

STOCK ASSESSMENT OF SOLDIER CATFISH *OSTEOGENEIOSUS MILITARIS* ALONG THE NORTHWEST COAST OF INDIA

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ABSTRACT

Value of length growth parameters L_{∞} , K and t_0 from age-length relation obtained from length-frequency analysis for the soldier catfish stock were estimated to be 47.6 cm, 0.51 per year and 0.03 year respectively. The age at recruitment (t_r) was 0.58 year and the age at first capture (t_c) 0.83 year. The total mortality (Z) was 0.88 including the present natural mortality (M) of 0.84 and fishing mortality (F) of 0.04. The total stock of this fish along the Northwest coast of India was assessed to be 32,413 tons and the MSY 5,426 tons which is much higher than the current catch of 863.8 tons. The potential yield (P_y) of 38.7 g per recruit could be obtained at the optimum of exploitation (t_y) of 2.84 years.

INTRODUCTION

Information on the population parameters and stock assessment of soldier catfish, *Osteogeneiosus militaris* is very meagre. Therefore an attempt is made to assess the growth and mortality parameters of this species.

In Maharashtra, the hooks and lines are operated during May-October and trawlers and dol net from September-October to April-May and catfishes form the second largest demersal group landed here. The yield of different species in trawl net varies from year to year, however, *Arius dussumieri* and *O.militaris* are commonly caught by trawl net in northwest coast. Catfishes are mostly abundant in shallower water of less than 50m depth. Nagabhushanam (1966) described the depthwise distribution of catfishes along the Andhra

Pradesh and Orissa coasts between Lat. 17° 00' N and 20° 00' N and Long. 82° 00' E and 86° 40' E. This study has shown that larger catfishes are caught more from deeper waters.

Devanesan and Chidambaram (1953) and Venkataraman (1960) had studied the food of *O.militaris* off southern Maharashtra, the average catfish biomass has been estimated as 15,624 tons (Rao *et. al.*, 1977). The chief fishery grounds are in Gulf of Mannar and Palk Bay. Species like *T. maculatus* and even *O.militaris* may occasionally be caught in quantities from Palk Bay (Menon, 1979). A resource estimate of catfishes off Andhra coast over a five year period gave a average estimated sustainable potential yield of 5,631 tons (Krishnamoorthi, 1974). Pantulu (1963) has studied age and growth, fecundity

and spawning of *O. militaris*. Alagaraja and Srinath (1987) assessed the resources of important marine catfishes.

MATERIAL AND METHODS

Length frequency data of 2,072 specimens collected during 1986-87 from catches of *M.F.V. Saraswati* and from various landing centres of Bombay viz, New Ferry Wharf, Versova and Sassoon Docks and of 2,556 specimens taken from Bombay coast by Sreekrishna (1978). Both data were pooled together for fitting an analytical model as well as for assessing stock of Northwest continental shelf of India.

Age was determined following Devaraj (1983) by tracing the progression of modes in the catter diagram of length mode against length groups for successive month (Fig.1).

The growth parameters were estimated by employing the von Bertalanffy growth function (VBGF). The natural mortality coefficient (M) was estimated following by empirical equation of Pauly (1980).

Yield per recruit (Y/R) as function of fishing coefficient (F) and age at first capture (t_c) were estimated as per the Beverton and Holt (1966), while the length cohort analysis was performed according to Jone's (1976).

RESULTS AND DISCUSSION

Length frequency reveals the release of two broods each year successively in

May and December. The fish attains average lengths of 19.4, 30.75 and 37.55 cm in the 1st, 2nd and 3rd year respectively. von Bertalanffy Growth Function (VBGF) parameters for growth in length found to be $L_\infty = 47.6$ cm, $K = 0.51$ year, $t_0 = 0.03$ year.

Age at first capture (t_c) and Age at first recruitment (t_r) calculated to be 0.83 year and 0.58 year respectively.

Annual total mortality coefficient (Z) was estimated to be 0.88 for the stock exploited by the trawlers 1986-87, while natural mortality coefficient (M) was 0.84 indicating very low fishing mortality (F) of 0.04.

The yield per recruit attains maximum value (Y/R=56.53g) at $E= 0.55$ ($F=1.03$) for the present $t_c=0.83$ year. The maximum sustainable yield (MSY) is 5,426 tons at $E=0.55$ ($F= 1.03$), while the present yield being 863.8 tons is attainable at $F=0.04$ (Fig.2).

