RELATIVE ABUNDANCE OF AGE GROUPS OF OILSARDINE AND ITS EFFECT ON FISHERY OF MANGALORE AREA

M. H. DHULKHED AND K. UMA KUMARI

Mangalore Research Centre of Central Marine Fisheries Research Institute, Mangalore

ABSTRACT

Analyses of catch data on oil sardine from 1966-67 through 1976-77 indicated that the fluctuations in the fishery were closely related to the strength of different age groups. The fishery appeared to be good when the 0 and 1 year groups were equally and continually represented in the catches. The estimated average rate of instantaneous rate of mortality was 1.87.

INTRODUCTION

The oil sardine *Sardinella longiceps* Val., fishery constitutes one of the important pelagic fisheries on the south-west coast of India. The fishery is subjected to wide annual fluctuations. Considerable work has been carried out on the fishery and biology of oil sardine (Nair 1959, Sekharan 1962, Bensam 1964, Antony Raja 1964, Radhakrishnan 1969, Annigeri 1969, Prabhu and Dhulkhed 1970 and Sam Bennet 1973). Since the Mangalore area falls in the active oil sardine fishery region, any change in the abundance of recruits is likely to affect the catch in this area. In view of this, the data collected at Baikampady (Dhulkhed, *MS*) near Mangalore from 1965-66 through 1976-77 have been analysed to elucidate the relationship between the age composition and fluctuations in the fishery and the results are presented.

MATERIAL AND METHODS

The fish landing centre Baikampady was visited on alternate days for the collection of catch data and samples. Cast net and *kairampani* and *rampani* are the main gear operated during monsoon and post-monsoon seasons respectively. The estimation of catch, catch per unit and size composition was carried out according to the methods described by Sekharan and Dhulkhed (1963).

The number of oil sardine in various length groups for the year was calculated as follows:

$$\frac{\sum_j \sum_k}{\sum_j \sum_k w_{jk}} \cdot \sum_j \sum W_{jk}$$

where $\sum_j \sum_k Njk$ = the total number of oil sardine in the j^{th} month of the k^{th} size group

$\sum_j \sum_k wjk$ = the total catch of oil sardine in the j^{th} month of the k^{th} size group

$\sum_j \sum_k Wjk$ = the total estimated catch in the j^{th} month of the k^{th} size group

At Baikampady, after the cessation of *rampani* activity i.e., during April-May small quantities of oil sardine are netted by *chalabale and idable* which are of selective nature. Therefore, these have not been taken into consideration for the estimation of year classes.

For purposes of this study, oil sardine measuring up to 149 mm, 179 mm and above 180 mm have been considered as belonging to 0, 1 and 2 year classes respectively based on the earlier investigations (Balan 1964, Bensam 1964, Radhakrishnan 1969, Annigeri 1969, Antony Raja 1970 and Qasim 1973).

Age groups and fishery seasons

Usually the oil sardine become mature by the end of first year. The active spawning in oil sardine is from June to August (Nair 1959, Antony Raja 1964 and Dhulkhed 1964). The new recruits which are the products of this spawning period appear in the catches from August onwards. These together with one and two-year-olds either in spent or spent recovering condition support the fishery to a great extent in the subsequent months. It may be mentioned here that in certain years, new recruits were noticed in the catches even as late as in January (Dhulkhed, *MS*), indicating as to the protracted nature of spawning.

The month-wise occurrence of various year classes in terms of percentages based on the pooled estimated numbers for cast net, *kairampani* and *rampani*, are given in Fig. 1.

During 1965-66, the one-year-olds together with the two-year-olds appeared in August and continued to gain strength till April when the contribution of the former year class attained 90% level. On the other hand, the entry of new recruits in the foreshore waters was witnessed in August. However, the numerical strength of this new group gradually declined after November. The catch during this season amounted to 2,146 tonnes, (Table 1). During 1966-67 the impact of the 0 year group on the fishery in most of the months was felt more. A steady depletion of 1 and 2 year groups was seen which resulted in reduced catches during this season. During 1967-68, the strong 0 year group of the previous year failed to assert itself on the fihery. The catches were dominated

