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ASSESSMENT OF *SAURIDA TUMBIL* (BLOCH) STOCK IN THE NORTHWEST CONTINENTAL SHELF WATER OF INDIA

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ABSTRACT

Based on the data collected from New Ferry Wharf, Sassoon Dock and exploratory survey of MFV *Saraswati* on the Northwest coast of India, the growth, mortality, population and stock parameters of *Saurida tumbil* is reported in the present communication. The Von Bertalanffy growth function (VBGF) parameters for growth on length were found to be $L\infty$ = 49.8 cm, K = 0.96/year, t_0 = –.141 year. The length at recruitment (l_r) is 80 mm. (t_r = .167 year) while the length at first capture (lc) for the commercial trawl fishery is 100 mm (t_c = 0.25 year). The annual fishing mortality coefficient (F) for 1983-85 was 0.43, the natural mortality coefficient (M) was 1.33 and the exploitation ratio (E) was 0.25. The yield per recruit (Y/R) attained the maximum of 54.99 g at F = 1.091 for E = 0.45 for the present t_c at 0.25 year. The annual total stock (P) and standing stock (P) in the exploitation portion at the inshore grounds to a depth of about 50 m were estimated to be 12,811 tons and 6,034 tons respectively. The average annual yield of 2,635 tons at the present F = 0.439 (E = 0.247) was less than the maximum sustainable yield (MSY) for 3,331 tons attainable from the inshore grounds at E = 0.45.

INTRODUCTION

The lizardfish, *Saurida tumbil* (Bloch) locally called the chorbombil in Maharashtra and Gujarat, is a fast growing demersal fish. Earlier studies on this species dealt with its systematic and comparative osteology (Rao, 1977), feeding habits (Rao, 1982), spawning biology (Rao, 1983a) and lenth weight relationship (Rao, 1983b). As there is no study on the population dynamics of this fish from Indian seas, investigations were undertaken based on the length frequency distribution of samples of specimens landed by the commercial trawlers at the landing centres of New Ferry Wharf, Sassoon Dock and Versova in Bombay and also the data from exploratory fishing by M.F.V. *Saraswati* in the northwest continental shelf during 1983-85.

MATERIAL AND METHODS

Length frequency data included

4,423 fish sampled during 1983-85 from (1) the catches of the 120 feet fishing vessel M.F.V. *Saraswati* during its trawling operations using 40 mm cod end mesh (stretched) trawls in the northwest continental shelf of India (Maharashtra, Gujarat and Karnataka from lat 22°00' to 16°30' N and long. 69°00' to 73°.30'E) at a ground ranging from 30 to 200 m depth and also the commercial landings at New Ferry Wharf, Sassoon Dock and Versova, in Bombay by the small inshore trawlers operating 20 mm cod end mesh trawl at a ground of upto 50m depth.

Age was determined following Devaraj (1982) by tracing the progression of modes in the scatter diagram for the plots of length modes against length groups for successive months.

The natural mortality coefficient (M) was estimated following empirical equation of Pauly (1980), while the total mortality coefficient (Z) was estimated from age composition data according to Jackson (1939). Yield per recruit (Y/R) as functions of fishing mortality coefficient (F) and age at first capture (t_c) was fitted as per Beverton and Holt (1966) while the length cohort analysis was performed according to Jones (1976, 1984). For the inshore fishery in 0-50 m deep grounds, the annual yield data (Y) was used for the estimation of total stock, p (P=Y/U) where U =F/Z(1-ι^{-Z})standing stock $\bar{P}$ (=Y/F) recruits R_c at t_c (R_c=Y/Y/R), the mean number Y_N (R_C x $Y_{N/R}$) (Beverton and Holt, 1957) for the inshore section of the stock. The maximum sustainable yield (MSY) was determined by calibrating the current catch onto the Y/R curve.

