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Growth, maturity and mortality of false travelly *Lactarius lactarius* Bloch & Schneider from Andhra Pradesh-Orissa coast

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ABSTRACT

The length-weight relationship, relative condition factor, growth, maturity, mortality and exploitation ratio of *Lactarius lactarius* from Andhra Pradesh-Orissa coast were studied. Length-weight relationship for male and female *L. lactarius* was obtained as:

Male $W = 0.000014\ L^{2.958291}$ $(r = 0.9809$

Female $W = 0.000031\ L^{2.808157}$ $(r = 0.9789)$

Growth parameters estimated for von Bertalanffy's growth function were: $L\infty = 26.95$ cm, $K = 0.6294$/year and $t_0 = -0.2741$ years. The fish attained maturity at 167.5 mm and had a longevity of 4.77 years. The total mortality Z and the fishing mortality F were estimated as 3.3254 and 2.6223 respectively. The exploitation ratio $E = 0.789$ indicated over-exploited state of the stock. The trend of fishery during 1980–91 is also presented.

The majority of the studies conducted on the false travelly (also known as white fish or big-jawed jumper) do not provide much information on the growth and exploitation of this species (Shanmughavelu 1973, Kaikini 1974, Kunjipalu 1975, Kartha 1977). In this paper the results of studies on the length-weight relationship, relative condition factor, growth, maturity, mortality and exploitation of *Lactarius lactarius* from Andhra Pradesh-Orissa coast are presented.

MATERIALS AND METHODS

Samples collected from the Fishery Survey of India vessels M. F. V. *Meena Shodhak* and M. F. V. *Meena Jawahar*, supplemented with samples collected from private trawlers, during 1976–79 (totaling 2 755 specimens) were used. Length (in mm) and weight (in g) measurements of 247 males ranging from 114 mm to 230 mm and 220 females ranging from 123 mm to 245 mm were used for estimating the length-weight relationship of the form

$$W = aL^b$$

by logarithmic transformation. ANOCOVA on the linearized length-weight regression equations for males and females and 't' test on regression and correlation coefficients were carried out as per the standard procedures (Snedecor 1961). Relative condition factor Kn (LeCren 1951) at different body lengths as well as for different months were calculated for females using the formula

$$K_n = W/\hat{W}$$

where W is the observed weight, and

$\hat{W}$ is the weight calculated using length-weight relationship.

Size at first maturity was arrived at by plotting the percentage of mature specimens (stage IV and above) against total length as given by Thomas (1969). The age at length data obtained by modal progression analysis

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were used in determining the parameters for von Bertalanffy's growth function (VBGF) viz. $L\infty$, K and t_0. The plot of L_{t+1} against L_t (Ford Walford Plot) was used to estimate $L\infty$ as detailed in Pauly (1983), while t_0 was estimated by plotting $-\ln(1-(L_t/L\infty)$ against t (Sparre *et al.* 1989). Longevity was estimated as from $t_{max} = 3/K$ (Pauly 1983). Pauly and Munroe's (1984) length growth performance index PHI' (ϕ') was computed from:

$$\phi' = \log K + 2 \log L\infty$$

Where K and L are von Bertalanffy's growth parameters. Age at length was calculated by the formula:

$$t = -(1/K) \ln\left(1 - \frac{Lt}{L\infty}\right) + t_0$$

It was used to estimate mean relative age. $\ln \frac{N}{\Delta t}$ values were plotted against relative age, and the slope of the resulting catch curve (with sign changed) was taken as estimate of total mortality Z. Value of Z was also computed from the mean size of the catch using the formula (Beverton and Holt 1956):

$$Z = \frac{K(L\infty - \bar{L})}{\bar{L} - L'}$$

where L' is the smallest size of the fish fully represented in the catch and $\bar{L}$ is the mean length of the catch. Natural mortality M was estimated by Pauly's empirical formula:

$$\text{Log}_{10} M = -0.0066 - 0.279 \log_{10} L\infty + 0.6543 \log_{10} K + 0.4634 \log_{10} T$$

taking T as 27°C

Exploitation ratio was computed using the formula E = F/Z (assuming F = Z-M).

