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ECOLOGICAL ASSESSMENT OF THE LAKE MIRESEI CAMPINA

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Abstract

The aim of this writing is to identify the water quality through physico- chemical and biological indicators. Considering this the water state and quality class of the agrement lake " Miresei" had been analyzed from 2012 to 2013. The investigation had been based on the quantitative and qualitative methods of the phytoplankton, zooplankton and phytobenthos. The main indicators of this study had been the following: the physico- chemical indicators (the temperature, pH, O2, CBO5, NH4, NO3, NO2, orthophosphates, P and N) and the biological indicators represented by the plankton and phytobentos saprobity index. The writing had been made in the Faculty of Land Reclamation and Environmental Engineering laboratory. The ecological analyses results, led in June 2012, showed that the lake was strongly eutrophic, and as a result the water belonged to the fourth quality class. After the ecological reconstruction from the autumn of 2013 the water quality improved significantly. The physico- chemical and biological analyses made in 2013, placed the lake water in the second quality class.

Keywords: *surface water, eutrophycation, plankton, ecological statement.*

INTRODUCTION

Inland water bodies was considered important ecological and sociological zones. (El-Masri si Rahman, 2003). The lake Miresei has been in a continuous process of eutrophycation.
According to Brooks et al. (2003) water qualiy standard refers to the physical, chemical, or biological characteristics of water in relation to a specific one. Thus, it was noted that poor water quality may be harmful to the ecosystem and aquatic organisms. (Gozlan et al., 2006; Miller et al., 2002, 2011; Weitz and Wilhelm, 2012).
Chlorophyll-a concentration is a key indicator of water quality. (Cheng et al., 2013). Chlorophyll a is the most common of the other types of chlorophyll that is found in photosynthetic organisms such as algae and plants.
Selection of quality indicators directly affect water quality assessment results. (Luo HJ and al., 2002).
According to Icaga (2007) not all parameters of the water have been included in a single class of quality. For evaluation of water quality were identified and physico-chemical parameters was observed if they are in accordance with accepted standards of law. In addition, it was necessary to identify and monitoring the water bodies. The primary objective was to determine the status of water quality of the Miresei lake (also called The Church).
Eutrophycation of lake has been a strong increase in summer because algae appeared overdevelopment.
Further, in eutrophication, phosphorus and nitrogen are principal indicators. (Ruley and et al.,2004).
In Romania, water must reach a condition of ecological (physical and biological) to protect human health, water resources, natural ecosystems and biodiversity.
(Water Framework Directive).
Quality status of water bodies in Romania was analyzed according to Norm 161/2006 by which it was achieved classification of ecological and chemical surface water.

MATERIALS AND METHODS

The lake is situated in the north-central part of Campina town.

Currently, is a source of recreation and relaxation for inhibators. Therefore, it's a agreement lake. In order to assess the following methods were applied ecological research synthesis and analysis method (documentation in order to obtain basic data), field observation method (research and field trips to analyzing samples) and the comparative method (needed to assess the water quality of the lake). Water samples were collected from two points of sampling: of the depth 0.5 m and from the surface.

Water samples collection were made in 2012-2013 in three different months (July 2012 the growth of phytoplankton, october 2012 the mineralization of organic matter and in Aprilie 2013 the prevernal period.

Water samples were kept in glass well washed with distilled water and dried. These were kept at 4 ° C both during transport and until their analysis.

Table 1. Presentation of physico-chemical indicators that were determined state water quality of the Miresei Lake. Units and standard methods of determination.

Indicators physico-chemical	Units	Determination methods
Temperature	°C	Thermometrical
pH	-	Electrochemical
dissolved O_2	mg O_2 /l	Titrimetric Method (Winkler)
BOD_5/ CBO_5	mg O_2 /l	Titrimetric Method (Winkler)
Ammonium	mg N/l	Spectrofometric
NO2	mg N/l	Spectrofotometric
NO3	mg N/l	Spectrofotometric
Total Nitrogen	mg N/l	Volumeric Method Kjeldahl
Total phosphor	mg P/l	Spectrofometric with molibdat of potassium
Orthophosphate	mg P/l	Spectrofometric with molibdat of potassium
Chlorophyll a	µ g/l	Extraction of chlorophyll pigments

As shown in Table 1. quality indicators physico-chemical were based on standard assay methods.

