FISHERIES OF THE WEST COAST OF INDIA

Published on the occasion of the opening of the new building of the Central Marine Fisheries Research Sub-Station at Calicut by Shri. M. V. Krishnappa, Union Deputy Minister for Agriculture, on 1st October 1958

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MARINE FISH FARMING

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The growing need in recent years to augment our supply of fish protein has been largely responsible for focussing our attention towards means of utilizing every possible ecological niche for fish culture as part of a programme on greater exploitation of our natural resources. Rearing fish in confined areas has certain definite advantages over fishing in open waters of the sea because of the control that can be exercised on a restricted body of water and the relative ease with which fish can be obtained more or less throughout the year irrespective of natural interferences by the weather. Marine fish farming may be considered as an extension of the principles of freshwater fish culture which has been practiced in India and elsewhere over centuries. Much of our knowledge in saltwater fish farming is still in an empirical state and more scientific techniques will have to be adopted in order to put the industry on a sound basis.

A brief mention about the different systems of saltwater fish culture as practiced elsewhere will be helpful before discussing the status of the industry in our own country. In Europe, since the Romans started culturing fish in freshwater as early as in the 1st century B.C., the principles were successfully adapted for saltwater fish culture and soon the practice spread along the coast of Italy and France. Renowned at present as the 'Valli culture' of the Adriatic lagoons along the north-east coast of Italy or the marine fish farms of Arcachon in France, these bring valuable crop of fish, particularly eels and mullets, which are highly esteemed in those regions.

Among the Eastern countries, saltwater fish culture is being widely carried out in Indonesia and the Philippines and to some extent in Japan and Formosa. One can appreciate the importance of this industry in the economy of these countries when it is understood that an annual yield of about 33 million pounds of fish (16·5 million kg.) are obtained from an area of nearly 200,000 acres (80,000 hectares) of ponds providing means of livelihood for the 250,000 people of the Islands of Java and Madura in Indonesia alone while in the Philippines about 173,000 acres (70,000 ha.) of fish ponds

are reported to produce approximately 89 million pounds (24·5 million kg.) of fish per year valued at nearly 40 million pesos or about 33 million rupees. From the extent of development of these ponds, it would appear that fish farming is part of the traditional culture of the people of these countries. The saltwater ponds of Indonesia known as 'Tambaks' are famous throughout the East and one of the popular beliefs that the Tambak industry came to be established under the influence of the Hindu rule of the Islands might be of incidental interest to us in India. The sizes of the present-day Tambaks vary widely up to many hectares, the water-supply is mainly brackish, tide controlled and regulated by means of sluice gates. The principal crop of fish in these ponds is the milkfish (*Chanos chanos*) but other species of salt-tolerant fish and prawns are also cultured.

Compared to the developments made in these regions mentioned above, it may be admitted that even the idea of marine fish farming in our country is of relatively recent origin. The immense scope for an organised system of marine fish farming in our country was originally conceived by James Hornell who, in 1911, suggested the development of coastal saline swamps, backwaters, estuaries, deltaic marshes and even salt-pan channels for purposes of cultivating saltwater fish. Since then the Madras Government started a marine fish farm near Tuticorin by converting some of the lagoons in that area and stocking it with mullets (*Mugil* spp.) and whiting (*Sillago* sp.). But after a brief trial period the venture was discontinued owing to certain unforeseen circumstances. Again, several years hence, the Madras Fisheries Department revived the idea by starting an experimental marine fish farm in Krusadai Island in 1944 by transforming a marshy swamp in the island into suitable ponds. The results of milkfish culture as conducted in these farms compared favourably well with those obtained in other countries and the experiment in general was encouraging.

The farms in Narakkal (Cochin, Kerala State) mark a definite achievement in saltwater fish culture on a large-scale. Originally about 13 acres of swampy area adjacent to the beach were converted into fish farms during 1940–42. Brackishwater supply was effected by means of canals and the farms were stocked with mullets and milkfish. The success in this experiment led to the further development of marshy area around this original site and at present the State-owned farms at Narakkal and vicinity cover an area of nearly 125 acres fetching a substantial revenue to the Fisheries Department. There is also an equally productive farm at Ayiramthengu adjoining the backwaters of the Kayamkulam Lake in Kerala and the ponds extending over 20 acres are utilized for culturing the pearl-spot (*Etroplus suratensis*), mullets and the milkfish.

The flourishing prawn industry of the Malabar coast deserves special mention in this connection as the backwaters in these regions constitute one of the most highly productive types of saline waters. At the close of the rice harvest by about October, almost every rice field is utilized for prawns and miscellaneous fish culture. Brackishwater let into these fields carries with it millions of prawn fry which are allowed to grow there for a period of about six months before they are caught. Experiments conducted by the Prawn Research Section of the Central Marine Fisheries Research Station have revealed that these fields, under proper management, can give a much higher annual yield (ranging from 900 to 1,300 kg. per hectare) of fish and prawns.