RESULTS AND DISCUSSION

The length frequency plot (Fig. 1) reveals the release of four broods each year : the first in March, the second in June, the third in September and the fourth in November-December. The fish attains a length of 276 mm in the first year, 430 mm in the second year and 480 mm in the third year of life. The maximum length was 490 mm while the maximum weight was 1,100 g.

Length growth parameters have been estimated to be l_∞ = 498 mm K = 0.95/y, t_o = -0.14/y.

Length at recruitment (l_r) was taken as the length of the smallest fish represented in the catch and has been 80 mm. Length at first capture (l_c) was taken as the lowest limit of fully represented length class in the catch and has been found to be 100 mm corresponding to 2 and 3 months of age respectively.

Annual total mortality coefficient (Z) was estimated to be 1.77 for the stock exploited by the trawlers during 1983-85 while natural mortality coefficient (M) was found to be 1.34 indicating very low fishing mortality (F = 0.44).

The optimum age of exploitation (t_y) and potential yield per recruit (Y') were estimated to be 1.93 years and 84.74 g respectively (Fig.2). The yield per recruit attains maximum value (Y/R = 54.99 g) E = 0.45 (F = 1.091) for the present t_c = 0.25 year (Fig. 3).

The standing stock ($\bar{P}$) and annual total stock (P) in the exploited inshore along the northwest coast (Maharashtra and Gujarat) during 1983-85 for E = 0.247 have been estimated to be 6,034 tons and 12,881 tons respectively.

The absolute number of recruits (R) at entry to the exploited phase (P_N) in the inshore grounds was estimated to be 61 x 10^6. The yield in number (YN) from the inshore grounds for the present F = 0.4393 and t_c = 0.25 year has been found to be 13.5 x 10^6 while the maximum yield in number 57.65 x 10^6 could be obtained at the exploitation ratio (E) of 0.95 (Table 1).

The mean number of fish in the exploited phase (PN) for the present F = 0.44, E = 0.25 and t_c = 0.25 year has been found to be 30.45 x 10^6, while the maximum mean number of fish (P_N) in the exploited phase to be 38.6 x 10^6 at the minimum E = 0.05 (F = 0.0702 (Table 1).

The maximum sustainable yield (MSY) of 3,337 tons is attainable at E = 0.45 (F = 1.091) (Fig. 3).

Jones' length cohort analysis for the period 1983-85 reveals that maximum fishing mortality, and hence, maximum exploitation ratio (E = F/Z) occur at the 28.0 to 30.0 cm length group at the age of 0.68 year when the fish just begin to attain maturity (Table 2). Hence, the catches are predominently of immature or just maturing fish.

The maximum catch of 367 tons from the inshore was obtained at the age 0.68 year which contributed 11.18% to the total biomass of the population. The mean annual number of fish caught along the northwest coast (Maharashtra, Gujarat and Karnataka) during 1983-85 was 23.26 x 10^6 which contributed only 4.9% to the total number of fishes in the size range of 60 to 500 mm available in the inshore sea. The average annual catch obtained during this period was 2,660 tons which was only 11.75% of total biomass (stock) of 22,643 tons available in the inshore sea. Thus, the standing stock ($\bar{P}$ = Y/F = 6,034 tons) represents 26.65% of the total biomass (Table 2).

The yield curve and yield mesh curve have been drawn to get a clear picture of the status of fishery at the existing level of mesh size and effort. The MSY/R of 54.99 could have been obtained at the level of E = 0.45 and F = 1.091 for the present t_c = 0.25 year, whereas the present yield per recruit was estimated to be 43.5 g only at the present exploitation level (E) of 0.247. This fish was found to be underexploited. Hence, it is suggested that in order to get

