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FISHERY AND POPULATION DYNAMICS OF THE RIBBONFISH *TRICHIURUS LEPTURUS* LINNAEUS OFF KAKINADA*

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ABSTRACT

Along the Andhra Coast the ribbonfishes are landed on an average 9,550 t/year. They form 7.3% of the total marine fish production of Andhra Pradesh. The results of a study conducted during May 1986 - April 1987 at Kakinada are presented here.

Among the ribbonfishes, *Trichiurus lepturus* was dominant, accounting for 84% of the ribbonfish catch and was abundant during January, March, May, September and October. The instantaneous rates of total (Z), natural (M) and fishing (F) mortalities were estimated at 3.16, 0.46 and 2.70 respectively. The age at recruitment was 0.37 yr and age at first capture (t_c) was 0.98. By taking into accunt the von Bertalanffy growth parameters of *T. lepturus*, earlier estimated by the present author, the yield in weight per recruit was calculated at different levels of F and t_c. The exploitation rate was high at 0.82. This study shows that *T. lepturus* is heavily exploited in the present fishing grounds, which extend upto 50 m depth, and there is hardly any scope to step up production.

INTRODUCTION

ALONG the Andhra Coast the ribbonfishes are an important group and during 1980-84, on an average 9,550 t/year were landed forming 7.3% of the marine fish production of Andhra Pradesh (Alagaraja *et al.*, 1987). Among the ribbonfishes, *Trichiurus lepturus* Linnaeus was most dominant. Based on a study conducted off Kakinada during 1967-71, Narasimham (1983) gave an account of the fishery, mortality rates and yield per recruit of this important species.

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MATERIAL AND METHODS

In the Kakinada area (16° 35' N to 17° 25' N - 82° 20' E to 83° 10' E) boatseines, shoreseines, gill nets and otter trawls land ribbonfishes. The fishing grounds are the same for these gears. In an earlier study (Narasimham, 1983) it was observed that the size composition of *T. lepturus* landed by different gears is comparable to that obtained by the otter trawls. During May 1986 — April 1987 weekly observations were made at Kakinada Fishing Harbour and the data on total catch, specieswise ribbonfish catch and the effort expended were recorded in about 20% of the fishing units landed. Also on the observation day 25-50 numbers of *T. lepturus*, depending upon availability, were measured for total length and their weight recorded. From these data, monthly

and annual estimates were made. The instantaneous total mortality, Z was estimated by the Beverton and Holt (1956) method. The natural mortality rate, M was estimated by following Sekharan (1975). The values of the parameters in the von Bertalanffy growth equation were taken from Narasimham (1978). Though the growth in weight in relation to length is known to be allometric (Narasimham, 1983), it is assumed to be isometric and the simple Beverton and Holt (1957) model was fitted. It may be mentioned that such an assumption does not affect the trend of the yield curve.

Fishery

During May 1986—April 1987 a total of 1501 t of ribbonfishes were landed by expending 3,53,030 trawling hours which gave a catch rate of 4.25 kg/hr (Table 1). The ribbonfishes formed 6.4% of the total trawl catch and *Trichiurus lepturus* accounted for 84% of the rbbonfish catch followed by *Lepturacanthus gangeticus* (6.9%), *Eupleurogrammus muticus* (4.2%), *L. savala* (2.9%) and *E. glossodon* (2%). Peak catches of *T. lepturus* were obtained during January, March, May, September and October (Table 1).

Population Dynamics

The values of the parameters of the von Bertalanffy growth equation are $L\infty$=145.4 cm, K=0.29 per year and t_0=—0.20 year (Narasimham, 1983). The corresponding weight, $W\infty$ for the above $L\infty$ value was estimated as 2,957 g (Narasimham, 1983).

