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The Flatfishes

By K. V. Narayana Rao
Central Marine Fisheries Research Institute

Among the food fishes which contribute to the marine fish production in India, flatfishes constitute an important element in the ground fish resources which, until recent years, could not be exploited adequately due to the lack of suitable gear. The indigenous gear that are employed in the fishery for flatfishes are not quite efficient to capture them from the bottom; and are able to capture only when these fishes shoal in the surface and subsurface waters in the inshore area. Inspite of these drawbacks, the fishery produces an estimated average annual catch of 9,913 tonnes. There is a great possibility of increasing the production of flatfishes from the present level.

The flatfishes comprising halibuts, flounders and soles are bottom fishes and are characterised by assymetry, for in the adults the eyes lie either on the right or on the left side of the head. These fishes are closely related to perch-like fishes and have a remarkable capacity to change the colour of their body to match with the surroundings. Most flatfishes live in moderate depth. Some of them extend to deep water; while a few live close to inshore and even in estuaries. They are predaceous and carnivorous feeding on small fishes, worms, molluscs and crustaceans. They are prolific breeders. Most flatfishes are small; while a few attain large size. Some of the species are greatly esteemed for their delicate and flavoured flesh. They are cheap and are within the easy reach of the low income people.

Flatfishes are well represented in our waters. Most of these, however, are not commercially important. The only species of commercial importance, at present, is the Malabar Sole, *Cynoglossus semifasciatus*, comparatively a small sized species. It grows to a maximum size of 18 cm (about 7"). The dominant size in the fishery, however, varies from 10–13 cm (4–5") only. Other larger species viz., *Cynoglossus dubius*, *C. puncticeps*, *C. lida* and *C. bilineatus* are also caught in the fishery in small quantities. In recent years the Indian Halibut, *Psettodes erumei*, is being taken frequently from the trawling grounds off Bombay and Saurashtra area. Many of these species are represented on the East Coast also; but are not important commercially (Plate – I).

The Malabar Sole, *Cynoglossus semifasciatus*, supports a rich seasonal fishery on the West Coast of India. On this coast it is important next only to the oil sardine, mackerel and shrimp fisheries in the magnitude of catches. Due to its great economic importance this species has been studied in detail at the Institute.

The region between Moolki in South Kanara and Quilon in Kerala is important for the sole fishery. The heaviest landings, however, are confined to the region between

Edakad and Kadapuram on the Malabar Coast. Soles are popularly called *Manthal* on the Malabar Coast; while they go by the name *Nangu* in the South Kanara region.

The season for the sole fishery starts by late August or early September and extends upto November. One of the characteristic features of the sole fishery is that the bulk of the seasonal catch is obtained within a short period at the commencement of the season. The data given in the following table would illustrate this fact.

Quarterly landings of soles at Calicut during 1960—61 season

Quarter	Landings (tonnes)	Divergence from quarterly men
April—June	9.3	—120.7
July—September	484.5	+354.5
October—December	24.6	—105.4
January—March	1.6*	—128.4
Average	130.0	

*Approximate.

It is obvious from the above data that the peak landings are obtained in the second quarter. From the divergence of the catches during different quarters from the quarterly mean it is instructive that there is a sudden increase in catches during the second quarter and an equally sudden decrease thereafter. Out of the estimated total landings of 484.5 tonnes during the second quarter, the entire catch was obtained in September alone. This sudden increase and decrease in the sole landings is typical of the fishery all along the coast and is connected with the large scale shoaling of the species in the surface and subsurface waters of the inshore area in enormous numbers. This phenomenon is known to the fishermen as *Manthayilakom* and is taken advantage of by them in the large scale capture by employing boat seines (*Thattum Vala* and *Paithu Vala*), Cast-Nets (*Veechu Valu*) and Shore Seines (*Noona Vala*). The range of the fishing operations is limited to 7 fathom (12.8 metres) area. One can well imagine as to what would happen to this rich restricted seasonal fishery, apart from other causes, if the large scale shoaling of fish in the inshore area is not detected right in time or it occurs at a distance or depth which cannot be reached or fished effectively with the gear presently employed in the fishery.

Since the major portion of the sole catch is obtained within a short period at the commencement of the season; the disposal of the catch, sometimes, becomes unmanageable. Consequently some of the sole catch is diverted for use as manure. A small fraction of the seasonal catch is consumed in fresh condition as it finds favour only with the poorer section of the community. Most of the sole catch, however, is exclusively cured by salting and sundrying (Plate-II). The cured fish is exported to the interior places where it finds ready market.

The sole fishery is subjected to both annual and long-term fluctuations which is evident from the following data compiled by the Central Marine Fisheries Research Institute.