Besides the Government sponsored experimental ponds reference may be made to the saltwater ' Bheris ' of Bengal and several tidal inlets, saltwater lakes and saline lagoons spread along the coast of Orissa, Andhra and Madras States. Some of the saline lagoons on the south-east coast of India, get periodically inundated during the monsoons and establish temporary connections with the sea allowing large numbers of fish fry to enter these areas. As such, an unorganised fishing of some magnitude exists which is of importance in the economy of the people of the neighbouring villages. These lagoons, which constitute a distinct type of ecological environment not wholly comparable to the other types of culturable waters and consequently presenting certain special problems, still seem to show scope for development into more productive areas. Recently, the Central Marine Fisheries Research Station has undertaken the construction of an experimental marine fish farm in the low-lying areas near Mandapam as a beginning towards the development of these regions and also to gather more scientific data relating to the various aspects of saltwater fish culture.

While several swampy or marshy areas exist along the coastal tracts, it may be pointed out that all of them need not necessarily be ideal for marine fish farming on commercial lines, as natural waters are known to vary widely in their productivity. Depending on the source of water and the physiography of such areas they may be classified variously. In the construction of fish farms an important consideration lies in the choice of the site which has to be determined in conjunction with factors such as the type of soil, availability of good water-supply, proximity to fry sources, facilities for transport and many more similar considerations. Both the physical and chemical characteristics of the soil are significant and as a general rule the farm must be underlain with clayey type of soil which is almost impervious to water.

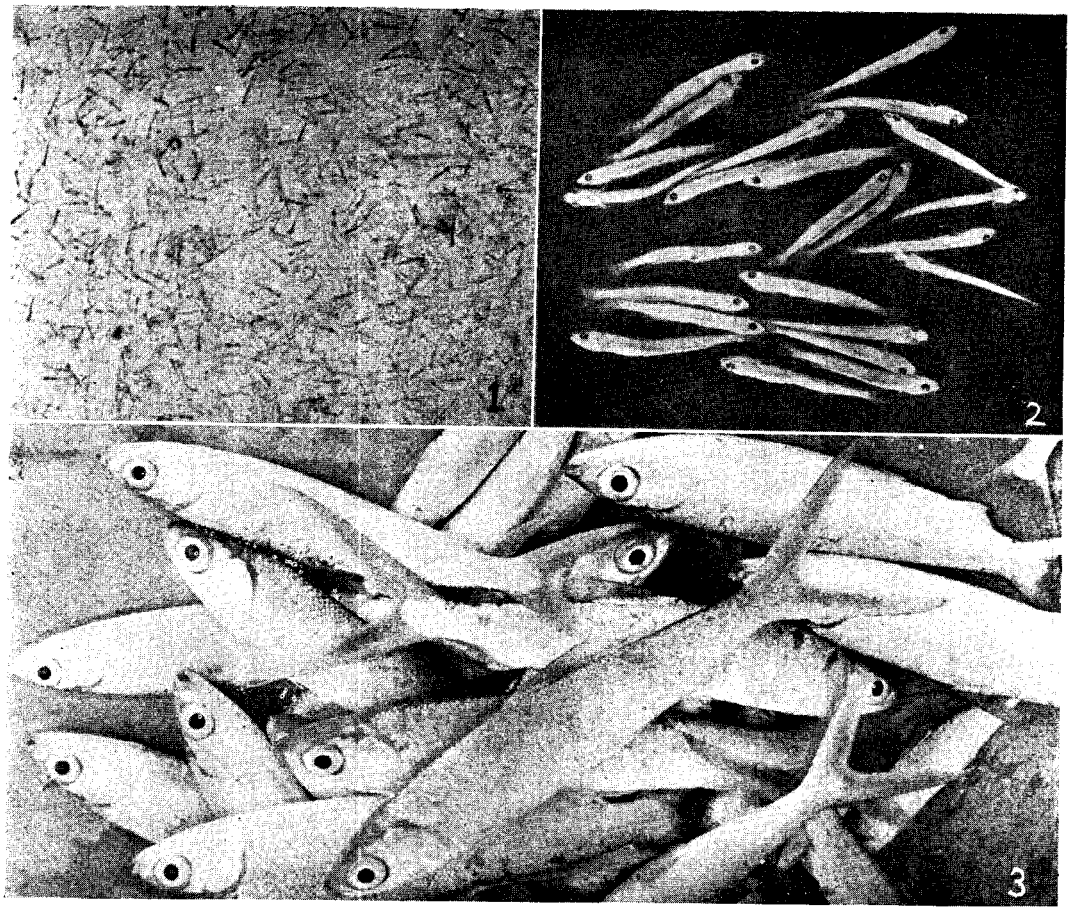
Actual construction of the ponds to adjust to the tidal factor usually involves excavation of earth and this earth can be utilized for the construction

