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# AXONOMIC COMPOSITION AND BIOLOGICAL INDICATORS OF MACROZOOBENTHOS IN LAKES SAYKOL AND SARYKAMYSH

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***Annotatsiya:*** Ushbu maqolada Orolbo‘yi hududida joylashgan Saykol va Sariqamish ko‘llaridagi makrozoobentos jamoalarining o‘rganilishi taqdim etiladi. Tadqiqot davomida Saykol ko‘lida 41 ta, Sariqamish ko‘lida esa 27 ta bentos organizmlari turlari aniqlandi. Ularning taksonomik tarkibi, mavsumiy dinamikasi, biomassa ko‘rsatkichlari hamda ustun turdagi organizmlar tahlil qilindi. Olingan natijalar asosida suv havzalarining ekologik holati va baliqchilik salohiyati baholandi. Tadqiqot natijalari ekologik monitoring, gidrobiontlarni introduktsiyalash va mintaqaviy biologik xilma-xillikni saqlash bo‘yicha ilmiy va amaliy ahamiyatga ega.

***Kalit so‘zlar:*** Saykol, Sariqamish, makrozoobentos, Chironomidae (xo‘rozquyruqlar oilasi), mollyuskalar, biomassa, taksonomik xilma-xillik, ustun turlar, kollektordrenaj suvlari, bioindikator, ekologik monitoring.

***Аннотация:*** В данной статье представлен анализ макрозообентосных сообществ озёр Сайколь и Сарыкамыш, расположенных в Приаральском регионе. В ходе исследований было выявлено 41 вид бентосных организмов в озере Сайколь и 27 видов — в озере Сарыкамыш. Проанализированы их таксономический состав, сезонная динамика, биомасса и доминирующие виды. На основе полученных данных дана оценка экологического состояния и рыбохозяйственного потенциала указанных водоёмов. Результаты имеют как научное, так и практическое значение для экологического мониторинга, интродукции гидробионтов и сохранения биоразнообразия в регионе.

***Ключевые слова:*** Сайколь, Сарыкамыш, макрозообентос, хирономиды, моллюски, биомасса, таксономическое разнообразие, доминирующие виды, коллекторно-дренажные воды, биоиндикатор, экологический мониторинг.

***Annotation:*** This article presents a study of the macrozoobenthic communities in Lakes Saykol and Sarykamysh, located in the Aral Sea region. During the research, 41 benthic organism species were identified in Saykol and 27 species in Sarykamysh. Their taxonomic composition, seasonal dynamics, biomass, and dominant species were analyzed. Based on the findings, the ecological status and fisheries potential of these water bodies were evaluated. The results have both scientific and practical significance for ecological monitoring, hydrobiont introduction, and biodiversity conservation in the region.

***Key words:*** Saykol, Sarykamysh, macrozoobenthos, Chironomidae, mollusks, biomass, taxonomic diversity, dominant species, collector-drainage waters, bioindicator, ecological monitoring.

**Introduction:** The desiccation of the Aral Sea and the ensuing ecological crisis have led to the formation of numerous new collector-drainage lakes in the Aral Sea region. Lakes Saykol and Sarykamysh are among these newly formed water bodies and currently play a significant role in the region’s ecological system. Assessing their biological productivity, particularly by studying the



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diversity of benthic organisms, is of great importance as these organisms serve as a vital resource for fisheries. This article focuses on the macrozoobenthic composition, seasonal dynamics, and dominant species in these two lakes, with the aim of evaluating their ecological condition and potential for sustainable use.

