

Length-weight relationship and condition factor of two cyprinid fishes *Squalius squalus* and *Barbus rebeli* from the river Crn Drim in the Republic of the North Macedonia

Должинско - тежински однос кај две ципринидни риби *Squalius squalus* и *Barbus rebeli* од реката Црн Дрим во Република Северна Македонија

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Abstract



In this study, for the first time Length-weight relationship (LWRs) were determined for two fish species: chub *Squalius squalus* Bonaparte, 1837 and *Barbus rebeli* Koller, 1926. Fish were collected from the river Crn Drim by electrofishing (Samus 725G) between January 2010 and January 2012. A total 552 specimens were collected. Body weight (W) and total length (L) were measured and weighed and LWRs was estimated as $W = a + b \cdot \log(L)$. The estimated b values were 2.877 and 2.994 for *S. squalus* and *B. rebeli*, respectively. No previous information is available for LWRs for those two species, not even in FishBase. The obtained data in this study would be useful for the future ichthyological research of these species.

Key words: length-weight relationship, barbel, chub

Апстракт

Во оваа студија за прв пат се определени должинско-тежинските односи (LWRs) кај два вида риби клен *Squalius squalus* Bonaparte, 1837 и *Barbus rebeli* Koller, 1926. Рибите беа колекционирани од реката Црн Дрим со електрофишинг од јануари 2010 до јануари 2012. Вкупно се колекционирани 552 единки. Телесната тежина (W) и тоталната должина (L) беа мерени за определување на LWRs, кој беше определен по следната формула $W = a + b \cdot \log(L)$. Добиената b вредност изнесуваше 2,877 за *S. squalus* и 2,994 *B. rebeli*. Претходни информации за тежинско должинските односи не се досега објавени за овие два вида дури ни во FishBase.

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Добиените резултати во оваа студија ќе бидат корисни за понатамошни икhtiолошки истражувања на овие видови риби.

Клучни зборови: тежинско-должински однос, мрена, клен

Introduction

Crn Drim is a river in the Republic of North Macedonia which flows out of Lake Ohrid near town of Struga and leaves North Macedonia near the town of Debar. It merges with the river Bel Drim near the town Kuks to form the Drim River which flows into the Adriatic Sea. Crn Drim is an important habitat for many fish species including chub *Squalius squalus* Bonaparte, 1837 and barbel *Barbus rebeli* Koller, 1926. These species are exploited for recreative, and for sport fishing. Some data for length-weight relationship for cyprinid fishes from the Vardar River is available (Georgiev 2003). However, for any species from the river Crn Drim as well as from many other rivers and species in the Republic of North Macedonia information for weight-length relationship is missing. Moreover, such data for species which we investigated in this study was also not available in Fish Base (<https://www.fishbase.se/>).

Length-weight relationship (LWRs) are of fundamental importance in the fishery sciences (Birecikligil et al. 2016) and provide important information for fish biology, fishery assessment (Oscoz et al. 2005), fishery management and conservation (Li et al. 2017). In this study the data for LWRs for two cyprinid fish *S. squalus* and for *B. rebeli* from the river Crn Drim was obtained for the first time.

Material and methods

Fish species were collected along the river Crn Drim, 280 specimens of *S. squalus* and 272 of *B. rebeli*, by electrofishing method quarterly from January 2010 until January

2012. Body weight (*W*) were measured using the digital balance (precision 0.01g) and total length (*L*) using the ichthyometer (with precision 0.1 cm) were estimated on the place of capture.

The length-weight relationships (LWRs) were estimated according to the following formula $\text{Log } W = a + b \cdot \log(L)$ where *a* and *b* were intercept and slope respectively (Froese 2006). A 95% confidence interval for both parameters *a* and *b* was estimated. Confidence limits and coefficient of determination (r^2) were also established. For all analyses Microsoft Office Excel and Statgraphics Plus 2.1 were used.

Results and discussion

In the present study a total of 552 individuals from two cyprinid fish species *S. squalus* and *B. rebeli* were used. The total length range, total body weight range, LWRs parameters, in both species were analyzed. The results for all investigated parameters are given in Table 1.

This study provides for the first time knowledge for LWRs for *S. squalus* and *B. rebeli*. For both fish species data was not available in FishBase. We obtained expected *b* values of 2.5-3.5 (Froese 2006) which indicates an isometric growth pattern for *B. rebeli* and negative allometric growth ($b < 3$) for *S. squalus* for which the upper 95% confidence interval was 2.877 and $p < 0.001$.

However, when *b* values estimated for both fish species in this study are compared to those estimated for related cyprinid species are sometimes lower (*Barbus barbus*, *Barbus meridionalis*, *Barbus prespensis*, *Squalius*

Table 1. Descriptive statistics and estimated length-weight parameters and Fulton's condition factor

Species	N	L (cm)		W (g)		LWR parameters				
		min	max	min	max	<i>a</i>	95% CL of <i>a</i>	<i>b</i>	95% CL of <i>b</i>	r^2
<i>Squalius squalus</i>	280	16.0	38.5	52.0	610.0	0.016	0.013-0.021	2.877	2.957-2.798	0.948
<i>Barbus rebeli</i>	272	14.0	30.5	24.5	340.0	0.011	0.008-0.015	2.994	2.887-3.100	0.919

N, number of species; L, total length; B, total body weight; *a*, intercept of regression; *b*, slope; CL, confidence level; r^2 , regression coefficient.

cephalus, *Leuciscus svallize*, *Telestes ukliva*) or higher (*Barbus albanicus*, *Barbus cyclolepis*, *Leuciscus borysthenticus*, *Leuciscus souffia*, *Leuciscus svallize*, *Barbodes semifasciolatus*, *Acrossocheilius beijiangensis* (Kleanthidis et al. 1999; Koutrakis and Tsikliras 2003; Treer et al. 2008; Dulčić et al. 2009). Obviously differences between different species from same family exist as well as between same species from different localities. However, LWRs depend on many factors such as specimen size, sex, season, gonadal maturation stage, nutritional condition or even fishing methods (Neophitou 1987; Tarkan et al. 2006; Hossain et al. 2013; Dey et al. 2018).

The obtained data in this study would be useful for future research of these species. Taking into account the importance of the estimation of, especially, LWRs parameters from an ichthyological point of view we believe that our study will provoke research of LWRs of other native fish species in the Republic of North Macedonia.

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