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Hydroecological indicators of Lake Bolshoy Sarykol, Karaganda region

Abstract. *The work studied the general ecological state of Lake Bolshoy Sarykol in the east of the Abay district of Karaganda region. Morphometric measurements of the reservoir, studies of samples for hydrochemical composition, composition of bottom sediments, diversity and quantitative indicators of coastal aquatic vegetation, diversity and quantitative indicators of phyto- and zooplankton, benthic organisms and fish populations were carried out. The results of studying the content of sulfates in bottom sediments and mobile sulfur indicate active sulfate reduction. According to hydrological data, the lake of the steppe zone Bolshoy Sarykol is experiencing its high-water period. The water in the lake is slightly brackish, sodium-hydrocorbanate-chloride type, the acidity is neutral, slightly alkaline without harmful impurities, favorable for fishery reservoirs. The species diversity of Lake Bolshoy Sarykol is mainly represented by widespread species of planktonic and benthic organisms, nekton and determines the mesotrophic type of trophism, as well as the β-mesosaprobic type of eutrophication. The results of the work can be useful for the development of measures and recommendations aimed at the rational use and protection of water resources in the Karaganda region, since the studied water body is a typical lake for this region.*
Keywords: *reservoirs, phytoplankton, zooplankton, zoobenthos, fish population, trophicity, saprobity.*

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Introduction

Karaganda region belongs to the small lake territories of the Republic of Kazakhstan. There is 0.27 km² of water surface per 100 km² [1,2]. The water resources of the region are a dynamic system that depends on many environmental factors and hydrological processes. In recent decades, in the Karaganda region there have been forecasts for climate trends, such as average annual temperature and changes in precipitation patterns, which can significantly affect the water balance of existing lakes [3]. This situation with climatic factors, as well as increased economic activity, also affects the general environmental characteristics of surface waters. The main source of nutrition for the lakes is winter precipitation. Lakes and rivers in the territory are subject to periods of severe water scarcity and eutrophication; therefore, environmental monitoring of surface waters is an urgent task for ecologists, hydrologists and water management specialists [4,5].

The purpose of this work was to study the ecological state of Lake Bolshoy Sarykol, which is a subject of fishery activities in Karaganda region. This water body is a typical type of water resource for Karaganda region, in particular, this is due to environmental factors common to the region, hydrological conditions, and similar species diversity.

The results of the work can be useful for the development of measures and recommendations aimed at the rational use and protection of water resources.

Objects of research

To obtain initial data, an ecological survey of Lake Bolshoy Sarykol, which is located in the east of the Abay district of Karaganda region, 60 km southwest of Karaganda (15 km southwest of the village of Suyuksu N 49° 28′ 40″, E 73° 42′ 17″), was conducted in the period from 09.08.2022 to 12.10.2022). Fish are caught in the lake, and the lake is also used for watering livestock.

