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The biometry of common minnow (*Phoxinus phoxinus*) population from Nădrag River

Ioan Bănățean-Dunea, Adrian Grozea, Marian Bura,
Silvia Pătruică, Eliza Simiz

Banat's University of Agricultural Sciences and Veterinary Medicine, Timișoara, Romania, EU. Corresponding author: Ioan Bănățean-Dunea, ionut_banatean@yahoo.com; ionut_banatean@sander.ro

Abstract. A fish population from a given geographical area can be characterized in morphological terms by means of somatic measurements. Seeing that Romanian literature does not provide information about common minnow (*Phoxinus phoxinus*) population from Banat Hidrografic Area, Timis Hidrografic Basin, we launched a number of researches on external morphology to reveal the conformation body characters. Investigated body segments were: total body length (Tl), standard body length (Sl), head length (lc), snout length (snl), caudal peduncle length (lpc), maximum body depth (H), minimum body depth (h) and body weight (w). Making an analysis of average for total body length for common minnow (*Phoxinus phoxinus*) females and males, we observed that the females body average length was 7.1 ± 0.66 cm and the average length of males was 4.47 ± 0.15 cm. Average body weight obtained for females was 4.31 ± 0.41 g, and for males was 0.98 ± 0.08 g. The standard length of common minnow (*Phoxinus phoxinus*) females is 84.78 % of the total body length, and head length (1.41 ± 0.17 cm) is 19.85 % of the total body length. For common minnow (*Phoxinus phoxinus*) males the standard body lenght is 83.44 % of the total body length and head length (0.93 ± 0.03 cm) is 20.80 % of the total body length.
Keywords: common minnow, *Phoxinus phoxinus*, river, somatic measurements.

Zussammenfassung. Die Fische Popullation kann durch bestimmte morphologische und somatische Messungen charakterisiern werden. In Rumänien, betrachtend die aktuelle Infortmationen über *Phoxinus phoxinus* Population In Hydrgarphischem Basin Timis, stehen keine Daten zur verfügung; durch durchgefürten Messungen wir haben die externe Morphologie samt Körpercharakteren des Gatung etabliert. Die totale Länge, Kopflänge, Schnautzlänge, Schwanzlänge. Maximal- und Minimalkörper Höheun d Körpergewicht. Nach Dateien Analyse wir haben festgestellt dass, das, die Weibchenlänge war (in Durchschnitt) 7,1±0,66 cm; Mänchenlänge 4,47±0,15 cm. Die durchschnittliche Körpergewicht bei Weibchen war 4,31±0,41 g und bei Mänchen 0,98±0,08 g. Prozentuell die Standardlänge des Weibchen und Mänchen ist dargestellt wie folgt 84,78 % (Weibchen) bzw. 83,44 % (Mänchen) von Totallänge und weiterhinn die Kopflänge entspricht 19,85 % von Totallänge bei Weibchen bzw 20,80 % bei Mänchen.
Stichworte: elritze, *Phoxinus phoxinus,* Fluss, somatische Messungen.

Rezumat. O populaţie piscicolă dintr-o anumită zonă geografică poate fi caracterizată din punct de vedere morfologic cu ajutorul măsurătorilor somatice. Având în vedere faptul că în literatura de specialitate din România nu există informaţii cu privire la populaţia de boiştean (*Phoxinus phoxinus*) din Spaţiul Hidrografic Banat, Bazinul Hidrografic Timiş, am întreprins o serie de cercetări asupra morfologiei externe pentru a pune în evidenţă caracterele de conformaţie corporală. Segmentele corporale investigate au fost: lungimea totală a corpului (Tl), lungimea standard a corpului (Sl), lungimea capului (lc), lungimea botului (snl), lungimea pedunculului caudal (lpc), înălţimea maximă a corpului (H), înălţimea minimă a corpului (h) şi greutatea corporală (w). Făcând o analiză a mediei privind lungimea totală a corpului la femele şi masculi de boiştean s-a observat faptul că la femele lungimea medie a corpului a fost de 7,1±0,66 cm, iar la masculi lungimea medie a fost de 4,47±0,15 cm. Greutatea corporală medie obţinută la femele a fost de 4,31±0,41 g, iar la masculi a fost de 0,98±0,08 g. Lungimea standard a femelelor de boiştean reprezintă 84,78 % din lungimea totală a corpului, iar lungimea capului (1,41±0,17 cm) reprezintă 19,85 % din lungimea totală a corpului. La masculii de boiştean lungimea standard a corpului reprezintă 83,44 % din lungimea totală a corpului, iar lungimea capului (0,93±0,03 cm) reprezintă 20,80% din lungimea totală a corpului.
Cuvinte cheie: boiştean, *Phoxinus phoxinus*, râu, măsurători somatice.

