Journal Home page : www.jeb.co.in ★ E-mail : editor@jeb.co.in

JEB
Journal of Environmental Biology

ISSN: 0254-8704
CODEN: JEBIDP

Study of the length-weight relationship and condition factor for the Golden Mahseer, *Tor putitora* from Himalayan rivers of India

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Publication Info

Paper received:
01 August 2012

Revised received:
01 March 2013

Accepted:
03 June 2013

Abstract

The Golden mahseer *Tor putitora* (Hamilton, 1822) is one of the most important sport fish even its endangered status is due to its declining population. The length-weight relationship and the condition factor for *T. putitora* (N=150) from four different geographical regions in eastern and western Himalayas were studied. Fish sampling took place from December 2009 to March 2011. The b (slope) values obtained ranged from 2.69-3.10. However, no significant deviation was observed from the isometric value (b=3) therefore population from all four locations followed isometric growth pattern. The length-weight regression equation obtained for Bhalokpong, Arunachal Pradesh was Log W = -5.276+3.108Log L; for Anji, J&K was Log W = -4.633+2.811Log L; for Basoli, J&K was Log W = -4.315+2.690Log L and for Jogindernagar, Himachal Pradesh was LogW= -5.260+3.082LogL. The condition factor revealed that the population of eastern Himalayas in Jia bhoreli river was in better condition (K=0.98±0.12) in comparison to western Himalayas. Among the western Himalayan region the population of Ravi river was in poor condition (K=0.78±0.11).

Key words

Condition factor, Golden mahseer, Length-weight relationship

Introduction

The golden or putitor mahseer *Tor putitora* (Hamilton 1822) is one of the most important cyprinid fish of the South Asian subcontinent, widely distributed along the Himalayas in India, Pakistan, Bhutan, Nepal and Bangladesh (Islam and Tanaka, 2007). It is an important food and game fish endemic to India distributed all along the eastern, western and central Himalayas in the large rivers, lakes and reservoirs (Sharma, 2003). The population in open water bodies (rivers/lakes) is declining and is under threat due to several anthropogenic pressure such as loss of habitats due to river impoundments, excessive fishing pressure and pollution. The ecological status of this species has been assigned as endangered by IUCN (Singh and Sharma, 1998; Ameen *et al*., 2000; Khan and Sinha, 2000; Sharma, 2003).

The information on length weight relationship and condition factor are important tools for understanding the biological changes in fish stocks and developing fishery management measures (Prasad and Anvar, 2007). Furthermore, it helps in monitoring the status of fish stock for obtaining optimum yield (Mercy *et al*., 2002; Oscoz *et al*., 2005) and comparisons among life history and morphologic differentiations of the same species in different areas (Petrakis and Stergiou, 1995). The condition factor generally indicates the physiological state of a fish including its reproductive capacity, developmental stages and physical well being. Hence, it represents the relative robustness related to its environment indicating that the heavier fish of a given length are better in condition (Goel *et al*., 2011). Condition factor has also been used as an index of growth and feeding intensity (Fagade, 1979). A fish is said to be in a better growth condition when the value of condition factor is more than 1 and in poor condition than an average individual of the same length, when its value is less than 1 (Nash *et al*., 2006).

Some information on general biology and length-weight relationships of *Tor putitora* is available from different environments such as rivers (Bhatt *et al*., 2000, 2004; Nautiyal *et al*., 2008), lakes

and reservoirs (Johal *et al*., 2005; Singh and Shafiq, 2010). In the present study, an attempt was made to compare the length-weight relationship and condition factor of the *Tor putitora* collected from different river systems in the eastern and western Himalayas and to assess the growth condition of the fish.

Materials and Methods

The fish sampling was done during December 2009 to March 2011 once from four different geographical locations. A total of 150 fish specimens were procured from 1,2,3,4 (Table 1). Out of the total catches, fish specimens were collected randomly for length and weight measurements. Being an endangered fish, the collection of specimens was limited from different geographical locations.

