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Mackerel fishery of the Malabar area - major broods and their recruitment

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ABSTRACT

Three important broods contribute to the bulk of the mackerel catch in the Malabar area - November brood, May brood and July brood. May and July broods are very abundant broods recruited to the fishery during the monsoon months. During the study period 86. 80 % of the May brood was exploited in the monsoon months (June-August) and 75 % of the July brood was exploited in the post monsoon months (September-October). The November brood recruited to the fishery in summer was comparatively less abundant and 53.59 % of this brood was exploited in the summer months (March-May). Favourable environment seems to be the reason for stronger recruitment during the monsoon. 63.03 % of the catch of mackerel was of size below 17 cm. It indicated growth over fishing as they were found to reach a size of around 24 cm by the end of first year of their life.

Introduction

Yohannan (1998) has given an account of the mackerel fishery of this area and the environmental characteristics that influence the behaviour of the fish and fishing success. Early juveniles of Indian mackerel, *Ratrelliger kanagurta,* are found to appear in the commercial catches of Malabar area at regular intervals in large numbers indicating recruitment of different broods to the fishery in an year with varying intensities. The pattern of these recruitments, the pressure of exploitation on these broods and their relative importance are studied in this paper.

Materials and methods

The data for this study were collected from four important fish landing centres namely Beypore, Vellayil, Puthiangadi and Puthiappa during the period from January 1994 to December 1995. Beypore, the southernmost centre of observation and Puthiappa the northernmost are fisheries harbours where mainly trawlers land their catch. During the southwest monsoon ringnets also land their catch at these harbours, especially at Puthiappa. Vellayil and Puthiangadi are situated in between these harbours where mainly ringnets land their catch during the non-monsoon period when sea is relatively calm. However, fishing is done by all gear in the same area and only landing places are different. Hence, to get an overall picture of the fishery, observations were

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made at all these centres and the data were pooled. The other landing centres in the Malabar area (from Kasaragod to Malappuram districts) were visited occasionally to study the variations in the fishery.

The catch: Catch and effort data were collected from the four centres by regular sampling. Each landing centre was visited once a week. At present about 99 % of the mackerel catch in the Malabar area is landed by 3 types of gear - ringnet, *Ayilachalavala* and trawl net. Hence, catches by these gear only were observed. The catch and effort on the observed days in each gear were raised to the monthly catch and effort following the standard method (Prabhu and Dhulkhed, 1970).

Length - frequency distribution: Sampling of the catch for length frequency distribution was made at least once in a week, depending on the availability from one or more of the landing centres from different gear. If there were distinctly different size groups landed, (which may probably represent another brood) another sample was collected. The catch percentages of diffferent broods were estimated visually for the purpose of raising the sample frequencies of different broods landed on that day. The idea was not to mix different broods in a day's sample as far as possible. The range and modal values of total length of the fish (in mm) of each sample were marked in a large sheet of graph paper, with day along the X-axis and length along the Y-axis, against the day of the sample to monitor the progression of their modal values regularly so that any possible missing links in their modal progression could be avoided by intensive sampling.

The length-frequencies in 5 mm interval were raised to the total catch of the gear on the particular day. If there were more than one sample from a gear in a day due to different size groups (broods) landed by different units, the raising was done to the respective portions of the day's catch estimated in that gear. The frequencies of different broods on the sampling days were raised to the catch portion of that brood estimated using the percentages observed on the sampling days. All these exercises were done to maintain the identity of each sample while getting total frequencies in each length interval for the month by simply adding the raised frequencies of the sample in that month.

Results

Fig. 1 shows the length range and modal values in the length-frequency distribution of the samples collected during the study period. It shows a clear pattern of shifting of modal values in the different broods contributing to the commercial fishery. It can be seen that the juveniles were recruited to the fishery in March/April, July and September. These three broods can be separated after studying the progression of the modal values in their length-frequency distribtion. In January 1994 the mackerel fishery was on the broods

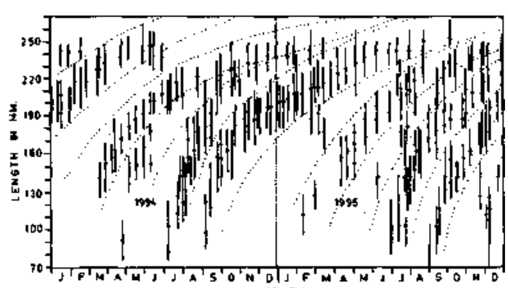

Fig. 1. Length range and modal values of the samples collected during the study period.

of the previous year which had already reached a size of around 180-215 mm. They were caught in trawl nets and *Ayilachalavala.* They continued to appear in the fishery till June, 1994, slowly declining in numbers. This brood is named as "O-brood".

