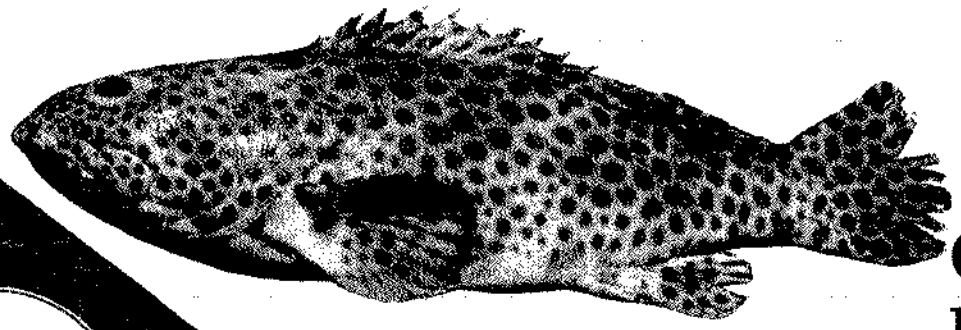

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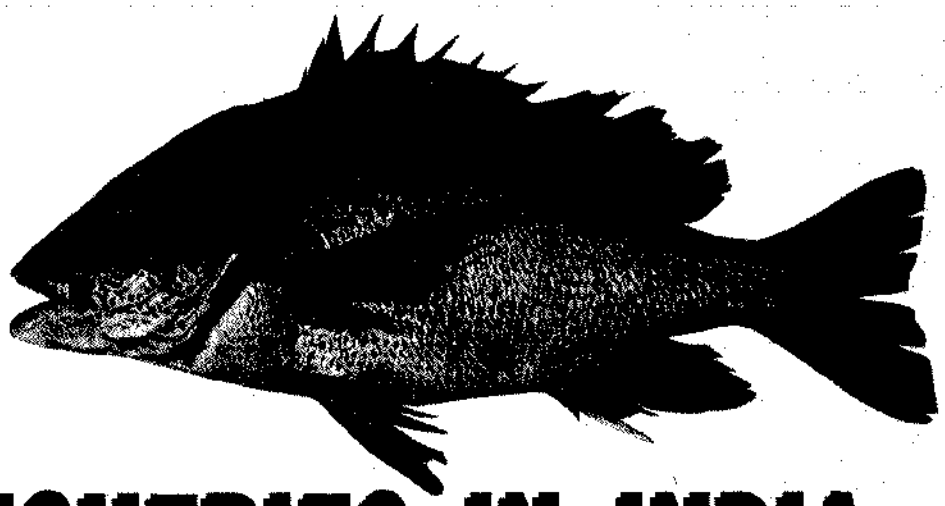

# PERCH FISHERIES IN INDIA

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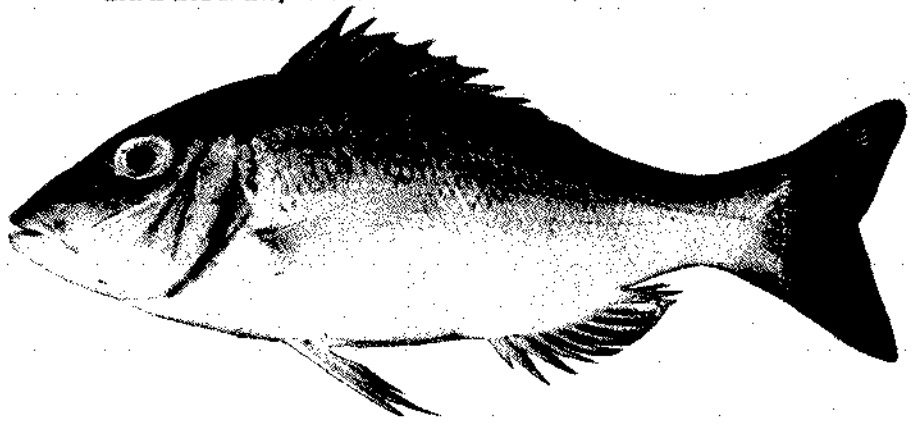

*Bull. Cent. Mar. Fish. Res. Inst.*, 1994, 47 : 121 - 127



# FISHERY, AGE, GROWTH, MORTALITY AND STOCK ASSESSMENT OF *PRIACANTHUS HAMRUR* FORSKÅL FROM BOMBAY WATERS

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ABSTRACT

Perches form an important marine fisheries resources from the coast of India. During 1969 - 81 period the average catch of perch was 27,184 tonnes. The annual average catch of perch during 1983 - 85 period in Maharashtra was 6508 t contributing 11% of the all India perch catch. The annual average catch of this resource at New Ferry Wharf and Sassoon Dock landing centres of Greater Bombay during 1980 - 88 period was 1791.6 t with New Ferry Wharf contributing 83.87% and Sassoon Dock 16.13%. Fitting of quadratic equation to the catch at both the landing centres indicated increasing trend.

