

CURRENT PROBLEMS OF ECOLOGICAL ASSESSMENT OF WATER ECOSYSTEMS IN REGIONS OF UZBEKISTAN

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Abstract:

The article deals with the formation of aquatic ecosystems in the new conditions of existence, which is an important scientific and practical task. The studies were carried out on the lakes Shurkul, Gaukkol, Adzhalikul, which have an important national economic value in the Khorezm region of Uzbekistan. It was found that with an increase in water depth, the content of phosphorus and ammonium nitrogen increases, the content of nitrate nitrogen in the surface horizon (0–70 cm) is greater than in the lower horizon. The stability of the oxygen regime and its deficiency, there are significant daily and seasonal fluctuations. It has been established that active destruction processes are going on in the reservoirs, despite the significant biogenic load.

Keywords: water ecosystems, Khorezm region, monitoring, dynamics, ecology.

Introduction

The Khorezm oasis is located in the lower reaches of the Amu Darya in the northwestern part of Uzbekistan. Its total area is 6,100,000 square kilometers, which is 1.4% of the territory of Uzbekistan. The Khorezm region borders the Republic of Karakalpakstan, Turkmenistan in the south and the Bukhara region of Uzbekistan in the northeast

Currently, land and water resources of the Khorezm region of Uzbekistan amount to 608.2 thousand. Of these, the irrigated agricultural area is 265.9 thousand. hectares The area of pastures for livestock farming is 109.4 thousand. hectares The climate in the Khorezm region is sharply continental, with hot and dry summers and fairly cold winters. In winter, the air temperature can be on average 5–8 °C lower than in the rest of the southern and eastern parts of Uzbekistan. The average annual temperature is +12.0 °C. The absolute minimum temperature was –32 °C, the absolute maximum temperature was +45 °C. On average, the region receives 78–79 mm of precipitation per year (the bulk of precipitation occurs in spring and autumn), the growing season lasts 200–210 days.

Global trends in the deterioration of the environmental situation are also typical for the territory of the Central Asian republics. In the territory of the republics of Central Asia, the processes of degradation of the natural environment have reached regional scales and in a number of places have appeared in the form of crisis situations for humans. Changes in the hydrological regime of aquatic ecosystems lead to a deterioration in their sanitary and environmental indicators, which, in turn, worsens the general ecological situation in the region. Studying the patterns of formation of limnic ecosystems of the Amu Darya delta in new conditions of existence and the problems of their sustainability is an important scientific and practical task, since it allows us to assess and predict environmental changes when creating reservoirs with a controlled water regime.



The purpose of the study is to study the functioning of aquatic ecosystems in the Khorezm region of the Republic of Uzbekistan.

Materials and methods The subject of our research is aquatic ecosystems of important national economic significance in the Khorezm region of Uzbekistan - Lake Ajalikul, Ga ukkul and Shurkol, with different water regimes and nutritional characteristics. The layout of the lakes is shown in Fig. 1.



Figure 1. Layout of the lake: 1 – Gaukkul, 2 – Ajalikul, 3 – Shurkul in the Khorezm region of Uzbekistan

Oz. Shurkul is located in the southwestern part of the Khorezm region in the Koshkupir region. The lake is divided into 2 parts, small streams flow around it. The total land area of Shurkul is 144 hectares. According to information from UNESCO scientific researchers, it has been established that the age of the lake. Shurkul is a little over 100 years old, and sediment is 0.5 cm per year. Age of the lake Gaukkul and Adzhalikul - more than 100 years. Studies of lake cores show an increase in organic matter over time. According to data from 2007–2008, since 1963, when the concentrations of organic matter in the lake were maximum, these concentrations have stabilized, but have not returned to peak values.

Lakes in Xopezma are regulated mainly by irrigation runoff and a small amount of evaporation from groundwater. All three lakes receive surface water from at least one drainage catchment, as well as seasonal direct runoff from neighboring fields. The soils of Khorezm are, as a rule, infertile, which is why fertilizers are widely used. However, despite the leaching of introduced nitrogen fertilizers into groundwater, the supply of nitrogen to Lake Shurkul in most seasons is small, and local agricultural and use is not related to this.

Water samples were taken at different depths, with an interval (in cm): 0–30; 50–70; 80–110; 140–160 and at the bottom of the reservoir. An “ES 300” apparatus was used to measure the water temperature. Indicators were also determined characterizing the content of organic substances in water - according to biochemical oxygen consumption over five days (BODs), the content of dissolved oxygen - O₂ and the ratio of production (A) to destruction (D) - A/D.

Results and discussions

Newly received materials 2019–2020 were compared with the results obtained in 2007–2008. The ecological state of various water bodies has been studied. Although many of the lakes may have existed before the construction of large irrigation and drainage canals in the Khorezm region, currently depth indicators, flow patterns, salinity and The levels of nutrients in these lakes are mainly controlled by sources of irrigation runoff.

In our research 2019–2021 We observed that the concentration of organic substances in the lake was the highest and stabilized. The reason for the increase in lake productivity (production of organic matter) is unknown, but there are similarities with other lakes. 41% of land within 0.5 km



is used for agricultural purposes.

During the growing season drought in 2008, residents of communities around the lake suffered from a reduction in irrigation and domestic water supplies. Most of the Khorezma lakes are shallow, with an average depth of 1–3 m. Therefore, they experience large seasonal shifts in water temperature.

