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The main sources of pollution of Valea Morilor lake which caused the asphygation of fish

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Abstract. The paper illustrates the role of bioindicators applied to identify the sources and degree of pollution of a water basin. The laboratory test reports, standard methodologies and scientific literature considered as an auxiliary tool for the preparation and planning the sampling campaigns for the assessment of the ecological status of the aquatic environment (including sampling, analysis and microscopy) served as support. There were applied the results of the laboratory analyses from the reports on quality indices and technical report, which include qualitative elements of the general physicochemical conditions, hydromorphological and biological qualitative components from Valea Morilor lake.
Keywords: aquatic environment, sources of pollution, negative anthropogenic action, bioindicators, asphyxiation of fish.

Principalele surse de poluare ale lacului Valea Morilor care au provocat asfixarea peștilor

Rezumat. În lucrare este elucidat rolul unor bioindicatori aplicați pentru identificarea surselor și gradului de poluare a unui bazin acvatic. Drept suport au servit rapoartele de încercări de laborator, metodicile tip și literatura științifică considerată drept instrument ajutător pentru pregătirea și planificarea campaniilor de prelevare pentru evaluarea stării ecologice a mediului acvatic, inclusiv prelevarea, analiza, microscopia. S-au aplicat rezultatele analizelor de laborator din roapoartele privind indicii de calitate, raport tehnic, care cuprind elemente calitative ale condițiilor generale fizicochimice, componente calitative hidromorfologice și biologice din lacul Valea Morilor.
Cuvinte cheie: mediul acvatic, surse de poluare, acțiune antropică negativă, bioindicatori, asfixierea peștilor.

1. Introduction

The impact of climate change on the biodiversity of a water basin involves the analysis of the impact on all existing ecosystems in the respective territory and the relationships between them. Disturbance of environmental factors has a direct effect on the evolution of living beings, initially on their ability to adapt and later on their ability to survive. In extreme cases, they are factors for the elimination of certain species on food webs with drastic consequences on the evolution of biodiversity at the local level and with impact at a general level. To prevent this phenomenon, you need to consider threats, opportunities, recommendations and adaptation measures.

The evaluation of water quality in an aquatic basin and anthropogenic changes in aquatic ecosystems can be carried out by analyzing both abiotic and biotic parameters (using bioindicators). The use of abiotic parameters is more convenient because it directly characterizes the quality of the environment, in particular, concrete negative changes with well-determined quantitative parameters. However, it is impossible to obtain the full characteristic of the environment, the main criterion - the reaction of the biota to the environment - remains unassessed [13].

The advantage of using biotic parameters (bioindication) lies in their great objectivity and validity. The state of the biota is determined by the state (as a whole) of the environment and generally reacts promptly to negative actions of various origins, regardless of evidence and their degree of studies.

Biological testing consists in the use of biological objects, under controllable conditions, for ascertaining and evaluating the actions of environmental factors on the organism and some functions or on a community of organisms.

2. Materials and methods

For the evaluation on 06/09/2022, six water samples were taken from the lake in Valea Morilor Park from Chisinau, in the points where the highest fish mortality rate in the coastal area was detected. The samples were analyzed under the microscope Optica ST-45-2L, Optica B-190TBPL and Optica B-510POL to determine the species that are present. The level of development of phyto- and zooplankton is a good indicator of the sanitary-hygienic quality of the water. In order to identify certain bioindicators, we resorted to:

- visual examination (sample appearance, tubidity);
- organoleptic properties;
- microscopic examination.

The so-called "water bloom" phenomenon can be observed more and more frequently in the lake. Thus, upon the decomposition of organic matter, biogenic substances (simple compounds of carbon, nitrogen, phosphorus) are quickly assimilated by autotrophic organisms (those that photosynthesize), a large part of which belong to algae with saprobic indices: Mougeotia sp. (o – 1.0), *Cymbella ventricosa* Bréb. (x-o–1.33), *Cymbella parva*

(W. Sm.) Kirchn, *Scenedesmus quadricauda* (Hegew.) Hegew. (β – 2.1), *Diatom vulgare* Bory (β-α – 2.4), *Gomphosphaeria lacustris* Chod. (β – 2.0), *Cymbella parva* (W. Sm.) Kirchn., *Achnanthes hauckiana* Grun, *Diatoma vulgare* Bory (β-α – 2.4), *Coelastrum microporum* Näg. (β – 2.1), *Navicula sp*., *Cosmarium venustum* (Bréb.) Archer in Pritchard, *Cymbella parva* (W. Sm.) Kirchn., *Mougeotia sp*. (o – 1.0), *Pediastrum boryanum* (Turp.) Menegh. (o-α – 1.9) (fig. 1-7). They can be uni- or multicellular, colonial or filamentous, usually microscopic. When they develop in large quantities, they can cause the phenomenon of "water bloom", which is expressed by changing the whate colour, pH value, viscosity, transparency decrease, toxic compounds (metabolic products) appearance in the water and the excess of nutrients contributing to the development excessive bacterioplankton, including the pathogenic one [5].

