

## Studies on wels catfish (*Silurus glanis*) development during cold season as an auxiliary species in sturgeon recirculated aquaculture systems

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**Abstract.** The research had the purpose to establish if the wels catfish is suitable for growing in closed recirculated system designed for sturgeon farming, because during the cold season the system does not need to reach high temperatures such as for other fish species. Our studies showed that the wels catfish can survive during the cold season from a recirculated system, and furthermore they accept feeds at temperatures as low as 17°C, and even have a slight body weight increase during this season. The wels catfish entered the spring in our experiment at a mean body weight of 72.5 grams, while the wels catfish from semi-intensive system after wintering in earthen ponds entered the winter at a mean body weight of 30 grams. Our experiments also studied the effect of stocking density on fish development in these conditions.

**Key words:** wels catfish, cold season, recirculated aquaculture system, sturgeon, wintering, stocking density.

**Rezumat.** Cercetările au avut ca scop stabilirea faptului dacă somnul european este potrivit a fi crescut ca specie auxiliară într-un sistem recirculat proiectat pentru cultura sturionilor, în care pe timpul sezonului rece temperatura apei nu este necesar să atingă valorile ridicate cum este uzual la alte specii. Studiile noastre au arătat că somnul european nu doar că supraviețuiește sezonului rece, dar și acceptă furajul la temperaturi relativ joase de 17°C, având chiar și o ușoară creștere în greutate pe timpul acestui sezon. Somnii au intrat în primăvară în experimentele noastre având o masă corporală medie de 72,5 grame, pe când semenii lor din sisteme semi-intensive după iernarea în bazine de pământ au avut o greutate medie de 30 de grame. Experimentele noastre au studiat de asemenea și efectul densității din bazinele de cultură asupra dezvoltării somnilor în aceste condiții.

**Cuvinte cheie:** somn european, sezon rece, sistem recirculat de acvacultură, sturioni, iernare, densitate de populare.

**Introduction.** The wels catfish or also known as the European catfish or sheatfish, enjoyed during the history a various approach from the aquaculturists (Proteau et al 1996; Carol et al 2009; Muscalu & Muscalu 2008). If in the last ten years it seemed that this species is not very profitable for intensive aquaculture, it seem that today this fish is attracting again the attention of fish farmers (Muscalu et al 2008) especially in monoculture, in intensive or superintensive aquaculture systems (Linhart et al 2002; Muscalu 2008; Talpeș et al 2009).

It is known that the wels catfish is growing well on pellets in closed systems but normally in water with temperatures above 20°C. The water temperature in a sturgeon system during the winter can drop as low as 12°C without major negative effects on sturgeon development, and furthermore sometimes it is even necessary to drop the system temperature regularly in order to stimulate the caviar production or the reproduction activity.

The European catfish is a good candidate in intensive sturgeon farms as an auxiliary species which will bring income much sooner than the sturgeons, sustaining in

this way the sturgeon farming activity. But, because the sturgeons are the main species they should benefit of all necessary conditions, including the regular drop of temperatures in the cold season. In this way, a species with high economic value, short development cycle to reach market size but also capable to adapt to these conditions is necessary. The European catfish seems like a good candidate.

**Material and Method.** The trials were conducted on 323 one summer old wels catfish juveniles, originated a nursery in Slovenia. The fish were divided in three fiberglass tanks with a volume of 1.1 m<sup>3</sup> each, connected to a single water treatment unit together with other bigger tanks in which sturgeons are grown. The location of experiments was in Timisoara, Romania, at an experimental aquaculture facility belonging to Banat's University of Agricultural Sciences and Veterinary Medicine, the same farm described by Bura et al (2008).

The trial tanks were populated as follows:

Variant 1 was populated with 90 pieces of average weight of 37.8 grams;

Variant 2 was populated with 110 pieces of average weight of 36 grams;

Variant 3 was populated with 130 pieces of average weight of 36.6 grams

Temperature and most essential chemical parameters were constantly monitored. The tanks were partially covered with panels in order to create favorable and stress free conditions.

The exchange rate of water in the tanks was around 1.5 fold per hour, which for a 1.125 m<sup>3</sup> tank was 27.5 L/min.

