

Growth, mortality and yield per recruit of bearded croaker *Johnius dussumieri* (Val.) from Mumbai waters

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ABSTRACT

Growth, mortality and yield per recruit of *Johnius dussumieri* (Val.) is reported in the present communication. The VBGF parameters in length were estimated as $L_{\infty} = 269$ mm, $K = 0.9633$ year and $t_0 = -0.013$ years. The asymptotic weight was calculated as 257 g. The mortality and yield parameters were $Z = 2.38$, $M = 2.02$, $F = 0.36$, $E = 0.15$ and $U = 0.13$. At the present level of $F = 0.36$, the yield per recruit stood at 5.46 g. It is seen that increase in the age at first capture (t_c) by increasing of cod end mesh size would result in decline in the catch even at the present level of F .

Introduction

Sciaenids, commonly known as jew fishes, croakers or drummers are widely distributed in different parts of the world and represented by a large number of species. Occurring as bycatch in shrimp trawls, sciaenids contribute 10 to 12% of the total fish catch at New Ferry Wharf and Sassoon Docks landing centres of Mumbai. At least about one dozen species contribute to the fishery. *Johnius dussumieri*, however, is a minor species whose contribution to the total catch of sciaenids never exceeded 4 to 5%. In the present communication growth, mortality and yield per recruit of *Johnius dussumieri* is reported.

Material and methods

Length-frequency data for this species were collected at New Ferry Wharf and Sassoon Docks landing centres of Mumbai. The data was grouped into 10 mm class interval and raised for the day and subsequently for the month using the method of Sekharan (1962). Growth was studied using scatter diagram technique of Devaraj (1982) and was expressed by von Bertalanffy's (1938) growth equation. The asymptotic length (L_{∞}) was estimated by Wetheral *et al.* (1987) method also. The natural mortality coefficient was estimated by Cushing's (1968) formula and the total mortality coefficient was calculated by

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length converted catch curve method of Pauly (1982). Using the length - weight relationship the W_{∞} at the asymptotic length was calculated. The exploitation rate and ratio was calculated as per the Beverton and Holt (1957) and Ricker (1975). The yield per recruit was done using the formula of Beverton and Holt (1957) and Ricker (1975) as:

$$\frac{Y_w}{R} = F \cdot e^{-M \cdot t_c} \cdot W_{\infty} \left[\frac{1}{Z} - \frac{3S}{Z+K} + \frac{3S^2}{Z+2K} - \frac{S^3}{Z+3K} \right]$$

The cod end mesh size for the shrimp trawls in use is 25 mm. Taking the length at first capture, the selection factor was determined by $S.F = L_c / M.S$. A set of values of cod end mesh sizes were taken giving corresponding values of L_c calculated as $L_c = S.F \times M.S$. The L_c values were converted to t_c . The length at first capture was calculated as per Beverton and Holt (1957) and the same was converted to age.

Results and discussion

By tracing the lengths in modal progression it was possible to obtain twelve growth curves of almost identical slopes (Fig. 1). The growths read out at

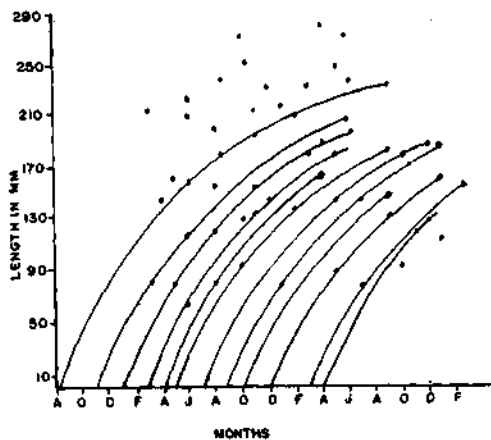


Fig. 1. Scattergram of modal length for *J. dussumieri*.

monthly intervals were used for the regression using the Ford (1933) and Walford (1946) plot. The asymptotic length (L_{∞}) was estimated as 269 mm and growth coefficient K as 0.9633 per year (Fig. 2). Using the method of Wetherall *et al.* (1987) the L_{∞} was estimated as 267.17 mm (Fig. 3). Thus the asymptotic length estimated by both the methods was almost identical. However, L_{∞} of 269 mm was considered as more realistic.

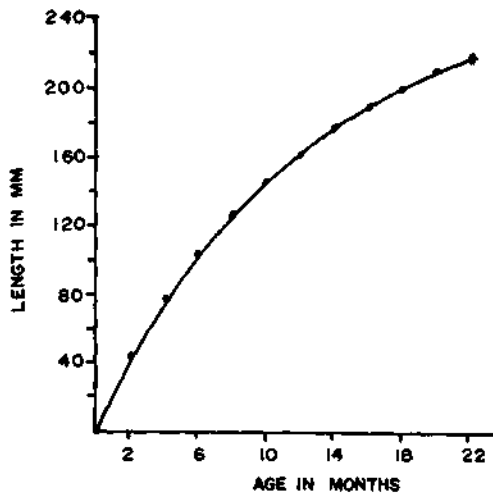


Fig. 2. Growth curve of *J. dussumieri*.

