

Physiological state of fishes and changes in fish stock composition in the Tisa River on the stretch Martonos-Becej Gate in the period 2001-2005

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Introduction

The Tisa is an international river, and also the Danube's biggest affluent in Serbia. It is formed by Black Tisa and the White Tisa in Ukraine's Carpathian Mountains, runs through Rumunia, Hungary and finally in northern Serbia (Vojvodina), on its 966.th km it's joining the Danube.

In the period from May 23. 2001. to November 15. 2005, the changes in the ecological system of the Tisa River on the stretch from the 60th to the 152nd river km (Martonos - the Becej Gate), were followed in relation to the influence of natural and anthropogenic factors.

Following our previous investigations (FEHER 2002-2004), this work summarizes the results which indicate the changes in the composition of fish stock and physiological state of fish species on the mentioned stretch, arising as a consequence of the presence of various pollution agents, bottom composition, and the effect of Becej Gate

Material and Methods

1. Composition of the fish stock was determined at Senta and Backo Petrovo Selo, whereas physiological state of fishes was assessed at Senta and the Becej Gate.

Fish catching was performed using one- and three-row surface nets, 80-100 m long, with 4-6 cm meshes, or deep one-row 40-m nets, as well as winged and deep traps.

2. Concentrations of heavy metals in fish samples were determined by graphite-furnace atomic absorption spectrometry after digestion and acidic washing (Hungarian Standard 214 447 – 50. 98. 3. 1.).

3. Activity of radionuclides in fish tissue was measured by gamma spectrometry after sample drying at 110°C. (BIKIT et al. 2006.)

Results and Discussion

The results of determining fish stock composition at Senta and Backo Petrovo Selo are presented in Table 1.

Compared to the year 1996, significant changes in the fish stock composition at Senta occurred in the investigation period.

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Diminishing of the giant bighead carp population (its proportion decreased from 35-40 % to 20-22%) can be explained partly by massive fish dying during the Tisa River contamination by cyanides in the spring of 2000, and partly by the allowed fish catching with the nets made of artificial materials. A further decrease in population of bighead carp appeared as a consequence of preventing the river from the discharge of duckweed from rice fields. (The duckweed on water surface is a natural spawning place of the bighead carp.)

With the exception of perch and sturgeon, the population of all naturally occurring fishes such as pike, carp, catfish, barbel, and white fish were observed on the Senta location. This phenomenon can be related to the decreased bighead carp population. Namely, the decreased proportion of this species yielded an increased amount of plankton remaining for the other naturally present fishes and their offspring.

Significant changes in the fish stock have also been observed on the stretch between Senta and Backo Petrovo Selo. The most probable cause of the disappearance of the sturgeon from the Senta area were the dike-reinforcing works in the 1990s, whereby large amounts of sand were extracted from the riverbed. The result of this was fish migration to the area of Backo Petrovo Selo, where the riverbed was sandy, which resulted in its mudding.

The other differences in the composition of fish stock along the stretch from Senta to Backo Petrovo Selo, whereby higher population of bighead carp, carp, catfish and barbel were observed on the former location, cannot be explained on the basis of the available data.

Table 1. Fish catch (in %) in the Tisa River on the stretches of 110-114 (Senta) and 80-84 km (Backo Petrovo Selo).

River	110 - 114			80 - 84	
Year	1996	2002	2005	2002	2005
Fish species	Percentage				
Sturgeon - <i>Acipenser ruthenus</i>	10 - 12	< 1	< 1	30 - 32	25 - 30
Pike - <i>Esox lucinus</i>	1 - 1.5	3 - 5	3 - 5	< 1	< 1
Carp - <i>Cyprinus carpio</i>	10 - 12	20 - 22	15 - 18	4 - 5	4 - 5
Grey and white bighead carp <i>Hypophthalmichthys nobilis & molitris</i>	35 - 40	20 - 22	15 - 20	13 - 15	10 - 12
Grass carp - <i>Ctenopharyngodon idella</i>	1 - 2	1 - 2	1 - 2	1 - 1.5	1 - 1.5
Barbel - <i>Barbus barbus</i>	1 - 1.5	3 - 5	2 - 3	< 1	< 1
Catfish - <i>Silurus glanis</i>	8 - 10	10 - 15	10	1 - 1.5	1 - 2
Bullhead - <i>Ameiurus nebulosus</i>	< 1	< 1	< 1	< 1	< 1
Burbot - <i>Lota lota</i>		< 1	< 1	< 1	< 1
Pikeperch - <i>Stizostedion luciperca</i>	3 - 5	1 - 1.5	1 - 1.5	1 - 1.5	1 - 1.5
White fish	20 - 25	35 - 40	40 - 50	45 - 50	45 - 55

White fish: *Carassius auratus*, *Abramis brama*, *Leuciscus idus*, *Pelecus culpratus*, *Alburnus alburnus*

Concentrations of heavy metals in catfish and barbel samples are presented in Table 2.

