THE STUDY OF SOME MORPHOLOGICAL CHARACTERISTICS OF THE STURGEON SPECIES OF *POLYODON SPATHULA* IN DIFFERENT DEVELOPMENT STAGES

Cristina Simeanu, B. Păsărin, D. Simeanu

U.S.A.M.V. Iaşi
e-mail: cristina.simeanu@yahoo.com

Abstract

The morphological characteristics analysis through biometry is a frequently used method in the study of systematic fish groups. The body measurements execution and fish age weighing is done with the purpose to deduce their maintenance status as well as their adaptability to the assured environment conditions. The sweet water sturgeon species Polyodon spathula, of North-American descent, is the object of this study by the analysis of 20 specimens, from which 10 of second summer and 10 of third summer. Based on the obtained data the most representative indices and factors of maintenance were estimated. The obtained values were: for the profile index - 6,89 for P.s.$_{1+}$ and 6,35 forP.s.$_{2+}$; for Fulton coefficient - 0,61% for P.s.$_{1+}$ and 0,65% for P.s.$_{2+}$; for Kiselev index - 2,36 in both situations; for the meat index which expresses the head ponder out of the standard length of the body - 8,33% for P.s.$_{1+}$ and 10,93% for P.s.$_{2+}$, and the index which expresses the caudal stern ponder out of the standard length - 5,03% for P.s.$_{1+}$ and 7,69% for P.s.$_{2+}$. Taking into consideration the obtained results we can conclude that the analyzed fishy material had a good maintenance status.

Key words: morphological characters, paddlefish, body indices, body tangible factors

INTRODUCTION

Paddlefish is the sole representative of the family Polyodontidae in North America, the natural range of species being represented by the Mississippi river basin and is found in fish ponds in Romania. It is a large fish, reaching approx. 1.5-2 m long and 50-70 kg, in natural environment [4]. Because of its feed system, mainly zooplanctonofag, and high growth rate, paddlefish has particular interest for fish farming in Romania, being possible to obtain a qualitative and quantitative increase of fish production, through the effective use of river fish feed compartment [3]. Performing body measurements by age and weighing groups is carried out in order to deduce the particular state of fish maintenance and adaptability to environmental conditions to which they are exposed [7]. 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.

MATERIAL AND METHODS

To achieve practical part of the study of morphological characters were used every 10 specimens (5 ♀ and 5 ♂) of paddlefish Summer II (PS1+), and 10 specimens (5 ♀ and 5 ♂) of paddlefish summer III (PS2+), from the SC ACVARES SA Ţigănaşi Farm, Iasi County. Systematic study of fish groups may be made by completing a series of observations on morphological characters, based on measurement, counting, weighing, thus constituting biometric studies.

The characters determined by studies of biometrics are:

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

Biometric data used to determine growth in length of fish, and to determine the general physiological condition and is obtained by measurements taken with special instruments (ihtiometers) or other measuring instruments (ruler, callipers) [1], [2], [5], [8]. These measurements are:

- weight (G) - determined by weighing;
- total body length (L) - is measured from the tip of the snout to the line joining the tips of the tail fin lobes;
- body length (l) - also called the standard length without caudal length is measured from the tip of the snout to the base of the tail fin;
- maximum body height (H) - is measured in the region of highest body in the first spin of the dorsal fin;
- minimum height of the body (h) - height is measured where the body is reduced, the rear extremity of caudal peduncle;
- the maximum circumference of the body (C) - is measured at maximum width and maximum height, or before peduncle;
- length of the head without paddle (lc) - measure the distance from the tip of the snout to the edge of tail;
- caudal peduncle length (lp) - is measured from the rear extremity of the anal fin and to the base of tail fin;
- paddle length (LR) - paddle is measured from the tip to the point of minimum width; (lr) - is measured from the paddle tip to the eye;
- maximum width of the paddle (e_1);
- minimum width of the paddle (e_2);
- head width (lat.).

Based on data obtained by measuring and weighing, it can calculate various indicators and fish maintenance coefficients (index profile coefficient of fattening or Fulton index, Kiselev index, meat index, etc.) [2], [5], [6], [8].

By determining the *profile index* (height) may determine whether the outer shape of the fish meets the desired character of farmers, showing off their body size and allowing the employment of individuals of a population in a particular type of profile. It can be calculated using the following formula:

$$\text{profile index} = ls/H, \quad (1)$$

where: ls = standard length, in cm;
H =maximum body height, in cm.

Determination *fattening coefficient* (*Fulton coefficient or condition coefficient*) shows the so-called general condition of fish or physiological condition (pathophysiological) thereof, by calculating the following formula:

$$\textit{fattening coefficient} = G \cdot 100/ls^3, \quad (2)$$

where: G = body weight, in g; ls = standard length, in cm.