The smell of the water becomes unpleasant (due to the odorous substances produced by algae: geosminte and methyl-isoborneolates) and the lack of dissolved oxygen (used in the process of respiration and decomposition of dead organic matter) can cause mass asphyxiation of fish and other hydrobionts (especially at night when plants consume oxygen as a result of respiration) [13]. About 2000 species of this family are known, but only about 40 are dangerous, due to their relevant toxicity (Anabaena, Oscillatoria, Microcystis, etc.). The composition and abundance of species, and the age structure of fish communities demonstrate irregularities that can be attributed to anthropogenic actions on the physico-chemical and hydromorphological indices of the environmental quality. In some cases, the deficit of reproduction or the development of a certain species can be found, which manifests itself in the absence of certain age groups [7, 8].

3. Results and discussions

In the Republic of Moldova, most of the water resources are polluted, and the natural self-purification processes of water are reduced due to human activities.

The lake from Valea Morilor Park was built in 1950 on an area of 34 hectares, maximum length - 835m and depth of 3.5-5m, perimeter - 2.7 km. The supply is made from the Durleşti river and its tributaries, and from precipitation. This lake presents an aquatic ecosystem characterized by the presence of characteristic species, frequently euconstant, that imprint the specific particularity.

The littoral vegetation at the extremities of Valea Morilor lake is represented insularly by reed *Phragmates australis* (Cav.) Trin.ex Steud. (fig. 9,11), heather *Ceratophyllum demersum* L., *Potamogeton crispus* L.*, P.lucens* L., *P.perfoliatus* L., *P.crispus* L., rush *Typha latifolium* L., *T.angustifolia* L., lentil - *Lemna trisulca* L., gorse *Gnaphalium uliginosum* L., rust - *Juncus bufonius* L., watercress *Polygonium hydropiper* L., dogwood -

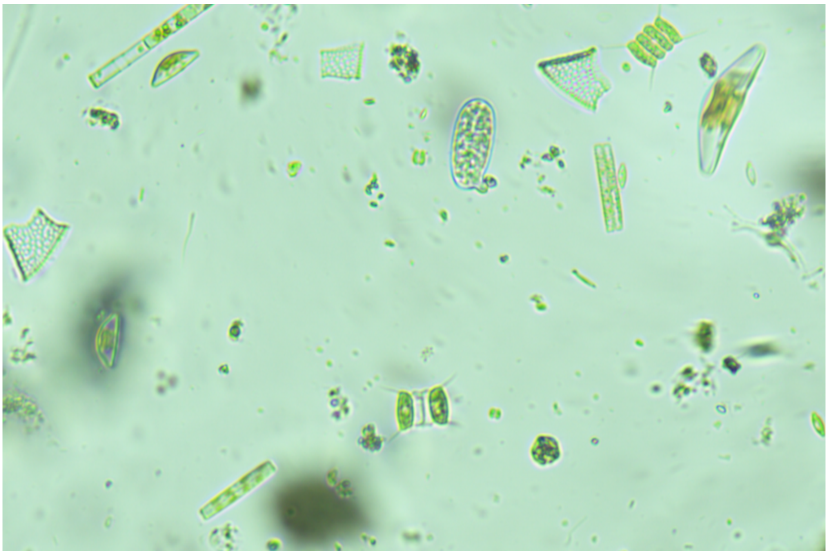

Figure 1. Microscopy of water sample no. 1 taken from Valea Morilor lake, Chisinau: Mougeotia sp. (o – 1.0); *Cymbella ventricosa* Bréb. (x-o – 1.33); *Cymbella parva* (W. Sm.) Kirchn.; *Scenedesmus quadricauda* (Hegew.) Hegew. (β – 2.1); *Diatom vulgare* Bory (β-α – 2.4).

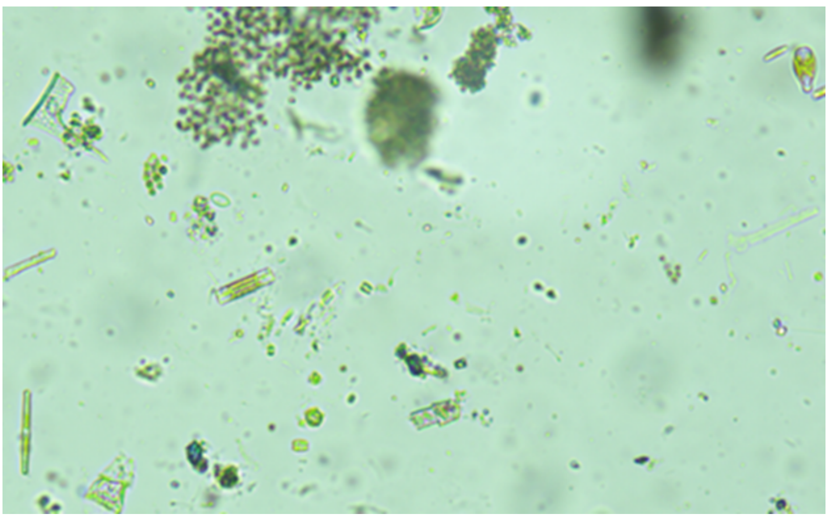

Figure 2. Microscopy of water sample no. 2 taken from Valea Morilor lake, Chisinau: *Diatom vulgare* Bory (β-α – 2.4); *Gomphosphaeria lacustris* Chod. (β – 2.0).

