SIZE STRUCTURE, LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF THE BLACK SEA ROACH (*RUTILUS FRISII* NORDMANN, 1840) IN THE RIVERS VELEKA AND REZOVSKA, BULGARIA

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Abstract: The size structure and length-weight relationship of *Rutilus frisii* (Nordmann, 1840) in the Rivers Veleka and Rezovska, Bulgaria were studied. The smallest individual caught in Veleka River was with length of 6.6 cm and weight of 5.2 g. The largest individual was with length of 15.5 cm and weight of 57.4 g. The smallest individual caught in Rezovska River was with length of 10.3 cm and weight of 18.8 g and the largest one was 13.2 cm in length and 31.5 g in weight. In the both rivers the most abundant was the size class 10.1-11 with 24 individuals in Veleka River and 12 individuals in Rezovska River. The L-W relationship for the catches from Veleka River was $W = 0,017L^{2,9664}$, $R^2 = 0,9805$. The L-W relationship for the catches from Rezovska River was $W = 0,1624L^{2,0152}$, $R^2 = 0,8432$. The condition factor for the fish from Veleka River was calculated as 1.7 and for Rezovska River 1.5.

INTRODUCTION

Veleka (Kocadere) is a river in the very Southeast of Bulgaria, as well as the very Northeast of European Turkey. It is 147 km long, of which 123 km in Bulgaria and 25 km in Turkey, and takes it sources from a number of Karst springs in the Turkish part of Strandzha (İstranca) mountain to flow into the Black Sea near the Bulgarian village of Sinemorets. Rezovska (Mutludere) is a river in the extreme Southeast of Bulgaria and Northernmost part of (European) Turkey.

Rezovska River is 112 km long and its source is in the Turkish part of Strandzha mountains east of Kofçaz under the name of Paspalderesi. It generally flows east and after Paspala becomes a border river between both countries until its mouth in the Black Sea at Rezovo village, Bulgaria. Both rivers are situated in Strandzha Nature Park and Natura 2000 site BG0001007 Strandzha.

Rutilus frisii is a semi-anadromous fish species from the Cyprinidae family, distributed in Black and Azov Sea basins. In Bulgaria, it is distributed in the rivers Rezovska, Veleka, Oarevska and Karaach. It spawns in April – May (Kottelat and Freyhof, 2007; Karapetkova and Zhivkov, 2000). In Bulgaria, the species is Critically Endangered (http://e-ecodb.bas.bg/rdb/bg/vol2/Rufrisii.html) while the international IUCN status is Least Concern (Freyhof and Kottelat, 2008). The negative factors influencing the population of *R. frisii* in Bulgaria are the pollution, habitat destruction from the fast growing touristic infrastructure, concurrence of introduced alien species and poaching (http://e-ecodb.bas.bg/rdb/bg/vol2/Rufrisii.html). Studies on the biology of the species in Bulgaria are missing.

The aim of the study is to evaluate the size structure, L-W relationship and condition factor of *R. frisii* from the freshwater part of the rivers Veleka and Rezovska in Bulgaria. For the successful management of this protected in Bulgaria species it is crucial to reveal these biological parameters.

MATERIAL AND METHODS

The material was collected from the rivers Veleka and Resovska in 2011. Fish sampling was done by electrofishing with 900 V/60-120 Hz straight, pulsating current. Six study sites with the following coordinates were studied on Veleka River: 1. N 42,05953˚ E 027,96652˚; 2. N 42,05865 E 27,77647; 3. N 42,0316 E 027,63282˚; 4.N 42,08148˚ E 027,86023˚; 5. N 42,03234 E 27,62049 and 6. N 42,08126 E 27,4311, and three on Resovska River: 1. N 41.98089˚ E 028,01419º; 2. N 41,98083˚ E 028,01427º; 3. N 41,96039˚ E 027,65930º.

Altogether 100 individuals of *R. frisii* from Veleka River and 25 from Resovska River were studied. Each fish was measured the standard length (to the end of the scale cover) to the nearest mm and the total weight to the nearest g. After the measurements on site, the fish were returned back alive in the river of their catchment.

