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LENGTH-WEIGHT RELATIONSHIP OF NINE FISH SPECIES FROM BOSNIA AND HERZEGOVINA

SUMMARY

This study provides data on the length-weight relationships (LWR) of 9 fish species from Bosnia and Herzegovina. Also, paper provides first comprehensive data of LWRs for endemic *Alburnus neretvae* for which no LWR information was available in Fish Base. Values of b parameter ranged from 2.772 to 3.356, while values of a parameter ranged from 0.001-0.024.

Keywords: Adriatic drainage, linear regression, endemic species, fisheries

INTRODUCTION

Bosnia and Hercegovina inhabited by 118 species of freshwater fish. Within the recorded number of fishes, 17 of them stayed in brackish and salt waters (Sofradžija, 2009). Until now, there were no available data on LWRs of freshwater ichthyofauna representatives except for the *Squalius svalize* (Ivanković *et al*, 2010).

Length-weight (L-W) relationship is one of the most widely used methods in fisheries research and its importance has been well documented (Froese, 2006). The morphometric relationships between length and weight (LWRs) can be useful tool in environmental monitoring program such as in the calculation of fish weight at a certain length and the conversion of an equation of growth in weight and vice versa (Petrakis & Stergiou, 1995).

The aim of the present study was to report for the first-time length-weight parameters for 9 species from Bosnia and Hercegovina, including one endemic for which no estimates were available in Fish Base (Froese and Pauly, 2014).

MATERIALS AND METHODS

Samples were collected using multi mesh size gillnets (EN 14757 standard), from October of 2010th to August of 2014th. In total, it was analyzed 408 individuals from 9 species sampled on several localities and water bodies within Adriatic catchment of Bosnia and Herzegovina (South-eastern part of the country). Species were identified in the field, measured to the nearest 1 mm (total length, TL) and weighed to the nearest 0,1 g (weight, W). The following mathematical function was used for estimation of LWRs (Ricker, 1975):

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$$W = aL^b ,$$

Where:
W is total body weight (in gr);
L is total length (TL) of body (in cm);
a and *b* are the coefficients of the functional regression between *W* and *L*.

The 95% confidence intervals (Cls) of the parameters and the statistical significance of the regression relationship (r^2) were estimated. The values of function parameters (*a* and *b*) were estimated by linear regression analysis based on log transformed equation log *w* = log *a* + *b* (log *l*) (Ricker, 1975). The determination coefficient (r^2) was used as an indicator of the quality of the linear regressions.

RESULTS AND DISCUSSION

The sample size, the minimum, maximum, and mean lengths and weights, the values of *a* and *b* with their respective 95% confidence limits and the coefficient of determination r^2 for each species are given in Table 1.

Table 1. Descriptive statistics and estimated parameters of LWR for 9 freshwater fishes from Bosnia and Herzegovina; *: indicates difference of *b* value from 3 (t-test; $p<0.05$)

			Length (cm)		Weight (g)		Regression parameters				
Species	Locality	N	Min	Max	Min	Max	*b*	95% Cl of *b*	*a*	95% Cl of *a*	r^2
Alburnus neretvae (Buj, Sanda & Perea,2010)	Trebišnjica river	75	6.9	13.2	2.7	22.4	2.940*	2.7244-3.1556	0.012	0.0061-0.0179	0.906
Carassius auratus (Linnaeus, 1758)	Lake Bilećko	30	10.3	36.4	12.8	812.3	3.356*	3.1012-3.6108	0.006	0.0021-0.0099	0.965
Gymnocephalus cernua (Linnaeus, 1758)	Lake Bilećko	55	3.8	13.2	0.5	25.3	3.052*	2.9285-3.1759	0.009	0.0070-0.0109	0.978
Lepomis gibosus (Linnaeus, 1758)	Lake Billećko	36	3.9	9.6	0.8	12.1	2.772	2.4760-3.0679	0.024	0.0102-0.0377	0.908
Oncorhynchus mykiss (Walbaum, 1792)	Trebišnjica river	25	12.2	43.7	12.7	705.4	3.118*	2.8946-3.3414	0.001	-0.0029-0.0049	0.972
Rutilus rutilus (Linnaeus, 1758)	Lake Bilećko	80	9.2	25.5	8.6	221.4	3.191*	3.1224-3.2596	0.007	0.0050-0.0089	0.991
Salmo obtusirostris (Heckel, 1851)	Buna river	43	11.5	38.1	22.8	354.5	2.953	1.7574-4.1486	0.015	0.0091-0.0209	0.983
Squalius svalize (Heckel & Kner,1858)	Trebišnjica river	44	14.4	44.1	26.6	989.2	2.849*	2.81176-2.8862	0.019	0.0014-0.0366	0.905
Tinca tinca (Linnaeus, 1758)	Trebišnjica river	20	12.7	29.2	29.4	451.2	2.978*	2.8016-3.1544	0.017	0.0072-0.0268	0.986

The *b* values ranged from 2.772 for *Lepomis gibossus* to 3.356 for *Carassius auratus*, while values of *a* parameter ranged from 0.001-0.024. For four species, the *b* values were higher than 3 (t-test; $p<0.05$), for three cases the b values were lower than 3 (t-test; $p<0.05$), while for the one species the *b* values of the L-W relationships were close to 3 and did not differ significantly (Table 1).

Results of this study are in accordance with Froese (2006), who reported that *b* values for teleost fish should fall within the expected range of 2.5 and 3.5. Differences in LWRs of fishes may be attributed to several factors, such as number and length range of the sampled specimens, gonad maturity, sex, diet, stomach fullness, and growth phase (Bagenal & Tesch, 1978; Froese, 2006; Wootton, 1990); these factors, however, were not consider in the present study. Froese (2006) demonstrated through a meta-analysis involving LWR data of 1773 species that 90% of the intercept values ranged between 0.001 and 0.05. In our study, all species showed *a* values within the range presented by Froese (2006). We found negative allometric growth for *Squalius svalize* (*b* - 2.849). These results differ from the available results of Ivanković *et al.* (2010) who reported positive allometric growth (*b* – 3.47). For *Salmo obtusirostris* we found that in river Buna it showed almost isometric growth (*b* - 2,953) while Treer *et al*. (2003) reported negative allometric growth for translocated population from Jadro river (*b* - 2,750). This species is endemic to relatively small region of Eastern Adriatic drainage and data about this species are very scarce. Therefore, reported data are very important for further knowledge acquiring about this rare trout species. It is noteworthy that for endemic *Alburnus neretvae* the data represent the first description of LWRs based on Fish Base (Froese and Pauly, 2014).

CONCLUSIONS

In conclusion, our study provides valuable information for the FishBase database and contributes to fishery research, management and conservation of freshwater fish fauna of Trebišnjica and Buna river which are either under heavy impact of hydro plants (Trebišnjica river) or will be in close future (Buna river). Such dramatic impact on river habitat causing or will cause habitat changing (riverine to artificial lake habitat) which could effect in changing of reported L-W relationship of affected populations.

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