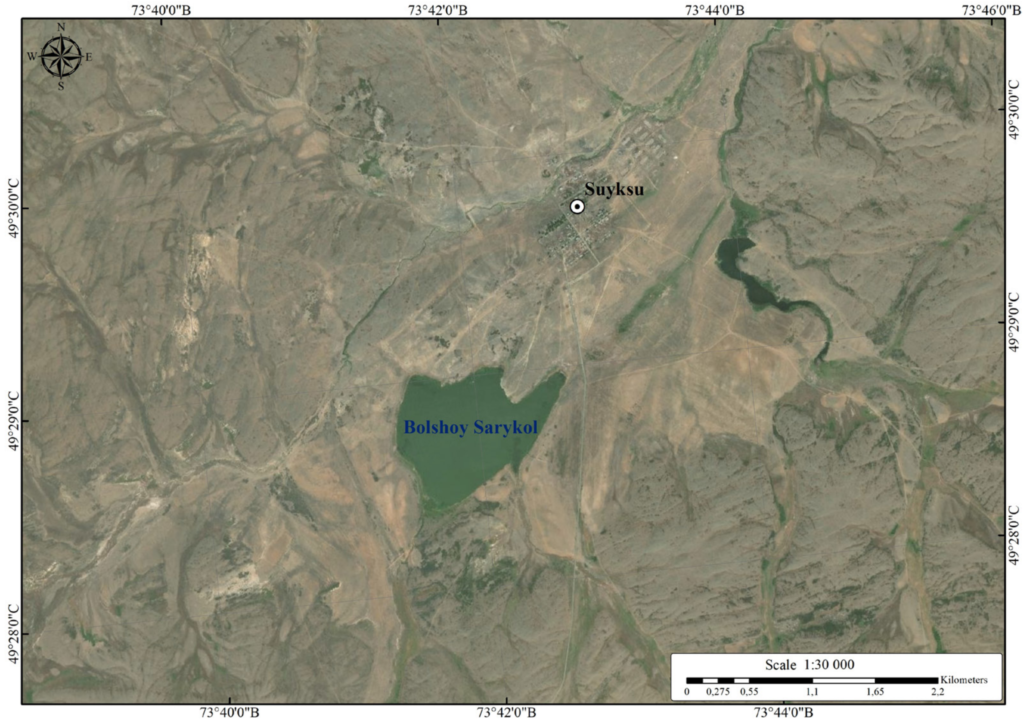

Figure 1. Bolshoy Sarykol Lake

Materials and methods

To measure the depth of the reservoir, a lot was used, transparency was determined using the modified Seki method.

The content of oxygen and carbon dioxide was determined using the iodometric method according to Winkler. Water from the lake and bottom silt sediments were studied for their chemical composition in laboratory conditions using atomic absorption analysis methods on the atomic absorption spectrometer AA-140 (ST RK ISO 8288-2005). Regulatory documents GOST 26951-86, GOST 26205-91, GOST 26490-85, GOST 26213-91, GOST 26483-85, GOST 26424-85, GOST12536-2014, GOST 12536-2014, GOST 26423-85, ERD F 16.1:2:2.2:2.3.74-2012 (KZ.07.00.03091-2015) were used for analysis. [6,7,8,9].

Samples of phytoplankton, zooplankton and zoobenthos were collected from the lake [10]. The species diversity, total number and biomass of planktonic organisms were determined, the composition of the fish population was studied, and an assessment of feeding capacity of the reservoir for the fish population was given.

Samples for studying planktonic organisms were selected using an Apstein net by filtering 100 liters of water through the net. Samples were fixed with 40% formalin solution and thickened. The concentration of phytoplankton was carried out using the sedimentation method [11].

Species identification was carried out with the help of determinants using an Olympus CX-31 microscope. The number of cells was counted in Goryaev's counting chamber; the biomass was calculated by summing the biomass of individual populations. Species identification of macrophytes was carried out visually on site.

The study of ichthyofauna was carried out using fixed fishing nets. Fish were caught using standard single-wall nets 10 meters long with mesh sizes of 10, 26, 40 and 60 mm. Networks of different sets (pits) were arranged according to the following scheme - 2 networks parallel and 2 perpendicular to each other. The nets were installed for a period of one day [12].

Identification and counting of plankton organisms under MBS-10 and MSX-300 microscopes was carried out in laboratory conditions. When identifying their species composition, determinants were used [13,14,15]. Zooplankton organisms were calculated in a certain part of the sample in the Bogorov chamber, followed by viewing half of its volume or the entire remainder to identify large and rare individuals. When calculating the individual weight of zooplankton species, linear-weight dependence equations were used [10,11]. The number of individuals and the weight index of all identified species were summarized further by the main groups of organisms and the community as a whole. The number and mass of zooplankton were calculated per 1 m3 of water column.

Benthic samples were taken using a scraper with a grip of 1.0 m^2, washed in sieves with different meshes. Benthic organisms were placed in 90% ethanol. To determine the number of organisms, they were placed in a Petri dish, the forms identified during the calculation were distributed into systematic groups and, after preliminary drying, were weighed in buckets on analytical scales. The determination of abundance and biomass was carried out according to the methodological recommendation [10,11]. The determination of taxonomic units was carried out according to generally accepted determinants [16,17,18,19,20,21,22]. The feeding capacity of the reservoir was determined according to S. P. Kitayev [23].

