WATER QUALITY OF THE SURDUC LAKE

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Abstract

Drinking water can be found in small amounts on Earth. Only 3% of the total amount of water is drinking water, and drinking water from lakes and marshes represent only 0.29% of the total amount of drinking water on Earth.

The present paper aims at presenting the quality of the water of the Lake Surduc, which was declared, in 2000, a national interest protected area. To achieve this goal, we sampled water from the Lake Surduc in March, June, September and November in the years 2011 and 2012. The analyses were made by the Quality Laboratory of the Banat Basin Water Administration and the results were processed and compared with the physical and chemical standards stipulated by Order 161/2006 that allows the classification of surface waters in order to establish the ecological state of the bodies of water. The main quality indices we determined were pH, oxygen regime, nutrients, salinity, and heavy metals.

Analyses and results show that the water of the Surduc Lake has a high degree of drinkability with most quality indices ranking 1st quality, except for the nutrient regime, where there was a slightly higher value and the content of oxygen, which decreased in June and September, ranking it 2nd quality.

Key words: Surduc Lake, water quality, oxygen regime, nutrients, salinity, heavy metals.

INTRODUCTION

Water is, certainly, due to its genesis and evolution, a natural resource, vital for the existence of life on Earth, vulnerable and limited in time and space, but renewable thanks to its natural perpetual cycle on Earth.

There is no human activity, form of life, or balance on the planet without water. So far, people have believed that humankind will always have enough amounts of water supplied generously by nature itself. However, the reality of the last decades (and particularly of the last years) shows that drinking water resources are far from being eternal. This may seem paradoxical since 2/3 of the planet is covered by water (Pișota, Zaharia, 2002).

We need to note that the water volume existing in rivers and lakes – the so-called drinking water volume exploitable at the current level of water supply – is slightly below 0.10% of the total amount of water on earth (Zăvoianu, 2002, 2005).

The development of industrial activities, the intensification of water use in agriculture, and the growth of the population and of the degree of civilisation have increased water demands all over the globe. The current civilisation has, thus, leaded to huge human concentrations, and supplying water to these cities has been an issue (Rojanschi et al., 2001).

In Romania, there are over 3,450 surface lakes covering about 2,620 km^2 (representing about 1.1% of the total area of the country). Every year, Romania loses of its water resources. Many waters dry out because of natural phenomena and other disappear because of the humankind, which has negative effects on soil quality and on the decrease of agricultural production. Almost 70,000 ha covered by water (representing 8% of the total area covered by water in Romania) have disappeared during the last two decades (1990-2010) (Asaftei, 2012).

MATERIAL AND METHOD

The Surduc Lake is part of the hydrotechnical works of the Timis-Bega basin; it is located on the River Gladna, a left-side affluent of the River Bega. The River Gladna measures about 34 km and it has a hydrographic basin of 173 km^2.

The lake is located upstream (km 12+700) the confluence of the River Gladna with the River Bega, between the localities Surduc Mic and Fârdea, Timiș County.

The Lake Surduc was established in a depression that could be flooded and closed by a dam, making the water measure 198 m in height. The excess water is used by a microelectric power station in the area. The construction of the dam started in 1972, and the accumulation started in 1976, reaching almost 25 million m^3 of water in 1977. The second stage started in 1981, to accumulate 51 million m^3 of water. The lake was established to ensure drinking water for the Timisoara area and to protect against floods. Measuring 400 ha, it is the largest lake in the Timiş County (Babescu, 2003) (Figure 1).

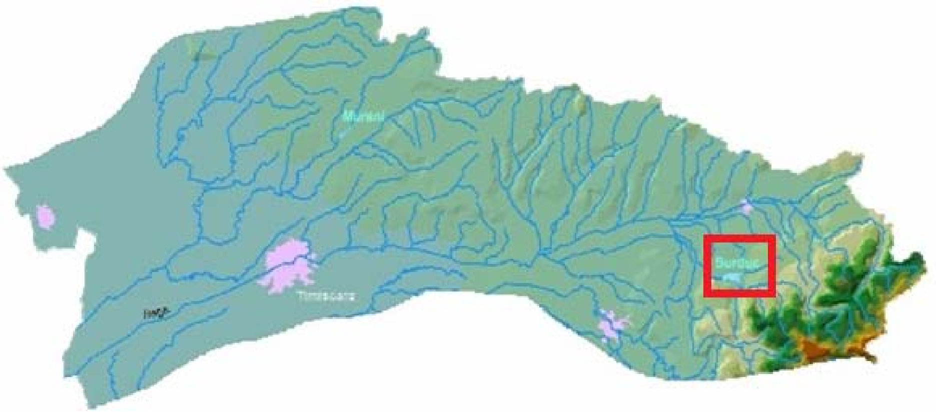

Fig. 1. Surduc Lake location in hydrographic basin of Bega river

In 2000, the Lake Surduc was declared a protected nature area of national interest for the protection of its ichtyofauna and avifauna, which ensures drinking water for the Timisoara area (Samfira et al., 2013).