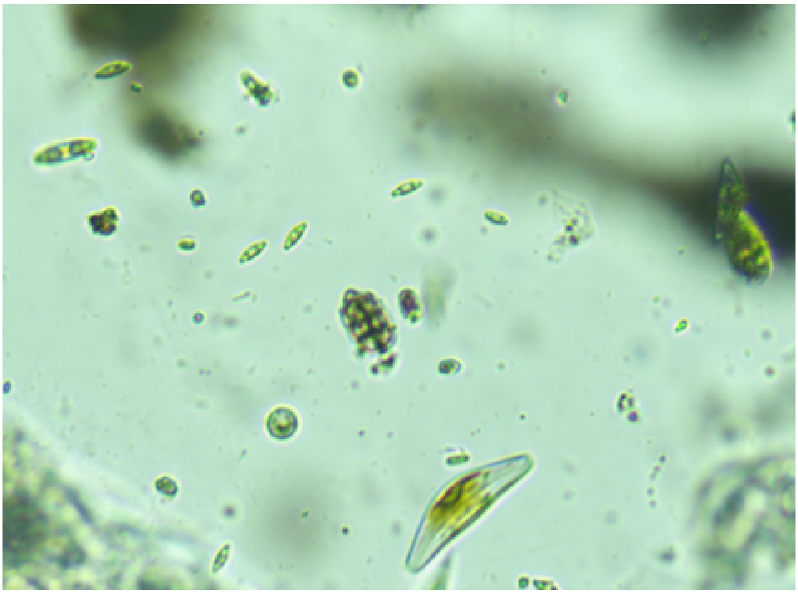

Figure 3. Microscopy of water sample no. 3 taken from Valea Morilor lake, Chisinau: *Cymbella parva* (W. Sm.) Kirchn.; *Achnanthes hauckiana* Grun.

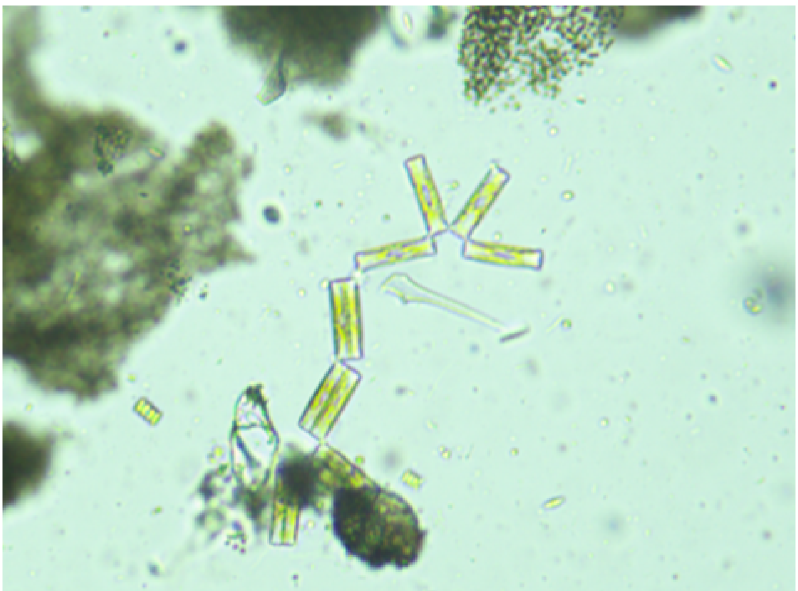

Figure 4. Microscopy of water sample no. 4 taken from Valea Morilor lake, Chisinau:*Diatom vulgare* Bory (β-α – 2.4).