In March 1994 a new brood with size ranging from 140-160 mm appeared in ringnet catches. In April again another new brood with size ranging from 75 to 115 mm appeared in the trawl catches. These broods continued to appear in trawl nets till May and in ringnets when their operations started. They persisted in the fishery till July 1994. As these broods were mixed and closeby they are named as 'brood-la and 'brood-lb'.

In July an abundant brood appeared in the ringnet catches with the length varying from 75 to 120 mm and continued to dominate ring net catches in August, but almost disappeared in September. This is 'brood-2'. Another abundant brood appeared in the ringnet catches in September with length ranging from 85 to 180 mm. This brood termed as 'brood-3' was the mainstay of the fishery till the end of 1994 and even continued their presence till July 1995.

Almost the same pattern continued in 1995 except that a new brood appeared in trawlnet catches in November and indications of more minor broods were there in the data. But the major broods were those corresponding to the broods in 1994. The brood corresponding to 'brood-la' of 1994 appeared in February 1995 with the length ranging from 95 to 129 mm. They persisted in the fishery till July 1995. This brood is termed as 'brood-4'. In June 1995 a brood corresponding to 'brood-2' appeared with a length between 75 and 129 mm. Unlike the 'brood-2' brood persisted in the fishery till December 1995. This brood is called 'brood-5'. The brood corresponding to 'brood-3' appeared in September 1995 with length between 75 andl69 mm. This is 'brood-6'. This brood supported the fishery till December 1995. The brood that appeared in November 1995 and could be observed only for 2 months was ignored in the present study.

The 'O-brood' of 1994 can most probably be the brood recruited to the fishery in September 1993 and corresponding to 'brood-3' and 'brood-6'. Thus, there are three major broods contributing to the bulk of the fishery in an year. Hence, these broods were separated for further detailed studies.

From Fig. 1 it can be seen that separating them from early stages of growth is easy. The broods are well apart. Since care was taken while sampling to get separate samples representing separate broods and identity of the samples were maintained while raising their length-frequency distribution to the catch of the month, the separation could be made even at later stages of growth. The differences in the gonadial condition of closeby broods also helped in the process. The separation was done as shown in Fig. 1 in dotted lines.

The length-frequency data for each brood were separated. The length interval was changed to 10 mm and monthly data for the corresponding broods were pooled to get three important broods as follows:

The 'brood-la' and 'brood-4' seemed to have originated sometime in November. They were pooled to form the 'November brood'. 'Brood-2' and 'brood-5' seemed to have originated in May and were pooled to form the 'May brood'. 'Brood 0', 'brood-3' and 'brood-6' seemed to have originated in July and hence they were pooled to form the 'July brood'.

November brood: In 1994 the 'November brood' appeared in the fishery in March and gave peak catches in May. On an average the November brood contributed only 19.66 % of the total number of mackerel caught in an year, but their contribution in weight was 22.52 % with a mean weight of 56.57 g. The monthly.progression of modal values of this brood is shown in Fig. 2.

May brood: This brood appeared as a strong brood in July 1994 and dominated the fishery in August, declining regularly and disappearing in September. In 1995 they appeared a bit early, but not in abundance. The peak catches came only in September, declining steadily but persisting in the fishery till the end of the year. They were much numerous than the 'November brood' forming 27.37 % of the total number of mackerel landed. In weight, on the other hand, they were much less than the 'November brood' forming only 17.31 % as their mean weight was only 30.66 g. Fig. 3 shows the monthly progression of modal values of this brood.

Fig. 2. Length range and modal values of the November brood in different months.