Age and growth study on *Priacanthus hamrur* Forskål shows that this species grows to 193, 283 and 323 mm at the end of I, II and III years of its life. The von Bertalanffy's growth parameters in length were estimated as follows : $L_\infty$ = 360 mm, K = 0.736 (annual) and $t_0$ = -0.009116 years. The total, natural and fishing mortality for 1989 - 90 period were calculated as : Z = 3.08, M = 1.52 and F = 1.56. The exploitation ratio (E) and exploitation rate (U) were calculated as 0.506 and 0.482 respectively. The standing stock (Y/F) and total stock (Y/U) were estimated as 331.92 t and 1074.28 t respectively as compared to the present combined yield of 517.81 t from New Ferry Wharf and Sassoon Docks. The MSY was estimated as 201.8 t.

## INTRODUCTION

The perches form an important fishery, but the exploitation of this resource is limited to the narrow belt of the continental shelf of about 50 m depth covering an area of 1,80,539 km. Annually on an average 59,215 t of perches are landed by different types of gears, both by mechanised and non-mechanised vessels along the east and west coasts of India (Jones and Banerjee, 1973; Anon., 1981, 1983, 1986). During 1969-81 period an average of 27,184 t to of perches were landed in India with fluctuations from 12,865 t in 1969 to 49,312 t in 1978 (Kasim *et al.*, 1989). During 1982-85 period the total catch of perches in Maharashtra was 6508 t contributing 11% of the all India catch of perches.

Perches are landed as by-catch of shrimp trawl and the area of operation, types of boats, etc. have been discussed by Chakraborty *et al.* (1983).

The total catch of New Ferry Wharf and Sassoon Dock during 1980 - 88 period was 16,124.8 t by an estimated 4,10,652 units. The contribution of New Ferry Wharf being 13,523.5 t and that of Sassoon Dock 2601.3 t. Percentage-wise New Ferry Wharf and Sassoon Docks contributed 83.87 and 16.13 respectively.

Priacanthids are widely distributed in the Indian seas. The five species of priacanthids found in Indian waters are *Priacanthus hamrur* Forskål, *P. blochii* Bleeker, *P. tayenus* Richardson, *P. macracanthus* Cuvier and *P. cruneatus* Lacepede. Of these five species, the most dominant species occurring in the Bombay waters is *P. hamrur*. This species is distributed in the east coast of Africa, seas of India to Malay Archipelago. In the present communication, based on eighteen months data from February 1989 to July 1990, the von Bertalanffy's growth parameters in length, mortality estimates, exploitation rate and ratio and stock assessment of *P. hamrur* are reported.

From Indian waters work on the biology of *P. macracanthus* has been done by Rao (1984). Age, growth and mortality estimates of *P. hamrur* have been done by Birader *et al.* (MS).

Stock assessment of *P. hamrur* and priacanthids has been done by Birader (1989) and John and Sudarsan (1988) respectively.

Most of the studies on the biology, growth and mortality parameters of priacanthids are restricted to southeast Asian countries. *P. macracanthus* has been worked out by Nugroho and Rusmadji (1983). Chomjurai (1970) and Ingles and Pauly (1984) have worked on Samar Seas and the Gulf of Thailand materials. Dwiponggo *et al.* (1986) have worked on *P. macracanthus* from Java Sea.

## Material and Methods

The catch and effort data were collected for the respective landing centres by the field staff. Apart from this, the data on catch composition and length frequency were collected once in a week at the landing centre.

In order to determine the trend of fishery the following quadratic equation was fitted $Y = a+b+ct^2$ where Y = annual yield, t = year with base year 1980 as $t_0$ and a, b and c are constants. This equation was worked out following Snedecor (1940).

Total length from the tip of the snout to the tip of the tail was taken. The length data obtained were raised to day's catch and the same were raised for the month. The length data obtained were raised to day's catch after grouping them in 10 mm groups for the growth study. Scatter diagram technique of Devaraj (1982) was employed in the present study. The growth was expressed using von Bertalanffy's (1983) equation given as

$$L_t = L_\infty \ (1-e^{-K\,(t-t_0)})$$

Where $L_\infty$ is the asymptotic length, 'K' is the growth coefficient and '$t_0$' the theoretical age at which length is zero. '$L_\infty$' and 'K' were estimated by Ford-Walford plot (Ford, 1933; Walford, 1946) of $L_t$ against $L_t+1$ on monthly basis and '$t_0$' was estimated by Gulland and Holt's (1959) plot.