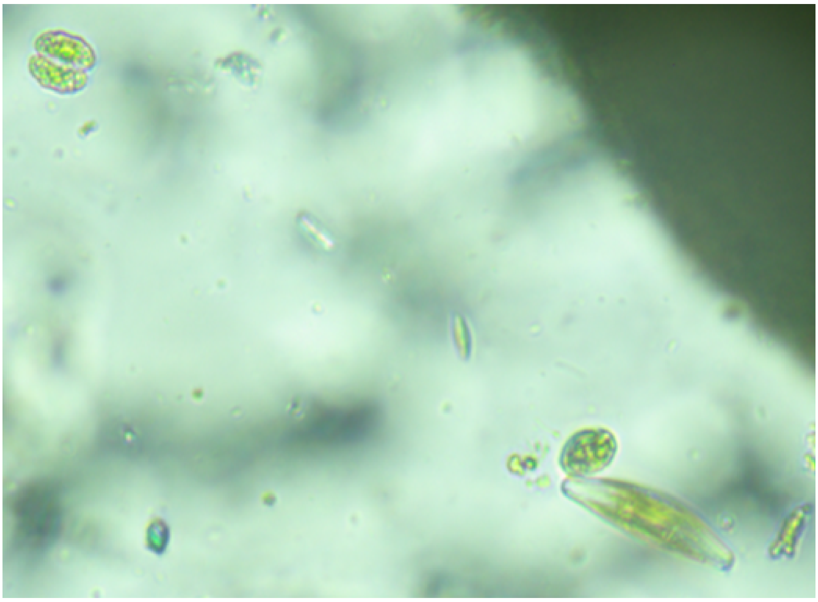

Figure 5. Microscopy of water sample no. 6 taken from Valea Morilor lake, Chisinau: *Navicula sp.*; *Cosmarium venustum* (Bréb.) Archer in Pritchard; *Cymbella parva* (W. Sm.) Kirchn.

Figure 6. Microscopy of water sample no. 6 taken from Valea Morilor lake, Chisinau: *Mougeotia sp.* (o – 1.0).

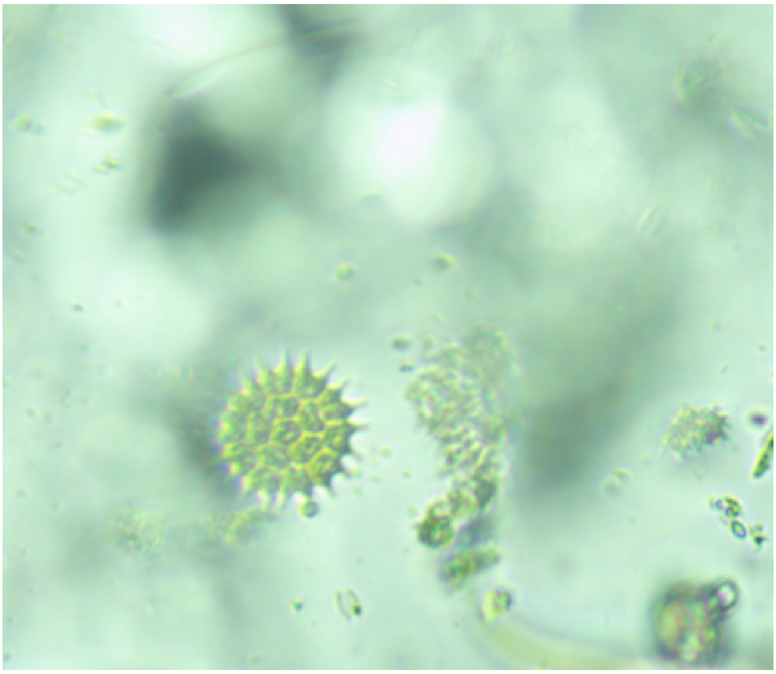

Figure 7. Microscopy of water sample no. 6 taken from Valea Morilor lake, Chisinau: *Pediastrum boryanum* (Turp.) Menegh. (o-α – 1.9).

Bidens tripartita L., etc. Filamentous green algae grow among these plants: *Cladophora glomerata* (L.) Kutz, *Oedogonium sp., Spirogyra sp.*; diatoms - *Nitzschia sp., Cymatopleura sp., Pinullaria sp., Gomphonema sp., Cymbella sp., Rhoicosphenia curvata* (Kutz) Grun, *Achnanthes* sp., while blue algae grow among *Oscillatoria sp., Lyngbya sp*., *Pseudoanabaena catenata* Boecher, etc. [7]. These strips of aquatic plants develop very intensively during the warm period of the year. The constant presence of these species makes them to be true bioindicators of the aquatic environment. If plant species are permanent and directly characterize the respective biotope, it is much more difficult to identify the presence of animal species and especially meso- and microfauna. And at their level, common species are frequently present, which build up the specific biocenosis.

Biological monitoring is an integral part of ecological monitoring, which provides for the supervision of the environment state regarding physical, chemical and biological parameters, by conducting investigations of the communities of microorganisms, plants, fungi and animals. Thus, numerous species of organisms manifest themselves as natural ecosystems bioindicators, responding to the presence of pollutants in the environment through changes in vital functions, or accumulating pollutants in their bodies. Lake pollution indicators can be differentiated into: sensitive species, which indicate the presence of a pollutant by the appearance of lesions or malformations, and accumulating species, which concentrate the pollutant in their body [13]. There is also another category of species, which proliferates and becomes abundant under conditions of intense pollution. Pollution indicators can be of animal, fungal or plant origin, the latter being more numerous [1]. It has been established that algae, mosses and lichens are much more sensitive to the action of pollutants than vascular plants, due to the way they absorb nutrients. The species used as bioindicators in the aquatic environment often reflect the trophic situation of the respective environment [8].

