

Sea Farming — an Appropriate Technology for Generating Sea Food

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In a developing country like India which has a population of about 630 million and an annual growth rate of 2.1%, the additional yearly requirement of protein cannot easily be obtained from the conventional sources such as agriculture, dairying, poultry and cattle farming or traditional fishing. While the production of food grain in India is reaching an all-time record of about 140 million tonnes/year, the production of sea food with an annual yield of approximately 1.3 million tonnes, has, during the last few years, shown only a marginal increase. This is also true for world fish production which has remained more or less stationary at about 68-70 million tonnes and the last six or seven years have often been referred to as 'stagnating years of world fisheries'. About 5 million tonnes of food is produced in the world by aquaculture from approximately 100,000 hectares of wetland under cultivation, therefore only about 7-8% of the total world's fish production comes from aquaculture.

At present the exploitation of natural fish populations from the traditional inshore fishing grounds of India has almost reached a level from where, unless a gigantic effort is made to exploit the deep sea areas, no substantial increase appears to be possible. Deep sea fishing involves a great deal of money in investment and is likely to give a very low rate of return. Therefore, what seems to be the most promising way in which to gain extra food resources is by sea farming or aquaculture.

Sea farming involves the application of certain principles of animal husbandry to reduce natural predation, improve chances of survival and finally introduce such changes in the environment which can lead to a speeding up of growth from early life to maturity so that the yield is quick and large.

Although the tradition of fish culture in India on a small scale dates back to ancient times, the application of sea farming technology on a commercial scale is a relatively new field. It is now being considered an appropriate technology for producing large quantities of protein-rich food. The reasons for such an approach are, to produce high quality sea food at a reasonable cost; to utilise the vast wetlands which are at present unused and are available at a cheap rate, and finally, to make use of the abundant manpower for the production of the choicest variety of sea foods.

In India, nearly 7.5 million people depend on marine and freshwater fish resources for their livelihood including those who are engaged in industries related to fishing. Of the country's available coastal wetlands of about one million hectares, only a small percentage is presently used for fishing while most of it is readily available for farming. The brackish water and nearshore areas offer great potential for farming shrimps, shell-fish, lobsters and exotic fishes.

Studies on the technical feasibility of farming of aquatic organisms have yielded very promising results and some of the production figures are much higher than those reported either from Europe or America. In tropical countries, marketable sizes of captive fish can be obtained in less than half the time needed in colder regions, resulting in annual yields many times greater. Cost-benefit-analysis shows a high rate of return on investment, thus making sea farming an economically viable industry. With new and better technologies a much higher yield is expected.

These technologies include production of fish spawn, formulation of fish food, development of mechanical food dispensing devices, maintenance of an adequate volume of water, control of disease and genetic upgrading.

One of the difficult problems as yet unsolved in fish farming is the non-availability of quality fish spawn for stocking on a large scale. Attempts have been made to find good sources of spawn from the estuarine and nearshore areas, where cultivable species normally breed. The other method used to raise fish spawn is to make the pregnant adults spawn in captivity by injecting hormones. Although both these methods have given encouraging results, the spawn obtained from the two sources are not adequate to meet the total demand. It has been demonstrated that an Indian fish farmer can earn from Rs.7,000 to Rs.10,000 in one season by selling shrimp, lobster and fish spawn of stockable size by raising them in one to two hectares of brackish water.

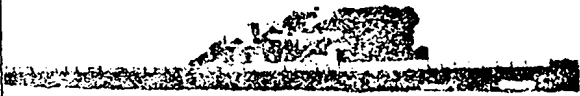


Fig. 1a Raft made of wooden frame and bamboos used for the cultivation of mussels on hanging ropes in Goa.



Fig. 1b Increase in size of mussels on ropes within five months (laid on side).



Fig. 1c Large bunches of mussels attached to a portion of the rope (laid on side).



