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MACKEREL FISHERY OF THE CALICUT AREA AND ITS FLUCTUATIONS DURING THE SEASONS FROM 1980-81 TO 1985-86 *

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ABSTRACT

After relatively good mackerel fishery at Calicut in 1980-81 it touched the lowest figure in 1983-84. Improvement was noticed subsequently. Recruitment to the fishery is almost completed by September. Mainstay of recruitment at Calicut is from the products of spawning in June and August. A good annual rainfall is found to be beneficial to the fishery, but the rainfall and catch in September is found to have an inverse relation. Catch in 1970-71 is found to be well above equilibrium level. The magnitude of spawning stock in April-June period is found to have direct relation to the total catch of that season. In general, mackerel fishery is on the decline at Calicut. There are indications that the current fishing pressure on the population is more than optimum.

INTRODUCTION

ERRATIC fluctuation in the abundance of mackerel in the exploited area have very often caused great concern among the fishermen. At Calicut after relatively a good mackerel fishery in 1980-81 season when 573 tonnes of mackerel were caught, the catches dwindled to 60 t in 1983-84 season. Subsequently there was a steady improvement and in 1985-86 season the total yield of mackerel fishery rose to 351 t. The results of a preliminary study of the pattern of these fluctuations are presented in this paper. The results of this study are also compared to that of Pradhan and Reddy (1962) and Venkataraman and Rao (1973).

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SOURCE OF DATA

Catch, effort and length frequency data collected from Vellayil, Calicut, regularly on the mackerel fishery during 1980-81 to 1985-86 form the basis of this paper. Daily weather reports supplied by India Meteorological Department were utilised for rainfall data for Calicut. Data presented by Venkataraman and Rao (1973) on the mackerel fishery of Calicut area during 1960-61 to 1965-66 and catch data for 1970-71 to 1975-76 taken from the records maintained at Calicut centre are also presented for a comparative study. All seasons referred to here are from April to March unless otherwise mentioned.

OBSERVATIONS

Fig. 1 shows the total landings of mackerel during different seasons and average monthly catches are shown in Fig. 2. The maximum catches are obtained in September. The average monthly contribution by different gears (Fig. 3) shows that *pattenkolli* maintains the peak in September. Fig. 4 shows the size groups available to the fishery during different

months. Here the length range and mode of each sample are plotted against the day of sampling for reasons given by Yohannan (1979). Part B of the figure is a repetition of Part A to see the progression of size-range and modal values from one season to another.

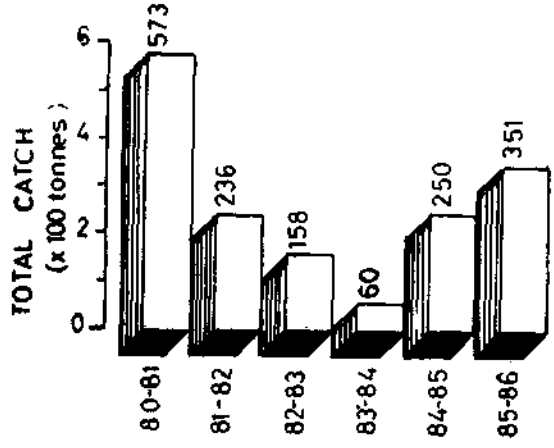

FIG. 1. The total seasonal catch of mackerel.

The figure indicate that during April, May and June the fishery solely depends on the previous season's recruits which are exploited by *Ayilachalavala* (gill net). The peak catches in June are from this group. By July the new recruits enter the fishery and *Pattenkolli* (boat seine) begins to dominate the fishery (Fig. 3, 4). By September another brood enters the fishery. There is an indication of a brood, though weak, entering the fishery in between. Indications of subsequent less important broods entering the fishery are also shown in Fig. 4.

Fig. 2 shows the average monthly rainfall and mackerel catch at Calicut. The rainfall shows a primary peak in June. Then it fall to a low value in September. There is a secondary peak in October. The September peak in mackerel catches coincides with the decrease of rainfall in that month after the primary peak. The second minor peak in catches in November coincides with the second decrease in the rainfall after the secondary peak in October.