From the physico-chemical point were determined 11 important indicators in determining water quality study: temperature, pH, dissolved O_2, BOD_5, NH_4, NO_2-, NO_3-, total nitrogen, total phosphorus, soluble orthophosphate and chlorophyll a.

The temperature and pH of the water samples were analyzed at mercury thermometer and the pH with the electrochemical method. The pH was measured with a portable pHmeter, a glass electrode and a calomel electrode. The other indicators in Table 1 were analyzed in the laboratory. From Table 1, it was observed that dissolved O_2 was determined by the most common methods: Titrimetric (Winckler).

BOD_5 analysis was determined by the titrimetric method Winckler, but diluted and undiluted water sample.

NH_4, NO_2-, NO_3-, P total and orthophosphate were measured spectrophotometrically and total N was determined by Kjeldahl volumetric method. Method of chlorophyll a was extracting chlorophyll pigments with organic solvents.

Table 2. Identifying biological analyzes were necessary to determine the statement water quality in the Lake of Campina and principles methods.

Biological methods for determination	Principle method
The qualitative analysis of phytoplankton	Sampling and species identification
Quantitative analysis of phytoplankton	Determination of algal density and biomass
Qualitative analysis of zooplankton	Sampling and sorting organisms taxonomic groups
Quantitative analysis of zooplankton	Count the zooplankton species in a sample, weighing bodies and extrapolation
Qualitative analysis a macrophytobenthos	Collection of aquatic flora, sorting and species identification
Quantitative analysis a macrophytobenthos	Sampling surface deep squares method. Counting, weighing and extrapolating water macrophytes.

It should be noted that this parameter has indicated biomass of phytoplankton complex.

In this writing were highlighted biological methods of plankton, zooplankton and phytoplankton in the Miresei Lake of Campina. This was studied both qualitatively and quantitatively. As can be seen in the results and discussion, biological parameters of a class of poor quality on phytoplankton acted quickly because it was the most sensitive to the changes in water quality.

RESULTS AND DISCUSSIONS

In July 2012 was taked the first sampling from the lake. The two water samples had been taked at the depth and the surface. During the growth of phytoplankton biomass the water quality in the summer was poor due to the high temperatures. (that was shown in Figure 1.a.).
This resulted in overdevelopment of organic matter thus promoting the phenomenon of eutrophycation.

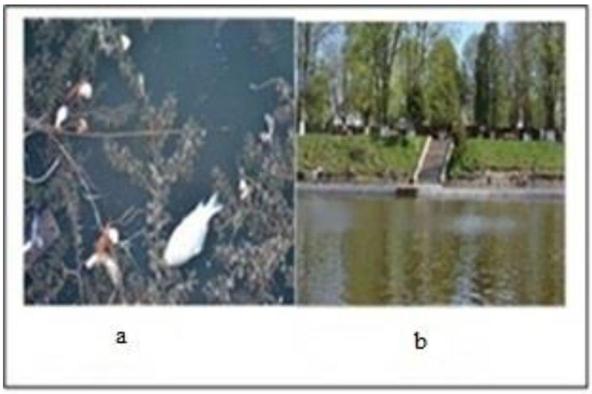


Figure 1. (a and b). Images from the 2012-2013 period at sampling. The Miresei Lake of Campina

Shortly, after the appearance of those problems that have affected water quality were taken measure to modernize and clean the water from the lake to return a state of good quality.
During installation of mineralization organic matter, ie in the second month after the water sampling the quality has changed significantly.

After upgrading the status of water quality had changed since the lake water have been cleaned out of excess algae. (figure 1.b). By default, the H_2S odor disappeared.
According that the Water Framework Directive provides quality five states: high, good, moderate, poor and very poor. For each class assigned a specific color.