The Pantle and Bucca method for assessing water quality by phytoplankton.

The water quality was determined by the method of indicator organisms of Pantle and Bukka using the formula:

$$S = \frac{\sum(sh)}{\sum h}$$

Where, s - indicator significance of each species (determined from the lists of saprobic organisms, h - a value that is from the six-step scale of frequency values and determines the relative number of species. The saprobity index was calculated with an accuracy of 0.01.

The gradations of the saprobity index and the corresponding water contamination were determined according to the established pattern:

<1 - xenosaprobic zone "very clean";

1.0-1.5 - oligosaprobic zone, "clean";

1.51-2.5 – β-mesosaprobic zone. "moderately polluted";

2.51-3.5 – α-mesosaprobic zone. "polluted";

3.51-4.0 - polysaprobic zone, "dirty";

>4 – hypersaprobic zone, "very dirty".

Research results

Lake Bolshoy Sarykol is located in a depression between low hills. The height above sea level is 689 m. The shores of the lake are flat, the bottom is silted, the silt is black. Main types of soil are red and gray loam, in some places it is gray sandstone. The hydrological characteristics of Lake Bolshoy Sarykol at the time of the study are represented by the following indicators: the lake has an area of 0.75 km2, the length of the lake is 1.5 km, the width is 1.0 km, maximum depth of the lake is 5 m, average depth is 2.2 m, the volume of water mass is 2.7 million m3, the catchment area is 12 km2. The catchment area is in economic use: partially plowed, and also for grazing. The main nutrition of the lake is due to snow water and groundwater. There are no signs of drying up of the lake, but according to local residents, the water level dropped sharply in some years and the coastline was reduced to 10 meters. Considering that the shallow lake of the steppe zone retains its depth in summer with a large occupied territory, the lake is experiencing its high-water period. Thickets of coastal aquatic vegetation occupy about 40 hectares.

Hydrochemical studies

Chemical analysis of water samples in Lake Bolshoy Sarykol is given in Table 1. The water in the lake is drumly, slightly yellowish in color, without unpleasant odors. Low water transparency may indicate the massive development of small hydrobionts. No films of petroleum products, oils, fats or accumulations of other harmful impurities were found on the surface of the water. The water temperature during the studied period ranged from 3 to 26°C.

The water in the lake is slightly brackish, sodium-hydrocarbonate-chloride type, acidity is neutral, slightly alkaline (pH - 7.5). This indicates water mineralization and the absence of waterlogging processes.

Table 1

Results of analyses of surface water samples in Lake Bolshoy Sarykol

№	Chemical composition of the reservoir	Concentration
1	Na	0.724 g/l
2	K	0.028g/l
3	Ca	0.112 g/l
4	Mg	0.041 g/l
5	HCO_3	0.42 g/l
6	CO_3	0.05 g/l
7	SO_4	0.54 g/l
8	Cl	0.66 g/l
9	Fe	0.052 g/l
10	Hg	no
11	Pb	no
12	pH	7.5
13	O_2	8.8mg/l
14	CO_2	11.2mg/l
15	Rigidity	5.4 units w
16	Transparency	0.6 m.
17	Dry residue	2.3 g/l
18	Biochemical oxygen consumption for 5 days BOC_5	1.5 mg O_2/dm^3

In summer, the content of oxygen dissolved in water should be at least 6 mg/dm3 in fishery water bodies, and 8.8 mg/l in Lake Bolshoy Sarykol. The content of carbon dioxide, BOC5 is also normal: 11.2 mg/l and 1.5 mg O2/l, respectively. Thus, the water is quite well saturated with oxygen, while the carbon dioxide content is not high. Water of medium hardness 5.4 units w. Heavy metals mercury and lead were not detected. In general, the hydrochemical composition of water and the acid-base balance are favorable for fishery reservoirs [24].

Analysis of the composition of bottom sediments

The comparative distribution of determined components in the water body of Lake Bolshoy Sarykol is given in Table 2.