The absolute number of recruit (R) at entry to the exploited phase (P_N) in the inshore grounds was estimated to be 93.79×10^6 0.04 and $t_c = 0.83$ year has been found to be 95.79×10^6 .

The maximum number in population (P_n) of 93.79×10^6 could be obtained at the exploitation ratio (E) of 0.05, whereas maximum number in yield (Y_n) of 72.8×10^6 could be obtained at the maximum exploitation (E)ⁿ of 0.95.

Standing stock found to be in the range of 150 to 21,640 tons corresponding to maximum (0.95) or minimum (0.05) exploitation ratio (E), whereas total stocks ranging from 32,597.7 to 2,523.2

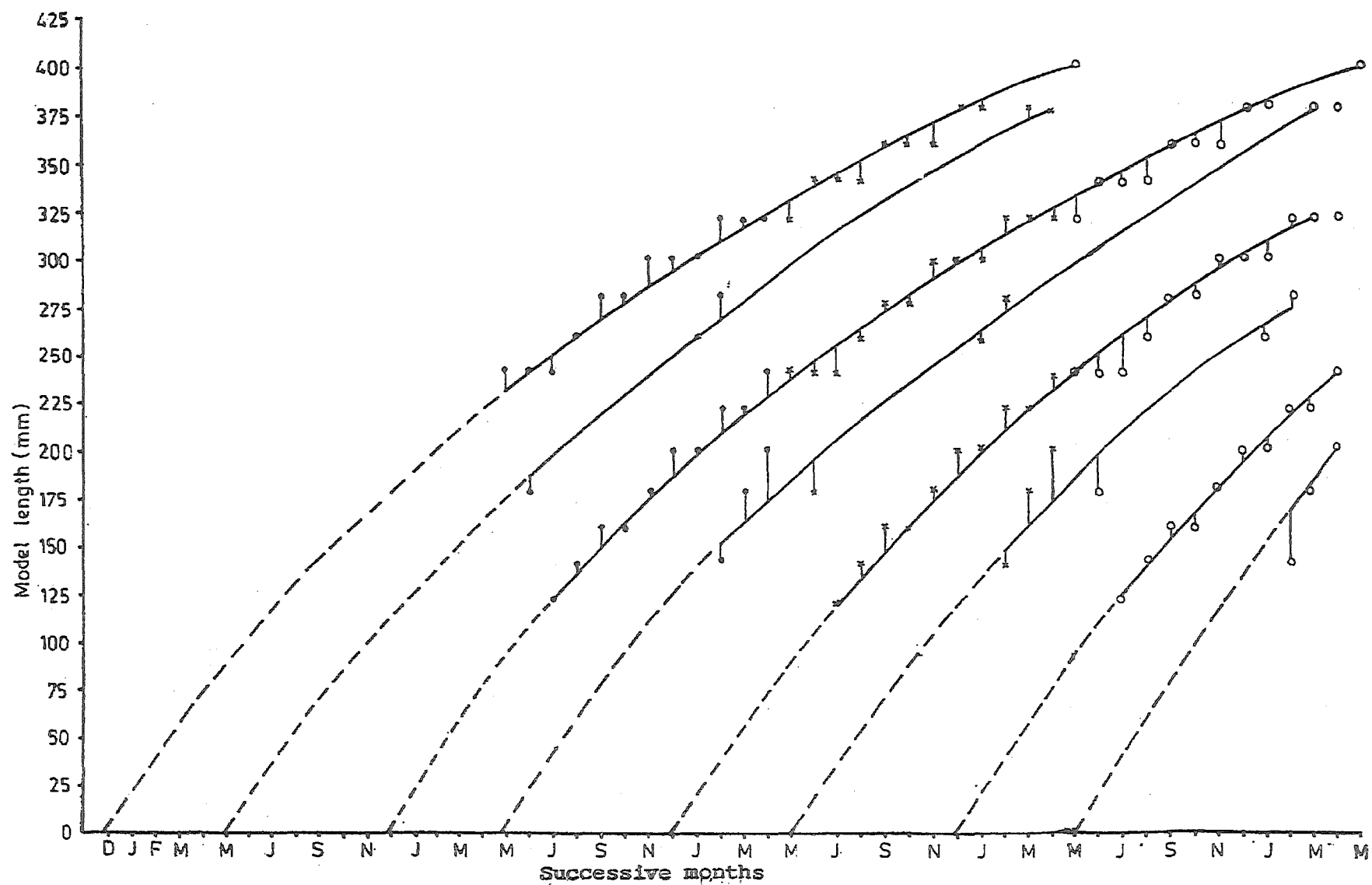


Fig 1 : Growth of individual broods on the basis of the modes in length frequency distribution for months.