Introduction. Ichthyology provides information used to understand characteristic phenomena of fish growth and development, of their feeding and reproduction (Moyle & Cech 2000; Bud et al 2001; Godeanu 2002; Grozea 2007).

In order to study the systematic groups of fish, it is necessary to carry out a series of observations on morphological characters, by measurement of body segments. Data obtained from these observations are statistically processed to highlight conformation features of the species or subspecies in a given geographical area, because it was found that within a species there are large differences in terms of body size.

The most complete data on biometric measurements to common minnow (*Phoxinus phoxinus*) encountered in the Romanian literature, were published by Bănărescu in 1964 (see also Hesthagen & Sandlund 2006; Popek et al 2008; or FISHBASE 2009 as international literature for other aspects on this species).

After Bănărescu (1964), the common minnow head length is 22-27 % of body length, the maximum depth is 17.7-24 % of standard length and minimum depth is 7.5-11.5 % of standard length, caudal peduncle length is 23.6-30.4 % of standard length.

Because literature does not provide information about common minnow (*Phoxinus phoxinus*) population from Banat Hidrografic Area until now (Bănățean-Dunea et al 2008), we launched a series of researches on external morphology to reveal the body conformation characters.

Material and Method. Sampling of biological material was made in Nădrag river basin. Nădrag River is formed in Nădrag locality by the confluence of two water courses: Cornetului Valley and Padeşului Valley. Branch of the Timiş River, Nădrag River is part of Banat Hidrografic Area, Timiş Hidrografic Basin.

Collection of samples for investigation was made with electrical fishing device Tyo FEG 3000 (Figure 1); the device is approved and complies with European legislation in force. Sampling was done in accordance with bill no. 3743/23.05.2008 on a stretch of 10.5 km of river. Collection of samples was made in 3 points in Carpathian Ecoregion and 4 points in Pannonian Plain Ecoregion (Figure 2).

The geographical coordinates of investigation points were established using a GPS which shows the following positions with an accuracy of 0.8 m:

- point I of collection: 45.62° N, 22.11° E, 204 m altitude;
- point II of collection: 45.61° N, 22.11° E, 195 m altitude;
- point III of collection: 45.61° N, 22.10° E, 163 m altitude;
- point IV of collection: 45.61° N, 22.10° E, 161 m altitudine;
- point V of collection: 45.62° N, 22.09° E, 149 m altitudine;
- point VI of collection: 45.62° N, 22.09° E, 136 m altitudine;
- point VII of collection: 45.612° N, 22.072° E, 117 m altitude.

The most important somatic measurements (Holcik et al 1989) that were made to common minnow (*Phoxinus phoxinus*) were:

- total body length (Tl): is the distance between the tip of the snout and the farthest tip of the caudal fin;
- standard body length (Sl): is measured from the tip of the snout to the last row of scales (the base of caudal fin);
- head length (lc): is the distance between the tip of snout and the end of the operculum;
- snout length (snl): is determined from the tip of the snout to the previous eye imaginary perpendicular line;
- length of caudal peduncle (lpc): is the distance between the base of the anal fin and posterior limit of the body (to the last row of scales);
- maximum body depth (H): is measured in the most developed part of body;
- minimum body depth (h): is determined in the most narrow part of caudal peduncle;
- body weight (w): is determined by balance.

