PROCEEDINGS OF THE SYMPOSIUM

ON

LIVING RESOURCES *of* THE SEAS AROUND INDIA

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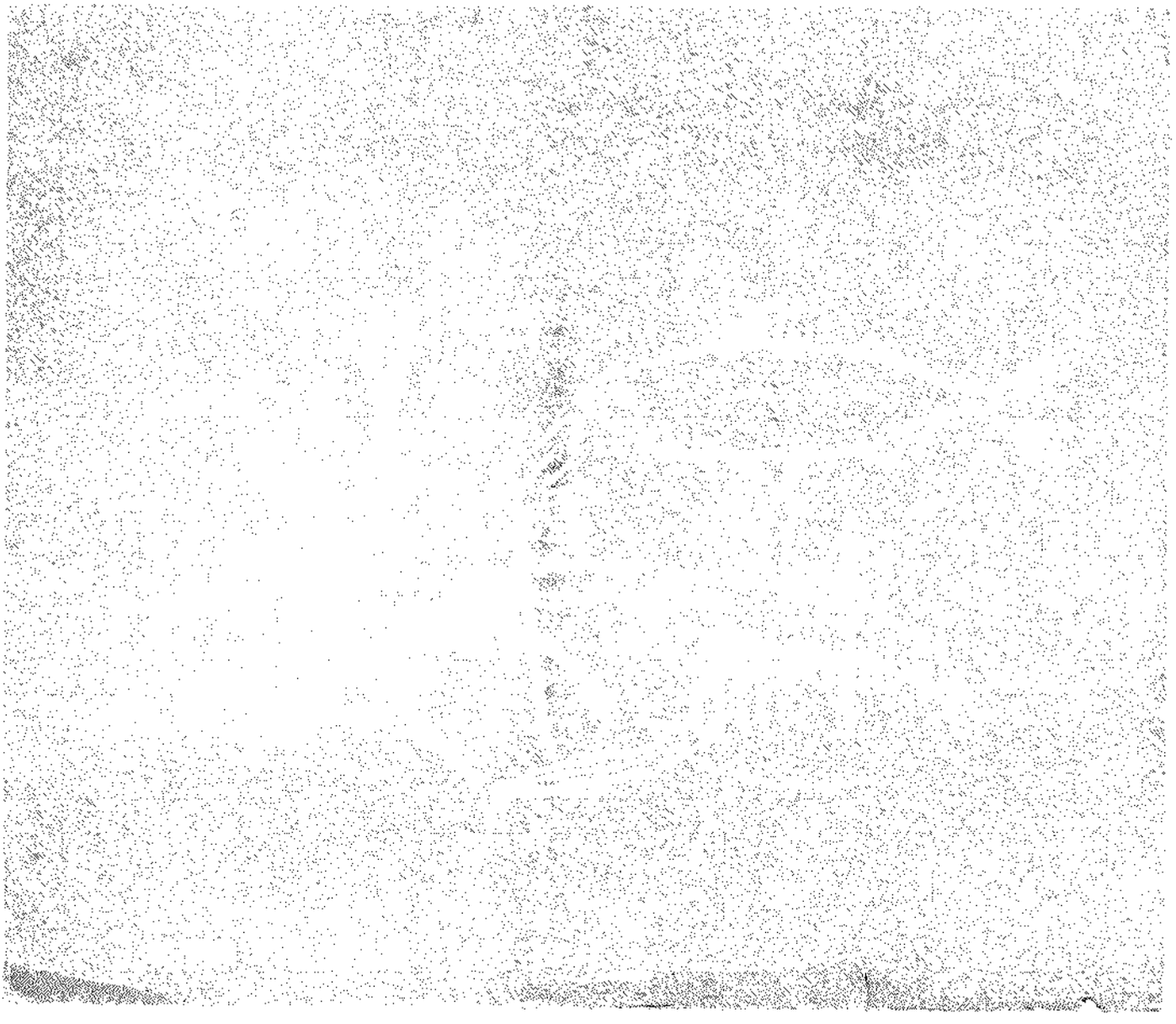

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THE FLAT FISH RESOURCES OF THE WEST COAST OF INDIA

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ABSTRACT

Among the marine fishery resources of India, the flat fishes occupy a place of some importance, especially along the West Coast. Among these, however, the only species that has been contributing to a sizable and regular fishery is *Cynoglossus semifasciatus* Day. The best fishery is restricted to the North Kerala and South Mysore coasts. This paper gives a brief account of the past and some recent trends in this fishery with a particular reference to Calicut on the Malabar coast.

The common nets used in the sole fishery at Calicut are the boat-seine (*Paithuvala*) and the cast net. In recent years mechanised boats have started fishing by small trawl nets in the area and it has been found that during 1966–67 and 1967–68 the off-season catches have been more than catches of the normal season, the difference being particularly marked in 1967–68 which accounted for a good annual total catch. A large percentage of the off-season catch consisted of juveniles. The extent to which this would affect the regular fishery remains to be studied.