Table 2

Main indicators of soils of former bottom sediments

№ s/n	Name of indicators, unit of measurement	Actual test results, unit of measurement	Exceeding MPC
1	2	3	4
1.	Nitrate nitrogen, mg/kg	4.00	low
2.	Mobile phosphorus, mg/kg	43.38	increased
3.	Mobile sulphur, mg/kg	99.08	increased
4.	Humus, %	5.19	low
5.	Mobile potassium, mg/kg	557.3	increased
6	Dissolved iron, µg/l	240	-
6.	pH (KCl)	7.01	neutral
7	Calcium in aqueous extract mEq/100g	11.75 (0.235%)	-
8.	Magnesium in aqueous extract, mEq/100g	2.00 (0.0244%)	-
9.	Sodium, mEq/100g 100г	7.62 (1.75%)	-
10.	Chlorides mmol/100g	2.2 (0.0781%)	-
11	Sulfates, mmol/100g	4.1 (0.197%)	-
12.	Specific electrical conductivity, mS/cm	1980	-
13.	Carbonates in aqueous extract, mEq/100g	Not detected	-
14.	Hydrocarbonates in aqueous extract, mEq/100g	166.9 (10.2%)	-
15	Dense water extract residue	1.212%	-
16.	Soil organic carbon	1.16%	-

In general, bottom sediments have a neutral environment. The sediment samples are saline, the type of salinity is soda, and there is little humus. One can note the high potassium content in the bottom sediments – 557.3 mg/kg and the increased phosphorus content of 43.380 mg/kg. No high content of nitrates was found in the bottom sediments of reservoirs. The average content of sulfates in the bottom sediments of this reservoir was 4.1 mmol/100g. At the same time, the concentration of mobile sulfur was 99.08 mg/kg. This indicates active sulfate reduction [25].

Hydrobiological studies

Hydrobiological studies

On Lake Bolshoy Sarykol, coastal aquatic plants are represented by common reed (*Phragmítes australis*), which forms mosaic-thicket and border overgrowths there. The narrow-leaved cattail (*Typha angustifolia*) is represented by sporadic clumps, reeds are absent, sedges (*Cārex*) are found in single specimens. Submerged vegetation: canadian elodea (*Elodea canadénsis*), spiky urut (*Myriophýllum spicátum*), submerged hornwort (Ceratophýllum demérsum) and comb pondweed (*Stuckenia pectinata*) are distributed in small thickets.

A total of 30 phytoplankton species were identified in the sample of Lake Bolshoy Sarykol: diatoms from the *Bacillariophyta* department: *Amphora ovalis Kütz; Cymbella sp; Cyclotella sp; Diatoma ehrenbergii* Kützing; *Chaetoceros wighamii* Bright; *Fragilaria sp; Gyrosigma attenuatum* Kuetz.; *Melosira sp; Navicula rhynchocephala* Kuetz., *Stephanodiscus astraea Ehr.; Pinnularia sp;*

Synedra sp; Tabellaria sp, from the Department of *Chlorophyta* – green algae: *Chlorella vulgaris* Krauss; *Crucigenia tetrapedia* Kirchner; *Lagerheimia sp; Monoraphidium sp; Oocystis; Pediatrum sp; Scenedesmus longus* Meyen; *Schroederia* Lemmermann; *Spirogyra maxima* Hassall; *Treubaria triappendiculata* C.Bernard;, from *Cyanophyta* Department - blue-green: *Aphanizomenon gracile* Lemmerm.; *Gomphosphaeria aponina* Kütz; *Microcystis aeruginosa* Kütz; *Oscillatoria chalybea* Mertens; *Oscillatoria proboscidea* Gomont; from *Xanthophyta* Department - yellow-green: *Tribonema viride Pascher;* from the Department *Euglenophyta* – euleng algae: *Lepocincli sp;*

The most common species were *Cyclotella sp., Melosira sp., Stephanodiscus astraea* Ehr., *Aphanizomenon gracile* Lemmerm., *Microcystis aeruginosa* Kütz.