Measurements of length to common minnow (*Phoxinus phoxinus*) were made using a calliper. The above somatic measurements (see Figure 3) were made by three

different persons and we used the average mean values. After the measurements the investigated specimens were released at the place where they were collected.

Figure 1. The method of sampling (original photo).

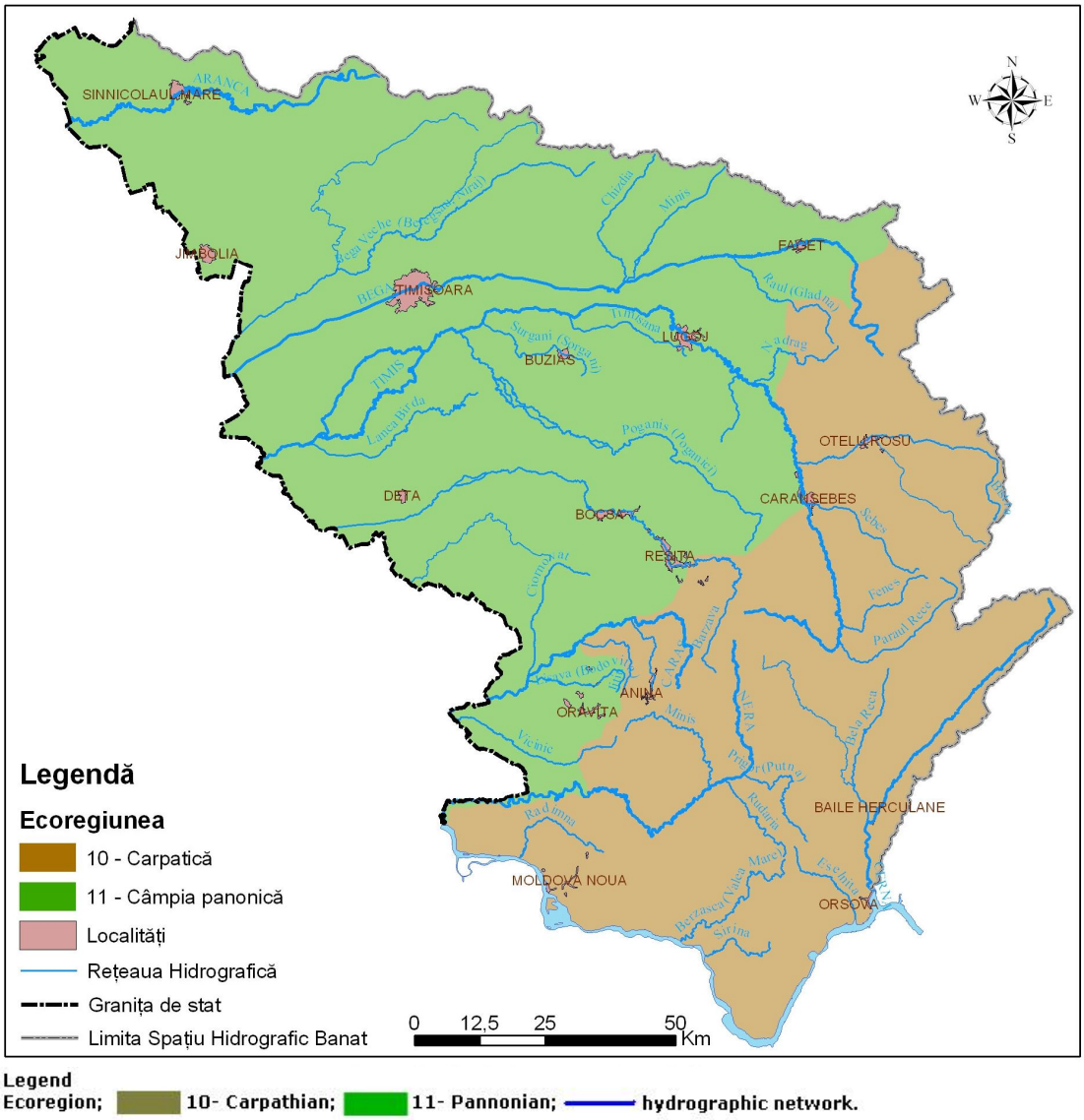


Figure 2. Ecoregions in Banat Hidrografic Area (National Administration of Romanian Waters).

