistance need be provided³. The Fifth Plan aimed at an increase in the yield from inland fisheries from an estimated 7,84,000 tonnes in the year 1974 to 1.05 million tonnes in 1978-79. The yield from marine fisheries is envisaged to increase from 1.48 million tonnes to 2.02 million tonnes by the end of the Fifth Plan. To achieve such a relatively high target, the investment in fisheries development was stepped up from Rs 570 million in the Fourth Plan to Rs 1605 million in the Fifth Plan. The main objectives are to achieve a significant rise in fish production, to improve the socio-economic conditions of fishermen, to create more employment opportunities, to improve the pace of land settlement (especially *Khar* lands) and to improve domestic and export marketing of marine products of commerce.

Biological risks

Biological systems are particularly susceptible to risks, mainly those originating from natural hazards such as variations in quality and quantity of water; the introduction of diseases in fishable stock; variable cost of production (e.g. filter feeding bivalves like oysters or mussels should be cheaper to produce than the herbivorous fin-fish or detritivorous shrimps). Thus, under certain conditions, the more complex the life-cycle involved, the more sophisticated and costly is likely to be the scale of investment needed. Such considerations are dictated largely by supply-demand relationship in the market.

Investment opportunities

The capital intensive nature of aquaculture represents a major problem for many developing countries². The investment opportunities are varied and can be broadly grouped as follows:

- (i) Engineering and construction services— design of fish farms, circulation systems, hatcheries, rafts, farm facilities, etc.
- (ii) Supply of fish seed, thrash fish (supplementary feed), compounded diet, etc.
- (iii) Fabrication of nets, holding facilities, etc.
- (iv) Manufacture and servicing of pumps, aerating systems, hydrographic monitoring instruments, etc.
- (v) Marketing—development of special type of containers for transport of live fish, mobile refrigerated holds, cold storage, retail services, etc.
- (vi) Processing — quick-freezing, peeling, disinfection, packaging materials, etc.

The main sources of funds are co-operatives, merchant or nationalized banks, international development funds, private investors or joint ventures.

Returns

The expected returns on the capital investment will vary considerably according to the location of the farm site, size of the proposed farm, farming technique, selection of species, market demand and many other factors. Not only is the reliability of the system important but also the cost, both capital and operational. It is natural that for some of the aquaculture techniques which are still to attain a stage of perfection, the initial cash flow will be negative. There are inadequacies in the procedures adopted for estimating accounting costs and gross profit margins in any aquaculture enterprise⁶.

Except for some preliminary results of cost-benefit analysis^{1,5,7}, there is dearth of information on the economics of cultivable species in Indian waters. Other relevant information is from

PROSPECTS FOR AQUACULTURE IN INDIA

affluent countries, where high cost-high value products are being cultured.

Production ventures

The pattern of expenditure during the different stages of commissioning and the return on capital investment can be forecast accurately². The individual cost components will, of course, vary from site to site and the species to be cultured, but can be estimated with a fair degree of accuracy from the baseline information which has generally to be had before embarking on any aquaculture venture. Such systems are suitable for investment by both small scale private investors and also by medium and large scale industrial investors requiring a relatively short lead-in time. The production capacity can be gradually stepped up after a thorough appraisal of the prevailing market trends.

The farming of aquatic organisms will be economically attractive, as the resource is renewable and of self-generating type. Moreover, there is always increasing demand for any type of sea food. Hence, the investor in such type of operations will have to realize that the whole enterprise may require an extended developmental phase. Therefore, the investor will have to impress upon the financial institutions the need for extending support for experimental production and for implementing the developmental plan before the financial viability can be assessed with certainty. The investor in such types of ventures will, therefore, tend to concentrate on those species like shrimps, lobsters, frogs, oysters, eels and mussels which have high market value, both domestic and export, provided technical know-how exists. It will ensure potentially higher rates of return on the investment. The investor should also explore the possibilities of culturing other species not presently commanding high prices, but which may be in short supply in the future.

Conclusion

At present, there exists a big gap between reliable economic appraisals and information on the techniques of fish farming. Ironically, the least documented areas represent the sphere of per-

haps the greatest potential for aquaculture, namely the developing and the underdeveloped countries². The necessity of undertaking aquaculture in India was indicated by Panikkar³, who advocated the conversion of low lying coastal areas into fish farms. In recent years, the importance of fish farming in Indian economy has been repeatedly emphasized by Qasim^{3,9}, who considers the culture of aquatic organisms as one of the possible solutions to the problem of protein deficiencies and rural development in the country.

In view of the anticipated population growth to 100 million by the year 2000, India's food requirement will go up by approximately 40%. At present, about 65% of the world protein production comes from vegetable sources, whereas out of the 35% animal protein, only 10% is from fish¹. Fish proteins have high contents of essential amino acids, tryptophan and lysine, and are, therefore, considered to be high quality protein foods. Aquaculture can also be considered as a primary step in pollution control wherein recycled industrial and domestic wastes can be used for generating a variety of aquatic organisms.

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