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# MODERN ECOLOGICAL SITUATION OF SHAMKIR WATER RESERVOIR

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# СОВРЕМЕННОЕ ЭКОЛОГИЧЕСКОЕ СОСТОЯНИЕ ШАМКИРСКОГО ВОДОХРАНИЛИЩА

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*Abstract.* During the study, it was found that the water collected in the Shamkir reservoir was contaminated with *Escherichia*, *Enterobacter*, *Salmonella* and others belonging to the family of coli-enterobacteria. Infection with taxa of the genus is also evidenced by their spread along the stream in the basin. Comparing our results with the results obtained in previous years, it is clear that the number of coli enterobacteria in the Shamkir reservoir is constantly increasing.

*Аннотация.* В ходе исследования было обнаружено, что вода, отобранная в Шамкирском водохранилище, была загрязнена эшерихиями, энтеробактерами, сальмонеллами и другими видами паразитов, принадлежащими к семейству кишечных энтеробактерий. О заражении вод свидетельствует также их распространение по течению в бассейне. Сравнивая результаты данного исследования с результатами, полученными в предыдущие годы, становится ясно, что количество коли-энтеробактерий в Шамкирском водохранилище неуклонно растет.

*Keywords*: silt, water, reservoir, microbiota, Shamkir.

*Ключевые слова:* ил, вода, водоем, микробиота, Шамкир.

## *Introduction*

The Shamkir Reservoir is the first of the four reservoirs created in the Azerbaijani course of the Middle Kura, and the second in terms of history (1982). The Shamkir Reservoir, located in the Tovuz and Shamkir districts, is fed by the Kura River (95%) and in addition is discharged from local rivers Tovuzchay and Shamkirchay. It is the second largest reservoir in the country in terms of, depth, area, and other hydro-morphological features. One of its main features is its direct intake of Kura water. It is the first to receive water discharged into the Kura Basin by neighboring countries, which is contaminated with hundreds of foreign substances, including snakes, liquids, solids, complex and simple substances.

## *Materials and methodology*

According to the official document [5–7] in the territory of Georgia, on average, 2.6 $km^3$ of sewage of different nature is discharged directly into the Kura River (as well as its tributaries) per year. In addition, Khramchay, Agstafachay, Tovuzchay and other polluted river waters in the territory of Armenia mix with the Kura River before reaching the Shamkir reservoir. It is typical

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that in the 70-80 years of the last century M. A. Salmanov [2] and S. N. Aliyev [3] defined that self-cleaning (200 km along the channel) in the polluted Kura River in the Georgian cities of Mtskheta, Tbilisi, Rustavi, and Gardobani is almost non-existent in the area up to the Azerbaijani cities of Gazakh and Tovuz.

*Research discussion and results*

Research and observations in 2016–2020, sample stations were selected in Azerbaijan, and in different years in the Shamkir reservoir, so that all biotopes were covered. To thoroughly assess the state of self-cleaning of the reservoir in the hydro-ecosystem, the negative effects of anthropogenic impacts on the physical-chemical, and finally sanitary-hydrobiological, ecological stability of water, all studies were conducted together with seasonal factors.

Water and silt samples with various devices for microbiological, hydrobiological and hydrochemical analysis: samples for microbiological research in sterile glass containers, With the Y. I. Sorokin bathometer, the water for hydrobiological-hydrochemical analysis was taken from the intended depth with the Knudsen bathometer. Depending on the depth of the basin, silt samples were obtained either with a small Peterson dredger or with a QOIN pipe device. In all cases, a microbiological emulsion was prepared from the topsoil for planting in various nutrient media. For this purpose, in different proportions with antimicrobial water — 1: 1000; 1: 10000 silt-soil with natural moisture was used. Microbiological sowing of water samples in all seasons was carried out not later than 1.5–2.0 hours (in many cases a “thermo” bag was used to keep the temperature in the water samples stable until the planting was completed). The transparency of the water was measured with a white Secchi disc, and the temperature was measured with a mercury column depth thermometer.

It is known that after the abolition of the USSR, many industrial centers-factories do not operate in the former republics, including Georgia-Armenia. Therefore, the main volume of wastewater discharged into transboundary rivers over the past 5 years — the volume of household — utilities and agricultural waste. However, this does not mean that the Kura River in Armenia and Georgia is not polluted by other pollutants, such as heavy metal salts, radionuclides, phenols, hydrocarbons. Unfortunately, the Shamkir reservoir, created based on polluted water in the upper bay, is used as drinking water in Azerbaijan. Therefore, once again, we remind you that special attention has been paid to the infection of water with coli-enterobacteria, which are directly related to health.