The instantaneous rate of total mortality 'Z' was calculated by length converted catch curve method of Pauly (1982).

The natural mortality coefficient was estimated by the method of Cushing (1968). Here, in the unexploited state, if the number of one year olds are taken as 100 and the number surviving to maximum age ( $T_{max}$) as 1 then the formula could be written as

$$M = \frac{1}{T_{max}^{-1}} . \log e \frac{100}{1}$$

The largest fish recorded during the present study was 341 mm. By using VBGF the age at this length was estimated as 4.02 years.

The instantaneous rate of fishing mortality 'F' was obtained by substracting M from Z.

The exploitation ratio (E) and exploitation rate (U) were calculated by the formula

$$E = \frac{F}{F+M} \text{ and } U = \frac{F}{Z} (1-e^{-z})$$

The total and standing stocks were estimated by using the relationship Y/U and Y/F in the usual notations. Maximum sustainable yield (MSY) was estimated by Gulland's (1971) formula

$$MSY = 0.4 \times M.Bv.$$

Instead of 0.5 as a multiplicative factor 0.4 was used. Here 'M' is the natural mortality coefficient and Bv is the virgin biomass.

## Results

### *Catch statistics*

The average annual catch of perhces at New Ferry Wharf and Sassoon Dock during 1980 - 88 period was 1791.6 t of which 1502.6 t and 289.0 t are respective shares of the former and latter landing centres respectively. The highest catch at Sassoon Dock was 907 t in 1988 whereas at New Ferry Wharf the highest catch of 6170 t was recorded in 1987. The lowest catch at both the centres was recorded in 1981 *i.e.* 23.25 t for Sassoon Dock and 40.3 t for New Ferry Wharf.

The lowest catch per boat of 38.4 kg was recorded in 1981 whereas the highest catch per

boat of 198.95 kg was recorded in 1987 for New Ferry Wharf. The lowest catch per boat at both places was in 1981 *i.e.* 1.05 kg for Sassoon Dock and 2.12 kg for New Ferry Wharf (Fig. 1). The percentage contribution of perch to the total fish catch at New Ferry Wharf varied from 0.33% in 1980 to 12.05% in 1987 and the same for Sassoon Dock varied from 0.12% in 1987 to 2.03% in 1988.

Monthwise average catch of 1980-88 shows that highest catch of 2569 t with CPUE of 109.54 Kg was obtained in November at New Ferry Wharf contributing 5.7% to the total fish catch.

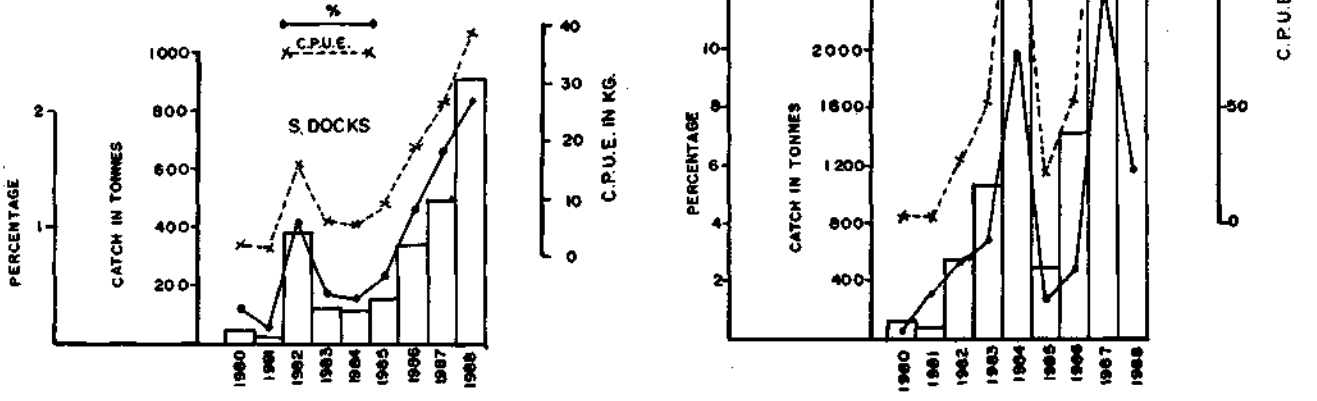


Fig. 1. Annual catch, CPUE and percentage of perch in total fish catch at Sasoon Dock and New Ferry Wharf during 1980-'88.

