



A mechanised catamaran operating at Muttam, Tamil Nadu

NEED FOR AN INTENSIFIED FISHERIES RESEARCH PROGRAMME

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It is now well over two decades since the all-India fisheries research institutions were established. The Central Marine Fisheries Research Institute at Mandapam and the Central Inland Fisheries Research Institute at Barrackpore were started in 1947 and about the same time the Deep Sea Fishing organisations of the Government of India were organised at Bombay. Ten years later came the establishment of the Central Institute of Fisheries Technology at Cochin and new off-shore fishing centres were opened at Visakhapatnam, Cochin and Tuticorin. The efforts of the State Governments in deep sea fishing activities came from Bengal, Madras, Mysore, Maharashtra and Gujarat. A network of fisheries extension centres, particularly in the field of inland fisheries were established in 1958.

On the educational side a Central Institute of Fisheries for training fisheries officers with a strong bias towards technology and administration was opened in Bombay



Sassoon Dock, Bombay, the main landing place for the city's fish supplies

in 1960 and has since then come into full fruition and later in 1962 the Central Institute of Fisheries Operatives was established in Cochin which since then has expanded with a similar organisation in Madras, for training the various kinds of fisheries operatives required for the industry. It is against this background of efforts that we need to have a closer look at the need for more intensive research in fisheries at the present time.

Marine Fisheries

In the sphere of achievements our fish production has substantially increased from about 4,00,000 tons per annum to about 1.2 million tons. This is despite the large fluctuations in the yield in certain fisheries like those for sardines and mackerel. We did not have any reliable figures of marine fishery production when the fishery institutions were started and one of the essential achievements has been the building up of a statistical system enabling us to evaluate our marine fish production, not only in terms of quantities but also in terms of species consumption, age groups entering the fishery, seasonal abundance and catch per unit of effort. Our

fisheries being essentially inshore in character, utilising a large variety of craft and gear, the collection of information and interpretation of results have been extremely difficult but a steady growth of this information has been of incalculable value and has enabled us to obtain a clear picture of our inshore marine fishery resources. These studies have clearly brought out the enormous disparity in the fishery yield of the Indian coasts adjoining the Arabian Sea and the Bay of Bengal. Although a very high production on the west coast of India was clearly recognised soon after the fishery surveys were initiated, only recently has the relationship between the productivity and oceanographic phenomena been understood. Unfortunately, oceanography in relation to marine fishery research came in only at a much later stage owing to the absence of research vessel facilities for marine fisheries research. Oceanographic correlation between fisheries and the environment received further impetus from the investigations carried out by India and other countries during the International Indian Ocean Expedition (1961-65) which enabled India to put forward and develop a comprehensive

oceanographic programme for the country. This development had a close impact in related research in fishery and meteorological organisations. The difference in the properties of the Arabian Sea and the Bay of Bengal are now better understood than before but how then can we proceed to utilize this information in further work leading to increased yields from the seas around India?

In terms of magnitude of production, the most important groups of fishes currently exploited are the sardines and the mackerel. In both these the inshore fisheries are apparently part of larger stocks, the extent and stock identities of which have not yet been established. In the Arabian Sea where these fisheries predominate, oceanographic studies have indicated large-scale upwelling of waters of the west coast of India following a regular pattern with the changes during the turbulent south-west monsoon and the somewhat static conditions of the north-east monsoon. Upwelled waters are of low oxygen, low temperature and high nutrients. Low oxygen waters in the Arabian Sea are somewhat widespread and deserve very critical study because of the close relationship which they have on concentrating fish population towards the surface or towards the coast or in some cases causing mass mortalities. A synoptic approach to this problem of upwelling and movement of oxygen minimum layers might well lead to a closer understanding of the relationship between the pelagic

fisheries of the Arabian Sea and the environmental conditions.

Deep sea fishing efforts mainly based from Bombay have opened up good fishing grounds for well-known stocks of ground fish comprising *ghol*, *dara*, *karkara*, *dome*, *koth*, etc. They have encouraged commercial fishing from Bombay on a big scale and have even resulted in change in the composition of fish landings in Bombay. The smaller sciaenoides which were not a major fishery before have emerged as a most important contributor to the city's fish supplies. Unfortunately, the correlation between research and fish stocks, oceanography and deep sea fishing operations has been lacking and will be one of the best means of furthering intensive work in areas west of Kathiawar and, in the eastern Arabian Sea, north of Bombay, which provide very promising fishing grounds.

