

## Stock Assessment of white fish, *Lactarius lactarius* (Bloch and Schneider, 1801) along Ratnagiri Coast of Maharashtra, India

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The study on the age, growth and mortality of white fish, *Lactarius lactarius* was carried out based on the length frequency data collected during August 2009 to August 2011. The asymptotic length ( $L_{\infty}$ ) and growth coefficient (K) were estimated as 366 mm and  $0.685 \text{ yr}^{-1}$  respectively. The total, natural and fishing mortalities were 3.31, 1.30 and  $2.01 \text{ yr}^{-1}$  respectively. The exploitation rate (U) and exploitation ratio (E) were calculated as 0.61 and 0.62 respectively. Though Emax obtained at 0.91, it is not advisable for a stock to be exploited at that level as in future, it would be detrimental.

**Key words:** *Lactarius lactarius*, growth, mortality, stock assessment

### Introduction

The white fish *Lactarius lactarius* (Bloch and Schneider, 1801) commonly known as false travelly is widespread in Indo-west Pacific region from East Africa to Southeast Asia, north to Japan, south to Queensland, Australia and Fiji islands. The white fish is more abundant on the East coast than the West coast of India<sup>1</sup>. The species is widely distributed in Indian waters forming local fisheries of considerable importance in different regions along the Indian coast and has high demand in coastal markets<sup>2</sup>. It is a small-sized fish that moves in shoals in inshore waters, occurs up to a depth of 100 m and is exploited mainly by trawl net along the coast of Maharashtra. The annual production of *Lactarius lactarius* of Maharashtra state was 1,405 t in 2005-06 which also showed increased production value up to 3,859 t in 2009-10. Once upon a time especially upto early seventies of the last century, the catch of false travelly was high on the Konkan coast of Maharashtra. However after its decline, again this resource has shown an increasing trend. This species contributes to fairly good percentage of fish catches along Ratnagiri coast with an annual production of 2,382 t in 2009-10<sup>3</sup>. Age and growth of this species is studied by<sup>4, 5, 6</sup> on the west coast while<sup>17</sup> on the east coast of India. Since no study have been reported from the coast of Ratnagiri, Maharashtra, where of late a revival of the fishery of false travelly is being observed, this investigation on growth, mortality and yield per recruit was undertaken.

### Material and Methods

The catch and efforts data was collected weekly from the commercial catches from Mirkarwada

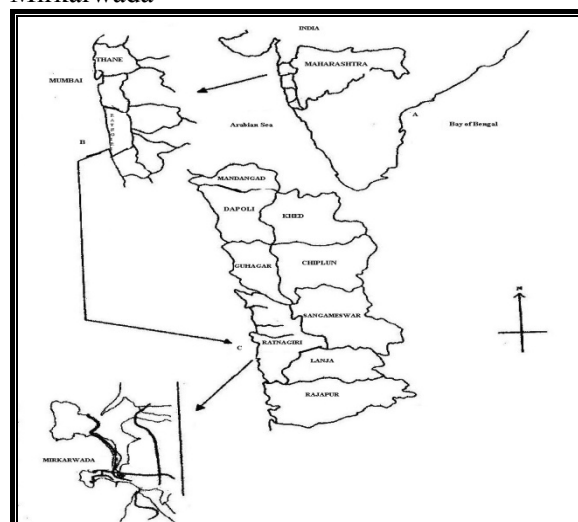


Fig.1- Map of Mirkarwada landing centre of Ratnagiri coast

landing centre ( $16.9800^{\circ} \text{ N}$ ,  $73.3000^{\circ} \text{ E}$ ) of Ratnagiri (Fig.1) in 2009-11. Total 5325 fish specimen were measured. The total length was measured to the nearest millimeter. The length frequency data were grouped into 10 mm class interval, then raised & pooled month wise<sup>7</sup>. Asymptotic length ( $L_{\infty}$ ) and growth coefficient (K) of the Bertalanffy's von equation<sup>8</sup> for the growth in length were estimated by means of ELEFAN employing FiSAT computer programme<sup>9</sup>.

The total instantaneous mortality (Z) was calculated following length-converted catch curve<sup>10,11</sup>. Natural mortality coefficient (M) was estimated by using Pauly<sup>12</sup> formula

$$\ln(M) = - 0.0152 - 0.279 \ln(L_{\infty}) + 0.6543 \ln(K) + 0.463 \ln(T)$$

(Where  $L_{\infty}$  is in cm, K is annual and T is the mean environmental temperature taken in degrees Celsius). The mean environmental temperature was taken as 28 °C. The fishing mortality (F) was arrived by subtracting M from Z.

The exploitation rate (U) is calculated as  $U = (F/Z) * (1 - e^{-Z})$  and exploitation ratio (E) by  $F / Z^{13}$ .

The relative yield/recruit was estimated from the relative yield /recruit model of <sup>13</sup> & <sup>14</sup> was represented by the equation:

$$(Y/R)' = E * U^{M/K} * \left\{ \frac{3U}{1+m} + \frac{3U^2}{1+2m} - \frac{U^3}{1+3m} \right\}$$

where  $E = F/Z$  the exploitation ratio or the fraction of deaths caused by fishing:

$$M = K/Z$$

$U = 1 - L_c / L_{\infty}$ , the fraction of growth to be completed after entry into the exploited phase,  $(Y/R)'$  is considered a fraction of U and E and the only parameters is M/K. Using different value of E on the X-axis and various sizes at first capture  $L_c/L_{\infty}$  ratios on Y-axis, the isovalues of relative yield per recruit were plotted to generate the yield isopleth diagram.

