

STUDY OF SOME MORPHOLOGICAL CHARACTERISTICS *ONCORHYNCHUS MYKISS* BREED FARMED IN SALMONID EXPLOATATIONS FROM MOLDOVA

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Abstract

*Study of morphological characters of fish by means of biometry is a frequently used method and consists in determining the variability of characters in isolated individuals or groups of individuals, by direct measurement, weighting and statistical processing of obtained data. Rainbow trout, *Oncorhynchus mykiss*, is characterized by intensively body growing superior to other salmonid breeds, being the breed which assimilates best the growing conditions of intensive trout farms. This breed is the object of the current study by analyzing of 40 individuals of third summer, 20 individuals in each batch (L_1 and L_2), in two trout farms from mountain area of Moldova. Based on the processing of the obtained data were calculated the most representative indexes and maintenance coefficients. The obtained values were between 3.58 at L_1 batch and 3.83 at L_2 batch for profile index; for Fulton coefficient 1.74 at L_1 batch and 1.56 at L_2 batch; for Kiselev index between 1.46 at L_1 batch and 1.55 at L_2 batch; for thickness index 44.44 at L_1 batch and 45.61 at L_2 batch; for fleshy index I 21.21 at L_1 batch and 20.10 at L_2 batch, and for fleshy index II 18.76 at L_1 batch and 19.18 at L_2 batch. After analyzing the obtained results we can conclude that the analyzed fish from both experimental batches presented a good state of maintenance.*

Key words: morphological characters, *Oncorhynchus mykiss*, body indices, maintenance coefficients

INTRODUCTION

Originally from western regions of the USA, rainbow trout *Oncorhynchus mykiss*, was brought to Europe around 1880 in Germany, and later was introduced in our country, in Moldova [2], [3], [12], [13], [14].

Is the breed which assimilates best the growing conditions from intensive trout fisheries, as it adjusts to warmer waters, is the least pretentious to temperature variations, is not so exigent to oxygen content, gets used easily with supplementary food, and has a good body growth [2], [3], [11], [12], [13], [14].

Rainbow trout is characterized by a growth rate superior to the others salmonid breeds, reaching in the second year of growing a weight of 250-350 g, and with an abundant feeding can reach even 435 g, can be exploited in the second year [2], [3], [11], [12], [13], [14].

Effectuation of somatic and gravimetric measurements serve for determining the increase in length of fish and to determine their general physiological condition [6], [7], [8], [9], [18]. Based on data obtained by measurement and weighing, it can calculate various indicators and tangible factors that make it possible for the farmer to evaluate the fish population [1], [5], [9], [15], [18].

MATERIAL AND METHODS

To achieve practical part of the study of morphological characters were used every 20 specimens of rainbow trout (*Oncorhynchus mykiss*) of third summer (P.s.₂₊), reared in two salmonid fisheries from the mountain area of Moldova.

In order to calculate growth indexes and coefficients, were determined several parameters, namely: total length, standard length, head length, caudal peduncle length, body height and thickness of the body.

Based, on somatic measurements can be calculated several corporal indexes, which provides information regarding maintenance

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status as well as their adaptability to the assured environmental conditions [9], [15].

Corporal indexes represent the ratio of two dimensions, morphological or physiological related, or which indicate certain general characteristics, specific productive skills [1], [4], [16], [17], [18].

Characters determinate through biometric studies are:

- metric characters: length, width, height, perimeters;
- gravimetric character: weight.

Biometric data are used to determine growth in length of fish and to determine the general physiological condition and is obtained by measurements taken with special instruments (ihtyometers) or other measuring instruments (ruler, callipers) [16], [17], [18].

These measurements are:

- ✓ body weight (M) – established through weighting;
- ✓ total length of body (L) – it is measured from the top of the snout till the top of the lobes of caudal fin;
- ✓ standard length of body (l) – also named standard length or length without the caudal fin, it is measured from the top of snout till the base of caudal fin;
- ✓ maximum height of body (H) - it is measured in the highest area of body, from ventral line to the dorsal line;
- ✓ maximum circumference of body (C) – it is measured at the level of maximum thickness and maximum height, respectively before dorsal fin;
- ✓ length of the head (lc) - represents the distance from top of snout to the posterior edge of operculum bone;
- ✓ length of caudal peduncle (lp) – it is measured from the posterior extremity of anal fin to the base of caudal fin;
- ✓ maximum thickness of body (G) – it is measured in the area where body have the greatest thickness;

Based on the somatic measurements could be calculated a series of corporal indexes which offers information regarding fishes maintenance state and corporal shape of body (profile index, thickness index Fulton coefficient, Kiselev index, fleshy index I and II, [1], [2], [3], [4], [5], [9], [10], [16], [17], [18].