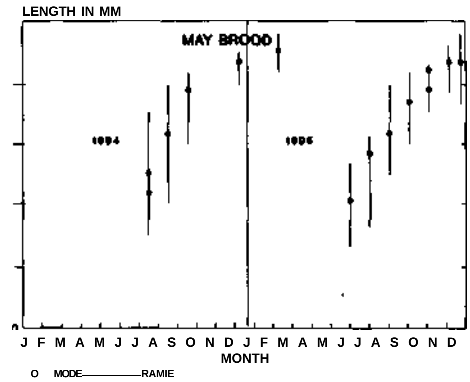

Fig. 3. Length range and modal values of the May brood in different months.

July brood: This was the most important brood forming 28.69 % in numbers and 27.48 % in weight of mackerel caught in an year. Their mean weight (47.29 g) was in between the broods discussed earlier. In 1994 they entered the fishery in September giving peak catches in October. In 1995 they appeared early in August and gave peak catches in September. The monthly progression of modal values of this brood is shown in Fig. 4.

Thus almost all peak catches from different broods were obtained when

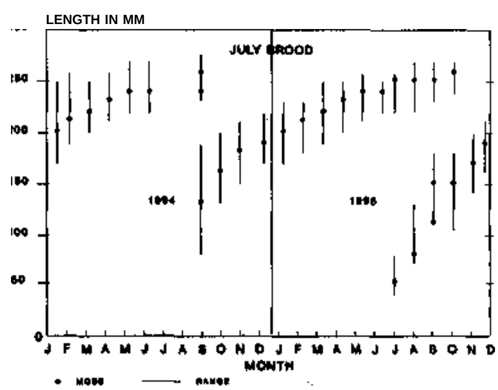

Fig. 4. Length range and modal values of the July brood in different months.

they were juveniles with weight below 40 g. Only the juveniles of 'November brood' were not exploited in such intensity as those of May and July broods, because they appeared in a period when fishery is not very active. Change of peak catches by one month altered the mean weight considerably. For example, the peak catch of 'May brood' in August 1994 had a mean weight of only 32.37 g. The peak catches of this brood in 1995 was in September and the mean weight was 68.92 g. Same was the case with the 'July brood'. In 1994 the peak was October when the mean weight was 41.52 g. When the peak catches of this brood were obtained during September 1995 the mean weight was only 19.03 g. The monthwise length frequencies of the different broods were pooled and are shown along with the total length frequency during the period in Fig. 5.

The total number of mackerel from each brood landed in different months and their mean weight are given in Table 1 which shows that all the three broods are exploited intensively when they are very small. Maximum exploitation of the 'May brood' was in July and

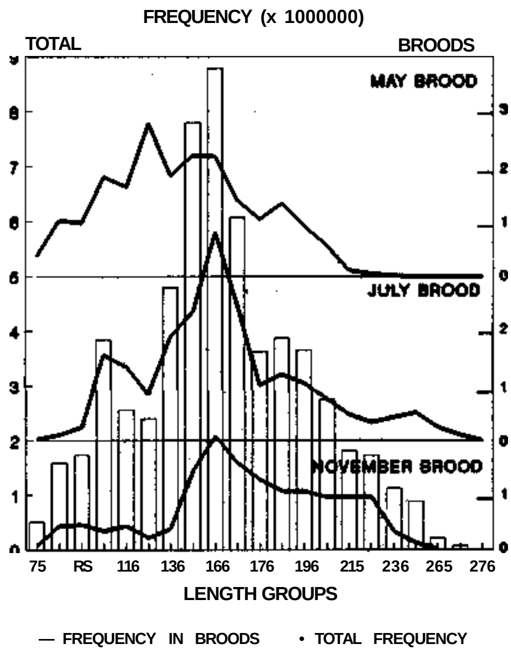

Fig. 5. Length-frequency distribution of total catch and catch from different broods.

TABLE 1. *Total number (N) of mackerel (x 1000000) landed in each brood and their mean weight (MW) in g during the period*

Month	November brood		May brood		July brood	
	N	MW	N	MW	N	MW
January	0.03	151.84	–	–	0.48	84.37
February	0.59	22.31	0.03	131.82	0.75	96.43
March	0.92	36.00	-	-	0.41	111.42
April	2.40	38.66	-	-	0.12	131.63
May	2.58	51.52	-	-	0.35	144.73
June	1.20	78.78	0.80	8.96	0.45	152.42
July	1.07	89.78	8.63	14.97	0.05	166.65
August	0.27	107.82	7.73	33.73	0.13	30.44
September	1.37	115.21	2.02	68.08	8.61	27.58
October	0.26	125.29	0.34	75.49	7.08	41.12
November	0.25	134.32	0.13	100.40	1.37	60.57
December	0.07	149.94	0.09	109.36	1.12	71.66
Total	11.03		20.28		20.88	
Mean weight		66.03		30.84		47.60

