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RESEARCH REGARDING THE EVOLUTION OF CORPORAL WEIGHTES AND FOOD CONVERSSION ON JUVENILE OF SIBERIAN STURGEON (*Acipenser baeri*) RAISED IN RECIRCULATING SYSTEM

CERCETĂRI PRIVIND EVOLUŢIA MASEI CORPORALE ŞI A CONVERSIEI HRANEI LA PUIETUL DE STURION SIBERIAN (*Acipenser baeri*) CRESCUT ÎN SISTEM RECIRCULANT

M. BURA, Z.T. SZELEI, A. GROZEA, R. MUSCALU-NAGY, I. BĂNĂŢEAN-DUNEA, SILVIA PĂTRUICĂ

Faculty of Animal Sciences and Biotechnologies, Timisoara, Romania

The research was performed within the recirculating aquaculture system for sturgeon growth, in Banat's Universsity of Agricultural Sciences and Veterinary Medicine from Timisoara, on 2851 juveniles of Siberian sturgeons (Acipenser baeri), aged between 132-175 days. Juveniles were maintained in 4 tanks with volume of 5.63 m^3, fed with granulated feed of 2 mm (44 & 22% PB and GB). Every 2 weeks the weight and body length was determinate on an effective of 30 individuals from each tank. Based on the obtained body weight, it has been established the food quantity used and bioproductive indicators. Having the weight differences between the individuals of a Siberian sturgeon population, it is needed at certain time intervals to practice assortment by body development. At the age of 175 days, Siberian sturgeons reached an average body weight between 90.13 ± 4.56 g and 197.63 ± 7.22 g and average body length between 28.73 ± 0.43 cm and 37.55 ± 0.38 cm. Individual values of minimum and maximum body weight varied between 32 g and 307 g and body length between 24.5 cm and 42 cm. For the entire population of Siberian sturgeons, there is a middle and high variability for the average body weight and a small variability for the average body length. During the 43 experimental days, the 2851 Siberian sturgeons have acquired a real weight gain of 184.66 kg, with a conversion factor of 0.84 kilograms of feed / kg growth and an index of feed conversion of 1.19 kilograms spore / kg feed consumed.

Keywords: *Acipenser baeri*, recirculating system, body weight, feed conversion.

Introduction

In September 2008, was put in function a super intensive equipment of growing sturgeons in recirculating system. The installation was achieved from funds obtained through a research grant funded by the Romanian Ministry of Education and Research. Given the fact that the facility is first placed in service in

our country, there are very little information about the evolution of body weight and feed conversion of reared sturgeons in a recirculating system. Informations about the components of a recirculating system and biological material used are provided by CRISTEA şi colab. (2002), PATRICHE (2001), BUD şi colab. (2001), MANEA (1980), BURA şi colab. (2008) şi LAZU şi colab. (2008). These few information determined us to approach research on body weight development and feed conversion of juvenile Siberian sturgeon (*Acipenser baeri*).

Material and Methods

The research was performed within the recirculated super intensive system resort of sturgeon growth from Didactical Station of Banat's University of Agricultural Sciences and Veterinary Medicine from Timişoara, during the period 10.10.2008 - 21.11.2008.

The 2851 fry of Siberian sturgeons used in our experiments were hatched on 1 June 2008.

Juveniles were maintained in 4 tanks of polyester reinforced with glass fiber with 3 m in diameter, 1 m height and 5.63 m^3 the volume of water. Water temperature varied from 14-16^{0}C. Juveniles were fed with granulated feed Aqua Bio in diameter of 2 mm with a 44% raw protein, 22% raw fat, 8% raw ash, crude fiber 1.9% and 1% phosphorus.

Every 2 weeks the body weight and body length were determined in a effective of 30 individuals from each tank. Based on the determinate body weight, it has been established the amount food given to the population of Siberian sturgeon from each tank.

In early October, the juveniles of Siberian sturgeon were sorted on 3 categories: large, medium and small were then divided into different tanks.

Based on calculations performed by weight were determined bio-productive indicators at juvenile Siberian sturgeon aged between 132-175 days.