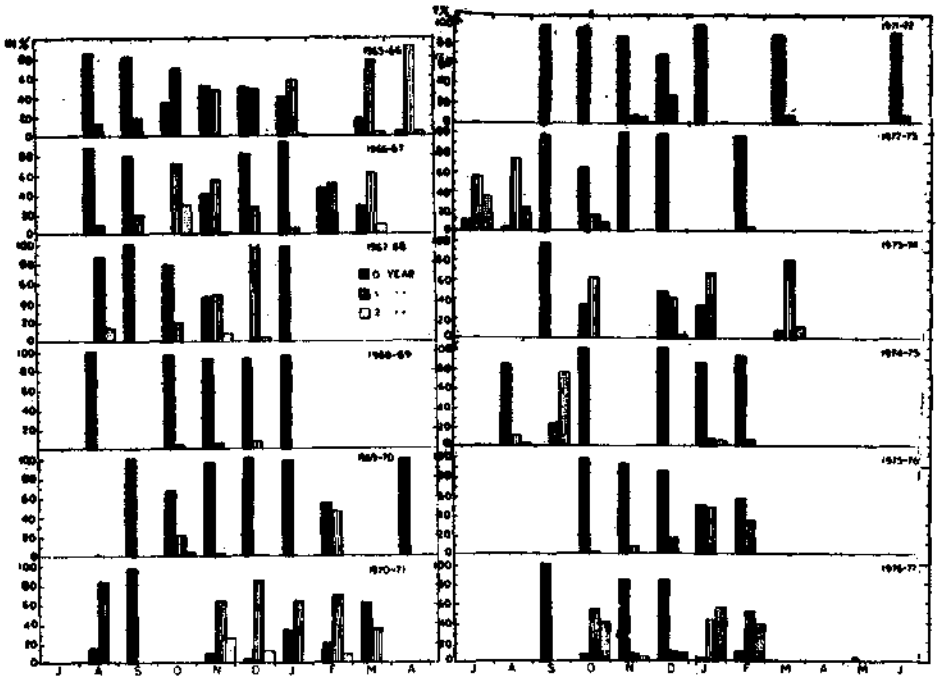

FIG. 1. Year-class composition of oil sardine for the years 1965-66 to 76-77.

by the 0 year class. 2 year group sparsely contributed to the fishery. The expectation that the successful 0 year class would constitute a good spawning stock in the ensuing season was belied. The nature of the fishery during 1969-70 was not different from that of the previous year. During these two seasons, the density of new recruits showed an increasing trend. On the contrary, the reduced strength of the older groups was discernible in the catches. Such an age composition resulted in a downward trend in yield. In fact, the catch during 1968-69 was 84.5% less than that of the previous year.

The season 1970-71 (Fig. 1), in certain respects was similar to that of 1965-66 season. The 0 year group which contributed to the bulk of the catches in the previous year reappeared in strength as spawners, during August and September and continued to dominate the fishery till March. On the other hand, the relative abundance of the new recruits was far below normal as compared to all the previous seasons. Furthermore, the successful 0 year class of 1968-69 seaon figured fairly well in the catches almost throughout the season. These resulted in improved catches.

The feature of the fishery for 1971-72 (Fig. 2) was the complete absence of spawners in inshore waters. The recruitment of 0 year group was more than 70% throughout the season. The products of 1969-70 and 1970-71 failed to

TABLE 1. *Catch of oil sardine (in kg) in the non-selective gear at Baikampady*

	Rampani	*Kai-rampani*	*Cast net*	*Total*
1965-66	21,28,619	3,881	13,233	21,45,733
1966-67	18,28,007	18,250	20,481	18,66,738
1967-68	18,20,320	352	6,095	18,26,767
1968-69	2,68,691	14,250	425	2,83,366
1969-70	2,00,793	210	33,410	2,34,413
1970-71	2,41,484	123	4,437	2,46,044
1971-72	3,40,182	——	27,588	3,67,770
1972-73	1,75,371	15,000	8,124	1,98,495
1973-74	2,15,117	4,414	344	2,19,875
1974-75	4,75,900	3,959	762	4,80,621
1975-76	3,97,858	——	150	3,98,008
19676-77	1,96,381	6	2,203	1,98,590

influence the yields. However, this was more than compensated by the predominance of the new stock and the catches showed an increase of about 50% over the previous season. In the ensuing season i.e., 1972-73 the resourceful 0 year class of 1971-72 reappeared as spawners during July and August and as spent fish in October. Thereafter this group failed to recoup. During this season the catches dropped by 169 tonnes as compared to 1971-72 and would have been still lower but for the strong 0 year class.

During 1973-74 the trend of the fishery was quite the reverse as compared to the previous two years, but was similar to that of 1965-66 season only in the pattern of distribution of various year classes. The successful 0 year group of

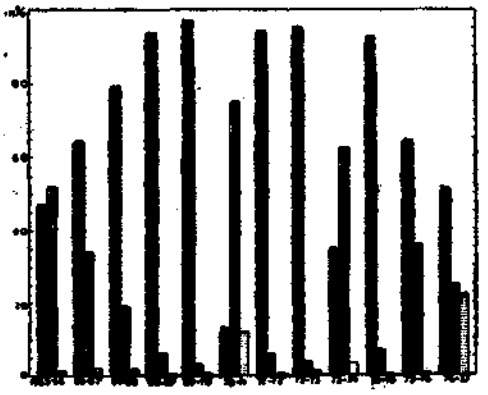

FIG. 2. Yearly occurrence of 0, 1 and 2 year classes of oil sardine during 1965-66 to 76-77.

TABLE 2. *Abundance of oil sardine* (cpue in nos.)

