THE IMPACT OF AGRICULTURAL, INDUSTRIAL AND HOUSEHOLD ACTIVITIES ON THE SURDUC LAKE WATER

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Abstract. *Water is one of the natural elements essential to the existence of the living world. It has a fundamental role in the development of natural processes (physico-chemical, biological, climatic, in relief modeling) and socio-economic activities, being an important means of communication and defense, a raw material for industry, a valuable source for energy, for irrigating crops, feeding the population. This paper is very topical given that its purpose is to monitor the quality of water in the Surduc Accumulation. In order to achieve this objective, water samples were taken from the Surduc Accumulation, the analyzes being performed by the Quality Laboratory of the Banat Water Basin Administration, the results being interpreted and compared with the physico-chemical quality standards of Order no. 161/2006 which allows the classification of surface waters in order to establish the ecological status of water bodies. The main quality indicators determined in the scientific paper were: pH, dissolved oxygen content, biochemical oxygen consumption, nitrite and nitrate content, ammonium, phosphates, hardness, conductivity, iron, copper content, phenols and arsenic. Following the analysis it was determined that the water is neutral to basic, the oxygen content falls the water in class I-a, II-nd quality, the nutrient content in class II of quality, and occasionally detected amounts of phenol and arsenic content.*

Keywords*: anthropogenic impact, water pollution, oxygenation regime, nutrient regime, metal content*

INTRODUCTION

Fresh water is relatively rare on the Earth's surface, with3% of the total amount of water on Earth being freshwater, and freshwater from lakes and swamps accounts for only 0.29% of the world's total freshwater, which makes water considered the Earth's most important resource. The water in the lakes represents only 0.260% of the planet's freshwater reserve, which amounts to a volume of 91,000 km^3. However, rivers and lakes are the main sources for water used daily by humans (Ichiki et all., 2006). In today's society it is considered a fundamental resource because it is the basis of all human activities (Raed et all., 2015).

The use of water by man is very varied because the properties it holds are also diverse. The presence of water is an indispensable condition for the emergence and development of life. Water is the key element in the development of industry, agriculture and transport (Roy et all., 2019).

In the last decades, the degradation of the environment, implicitly of the water, has continuously worsened, taking forms that have gradually engulfed the entire planet, as a result of industrialization, with the proper stimulation of the procurement of raw materials, of the development of transport, the intensification of agriculture and urban agglomerations, finally triggering the current "ecological crisis" (He et all, 2020).

The preservation of water causes an alteration of its physical, chemical or biological qualities, produced directly or indirectly by a human activity, as a result of which the waters become unsuitable for normal use for the purposes for which such use was possible before such deterioration occurred (Parparov et all., 2006). Water pollution can be: physical pollution (thermal, radioactive, with solid particles), chemical pollution (derivatives of carbon and hydrocarbons, sulfur, nitrogen, plastics, pesticides and other synthetic organic compounds,

fluorides, heavy metals, fermentable organic matter, etc.) and biological pollution (organic slurry, pathogens, bacteria and infectious viruses, etc.) (Malaescu et all, 2019, Smuleac et all., 2016, 2017).

It is the vacuation in the waters of various chemicals included in industrial residues, generated from agricultural land treated with fertilizers or pesticides or included in the city wastewater coming from, mainly from detergents, greatly affects the quality of the water (Bayat et all., 2021, Firoanda et all, 2019). Salts of some metals (copper, lead, zinc, mercury, cadmium), fluorides, acids and bases, nitrates and phosphates (very common, especially in areas with advanced agriculture, where fertilisers or phosphates from high-fattened crops, where fertilisers or phosphates from sewers containing detergents are used intensively) are reported depending on the nature of human activities, depending on the nature of human activities bordering the river basins or the origin of the residues in the watersheds, hydrocarbons, petroleum and other chemicals (some of pharmaceutical origin) (Hameed et all., 2010). Significant contaminations are due to pesticides used in agriculture (Lato et all, 2013).

MATERIAL AND METHODS

The Surduc Reservoir is located in the Bega hydrographic basin on the Gladna River, a left tributary of the Bega River. Gladna River has a length of about 34km and a watershed of 173 sq km. The watershed has an average altitude of 282m (between 820m and 119m), with an average slope of 2.1%. The main functions of the accumulation are the supplementation of the flow of the Bega River in order to ensure the consuming and non-consuming uses, respectively the attenuation of the floods, implicitly the protection against floods.

