

PRELIMINARY RESULTS LENGTH AND WEIGHT GROWTH RATES OF SPECIES *Oncorhynchus mykiss* (WALBAUM, 1792) (Salmoniformes, Salmonidae) ON THE POND "NORFISH" IN BLAGAJ

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Abstract

Phenotypic plasticity in the biological properties of rainbow trout *Oncorhynchus mykiss* (Walbaum, 1792) is the main reason for the prevalence of this type of intensive cage rearing process in the trout ponds across Europe. Cold water fish ponds are characterized by large variations in physical and chemical characteristics of water. In addition to morphological and physiological adaptive nature this is characterized by high quality meat with a significant fat and protein gain in their biochemical composition. Also, rainbow trout has a great feature to achieve growth of biomass in a short period of time. Nutritive value of meat as well as achieving high biomass value is sufficient reason why the rainbow trout has become one of the dominant fish species in the world market of fish meat. Notes from previous explorations are saying that rainbow trout growth achieved during the drab months of breeding and the key role in biomass growth is composition of a food and the number of meals during the day. To this is added that the growth of rainbow trout depends on small variations in the physical and chemical nature of the water medium. Therefore, the issue of this paper highlights the need to be in the pond "Norfish" in Blagaj, during the three-month study period, the 2011th year, to substantiate or refute earlier results, which show a uniform increase in the analyzed species in deep cages, a water temperature of 7 °C to 9 °C with a constant number of daily meals during the three-month research period.

Keywords: *biomass, intensive cultivation, phenotypic plasticity, rainbow trout - Oncorhynchus mykiss (Walbaum, 1792), the pond "Norfish" Blagaj.*

Introduction

Fishing, as an agricultural industry in this country is able to manufacture large quantities of fish of different species and categories. The data indicate that Bosnia and Herzegovina if they want to keep up with the rest of the World with the economic progress in the sphere of the industry has to significantly increase the diversity, quality and overall fish production. However, despite the favorable conditions in recent years in our country there has been a steady decline in production in carp (carp) pond, with a smaller increase in production achieved in trout (trout) fisheries (FAO, the Food and Agriculture Organization of the United Nations, 1997). Therefore, Hamzić (1993) highlights the need for further development of the legal and institutional support for the development of fisheries in Bosnia and Herzegovina. Statistics FAO (1997) showed an annual increase of 8 to 10% higher compared to that of 1970. Total production of about 42.7 million tons in 1999 year's record also shows that the prediction accuracy of the FAO for the need to increase production in the fishery.

The most important fish species that are grown here in the trout ponds is the rainbow trout *Oncorhynchus mykiss* (Walbaum, 1792). Cultivation of fish species requires special

conditions, sufficient water flow, adequate temperature, high water quality, and the content of dissolved oxygen in the water shall not be less than 7-8 mg/l (Ćuk, et al., 2006). Rainbow trout are grown in concrete or earthed pools and per hectare basin can achieve a yield of 100,000 to 500,000 kg trout. Period of growing intensively managed mainly for 18 months (Hamzić, 1993).

Types of biological adaptation caused the intensive farming of rainbow trout - *Oncorhynchus mykiss* (Walbaum, 1792) in the pond "Norfish" Blagaj situated on the River Buna. Due to the relatively shallow and rapid flow of the entire water column, the water in the river Buna gets constantly mixed and the result is not only a large amount of dissolved oxygen but its uniform distribution of the entire course. Such uniformity and vertical distributions related to temperature and other physical and chemical characters of the Buna (Mičijević, 2004).

The interesting biology and a significant economic importance caused great interest from people in the profession and have studied this type of numerous authors from the region: Bojčić and Bunjevac (1982), Klontz (1988), Marinus et al., (1992), Marić (2002), Savić et al., (2003), Mikhail (2004) Mikavica et al., (2005), Savić et al., (2005), Saeed and Purser (2005), Velebit et al., (2005), Trebović et al., (2005), Bećiraj et al., (2006).

Based on the above it can be seen, a very great interest and the number of published works whose subject matter deals with growth of rainbow trout under different environmental conditions. Driven by various allegations during the 2011. period the quarterly survey on the pond "Norfish" Blagaj was done in an independent research project by student Aida Pelo. The research was done intentionally to compare that the available scientific literature is a reference, corroborate or reject of the findings which show a significant growth (length and weight) of rainbow trout *Oncorhynchus mykiss* (Walbaum, 1792) in the cages with adequate nutritional substrates with an approximate fat and protein.