	Rampani			Castnet		
	0-*year*	1-*year*	2-*year*	0-*year*	1-*year*	2-*year*
1965-66	1,62,247	1,84,169	4,161	611	243	3
1966-67	2,69,808	1,48,371	9,409	4,257	216	30
1967-68	8,69,669	2,08,536	19,099	130	333	50
1968-69	1,23,593	9,078	273	——	—	—
1969-70	1,10,435	4,459	274	7,127	9	—
1970-71	6,882	45,939	7,655	432	299	5
1971-72	2,26,520	13,591	896	3,184	227	56
1972-73	1,00,659	1,692	474	1,401	77	38
1973-74	24,917	55,950	3,277	13	8	—
1974-75	17,60,126	1,28,729	10,180	387	—	—
1975-76	1,45,067	80,682	155	——	—	—
1976-77	22,011	14,083	11,853	4,150	—	—

1972-73 continued to replenish the catches in strength, besides the products of 1971-72 as two-year-olds. However, the catches during this season were of a lower order, because of the low level of abundance of the new recruits. In 1974-75, all the three age groups were observed entering the fishery during Angust. However, after October, the oil sardine measuring upto 149 mm formed the bulk of the catches. During 1975-76, the fishery lasted only for five months. The 0 year group which was by and large dominant appeared along with the recruits of 1974-75 season. An interesting feature of the fishery of 1976-77 was the lack of abundance of new recruits particularly after December. On the contrary, the successful 0 year class of 1974-75 which failed to influence in the subsequent season was conspicuous and consistently contributed to the catches. Besides, as expected 0 year class belonging to the previous year reappeared in the fishery as one-year-olds and their share in the catch was as high as 26%.

In Fig. 2 the occurrence of various year classes expressed in terms of percentages based on the estimated annual numbers are given. It is seen that the recruitment of 0 year class to the fishery was on the increase from 1966-67 to 1969-70 when it reached a level of 95% of the total catch and conversely it synchronised with a gradual decline in the yield of the 1 year class. This trend in the fishery was also observed in all the other years except 1970-71 and 1973-74. During these years, on the contrary the one-year-olds formed the mainstay of the catches. During the entire period of observation the two-year-olds did not influence the fishery to any great extent except in 1976-77 when their contribution was as high as 22%.

TABLE 3. *Annual rate of decrease of oil sardine*

	Rampani	*Cast net*
1965-66/66-67	0.05	0.12
1966-67/67-68	0.13	0.25
1967-68/68-69	0.001	—
1968-69/69-70	0.03	—
1969-70/70-71	—	0.56
1970-71/71-72	0.02	0.19
1971-72/72-73	0.03	0.17
1972-73/73-74	—	—
1973-74/74-75	0.18	—
1974-75/75-76	0.001	—
1975-76/76-77	0.15	—
Average	0.66	0.26

Mortality rate (Table 2)

The annual instantaneous rate of mortality was calculated between the year classes 1 and 2 based on the catch per unit of effort (cpue) in numbers in respect of *rampani* and cast net. The average rate of decrease for the entire period was 0.52 (Table 3) and the instantaneous rate of mortality was estimated at 1.87.

ACKNOWLEDGEMENTS

The authors thank Dr. S. Ramamurthy and Shri K. S. Udupa, for their useful suggestions.

REFERENCES

ANTONY RAJA, B. T. 1964. Some aspects of spawning biology of oil sardine *Sardinella longiceps* Valenciennes *Indian J. Fish.*, 11(A): 45-120.

ANTONY RAJA, B. T. 1970. Estimation of age and growth of the Indian oil sardine, *Sardinella longiceps* Val. *Indian J. Fish.*, 17: 26-42.

ANNIGERI, G. G. 1969. Fishery and biology of oil sardine. *Indian J. Fish.*, 16:35-50.

BALAN, V. 1964. Studies on the age and growth of the oil sardine, *Sardinella longiceps* Valenciennes by means of scales. *Indian J. Fish.*, 11A(2): 663-696.

SAM BENNET, P. 1973. Fluctuations in the oil sardine fishery - An explanation. *Proc. Symp. on the living resources of the seas around India. CMFRI.*, 234-240.

BENSAM, P. 1964. Growth variations in the Indian oil sardine, *Sardinella longiceps* Valenciennes. *Indian J. Fish.*, 11A(2): 699-708.

DHULKHED, M. H. 1964. Observations on the spawning behaviour of the oil sardine, *Sardinella longiceps* Valenciennes determined by ova diameter studies. *Indian J. Fish.*, XI(1): 371-376.

NAIR, R. V. 1959. Notes on the spawning habits and early life history of the oil sardine, *Sardinella longiceps* Cuv. and Val. *Indian J. Fish.*, 6: 342-59.

PRABHU, M. S. AND M. H. DHULKHED. 1970. The oil sardine fishery of the Mangalore zone during the season 1963-64 to 1967-68. *Indian J. Fish.*, 17: 57-75.

QASIM, S. Z. 1973. Some implications of problems of age and growth of marine fishes from the Indian waters. *Indian J. Fish.*, 20(2): 351-71.

RADHAKRISHNAN, R. 1969. Oil sardine investigation at Karwar *Indian J. Fish.*, 12(1): 99-117.

SEKHARAN, K. V. 1962. On the oil sardine fishery of the Calicut area during the years 1955-56 to 1958-59. *Indian J. Fish.*, 9A(2): 679-700.

SEKHARAN, K. V. AND M. H. DHULKHED. 1963. On the oil sardine fishery of the Mangalore zone during the years 1957-1963. *Indian J. Fish.*, 10A(2): 601-626.