J. Mar. biol. Ass. India, 1969, 11 (1 & 2): 59-61

PROBLEMS OF COASTAL AQUACULTURE IN INDIA

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INDIA is estimated to possess along its coast a total area of 2 million hectares suitable for brackishwater fish farming. Very little of this vast fishery resource is currently being utilized. Suitably harnessed for coastal aquaculture, the 2 million hectares can, at the moderate rate of production of 500 kg./ha, yield 1 million tonnes of fish. The Sunderbans of West Bengal and the extensive backwaters of Kerala, where certain amount of brackishwater fish culture already exist, as well as other areas—both along the coasts of Bay of Bengal and the Arabian Sea are suitable for development of coastal aquaculture.

In essence, brackishwater fish farming as practised now, comprises culture of fish in tidal waters admitted through sluices in suitably embanked enclosures called 'Bheries' in Bengal. Fish that are cultured in such impoundments are generally euryhaline forms which can naturally tolerate wide changes in water salinity, the kind of environment which tidal waters in estuaries present. The tide, in proper seasons, usually carries along with it seed of euryhaline species and hence, intake of tidal water in a 'bheri' through sluices serves the double purpose of intake of water as well as the fish seed for culture. Such a fishery (called 'Bhasa Bada' fishery in Bengal) does not need much capital investment. It involves only construction of embankments and erection of sluices. A 'Bhasa Bada' fishery generally involves little digging. In a fishery of this type, however, the seed of desirable as well as those of uneconomic species and the predatory fish get inside the impoundment and the ultimate yield from the fishery is the net result of the survivors grown over the duration the season lasts. The skill of the operator of a 'Bhasa Bada' fishery lies in the timing of the tidal intake and the income the owner makes depends on the seed conglomeration that goes in the fishery. It is obvious that no steady income is possible when chance plays a dominant role in the operation of the fishery. Modern coastal aquaculture seeks to do away with uncertainties of fish production. It entails construction of a proper farm incorporating nurseries, rearing ponds and stocking ponds. It entails selective stocking of compatible species of fish in appropriate densities and adoption of proper nursery management and rearing practices. It involves pond fertilization and feeding so that a predictable harvest can be obtained. Coastal aquaculture, therefore, has all the problems similar to freshwater pisciculture as an industry.

First and foremost, there has to be an assured supply of fish seed of desired species. This will necessitate young fish survey in estuaries and charting of areas of their availability and the quantities in which they can be collected in different seasons. Method of seed collection in tidal creeks where the current reverses itself every six hours, where tides are forceful and turbulent, where water level often rises and falls quickly, itself needs gear research. Basic to the availability of seed is the occurrence and abundance of adult fish in the estuary concerned, adjacent seas and connected rivers for the progeny can only be expected of the adults that inhabit these areas. Hence, year round survey of the fishery resources of the estuary highlighting the

species and size composition of the commercial fishery, the stock densities and catches per unit of effort become necessary. Often commercial effort takes selected varieties of fish and, to obtain a comprehensive picture of the fishery resource, experimental fishing to know about bottom, column and surface dwelling fishes becomes necessary.

For construction of fish farms, knowledge of soil type of the area is essential from the view point of constructional feasibility of the farm as also its productivity and response to fertilization towards release of nutrients. The properties of soil, which are important from the point of view of the former, are its porosity, its bearing capacity and resistance against erosion. Soil porosity and its bearing capacity are determined by its texture which is also responsible for its permeability. The degree of moisture content and water logging affect the soil consistency, the latter in turn controlling its permeability as well as bearing capacity.

Even if soil texture is suitable for purposes of farm construction, fish farming in such areas without knowledge of soil productivity may not be very successful. This necessitates testing of soil-water extracts and acquiring an understanding of soil nutrients in available form on profile basis to bring out their fertility levels which will help in deciding the need for and extent of digging required to reach the most productive layer in the farm.

Since tidal inundation is the main source of regular water supply to a brackish-water fish farm, knowledge of tidal amplitude, elevation of proposed farm site in relation to mean sea-level and the adjacent creek and the hydraulic and energy gradient of the system are of vital importance. The total tidal range oscillates around the mean sea-level and, therefore, the elevation of the site will determine the number of times high tides will inundate the farm site.

For successful coastal aquaculture, it is necessary that the temperature tolerance of the farmed species of fish and prawns should be known as temperature controls a number of vital biochemical processes and crucially governs survival and growth of the organisms. Shallow waters, such as ' bheries ', are liable to be overheated in tropical climate and knowledge of temperature tolerance will help provision of adequate areas of optimal depths in the brackishwater farm ponds. Turbidity interferes with photosynthesis and limits primary production but its beneficial effects in supplying silica for growth of diatoms are important in brackishwaters. The problem that poses itself is to acquire an understanding between turbidity levels and rates of primary production and the effect turbidity produces on pond fertilization by changing soil bottom texture through deposition of silt.

It is known that water productivity is governed by balance between nine major elements (C, H, O, N, P, K, Ca, Mg and S) and seven minor ones (B, Cu, Mn, Zn, Mo, Fe and Cl) besides some trace elements. An understanding of the relationship of elements for optimal production of fish food organisms so as to develop a scientific theme for pond fertilization is, therefore, a necessary prerequisite. In brackish-waters, salinity as a single factor plays the most dominant role in the survival of animal life as well as release of nutrients. It is of vital importance to know in advance the salinity tolerance limits of animals involved in coastal aquaculture.

Selective stocking and culture of euryhaline species of aquatic animals pose the problem of compatibility of costocked fishes and determination of optimum stocking densities thereof to make the utmost use of the food available in the body of water. High production per unit of water area cannot be obtained without artificial feeding.

The preparation of such feeds from waste products of agricultural farms and domestic animals and to make them nutritive for fish growth is yet another problem. The conversion ratios of artificial feeds have to be known too. The economics of brackishwater farming has not to be lost sight of, for unless such farming is economically viable and compares favourably with agricultural production, it will not catch the imagination of the private entrepreneur without which coastal aquaculture cannot play the role of production of animal protein it deserves.

Brackishwater areas are yet subject to another type of fish farming which is the polyculture of fresh and brackishwater animals. India's know-how of freshwater fish farming is appreciable. This is, however, not the case with true brackishwater fish farming. Polyculture differs radically from true brackishwater fish culture of the 'Bheri' type. Here, there are no sluices and no mechanism for tidal water intake. It is in fact a culture of compatible fresh and brackishwater species in waters of low salinity. When brackishwater areas are reclaimed for construction of sky ponds, their desalination takes a long time and, for many years such waters retain low salinity. These ponds prove congenial for mixed culture of such freshwater fish as can grow in waters of low salinity and of brackishwater fish with wide salinity tolerance. With lapse of time, however, such ponds will eventually become true freshwater ponds.