Short Communication

Length-weight and length-length relationships for six fish species from Zohreh River, Iran

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Abstract: The present study reports Length-weight and length-length parameters for six fish species belonging to four families from the Zohreh River. The weight-length relationships were estimated using the equation $W=\alpha L^b$. The values of the slope parameter (b) varied between 2.72 and 3.72, with a mean±SD of 3.015±0.18. The values b parameter in the length-weight relationship equations were calculated as 2.72 for *Arabibarbus grypus* (Heckel, 1843), 2.96 for *Capoeta trutta* (Heckel, 1843), 2.72 for *Garra rufa* (Heckel, 1843), 3.25 for *Aphanius dispar* (Rüppell, 1829), 2.91 for *Sillago sihama* (Forsskål, 1775) and 3.15 for *Glyptothorax silviae* Coad, 1981. This study presents the first reference on LWR and LLR for these species in Zohreh River.

Introduction

The length-weight relationships (LWRs) of fishes are commonly used to estimate the weight of a specimen from its length and vice versa (Binohlan and Pauly, 1998; Keivany et al., 2015). In addition, LWRs of fishes are important in fisheries and biology (Sarkar et al., 2008) and ecology of fishes (Froes, 2006). LWRs are also applied for evaluation of fish stocks and give information on their growth and condition patterns (Ricker, 1968), estimate biomass of the standing stock (Martin-Smith, 1996), condition indices, ontogenetic changes (Sarafan, 1992) and growth studies (Garcia et al., 1989; Haimovici and Velasco, 2000; Moutopoulos and Stergion, 2002).

Length-length relationships (LLRs) are useful for standardization of length type when data are summarized (Froes, 1998) and are also functional for comparative growth studies (Moutopoulos and Stergiou, 2002). Length-weight relationships were reported for many freshwater fishes of Iran (Gerami et al., 2014; Hasankhani et al., 2014; Keivany et al., 2015; 2016; 2016; Keivany and Zamani Faradonbe, 2016; Tabatabaei et al., 2015; Zamani Faradonbe et al., 2015a, b; Radkhah and Eagderi, 2015), but such

a data for fishes of the Zohreh River are limited. Therefore, the present study aimed to reports length-weight and length-length relationships' parameters of six fish species from the Zohreh River, a sub-basin of the Tigris basin in the Khuzestan Provinces, southwestern Iran.

Materials and Methods

A total of 114 specimens belonging to six species were collected by electrofishing device and net from the Zohreh River, Persian Gulf basin, Iran. The collected specimens were preserved in 10% buffered formalin and transferred to the laboratory for subsequent analyses. The total length (TL), fork length (FL) and standard length (SL) of specimens were measured with a digital caliper to the nearest 0.1 cm (length, L) and weight with a digital balance to the nearest 0.01 g (weight, W). Length-weight relationships were determined by applying the equation $W=\alpha L^b$, where W is the total body weight (g), L is the total body length (cm), α is the intercept and b is the slope (Le Cren, 1951; Ricker, 1975; Froese, 2006; Froese et al., 2011). The length-length relationship was estimated by linear regression analysis: TL=α+b*SL and SL=α+b*FL, where α

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Table 1. Length-weight relationships parameters for six fish species collected from Zohreh River, Iran.

Family/species	n	TL (cm) min-max	W (g) min-max	Parameters				
				α	% CI-a (mean±SE)	b	% CI-b (mean±SE)	r^2
Cyprinidae								
Arabibarbus grypus	32	3.3-8.1	0.2-3.72	0.0066	0.0064±0. 0017	2.94	2.91±0.08	0.98
Capoeta trutta	21	3.7-11.6	0.37-11.09	0.008	0.009±0.006	2.96	2.89±0.16	0.98
Garra rufa	30	3.0-7.2	0.22-2.58	0.012	0.011±0.001	2.72	2.75±0.065	0.98
Cyprinodontidae								
Aphanius dispar	10	2.6-3.5	0.22-0.57	0.0105	0. 026±0. 58	3.24	3.22±0.16	0.97
Sillaginidae								
Sillago sihama	12	6.2-11.3	0.79-5.06	0.0026	0.0068±0.0033	3.15	2.72±0.12	0.96
Sisoridae								
Glyptothorax silviae	9	2.9-4.8	0.15-0.84	0.0058	0.006±0.0018	3.08	3.09±0.099	0.97

Table 2. Length–length relationship for six fish species from Zohreh River, Iran.

Species	Equation	α	b	r^2
Arabibarbus grypus	TL = a + bSL	0.1373	1.256	0.99
	SL = a + bFL	-0.2696	0.93	0.99
Capoeta trutta	TL = a + bSL	0.2767	1.207	0.99
	SL = a + bFL	-0.2567	0.937	0.99
Garra rufa	TL = a + bSL	0.1078	1.206	0.99
	SL = a + bFL	-0.0889	0.914	0.99
Aphanius dispar	TL = a + bSL	-0.055	1.209	0.99
	SL = a + bFL	-	-	-
Sillago sihama	TL = a + bSL	0.2175	1.13	0.99
	SL = a + bFL	0.1306	0.865	0.99
Glyptothorax silviae	TL = a + bSL	-0.0437	1.27	0.98
	SL = a + bFL	0.1085	0.855	0.99

parameter is the intercept and *b* parameter is the slope of the linear regression (Cao et al., 2015).