To assess the size structure, the fish catches from each river were divided in size classes over 1 cm each. The length-weight relationship was calculated using the power function: $W=aL^b$, where W is the total weight (g), L is the standard length (cm); a is the regression constant and b is the regression coefficient (Le Cren, 1951). The condition factor was calculated by the use of Fulton's coefficient: $CF= (W/L^3)$ x100 (Ricker, 1975; Nash et. al. 2006).

RESULTS AND DISCUSSION

From all studied points in Veleka River *R. frisii* was found only on the points with the following coordinates N 42,08148˚ E027,86023˚; N 42,03234 E

27,62049 and N 42,08126 E 27,4311. In Resovska River the species was found on the sampling point with the coordinates N 41,98083˚ E 028,01427º.

The fish catch from Veleka River was divided in 9 size classes from 6.1-7 to 15.1-16 (Table 1). The most abundant was size class 10.1-11 with 24 individuals. The less numerous was the size class 15.1-16 with just one individual. The individual with the smallest size was 6.6 cm in length and 5.3 g in weight. The individual with the highest size was 15.5 cm in length and 57.4 g in weight.

Table 1. Size structure of the *R. frisii* catches from Veleka River

Size class (cm)	Average length (cm)	Average weight (g)	Number
6,1-7	6,8	5,2	5
7,1-8	7,4	6,6	14
8,1-9	8,5	9,8	12
9,1-10	9,6	14,1	11
10,1-11	10,6	18,2	24
11,1-12	11,4	24	20
12,1-13	12,5	30,3	11
13,1-14	13,3	36	2
15,1-16	15,5	57,4	1

The L-W relationship for the fish from Veleka River is presented on Fig. 1. The regression between the length and the weight is depictured with a power function with the equation $W = 0,017L^{2,9664}$, $R^2 = 0,9805$. The coefficient b from the equation is very close to 3 which indicates isometric growth of the population of *R. frisii* from Veleka River. This means that the fish increase in their length with increasing weight in cubic form (Morey et al. 2003; Rosli, Isa, 2012).
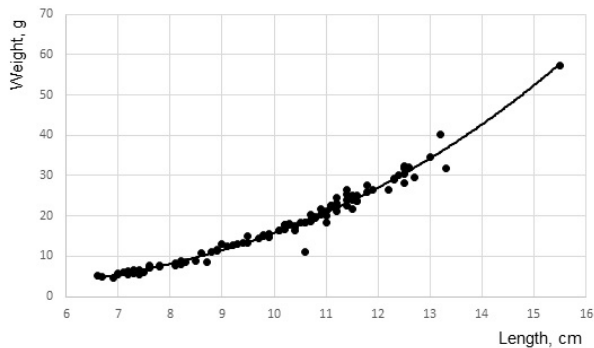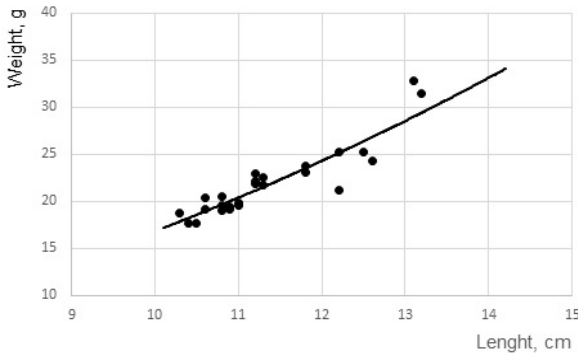

Fig 1. L-W relationship for *R. frisii* from Veleka River

The fish catch from Rezovska River is divided in 4 size classes from 10.1-11 to 13.1-14 (Table 2). The most abundant was size class 10.1-11 with 12 individuals. The less numerous was the size class 13.1-14 with two individuals. The individual with the smallest size was 10.3 cm in length and 18.8 g in weight. The individual with the highest size was 13.2 cm in length and 31.5 g in weight.

Table 2. Size structure of the *R. frisii* catches from Rezovska River

Size class (cm)	Average length (cm)	Average weight (g)	Number
10,1-11	10,7	19,2	12
11,1-12	11,4	22,5	7
12,1-13	12,4	24	4
13,1-14	13,2	32,2	2

The L-W relationship for the fish from Rezovska River is presented on Fig. 2. A power function describes the regression between the length and the weight with the equation $W = 0,1624L^{2,0152}$, $R^2 = 0,8432$. The coefficient b from the equation is less than 3, which indicates negative allometric growth for the population from Rezovska River (Morey et al. 2003; Rosli, Isa, 2012).