The annual length composition (Fig. 1) ranged from 22 to 94 cm with a dominant mode at 42 cm. From this figure, the length at recruitment (lr) is 22 cm and the length at first capture (lc) is 42 cm. The corresponding

Table 1. *Catch (t), Effort (trawling hours) and species composition of ribbonfish landed at Kakinada Fishing Harbour during May 1986 - April 1987*

Month	Effort	Total fish catch	Ribbonfish catch	% Ribbonfish in total	*T. lepturus*	*L. savala*	*L. gangeticus*	*E. glossodon*	*E. muticus*
May, 1986	36007	2252.7	200.6	8.9	113.4	16.7	30.8	4.5	35.2
June	32898	1236.0	46.9	3.8	31.0	4.8	2.1	—	9.0
July	23128	1269.3	36.2	2.9	32.2	0.9	—	—	3.1
August	20061	1024.1	68.2	6.7	55.2	0.8	7.3	2.5	2.4
September	29342	2289.3	225.0	9.8	188.1	7.0	19.1	6.4	4.4
October	26973	2033.1	131.9	6.5	115.1	0.4	14.1	2.3	—
November	25949	1682.7	97.9	5.8	88.9	1.0	3.8	4.0	0.2
December	18987	1912.8	115.8	6.1	109.6	1.7	3.2	0.7	0.6
January, 1987	41398	3259.4	206.6	6.3	188.9	4.0	7.8	2.0	3.9
February	39284	2621.8	96.9	3.7	88.0	2.5	4.1	0.3	1.1
March	41943	2831.7	214.6	7.6	196.8	4.2	8.9	1.2	3.5
April	17060	924.1	60.5	6.5	52.5	—	1.8	6.2	—

ages at recruitment (tr) and first capture (tc) are estimated as 0.37 and 0.98 years

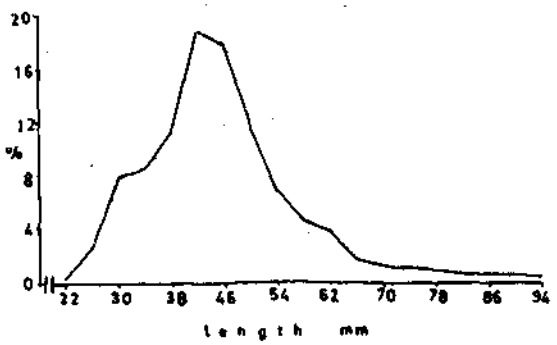

Fig. 1. Annual length composition of *T. lepturus*

respectively. From the annual length composition the instantaneous total mortality rate, Z was estimated as 3.16. Taylor (1958) suggested that the maximum attainable length by individual specimens in a population occurs at 95% of L_∞. The 95% of L_∞ in *T. lepturus* is 138.1 cm and the corresponding age is calculated as 10.1 years. Assuming that in an unexploited state, 99% of *T. lepturus* by numbers die before they attain 10.1 years, M is calculated 0.46. The present fishing mortality rate becomes 2.70.

In Fig. 2 are shown the yield isopleths, eumetric fishing line AA, and the maximum yield line BB1. At present with F at 2.7 and lc at 42 cm (tc=0.98 yr) the yield in weight per recruit (Yw/R) is 92.5 g whereas the maximum Yw/R of 140.4 g is attainable by

