

## **Water Quality as Sturgeons' Welfare Indicators in a Farm from the Center of the Country**

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**Abstract.** Sturgeons can both make upriver migrations for spawning and downriver for developing and wintering. The importance is related to their meat, roe and the use for Danube Delta repopulation. From a sturgeon farm are harvested water samples from three checkpoints. From the samples there were analyzed physical chemical parameters and microbiological ones. The physical chemical parameters are determined by using Spectroquant Nova 60 photocolorimeter and the microbiological parameters by cultivation on dehydrated (dry) media. The results interpretation was done according to reference values from literatures for sturgeons and to provisions of the 161/2006 Order of the Environment and Water Resources Management Ministry. Following the researches can be concluded that the fish welfare in the assessed farm are medium, because of the water high microbial load and of the exceeding of the nitrates and sulfates among the chemical parameters.

**Keywords:** sturgeons, quality parameters, water, welfare

### INTRODUCTION

Sturgeons are among the oldest species living in water, being well-known by the nutritional and gustative features of the meat and roe [1, 3].

This fish can migrate both anadromous and catadromous. The migrations are related to important osmotic pressure changes in the environment (when moving from the sea saltwater to river freshwater and vice-versa). In our country, the sturgeon populations are beginning to decrease, on one side because of the Danube dams and on the other because of the pollution and trespass [4, 5].

At present more and more sturgeons farms are developing, in order to assure the meat and caviar production and for Danube Delta repopulation.

In modern aquaculture, the good fish welfare implies rearing conditions in which fish can maintain homeostasis, can develop normally and can be protected by environmental stressors.

### MATERIAL AND METHODS

In the sturgeons farm there were harvested water samples from three checkpoints: fishpond chute, center and outlet. From the samples there were analyzed: physical parameters (temperature, turbidity); chemical parameters (dissolved oxygen, chlorine, pH, ammonia, nitrites, nitrates, phosphates, phenols, detergents, iron, copper, sulfates) and microbiological ones (total count – TC and total coliform - CF). The physical chemical water parameters are

determined by using Spectroquant Nova 60 photocolimeter. The microbiological parameters determination was done by cultivation on dehydrated (dry) media Compact Dry TC (total count – aerobic plate count) and CF (total coliforms). The methods consisted in the aseptic spread of 1 ml water samples in the middle of the media, which diffuses automatically and evenly into all over the sheet and transform it into gel. The incubation period is one day at 25-35 °C temperature for total coliform and two days at 35-37 °C for total count [2].

The results interpretation was done according to reference values from abroad literatures for sturgeons and to provisions of the 161/2006 Order of the Environment and Water Resources Management Ministry.

## RESULTS AND DISCUSSIONS

Concerning the physical water parameters, the turbidity was acceptable, the Sechi disk being visible at 80 cm depth and the temperature record a value of 22 °C, framing into the normal limits for sturgeons.

The results for chemical water parameters in the assessed farm are shown in table 1 and 2.

Table no. 1

The average values of water chemical parameters in the sturgeons farm:  
oxygen, chlorine, nitrates, nitrites and phosphates

Assessed parameters	Oxygen mg/l	Chlorine mg/l	pH	Nitrates mg/l	Nitrites mg/l	Phosphates mg/l
Fishpond chute	8	0.15	7.7	9	0.023	0.7
Center of the pond	7.9	0.09	7.7	15	0.036	1.3
Water outlet	7.2	0.13	7.4	14	0.056	0.8
Admitted limits	9	0.3	7-8	10	0.1	2

Table no. 2

The average values of water chemical parameters in the sturgeons farm:  
iron, copper, ammonia, sulfates, phenols and detergents

Assessed parameters	Iron mg/l	Copper mg/l	Ammonia	Sulfates mg/l	Phenols mg/l	Detergents mg/l
Fishpond chute	0.05	0.04	undetected	30	0.1	0.03
Center of the pond	0.05	0.03	undetected	32	0.21	0.03
Water outlet	0.05	0.03	undetected	30	0.2	0.02
Admitted limits	1	0.3	0.05	2-7	1-2	0.1

Dissolved oxygen is an important chemical factor for fish life. The average values in the water sampled from three points frames within the normal limits of 7-8 mg/l according to Order 161/2006 and with the normal limits of less than 9 mg/l according to the reference values for sturgeon.

Clean water oxygen content always tends to the normal value, corresponding to the standard saturation temperature and atmospheric pressure.

