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Research Article

Age-Size Composition, L-W Relationship and Condition Factor of the Brown Trout (*Salmo trutta* Linnaeus, 1758) in the River Iliyana, Bulgaria

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Abstract

Contemporary study of the age-size composition, L-W relationship and condition factor of the population of *Salmo trutta* from Iliyana River, Bulgaria was made. Classical methods for assessment of fish age, condition and population structure were applied. Five age groups were found. The maximum age, length and weight of the caught trout was 5 years, 24.7 cm and 199 g. The most abundant was the 2nd age group- 43.2% of the population and the less numerous was the 5th age group composed from 2.7% of the individuals in the population. The fish catch was divided in 17 size classes. The most abundant were the size classes 15.1-16 and 16.1-17 with six individuals each. The first and the second age groups were with highest size range with 5 and 6 size classes respectively. Power function describes the regression between the length and the weight of the fish ($W=0.0162L^{2.9444}$, $r=0.999$). Fulton's Condition Factor was 1.84, showing the wellbeing of the population.

Keywords: Age-Size Structure; Condition Factor; Iliyana River; L-W Relationship; *Salmo trutta*

Introduction

Salmo trutta is the only species from the gender *Salmo*, naturally distributed in the rivers of Bulgaria [1]. The species is native for almost all the Europe. It is widespread and overall Least Concern. However, anadromous part of populations (sea trout) and many lacustrine stocks have in many cases markedly declined because of pollution (and possibly from impacts from salmon farming). The phylogeographic structure is almost destroyed by stocking. Its preferred habitat is cold streams, rivers and lakes. Spawns in rivers and streams with swift water. Spawning sites are usually characterized by downward movement of water into gravel. Spawns in couples between late October and March, usually in November-December [2]. The brown trout is not a subject to commercial fishing in the rivers in Bulgaria, as there are many trout farms. However, its populations are under pressure as it is one of the preferred subjects for angling. Additionally, there is a severe pressure on brown trout's population through poacher activities. For this reason, it is very important periodically to check the status of brown trout's populations.

Contemporary studies on the biology of *S. trutta* in Bulgaria are missing. The present study is the first since 30 years pause

of studying the biology of wild brown trout's populations. As studying area Iliyana River was chosen. Its Valley is part of the National Park "Rila" and Natura 2000 site "Rilski monastery" in Bulgaria.

The aim of the study is to evaluate the, age-size composition, L-W relationship and condition factor of the brown trout (*S. trutta*) in the River Iliyana, Bulgaria. For the successful management of the species in the protected area it is crucial to evaluate the studied basic biological parameters. Classical methods for assessment of fish age, size structure and condition were applied.

Material and Methods

The material was collected in September 2011 by electro fishing with 700 A/50-70 Hz straight, pulsating current. Two sampling points with the following coordinates were studied: 1. N 42, 09592° E 023, 40512°; 2. N 42, 10099° E 023, 34944°. Altogether 38 brown trout from Iliyana River were analyzed. Each specimen was measured the standard length (to the end of the scale cover) to the nearest millimeter (mm) and the total weight to the nearest gram (g). After the measurements on site, the fish were returned back alive in the river of their catchment.

The age of the fish was determined on their scales, counting the number of annuli. The diagonal radius of the scale as well as of

each annulus was measured by the use of Dokumator, Lasergeret (Carl Zeiss, Jena) at magnification 17 and 5x. To assess the size structure, the fish catch was divided in size classes over 1 cm each. The length-weight relationship was calculated using the power function:

$$W = aL^n,$$

Where,

W is the total weight (g)

L is the standard length (cm)

a is the regression constant

n is the regression coefficient [3].

Four approaches were applied to evaluate the condition of the trout from the Iliyana River: 1. Fulton's coefficient: $CF = (W/L^3) \times 100$ [4-5]; 2. The modified Fulton's coefficient $CF_n = (W/L^n) \times 100$, where instead of the rate indicator 3 was used the rate indicator from the L-W relationship of the population; 3. The coefficient a (CF_a) from the L-W relationship of the population $W = aL^n$, magnified by 10^3 to be converted as an integer for easier comparison; 4. Comparing the values of the fish weight (W) from different water bodies, calculated with the same randomly selected round values of the lengths (L) (for example 5, 10, 15 cm) using the L-W relationship ($W = aL^n$) for each of the populations. The population with the better condition is the one with higher values of W, at the same value of L [6-9].

Results and Discussion

Five age groups were found in the population of brown trout from Iliyana River. The maximum age, length and weight of the caught trout was 5 years, 24.7 cm and 199 g. The most abundant

was the 2nd age group - 43.2% of the population, followed by the first age group with 21.6%. The less numerous was the 5th age group composed from 2.7% of the individuals in the population (Figure 1).

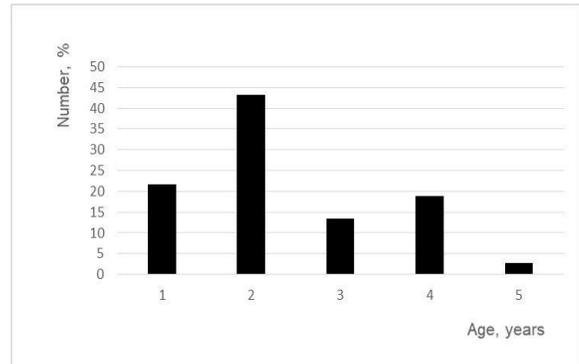


Figure 1: Age composition of the trout catch from the Iliyana River.