Table 3

Species diversity and frequency of occurrence of identified phytoplankton species in Lake Bolshoy Sarykol

No.	Species	Indicative significance	Relative occurrence
	Bacillariophyta – diatoms		
1	*Amphora ovalis Kütz*	1	3
2	*Cymbella sp*	2	4
3	*Cyclotella sp*	2	3
4	*Diatoma ehrenbergii* Kützing	2	2
5	*Chaetoceros wighamii* Bright	2	3
6	*Fragilaria sp*	2	4
7	*Gyrosigma attenuatum* Kuetz	2	2
8	*Melosira sp*	2	5
9	*Navicula rhynchocephala* Kuetz	2	5
10	*Stephanodiscus astraea* Ehr.	2	5
11	*Pinnularia sp*	1	1
12	*Synedra sp*	2	4
13	*Tabellaria sp*	1	2
	Chlorophyta – green algae		
14	*Chlorella* vulgaris Krauss	3	3
15	*Crucigenia tetrapedia* Kirchner	2	1
16	*Lagerheimia sp*	3	2
17	*Monoraphidium sp*	1	1
18	*Oocystis sp.*	2	3
19	*Pediastrum sp*	2	2
20	*Scenedesmus longus* Meyen	2	4
21	*Schroederia* Lemmermann	2	1
22	*Spirogyra maxima* Hassall	2	5
23	*Treubaria triappendiculata* C.Bernard	2	1
	Cyanophyta – blue- green algae		
24	*Aphanizomenon gracile* Lemmerm.	2	5
25	*Gomphosphaeria aponina* Kütz	2	4
26	*Microcystis aeruginosa* Kütz	2	4
27	*Oscillatoria chalybea* Mertens	3	2
28	*Oscillatoria proboscidea* Gomont	2	3
	Xanthophyta - yellow-green algae		
29	*Tribonema viride* Pascher	2	3
	Euglenophyta – euglen algae		
30	*Lepocincli sp*	2	1

The studied water in Lake Bolshoy Sarykol was assigned to the β-mesosaprobic zone (Table 4). Thus, the studied water body tends to eutrophicate water, which means it has a low self-purifying potential.

In addition, in terms of the total number of phytoplankton, the trophicity of the selected territories is mesotrophic, since it is in the range from 3.85-20 million cells/l.

Table 4

Quantitative indicators of phytoplankton in a water body

Indicators	Bolshoy Sarykol
Total number of phytoplankton (thousand cells/cm^3)	12.19
Total biomass mg/dm^3	3.21
Saprobity index	2.0

9 species of invertebrates have been identified among zooplankton. 10 species have been identified from *Rotifera* kolovpes: *Brachionus urceus* Linnaeus, *Cephalodella sp.*, *Synchaeta cecilia* Rousselet, *Aslanchna girodi* Guerne, *Lecane luna* Muller, *Euchlanis dilatata* Ehrenberg, *Trichocerca elongate* Gosse, *Trichothria pocillum* Muller, *Testudinella patina intermedia* Anderson, *Keratella quadrata* Muller. 5 species of *Daphnia cucullata* Sars, *Diaphanosoma orghidani* Negrea, *Alona costata* Sars, *Bosmina longirostris* Muller, *Pleuroxus aduncus* Muller have been identified from branched crustaceans of Cladocera. Copepoda copepod crustaceans in the lake are represented by 4 species of *Nitocra lacustris* Schmank, *Eurytemora affinis* Poppe, *Eucyclops macrurus* Sars, *Paracyclops affinis* Sars.

Table 5

Species diversity and frequency of occurrence of identified zooplankton species in Lake Bolshoy Sarykol

No.	Species	Indicative significance	Relative occurrence
	Rotifera		
1	*Brachionus urceus* Linnaeus	1	3
2	*Cephalodella sp.*	3	3
3	*Synchaeta cecilia* Rousselet	1	2
4	*Aslanchna girodi* Guerne	1	1
5	*Lecane luna* Muller	2	5
6	*Euchlanis dilatata* Ehrenberg	2	4
7	*Trichocerca elongate* Gosse	1	1
8	*Trichothria pocillum* Muller	2	5
9	*Testudinella patina intermedia* Anderson	2	5
10	*Keratella quadrata* Muller	3	3
	Cladocera crustaceans		
11	*Daphnia cucullata* Sars	3	2
12	*Diaphanosoma orghidani* Negrea	2	4
13	*Alona costata* Sars	1	2
14	*Bosmina longirostris* Muller	3	2
15	*Pleuroxus aduncus* Muller	2	5
	Copepoda		
16	*Nitocra lacustris* Schmank	2	3
17	*Eurytemora affinis* Poppe	2	3
18	*Eucyclops macrurus* Sars	1	2
19	*Paracyclops affinis* Sars	1	2

