

REFERENCED TECHNOLOGICAL PERFORMANCES FOR STURGEON FINGERLING BREEDING IN INTENSIVE SYSTEM

PERFORMANȚE TEHNOLOGICE ÎNREGISTRATE LA PUIETUL DE STURIONI CRESCUT ÎN SISTEM INTENSIV

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*Work objective is to present an oversight regarding the modality to rearing the descendents of anadromous sturgeon species, *Acipenser stellatus*, *Acipenser gueldenstaedti* and *Huso huso*, obtained through artificial reproduction, indicating successively, the production system, its management, alimentary strategy for sturgeon species and technological performances registered by these. Experiments developed during two phases, respectively the post-embryonary one and sapling rearing during of a 168 days period. Registered performances of sturgeon species material were assessed in conformity with specifically biotechnological indicators.*

Key words: sturgeon, aquaculture, intensive breeding

Introduction

Sturgeons breeding in a complete production cycle assume to get through two essential phases: larval breeding and sapling rearing until the advisable dimension.

Larval breeding until the phenotypical characters defining, similarly to adults, is the most sensible phase from the whole technological process for sturgeon species rearing. After hatchery and vitelline reservoirs utilization, the surviving depends only by rearing system and its management, and of nutritive addition, bringing by exogenous alimentary.

After this phase of post-embryonary development, technological sequences practiced for sturgeons sapling breeding could be assumed with the usually ones, utilized for farmed species breeds in intensive system.

The first tests at industrial scale, for producing and breeding sturgeon fingerling in Romania they have been realized in 1955-1966 period, thereafter in 90's there have been continued being implemented during 15 years of researches, systems and intensive rearing technologies for *Acipenser stellatus*, *Acipenser gueldenstaedti*, *Acipenser ruthenus* and *Huso huso* species.

This work will present an ensemble viewing about the rearing method of these species, indicating consequently the production system, management, feeding strategy of sturgeon material and his technological performances.

Materials and Methods

The rearing experiments have been achieved on descendants of sturgeon migratory species *Acipenser stellatus*, *Acipenser gueldenstaedti*, and *Huso huso*, obtained through artificial spawning by researchers of I.C.D.E.A.P.A. Galați.

The experiments were lasting 168 days and starting when larva record 5 days old from hatching.

Breeding system has been constitutes in stage of postembryonic growth from fiberglass rearing tanks with size 1,40 m x 1,40 m x 0,6 m, thereafter being used circular rearing units manufactured from the same material, with 5 m diameter. Usually depth of technological water has been 15-20 cm in postembryonic growth stage and 70-90 cm in breeding stage.

The maintenance of breeding system has achieved in manner of capacity efficiency in the larval and fingerling stocking moment but there has been in attention to avoid getting technological limit of stress through number and biomass stocking quantity, respectively.

Stage I - postembryonic growth (from larva in 45 growth phase to fingerling with aprox. 1.0g/ex body weight), stocking density-15 larva/l, exchange debit of technological water - 7 l/min.

Stage II – rearing

Phase II.1 (from fingerling with aprox.1,0g/ex body weight to fingerling with 5g/ex body weight), quantity of stocked biomass – 1.5 kg/m², exchange debit of technological water - 10 l/min.

Phase II.2(from fingerling with aprox.5g/ex body weight to sapling with 50g/ex body weight), quantity of stocked biomass–4kg/m²;exchange debit of technological water - 17 l/min.

Phase II.3. (from sapling with 50g/ex body weight to sapling with100g/ex body weight), quantity of stocked biomass from specie: *Acipenser stellatus* – 12.5 kg/m², *Acipenser gueldenstaedti* – 5 kg/m², *Huso huso* - 5 kg/m²; exchange debit of technological water- 25 l/min.

The larval rearing in stage of postembryonic growth has achieved based on nutritional scheme which consists in live food diet for the first 7-8 days and then mixture diet consisting of natural food and extruded feed.

Exclusive feeding with natural food is based on using the plankton and benthos in simple or combined ways.

Natural food combinations were varied from specie to other.

Food ratio has been daily assessed according to lot's weight. 24 hours food ratio was calculated in 100% percentage from lot's weight in that day. Balanced fractions from this ratio have been delivered at 3 hours interval daily and night period.

The larval passing from a diet based on live natural food to a mixture diet - natural food - extruded feed one was gradually achieved through feeding scheme application that was consisted in decrease of live food percentage and increase of

extruded feed. The extruded feed was Nutra 4 from Trouvit with protein content by 58% and administrated in stage of postembryonic growth.

Thereafter, the rearing was achieved based only on a diet from Trouvit extruded food: Nutra 3, Nutra 2, Nutra 0 and Extra 1 respectively having a protein content of 55% - 48%.