From this general picture an examination of the variations from season to season will be interesting (Fig. 5, Table 1). With a total catch of 573 tonnes of mackerel, 1980-81 season was the best of all seasons under study. It had the maximum annual rainfall, but the rainfall during September was very low. The

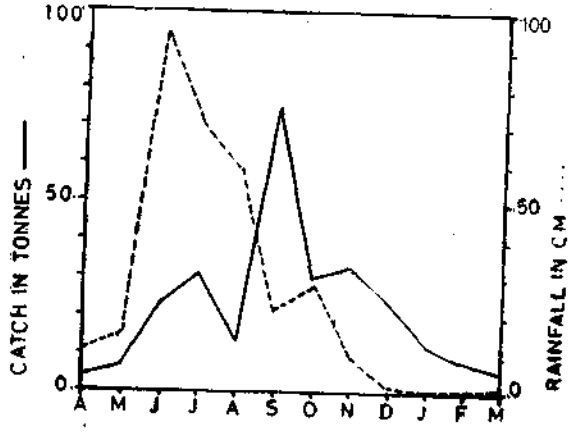

FIG. 2. Average monthly catch of mackerel and rainfall.

November peak in catches was better than the September peak. In 1981-82 the annual catch was reduced to 236 t. The total rainfall was less than that of the previous year and the

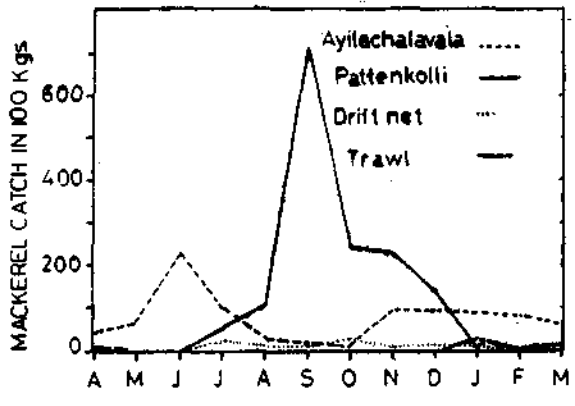

FIG. 3. Average monthly catch by different gears.

September value was comparatively more. The total catch and rainfall came down further

in 1982-83. In 1983-84 the catch was just 60 t. Though the rainfall was better than that of previous season the September value was an all time high and the catch in September was extremely low. In 1984-85 there was an improvement in catch and rainfall. The rainfall value in September was low. In 1985-86 a further improvement in catch was noticed though the rainfall was slightly less than that of the preceeding season. The rainfall value in September was the lowest of all seasons.

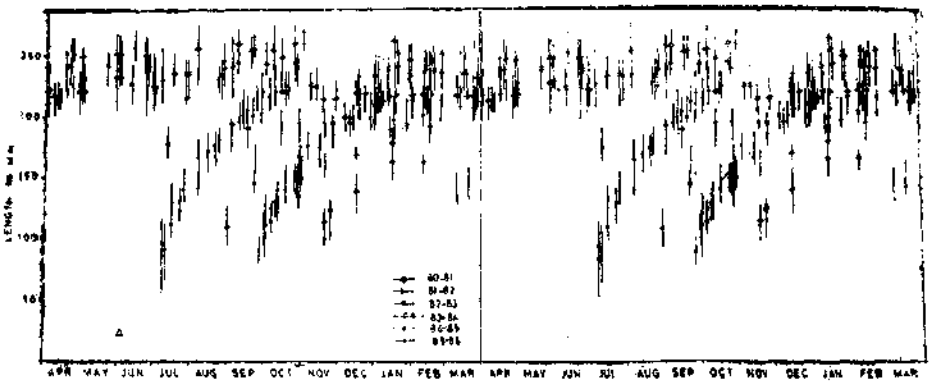

FIG. 4. Length groups and modal values observed in the fishery in different months (Part B is a repetition of part A).