RESULTS AND DISCUSSION

Length-weight relationship

The length-weight relationship for males, and females was obtained as follows:

Male : $W = 0.000014\ L^{2.958291}$ $(r = 0.9809)$
Female : $W = 0.000031\ L^{2.808157}$ $(r = 0.9689)$

ANOCOVA (Table 1) showed that the two regression lines have significantly (5%) different slopes but elevations did not show any significant (5%) difference. 't' test on correlation coefficient through Z conversion showed that the two 'r' values are from a common population correlation. While the regression coefficient for male did not show any significant (1%) departure from isometric value 3, that of female was slightly lower than 3.

Table 1. Comparison of regression lines of female and male *Lactarius lactarius* by ANOCOVA

Within	Df	Reg. coefficient	Deviation from regression		
			Df	SS	MSS
Males	246	2.958291	245	1.588842	0.006485
Females	219	2.808157	218	1.668975	0.007656
Total			463	3.257817	0.007036
Pooled	465		464	3.300776	0.007114
Difference			1	0.042959	0.042959
Total	466		465	3.302529	0.007102
Between adjusted mean			1	0.001753	0.001753

Comparison of slope: $F = \frac{0.042959}{0.007036}$ (df 1,463) = 6.105600 (significant at 5% level).

Comparison of elevation: $F = \frac{0.001753}{0.007114}$ (df 1, 464) = 0.246416 (not significant at 5%)

