

## RESEARCH CONCERNING SOME FACTORS INFLUENCING THE GROWTH PHYSIOLOGY IN A RAINBOW TROUT POPULATION (*Oncorhynchus mykiss*), REARED WITHIN CONTROLLED ENVIRONMENT

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### Abstract

*In this research the authors aim to emphasize the way in which the environmental factors act on the growing rhythm in a rainbow trout (*Oncorhynchus mykiss*) population, reared within controlled environmental conditions. After the experimental period, the results were compared to those recorded within salmonidae classical rearing system – Trout Fiad Fishery, county of Bistrița - Năsăud. In experimental development, 100 individuals were randomly selected from the experimental system and 100 from Fiad trout fishery, and measured monthly. According to the presented data, for the described experimental system, superior results of the growing rhythm of the body weight and total length were recorded compared to the results recorded within classical system of salmonidae rearing – Fiad trout fishery. This can be explained by the influence of the temperature factor, because pH and dissolved oxygen frame within normal values in both rearing systems.*

**Key words:** rainbow trout, growth physiology, environmental factors, rearing systems

### INTRODUCTION

The very rapid increase of the aquatic products (fishes, clams, shell fishes, etc.) consumption determined men to better and more consciously understand that fish and fish products or by-products must be more attentive and responsible treated, because the animal origin protein obtained from aquatic environment play a very important role for the development and maintaining of the human organism health and development.

Majority of the countries possessing aquatic resources look for directing their efforts towards obtaining fish productions, as big as possible, with maximum efficiency. In this context, salmoniculture represents one of the most important branches of fishery and aquaculture.[1]

The rainbow trout (*Oncorhynchus mykiss*) is the most important specie reared in salmonicole complexes, due to the plasticity and resistance against environmental factors and diseases, as well as rapid growing

rhythm, obtained as result of the selection and improvement processes applied to this specie.[2]

In the last time, the researchers' attention was directed towards supplying optimum environmental conditions, that will create conditions for shorter time needed for developing production cycles, while obtained products have superior quality.

In this paper the authors aim to emphasize the way in which the environmental factors act on the growing rhythm in a rainbow trout (*Oncorhynchus mykiss*) population, reared within controlled environmental conditions. After the experimental period, the results were compared to those recorded within salmonidae classical rearing system – Trout Fiad Fishery, county of Bistrița - Năsăud.

## MATERIAL AND METHOD

The research performed on the biological studied material were performed during 210 days (December - June), in two different locations: a system of water recirculation destined to fish rearing organized in Cluj-Napoca town and Fiad trout fishery, county of Bistrița - Năsăud.

The recirculation system was organized in a small size hall (30 m<sup>2</sup>), and in its constitution are included a circular pool with 3 m<sup>3</sup> capacity, electric pumps with water recirculation, pipes, mechanical and biological filters for water, air pumps and oxygen spreaders. The used water source was the public network for water distribution from Cluj - Napoca. [3]

The Fiad trout fishery was founded in 1983, and the main activity object is represented by the salmonidae reproduction and obtaining biological material destined to the repopulation of the waters from the mountain areas. Pools populated with biological material destined for consumption are also managed in this unity with the aim of increasing profitableness. The Fiad trout fishery has an area of 1.7 ha, and is located at 452 m altitude, while the water supply is obtained from two sources: Valea Sălăuța with a flow of 200 L/s and Valea Fiad with a flow of 100 L/s. The water temperature within this salmonicole unity records large variations in last years, with a minimum of 0.5°C in January and a maximum around 26.5°C in August. In lasts years, during summer, an increase of the numbers of the days when water has temperatures over 20°C was recorded.

The experimented biological material belongs to the same line and generation, both within the recycling system realized in Cluj-Napoca and trout fishery Fiad.

With the aim of marinating of some constant environmental factors, appropriate to the biology of the rainbow trout (*Oncorhynchus mykiss*), within the recycling system placed in Cluj-Napoca the following methods were used:

- The dissolved oxygen was maintained within an optimum level by recirculation of the water and falling back in the culture pool from 1 m height, as well as by using some air pumps and oxygen spreaders installed within the pool. The

monitoring of the dissolved oxygen was periodically performed, using mobile electronic pH-meters.

