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Length-Weight Relationship of *Priacanthus hamrur* (Forsskal) Inhabiting the Continental Slopes Beyond 300m Depth Along the West Coast of India

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The length–weight relationship of *Priacanthus hamrur* inhabiting the continental slopes beyond 300m along the west coast of India was estimated. The length–weight relationship was analyzed using the formulae $W = a L^b$ which was further logarithmically transformed into Ln W=Ln a+b Log L. A total of 295 fishes comprising of 105 females and 190 males with size groups ranging from 196 to 297mm(TL) were used. The length–weight relationship of *P. hamrur* can be represented by the equations, Females $W=0.0097\ L^{3.05}$ and Males $W=0.025\ L^{2.73}$. While comparing the 'b' values of male, female and combined *P.hamrur*, it was understood that there was no significant difference among them. The value of the exponent 'b' computed in the parabolic equation for females did not show much variation for the isometric value of 3 whereas the value of b in males was found to be less indicating a very slight negative allometric growth. This was also reflected on the length-weight relationship of the combined population of *P. hamrur*.

Key words: Length-weight relationship, *Priacanthus hamrur*, continental slope

Length -weight relationship of fishes are important in fisheries biology because they allow the estimation of average weight of the fishes of a given length group by establishing a mathematical relation between the two (Beyer, 1987) and also a comparison of inter-specific and inter-population morphometrics of the fish species is also possible which is useful for assessing the relative well-being of the fish population (Bolger & Connolly; 1989). Like any other morphometric characters, length- weight relationship can be used as a character for the differentiation of taxonomic units and this relationship is seen to change with various developmental events in life such as metamorphosis, growth and onset of maturity (Le Cren, 1951). Besides this, length-weight relationship can also be used in setting yield equations for estimating the number of fishes landed and comparing the population in space and time (Beverton & Holt, 1957) and thereby helping in population dynamics and stock assessment (Gulland, 1983) and also for allowing future comparisons between populations of the same species encountered at different locations. No attempt was hitherto made to study the length-weight relationship of *P.hamrur* inhabiting beyond the depths of 300m along the West coast of India. However, similar studies were conducted on *P. hamrur* along the west coast between depth 100 – 300m (Khan *et.al.*,1996) and coastal waters of the east coast of India by Philip & Mathew (1996) and on *P. macranthus* (Rao, 1984). The present paper contributes to the length -weight relationship of *P. hamrur* population collected at the continental slopes below 300 m depth, all along the west coast of India.

Materials and Methods

Samples of *P. hamrur* collected during the trawl survey of FORV Sagar Sampada along the Indian EEZ during three cruises in the years 1999, 2000 and 2001 respectively, covering about 70 stations were utilized for this study. These stations were selected randomly within latitudes 7°N - 20°N along the west coast. The trawling operations were conducted for 45 minutes at each station at different depths ranging from 200-500m. Random samples were collected from each haul for biological investigation on length frequency, sex, maturity, food, etc. A total of 295 fishes comprising of 105 females and 190 males ranging from 196 to 297mm were used for the analysis. For length and weight studies, length of the fish was measured from the anterior part of the head with the mouth closed, to the farthest tip of the caudal fin and this was assigned as the total length (TL) of the fish. Total weight (W) of the fish was rounded to the nearest ten grams was recorded with the help of a top loader scale (Kurup and Samuel, 1992). Sample size (n) depended on species size range and availability.

The relation between length and weight in a fish could be expressed as:-

$$W = aL^b \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Logarithmic transformation of the above formula gives a linear equation:-

$$\log W = \log a + b \log L \quad \ldots\ldots\ldots \quad (2)$$

where W is weight in grams, L is the length measured in centimeters, 'b' the regression coefficient and 'a' a constant. This represents a general linear equation and the values of 'a' and 'b' are estimated by the method of least square regression (Zar, 1984). Analysis of covariance (ANACOVA) on the regression equations and comparisons of slopes were done following Snedecor & Cochran (1967).