**Annotated Review of the References:** Joldasova's seminal monograph offers an in-depth taxonomic and ecological overview of benthic fauna in the Aral Sea, providing a critical baseline for understanding long-term ecological changes in this shrinking water body. Her work is foundational in characterizing the shifts in benthic communities as saline conditions intensified [1,2]. This study examines the hydrobiological characteristics of collector-drainage lakes, revealing how high salinity and erratic hydrological regimes shape fauna and water quality. It underscores the importance of these artificial lakes for biodiversity conservation and aquaculture, despite their anthropogenic origins [3,4,5]. This article contributes vital data on macrozoobenthos diversity in the Amudarya River's lower reaches, offering valuable context for regional comparisons of benthic diversity—particularly in newly formed or impacted lake systems [6]. This work analyzes benthic community changes in irrigation reservoirs, highlighting seasonal biomass trends and linking them to ecological stressors such as temperature and fish predation—topics directly relevant to your study's seasonal findings [7,8]. This study explores the roles of macrozoobenthos and periphyton in assessing water quality — reinforcing their value as bioindicators in inland water monitoring efforts [9]. Focusing on Fergana Valley's aquatic systems, this study enhances regional understanding of benthic taxonomic composition and informs broader biogeographical comparisons across inland waters [10]. By providing data on benthic species composition, abundance, and biomass in six lakes of Western Kazakhstan, this research supports comparative analysis and highlights regional ecological linkages with the Aral and post-Aral aquatic environments [11].

**Results and Their Analysis**

A total of 27 species of macrozoobenthos organisms were recorded in Lake Sarykamysh (Appendix 4). These species mainly represent the fauna of saline waters. Three species of oligochaetes were identified in this lake: Limnodrilus helveticus, Nereis diversicolor, and Paranais simplex. Among them, Nereis diversicolor is unique to this lake and has not been observed in any of the other studied lakes. Overall, Lake Sarykamysh showed the highest diversity of annelids. In contrast, Lake Sarykamysh had the lowest diversity of mollusks, with only two species recorded: Cerastoderma isthmicum and Theodoxus pallasi, both of which are typically found in saline environments. Interestingly, these mollusk species were not found in any other surveyed water bodies. Three crustacean species commonly found in other lakes were also present in Sarykamysh: Turkogammarus aralensis, Paramysis lacustris, and Macrobrachium nipponense. The insect component of macrozoobenthos in Lake Sarykamysh included 19 species, comprising: 1 species of Heteroptera, 1 species of Odonata, 14 species of Diptera, 2 species of Trichoptera, and 1 species of Coleoptera. All recorded Diptera species belonged exclusively to the Chironomidae family, with no representatives from other dipteran families observed. This pattern, aside from Sarykamysh, was also observed only in Lake Achchiköl. However, both lakes demonstrated greater chironomid diversity compared to the other studied lakes. Among the dominant chironomid species were Cryptochironomus supplicans, Cryptocladopelma gl. viridulus, Polypedilum scalaenum, Rheotanytarsus

gr. exiguous, and Tanytarsus gregarius — all of which are specific to Sarykamysh and Achchiköl. Additionally, Cryptocladopelma conjugens and Chironomus behningi were also identified as dominant species in Lake Sarykamysh. Two trichopteran species were recorded in this lake: Agrypnetes crassicornis and Oecetis i ntima. While Oecetis intima was found in all studied lakes, Agrypnetes crassicornis was recorded only in Sarykamysh, Achchiköl, and East Karateren.

In summary, Lake Sarykamysh supports a unique macrozoobenthos community. Among the recorded species, several stand out as representatives of the original Aral Sea fauna, including: Nereis diversicolor O.F. Müller (intentionally introduced), Cerastoderma isthmicum Issel, Theodoxus pallasi Lindholm, and Turkogammarus aralensis (Uljanin) (see Figures 1 and 2).

