Hydrochemical regime and water quality of the Danubian lake Katlabukh

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Introduction

The Danube lakes existed mainly due to the hydrology of the Danube. At the same time, their geographical location along the banks of the Danube had little effect on their historically established hydrochemical regime (Romanova et al, 2019). With the intensification of agriculture in the 1970s, additional use of the floodplains of the Danube began, and to protect them, embankment dams were built along the Danube, which radically changed the hydrological and historical water regime of the Danube Lakes. It is for this reason that the geographical location of Lake Katlabukh relative to other upstream lakes has created the conditions under which it has become hostage to the level regime of the Danube. Therefore, in recent decades, the filling of Lake Katlabukh in terms of its damping without forced water supply has significantly affected the deterioration of both the level regime of the lake and its hydrochemical condition.It is the reduction of water exchange processes with the Danube in combination with anthropogenic load on the catchment area of small rivers flowing into Lake Katlabukh, as well as the negative phenomena associated with climate change, create a number of environmental, water and social problems for the lake. The hydrochemical state of the lake water has deteriorated, and water salinity has increased 4-5 times, ie from 800 mg / dm3 to 4.7 g / dm3. Therefore, it is necessary to analyze carefully the hydrological and hydrochemical regime of the lake and the rivers flowing into it, in order to develop both scientific recommendations and operational measures to improve the condition of Lake Katlabukh and optimal conditions for its operation in accordance with the Water Framework Directive 2000/60 / EU (Directive 2000/60/EC, 2000).

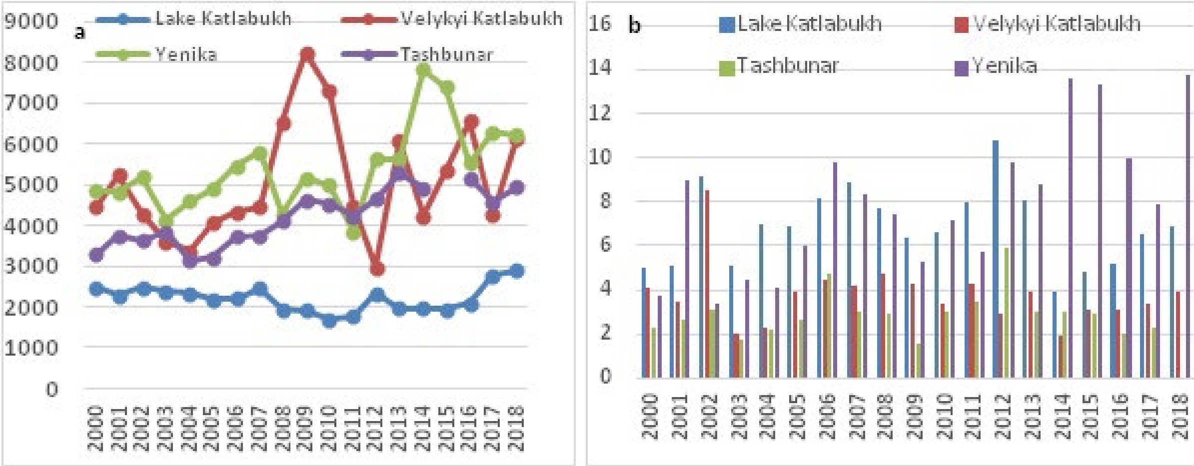
The aim of the work is to analyze the hydrochemical regime and assess the quality of surface waters by hydrochemical parameters in the Danube Lake Katlabukh and its tributaries, using modern calculation methods.

Results

The hydrochemical regime and water quality of Lake Katlabukh are influenced by a number of factors: the volume of runoff of small rivers and its mineralization; the volume of water intake for irrigation and water supply; the amount of precipitation and evaporation from the water surface of lakes; the volume of filling from the Danube and discharge of water into the river (Romanova et al, 2019). Determination of water mineralization was carried out according to the laboratory of the Danube BDWR in such facilities; lake Katlabukh, Velykyi Katlabukh, Yenika, Tashbunar.

The dynamics of the average annual mineralization of water bodies for the period 2000–2018 is shown in Fig.1a. The highest mineralization is observed in the Velykyi Katlabukh and Yenika rivers, which is associated with both natural conditions and anthropogenic pollution.

Lake Katlabukh and the rivers flowing into it are characterized by high water salinity. A significant contribution to such indicators is made, first of all, by sulfate ions, as well as chloride ions, sodium and potassium ions. In order to identify the anthropogenic impact on the hydrochemical regime of the studied objects, studies of pollution with nutrients, organic substances and heavy metals were conducted. To quantify the content of organic matter in the water of Lake Katlabukh and its rivers, the indicators of chemical oxygen consumption (COC) and 5-day biochemical oxygen consumption (BOC5) were used. In surface waters, the values of BOC5 vary from 0.5 to 4.0 mg / dm3 relative to 02 and there are seasonal and daily fluctuations (Fig. 1b). The highest rates of organic pollution are characteristic of the Yenika River and Lake Katlabukh, which is associated with water pollution in the Danube.



(b) for the period 2000–2018, mg / dm

The significant pollution by heavy metals (manganese, iron), as well as phenols and, to a lesser extent, petroleum products, is also observed in all studied water bodies. Such a significant degree of pollution, in our opinion, is due primarily to the anthropogenic impact on the catchment area of small rivers. The hydrochemical index of water pollution (HIWP) was also used to assess the water quality of the studied objects (Snizhko, 2001). Estimation of water quality according to IZV was performed on 6 chemical indicators for the lake. Katlabukh, V. Katlabukh river, Yenika river, Tashbunar river: oxygen, phenols, oil products, ammonium nitrogen, nitrite nitrogen and BOC5 based on the data of the Danube BDWR laboratory for 2000–2018. Analysis of the dynamics of the average annual values of HIWP at the observation points for the study period showed that the level of pollutants remains at the same level, fluctuating up or down depending on the anthropogenic impact. The cleanest water in Lake Katlabukh, where the values of HIWP vary from 0.56 (class II) to 1.87 (class III), but there are only five years with water of the third class for the studied period.

Conclusion

The main reason for the unsatisfactory condition of the studied objects is the significant anthropogenic impact on the catchment area of small rivers flowing into Lake Katlabukh, deteriorating the quality of its water resources. One of the main factors in the deterioration of water quality is the lack of water exchange in the lake itself due to a number of negative factors, including geographical location, the impact of climate change, and imperfect management of operational processes.

To improve the condition of surface waters in Lake Katlabukh it is proposed:

- to conduct a detailed analysis of the impact of human activities and natural factors on the water quality of Lake Katlabukh and the rivers flowing into it;
- both for the lake itself and for the territory of its basin to develop a program of specific measures against water pollution by all possible sources of pollution;
- ensure compliance with environmental legislation by all water users, regulate (restrict) or completely prohibit such activities that affect water quality, in particular, fishery water use.

References

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