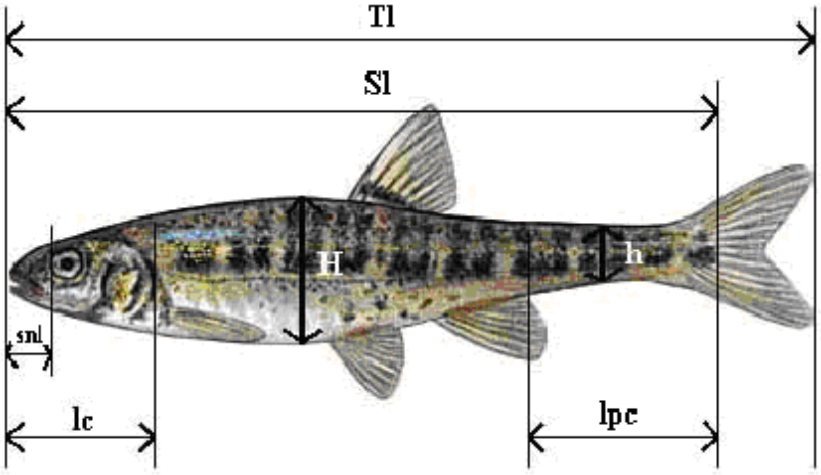


Figure 3. The most important somatic measurements (Holcik et al 1989).

Results and Discussion. Averages and dispersion indices for body size for *Phoxinus phoxinus* females and males are presented in Table 1 and Table 2.

Making an analysis of the average regarding females and males total body length, it can be seen that the females average body length was 7.1 ± 0.66 cm and average body length for males was 4.47 ± 0.15 cm.

Analyzing the average weight, we may observe that the average weight obtained for females was 4.31 ± 0.41 g and the average weight for males was 0.98 ± 0.08 g.

The average females head length was 1.41 ± 0.17 cm and the males average head length was 0.93 ± 0.03 cm.

Table 1

Body sizes for *Phoxinus phoxinus* (common minnow) females, collected from Nădrag river basin

Average and dispersion indices	Tl	Sl	lc	snl	lpc	H	h	w
	U. M – cm-							U. M – g
n	30	30	30	30	30	30	30	30
$\bar{x} \pm S\bar{x}$	7.1±0.66	6.02±0.55	1.41±0.17	0.46±0.06	1.47±0.14	1.52±0.10	0.53±0.04	4.31±0.41
S	1.49	1.23	0.38	0.13	0.32	0.22	0.10	0.93
CV%	20.94	20.46	27.16	28.57	21.61	14.44	17.84	21.49
val. min.	5.4	4.6	0.91	0.29	1.18	1.2	0.4	1.69
val. max.	9.4	7.9	1.98	0.98	2.0	1.81	0.64	6.93

n - Numbers of specimens, x - mean, S - standard deviation, Sx - medium mean error, CV - variability coefficient, val. min. - minimum registered value, val. max. - maximum registered value.

Analyzing the coefficients of variability for females, we observed that most somatic measurements had high variability (CV> 20%), except maximum and minimum height where is note a medium variability (CV between 10% and 20%).

Standard length of common minnow females (6.02 ± 0.55 cm) is 84.78% of the total body length (7.1 ± 0.66 cm) and head length (1.41 ± 0.17 cm) representing 19.85% of the total body length. Caudal peduncle length (1.47 ± 0.14 cm) is 20.70% of the total body length.

