Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 5, No. 1, p. 140-144, 2014
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

# Length-weight relationships *Carsobarbus luteus* (Heckel 1843) from Karoon River, Iran

**Mehdi Biria[1*], Narges Javadzadeh-Poorshalkoohi[1], Seyed Ahmad Hosseini[2]**

[1]*Department Fisheries, Khuzestan Science and Research Branch, Islamic Azad University, Iran*

[2]*Department Fisheries, Kermanshah Branch, Islamic Azad University, Iran*

Article published on July 08, 2014

**Key words:** Himrri barbel, Karoon River, Length-weight relationship.

**Abstract**

Length-weight relationships were estimated for *Carasobarbus luteus* wild population from the Karoon River, Aqilli desert discovered localities in the Iranian Tigris drainage. According to the monthly sampling for 1 year, 384 individual fish from Karoon River were collected. Standard length (SL), total length (TL) and fork length (FL) were measured by digital slide calipers and each body weight (BW) was taken by a digital balance. The sample size, length range, weight range, length weight relationships, 95% confidence intervals of a and b, coefficient of correlation and growth type are given. Mean±S.D Standard length Values for Female and male were 170.19±25.38 and 154.24±19.30 respectively and maximum and minimum total length were 118 mm and 252 mm respectively. Isometric growth was identified from length-weight relationships. To the best our knowledge, this study presented the first reference on LWR for *Carasobarbus luteus* in Karoon River, Iran.

***Corresponding Author:** Mehdi Biria ✉ mehdi.biria@yahoo.com

## Introduction

Length-weight relationships (LWR) provide basic information in fisheries biology, being useful to determine the weight of an individual fish of known length or total weight from the length frequency distribution, and to compare specific growth among different regions (Froese, 1998). The himri barbell, an indigenous cyprinid in the Mesopotamian basin, is a highly valuable food fish in the region. Since it is omnivorous and a detritus feeder (Epler *et al.,* 2001), it may be possible to adapt it to aquaculture in polyculture ponds. Barbel specimens have adapted to earthen ponds stocked with common carp (*Cyprinus carpio*) and other cyprinids after accidentally entering the ponds with water inflow from the nearby Euphrates River. Therefore, this fish could become a new aquaculture species (Al-Hazza and Hussein, 2003). The biology of the species in Iraq, Syria, and Turkey has been studied (Epler *et al.*, 1996, 2001; Szypula *et al.,* 2001; Al-Hazza, 2005), but there is little information on its culture (Al-Hazza and Hussein, 2003). Overexploitations of natural stocks and deteriorated environmental conditions have caused a marked decline of the wild himri barbel population (Gokcek and Akyurt, 2007). Yet understanding the population biology of fished species is essential to meet one of the main objective of fishery science, that of maximizing yield to fisheries, while safeguarding the long-term viability of populations and ecosystem (Jenning *et al.,* 2000).

Length–weight relationship (LWR) parameters are important for providing information on fish stock conditions (Bagenal and Tesch, 1978); these parameters are also required to calculate growth rates, length and age structures and other biological characteristics of fish population dynamics. To the best of our knowledge, no information is available on the biology of *Carsobarbus luteus* in the Karoon River, hampering the formulation of sound management strategies for this important fishery. Therefore, this paper describes length-weight relationships, 95% confidence intervals of *a* and *b*, coefficient of correlation and growth type of *Carsobarbus luteus* in the Karoon River, southwest Iran.

## Materials and methods

*Sampling*

Samples were collected between February 2012 to April 2013 from the Karoon River- Aqilli desert, Shushtar in western Iran. Several fishing gear types were used in the survey such as hand nets with 5 mm stretched mesh size, gill nets with 30 mm stretched mesh size, and beach seines with 5 mm mesh size. The collected specimens were preserved in 10% formalin solution and then identified.

*Measurement*

Specimens then were measured to the nearest 0.05 mm total length (TL) using a vernier calliper and weighed to the nearest 0.001 g (total weight, TW). The parameters of length–weight relationships were estimated by the method of least squares using the parabolic equation suggested by Le Cren (1951): $W = aL^b$ where W is the total body weight (expressed in grams), L is the length (expressed in millimeters), *a* is a coefficient related to body form, and *b* is an exponent indicating isometric growth when equal to 3 and indicating allometric growth when significantly different from 3. Therefore, $b < 3$ represents fish that become less rotund as their lengths increase; $b > 3$ represents fish that become more rotund as their lengths increase. The parameters *a* and *b* were estimated by linear regression on the transformed equation: $\log W = \log a + b \log L$ (Koutrakis and Tsikliras, 2003). The significance of the regression was assessed by ANOVA.

## Results

Length–weight relationships and basic statistics are presented in Table 1 and 2. The Length–weight relationships of males and females are plotted in the Figures 1 and 2. It should be noted that these data are based on formalin preserved samples; a correction factor may be needed to convert these to the relationships of live specimens. The minimum and maximum observed TLs of all individuals captured was 11.8 and 25.2 cm, respectively. The regression

parameters *a* and *b* of the LWR, 95% confidence intervals, the coefficient of determination (*r2*), and growth type for *Carasobarbus luteus* in the Karoon River are given in Table 2. All relationships were highly significant (P<0.001), with *r2* values being greater than 0.83.

