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ON THE AGE, GROWTH AND MORTALITY OF *SARDINELLA GIBBOSA* (BLKR.) OF KARWAR WATERS (WEST COAST OF INDIA)

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ABSTRACT

Age, growth and mortality were estimated based on age composition of the fishery. *Sardinella gibbosa* (Bllkr.) attains a size of 140-150 mm, 160-165 mm and 180-185 mm at the end of 1, 2 and 3 years of life. The average value of total instantaneous rate of mortality (Z) was 1.31 and the natural mortality rate (M), 0.8212. The fishing mortality (F) varied from 0.09 to 0.38 indicating further scope of exploitation of this resource Growth parameters estimated by Von Bertalanffy equation showed Loc of 183 mm, K of 1.61 and t_0 of -0.43 for 1979-1983 period. This resource ranks first in abundance among lesser sardine resources of this area in purse seiners.

INTRODUCTION

With the introduction of purse seines in the Karwar waters, a new resource viz., *Sardinella gibbosa* has emerged. This resource ranks first in order of abundance among 'other lesser sardines' that are caught along this coast. As such, there are no information on its biology and population dynamics. In order to elucidate its resource abundance, investigations on growth, age and mortality were undertaken from 1979 through 1983 and the results are highlighted here.

MATERIALS AND METHODS

Bi-weekly samples were collected from the catches of purse seiners ar Karwar. Catch, cpue and fish in various size group were estimated by the method followed by Sekharan and Dhulkhed (1963) and Sekharan (1968). Mortality rates were estimated following the method of Jackson (1939) and growth parameters by Von Bertalanffy (Beverton and Holt, 1957).

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AGE COMPOSITION

The length frequency study was characterised by the presence of three age groups I, II and III as described below. The modes can be traced from January through December for five years. In 1979, modes at the end of I and II years could be traced to 140 mm and 160 mm modal lengths. In 1980, modes representing I, II and III years could be identifed at 145 mm 160 -165 mm, and 180 mm respectively. During 1981, three age groups I, II, and III could be traced to 145 -150 mm, 160 mm and 185 mm modal lengths. In 1982,1, II, and III year groups showed the modal size of 145 , 160 and 185 mm respectively. For 1983,1 and II year classes showed the modal length of 145 and 165 mm respectively. Fig.l shows length-frequency distribution of pooled data for the five year period, 1979 to 1983. This depicts general picture of length- frequency of this species. From January to December, the average growth for juveniles approached to 135 mm in November and for