From the economic possibilities the fisheries which have aroused phenomenal interest and importance are the crustacean or prawn fishery resources. These were known and crudely exploited for several decades but the enormous export possibilities opened up by the lucrative markets in the United States have stimulated fishing efforts through mechanised vessels. Not only have the catches been increased but new grounds for prawns have been discovered. Penaeid prawns form the mainstay of the marine prawn fisheries and some of the inshore regions such as around Cochin seem to show indications of over-fishing. This aspect deserves immediate and careful study. A heartening feature is the discovery of Pandalid prawns in deeper waters in commercial quantities through the exploratory fishing done by the Indo-Norwegian Project to whom also should go the credit for locating dense concentrations of the genus *Puerulus*, known formerly from occasional specimens. The most important research needed on crustacean fisheries is intensive study of breeding and rearing of penaeid prawns, a field in which efforts are going on in Japan and the United States. Successful procedures for raising penaeid prawns in artificial farms have been developed in Japan. The fact that prawns and similar crustaceans occupy an intermediate stage in the productivity chain and hence could assure a much higher turnover into harvestable resource than fish themselves, gives them a high biological importance in fisheries. It is quite obvious that in coming years the world crustacean fisheries will occupy a much higher place than at the present time. New beds of shrimps and prawns continue to be discovered in many parts of Asia, Australia and Latin America. It is reasonable to assume that apart from the rich prawn resources of the Indian west coast, the east coast of India also offers much scope for increase in the yield of prawns as could be judged from mechanised vessel operations.

In the researches dealing with fish and crustacean

Trainees at the Indian Fisheries Training Institute, Bombay, being given lessons in navigation



stocks, an essential basis is the assessment through egg and larval surveys. The plankton collections made during the International Indian Ocean Expedition are now being sorted at the Indian Ocean Biological Centre at Cochin. This work has given indication of the areas of higher plankton production and the distribution of eggs and larvae of fish and prawns. The information is now being prepared in atlas form, as a guide for future work. One of the essential elements in an intensified research programme should be the close link up of inshore research carried out by the Marine Fisheries Institute and of oceanic research which the National Institute of Oceanography is engaged upon. It is interesting to mention, for example, that the life histories and breeding grounds of the mackerel which is the largest single species of fishery in India is still unknown. Mackerel eggs and larvae had hardly been seen anywhere on the Indian coast but stray specimens of the early stages of mackerel have been found in far-off oceanic regions, in the collections examined at the Indian Ocean Biological Centre, Cochin.

Brackish Waters and Marginal Seas

The inshore waters forming the marginal seas together with the coastal inlets, estuaries and brackish waters constitute an environment of high productivity offering scope for culture of desired marine and estuarine organisms in a big way. We have been utilising this environment having natural facilities in certain areas for prawn fishery practices but there is enormous scope for increasing the yield from these areas, particularly the crustacean and molluscan resources. It is known that the yield per unit area of the substratum is highest in cultivating clams. Primary production studies made at the National Institute of Oceanography and the biological studies carried out at the Marine Fisheries Institute leave no room for doubt about the possibilities of using coastal inlets for large-scale culture. These investigations deserve to be carried out in a more intensive manner with reference to the organisms that can be marketed either in the fresh or the processed state. The information already available should be put to good use and more outcome of research programmes developed. Work started at certain centres was abandoned without full evaluation of results or attempts at starting studies at more favourable centres. Cultural practices of coastal inlets could also profitably include marine algal resources and augmented efforts at *Chanos*, prawns and mullet culture. Aqua-culture is a line of work which is expanding all over the world while we seem to be reluctant to expand even our existing knowledge and experience.

Inland Fisheries

In the field of inland fisheries we have made considerable progress, the most important of which is the deve-

lopment of induced breeding of indigenous carps which are the mainstay of Indian fish culture. The administration of pituitary hormones has enabled us to have Rohu, Mrigal and Catla spawn in captivity, as against the old practice of depending upon the naturally occurring spawn and fry collected from the river systems. Here, the researches have succeeded in developing a successful field practice, but research has not been taken to the point of isolating the active principles and their identification with reference to the well-known constituents of the mammalian pituitary hormones. The field practice is still dependent on the crude extracts of pituitary taken from fish in an *ad hoc* manner rather than the administration of a standard product the composition of which is known and doses of which could be controlled. Here we have not taken advantage of the large strides made in researches on pituitary hormones elsewhere and on the active principles in the fish pituitary hormones itself.

In the handling of fry and fingerlings during nursery practices the high mortality which used to occur have been reduced and certain criteria evolved to safeguard good survival. Similarly, the survival of fingerlings in the stocking tanks also needs to be further improved. Information is certainly available to help us raise the yield. The figures available at the Central Inland Fisheries Research Institute based on field trials from small farms are that for cultures of Indian carps the yield per hectare is of the order of 2000 kg per annum whereas in composite culture employing both indigenous and introduced species the yield may be as high as 3000 kg. I am inclined to consider that although these yields can be achieved, they do not represent the normal yield from most areas, particularly the larger farms.