In order to monitor the quality of the water of the Lake Surduc, we sampled water 150 m from the dam from a photic zone 0-3 m deep.

The water was sampled in March, June, September and November in 2011 and 2012. The main quality indices we measured were pH, dissolved oxygen content, biochemical oxygen consumption, content of nitrates and nitrites, ammonia, sulphates, hardness, natrium, iron, manganese, copper, zinc, lead, nickel, and cadmium. The analyses were made by the Quality Laboratory of the Banat Basin Water Administration and the results were interpreted and compared with physical and chemical standards according to the Order 161/2006, which allows the classification of surface waters to establish the ecological state of the bodies of water. This Order establishes five ecological states for natural and artificial rivers and lakes: Very good (1st quality), Good (2nd quality), Moderate (3rd quality), Poor (4th quality), Bad (5th quality).

RESULTS AND DISCUSSION

Laboratory analyses of the water of the Lake Surduc in 2011 show that the pH of the water had very good values (it was slightly basic). In the four months, there were slight variations of the values, which ranged between 7.2 and 7.4 pH units (Figure 2).

Oxygen content (Figure 3) ranged between 8.3 and 10.5 mg/l, which confers the water superior quality in March and November (10.4-10.5 mg/l); in June and September, the water showed a decrease of the content of oxygen (8.3-8.7 mg/l), ranking it 2nd quality.

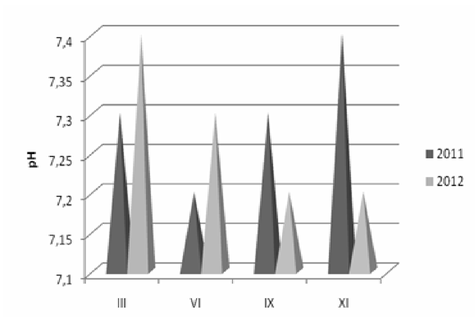

Fig. 2. Evolution of pH

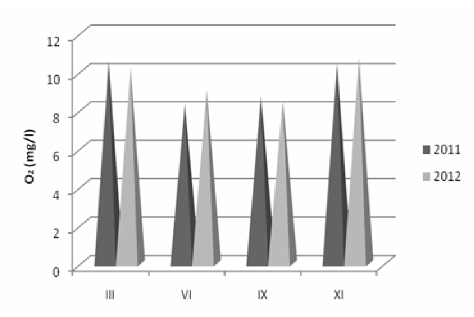

Fig. 3. Evolution of oxygen content

The values of the biochemical consumption of oxygen were very low, which makes the water high quality; the highest value was in June (2.0 mg/l), which ranked it 1st quality (Figure 4).

As for nutrient regime, in 2011 there were slightly higher values of nitrite concentration (Figure 5), with an ascending trend in March (0.025 mg/l), June (0.035 mg/l), September (0.043 mg/l) and a descending one in November (0.031 mg/l).

The highest value of the concentration of nitrites was 0.043 mg/l, which ranks it 2nd quality.

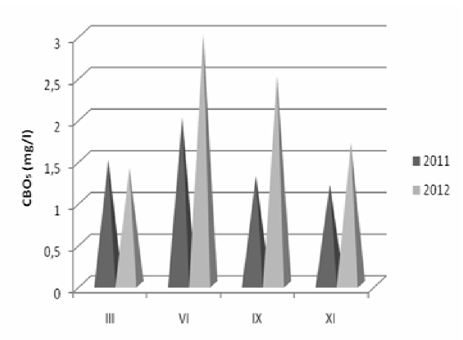

Fig. 4. Biochemical consumption of oxygen evolution

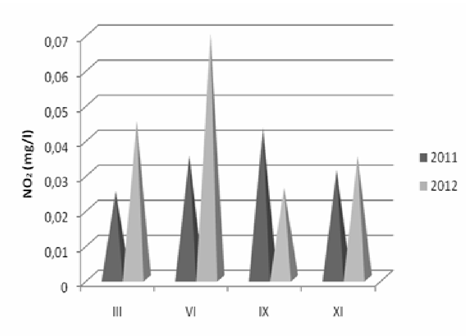

Fig. 5. Evolution of nitrite content

Nitrate content was low, oscillating between 0.95 mg/l in September and 1.7 mg/l in June (Figure 6), which makes the water 1st quality.

Ammonia values (Figure 7) rank the water 1st quality due to the low concentrations; the highest value was 0.21 mg/l in September.