Sole landings in India during the decade from 1956 to 1965

Year	Landings (tonnes)	Divergence from annual average
1956	9,122	— 761
1957	3,687	— 6,226
1958	12,856	+ 2,943
1959	10,360	+ 447
1960	14,107	+ 4,194
1961	7,730	— 2,184
1962	17,644	+ 7,731
1963	8,781	— 1,132
1964	6,146	— 3,767
1965	8,693	— 1,220
Average...	9,913	

The magnitude of the sole landings, as could be judged from the above table, varies from year to year. During the decade the best catch was recorded in 1962 season, while the fishery in 1957 was least productive. The average annual catch of soles, for the ten year period, works out to 9,913 tonnes which is about 1.33% of the total marine fish production in India during the period. The divergence of the annual landings from the average annual catch during the decade shows that the sole landings during the years 1958, 1959, 1960 and 1962 are above average; while during the remaining years they are much below average.

The studies on the rate of growth and age of the Malabar Sole by means of its scales and length frequency distribution have shown that the species grows to a size of 10–12 cm during the first year and to about 14–16 cm by the end of second year of its life. The peak fishery is supported exclusively by the one-year olds; the older individuals being negligible in proportion. In other words the products of a spawing season grow to the adult size and directly enter the fishery in the following season. The strength of juveniles in one season, therefore, determines the number of adult fish available for capture during the next season. Thus it appears that the large scale fluctuations of the sole fishery, to a large extent, are related to the success of the spawning and the recruitment of the young fish into the fishery.

The peak fishery is based on potential spawners. By September when the large scale shoaling occurs in the inshore waters, soles in a large majority (75–80%) are already fully mature. The species spawns, for the first time, at the end of first year of its growth, attaining an average length of 11 cm. A single fish having a lengh of 15.5 cm produces, on an average, an estimated number of 55 thousand eggs. The breeding season is