From the above account it can be seen that a good rainfall in a season is beneficial to the fishery of that season. But in September when peak catches are expected an increase in rainfall is seen to affect the fishery adversely. A negative regression of catch in September on the rainfall value of that month is shown in Fig. 6. A correlation coefficient of -0.85 indicates a good inverse relation. Hence, the annual rainfall is taken without adding the September value, but subtracting it, since it is found to have adverse effect on the fishery. The regression of total seasonal catch on these values are found (Table 1). The correlation coefficient was found to be 0.898 indicating good relation. Correlation of these rainfall values with the total catch of a season from July of that year of June of next year was also studied. It was found to have a better correlation (0.93) (Table 1).

From Fig. 3 it can be seen that *Pattenkolli* is the most important gear in the mackerel fishery at Calicut. On an average it lands about 55% of the total seasonal mackerel catch. The next important gear is *Ayilachalavala* which lands about 33% of the total mackerel catch. The rest of the catch is made by drift nets, trawl nets, *Mathichalavala* and *Nethalvala*.

Table 2 gives the annual CPUE of *Pattenkolli* and *Ayilachalavala*.

Schaefer (1954) suggested that the CPUE is dependent on effort and the relation is :

$$Y/F = a + bF$$

where Y is the catch and F effort, a and b are constants. The Maximum Sustainable Yield (MSY) is given by the equation :

$$-a^2/(4b)$$

The effort required to produce this yield (fMSY) is estimated by the equation :

$$-a/(2b)$$

The F value at which the stock is completely annihilated is given by the equation :

$$-a/b$$

Fox (1970) has given a similar model with an equation

$$\text{Ln } (Y/F) = a + bF$$

and the MSY from the equation :

$$-(1/b)\ e^{(a-1)}$$

and the effort to produce the MSY by the equation :

$$-1/b$$

But, in his model the stock is never annihilated by any amount of fishing intensity. The estimates of these parameters based on the effort and catch of *Pattenkolli* and *Ayilachalavala* are given in Table 3. The yield curve of Schaefer superimposed on CPUE and catch data for these two gears are shown in Fig. 7.

surplus production models of Schaefer and Fox were applied to the data for the first 4 seasons only and the results are given in Table 3. Since the *Pattenkolli* data gave a positive value for *b* the estimates are given only for *Ayilachalavala* data.

From Fig. 4 it can be seen that during April-June the fishery solely depend on the previous season's recruits which are sexually mature. They can be taken as the spawning stock for that season. The average monthly catch of this period is taken as roughly propor-

TABLE 1. *Relation between total annual rainfall and seasonal mackerel catch*

Year	Rainfall in cm omitting Sep. value	—Sep. value	X	Season	Total mackerel catch in tonnes	
					Apr.-Mar. Y_1	July-June Y_2
1980 ..	353	10	343	1980-81	573	523
1981 ..	319	30	289	1981-82	236	239
1982 ..	218	11	207	1982-83	158	130
1983 ..	227	61	166	1983-84	60	72
1984 ..	297	9	288	1984-85	250	266
1985 ..	289	8	281	1985-86	351	—
			Intercept		$a_1 = -378.6710$	$a_2 = -342.4763$
			Slope		$b_1 = 2.4778$	$b_2 = 2.2756$
			Correlation		$r_1 = 0.8981$	$r_2 = 0.9290$

In the season 1984-85 there was an important development in the indigenous fishery at Calicut. Fishermen started using out-board engines for the propulsion of country crafts. About 22% of the country crafts were fitted with YAMAHA 7 hp engines, EVINRUDE 11 hp engines or JOHNSON 11 hp engines during that season. By 1985-86 the mechanisation spread to another 23% and the fishermen were reluctant to work in country crafts without these engines which requires more physical work with less returns. This development affected the number of effort and catch.