- The water pH was permanently monitored with mobile electronic pH-meters.

- During December - April, with the aim of maintaining a temperature as similar as possible to the optimum necessary for the *Oncorhynchus mykiss* specie, a thermic microstation was used. Through radiators, it warmed the closed space where the recirculation system was installed. During May - June the supplementary heating was not necessary, because the water temperature framed within normal values: in May - 13°C, and in June - 16°C. the temperature monitoring was performed with portable electronic thermometers.

Within Fiad trout fishery the following methods were used:

- The dissolved oxygen was maintained within optimum values with fruit support type aerators from endowment.

- The water pH was permanently monitored with mobile electronic pH-meters.

- The water temperature within trout fishery was monitored with some portable electronic thermometers, but on the recorded values corrections could not be performed because the pools were placed in open spaces.[4]

In order to avoid the most likely differences of the growing rhythm determined by the feeding system, the same forage type was used and the same foraging regimen was applied in both experimental locations.

In experimental development, 100 individuals were randomly selected from the recirculation system and 100 from Fiad trout fishery. The somatic measurements were monthly performed and aimed two essential traits in emphasizing the growing rhythm of the individuals from both locations: body weight and total length (the distance from the edge of the mouth and line connecting the edges of the caudal flippers lobes). The body weight was expressed in grams and total length in centimetres. The three studied microclimate parameters were also studied and monitored: dissolved oxygen, water pH, and water temperature.

All values were statistically processed and interpreted.

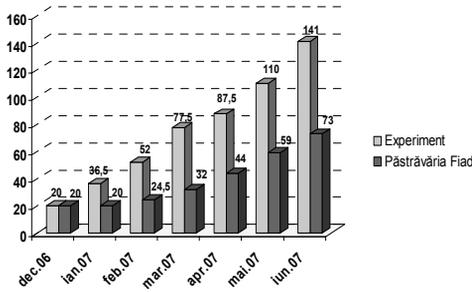


Fig.1 Growing rhythm – body weight

THE SOMATIC MEASUREMENTS.  
 The somatic measurements deliver a series of results graphically represented (fig. 1 and 2)

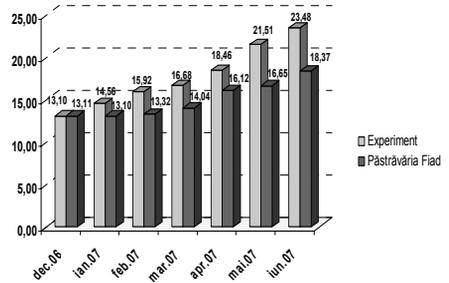


Fig.2 Growing rhythm – total length

The analyze of the three studied environmental factors led to the following results:

**THE DISSOLVED OXYGEN.** The values of the dissolved oxygen were relative constant within experimental system during the experimental development, but with light variations: 9.8 mg/L – June, 10.6 mg/L – January, respectively. In trout fishery Fiad, the values of the dissolved oxygen were between 8.8 mg/L – June and 12.8 mg/L – December – February. The evolution of the

dissolved oxygen values in both locations are presented in fig.3.

**THE WATER pH.** Concerning the environmental factor pH, it framed within normal and specific limits for the rainbow trout biology (*Oncorhynchus mykiss*). Within the recirculation system a minimum was recorded in June (pH=7.0) and a maximum in February. Within the trout fishery Fiad, a minimum of the pH value was recorded in April (pH=7.0) and a maximum in March (pH=7.3). The pH values recorded in both locations of the experiment are graphically presented in.4.