This was followed by 1836 t in December with CPUE of 73.49 kg and contributing 3.7% to the total fish catch. Poorest catch of 11.61 t with CPUE of 4.89 kg was obtained in July contributing only 0.43% to the total fish catch. October - December appears to be the peak season for these perches at this landing centre (Fig. 2).

At Sassoon Dock also the highest CPUE of 19.41 kg was recorded in November with a catch of 328 t and it contributed 1.33% to the total fish catch at this landing centre.

Percentagewise highest contribution was obtained in September (7.91) at New Ferry Wharf and 1.36 in May at Sassoon Dock. At Sassoon Dock November - January appears to be the best season for perches.

Fitting of the quadratic for the catch of Sassoon Dock and New Ferry Wharf separately and Sassoon Dock and New Ferry Wharf catches pooled indicated an increasing trend (Fig. 3, 4 and 5). The equations obtained are given below.

Sassoon Dock : $Y = 227.5798 + -107.577\ t + 18.926\ t^2$ ($r^2 = 0.79231$)

New Ferry Wharf : $Y = 402.1339 + -81.483\ t + 295.967\ t^2$ ($r^2 = 0.69368$)

New Ferry Wharf and Sassoon Dock : $Y = 629.7137 + -403.545 + 100.412\ t^2$ ($r^2 = 0.651660$)

The increasing trend in the perch catch is already indicated at New Ferry Wharf and Sassoon Docks. At New Ferry Wharf from a catch 40.36 t in 1981 the catches have gone upto 6170 t in 1987. At Sassoon Dock too from 23 t in 1981 the catches have gone upto 907.29 t in 1988.

### *Age and growth*

A total of 2507 specimens in the size range of 150-341 mm were measured for length

frequency studies during February 1989 to July 1990. By connecting maximum number of modes

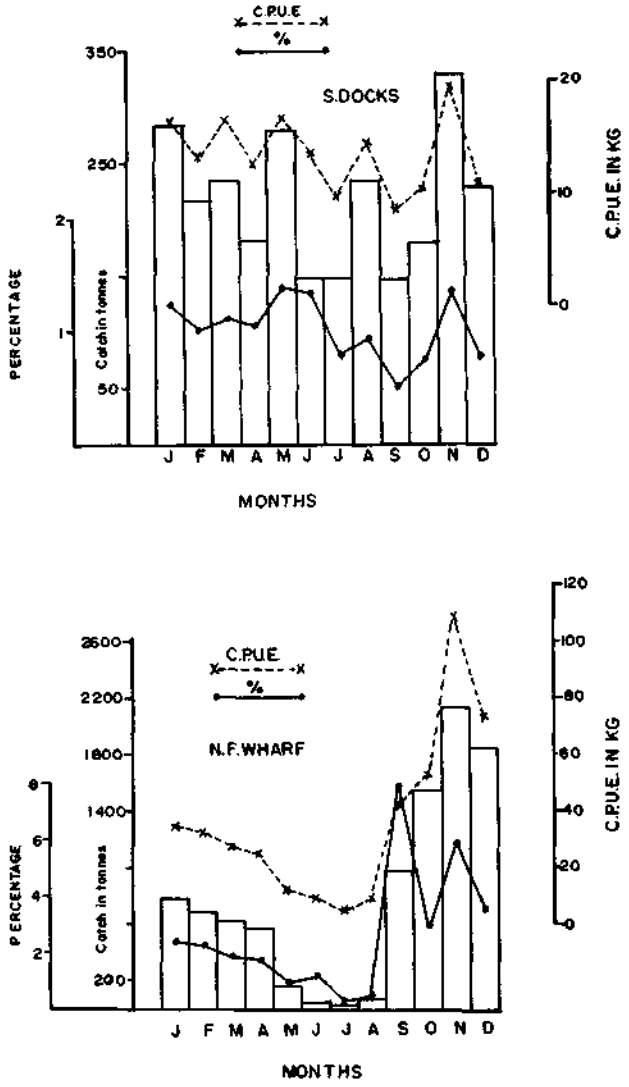


Fig. 2. Monthwise catch, CPUE and percentage of perch in total fish catch.