Now, supposing that due to mechanisation the catchability coefficient *q* has changed, the

tional to the spawning stock. The regression of that season's total catch on the spawning stock was estimated and the values are given in Fig. 8. An *r* value of 0.92 indicated good relation. Fig. 9 shows how the spawning stock and yield fluctuated from season to season.

DISCUSSIONS AND CONCLUSIONS

Average monthly catches of mackerel at Calicut for three six-yearly periods, 1960-61 to 1965-66, 1970-71 to 1975-76 and 1980-81 to 1985-86 are shown in Fig. 10. The average seasonal catches during these periods are 568 t, 1,850 t and 271 t respectively. A definite decline in the catches during the period under

study is apparent. But, general pattern of the fishery continues to be the same. Peak catches are obtained in September though there are minor variations in some seasons.

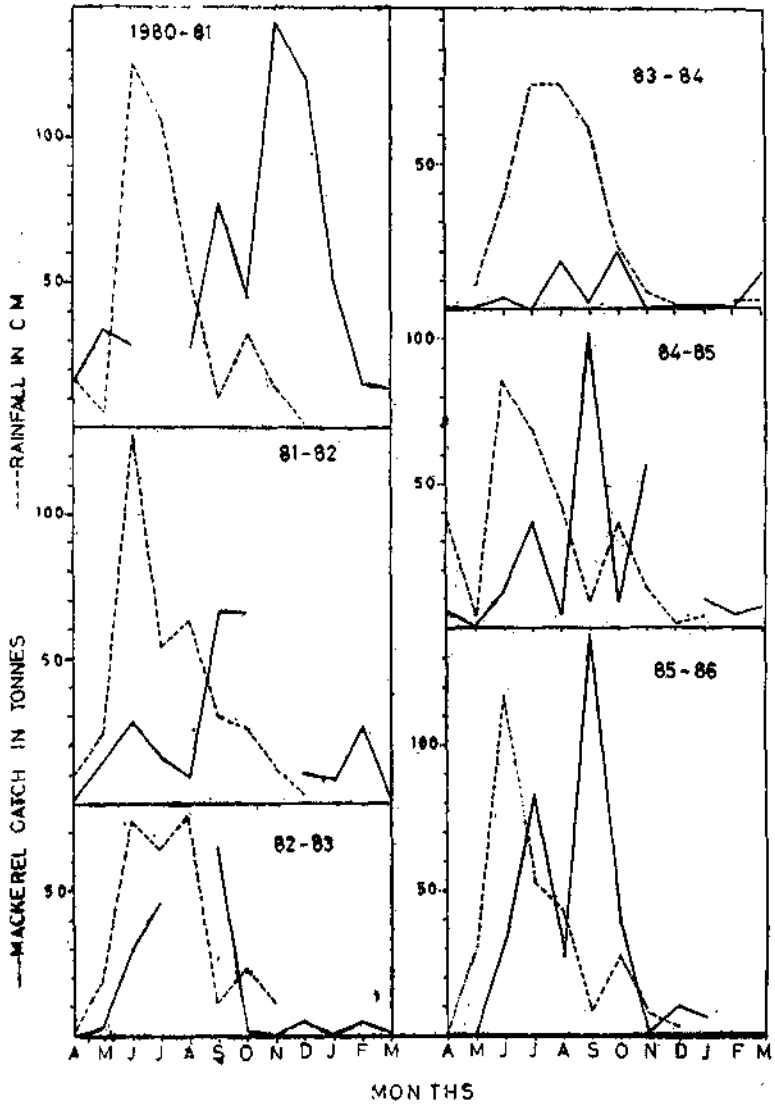

FIG. 5. Monthly catch and rainfall during different seasons.