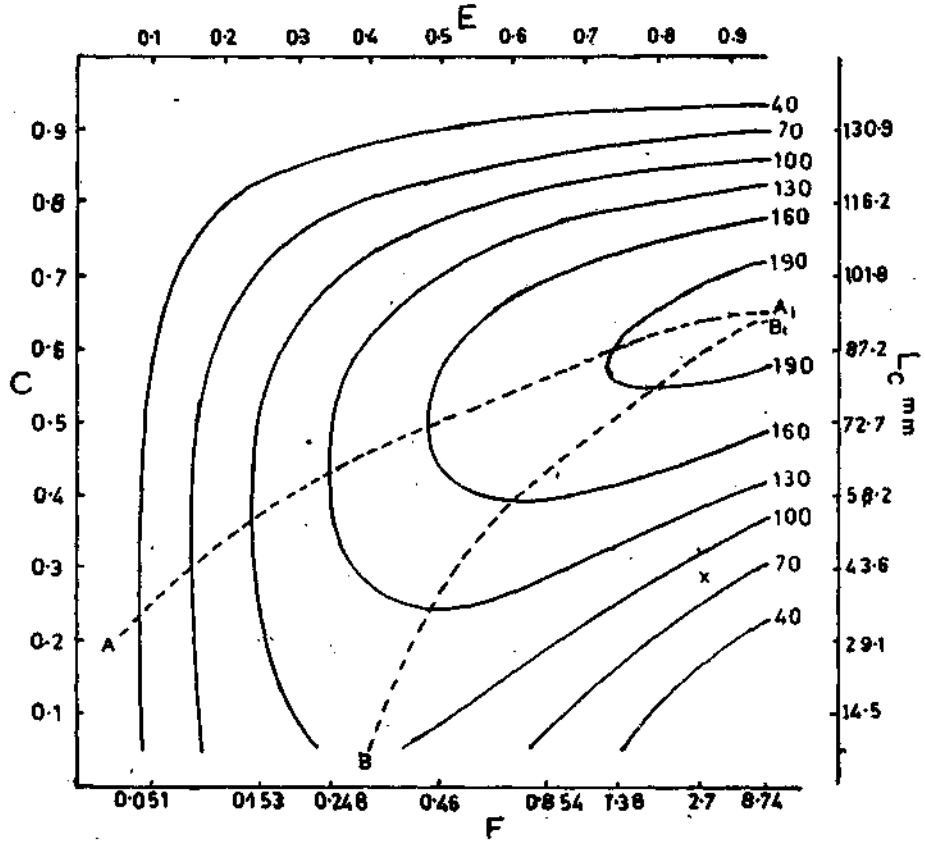

Fig. 2. Yield isopleth of *T. lepturus*. $C = \frac{L_\infty}{Lt}$ and $E = \frac{F}{Z}$. The current yield in weight per recruit is indicated by x. A – A1 shows the eumetric fishing line and B – B1 the maximum yield line.

reducing F to 0.46; any further increase in F would result only in lower yield. This suggests that *T. lepturus* is heavily exploited in the present fishing grounds, which extend upto 50 m depth and further increase in effort would be counter-productive. By increasing lc to 87.2 cm (tc=2.96 yr) maximum Yw/R of 196.7 g is obtainable at the present level of F.

Discussion

In an earlier study, off Kakinada, Narasimham (1983) estimated Z at 1.3 in *T. lepturus* by the catch curve method. This value is much lower compared to 3.16 obtained in this study. This may be due to about nine-fold increase in the trawl fishing effort between 1967-'71 and 1985-'86. Also the lower estimate of Z in the earlier study may be due to the dissection of length composition into age groups by knife edge selection. In the earlier study the maximum attainable age, t_{max} was estimated as 5 years, based on the length of the largest specimen available in the commercial catches. Though in both the earlier and the present study, Sekharan's (1975) method was adopted to estimate M, a higher value of M at 0.9 was obtained earlier due to the lower estimate of t_{max}. It may be mentioned that in the East China and Yellow Seas, Misu (1964) estimated M in *T. lepturus* at 0.36 which is close to the value arrived at in this study.

T. lepturus attains first maturity between 41-48 cm length (Prabhu, 1955; James *et al.*, 1983; Narasimham, 1987). It is shown that the length at first capture is 42 cm which is close to the lower limit in the above range. This points out that the fishes are harvested before they have spawned at least once in their life time and such a situation would lead to recruitment overfishing. It has been shown that by increasing lc to 87.2 cm maximum Yw/R is obtainable at current F. However, this option is very difficult to practice since *T. lepturus* is landed as bycatch the trawlers whose effort is directed to catch the highly valued prawns. For this reason and also since *T. lepturus* is a minor component in multispecies and multigear fishery, any attempt to regulate the ribbonfish fishery either by increasing lc or reducing F is besect with difficulties as it may result in the loss of a particular resource to the fishery or in over-exploitation of another resource.

The exploitation rate, U was estimated as 0.82 which is high. The fishing grounds off Kakinada closely correspond to the marine fishing zone of the East Godavari District of Andhra Pradesh. The average annual ribbonfish catch of this district during 1980-84 by all gears was estimated at 2,200 t (Alagarja *et al.*, 1987). By taking 84% of the ribbonfish catch as *T. lepturus* the average annual stock and the average standing stock are estimated as 2,330 t and 690 t respectively in the present fishing grounds off Kakinada.

To conclude, the present fishing pressure has already reached a level beyond maximum sustainable yield level in the trawling grounds.

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