INTRODUCTION

AMONG the marine fishery resources of India the flat fishes also occupy a place of some importance along the West coast. Although, Norman (1927 and 1928) has described about 91 species of this group (Heterosomata) in the Indian waters, it is only a very small number that contributes to any large catches and in fact only a single species *Cynoglossus semifasciatus* Day** has been contributing a regular fishery of importance, mainly on the Mysore and Kerala coasts. A species af the same genus that contributes to a small fishery occasionally along these coasts is *C. dubius* Day, a larger-growing species. Species of *Solea* and *Synaptura*, members of the *Soleidae* occasionally come in small quantities in the miscellaneous inshore catches. *Psettodes erumei*, another species of our flat fishes, called the Indian halibut by some workers also, occurs in small quantities on both the east and west coasts and has been known to occur in deeper waters (Pradhan, 1967), unlike the tongue soles or Cynoglossids which are mainly confined to the shallow waters. Occurring along with the catches of *C. semifasiatus* (The Malabar sole) can be seen occasional specimens of other species such as *C. lida*, *C. puncticeps*, *C. bilineatus*, *Paraplagusia* spp. and *Pseudorhombus* spp., but these are hardly worth a mention from the fishery point of view as far as the present knowledge goes but the species *C. lingua*? seems to contribute to small quantities now and then in the commercial landings, along the Mysore coast. *C. macrolepidotus* is another species that seems to occur in small quantities here and there; this species has been studied by Kutty (1967) and Kutty and Quasim from a fishery biological point of view. It is quite possible that one or more of the other species of flat fishes known to occur in our waters, may occur in some numbers occasionally here and there when they will be useful, as almost all the species seem to be more or less suitable for use as food; no data are available on such sporadic fisheries at present. The following statement taken from the *Madras Fishery Bulletin*, No. 15 (1922), dealing with the fish supply of Madras City will be of interest in this connection: "Soles are prime fish; *Psettodes erumei* (Erumei nakku), the largest flat fish of Madras, and *Pseudorhombus arsius* (nakku) are commonly valuable food fishes. Other soles seen in

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** Note :—The Malabar Sole, *Cyooglossus semifasciatus* is hereafter to be called *C. macrostomus* (Norman), following A. G. Menon (1971).

the markets are *Cynog lossuslingua* (Vari Allu), *Plagusia marmorata* (Nedu nakku), *Synaptura cornuta* (Vari Allu) and *S. commersoniana* (nakku). *Synaptura* is not esteemed as food in Madras. Soles were sold round, the best month being August and November".

The Malabar Sole Fishery

The species *C. semifasciatus* occurs in the sea on both the coasts of India and is essentially a shallow water form though it migrates and gets scattered about in the relatively deeper waters of the fishing grounds during the off-season. The commercial catches are mostly made within two to three months immediately after the completion of the south-west monsoon, occurring at that time in large and numerous shoals at the surface and the midwaters of the inshore sea. This fishery seems to have been in operation from ancient times, even like the mackerel and oil sardine fisheries though its value is much less compared to the latter forms. The data included in the various reports and bulletins of the former Madras Fisheries Department indicate that this fish was considered as of some value at least from the beginning of this century. Chari (1948) has shown that *C. semifasciatus* has high nutritive value by means of chemical analysis. Seshappa and Bhimachar (1955) analysed the catch data (taken from the West Hill Marine Biological Station from the original records) for the year 1932 onwards, for the various fish landing centres of the West coast commencing from Kirimanjeshwar in the North (now in Mysore State) to Kodambi in the south (now in Kerala State); these data showed that the catches had an increasing trend from 1944–45 onwards with record landings in the year 1950–51 (5,02,759 maunds or about 18,800 metric tons), this being nearly double the maximum ever recorded in the pre-war years. A detailed study of the data from 1940–41 to 1949–50 showed certain constant features which were as follows: There were some landings in the month of August but September always showed the best catches, October already showing a considerable decline in most of the centres; during the subsequent months, there is not only a reduction in the landings but also a gradual restriction of the fishery to the Central region, until finally during the following pre-monsoon months the soles are recorded in very small quantities and at a few places only. There is actually no distinct fishery normally during these off-season months, the small occasional catches forming part of a miscellaneous inshore fishery of various common species along with some prawns and crabs also.