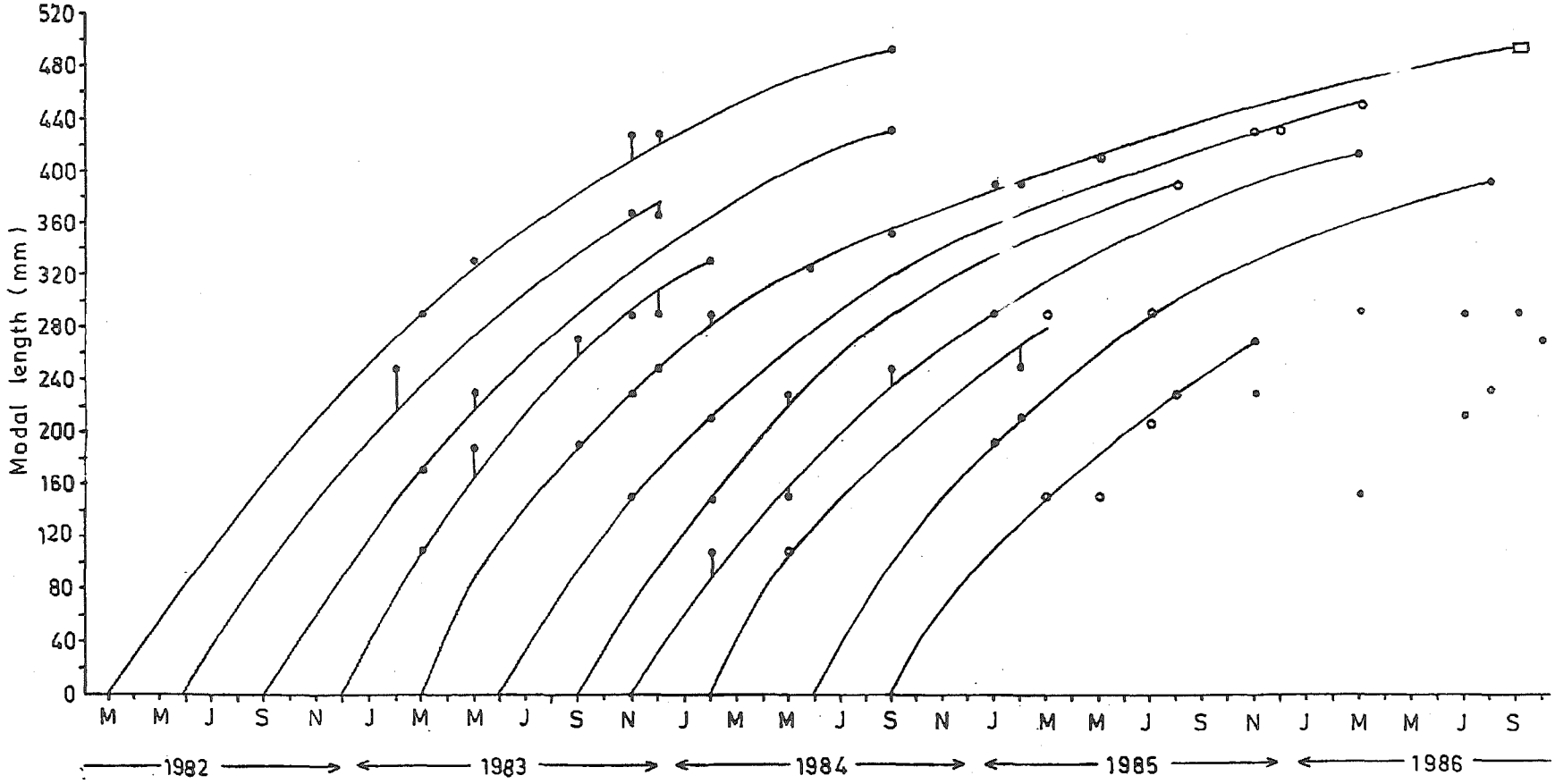

Fig. 1 : *Growth of individual broods on the basis of the modes in the length frequency distribution for successive months*