Results and Discussion

This study increases the information related to LWRs and LLRs for six fish species inhabit in the Zohreh River. The number of samples, minimum and maximum of total length (cm), minimum and maximum of weight (g), length-weight relationships parameters (α, 95%CI-α, *b* and 95%CI-*b*) and the coefficient of determination (r^2) are presented in Table 1 and length-length relationships parameters (α and *b*) and the coefficient of determination (r^2) are presented in Table 2. The maximum value for *b* parameter in LWRs was 3.24 for *Aphanius dispar* and minimum value was 2.72 for *Garra rufa*.

Froese (2006) expressed that the parameter *b* should normally range between 2.5 to 3.5 and Tesch

(1971) reported values of *b* parameter varies usually between 2 and 4. In this study, the values *b* ranged from 2.72 for *G. rufa* to 3.24 for *A. dispar*, so the parameters can be used safely within the indicated length ranges. This study showing that linear regressions on data are highly significant (*P*<0.01) with all r^2>0.905. The *b* values of LWRs that indicate allometric or isometric growth pattern and the α parameter was close to 0.01, which is suggested as normal by Froese (2006) for fusiform fish species. Bibak et al. (2013) reported that for *Arabibarbus grypus* in Dalaki River and *G. rufa* in Shahpur River, the *b* parameter were 2.93 and 3.242, respectively and the values of *b* parameter for *G. rufa* were 3.10 in Tigris drainage, 3.02 in Karkheh drainage, 3.06 in Karun drainage, 3.06 in Persis basin and 3.34 in Hormuz basin, respectively (Keivany et al., 2015), while our study *b* parameter for this species was 2.94

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and 2.72.

The *b* parameter was 2.9475 and 2.9475 in male and female of *C. trutta* of shour river (Taghavi Niya et al., 2015) and were 30149 in male, 3.0003 in female and 3.0065 in overall of *C. trutta* in Shour River downstream (Baboli et al., 2012), whereas *b* parameter in this study was 2.93 for *C. trutta*.

The *b* parameter for male, female and overall of *A. dispar* were 3.0745, 3.292 and 3.2053 from Dalaki river, respectively (Bibak et al., 2012), 3.03 and 2.98 for female and male in *Sillago sihama* (Mirzaei et al., 2013) and 3.045 for *G. silviae* (Gerami et al., 2014); however in this study *b* parameter was 3.24 for *A. dispar*, 3.15 for *S. sihama* and 3.08 for *G. silviae*.

The variances observed in values of the length-weight relationship parameters in fishes is affected by a number of factors, including season, habitat, population, gonad maturity, sex, diet, stomach fullness, health, sample size, preservation techniques and locality (Tesch, 1971; Moutopoulos and Stergiou, 2002; Froese, 2006; Hasankhani et al., 2014; Zamani-Faradonbe et al., 2015).

This is the report of LWRs and LLRs parameters for these species in the western Iran, thus the data serve as a baseline for further studies of a possible alteration in the biometric parameters. With threats to fish communities such as damming and overexploitation, the data will be helpful in future species management and conservation.

Acknowledgements

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چکیده فارسی

ارزیابی رابطه طول-وزن و طول-طول شش گونه ماهی در رودخانه زهره، ایران

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چکیده:

در این مطالعه رابطه طول-وزن و طول-طول شش گونه ماهی متعلق به چهار خانواده در رودخانه زهره مورد بررسی قرار گرفته است. رابطه طول-وزن با استفاده از رابطه $W=\alpha L^b$ محاسبه گردید. مقادیر مربوط به شیب خط (b) بین مقادیر ۲/۷۲ و ۳/۷۲ قرار دارد. مقادیر پارامتر b در معادله طول-وزن برای گونه (Heckel, 1843) *Arabibarbus grypus* برابر ۲/۷۲، برای گونه (Heckel, 1843) *Capoeta trutta* برابر ۲/۹۶، برای گونه (Heckel, 1843) *Garra rufa* برابر ۲/۷۲، برای گونه (Rüppell, 1829) Aphanius dispar برابر ۳/۲۵، برای گونه *Sillago sihama* (Forsskål, 1775) برابر ۲/۹۱ و برای گونه *Glyptothorax silviae* Coad, 1981 برابر ۳/۱۵ بدست آمد. این مطالعه از اولین اطلاعات ارائه شده در مورد رابطه طول-وزن و طول-طول این شش گونه ماهی از رودخانه زهره می‌باشد.

کلمات کلیدی: کپورماهیان، کپوردندان‌ماهیان، شورت‌ماهیان، گربه‌ماهیان.