It would appear that the Malabar sole fishery of the West coast has always been an inshore fishery; the fishing cruises made by the Madras Fisheries Department yielded no catches of any mentionable magnitude in the deeper waters. The voyage report of the "Lady Goschen" during November-December 1928 and March-May 1929* shows for instance that out of a total of 96 hauls taken during the period in depths ranging from 8 to 54 fathoms, 'soles' were recorded on six occasions, one of these occasions being negligible and ignored; of the other five hauls one was off Cape Comorin (9–3–1929) the yield of soles being 125 lb. (in a total of 1,357 lb.), and being mostly *Psettodes erumei*. The other four hauls were off Calicut, made on the 9th and 10th April 1929, and these yielded some soles ranging in quantity from 23 to 84 lb. per haul; the species is mentioned as *Psettodes erumei* for haul No. 70 (of 9–4–1929) and the same may be assumed to be true of other hauls also. Thus *Cynoglossus* was more or less absent or insignificant in the deeper waters during the period.

Bhimachar and Venkataraman (1952) who studied the inshore fish populations off Calicut State that the main species in the Malabar sole fishery was *C. semifasciatus*, the only other flat fish worth mentioning in these catches being *Solea ovata* (Richardson) that had a restricted occurrence ("appreciable numbers in August and again the first week of October"). They found that the family Cynoglossidae was represented by *C. semifasciatus*, *C. dubius* and *C. puncticeps* of which *C. semifasciatus* contributed to a rich fishery in the inshore area while the other two species were practically insignificant in the catches. They stated that the Malabar sole was the most persistent and abundant

* *Madras Fisheries Bulletin*. No. 24 (Fisher Reports for 1930). Government of Madras.

fish of the inshore area, constituting 21% of the total fish catch of the year in their experimental catches.

Recent Trends

The total sole landings (All-India) as estimated by the Central Marine Fisheries Research Institute for the year 1957 to 1966 were as follows (*see* Table I) :

Table I

Total marine sole landings in India during the years 1957 to 1966

Years	Landings in thousands of metric tons	Deviation from the Mean
1957	3.7	(− 6·2)
1958	12.9	(+ 3·0)
1959	10.4	(+ 0·5)
1960	14.1	(+ 4·2)
1961	7.7	(+ 2·2)
1962	17.6	(+ 7·7)
1963	8.8	(− 1·1)
1964	6.2	(− 3·7)
1965	9.8	(− 0·1)
1966	7.4	(− 2·5)

The mean value for the period was 9·9 thousand m. tons. These figures represent soles a very large percentage of which may be said to be *C. semifasciatus* from the West coast.* The present author has analysed the catch trends of *C. semifasciatus* at Calicut during the years 1959 to 1963 (Seshappa, unpublished) and the following table shows the monthly catch trend (from all the gears together) during these years:

Table II

Monthly total landings (in kg.) of Cynoglossus semifasciatus *at Calicut (Vellayil) during* 1959–63

Months	1959	1960	1961	1962	1963
January	0	1,278	..	0	75
February	45	795	0	41	21
March	13,048	1,912	301	165	64
April	2,856	7,967	..	192	467
May	2,218	1,228	578	32	9
June	6,110	0	31	0	911
July	0	0	32	0	398
August	0	0	0	1,974	14
September	0	1,16,785	2,722	1,02,413	19,775
October	1,61,002	25,799	2,36,906	1,03,827	12,989
November	46,171	15,942	..	617	17,995
December	9,645	..	..	3	836
Total	2,41,095	1,71,707	2,40,569	2,09,263	53,554

* Tables IX and X show the quarterly and annual fiat fish landings along the Kerala and Mysore coasts respectively for the years 1960 to 1967; the figures for *C. semifasciatus* are underestimates.

The total sole landings at Calicut have shown fluctuations even during this short period of five years. The years 1959 and 1961 showed total sole catches of more or less the same magnitude, the former year being better by half a ton. In 1960, the catch by all the gears together was much less than 1959, amounting only to 171·7 m. tons. The year 1962 again showed a decline over 1961 and registered a total catch of only 209·3 m. tons. It is to be noted, however, that the catches during all these years have been only of a poor magnitude when compared to the yields of the earlier years, namely 1944–51. The approximate catches at Calicut (Vellayil) during the years 1940–41 to 1951–52 are given below:

Years and catches in tonnes

1940–41: 655	1946–47: 494
1941–42: 477	1947–48: 1,993
1942–43: 510	1948–49: 1,810
1943–44: 268	1949–50: 1,548
1944–45: 1,597	1950–51: 1,799
1945–46: 881	1951–52: 92·5

Table III shows the catches (and the catch per unit) by *Paithuvala* only during 1959–63

TABLE III

Catch (and catch per unit) in kg. of C. semifasciatus in Paithuvala *at Calicut (Vellyail) during* 1959–63