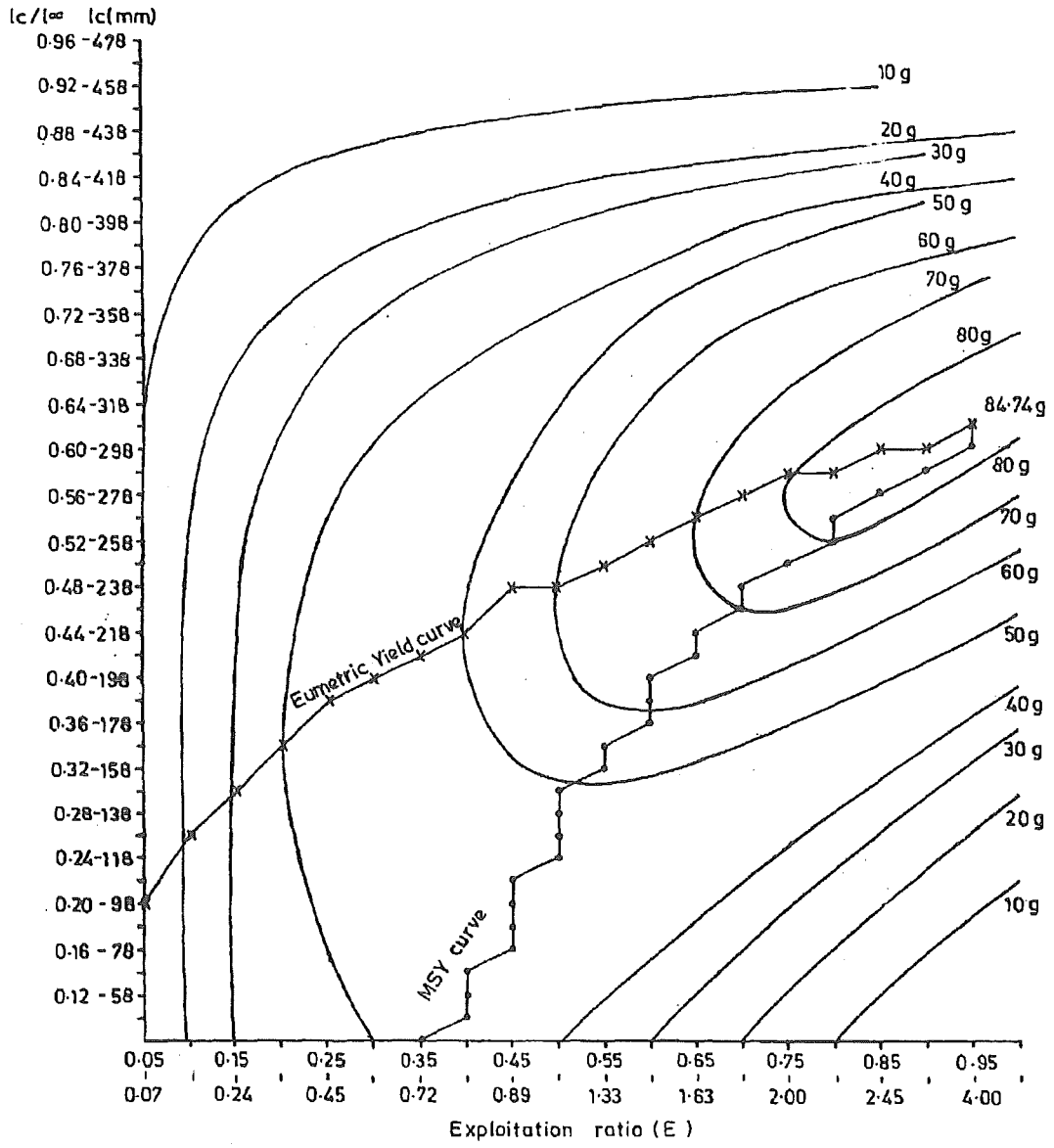

Fig. 2 : *Yield isopleth diagram depicting Y/R as a function of length at first capture (lc) and exploitation ratio (E)*

