QUALITY OF THE WATER FROM LAKE POIANA MĂRULUI IN THE SITE NATURA 2000 ȚARCU MOUNTAINS (ROMANIA)

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Abstract: *Humankind is increasingly asking for more and more water both for different uses and as emissary for waste removal. This draw to the conclusion that water is closely related to the land ecological system and to maintain the balance of this system and to survive humankind needs to take measures for the preservation and conservation of the hydrosphere worldwide. This paper presents the quality of the Lake Poiana Mărului as a component of the site Natura 2000 ȚARCU Mountains. Water was sampled from upstream the dike and from the middle of the lake in March, June, August and October 2014. The main quality indices we determined were pH, content of dissolved oxygen, biochemical consumption of oxygen, chemical consumption of oxygen, content of nitrates and nitrites, ammonia and phosphates, residues, conductibility, turbidity, total water hardness, content of calcium, magnesium, nickel, chromium, copper, zinc, cadmium, and lead. Analyses were made in the Quality Laboratory of Reșița of the Banat Water Basin Administration and results were interpreted and compared with physico-chemical standards stipulated in the Order no. 161/2006. Overall, Poiana Mărului Lake water quality is good, basic, with slightly higher nitrite and nitrate contents and high content of copper.*

Keywords: *Lake Poiana Mărului, site Natura 2000 Țarcu Mountains, pH, oxygen regime, nutrients, salinity, toxic pollutants*

INTRODUCTION

Humanity has use to ask, whether we succeed in increasing water resources, both levies for different uses, and for use as an emissary for discharges. At this stage it has reached a finding that water is intimately linked to the terrestrial ecological system and to maintaining this system and the very survival of humanity, we need to find measurements for conservation and protection of the hydrosphere worldwide (ȘMULEAC L et al., 2013).

READ et al, 2015 observed that the lake water quality is affected by local and regional drivers, the lake physical characteristics, landscape position, hydrology, land cover, geology, land use and climate.

MATERIAL AND METHODS

Lake Poiana Mărului is part of the site Natura 2000 Munții ȚARCU. The site is limited west by the Timiș-Cerna corridor, north by the Bistrei Valley, and east and south by the National Parks Retezat and Domogled-Valea Cernei. It covers 58,840 ha.

The area is located in the alpine biogeographical region between 400 and 2,190 m altitude.

ȚARCU Mountains make up an area that is practically unaltered and with no human settlements, except for Poiana Mărului and the Muntele Mic tourism complex. The mountain concentrates a complex of mainly natural ecosystems (81%) with outstanding diversity and 25-78 higher local abundance than the national average. The Țarcu Mountains are a priority among high-value Carpathian biodiversity sites to be conserved.

Most rivers in the ȚARCU Mountains belong to the Timiș River. The main rivers in the region flow north-east-south-west or south-west-north-east (Hideg, Pîrîul Alb, Pîrîul Lung, Rîul Șes and Rîul Mare) and went deep in a lower form of relief making up a true corridor separating the ȚARCU Mountains from the Godeanu and Retezat Mountains (Figure 1).

In the ȚARCU Mountains, there are several natural lakes some of which are rather large. Their presence is related mainly to glacier valleys. The lakes are supplied from by the waters at the basis of the detritus and reach maximum level at the end of spring, when snows melt and it rains heavily (May and June).

Figure 1. The hydrographic network of the site Țarcu Mountains (http://www.tarcu.ro)

Along the Bistra Rivulet, they have arranged 80 water storages: the Poiana Marului Lake has a total volume of 96,200,000 m^3 and a useful volume of 90,800,000 m^3. The lake measures 273.0 ha. The presence of metamorphic rocks over the entire area of the basin as well as the milder slopes covered with a rather thin diluvium layer make the basin rather stable and fully tight. The dike is of the anchored type with a core of clay material.

To monitor water quality in Lake Poiana Mărului, we sampled water from before the dam and from the middle of the lake 3-6 m deep (Figure 2).

The water was sampled in March, June, August and October 2014. The main indices of quality we determined were pH, content of dissolved oxygen, biochemical consumption of oxygen, chemical consumption of oxygen, content of nitrates and nitrites, ammonia and phosphates, residues, conductibility, turbidity, total water hardness, content of calcium, magnesium, nickel, chromium, copper, zinc, cadmium, and lead.