Months	1959	1960	1961	1962	1963
January	0 (0)	1,278 (47·4)	— (—)	0 (0)	75 (3·9)
February	45 (4·1)	795 (4·7)	0 (0)	41 (1·5)	10 (0·9)
March	13,048 (28·3)	1,912 (4·7)	18 (0·6)	165 (0·4)	64 (2·2)
April	2,856 (8·1)	7,967 (3·7)	— (—)	192 (0·5)	467 (5·0)
May	2,218 (11·0)	684 (3·6)	532 (6·4)	32 (0·1)	9 (1·1)
June	6,110 (9·4)	0 (0)	31 (0)	0 (0)	0 (0)
July	0 (0)	0 (0)	21 (0)	0 (0)	217 (0·7)
August	0 (0)	0 (0)	0 (0)	1,025 (0·9)	14 (0)
September	0 (0)	7,608 (31·3)	0 (0)	22,139 (37·9)	3,389 (5·0)
October	1,40,118 (198·8)	20,175 (240·2)	6,568 (437·9)	1,01,463 (193·6)	10,188 (9.0)
November	6,291 (99.9)	15,942 (388.8)	— (—)	0 (0)	17,995 (140.6)
December	7,690 (74·7)	— (--)	— (—)	3 (0·9)	836 8·9
TOTAL	1,78,376 (21·6)	69,886 (17·9)	7,171 (1·9)	1,25,060 (22·8)	33,263 (10·9)

Regarding the gear used in the sole fishery there is again no evidence to show that there have been any major long-term changes during this century. The soles are normally caught either by the cast net or the boat-seine (Paithuvala) on the Kerala coast. Types of drag nets such as the *Kairampani* (or even the *Rampani*) may be used as along the Kanara coast. The larger sizes are frequently caught in the various types of gill-nets also during the season though this is not a regular

practice. Surface shoals are easily caught in cast nets. On the Malabar coast the *Paithuvala* is the standard gear in use for several decades, the same net being used for miscellaneous inshore fisheries also. This *Paithuvala* or boat-seine has been described briefly by Dr. Bhimachar and Venkataraman (1952) and it is essentially a bag-type of net operated by two boats with a crew of 4 to 8 persons.

During very recent years small trawl nets are operated in some places (for example, at Calicut) with mechanised boats. As Table V will show, during the years 1966–67 and 1967–68 these mechanised boats played a dominant role in the sole fishery at Calicut the *Paithuvala* becoming a gear of minor importance for the commercial catches.

TABLE IV

Statement of monthly total landings of Cynoglossus semifasciatus *at Calicut (Vellayil) during July* 1966 *to June* 1968
(Catch figures are in Kg.)

Month and year	Total catch by all gears	Catch by mechanised boats	Percentage in all fish total	Catch by *Paithuvala* units	Percentage in all fish total	Catch in other gears with percentage values
1966						
July	547	..	..	547	0·24	..
August	892	..	..	892	0·14	..
September	12,812	..	..	12,812	24·43	..
October	..	..	..	..	..	..
November	25,972	1,631	31·52	16,979	98·12	7,162 Carrier boats (100%)
December	24,207	23,690	12·21	517	21·35	..
1967						
January	41,200	41,200	10·88	0	..	..
February	38,625	38,625	12·71	0	..	0
March	31,419	31,419	11·41	0	..	0
April	12,756	12,507	5·83	249	21·10	0
May	7,229	394	6·64	6,835	74·36	0
June	1,450	0	..	1,450	73·40	0
July	0	..	..	..	..	..
August	0	..	..	..	..	..
September	79,220	0	..	71,377	23·93	7,843 *Nethelvala* and cast nets) (28·0%)
October	15,816	15,816	12·52	0	..	0
November	75,017	75,017	38·70	0	..	0
December	1,28,806	1,28,806	22·45	0	..	0
1968						
January	65,243	65,243	17·73	0	..	0
February	52,846	52,742	24·62	104	32·71	0
March	39,584	37,781	11·11	1,803	23·18	0
April	48,538	18,756	19·80	29,782	75·65	0
May	2,401	560	6·30	1,600	12·95	241 (*Odamvala*) (15·13%)
June	3	0	..	£	0·91	0

As already stated, for the total catches of the Malabar sole it is the post-monsoon period of September to November that largely counts, though naturally the trends of these months will have some remote relation (noticeable or otherwise) to the trends of the other months also. Considering the above three months of the present five-year period (1959–63), it is seen that September showed the best catch in 1962 (this being still a low figure when compared to the best monthly catch during any of these five years), poor catch in 1963 and no catch in 1959 and 1961. October was the month that yielded relatively good catches throughout with the highest monthly catch rate (which is here expressed in terms of catch per unit of boat-seine itself) of 437·9 kg. in 1961; the lowest monthly catch rate was in October 1963. The month of November made a very good contribution to the catches during 1960 and 1963, some contribution in 1959 and no contribution during the other two years.

In contrast to the above the catch data for the years 1966–67 and 1967–68 are shown in Table IV. During this period mechanised boats with indigenous trawl-type of nets have taken over much of the fishing activities from the *Paithuvala* units, and these boats cover the slightly offshore areas also of the usual fishing grounds. *C. semifasciatus* has been found to be one of the dominant components of these trawl catches, and what is interesting is that during these months the catches were high during some months of the off-season period also, there being little or no catch during the monsoon months of June to August. Table V will show that during these two years, the total catches of *C. semifasciatus* for the months of December to May are considerably high.

