Water Quality of Some Lakes in Dolj County

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Abstract. In Dolj County there are a number of lakes that are particularly important, because they have a large quantity of water, some of them originating from hydrotechnical accumulations, and other from natural waters. In the present study, it was performed the monitoring of the water quality of the lakes in Dolj County, in the year of 2012, namely: Victoria - Geormane, Bistreţ and Caraula. The ecological conditions of the natural and artificial lakes was established based on the state of acidification, of the oxygen regime (dissolved oxygen, biochemical oxygen demand and chemical oxygen demand), the degree of eutrophication (biogenic substances, phytoplankton biomass and chlorophyll “a”) and also based on transparency. The water samples were taken from three points: tail, middle and upstream of the lake and were analyzed using high performance equipment, namely: pH-meter, spectrophotometer DR 2010, Sechi disc, BOD$_5$ system. In terms of the degree of eutrophication, the water from the studied lakes belongs to the third category of water quality. Geormane is a natural lake which has a very good ecological status, except regarding the eutrophication, which is considerably visible. Bistret lake has a good environmental status and is visible eutrophic. Caraula lake’s water belongs to the third category of water quality, being heavily eutrophic.

Keywords: pollution, anthropogenic, lakes, physico-chemical indicators, phytoplankton biomass.

INTRODUCTION

Indispensable element of life, water is not a commercial product, but is a natural product that must be protected, defended and treated as such, is an exhaustible and vulnerable resource, also being at the same time raw materials for industrial, agricultural and recreational activities, power energy and transport route. In the context of socio-economic development and current progress of civilization, there are constantly increasing demands for water, while water resources are subject to a strong process of decay, with adverse consequences for human health and the environment.

The increased anthropogenic activities, in and around the water bodies, damage the aquatic systems and ultimately the physico-chemical properties of water (Patel and Patel, 2012).

Discharge of toxic chemicals, over pumping of aquifer and contamination of water bodies with substance that promote algae growth are some of the today’s major cause for water quality degradation (Mahananda et al, 2010).

Water quality does not remain constant over time, but may vary due to natural or artificial sources of contamination (Cîrţînă, 2010), which requires a permanent control of parameters values, which defines the quality of surface water and their ability to form the power supply or utilization of human settlements in industrial and agricultural activities.

Stagnant water bodies have more complex and fragile ecosystems in comparison to running water bodies as they lack self cleaning ability and hence, readily accumulate greater quantities of populations (Patel and Patel, 2012).
In Dolj County there are a number of lakes that are particularly important because they have a large quantity of water, some of them originating from hydrotechnical accumulations and other from natural waters.

The aim of the current study was to perform the monitoring of the water quality of the lakes in Dolj County, in the year of 2012, namely: Victoria - Geormane, Bistreț and Caraula, with respect to different physico-chemical and biological parameters.

MATERIAL AND METHOD

In the present paper, we monitored the quality status of some lakes in Dolj County, namely: Victoria Geormane, Bistreț and Caraula, and aimed to determine the water quality in 2012.

Dolj county lies between 43° 43 ’ and 44° 42’ north latitude and 22° 50’ and 24° 16’ east longitude ie one degree latitude and one degree and a half longitudinally.

Lake Victoria - Geormane is a natural accumulation of water, located 25 km downstream from the city of Craiova, on the left side of the Jiu Valley. The lake has a maximum length of 1100 m and a maximum depth of 2 m, the lake surface is at average levels of 59 ha, being used for pisciculture.

Bistreț Lake is located in the Cărna village, on Desnățui stream and is the largest lake in the county, with an area of 18.67 km² and a volume of 28 million. It was constructed for fishing and also for diminishing high floods in the event of flooding.

Caraula accumulation is located in the village Caraula on stream Baboia, being made up of a basin bordered by the natural slopes of the valley. The dam is constructed of heavy earth with a mask of reinforced concrete. The dam, which has a length of 451 m, width 6 m and a height of 6 m, has been built for irrigation and flood wave attenuation in case of floods.

The ecological conditions of the natural and artificial lakes was established based on the state of acidification (pH), of the oxygen regime (dissolved oxygen, biochemical oxygen demand and chemical oxygen demand), the degree of eutrophication (biogenic substances, phytoplankton and chlorophyll a) and also based on transparency. Also, there were analyzed the general ions (Cl, Na, Ca) which provides information on the degree of mineralization of these waters. The water samples from the 3 lakes were collected in the morning hours between 9 to 11 a.m. in polyethylene bottle, regularly for every month, in the study being presented the average. Transparency and pH were recorded at the time of sample collection, with the help of Secchi Disc and pH - meter. Other physico-chemical parameters were analyzed in the laboratory and estimated using standard methods (Simpi et al., 2011; Sinha and Biswas, 2011).

RESULTS AND DISCUSSIONS

The study was conducted in 2012, on the lakes Victoria - Geormane, Caraula and Bistreț, when there were made four sampling in march, june, august and october.

Lake Geormane shows a pH of 6.8 upH, variation limit being 6.5 – 8.5 upH. Regardless of months of sampling collection, the average value ranged between 6.2 to 6.8 upH (Fig. 1).
As for the regime of oxygen (dissolved oxygen, biochemical oxygen demand and chemical oxygen demand) they are presented in Fig. 2.

Important indicator of the quality of surface water, dissolved oxygen is the amount of oxygen dissolved in the water and depends on a number of factors such as water temperature, pressure, depth, turbidity and the amount of organic matter in decomposition.