Analyses were made at the Reșița Quality Laboratory of the Banat Water Basin Administration and results were interpreted and compared with physico-chemical quality

standards stipulated by Order no. 161/2006 published in ***Monitorul oficial al României*** allowing the classification of water in quality classes between I and V.

Figure 2. Water sampling points from Lake Poiana Mărului

Order no. 161/2006 approved the list of elements of physico-chemical, chemical, hydromorphological, and biological quality in order to establish ecologically the continental water ecosystems – rivers and lakes, natural or artificial, or irreversibly changed.

RESULTS AND DISCUSSION

Water was sampled at 6 m in March, at 3.75 m in June and at 5 m in August and October.

Analysis of water sampled from the two points shows that water is slightly basic with values slightly above the upper threshold in June – 8.7 pH units upstream and 8.8 pH units in the middle of the lake (Figure 3).

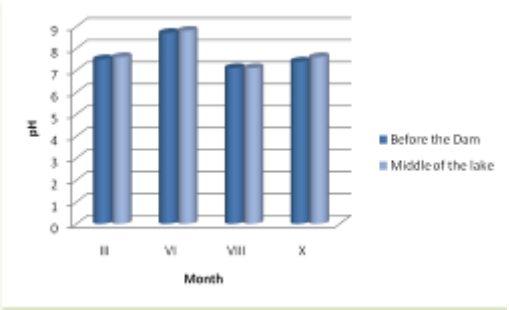

Figure 3. Evolution of the pH

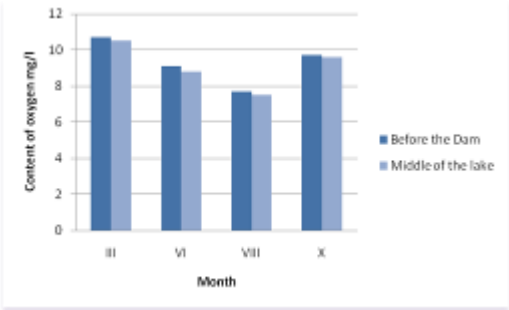

Figure 4. Content of oxygen

Content of oxygen (between 9.1 and 10.7 mg/l) classifies water in the 1st class in the case of the water sampled upstream the dike, except for August when it decreased down to 7.7.

mg/l, ranging the water in the 2nd class of quality. As for the water sampled from the middle of the lake, content of oxygen was higher in March and October with values ranging the water in the 1st class of quality, and lower in March (8.8. mg/l) and in August (7.5 mg/l) ranging the water in the 2nd class of quality (Figure 4).

Biochemical consumption of oxygen in 5 days (Figure 5) had very low values (between 1.3 and 1.6 mg/l) in all four months of study, which makes water high quality. Chemical consumption of oxygen (Figure 6) had very good values in the water sampled upstream the dike, with a single exception, in August (10.2 mg/l) unlike the water sampled from the middle of the lake where it was slightly below 1st class of quality in June, August and October.

