

Research regarding bioproductive indicators achieved by the Siberian sturgeon (*Acipenser baerii*) juvenile in recirculated system

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Abstract. For this research we used a population of 2799 Siberian sturgeons (*Acipenser baerii*) between 11.04.2009 and 23.05.2009. The age of juveniles was between 316 days and 360 days and they were maintained in 4 tanks with a volume of 12.56 m³/tank. Average water temperature in the breeding tanks was 17.3 °C in the first study period, 18 °C in the second period and 19.8 °C in the third period. In this period the average value of dissolved oxygen level in the tanks was 5.1 mg/L. The Siberian sturgeon juveniles were fed with Aqua Bio Sturion (Ø=3 mm; 45% Protein and 20% Fat). At every 2 weeks, the average body weight and the average body length of 30 individuals from each tank were registered. At the age of 316 days the juveniles reached an average body weight between 164.43±7.63 g and 325.80±15.20 g and an average body length between 35.78±0.48 cm and 45.31±0.66 cm. During the 44 experimental days, the 2799 Siberian sturgeons have achieved a real weight gain of 310.67 kg, with a specific consumption of 0.67 kg feed/kg body weight gain and an index of feed conversion of 1.48 kg body weight gain/kg of consumed feed.

Key Words: *Acipenser baerii*, body weight, body length, conversion feed, recirculated system.

Rezumat. Cercetările au fost efectuate pe o populație de 2799 sturioni siberieni (*Acipenser baerii*) în perioada cuprinsă între 11.04.2009 și 23.05.2009. Puietul, cu vârsta cuprinsă între 316 de zile și 360 de zile, a fost întreținut în 4 bazine cu volumul de 12,56 m³/bazin. Temperatura medie a apei din bazinele de creștere a fost de 17,3°C în prima perioadă de control, de 18°C în a doua perioadă și de 19,8 °C în cea de a treia perioadă. În această perioadă, valoarea medie a oxigenului dizolvat din bazinele de creștere a fost de 5,1 mg/L. Puietul de sturion siberian a fost hrănit cu Aqua Bio Sturion (Ø=3 mm; 45% proteină brută și 20% grăsime brută). La interval de 2 săptămâni, s-a determinat masa corporală medie și lungimea medie a corpului la 30 de indivizi din fiecare bazin. La vârsta de 360 de zile puietul a atins o masă corporală medie cuprinsă între 266,20±19,50 g și 470,30±15,20 g, precum și o lungime corporală medie între 42,18±0,81 cm și 51,18±0,43 cm. Pe parcursul celor 44 de zile experimentale, cei 2799 sturioni siberieni au acumulat un spor real de creștere de 310,67 kg, cu un consum specific de 0,67 kg furaj/kg spor și un indice de conversie a hranei de 1,48 kg spor/kg furaj consumat.

Cuvinte cheie: *Acipenser baerii*, greutate corporală, lungime corporală, conversia furajelor, sistem recirculant.

Introduction. Present research continue the previous studies from the period 14.02.2009 – 28.03.2009, in sturgeon raising technology platform of super intensive recirculated system from Banat`s UASVM – Timisoara. Research made by Bura et al (2008, 2009), have revealed a specific consumption of feed of 1.87 kg feed/kg weight gain and an index of feed conversion of 0.53 kg weight gain/kg consumed feed at *Acipenser baerii* (Brandt 1869). In a similar research (in the same system) on *Acipenser ruthenus* a specific consumption of 0.79 kg feed/kg was obtained, and also an index of feed conversion of 1.27 kg weight gain/kg consumed feed (Bura & Szelei 2009).

As literature which we investigated is poor in such information (Prokeš et al 1997; Oprea & Georgescu 2000; Gisbert & Williot 2002), this research offers useful information about evolution of body weight and length at Siberian sturgeon breed in first year of life in a water recirculated system, and also presents bioproductive indices registered by this species.

Material and Method. A number of 2799 of Siberian sturgeon juvenile (*A. baerii*) individuals were included in this experiment between 11.04.2009 and 23.05.2009.

Juvenile, spawned at 01.06.2008, were maintained in 4 fiberglass reinforced polyester with 4m diameter, 1.2m high and 12.56m³. Water temperature, in period 11.04.2009 - 24.04.2009 varied between 17°C and 18°C (with 17.3°C average). Between 25.04.2009 and 08.05.2009, water temperature was constantly 18°C; in period 09.05.2009 - 23.05.2009 the temperature ranged between 18.5°C and 21°C (with 19.8°C average). The average level of dissolved oxygen in this period was 5.1 mg/L. In the days between 11.04.2009 and 23.05.2009, the juvenile Siberian sturgeon was fed with completely extruded fodder (AquaBio), designed for juvenile sturgeons with a 45% concentration of protein, 20% fat, 8.5% ash, 1.7% fiber and total phosphorus of 1.2%. The weighing and measurement of 30 individuals from each tank were made at regular periods, once at every two weeks. On the base of determined body weight, using a certain formula we could establish the quantity of administered feed in every tank. Considering the obtained data from body weight determinations, the bioproductive indices were calculated for Siberian sturgeon juvenile with the age between 316 and 360 days.