Results and Discussion

Body weight of juveniles of Siberian sturgeon (Table 1) had registrated on the 10.10.2008 balance, the smallest value in the tank III/4, 35.83±1.18 g, an average value in the tank III/5, 65.10 ± 1.74 g and the highest value in tanks III/3 and III/6, 123.43±4.63 g.

The 2851 individuals of Siberian sturgeon have a differentially body weight, so that while the smallest are weighting 24 g, the largest reach 173 g/individual around the age of 4 months and 10 days (132 days). From the analysis of the coefficient of variability, it results the existence of average variability in experimental tanks III/4 and III/5, and a large variability (CV> 20%) in tanks III/3 and III/6.

At all 4 lots, the safety index of the mean pleases us as precision (Sx%<5%).

The determinations made on 23.10.2008 (at the juveniles age of 4 months and 23 days = 145 days) the differences between the populations fed in the 4 tanks have maintained. The juveniles from the tank III/4 reached 52,83±3,18 g, at tank III/5 weighted 74,70±3,21 g, and the heavier ones were in tank III/6 with an average of 133,17±4,61 g. In the lots have been found individuals who weighted between 25 g and 191 g. The coefficient of variability shows an average variability for the population of tanks III/3 and III/6, and an average variability of Siberian sturgeons from tanks III/4 and III/5. The safety index of the average value satisfied us as precision for most lots, except the population of tank III/4.

Average body length of Siberian sturgeons aged 145 days, was between 24.75±0.48 cm (tank III / 4) and 34.10±0.40 cm (tank III / 6). Individual values recorded vary between 18 and 39 cm. For the body length were determined average values of coefficient of variability in the population of tank III/4 and small values of the other populations (CV x3c10%). From the analysis of the safety index of the mean, results from all lots, that the average value satisfied us as precision.

On 08.11.2008, at the age of 161 days, juveniles of Siberian sturgeon has reached an average body weight that ranged from 57.17 ± 3.38 g and 163.23 ± 5.59 g and body length average between 26.73 ± 0.48 cm and 36.12 ± 0.45 cm. The variability coefficient is high only for the body weight of population in tank III/4, wherefore nor the mean doesn't satisfy us as accuracy. In terms of the individual body weight at this age ranged between 23 g and 227 g and body length between 19 cm and 42 cm.

On 22.11.2008, at the age of 175 days, Siberian sturgeons have reached an average body weight ranged between 90.13 ± 4.56 g (tank III/4) and 197.63 ± 7.22 g (tank III/6) and an average body length of 28.73 ± 0.43 cm (tank III/4) and 37.55 ± 0.38 cm (tank III/3). The coefficient of variability of body weight values recorded were high (tanks III/4 and III/6) and medium (tanks III/3 and III/5), while body length values were low in all groups. In all cases, the safety index of media satisfied us as precision. At the age of 175 days, Siberian sturgeons reached individual values varied to body weight between 32 g and 307 g and body length between 24.5 cm and 42 cm.

Within the 4 calculations, it is notable for the average body weight, the coefficient of variability registers average and high values, while for the average body lenght, the values are mostly small.

In table 2, is shown the amount of food given to Siberian sturgeons (*Acipenser baeri*) in relation to the number of individuals and their body weight.

At each of the 4 analyzed weightings was determined by multiplying the average body weight with the number of individuals, the total body weight. By multiplying the total body weight with the percentage of feed from total body weight, it was calculated the amount of feed.

Table 1a

Mass and body lenght of Siberian sturgeon juveniles (*Acipenser baeri*) in period 10.10.2008-22.11.2008

