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Research Note

Length Weight Relationship and Condition Factor of *Botia dario* (Hamilton) from Gumti River of Tripura, India

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Botia dario (Hamilton) is commonly known as Bengal loach and it is one of the endemic ornamental fish of the north-eastern region of the country (Kar & Sen, 2007). It is also esteemed as a food fish on account of invigorating qualities of its flesh (Hussain et al., 2007). *B. dario* is small in size and available in rivers, streams, ponds, lakes and inundated areas throughout Tripura, India. This species has great economic value as an ornamental fish. *B. dario* was discovered as long ago as 1822 by Hamilton. Their body is characterised by base yellow to golden colour with 7-9 blue, green, grey or black body bars usually with thinner, lighter bars between. In some individuals, the bars break-up to varying degrees in a process sometimes referred to as anastomosis meaning patterning can be highly variable, and in *B. dario,* base body colour also ranges from light to dusky, yellowish to greenish. It is one of the most easily recognisable species under the genus due to its particularly curved head.

Length-weight relationship has both applied and basic uses (Pitcher & Hart, 1982). A pre-determined length-weight relationship helps to estimate the live weight of a fish given the length or vice-versa. The length weight relationships are important in fish biology and can provide information on stock condition (Bagenal & Tesch, 1978). Like any other morphometric characters, the length-weight relationship can also be used to differentiate the taxonomic units. This relationship is seen to change with various developmental events in life such as metamorphosis, growth and the onset of maturity. Length-weight relationship can also be used in setting yield equations for estimating the number of fish landed and comparing the population in space and time (Beverton & Holt, 1957). The study length-weight relationship has been done by several workers for different species from freshwater habitats. Some of the recent works in this aspect are those by Mercy et al. (2002), Norejo et al. (2002), Oscoz et al. (2005), Serajuddin (2005), Prasad & Ali (2007), Pervin & Mortuza (2008) and Dars et al. (2010). In fishes, generally the growth pattern follows the cube law (Lagler, 1952). Such relationship for fishes will be valid when the fish grows isometrically. In such cases, the exponential value must be exactly 3. But in reality, the actual relationship between length and weight may depart from the ideal value due to environmental conditions or condition of fish (Le Cren, 1951). However, no such information is available for *B. dario*. Hence the present investigation was undertaken for *B. dario* from Tripura as it is endemic to this region.

The specimens of *B. dario* were collected from Tripura which is situated in 22° 56' N & 24° 32' N and 90° 09' E & 92° 10' E. Fishing gear such as cast nets and traps were used to catch the fish from various region of Gumti River. Fish was collected for a period of eight months (January to August). Fish specimen was identified using keys and descriptions (Talwar & Jhingran 1991; Nalbant, 2002). Specimens were stored in coolers containing ice and transported to the laboratory for further analysis. Total length and weight of 76 (47 female and 29 male) specimens of different length groups was recorded

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in the laboratory using standard methods. The lengths were taken with measuring board to the nearest 0.1 cm. Body weight of individual fish was measured to the nearest 0.1 g with an electronic balance after removing the adhered water and other particles from the surface of body. The degree of association between the length and weight was computed from linear regression analysis.

The length-weight relationship (LWR) was estimated by using the equation: $W = aL^b$ (Le Cren, 1951) where W= weight (g), L = total length (cm), a = constant, b = growth exponent. A logarithmic transformation was used to make the relationship linear.

$$\text{Log } W = \log a + b \log L.$$

The values of the compiled growth exponent were used for the calculation of condition factor, K.

$$K = 100\ W/\ L^b$$

Where K= condition factor, W= total body weight (g), L= total length (cm), b= growth exponent. For each species, the slopes of length-weight regressions were compared against 3 using student's t-test (Sokal & Rohlf, 1987) to determine whether species grew isometrically. The relative condition factor was calculated by the formula: $Kn = W/aL^b$. The observed average weight was plotted against the observed average length to examine the nature of parabola. On converting the values to logarithms, the exponential relationship obtained from the linear equation described above was also examined. The regression of log-weight on log-length was calculated by the method of "Linear" by grouping the sample data into two length groups at 20 mm interval, for male, female and pooled data.