Identified species of zoobenthos: from the crustaceans *Gammarus lacustris*, from the mollusks *Planorbis complanata* Draparnaud, *Pl.contortus* Rudolphi, *Pl.planorbis* Muller, *Sphaerium corneum* Linnaeus, *Valvata piscinalis* Müller, *Lymnaea auricularia* Linnaeus, *Pisidium casertanum* Poli, *Sphaerium solidum* Normand. From insect larvae *Chaoborus sp., Hydroporus sp., Rhantus sp., Corixa sp.*

General quantitative indicators of zooplankton are represented in Table 6, from which it can be seen that the total number of species is 8.80 thousand specimens/m^3, biomass is 8.57 g/m^3. The trophic level of the reservoir is β-mesotrophic.

Table 6

Abundance and biomass of zooplankton

Total			Trophic level	Dominant species (groups)
number of species	number, thousand specimen/m^3	biomass, g/m^3		
18	8.80	8.57	S=2.44 β-MT	*Rotifera, Cladocera, Copepoda*

Insects are dominated by numerous hemiptera *Hemiptera sp.*

The dominant species of zoobenthos (Table 7) are *Gammarus lacustris and Hemiptera sp.* The number of zoobenthos was found to be 41 specimens/m^2, biomass 8.34 g/m^2, which also classifies the reservoir as a β-mesotrophic feeding type.

Table 7

Abundance and biomass of zoobenthos

Reservoir	Number, specimens/m^2	Biomass, g/m^2	Trophic level	Dominant species (groups)
lake Bolshoy Sarykol	41	8.34	β-MT	*Gammarus lacustris, Hemiptera sp.*

Thus, the food supply of fish in this reservoir is quite diverse: phyto- and zooplankton, elements of periphyton, neuston, benthic organisms. The level of feeding capacity of the studied reservoir of mesotrophic type. The elements of the necton are represented by four species of fish, river crustaceans and aquatic insects.

Lake Bolshoy Sarykol is home to 4 species of fish: crucian carp, roach, perch and carp, which are of commercial importance.

The species composition of fish on Lake Bolshoy Sarykol is given in Table 8.

Table 8

Fish population of Lake B. Sarykol

№	Species, Russian name	Species, Latin name	Status
1	Roach	*Rutilus rutilus (L.)*	aboriginal
2	Silver crucian	*Carassius gibelio (Bloch)*	aboriginal
3	Carp	*Cyprinus carpio L.*	aboriginal
4	Common perch	*Perca fluviatilis L.*	aboriginal

However, only amateur fishing takes place on the lake, which is determined by the general low fish productivity of the reservoir.

Lake Bolshoy Sarykol is a fairly typical medium-sized body of water for the Karaganda region. According to hydrological parameters, this lake can be classified as a group of lakes which area ranges from 6 km² to 20 km² and an average depth of about 2 m. This group of lakes, unlike many small lakes in the Karaganda region that dry up in the summer, retain water throughout the year, have fishery importance and a similar level of eutrophication. These also include lakes such as Sasykkol, Botakara, Balyktykol, Katynkol, Saumalkol 50°02′56.3″N 75°59′46.2″E, Saumalkol 49°48′47.6″N 74°59′24.0″E, Barakkol, Karaukamys, Kumkol, Toksumak, Karakol.

The lakes we noted may be under threat of degradation due to climatic and anthropogenic factors [26]. Thus, promising preventive measures for the protection of Lake Bolshoy Sarykol, developed on the basis of environmental monitoring, can also be used for the listed reservoirs.