of bunds and embankments. A good binding clay is essential for the stability of these embankments; additional protection by turfing or growing of suitable plants is very necessary. This can substantially reduce the cost of maintenance of farms. In many of the Eastern countries the farmers make use of the embankments for growing cash crops as an additional source of income. In an ideally planned farm two or three separate types of ponds should be set apart for fish of different stages, as for example, small shallow-water compartments or nurseries for the care of the fry and progressively larger tanks for rearing the fingerlings and the growing fish. Intercommunications with sluices will in such cases be helpful in transfering the fish from pond to pond with least injury to them and this can be achieved by manipulation of the sluices during water flow and based on the habits of the fish.

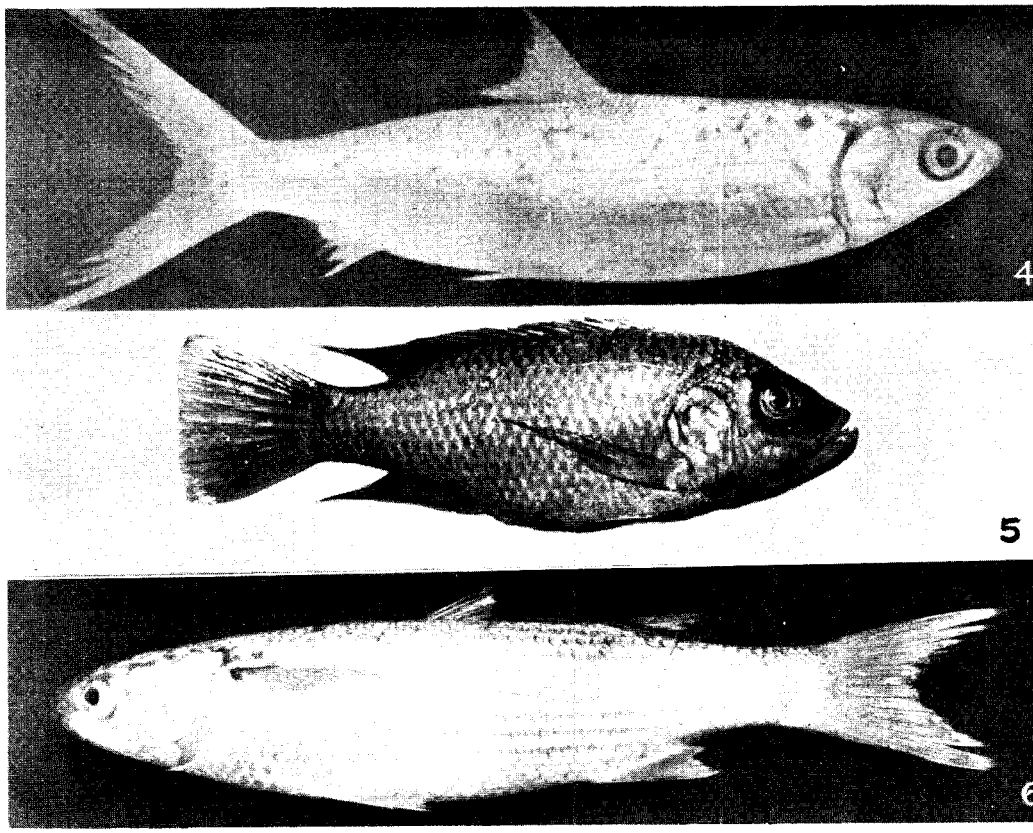
In marine fish culture it is more or less implied that the major source of water-supply is from the sea. Although properly designed marine fish farms can be wholly dependent upon seawater for their supply, this factor itself might sometimes lead to limitations on effective operation and satisfactory management. Proximity to freshwater streams or canals is desirable as providing an additional source of water especially in regions where the tidal amplitude is insufficient during part of the year and in summer months when the salinity in ponds shows a tendency to go up. Some of the well-known characteristics of the pond water such as temperature, pH, dissolved oxygen and availability of nutrients are important here as they are for freshwater fish culture for the proper growth of fish food organisms. The farmer may be cautioned of the possibility of some of these factors, especially the salinity and temperature, attaining lethal levels for certain species of fish during particular periods of the year and a periodic check becomes essential. This will also help to make up certain vital deficiencies that might occur due to natural causes.