**Results**

The asymptotic length ( $L_{\infty}$ ) and growth coefficient (K) were estimated as 366 mm and 0.685/year, respectively using ELEFAN method of FiSAT programme (Fig.2).

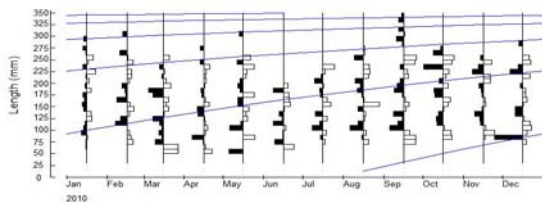


Fig.2- Growth curve fitted by ELEFAN method

The total mortality calculated as 3.31 by Pauly's length converted catch curve method (Fig.3). The natural mortality (M) calculated by Pauly's method was found 1.30. The fishing mortality thus obtained as 2.01. The exploitation ratio and exploitation rate were calculated as 0.61 and 0.62 respectively.

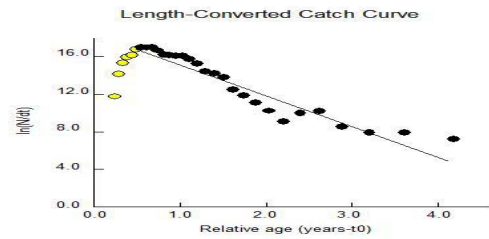


Fig.3- Length converted catch curve for estimation of Z

The relative yield and biomass per recruit obtained  $E_{max}$  at 0.91 (Fig.4). The input data used for this was  $L_c / L_{\infty} = 0.66$  and  $M/K = 1.28$ .

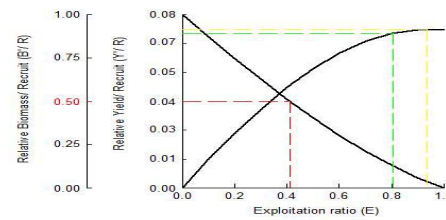


Fig.4- Relative yield per recruit and relative biomass per recruit of *L.lactarius*

**Discussion**

Pauly<sup>15</sup> based on the published data of Apparao<sup>16</sup> from Waltair and Reuben<sup>17</sup> from Andhra Pradesh-Orissa coast estimated  $L_{\infty}$  as 320 mm, K 0.85 year<sup>-1</sup> and  $t_0$  - 0.18. Reuben<sup>17</sup> estimated  $L_{\infty}$ , K, and  $t_0$  using model progression analysis were 269.5 mm, 0.6294 year<sup>-1</sup> and - 0.2741 years of age respectively, the longevity was estimated to be 4.8 years. The  $L_{\infty}$  of this species recorded 250 mm with lifespan of 2.7 years was estimated by Vivekanandan<sup>1</sup>. Zacharia & Jayabalan<sup>18</sup> estimated the values of  $L_{\infty}$  for males as 240 mm, K as 1.01 year<sup>-1</sup>, while for female  $t_0$  as - 0.0151;  $L_{\infty}$  as 285 mm, K as 0.91 year<sup>-1</sup>. For unsexed fishes (juveniles, males and females pooled)  $L_{\infty}$  as 294 mm, K as 0.84 year<sup>-1</sup> and  $t_0 = -0.0215$ . In the present study, estimated  $L_{\infty}$  was slightly high as 366 mm and K as 0.685 was on the lower side for *L.lactarius*. The largest fish observed in the catch was 331 mm.

It is general trend seen in India that the fish from west coast usually grow bigger than their counterpart on the east coast. In the present investigation, the total instantaneous mortality coefficient (Z), natural mortality coefficient (M) and fishing mortality coefficient (F) for *L. lactarius* have been estimated were 3.31, 1.30 and 2.01 yr<sup>-1</sup>, respectively. Reuben<sup>17</sup> estimated the total instantaneous mortality coefficient (Z), natural

mortality coefficient (M) and fishing mortality coefficient (F) by using Pauly<sup>12</sup> method for *L. lactarius* as 3.3254, 0.7031 and 2.6223 respectively. The problem of estimating the natural mortality (M) is well known in tropical multigear system. However, we used the Pauly's empirical formula, which is widely used in tropical waters and M of 1.30 was calculated which is well within the range of 1-2.2 given by<sup>13</sup>. Fishing and total mortality were with at the same level as that of<sup>17</sup>.

The catch of this species showed declining trend in 1980-2000 due to recruitment overfishing combine with sudden changes in environmental parameters such as increased water temperature and decreased rainfall as it is observed in gulf of Mannar<sup>19</sup>. Kaikini<sup>20</sup> recorded the pattern of *L. lactarius* in the different depth ranges changes with the seasons and stock have been gradually shifted to the deeper waters. After 2000, species showed increasing trends in Konkan coast may be due favorable environmental conditions, also with contribution made by trawlers to the demersal catches when commercial trawlers started venturing in deeper waters.

Employing the selective ogive of relative yield per recruit of Beverton & Holt, the exploitation rate (U) and exploitation ratio (E) were calculated 0.61 and 0.62, respectively which are on the higher side of the optimum 0.5. At that level, 36% of virgin stock remains. Though the Emax obtain at 0.91, exploiting the fish upto that level is not healthy for the stock. However in a multispecies gear like trawl where shrimp is the target species, suggesting management measures are certainly difficult.

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