The fish catch was divided in 17 size classes. The most abundant were the size classes 15.1-16 and 16.1-17 with six individuals each (Figure 2, Table 1). The age-size structure of the catch is presented on Table 1. The first and the second age groups are with highest size range with 5 and 6 size classes respectively. The main probable reason for the low number of age groups and the prevalence of the young individuals (up to two years) in the trout's population from Iliyana River is the unregulated fishing in the river. The authorized by the law as well as the preferred from the angler's fish are with size 15-20 cm. This significantly decreases the possibility of the species to gain its maximal size and age in the studied river. Another probable reason for the smaller size is the unfavorable river conditions during the period of low water such as high temperature, low oxygen level, river pollution and etc.

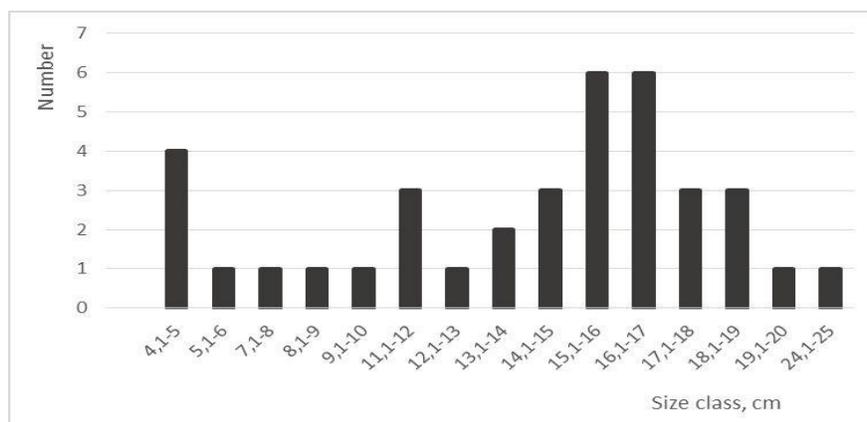


Figure 2: Size structure of the trout catch from the Iliyana River.

Size class	Age, year					Number	%
	1	2	3	4	5		
4,1-5	4					4	10,81

5,1-6	1					1	2,70
7,1-8	1					1	2,70
8,1-9	1					1	2,70
9,1-10	1					1	2,70
11,1-12		3				3	8,11
12,1-13		1				1	2,70
13,1-14		2				2	5,41
14,1-15		3				3	8,11
15,1-16		6				6	16,22
16,1-17		1	5			6	16,22
17,1-18				3		3	8,11
18,1-19				3		3	8,11
19,1-20				1		1	2,70
24,1-25					1	1	2,70
Total number	8	16	5	7	1	37	
%	21,62	43,24	13,51	18,92	2,70		

Table 1: Age-size compositions of the trout catch from the Iliyina River.

The L-W relationship for the brown trout from Iliyina River is presented on Figure 3. Power function is describing the regression between the length and the weight of the fish ($W=0.0162L^{2.9444}$, $r=0,999$). The coefficient n from the equation is close to 3. This indicates isometric growth of the population of *S. trutta* from Iliyina River. This means that the fish increase in their length with increasing weight in cubic form [10-11].

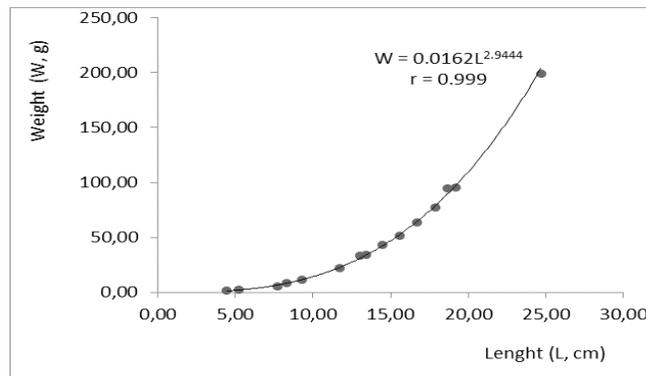


Figure 3: L-W relationship for *S. trutta* from the Iliyina River.

The values for the Condition Factor, calculated with the use of the four methods are given in Table 2. Fulton's Condition Factor for the trout from Iliyina River is 1.84. This value, higher than 1 shows the well being of the population and good habitat condition [12]. The condition of the population from Iliyina River was compared with other populations from rivers in Rila Mountain. All the four methods show higher values of the Condition for the fish from Iliyina River. Most probably the reason for this is the better food base and the autumn fish catch for the study as well as the young average age of the population. The Condition Factor for fish decreases in winter and beginning of the spring, which is connected with keeping up the active metabolism and mostly for ensuring the spawning process [13].

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River /Author	L-W relationship ($W=aL^n$)	Length (L, cm)						CF	CF _n	CF _a .10 ³
		5	10	15	20	25	$\bar{L} = 14,94$			
		Weight (W, g) calculated at one and the same length								
		W ₅	W ₁₀	W ₁₅	W ₂₀	W ₂₅	\bar{W}			
Iliyana River (our data)	$W = 0.0162L^{2.9444}$	1,85	14,25	47,03	109,72	211,65	61,37	1,84	2,14	16,20
Rivers in Rila mountain [1]	$W = 0.0088L^{3.09}$	1,27	10,83	37,90	92,19	183,70	63,47	1,45	1,13	8,80

Table 2: Condition Factor of brown trout from Iliyana River and altogether for the rivers from Rila Mountain [1], calculated using the four methods.

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