Materials and methods

Research work done on the pond "Norfish" in Blagaj, which is located some 600 meters from the source of the Buna. Close proximity of the source had impact on the physical-chemical water quality (Table 1.), which meets the demanding habitat for rainbow trout. Research was conducted in February, March and April months of the year 2011. In this time period there were six continuous measurements and weighings of fish from the two pools (numbered 9 and 12). The weight of each specimen was measured by a digital scale brand Mettler-Toledo JL-601 61, and the length was analyzed using ihtiometra. Each individual is taken out of the cage was photographed with the camera brand Samsung, A750, and returned back again. During the study, the average water temperature range from 7 °C to 9 °C were observed during the measurement cycle. For working was used a descriptive- comparative research methods, the method of theoretical analysis, discussion of methods, methods of observation and statistical methods of data processing. All listed methods have been applied in each month study. During operation used the following accessories: camera, netting, feeders, tweezers, containers for water sampling, fish sorting machine, scales, etc. ... ihtiometar Laboratory analysis of water was carried out in the month of April, in the laboratory of the Veterinary Faculty of the University of Sarajevo, where they are processed main physio-chemical parameters of water (Table 1).

Table 1. Physio-chemical characteristics of water from the pond "Norfish" Blagaj (made in the laboratory of the Veterinary Faculty in Sarajevo)

PARAMETER	VALUES
Water temperature (° C)	8, 03
pH	7,32
Oxygen (mg/l)	7,02
Carbon dioxide (mg/l)	2
Amonioni (mg/L)	<0. 01
Ammonia (mg/L)	<0, 001
m-alkalinity,	10, 75
Turbidity	6
Carbonate hardness (°dH)	12, 38



Figure 1. Pool pond "Norfish" Blagaj (photo: A. Pelo)



Figure 2. Pool pond "Norfish" Blagaj



Figure 3. Pool pond "Norfish" Blagaj (photo: A. Pelo)

Results and discussion

Data on the length and weight of all rainbow trout *Oncorhynchus mykiss* (Walbaum, 1792) individuals caught in the pond "Norfish" in Blagaj are shown in Table 2. In addition to the data in Table 2. There are also preliminary results of increasing length and body weight at intervals of research. Statistical analysis consisted in the application of comparative statistical procedures using the software program "SPSS for Windows 17.0." Statistical analysis of the results are reported to show that rainbow trout ranged from 0 to 15 days achieved by uneven growth of body length, as and observed during the measurement the length of the body. Based on comparison of the results observed value body length ranging from a minimum of 90,00

mm to a maximum of 170,70 mm. increase in the total for all measurement interval is 24.496 mm. Growth in length and weight of the body at intervals analyzed the F-test (ANOVA - Single actor), and the results do not point out the significant statistical difference in the increase of body weight per day and on average ranged from a minimum to a maximum of 0.029 g 0.080 g. The total increase in the mass of all six intervals was 0.053 g. Coefficients of variation – CV shows a decline in the growth dynamics of the body length of rainbow trout that range from a minimum of 6.01 to a maximum of 7.04 which means that the average increase in body length per day going in the range of 0.491 to 0.974 mm in all six stages of measurement.

Cage farming system is specific for the large seasonal and daily variations in the physio-chemical properties of water, which has a direct impact on the entire breeding process.

Table 2. Review data on length and weight of specimens of rainbow trout - *Oncorhynchus mykiss* (Walbaum, 1792) in the pond "Norfish" in Blagaj and statistically derived values

		POOL 9 th			POOL 12 th		
Dated		15.02. 2011.	28. 02. 2011	14.03. 2011.	29. 03. 2011	14.04. 2011.	29. 04. 2011
1.st	mm	120,34	120,40	130,50	130,80	150,90	140,29
	g.	80,20	109,90	120,80	120,20	143,80	150,00
2.nd	mm	100,23	130,57	150,77	140,23	150,00	160,17
	g.	72,10	110,10	132,50	130,60	139,80	165,00
3.rd	mm	150,11	110,98	160,90	110,11	140,90	150,80
	g.	120,10	102,40	152,90	100,70	143,70	154,80
4.th	mm	120,50	130,23	140,03	160,15	150,83	160,10
	g.	102,50	100,00	130,10	153,60	163,90	164,70
5. th	mm	90,00	130,03	140,10	130,90	170,53	150,90
	g.	80,00	102,00	130,20	123,40	183,50	183,50
6.th	mm	120,73.	160,34	160,49	120,54	140,60	160,50
	g.	112,60	143,40	155,20	123,80	133,70	165,50
7.th	mm	110,04	110,95	130,80	110,53	150,40	170,00
	g.	90,00	130,00	120,80	103,80	153,80	186,00
8.th	mm	150,00	140,34	110,37	170,34	190,41	140,30
	g.	112,90	112,90	103,20	160,70	200,70	156,00
9.th	mm	170,70	130,39	140,20	110,62	150,03	160,10
	g.	130,60	110,80	130,00	103,90	160,80	176,80
10.th	mm	120,10	130,20	130,09	140,00	130,53	150,56
	g.	120,05	129,15	123,00	139,00	133,50	14,60
CV		6.80	6.81	6.01	7.04	6.20	6.32
Average growth mm in		15,39	30,21	20,71	30,52	30,00	20,15
Growth average length in mm		min. 0.491 mm max. 0.974 mm					
Growth average length in mm		24,496 mm					
The increase in mass per interval		0.050 g.	0.080 g.	0.071 g.	0.049 g.	0.043 g.	0.029 g.
Total growth mass in all intervals		0.053 g					

