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Growth and mortality estimates of a sciaenid *Johnieops sina* (Pisces/Perciformes) from Bombay waters

Sushant Kumar Chakraborty
Central Marine Fisheries Research Institute, Bombay Research Centre, Army & Navy Building, 148, M.G. Road, Bombay 400 001, India

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Growth and mortality in *J. sina* based on the length frequency data collected during 1987-90 were computed. von Bertalanffy's growth parameters in length were estimated as L_∞ = 239 mm, K = 0.777 (per year) and t_o = −0.03814 y. This species attained 132 and 192 mm at the end of 1st and 2nd year of its life respectively. Fishery was supported mostly by zero and 1 y class individuals. The instantaneous rates of total, natural and fisihing mortalities were 4.35, 1.76 and 2.59 respectively. The exploitation rate and ratios were same (0.59).

Sciaenids are one of the important components of shrimp trawl in Bombay waters and they constitute about 10% of total fish landings. Studies on the growth and mortality have been done on sciaenids from Bombay[1-4]. In the present investigations growth and mortality of *Johnieops sina* (Cuvier) were computed using the data collected from September '87 to December '90.

Weekly observation on length and species composition were made from the commercial trawlers operating from New Ferry Wharf and Sassoon Docks. Length frequency data was collected on 2,588 specimens of *J. sina* in the length range of 70-225 mm during September '87 to December '90. The length data were raised to day's catch and subsequently to month's catch[5]. Employing LFSA package[6] length frequency samples were resolved into normally distributed component using Bhattacharya and Gulland and Holt plot[7,8]. The mean lengths of different components in the length frequency were used for the estimation of asymptotic length (L_∞) and growth coefficient (K). The hypothetical age at which length is zero (t_o) was estimated by regression of age, 't' against $-\log e\, L_\infty - L_t$. Here 'L_t' is length at age 't'.

The instantaneous rate of total mortality (Z) was estimated by the length converted catch curve method[7] given as

$$\text{Log e } (N/\Delta t) = a + b.t$$

where Δt is time taken to grow from lower limit to upper limit in each length class; N, numbers caught in each length group; Y-axis intercept being a and b is equal to Z with the sign changed; and t, midpoint in each length group. Here only the descending right limb is taken for the estimation of Z. Length frequency distribution was smoothened by a 3 point moving average of numbers in each length group.

Natural mortality coefficient was estimated by methods[9,10]. The largest fish observed during the present study was 225 mm. Using the formula of Beverton and Holt[11] the t_{max} was calculated as 3.61 y. The mean environmental temperature was taken from Bapat *et al.*[12]. The exploitation rate and ratio was calculated[11].

Using the method Bhattacharya[7] the monthly distribution of components and their mean lengths were made (Fig. 1). For the 12 month period spreading from January to December 45 components (mean lengths) could be resolved. Highest of 5 components in a month was resolved in March, May, August and November and lowest components of 3

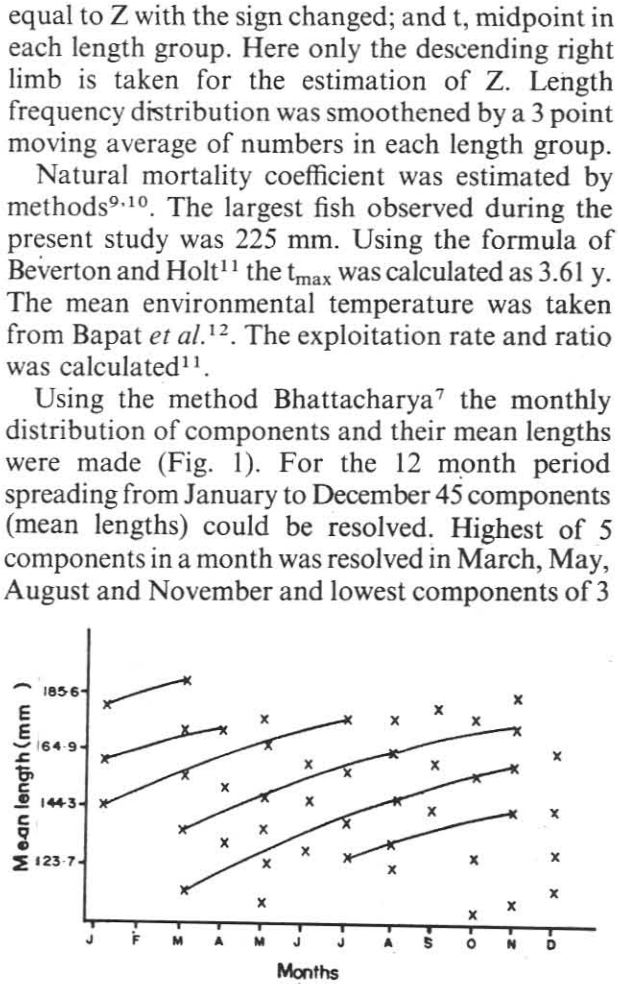

Fig. 1—Mean lengths of the assumed cohorts for the Bhattacharya plot

were resolved in January, April, June and September. A total of 6 curves were obtained and employing Gulland and Holt's plot[8] (Fig. 2) asymptotic length and growth coefficient were estimated as 239 mm and 0.777 on annual basis. The t_o was as estimated -0.0381y. The lengths attained by this species at the end of 6, 12, 18 and 24 months were calculated as 82, 132, 166 and 192 mm. Length growth parameters of *J sina* based on the von Bertalanffy's can be written as