By comparison the head length (1.41 ± 0.17 cm) and snout length (0.46 ± 0.06 cm) for common minnow females was found that snout length is 32.62% of head length. Minimum height (0.53 ± 0.04 cm) is 34.86% of the maximum height (1.52 ± 0.10 cm).

Table 2

Body dimensions for *Phoxinus phoxinus* (common minnow) males collected from Nădrag river basin

Average and dispersion indices	Tl	Sl	lc	snl	lpc	H	h	w
	U. M – cm-							U. M – g
n	30	30	30	30	30	30	30	30
$\bar{x} \pm S\bar{x}$	4.47±0.15	3.73±0.12	0.93±0.03	0.23±0.01	0.92±0.10	1.01±0.05	0.44±0.03	0.98±0.08
S	0.25	0.21	0.04	0.02	0.18	0.09	0.05	0.14
CV%	5.63	5.58	4.69	7.53	18.96	8.96	10.41	13.98
val. min.	4.2	3.5	0.9	0.21	0.75	0.92	0.45	0.82
val. max.	4.7	3.9	0.98	0.24	1.1	1.1	0.48	1.07

n - Numbers of specimens, x - mean, S - standard deviation, Sx - medium mean error, CV - variability coefficient, val. min. - minimum registered value, val. max. - maximum registered value.

Analyzing the coefficients of variability for males, we observed that most somatic measurements had a low variability (CV <10 %), except for caudal peduncle length, minimum depth and body weight where is noted a medium variability (CV between 10 % and 20 %).

Common minnow males standard length (3.73 ± 0.12 cm) is 83.44 % of the total body length (4.47 ± 0.15 cm) and head length (0.93 ± 0.03 cm) represents 20.80 % of the total body length. Caudal peduncle length (0.92 ± 0.10 cm) is 20.58% of the total body length.

Making a comparison between common minnow males head length (0.93 ± 0.03 cm) and snout length (0.23 ± 0.01 cm) we found that snout length is 24.73 % of head length. Minimum depth (0.44 ± 0.03 cm) is 43.56 % of the maximum depth (1.01 ± 0.05 cm).

To easily see the differences that arise between females and males, we represented graphically (Figure 4) average values for body sizes listed in the material and working method.

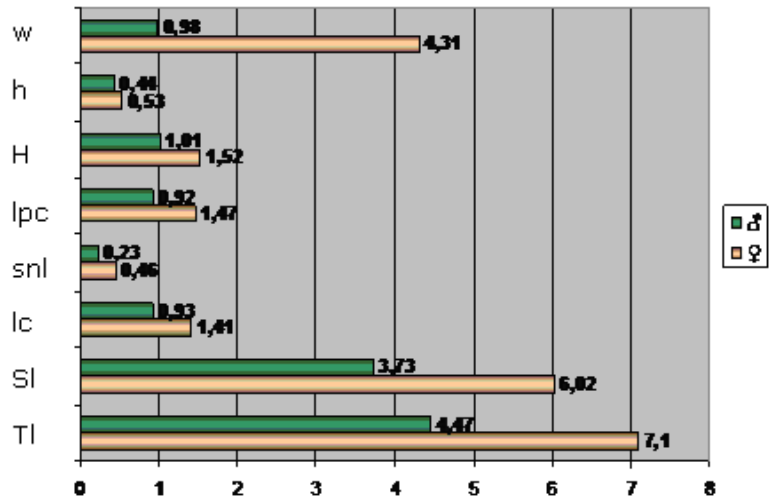
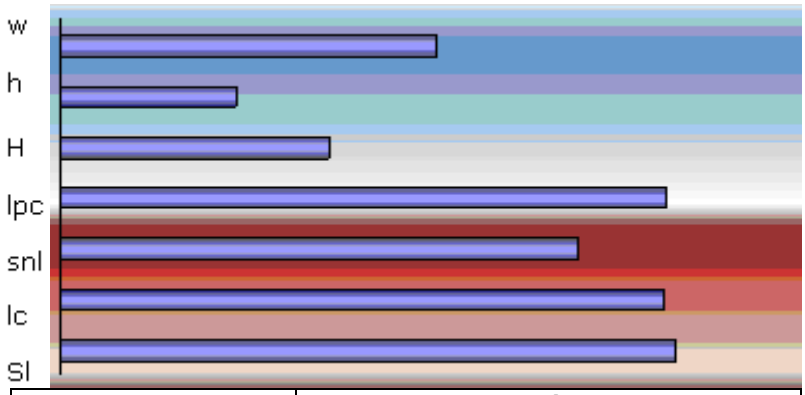