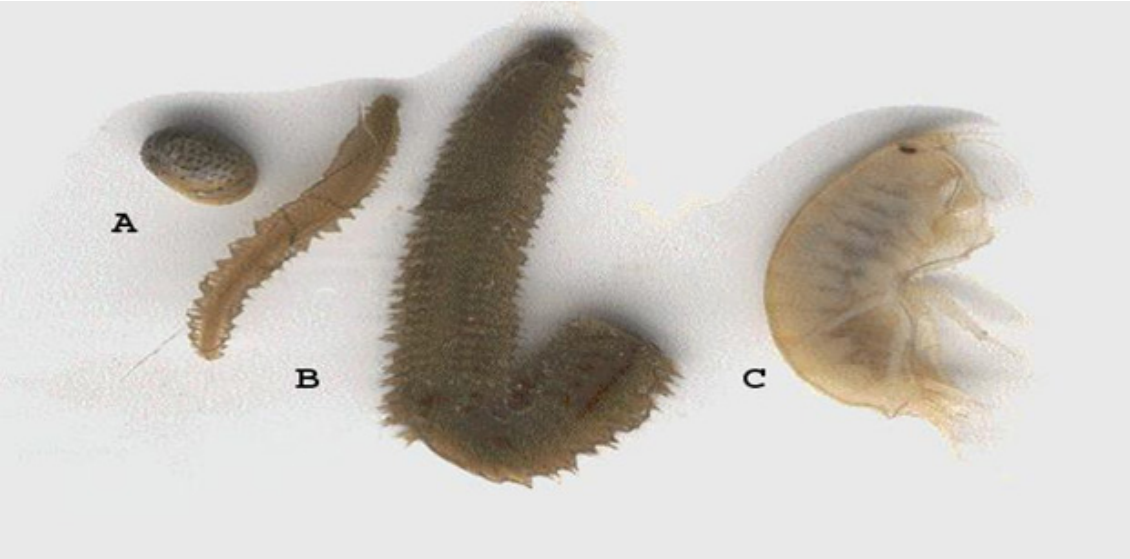



**Figure 1. Theodoxus pallasi Lindholm (A), Nereis diversicolor O.F. Müller (B), and Turkogammarus aralensis (Uljanin) (C) from Lake Sarykamysh.**



**Figure 2. Shell of Cerastoderma isthmicum Issel from Lake Sarykamysh.**

**Results and Their Analysis:**

A total of 27 species of macro-zoobenthos organisms were recorded in Lake Sarykamysh (Appendix 4). These primarily represent representatives of the brackish water fauna. Three species



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of annelid worms were identified in this lake: Limnodrilus helveticus, Nereis diversicolor, and Paranais simplex. Among them, Nereis diversicolor is unique to this lake and is not found in other lakes. Overall, Lake Sarykamysh exhibited the highest diversity of annelid worms. In contrast, in terms of mollusk diversity, Sarykamysh ranked the lowest. Only two mollusk species were recorded here: Cerastoderma isthmicum and Theodoxus pallasi, both of which are typically distributed in saline waters. Interestingly, these mollusk species were not found in other water bodies. Three species of crustaceans typical for other lakes were also recorded in Sarykamysh: Turkogammarus aralensis, Paramysis lacustris, and Macrobrachium nipponense.