Thus, in the table 3 were presented chromatic values resulting from laboratory analyzes.
Further, progress has been made for physico-chemical parameters are mainly responsible for setting environmental quality statement in the period 2012-2013. (Table 3).

Table 3. Physico-chemical indicators, measurement units and their values in the months of analysis (July 2012, October 2012, April 2013). Concentrations are represented by standardized colors for each class quality

No.	Physical-chemical indicators	Unit	Analyse period		
			July 2012	Oct 2012	April 2013
1.	T	°C	18,8	10,2	14,1
2.	pH	-	8,2	8,04	7,9
3.	O_2	Mg O2 /l	4,62	7,22	7,21
4.	CBO_5	Mg O2 /l	16,2	4,92	5,18
5.	NH_4	mg N/l	1,7	0,81	0,82
6.	NO_2^-	mg N/l	0,27	0,031	0,032
7.	NO_3^-	mg N/l	7,2	3,18	3,06
8.	N total	mg N/l	13,2	7,21	7,22
9.	PO_4	mg P/l	0,48	0,21	0,19
10.	P total	mg P/l	0,94	0,42	0,40
11.	Chlorophyll "a"	µ g/l	136	49,7	51,8

Key: Oligotrophic– green; Mesotrophic– yellow; eutrophic- orange;

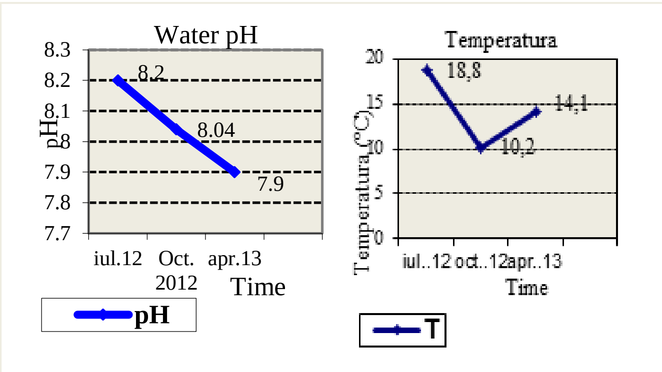


Figure 2. Evaluation of physico-chemical indicators of pH and temperature.

Permissible limit in norm 161/2007 on the classification of surface water pH is between 6.5-8.5. It can be seen in Figure 2 that the water in July 2012 has a pH value 8.2, higher than the other two-month study. In terms of temperature, in July 2012 was 18.8° C, higher than in October 2012 and April 2013.

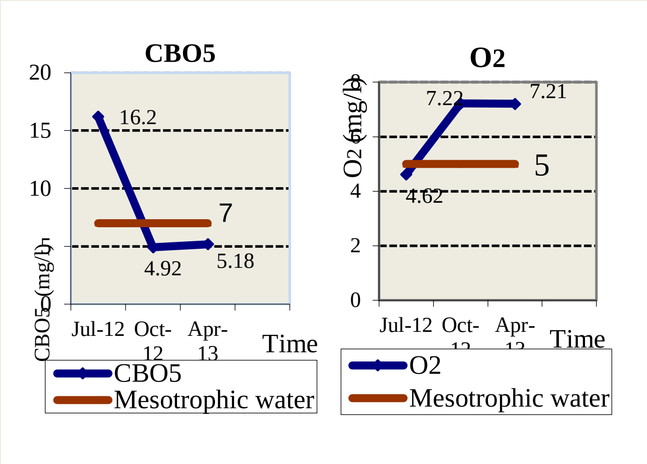


Figure 3. The evolution of the oxygen in 2012-2013 in Lake in Campina. Regime of oxygen is given chemical indicators: BOD5 and 02.

During phytoplankton growth with increasing temperature decreased the amount of oxygen dissolved in water (Figures 2 and 3).

Dissolved oxygen concentration recorded significant growth during the mineralization of organic matter and simultaneously decreased during prevernal period BOD5 concentrations (Figure 3).