in the scatter diagram it was possible to obtain ten growth curves of almost identical shapes (Fig. 6). The average length at monthly interval were read and the same were used for the Ford-Walford plot. The growth coefficient, K was estimated as 0.736 on annual basis and the asymptotic length as 360 mm. The '$t_0$' was estimated as -0.009116 years. This species grows to 193, 283 and 323 mm at the age of I to III years of its life. The Ford-Walford plot and growth curve of this species is presented in Fig. 7 and 8 respectively. The $L\infty$ of 360 mm is close to largest speciman of 341 mm obtained in the population during the present study. Using the VBGF formula the age at 431 mm was calculated as 4.02 years. The VBGF for this species could thus be written as

$$L_t = 360\ (1\text{-}e^{-0.736\ (t+0.009116)})$$

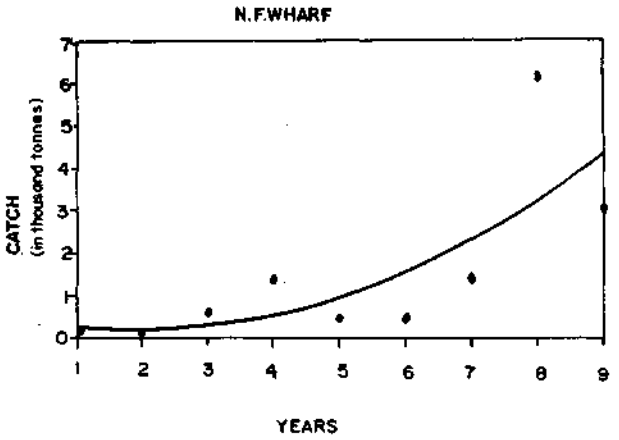


Fig. 3. Trend of perch fishery at N.F. Wharf as indicated by fitting of quadratic equation.

### *Mortality rates*

Using the length converted catch curve method the total mortality coefficient 'Z' for this species for the year 1989-90 was estimated as 3.08 (Fig. 9). The natural mortality coefficient 'M' is estimated to be 1.52. The fishing mortality is obtained by substracting M from Z and it is 1.56. The exploitation ratio (E) and exploitation rate (U) were obtained as 0.505 and 0.482 respectively.

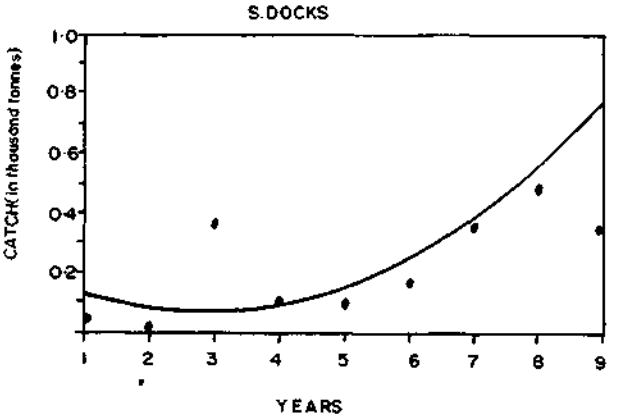


Fig. 4. Trend of perch fishery at S. Dock as indicated by fitting of quadratic equation.

### *Stock assessment*

The total and standing stock of *P. hamrur* obtained from the combined catch of New Ferry

Wharf and Sassoon Dock were estimated as 1074.28 and 331.92 t respectively. The MSY was estimated as 201.80 t.

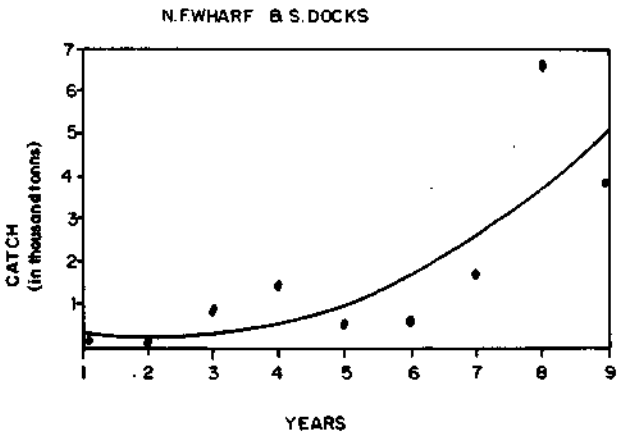


Fig. 5. Trend of perch fishery at N.F. Wharf & S. Dock as indicated by fitting of quadratic equation.