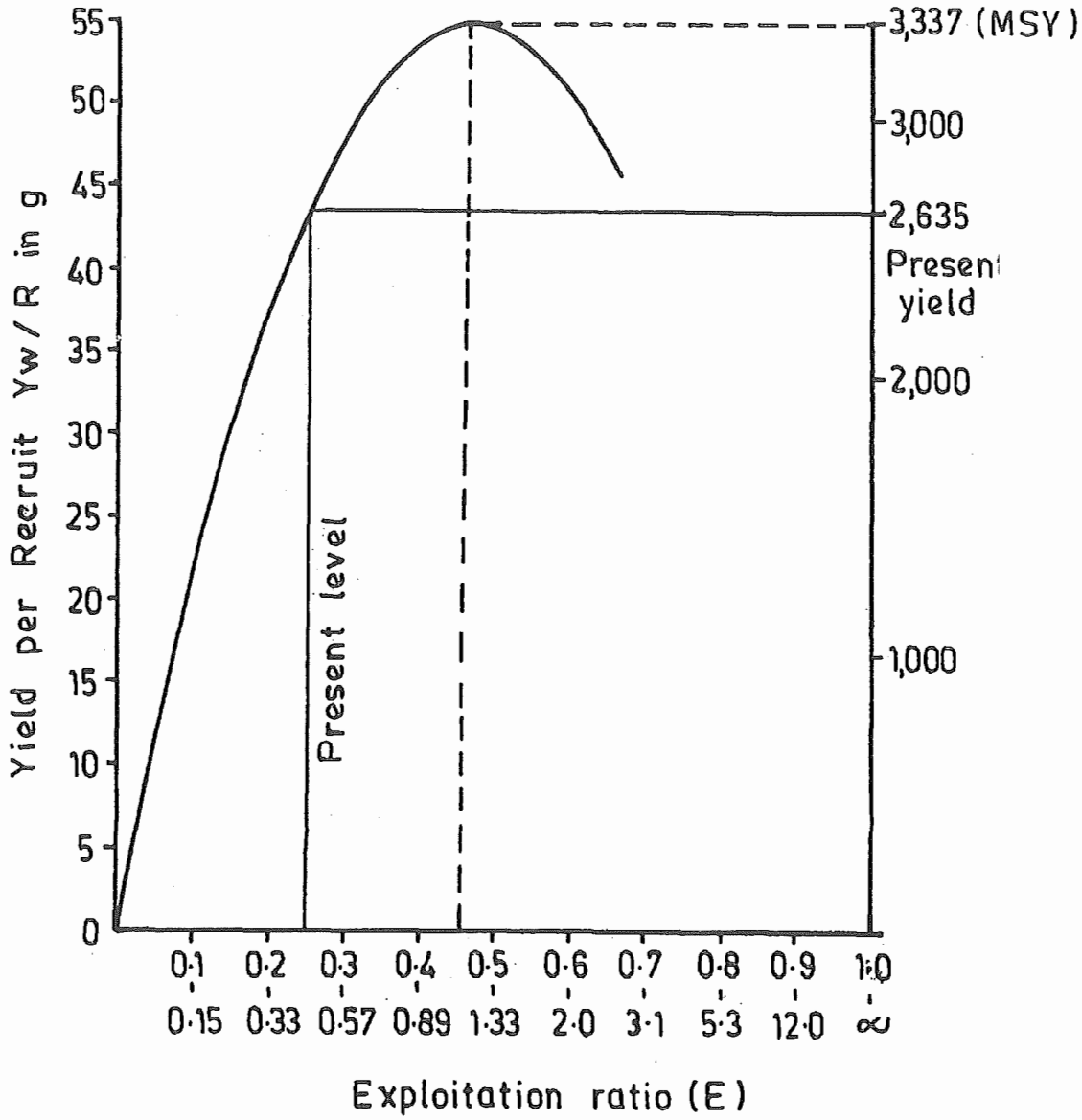

Fig. 3 : *Estimation of MSY and annual yield for various levels of exploitation from current yield and exploitation for northwest coast*

optimum yield from the stock, either effort (E) has to be increased from 0.247 to 0.45 or the level of c (index of size at first capture) be increased upto the level of 0.60.