TABLE V

Total landings of C. semifasciatus *at Calicut (Vellayil) during the period* 1966–68

Years	September–November (Season)		December–May (Off-season)	
	Mechanised boats	*Paithuvala*	Mechanised boats	*Paithuvala*
	m. tons.	m. tons	m. tons	m. tons
1966–67	9·0	29·8	147·6	9·1
1967–68	98·7	71·4	747·2	32·3

The data given in Table V will show that (1) the *Paithuvala* had only a minor position in the *Cynoglossus* fishery during this period, and (2) in both the years the off-season 'take' has been much more than the season's 'take', the difference being particularly marked in 1967–68. The very high improvement in these catch figures as compared to the five-year period mentioned above (1959–63) may also be noted. The increase is mainly contributed by the off-season catch of the mechanised boats, this being very good in 1967–68. (The catch of the monsoon months of June to August are nil or negligible.)

Biology

Detailed studies on the biology of *C. semifasciatus* at Calicut have been made by Seshappa and Bhimachar (1951, 1954 and 1955); some observations were made by George (1958) subsequently. More recently observations on the species at Calicut were resumed by the present author who has summarised the data on some aspects of the biology and fisheries respectively for the years 1959–63 in two papers (Seshappa, 1964, & MSS). The species has been found from earlier studies to be a bottom feeder preferring mainly a diet of polychaetes, amphipods and small lamellibranchs. It was found tha the polychaete worm *Prionospio pinnata* was the dominant item of food in the stomach of the Malabar sole during some periods. During the monsoon months of June to August the fish is not found in the inshore grounds but appears to be scattered about in the slightly deeper areas of the fishing

grounds But large shoals occur at all depths in the inshore waters during September and October, and sometimes in November. After these months the fish does not usually occur in shoals. Spawning seems to take place mainly in the deeper areas of the fishing grounds where the fish retreat after September–October; variable intensities of spawning activity may continue till about the following April–May. Unusual instances of out-of-season spawning and consequent off-season fisheries are also known from the trends of recent years; the unusually high catches in the off-season period shown in Table V is also of special interest.

Though the major part of the spawning is in the farther regions of the inshore sea, specimens with gonads in the ripe and spawning conditions are frequently seen in the inshore catches particularly of October–November, and spent individuals are also seen in some numbers subsequently.

The scales of *C. semifasciatus* have growth-rings on them which can be used in the assessment of age and growth trends. Usually, a large majority of the individuals in the September-October fishery are only one-year old, being products of the previous spawning season; considerable quantities of two-year olds have also been found in some years but three-year olds seem to be absent in the catches except as rare specimens. The bulk of the commercial catches during 1949–52 consisted of individuals with one monsoon ring. During September–October of 1949 and 1950 the size-groups with the highest frequency was 10–10·9 cm, but in the season of 1951 this was 12–12·9 thus showing a higher growth. The data for 1959–63 showed that while the 1-year olds again formed the bulk of the commercial catches, the two-year olds also had a modal frequency in the catches of 1960–61 and 1962–63; this factor actually contributed during some months to the occurrence of three generations together in the fishery. In October 1959 the mode was in the 11–11·9 cm. group; in the commercial season of 1960 there were two modes, at 11–11·9 cm. and 14–14·9 cm. In the season of 1961–62 there were early juveniles with mode at 5–5·9 cm. in the commercial catches, the main mode being at 13–13·9 cm. During August–October of 1962 there were mainly two modes in the sizes, namely at 12–12·9 cm. and 14–14·9 cm.; the last group formed 34·5% of the total in August, 22·3% in September and 29·7% in October.

Available data from the Madras Fisheries Reports indicate that the Malabar sole in the commercial catches has not at any time exceeded the upper size limits noticed during recent years, though detailed size-frequency data are not available from published papers. It would appear that nobody has so far seen any specimen of *C. semifasciatus* reaching in size beyond the 17–18 cm. group, so far as the West Coast is concerned. There is reason to suspect that still larger sizes may be occurring at some places on the East Coast; however this may not be an important consideration as on the East Coast this does not support any big fishery.

CYNOGLOSSUS DUBIUS

With the introduction of the mechanised boats for trawl fishing in the inshore and near-offshore waters another species of *Cynoglossus*, namely, *C. dubius* has been found to occur in small quantities now and then but the quantities being sufficient enough to assess the species separately from *C. semifasciatus*, occasional specimens of various species of *Cynoglossus* being normally ignored in the estimation of commercial sole catches. During the period from July 1966 to June 1968, the following quantities of this fish were estimated to have been landed in Vellayil (*see* Table VI).