n = 2851 specimens

Tank	Body mass (g)							
	n	X	Sx	S	CV	Sx%	Min.	Max.
10.10.2008								
III/3	30	123,43	4,63	25,35	20,54	3,75	83	173
III/4	30	35,83	1,18	6,46	18,03	3,29	24	48
III/5	30	65,10	1,74	9,53	14,64	2,67	42	92
III/6	30	123,43	4,63	25,36	20,54	3,75	83	173
23.10.2008								
III/3	30	125,77	3,83	20,97	16,67	3,05	94	178
III/4	30	52,83	3,18	17,40	32,93	6,02	25	88
III/5	30	74,70	3,21	17,57	23,52	4,30	42	107
III/6	30	133,17	4,61	25,26	18,97	3,46	88	191
08.11.2008								
III/3	30	156,77	4,32	23,65	15,09	2,76	118	215
III/4	30	57,17	3,38	18,52	32,40	5,91	23	104
III/5	30	96,93	2,29	12,55	12,94	2,36	78	118
III/6	30	163,23	5,59	30,61	18,75	3,42	101	227
22.11.2008								
III/3	30	184,13	6,07	33,26	18,07	3,30	120	250
III/4	30	90,13	4,56	24,97	27,70	5,05	32	153
III/5	30	128,43	3,56	19,48	15,17	2,77	100	177
III/6	30	197,63	7,22	39,56	20,02	3,65	130	307

Table 1b

Mass and body lenght of Siberian sturgeon juveniles (*Acipenser baeri*) in period 10.10.2008-22.11.2008

n = 2851 specimens

Tank	Body mass (g)							
	n	X	Sx	S	CV	Sx%	Min.	Max.
10.10.2008								
III/3	-	-	-	-	-	-	-	-
III/4	-	-	-	-	-	-	-	-
III/5								
III/6	-	-	-	-	-	-	-	-
23.10.2008								
III/3	30	32,7	0,38	2,07	6,33	1,16	28	37
III/4	30	24,75	0,48	2,63	10,63	1,94	18	30
III/5	30	28,92	0,38	2,01	7,27	1,31	24,5	33
III/6	30	34,10	0,40	2,16	6,34	1,17	30	39
08.11.2008								
III/3	30	35,88	0,30	1,62	4,52	0,84	33,5	40
III/4	30	26,73	0,48	2,60	9,73	1,79	19	30
III/5	30	30,45	0,26	1,42	4,69	0,85	27	32,5
III/6	30	36,12	0,45	2,46	6,82	1,25	31	42
22.11.2008								
III/3	30	37,55	0,38	2,07	5,50	1,01	33	42
III/4	30	28,73	0,43	2,37	8,26	1,50	24,5	34
III/5	30	32,45	0,37	2,02	6,23	1,14	28,5	36,5
III/6	30	37,52	0,43	2,37	6,30	1,15	32,5	42

Table 2

The amount of food given to Siberian sturgeon (*Acipenser baeri*) in relation to the number of individuals and their body weight

Tank	Nr. individuals	Body weight (g)	Body weight (kg)	Feed balance (%)	Calculated amount of feed (kg)	The amount of feed given (kg)
10.10.2008						
III/3	663	0,123	81,54	1,2	0,979	0,857
III/4	472	0,036	14,16	2,0	0,283	0,343
III/5	1067	0,065	69,36	1,4	0,970	0,857
III/6	649	0,123	79,83	1,2	0,958	0,857
TOTAL	**2851**		**244,89**		**3,190**	**2,914**
23.10.2008						
III/3	663	0,126	83,54	1,2	1,002	0,967
III/4	472	0,053	25,01	1,5	0,375	0,363
III/5	1067	0,075	80,03	1,4	1,120	0,975
III/6	649	0,133	86,31	1,2	1,030	1,000
TOTAL	**2851**		**274,89**		**3,527**	**3,305**
08.11.2008						
III/3	663	0,157	104,09	1,2	1,249	1,300
III/4	472	0,057	26,90	1,5	0,404	0,450
III/5	1067	0,097	103,49	1,4	1,448	1,500
III/6	649	0,163	105,78	1,2	1,269	1,300
TOTAL	**2851**		**340,26**		**4,370**	**4,550**
22.11.2008						
III/3	663	0,184	121,99	1,2	1,464	1,204
III/4	472	0,090	42,48	1,5	0,637	0,475
III/5	1067	0,128	136,58	1,4	1,912	1,393
III/6	649	0,198	128,50	1,2	1,542	1,221
TOTAL	**2851**		**429,55**		**5,555**	**4,293**

Analyzing table 2, it is notable that the total body weight of the 2851 Siberian sturgeons increased from 244.89 kilograms on 10.10.2008, at 429.55 kilograms, on 23.11.2008. In view of the variations in temperature and concern for maintaining water quality within limits of appropriate quality, we were forced to reduce the amount of feed given daily from the calculated daily amount of feed. Hereby, if after weighing on the 22.11.2008 we had to manage 5555 kg feed/day, environmental conditions have forced us to distribute just 4293 kg feed/day.