## DISCUSSION

The catches of perch show fluctuating trend. The lowest catch of 23.45 t and 40.36 t at Sassoon Dock and New Ferry Wharf respectively in 1981 increased to 907 t and 6170 t in 1988 and 1987 in these respective centres. The catches at New Ferry Wharf went up from 1413 t in 1986 to 6170 in 1987, but then again went down to 3043 t in 1988. At Sassoon Dock a steady increase in the catch from 362 t in 1986 to 907 t in 1988 was observed. From the overall catch of perch it is obvious that the contribution of New Ferry Wharf is higher *i.e.* 83.87% as compared to 16.13% by Sassoon Dock. The monthwise catch indicated that the catches of perch at New Ferry Wharf was better in October - December period, while the same was true in the months of November - January for Sassoon Dock.

The increasing trend of the catch at both the landing centres is clearly indicated by the resultant graph obtained by fitting of the quadratic equation. From the Andhra Coast, Rao (1984) reported that *P. macracanthus* grows at the rate of 10 mm/month for specimen measuring 140-240 mm. Apart from this there is no published account on the age and growth studies of priacanthids from the Indian waters.

Chomjurai (1970) observed a monthly growth rate of 2 mm for *P. tayenus* from Samar Sea. Nugroho and Rusmadji (1983) reported $L\infty$ and K of *P. macracanthus* as 26.0 cm and 1.36 respectively. Ingles and Pauly (1984) reported that the $L\infty$ and 'K' of *P. tayenus* as 29 cm and 1.25 respectively. Working on *P. macracanthus* Dwiponggo *et al.* (1986) reported the asymptotic length and growth coefficient to be 23.8 and 1.30, and 23.0 and 1.15 based on the data of 1977-78 and 1978-79.

In the present investigation however, the $L\infty$ of *P. hamrur* was estimated as 36 cm and the annual growth coefficient as 0.736. This species grows to 193, 283 and 323 mm at the end of I, II and III years of its life in Bombay waters. As the growth coefficientis inversely proportional to the asymptotic length it is obvious that the higher 'K' obtained by workers of southeast Asian countries is related to the smaller sizes the respective species attain there.

There is a wide variation in the estimates of mortality rates of *Priacanthus* spp. Ingles and Pauly (1984) reported 'M' of 8.09 for *P. tayenus* from Samar Sea. Nugroho and Rusmadji (1983) estimated 'M' of 3.45 for *P. macracanthus* whereas Dwiponggo *et al.* (1986) the 'M' as 2.13 and 2.28. John and Sudarsan (1988) calculated the 'M' of *Priacanthus* spp. using Pauly's (1979) empirical formula utilizing the $L\infty$ and K of priacanthids from Southeast Asian countries. The 'M' thus obtained ranged from 1.7 to 1.9 and for their study on the stock assessment they assumed the 'M' of priacanthids of the Indian waters as 1.75. Birader *et al* (MS) estimated the 'M' of *P. hamrur* as 1.0.

The M estimated by Ingles and Pauly (1984) and Nugroho (1983) are obviously over estimate and as it does give a proper M/K ratio which should fall between 1 - 2.5 (Beverton and Holt, 1959). The estimates of John and Sudarsan (1988) also appear to be on the higher side as the calculations are based on the growth parameters of Java and Samar Seas where depending on the species the $L\infty$ varied from 23-29 cm and K 1.15 - 1.36. Birader *et al.* (MS) obtained a 'M' of 1.0 which is lower than the present study of 1.52. But we must give due consideration to the fact that Birader *et al.* (MS) have recorded specimens of *P. hamrur* upto 36.0 cm whereas the largest specimen obtained during the present

study is only 34.1 cm. The chief reason for obtaining larger specimens in the former and small in the latter is due to the fact that the data by Birader *et al.* (MS) is collected from M. V. *Saraswati* which could venture into the deeper waters as compared to data collected from commercial trawlers in the present study which carry out fishing operations upto a depth of 70 m only.