Conclusions

1. Hydrological indicators indicate that the shallow lake of the steppe zone Bolshoy Sarykol is experiencing its high-water period.
2. The water in the lake is slightly brackish, sodium-hydrocorbanate-chloride type, the acidity is neutral, slightly alkaline without harmful impurities, favorable for fishery reservoirs.
3. Salinization and processes of active sulfate reduction are observed in bottom sediments.
4. The species diversity of Lake Bolshoy Sarykol is mainly represented by widespread species of planktonic and benthic organisms, nekton and determines the mesotrophic type of trophism, as well as the β-mesosaprobic type of eutrophication.

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Қарағанды облысы Үлкен Сарыкөл көлінің гидроэкологиялық көрсеткіштері

Аңдатпа. Мақалада Қарағанды облысы Абай ауданының шығысындағы Үлкен Сарыкөл көлінің жалпы экологиялық жағдайы зерттелген. Су қоймасының морфометриялық өлшемдері, гидрохимиялық құрамы, көл түбі шөгінділерінің құрамы, жағалаудағы су өсімдіктерінің сан алуандығы мен сандық көрсеткіштері, фито- және зоопланктондардың, су түбіндегі организмдер мен балық популяциясының алуан түрлілігі мен сандық көрсеткіштері бойынша үлгілерді зерттеу жүргізілді. Су түбі шөгінділері құрамындағы сульфаттарды және жылжымалы күкірттерді зерттеу нәтижелері сульфаттың белсенді тотықсыздануын көрсетеді. Гидрологиялық мәліметтерге сәйкес, далалық аймақ көлі болып саналатын Үлкен Сарыкөл көлі өзінің суы мол кезеңін бастан кешуде. Көлдің суы әлсіз тұзды, натрий-гидрокорбанатты-хлоридті типті, қышқылдығы - бейтарап, аздап сілтілі және зиянды қоспасыз, балық шаруашылығы үшін қолайлы. Үлкен Сарыкөл көлінің түрлік әртүрлілігі негізінен планктондық және бентикалық организмдердің кең таралған түрлерімен, нектонмен және трофизмнің мезотрофиялық, сондай-ақ эвтрофикацияның β-мезосапробты түрімен анықталған. Жұмыстың нәтижелері Қарағанды облысының су ресурстарын тиімді пайдалану мен қорғауға бағытталған шаралар мен ұсыныстарды әзірлеу үшін пайдалы болуы мүмкін, өйткені зерттелетін су объектісі осы аймаққа тән көл болып табылады.

Түйін сөздер: су қоймалары, фитопланктон, зоопланктон, зообентос, трофтылық.

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Гидроэкологические показатели озера Большой Сарыколь Карагандинской области

Аннотация. В работе изучалось общее экологическое состояние озера Большой Сарыколь на востоке Абайского района Карагандинской области. Актуальность исследования вызвана как изменением климатических факторов за последние десятилетия, так и усилением антропогенного вмешательства в гидроэкосистемы. Были проведены морфометрические измерения водоема, исследования проб на гидрохимический состав, состав донных отложений, разнообразие и количественные показатели прибрежно-водной растительности, фито- и зоопланктона, бентосных организмов и рыбного населения. Результаты изучения содержания сульфатов в донных отложениях и подвижной серы свидетельствуют об активной сульфатредукции. По гидрологическим данным озеро степной зоны Большой Сарыколь переживает свой многоводный период. Вода в озере слабо солоноватая, натрий-гидрокорбанатно-хлоридного типа, кислотность - нейтральная слабощелочная без вредных примесей, благоприятная для рыбохозяйственных водоемов. Видовое разнообразие озера Большой Сарыколь представлено главным образом широко распространенными видами планктонных и бентосных организмов, нектона и определяет мезотрофный тип трофности, а также β-мезосапробной тип эвтрофирования. Результаты работы могут быть полезны для разработки мероприятий и рекомендаций, направленных на рациональное использование и охрану водных ресурсов в Карагандинской области, так как изученный водный объект является типичным озером для данного региона.

Ключевые слова: водоемы, фитопланктон, зоопланктон, зообентос, рыбное население, трофность, сапробность.

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