The entire length-weight data of *B. dario* were pooled into a single equation which was calculated to be: Log W= -2.01 + 3.13 log L (r =0.96). A positive correlation between length and weight was indicated by the correlation coefficient. The value of 'b' (regression coefficient) in the equation is 3.13 which indicates that the length weight relationship follow the cube law for isometric growth (Grover & Juliano, 1976).

Length-weight relationship of 47 female specimens and 29 male specimens were studied, the regression equation for female *B. dario* was estimated to be: Log W= -2.06 + 3.19 log L (r =0.98) and for males: Log W= -1.97 + 3.09 log L (r =0.94). On plotting the observed weight of *B. dario* against the observed length a parabolic curve was obtained (Fig. 1). The regression equations on length-weight relationship of *B. dario* has been presented in Table 1. The coefficient of determination (r^2) (Croxton, 1953) revealed that the fitted equation explains the variations in weight in relation to the variation in length. The 'r^2' values showed minimum variation of 89% in weight for male in relation to the variation in length while female showed the maximum 'r^2' value of 97% and for pooled data r^2 value was 92% (Table 1). Condition factor or K value indicates its general appearance and fat content. If the K value is less than 1, it indicates that fish is poor, long and thin and more than 1 indicates that the general well being of fish as good (Goswami et al., 2008). Here the K value is 1.25 for pooled data; for male the K value is 1.22 which indicates less gut content than that of female whose K value is 1.27 (Table 1). The 't' test was conducted to test isometry and the values of 't' for male, female and total are given in Table 1. The 't' test showed significant difference at 5% level denoting allometric growth.

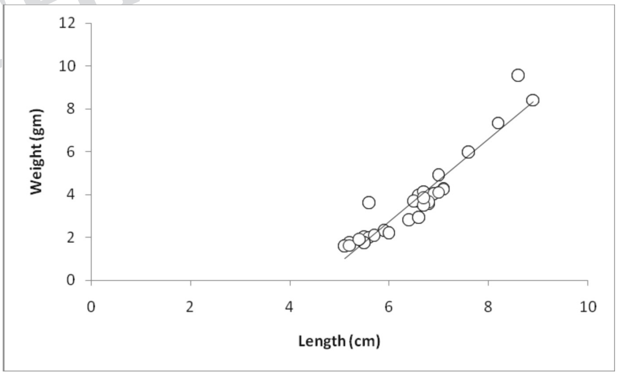

Fig. 1. Length weight relationship of absolute values of Botia dario

Total sample was divided into two groups based on their length. Length-weight equations, condition factor (K) and relative condition factor (Kn) of these two groups are presented in Table 2. Le Cren (1951) and Jhingran (1972) observed that changes in the condition value with the increase in length may yield evidence concerning the size at first maturity. In its variation with the increasing length, the 'K' value (1.30) in *B. dario* showed a peak at length group II (70-90 mm) whereas 'K' value is lower *viz.,* 1.23 in length group I (50-70 mm). From this, it can

Table 1. Regression equations on length-weight relationship of *Botia dario*

B. dario	Logarithmic equation	Corr. Coefficient	Parabolic equation	K	Kn	r^2	t-value
Total	Log W = -2.01 + 3.13 log L	0.96	W = 0.00977 $L^{3.13}$	1.25	-0.0048	92%	18.26*
Male	Log W = -1.97 + 3.09 log L	0.94	W = 0.01071 $L^{3.09}$	1.22	-0.0043	89%	11.69*
Female	Log W = -2.06 + 3.19 log L	0.98	W = 0.00870 $L^{3.19}$	1.27	-0.0052	97%	17.93*

Table 2. Regression equations on length-weight relationship for various length group of *Botia dario*

Length group	Logarithmic equation	Corr. Coefficient	Condition factor (K)	Relative condition factor (Kn)
Group I (50-70 mm)	Log W = -1.87 + 2.94 log L	0.90	1.23	-0.0073
Group II (70-90 mm)	Log W = -2.09 + 3.23 log L	0.96	1.30	-0.0039

be indicated that middle age group has better condition factor. Many researchers (Verghese, 1961; Mortuza & Rahman, 2006; Saha et al., 2009; Dars et al., 2010) have also observed higher 'Kn' values in middle age group of freshwater and marine species. In case of *B. dario*, the 'Kn' value is less than 1 indicating general well being of the fish; its relative robustness, sustainability of habitat and to some extent the size at first maturity and peak period of spawning (Goswami et al., 2008).

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