Food percentage has been required by size of fingerling and temperature of technological water and varying between 2% - 5% with 4 hours delivery interval.

During all rearing period in system was respected a strictly hygiene. The essentials physical-chemical parameters, oxygen and temperature have been permanently monitored and complete analysis of technological water was achieved at 7 days interval.

Biotechnological indices, average weight, individual rearing gain, daily growth rate, specific growth rate have been assessed at regular intervals of 10 days through monitoring three sample lots of 15 exemplars each. The survivor percentage has been assessed at the end of each rearing stage.

Results and Discussions

Results obtained allow appreciations, ascertainties and assessments on sturgeon species material in the context of specifically conditions of aquatic environment.

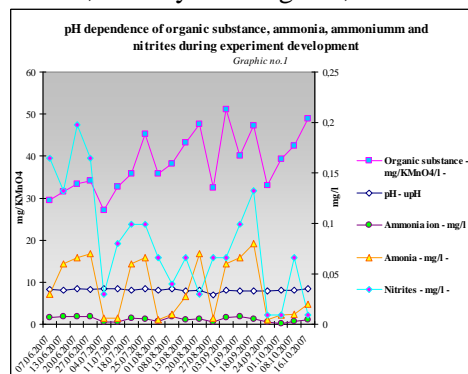
From analyzes of physico-chemical data of technological water it could be observed that the average temperature during a 90 days period, maintain at a superior level of optimum values supported by sturgeon species, respectively of 25° C. In September this registered an average value of 19.8° C, optimum for a proper breeding rhythm of sturgeons, and in October this registered a decrease with 6° C compared with optimum level for development, 21° C. Variation of temperature between day and night was of 0.2 – 0.8° C.

Oxygen does not present significance variations. Analyzing this parameter during the whole period of breeding, it was observe that 70 days from 168 days, this is maintaining at values under 7 mg/l and to a saturation under 100%, situation that not allow the sturgeon species to assimilate efficiency the distributed food.

Regarding the other chemical parameters, weekly investigated, it could be observe:

- **pH** (*Graphic no. 1*) are not registered major variations during the breeding period, maintain in alkaline domain during the whole breeding period of sturgeon material, exceeding with 0.5 unit the optimum value for this kind of fishy material.

- **ammonium cation** (*Graphic no. 1*) registered high values during the June period, encouraging the ammonia



composition, in conditions of a pH alkaline. The phenomenon, with rare exceptions, is registered during the whole breeding period of sturgeon material.

- **free ammonia** (*Graphic no. 1*) in conditions of a pH alkaline and of ammonium cation values, was present in quantities that exceed the maximum admissible value during the first half of June. Further on, this is maintained in normal limits till the middle of August, when it is registered a new increase that exceed the maximum admissible value;

- **nitrite ion** (*Graphic no. 1*), registered also, high values during the June and then, during the whole period, variations in optimum and maximum levels;

- **organically substance** (*Graphic no. 1*) does not register significance variations; values are contained in optimum admissible interval for a technological water.

Centralization of obtained data from determinations of average weights and generally average accessions for breeding in regularly time intervals, offer the possibility of evolution comparison for descendents breeding of anadromous sturgeon species.

From analyze of technological indicators realized in post-embryonary phase it could be observe that the descendents of *Huso huso* attain the fingerling stage with 1g weight after 15 days from exogene feeding, the *Acipenser gueldenstaedti* descendents, after 19 days and the *Acipenser stellatus* descendents, after 25 days. Average rate for daily breeding (*Table no. 1*), during the first 8 days of feeding with a diet represented exclusively by natural food is of 20.25 mg. for beluga descendents, 18 mg for oisetr and 15.9 mg for sevruga ones. Further on, the daily breeding rate, till 1 g weight, registered an average value of 107. 2 mg for beluga, 75.4 mg for osetr, 47mg for sevruga. Losses of sturgeon exemplars, in the first 8 days of feeding, are insignificance, 4% for beluga, 9% for oisetr, 5% for sevruga. These losses increase in a percent of 10% for beluga in the following 7 days, when it registered almost 1 g weight, 12% for oisetr, 7.5% for sevruga.

In the first phase of rearing stage from 1 gram average weight to 5g/ex. average weight respectively related to 15 days period for beluga fingerling, the registered data indicate an increase of average weight during all period but daily growth rate records high variations in growth interval from 1g to 2 g and from 2 g to 5 g weight. Thereby, in growth interval from 1 g to 2 g the daily growth rate is only 120 mg/day and significant increasing to 428 mg/day in growth interval from 2 g to 5 g. The phenomenon could be only justified due to decrease of natural food percentage from ratio related to hydro-chemical parameters of technological water which were recorded normal values specified with sturgeon species. For *Acipenser gueldenstaedti* fingerling the evolution is constantly ascendant, the daily growth rate's varying about 210 mg. It's getting average weight of 5 g in 19 days from beginning the growth stage. For sevruga specie the growth is ascendant and recording a linear evolution of daily growth rate which varying about 193 mg. The sevruga is getting 5 g average weight after 21 days from starting the growth stage.