In table 3 are listed bio-productive indicators at juvenile Siberian sturgeon (*Acipenser baeri*) between the age of 132 days and 175 days.

During the 43 days of experiment, the 2851 population of Siberian sturgeon has accumulated a real weight gain of 184.66 kilograms, with a conversion factor of 0.84 kilograms of feed feed/kg growth and an index of feed conversion of 1.19 kilograms gain/kg feed consumed.

Analyzing table 3, it is notable that the populations which have achieved a small weight gain, the rate of conversion of food was big and the index of food conversion decreased and vice versa.

Table 3

Bio-productive indicators of Siberian sturgeons juveniles (*Acipenser baeri*)

n = 2851 individuals

Period	Tank	Real weight gain (kg) (S_r)	Apparent weight gain (g) (S_a)	Daily rhythm of growth (kg/zi) (R_{zc})	Specific growth rate (%/zi) (R_{cs})	Conversion factor of feed (kg feed / kg growth) (Q_{ch})	Index of feed conversion (spore kg / kg feed) (I_{ch})
10-23.10. 2008	III/3	2,00	3	0,143	14,30	6,00	0,17
	III/4	10,85	17	0,775	77,50	0,44	2,26
	III/5	10,67	10	0,762	76,20	1,12	0,89
	III/6	6,48	10	0,463	46,30	1,85	0,54
	TOTAL	**30,00**	**-**	**2,140**	**214,00**	**1,36**	**0,74**
24.10.2008 07.11.2008	III/3	20,55	31	1,370	137,00	0,71	1,42
	III/4	1,89	4	0,126	12,60	2,88	0,35
	III/5	23,46	22	1,564	156,40	0,62	1,60
	III/6	19,47	30	1,298	129,80	0,77	1,29
	TOTAL	**65,37**	**-**	**4,358**	**435,80**	**0,78**	**1,32**
08.-21.11. 2008	III/3	17,90	27	1,278	127,80	1,02	0,98
	III/4	15,58	33	1,113	111,30	0,40	2,47
	III/5	33,09	31	2,364	236,40	0,63	1,82
	III/6	22,72	35	1,623	162,30	0,80	1,25
	TOTAL	**89,29**	**-**	**6,378**	**637,80**	**0,72**	**1,38**
10.10.-21.11. 2008	**TOTAL PERIOADE**	**184,66**	**-**	**12,876**		**0,84**	**1,19**

where:

$S_r = B_f - B_i$; $S_a = M_t - M_i$; $R_{zc} = (B_f - B_i):t$; $R_{cs}=[(B_f - B_i):t] \times 100$; $Q_{ch} = C_{fa}/S_r$; $I_{ch} = S_r/C_{fa}$

Conclusions

1. Having the weight differences between the individuals of a Siberian sturgeon population, it is needed at certain time intervals to practice assortment by body development.

2. At the age of 175 days, Siberian sturgeons have reached an average body weight ranged between 90.13±4.56 g and 197.63±7.22 g and average body length of 28.73±0.43 cm and 37,55±0.38 cm. Individual values of minimum and maximum body weight were located between 32 g and 307 g and body length between 24.5 cm and 42 cm.

3. For the entire population of Siberian sturgeons, there is a middle and high variability for the average body weight and a small variance for the average body length.

4. During the 43-days trial, the 2851 Siberian sturgeons have acquired a real weight gain of 184.66 kilograms, with a conversion factor of 0.84 kilograms of

feed feed/kg growth and an index of feed conversion of 1.19 kg spore/kg feed consumed.

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