PRELIMINARY DATA ON ECOLOGICAL PLASTICITY IN STURGEON FRIES

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Abstract. The paper discusses the first results obtained on the growth - between May-August 2006 - of a group of 1 year-old sturgeon fries (beluga, Russian surgeon and starry sturgeon) living in a floating cage placed on the surface of the Bordea pond (the district of Iasi). In spite of their phylogenetic position, the sturgeons manifest a high ecological plasticity, which is an advantage as to the conservation condition of the populations from both the natural environment and aquaculture. After 84 days of experiment, the fish recorded a survival ratio of 100% and an active growth rhythm (the growth gain being of 1.309 g/ex. in the beluga, 729 g/ex. in the Russian sturgeon and 524 g/ex. in the starry sturgeon). More than that, the values of the biometric indices determined (the Kiselev index, the index of profile and Fulton coefficient) show a good condition of the fish and a harmonious development.

Keywords: adaptability, sturgeons fries, pond, water quality, growth gain, bodily indices.

Rezumat. Date preliminare privind plasticitatea ecologică a puietului de sturioni. Lucrarea prezintă primele rezultate privind creșterea în perioada mai-august 2006 a unui lot de puiet de sturioni (morun, nisetru și păstrugă) în vârstă de un an, parcat într-o vivieră amplasată pe suprafața apei iazului Bordea din jud. Iași. În pofida poziției lor filogenetice, sturionii manifestă o înaltă plasticitate ecologică, însușire care îi avantajează pe linia conservării populațiilor din mediul natural, cât și a celor din acvacultură. După 84 zile de experiment, peștii au înregistrat un procent de supraviețuire de 100% și un ritm activ de creștere (sporul de creștere a fost de 1309 g/ex. la morun, 729 g/ex. la nisetru și 524 g/ex. la păstrugă). In plus, valorile indicilor biometrici determinați (indicele Kiselev, indicele de profil, indicele de grosime și coeficientul Fulton) atestă o stare de întreținere bună și o dezvoltare armonioasă a peștilor.

Cuvinte cheie: adaptabilitate, puiet sturioni, iaz, calitate apă, spor de creștere, indici corporali.

Introduction

Acipenserides (the sturgeons) are primitive fish, with a partially cartilaginous skeleton, living exclusively in the waters of Northern hemisphere's temperate regions. They represent the biggest and most highly appreciated fish of our waters, being one of the species of special interest in the fauna of Romania, if considering both their old age (exceeding 200 million years / the Inferior Jurassic) and their economic value.

In the waters of Romania there live 3 species of migratory marine sturgeons, namely: beluga (*Huso huso* Linnaeus, 1758), Russian sturgeon (*Acipenser gueldenstaedtii* Brand, 1833) and starry surgeon (*Acipenser stellatus* Brand, 1833), as well as a sedentary sweet-water species, the sterlet (*Acipenser ruthenus* Linnaeus, 1758). In aquaculture, one may also find the bester, an artificial hybrid between the female of the beluga and the male of sterlet and the American paddlefish (*Polyodon spathula* Walbaum, 1792), a planktonophagous sweet water species, coming from North America and acclimated in Romania in 1992.

As a result of uncontrolled fishing, to which one should also add the pollution and the hydroenergetic works along the Danube River, a continuous decline of the natural sturgeon populations could be observed in the last 6 decades. Thus, the yearly level of the Romanian sturgeon captures decreased from 1.144 t in 1940 to 292 t in 1960 and 50 t in 1980, a value somehow constant until the year 2000 (Manea, 1980; Ciolac *et al.*, 2005). Naturally, such a decline affected the sturgeon populations of all hydrographic basins, so

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that 25 of the 27 species of sturgeons now living in the whole world are in danger of extinction (Bacalbaşa-Dobrovici, 1992; 1993; 1995; 1996; 2002; Billard, 2002). Out of the species reproducing themselves in the north-western region of the Black Sea and Inferior Danube, the ship sturgeon (*A. nudiventris*) is viewed as an endangered species / extincted one, while the beluga (*Huso huso*), the Russian sturgeon (*A. guldenstaedti*) and the starry sturgeon (*A. stellatus*) are endangered species, and the sterlet (*A. ruthenus*) is considered as vulnerable (Grozea, 2006).

