Length-Weight, Length-Length Relationship and Condition Factor of *Garra rufa* in Cholvar River of Iran

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Abstract: This study conducted to achieve Length-Length and Length-Weight relationships and Condition Factor of *Garra rufa* in Cholvar River in Iran. 535 Samples were collected during June 2011 to August 2011 by beach seine with 5-milimeter mesh size. Length-weight relationship was $W = 5E\text{-}06TL^{3.225}$ for males, $W = 6E\text{-}06TL^{3.156}$ for females and $W = 5E\text{-}06TL^{3.196}$ for both sexes. Also L-L relationship was $SL = 0.728TL^{1.030}$ for both sexes, $SL = 0.715TL^{1.034}$ for females and $SL = 0.765TL^{1.018}$ for males.. Statistical 't' test showed that the value of (b) estimated, significantly vary from 3. Condition Factor for *Garra rufa* showed that this species is not in welfare condition in Cholvar River.

Key words: Length-Weight Relationship · Length-Length Relationship · Condition Factor · *Garra rufa* · Iran

INTRODUCTION

Three families of *Cyprinidae*, *Balitoridae* and *Cobitidae* have the widest spread in inland waters of Iran. Wide range of geographical distribution, life histories and reproductive styles belongs to the cyprinid species [1]. *Garra rufa* Hackel, 1843 is the member of the genus *Garra* Hamilton-Buchanan, 1822 that found in Iran in the Tigris River, Kor River, Lake Maharlu and the Gulf and Hormoz basins [2, 3]. *Garra rufa* is one of the important biological species among Iranian inland fishes, which is native to the Tigris basin. Size of the fish is small and has no economic importance. Some of the common names of this fish used in Iran are Gel-Cheragh, Gel-khorak, Mahi-e-sang lis and Shirbot [3].

Weight-length relationships (WLR) are used for estimating the weight corresponding to a given length and condition factors are used for comparing the condition, fatness, or well-being [4] of fish, based on the assumption that heavier fish of a given length are in better condition. Both concepts have been used in fisheries research since the beginning of the 20th century [5]. The usual starting point in fisheries' work is determination of growth quality, the basis of which is the weight-length relationship (WLR) of the target species [6]. The relationship between body weight and length is a simple but essential in fishery management [7]. Length-weight relationships drastically help scientists to convert growth-in-length equations to growth in weight in stock assessment models [8]. This equation has been used in yield per recruit model analyses [9] and age-structured model analyses [10,11]. Finally santos *et al*. [12] said that, W-L relationship allow life history and morphological comparison between different fish species, or between fish population from different habitat and/or region [13].

Lazima *et al*. [14] said that Condition Factor in species, gives information that tow population living in certain feeding, density, climate and other condition; when determining the period of gonadal maturation; and when following up the degree of feeding activity of a species to verify whether it is making good use of its feeding source [15].

Garra rufa has a wide dispersion, but there is little information on its Weight-length and no information about Length-length relationship or condition factor. In this paper, we represented a further contribution these information of *Garra rufa* from Iran inland waters.

MATERIALS AND METHODS

In this study, 535 individuals (217 males and 318 females) of *Garra rufa* were caught in Cholvar River in Iran that one of the branches of Karoon River from June to August 2011. Samples were taken by beach seine with 5-milimeter mesh size, fixed and transferred to laboratory

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to measure total length (TL), standard length (SL) and total wet weight for each species. Measuring length was nearest millimeter and weight was nearest 0.01 gram. The Length-Weight relationship, $W = aL^b$ [16, 17] was converted into its logarithmic expression: $\ln W = \ln a + b \ln L$. In this formula W is weight in gram and L is total length of fish. Least-squares regression used to calculate the (a) and (b) parameters, as was the coefficient of determination (R2). The b value for each species was tested by a t-test at the 0.05 significance level to verify if it was significantly different from 3. The relationship between total and standard lengths (TL and SL) was determined according to the power regression model.

Condition factor of *Garra rufa* for individual species used to calculate by Fulton's Condition Factor Index [18] which estimated by following formula:

$$CF = \left\{ \frac{W}{L^3} \right\} \times 100$$

Where L is the length in centimeters (cm) and W is the weight in grams (g).

RESULTS

Length-Weight relationship, Length-Length relationship and Condition Factor from 535 individuals *Garra rufa* were analyzed in this study. L-W relationship was calculated $W = 5E\text{-}06TL^{3.225}$ for males, $W = 6E\text{-}06TL^{3.156}$ for females and $W = 5E\text{-}06TL^{3.196}$ for both sexes. L-L relationship was $SL = 0.728TL^{1.030}$ for both sexes, $SL = 0.715TL^{1.034}$ for females and $SL = 0.765TL^{1.018}$ for males (Fig. 1-4). Statistical 't' test showed that the value of (b) estimated for *Garra rufa* all the (b) values are significantly vary from 3.