The used feed was Aller Exo specially formulated for catfish, having 45% raw protein, 7% fat, 8% ash and 3% fibers, close to the formulation suggested by Przybył et al (2008) and earlier by Ulikowski et al (2003). We must mention here that on the feeding table of this kind of feed, the manufacturer does not specify feeding ratios at temperatures lower than 24°C, therefore, the feeding was performed according to appetite. This was possible since the small light colored tank made available the observation of feeding behavior, and very small amounts of feeds were wasted.

During the experiment, which lasted from 31 October 2009 until 29 of May 2010, 8 essays were done, when body measurements (standard length and weight) were determined. Each time, 30 randomly picked individuals were measured except at the last essay when all individuals were measured, by methods described by Bura & Grozea (1997). Mortality rate was also recorded.

**Results and Discussion.** One of the most important observations that was made during this experiment, was that the wels catfish fingerlings stop eating at temperatures below 17°C. the appetite as it was predicted increases with water temperature. Based on our observation, the following table contains estimated feed intake according to water temperature for European catfish fingerlings at a density of 130 pcs/tank.

Table 1

Estimated feeding guidelines for wels catfish fingerlings

Water temperature (T°C)	% Body weight per day
<17	0
17	0.5
18	0.75
19	1
20	1.5
21	2
22	2.5
23	3

We used in our experiment the feeding appetite of the highest density since we anticipated that high density has an positive effect on feed intake ratio.

The second observation made in the experiment was the Feed Conversion Ratio in each of the variants. It seems that according to stocking density there are slight differences in the FCR. Therefore, in the variant with 90 pcs/tank, the FCR was 1.265, at

the second variant with 110 pcs/tank, the FCR was 1.24, and in the variant with 130 pcs/tank, the determined FCR was 1.20.

These values are also estimates since we could not determine exactly the amount of uneaten feed. The above mention values for the FCR include the losses of feed. Therefore, we consider that the real value of FCR is much smaller, but still should be related to stocking density. It is possible that in variant 3, at a higher stocking density the feed was better used and less losses, and maybe a more exact value of the FCR is closer to the one in this experimental variant.

The 8 measurements made to the three experimental variants revealed important data on the growth of catfish fingerlings in cold water. The following table shows the main parameters of the water at the time of measurements.

Table 2  
Physical and chemical parameters of the inflow water in experimental tanks

	T°C	DO (mg·L <sup>-1</sup> )	pH	NH <sub>3</sub> (mg·L <sup>-1</sup> )	NO <sub>2</sub> (mg·L <sup>-1</sup> )	NO <sub>3</sub> (mg·L <sup>-1</sup> )
31.10.2009	17.5	8	7.5	0.05	0.1	70
28.11.2009	17	8.8	7.5	0.1	0.1	80
24.12.2009	17.5	7	8	0.2	0.3	140
30.01.2010	16.5	7	8.2	0.2	0.2	100
27.02.2010	16	7.5	8.1	0.2	0.3	170
27.03.2010	18	7	7.8	0.05	0.1	100
30.04.2010	19	6.8	7.7	0.05	0.05	90
29.05.2010	22.5	6.5	7.2	0.05	0.05	50

Analyzing all the recorded data, we can specify that the variability for the studied elements is increasing with size of the fish. This is very important for the aquaculturist, which has to make frequent sorting in the population, since this fish shows an aggressive behavior during feeding. Actually during the entire experiment, only three fish died, and all of them showed signs of aggression. Two cases of mortality were recorded in the highest density variant, and one case in the medium density variant.

The measured body parameters revealed a high variability in catfish population, unlike the research of Arteni (2009).

The recorded data throughout the 7 months of experiment were used to calculate the growth curve for body weight and standard length.