In evolution the Miresei lake water the nitrate observed a significant decrease in concentration in July 2012 (7.2 mg / l) which was above the mesotrophic waters at concentrations up to 3.18 mg / l, respectively 3.06 mg / l. (Figure 4.a.)

Figure 4.b. shows the concentration of ammonium decreased in July compared to the other two months. The nitrite concentration during growth of phytoplankton biomass was 0.27 mg /l above the water mesotrophic 0.06 mg / l. (figure 4.c).

The concentration of total nitrogen in water tended to decrease in October 2012 and April 2013 by an oligotrophic character. (Figure 4.d.). The excess nitrogen in July 2012 led to the rapid development of algae.

Referring to Figure 5 shows that in the case of orthophosphates and total phosphorus concentrations in July 2012 has exceeded the mesotrophic waters.

During installation of the mineralization of organic matter and period prevernal concentrations were in quality class second with slight tendencies to third.

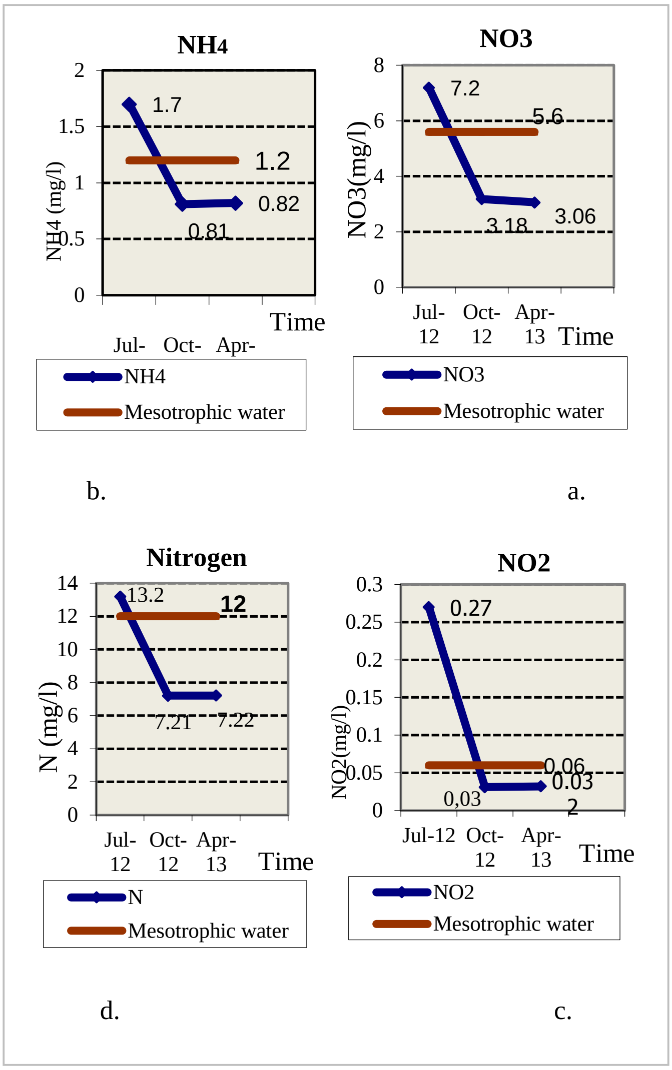


Figure 4. Evolution of trophic regime parameters nutrients (total N, NO3, NO2, NH4) in July 2012 in October 2012 and April 2013.