A pertinent question now to ask is whether a thousand kilograms per hectare is enough to attract persons in sufficient numbers to take up fish culture as an industry. This is certainly lucrative as a side-occupation but with small holdings of water as is found in most parts of India, and the tremendous pressure on use of land for cultivating cereals, culturable waters are likely to shrink in course of time. Competitive claims for fish production may well be there for areas like Bengal where even the existing retail price of fish is substantially high. Economic possibilities for fish culture are not as bright for many other parts of the country, unless the feasibility of fish production as an industrial practice is established, in the same way we have taken to increased production of food-grains through the use of fertilisers.

To my mind if such a change has to take place, a more rational approach to providing artificial food in fish ponds will become necessary if the fish yield has to be raised sufficiently high to a level economically attractive. Natural conditions favour certain areas where productivity and soil conditions are exceptionally good and the yield economical. Fish yields through culture

cannot be raised to levels of high yields except through direct feeding of fish. This is impracticable if fish are to be fed and the yield increased through cereals. But we must naturally utilise the waste-products in farms and lands. Can we produce a cheap artificial feed for our cultural fish by utilising weeds, farm-wastes (like rice and wheat glume, oilseed skin, water hyacinth, straw, hay, etc. after suitable chemical treatment) and other products? Research in this direction will be extremely worthwhile, as also the use of artificial fertilisers for augmenting the natural productivity of waters. In work of this type the active cooperation of food technologists, and fishery experts will be necessary. It is pertinent to mention here that fish culture which was practically unheard of in many parts of Europe is now making rapid progress in countries like Hungary, Poland, Yugoslavia and Israel where the high yield is directly related to the artificial feeding of fish.

Fisheries Technology

Curing fish is an ancient practice still prevalent in many parts of India through the simple application of salt and drying of the surplus fish. Thanks to the high acceptance value of the prawns in the world market, particularly the USA, the frozen shrimp industry has expanded several fold in the Cochin area and the export of frozen prawns has earned a respectable place in our foreign trade. Through the introduction of quality control, the standard of the Indian product has improved and is being received in the consuming markets of the western countries. There, however, is no room for complacency; persistent efforts to improve our products have to be kept up. A similar effort at fish processing and preservation should go to other categories of fish production. Frozen fish is becoming increasingly acceptable at many urban centres, slowly replacing the iced fish. With this trend increasing we may expect more of fish, which were formerly dried, to become available in the fresh state which is certainly more acceptable to the Indian consumer. In fact, a time should come when there should be no need to dry fish in the open which has been one of the most objectionable features of the fishing industry so far as the public are concerned. New methods of preserving fish through irradiation are being developed and it has been established that unlike certain other foods, marine products are not affected as regards their taste and flavour by irradiation. Very intensive research on safe dosage and chemical changes are essential before irradiation is accepted as a safe and inexpensive method of fish preservation. In this field and in the manufacture of fish protein concentrates from surplus fish much further work is called for.

As a country not affluent in tin and steel plate for use as cheap containers there is room for intensive effort to develop new types of containers, both for brief period transport and storage and for long period packaging.

Changes in conventional methods like canning may make our products cheap for consumption within the country and make large-scale handling of the fish products easy and unobjectionable.

While much effort has gone in other countries in the improvement of fishing craft and gear we have only made a beginning. Mechanisation of boats has largely been only an improvement of boat propulsion by engines and not in the use of power for fishing itself. Notable advances, however, have been made in the south-west coast of India in this direction but much more experimental work is needed in evolving economical craft and gear units. Thanks to the efforts of the Central and State Fisheries Departments through successive F.A.O. experts who have worked in India, the Indo-Norwegian Project and our own craft and gear specialists, several new designs of boats have been built and progressively improved upon. Indigenous manufacture of diesel engines has helped the process of mechanisation at a time when import of foreign engines is difficult. Synthetic fibres in place of cotton as gear material have improved the catches. It cannot be said, however, that all these trends have been checked with due regard to economy and efficiency in operation which alone can make the changes viable. An intensive effort in research pertaining to craft and gear should be simultaneously carried out along with studies on economics of fishing and periodical appraisals of the results in different places.

Conclusions

The need for substantial increase in our fish production to augment our supplies of protein is widely recognised. Scientific information pertaining to the varied facets of Indian fisheries indicate that our annual yield can be raised substantially more than the present level. Certain lines of intensive work which may be of importance in raising the production and utilization of fish have been indicated in the preceding paragraphs. Specialists in different fields based on their own experience will be commenting in the many other articles in this issue. There is no doubt, however, that concerted efforts of fishery scientists in India can contribute much to increase our fish production, to improve the quality of our fish products and to raise the economic status of the fishing industry.

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