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**MARINE CATFISH
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EXPLOITATION AND PROSPECTS

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GENERAL FEATURES OF THE CATFISH FISHERIES

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Catfishes had formed significant seasonal fisheries along the west and east coasts of the country since the early artisanal days, but had seldom been viewed as anything more than of local importance. The traditional gears were mostly aimed at pelagic fisheries and caught demersal species by the way when they fished in shallower coastal areas and the gear took in the bottom layers also. So the ground fish contribution to the country's total marine fish landings was small. Thus, in the earlier years of our concern with the assessment and development of marine fisheries, the sardine and mackerel fisheries easily caught the attention as national fisheries, and the prawn fisheries rapidly turned into an export-oriented industry and assumed tremendous importance as a foreign-exchange earner. Many others, potentially significant, tended to be passed over, and the catfish fishery was among them.

With the large-scale introduction of mechanized fishing, particularly in the past two decades, and a distinctive demersal fishery coming into its own, it became clear that the earlier restricted nature of the catfish fishery was not an index of the occurrence of magnitude of the resource, but only of the limitations in the exploitation. Directed fishing with greater efficiency resulted in increased ground fish production and catfishes formed a consistently important part of the demersal catches (CMFRI Annual Reports).

Such increased exploitation is, no doubt, an inevitable step in the context of the increasing demand for fish. But the mechanization did not come above at a nationally planned pace, nor was it aimed at a judicious distribution of the enhanced fishing effort. Also, the mechanization was largely confined to small and medium crafts, which did not lead to any great extension of the fishing grounds or

diversification of fishing. The small trawlers, which made up the bulk of the fleet, still aimed at the lucrative prawn fisheries, but even so succeeded in more or less full exploitation of many other coastal resources as well.

A coastal fishery that is subjected to a sudden and steep increase of fishing pressure requires to be closely studied to see whether the resources can stand the rate of exploitation. This involves a comprehensive understanding of the fishery, its magnitude, distribution and pattern of variations, the species composition of its landings, as also detailed investigations on the biology of the main species that make up the catches, the dynamics of the populations fished and the present level of fishing and its impact on the stocks. Only based on such studies can realistic management policies be derived.

A study of this kind, based on the relevant work projects of this Institute at different centres over the past five to ten years, is what is attempted in the present account. Chapters on the detailed studies on particular aspects follow; a general picture of the catfish fishery of our waters is given below as background information to the specific studies.

THE FISHERY

Catfishes form important fisheries along the coasts of Kerala, Maharashtra, Tamil Nadu, Andhra Pradesh, Karnataka, Gujarat, West-Bengal and Orissa more or less in that order of abundance. The annual landings, during the decade, averaged over 53,000 tonnes; catfishes contributed approximately 10% of the country's ground-fish catches and 4-6% of the total marine fish landings. Nearly 70% of the catch came from the west coast. Statewise, the largest shares were from Kerala (29%) and Maharashtra (20%), Karnataka, since the large-

scale introduction of purse seiners, is also fast rising to a top position. (CMFRI Annual Reports).

Marine catfishes are generally bottom-living, preferring a muddy habitat, which makes it a suitable target for bottom-trawling. Some ascend the column to the surface for feeding and some species seasonally shoal near the surface, which makes them available for midwater trawling or purse-seining. A few tachysurids tolerate low salinities, even up to 5 ppm, which enable them to enter the estuaries or tidal rivers. But generally speaking, the catfishes have been observed to be most dense over inshore muddy areas particularly in 30-80m depths.

Species Composition

Though nearly a dozen species of catfish are caught along the coasts of the country, only five species are of importance from the fisheries point of view. Marine catfishes belong mostly to Tachysuridae, hence it is not surprising that 99% of the catches are of the four species of this family, viz., *T. tenuispinis*, *T. thalassinus*, *T. dussumieri*, and *T. serratus*. The first three are more or less uniformly abundant in the grounds off west and east coasts, *T. serratus* being more restricted to the south-west coast. The only other catfish species of importance is *Osteogeneiosus militaris* which is abundantly caught off Saurashtra coast.