Coliform bacteria a group of bacteria belonging to the family Enterobacreriaceae, operating in the intestinal system of humans and animals, and their detection in water is considered direct evidence of fecal contamination. Therefore, there is an internationally accepted determinant of water purity as a sanitary-epidemiological, hygienic indicator, coli-titer, coli -index. In fact, intestinal worms are not so indifferent to health, harmless living. It has been proven that if most of the coli in household waste (usually wastewater) viruses, streptococci, staphylococci, sarcins, actinomycetes, etc., which are harmful for health, are present in the environment [8, 9]. Fish, crabs, mollusks (shellfish) that develop under such microbiota conditions and are assimilated by humans, transient jaundice, anemia, etc. diseases can be widespread.

It should be noted that the number of bacteria belonging to the group of coli-enterobacteria in the water of the Kura River in the area from Borjomi to the Caspian Sea is many times higher than the sanitary norms. It was noted by S. N. Aliyev in the 80s, and in the reservoir at the beginning of the XXI century — by V. F. Mammadova [1, 2, 4]. Our research was completed in 2020 by seasons (Table).

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Table

AMOUNT OF COLIFORM BACTERIA IN THE UPPER LAYER
OF WATER IN SHAMKIR RESERVOIR (THOUSAND, MILLION)

| *Station* | *Winter* | *Spring* | *Summer* | *Fall* |
|---|---|---|---|---|
| 1 | 8.40 ± 0.44 | 13.80 ± 0.65 | 17.50 ± 0.77 | 16.30 ± 0.76 |
| 2 | 7.40 ± 0.38 | 12.50 ± 0.59 | 15.40 ± 0.76 | 16.00 ± 0.73 |
| 3 | 6.30 ± 0.32 | 11.80 ± 0.53 | 13.30 ± 0.67 | 12.50 0 ± 0.55 |
| 4 | 5.40 ± 0.28 | 10,20 ± 0.47 | 7.80 ± 0.45 | 6.40 ± 0.35 |
| 5 | 4.20 ± 0.16 | 5.40 ± 0.41 | 6.60 ± 0.39 | 5.80 ± 0.33 |
| 6 | 3.00 ± 0.10 | 4.60 ± 0.34 | 5.80 ± 0.33 | 5.60 ± 0.27 |
| 7 | 2.40 ± 0.08 | 4.00 ± 0.28 | 4.70 ± 0.26 | 5.00 ± 0.21 |
| 8 | 2.60 ± 0.07 | 3.40 ± 0.22 | 4.10 ± 0.21 | 4.44 ± 0.15 |
| 9 | 2.10 ± 0.06 | 2.60 ± 0.15 | 3.60 ± 0.15 | 4.38 ± 0.09 |

The Table shows that the (average) amount of coliform bacteria throughout the year varies around 4.5–8.6 thousand\ml. It is typical that in winter the water temperature is 8–9 times lower than in summer, but the difference in the average is not more than 2 times. It is also clear from the table that the number of coliform bacteria in all seasons is 5–6 times higher than the number of coliform bacteria obtained at the beginning of the Shamkir reservoir (in the waters of the Kura) near the dam. Therefore, the pollution of the Kura River occurs in the upper bay, and this undesirable event continues throughout the year. In addition, Escherichia, Enterobacter, Salmonella, etc., belonging to the coli-Enterobacteriaceae family of water collected in the Shamkir reservoir. Infection with taxa of the genus is also evidenced by their spread along the stream in the basin. Comparing our results with the results obtained in previous years, the amount of coli-enterobacteria in the Shamkir reservoir is constantly increasing.

*Results*

1. The Kura River, which is the main source, is polluted along the entire course in Georgia. Naturally, even in the distant future, the Georgian state will not be able to create advanced treatment facilities to neutralize the sewage discharged into the Kura in dozens of large settlements and industrial cities that pollute the Kura River basin (economic factors). Research on the Kura River has shown that it needs more protection.

2. The number of coliform bacteria in all seasons is 5–6 times higher than the amount of coliform bacteria obtained at the beginning of Shamkir reservoir (in the water area where Kura water is received) near the dam. Therefore, the pollution of the Kura River occurs in the upper bay, and this undesirable event continues throughout the year.

3. Escherichia, Enterobacter, Salmonella and others belonging to the coli-Enterobacteriaceae family of water collected in Shamkir reservoir. Infection with taxa of the genus is also evidenced by their spread along the stream in the basin. Comparing our results with the results obtained in previous years, the amount of coli-enterobacteria in the Shamkir reservoir is constantly increasing.

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