Results and Discussion. Siberian sturgeon juvenile body weight (Table 1) was measured at date of 11.04.2009 when they reached the age of 316 days. The minimum value (164.43±7.63g) was registered in the IV/4 tank, and the maximum value (325.80±15.20g) was registered in the IV/6 tank. Individual body weight varied between 82g and 530g. Analyzing the coefficient of variation we noticed a medium variation for body weight in IV/5 and IV/7 tanks, and big body weight variability in IV/4 and IV/6 tanks. At all four groups the safety index of the mean had a satisfactory value ($S_{\bar{x}} < 5\%$). Total body length of Siberian sturgeon juvenile, at age of 316 days, from the IV/4 tank was 35.78±0.48 cm and 45.31±0.66 cm in the IV/6 tank. Individual values of this character varied between 30 and 54.5 cm. For total body length, the groups had a small variability (CV<10%), and the safety index of the mean had a satisfactory value. Determinations from the date of 25.04.2009 (at the age of 330 days) indicated the smallest value for average body weight (191.20±10.20g) was registered in the IV/4 tank, and the biggest value (389.70±18.80g) was registered in the IV/7 tank. Individual values of body weight were situated between the minimum value of 112g and the maximum value of 640g. The variability for body weight is high at all groups (CV>20%). The safety index of the mean had a satisfactory value at all groups, except the IV/4 tank. At age of 330 days, the body length registered the smallest average value in the tank IV/4 (37.28±0.63 cm), and the biggest value (47.36±0.60 cm) in the tank IV/7. Individual body lengths were situated between the limits of 29.5 cm and 58 cm. Variability of this character was small in all groups, and the safety index of the mean had a satisfactory value. At measurement from the date of 09.05.2009, at age of 344 days, we registered an increase of average body weight in the IV/7 tank (389.70g compared to 420.50g). The variability for this character is high for all experimental groups, except tank IV/7 where a medium variability for body weight was registered. Body length registered growth in the IV/4 tank, reaching at average values between 40.45±0.69 cm and 48.63±0.49 cm (IV/7). Individual values were situated in the interval 33 - 59 cm. At measurements from the date of 23.05.2009 (at the 360 days) average body weight registered increased values than at first measurements. At this date, the smallest increase of the average body weight was registered in the IV/4 tank, 266.20±19.50 g and the highest value in the IV/7 tank, 470.30±16.30 g. The variability of this character is higher at groups IV/4 and IV/5 and it is middle in the IV/6 and IV/7. Body length of group from the tank IV/4 registered the smallest average values, 18±0.81 cm; the highest values were registered at the group from IV/7 tank, 51.18±0.43 cm. Individual values were situated between 36.5 cm and 58 cm. The variability of this character in the groups was middle in the case of IV/4 tank and small in the case of the other tanks, and the safety index of the mean had a satisfactory value at all groups. In Table 2 is presented the quantity of administered feed at Siberian sturgeon juveniles versus the number of individuals and their body weight. Analyzing overall data from Table 2 it can be noted that total body weight of all 2799 Siberian sturgeon individuals increased from 705.10 kg, at the date of 11.04.2009 to 1015.79 kg, at the date of 23.05.2009. Mortalities registered during this experimental period were 55 individuals.

Table 1

Body weight and body length of *A. baerii* juveniles at ages between 316 and 360 days