For the conservation of the endangered species and recovery of the sturgeons still present in the natural waters, repopulation of these waters with biological materials provided by aquaculture is required. In spite of their phylogenetic position, the sturgeons manifest a high ecological plasticity, which is an advantage as to the conservation condition of the populations from both the natural environment and aquaculture (Barannikova, 1998)

The present paper analyzes the adaptive response of a batch of 1 year-old 100 copies of sturgeon fries to artificialized growing conditions, the main objective being monitorization of the behavior of the fish grown for 84 days in a floating cage introduced in the waters of a small-sized pound from the north-eastern part of the country.

Material and Methods

The experiment was developed between May 17 - August 11, 2006, in the Bordea pond, having a surface of 5 ha and situated at a 20 km distance of the Iasi city. The working material was a batch of 100 sturgeons (56 ex. beluga, 28 ex. Russian sturgeon and 16 ex. starry sturgeon) taken over from the Sturgeon Biobasis of Constanta belonging to the National Company for the Administration of the Piscicultural Fund.

The fish batch was put into a circular floating cage made of zinc wire, 5 m in diameter and 2.5 m in depth. Fish feeding was done daily, at 7 o'clock in the morning, with concentrated granulated "Trouvit"-type yeasts for salmonoids containing 42% raw protein. The daily ration oscillated between 2 and 5% of the fish total weight, being administered on a table immersed near the bottom of the cage.

Along the experiment, the evolution of temperature and of the water's oxygenation was measured twice a week, while the dynamics of the growing rhythm and of food's conversion - by monthly control weightings; also, fish' sanitary condition was followed by direct observations. In the end of the experiment, the survival ratio and fish' conservation condition was appreciated from the values of the special biometric indices, calculated from the biometric measurements made on 12 copies of each sample, (with) the following formulae:

profile index = 1/H; Kiselev index = 1/Ci and Fulton coefficient = $100 G/l^3$

where: "l" = standard length (cm); "H" = maximum height (cm); "G" = weight and "Ci" =

maximum circumference of the body (cm) (Voican et al., 1981; Lustun et al., 1978).

Results and Discussion

The accumulation lake of Bordea is situated in a forest area on the valley of the Rebricea stream, in the hydrographic basin of the Barlad River. The water of the pond may be ranked, according to the standards in force, as of 2^{nd} category, being compatible for pisciculture. Figure 1 plots the comparative dynamics of the values of temperature and water oxygenation, during the experiment. As a small-sized accumulation, the dependence of water's temperature on the fact of air is quite high, so that, in the second part of the interval considered, the values recorded exceeded 26°C. In correlation with the evolution of water's temperature, the level of the dissolved oxygen follows a progressive decrease,

from optimum values of 8-8.5 mg/L up to 4.6-5.7 mg/L, the installation of some temporary hypoxia conditions being possible, so that special measures of aeration and adequate combat of the excess vegetation should be taken.



Figure 1. Dynamics of water's temperature and oxygenation.

In spite of this decreasing trend of water's oxygenation, the fish adapted the breathing function so that no real deficit of oxygen was felt, the survival index remaining, along the whole period of observations, at a value of 100%.

As to the growing rhythm, the recorded values of the average individual weight (Fig. 2) show an active increase in all species under study, more pronounced in the case of beluga. Thus, along the 82 days of the experiment, beluga's initial individual average weight gets multiplied 2.39 times *versus* 2.39, as recorded in the case of the Russian sturgeon, and *versus* only 1.92 - in the case of the starry sturgeon. The literature of the field mentions the growing performances of the beluga, which lives in free waters between 30 and 60 years, attaining bodily heights of 6 m and maximum individual weights of 1000 kg. In the Danube River, the largest reported specimen weighed 882 kg.