For the normal development of the fish in this water basin, it is necessary to take into account a series of conditions:

- the volume of water;
- surface-depth ratio;
- the level of eutrophication (pollution with organic substances) of the aquatic objective;
- the biological productivity of the aquatic objective;
- the chemical composition of the water.

The biological characteristics of water allow it to constitute the vital environment of a whole chain of aquatic organisms, from bacteria and algae to fish. Water is the carrier of biological substances for most organisms. Under the influence of solar energy, the microorganisms in the water at the bottom of the pond mineralize the organic substances that enrich the water following the destruction of bacteria, algae and other hydrobionts, the water being enriched in biogenic elements and mineral salts. When the oxygen concentration is satisfactory, bacteria decompose organic substances into carbon and hydrogen, transforming them into carbonic acid and water; nitrogen from albumin into urea and ammonia. The increased concentration of dissolved oxygen in the lake is due to the presence of algae, which produce oxygen during the day in the process of photosynthesis and consume it at night, causing the fish to suffocate. The Environment Agency, following the laboratory analyses, communicates that this case is a specific one for these freshwater bodies, characterized by the process of water eutrophication (water greening), which leads to an unwanted disturbance of the balance of the organisms present in water and on water quality, especially, by increasing or enriching the organic mass in standing waters.

An important problem is the biological purification of stagnant waters, based on the activity of various organisms, which, following their vital activity, use some pollutants, and oxidize others with the participation of oxygen which is emitted together with photosynthesis. An important component of this system is bacteria and algae. Bacterial and algal metabolism represent important biological processes that ensure the degradation of organic substances of pollutants together with water purification [6].

On one hand, the development of algae has an important role in the process of biological purification of aquatic objects, on the other hand, algal biomass can be used in the nutrition of invertebrate animals, which represents the initial step of the trophic pyramid. Algae studies have shown that green algae, diatoms and cyanophytes are in the foreground, due to the purifying activity. Of special interest is the ability of algae to concentrate radioactive elements and various inorganic substances, including heavy metals. Dead cells of algae retain accumulated cations and anions no worse than living cells [7]. Along with the mass development of algae in water basins, the rate of quantitative reduction of pathogenic microorganisms essentially increases. Some green, blue algae and diatoms are antagonists of the influenza virus. Algae can even use synthetic detergents as a source of phosphorus. Some algae destroy saccharides, amino acids, pectins, as well as phenols [10].

There are insignificant changes in the composition and abundance of species belonging to the species communities, which can be attributed to anthropogenic actions on the physico-chemical and hydrobiological indices of water quality. The age structure of the fish communities demonstrates irregularities that can be attributed as anthropic actions on the physico-chemical and hydromorphological indices of the environmental quality. In some cases, the deficit of reproduction or the development of certain species can be found, which manifests itself in the absence of a certain age groups.

Currently, a large amount of waste, plastic, plant debris has accumulated in the lake, among which fish die daily. Dozens of dead fish can be seen floating on the surface of the lake.

Due to the high temperatures that are favorable for the development of bacteria and algae, this fact leads to the so-called "blooming" of the water [5]. Phosphorus and nitrogen concentrations also contributed to this. Phosphorus and nitrogen reach the lake water through small streams. Great danger now appears as a consequence of last year blue-green algae death, because, when they decompose, they absorb the oxygen that is in the water and remove toxins that are harmful to other aquatic life, also causing the death of fish [10].

According to specialists, there is a high concentration of nitrogen in the water, but the exact cause of the fish death is not known yet. Over the course of several years, at the same time, according to specialists, this phenomenon occurs because the water is not

Figure 8. The general appearance of the water in Valea Morilor lake, Chisinau (sample 1, 2): a - vegetable remains and dead fish; b – appearance and quality of water.

sufficiently oxygenated. The content of O2 in water varies from 855 to 140%, compared to the saturation norm, being maximum in the summer period, along with the massive development of algal vegetation. Water mineralization oscillates between 700 and 1070 mg/l. The water of the lake belongs to the category of hydrocarbonate-sulfate-chlorine and hydrocarbonate-chlorine-sulfate from the Mg+K and Mg+Na groups, the pH is slightly alkaline. To solve the problem, the municipal authorities proposed to procure 25 aerators, that would activate in addition to the 13 already existing. Later, the specialists took samples that proved that there is insufficient oxygen in water, which leads to the death of the fish.

Eutrophication contributes to the overgrowth of various species of algae in water bodies. The presence of an increased amount of nutrients in water contributes to the intensification of the process of photosynthesis and cell division, which ensures the exaggerated reproduction of algae [5].

Algae-indicators of saprobity in Valea Morilor lake refer to all 4 self-purification groups: xenosaprobe indicates very clean water; oligosaprobe – slightly polluted water, mesosaprobe – water with medium pollution (betamezosaprobe, in which the content of dissolved oxygen is still high, and alphamesosaprobe, with oxygen deficiency) and polysaprobe – highly polluted (with very little or no oxygen, often rich in ammonia and hydrogen sulfide) (Fig. 1-7).

