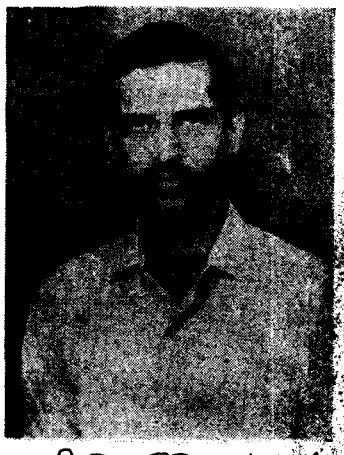
"Fringe Benefits"



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THE urgent need to increase the protein food resources of the world has been pushing the frontiers of fishing operations farther and farther out. During the last two decades the estimated total world fish production has more than doubled and according to recent reports the world's catch has gone up by five per cent during the last year alone. The tempo continues unabated and this has created genuine doubts about the future because it is now known that the resources of the sea are not inexhaustible as it was believed earlier. To meet the increasing demand for fish, exploitation of the stocks in the deep sea and open ocean is imperative. In this process the potentialities of the area along the 'edges of the sea' are either not fully appreciated or are overlooked. This is an area of vital importance especially in a country like India where the pattern of development is village oriented. The area may be called the on-shore marine environment which will include shorelands, the salt marshes, saline water-logged lagoons, backwaters and estuaries. Each of these has its own peculiar chemical, physical and biological characteristics but they all have great economic implications for both short and

About the Author.....

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long term. In this short article it is not possible to go into the economic significance of the area such as mineral deposits, petroleum production, etc., but mention only about the natural food and related resources which could be harvested or produced from it. The development of the oceanic fishery resources as well as deep sea fishery would naturally entail considerable capital investment, whereas the underexploited or unexploited resources of the coastal regions could be developed with great advantage and with much less outlay.

Shorelands

Along the coasts of India the shoreland in the intertidal region at many places is found to be rich in edible clams, mussels and oysters. Although the clams and mussels are considered as the poor man's food they are highly nutritious and certain species are delicious too. There are instances where area for area the yield of clams is more than the yield of fish from the sea-bed or the water mass overlying the area. The sub-fossil deposits of the black clam form the basis of lime and cement industry along the west coast.

Yet another resource from the intertidal area which has not been fully exploited is the seaweed. This can be used as supplementary food for human beings and farm animals, as compost and for the manufacture of algin, alginic acid and agar. A variety of seaweeds occur abundantly along our coasts and these give high yields of their respective products. The demand for agar and other seaweed products is increasing while the production is failing to meet this increased demand. An approximate estimate of fresh seaweeds and sea-grasses cast up along the shores of Ramanathapuram, Tirunelveli and Kanyakumari districts alone would exceed 5,000 tonnes annually but yet the possibility of properly utilizing this cheap resource as manure sufficient to enrich more than 200 hectares does not seem to have caught the imagination of those living along the shores. The manufacture of liquid seaweed fertilizers in Britain, America and in several other parts of the world has been showing a phenomenal growth particularly because these liquid products seem to inhibit the multiplication of insect pests. Seaweed was until recently regarded "as a commercial gimmick in academic horticultural circles but the success of the liquid seaweed extracts has changed the situation". Similarly, seaweeds as they are now eaten are tasteless. But with further progress in enzymology the day may not be far off when delicious steaks composed of extracted seaweed protein, spiced with enzymes and made chewable by suitable digestible plastic are prepared. Many scientists and nutritionists are of the opinion that with proper planning it should be possible to meet one-third of the food requirements from this source.

Estuaries, backwaters, lagoons and salt marshes

Along the coasts of India there are several thousand square miles of backwaters, lagoons, estuaries and salt marshes. Amongst these the most important are the estuaries and the backwaters. Then we have the salt marshes and the salt water lagoons long considered as "waste land". Now it is well recognized that the estuaries, backwaters and the salt marshes form an essential factor in the overall marine environment. These are very efficient factories where organic matter is constantly built up in large quantities which in turn sustains considerable animal populations. Here nutrient salts are regenerated and these enrich the coastal waters due to the tidal action. Although no reliable estimates are available of the quantity of fish or prawn caught in these areas, in the case of prawns the production from the most important estuaries and lakes is estimated to be roughly 14,000 tonnes. Still it is mostly capture fisheries that are in vogue rather than culture fisheries. The environment offers a situation ideal for fish culture and fish farming.

