

ANALYSIS OF SOME MORPHOLOGICAL CHARACTERISTICS OF *SALVELINUS FONTINALIS* TROUT BREED FARMED IN SALMONID EXPLOATATIONS FROM NEAMȚ AND SUCEAVA COUNTIES

C.E. Nistor^{1*}, I.B. Pagu¹, Cristina Simeanu¹, B. Păsărin¹

¹ University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

Abstract

Analysis of some 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.

Effectuation of body measurements and weighting is used to determine the increase in length of fish and to evaluate the general physiological condition. Brook trout, *Salvelinus fontinalis*, 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), from two trout farms in Neamt and Suceava Counties. After processing the obtained data were calculated the most representative indexes and maintenance coefficients. The obtained values were between 3.46 at L_1 batch and 3.77 at L_2 batch for profile index; 1.80 at L_1 batch and 1.74 at L_2 batch for Fulton coefficient; 1.45 at L_1 batch and 1.49 at L_2 batch for Kiselev index; 38.43 L_1 batch and 41.39 at L_2 batch for thickness index; 22.57 L_1 batch and 21.43 at L_2 batch for fleshy index I, and 20.27 L_1 batch and 19.52 at L_2 batch for fleshy index II.

The main values of the calculated indexes, reflects a corresponding growth, a better use of nutrition, correlated with a good maintenance and health of the analysed fishes.

Key words: morphological characters, brook trout, body indices, maintenance coefficients

INTRODUCTION

Known by many names (spring trout, brook trout, speckled trout), this breed is native, from river springs region of the U.S. Atlantic coast, being brought in Europe since 1884, and in our country around 1906, first in Moldova (Putna Valley, Tarcău Valley), then in Transylvania, expanding rapidly in other mountain waters [2], [3], [12], [13], [14].

Brook trout show a special exigency to the water temperature which must not fall below 4°C or exceed 15°C. Feeding activity is most intense between 12 and 14°C generally consuming snails, worms, insects and insect's larvae from the water surface, juvenile fish of other species and even with smaller individuals of its own breeds [2], [3], [11], [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 be 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 brook trout (*Salvelinus fontinalis*) of third summer (P.s.₂₊), reared from two salmonid fisheries from Neamt and Suceava County.

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

*Corresponding author: is_cata@yahoo.com

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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 brook trout (*Salvelinus fontinalis*)

Specification	<i>Salvelinus fontinalis</i> Pc ₂₊ L ₁ (n=20)		<i>Salvelinus fontinalis</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)	262.90±7.58	9.12	279.49±5.94	6.72
Total length – L (cm)	27.02±0.35	4.11	27.75±0.28	3.17
Standard length– ls (cm)	24.45±0.36	4.68	25.25±0.28	3.45
Maximum height – H (cm)	7.08±0.12	5.57	6.73±0.14	6.67
Heads' length – lc (cm)	5.52±0.15	8.82	5.41±0.09	5.04
Maximum circumference – C (cm)	16.89±0.32	5.99	17.03±0.27	5.02
Length of caudal peduncle – lp (cm)	4.96±0.11	7.14	4.93±0.15	9.68
Maximum thickness of body (G) (cm)	2.72±0.04	5.99	2.78±0.05	5.49

Based on data obtained by measurements and weightings' for brook 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.

The coefficients of variance highlighted each time a good homogeneity of the two studied 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 fish.

Profile index (I_p), highlights the corporal shape of the fish, and allows the placement of the individuals from a population in a certain profile type. This index represents the ratio between standard length and maximum height.

At the studied brook trout specimens, the profile index registered a mean value of 3.46±0.05 at L₁ batch and 3.77±0.09 at specimens from L₂ batch, which indicated a good body shape in both experimental batches.

Table 2 Profile index at brook trout (*Salvelinus fontinalis*)

Specification	Batch	n	$\bar{X} \pm s_{\bar{x}}$	V%	Min.	Max.
<i>Salvelinus fontinalis</i>	L ₁	20	3.46±0.05	5.99	3.28	3.79
<i>Salvelinus fontinalis</i>	L ₂	20	3.77±0.09	7.33	3.34	4.10

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

In the case of thickness index, shows a mean value of 38.43 ± 0.34 for specimens

from L₁ batch, and 41.39 ± 0.92 for those in L₂. The studied character was homogeneous aspect highlighted by the coefficient of variation which ranged between 2.82% and 7.04%.

Table 3 Thickness index at brook trout (*Salvelinus fontinalis*)

Specification	Batch	n	$\bar{X} \pm s_{\bar{x}}$	V%	Min.	Max.
<i>Salvelinus fontinalis</i>	L ₁	20	38.43±0.34	2.82	37.09	40.25
<i>Salvelinus fontinalis</i>	L ₂	20	41.39±0.92	7.04	37.79	45.95

Quality index (IC) is determined according to Kiselev relation, and offers information regarding fish quality, being calculated as the ratio between standard length and maximum circumference of the body. Specimens that have the lowest values of this index are recommended because they

have greater circumference in relation to standard length, which indicates a healthy muscular mass.

The trout from L₁ batch presents the lower values for quality index, of only 1.45±0.02, in comparison with L₂ batch, which had a greater value for this index 1.49±0.03.

Table 4 Quality index at brook trout (*Salvelinus fontinalis*)

Specification	Batch	n	$\bar{X} \pm s_{\bar{x}}$	V%	Min.	Max.
<i>Salvelinus fontinalis</i>	L ₁	20	1.45±0.02	4.62	1.38	1.58
<i>Salvelinus fontinalis</i>	L ₂	20	1.49±0.03	5.45	1.34	1.60

Fulton coefficient (I_i) or biogenic capacity provides information on food factor, reflecting the maintenance condition of trout and is the ratio between body weight and total length cubed. The higher the Fulton index values are higher, the fish is more developed.

Fulton coefficient calculated for brook trout specimens ranged between 1.74±0.06 value determined at L₂ batch and 1.80±0.05, as was at L₁ batch. The studied character had a mean variability and the coefficient of variation was within the range 9.62 and 10.15%.

Table 5 Fulton coefficient at brook trout (*Salvelinus fontinalis*)

Specification	Batch	n	$\bar{X} \pm s_{\bar{x}}$	V%	Min.	Max.
<i>Salvelinus fontinalis</i>	L ₁	20	1.80±0.05	9.62	1.54	2.01
<i>Salvelinus fontinalis</i>	L ₂	20	1.74±0.06	10.15	1.50	2.00

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

At brook trout specimens, fleshy index presented a minimum value of 1.43±0.32 for L₂ batch and a maximum value of 22.57±0.56 for L₁ batch.

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

After processing the experimental data, the values for fleshy index II, ranged between 19.52±0.57 for L₂ batch and 20.27±0.39 at L₁ batch.

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

Table 6 Fleshy index at brook trout (*Salvelinus fontinalis*)

Specification	Batch	n	Ic	$\bar{X} \pm s_{\bar{x}}$	V%	Min.	Max.
<i>Salvelinus fontinalis</i>	L ₁	20	I	22.57±0.56	7.84	19.95	25.21
			II	20.27±0.39	6.11	18.50	22.07
<i>Salvelinus fontinalis</i>	L ₂	20	I	21.43±0.32	4.66	19.17	22.81
			II	19.52±0.57	9.26	19.52	21.88

Values obtained by calculating indexes and growth coefficients are comparable with 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.

Growth and development of brook trout specimens' (*Salvelinus fontinalis*) from the two salmonid fisheries taken in study, fits within the breed characteristics which show a good adaptation to the specific area.

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