Species	Occurrence in Indian waters
1. <i>Tachysurus caelatus</i> (Val.)	Shallow coastal waters of east and west coasts, particularly around the river mouths on east coast.
2. <i>T. Subrostratus</i> (C & V)	Coastal waters, also estuaries and tidal rivers along SW coast.
3. <i>T. sona</i> (Buch-Ham.)	Coastal waters, mainly west coast; stray catches from east coast.
4. <i>T. thalassinus</i> (Ruppell)	All along west and east coasts, also in estuaries. Seldom in shoals.
5. <i>T. serratus</i> (Day)	Along the east and west coasts, particularly during monsoon.

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| 6. <i>T. platystomus</i> (Day) | Along the east and west coasts, abundant in Gulf of Mannar. |
| 7. <i>T. tenuispinis</i> (Day) | Along the coasts, abundant along SW and NE coasts—large shoals in surface and columnar waters. |
| 8. <i>T. jella</i> (Russell) | Along the coasts, abundant on east coast, also in estuaries. |
| 9. <i>T. maculatus</i> (Thunberg) | Along the east and west coasts, also estuaries and tidal rivers. |
| 10. <i>T. dussumieri</i> (Val.) | Along east and west coasts, large shoals in surface and columnar waters, particularly along SW and SE coasts. |
| 11. <i>Osteogeneiosus militaris</i> (Linn) | Along the coasts, particularly NW and NE. |

Seasonal and Regional Patterns

In the northwest sector of Gujarat, Maharashtra and Goa, the exploited area is a coastal strip up to 40-50 m depth, though exploratory trawling has been carried out to over 100 m depth. Drift-nets, hooks and lines and trawls are the important gears, though bottom-set gill nets are widely used off Maharashtra and Gujarat. The characteristic 'dol' net of the area also catches small quantities of catfish. *T. thalassinus*, *T. dussumieri*, *T. sona*, *T. tenuispinis*, *T. jella* and *O. militaris* are the species commercially caught.

Off Goa catfishes form a good fishery from October-November to May-June by gillnet, trawl and purse-seine at depths up to 30 m. *T. dussumieri* and *T. tenuispinis* are the main species caught, especially by the purse-seines. Whereas, a year-round traditional fishery used to be maintained by hooks and line, mechanized trawling has, of late, more or less displaced it in all but the monsoon months and boosted the catch until catfishes now form nearly 5% of the total fish landings here. Off Maharashtra the hooks and line operate during May-October and trawls and 'dol' net from September-October to April-May; and catfish form the second largest demersal group landed here. *T. sona* constitutes nearly 60% of the catfish catches along Bombay

coast. Off Gujarat, catfish constitute a relatively smaller part and are generally caught during September-May by trawlers and hooks and line.

Along the south-west coast the commercial fishing grounds are generally confined to within 35 m depth and even more restricted during the S. W. monsoon months of May-September. *T. dussumieri* and *T. tenuispinis* are the species that contribute to the bulk of the catfish landings, other important species being *T. thalassinus* and *T. serratus*. Trawls, boat-seines, hooks and lines and drift-nets are the main gear in use in Karnataka and large parts of Kerala, while trawls are scarce in extreme south Kerala where the coastal belt (except for occasional patches) is generally not suitable for trawling. As already mentioned, purse-seines have made an impact on the production in this zone, particularly off Karnataka. Catfishes are caught in all quarters, generally forming 4-8% of total fish landings. The trawl fishery is generally prevalent in February-April, drift-nets in July-October and hooks and lines in August-December. The surface-moving shoals are caught by the traditional boat-seines and lately more efficiently by Purse-seines during August-October. Exploratory surveys have shown that the seasonal shifts of shoals make available a higher concentration of catfish for a longer duration off Karnataka and Kerala coasts.