Marine Fish Farming

Fish culture has been practised from as early as the first century B.C. and the Romans seem to be the pioneers in the field. They started fish culture in freshwater and subsequently the principle was successfully adapted also for brackish and saltwaters in Europe. Saltwater fish culture gradually spread to the East and is now being extensively carried out in Indonesia, the Phillipines, Japan, Formosa, etc. It is reported that in Indonesia nearly 80,000 hectares yield about 16.5 million kg. of fish annually and provide a means of livelihood for 250,000 people. Similarly, in the Phillipines about 70,000 hectares produce 24.5 million kg. of fish a year. These figures are quite impressive and show the importance of the industry. As early as 1911 James Hornell, one of the pioneers in the development of fisheries in India, suggested the development of coastal saline swamps, backwaters, estuaries, deltaic marshes and even salt-pan channels for purposes of cultivating marine fish.

The status of marine fish farming in India is generally still poor. Farming has made rapid strides and is followed on scientific lines in agriculture, livestock, poultry and dairy sectors. In fisheries the little that is done is not "farming" in the sense an agriculturist would understand the term. The fish farming carried out in certain places along the backwaters of Kerala, in the 'Bheris' of Bengal and some of the experimental work carried out in the marshy swamp of Krusadai and in the saline mud flats near Mandapam are instances of the saltwater fish cultural practices in existence. This involves fish culture by the stocking of fish fry or by a process called 'filtration' in which sea water is let into ponds or brackish water into rice fields during high tide which carry with it millions of prawn fry. By sluice arrangements the fry are prevented from going back and they are allowed to grow in the confined area for a limited time. The operations sometimes include the removal of predators and addition of organic manures although these are not done on a scientific basis. Usually the fish or prawns are harvested after varying periods. Under proper management such farming can yield anywhere from 900 to 1,300 kg. per hectare depending upon the productivity of the area. However, this could be further increased if systematic manuring also is done. In this context it is interesting to mention about the experiments in marine fish cultivation conducted in one of the Scottish lochs. These experiments included addition of chemical fertilizers to increase production and although the results were encouraging the difficulties of preventing wasteful dispersion of the fertilizer were great. But at some stage, not too far distant, it should be possible to utilize the knowledge of the dynamics of the current system of the zone of interest in such a way as to avoid this dispersion.

This raises the problem of marine fish farming *sensu stricto*. Awareness to this problem is increasiug and the question now is: Can marine fish farming i. e., rearing fish from eggs in controlled conditions, be dismissed merely as an academic exercise or will it now be developed to a level where it will make a sizeable contribution to the food resources? This type of fish farming is being done in several countries including India in freshwater fishes. Precious little, however, has been done with the marine fishes or prawns. The stumbling-block presumably is the difficulty in getting these to spawn in confined waters. In this connection two examples concerning four species of prawns are worth mentioning. As early as 1942 it has been possible to rear the Japanese Kuruma shrimp, *Penaeus japonicus* in confined waters and large scale culture of this is being practised at present. Recently three other species of commercially important marine prawns *viz.*, the White shrimp, *Penaeus setiferus*, the Pink shrimp, *P. duorarum* and the Brown shrimp *P. aztecus* have successfully spawned in the laboratory in the United States of America. But it is still a common belief that marine fishes do not breed in confined waters. At least there is one positive instance of a typical marine fish

(*Nematalosa*) spawning in a fish farm without applying any artificial stimulus and the chances are that an intensive search would reveal more species with similar behaviour. In addition to this the technique of induced spawning, now extensively practised in freshwater fish culture, could be profitably tried on some of marine species especially those which enter estuaries and backwaters. The techniques are neither expensive nor difficult. Apart from its role in food production, the development of fish farming has great significance in the rural economy with a lower level of capitalization involved and greater dependence upon the human element.