$$L_t = 239\ [1 - e^{-0.777(t-(-0.03814))}]$$

The instantaneous rate of total mortality coefficient (Z) for the years 1987 to 1990 was 4.53, 4.46, 4.73 and 3.68 respectively (average 4.36). The natural mortality coefficient (M) obtained was 1.76 by Cushing's and 1.62 by Pauly's method.

As the asymptotic length of *J sina* is low, the natural mortality rate would be high. Moreover, sciaenids form food of a large number of fish groups. Therefore M of 1.76 obtained by Cushing's method was considered more reasonable and the same taken for further calculations. The fishing mortality coefficient obtained by subtracting M from Z was thus $F = Z - M = 4.36 - 1.76 = 2.59$. Both, the exploitation rate (U) and exploitation rate (E) were calculated as 0.59.

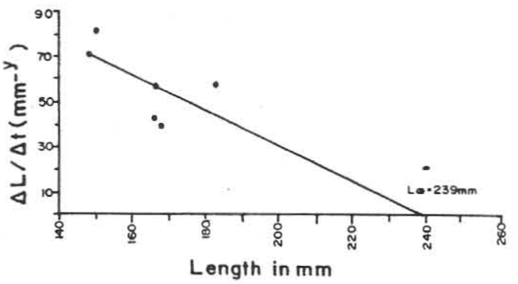

Fig. 2—Gulland and Holt's plot for *J. sina*

Nair[13] reported that *Pseudosciaena sina* (=*Johnieops sina*) from Calicut water attains 135 and 165 mm at the end of 1st and 2nd y of its life. The von Bertalanffy's growth parameters have not been estimated by him. Growth rate of *J. sina* estimated from Calicut waters compares well with the 132 and 192 mm estimated for the same species in Bombay. In Bombay also 0 and 1 y class groups were the mainstay of fishery as reported from Calicut waters[13].

Inverse relationship between growth coefficient K and longevity of the fish is well documented. The basic concept behind this being that a slow growing fish with a low K cannot bear high M and if this happens the species would soon be extinct[6]. Growth coefficients of various lesser sciaenids from Indian waters[14] fall in the range of 0.21-1. The growth coefficient of 0.777 for *J. sina* obtained in the present study is within that range. Furthermore, the K of *J sina* is close to that of *J. carutta* (0.762/y) reported from Madras[15]. The asymptotic length for *J. carutta* from Madras coast is 259 mm which is very close to the L_∞ of, *J. sina* (239 mm) estimated in the present study.

Natural mortality coefficient of 1.76 estimated by Cushing's[10] model is relatively higher than *J. vogleri, J. macrorhynus* and *O. cuvieri*[2-4]. But it must be noted that these species grow to relatively larger size (35.4, 31.0 and 39.5 cm respectively) and it is well known the larger the size, less would be predators and consequently lower would be the mortality rates.

In tropical multispecies multigears systems, the estimation of species specific efforts is rather difficult. Because of this the conventional method of estimating M by Z against efforts often gives errorneous results. Thus a number of methods have to

Table 1—Growth, natural mortality and M/K ratios of some of the sciaenids

Species/locality	Body Size/L_∞ in cm	K	M	M/K	Source of information
San Miguel Bay					
D. russelli	17.5	0.95	2.01	2.11	Ingles and Pauly[14]
O. ruber	25.5	0.44	1.02	2.32	Ingles and Pauly[14]
P. macropthalamus	20.0	0.6	1.43	2.38	Ingles and Pauly[14]
Bombay Coast					
J. vogleri	35.4	0.5077	1.0	2.16	Chakraborty[1]
O. cuvieri	39.5	0.5331	1.3	2.43	Chakraborty[2]
J. macrorhynus	31.0	0.5415	1.18	2.17	Chakraborty[3]
J.sina	23.9	0.5415	1.76	2.32	Present study
Andhra Coast					
J. carutta	33.3	0.44	1.0	2.27	Murty[18]

be tried to choose most appropriate estimate of natural mortality for a particular species. In the present study 2 methods[9,10] were employed for estimating M.

M/K ratio is constant for closely related species and often similar taxonomic group[16,17]. Therefore, given this constant for one species and K for a closely related species, M for the latter could easily be worked out. M/K ratios of some of the sciaenids from Indian and International waters[14] are presented in Table 1. In the present investigation M/K ratio was 2.32 thus substantiating the constancy of M/K ratio of a family or similar taxonomic group.

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