Fig 2. L-W relationship for R. frisii from Rezovska River

As the current research is a first report on the studied biological parameters of *R. frisii* in freshwater environment in Bulgaria there is no data to compare the obtained results. For *R. frisii* kutum from Tajan River the total length ranged from 42 to 54.7 cm and weight from 757 to 1658.66 g, respectively for females and from 37.1 to 51.7 cm and 400 to 1251 g for males (Arabi et al. 2012). The smaller

size of the fishes established from the present study comparing to the one reported from Arabi et al. (2012) is due to the difference in the sampling methodology. The sampling for the aim of the current research was done by electrofishing in the freshwater part of the rivers, where the younger fish respectively with smaller size are concentrated. The bigger fish after spawning return back for feeding in the river mouth where net fishing must be applied. As the species is protected in Bulgaria the net fishing was excluded as a potential fishing method preserve the studied individuals.

The condition factor for the fish catch from Veleka River was 1.7 and for the one from Rezovska River 1.5. Condition factor greater than one shows the wellbeing of fishes in the population (Datta et al. 2013) and is an indicator for the good habitat condition of the studied population. The condition factor in fish reflects physical and biological circumstances and fluctuations by interaction among feeding conditions, parasitic infections and physiological factors (Le Cren 1951). This also indicates the changes in food supply and therefore is an indicator of the general fish condition. Arabi et al. (2012) evaluated the mean condition factor for the subspecies R. f. kutum from Tajan River as 0.97.

The obtained results for the studied parameters, described in the current paper are primary data on the biology of *R. frisii* in Bulgaria. Future research on the biology of the species will check for deviations from this parameters. If the deviations are negative, implementation of management practices will be required.

CONCLUSION

The size structure, length-weight relationship and condition factor of Rutilus frisii were studied for the first time in Bulgaria. The species is unequally distributed in both of the studied rivers. The population of *R. frisii* from Veleka River grows isometrically, while the population from Resovska River has allometric growth. In both rivers the species has Condition factor greater than 1, which indicates good fish and habitat condition.

REFFERENCE

1. Arabi M.H. G., S. Sedaghat, S. A. Hoseini, A.Fakhri. Age and Growth of Kutum, Rutilus frisii kutum (Kamenskii 1901) in Tajan River (Southern Caspian Sea to Iran). *Global Veterinaria* 2012, 9 (2): 211-214
2. Datta SN, Kaur VI, Dhawan A, Jassal G. Estimation of length-weight relationship and condition factor of spotted snakehead *Channa punctata* (Bloch) under different feeding regimes. *SpringerPlus*. 2013, 2:436. doi:10.1186/21931801-2-436.
3. Freyhof, J., Kottelat, M. *Rutilus frisii.* The IUCN Red List of Threatened Species 2008
4. Karapetkova, M., M. Zhivkov. Fish in Bulgaria. Geya Libris, Sofia, 2006, 215 pp. (Bg)
5. Kottelat, M., J. Freyhof. Handbook of European freshwater fishes. Publications Kottelat, Cornol and Freyhof, Berlin, 2007, 646 pp.

6. Le Cren ED. The length-weight relationships and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). *J Anim Ecol*, 1951, 20:201–219.
7. Morey G, Moranta J, Massuti E, Grau A, Linde M, Riera F, Morales-Nin B. Weight-length relationships of littoral to lower slope fishes from the Western Mediterranean. *Fisheries Research*, 2003, 62(1):89–96.
8. Nash R. D. M., A. H. Valencia, A. J. Geffen. The Origin of Fulton's Condition Factor— Setting the Record Straight. *Fisheries*, 2006, Vol. 31, No 5: 236-238.
9. Ricker, W. E. Computation and interpretation of biological statistics of fish populations. *Bulletin of the Fisheries Research Board of Canada,* 1975, 191:1-382.
10. Rosli, N. A. M., M. M. Isa. Length-weight and Length-length Relationship of Longsnouted Catfish, *Plicofollis argyropleuron* (Valenciennes, 1840) in the Northern Part of Peninsular Malaysia. T*ropical Life Sciences Research*, 2012, 23(2), 59–65.
11. http://e-ecodb.bas.bg/rdb/bg/vol2/Rufrisii.html