Results and Discussion

The size of *P. hamrur* ranged from a minimum length of 196mm to a maximum length of 297mm, with a mean length of 199mm and the weight ranged from a minimum of 46.37g and maximum of 268g, with a mean weight of 86.71g. Majority of specimens analyzed were found to belong to the size group of 207 - 252mm. The length-weight relationship estimated for *P. hamrur* collected along the west coast beyond 300m depth is represented in Table 1. The logarithmic regression equations worked out by substituting the respective values of 'a' and 'b' give an overall picture about the length-weight relationship of the female individuals, male individuals, as well as

Table 1. Regression values relating to the length and weight of *Priacanthus hamrur*

		Length (TL) in cm		Weight (W) in gms				
	n	min	max	min	max	b	a	r
CUMULATIVE	284	14.6	27.7	35.7	257	2.8567	-1.7579	0.941
FEMALE	109	15.5	27.7	44	257	3.0454	-2.0015	0.981
MALE	186	14.6	24.4	35	24.4	2.7325	-1.5972	0.916

Logarithmic Equation
Log W= -1.7579+2.8567 Log L
Log W= -2.0015+ 3.0454 Log L
Log W= -1.5972 + 2.7325 Log L

length-weight relationship of both male and female combined in the population

The equations thus worked out are as follows: -

Combined (Fig. 1) :

Log W= -1.76 + 2.86 Log L (r=0.94)

Female (Fig. 2) :

Log W= -2.00+ 3.05 Log L (r=0.98)

Male (Fig. 3) :

Log W= -1.60 + 2.73 Log L (r=0.92)

The corresponding exponential formulae in the form $W = a L^b$ can also be expressed as follows: -

1. $W=0.018 \quad L^{2.86}$
2. $W=0.0096 \quad L^{3.05}$
3. $W=0.025 \quad L^{2.73}$

In the present study, the exponential value 'b' for females was 3.05, which indicates that the growth is isometric whereas in males the 'b' value is slightly less than ideal 'b' value, which was worked out to be 2.73. This denotes that in males, the growth does not exactly follow the cube law and exhibits a slight negative allometric growth. When the length -weight relationship of the population combining both males and females was analyzed, a similar trend of a slight negative allometric growth was observed due to the predominance of males in the samples studied. The 'b' value of the combined population was worked out to be 2.86. It would thus appear that in *P.hamrur* the weight increases by power less than 3 with unit increase in body length. The regression values of male, female and combined population were compared with the help of ANACOVA and the results show that there is no significant difference (P>0.05)

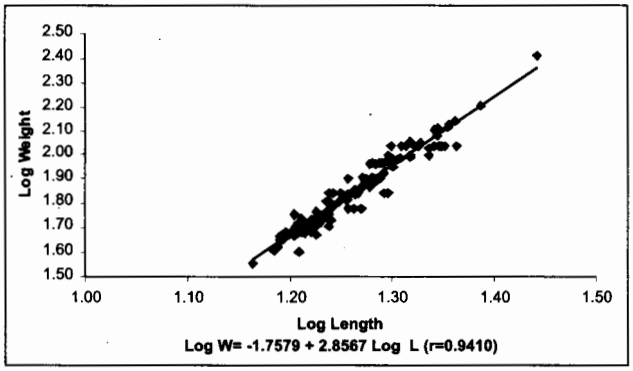

Fig 1. L-W relationship of *Priacanthus hamrur* (cumulative)

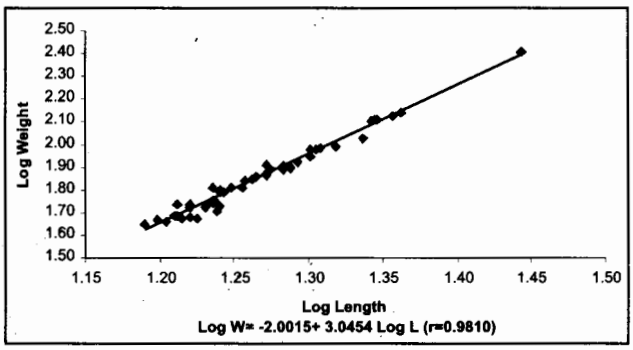

Fig 2. L-W Relationship *Priacanthus hamrur* (female)

