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Salt Water Fish Culture in India

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Despite a tradition that dates back to the very ancient times, salt water fish culture as a profitable industry is only a recent development in India, largely prompted by the urgent need to increase our much-needed protein food. But within the past half a century even after the realisation of our potential, it must be said at the outset that we have not made adequate progress in harnessing our resources, especially when compared to the great strides this industry has taken in the east-Asian countries or along the Adriatic coast of the Mediterranean region. Generally speaking, fresh water fish culture has shown much greater promise and improvement and this practice is fast developing in our country, perhaps on account of easier management and quicker results that are obtained. The following discussion, however, will be confined to some of the special aspects involved in fish farming in environments that are more akin to marine conditions, and the scope for improvement in the existing methods of salt water fish culture.

Ever since the practical possibilities for coastal fish farming were suggested by some of our pioneering fishery workers, there had been sporadic attempts to rear fish in saline ponds and lagoons. Most of these efforts were only on experimental levels and in very few instances have these been developed into any full-fledged industry. The salt marshes of the Sunderbans in West Bengal (deltaic regions of the Ganges) are well known for their natural fishery potential and a lucrative, but unorganised, fishery amounting to primitive fish culture methods exists in these regions.

While such simple fish cultural practices exist in many of the coastal regions, one of the earliest attempts to start a salt water fish farm, where selected species of fish could be reared, was made by the Fisheries Department of the Madras State. They had their farms started near Tuticorin and later another one in Krusadi Islands (both in the Gulf of Mannar on the south-east coast). However, the Tuticorin farm was swept away by coastal floods while the Krusadi farm had gone to disuse for want of proper maintenance and up-keep. The Krusadi farm particularly had indicated definite possibilities of how salt marshes and tidal creeks which are common in those surroundings could be utilised for fish culture purposes. Encouraged by these results some private enterprise had sprung up locally utilizing restricted areas for fish culture, besides organising nurseries and fish fry trade. Currently, work on an estuarine fish farm is in progress within the city of Madras where a system of ponds is being developed near the mouth of the Adyar river.

The Fisheries Department of the State of Cochin (now a part of the Kerala State) on the south-west coast of peninsular India ventured on a more extensive brackishwater fish farm. The gradual expansion of these farms from about 13 acres (5.5 hectares) to nearly

ten times in extent is itself indicative of the success of the project. Mullets constitute the main-stay of these farms while the milkfish, and to a small extent the 'bekti' are also grown in these ponds. In the matter of natural production the farms in these regions are unrivalled because of the excellent soil conditions and the constant supply of nutrients from the back-waters. The annual variations in salinity is of the order of 2-32 parts per thousand while the temperature goes up to nearly 31°C in the summer months. Almost a similar but smaller fish farm is in operation further south in Ayiramthengu, which also enjoys somewhat similar environmental conditions and consequently a high rate of production. Experimental prawn culture in the backwater ponds of Cochin has given a phenomenal production rate of approximately 1000 lbs per acre per year, consisting mainly of prawns.

In contrast to these fish culture attempts were the experiments undertaken by the present author from the Central Marine Fisheries Research Institute at Mandapam. Low-lying salt lagoons which remain cut off from the sea for the greater part of the year occupy several square miles in this part of the south-east coast. A remarkably low degree of biological productivity has resulted because of several basic factors such as the poor quality of the soil, the meagre organic content with very low nutrient level combined with hypersaline conditions for most part of the year. Thus the conditions that prevail in the area are far from conducive to promoting biological production, much less to fish life. Judging from the seasonal fishery an average annual catch of 57 kg per hectare of fishable area limited to a short period of the year was estimated from these waters. Nevertheless, a pilot-scale experiment was launched to find out how these places could be made to yield higher rates with minimum effort and investment so that wastage of precious land could be reduced. The fact that even such apparently unproductive waters could be successfully converted to give at least about 450 kg of fish per hectare has been proved by our experiments. The most significant achievement in these experiments is that but for the initial expenses in acquiring the land and for the construction of the ponds, the recurring expenditure in management had been very low while the annual returns at the rate indicated had been justifiably high. This is a very important factor for Indian conditions.

Some of the figures on the basic productivity of these lagoons reveal the low productive potential of our coastal lagoons. Fluctuation in salinity is a major factor. While fluctuation from hypersaline conditions in summer to comparatively low salinity during the short monsoon period restricts the species of micro-organisms which constitute an important link in the food chain. Similarly the concentration of phosphates and nitrate-nitrogen is very low all through the year. The replenishment of nutrients from the surroundings through the run-off water is negligible and the only source is through inundation from the sea with which the lagoons get connected during the short monsoon period.

It is said that in the High Venice Lagoons, the hydrographic conditions, particularly the concentration of the nutrient salts, undergo constant changes as they depend on incoming and outgoing tidal currents. The organic phosphorus in these lagoons is very low but tends to be high in the inner canals due to the human metabolites, rich in ammonia

and nitrogen, which are constantly being discharged into the canals. Our coastal lagoons are thus in no way comparable to the lagoons in the Adriatic region which are reputed for their high degree of natural fertility.

Supplementing with chemical fertilisers, such as superphosphates or organic manures like green manure and compost fertilisers, showed that the basic productivity of our lagoons could be temporarily enhanced to some extent. Normally the total production of a fixed area of these lagoons per day is considerably lower than the values obtained from the adjoining open seas or when compared with the values reported as the average production for all the oceans.