Profile index (IP) express the morphological appearance and is calculated as:

$$IP = \frac{l}{H}$$

where:

- l – standard length of body;
- H - maximum height of body

Thickness index (IG) (dorsum width) expresses the width of musculature from dorsum area in connection with the maximum height of body. Thickness index could be calculated with the formula:

$$IG = \frac{G}{H} \times 100$$

where:

- G = maximum thickness of body (cm);
- H = maximum height of body (cm).

Body circumference index (Kiselev) (IC) reflects the individual's weight, length, thickness, fattening degree and maturation of the gonads degree.

It is a stable index, accurate with a small variation scale and is given by:

$$IC = \frac{l}{C}$$

where:

- l - standard length of body;
- C – body circumference.

Fattening coefficient, Fulton (K) expresses the state of maintenance of fish and is calculated as:

$$K = \frac{g \times 100}{l^3}$$

where:

- g – body weight;
- l - standard length of body.

Fish length is taken at cube, since weight gain is directly proportional to the growth of the body.

Fleshy index (Ic) expresses the proportion of head or caudal peduncle from the standard length of the body. For its calculation, was used the following formula:

$$Ic = lc \times 100/l_s, \text{ or} \\ Ic = lp \times 100/l_s$$

where:

- lc = length of the head, in cm;
- l_s = standard length of body, in cm;
- lp = length of caudal peduncle, in cm.

As the quality index values are lower the fish is much well developed. [1], [5], [6], [10], [17].

RESULTS AND DISCUSSIONS

Research has debuted with biometric determinations: body weight (M), total body length (L), body length (standard length) (ls),

maximum body height (H), maximum body circumference (C), length of the head (lc), caudal peduncle length (lp), and maximum thickness of body (G).

Following measurements, was calculate the average of 20 specimens for each experimental batch (table 1).

Table 1 Biometric measurements at rainbow trout (*Oncorhynchus mykiss*)

Specification	<i>Oncorhynchus mykiss</i> PC ₂₊ L ₁ (n=20)		<i>Oncorhynchus mykiss</i> PC ₂₊ L ₂ (n=20)	
	$\bar{X} \pm s_{\bar{x}}$	V%	$\bar{X} \pm s_{\bar{x}}$	V%
Body weight – M (g)	282.44±7.89	8.83	288.92±5.03	5.51
Total length – L (cm)	27.60±0.39	4.48	29.04±0.32	3.47
Standard length– ls (cm)	25.34±0.36	4.47	26.49±0.30	3.56
Maximum height – H (cm)	7.09±0.09	4.23	6.95±0.14	6.33
Heads' length – lc (cm)	5.36±0.09	5.09	5.32±0.09	5.65
Maximum circumference – C (cm)	17.31±0.16	2.91	17.09±0.26	2.65
Length of caudal peduncle – lp (cm)	4.76±0.15	9.86	5.11±0.11	6.74
Maximum thickness of body (G) (cm)	3.15±0.03	3.04	3.16±0.05	4.58

Following the performed measurements for rainbow trout specimens of third summer, were obtained values close to those presented in the consulted literature [3], [5], [10], [16], which shows that the studied specimens had adequate development appropriate of the breed.

The coefficients of variance highlighted each time a good homogeneity of the two experimental batches (L₁ and L₂).

After processing the data obtained from measurements and weighing were then calculated the values of the most representative maintenance and coefficients indexes to highlight the state of maintenance of studied trout.

By calculating the profile index (I_p), may determine whether the outer shape of the fish

meets the desired character of farmers, showing off their body size and allowing classification of individuals of a population in a particular type of profile. This index represents the ratio between the standard length and maximum height of the body.

By calculating the profile index, it was found that the body size of studied fish for the two batches L₁ and L₂, is appropriate and fits the profile of the specimens examined species

The value obtained in L₁ batch was 3.58±0.05, and at L₂ batch 3.83±0.10. The coefficient of variability shows a good homogeneity of the analyzed batches of fish (V% < 10) (table 2).

Table 2 Values of the profile index at rainbow trout (*Oncorhynchus mykiss*)

Specification	Batch	n	$\bar{X} \pm s_{\bar{x}}$	V%	Min.	Max.
<i>Oncorhynchus mykiss</i>	L ₁	20	3.58±0.05	4.63	3.39	3.96
<i>Oncorhynchus mykiss</i>	L ₂	20	3.83±0.10	8.56	3.34	4.33

Thickness index (IG), is calculated using the ratio between muscle thickness and maximum height from spinal region of the body.