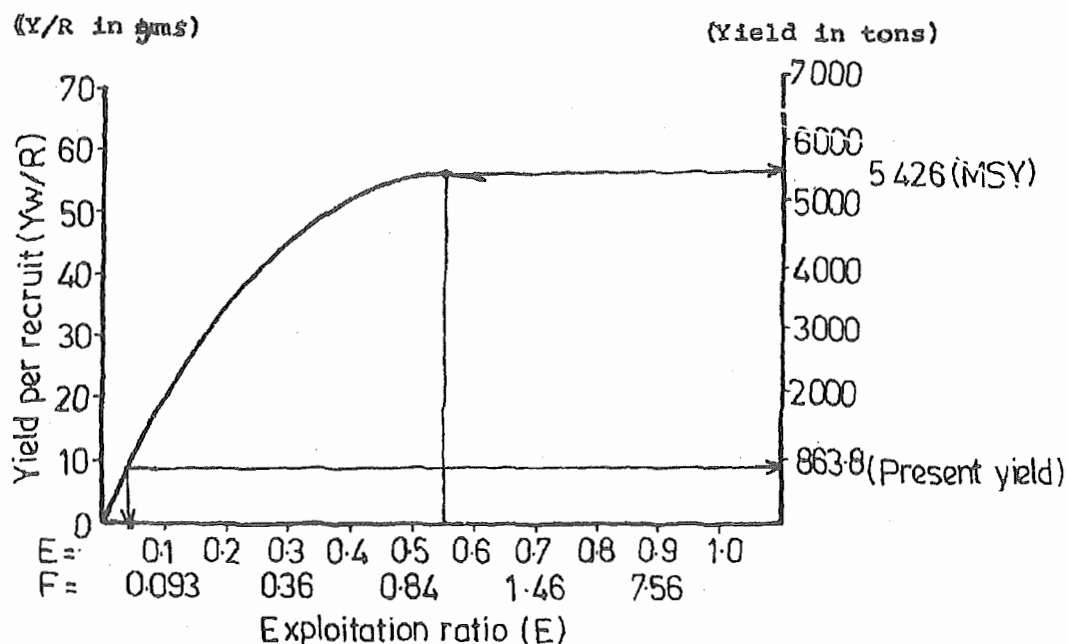


Fig. 2 : Estimation of MSY and annual yield for various levels of exploitation from current yield and exploitation for the northwest coast.

tons varied from minimum to maximum exploitation ratio (E). The optimum yield of 5,425.8 tons could be obtained at an exploitation ratio of 0.55 (Table 1).

Jones Length Cohort analysis for the period of 1977-78 reveals that maximum number of fish exploited belong to 23.25 cm length group, when the fish are just maturing as they attain first maturity at the length of 22.23 cm (Sreekrishna, 1978) (Table 2). Hence, the catches are predominated with immature or just maturing in number found to be 405,151.

The maximum catch 129.57 tons from the inshore was obtained at age of 2.64 year which contributed 15% to the total catch of the population. The mean annual number of fish caught along the Northwest coast during 1986-87 was 4.093×10^6 which contributed only 0.9% to the total number of fishes in size range

of 9 to 41 cm available in the inshore sea. The average annual catch obtained during this period was 877 tons which was only 1.7% of total biomass (stock) of 50,189 tons available in the inshore sea.

The yield effort 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. Maximum yield per recruit/R of 56.53 g could be obtained at the level of $E = 0.55$ and $F = 1.03$ for the present $t_c = 0.83$ year, whereas the present yield per recruit has been estimated to be 9.22 g only at the present exploitation level of (E) of 0.05 corresponding $F = 0.04$ (Fig.2).