There is a rich fishery for many species of catfish along the south-east coast. *T. thalassinus*, *T. dussumieri*, *T. tenuispinis*, *T. caelatus* and *T. platystomus* are commercially important, all except the first being seasonal. The chief fishing grounds are in the Gulf of Mannar and Palk Bay; species like *T. maculatus* and even *O. militaris* may occasionally be caught in quantities from Palk Bay (Menon, 1979). The fishing, carried out throughout the year shifts from the Gulf to the Bay and back again according to the changing N. E. and S. W. monsoons. The depth of fishing seldom exceeds 15-20 m. Drift nets and hooks and lines are the important traditional gear. Experimental fishing by purse-seines has been attempted successfully, but it has not caught on commercially. However, the traditional gear is slowly losing ground to mechanized trawling. So the best fishing ground for catfish is the Palk Bay which has more trawlable

areas and has extensive shallow muddy bottom suitable for catfish. The best fishing season for catfish appears to be the second quarter.

The main catfish fisheries in the north-east sector are along the Andhra coast (Sekharan, 1968). The commercial fishery is mostly in the shallow coastal region of less than 40 m depth, by indigenous crafts plying hooks and lines, boat seines and bottom-set gill nets and by small mechanized trawlers. The fishery is mainly sustained by *T. thalassinus*; *T. caelatus*, *T. tenuispinis*, *T. dussumieri*, *T. jella* and *T. maculatus* are also caught but more in West Bengal and Orissa waters. *O. militaris* is caught in bag-nets from the Hooghly-Matlah estuaries in West Bengal (Pillai & Ghosh, 1962). The high seasonal catches are in March-June. The Andhra coast produces nearly 80% of the catfish landings of the northeast sector.

Offshore Fishery and Potential Grounds

Exploratory trawling has been carried out in the northeast sector between Kakinada and Sandheads covering about 23,600 sq. km of the shelf area (Nagbhushanam, 1966; Sekharan, 1968; Kuthalingam, 1968). The coverage was not uniform and the bulk of the effort was off the Andhra coast (16°40'-21°10'), generally up to 80 m depth, occasionally to 100 m. Catfishes were found to make up 9-24% of the trawl catches. Rich grounds have been indicated off Visakhapatnam, Calingapatnam, Gopalpur and Chilaka lake. *T. tenuispinis* was dominant in the mid region (17°40'-18°40'), *T. thalassinus* abundant towards the south (16°40'-17°10') as well as the north (20°10'-21°10') (Sekharan, 1973a). The larger fish have been obtained from the deeper waters (Nagabhushanam, 1966; Sekharan, 1973b). A resource estimate of catfishes off Andhra coast over a 5-year period gave an average estimated sustainable potential yield of 5631 tonnes (Krishnamoorthi, 1974).

Off the southeast coast some detailed offshore exploratory fishing has been done in the Gulf of Mannar and Palk Bay in 1964. Catfish were found to form 2-8% of the catches from Palk Bay up to a depth of 15 m, while from the Gulf, fished up to 30 m depth, the catfish were meagre in catches (Rao, 1969).

However, later studies by acoustic surveys with experimental fishing in the Gulf of Mannar found an average catfish biomass of 3,604 tonnes, with the larger and older fish more abundant in deeper waters (Rao *et al.*, 1977). Experimental purse-seining in the Palk Bay during 1970-72 indicated large shoals of *T. dussumieri* during August-December, a single haul fetching up to 50 tonnes.

Exploratory fishing between 7°30' and 15°0' N along the southwest coast has charted out many catfish grounds even though the relative narrowness of the shelf here reduces trawling opportunities as compared to the northwest sector. The better grounds have been found to be between Calicut and Cannanore, with catfish making up about 23% of the trawl catches, with the catches diminishing southward (Tholasilingam *et al.*, 1973). While exploratory surveys have shown maximum catfish abundance during the second and third quarters, the commercial landings here are in the third and fourth quarters off Kerala and in the second quarter off Karnataka. The inability of artisanal and other small-sized crafts to exploit, during the monsoon period, the maximum availability of the resource point to the need for larger vessels fishing further. Acoustic-cum-experimental fishing surveys in the region have given average estimated catfish biomass as 43,791 tonnes off Kerala and 26,672 tonnes off Karnataka-Goa (Rao *et al.*, 1977). These surveys have also indicated concentrations of catfish moving northward and southward according to the monsoonal drift and the proportion of large-sized fish considerably higher in the offshore waters.