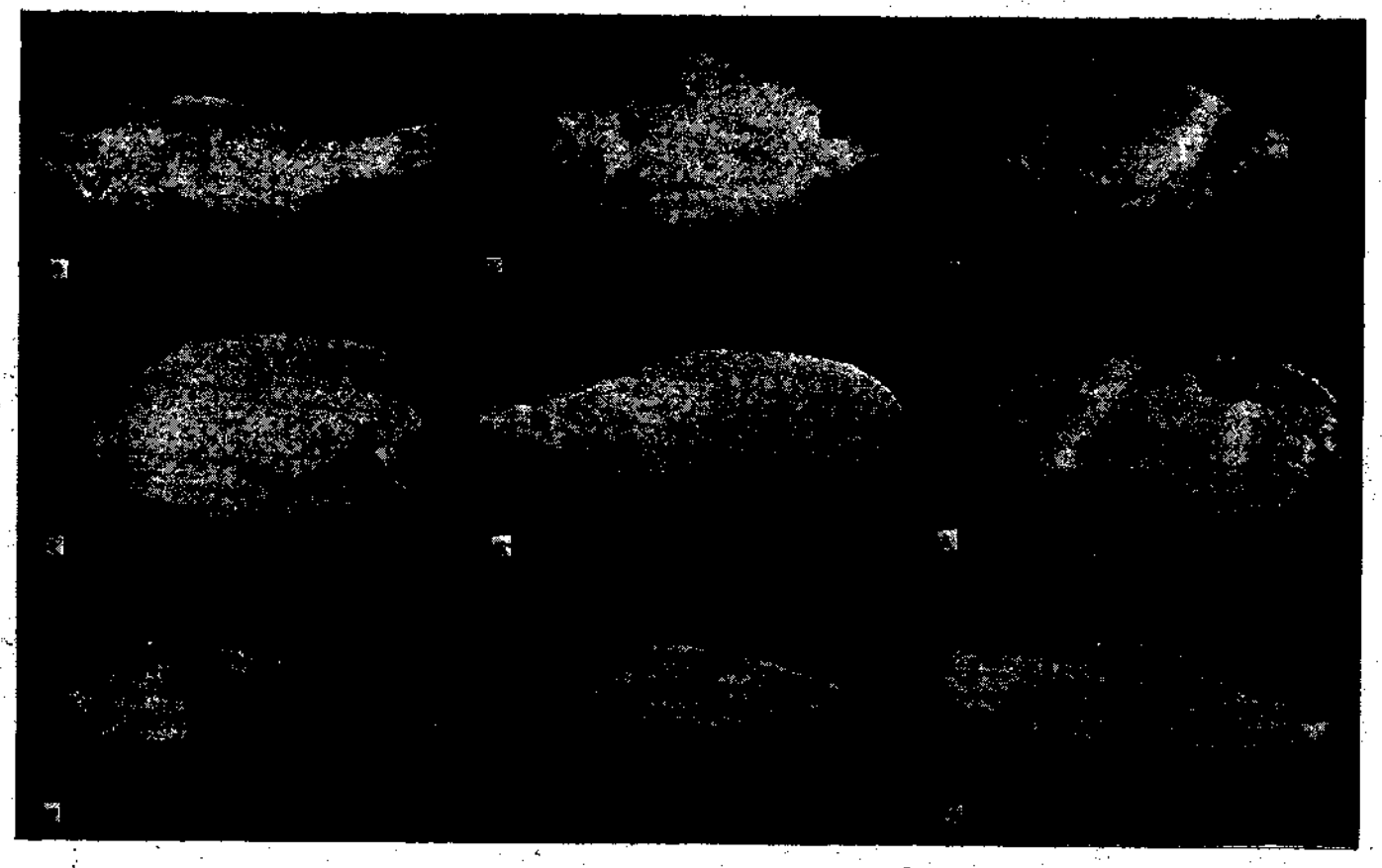

PLATE – I. Some representative species of the Indian Flatfishes: 1. Indian Halibut (*Psettodes erumei*) 16.7 cm; 2. Large-Toothed Flounder (*Pseudorhombus arsius*) 25.6 cm; 3. Javanese Flounder (*P. javanicus*) 12.1 cm; 4. Ovate Sole (*Solea ovata*) 10.0 cm; 5. Eyed Sole (*Heteromycteris oculus*) 9.7 cm; 6. Oriental Sole (*Brachirus orientalis*) 11.2 cm; 7. Malabar Sole (*Cynoglossus semifasciatus*) 14.7 cm; 8. Spotted Sole (*C. puncticeps*) 19.9cm and 9. Doublelined Sole (*C. bilineatus*) 18.2 cm.

PLATE – II. Extensive Dry Curing of the Malabar Sole in one of the Fish Curing Yards on the Malabar Coast.

protracted over several months with peak spawning occurring during the period October-January. The spawning is believed to take place in the deeper area. The eggs of the Malabar Sole are small, pelagic and each egg contains several oil globules. They start appearing in the plankton right from October onwards. The larvae which hatch out are symmetrical. They grow and metamorphose into young ones in about a month or so. The movement of the right eye of the larva to its left side during the metamorphosis is completed by the time the larva grows to a size of about 9-10 mm. Young soles (below 50mm) start appearing in the inshore catches right from November or December until May, with a peak abundance in March. It remains to be studied whether the large scale capture of both the potential spawners and the juveniles from the inshore area is likely to affect the sole stock in the area.

In the Malabar Sole sexes are recognizable when it has grown to a size of 6-7 cm. In smaller size and age groups males are more in number than females; but in the older fish females outnumber males. The females grow faster than males at comparable age and appear to survive for a longer period also.

The Malabar Sole being a bottom fish is a bottom feeder; feeding on the bottom fauna available in the area. It feeds actively on polychaetes (*Prionospio pinnata*), amphipods (*Cheiriphotis megachelis*) molluscs (*Pholas orientalis* and *Nucula* sp.). When the sole is in the surface waters it feeds on the planktonic stages of polychaetes (dominated by *P. pinnata*). molluscs and on diatoms etc. The occurrence of the food species in the gut content of the Malabar Sole has been found to be closely related to the occurrence of the fauna in the area.

A great deal has been said on the migrations of the Malabar Sole. The sudden appearance of the sole in enormous numbers in the inshore surface waters in September and their equally sudden disappearance from these waters soon after is considered to be connected with the migration of these fish from the offshore area to the inshore and *vice versa* for feeding and breeding purposes respectively. The actual contributory factors for this phenomenon are still obscure for want of adequate data on the behaviour of the Malabar Sole in the inshore area during the monsoon season.

It is pertinent, in this connection, to consider the profound role the South West Monsoon plays in the biologial cycle of the inshore area along the Malabar Coast. Every year with the onset of the monsoon the sea off Malabar Coast becomes turbulent due to the prevailing strong winds and tidal currents. As a result the bottom mud is greatly and frequently agitated, resulting in the formation and dissolution of extensive mud banks so characteristic of the inshore area. These mud banks are known to be rich sources of inorganic nutrients, especially phosphates. These nutrients are released into the surface waters during the monsoon and thus contributing to the production of rich plankton which in turn is responsible for the rich fisheries of the area.

Incidental to the turbulent conditions of the sea during the South West Monsoon and as a result of the violent and frequent agitation of the bottom mud, the bottom fauna

of the inshore area is almost completely destroyed. It would, therefore, appear likely that the shoaling up of the Malabar Sole in the inshore surface waters in enormous numbers in September has something to do with these unfavourable physical and biological conditions of the inshore bottom habitat attendent with the monsoon. The disappearence of the sole from the inshore surface waters coincides significantly, with the return of favourable conditions attendant with the re-settlement of bottom fauna in the inshore bottom habitat. In other words the migration of the sole occurs, very likely, in vertical direction and appears to be limited in extent. This assumes added significance if it is remembered that the Malabar Sole is an inshore bottom species. If the fish is there in abundance all the time in the inshore area, why then, it may be asked, they are no longer caught in such large quantities as they were during the months of large scale shoaling of the species in the surface waters. This, obviously, has something to do with the suitability of the gear employed in the fishery at this time. The gear presently employed in the sole fishery can catch the the soles effectively only when they are shoaling in the surface and subsurface waters; but are inefficient to capture them when they are on the bottom. In this respect there is a certain extent of parallelism between the sole and shrimp fisheries of the west coast of India.