**Table 1.** Descriptive statistics on the length (cm) and weight (g) measurements of the Himri barbel *Carsobarbus luteus* (Heckel 1843) from the Karoon River, Western Iran.

| Measurements | Male | | | Female | | | 95% CL | |
|---|---|---|---|---|---|---|---|---|
| | Min | Max | Mean±SD | Min | Max | Mean±SD | Male | Female |
| TL | 118 | 226 | 154.24±19.30 | 119 | 252 | 170.19±25.38 | 151.37-157.11 | 166.42-173.96 |
| FL | 110 | 209 | 139.92±17.97 | 104 | 227 | 154.81±23.77 | 137.25-142.59 | 151.28-158.34 |
| SL | 104 | 190 | 129.46±16.48 | 98 | 213 | 143.14±21.72 | 127.01-131.91 | 139.91-146.37 |
| BW | 17.34 | 154.35 | 54.73±25.59 | 24.16 | 248.48 | 75.66±41.38 | 50.93-58.53 | 69.51-81.81 |

BW: Body Weight, SL: Standard Length, FL: Fork Length, TL: Total Length.

**Table 2.** Descriptive statistics and estimated parameters of the length-weight relationships of the Himri barbel *Carsobarbus luteus* (Heckel 1843) from the Karoon River, Western Iran.

| Equation | F | M | Regression parameters | | | | $r^2$ | | Growth | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | a | | b | | M | F | M | F |
| | | | M | F | M | F | | | | |
| $BW = a \times TL^b$ | BW= 0.00001TL$^{3.02}$ | BW= 0.00001TL$^{2.99}$ | 0.000 01 | 0.0000 1 | 2.9 9 | 3.02 | 0.8 6 | 0.9 2 | I | I |
| $BW = a \times FL^b$ | BW= 0.00003FL$^{2.94}$ | BW= 0.00003FL$^{2.91}$ | 0.000 03 | 0.0000 3 | 2.9 1 | 2.94 | 0.8 4 | 0.9 1 | I | I |
| $BW = a \times SL^b$ | BW= 0.00003SL$^{2.95}$ | BW= 0.00004SL$^{2.92}$ | 0.000 04 | 0.0000 3 | 2.9 2 | 2.95 | 0.8 3 | 0.9 1 | I | I |

M: Male, F: Female, I: Isometric.

## Discussion

Length–weight relationships (LWRs) may not always remain constant over the years and may vary significantly due to biological factors such as food availability and special, temporal distribution. Additionally, sampling gear may influence the size range covered and cause deviations from existing values for parameters '*a*' and '*b*'. Further, health, and sex certainly also affect these parameters (Bagenal and Tesch, 1987; Froese, 2006). The b parameter values in the weight-length model, $W = aL^b$ are close to 3 for *C. luteus*, indicating isometric growth (King, 2007).The present results were comparable with other studies, According to Szypula *et al.* (2001) in Iraq the value of parameter *b* in lakes Tharthar, Razzazah and Habbaniya is 3.086, 2.926 and 3.039 respectively and in 1982 is 2.973, 3.002 and 3.199 respectively and in another study by Al Hazzaa (2005) in Euphrates River Syria the value of parameter b for female and male is 2.98 and 3.05 respectively. According to Eydizadeh *et al.* (2013) In Iran the value of parameter *b* in Hoor Al-azim wetland in 2011 is 3.18. In different regions of the parameter *b* does not show significant differences. It is hoped that further studies of these species in other areas will provide us with a more comprehensive picture of these basic variables in response to habitat and geographic region.

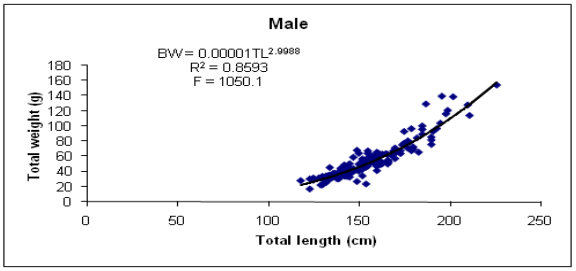


**Fig. 1.** Length weight relationship in male *Carsobarbus luteus*.

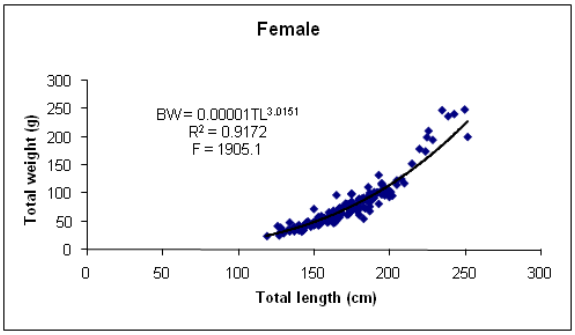


**Fig. 2.** Length weight relationship in female *Carsobarbus luteus*.

From this study and previous studies values of exponent *b* for *C. luteus* often do not vary from river to river. This observation cannot be explained merely in terms of the different number of fish studied; these might also be due to individual, population-specific characteristics affected by local environmental conditions. The length-weight relationships in fishes can be affected by a number of factors including season, habitat, gonad maturity, sex, diet, and health and preservation techniques of the captured specimens (Wootton, 1998; Tesch, 1971; Esmaeili, 2001), which were not accounted for in the present study. Thus, not differences in LWR between this and other studies could potentially be attributed to the combination of one or more of the factors given above.

In conclusion, this study has provided basic information on the LWR that would be useful for fishery biologists/managers to impose adequate regulations for sustainable fishery management in the Karoon River and nearby areas of Iran.

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