Fig. 2a Oyster bags hung from nylon ropes in an estuarine farm

As compared to mechanised fishing, aquaculture can be carried out using inexpensive gadgets and simple techniques. The advantages of aquaculture as compared to traditional fishing are:

1. dispensing with expensive fishing craft and gear together with the cost of their operation and maintenance
2. low capital investment and little recurring expenditure
3. prediction of unit yield in advance
4. less loss of man-hours due to bad weather or breakdowns
5. no risk to consumers as the controlled environment could be made more or less pollution-free
6. supplementary income from the supply of fish spawn if fish breeding and hatchery practices are combined with fish farming.

During the last few years very encouraging results have been obtained on composite fish culture of freshwater crops, resulting in a very high annual yield of 8750 kg/ha. Rope culture of mussels from floating rafts (Fig. 1a) in estuarine and coastal waters, with a possibility of three crops per year, has shown a phenomenal yield of 480 tonnes/ha/year. It has a rate of return of 181% on a low initial investment of Rs.2,500. Similarly, the giant edible oyster, when grown in frames or in bags made of nylon net hung from floating rafts or from ropes in an estuarine farm (Figs. 2a and 2b) has led to a 40% reduction in time in attaining commercial size as compared to the period it takes to grow in its natural environment.



Fig. 3a Frame-net containing pearl oysters being lowered in water.



Fig. 3b A cultured pearl showing a feature in the tissue by arrow.



Fig. 2. Oysters being held in a frame net prior to suspension in water

The success achieved in the production of cultured oysters in India clearly demonstrates that aquaculture is an appropriate technology. In recent years, the natural population of the pearl oyster, because of mass killing by hunters, had declined alarmingly. The development of an indigenous technique for the culture of pearl oysters on floating rafts resulted in the building of a large population of pearl oysters within a short time (Fig. 3). This gave rise to the development of a technology for producing perfectly spherical pearls by nuclei implantation. The nuclei implanted in the tissue of oysters were also developed indigenously.

In India, culture of shrimps in low-lying areas and pond fields is an age-old practice but the rate of return on traditional methods is fairly low. With the application of a few simple innovations, such as choosing the right site, controlled stocking and maintenance of an adequate supply of natural food, the yield is constantly on the increase (Fig. 4). Recently, the polyculture of prawns along with mullets and milk fish in brackish water farms has given very promising results. Fish and shrimp production, a cheap technology and without artificial feeding, was about 2220 kg/ha/year. This included 1960 kg of fish and 260 kg of shrimps and fetched a price of Rs.15,770. Lobster farming is going to give even better returns, once an answer to their natural behaviour in captivity — cannibalism — is found.

However, in spite of a number of 'plus points' in favour of sea farming, the ultimate success of aquaculture in a country

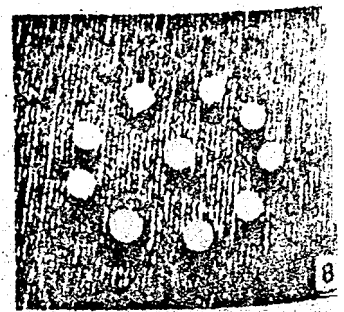


Fig. 3c First few cultured pearls produced in India.



Fig. 4 Male (larger) and female (smaller) of the giant clam.

India will largely depend upon the availability of substantial assistance in the form of inputs including credit facilities to fish farmers and technical guidance from marine scientists. Besides financial and technical assistance, a liberal leasing policy of suitable wetlands is also necessary so that fish farmers do not have much at stake at least in the initial phase of the development of aquaculture.

Fish farming on a commercial scale has great potential not only in providing work to the rural unemployed but also in meeting the protein requirement - the lack of which is one of the major causes of many diseases in developing countries. Though aquaculture cannot replace traditional fisheries, it would certainly provide an appropriate technology for generating extra sea food. The importance of aquaculture in the Indian economy as a small-scale rural industry should not be overlooked at the present stage of national development because it is a labour-intensive activity which would mean an excellent investment of human resources.