Tank	Body weight (g)								Body length (cm)							
	n	X	Sx	S	CV	Sx%	Min.	Max.	n	X	Sx	S	CV	Sx%	Min.	Max.
11.04.2009 (316 days)																
IV/4	30	164.43	7.63	41.78	25.41	4.64	82	278	30	35.78	0.48	2.68	7.49	1.34	30	41
IV/5	30	224.33	7.98	43.70	19.48	3.55	136	324	30	40.41	0.42	2.34	5.79	1.03	35.5	46.5
IV/6	30	325.80	15.20	83.40	25.58	4.66	220	518	30	45.31	0.66	3.65	8.06	1.45	39.5	54.5
IV/7	30	313.60	11.20	61.40	19.57	3.57	210	530	30	45.15	0.47	2.59	5.74	1.04	39	52
Total	120	257.04	10.50	57.57	22.51	4.10	162	412.5	30	41.66	0.50	2.81	6.77	1.21	36	48.50
25.04.2009 (330 days)																
IV/4	30	191.20	10.20	56.10	29.36	5.33	112	378	30	37.28	0.63	3.46	9.28	1.68	29.5	44.5
IV/5	30	252.77	9.51	52.12	20.62	3.76	164	350	30	42.45	0.47	2.58	6.10	1.10	38	47
IV/6	30	352.10	15.80	86.60	24.60	4.48	268	640	30	46.08	0.60	3.29	7.15	1.30	41	58
IV/7	30	389.70	18.80	102.70	26.36	4.82	238	630	30	47.36	0.60	3.30	6.97	1.26	41	54
Total	120	296.44	13.57	74.38	25.23	4.59	195.50	499.50	30	43.29	0.57	3.15	7.37	1.33	37.37	50.85
09.05.2009 (344 days)																
IV/4	30	238.40	12.20	66.70	27.99	5.11	108	380	30	40.45	0.69	3.80	9.42	1.70	33	47
IV/5	30	302.20	11.20	61.50	20.37	3.70	216	450	30	44.48	0.57	3.12	7.01	1.28	37	50.5
IV/6	30	400.90	14.90	81.50	20.34	3.71	316	660	30	47.70	0.65	3.57	7.50	1.36	43	59
IV/7	30	420.50	14.70	80.30	19.10	3.49	316	582	30	48.63	0.49	2.69	5.54	1.00	44	53
Total	120	340.50	13.25	72.50	19.93	4.00	239	518	30	45.31	0.60	3.29	7.36	1.33	39.25	52.37
23.05.2009 (360 days)																
IV/4	30	266.20	19.50	107.00	40.20	7.32	160	510	30	42.18	0.81	4.46	10.57	1.92	36.5	49.5
IV/5	30	350.40	15.00	82.40	23.50	4.28	220	532	30	46.70	0.64	3.53	7.56	1.37	41	53
IV/6	30	414.10	13.20	72.50	17.51	3.18	232	592	30	50.06	0.44	2.42	4.83	0.87	46	58
IV/7	30	470.30	16.30	89.10	18.94	3.46	271	676	30	51.18	0.43	2.38	4.65	0.84	45	54.5
Total	120	375.25	16.00	87.75	25.03	4.56	220.75	577.50	30	47.53	0.62	3.19	6.90	1.25	42.12	53.75

Table 2

The amount of feed given to the *A. baerij* juveniles between 11.04.2009 and 23.05.2009

<i>Tank</i>	<i>Number of individuals</i>	<i>Average body weight (kg/individual)</i>	<i>Total body weight (kg)</i>	<i>Feeding rate (%)</i>	<i>Quantity of calculated feed (kg/days)</i>	<i>Quantity of given feed (kg/days)</i>	<i>Fish density (kg/m² tank bottom)</i>
11.04.2009 (316 days)							
IV/4	751	0.164	123.16	1.4	1.724	0.750	9.80
IV/5	752	0.224	168.44	1.2	2.021	1.000	13.41
IV/6	655	0.325	212.87	1.1	2.341	1.200	16.94
IV/7	641	0.313	200.63	1.1	2.206	1.200	15.97
TOTAL	2799	0.251	705.10	1.17/0.58	8.292	4.150	14.03
25.04.2009 (330 days)							
IV/4	749	0.191	143.05	1.5	2.145	0.928	11.38
IV/5	750	0.252	189.00	1.1	2.079	1.240	15.04
IV/6	654	0.352	230.20	1.0	2.302	1.453	18.32
IV/7	640	0.389	248.96	1.0	2.489	1.557	19.82
TOTAL	2793	0.290	811.21	1.11/0.6	9.015	5.178	16.14
09.05.2009 (344 days)							
IV/4	746	0.238	177.54	1.3	2.308	0.880	14.13
IV/5	724	0.302	218.64	1.1	2.405	1.200	17.40
IV/6	646	0.400	258.40	1.0	2.584	1.278	20.57
IV/7	638	0.420	267.96	1.0	2.679	1.520	21.33
TOTAL	2754	0.334	922.54	1.08/0.52	9.976	4.878	18.36
23.05.2009 (360 days)							
IV/4	742	0.266	197.37	1.35	2.664	1.080	15.71
IV/5	720	0.350	252.00	1.3	3.276	1.400	20.06
IV/6	645	0.414	267.03	1.2	3.204	1.600	21.26
IV/7	637	0.470	299.39	1.1	3.293	1.800	23.83
TOTAL	2744	0.370	1015.79	1.22/0.57	12.437	5.880	20.21

Table 3

Bioproductive indicators of the Siberian sturgeon (*A. baerii*) calculated for the period between 11.04.2009 and 23.05.2009

