INDIAN FISHERIES*

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THE fishery resources of India include marine, estuarine and fresh water fisheries consisting of a very large number of species. Our present sea fish production is of the order of 7 to 8 lakh tons per annum and it is estimated that another 3 lakh tons of fish are produced in inland waters. There is in addition a considerable amount of subsistence fishing. This production is high and places India among the first seven nations having annual production of over a million tons. In 1957 our catch from marine and inland sources totalled about 12 lakh tons which is a very substantial increase over those of previous years. This is, however, inadequate to meet the country's needs which may be roughly computed at about 40 lakh tons per annum. The national income from fisheries is estimated at about 50 crores of rupees per annum and overseas trade in fish and fish products secures for the country about 3 to 5 crores of rupees as foreign exchange.

The sea fisheries resources comprise a large variety of fishes the most important of which are Sardines, Mackerel and Prawns. Many other esteemed varieties exist, particularly pomfrets and seer fish. Fishing is generally confined to the narrow coastal belt of about 6 to 10 miles from the coast and production is in the hands of nearly a million fishermen. Coastal fisheries are largely seasonal which accounts for surplus in some months with the attendant problems of transportation, marketing, processing and storage. The West Coast of India at present accounts for well over two-thirds of our total sea fish production. Exploratory fishing has shown that there are rich deep sea fishing grounds off Kathiawar and extensive prawn resources exist off Bombay and Cochin.

As a result of researches on marine fisheries at the Central Marine Fisheries Station, Mandapam, for the past ten years, we now have a fairly accurate idea of our present sea fish production, important species and regions of the coast where they are found and their seasonal variations. Considerable progress has been made in the study of the biology of important commercial species and in the augmentation of coastal fishery resources by culture and farming practices. Latent resources in sea weeds and molluscan fisheries have been investigated to give some idea of their value in future development. Basic data on the productivity of the Indian seas, oceanographical conditions and their relation to fisheries are being obtained in an effort to understand and thereby foresee the magnitude and variations of the more important sea fisheries.

The pronounced difference between the West and East Coasts of India in respect of fish landings is associated with the oceanographic conditions prevailing in the Arabian Sea and the Bay of Bengal. The Arabian Sea is an area subjected to continual replenishment of the dissolved nutrients of the surface through the upwelling of deeper waters, the coastal currents and the stress on inshore waters through the strong mansoon winds. There is further a reversal of winds and currents between the South-West and North-East monsoons. Plankton studies have indicated a high degree of productivity in waters off Kerala Coast as compared with the coastal waters of Mandapam and Madras.

The inland fisheries resources consist of the capture fisheries of the large number of rivers, lakes, irrigation dams, etc., and the culture fisheries in the thousands of fish ponds scattered throughout India. Fish cultural practices are particularly developed in Bengal, Bihar and Orissa, where there is an organised fish culture industry. Efforts in inland fisheries development lie in extending fish culture to all parts of India and in the adoption of scientific methods of fish farming. An acre of cultivated fish pond will yield, without artificial feeding, a quantity of about 1000 lb. of fish per acre per annum as against about 200 lb. from fish ponds not subject to cultural practices. Several lakhs of acres of water are now remaining fallow but with effort, all these could be brought to yield a regular harvest.

A major problem here is that the important culture fishes of India, *viz.*, the major carps, Rohu (*Labeo rohita*), Mrigal (*Cirrhina mrigala*) and Catla (*Catla catla*) do not breed in the confined waters where they are cultured. Fish culture industry is, therefore, dependent upon naturally occurring spawn and fry for stocking purposes. As the spawning period is confined to the monsoon months (June-August) and the spawning areas confined to certain portions of rivers or adjoining waters subject to flooding

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the available fish seed is limited. Researches at the Central Inland Fisheries Station have helped to reduce the mortality of fish seed while they are collected and transported. A promising line of work has been successfully opened up whereby the carps have been induced to spawn in the ponds by the administration of pituitary hormone.

The estuarine fisheries mainly consist of capture fisheries in the coastal tracts like Chilka and Pulicat Lakes, large numbers of backwaters on the coasts and estuaries of the large rivers. Important estuarine fishes are Bhekti (*Lates calcarifer*), mullets (*Mugil* spp.), milk fish (*Chanos chanos*) and prawns.

A large part of our sea fish catches is seasonal and based on shoaling species like Sardines and Mackerel. This fact combined with the inadequacy of transportational facilities to send fish in fresh condition to the interior, has led to the development of a fish curing industry. The surplus catches are either sun-dried or salt cured and later sun-dried. Prawns are often boiled and sun-dried. Pit-curing and wet-curing by different methods are also practised throughout India, but the curing industry is best developed on the Kanara, Konkan and Malabar coasts. Recently, cold storage and ice plants have been established in various places and private industry has come into the field of freezing good quality prawns and fish. The bulk of cured fish produced in India is exported to Ceylon and other eastern countries and there is a growing market for frozen shrimp in the United States. In addition, small quantities of fish meal, fish guano, fish manure and fish oil have been exported to other countries for many years.

Fisheries have been looked upon for many years only as a source of revenue. It took many years to have that orientated to development and better utilisation of an important natural resource. In recent years administrative organisations to deal with fisheries have come into being in most States but much more remains to be accomplished if fishery industry is to contribute its full share to national economy.

SOME ASPECTS OF ESTUARINE HYDROLOGY AND BIOLOGY*

ESTUARIES are characterised by complexity of physical structure and pattern of circulation and ever-unsettled hydrological features. Studies of the vellar estuary (Lat. 11·29° N and Long. 79° 49° E) which is a bar-built estuary and always open to the sea show that it can be demarcated into (1) *a marine zone* with homogeneous salinity, (2) *a tidal zone* with higher salinity at the bottom and lower salinity at the surface, and with the difference between the bottom and surface salinities progressively increasing up the estuary and (3) *a gradient zone* with the difference in salinity progressively diminishing up the estuary, and which merges into (4) *the freshwater zone*. The existence of a stratification into an upper less saline and a lower more saline layer in this bar-built estuary makes it difficult to fit it into the generally accepted schemes of classification of estuaries. There is need for critical studies of the hydrography of Indian estuaries.

The salinity of estuarine waters is continually changing. Hourly and two-hourly studies of the hydrobiology of the vellar estuary have been continuously made for twenty-four hours on full-moon and new-moon days. The rate of change of salinity is not uniform but varies frequently in a marked manner during the flow as well as ebb tides. This is much more marked at the surface than at the bottom. The differential rate of the continual change of salinity is very significant for organisms in relation to their physiological adaptations and distribution in the different zones of the estuary.

The dynamic state of estuarine waters is also reflected in the fluctuations in the volume and composition of plankton from hour to hour. The volume of plankton collected has its maximum during night time at low tide.

Estuarine organisms are very suitable for comparative biochemical studies. Biochemical features of the gonadial cycles of estuarine fish have been under investigation in comparison with those in other environments. The pituitary and ovary during different stages show interesting variations in their biochemical constituents like free and protein bound amino acids, amino-nitrogen, alkaline phosphatase, etc.

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