Figure 9. Fish molting from the Valea Morilor lake, Chisinau (taking samples 3, 4): a - dead fish; b – appearance and quality of water.

Water pollution occurs due to a large concentration of chemical or biological waste that reaches the lake. It is dangerous, posing a great threat to human health.

Some of the most common problems faced by fish species are: insufficient oxygen and organic pollution, thermal pollution, pollution with persistent synthetic compounds, etc. For this, all species characteristic of the habitat type that exploit natural resources in a similar way are taken into consideration, grouping them according to: mode of nutrition, reproduction, tolerability to alternation of environmental gradients, etc. (and serving as input data in the bioindication process); the functional approach - treated through the prism of biochemical, physiological processes, etc. [9].

Due to the recent high temperatures, primary production is increasing. At higher temperatures there is an inhibition of photosynthesis, followed by the quantitative decrease of phytoplankton and primary production, which often leads to the mass death of zooplankton. Also, high water temperatures lead to a decrease in the content of dissolved oxygen in the water, which in turn can cause the death of a large number of fish. Each species is characterized by a thermal interval, having a lower and an upper limit between which the specific life of the group takes place. Within this range, usually wider, there is an optimum value, always narrower, in which the respective species develops best. Most of the fish species in our waters are eurythermic, withstanding water temperature variations between 0°C and 30-35°C [13].

Aquatic microorganisms are good indicators because they spend all or most of their lives in water, are found in areas where conditions allow their survival, are easy to collect, differ in tolerance to the amount and type of pollution, and are easy to identified in the laboratory. They are good monitoring indices because they live more than a year, have low mobility and are integrators of environmental conditions.

Figure 10. Water sampling points 5, 6 (a, b).

Algae have long been applied as indicators of the state of the aquatic environment and of pollution sources of a water body [6]. As biological indicators, unicellular algae have a number of advantages over other microorganisms. Due to the life cycle, they quickly adapt to the polluted environment or leave life. Identifying correctly the species and appreciating the composition of algocenoses and their population in different water basins, algae serve as reliable witnesses of the quality of the environment. Algal species populations and their communities react quickly to the changes in the chemical composition and other characteristics of the aquatic environment. Diatom algae have the ability to concentrate in their cells heavy metals and radioactive substances from water [5, 14].

In this case, the fish are an indicator of the entire ecosystem, including the presence of species, age characteristics, abundance and their physiological state. Fish are good indicators because they live in water all their lives, differ in tolerance to the intensity and types of pollution, live for many years and are easy to identify in the field. Individuals and populations of fish generally remain in the same area throughout the summer season; communities are persistent and quickly recover from disturbances in the aquatic environment. Fish represent a very broad spectrum of tolerance from very sensitive to extremely tolerant and show specific responses to chemical, physical and biological degradation of water [9].

If no biological cleaning actions are taken, the lake from Valea Morilor Park in the capital city will turn into "dead water".

The sources of water pollution are varied and can be grouped into:

(1) demographic, dependent on the number and activity of the population in a certain area, being directly proportional to pollution;
(2) urban planning, corresponding to the development of human communities, which use large amounts of water and produce a large volume of waste water;
(3) industrial, dependent on the level of economic, industrial and agricultural development of a region, in the sense of increasing pollution parallel to the intensification of industry [4]. Another problem is micro-plastic pollution, particles that cannot be seen with the naked eye, being also contained in hygiene and washing products.

This micro-plastic ends up in water with discharge of waste water. Pollution also occurs through plastic bags that end up in water bodies.

Currently, water quality assessment based only on physico-chemical parameters does not always provide complete information on the effects of pollution on aquatic organisms or on the health status of the respective ecosystem. The representatives of the Laboratory for Water Quality within the Environment Agency took water samples from the lake in Valea Morilor park in order to determine the quality of the surface water, according to the analysis indices - pH, dissolved oxygen (O2), suspended matter (MS), consumption chemical oxygen (CCO-Cr), biochemical oxygen consumption (CBO5), ammoniacal nitrogen (N/NH4), nitrites (NO2), nitrates (NO3), total phosphorus (Ptotal). According to the physical-chemical test report, the water of the lake is attributed to the IV quality class (polluted, according to the environmental quality requirements for surface waters, regulated in the Decision of the Government of the Republic of Moldova no. 890 of 12.11.2013, Annex no. 1) [4].

The effect of the influence of heavy metals on hydrobionts, from the necessary and vitally important concentration to the toxic and even lethal concentration, can be in a very narrow range of values, moreover, some and the same concentrations can be optimal for a group of hydrobionts and lethal for another. The same concentration can have special effects in different aquatic ecosystems, even in the same ecosystem, but in different circumstances of environmental parameters (water hardness, pH, dissolved oxygen, presence of antagonistic or synergistic elements, temperature, etc.) [13].