In order to follow the water quality of Surduc Lake, water samples were taken in March, June, September and October for two years: 2019 and 2020 from two sections: middle lake and upstream dam (fig.1).

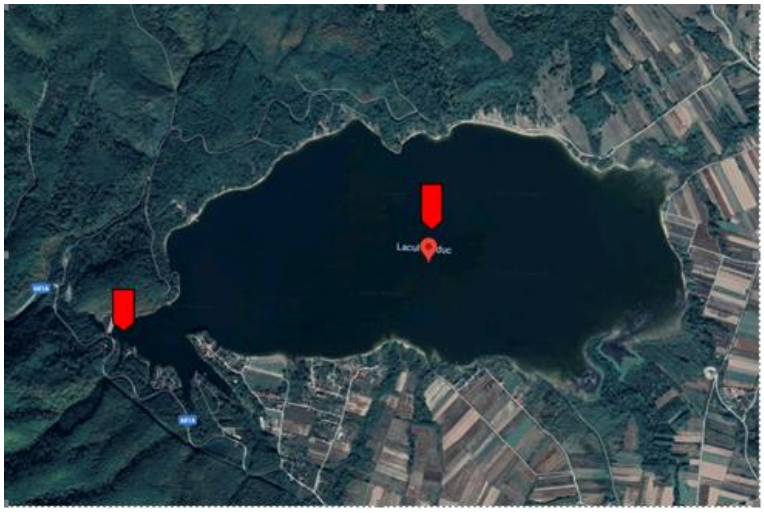

Figure 1. Water sampling points in Surduc Lake

The main quality indicators determined were: pH, dissolved oxygen content, biochemical oxygen consumption, content of nitrates and nitrites, ammonium, phosphates, hardness, conductivity, iron, copper content, phenols and arsenic. The analyses were performed by the Quality Laboratory of the Banat Water Basin Administration and the results were

interpreted and compared with the physico-chemical quality standards of Order no. 161/2006 which allows the classification of surface waters in order to establish the ecological status of water bodies.

RESULTS AND DISCUSSIONS

Following the laboratory analysis of the water from the Surduc Accumulation, it was noted that in 2019 the water reaction was neutral towards the base, with the highest value of 8.4 pH units in June Upstream dam, the fluctuations being very small, between 7.6 – 8.4 pH units.

The oxygen content shall classify water in quality class I only for March 2019, class II quality for June and October at both sampling points and class III quality for September. The biochemical oxygen consumption values are lower in March and September, below 3 mg/l (minimum 1.74 mg/l in September Middle Lake), which includes the water in class I of quality, and for June and October the water of Surduc Lake is in the second class of quality.

As regards the nutrient regime, in June the nitrite content is in class I of quality for both locations (0,005 - 0,006 mg/l), while otherwise falling into class II of quality. The nitrate content is very low, between 0,023 and 0,340 mg/l, well below the maximum permissible limit for quality class I. The same trend is noted for the ammonium content, all recorded values (between 0,01 - 0,082 mg/l) being well below the maximum permissible quality class I limit of 1 mg/l. The phosphate content of the water is within the quality class I for September and October for both locations (0.013 – 0.039 mg/l) and the month of June for upstream dam (0.063 mg/l), the rest of the values falling within the quality class II.

The conductivity indicates the degree of mineralization of water, having close values, between 151-159 μScui-1, the highest value recorded being in March in the Middle Lake.

The copper content was present in all the months in which determinations were made, with the exception of September when it was undetectable, with the highest value recorded in June of 19,25 mg/l close to the class II quality limit.

A moderate content of phenols was recorded only in June, of 10,8 μg/l and 12,4 μg/l respectively in upstream dam and Middle lake, values of class II of water quality.

A low arsenic content between 3,3 and 2,7 μg/l was also detected in September 2019, which is well below the maximum permissible quality class I limit of 10 μg/l.

In 2020,the water evolution of the Surduc Storage ranged from 6.9 pH units (September) to 8.4 pH units in June, framing the water in the neutral regime towards the base.

The dissolved oxygen content in water is corresponding to quality class I for March and June for both locations (between 9,8 and 11,8 mg/l), for the rest of the months the water falling within class II of quality, with a minimum of 7,2 mg/l in September Upstream dam.