The fattening index values are higher, the fish is well developed. Quality Index (Kiselev) is an important indicator in assessing the growth rate of fish. Is a parameter directly proportional to the degree of fattening, which allows estimation of fattening. The score that is given is from 0 to 5 and is based on observations regarding the extension and place the deposit of fat [6]. Calculate the index Kiselev, help to determine the quality of fish quickly without the need for weighing and other measurements. For calculation use the following formula:

$$K = ls/Ci, \quad (3)$$

where ls = body standard length in cm;
Ci = body circumference in cm.

The Kiselev index has a lower value, the better the fish meets the selection [2], [6], [8].

Meat index expresses the proportion of the head or caudal peduncle from the standard length of the body. For its calculation the following formula applies:

$$Ic = lc \cdot 100/ls \quad (4)$$
$$Ic = lp \cdot 100/ls, \quad (5)$$

where: lc = head length in cm; ls = body standard length in cm; lp = caudal pedunclelength in cm.

The meat index is lower, the fish has more meat [2], [6], [8].

The data obtained were statistically processed by calculating the average, the average standard deviation and coefficient of variability.

RESULTS AND DISCUSSION

Research has debuted with biometric determinations: weight (G), total body length (L), body length (standard length) (ls), maximum body height (H), minimum body height (h), maximum body circumference (IC), head length without paddle (LC), caudal peduncle length (LP), paddle length (LR, LR), maximum paddle width (e_1), minimum paddle width (e_2), head width (lat_c).

Following measurements, was calculate the average of 10 specimens (5♀ and 5♂) Summer II and Summer III respectively (Table 1).

Table1. Biometric measurements in paddlefish (Polyodon spathula)

Specification	*Polyodon spathula* summer II P.s.$_{1+}$ (n=10)		*Polyodon spathula* summer III P.s.$_{2+}$ (n=10)	
	$\overline{X} \pm s_{\overline{X}}$	V%	$\overline{X} \pm s_{\overline{X}}$	V%
Weight – G (g)	2050 ± 18	5.25	3750 ± 21	6.21
Total body length – L (cm)	80.3 ± 0.35	6.71	98.2 ± 0.42	6.04
Standard length– ls (cm)	69.6 ± 0.31	4.86	83.2 ± 0.35	5.29
Maximum body height – H (cm)	10.1 ± 0.18	6.24	13.1 ± 0.20	5.84
Minimum body height - h (cm)	3.3 ± 0.12	5.37	5.4 ± 0.15	6.34
Maximum body circumference – Ci (cm)	29.4 ± 0.21	6.34	35.2 ± 0.24	7.05
Head length without paddle – lc (cm)	5.8 ± 0.13	4.39	9.1 ± 0.15	7.21
Caudal peduncle length – lp (cm)	3.5 ± 0.11	5.27	6.4 ± 0.13	6.29
Paddle length - l_R, (cm) - l_r (cm)	21.7 ± 0.30 25.3 ± 0.32	6.01 5.78	24.4 ± 0.31 28.7 ± 0.29	5.89 6.38
maximum paddle width - e_1 (cm)	6.9 ± 0.14	6.31	7.6 ± 0.12	6.08
minimum paddle width - e_2 (cm)	19.4 ± 0.19	5.44	24.3 ± 0.21	5.99
head width - lat_c (cm)	8.4 ± 0.17	4.97	9.3 ± 0.19	7.04

Following measurements, both in specimens by Summer II and Summer III were obtained data close to the values presented in the literature consulted [3], [6], which shows that the specimens studied had an adequate development of the species.

The coefficients of variability were revealed every time a good homogeneity of the two batches of fish analyzed (P.s.$_{1+}$ P.s.$_{2+}$).

Based on data obtained by measurements and weighings were calculated the values of most representative indices and maintenance factors to highlight the state of maintenance of the fish studied.

By calculating the index profile, it was found that body size of fish studied for the two stages of development (Summer II and Summer III), is appropriate and fits the profile of the specimens examined species. The value obtained in P.s.$_{1+}$ was 6.89, with 7.83% higher than the P.s.$_{2+}$ (6.35). The coefficient of variability shows a good homogeneity of the batches of fish analyzed (V% < 10) (Table 2).

Table2. Index profile calculated in paddlefish

Specification	Statistics	
	$\overline{X} \pm s_{\overline{X}}$	V%
Polyodon spathula Summer II - P.s.$_{1+}$ (n=10)	6.89 ± 0.11	7.34
Polyodon spathula Summer III - P.s.$_{2+}$ (n=10)	6.35 ± 0.21	8.20

Fulton coefficient that reflects the physiological condition of fish, recorded value of 0.61 at the P.s.$_{1+}$, while the P.s.$_{2+}$ was 0.65, with 6.55% higher (Table 3). Fattening index (Fulton) shows that fish studied have benefited from very good maintenance and feeding, since data obtained were lower by 67.5 to 69.5% from ideal value - 2, but similar data recorded in various holdings in Eastern Europe (Bulgaria, Serbia, Moldova Rep.) [1], [5]. The coefficients of variability, indicates once again a good homogeneity of the batches of fish analyzed.