Figure 4. Average values for body size.

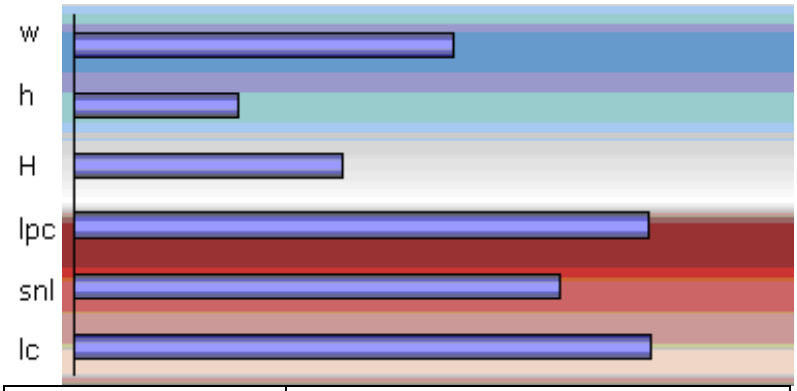
On the basis of results obtained, we studied the correlations between different body regions (Figs 5-8) determined by measuring and by weighing the fish. Correlation coefficients help us better understand the relationships between different body sizes seen to common minnow.

From the study of the correlation coefficient is observed that there are positive correlations between most characters considered for the study. A negative correlation was recorded for common minnow males between standard length and minimum depth (r= -0.577, p= 0.609).



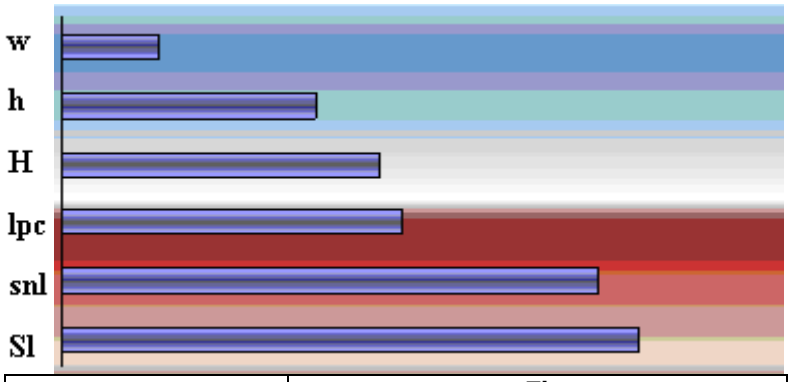
Pearson Correlation	Tl	
	r	p
Sl	0.998	0.000
lc	0.980	0.003
snl	0.840	0.075
lpc	0.984	0.002
H	0.434	0.643
h	0.284	0.643
w	0.611	0.273

Figure 5. Correlation between total body length and standard length, head length, snout length, peduncle length, maximum depth, minimum depth and weight for females.