In the case of present study on *Osteogeneiosus militaris* the index of size at first capture (C) had to be increased from existing level of 0.3 to the optimum level of 0.76, where as the exploitation

Table 1 : Stock assessment of *O. militaris*

Exploitation ratio	Fishing mortality	$P_N = R_c \times P_{N/R}$ million	$Y_n = R_c \times Y_N$ million	Standing stock Y/F (tons)	Total stock Y/U (tons)
0.05	0.04	93.79	4.12	21640.91	32597.70
0.10	0.09	83.04	7.72	19423.65	29873.77
0.15	0.19	78.41	11.60	17437.16	27447.00
0.20	0.21	73.61	15.45	16754.76	27062.80
0.25	0.28	69.19	19.37	13777.85	22904.50
0.30	0.36	64.54	23.23	11982.02	30575.70
0.35	0.45	60.05	27.02	10505.93	18700.30
0.40	0.56	55.32	30.97	8977.00	16682.00
0.45	0.69	50.59	34.90	7579.00	14801.00
0.50	0.84	46.09	38.71	6379.00	13172.40
0.55	1.02	41.53	42.75	5283.00	11667.00
0.60	1.26	36.88	46.47	4212.60	10081.00
0.65	1.56	32.31	50.39	3351.00	8845.50
0.70	1.96	27.62	54.21	2520.00	7514.00
0.75	2.52	22.77	57.27	1812.00	6307.60
0.80	3.36	18.44	61.96	1329.40	5668.40
0.85	4.76	13.86	65.99	897.77	5046.10
0.90	7.56	9.21	69.74	492.00	4134.00
0.95	15.96	4.56	72.84	150.20	2523.20

$Y_{N/R}$ = Yield in number per recruit.

P_N = The number of fish in the exploited phase

$P_{N/R}$ = Mean population number per recruit

Y_N = Yield in number.

Table 2 : Length cohort analysis from the inshore (0-20 m) depth section of *O.militaris*

Length group (cm)	Age in years		Number caught	Number of survivors (millions)	Exploitation rate	Fishing mortality	Total mortality
L1-L2		(X(L1, L2)	C(L1, L2)	N(L1)	F/Z	F	Z
9-11	0.441	1.054	8,007	67.026	0.001	0.001	0.843
11-13	0.546	1.052	121,706	60.269	0.098	0.016	0.058
13-15	0.657	1.061	185,761	53,768	0.030	0.026	0.868
15-17	0.774	1.065	185,761	47.584	0.032	0.028	0.870
17-19	0.898	1.069	248,215	41,778	0.045	0.040	0.882
19-21	1.031	1.075	347,501	36,327	0.066	0.059	0.901
21-23	1.174	1.081	307,466	31.111	0.057	0.051	0.899
23-25	1.327	1.088	405,151	26.339	0.091	0.084	0.925
25-27	1.490	1.097	315,473	21.878	0.079	0.072	0.914
27-29	1.676	1.086	357,109	17,893	0.117	0.112	0.954
29-31	1.877	1.119	369,921	14.847	0.114	0.108	0.950
31-33	2.097	1.136	343,346	11.527	0.116	0.110	0.952
33-35	2.351	1.158	256,222	8,638	0.106	0.999	0.941
35-37	2.640	1.187	294,655	6.220	0.143	0.140	0.982
37-39	2.978	1.230	238,607	4.166	0.151	0.149	0.991
39-41	3.387	1.299	116,901	2.590	0.045	0.040	0.881

ratio (E) has to be raised from 0.05 to 0.55 to achieve the MSY of 5,426 tons. Earlier workers (Alagaraja and Srinath, 1987) worked at exploitation ratio (E) and index of size at first capture (C) for *O.militaris* caught off Veraval coast was estimated to be 0.64 and 0.56 respectively which are closer to the findings of the present study.

This fish was found to be underexploited. Hence it is suggested that in order to get optimum yield from this stock, either effort has to be increased for existing level of C (Index of size at first capture) or the present level of C to be increased or decreased considerably at the existing level of fishing efforts.

Suggestion to increase mesh size as to increase C may not be advisable as the trawl fishery is mainly aimed at fishing of other commercially fisheries. Further, as such this form only a by-catch. Hence, suggestion to increase fishing effort to exploit such stocks may be acceptable for fishermen.

Suggestion to increase mesh size as to increase C or increase efforts in order to get optimum yield from this stock also may not be advisable. Hence, multispecies mode is to be applied to get a clear picture of efforts and mesh size assessment.

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