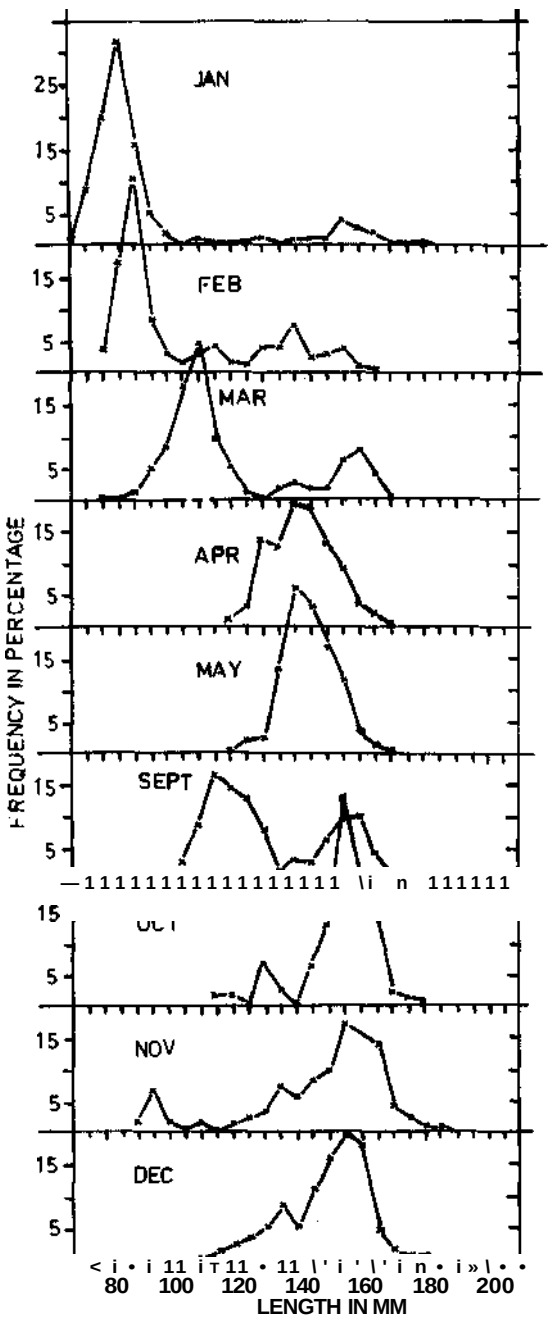

FIG. 1. Length - frequency distribution of S. *Gibbosa* from 1979-1983.

adults to 160 mm indicating I and II year groups. By combining the frequency for five year period, the higher modes manifested in different years taken individually may not be seen due to this effect. Therefore, from the progression of modes during different years, it seems that this species attains a length of 140-150 mm, 160-165 mm and 180-185 mm at the age of I, II and III respectively. Table 1 shows the modal progression of broods.

From the above table, it is clearly seen that there is modal progression of broods which contribute to the fishery in successive years in various degree.

MORTALITY RATES

Mortality rates from age composition of the fishery were estimated by the formula, N2+N3/N1+N2 = S, where 'N' is the cpue in number and 1,2,3 etc., represent year-classes in the fishery and 'S' is the survival rate. From S, total instantaneous mortality (Z) could be derived (Jackson, 1939). This method is described in detail by the author for *S.dayi* (Annigeri, 1982). For this purpose various year-classes were separated for each year by breaking the monthly length - frequency at the lowest frequency in the component age groups. When complete modes forming each age class was taken, some overlap at tail end of mode occured in the next age class, wihich was included in the previous age group as judged from dwindling of one group into the next component group. The 'Z' in any given year between (I+II and H+III) ages is shown in Table 2.

Three interaction processes were carried out to get the improved set of 'Z ' values. After second interaction process, Z, M and F values remained constant. The third and final set of Z, M, F and refined 'Z'values are shown in Table 3.

It is clear from Table 2 that cpue in all the

TABLE 1. ***Modal progression of broods of S.*** **gibbosa**

Year class	Broods (mm)	Modal progression
1977	160 (May) 180 (Nov.)	1979 1980
	125 (May), 140 (Apr.), 145 (May), 155 (Oct.), 155 (Dec.)	1979
1978	160 (Nov.), 175 (Mar.), 160 (Mar.)	1980
	95,110,120,135 (Nov.), 135 (Dec.)	1979
	85,115,130,140 Oan.), 140 (Feb.), 115,140 (Mar.), 145,155 (Apr.), 130 (May), 140,155 (Oct.), 135,155 (Nov.), 145 (Dec.) 160 (mar.), 160 (Sept.), 175 (Oct.)	1980 1981
1979	185 (Nov.) 110 (Sept.)	1982 1980
1980	150 Oan.), 155 (Feb.), 150 (Sept.), 155 (Oct.), 155 (Nov.), 145 (Dec.) 130 (Oct.), 125,135 (Nov.)	1981 1981
1981	150 Oan.), 115,130 (Feb.), 130 (Oct.), 110,140 (Mar.), 150 (Mar.), 155 (Apr.), 150,140 (May), 155 (Oct.), 145 (Nov.) 165 (Oct.),165,155 (Nov.) 120 Oan.), 130 (Feb.),135 (Nov.), 145 (Dec.)	1982 1983 1982
1982	85 Oan.), 90,145 (Feb.), 110 (Mar.), 130 (Apr.), 140 (Sept.), 140 (May), 155 (Sept.), 150 (Oct.)	1983

TABLE 2. ***Total instantaneous mortality rates (Z) during different years for S.*** **gibbosa**

Ages (I+ 11) and (11 + III)	1979	1980	1981	1982	1983	1984	Natural mortality and catchability rate
Z-values	0.2631	2.4829	1.6609	0.6533	1.8348	0.9333	M =0.8118 q = 0.00005779