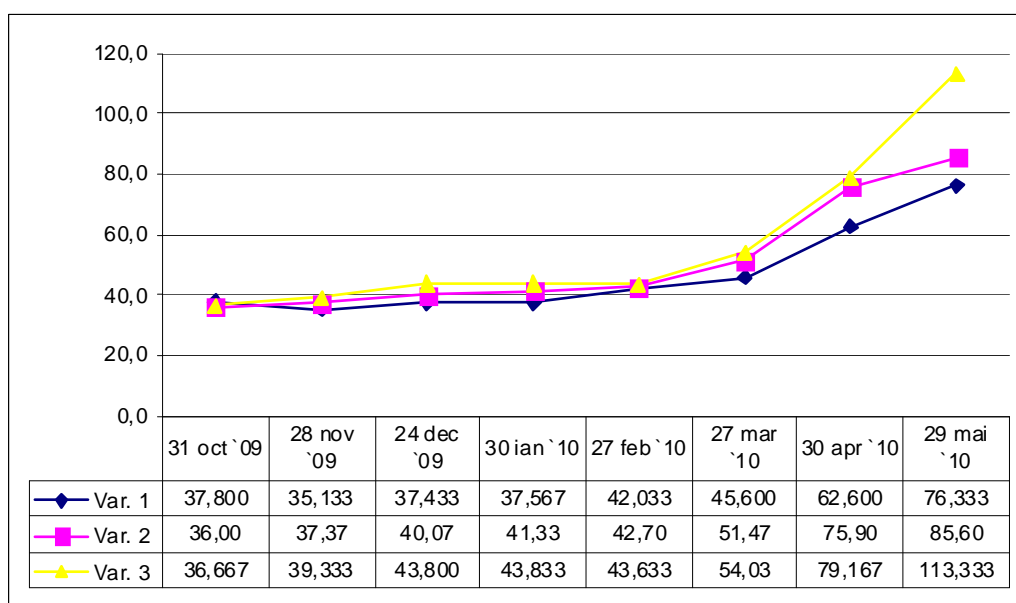


Figure 1. Evolution of body weight of wels catfish fingerlings during the experiment.

The table in Figure 1 shows the values of body weight in grams by the time of measuring.

It is very clear that the stocking density has a major impact on the growth rate of wels catfish. Also, during the cold period, when feeding rate was very low, or even absent, in the low density variant, the fish lost weight.

The situation is similar also for the next growth parameter, the standard length. The below table (Figure 2) shows the values of standard length in cm.

