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Research Article

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Length-weight relationships and condition factor of three fish species from Taleghan River (Alborz Province, Iran)

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ABSTRACT

Length-weight (LWR), length-length (LLR) relationships and condition factor (K) were calculated for three fish species of Taleghan River (Alborz Province, Iran). In total 113 fish specimens were collected by electrofishing, anesthetized in 1% clove solution in the field and immediately their weights and lengths measured, finally all samples returned to river. The values of the parameter slope ('b') in the length–weight relationship were 2.966 for *Barbus ciry*, 2.96 for *Capoeta gracilis* and 3.053 for *Oxynoemacheilus bergianus*. The all relationships between TL, FL and SL were linear (for all cases: $r^2 > 0.98$). Also, the coefficient 'K' in the condition factor equation were calculated 0.898 for *B. ciry*, 0.833 for *C. gracilis* and 0.830 for *O. bergianus*.

Keyword: Length-weight, Length-length, Condition factor, Taleghan River, Caspian Sea basin.

INTRODUCTION

Length-weight and length-length relationships and condition factor (Fulton's function), as quantitative traits of fishes, are important tool in fishing biology [1]. Length-weight relationships (LWRs) can be used to estimate fish biomass from length frequency distributions, to estimate weight of individual from its length, understanding some biological aspects of fishes such as growth and production [2], comparison of the population in space and time [3, 4] and to compare life history and morphological aspects of fish populations inhabiting in different habitats [2].

Condition factor ('K' value, Fulton's function) [5, 6] is vastly used in fisheries and fish biology. This factor is calculated from the relationship between the weight of fish and its length, with the intention of describing the "condition" of that individual fish [7, 8]. Variations in 'K' values indicate the state of sexual maturity, the degree of food source availability and suitability of a specific water body for growth of fish [9].

Iran with 19 interior water basins consists a great fish diversity with many valuable endemic species indicating the necessity of their protection and management [10]. Given this great diversity and wide dispersal of Iranian freshwater fishes, this study aimed to provide the status of LWRs, LLRs and 'K' value of three species, i.e. *Barbus ciry* (Heckel, 1843), *Capoeta gracilis* (Keyserling, 1861) and *Oxynoemacheilus bergianus* (Derzhavin, 1934) inhabiting in Taleghan River from the Caspian Sea basin, Iran.

MATERIALS AND METHODS

In total 113 fish specimens were collected from the Taleghan River (36°17'N, 50°82'E to 36°26'N, 50°47'E), (Alborz Province, central of Iran). All specimens were collected by backpack electrofishing (Samus Mp750, 45 cm diameter, aluminum ring anode) during October 2013. During sampling,

only three species, including *B. ciry*, *C. gracilis* and *O. bergianus* were caught. The specimens were anesthetized in 1% clove solution and immediately, weighted using a digital balance (Model Sunli) to the nearest 0.1 gr and photographed using a digital camera (Canon, 510 IS, 12 Mpix) installed on a copy-stand. Finally, all specimens were returned to the river after recovery of their swimming ability. Using the obtained images, Total Length (TL), Standard Length (SL) and Fork Length (FL) were measured using ImageJ software (version: 1.47) to the nearest 0.1 mm. Due to using live specimens, the data of both sex were pooled for further analysis.

The statistical relationship between TL and BW was calculated using the logarithmic transformation (log BW = log $a \times b$ log TL) of the power function (BW = a TL^b) [11, 12, 6], where: BW = body weight of fish (gr), a = intercept (constant), TL = total length of fish (cm) and b = regression coefficient (slope). Furthermore, the relationships between TL with FL, TL with SL and FL with SL were calculated by linear regression. Also, the condition factor (K value) was calculated using: K = $100W/L^3$ [5, 6], where K is condition factor, W is weight of fish (gr) and L is the length of fish (cm). Statistical analysis were performed using the SPSS package version 16.0.