The biological material losses are 4.6% for the beluga, 6.2% for the Russian sturgeon and 4% for sevruga.

Table 1

Technological indexes to the descendents of *Huso huso*, *Acipenser gueldenstaedti* and *Acipenser stellatus* after passing to exogenous food

| A. Technological indexes after 8 days with a diet feeding, composed exclusively from natural food | | | | | |
|---|---------------------------------|-------------------------------|------------------------|-----------------|---------------|
| No. | Specie | Gm/ex (to population) -mg- | G m/ex. (final)-mg- | RC/day* -mg- | Losses -%- |
| 1. | <i>Huso huso</i> | 48 | 210 | 20.25 | 4.0 |
| 2. | <i>Acipenser gueldenstaedti</i> | 36 | 180 | 18 | 9 |
| 3. | <i>Acipenser stellatus</i> | 23 | 150 | 15.9 | 5 |
| B. Technological indexes registered at an average weight at 1 g. in conditions of a mixed alimentary diet- natural food – fodder. | | | | | |
| 1. | <i>Huso huso</i> | 210 | 0.963 | 260 | 10 |
| 2. | <i>Acipenser gueldenstaedti</i> | 180 | 1010 | 91.5 | 12 |
| 3. | <i>Acipenser stellatus</i> | 150 | 0.950 | 187.5 | 7.5 |

* daily breeding rate

The second and third phases of growth stage that meaning the growth until 50g average weight and bigger than 100g they are governed by species adaptation to a diet total based on extruded feed. Specific for these growth stages it is represented by high homogeneity of beluga stock and differentiation on weight classes for Russian sturgeon and, especially sevruga.

Analyzing the average values of biotechnological indexes at the whole breeding period level, are contains in the *Table no. 2*:

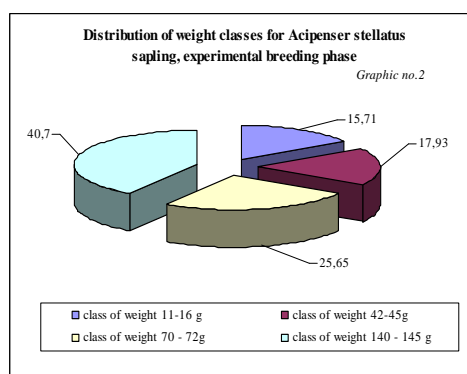
Table 2

Average values of biotechnological indicators, obtained from descendents of *Huso huso*, *Acipenser gueldenstaedti* and *Acipenser stellatus* during the experiment execution period

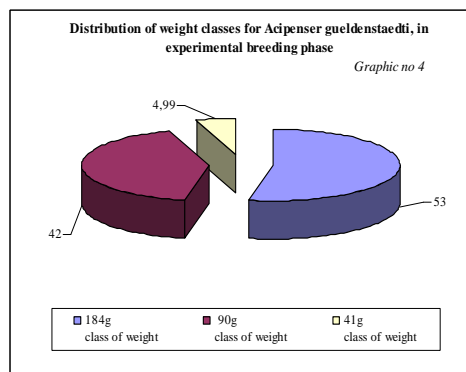
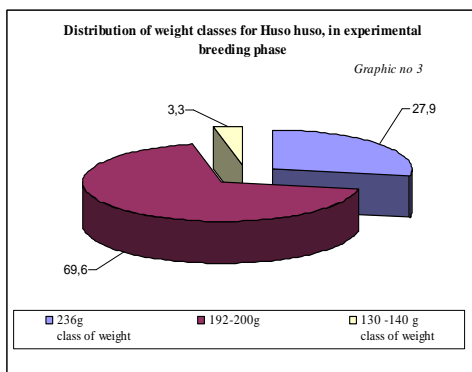
| Indicators | A – BELUGA | | | | B - OSETR | | | |
|-------------------------------|------------|-------------------|-----------------------|------------------------|-----------|-------------------|-----------------------|------------------------|
| | Total | Weight class 140g | Weight class 70 – 72g | Weight class 40 – 42 g | Total | Weight class 140g | Weight class 70 – 72g | Weight class 40 – 42 g |
| Tank population | | | | | | | | |
| No. of exemplars | 6793 | | | | 5255 | | | |
| Initial biomass - g - | 326 | | | | 189.18 | | | |
| Individual weight - g - | 0.048 | | | | 0.036 | | | |
| Harvesting | | | | | | | | |
| No. of exemplars | 5394 | 1456 | 3757 | 181 | 3.826 | 1.607 | 2.028 | 191 |
| Surviving rate % | 79.4 | | | | 72.8 | | | |
| Final biomass - Kg | 1108 | 344 | 736 | 24 | 485.83 | 295.59 | 182.41 | 7.84 |
| Final individual weight - g - | | 236 | 196 | 135 | 105.0 | 184.0 | 90.0 | 41.0 |
| Parameters | | | | | | | | |
| No. growth days | 124 | | | | 149 | | | |
| Individual growth gain g | | 235.95 | 195.95 | 134.95 | | 183.93 | 89.93 | 40.93 |