In respect of fish stocks an essential consideration lies in the choice of suitable species that are able to adapt themselves to a fairly wide range in salinity and temperature because of the possible fluctuations in these factors in the tropics. Species which attain marketable size during the course of one season usually satisfy the primary objectives of the average fish farmer as he can get his ponds ready for restocking during the subsequent fry season after the harvest. But in commercial practice with species that are able to grow to an economic size by rearing them beyond one year, larger ponds become necessary and the farmer is faced with additional problems in their management. Judicious combinations of more than one species of fish often give better yield than monoculture. The principle involved here

SOME FISHES FOR OUR SALTWATER PONDS



1. A swarm of the fry of the Milkfish (*Chanos*) 15–20 mm. long at the time of their appearance along the coast. 2. A few from the above enlarged. 3. The Milkfish, at the end of one growing season in the marine fish pond at Mandapam Camp.



4. An adult Milkfish. 5. *Tilapia*, an exotic species. 6. A Mullet (*Mugil*). Several species are useful for saltwater fish culture.

is the fuller utilization of available food. But the farmer has to bear in mind that production cannot be increased by mere overstocking. The addition of too large a number results in small stunted individuals while a very low level of stocking is uneconomical as all the food in the pond may not be properly utilized. The question of maintaining a proper condition of the fish and obtaining a sustained yield is, perhaps, the most difficult in many cases. Even in ponds with fairly stable physico-chemical conditions many fish farmers experience a gradual fall in yield year after year unless other measures are employed to provide a steady supply of food for the growing fish. Proper encouragement for the growth of aquatic microflora which play an important part in the food chain in the pond becomes essential and for this chemical fertilizers such as superphosphates and nitrates have been found helpful. The growing fish can well be maintained on supplemental feeds such as oil-cakes, cotton-seed meal, rice bran and similar material which will also serve to increase the fertility of the water. Indescriminate use of fertilizers may sometimes result in the overgrowth of undesirable algæ and weeds which can be a menace in fish ponds. Timely control and eradication of these by physical means seems more desirable than use of chemicals. Considerable practical experience rests behind all these methods in successful fish culture.

One great handicap to our fish farmer is his dependence upon natural sources for the collection of fry for stocking purposes as many of our cultivable fish do not breed in confined waters. The difficulties involved in their collection and transport are great. However, in recent years a very useful line of research has met with success in hastening the spawning or inducing spawning in fish in captivity by the administration of hormones. Very significant results have been achieved in our country too, of late, in making carps breed in ponds by this technique and this would indicate possibilities for its application to other freshwater fish and, perhaps, marine species as well.

We have in our country several useful varieties of fish which are admirably suited for culture in different types of saline waters. The milkfish (*Chanos chanos*) and the mullets (*Mugil* spp.) rank foremost among these as they satisfy most of the requirements for saltwater fish culture. Both these are widely distributed in the Indo-Pacific region. The fry and fingerlings of *Chanos* show some preference for certain types of ecological environments characteristic of shallow sheltered tidal creeks and mud flats, and large numbers of them are usually collected from April to July in several centres in peninsular India. Mullet fingerlings can also be obtained from similar

surroundings and although available more or less throughout the year, they are particularly abundant during the post-monsoon seasons. Both are non-carnivorous marine species while the pearl-spot (*Etroplus suratensis*) is more an estuarine form and is also largely used for culture in brackish-waters. Similarly, the prawns of the *Penæus* and *Metapenæus* groups are invaluable for culture in saltwater ponds either by themselves or in combination with fishes when these can fetch a proportionately significant yield as compared to the main species under cultivation. In contrast to these non-carnivores mention must be made of the many less important fishes, particularly the Bhekti (*Lates calcarifer*) which thrive well in saline environments where there is a natural abundance of forage fishes. The mouthbreeding fish *Tilapia mossambica*, originally a native of the freshwaters of Africa and recently introduced into our country from the East, has shown some promise for culture in a variety of environments including saline waters some of which are not quite conducive for the growth of better indigenous species. Special methods for the management of the different species will have to be adopted as their feeding habits and adaptability to environmental conditions vary considerably.

A brief reference to the future scope for marine fish farming in India seems appropriate in this context. Our cultivable saline waters including the tidal estuaries, backwaters and swamps scattered along the coast cover nearly 1·3 million acres (about 0·5 million hectares) and a theoretical estimate of annual yield from these waters amounts to 640 million pounds (approximately 30,000 metric tons) of fish. As pointed out earlier, all these places may not be ideally suited for conversion into productive areas. However, a satisfactory yield seems possible in our country too with increased knowledge and adoption of better techniques. Small farms can hardly serve as the whole source of income for the individual farmer or be self-sufficient, but they are invaluable as an auxiliary source of profits. On the other hand, farms on commercial lines, extending for about 20 hectares or more, have greater significance to the community and the local population, whose economy will be served by providing work for the people, by meeting the local fish requirements and by yielding a relatively easy income from the immediate neighbourhood almost throughout the year. The cost of such a project need not be very high. Placing some of the unused saline coastal swamps at the disposal of interested public and, possibly, some kind of initial financial assistance from the respective State Governments might however serve as an impetus and encouragement for establishment of commercial fish farms and promotion of this useful industry.