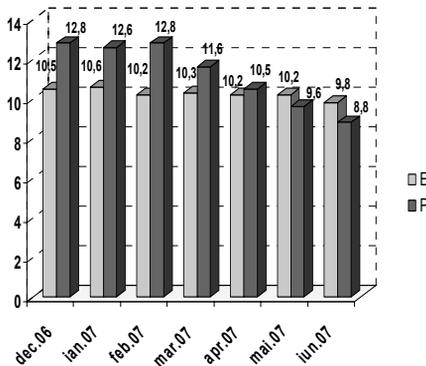


Fig.3 The values of the dissolved oxygen

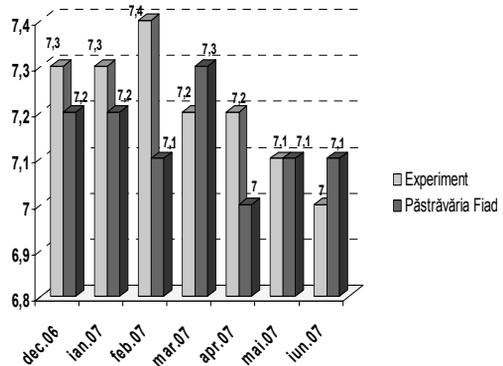


Fig.4 The pH values water

**TEMPERATURE.** The temperature of the culture environment differs within the recirculation system between 4°C in January and 16°C in June. In Fiad trout fishery, the values of the culture environmental

temperatures had variation between 0.5°C in January and 18.2°C in June. The temperature evolution during the experimental time interval, in both locations, is graphically emphasized in fig.5.

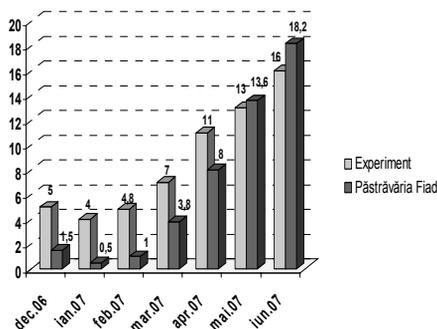


Fig.5 The temperature water

An average of the measurements was performed, and a monthly value was obtained for both body weight and total length. The monthly data aiming both studied traits were compared and sample statistical parameters were calculated, then statistical interpretation of the averages was performed using the „t<sup>2</sup>-Student test. From data analysis presented in Tabel 1, we found that body weight of fishies raised in experimental system have values of 74,90±4,23 g, compare with the fishies from

Fiad trout fishery, with body weight of just 38,92±2,06 g. The differences were very significant and is related to the environmental factors, which were optimum in the experimental system. The same aspect we found in the case of total length, where are also very significant differences between the two raised systems, 17,67±0,37 cm in experimental system, compare with 14,95±0,20 cm found in Fiad trout fishery.

Table 1

The average values and significance of the differences of the body weight and total length in rainbow trout (*Oncorhynchus mykiss*)

Issue	Experimental system				Fiad trout fishery				d	sd	t
	n	X±s <sub>x</sub>	s	V%	n	X±s <sub>x</sub>	s	V%			
<b>Body weight</b>	100	74.90±4.23	42.38	56.58	100	38.92±2.06	20.66	53.11	35.98 xxx	4.71	7.63
<b>Total length</b>	100	17.67±0.37	3.73	21.10	100	14.95±0.20	2.09	13.97	2.72 xxx	0.42	6.47

## CONCLUSIONS

According to the presented data, for the described experimental system, superior results of the growing rhythm of the body weight and total length were recorded compared to the results recorded within classical system of salmonidae rearing – Fiad

trout fishery. This can be explained by the influence of the temperature factor, because pH and dissolved oxygen frame within normal values in both rearing systems.

Under the influence of the low temperatures recorded in winter season (0.5°C – January; 1°C – February; 1.5°C – December; 3.8°C – March), in Fiad trout

fishery, the central nervous system (through hypothalamus) determines a clear slowing of the metabolic processes development, with clear consequences on the growing rhythm, while in experimental system, the minimum water temperature of 4°C recorded in January, has a very small influence on the growing rhythm. Because the fishes are poikilotherm organisms a slowing of the metabolic processes is produced in the mean time with water temperature decrease, and increase of the metabolic activity in the mean time with temperature increase.

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