The lowest biochemical oxygen consumption is in October upstream dam and falls water into class I quality, in September for both locations and March for upstream dam, water is classified in category II quality, and for June and March Middle Lake, water falls into class III quality.

The nitrite content is in quality class I in September for both sampling sites and October Middle Lake (less than 0,01 mg/l), for the rest of the months the water falls into class II quality.

The nitrate content values are below 1 mg/l, between 0.080 – 0.970 mg/l, values that fall under quality class I water. The ammonium content is between 0.023 – 0.322 mg/l, values below the maximum permissible quality class I limit of 0.4 mg/l.

The phosphate content in water is low, with the lowest value recorded in June of 0,013 mg/l and the maximum in October of 0,067 mg/l, all values being in class I of quality.

The mineral content in the water is evidenced by the conductivity of water, which has values between 144 - 162 mg/l.

The copper content maintains the same trend as in 2019, of class I quality values, except for june in middle lacquer when 96 mg/l (class IV quality) and June upstream dam with 31 mg/l (class II quality) are recorded.

Phenols were also present in June, between 3.2 and 3.4 µg/l, which places water in class II quality.

In the year 2020, no more arsenic content was detected in the water.

From the comparative evolution of the main indicators of water quality in the Surduc accumulation for the years 2019 and 2020, it is observed that the water reaction is neutral towards the base, remaining in the years taken in the study within the limits allowed for quality class I (Figure 2). The dissolved oxygen content in water (Figure 3) includes water in quality class I for March of 2019 and 2020, as well as June 2020. In June of 2019, September 2020 and October, the water falls into class II quality, and for September 2019 in class III quality.

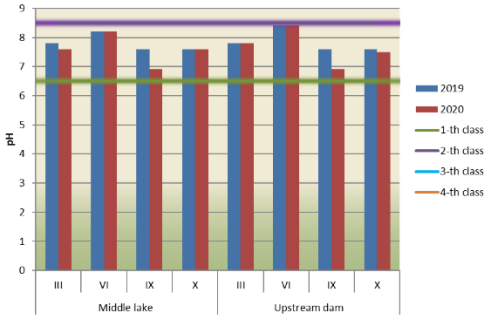

Figure 2. The water reaction

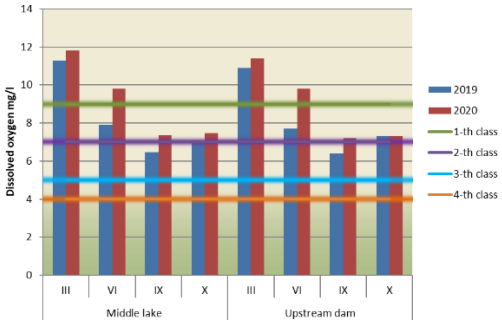

Figure 3. The dissolved oxygen content

Biochemical oxygen consumption (Figure 4) is an indicator indicating the degree of water pollution. For 2019, the values fall water into quality class I, except for October when it is in class II quality. The year 2020 shows higher values, corresponding to class II quality and even III for the months of March middle lacquer and June. The nitrites content falls into class I quality with the exception of March 2019 Middle lake and upstream dam, September Middle Lake 2019 and the months of June and October Upstream dam 2020, when all these values fall water into class II quality (Figure 5).

The nitrates content in the water is very low, below the quality class I limit, with a maximum in March 2020 at Middle Lake of 0.970 mg/l (Figure 6). Ammonium content (Figure 7) it maintains the same trend as the nitrate content, being below the quality class I limit. The content of phosphates in water is very low, being well below the limit of class I quality, only in June 2019 being in class II quality (Figure 8).