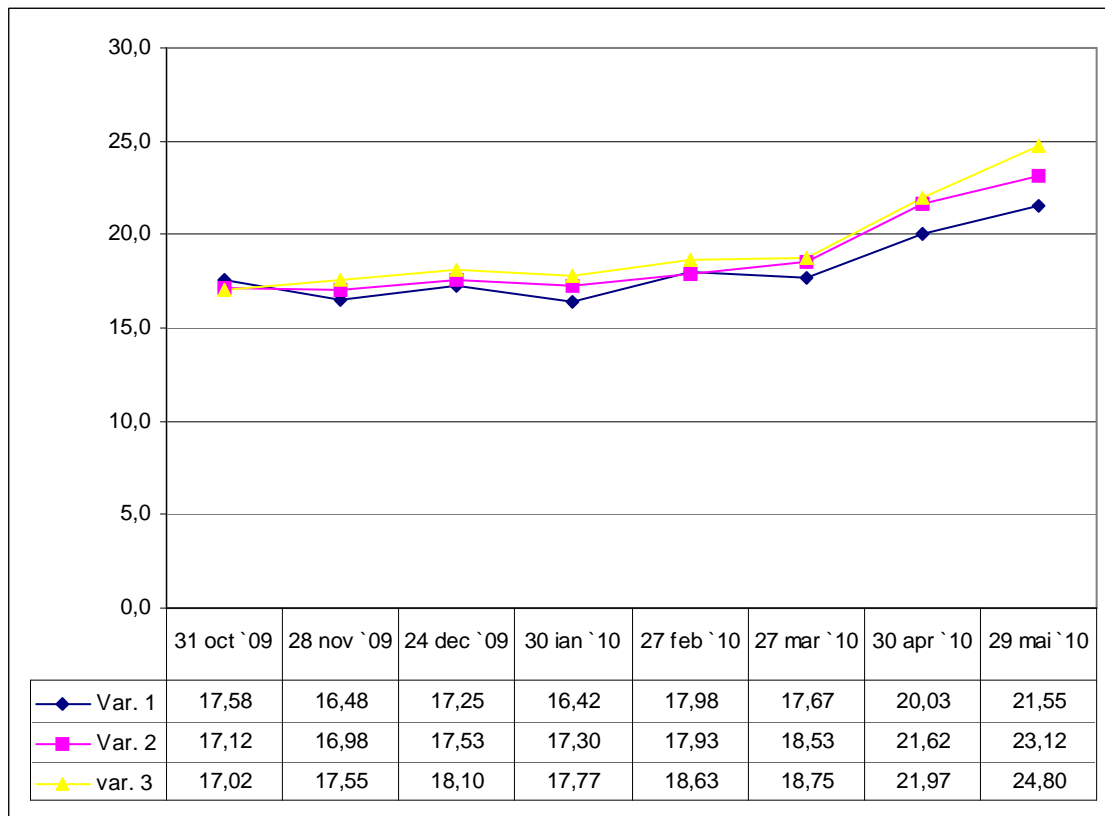


Figure 2. Evolution of standard length of wels catfish fingerlings during the experiment.

In this case, the data shows a big variability in fish's standard length, at all stocking densities.

Meanwhile, in Slovenia, the wels catfish population from where our fish originated spend the winter in earth pond, under ice. In late April, when the fish was moved in growing ponds, it had an average weight of 30 grams. During the last month of our experiment, when water temperature increased to over 22°C, the growth was accelerated.

## Conclusions

- The indoor sturgeon farms that function with water recirculation, can be populated with wels catfish as an auxiliary species.
- Even in colder water, the wels catfish shows some growth, and survives well.
- Under 17°C this species is not consuming the offered feed.
- At higher stocking densities even at low temperatures the wels catfish shows higher consume rate.
- The FCR has lower values at high densities, around 1.2, because the feed was better consumed.
- The mortality rate is higher at high stocking density, and it is correlated with aggression during feeding.
- Frequent sorting is necessary because the fish shows high variability.

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## References

- Arteni M., 2009 Studies regarding some morphological features of one-summer old catfish (*Silurus glanis* Linnaeus, 1758). AACL Bioflux **2**(2):217-222
- Bura M., et al, 2008 [Manual of Presentation and Use of Technology for Rearing Sturgeons in Super-intensive Recirculated Water System]. Editura Eurobit, Timișoara. [In Romanian]
- Bura M., Grozea A., 1997 [Guide to Practical Work on Aquaculture]. USAMVB Timișoara. [In Romanian]
- Carol J., Benejam L., Benito J., García-Berthou E., 2009 Growth and diet of European catfish (*Silurus glanis*) in early and late invasion stages. Fundamental and Applied Limnology **174**(4):317-328.
- Linhart O., Stech L., Svarc J., Rodina M., Audebert J. P., Grecu J., Billard R., 2002 The culture of the European catfish, *Silurus glanis*, in the Czech Republic and in France. Aquatic Living Resources **15**:139-144.
- Muscalu R., 2008 [Auxiliary aquatic species in sturgeon farming systems with recirculated water]. Revista Ferma, May 2008. [In Romanian]
- Muscalu R., Muscalu C., 2008 [Wels among the thermophilic fish reared in super-intensive aquaculture systems]. Revista Ferma, February 2008. [In Romanian]
- Muscalu R., Andrievici I., Andrievici V., Turza F., 2008 [Business Ideas. Farm in the Family System]. Rantrop & Straton publishing house, Bucharest. [In Romanian]
- Proteau J. P., Hilge V., Linhart O., 1996 Present state and prospects of the aquaculture of catfishes (Siluroidei) in Europe. Aquatic Living Resources **9**:229-235.
- Przybył A., Mazurkiewicz J., Golski J., 2008 Evaluation of selected feeds differing in dietary lipids levels in feeding juveniles of wels catfish, *Silurus glanis* L. . Acta Ichthyol Piscat **38**(2):91-96.
- Talpeș M., Patriche N., Tenciu M., Arsene F., 2009 [Prospects for the development of technology for intensive rearing of *Silurus glanis* in Romania]. Lucr Șt Zootehnie și Biotehnologii, Timișoara **42**(2):130-135. [In Romanian]
- Ulikowski D., 2003 Intensive production of European catfish (*Silurus glanis* L.) in water recirculating systems. Komunikaty Rybackie **2**:10-12.

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