This species was not found in the catches (except as occasional specimens like other species such as *C. bilineatus* and *C. puncticeps*) during the months of July to October not included in Table VI. It seems clear that this species occurs more in the slightly deeper waters of the inshore fishing grounds fished by the mechanised boats; the *Paithuvala* units perhaps do not include this form in larger numbers as they mostly fish in the shallower regions of the sea. This species grows to a much larger size (up to 50 cm., above 20 cm. being common in the catches) than *C. semifasciatus*, and is equally preferred as food. Its capture is a newly added contribution to the exploitation of the food resource m the sea in the area, though the quantity is not quite impressive at present. Observations are

therefore being made on this fish also along with *C. semifasciatus* according to the availability of samples. Ripening specimens in Stage IV of maturity have been observed in August–September and the spawning season seems to coincide with that of the Malabar sole. The juveniles of this species are however not very frequent in the inshore catches, though seen in small numbers along with the juveniles of *C. semifasciatus* now and then.

TABLE VI

Landings of Cynoglossus dubius at Vellayil. Calicut

Month	Quantity (in kg.)	Gear used
1966		
November	14	Mechanised boats (trawling)
December	1,624	do.
1967		
January	1,937	do.
February	874	do.
April	48	do.
June	12	do.
July	9	*Paithuvala* units
October	75	Mechanised boats (trawling)
November	752	do.
December	570	do.
1968		
January	3,772	do.
February	1,939	do.
March	1,070	6 kg. by *Paithuvala* units and rest by mechanised boats (trawling)
April	253	35 kg. by *Paithuvala* units and rest by mechanised boats (trawling)
May	5	Mechainsed boats

OTHER SPEICES

Psettodes erumei seems to occur in small quantities in the near-offshore waters in the area, more than a metric ton of the fish being landed during April 1968 at Vellayil (Calicut), this being however the only occasion when it occurred in such a large quantity during the period July 1966 to June 1968. But in view of the past records from experiments also, it seems possible that this fish exists as a resource of variable abundance both at the farther end of the inshore fishing grounds and perhaps in the more offshore regions also. It is however doubtful whether this is enough to form an inducement for any regular offshore trawling work in the area. It is more likely that in due course the present mechanised vessels can gradually extend their sphere of operation to exploit this resource as far as available. The only other flat fishes worth mentioning as a resource are *Solea ovata* and *Pseudorhombus* spp. occurring very occasionally in some quantities. These do not seem to be an unexploited resource as invariably they enter the miscelloneous catches when occurring in the inshore area and are utilized whenever caught.

TABLE VII

Size-distribution in the monthly totals of the departmental random samples of C. semifasciatus *during December* 1966 to *May* 1967

Lengths cm.	December 1966	January 1967	February 1967	March 1967	April 1967	May 1967	Total (Percentage)
3– 3·9	0	0	0	0	3	0	3 (0·08)
4– 4·9	54	6	0	4	14	2	80 (2·30)
5– 5·9	614	48	0	8	24	5	699 (20·08)
6– 6·9	1,055	143	25	5	35	16	1,279 (36·07)
7– 7·9	396	58	54	15	18	31	572 (16.43)
8– 8·9	148	24	28	39	18	18	275 (7·90)
9– 9·9	20	17	10	59	40	46	192 (5·51)
10–10·9	10	16	7	37	49	52	171 (5·00)
11–11·9	12	5	8	13	16	29	83 (2·38)
12–12·9	14	10	1	5	3	12	45 (1·29)
13–13·9	20	4	4	15	1	11	55 (1·58)
14–14·9	2	1	5	4	0	9	21 (0·60)
15–15·9	0	0	0	3	0	3	6 (0·17)
16–16·9	0	0	0	1	0	0	1 (0·03)
TOTAL	2,345	332	142	208	221	234	3,482
(Percentage)	(67·35)	(9·53)	(4·08)	(5·97)	(6·35)	(6·71)	..

TABLE VIII

Size distribution in the monthly totals of the departmental random samples of C. semifasciatus *during December* 1967 *to May* 1968

Lengths cm.	December 1967	January 1968	February 1968	March 1968	April 1968	May 1968	Total (percentage)
3– 3·9	0	0	0	1	1	0	2 (0·05)
4– 4·9	3	0	4	16	20	14	57 (1·35)
5– 5·9	37	4	18	46	32	76	213 (5·05)
6– 6·9	127	18	21	43	33	131	373 (8·85)
7– 7·9	138	28	43	51	36	159	455 (10·79)
8– 8·9	125	92	78	99	39	143	576 (13·67)
9– 9·9	364	150	157	193	35	85	984 (23·35)
10–10·9	280	110	184	226	36	47	883 (2·950)
11–11·9	36	60	78	151	22	33	380 (9·02)
12–12·9	14	11	31	41	12	18	127 (3·01)
13–13·9	32	7	7	18	4	17	85 (2·02)
14–14·9	27	5	3	5	1	16	57 (1·35)
15–15·9	14	3	0	3	0	3	23 (0·55)
TOTAL	1,197	488	624	893	271	742	4,215
(Percentage)	(28·40)	(11·58)	(14·80)	(21·19)	(6·43)	(17·60)	..