The mean values of the thickness index at the studied rainbow trout specimens were

44.44±0.61 cm for L₁ batch and 45.61±1.04 cm for L₂ batch and the values determinate for the variance coefficient (4.35 and 7.19) shows a good homogeneity of the studied character.

Table 3 Values of thickness index at rainbow trout (*Oncorhynchus mykiss*)

Specification	Batch	n	$\bar{X} \pm s_{\bar{x}}$	V%	Min.	Max.
<i>Oncorhynchus mykiss</i>	L ₁	20	44.44±0.61	4.35	41.61	48.18
<i>Oncorhynchus mykiss</i>	L ₂	20	45.61±1.04	7.19	39.71	49.25

Quality index or Kiselev (IC) serves to fast determination of fish quality, without any other weighting and measurements, being calculated as the ratio between the standard length and maximum body circumference. As the quality index values

are lower, the fish meets the best conditions for selection.

Rainbow trout from L₁ batch presented lower values for the quality index of 1.46±0.02, relative to L₂ batch, which had a bigger value of this index, of 1.55±0.03

Table 4 Values of quality index Kiselev at rainbow trout (*Oncorhynchus mykiss*)

Specification	Batch	n	$\bar{X} \pm s_{\bar{x}}$	V%	Min.	Max.
<i>Oncorhynchus mykiss</i>	L ₁	20	1.46±0.02	4.90	1.39	1.60
<i>Oncorhynchus mykiss</i>	L ₂	20	1.55±0.03	6.91	1.35	1.70

Fulton coefficient (I_f) or fattening coefficient provides us information regarding the food factor, reflecting the maintenance condition of trout and is represented ratio between body weight and total length cubed. As the Fulton coefficient values are higher the fish is much well developed.

Fulton coefficient, which reflects the physiological or pathophysiological state of

fish, registered in the case of analysed rainbow trout individuals differences between the two experimental batches, the calculated coefficient ranged between 1.56±0.05 at L₂ batch and 1.74±0.05 at L₁ experimental batch.

The studied character presented a middle variability in case of L₂ batch (V%>10) and lower in case of L₁ batch (V%<10).

Table 5 Values of Fulton coefficient at rainbow trout (*Oncorhynchus mykiss*)

Specification	Batch	n	$\bar{X} \pm s_{\bar{x}}$	V%	Min.	Max.
<i>Oncorhynchus mykiss</i>	L ₁	20	1.74±0.05	9.24	1.48	2.06
<i>Oncorhynchus mykiss</i>	L ₂	20	1.56±0.05	10.89	1.29	1.88

Fleshy index (I_c) express the head proportion from the standard length of the body.

In the case of experimental batches L₁ and L₂ fleshy index I, registered values between 20.73±0.34% and respectively 21.01±0.35%. The studied character was homogenous for both rainbow trout batches, aspect highlighted by the value of the variation coefficient.

Fleshy index II, express the proportion of the caudal peduncle from the standard length of the body.

For fleshy index II, the values ranged between 18.76 in the case of L₁ batch and 19.18 in the case of L₂ batch.

The fact that the values of fleshy index I and II, oscillates around the value of 20% certify that the studied trout have a high percentage of meat.

Table 6 Values of fleshy index at rainbow trout (*Oncorhynchus mykiss*)

Specification	Batch	n	Ic	$\bar{X} \pm s_{\bar{x}}$	V%	Min.	Max.
<i>Oncorhynchus mykiss</i>	L ₁	20	I	21.21±0.51	7.63	18.66	23.43
			II	18.76±0.38	6.35	18.76	20.90
<i>Oncorhynchus mykiss</i>	L ₂	20	I	20.10±0.52	8.23	17.75	22.96
			II	19.18±0.31	5.14	17.12	20.98

Following calculation of indexes and growth coefficients, at the two experimental batches the obtained values are similar to those from the literature, resulting that the specimens analyzed had a good maintenance condition [5], [10], [16].

CONCLUSIONS

The values of the calculated main indexes reflect a corresponding increase, a better use of nutrition, correlated with good maintenance and health of the analyzed fish.

Growth and development of rainbow trout specimens' (*Oncorhynchus mykiss*) in the two salmonid fishery from the mountain area of Moldova taken in study, fits within the breed characteristics which show a good adaptation to the specific area.

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