Accurate figures are not available for the yield of fish per unit area from the different types of environments mentioned earlier. However, the salt water lagoons are considered to be the least productive of these with an average annual yield of 57 kg / hectare. Even these appprently unproductive waters could be successfully worked to yield at least about 450 kg / hectare. The more productive areas would yield proportionately higher returns and there are records to show that as much as 2,000 kg of fish per hectare are being produced in certain countries in the Indo-Pacific region. It has been estimated that the cultivable saline waters including the tidal estuaries, backwaters and swamps scattered along the coast of India cover nearly 0.5 million hectares and a theoretical estimate of annual yield from this area would be to the tune of 30,000 tonnes of fish. Therefore, judicious marine fish farming not only provides the much needed protein but also contributes to the economic welfare of the community by providing work for the people.

Protection

While discussing the possibilities of augmenting the supply of fish by a better utilization of the backwaters, swampy and marshy areas and lagoons along the coastal belt, it should be mentioned that a dangerous trend seems to be developing particularly in Kerala. There seems to be a massive programme for the reclamation of backwaters and the low-lying area along the coast for large scale paddy cultivation. Such attempts are likely to have serious repercussions in the long run particularly on the prawn fishery as the prawns lose their nursery ground. It is a well-known fact that with the exception of a single species all other penaeid prawns of commercial importance occurring along the south-west coast of India migrate to the backwaters in their post-larval stage and grow in this environment later to return to the sea for breeding. This seems to be an essential phase in the life cycle of the prawns. If this nursery ground is virtually obliterated the rich prawn fishery not only in the backwaters but also in the sea would naturally be affected. To this end comes definite proof from the work carried out by the Bureau of Commercial Fisheries, Galveston, Texas. It has been demonstrated that shrimp nursery can be adversely affected when it is altered by bulkheading. Two areas, one adjacent to an unaltered vegetative shore and the other near a concrete bulkhead were chosen. Both of these had similar hydrological condition but differed in the amount of organic detritus in bottom sediments and also the depth. Sampling over a period of ten months showed that the natural habitat produced more shrimps than the bulkheaded area. Similarly, it is also the experience of biologists that man-made changes in estuaries such as construction of canals, channels, spillways for salt water exclusion, reclamation for agricultural purposes, etc., alter the ecological balance and create environmental changes which do not benefit production in the area and in many cases bring about destruction of fauna.

Two more aspects need to be highlighted in this connection. Pollution either by factory effluents or by sewage can upset the equilibrium and bring about destruction or damage. The present accepted methods of determining the waste capacity of freshwater streams are completely inadequate for predicting the pollution of backwaters, estuaries and coastal waters.

Some industrial wastes have more serious effect on fish and fisheries than sewage discharges and a thorough investigation is needed to learn how to deal with these. The last but not the least is the role played by the rivers. The organic material carried by the rivers are deposited in the deltaic region as well as the continental shelf along the coast. There is some evidence to show that in tropical regions it is the depositing of this riverine organic material that determines the level of demersal fish production in the coastal belt rather than the primary organic production. Further, the river mud is known to have the property of absorbing phosphate thus making it available for the growth of the estuarine fauna. The large scale construction of dams and barrages would therefore prevent the riverine mud and organic material from reaching the estuarine and coastal areas resulting in the long run a decline in the fishery potential not to speak of the effects it will have on the migratory fishes.

Industrial and agricultural developments, construction of dams for irrigation and hydro-electric power generation are all essential developments for the country. Therefore, there is clearly a conflict of interests and demands upon these areas for fishing or fish farming, agriculture, waste disposal, construction of harbours and industrial undertakings including possibly petroleum production. These must all be assessed properly before attempting large scale changes which are likely to upset nature's balance. Once this delicate balance is lost through human intervention it may set in motion a chain reaction leading to far-reaching consequences. So the objectives should be categorised into long-term conservation and developments and immediate use and a properly regulated use of the 'edge of the sea' should be attempted. A co-ordinated planning and development based on adequate information on the chemical, physical and biological conditions of the area should be carried out as then only the conflict of interests can be solved. The recent International Symposium on coastal lagoons will no doubt enable a proper evaluation of the present status of knowledge of these lagoons in their different aspects and establish new trends of investigation. As people become increasingly aware of the value of these areas it is to be hoped that they would come under proper development and protection. All thoughtful persons will agree that "it is a despicably inhuman thing for the current generation wilfully to make the way of life harder for the next generation, whether through neglect of due provision for their subsistence and proper training or through wasting their heritage of resources and opportunity by improvident greed and indolence."