

Length-Weight and Length-Length Relationships of *Cyprinion macrostomus*, (Heckel, 1843) in Dalaki River Bushehr, in South of Iran

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Abstract: Length-weight and length-length relationships were derived for *Cyprinion macrostomus*, (Heckel, 1843) in Dalaki River Bushehr, in south of Iran. Sampling was done between January to March of 2011 using gill net. Total length and weight ranged from 41 to 92 mm and weights from 0.068 g to 7.67 g, respectively. The relationship between total and standard lengths (TL and SL) was determined according to the power regression model. The b value in the length-weight relationship didn't differ significantly between males and females (t-test, $P > 0.05$). Length-weight relationship showed positive allometric for average Total species as: $W = 0.06 \times L^{3.10}$ ($r^2 = 0.96$). This study reported the length-weight relationship of *Cyprinion macrostomus* for the first time in the worldwide and it provides basic information for fishery biologists in Iran.

Key words: *Cyprinion macrostomus* % Length-Weight Relationships % Dalaki River

INTRODUCTION

Dalaki River located in 50-52°E geographical area. The length of Dalaki River in the province Bushehr has 115 kilometers, which this river is permanent river in south of Iran. From connection of Shapur River and Dalaki, Helleh River was formed and finally falls into the Persian Gulf [1]. This River has a diversity of fishes such as *Cyprinion macrostomus*.

Cyprinion macrostomus, also known as the kangal fish, is a ray-finned cyprinid doctor fish, similar to another species of carp, *Garra rufa*. It is native to Iran, Syria and Turkey [2].

The relationship between body weight and length is a simple but essential in fishery management [3]. Length-weight relationships drastically help scientists to convert growth-in-length equations to growth in weight in stock assessment models [4], to estimating growth rates, age structure, to obtain the condition of fish and comparative growth studies [5-7], to estimate biomass from length frequency data and for the estimation of fish condition [6]. In addition, these relationships contribute to the comparison of life history and morphological aspects of populations between different regions of the same country.

In Iranian waters (freshwater and sea water), fish have been poorly studied and little biological information is available [8-12].

The present study describes the length-weight relationship of *Cyprinion macrostomus*, (Heckel, 1843) in Dalaki River Bushehr, in south of Iran.

MATERIALS AND METHODS

In this study, 70 individuals (30 females and 40 males) of *Cyprinion macrostomus* were caught in Dalaki River Bushehr, in south of Iran using gill net at monthly intervals between January to March of 2011. Sampled fishes were fixed with 10% formalin and transferred to the laboratory. For each specimen, total length (TL) and standard length (SL), whole body wet weight (g) and sex was recorded. The length-weight relationship was estimated by using following equation:

$$W = a L^b$$

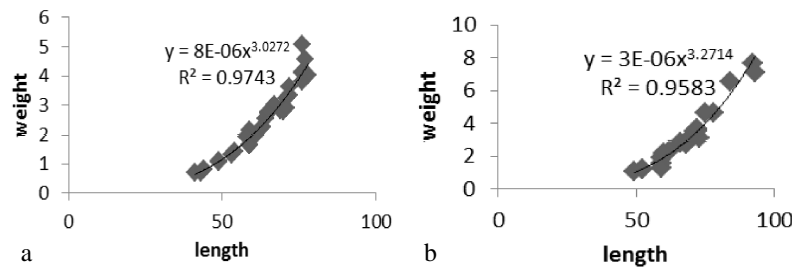
Where W is the whole body weight (g), L is the total length (mm), a is the intercept of the regression and b is the regression coefficient (slope) [13]. The parameters a and b of the length-weight relationship was estimated by the least-squares method based on logarithms [14].

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

A t-test was used for comparison b value obtained in the power regression with isometric value [15]. Also a

Table1: Length (mm) and weight characteristics (g) of *Cyprinion macrostomus* in Dalaki River Bushehr, in south of Iran.

Sex	Length characteristics (mm)				Weight characteristics (g)		
	n	min	max	Mean±STD	min	max	Mean±STD
Males	40	41	78	62.75±10.44	0.068	5.09	2.48±1.15
Females	30	49	92	68.12±11.16	1.07	7.67	3.22±1.77
Total	70	41	92	64.95±10.98	0.068	7.67	2.78±1.47

Fig. 1: Length-weight relationship of *Cyprinion macrostomus* (Heckel, 1843) in Dalaki River Bushehr, in south of Iran. (a):males, (b): females

t-test was used for comparison b value in the power regression of male and female fishes) [14]. The relationship between total and standard lengths (TL and SL) was determined according to the power regression model.

The growth pattern (t) was using the following equation: [16].

$$t = \frac{sd \ln L}{sd \ln W} * \frac{|b-3|}{\sqrt{1-r^2}} * \sqrt{n-2}$$

Where SdlnL is standard deviation of the length natural logarithm (cm), Sdlnw is standard deviation of the natural logarithm weight (g), b is curve slope of the relationship between length and weight, r2 is Regression coefficient between length and weight and n is number of samples. Data were statistically analyzed by analysis of variance (ANOVA) using the general liner models procedure coupled with Duncan's multiple range test in SPSS software (ver16.0).

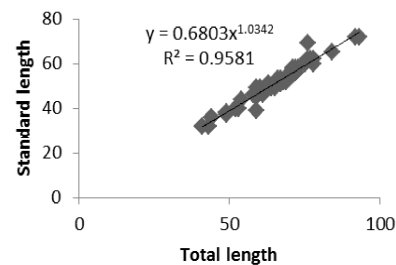
RESULTS AND DISCUSSION

Overall 70 fish were measured. The length-weight relationship differed significantly between males and females ($P < 0.05$). The sample size, the minimum, maximum and mean length and weight (\pm STD), are presented in Table 1.

For both sexes of all individuals, the relationship between total length and weight was described as: $W = 0.06 \times L^{3.10}$ ($r^2 = 0.96$); for females: $W = 0.06 \times L^{3.27}$ ($r^2 = 0.95$, $n = 30$); and for males: $W = 0.08 \times L^{3.02}$ ($r^2 = 0.97$, $n = 40$), (Figure. 1).

Table 2: Length-weight relationship of *Cyprinion macrostomus*, (Heckel, 1843) in Dalaki River Bushehr, in south of Iran

Sex	Parameters of the relationship			
	n	a	b	R ²
Males	40	0.06	3.02	0.97
Females	30	0.06	3.27	0.95
Total	70	0.06	3.10	0.96

Fig. 2: The relationship between total and standard lengths (TL and SL) of *Cyprinion macrostomus*, (Heckel, 1843) in Dalaki River Bushehr, in south of Iran

We determined a positive allometry power length-weight relationship for average total species.

There wasn't significant difference between sexes in the slopes (b) of length-weight relationship ($P > 0.05$) (Table 2).

The relationship between total and standard lengths (TL and SL) was determined according to the power regression model which is presented in Figure. 2.

According to Weatherley and Gill [17], the annual length-weight relationships could differ between seasons and years and many other factors could contribute to

these differences namely, maturity, temperature, salinity, food availability and size. Length-weight relationship may vary seasonally according to the degree of sexual maturity sex, diet, stomach fullness and sample preservation techniques [18].

Information to fishery biologists about length-weight and this study gives basic length-length relationships for *Cyprinion macrostomus*, (Heckel, 1843) in Dalaki River Bushehr, in south of Iran

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