The reasons for the peak catches in September can be found in Fig. 4. The first important brood of the season appear in July. From the figure it can be safely assumed that these are the products of spawning in June. By September they grow to an average size of around 20 cm and are available to the fishery in its maximum magnitude. In the same month the second important brood, possibly born in August, enter the fishery. These two broods contribute to the bulk of the catches in September, when the recruitment of the second important brood to the fishery at Calicut is more successful than that of the first, the month

of peak landings may be in October or November. After September the catches from the first brood start declining though there is an increase in the catches from the second brood (Fig. 4). Hence, it can be said that at Calicut the recruitment is almost complete by September. It may be noted here that the height of recruitment in northern centres like Mangalore, Karwar and Goa is in October and in Maharashtra in November (Noble, 1985), indicating a northward migration of mackerel shoals. Simultaneous information as in Fig. 4 from all along the west coast alongwith the related catch data will definitely throw light on the migration and on different unit stocks, if any, of mackerel that contribute to the fishery of different areas.

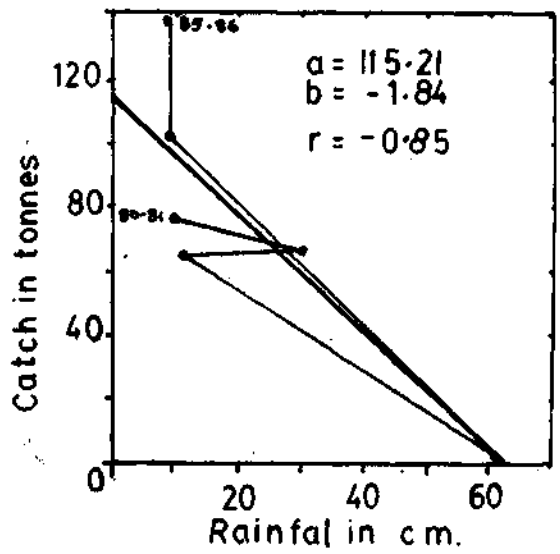

FIG. 6. Relation between catch and rainfall in September.

The mackerel catch shows a definite direct relation to the amount of rainfall. It can be seen that the intensive rainfall is over before September when peak catches of mackerel are expected in Calicut. Possibly a good monsoon helps better recruitment. By September when rains subside the environmental conditions in the inshore area become conducive for the movement of mackerel shoals in full density where they are intensively fished. But, if monsoon conditions still prevail in that month it may affect the movement of shoals and the fishery. This peculiar condition may not be there in northern centres where the peak catches are made in October or November. Hence, at Calicut though the catch is having a positive regression on total rainfall the catch in September is having a negative regression on the rainfall of that month. Since the recruitment starts only in July the catch of mackerel from that month to June of next year is having a better correlation with annual rainfall.

Pradhan and Reddy (1962) has found an inverse relation between mackerel catches and

TABLE 2. *Effort, catch and* CPUE *of Pattenkolli and Ayilachalavala during different seasons*

Season	Pattenkolli			Ayilachalavala		
	Effort (Hrs)	Catch (kg)	CPUE (kg/hr)	Effort (Hrs)	Catch (kg)	CPUE (kg/hr)
1980-81	8,540	3,49,113	40.88	5,990	1,92,384	32.12
1981-82	8,003	1,41,127	17.63	6,353	83,712	13.18
1982-83	7,590	64,260	8.47	1,665	90,137	54.14
1983-84	7,419	16,230	2.19	1,047	28,769	27.48
1984-85	2,833	1,25,788	44.40	1,437	97,389	67.77
1985-86	4,455	2,01,696	45.27	1,197	45,106	37.68

rainfall at Calicut, while discussing the mackerel landings in relation to certain hydrographical factors during the season (October-September) from 1957-58 to 1959-60. The figures given by them show peak mackerel catches during the month of December instead of the present September showing a major change in the pattern of recruitment, movement or fishing. Thus the present direct relation of catches with rainfall is not comparable with their findings.

