Length weight relationship and condition factor of *Tor putitora* from Jhajjar stream

Bipu Khajuria, Seema Langer, Rahul Sharma

Abstract - Length weight relationship of Tor putitora was studied from Jhajjar stream, a tributary of river Chenab. A total of 60 specimens were collected from March, 2012 to Feb, 2013. Total length of the specimens ranged from 9.2 cm to 18 cm. Multiple regression analysis was done by using SPSS software to compute the degree of relationship between length and weight and exhibited highly significant correlation ($p<0.001$). The values of length weight relationship according to formula was observed to be Log W = -1.899+2.922 Log TL, where b = 2.922 showing isometric growth pattern and coefficient of correlation $R^2 = 0.7953$. The condition factor also varied month wise.

Index Terms – Condition factor, Regression, Significance

INTRODUCTION

Tor putitora the golden mahseer is the most important fish of cyprinid fish group of south Asian continent. It is regarded as sport fish by anglers, because of its big size, fighting properties and as an excellent game fish [1]

Different fishes grow with different rates depending upon their genetic makeup, food resources available and the environment conditions in which they live and grow. One of the methods for the estimation of the growth of a fish is by way of studying its length and weight parameters. Length and weight are two basic components in the species biology at individual and population level. Information on length – weight relationship has been used to predict weight from length during yield assessment.

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The length weight relationship of *Tor sp*. has been reported by different researchers from different water bodies of India as well outside India[2-10]. The relationship also provides an index of well being of fish population [11] and a comparison of life history parameters of populations residing in different geo-climatic conditions [12].

The condition factor [13] is an organism level response to factors such as nutritional status, organo-somatic indices and serves as an indicator of the well being of individual organism as it integrates many levels of organismal processes. A decrease in condition factor is considered a reflection of depletion of energy reserves because these indices are positively related to muscle and liver energy content [14]. The condition factor is a quantitative parameter of well being state of fish and reflects recent feeding condition as well as its reproductive status.

MATERIAL AND METHOD

The present study was carried out at Jhajjar stream in District Jammu (J&K), India. Sixty fish samples of *Tor putitora* were collected with a length range of 9.2 – 18 cm and weight range of 9.9 – 60 gm with the help of cast net. The fishes were killed on the spot and preserved in 10 % formalin and brought to laboratory for study purpose. The samples were weighed by using electric balance up to 0.01 gm by removing debris and excess of water, whereas body length was carefully measured by using scale and divider.

The fish grouping was done in three groups in accordance with total length of body as shown in table 1:

Groups	Fish Length (cms)
Group I	8 – 12
Group II	12 – 16
Group III	16 - 18

Table-1 Table showing different length groups

Length – Weight Relationship: The length weight relationship was calculated by using Le Cren's formula. The equation is as:

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$$W = aL^b$$

Where W is weight of fish; L is length of fish; 'a' is intercept and 'b' is slope.

For practical purpose this relationship was expressed in logarithmic form as:

Log W = Log a + b Log L

The relationship between Length weight relationship parameters was determined by multiple regression analysis using the SPSS 20.0.

The condition factor was calculated by formula:

$$K = \frac{\mathrm{W} \times 100}{\mathrm{L3}}$$

Where W = weight of fish, L = total length

100 = factor to bring the value near to unity.

Length Group	Length (cm)		Relationship Parameter		95 % Cl of a	95 % Cl of b	R^2	p- Value
	Min	Max	a	b				
Group I	9.2	11.8	-0.5074	1.5553	-1.5219 to 0.5070	0.5687 to 2.5418	0.271	0.003
Group II	12.1	15.8	-1.2640	2.3665	-3.0830 to 0.5549	0.7584 to 3.9746	0.277	0.006
Group III	16	18	-0.5849	1.8767	-5.6234 to 4.4535	-2.2562 to 6.0095	0.656	0.190
Combined	9.2	18	-1.8999	2.9220	-2.3235 to -1.4763	2.5324 to 3.3116	0.795	0.001

Table-2 Descriptive statistics of length weight relationship of *Tor putitora* of different groups from Jhajjar stream Jammu.

Length group	Mean K Value
Group I	1.0389
Group II	1.1291
Group III	1.8837
Combined	1.0831