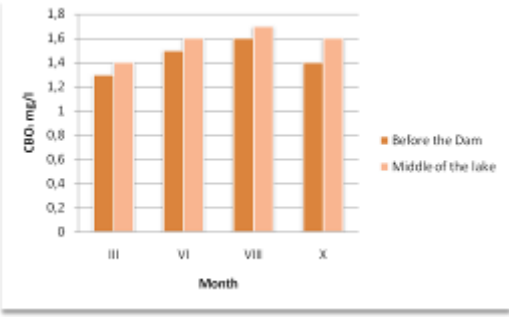

Figure 5. Biochemical consumption of oxygen in 5 days

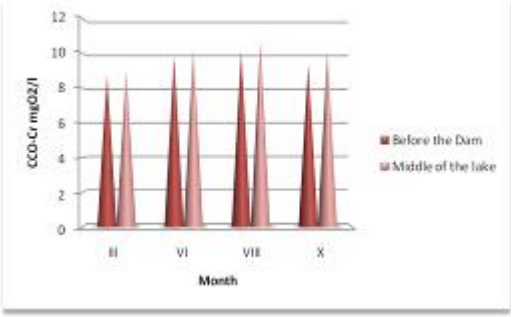

Figure 6. Chemical consumption of oxygen

Content of nitrites ranged the water in the 3rd class of quality in March and June, the rest of the values ranging it in the 2nd class of quality (Figure 7). The values of the content of nitrates (Figure 8) ranged the water in the 1st class of quality only in August for the water sampled from the middle of the lake; in the rest of the months, water ranged in the 2nd class of quality. Content of ammonia in the four studied months (Figure 9) was very low, much below the level of the 1st class of quality.

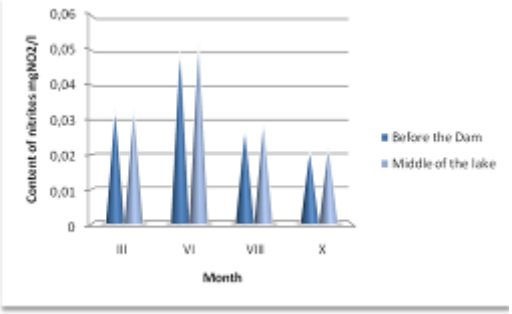

Figure 7. Content of nitrites

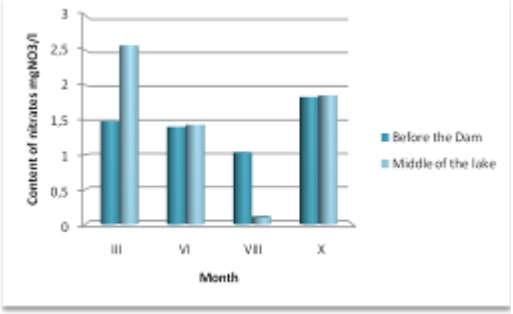

Figure 8. Content of nitrates

Figure 10 shows that phosphates reached very small amounts, below the 1st class of quality, ranging between 0.007 and 0.11 mg/l.

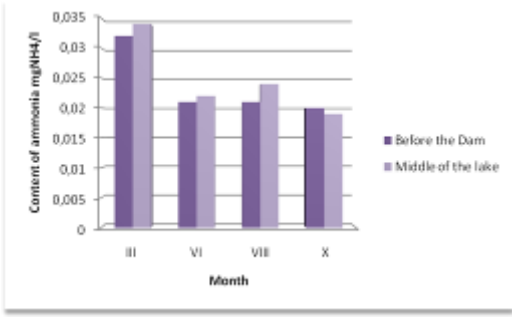

Figure 9. Content of ammonia

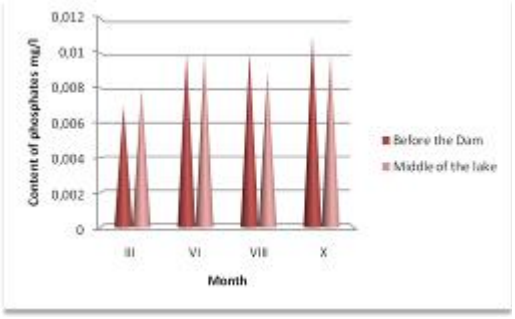

Figure 10. Content of phosphates

Content of filterable residue dried at 105^{o}C is very low; it was higher in August, about 100 mg/l, much below the limit of the 1st class of quality (Figure 11). Water conductivity was directly proportional with water mineralisation: it was lower in June and it increased up to about 120 µScui^{-1} in August (Figure 12). Content of calcium (Figure 13) and magnesium (Figure 14) was very low, much below the limit of the 1st class of quality. Content of nickel (Figure 15) and chromium (Figure 16) was very low, much below the limit of the 1st class of quality.