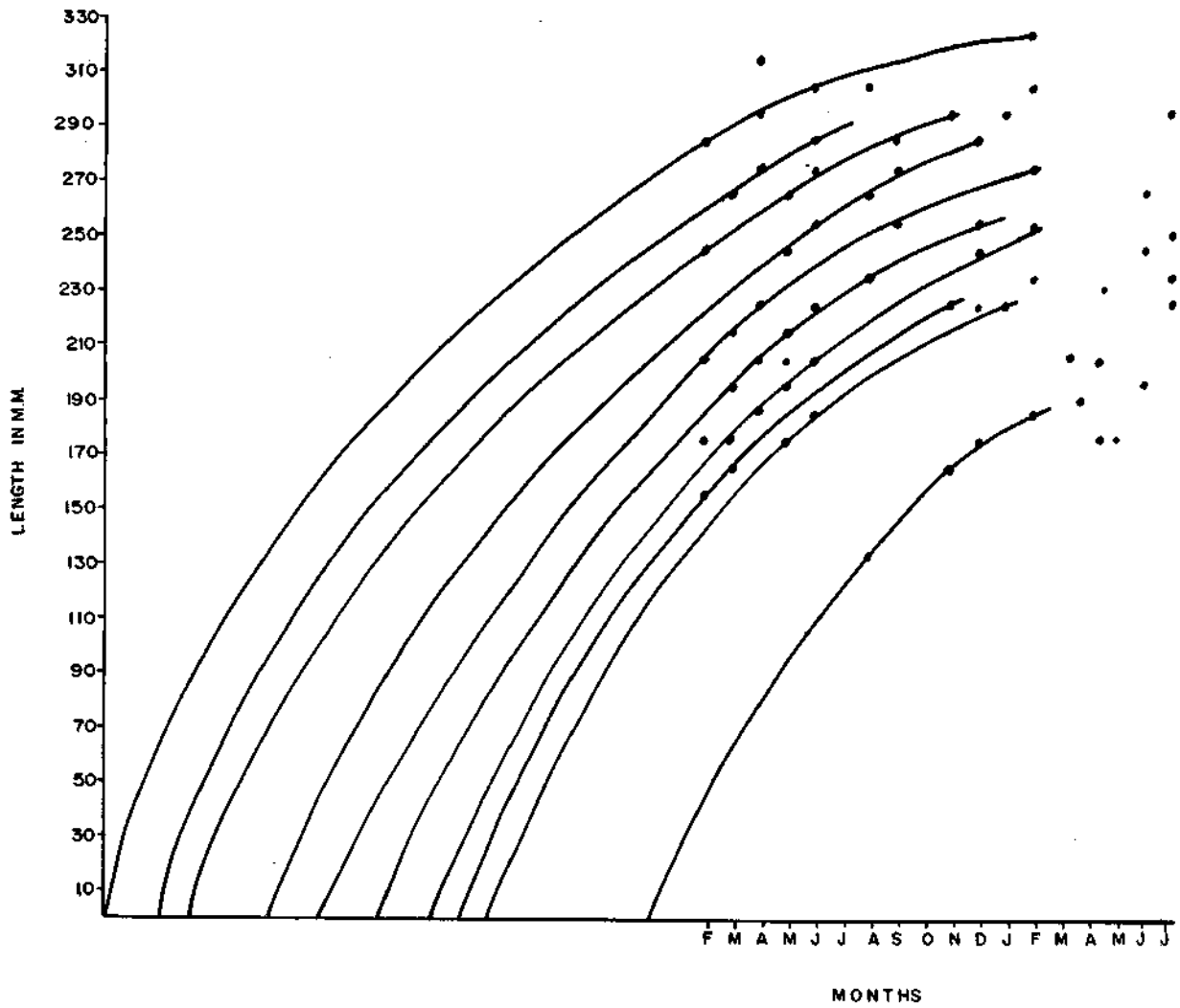


Fig. 6. Scatter diagram of modal length for *P. hamrur*.

The natural mortality of fishes vary with age (Boiko, 1964) and most probably with predator abundance (Pauly, 1980 a, 1982; Munro, 1982; Jones, 1982). Natural mortality should be related to size since larger fish as a rule would have lesser predators. Since 'M' is related to longevity, its relation to growth coefficient is obvious. This could be the chief reason for a higher 'K' and 'M' obtained for Priacanthids by workers from Java and Samar Seas while the reverse is true from the study of *P. hamrur* by Birader *et al.* (MS) from Indian waters. The 'M' of 1.52 thus obtained in the present study appears to be very reasonable.

The total stock and standing stock for this species based on the data collected from New Ferry Wharf and Sassoon Dock landing centre of Greater Bombay for the period 1989-90 comes to 1074.28 t and 331.92 t as compared to the present yield of 517.81 t. Taking 0.4 as the

multiplier, the MSY was estimated as 201.8 t. According to Gulland (1971) MSY = 0.5 MBv where M is the natural mortality and Bv is the

