# QUALITY OF THE WATER OF THE BARZAVA RIVER

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***Abstract***

*The study of the quality of the water of a river has a great ecological, social and economic importance taking into account that the pollution of the ground waters is an issue whose size is increasingly amplifying.*

*Increasing the quality of the water of a river can be done through non-structural techniques (stopping pollution, legislation, standards, education, altering the processing regime in hydropower stations, recovering moist areas, etc.) and structural techniques (fences, watch, current deflection, waterbed remodelling, vegetation manipulation, organic matter manipulation, etc.) The River Bârzava draws its waters from the Semenic Mountains going along a relatively short mountain range towards south-north and then south-north-west to the confluence with the Timiş on Serbian territory.*

*The quality of the water of the River Bârzava was monitored during the years 2011-2012 in three surveillance points in the upper sector: Gozna Crivaia, Moniom Reşiţa and Berzovia pod Vermeş where we sampled and analysed the water samples in the laboratories of the Water Basin Administration of Reşiţa. Following water analyses, we monitored and analysed the evolution of the main quality indices such as suspended matter amount, oxygen biochemical consumption, nitrate amount, nitrite amount, etc.*

*In the control point Gozna Crivaia, the water of the River Bârzava was assessed as 1st and 2nd quality in the two years both in suspended matter amount, oxygen consumption, nitrate content and nitrite content, while the control points Moniom Reşiţa and Berzovia the water was assessed as 3rd and 4th quality in nitrate and nitrite contents because of the discharge of town and agricultural (from vegetal and animal farms) wastewaters, of the sue of organic fertilisers and of the storage of wastes by the river banks.*

**Key words**: quality of a river's waters, quality indices, nitrate content oxygen, chemical consumption.

## INTRODUCTION

Bârzava springs from the Semenic Mountains flowing along a relatively short mountain way towards south-north and then to south-north-west until the confluence with the Timiş River on Serbian territory. Bârzava is a 2nd degree tributary of the Timiş River and it belongs to the Bega-Timiş-Caraş hydrologic basin, the Timiş sub-basin. It flows into the Timiş River on Serbian territory (Grozav, 2010).

Bârzava collects from numerous small tributaries of the torrent-like type (variable water flows, quick transport and accompanied by stones, gravel and sand) such as Bolnovăţ, Groapa, etc. (from the right side of the valley, from the Semenic Mountains) or Crivaia Mică, Grădişte, Văliug, Valea Mare, Râul Alb (under the shape of gorges), Secu, etc. Along the Bârzava River there are also, starting with Văliug and up to Reşiţa, the lakes

Gozna, Văliug and Secu (www.rowater.ro/dabanat).

The Water Frame Directive 2000/60EC is a new approach in the field of water management based on a basin principle and asking for strict measures.

According to this Directive, the Member States of the European Union should ensure proper quality levels in all surface waters until 2015.

## MATERIAL AND METHOD

The quality of the water of the River Bârzava was monitored in the years 2011-2012 in three surveillance points and three control points: Gozna Crivaia, Moniom Reşiţa and Berzovia pod Vermeş, where we sampled water, which we analysed in the laboratories of the Banat Water Basin Administration in Reşiţa.

Water quality was determined depending on the concentration of the values of the quality indices and on the river flow at the time of the sampling, according to current standards 161/2006.

In this paper, we present the evolution of the main quality indices of the water of the River Bârzava in three hydrometric points during the period 2011-2012. Below is the description of the methods we used in the measurements of these quality indices.

*a. Determining total suspension amount*

*The gravimetric method* consists in separating suspended matter through filtering, followed by the drying and weighing until constant volume. The sample is homogenised and then 100...250 ml of sample is measured. In the case of the samples with smaller amounts of total suspended matter, we analyse a larger sample so that the content of total suspended matter weighs at least 10 mg. If the sample is too loaded, we analyse a smaller sample in the following steps:

- we filter with a filter paper;
- we wash the residue on the filter paper with distilled water to remove soluble salts;
- we introduce the paper with suspended matter in the weighing vial and dry it for 1 hour at $105^0$C;
- we cool the vial and the filter paper in an exsiccator, covered by a lid;
- we weigh the vial;
- we repeat the drying, cooling and weighing until constant volume.

*b. Determining $CBO_5$ on non-diluted water samples*

We control the pH of the water sample and then we aerate until oxygen saturation for $20^0C$. For each 1 $dm^3$ of sample we add 1 $cm^3$ of the solutions prepared and, if the case, we add seeding material. For the samples from effluents of a biological purification process, for house wastewaters and for ground waters we do not need to seed.