Results of condition Factor are computed by the previous formula and shown in Table 1.

DISCUSSION

The condition factor is an index expression the interactions between biotic and abiotic factors in the physiological condition of fishes. It shows the population's welfare during the various stages of the life cycle [19]. Condition Factor also gives information when comparing two populations living in certain feeding, density, climate and other conditions; when determining the period of gonadal maturation and when following up the degree of feeding activity of a species to verify whether it is making good use of its feeding source [20].
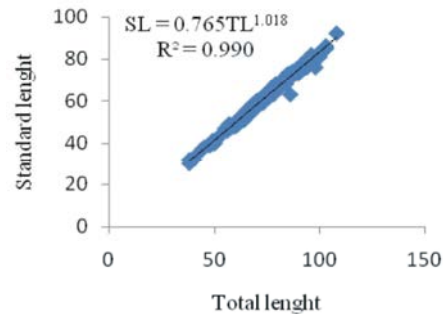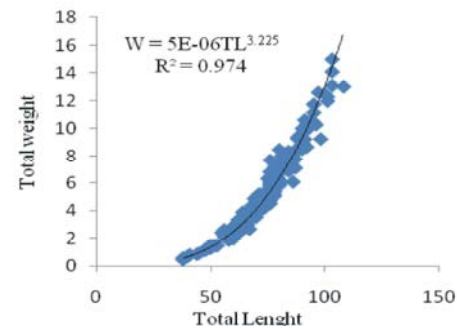

Fig. 1: L-L relationship of Garra rufa for females
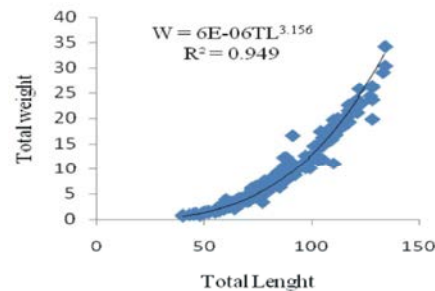

Fig. 2: L-L relationship of Garra rufa for males
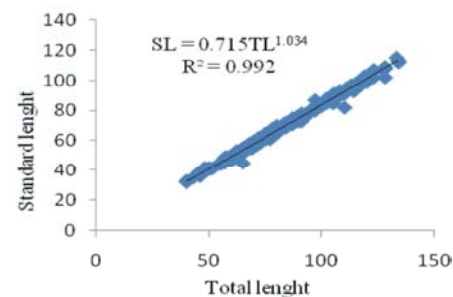

Fig. 3: L-W relationship of males

Fig. 4: L-W relationship of females

Table 1: Condition Factor of *Garra rufa* in Cholvar River of Iran.

Sex	Average	Max	Min
Males	1.212±0.13	1.742	0.801
Females	1.217±0.16	2.198	0.651
Combined sex	1.218±0.18	2.198	0.651

Barnham PSM and Baxter [21] said the comparison range of condition factor for trout and salmon by following standard: 1.60 Excellent condition, trophy class fish, 1.40 A good; well proportioned fish, 1.20 A fair fish; acceptable to many anglers, 1.00, A poor fish; long and thin, 0.80 Extremely poor fish; resembling a barracuda; big head and narrow, thin body. In addition, Olurin and Aderibigbe [22] said that if the values of condition factor were higher than one, fish would be observed in good condition. Results showed that, *Garra rufa* were caught in Cholvar River was in a fair to good condition. It means that food availability, environmental condition, stress and other conditions for this species are not suitable and needs to be reviewed.

In view of the importance of length-weight relationships in understanding growth and stock dynamics of fish populations, it has been extensively studied in several species of fishes distributed in different parts of the world [23]. When b= 3, the fish grows isometrically resulting in ideal shape of fish. When the value of b is less than 3.0, the fish experiences a negative allometric growth or if more than 3 fish has a positive allometric growth. When it is equal or nearby 3 growth of aquatic species is Isometric and growth occurs equally in all dimensions [24]. The b values for *Garra rufa* were 3.156, 3.225 and 3.196 for females, males and combined sex respectively.

Esmaeili and Ebrahimi [25] found b, a and R-value for *Garra rufa* by Total length. It was 3.139, 0.0119 and 0.992 respectively for combined sex. The results in this study coincided with Esmaeili and Ebrahimi.

CONCLUSION

From the obtained results we could conclude that food availability, environmental condition, stress and other conditions for *Garra rufa* are not suitable for this species and needs to be reviewed. In addition, Results showed that this species has a positive allometric growth.

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