Table-3 K- Value for different length groups

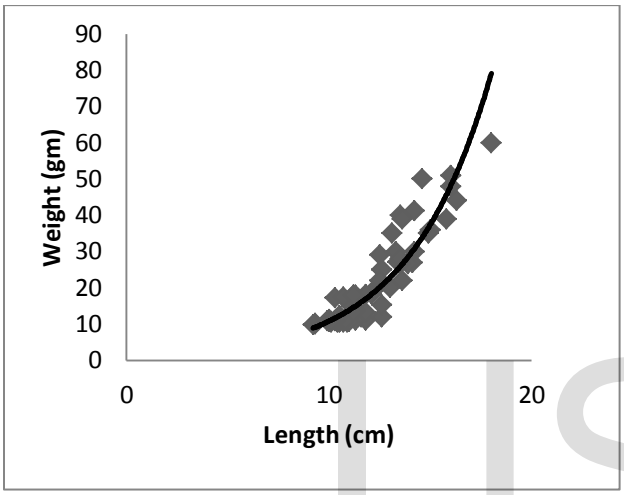

Fig 1- Length-weight relationship

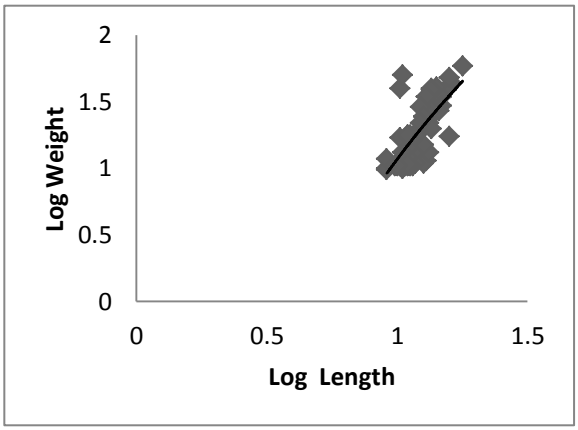

Fig 2- Log length-Log weight relationship

RESULTS

The estimated parameters for length weight relationship are summarised in table 2. Observed values for length weight relationship for all the 60 specimens of *Tor putitora* having b value 2.922, is well within the prescribed range (2.5-3.5) as defined by [15-16], thereby indicating the results to be statistically significant. The length weight relationship was determined by applying the formula, $W = aL^b$. This equation corresponds to the logrithmized form i.e., log W = -1.899+2.922 log L. When a comparison was drawn for three length groups (Table 2), it showed different values for b. The statistical relations for length weight for different length groups derived by formula are as:

Length Group I Log W = -0.507+1.555 Log TL

Length Group II Log W = -1.264+2.366 Log TL

Length Group III Log W = -0.584+1.876 Log TL

Combined Log W = -1.899+2.922 Log TL

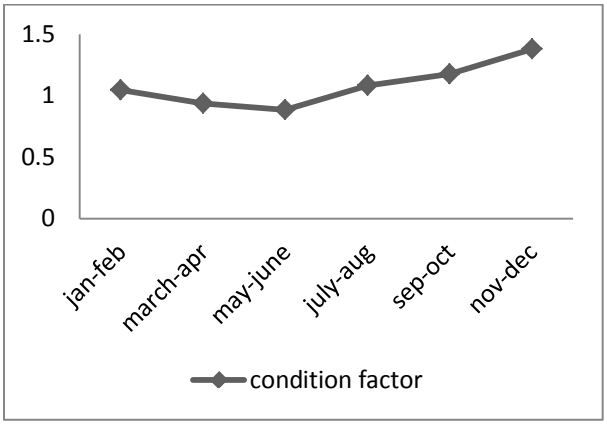

Fig 3- Monthly variation in condition factor

The length weight relationship for length group I was found to be very less significant ($p<0.003$) with coefficient of determination $R^2 = 0.2714$ except for overall combined coefficient of correlation $R^2 = 0.7953$. The b value for all length groups was found to be 1.555, 2.366 and 1.876 for group I, II and III respectively, with an overall combined b value 2.922 (Table 2). The group II showed little non significant value ($p<0.006$) and the coefficient of determination was found to be $R^2 = 0.656$ which supports a little for value of b. Same is the case observed for Length group III showing highly non significant values. When the empirical values of length and weight were plotted on the arithmetic scale, smooth curves were obtained (Figure 1, 2).

The condition factor of different size groups also have been plotted as shown in Figure 3. The condition factor of the fish remained high during winters but falls down following the summers. The overall condition factor for all the length groups however, remained high (Table 3). The condition factor was less in small fishes (8-12cm) and increased with the increase in length of fishes indicating high growth in juveniles.

DISCUSSION

The overall exponential value of the length weight relationship (b) in *Tor putitora* followed the cube law in the fish, indicating there by isometric growth pattern in the fish. The length weight relationship in *Tor putitora* has been described for various rivers and reservoir populations [2,3, 6, 8, 9, 17, 18] and found the value of b either 3 or close to it. The value of b as calculated in present study (b = 2.922) is in conformity to those recorded by Chaturvedi [19] Nautiyal [3], Tandon [20], Patiyal et al [21] and Naeem et al [9] in their observation on length weight relationship, emphasising that cubic relationship holds true only when the form of fish and its specific gravity remain constant throughout life .

When the b value was calculated for all the three length groups differently, it ranged as b= 1.555, 2.366 and 1.876 for Group I, II, and III respectively. These values are different from the combined value depicting allometric growth rate in these length groups. These may be a result of slightly different size ranges of studied samples. The reason accounting for this may be environmental conditions, geographical sampling factors [16] as well fast flowing stream environment [22] and other physiological growth conditions such as food availability of fishes of different length groups, their efforts and efficiency for food capture etc. Also the low value of coefficient of correlation of determination $R^2 = 0.271$, 0.277 and 0.656 for Group I, II and III respectively are due to inappropriate sample size ranges sampled or because juveniles have different length weight relationships [16].

The value of K is high during monsoon (July-Aug), rising further in winters (Sept-Oct) finally attaining peak during Nov-Dec. (Figure 3). January onwards, values however, remain high though low as compared to previous two months (Nov-Dec). February onwards, a gradual fall in K value is evident, attaining minima during summers (May-June). Nautiyal [3] also reported similar trends in this fish from Srinagar. Similar results were also observed by Dasgupta[4] in *Tor putitora* and Kanwal and Pathani [23] in *Garra lamta.* Despite the observed seasonal variation in K factor, these cannot be related to sexual cycle because of non availability/rare availability of adults in the collection. Since in the study station, seed is replenished regularly from Anji fish farm and as the fish attains marketable size, they are immediately fished/harvested by farmers, therefore accounting for the non availability of adults in the collection. The condition factor is high in monsoon and winters and comparatively low in summers, but in general the value of condition factor is high in all the length groups

thereby, indicating a general well being and adaptability of fish.

CONCLUSION

Following conclusion have emerged from the present studies on length weight relationship and condition factor:

1. When total sample (60) as whole is taken, isometric growth pattern is evident.
2. When taken group wise (Group I, II and III), allometry is recorded.
3. Value of condition factor is high (1.2-1.8) in all the length groups indicating a general well being and adaptability of fish.
4. Condition factor is high in monsoons and winters as compared to summers.

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