The sample thus prepared is homogenised and introduced into three incubation vials that are completely filled. We close the vials avoiding air bubbles. In one of the vials, we determine initial dissolved oxygen concentration and we note down the result. After incubation, we determine the dissolved oxygen concentration in the sample (the arithmetic mean of the two results). The difference between the concentration of the dissolved oxygen in the sample not incubated and the mean of the concentrations of dissolved oxygen in the samples incubated for 5 days represents the $CBO_5$ of the sample analysed.

*c. Determining nitrite content*

The method concerns the measurement of nitrites through the spectrometric method of molecular absorption from drinking water, raw waters and wastewaters. The method can be applied in the measurement of nitrite concentration up to $\rho N = 0.25$ mg/l, using a sample of maximum 40 ml. The working method concerns the reaction of the nitrite ions in the sample with a pH = 1.9, with a reactive 4-amino benzene sulphonamide in the presence of the orthophosphoric acid to form a salt of diazonium making up a red complex with N (1-naphtil)-ethylen-diamine dichlorhydrate (plus the reactive 4-amino benzene sulphonamide). We measure absorbance at 540 nm.

The maximum volume of the sample is 40 ml that can be used for nitrite concentrations of up to $\rho N = 0.25$ mg/l. Smaller samples are used to determine much higher nitrite concentrations. If the sample contains suspended matter, it is left to set or it is filtered through filter paper with glass fibber, then we remove the necessary sample.

*d. Determining nitrate content*

The method is applied to determine the nitrate content of surface waters and of wastewaters. It is applied for concentrations of nitrogen in nitrates up to 25 mg/l. A concentration of the nitrogen in the nitrates of 25 mg/l determines an absorbance of about 1.5 units in a basin with optic way of 10 mm. Through the proper dilution of the water samples, we can determine nitrogen concentrations in nitrates above 25 mg/l.

Through the reaction of the nitrates with 2.6-dimethylphenol in the presence of sulphuric acid and of phosphoric acid, we obtain 4-nitro-2.6-dimethylphenol. The duration of the reaction is about 5 minutes. The spectrophotometric measurement of the absorbance of the reaction product to the wavelength of 324 nm is followed by the reading on the sampling curve of the concentration of nitrates in the sample (STAS 161/2006).

**RESULTS AND DISCUSSION**

In the paper, we present the evolution of the main quality indices of the water of the River Bârzava during the period 2011-2012, in three control points: Gozna Crivaia, Moniom Reşiţa and Berzovia pod Vermeş. We sampled water during four sampling campaigns, in January, May, September and November, and we analysed them in the laboratories of the Water Basin Administration in Reşiţa.

Following the analyses, we monitored and analysed the evolution of the main quality indices such as amount of suspended matter, biochemical consumption of oxygen, amount of nitrates, amount of nitrites, etc.

Then we assessed the quality of the water in the three control points depending on the quality limits and classes stipulated by the STAS 161/2006 for the period analysed, during the four sampling campaigns representative for each season. This is how the five ecological states for rivers and lakes are established: very good ($1^{st}$ quality); good ($2^{nd}$ quality); moderate ($3^{rd}$ quality); poor ($4^{th}$ quality) and bad ($5^{th}$ quality). The three control points are representative for upstream Bârzava.

*The control point Gozna Crivaia*

In this control point, the amount of suspended matter was above maximum admitted limits in both years, classifying as $1^{st}$ and $3^{rd}$ quality (May 2012) (Figure 1).

From the point of view of the regime of oxygen, of the biochemical content of oxygen $CBO_5$, the water was classified $1^{st}$ quality in the two years (Figure 2).

As for the content of nitrates, water classified $1^{st}$ and $2^{nd}$ quality in September 2011. The content of nitrites was a little above maximum admitted limits, classifying $1^{st}$ and $2^{nd}$ quality (Figures 3 and 4). The quality of the water in this control point was good and very good in the two years in both nutrient class and oxygen regime.