Figure 2. Individual growing of the sturgeon fries in the second summer.

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The differences in the growing rhythm recorded among the copies of the 3 species under study are suggestively illustrated, too, by the analysis of the data on the individual growth gain (Fig. 3). From this point of view, along the 84 days of the experiment, the beluga attains an individual growth gain of 1.309 g/ex. *versus* 729 g/ex. in the case of Russian sturgeon and of 594 g/ex., respectively, in the starry sturgeon. When growing free, the Russian sturgeon may attain a maximum longevity exceeding 40 years, a maximum bodily height of 2.5 m and a maximum individual bodily weight of 115 kg. The maximum length value ever recorded in the case of the starry sturgeon was of 2.18 m, while the maximum weight was of 54 kg (Manea, 1980).



Figure 3. Individual growth gain (g/piece) in the sturgeons under analysis.



Figure 4. Food conversion in the sturgeon fries under study.

All these results evidence, first, that the fish under analysis has easily assimilated the artificialized environmental conditions, as confirmed - apart from the integral survival

of the initial group - by a suitable, active, individual growing of the organisms. More than that, a good compatibility was found out between the quality and quantity of the administered fodder, on one side, and fish alimentary requirements, on the other. The data plotted in Figure 4 support the observation that the amount of fodder necessary for attaining a growth gain of 1 kg - at the level of the whole batch - is of 1.64 kg. From this point of view, food conversion efficiency - ranging between 1.26-1.31 - , recorded in the first half of the experimental period, suggests an efficient metabolic turning to good account of the fodder. Mention should be also made of the existence of a small gain of natural food, even if quantitatively negligible, constituted by crucian fries, that might have crossed the space of the cage, the access to the natural food of the representatives of the three species under study being theoretically equal.



Figure 5. Average values of the profile index.



Figure 6. Values of the Kiselev index.

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Generally, a correct estimation of fish condition starts from the determination of some biometric indices, on the basis of which one may appreciate the normality or the physiological comfort degree of the fish, especially in the case of selection and amelioration works. Such indices express the health condition of the population under consideration, in parallels with the natural and harmonious bodily indices development of fish. A comparison among the values of the bodily indices thus determined evidences a harmonious development and a good physical condition of the fish. Thus, the values of the profile index (Fig.5) show that the starry surgeon is the most slender among all, *i.e.*, the lowest value (3.31) *versus* 6.48 in the Russian sturgeon and 6.25, respectively, is recorded in the beluga.



Figure 7. Values of the Fulton coefficient.

As to the Kiselev index (Fig. 6), the highest corpulence is observed in the beluga, the average values of the length: circumference ratio being the lowest (2.32), followed by the Russian sturgeon (2.86) and starry sturgeon (3.13). These values are to be correlated with the values of the Fulton coefficients (Fig. 7), expressing fish' vigour. Thus, in the case of the beluga, the average value of this coefficient (0.887) is two times higher than that recorded for the starry sturgeon (0.457), while the Russian sturgeon, similarly with the one from free waters, records intermediary values of this parameter.

Conclusions

1. Preliminary investigations confirmed the possible growing of beluga, Russian sturgeon and starry sturgeon fries, in the second summer, in the conditions provided by the Bordea accumulation.

2. The 100% survival of the initial experimental effective along the 84 days of the experiments, and also the harmonious bodily development, indicate the high ecological plasticity of the sturgeons.

3. The most rapid growth has been recorded in the beluga, a case in which the growth gain was of 1.309 g/ex., followed by the Russian sturgeon (729 g/ex.) and starry sturgeon (594 g/ex.).

4. The metabolic turning to good account of the administered food was efficient, 1.64 kg food being necessary for attaining a growth gain of 1 kg.

5. The calculated biometric indices show normal values in all species under study, suggesting that the fish had suitable conditions, *i.e.*, physiological comfort, which explains the full vigour and harmonious bodily development.

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