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LENGTH-WEIGHT RELATIONSHIPS AND CONDITION FACTOR OF 11 FISH SPECIES FROM THE TIMIŞ RIVER, WESTERN ROMANIA

SUMMARY

Length-weight relationship (LWR) parameters and Fulton's condition factor (K) were evaluated for eleven native fish species collected from October 2014 to May 2015 from the Timiş River, in western Romania, namely: *Alburnus alburnus* L., 1758; *Cobitis taenia* L., 1758; *Gobio gobio* L., 1758; *Leucaspius delineatus* Heckel, 1843; *Pseudorasbora parva* Temminck & Schlegel, 1846; *Rhodeus amarus* Bloch, 1782; *Romanogobio albipinnatus* Lukasch, 1933; *R. kesslerii Dybowsky*, 1862; *Squalius cephalus* L., 1758; *Sabanejewia balcanica* De Filippi, 1863 and *Vimba vimba* L., 1758.

Parameter *b* ranged from 1.339 (*Leucaspius delineatus*) to 3.277 (*Gobio gobio*), r^2 values ranged from 0.723 (*Pseudorasbora parva*) to 0.935 (*Alburnus alburnus*), whereas the average K values varied between 1.03 (*Sabanejewia balcanica*) and 2.22 (*Rhodeus amarus*).

These are the first estimated parameters of length-weight relationships for the fish species inhabiting the Timiş River basin. In addition, from all studied species data regarding LWRs for cyprinids *Romanogobio albipinnatus* Lukasch, 1933 and *R. kesslerii* Dybowsky, 1862 were unknown before to FishBase.

Keywords: Timiş River, length-weight relationship, FishBase, Romania

RESULTS AND DISCUSSION

Although the Timiş River is the main lotic system in the south-western Romania and the largest river of the Banat area, representing a site of comunity interest listed in Natura 2000 network, there is still a paucity of biometric data on fish species living in this water basin (Bănăduc et al., 2013; Năstase and Oţel, 2016).

Length-weight relationship (LWR) is usually estimated for giving information about the growth patterns of a fish species, while condition factor is used to provide the state of well-being of individuals in their habitat (Nehemia et al., 2012; Omar et al., 2015; Stavrescu-Bedivan et al., 2016).

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As no study currently exists on the type of growth of fish species from the Timiş River, the aim of this report was to investigate the length-weight relationship, Fulton's condition factor and the growth pattern for the fish species collected from the above mentioned freshwater ecosystem.

This study was conducted in western Romania, along the Romanian length of the Timiş River.

Fish samples were collected from 26 different stations, covering a distance of 144 km, between Lugoj (45°41′10″N; 26°54′2″E) and Grăniceri, near Romanian-Serbian border (45°26′22″N; 20°52′59″E), respectively.

In surveys taking place monthly from October 2014 to May 2015, overall 529 fish individuals belonging to 22 species, 19 genera and five families were obtained using electrofishing from the Timiş River freshwater ecosystem, as follows: Centrarchidae (*Lepomis gibbosus* L., 1758 - pumpkinseed); Cobitidae (*Cobitis taenia* L., 1758 - spined loach, *Sabanejewia aurata* De Filippi, 1863 - golden spined loach, *S. balcanica* Karaman, 1922 - Balcan spined loach); Cyprinidae (*Abramis brama* L., 1758 - freshwater bream, *Alburnus alburnus* L., 1758 - bleak, *A. chalcoides* Güldenstädt, 1772 - Danube bleak, *Alburnoides bipunctatus* Bloch, 1782 - schneider, *Carassius auratus* L., 1758 - European crucian carp, *Gobio gobio* L., 1758 - gudgeon, *Leucaspius delineatus* Heckel, 1843 - belica, *Leuciscus aspius* L., 1758 - asp, *Pseudorasbora parva* Temminck & Schlegel, 1846 - stone moroko, *Rhodeus amarus* Bloch, 1782 - European bitterling, *Romanogobio albipinnatus* Lukasch, 1933 - white-finned gudgeon, *R. kesslerii* Dybowsky, 1862 - Kessler's gudgeon, *R. uranscopus* Agassiz, 1828 - Danubian longbarbel gudgeon, *Rutilus rutilus* L., 1758 - roach, *Squalius cephalus* L., 1758 - chub, *Vimba vimba* L., 1758 - vimba bream); Gobiidae (*Proterorhinus marmoratus* Pallas, 1814 - tubenose goby); Ictaluridae (*Ameirus nebulosus* Lesueur, 1819 - brown bullhead). Only *Ameiurus nebulosus* and *Lepomis gibbosus* are introduced, the remainder being native fish species in Romanian ichthyofauna.

The scientific names and occurence of each identified species were confirmed using the FishBase (Froese and Pauly, 2017). After sampling, fish specimens were preserved in recipients filled with 4% formalin solution and transported in laboratory for biometric analysis.

From the total of collected fish, 506 individuals from selected 11 species were considered in this study for estimating LWRs, only those with sample size ≥ 10 specimens.

All collected fish specimens were measured for length (standard length, SL ± 1 mm) and weighed (total weight, TW ± 0.001 g). It is known that, over time, the caudal fins of collected and stored fish could become brittle and break off, in which case the measurement of standard length instead of total length is preferred (Önsoy et al., 2011).

The relationship between the length and the weight of fish was calculated through linear regression (log W= log a + b *log L), where log a (intercept of the regression), and coefficient b (slope) offers information about the growth pattern (Froese, 2006).