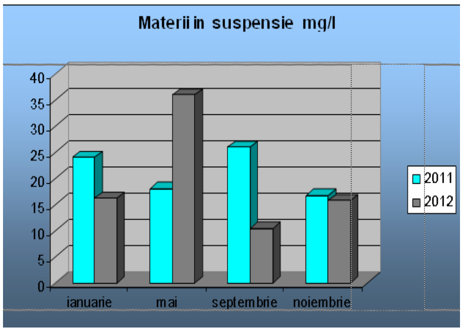


Fig. 1. Evolution of suspended matter amount

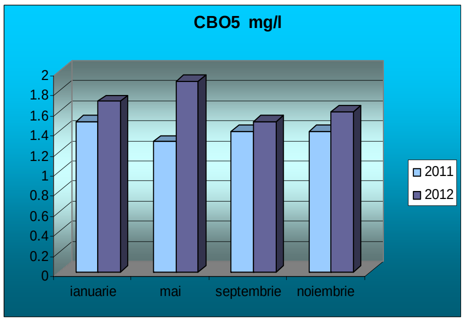


Fig. 2. Evolution of the content of biochemical oxygen

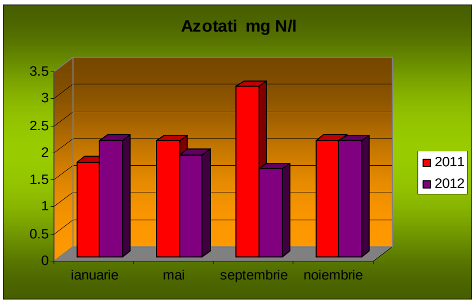


Fig. 3. Evolution of the content of nitrates

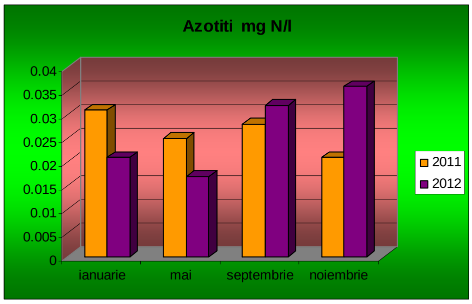


Fig. 4. Evolution of the content of nitrites

*The control point Moniom Reşiţa*

We can see that water classified 1$^{st}$ and 2$^{nd}$ quality from the point of view of suspended matter content (Figure 5). The biochemical consumption of oxygen shows that it classifies 1$^{st}$ quality in all four seasons and in both years according to the oxygen regime STAS 161/2006. These evolutions of the quality indices are shown in Figure 6. In the nutrient class, the content of nitrates was above maximum admitted limits: the water classified 3$^{rd}$ quality in January and May 2012. The content of nitrites was also above maximum admitted limits: water classified 4$^{th}$ quality in November 2012 and 3$^{rd}$ quality in 2011, which points to a significant pollution. These evolutions are shown in Figures 7 and 8.

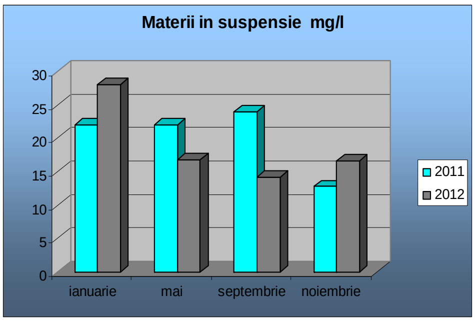


Fig. 5. Evolution of suspended matter amount

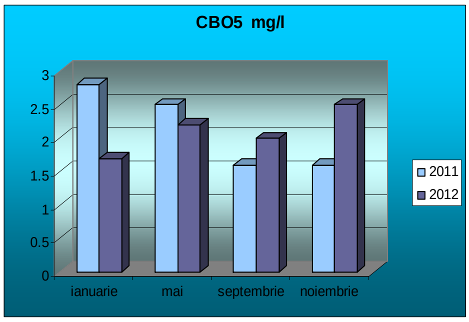


Fig. 6. Evolution of the content of biochemical oxygen

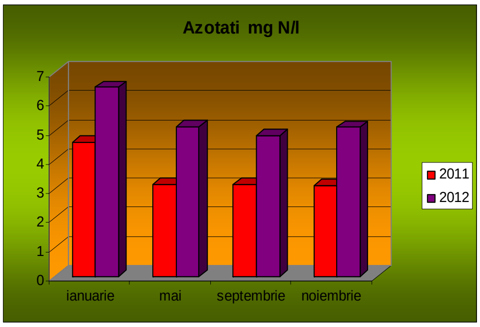


Fig. 7. Evolution of the content of nitrates

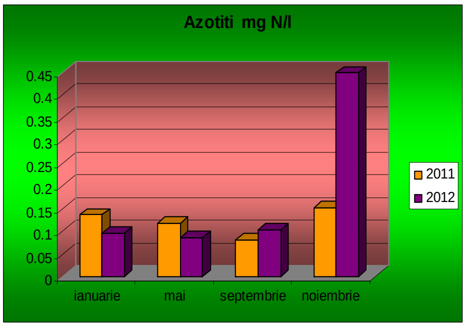


Fig. 8. Evolution of the content of nitrites

*The control point pod Vermeş Berzovia*

Here, the water classified 1st and 2$^{nd}$ quality from the point of view of the amount of suspended matter, as shown in Figure 9.