According Radević et al., (1997) fish growth rates is equalized by months at a constant water temperature of 7°C. Fish in the intensive rearing receive the same average body length of up to 6 months of cultivation, some 0.530 mm per day, and the rapid growth of 9 months starts when double length per day. Our results support the findings and allegations Radevića et al., (1997), because the average temperature of the water in the pond during all the study ranged from 7 to 9°C.

Also, Filipović and Stamenković (2001) concluded that the direct effect of cultivation is the quality of the physical and chemical properties of water. According to their statement to achieve the best rainbow trout growth is the small variations in the character of the water, as well as in meeting its energy needs for food, which in itself has a certain level of fat and protein. They point out that with the increase of the share of fats and proteins increases the growth of fish and the shorter the period of growing up to commercial size. Rainbow trout in the pond of the Blagaj was not achieving so significant weight gain per day is probably because it was fed with food that had the same proportion of fat and protein in each meal during the three month study. It seems to be one of the reasons, where the results obtained in the pond in Blagaj disagree with the allegations Filipović and Stamenković (2001) note that higher growth due to increase in fat and protein in meals. Thus, the resulting small increase in the pond in Blagaj can be found in the monotonous diet, and a great variation of some physico-chemical parameters of the water. Ćuk et al., (2006), and Filipović and Stolić, (2007) suggest that low weight gain and body length per day may be a consequence of the high variability of water flowing through the pond.

Statistical analysis of the results show no significant increase in weight and thus in body length during our research.

Data on length and a weight gain of rainbow trout from the pond "Norfish" in Blagaj coincide with those obtained by Klontz (1988), Mikavica (1992), Marinus et al., (1992), Yıldız (2004), which relate to daily gain in the cages. The reasons why results from the pond "Norfish" Blagaj in line with their results can be found in the water temperature, the variability of other physico-chemical properties of water, as well as a constant proportion of fat and protein in the food that the fish are fed. Results of daily gain body length with a water temperature of 7°C in the pond "Norfish" in Blagaj ranged from 0.491 to 0.974 mm during the study. The results of the increasing length of the body is consistent with the results Klontz (1988) and Mikavica (1992) who state that a water temperature of 7 °C, daily weight gain of rainbow trout body length is a 0.432 mm, while the water temperature of 8 °C daily gain of body length was 0.537 mm. According to data Mikavica (1992) rise in water temperature of 13.24 °C for the Spring-Summer linear growth of rainbow trout becomes more intense. However, our results do not agree with the allegations Mikavica (1992) because in the process of breeding pond in Blagaj declined in increasing body weight and length, as water temperature increased in the month of April. Presented with no agreement made by Mikavica (1992) probably due to the composition of the food that is the share of fats and proteins as well as the number of daily meals in the diet of rainbow trout in the pond "Norfish" Blagaj. Similarly, Marinus et al., (1992), suggest that a water temperature of 13 °C daily gain of the body length is 1.006 mm, and the daily increase in body length season spring - summer of 1990.the pond Gornji Ribnik ranged from a minimum of 0.462 mm to 0.551 mm maximum. In this regard, the reason for the low daily gain in the pond in Blagaj agree with their data, because the increase in body length per day ranged from 0.491 to 0.974 mm in all six measurements.

According to Saeed and Purser (2010) length and weight gain also depends on the method and amount of food and the number of daily meals. Thus, the reason for the low weight gain can be found in the type of food used in the breeding process and the number of meals that were present during the study period.

Conclusion

Because of its adaptive capabilities rainbow trout - *Oncorhynchus mykiss* (Walbaum, 1792) has become one of the dominant fish species in deep cages in the world. Rainbow trout - *Oncorhynchus mykiss* (Walbaum, 1792) in many countries of the world have become known and recognized as a breeding species, due to the rapid growth and excellent nutritional quality of meat. The economic importance of this fish is enough reason why, nowadays more and more attention to its cultivation, which is directly related to the physico-chemical properties of water, as well as diet. For this reason the pond "Norfish" Blagaj research conducted for a period of three months. During this study it was found that rainbow trout in deep cages does not achieve a balanced growth in biomass during each month of cultivation, although food substrate which in itself has the same fat and protein. Also, it was found that the most intense rainbow trout achieved growth at a constant temperature water and large variations in other physico-chemical properties of water is not conducive to growing them.

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