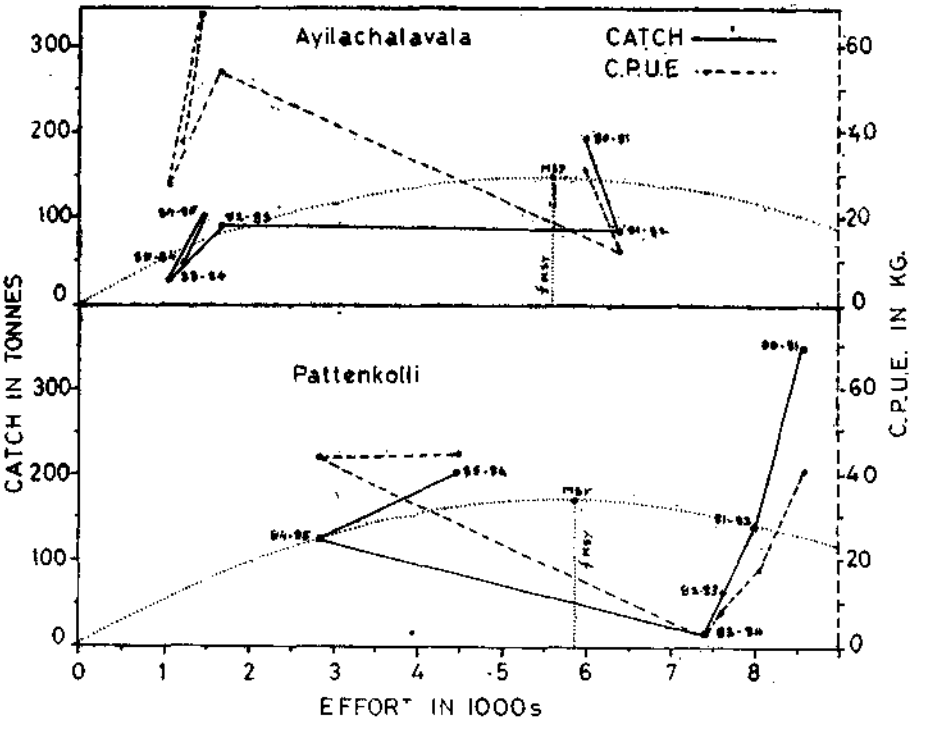

FIG. 7. Effort, Catch and CPUE relation during different seasons and Schaefer's curve.

TABLE 3. *MSY and fMSY estimated from Schaefer and Fox models*

Ayilachavala 6 seasons		Ayilachavala 1st 4 seasons		Pattenkolli 6 seasons	
Schaefer model	Fox model	Schaefer model	Fox model	Schaefer model	Fox model
a = 52.5582	3.9843	44.9976	3.8164	58.7478	4.4196
b = —0.0047	—0.000153	—0.0035	—0.000127	—0.005	—0.000242
MSY = 146.934	129.228	143.6	131.628	172.566	126.263
fMSY = 5591.3	6535.95	6382.64	7874.0	5874.78	4132.23
MSY/fMSY = 0.026	0.02	0.022	0.017	—	—

Noble (1972) has observed an inverse relation between mackerel catches and rainfall at Karwar during the seasons 1954-55 to 1964-65. The peak landings in Karwar are late in October well after the southwest monsoon. Hence, effect on the recruitment and movement of mackerel is an important subject to be studied in detail as the short-lived, pelagic, shoaling and migratory fish populations are very much sensitive to changes in the environment.

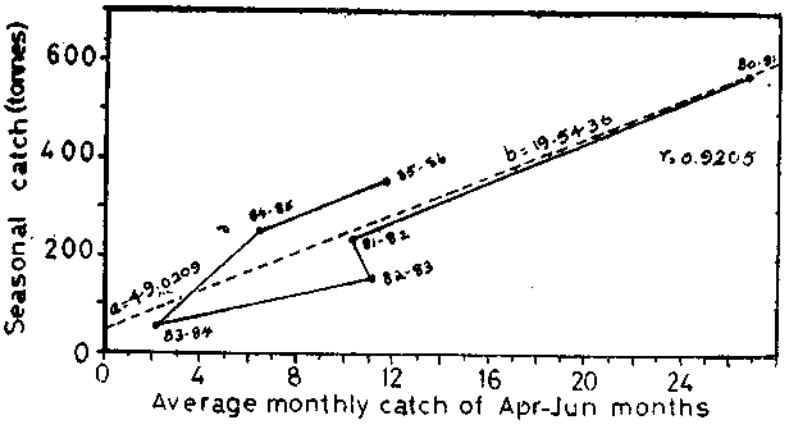

FIG. 8. Relation between spawning stock and seasonal catch.