TABLE 3. ***Calculated Z3,F,M and improved Z values for*** **S. gibbosa**

Final iteration	1979	1980	1981	1982	1983	1984	Natural mortality and catchability rate
Z3-values	0.9088	0.9688	1.0938	1.2045	1.0371	1.1510	M= 0.8218
F-values	0.0870	0.1470	0.2720	03827	0.2153	0.3292	q=0.00005778
ZGmproved values)	0.6306	2.4310	1.6161	0.7216	1.7881	0.9800	

years except in 1979 was within limits. But in 1980, the Z value was as high as 2.4. The distribution of Z value depends on strength of year classes from year to year. Fig. 2 shows Z values plotted against effort which gives a slope of 0.00005778 that intersects the Y-axis at 0.8218 being the natural mortality (M).

ESTIMATION OF GROWTH PARMETERS

The equation of Von Bertalanffy of growth was fitted to the data from 1979 to 1983 (Beverton and Holt, 1957) for each year separately and for the pooled data. Growth parameters were determined by the progression of modes on monthly basis and the annual values of different parameters are presented in Table 4.

The values of L« , K and 't„' obtained by Sekharan (1968) for this species were 95.59 , 93.81,96.36 mm (Standard length); 0.31,0.24, 0.32 and -0.10, -0.76, -0.48 for 1952,1953 and 1954 respectively in the Mandapam area. On the other hand according to Devaraj (1983) the values for Loo and K were 171 mm and 1.44 respectively for this species.

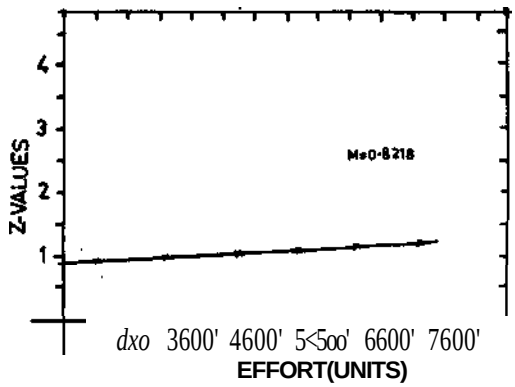

FIG. 2. Regression of 'Z' on effort (E) for S. *Gibbosa*.

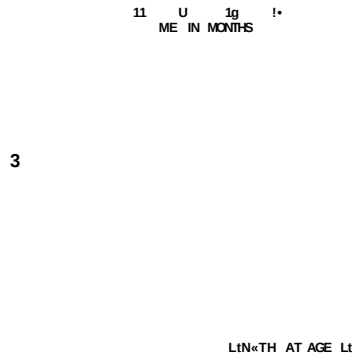

FIG. 3. Length (mm) at age L_{t+b} against at age L_t (A) and Ln (1-Lt/L) on age Lt (B).

TABLE 4. *Annual values of different parameters*

Parameters	1979	1980	1981	1982	1983	1979-'83 period
Loo	182.50	181.27	191.78	187.00	172.06	182.92
K	1.40	1.44	1.24	1.22	2.04	1.61
"to"	0.23	-0.08	-2.96	-1.59	-0.47	-0.43

Figs. 3A and B show relationship of l(t+3), the next length at time (t+3) on It, the length at time t and In (l-lt/L«>) on age for fitting Bertalanffy's growth function. Beverton's approach for estimating growth parameters for Von Bertalanffy equation was by taking trial values of 1°° But 1<» obtained by the regression method (Fig. 3A) proved to be better suited.

GENERAL CONSIDERATION

According to Sekharan (1959), *S.gibbosa* attains a size of 107-120 mm (Standard length) at the end of one year. The forthcoming investigation also indicates 140-150 mm, 160-165 mm and 180-185 mm at the end of 1,2 and 3 years. Sekharan's estimate of 1 year growth closely agrees with the present observation. All the age groups are accessible to the purse seiners operating in the offshore grounds unlike the indigenous gears.

Mortality estimates varied from 0.63 to 2.43 and the average value of instantaneous total mortality was 1.305. Natural mortality of 0.8212 and fishing mortality ranging from 0.09 to 0.38 indicated that there was resource and could still be exploited. The growth parameters pooled for the five year period showed higher values of Loo and K than those estimated by Sekharan and closer to those in one or two years derived by Devaraj.

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