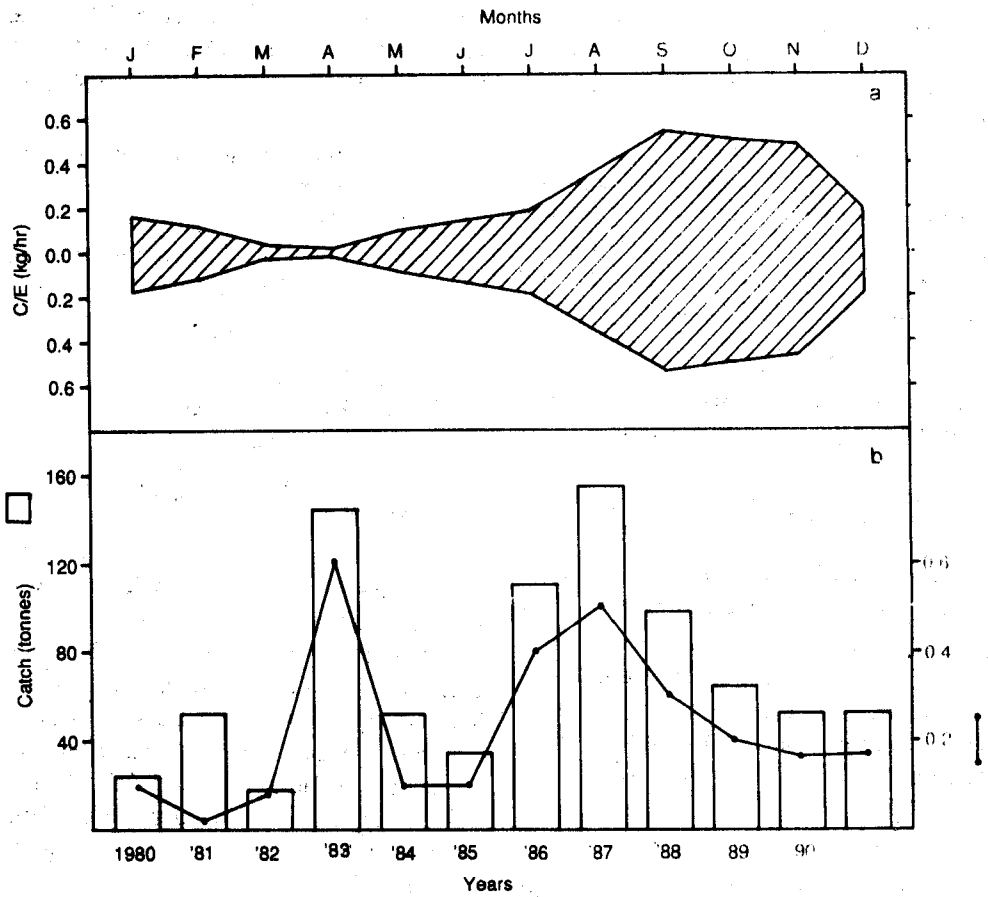

Fig. 1. (a) Seasonal abundance, and (b) annual abundance of *Lactarius lactarius* in the small trawler landings at Visakhapatnam for the period 1980–1991.

Condition factor

The fish attained good condition during August–October, probably due to intense feeding (Fig. 2a). A decline in 'K_n' value started from October and reached the lowest value in March. Then the condition went up till May to decline to the second low value in July. This indicated that spawning in whitefish is protracted from October to July, with a major peak in March and minor one in July. Apparao (1966) indicated that *L. lactarius* is a fractional spawner. It could be possible to relate the two spawning peaks seen in March and July to the first and second groups of ova developing in the ovary of this fish. 'Kn' values for different body lengths showed the condition attaining a local maximum at 147.5 mm followed by an inflexion which leads to a local minimum at 172.5 mm. If the inflexion at 142.5 mm is indicative of onset of sexual maturity (Hart 1964) it lends support to the finding that the fish attains maturity at 167.5 mm (Fig. 2b). Between the body lengths of 172.5 mm and 197.5 mm the 'Kn' values oscillate at more or less regular intervals indicating different stages of spawning cycles of the fish as a result of protracted breeding. From 197.5 to 217.5 mm