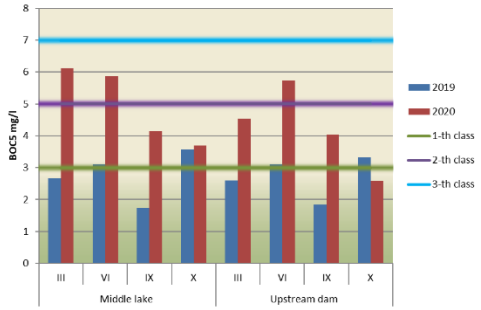

Figure 4. Biochemical oxygen consumption

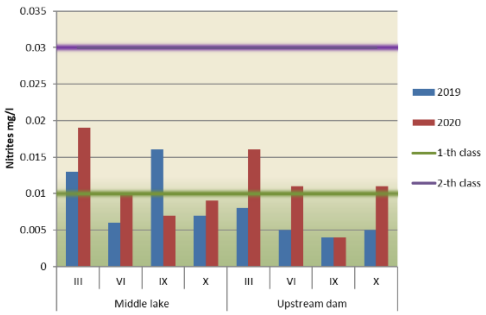

Figure 5. The nitrites content

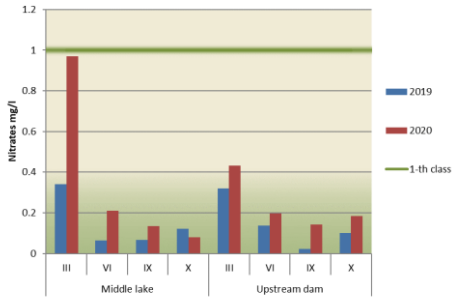

Figure 6. The nitrates content

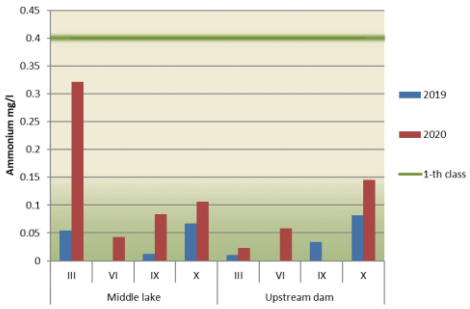

Figure 7. The ammonium content

The copper content (Figure 9) was present in all the months in which determinations were made, with the exception of September of 2019 when it was undetectable, with values in class I of quality, except for June Upstream dam with class II quality values and june Middle lake with a maximum value of 96 mg/l that includes water in class IV quality.

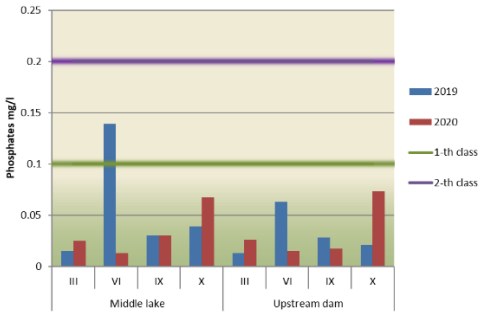

Figure 8. The phosphates content

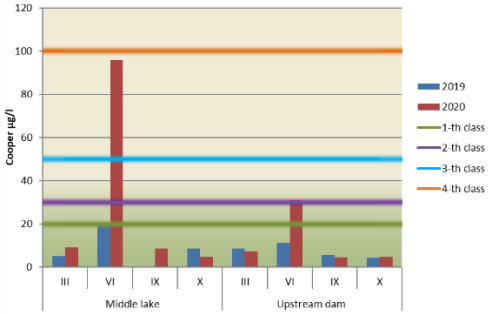

Figure 9. The copper content

CONCLUSIONS

Following the analysis of the water quality of Surduc Lake, the following aspects were obtained:

- The reaction of the water is neutral towards the basics, being maintained in the years taken in the study within the limits allowed for class I quality;
- The dissolved oxygen content in water falls into quality class I water for March of 2019 and 2020, as well as June 2020. In June of 2019, September 2020 and October, the water falls into class II of quality, and for September 2019 in the class III of quality;
- Biochemical oxygen consumption falls water into quality class I for 2019, with the exception of October when it is in class II quality. The year 2020 shows higher values, corresponding to class II of quality and even III for the months of March middle lacquer and June;
- The nitrite content falls within class I and II of quality, the nitrate and ammonium content is very low, below the quality class I limit;
- The phosphate content in water is very low, being well below the quality class I limit;
- The copper content was present with values in class I of quality, the exception being the month of June Upstream dam with class II quality values and june Middle lake with a maximum value of 96 mg / l that includes the water in class IV quality;
- Phenols were present in June of 2019 and 2020, with values that classify water in class II quality;
- A low arsenic content was also detected, between 3,3 and 2,7 μg/l in September 2019, which is well below the maximum permissible quality class I limit.

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