In most cases, in the natural aquatic ecosystems of the Republic of Moldova, we are faced with sub-lethal concentrations of pollutants (with the exception of the observed stichinic cases where the large amount of pollutants and the short time of diversion cause catastrophic ecological conditions). Namely, these negative changes, which give "at first glance" invisible reactions and appear at various levels of organization, must be promptly identified and correctly interpreted. Particular attention in the monitoring process is given to the action of toxicants on the fish fauna. If an ecosystem is subjected to multiple chemical stressors, the indicator species approach is difficult because they respond differently to different sets of stressors [4].

The species used as bioindicators in the aquatic environment are unique environmental indicators to the extent that they provide a signal on the biological condition in the aquatic environment. Using bioindicators as an early way to detect pollution or ecosystem degradation can help to maintain critical resources. Although the term indicator species is frequently used, it is somewhat inappropriate, as indicators are actually groups or types of biological resources that can be used to assess the state of the environment [2].

The estimation of the quality of the environment can be carried out not only on the basis of species hypersensitive to the modification of environmental factors, but also by the presence in the hydrobiotope of some species resistant to pollution, their abundance serving as an indicator of the unfavorable ecological state. Thus, the phenomenon of bioinvasion can serve to evaluate the quality of aquatic ecosystems. Pollutants affect aquatic organisms and primarily act on the diversity, structure and production capacity of phytoplankton. In the conditions of high toxicity, but with a sublethal effect, there is a decrease in the numbers of all age groups, only tolerant individuals with a slow growth rate are selected (for example in the intensely polluted areas of the lake) [11]. Under the conditions of high concentrations of nutrients and high temperatures in the water basins of the municipality of Chisinau, the rapid multiplication of algae species from the genera Anabaena, Aphanizomenon, Oscillatoria, Microcystis, Euglena, Trachelomonas etc., which sometimes causes the phenomenon of "water blooming" [3].

Phytoplanktonophagous fish are used to combat the "water bloom" phenomenon. Thus, the inclusion of algal biomass in the nutrition of phytoplanktonophagous fish becomes useful for the functionality of the ecosystem, reducing the negative risks caused by this phenomenon. A biological, effective and harmless method of preventing this dangerous phenomenon is the breeding of the blood carp, also called the silver carp (*Hypophthalmichthys molitrix*). Due to its very fine gill filter, it can retain particles of 0.35-0.45mm, mostly formed by planktonic algae from all categories, including cyanophytes, zooplankton and organic detritus. Thus, the inclusion of algal biomass in the nutrition of phytoplanktonophagous fish leads to the reduction of fish asphyxia, caused by the phenomenon of "water bloom" [5].

Macrophytes are also beneficial to lakes because they produce oxygen, are a source of food for certain organisms, provide substrate for aquatic invertebrates and camouflage for fish. A lake without macrophytes suggests a reduction in fish populations, or water quality problems as a result of excessive turbidity, the presence of pollutants. Macrophytes are excellent indicators of aquatic ecosystems because they react to nutrients, toxic contaminants, metals, herbicides, turbidity and water level [2].

Many researchers have tried to use these structural indices as tools for monitoring and evaluating the state of ecosystems, because they express some quantitative ratios and some grouping relationships between the species of a biocenosis that, thus, allow a more complete and correct characterization of the structure and role of different species in the biocenosis activity, as well as the comparison of the biocenoses with each other (in our case, the ichthyocenoses).

Aquatic ecosystems are particularly affected by chemical stress due to the tendency of pollutants to distribute themselves homogeneously and rapidly in the active mixing zone. Under these conditions, changing the chemical characteristics of the environment will eliminate some sensitive species and will favour others that are more toxic-resistant. Chemical stress can be expressed by the replacement of "more competitive but more sensitive" species by stress tolerant species. In some cases, a true "blooming of opportunistic species" may occur, which are normally excluded or are marginalized by competition or predation. In the current ecological conditions, when the anthropic pressure is continuously maintained on natural aquatic ecosystems, demonstrating an already chronic character, and the most noticeable changes are those at the level of the ichthyocenosis structure.

The use of bioindicators in ecological forensic expertise is motivated by the direct determination of biological effects, synergistic or antagonistic effects of multiple pollutants on an organism, allowing the rapid recognition of the effect that the pollutant has on organisms, including humans, and the relatively low cost compared to other methods. Bioindicators are differentiated into accumulation bioindicators (they store pollutants without manifesting metabolic changes, accumulative indicators are often considered biomonitors) and response bioindicators (they react through cellular changes or visible symptoms even to small amounts of substance) [12].

In order to obtain a more complete picture regarding the state of water quality, the evaluation must also be extended to the biological components that can store information at a structural and functional level, in time and space, etc. [11]. It is almost impossible to achieve an integrated monitoring of abiotic and biotic parameters even in the simplest structured ecosystem, therefore, one of the most important objectives is to replace, as efficiently as possible, the complicated, painstaking, too expensive and often time-consuming measurements with "delayed effect" with long-term research. Various groups of living things (from bacteria to mammals) are used to monitor the health of the environment and investigations are carried out at different levels of integration and organization of life (from intracellular to supra-population). The ecobiological indication of water quality allows the express assessment of the level of pollution of the aquatic environment, presenting an advantage for forensics in the framework of ecological forensic expertise that requires a quick assessment [12]. The rapid assessment of the quality of the aquatic environment is becoming more and more effective and current.