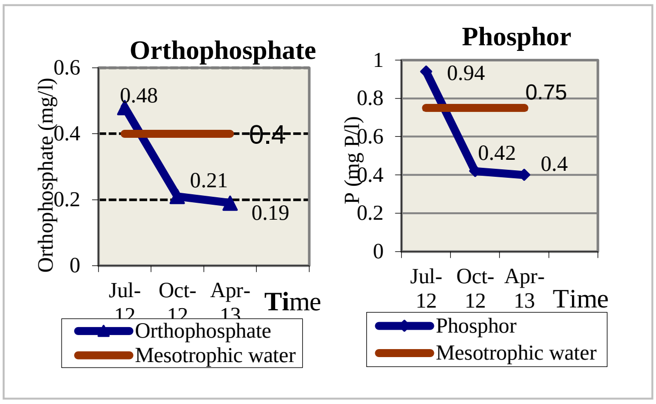


Figure 5. Evolution regime phosphorus (total P and orthophosphate) in Miresei Lake of Campina

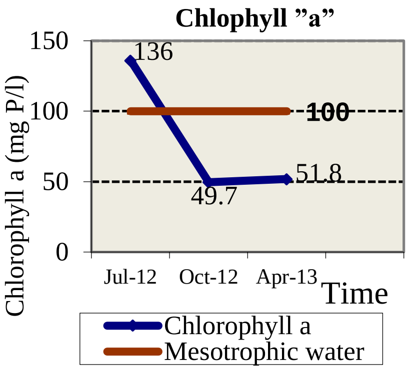


Figure 6. Evolution of chlorophyll a in the Miresei Lake Campina in July 2012 in October 2012 and April 2013.

High amount of phytoplankton biomass indicated eutrophic state of water and noted that in July 2012 the concentration was 136 mg/l above the mesotrophic waters. (Figure 6).

During installation of the mineralization of organic matter in 2012 and prevernal period in 2013, ie after modernization measures water quality physico-chemical change in second class, and some slight indicators for third quality class.

Table 4. Biological analyzes of water lake plankton and phytobenthos in 2012-2013. Color table is characterized by quality classes.

	The Plankton/ saprobity index	Benthonic algae (Phytobenthos) /saprobity index
July 2012	2,82	2,78
Oct. 2012	2,38	2,37
April 2013	2,36	2,35

Key: Oligotrophic– green; Mesotrophic– yellow; eutrophic- orange;

From the biological results presented in Table 4 highlights that water in July 2012 fall in fourth quality class, and after arranging lake grade of biologically ranged in quality second of quality. To observe in detail the evolution of biological indicators (saprobity index of plankton and phytobenthos) is plotted below.

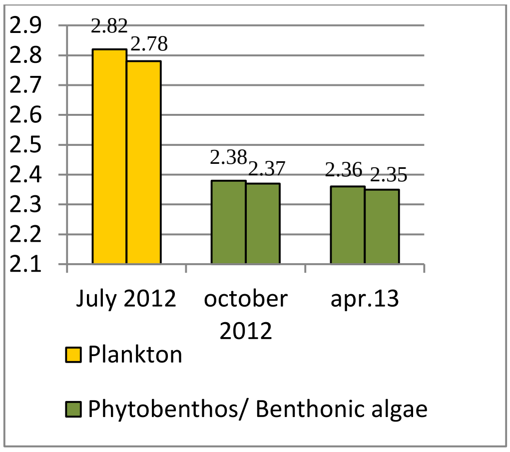


Figure 7. Evolution saprobity index in 2012-2013 during the months of analysis. In July 2012 the high values of the two indicators of saprobity of plankton and phytobenthos (algae bentonite) be identified by yellow color.