TABLE IX *

Total flat fish landings along the Kerala coast, during the years 1960–67 *in tonnes*
(Based on the data from Fishery Survey Section of C.M.F.R. Institute)

Years	Quarter	*C. semifasciatus*	*Cynoglossus dubius*	*Cynoglossus*, spp.	*Psettodes erumei*	*Pseudorhombus*	Total
1960	I	155·90	2·14	183·79	5·47	0	347·30
	II	236·84	0·80	21·56	15·78	0	274·78
	III	11291·38	0	85·53	0·07	0	11376·98
	IV	703·72	0	12·28	0	0	716·00
Total ..		12387·84	2·74	303·16	21·32	0	12715·06
1961	I	9·95	0	17·12	0	0	27·07
	II	87·63	0	103·12	2·07	0·23	193·05
	III	3369·27	0	4·47	0	0	3373·74
	IV	2274·71	0	13·79	0	0	2288·50
Total ..		5741·56	0	138·50	2·07	0·23	5882·36
1962	I	0	0	21·39	0	0	21·39
	II	22·47	0	9·40	0	0·10	31·97
	III	1167·36	0	30·08	0	9·32	1206·76
	IV	14758·15	0	166·36	0	3·89	14928·40
Total ..		15947·98	0	227·23	0	13·31	16188·52
1963	I	216·90	0	441·78	0	2·76	661·44
	II	0·28	0	162·43	0	2·37	165·08
	III	15·04	0	4036·60	0	2·16	4053·80
	IV	3·42	0	2599·84	0	0·98	2604·24
Total ..		235·64	0	7240·65	0	8·27	7484·56
1964	I	1·13	0	239·57	0	4·36	245·06
	II	206·78	0	631·07	0	0·95	838·80
	III	0	0	2773·82	0	0·41	2774·23
	IV	221·70	0	242·58	0	1·51	465·79
Total ..		429·61	0	3887·04	0	7·23	4323·88
1965	I	564·39	0	185·20	0	0·16	749·75
	II	634·73	0	217·22	0	0·53	852·48
	III	1253·06	0	2834·56	0	0	4087·62
	IV	975·94	0	639·22	0	5·95	1621·11
Total ..		3428·12	0	3876·20	0	6·64	3310·96
1966	I	0·42	0	392·74	0	13·62	406·78
	II	529·48	0	396·56	2·21	0·94	929·19
	III	80·68	0	575·02	0	10·07	665·77
	VI	333·44	0	2399·33	0	0·69	2733·46
Total ..		944·02	0	3763·65	2·21	25·32	4735·20
1967	I	20·90	0	204·92	0	3·69	229·51
	II	12·96	0	822·13	0	3·09	838·18
	III	3·50	0	487·08	0	0	490·58
	IV	122·03	0	1459·54	47·86	13·34	1642·77
Total ..		159·39	0	2973·67	47·86	20·12	3201·04
Grand totals ..		39274·16	5·48	22410·10	73·46	81·12	57841·58
Mean value (Annual)		4909·27 (=67·90%)	0·69	2801·26 (=38·74%)	9·18	10·14	7230·20

TABLE X *

Total flat fish landings along the Mysore coast, during the years 1960–67 in tonnes

(Based on data from the Fishery Survey Section of C.M.F.R. Institute)