Comparison of the data obtained for the 2001-2005 period with those from 1996 could lead to wrong conclusion because of the individual measurements and difference in sample mass. However, the fact is that the concentrations of heavy metals in the fishes did not exceed the maximally tolerable concentration (MTC).

Table 2. Concentrations of heavy metals in the fish caught in the Tisa River on the stretches of 126-130 (Sanad) and 110-114 km (Senta) in 2002 and 2005

Unit	microgram/g dry substance						MTC
Fish	Barbel			Catfish			
Year	1997	2002	2005	1997	2002	2005	
Mass(g)	810	1870	1240	1050	1460	1650	
As	0.52	0.39	0.47	0.11	0.34	0.46	2.0
Cd	0.08	0.09	0.07	0.08	0.09	0.09	0.1
Hg	0.08	0.06	0.09	0.08	0.09	0.09	0.5
Pb	0.52	0.90	0.84	0.78	0.98	0.91	1.0

In 1997, measurements were carried out in the Institute of Hygiene and Meat Technology in Belgrade on the request of the Ministry for Environment of the Republic of Serbia

The data for activity of radionuclides are presented in Table 3.

Table 3. Activities of radionuclides in the fish caught in the Tisa River on the 110-114-km stretch (Senta) on July 14, 2002.

Measurement	August 18, 2002	August 19, 2002
Fish	Barbel	Catfish
Mass (g)	1870	1460
Radionuclide	Activity concentration As [Bq / kg]	
⁷⁵ Se	< 0,05	< 0.06
¹⁴¹ Ce	< 0,13	< 0.13
¹⁴⁴ Ce	< 0,4	< 0.60
¹²⁴ Sb	< 0,09	< 0.05
¹²⁵ Sb	< 0,14	< 0.14
⁷ Be	< 0,8	< 0.90
¹⁰³ Ru	< 0,06	< 0.06
¹⁰⁶ Ru	< 0,8	< 0.70
¹³⁴ Cs	< 0,07	< 0.05
¹³⁷ Cs	< 0,11	< 0.07
^{110m} Ag	< 0,05	< 0.06
⁹⁵ Zr	< 0,07	< 0.08
⁹⁵ Nb	< 0,05	< 0.08
⁵⁸ Co	< 0,06	< 0.09
⁶⁰ Co	< 0,04	< 0.05
¹⁶⁰ Tb	< 0,22	< 0.18
²³⁸ U	< 1,6	< 1.10
²²⁶ Ra	< 0,24	< 0,19
²³² Th	< 0,13	< 0,29
⁴⁰ K	61 ± 3	69 ± 4

No such investigations have been previously carried out on these locations. The MTC of activity of radionuclides introduced by taking fish as food is 30 Bq/kg. The measured results were below this limit.

Health state of fishes has been permanently monitored at Senta in the open river and in the fish breeding field with open-type cages at the Novi Becej (FEHER, I et al. 2002-2004).

In 2002, in the fish breeding field at Novi Becej there were three fish dying accidents. In February, the loss of commercial fish was 25 %, and of two-year fish species 6 %. At that time, the nitrite concentration in the Tisa was significantly higher than the expected values. The cause of this increased nitrite concentration, as well as fish dying accident remained

unexplained. With one-year fishes the loss registered on May 8th was 5% and on July 18th and 19th it was 15%.

On May 8th, the nitrite concentration in the Tisa water upstream and downstream the Becej Gate was also extremely high. On May 8th, the nitrite concentration in the Tisa water in front and behind the Becej Gate was also extremely high, the cause of which also remained unexplained. On the July 18th and 19th, the fish dying was directly caused by *Dactylogyrus* parasites, affecting the fish gill.

Summary

Composition of the fish stock in the Tisa River on the stretch between Senta and Bačko Petrovo Selo were significant changed compared to the year 1996. Diminishing of the giant bighead carp population can be explained partly by massive fish dying during the Tisa River contamination by cynides in the spring of 2000, and partly by the allowed fish catching with the nets made of artificial materials. The population of all naturally occurring fishes such as pike, carp, catfish, barbel, and white fish were observed on the Senta location. This phenomenon can be related to the decreased bighead carp population. Namely, the decreased proportion of this species yielded an increased amount of plankton remaining for the other naturally present fishes and their offspring. The most probable cause of the disappearance of the sturgeon from the Senta area were extraction of large amounts of sand from the riverbed. The concentrations of heavy metal, as well as activity of radionuclides in the fishes did not exceed the maximally tolerable concentration (MTC). In the last period, there were three fish dying accidents. At that time, the nitrite concentration in the Tisa was significantly higher than the expected values.

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