As for the oxygen regime, the water classified 1$^{st}$ quality if we also take into account the biochemical content of oxygen, as shown in Figure 10.

The content of nitrates was above maximum admitted limits: the water classified 2$^{nd}$ quality in 2011 and 3$^{rd}$ quality in 2012, with the highest values above maximum admitted limits in January and May, as shown in Figures 11 and 12. The content of nitrites was high in 2011, when water classified 3$^{rd}$ quality, as it was in 2012, when water classified 4$^{th}$, because of the high content of nitrites in November.

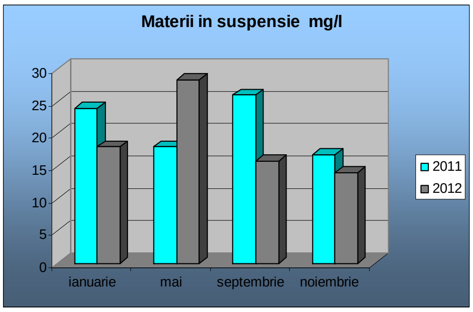


Fig. 9. Evolution of suspended matter amount

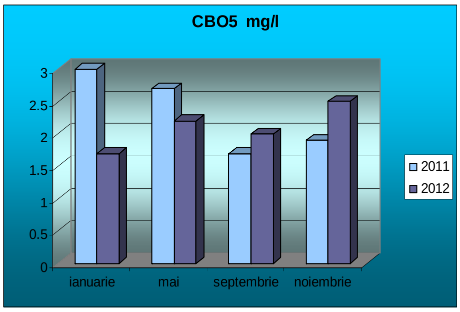


Fig. 10. Evolution of the content of biochemical oxygen

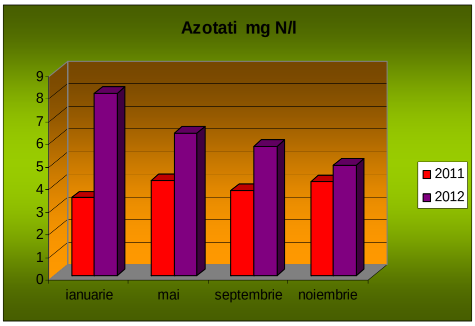


Fig. 11. Evolution of the content of nitrates

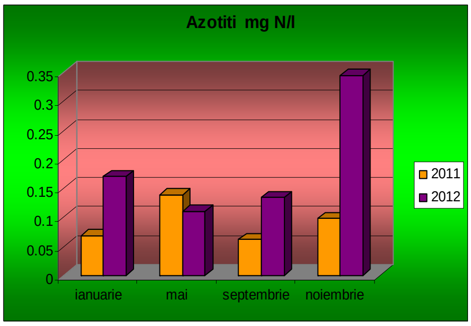


Fig. 12. Evolution of the content of nitrites

**CONCLUSIONS**

- The quality of the water of the River Bârzava (upstream) was monitored in the years 2011-2012, in three surveillance points – Gozna Crivaia, Moniom Reşiţa and Berzovia pod Vermeş when we analysed the main quality indices.
- In the control point Gozna Crivaia, the water of the River Bârzava classified 1st and 2nd quality in the two years both in suspended matter amount and in oxygen regime and nitrate and nitrite contents.
- In the control points Moniom Reşiţa and Berzovia pod Vermeş, the water classified 1st and 2nd quality in suspended matter amount, content of dissolved oxygen and content of biochemical oxygen, and 3rd and 4th quality because of the nitrate and nitrite contents.
- In the control points Moniom Reşiţa and Berzovia, there was water pollution by nutrients in the two years because of the discharge of wastewaters from houses and vegetal and animal farms in the area, of the use of organic fertilisers and of the storage of wastes by the riverbanks.
- We recommend the building of sewage systems in rural areas and of

enough water plants for controlled discharge of home and agricultural wastewaters into the rivers.

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