Exploratory fishing has been carried out in the sector between 15° and 24° covering over 25,000 sq. miles. This sector has wide shelf areas available for trawling and catfish yield has been found to be all through the year with the maximum in November-February. The abundance was maximum off Kutch and decreased gradually through Porbandar, Cambay, Dwarka and Veraval-Bombay. However, rich grounds have been marked off Malwan and Marmagoa. The potential sustainable yield of this region has been estimated as 4254 tonnes (Rao & Dorairaj, 1968). Off southern Maharashtra the average catfish biomass has been estimated as 15,629 tonnes (Rao *et al.*, 1977). The Indo-Polish Industrial

Fishery survey that covered the area from 55 to 360 m depth for one year (Bapat *et al.*, 1982) found catfish an important component of the catches from the offshore waters in all months except September-October. While better catch rates were recorded generally from the 55 to 90 m depth, high catch rates were observed in 91-125 m zone in February-April. The southern region was richer than the northern.

Utilization and Marketing

The catfishes are for the most part utilized fresh and so are marketed directly to local consumers. At times of abundance beyond local demand and in the likelihood of spoilage, the fish are cured by various methods. Larger fish of *T. thalassinus*, *T. dussumieri*, *T. tenuispinis*, *T. serratus* and *T. caelatus* are filleted while fresh and cured by salting and sun-drying. This is marketed in the interior villages. Larger fish are also sometimes slit length-wise, the viscera removed and the fish pit-cured for special markets like Sri Lanka and some East Asian countries. With the establishment of ice factories and cold storages near the landing centres at many places, fish packed with ice in boxes or baskets are also taken to interior markets. This is particularly true of the catches of the mechanized trawlers where the fishes, with entrails removed, are kept in holds with ice and sold either frozen whole or as fillets.

Small-sized catfish are used, along with the miscellaneous catch of trash fish, for the preparation of fish meal or fish protein concentrate. Studies have shown that *T. jella* gives a product containing over 90% protein (Gopakumar and Shenoy, 1977), while the lipid content is found to be higher in other species, e. g., muscles of belly flaps of *T. dussumieri* gave nearly 38.5 g per 100g (Alexander, 1970). Tachysurids have also been found to yield phosphorus, calcium, sodium and potassium in small quantities (Kutty *et al.*, 1976). Catfish liver is found to be a very good source of vitamin (Singh & Rege, 1964.)

The air-bladders of large-sized catfish are used in the preparation of isinglass. The bladder is slit, washed, dried and marketed. Because catfish bladder yields only a relatively inferior type of isinglass, the market remains limited.

In general, the marketing of catfish and its products is not well-organised and is, on the other hand, characterized by the unhygienic conditions of beach drying and curing and, even in the marketed products like fillets, the crudity of the packing and despatch.

Limitations and Possible Conclusions of Present Study

The work reported on in this Bulletin comprises the detailed studies on specific aspects of the catfish biology carried out at seven centres along the east and west coasts, and analysis of the All-India catch and effort figures from the CMFRI data centre. In the latter, the catfishes have been estimated as a group and the separate landing figures are not available for individual species. In the centre-based observations the data have been collected for varying periods for different species and centres as the Institute's investigations started at the main centres of Waltair and Mandapam Camp

in 1970-71 and the other centres were added as the work progressed; Cochin, Calicut, Mangalore and Bombay in 1978-79 and Veraval in 1980. So not all centres could be considered for all the species in the resources assessment studies. Still the conclusions that could be derived from this study have been sufficiently indicative of the trend of changes in exploitation and the direction in which further management steps should be taken.

The picture that emerges is of a resource that is potentially large, but is now exploited in coastal waters only. Here it is subjected to such intensive fishing pressure that any increased effort would be detrimental to the stocks in the area. Restrictions on effort in an inshore fishery that is mainly carried on by small and medium-sized vessels and which is primarily aimed at the lucrative prawn fishery, is difficult but appears necessary. Additional effort for increased production has to be applied elsewhere, in the potential grounds beyond.

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