August when their mean weights were between 8 and 15 g. The 'July brood' was intensively exploited in September and October when their mean weights were between 27 and 41 g. The peak exploitation of 'November brood' was at higher size in April and May when they had a mean weight of 38 to 52 g. But their recruitment was not very strong as that of May and July broods. The 'May brood' was fully recruited to the fishery by July and the 'July brood' in September. The overall mean length during different months are shown in Fig. 6. The mean length was below 16 cm in the monsoon months when the fishery was active. Larger size groups were caught from November to March when the catches were generally poor. The lowest mean length in July indicated the recruitment of the May brood. From July the increase in mean length is interrupted in September due to the recruitment of July brood. Recruitment of an unidentified minor brood in December is indicated by a minor dip in the mean length increase. Recruitment of the November brood in April is very clear from the Figure. Appearance of this brood had influenced the mean length from January till May.

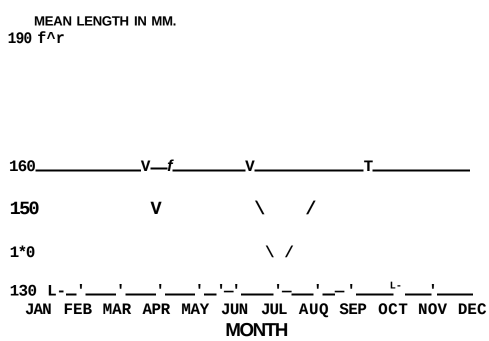

Fig. 6. The mean length of mackerel in different months.

Discussion

Yohannan (1979) observed important broods of mackerel produced during the period from April to July in Mangalore. In Calicut new recruits were found to enter the fishery by July and September (Yohannan and Balasubramanian, 1991). These are probably the broods originated around May and July. Devaraj *et al.* (1994) found important broods produced in April and May along the southwest coast of India. They also observed minor broods originated in June-August and September-October. The present observations broadly agree with these findings. But the importance of the July brood in the fishery is revealed here. Peak recruitment is from the products of spawning from May to July. The recruitment to the fishery and exploitation are intense during the monsoon months resulting in heavy exploitation of juveniles of size around 15 cm weighing around 35 g. General observations indicated that the situation is similar all along the Malabar coast. George (1953), Seshappa and Jayaraman (1956), Subrahmanyan (1959 & 1959 a), Subrahmanyan and Sarma (1965) and Mukundan (1967) have studied the inshore waters of Calicut and observed an increase in the fertility and productivity of the area during monsoon causing a bloom of planktonic organisms. Tropical scombroids spawn serially over a protracted period but it is possible that some increase in reproductive output occur during certain months (Orange, 1961; Joseph, 1963; Klawe, 1966: Hunter *et al.,* 1986; Schaefer, 1987). Many spawn during every month of the year with peaks during or just before the upwelling period (Lauth and Olson, 1996). Wootton (1979) opined that when food resources are abundant the reproductive output of adult fish increases due to energy surplus. The time and duration of spawning in fish are often synchronised with zooplankton production cycles, resulting in better larval survival (Nikolsky, 1963; Cushing, 1982). Research in other upwelling areas has shown that recruitment success of pelagic marine species increases with upwelling intensity (Cury and Roy, 1989; Bakun *et al,* 1991). Food abundance and higher temperature can promote growth rate of fish larvae, reducing duration of larval stages and exposure to predation resulting in better recruitment (Houde, 1987). This situation causes an increase in the recruitment of May and July broods during monsoon. January-March is the period of low plankton production over the shelf along the west coast of India (Anon., 1976) which explains the low recruitment of the November brood. But with low recruitment this brood gives comparatively better catch because of low exploitation of their juveniles. With similar pattern of exploitation the May and July broods can give better yield. But indications are that the fast increasing fleet of ringnet units active during the monsoon months, when early juveniles of the new recruits are abundant at the coastal surface area, can soon deteriorate the condition of the stocks already subjected to growth over fishing.

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