RESULTS AND DISCUSSION

LWRs of three studied species are presented in Table 1, showing that linear regressions on data are highly significant (P<0.01) with all r² > 0.905. LWRs indicated that growth patterns of studied species are isometric based on Pauly's equation. The values of 'b' of LWRs equations were obtained as 2.966 for *B. ciry*, 2.96 for *C. gracilis* and 3.053 for *O. bergianus*. The 'b' values significantly larger or smaller than 3.0 indicates allometric growth, the 'b' value less than 3.0 shows that the fish becomes lighter (negative allometric) or

greater than 3.0 indicates that the fish become heavier (positive allometric) for a particular length as it increases in size [3]. Also, all LLRs presented in Table 2, were highly significant (P<0.01), with the coefficient ('b') values being >0.954; which, the parameter 'b' ranges between 0.954-1.07 in studied fishes.

Difference in 'b' values can be due to the combination various

factors such as number of specimens examined, area/seasonal effect, habitat, degree of stomach fullness, gonadal maturity, sex, health and general fish condition, preservation technique and differences in the observed length ranges of the specimens caught, all of these were not accounted in this study [13, 4].

rubie i. Debeliptive statistics and length weight parameters for three stadied species, ruleghan fiver	Table 1. Descrip	ptive statistics and	length-weigh	parameters fo	r three studied s	pecies, Taleghan Rive
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			Total length (cm)			Body weight (gr)			Growth coefficient					
Family	Species	n	min	max	mn±SD	min	max	mn±SD	а	b	r^2	SE	ts	tg
Cyprinidae	B. ciry	40	5.33	17.57	11.69±2.84	1.52	36.78	16.50±9.60	0.0096	2.966	0.946	0.265	0.127	Ι
	C. gracilis	33	8.54	20.24	12.48±2.57	3.26	52.18	17.91±10.96	0.0091	2.96	0.905	0.503	0.085	Ι
Nemacheilidae	O. bergianus	40	3.17	8.68	4.66±1.48	0.25	5.84	1.13±1.25	0.0075	3.053	0.942	0.48	0.11	Ι

Legend: n: number of specimens, min: minimum, max: maximum, mm: millimeter, gr: gram, mn \pm SD: mean \pm Standard Deviation, a: intercept, b: slope, r²: correlation coefficient, SE: standard error of the slope, ts: students t-test, tg: Types of growth, I: isometric growth.

Table 2. LLRs of total length (TL), fork length (FL) and standard length (SL) for three studied species, Taleghan River

			$FL = aTL^{b}$				SL= aTL	b	$FL = aSL^{b}$			
Family	Species	n	а	b	r ²	а	b	r^2	а	b	r ²	
	B. lacerta	40	0.929	1.0015	0.993	0.787	1.034	0.993	0.853	1.031	0.996	
Cyprinidae	C gracilis	33	0.949	0.988	0.989	0.857	0.992	0.992	0.913	0.999	0.993	
Nemacheilidae	O. bergianus	40	0.835	1.07	0.995	0.803	1.023	0.994	0.956	0.954	0.996	

Legend: n: number of specimens, r2: coefficient of determination, a: intercept; b: slope.

The condition factor ('K') values was calculated for three studied. This values for B. ciry was 0.898 ± 0.143 (Mean \pm SD), for C. gracilis was 0.833 ± 0.146 and for O. bergianus was 0.830 ± 0.21 . Correlation coefficients were high and highly significant indicating that changes in total length and weight of these freshwater fish species are proportional in one direction. The larger condition factor shows better the condition of the fish [3]. The condition factor ('K') reflects information on the biological state of fish in relation to its well-being [14, 15]. In terms of nutrition its shows a proper accumulation of fat due to proper feeding [11]. In terms of reproduction point, the highest 'K' values can show gonadal development [16, 17]. 'K' also gives in formation when comparing two populations inhabiting in certain feeding, density, climate and other conditions.

CONCLUSION

Finding of this study has provided basic information on LWRs, LLRs and 'K' for three endemic species i.e. B. ciry, C. gracilis and O. bergianus, inhibiting in Taleghan River and would be useful for fishery biologists and managers in all rivers in Iran.

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