Increasing the amount of organic substances in water or their appearance at a time is synonymous with water pollution of pathogene germs. Chemical oxygen demand (COD-Cr) generally reflects 60-70% of the total organic load (including non-biodegradable). Biochemical oxygen demand varies in direct proportion to the amount of organic substances contained in the water and is influenced by the action of reducing chemical compounds. As it can be seen, the lake Geormane fall within first class, in terms of oxygen regime. Bistreţ and Caraula lakes, in terms of COD-Mn, fall in the third category of water quality (Fig.3).
From the group of biogenic elements (nutrients) are part the main forms of nitrogen, phosphorus and chlorophyll "a" indicator, which, although presents a relatively low toxicity, are the generators of the processes of eutrophication.

The presence of ammonia in the water is due to the decomposition of substances of protein, but may also have mineral or vegetable origin.

Nitrites ions (NO$_2^-$ nitrite) are intermediate products (slightly unstable) of oxidation of ammonia or nitrate reduction by bacterial processes (ammonia under the action of *Nitromonas* and *Nitrobacter* bacteria in the presence of oxygen is gradually turning into nitrites and then into nitrates. The studied lakes belong to the second category of water quality.

Nitrate ions (NO$_3^-$ nitrate) is an advanced stage of oxidation of ammonia or molecular nitrogen is formed directly. Lake Geormane is part of the first category of water quality and the other 2 lakes belong to second and third water quality category (Fig. 4).

Total nitrogen amount is composed of mineral oxide forms: ammonia nitrogen (N-NH$_4^+$), nitrites (N-NO$_2^-$), nitrate (N-NO$_3^-$) and organic nitrogen. Geormane and Bistret lakes fall into the first water quality category and Caraula in the second water quality category.

Phosphorus is present in surface waters naturally or due to anthropogenic pollution: point sources from agriculture, industry of polyphosphates detergents. Phosphorus in the form of combinations may be present in surface waters, either dissolved or in suspension (sediment) (Fig. 4). Waters from lake Geormane is part of the first water quality category and the waters from Bistret and Caraula lakes belong to third water quality category.
Ecological state of natural and artificial lakes was determined based on the degree of eutrophication, through the analysis of the following quality indicators: total phosphorus, total nitrogen, phytoplankton biomass and chlorophyll "a".

The process of eutrophication is manifested especially in stagnant waters, through accelerated growth of algae and higher aquatic plants, which disturb the balance of organisms present in the water and threatens quality. Overgrowth of algae leads to decreased water transparency and low concentrations of dissolved oxygen in water, phenomena accompanied by the disappearance of aquatic fauna. Chlorophyll "a" provides information on biomass and photosynthetic activity of algae as a potential indicator of trophic state representative. Eutrophication is a process that also occurs naturally, but very slowly, but anthropogenic sources of pollution have accelerated this process resulting in degradation of the aquatic environment in a very short time (Fig. 5). The lakes water is in the third category of water quality.
Chemical parameters analyzed under "general ions, salinity" are not indicators of anthropogenic pollution, they are found naturally in surface waters, providing general information on their degree of mineralization (Fig. 6). Lakes are part of the second category of water quality in terms of ions studied, as well as the transparency (Fig. 7).

![Fig. 6. The content of chlorides, sulfates, calcium and sodium (mg/l)](image)

![Fig. 7. Transparency of the lakes (UNT)](image)

From the point of view of phytoplankton biomass, lake Victoria Geormane is a mesotrophic lake (BFP=4.95 mg/l). Phytoplankton density values recorded 624 021 ex/l. Mineralization processes of organic material deposited on the bottom are reduced, which leads to the accumulation of organic mud in large amounts. Phytoplankton community includes:

- Bacillariophyta: Cymbella venticosa, Pinnularia viridis, Amphora ovalis, Cymatopleura solea, Navicula viridula;
Chlorophyta: Scenedesmus quadricauda, Pedistrum duplex, Petiastrum boryanum, Chlorella vulgaris.

Macrophytes: Elodea canadensis, Caltha palustris, Potamogeton amphidium, Potamogeton pectinatum, Ceratophyllum demersum, Gratiola officinalis, Carex liparia, Lemna minor, Polygonum mie, Cyperus longissima, Mentha pulegium, Cicuta virosa, Cyperus flavescens.

Phytoplankton density of the Bistret lake recorded values of 721.410 ex/l. Phytoplankton community is composed of:
- Bacillariophyta: Melosira varians, Nitzschia holsatica, Stephanodiscus hantzschii, Synedra acus, Synedra ulna;
- Chlorophyta: Scenedesmus quadricauda, Scenedesmus acuminatus, Petiastrum boryanum, Monariphidium contortum, Tetrastrum staurogeniaeforme;
- Myzozoa: Peridinium bipes;
- Euglenozoa: Euglena acus, Stromonas verrucosa.

Phytoplankton community of Caraula lake includes:
- Bacillariophyta: Cymatopleura solea, Nitzschia palea, Cyclotella meneghiniana, Synedra acus, Synedra ulna;
- Chlorophyta: Scenedesmus quadricauda, Scenedesmus acuminatus, Petiastrum boryanum, Monariphidium contortum, Tetrastrum staurogeniaeforme, Actinastrum hantzschii, Chlorohomidium rivulare;
- Cyanobacteria: Merismotrichia tenuissima.
- Euglenozoa: Euglena acus, Euglena viridis.

CONCLUSION

Geormane natural lake has a very good ecological status, except in terms of eutrophication which is considerably noticeable.

Lake Bistret has a good environmental status, being visible eutrophic.

Caraula lake is a lake whose water is part of the second category of quality, being strongly eutrophic.

REFERENCES