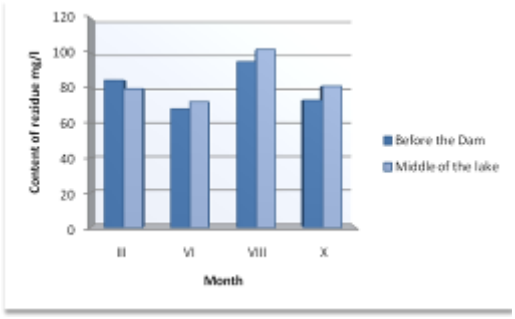

Figure 11. Content of rezidue

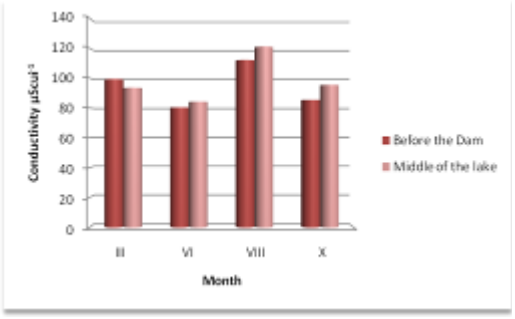

Figure 12. Water conductivity

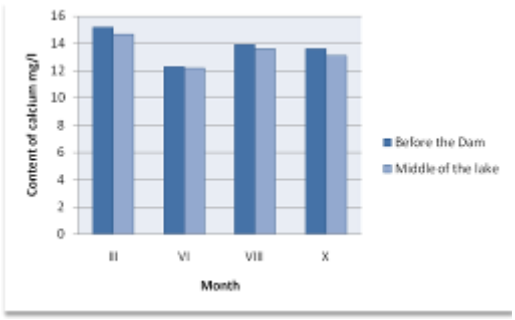

Figure 13. Content of calcium

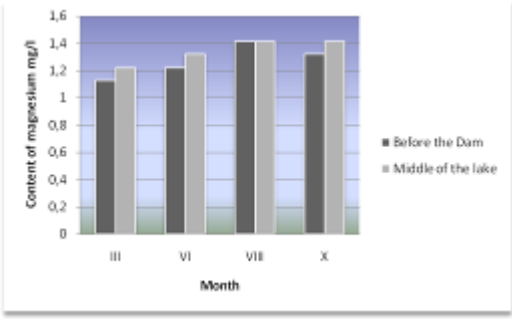

Figure 14. Content of magnesium

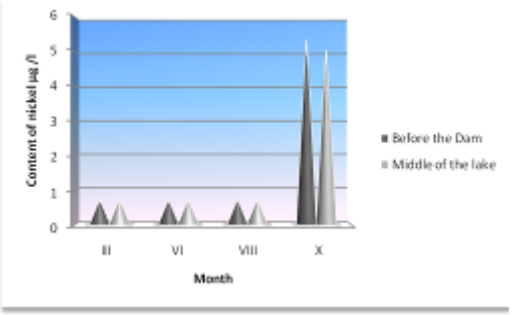

Figure 15. Content of nickel

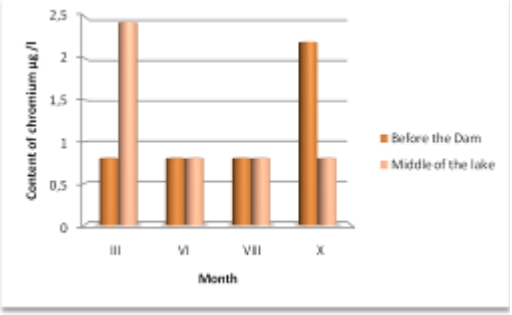

Figure 16. Content of chromium

Content of copper increased progressively (Figure 17): in the water sample from upstream the dike, it reached the 2nd class of quality in October, unlike the water sampled from the middle of the lake that ranged in the 2nd class of quality in June, the 3rd class of quality in August and the 4th class of quality in October. Content of zinc (Figure 18) was very low, much below the limit of the 1st class of quality, with peaks for the water sampled upstream the dike in June and October.