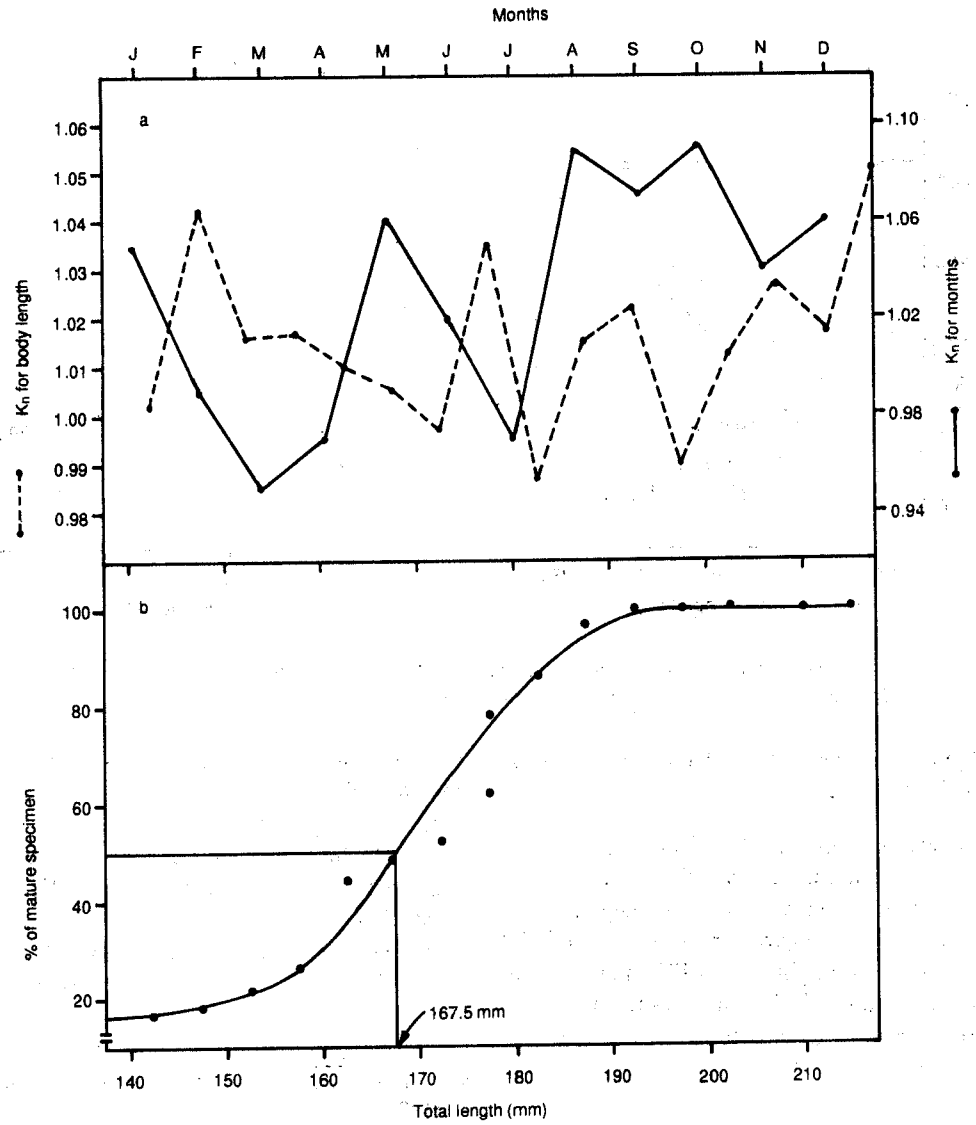

Fig. 2. (a) Relative condition factor K_n for different body lengths and different months, and (b) size of maturity of *Lactarius lactarius* from Andhra Pradesh-Orissa coast.

condition values show more or less increasing trend.

Size at first maturity and spawning

The length at which 50% of the fish matured was 167.5 mm. All fish matured at 192.5 mm length. This is in agreement with the corresponding values of 167 and 188 m reported by Apparao (196) for this species from the same locality. The distribution data of spawners during different months showed their predominance during February to July.

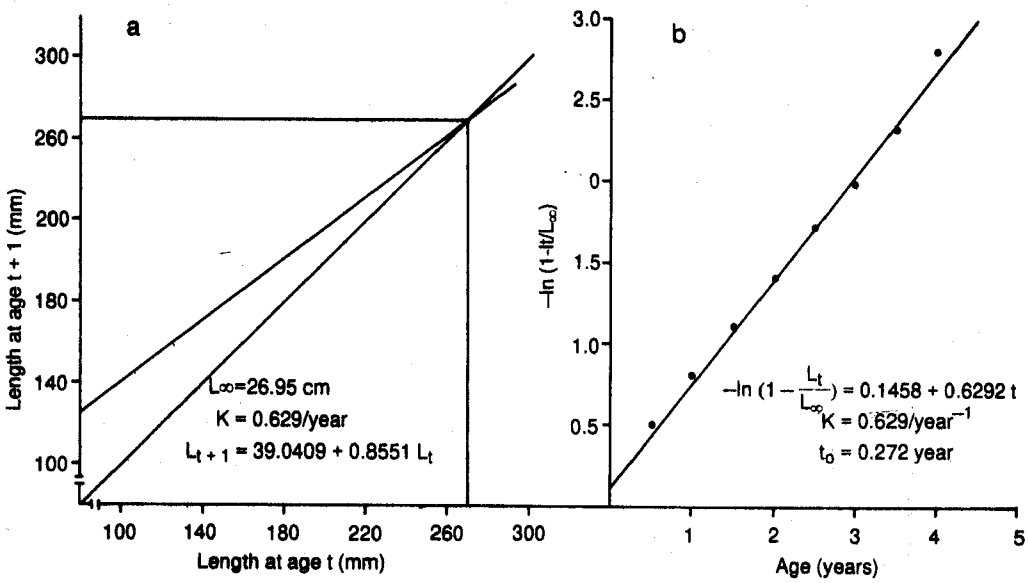

Fig. 3. (a) Ford-Walford plot for estimating L_∞ and K, and (b) plot for estimating t_o and K, given L_∞, of *Lactarius lactarius* from Andhra Pradesh-Orissa coast.