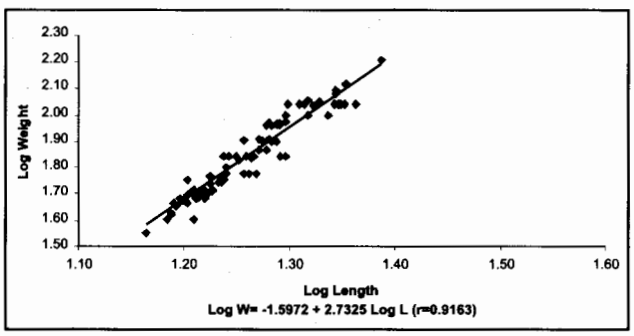

Fig 3. L-W relationship of *Priacanthus hamrur* (male)

in the 'b' values among them. It can therefore be concluded that the length-weight relationship worked out for the combined population will be a sufficient representative of both the male and female population of *P.hamrur*.

For an ideal fish, which maintains dimension equality, isometric value of 'b' tending to 3 has occasionally been observed (Allen, 1938). Slope value less than 3 indicates that fish becomes more slender as it increases in length and with a slope value

greater than 3 denotes stoutness indicating allometric growth (Grover & Juliano, 1976). However, deviation from cube law is often observed in most of the fishes as they change their body shape during growth. The value of 'b' usually varies between 2.5 and 4.0 (Martin, 1949). In this case the fishes show a trend of declining body weight.

These results were seen to be in accordance with the reports of Letorneur *et al.* (1998) on *P.hamrur* collected from coral reefs and lagoons of New Caledonia at very shallow depths of 50m. Here the 'b' value was reported as 2.775. Lester & Watson (1985) reported a 'b' value of 2.7 and 2.9 respectively for *P. tayenus* and *P.macracanthus*. In *P.macracanthus*, Joung & Chen (1992) observed that 'b' value obtained for females did not show significant variation from the isometric value 3 whereas in male the departure from 3 was significant. They reported a 'b' value of 2.67 for male *P.macracanthus*. Nugroho and Rustam (1983) estimated 'b' value of 2.7 for both sexes of *P. macracanthus*. Whereas Khan *et al.*, (1996) reported even less 'b' values viz. 2.3 and 2.6 for males and females of *P. hamrur* respectively in the west coast of Indian EEZ in the depth 100 – 300m. All reports thus indicating *P.hamrur* populations to exhibit a trend of a negative allometric growth.

In contrary, Philip (1994) observed in a population of male *P.hamrur* collected along the coastal waters from the east coast of India, the regression coefficient 'b' was reported to be 3.11. This indicated a positive allometric growth i.e., the fish grew stouter with the increase in length when compared to its related species in the Southeast waters. However the 'b' value for female of the same population was found to be in accordance to the cube law. Philip & Mathew (1996) again worked out an higher b value of 3.11 for a sample of *P. hamrur* collected from coastal waters of Vishakapatanam where the samples used for the study was predominated by females invariably representing smaller size ranges.

The value of 'b' is inferred to be greatly influenced by the year class of the specimens used for arriving at the length- weight relationship. Positive allometric growth in the population is usually arrived at when there is a predominance of younger fishes or juveniles in the sample, which results a higher 'b'value. On the other hand, predominance of older or mature groups of fishes could significantly reduce the 'b' value.

The length range indicated in this case showed that most of the specimens belonged to the first two years of growth and the occurrence of mature males was seen to predominate over that of mature females. This pattern of distribution may be accounted for the depths at which the fishes were caught. Philip (1994) reported *P.hamrur* to show a distinct pattern of depth wise distribution based on the maturity stages and sex of the fishes. Immature specimens of both the sexes were abundant in areas below 50m whereas the abundance of juveniles was found to decline with an increase in depth. Thus, the mature and the spent individuals were usually concentrated beyond the depths of 200m and this finding would manifest their spawning in deeper waters.

Depth-wise distribution of sexes also showed that there was a remarkable dominance of females in the shallower waters beyond which males predominated and the

males collected from deeper depths were usually the mature and spent ones. Philip (1994) reported that the size at first maturity of *P.hamrur* to be 123.5mm for male and 126.5mm for female. The fish attains this length within 1.5 years of growth. Similar condition was seen in the present study where the number of male specimens used for the length-weight relationship belonged to the size group of 20.7 and 25.2cm, which represents a class of mature individuals. It may therefore be inferred that the reason for a negative allometric growth can be due to the presence of mature males from the samples collected from depths beyond 300m.

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