During the flood of the lakes, the maximum depth was ~ 3 m. Seasonal water temperature can fluctuate from 2 to 30 °C, neutral pH values fluctuate from 7.5 to 8.1, and The concentration of dissolved oxygen is, as a rule, inversely proportional to the water temperature. In 2006 and 2007 Salinity in the lake averaged 2 g/l, but during the drought of 2008 it tripled and reached almost 6 g/l. During the period 2019–2021 this indicator has decreased significantly, i.e. the level of mineralization was about 3 g/l in the lake. Shurkkule, 2 g/l in lake. Adzhalikul and 4 g/l in the lake. Gaukkule. Despite the previous intensive use of polar pesticides such as DDT, very low levels of such pollutants were measured in the lake water column.

Characteristic features of the hydrological and hydrochemical regime in the lower reaches of the Amu Darya are the development of irrigated agriculture, flow regulation, and the entry of highly mineralized substances into the river beds. new return waters and a reduction in river flow. At the same time, the quality of the incoming water flow deteriorates.

Studies have shown that oxygen content is very variable, depends on many factors and is determined by the seasons of the year. During the period of spring and autumn homothermy and complete mixing of water masses, dissolved oxygen is distributed unevenly in the water column. In all lakes, the content of dissolved oxygen in the surface layers of water is higher, but decreases with depth.

In water bodies, its distribution is very specific and is determined by a combination of numerous external environmental factors. These include temperature, namely in shallow lakes temperature stratification is more pronounced, in deeper lakes it is weaker. In shallow water bodies the range of fluctuations is sharper, i.e. there are more maximums, less minimums, which is very unfavorable for various hydrobionts.

Information on the seasonal and long-term dynamics of the content of nutrients in the studied water bodies (Lake Gaukkul, Adzhalikul and Shurkul) for 2014–2020. are given in the table. 1. As is known, the content of individual forms of nitrogen in water bodies varies greatly with the seasons of the year and depends on the development of plankton and the ratio of the intensity of intra-water biochemical reactions processes regulating the conversion of nitrogen.

Changes in the content of nutrients along the depth of water bodies were studied in lakes Gaukkul, Adzhalikul, Shurkul. Revealed that the depths of the time of the time of the time and the ammunition is azed by the same, Lower Gop -Enter. The content of nitrite nitrogen is higher in the middle horizons.

In all examined water bodies, the dissolved oxygen regime was studied – O₂ mgO₂/l. It was found that optimal oxygen content (5.5–12.3 mgO₂/l) is observed in all water bodies [20]. The values of primary production and destruction are highly dynamic and depend on the internal processes of many other factors. The validity of this situation is well illustrated by our research on water bodies of various trophicities (Table 2). As studies have shown, the intensity of production of organic matter in various types of water bodies is quite high and ranges from 0.7 to 4.2 g s/m².

In Lake Ajalikul, the level of production of organic matter is different, despite the same food



source: it has unequal transparency. The destruction of organic matter occurs at varying rates (from 3.2 to 1.1 g/m). But in general, its magnitude is quite significant, especially considering that destruction occurs throughout the entire thickness of the lakes. The maximum destruction of organic matter was noted in Lake Shukul (3.2 g s/m²), fed by discharges from the irrigation network.

Table 2

Comparative characteristics of the degree of eutrophication of the most important water bodies

Название водоемов	Годы	Площадь (га)	Прозрачность (м)	O ₂ мг/л	БПК ₅ мгO ₂ /л	A	Д	A:Д	Тип водоема по степени трофности
оз. Гауккуль	2014–2020	421128	0,8	7,0	1,3	0,7	1,0	0,75	олиготрофный олиготрофный
		406020	0,7	6,8	1,9	1,7	2,5	0,68	
оз. Аджали куль	2014–2020	466542	0,4	8,9	2,3	1,8	2,7	0,67	олиготрофный мезотрофный
		456843	0,8	7,7	3,3	4,9	4,8	1,02	
оз. Шуркуль	2014–2020	426097	1,2	7,3	4,4	5,2	3,9	1,37	эвтрофный мезотрофный
		403889	0,8	7,4	5,9	1,5	1,4	1,07	

The ratio of primary production to the destruction of organic matter is closely linked to the nature of the nutrition of water bodies. In the lake Shurkul receives an excess of biogenic elements from collector drainage waters, therefore the producers of primary products are well provided with them and the A/D ratio is >1.

Studies of different types of water bodies, carried out over a number of years, have shown that in such indicators as the stability of the oxygen regime and its deficiency, there are significant fluctuations - to both daily and seasonal. There is a very significant difference in the oxygen content in the trophogenic layer and the bottom layers.

Based on the increased content of biogenic elements in the water mass, one can judge the strongly pronounced anthropogenic impact on water bodies [15; 16]. Accumulations of nutrients entering aquatic ecosystems with agricultural runoff contribute to the accumulation of nutrients, which leads to the formation of a certain regime inherent in eutrophic lakes. Assessment of the quality of lake waters based on the self-purification index allows us to state that destructive processes are actively taking place in reservoirs, despite the significant nutrient load. In many lakes, low values of A/D >1 indicate the intensity of self-purification processes. However, polar variants A/D = 1 (Ajalikul) are also noted, where organic matter accumulates and water quality deteriorates and A/D >1 (Lake Shurkul), where the system controls deal with self-cleaning.

Conclusions

The Khorezm region of Uzbekistan, located in the Aral Sea basin, faces serious problems related to ecology and human health due to unsustainable management of land and water resources for decades. Agriculture dominates the Xopezma lands, and agricultural runoff has affected many small lakes. In this low-water region, these lakes can be a source of water for irrigation or fish farming.

Thus, in modern conditions of the unstable state of aquatic ecosystems in this region, it has been established that there is a stability of the oxygen regime and its deficiency, there are significant



daily and seasonal fluctuations. In the studied water bodies, destructive processes are actively taking place, despite the significant nutrient load. The aquatic ecosystems under consideration are among the most prosperous and economically promising water bodies. In connection with this, the main measure for these water bodies under consideration should be a regular flow of river water.

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