4. Conclusions

Based on the results of scientific research, it should be noted that the risk of pollution of the lake in the Valea Morilor park admits that human activities can generate certain forms of modification of this ecosystem through these activities and the storage of waste (from construction, housekeeping, etc.), affecting considerably flora and fauna. This environmental degradation represents both a disaster risk factor and a cause for increasing the vulnerability of plant, animal and microorganism communities. The numerical increase of algae species in the lake indicates a drastic risk of pollution in recent years.

Through their vital activity, planktonic algae contribute to the biological productivity of aquatic ecosystems, regardless of whether the percentage of participation in it is high or low, and they constitute a part of animal food at different trophic levels. The study of phytoplankton photosynthesis intensity is necessary for estimating the biological productivity of aquatic ecosystems, determining the legitimacy of biotic transformations of matter and energy, and developing recommendations for the rational exploitation of aquatic ecosystems. In biomonitoring systems, planktonic algae play a special role as bioindicators with a high sensitivity to physico-chemical changes in the environment and the degree of organic loading. Currently, the self-purification index is increasingly used to determine water quality - the ratio of gross primary production to the summary destruction of plankton.

Pollutants have a direct negative influence at various levels of integration and organization of life from the molecular to the organismic level - growth retardation, various forms of pathologies, the reduction of reproductive capacity up to the death of the organism and the definitive disappearance of sensitive species. Thus, water pollution decreases the longevity of living organisms (flora, fauna) and leads to the disappearance of species in large proportions or to the disappearance of the entire ecosystem.

Currently, the express control of the quality of the aquatic environment, by means of ecobioindicator organisms, is becoming more and more current, in connection with the diversification and increasing dimensions of the changes taking place in nature. The use of eco-bioindicator objects has several advantages over the technical, chemical and organoleptic methods of assessing the state of the biological components of ecosystems.

References

[1] Begu, A. Ecobioindicaţia - metodă eficientă în monitorizarea calităţii mediului, *Mediul Ambiant*, Chişinău, 2005, special edition, p. 45-49. 3.

[2] Malacea, I. *Biologia apelor impurificate.* Ed. Acad. Române, Bucureşti, 1974, p. 246.

[3] Nedbaliuc, B.; Pelin, V.; Druţa, C.; Ivanov, L. Utilizarea bioindicatorilor în supravegherea ecosistemelor acvatice în condiţiile mun. Chişinău. In.: *Materialele Conferinței "Instruire prin cercetare pentru o societate prosperă"* Vol.1. 2020. Chişinău. p. 114-116. ISBN 978-9975-76-307-3.

[4] *Starea Mediului în RM în anul 2004* (Raport Naţional), Chişinău, 2004, p. 154. 2.

[5] Şalaru, V.; Şalaru, V.; Melnic, V. Fenomenul „înfloririi" apei şi solului – aspecte ecologice şi economice. *Revista Botanica*, Vol.III, Nr.3, Chişinău, 2011. p. 20-28.

[6] Tumanova, D. Algele planctonice – indicatoare a calităţii apei fluviului Nistru. *Buletinul AŞM. Seria „Ştiinţele vieţii"*. 2016, 2 (329), p. 95-102.

[7] Баринова С. С., Медведева, Л. А., Анисимова, О. В. Биоазнообразие водорослей-индикаторов окружающей среды. Тель Авив: PiliesStudio, 2006, 498 с.

[8] Баринова С.С., Медведева Л.А., Анисимова О.В. Водоросли индикаторы в оценке качества окружающей среды. Москва, ВНИИ Природы, 2000. с. 1-150.

[9] Кожокару Е. В., Пояг М. А., Рыбохозяйственное использование водных ресурсов Молдавии, Кишинев, 1973, 208с.

[10] Кузьменко М. И., Миксотрофизм синезеленых водорослей и его экологическое значение, Киев, Наук. Думка, 1981, с. 212.

[11] Ленова Л. И., Ступина В. В., Водоросли в доочистке сточных вод, Киев, Наук. Думка, 1990, с. 184.

[12] Майорова Е.И., Омельянюк Г.Г. Экспертные ошибки при производстве судебно-экологической экспертизы// Судебная экспертиза: типичные ошибки/ под ред. Е.Р. Росинской, 2012., стр. 413-424.

[13] Руководство по методам гидробиологического анализа поверхностных вод и донных отложений. Ленинград: Гидрометеоиздат., 1983. с. 78-112.

[14] Шаларь В. М., Обух П. А., Росеро Э., Особенности развития фитопланктона в водоемах окрестностей г. Кишинев, Иссл. экол., флорист. и физиол. растений Молдавии, Кишинев, Штиинца, 1988, с.3-43.

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