The total length (TL) of the fish was measured from the snout to the caudal fin using meter rule calibrated in millimeter. Fishes were measured to the nearest millimeter. Fish weight (W) was measured after blot drying with a piece of clean hand towel. Weighing was done with a tabletop weighing balance to the nearest gram. The statistical relationship between length (L) and weight (W) of the fish was calculated by equation given by Le Cren (1951) as: $W = aL^b$ (a and b being constant).

The 'a' and 'b' values were obtained by the least square linear regression from the log transformed equation Log W= Log a + b Log L. The correlation (r^2) that is the degree of association between the length and weight was computed from the linear regression analysis $R = r^2$

To test the significant difference of obtained b-value in equation from the isometric value (b=3), t-test was used, which is expressed by the equation (Sokal and Rohlf, 1987). The condition factor (K) was determined as per formula of Hile (1936). All statistical analysis was done using SPSS Ver. 19.

Results and Discussion

A high degree of positive correlation between length-weight was indicated by co-efficient of correlation (*r*). The slope (b) value for the population of Jia Bhoreli (3.108) (Fig. 1) and Beas (3.082) (Fig. 4) river was found to be higher than the Chenab (2.811) (Fig. 2) and Ravi (2.69) (Fig. 3) rivers. However, b values did not differ significantly (t-test, $p>0.05$) when compared with the isometric value (b=3) between the four population studied. According to Froese (2006), the expected range of b value was reported between 2.5-3.5. Studies on length-weight relationship of *T. putitora* from different riverine and reservoir population by Johal *et al*. (2005) also described the value of 'b' either 3 or very close to 3. In the present study, the value of b indicated an isometric pattern for the fish.

The mean condition factor (K) calculated in the present study showed that the population of Jia Bhoreli being close to unity (0.98±0.12) indicated that fish was in good condition. In contrast, the population of western Himalayan region in Chenab, Ravi and Beas rivers showed mean condition factor values (Table 1) lower than unity indicating distressful condition. Among the western Himalayan region, the population of Ravi river showed poorest condition. The condition factor (K) reflects, through its variation, information on the physiological state of the fish in relation to its welfare (Abowei *et al*., 2009). A number of factors (e.g. sex, season, stress, environmental conditions, availability of food and gonadal maturity) may affect the condition of fish (Lambert and Dutil, 1997). Furthermore, the lowest K values were reported during more developed gonadal stage or during the reproductive period (Goswami, 2008). The lowest mean K value in the population of Ravi river might be due the higher numbers of mature specimens. The variation in mean K values from different populations might be due the different environmental condition influenced by many biotic and abiotic factors, which favours the equilibrium of all the species in the ecosystem (Zargar *et al*., 2012; Ahmad, 2013).

The result of the present study indicated that the *Tor putitora* population in all the four locations followed isometric pattern of growth. However, the condition factor indicated that the population at eastern Himalayan region in Jia Bhoreli river was in better condition as compared to the western Himalayan region. The population at Ravi river reflected poor condition of the fish among the populations of western Himalayan region.

Table 1 : Length-weight relationship and Condition factor for golden mahseer, *Tor putitora* from different geographical areas

Geographical area	Drainage	N	Total length (mm) (min-max)	Weight (g) (min-max)	L-W relationship	b	Condition factor (K)
1. Bhalokpong, Arunachal Pradesh	Jia Bhoreli river	36	135-520	25-1300	$W= 0.0051L^{3.108}$	3.108	0.98±0.12
2. Anji, J&K	Chenab river	38	150-260	25-147	$W= 0.00972L^{2.811}$	2.811	0.87±0.24
3. Basoli, J&K	Ravi river	35	280-550	175-1574	$W= 0.01336L^{2.690}$	2.690	0.78±0.11
4. Badon, Jogindarnagar, H.P	Beas river	41	112-190	10.1-63.6	$W= 0.0005195L^{3.082}$	3.082	0.82±0.06