Years	Quarter	*C. semi-fasciatus*	*C. lingua*	*Cynoglossus* spp.	*Pset-todes*	*Solea*	*Synap-tura*	*Pseudo-rhombus*	Totals
1960	I	0	0	2·00	0	0	0	0·17	2·17
	II	0·63	0	1·44	3·91	0	0	0·28	6·26
	III	175·44	0·31	142·18	0	0	0	2·05	319·98
	IV	0	0	58·59	0	0	0	1·20	59·79
Total ..		176·07	0·31	204·21	3·91	0	0	3·25	388·20
1961	I	7·35	0	0	0	0	0	0	7·35
	II	6·52	0	0	0	0	0	0	6·52
	III	0	0·30	0	0	0	0	0	0·30
	IV	284·81	0	8·43	0	0	0	0	293·24
Total ..		298·68	0·30	8·43	0	0	0	0	307·41
1962	I	0	0	0	0	0·94	0	0	0·94
	II	0	0	0	0	0	2·06	0	2·06
	III	163·67	1·21	4·58	0	0	0	0	169·46
	IV	16·41	0	16·28	0	0	0	0	32·69
Total ..		180·08	1·21	20·86	0	0·94	2·06	0	205·15
1963	I	0	0	1·07	0	0	0	0	1·07
	II	0	0	8·91	0	0	0	0	8·91
	III	0	0	478·14	0	0	0	0	478·14
	IV	0	0	63·90	0	0	0	0	63·90
Total ..		0	0	552·02	0	0	0	0	552·02
1964	I	0	0	1·22	0	0	0	0	1·22
	II	0	0	1·76	0	0	0	0	1·76
	III	0	0	134·11	0	0	0	0	134·11
	IV	0	0	186·86	0	0	0	0	186·86
Total ..		0	0	323·95	0	0	0	0	323·95
1965	I	0	0	1·33	0	0	0	0	1·33
	II	0	0	2·39	0	0	0	0	2·39
	III	0	0	131·69	0	0	0	0	131·69
	IV	0	0	182·73	0	0	0	0	182·73
Total ..		0	0	318·14	0	0	0	0	318·14
1966	I	0	0	0·11	0	0	0	0	0·11
	II	0	0	5·81	0	0	0	0	5·81
	III	0	0	33·48	0	0	0	0·16	33·64
	IV	0	0	169·43	0	0	0	0	169·43
Total ..		0	0	208·73	0	0	0	0·16	208·99
1967	I	0	0	4·04	0	0	0	0	4·04
	II	0	0	2·37	0	0	0	0	2·37
	III	0	0	716·72	0	0	0	0	716·72
	IV	0	0	397·72	0	0	0	0	397·72
Total ..		0	0	1120·33 +0·52	0	0	0	0	1120·85
Grand total		654·83	1·81	2757·19	3·91	0·94	2·06	3·41	3424·71
Annual means		81·85 (19·16%)	0·23	344·65 (80·61%)	0·49	0·12	0·26	0·43	428·09

* I am grateful to Shri D. Chakraborty for making available to me the survey data given in these tables.

There are no other species forming fisheries of importance, but *C. macrolepidotus* is mentioned by some workers as occurring in considerable quantities in some places; Dr. Kutty (1966) has done some work in this species using scale rings for age study. Kutty and Quasim (1967) have made some theoretical yield studies on the same species. *C. lingua* is mentioned in the survey records as contributing to small occasional catches along the Mysore coast.

Tables IX and X show the relative abundance of the different commercial categories of flat fishes along the Kerala and Mysore coasts respectively during the years 1960 to 1967; the category shown as *Cynoglossus* spp. would include a very large percentage of *C. semifasciatus*, the figures given for the latter species being thus underestimates in these tables.

Remarks

Seshappa and Bhimachar (1955) suggested continued studies on the following main-lines while concluding their paper on the fishery biology of the Malabar tongue sole, *Cynoglossus semifasciatus*: (1) to study the species in relation to its environment in several regions along the coast and also in the deeper waters; (2) to confirm the probable absence of south to north migration in the species; (3) to restrict the exploitation of juveniles and (4) to carry out investigations on the bottom organisms at different centres in relation to the food of the species, in view of the coincidence noticed between the commencement of the post-monsoon sole fishery and the commencement of bottom animal settlement. These recommendations would mean in effect that there should be scientists working on these aspects at all our existing centres along the Kerala and Mysore coasts. This has however not been possible so far owing to various reasons, and especially because of the priority that had to be given by the existing staff to the other and more important fisheries. Even at Calicut it has been possible to pursue the work only in part and also not in a continuing way. According to the availability of staff and facilities it should prove useful to implement the above recommendations even now, as the work becomes more important with the introduction of mechanised boats which increase the efficiency of fishing and also exploit the resource in the near-offshore region.

The failure of the sole fishery during 1951–52 was attributed in the above work to (1) the high off-season catches taken during 1949–50, the best monthly catches of that year (25,420 maunds) being obtained in January 1950 instead of September 1949, and (2) the very high catches of breeders in September 1950 (42,410 maunds), the highest for that month during the period 1940–52 (the year 1950-51 also showed record landings for the West Coast).

The data given in this paper for the years 1966-68 show a very high off-season catch as a result of the introduction of mechanised boats; Tables VII and VIII show the monthly size-distribution in *C. semifasciatus* as seen from departmental random samples during the off-season months of 1966-67 and 1967-68 respectively. These tables show that the juveniles dominated the stock of the species during the off-season months, the fish below 10 cm. total length for the December–May period forming about 89% in 1966-67 and about 63% in 1967–68. It is highly probable that this may tell on the magnitude of the future fishery unless these quantities represent a hitherto unexploited part of the resource in view of the relatively deeper areas fished by the mechanised boats. The current year's results are already indicative of a poor fishery.

As it is likely that a further seaward extension of the range of activity of the mechanised boats may bring in more of *Cynoglossus dubius* and *Psettodes* as hitherto under-exploited or unexploited resources, those engaged in this would deserve suitable encouragement for the same.

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