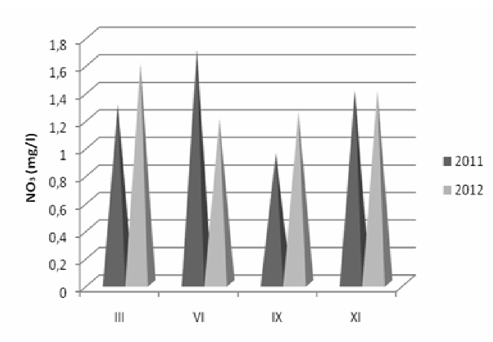

Fig. 6. Evolution of nitrate content

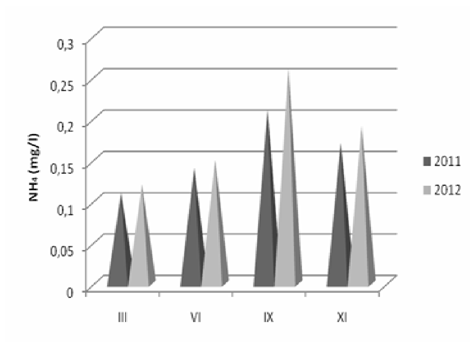

Fig. 7. Evolution of ammonia content

As for the sulphates concentration, the values were very low, ranking the water 1st quality (Figure 8). Figure 9 shows that water hardness had slight variations in the studied months, oscillating between 4.3^0G in November and 6.1^0G in September, which makes the water soft.

Natrium (Figure 10) and iron (Figure 11) also had low values, which rank water 1st quality.

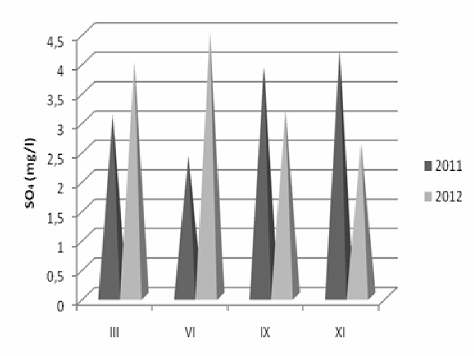

Fig. 8. Evolution of sulphates concentration

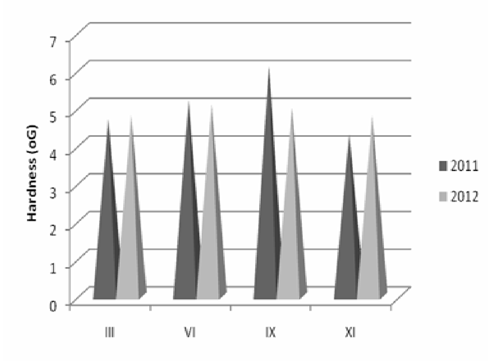

Fig. 9. Water hardness

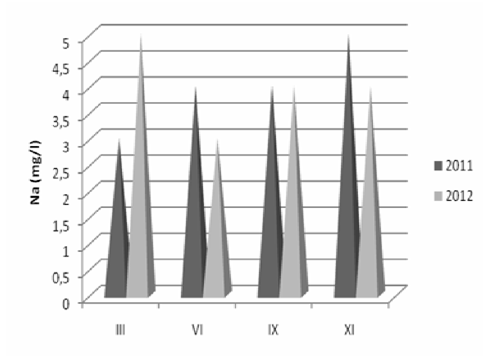

Fig. 10. Evolution of natrium content

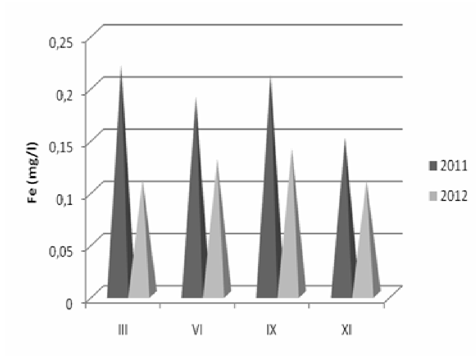

Fig. 11. Evolution of iron content

As for heavy metals content, it had very low concentrations ranking the water high quality.

Manganese had low concentrations in all analysed months, with minor fluctuations in March (0.06 mg/l) and September (0.07 mg/l). The best values were in June and November (0.05 mg/l) (Figure 12). These values rank the water 1st quality.