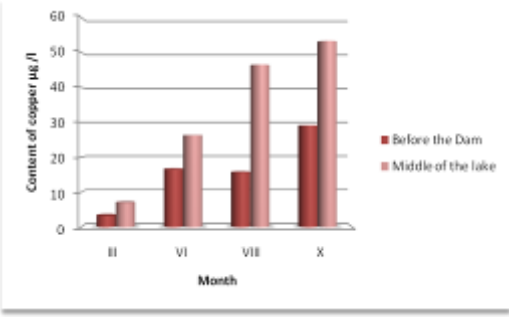

Figure 17. Content of copper

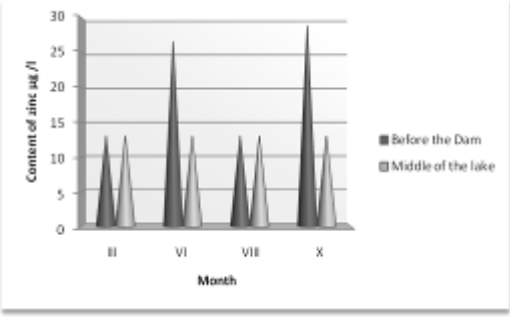

Figure 18. Content of zinc

Content of cadmium (Figure 19) was very low, with a peak of 0.16 µg/l in August, ranging the water in the 1st class of quality. Turbidity (Figure 20) had low values: the highest were in March and October for the water from the middle of the lake and the lowest were in August in both sampling points.

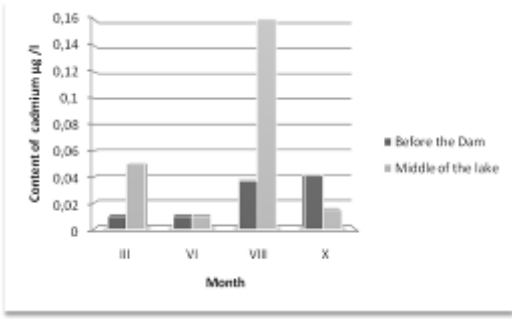

Figure 19. Content of cadmium

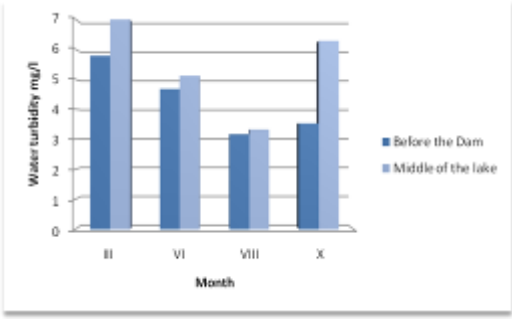

Figure 20. Water turbidity

As for hardness (Figure 21), water ranged in the soft category of waters, with the lowest values in June.

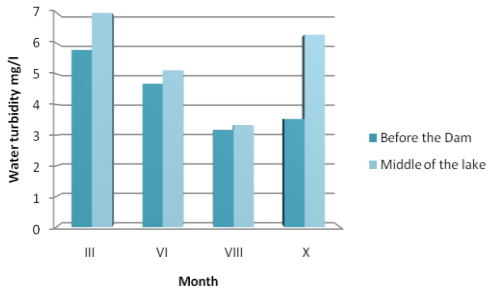

Figure 21. Water hardness

CONCLUSIONS

1) The Lake Poiana Mărului is part of the **site Natura 2000 ȚARCU** Mountains. The Țarcu Mountains make up a compact area that is practically unaltered and has not human settlements, except for Poiana Mărului and the tourism complex Muntele Mic. The mountain concentrates a complex of mainly natural ecosystems (81%), with remarkable diversity and local abundance 25-78 higher than the national average.
2) Taking into account that Lake Poiana Mărului is located in a protected area, we need to monitor water quality. We sampled water from upstream the dike and from the middle of the lake (3-6 m deep) in March, June, August and October 2014; results were interpreted and compared with the standards stipulated in Order no. 161/2006.
3) The water of the lake is basic, with a slightly higher value in June.
4) Oxygen regime had good values, except for oxygen content that decreased to the 2nd class of quality in June and August.
5) As for the content of nitrites, it ranged the water in the 3rd class of quality in March and June, and in the 2nd class of quality in the rest of the months; content of nitrates ranged the water in the 2nd class of quality.

6) Water salinity was not above the level admitted for the 1st class of quality; toxic pollutants were much below the limit, except for copper that increased progressively, particularly in the water sampled from the middle of the lake.
7) Overall, the quality of the water in the Lake Poiana Mărului is good, basic, with slightly higher values of the nitrite and nitrate contents and a high content of copper.

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