The macrozoobenthos of Sarykamysh includes 19 insect species: 1 species of dragonflies, 1 species of damselflies, 14 species of dipterans, 2 species of caddisflies, and 1 species of beetles. All recorded dipteran species belong to the Chironomidae family, with no representatives from other dipteran families. Such a situation was observed only in Sarykamysh and Achchik lakes. The chironomid larvae diversity in these two lakes is higher compared to others. Among chironomids, Cryptochironomus supplicans, Cryptocladopelma gl. viridulus, Polypedilum scalaenum, Rheotanytarsus gr. exiguous, and Tanytarsus gregarius were numerous, and these species are found only in Sarykamysh and Achchik lakes. Dominant chironomid species here also include Cryptocladopelma conjugens and Chironomus behningi. Two species of caddisflies were recorded in Sarykamysh: Agrypnetes crassicornis and Oecetis intima. While Oecetis intima was found in all studied lakes, Agrypnetes crassicornis was recorded only in Sarykamysh, Achchik, and Eastern Korateren. In general, Lake Sarykamysh hosts a unique macrozoobenthos community, with the following representatives of the Aral fauna of special interest: Nereis diversicolor O.F. Müller (likely introduced+ deliberately), Cerastoderma isthmicum Issel, Theodoxus pallasi Lindholm, and Turkogammarus aralensis (Uljanin) (Figures 1 and 2). These species are new to this lake, and the methods of introducing them to Sariqamish remain unknown. Their presence in the water body appears accidental, with causes not yet identified. Moreover, no planned introduction of hydrobiota has taken place in these locations. According to I.M. Joldasova, at the end of the 1980s, fishermen started fishing in Lake Sarykamysh due to the cessation of fishing in the Aral Sea. During this time, hydrobiota could have accidentally entered fishing boats transporting fish, resulting in unintentional introduction. Currently, these species have disappeared from the Aral Sea due to increased salinity. All these species (except Theodoxus) serve as good food for fish. They could be introduced into fishery water bodies across the republic, including the saline fisheries of Bukhara, Kashkadarya, Navoi, Jizzakh regions, and the Republic of Karakalpakstan. Furthermore, T. aralensis, listed in the Red Book of Uzbekistan as an Aral Sea invertebrate, could expand its range and reduce extinction risk if distributed to other republic water bodies, contributing to nature conservation. Mollusk species such as Cerastoderma isthmicum, Colletopterum cyreum, Dreissena polymorpha, and Theodoxus pallasi were not recorded in Lake Saykol. However, Lymnaea sp., Lymnaea stagnalis, and Castatella fontinalis were unique to Saykol and absent from other lakes. The crustacean Turkogammarus aralensis, common in the studied lakes, was not recorded in Saykol. Instead, Paramysis lacustris and Macrobrachium nipponense were found. Water bugs (Sigara assimilis and Corixidae sp.) were present as in other lakes. All four species of damselflies recorded in different water bodies were also found here. Interestingly, while Saykol ranks first in macrozoobenthos

diversity, it has the lowest diversity of chironomid larvae, with only 10 species recorded. Common chironomid species (Tanytarsus gregarious, Procladius ferrugineus, Cryptocladopelma defectus) found in all lakes were absent here. Dipteran species from other families were more abundant in Saykol. For example, Prodezzia semigigra and Sphaeromias pictus were recorded only in Saykol and Sarbas lakes. Only one species of caddisfly, Oecetis intima, common to all lakes, was found in Saykol. All five species of aquatic beetles recorded across six lakes were also present in Saykol—a situation previously observed only in Sarbas lake. It should be noted that the high diversity in this lake leads to a decrease in dominance level, resulting in fewer dominant species. Depending on year and season, about 10 species can be dominant here. Dominant species include Limnodrilus helveticus, Anisus albus, Anisus sp., Lymnaea auricularia, Lymnaea stagnalis, Paramysis lacustris, Sigara assimilis, Camptochironomus pallidivittatus, Chironomus cingulatus, Cricotopus silvestris, Tanytarsus exiguous, and Berosus sp. Thus, 41 species of macrozoobenthos were recorded in the Saykol basin, distributed as follows by main taxa: Annelida - 2 species, Mollusca – 11 species, Crustacea – 2 species, Heteroptera – 2 species, Odonata – 4 species, Chironomidae – 10 species, Coleoptera – 5 species, Trichoptera – 1 species, other Diptera – 4 species. The number of dominant species is 10.

**Conclusion:**

According to the study results, Lake Saykol stands out as the water body with the highest macrozoobenthos diversity (41 species). Lake Sarykamysh recorded 27 species, with some hydrobiota unique to this lake. Both lakes are important biological resource sources for the Aral Sea ecosystem. Chironomids, mollusks, and crustaceans form the main part of benthic biomass in these lakes. Their seasonal dynamics, dominant species succession, and adaptation to environmental conditions reflect the biological stability of the lakes. These findings provide a scientific basis for future development of fisheries in these water bodies.

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