Table 3. Fulton coefficient calculated from paddlefish

Specification	Statistics	
	$\overline{X} \pm s_{\overline{X}}$	V%
Polyodon spathula Summer II - P.s.$_{1+}$ (n=10)	0.61 ± 0.02	5.41
Polyodon spathula Summer III - P.s.$_{2+}$ (n=10)	0.65 ± 0.03	6.02

Kiselev index which serves to determine quality of fish was 2.36 in both stages of development (P.s.$_{1+}$ P.s.$_{2+}$), coefficient of variability reflecting once again a good homogeneity of the batches examined (V% < 10) (Table 4).

Table 4. Kiselev index calculated from paddlefish

Specification	Statisticis	
	$\overline{X} \pm s_{\overline{X}}$	V%
Polyodon spathula Summer II - P.s.$_{1+}$ (n=10)	2.36 ± 0.05	4.39
Polyodon spathula Summer III - P.s.$_{2+}$ (n=10)	2.36 ± 0.07	5.27

Values of 2.36 in both groups of fish, indicates that fish are eligible for selection.

Meat index, which expresses the proportion of the head in standard length of the body was 8.33% in P.s.$_{1+}$, with 31.21% lower compared to the value calculated from P.s.$_{2+}$ and meat index expresses the weight of the caudal peduncle standard length values was 5.03% in P.s.$_{1+}$, 52.88% lower compared with the value determined from P.s.$_{2+}$. The coefficient of variability indicates a good homogeneity of the batches of fish analyzed (V% < 10) (Table 5).

Although the appearance of this fish we can suggest that the proportion of the head would be much higher (due paddle representing 1/3 of total body length) found that the weight of the head is relatively low [3], [4], [5], [6], [7].

Meat index values, shows a high quantity of meat in this species.

Table 5. Meat index calculated from paddlefish

Specification	Statisticis	
	$\overline{X} \pm s_{\overline{X}}$	V%
Polyodon spathula Summer II - P.s.$_{1+}$ (n=10)		
(4)	8.33 ± 0.13	5.82
(5)	5.03 ± 0.09	5.41
Polyodon spathula Summer III - P.s.$_{2+}$ (n=10)		
(4)	10.93 ± 0.15	6.12
(5)	7.69 ± 0.11	5.89

Values obtained by calculating indices and growth coefficients are comparable with literature values, resulting that the specimens analyzed had a good maintenance condition [3], [5], [6], [7].

CONCLUSIONS

Main indices calculated values, reflecting a corresponding increase, good food recovery related to maintenance and good health.

Growth and development of paddlefish specimens fall within the species characteristics which show a good adaptation to the specific area.

REFERENCES

Articles in journals:

[3] Costache Mioara şi col.: Cercetări privind hrana şi comportamentul de hrănire a speciei *Polyodon spathula* (Walb.), Simpozionul internaţional „AQUAROM 98" Galaţi, Vol. Lucrările Simpozionului, 1998, 254-256.

[4] Mims S.D. and Shelton W.L.: Paddlefish, American Fisheries Society Symposium, 2005, 46:227-249.

[6] Păsărin B., Stan Tr., Radu C.: Contribuţii privind aclimatizarea şi îmbunătăţirea unor indicatori productivi la specia *Polyodon spathula* în condiţiile de Nord-Est a României, Analele Universităţii din Oradea, Fascicula: Ecotoxicologie, zootehnie şi tehnologii de industrie alimentară, vol. IV, Anul 4, Editura Universităţii din Oradea, 2005, pag 277-286.

[7] Simeanu Cristina, Păsărin B.: Importanţa speciei de sturioni dulcicoli *Polyodon spathula*, pentru acvacultura românească, Revista de Zootehnie, Anul VI, nr. 4/oct.-dec., Iaşi 2009, pag 44-46.

Books:

[1] Bura M.: Acvacultură specială, Editura Orizonturi, Universitatea Timişoara, 2002.

[2] Bura M., Grozea A.: Îndrumător de lucrări practice în acvacultură, Curs litografiat, Editura USAMVB, Timişoara, 1997.

[5] Păsărin B., Stan Tr.: Acvacultură, îndrumător practic, Editura Karro, Iaşi, 2003.

[8] Turliu N.: Piscicultura practică, Editura Ceres, Bucureşti, 2008.