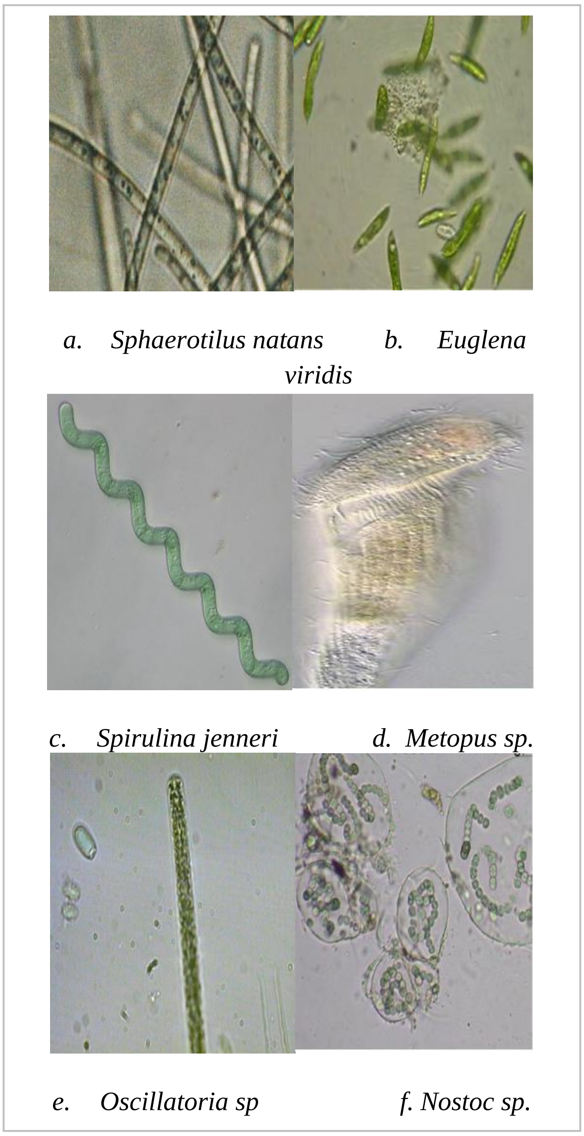


Figure 8. The Species identified in July 2012 in Miresei Lake of Campina. (X400 microscopic images)

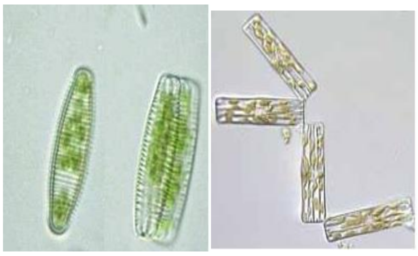
As previously noted in Table 4, the distribution of index saprobity values not uniform. In July 2012 there is a major difference in water quality to two months. (Figure 7). Lake water during the growing phytoplankton fit into a low-class quality, and water was eutrophic character. In October 2012 and April 2013 with slight acquires oligotrophic to mesotrophic.

Further, were presented species of organisms living in the lake of Campina.

In July 2012, the water was eutrophic character which generated a greater amount of sludge on the bottom, leading to filamentous bacteria *Sphaerotilus natans* (Figure 8.a).

In the lake water were identified and flagellate protozoan species such as *Euglena Viridis* (Figure 8.b) and filamentous cyanobacteria *Oscillatoria sp*. (Figure 8.e) and *Nostoc sp.* (Figure 8 f). By the analysis of water samples that are blue algae *Spirulina Jenneri.* (Figure 8c.).

The eutrophication favors the appearance of bacterial species in sulfur and while the ciliates (*Metopus sp.*, Figure 9.d) that feed with them. The species identified in the lake water during mineralization of organic matter and prevernal period were shown below in Figure 9.



a. Diatoma sp *b. Tabellaria fenestrata*

c. Vorticella campanula *d. Cladophora crispata*

Figure 9. The indicators species of quality class second in the Miresei Lake in October 2012 and Aprilie 2013 (x400 microscopic images)

The biological indicators of water falls in class II quality are represented by species of diatoms (*Diatoma sp*. Figure 9.a. and *Tabellaria Fenestra*, Figure 9.b) cilitate species as *Vorticella campanula* (Figure 9.c.).

By the water sampling identified the species of filamentous green algae *Chladophora crispata. (*Figure 9.d.).

CONCLUSIONS

This writing was based on monitoring and analyzing the water quality in 2012-2013 of Miresei Lake (also called The Church).

Ecological statement was determined by physical, chemical and biological indicators presented in Results and Discussion.

In early research, poor quality water of July 2012 had unpleasant consequences: the species of fish have died without enough dissolved oxygen, appeared smell and unsightly appearance which affect the landscape.

Once you have applied measures of modernization, ecological statement of water changed into a good one and has become an oligotrophic character. Currently, the Miresei Lake gives a pleasant city and a recreational environment for inhibators.

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