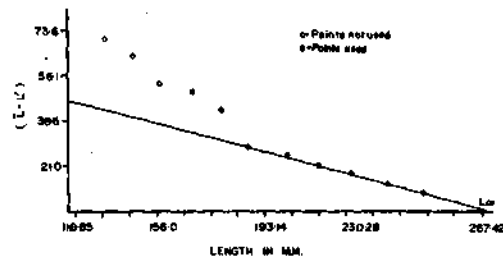


Fig. 3. Wetherall *et al.* plot for the estimation of L_{∞} for *J. dussumieri*.

The growth curve of this species is presented in Fig. 4. The VBGF parameters in length for this species could thus be written as:

$$L_t = 269 (1 - e^{-0.9633(t - 0.013)})$$

This species grows to 169 and 231 mm at the end of I and II years of its life time.

The total, natural and fishing mortality coefficients were calculated as 2.38, 2.02 and 0.36 respectively (Fig. 4). The exploitation rate and ratios were calculated as 0.13 and 0.15 respectively.

Using Beverton and Holt (1957) formula the age at recruitment (t_r) and age at first capture (t_c) were calculated as 0.2987 and 0.6767 years. The t_{max} was calculated as 3.3747 years. Using the length weight formula the W_w at L_w of 269 mm was calculated as 257 g.

The yield-per-recruit study showed that Y_w/R is 5.46 (Fig. 5) which can be increased to 9.20 g by increasing the present level of F to three times.

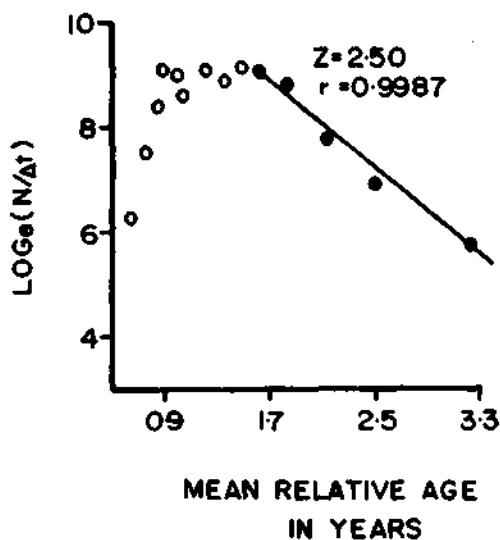


Fig. 4. Length converted catch curve for the estimation of 'Z'.

As mesh selection experiments were not practicable, calculations were done by increasing the cod end mesh size by 10, 20 and 30% respectively thus increasing the age at first capture. But it has been observed that increase in the mesh size resulted in a decline in the Y_w/R even at the present F .

The rate of growth of this species appears to be faster as compared to the other three species studied by Chakraborty (1989, 1993 and 1994) (Table 1). As this species has a lower asymptotic length, the rate of growth is ought to be faster. The annual K of 0.9633 for this species is within the range of K values of 0.21-1.10 estimated for various species of sciaenids from Indian waters (Pauly, 1980).

The M/K ratios for sciaenids from various localities on a global basis range from 1:1 to 2.63. For *J. dussumieri* the same was found to be 2.27 which substantiates the hypothesis that M/K ratios for closely related species and often for similar taxonomic groups are constant (Beverton and Holt, 1959; Banerjee, 1973). As the L_w of this species is low the higher M is justified. Low values of F , E indicates very low

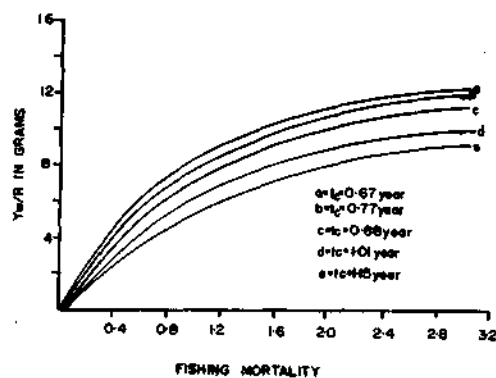


Fig. 5. Yield per recruit as function of fishing mortality.

TABLE 1. Growth parameters, natural mortality and exploitation ratios for four species of sciaenids from Mumbai waters

Species	L _∞ (in mm)	K ^{year}	t ₀ (years)	M	E	Source of information
<i>J. macrorhynchus</i>	331	0.5415	-0.07813	1.16	0.65	Chakraborty, 1994
<i>J. vogleri</i>	354	0.5057	-0.08128	1.1	0.49	Chakraborty, 1993
<i>O. cuvieri</i>	395	0.5331	-0.06246	1.3	0.50	Chakraborty, 1989
<i>J. dussumieri</i>	269	0.9633	-0.01300	2.02	0.15	Present study

exploitation of this species. As already mentioned in the preceding columns *J. dussumieri* is one of the minor species of sciaenids in the Mumbai waters.

The yield per recruit study showed that at the present mortality and yield the Y_w/R can be increased by trebling the F to 1.20. But this cannot be treated in isolation. Concomitant effects on the catch of other stocks and the biomass per recruit on the same stock should be considered. Thus, it would be better if *J. dussumieri* is exploited at the present level only as that would not have any detrimental effect on the stock.

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