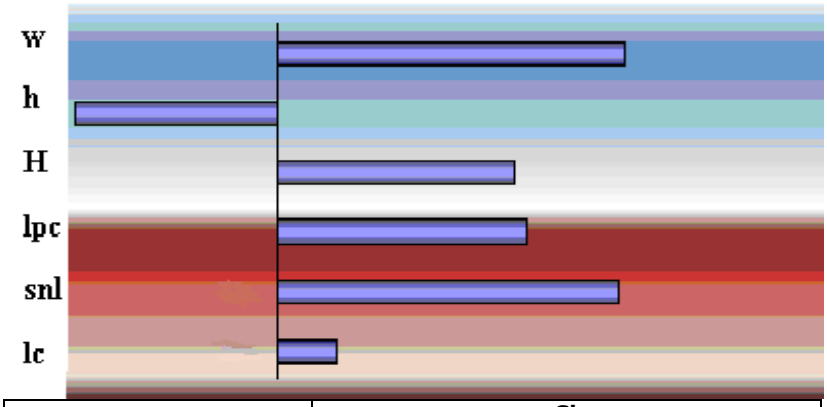
Pearson Correlation	Sl	
	r	p
lc	0.982	0.003
snl	0.825	0.067
lpc	0.976	0.004
H	0.458	0.438
h	0.280	0.648
w	0.644	0.241

Figure 6. Correlation between standard length and head length, snout length, peduncle length, maximum depth, minimum depth and weight for females.



Pearson Correlation	Tl	
	r	p
Sl	0.986	0.106
snl	0.918	0.260
lpc	0.583	0.604
H	0.543	0.634
h	0.434	0.715
w	0.165	0.894

Figure 7. Correlation between total body length and standard length, head length, snout length, peduncle length, maximum depth, minimum depth and weight for males.



Pearson Correlation	Sl	
	r	p
lc	0.165	0.894
snl	0.971	0.154
lpc	0.709	0.498
H	0.675	0.529
h	-0.577	0.609
w	0.991	0.084

Figure 8. Correlation between standard length and head length, snout length, peduncle length, maximum depth, minimum depth and weight for males.

Conclusions. The average body length for common minnow females was 7.1 ± 0.66 cm and average body length of males was 4.47 ± 0.15 cm.

Average body weight obtained for females was 4.31 ± 0.41 g and the average value obtained for males was 0.98 ± 0.08 g

Standard length of common minnow females represents 84.78 % of the total body length and head length is 19.85 % of the total body length.

Length of caudal peduncle of common minnow females is 20.70 % of the total body length.

Common minnow males standard length is 83.44 % of the total body length and head length is 20.80 % of the total body length.

Length of caudal peduncle for common minnow males represents 20.58 % of the total body length.

Average values for body segments investigated for common minnow population from the Nădrag river were lower than those mentioned in the literature.

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Authors:
Ioan Bănăţean-Dunea, Banat's University of Agricultural Sciences and Veterinary Medicine, Timișoara, Faculty of Agriculture, Department of Biology, Calea Aradului street, no 119, 300645, Romania, Eu, e-mail: ionut_banatean@yahoo.com, ionut_banatean@sander.ro
Adrian Grozea, Banat's University of Agricultural Sciences and Veterinary Medicine, Timișoara, Faculty of Animal Science and Biotechnologies, Calea Aradului street, no 119, 300645, Romania, Eu, e-mail: grozea@sander.ro, grozea@animalsci-tm.ro
Marian Bura, Banat's University of Agricultural Sciences and Veterinary Medicine, Timișoara, Faculty of Animal Science and Biotechnologies, Calea Aradului street, no 119, 300645, Romania, Eu, e-mail: marian_bura@yahoo.com
Silvia Patruică, Banat's University of Agricultural Sciences and Veterinary Medicine, Timișoara, Faculty of Animal Science and Biotechnologies, Calea Aradului street, no 119, 300645, Romania, Eu, e-mail: patruica_silvia@yahoo.com
Eliza Simiz, Banat's University of Agricultural Sciences and Veterinary Medicine, Timișoara, Faculty of Animal Science and Biotechnologies, Calea Aradului street, no 119, 300645, Romania, Eu, e-mail: esimiz@animalsci-tm.ro, esimiz@yahoo.com

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