Suggestion to increase mesh size as to increase c may not be advisable as the trawl fishery is mainly aimed at fishing of other commercial fishes. Further, as this fish forms only a bycatch the suggestion to increase fishing effort to exploit such a stock may be acceptable to fishermen.

Table 1 : *Estimate of yield in number (PN) and mean number of exploited fish S.tumbil for the period 1983-85.*

Exploitation ratio	Fishing mortality	PN=RCxPN/R million	YN=RCxYN/R million	Standing stock Y/F (tons)	Total Y/U (tons)
0.05	0.07	38.60	2.78	9710.68	18072.60
0.10	0.15	36.59	5.42	8691.05	16669.66
0.15	0.24	34.47	8.10	7675.44	15190.25
0.20	0.33	32.47	19.82	6734.30	13842.26
0.25	0.45	30.45	13.57	5914.58	12692.20
0.30	0.57	28.44	16.23	5104.59	11432.80
0.35	0.72	26.39	19.87	4335.51	10212.40
0.40	0.89	24.38	21.67	3669.40	1145.80
0.45	1.09	22.35	24.38	3053.38	8121.47
0.50	1.34	20.29	27.14	2479.62	7126.00
0.55	1.63	18.29	29.82	1980.44	6189.40
0.60	2.01	16.25	32.51	1526.62	5294.00
0.65	2.48	14.19	35.27	1145.94	4479.38
0.70	3.12	12.19	37.94	838.29	3771.03
0.75	4.01	10.16	41.12	548.41	2939.50
0.80	5.34	8.13	43.38	369.18	2465.11
0.85	7.56	6.09	46.04	236.05	2099.30
0.90	12.01	4.06	48.74	115.28	1538.19
0.95	25.34	2.08	57.56	41.90	1117.89

P_N/R = Mean population number per recruit
P_N = The number of fish in the exploited phase
Y_N/R = Yield in number per recruit
Y_N = Yield in number

Table 2 : *Length Cohort analysis of S. tumbil for inshore (0 to 50 m. depth) section of populations for the period of 1983-85.*

Length group (mm) L_1-L_2	Number caught (in 000) (L_1, L_2)	Fishing (F)	Total (Z)	Age in year	C_W C_N x W_t (tons)	PW P_N x W_t (tons)
60-100	73	0.02	1.36	0.02	0.06	53.37
80-100	415	0.14	1.48	0.04	0.90	127.17
100-120	1562	0.56	1.89	0.09	7.13	248.61
120-140	2051	0.78	2.11	0.15	17.44	417.72
140-160	2335	0.95	2.28	0.20	33.81	630.54
160-180	983	0.43	1.76	0.27	22.68	874.73
180-200	1194	0.55	1.88	0.33	41.64	1181.82
200-220	1998	0.10	2.33	0.40	101.14	1507.83
220-240	2167	1.21	2.54	0.47	153.80	1783.54
240-260	1825	1.16	2.49	0.55	176.64	1991.31
260-280	1730	1.26	2.60	0.63	222.98	2145.45
280-300	2182	1.93	3.26	0.68	366.90	2201.06
300-320	1572	1.76	3.09	0.78	338.77	2025.20
320-340	1788	1.87	3.20	0.89	350.25	1804.30
340-360	883	1.72	3.05	1.06	298.93	1499.12
360-380	489	1.27	2.60	1.14	203.43	1190.48
380-400	241	0.81	2.15	1.30	122.40	940.83
400-420	120	0.50	1.84	1.48	73.72	744.02
420-440	63	0.33	1.66	1.71	45.91	570.00
440-460	42	0.28	1.61	2.00	36.25	401.41
460-480	26	0.26	1.59	2.56	26.63	228.81
480-500	15	0.44	1.77	3.34	18.66	75.30

C_W = Catch biomass *P_W = Population biomass*

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