the situation in Calicut can not be compared with that of Karwar. However, Yohannan (1977) has found a direct relation between

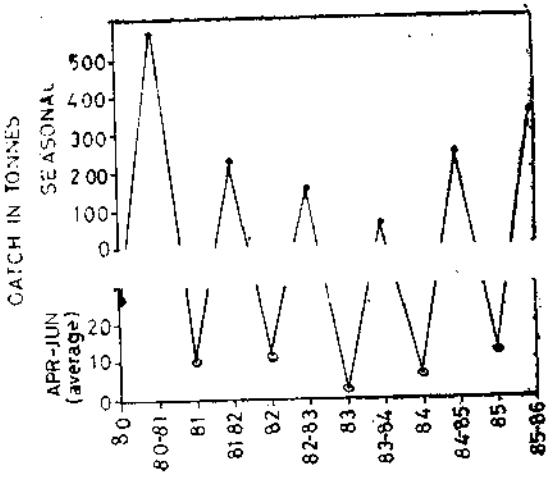

FIG. 9. Variations in the spawning stock and seasonal catch.

mackerel landings and rainfall at Mangalore during 1969-73. The monsoon and consequent dynamic changes in the environment and its

Fig. 8 indicates the dependence of catch on spawning stock. This is a warning signal indicating more than optimum fishing pressure the population can withstand. Fig. 9 clarifies

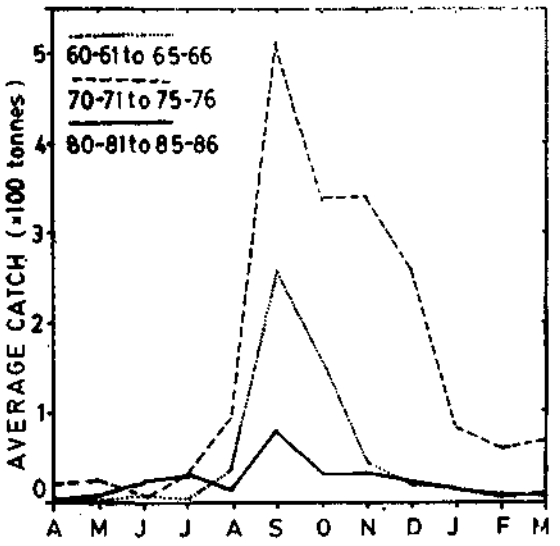

FIG. 10. Monthly average catch during different periods.

the point. During each season the left line starting from spawning stock and ending at the total catch in the figure indicates the production and the right line starting from total catch and ending in the spawning stock indicates reduction due to mortalities. It can be seen that in 1980-81 and 1982-83 the reduction line is longer than the production line and consequently the total catch was decreasing. But, subsequently the situation is reversed and an increase in catches is noticed. In Fig. 7 the catch by *Ayilachalavala* stands above the MSY. The reason perhaps may not be that of intensity of effort, but a better availability of shoals in the fishing area due to certain environmental factors. The only consolation is that the situation at Calicut may, perhaps, not be quite true of the mackerel fishery throughout the west coast of India. But, still it is time we have proved it.

Sparre (1985) has cautioned against including 'too long a time series of data in the surplus, production analysis', because of the probable changes in the catchability coefficient which usually is a function of time. With the introduction of out-board engines an increase in the catchability coefficient can be expected. From Table 3 it can be seen that for *Ayilachalavala* the fMSY for the whole season is lower than the estimate for the first four seasons when out-board engines were not used and MSY/fMSY values were higher for the whole seasons' estimates which can be an indication of increased q which under the circumstances should be watched cautiously.

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