| | | | | | | | | |
|---------------------------------------|---------|---------|-------------------|----------------------|------------------------|----------------------|------|------|
| Total growth gain - g - | | 344 | 736 | 24 | | | | |
| Total of delivered feed - kg - | 1214.58 | | | | 510.125 | | | |
| Conversion coefficient g food/ g gain | 1.1 | | | | 1.05 | | | |
| Daily growth rate /day | | 1.90 | 1.58 | 1.09 | | 1.23 | 0.60 | 0.27 |
| C - SEVRUGA | | | | | | | | |
| Indicators | | Total | Weight class 140g | Weight class 70 –72g | Weight class 40 – 42 g | Weight class 11-16 g | | |
| Tank population | | | | | | | | |
| No. of exemplars | | 34.133 | | | | | | |
| Initial biomass - g | | 785 | | | | | | |
| Individual weight - g - | | 0.023 | | | | | | |
| Harvesting | | | | | | | | |
| No. of exemplars | | 26.624 | 10.847 | 6.829 | 4.774 | 4.183 | | |
| Surviving rate % | | 78 | | | | | | |
| Final biomass - kg | | 2.255.6 | 1.518.6 | 484.9 | 195.7 | 56.5 | | |
| Final individual weight - g - | | | 140 | 71 | 41 | 13.5 | | |
| Parameters | | | | | | | | |
| No. growth days | | 168 | | | | | | |
| Individual growth gain - g - | | | 139.98 | 70.98 | 40.98 | 13.48 | | |
| Total growth gain - g - | | 2.255 | 1.518.3 | 484.7 | 195.6 | 56.4 | | |
| Total of delivered feed - kg - | | 2.075 | | | | | | |
| Conversion coefficient g food/ g gain | | 0.92 | | | | | | |
| Daily growth rate g/day | | | 0.83 | 0.42 | 0.24 | 0.08 | | |

For sevruga is noticed that into 168 days of breeding interval for the same stock the growth rhythm is different. A percentage of 40.74% (*Graphic no. 2*) from descendants is represented by plus variants that achieve a daily growth rate of 0,83g/day. The exemplars that are enclosed in weight classes of 42-45 g and 70 – 72 g, they accomplish a daily growth rate of 0,24g/day and 0,42g/day respectively. The minus variants which



are found out within stock into 15.71% percentage they achieve a daily growth rate of 0.08 g/day. For beluga is noticed that into 124 days of breeding interval in a percent at 27.9% (*Graphic 3*) is represented by plus variants that achieve a daily growth rate of 1.9 g/day, 69.6 % are exemplars with an average weight of 196g/ex . and a daily growth rate of 1.58 g/day, and 3.3% are exemplars with an average weight of 135g/ex. and a daily growth rate of 1.09 g/day. For Russian sturgeon is noticed that into 149 days of breeding interval in a percent at 53% (*Graphic 4*) is represented by plus variants that achieve a daily growth rate of 1.23g/day, 42 % are exemplars with an average weight of 196g/ex, and a daily growth rate of 0.6 g/day, and 3.3% are exemplars with an average weight of 135g/ex. and a daily growth rate of 0.27 g/day.



Conclusions

From researches and experiments realized from descendents of anadromous sturgeon species from Danube River, obtained in the post-embryonary development stage, in intensive breeding conditions, biotechnological indexes comparative with the indexes obtained from descendents of *Acipenser baeri* Siberian sturgeon (Billard 2000). During a breeding period in equivalent time period, only the descendents of beluga specie obtained biotechnological indexes, comparatives with the descendents of Siberian sturgeon (Medale și Kaushik, 1991).

In the comparison case of our experiments with the tests achieved on descendents of Siberian sturgeon by Hungarian specialists in 1998, we observe that in equivalent time intervals regarding an average weight at 60–70g/ex, beluga and osetr obtained biotechnological comparative indexes. The situation is similarly too in the comparison case of obtained results from *Acipenser transmontanus* by American experts.

The obtained results confirmed the fact that the *Huso huso* specie has a performance potential breeding and also, could make the object of intensive rearing at the industrial level, with osetr. It is a necessity the breeding technology improvement for sevruga for an increase of bio-productive indexes values.

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