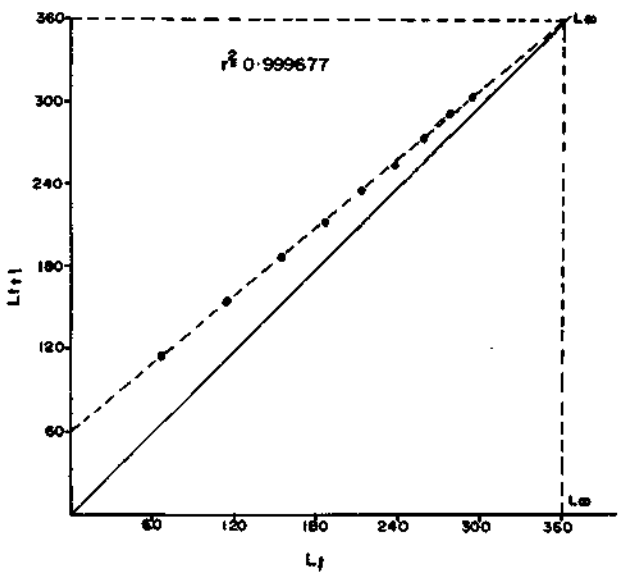


Fig. 7. Ford-Walford plot for *P. hamrur.*

virgin biomass. The use of 0.5 as the multiplication factor has been criticised by many

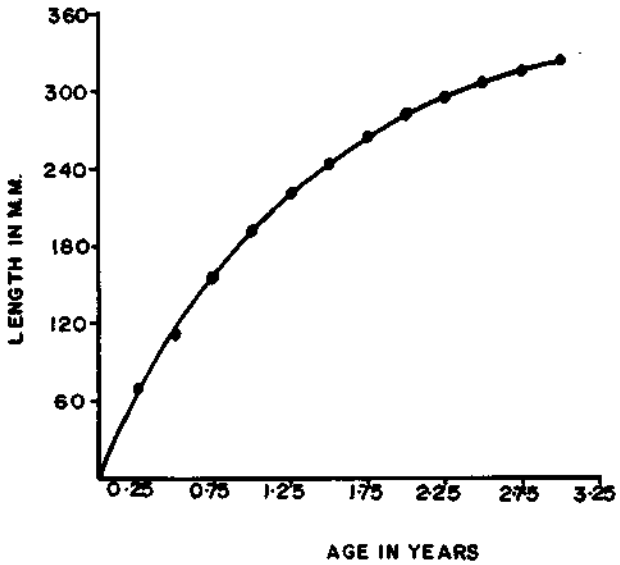


Fig. 8. Growth curve of *P. hamrur.*

authors (Francis, 1974; Buddington and Cooke, 1983; Caddy and Csirke, 1983; Garcia *et al.*, 1987). Garcia and Le Reste (1981) used value ranging from 0.32 to 0.44. John and Sudarsan (1988) used 0.4 as the multiplication factor. Sparre (1988) suggested a factor of 0.2 to be more appropriate. Thus there is no hard and fast rule for taking the multiplication factor and the estimates arrived at could be subjective.

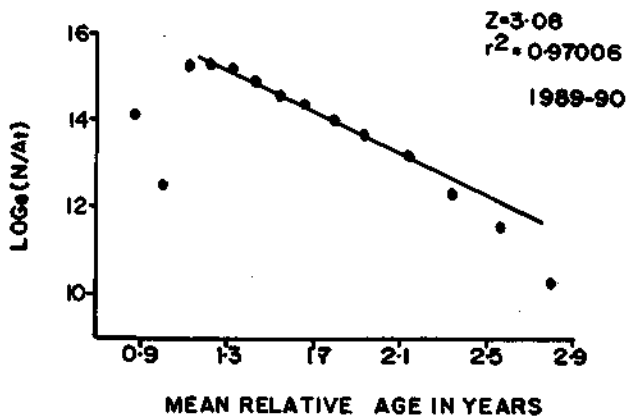


Fig. 9. Length converted catch curve for *P. hamrur.*

*Priacanthus* spp. from the Waltair Coast is consumed both in fresh and dried condition and is very popular with the poorer section of the people (Rao, 1984). Priacanthids compare favourably as far as the nutritive value of other popular table fishes. Studies on the meat characteristics reveal that it is of high nutritional value with 17.5% protein and 5.1% fat (John and Sudarsan, 1988). They have a good international market as priacanthids are highly priced in Southeast Asian countries. The comment that the big-eye snappers are being exploited only by chartered vessels (John and Sudarsan, 1988) is not correct as the present study is based, exclusively on the data of the commercial trawlers operating upto a depth of 70 m. In the present days of paucity of fish protein it would be very useful to popularise the Priacanthids in the domestic as well as international markets.

## ACKNOWLEDGEMENT

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