When $b > 3$, positive allometric pattern of growth was indicated, while low values of b (< 3) exhibit negative allometric or hypoallometric growth (Karachle and Stergiou, 2012). The coefficient of determination (r^2) and confidence intervals ($CI_{95\%}$) for parameters *a* and *b*, were computed by the least-square method using PAST (Paleontological Statistics Software) version 3.04 and MS-Excel 2010.

Fulton's condition factor (*K*) of the fish species in their habitat was calculated using the equation: $K= (W/L^3)*100$ (Froese, 2006).

All 11 examined fish species are native in Romania. The biological data (parameters of LWR and their confidence intervals, range for length and weight, *K* Fulton's condition factor, r^2 coefficient of determination, allometric type of growth) for each analyzed species (sex combined) are shown in Table 1.

Length-weight equations determined from regression of log weight on log length of the selected fish indicated a negative allometric type of growth for both cobitids (*Cobitis taenia*, *Sabanejewia aurata*) and four cyprinids species (*Leucaspius delineatus*, *Pseudorasbora parva Squalius cephalus* and *Vimba vimba*), while cyprinds *Alburnus alburnus*, *Gobio gobio*, *Rhodeus amarus*, *Romanogobio albipinnatus* and *R. kesslerii* seems to increase in body thickness rather than in length, exhibiting a positive allometric pattern of growth.

The mean value of Fulton's condition factor (*K*) of the captured fish in the study area varied from 1.03 (*Sabanejewia balcanica*) to 2.2 (*Rhodeus amarus*).

No information regarding length-weight relationship was reported previously in the FishBase online database for *Romanogobio albipinnatus* Lukasch, 1933 and *R. kesslerii* Dybowsky, 1862 (Froese and Pauly, 2017). Moreover, to the best of author's knowledge, this study provides the first findings on length-weight relationship parameters for native fish species from the Timiş River.

The slope (*b*) values for selected species were within expected range of 2.5-3.5, except for *Leucaspius delineatus*, represented by a small sample size. The average coefficient of determination (r^2) was 0.874; for seven species from the total of 11, the r^2 value was > 0.874. The calculated r^2 values for all fishes could be affected by the using of combined sexes, as suggested before (Esmaeili et al., 2014).

The high values of *K* for *P. parva*, *R. amarus* and *S. cephalus* might indicate that these species are living well in the habitat and have fat deposits due to their feeding activity (Falaje et al., 2015; Banerjee et al., 2016).

More than a half of studied fishes seem to have a negative allometric growth type, but further investigations are required to detect the factors that could influence the growth patterns, e.g. sample size, fish age or water quality parameters (Stavrescu-Bedivan et al., 2016).

Considering the above mentioned statements, it can be concluded that the contributions presented in this paper will be useful references for fishery biologists in future studies on the population assessment of the species inhabiting the Timiş River freshwater ecosystem.

Table 1. Length-weight relationship parameters (*n*, sample size; range, minimum and maximum size; *a*, antilog of the intercept; *b*, slope, $CI_{95\%}$, confidence intervals of *a* and *b*, respectively; r^2, coefficient of determination), condition factor (*K*) and type of growth, tg (A+, allometric positive; A -, allometric negative) for ten fish species from the Timiş River, Romania. Bold: fish species with LWR reported here for the first time. SL- standard length (cm); W-total weight of the fish (g).

Family	Species	*n*	SL range	W range	*a*	$CI_{95\%}$ of *a*	*b*	$CI_{95\%}$ of *b*	r^2	*K*	tg
Cobitidae	*Cobitis taenia* (L., 1758)	22	2.80-9.02	0.23-6.55	0.0186	0.0066-0.0517	2.690	2.145-3.234	0.841	1.10	A-
Cobitidae	*Sabanejewia balcanica* (De Filippi, 1863)	41	3.70-7.51	0.97-3.80	0.0117	0.0055-0.0247	2.906	2.476-3.336	0.827	1.03	A-
Cyprinidae	*Alburnus alburnus* (L., 1758)	71	2.30-8.20	0.08-10.11	0.0087	0.0064-0.0117	3.215	3.012-3.418	0.935	1.22	A+
Cyprinidae	*Gobio gobio* (L., 1758)	22	3.30-8.60	0.65-10.72	0.0088	0.0041-0.0186	3.277	2.847-3.708	0.926	1.47	A+
Cyprinidae	*Leucaspius delineatus* (Heckel, 1843)	10	2.20-5.30	0.51-1.70	0.0168	0.0280-0.4038	1.339	0.720-1.958	0.756	1.88	A-
Cyprinidae	*Pseudorasbora parva* (Temminck& Schlegel, 1846)	29	3.92-5.31	1.98-3.37	0.0976	0.0414-0.2300	2.037	1.539-2.535	0.723	1.96	A-
Cyprinidae	*Rhodeus amarus* (Bloch, 1782)	154	2.30-6.60	0.25-6.84	0.0204	0.0164-0.2543	3.044	2.894-3.193	0.914	2.22	A+
Cyprinidae	***Romanogobio albipinnatus* (Lukasch, 1933)**	17	3.60-7.10	0.77-4.95	0.0136	0.0062-0.0297	3.008	2.533-3.483	0.924	1.41	A+
Cyprinidae	***Romanogobio kesslerii* (Dybowsky, 1862)**	10	3.20-6.50	0.44-4.43	0.0076	0.0018-0.0313	3.325	2.426-4.224	0.901	1.29	A+
Cyprinidae	*Squalius cephalus* (L., 1758)	96	2.95-21.07	0.40-214.33	0.0227	0.0149-0.0345	2.915	2.738-3.092	0.919	1.92	A-
Cyprinidae	*Vimba vimba* (L., 1758)	34	2.40-11.60	0.34-23.54	0.0325	0.0208-0.0506	2.588	2.372-2.805	0.948	1.44	A-

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