Apparao (1966) reported February-April as peak spawning period.

Growth, mortality and exploitation

The maximum size of *L. lactarius* encountered by us was 245 mm. This is much smaller than the earlier reported size of 330 mm by Shanmughavelu (1973) and 350 mm by Kunjipalu (1975). The parameters of von Bertalanffy's growth function (VBGF) obtained (Fig. 3a, b) were:

$L_\infty = 26.95$ cm

$K = 0.6294$/year

$t_o = -0.2741$ year

Thus the VBGF for *Lactarius lactarius* (Fig. 4a) is

$$L_t = 26.95\,(1-e^{-0.6294\,(t+0.2741)})$$

Pauly and Monro's growth performance index was calculated as

$$\phi = (\log_{10} 0.6294 + 2\log_{10} 26.95) = 2.6601$$

This was slightly lower than the value of 2.9418 calculated based on the growth parameters reported by Pauly (estimated from the length frequency data given in Apparao 1966, personal communication) from Waltair coast. The fishery is represented by fishes of 1 to 3 years of age. The longevity, t_{max} (= 3/0.6294) obtained for this fish was 4.776 years.

The total mortality Z obtained from mean size of the catch (Beverton and Holt 1956) was 3.0409. By catch curve method a little higher value of 3.3254 was obtained (Fig. 4b). This was used for further calculations. The value of natural mortality, M, obtained by using Pauly's empirical formula was 0.7031. From this the value of fishing mortality, F(= Z−M) was calculated to be 2.6223. The exploitation ratio, E (=2.6223/3.3254=0.7886) obtained here indicated the over-exploited state of the stock. The catch as well as CPUE during the 3 years (1980–82) succeeding the period of

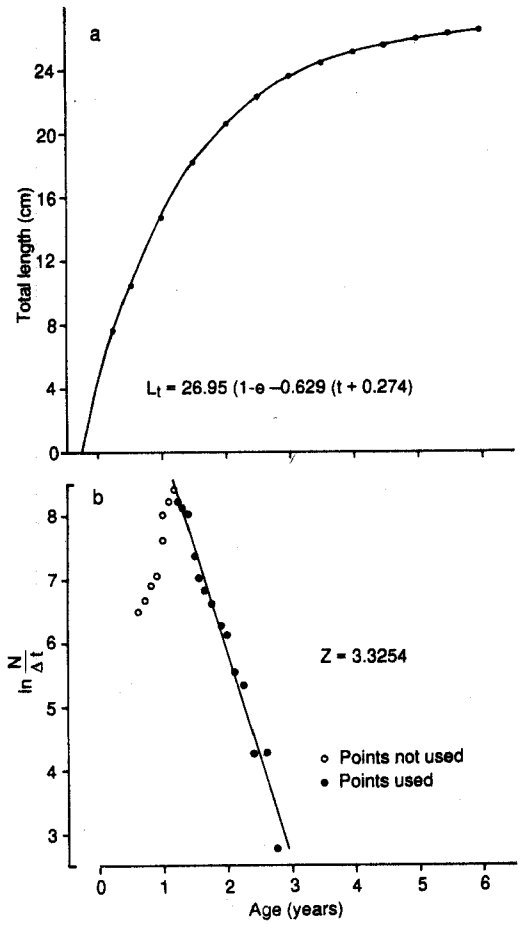

Fig. 4. (a) Estimated growth curve, and (b) age structured catch curve of *Lactarius lactarius* from Andhra Pradesh-Orissa coast.

study was vary low (Fig. 1b). Though a recovery was seen in 1983, the catch and catch rate plummeted in the next 2 years. A revival was observed during 1986–1987 and a gradual decline thereafter. The effect of fishing pressure on this species in the context of multispecies interaction needs further study.

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