The foregoing general resume only shows the little progress that we have made so far in salt water fish farming, especially when great potentialities do exist and resources are in no way lacking. Apart from the experimental and pilot-scale projects initiated through governmental channels which have no doubt given us some scientific background to this important field of study, the private investments that could be drawn towards this industry has been only negligible. Perhaps, this is not entirely surprising in this country where marine fishing itself as a commercial proposition has begun to appeal to the private agencies only within the last decade or so. Besides the very fertile backwaters of the south-west coast there are other extensive but less productive salt water lagoons spread over the east coast which altogether are estimated to cover about 3000 hectares. It is to develop these areas and to take advantage of their potential that our attention will have to be immediately devoted.

These coastal saline lagoons may be broadly divided into two categories, namely, (i) those that are more or less perennial bodies of water which periodically get inundated from the sea and where some kind of unorganised seasonal fishery exists, and (ii) those that are only transcient and where the water that comes in during the tides dries up, giving the appearance of barren lands. The latter type of environment may have to be given up as almost unsuitable for our immediate requirements of fish culture as conversion of such areas are bound to involve extra heavy expenditure and prove uneconomical for our present conditions. Besides these two categories there are other salt water areas adjoining river mouths and surrounding the salt water lakes where some amount of fish culture could be carried out with advantage.

It may be seen that in some of our experimental work, the soil conditions, the effect of tidal influence and such other basic factors had not been given due importance. There had been serious and unexpected problems on management and maintenance or, as it had happened in more than one instance, the farms had been swept away by severe tidal floods. Many of these saline lagoons are isolated from any access to fresh water and this becomes a serious handicap especially when in summer the connection with the sea is cut off and the salinity goes up beyond limits that could be tolerated by many fish. Thus, fish culture in such environments has been fraught with several special problems. Although we have achieved some interesting results of a fundamental nature our experiments had been aimed more to seek scientific information connected with the problem.

Our present conditions, however, call for an increase in actual production of fish in available areas. A large part of our time and expenditure has also been invested in the construction of model farms. Fish farming, to function on sound economical basis, should be planned on a much larger scale than had been attempted hitherto. Judicious investment and utilisation of all the local resources are necessary in order to maintain satisfactory economy. With these objects in view and in the background of our experience, the following suggestions are made in order that the industry may be developed in its proper perspective.

Our experience so far seems to indicate that governmental undertakings of this type are likely to be less economical whereas private enterprise is bound to make better progress because of vested interest. Therefore, practical fish farming may be left in the hands of private or co-operative agencies who should be given suitable encouragement and scientific advice and governmental agencies should function only in a supervisory or advisory capacity to render technical assistance.

One positive way in which the government can help authorised co-operative bodies is by giving them on nominal lease the extensive lagoons so that within a specific period these corporate bodies should be able to reap the benefit of their labour and investments. In many such instances the government should extend to them suitable subsidy. Most of the fisherfolk in the coastal areas who cannot go out into the sea during unfavourable weather would find it a useful occupation to attend to the management of the fish farms during the off-season. Thus the expenditure on labour will be at a minimum which will be a very helpful factor in the management.

Many of the salt lagoons are so diffused and shallow that conversion of these places into regular fish ponds will necessarily involve considerable initial expenditure, and this will be beyond the capacity of any private investment. On the other hand, if the excavations and bunding up can be restricted to a minimum, the cost can be kept low. In the Valli culture of the Adriatic or the Tambak system of the Far Eastern countries, it may be seen that the existing physiognomy of the land is disturbed to a minimum and the farms are laid out so as to make effective use of the tidal flow. For peninsular Indian coast this may pose a serious problem because of the low tidal amplitude during any part of the year. Even so, if the low-lying areas are managed in such a way as to provide permanent connection with the sea so that effective tidal flow could be maintained throughout the year, this itself will improve the habitat and make it favourable for the growth of organisms. The environment will thus be able to support a richer growth of fish and the problem of periodical enrichment of the waters will also be solved to a great extent. Access to fresh water sources will be an added advantage.

Many of the shallow bays and tidal creeks at present serve as excellent collection grounds for the fry and fingerlings of important culturable species of salt water fish, such as the milkfish and mullets besides shrimps. On the southern coast alone there are about sixty fry collection centres and from where several lakhs of fish fry may be collected without much effort. However, these fry resources are not fully utilised. With a possible increase

in fish farm development there will, no doubt, be an increasing demand for these fish fry which can be met from many of these places and for this a proper organisation of the fish fry trade will be essential. Even in those places where fertile fish farms cannot be constructed, smaller nurseries for temporary holding of fry and fingerlings should be organised so that a continual supply of healthy fry and fingerlings can be assured. Thus side by side with the development of coastal fish farming, due attention will have to be paid for improvement in fish fry industry and nursery management.

The idea of improving our culturable waters with the use of fertilisers has not yet been fully appreciated in this country and is often looked upon as an uneconomic practice. The success of artificial manuring of enclosed bodies of salt water and bays have long been demonstrated experimentally in the European regions. Making up deficiencies in the environment by the use of chemical fertilisers or supplementing with cheap and easily available compost manures made up of materials like sea weeds, cow dung and the like, can play a significant role in the improvement of the farms.

Only a kind of salt marsh vegetation exists in and around many of these coastal lagoons. Nevertheless, there are important crops such as the coconuts that may be raised in these areas, particularly along the farm bunds. This will form an important aspect while working out the economics of the industry.

With the gradual development of coastal fish farming in our country and after the conversion of the existing extensive low-lying areas, even on a conservative estimate these areas can provide not less than 1200 tonnes of fish annually. Thus, the urgent need for harnessing our resources needs no further emphasis.