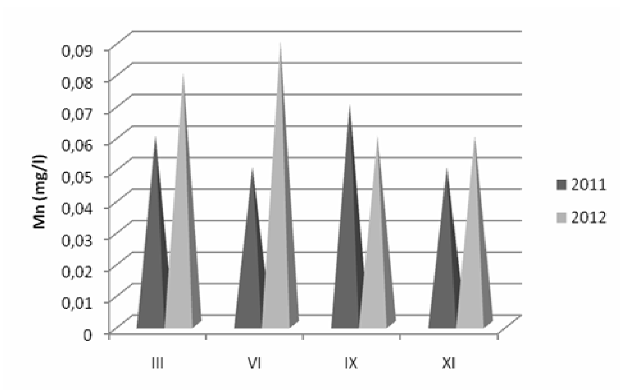

Fig. 12. Evolution of iron content

Copper, zinc, lead, nickel and cadmium also had low values: copper reached 3.5 µg /l, zinc 17.2 µg/l, lead 2.4 µg/l, nickel 4.5 µg/l and cadmium 0.27 µg/l. These values show that the water is high quality (1st quality).

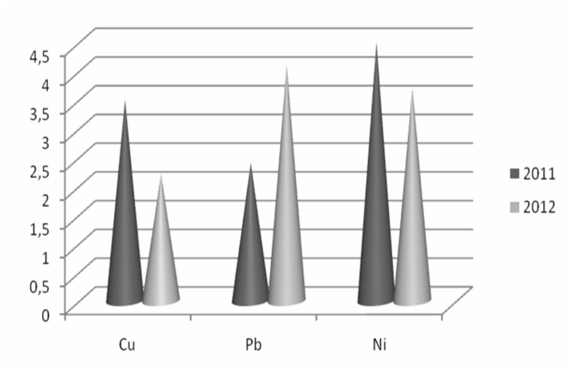

Fig. 13. Evolution of hard metals

Analyses of the water samples in the four months of 2012 showed that the pH had no significant changes of the values in the studied months, maintaining almost constant, with a pH slightly basic, with values ranging between 7.2 and 7.4 pH units.

As for the content of oxygen, it peaked in March (10.2 mg/l) and November (10.7 mg/l), ranking the water 1st quality, and decreased only in June (9.0 mg/l) and September (8.5 mg/l), ranking the water 2nd quality.

The biochemical consumption of oxygen had very good values ranging between 1.4 and 3.0 mg/l, which ranked it 1st quality.

The evolution of the nutrient regime had increased values: thus, nitrite content peaked in June (0.07 mg/l) and ranked the water 3rd quality, but there was a decrease in September (0.026 mg/l), which ranked the water 2nd quality.

As for the nitrate concentration, it also had slightly increased values, oscillating between 1.2 mg/l in June and 1.6 mg/l in March, which ranked it 2nd quality.

The low values of ammonia ranked the water 1st quality due to the low concentrations that ranged between 0.12 and 0.26 mg/l. There were no values above maximum admitted limits in sulphate concentrations, which ranked the water 1st quality.

Water hardness showed slight changes in the months analysed, with a peak of 5.1^0G in June, which ranked the water as soft.

As for water salinity, the presence of natrium was low, reaching values that ranked the water 1st quality.

Iron concentrations had very low values, with minor oscillations (0.11-0.14 mg/l) in the months analysed, ranking the water 1st quality.

Taking into account the content of heavy metals, it had very low concentrations, which made the water high quality.

Manganese showed small variations in the months analysed, with a peak (0.09 µg/l) in June, and with constant values (0.06 µg/l) in September and November. The values were slightly high and ranked the water 2nd quality.

Copper, zinc, lead, nickel and cadmium concentrations were also very low: copper reached 2.2 µg/l, zinc reached 26.3 µg/l, lead reached 4.1 µg/l, nickel reached 3.7 µg/l and cadmium reached 0.11 µg/l. these data show that water ranked 1st quality.

In conclusion, in 2011, the water of the Lake Surduc was highly drinkable; most indices analysed ranged within the 1st quality class, except for the nutrient regime, where there was a slight increase and for the content of oxygen, which decreased in June and September, which ranked the water 2nd quality. In 2012, the water maintained its quality, most quality indices maintaining their levels, except for the nutrient regime, where there was a continuous increase that ranked the water 2nd and 3rd.

CONCLUSIONS

1. The study of the water quality in the Lake Surduc was made by sampling 150 m from the dam on a photic area 0-3 m deep.
2. Water was sampled in March, June, September and November in 2011-2012. The analyses were made by the Quality Laboratory of the Banat Basin Water Administration and the results were processed and compared with the physical and chemical standards stipulated in the Order 11/2006, which allows the classification of the surface waters in order to establish the ecologic state of the bodies of water.
3. In 2011, the water had a high degree of drinkability, most indices analysed ranging in the 1st class of quality, except for the nutrient regime and for oxygen content.
4. In 2012, the water maintained its high quality, most quality indices ranging in the 1st quality, except for the nutrient regime, where there was a slight increase, which ranked the water 2nd and 3rd quality.

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