Generally, the dissolved oxygen content is lower than these values because of the complex biological and chemical processes which evolved in the water.

Chlorine in water samples presented values (0.15 mg/l, 0.09 mg/l and 0.13 mg/l) that frame within the corresponding values of class I of water quality in accordance with Order 161/2006, but also within the normal limits of less than 0.3 mg/l reference value for sturgeon.

The pH of the water for ponds supply must record the value of 7, i.e. to provide a neutral reaction. Acid reaction of water, especially in the presence of chemicals, affects in a negative way the processes of breathing and feeding in fish, which contributes to a poor nutritional base use and to a slowdown of fish development. Also in the acidic environment fish has a reduced mobility, it seems fearful, coming to the surface and piping air, although the oxygen level is normal. Alkaline environment is again unfavorable. It is unbearable, a pH higher than 9 can lead to death of the sturgeon. In this case, the pH values range into the Class I of water quality, according to Order 161/2006, but also within the reference values for sturgeon.

Nitrates, according to Order 161/2006, frame within the normal range (less than 50 mg/l) but exceed the normal limits, if there are taken into account the reference values for sturgeon (max 10 mg/l). Higher values than normal up to 5-6 times can lead to death of the population.

Nitrites in water samples recorded values (less than 0.1 mg/l) corresponding to class I of water quality in accordance with Order 161/2006, as well as reference values for sturgeon.

Phosphorus shows values (0.7, 1.3, 0.8 mg/l) which frame within the normal range according to Order 161/2006 (2 mg/l) and the normal limits for sturgeon (2 mg/l). For the fishery waters phosphorus to 1 mg is considered optimal, and in 2 mg/l it is related to the processes of water contamination.

Iron values recorded 0.5 mg/l, ranging within the limits provided by Order 161/2006, but also within normal limits for sturgeon. At values higher than 3 mg / l of iron salts in water fish die.

Copper in water samples presented the same value in two sampling points, namely the center and the outlet (0.3 mg/l), but recorded a value slightly increased in the chute (0.4 mg/l). It can be argued however that these values are appropriate to class II of water quality according to Order 161/2006 and a little beyond the normal values for sturgeon (less than 0.3 mg/l).

Ammonia recorded insignificant values, within the Class I of water quality according to Order 161/2006 and fitting the reference values for sturgeon (up to 0.05 mg/l).

Sulfate in water samples recorded important exceeding of the normal values (30, 32, 30 mg/l), both provided by the Order 161/2006 (2-7 mg / l) and for sturgeons farming (less than 8 mg/l). An increase in sulfate can damage the skin and resulting in neuronal disorders, inducing a poor welfare.

Phenols had values (0.1, 0.2 mg/l) in two sampling points (the chute and the outlet) that framing within both the normal values in terms of water quality classes specified in the Order 161/2006 and the provided standards for sturgeon (1-2 mg/l), but a slightly higher value than reference (0.21 mg/l) in the center of the pond.

Detergents in water samples showed values (0.03 mg/l, 0.03 mg/l, 0.02 mg/l) which framing within the corresponding values of class I of water quality according to the Order 161/2006, but also the standard for sturgeon (less than 0.1 mg/l).

The results of microbiological parameters analyze of water in the sturgeons' farm are shown in Table no. 3.

Table no. 3

## Microbiological parameters of water

Sampling point	TC/ml water	CF/ml (total coliforms)
Chute	720	428
Middle	1005	920
Outlet	900	700

From the data presented in Table no. 3 it can be concluded that water has a fairly large microbiological load, which may be due to a lack of water sanitation programs under its regular cleaning. This can be harmful and may increase the frequency of skin and respiratory diseases, resulting in poor welfare of sturgeons.

## CONCLUSIONS

- Physical parameters (turbidity, temperature) and some chemical parameters (dissolved oxygen, pH, ammonia, phenols, chlorine, nitrite, detergents) of water are adequate for sturgeon rearing.
- Nitrates exceeded the standard limits for sturgeon in samples from the center of the pond and outlet by 1.5 times.
- The concentrations of copper and phenols ranged the water from the farm within class II of water quality according to Order 161/2006.
- Sulfates exceed standard limits for sturgeon about 6 times, framing the water into class IV of quality.
- Microbiological load of water exceeds the standard in all sampling points.
- Based on water quality parameters, the welfare of sturgeons in the farm is medium.

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