Period	Tank	Real weight gain (S _r) (kg)	Apparent weight gain (S _a) (g)	Daily growth rythm (kg/day)	Specific growth rate (%/day)	Specific feed consumption (kg feed/kg weight gain)	Index of feed conversion (kg weight gain/kg feed)
11.04.2009	IV/4	19.89	27	1.42	142	0.52	1.89
	IV/5	20.56	28	1.46	146	0.68	1.46
	-	17.33	27	1.23	123	0.96	1.03
24.04.2009	IV/7	48.33	76	3.45	345	0.34	2.87
	TOTAL	106.11	-	7.56	756	0.54	1.82
25.04.2009	IV/4	34.49	47	2.46	246	0.37	2.65
	IV/5	29.64	50	2.11	211	0.58	1.70
	-	28.20	48	2.01	201	0.72	1.38
08.05.2009	IV/7	19.00	31	1.35	135	1.14	0.87
	TOTAL	111.33	-	7.93	793	0.65	1.53
09.05.2009	IV/4	19.83	28	1.43	143	0.62	1.60
	IV/5	33.36	48	2.38	238	0.50	1.98
	-	8.63	14	0.61	61	2.07	0.48
22.05.2009	IV/7	31.43	50	2.24	224	0.67	1.47
	TOTAL	93.23	-	6.66	666	0.73	1.36
28.03.2009	TOTAL						
-	PERIOD	310.67	-	27.73	-	0.67	1.48
23.05.2009							

Where,

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

B_f = final biomass; B_i = initial biomass; M_t = final mean; M_i = initial mean; R_{ZC} = daily growth rythm; t = number of days; Q_{ch} = specific feed consumption; C_{fa} = administered feed quantity, I_{ch} = index of feed conversion.

Regarding the concerns for maintaining the water quality between the appropriate quality parameters, we were forced to reduce daily administered feed quantity comparing to calculated quantity. Thereby, if after the measurements from the date of 23.05.2009 we should administrate 12.437 kg feed/day, environmental factors forced us to administrate only 5.880 kg feed/day. In Table 3 bioproductive indicators of 2799 individuals of *A. baerii* juveniles with ages between 316 and 360 days are presented.

Over the 44 experimental days, all 2799 Siberian sturgeon juveniles accumulated a real weight gain of 310.67 kg, with a specific feed consumption of 0.67 kg feed/kg weight gain, and an index of feed conversion of 1.48 kg weight gain/kg feed.

Conclusions. At age of 360 days, Siberian sturgeons reached a body weight comprised between 266.20 ± 19.50 g and 470.30 ± 16.30 g, and a body length between 42.18 ± 0.81 cm and 51.18 ± 0.43 cm. The individual minimum and maximum values were situated between 160 and 676g for body weight and 36.5 and 58 cm for body length. For the entire population of sturgeons involved in this study, at the age of 360 days, a medium variability was registered for average body weight and a medium and small variability for total body length. During all the 44 experimental days, all 2799 Siberian sturgeons accumulated a real weight gain of 310.67 kg, with a specific feed consumption of 0.67 kg feed/kg weight gain and an index of feed conversion of 1.48 kg weight gain/kg feed consumed. For obtaining a better fish population increasing rate is necessary to execute from time to time more water analyses in order to control the nitrite concentration and also the level of dissolved oxygen from the raising tanks. If the registered data of controlled parameters are maintained at constant level and does not exist fluctuations from a period to other, better growing and developing rates are obtained.

References

- Bura M. (ed.), et al, 2008 [Guide of Presentation and Utilization of Sturgeons' Culture Technology in Super Intensive and Recirculating System]. Editura Eurobit, Timișoara, 373p. [In Romanian]
- Bura M., Szelei Z. T., Grozea A., Muscalu-Nagy R., Bănățean-Dunea I., Pătruică S., 2009 Research regarding the evolution of corporal masses and food conversion on juveniles of siberian sturgeons (*Acipenser baerii*) raised in recirculating system; *Lucr Șt Zoot Biot* **42**(2):14-20.
- Bura M., Szelei Z. T., 2009 Research regarding the evolution of corporal masses and feed conversion on sterlet (*Acipenser ruthenus*) juvenile raised in recirculating system. *AACL Bioflux* **2**(2):223-228.
- Gisbert E., Williot P., 2002 Advances in larval rearing of Siberian sturgeon. *Journal of Fish Biology* **60**:1071-1092.
- Oprea L., Georgescu R., 2000 [Fish Nutrition and Alimentation]. Editura Tehnică, Bucharest, 272p. [In Romanian]
- Prokeš M., Barus V., Penaz M., 1997 Comparative growth of juvenile sterlet (*Acipenser ruthenus*) and Siberian sturgeon (*A. baerii*) under identical experimental conditions. *Folia Zoologica* **46**(2):163-176.

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