N=number of specimen collected; Values are mean of replicates ±SD

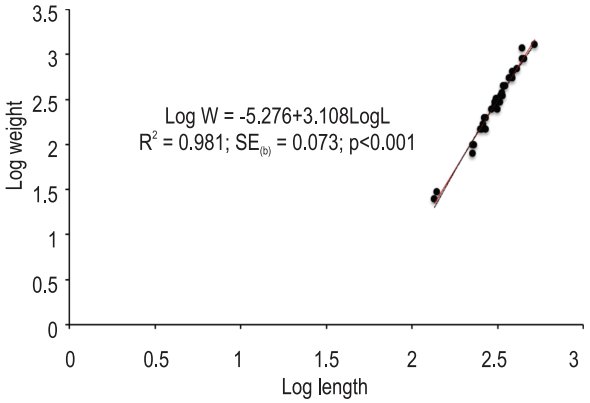

Fig.1 : Least square regression of Log weight x Log length for *Tor putitora* from Jia Bhoreli Bhalokpong, Arunachal Pradesh

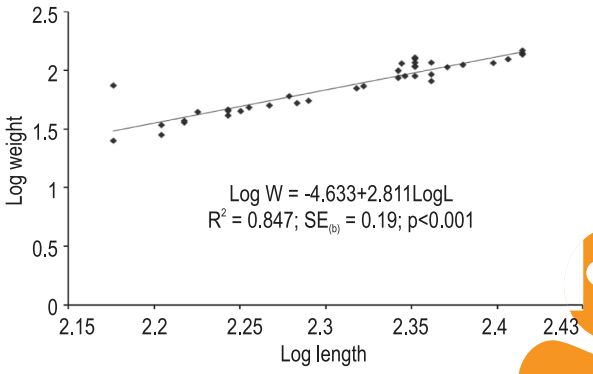

Fig. 2 : Least square regression of Log weight x Log length for *Tor putitora* from Chenab river at Anji, Jammu and Kashmir

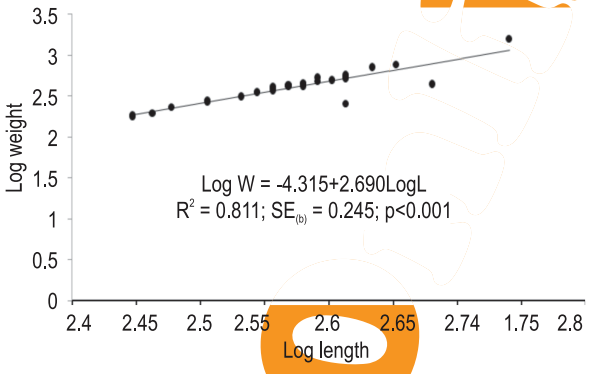

Fig. 3 : Least square regression of Log weight x Log length for *Tor putitora* from Ravi river at Basoli, Jammu and Kashmir

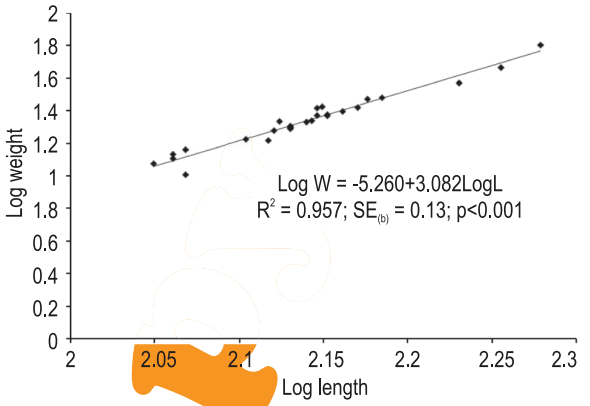

Fig. 4 : Least square regression of Log weight x Log length for *Tor putitora* from Beas river near Jogindarnagar, Himachal Pradesh

Acknowledgment

The authors thank Dr. P.C. Mahanta, Former Director, DCFR, Bhimtal for providing facilities and guidance. The authors acknowledge the financial assistance provided by Indian Council of Agricultural Research (ICAR) New Delhi, India for carrying out this research work under Fish Genetic Stock- An Outreach Activity.

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