SPECIES COMPOSITION OF THE *OLIGOCHAETA* FAUNA OF THE MINGACHEVIR RESERVOIR

Konul Ahmadova[1,2], Shabnam Farzali[2]
[1]Western Caspian University, Baku, Azerbaijan
[2]Firat University, Elazığ, Türkiye

Abstract: The article provides information on the species composition and quantitative distribution of oligochaetes in the Mingachevir reservoir by season. The studies were conducted in 2011-2018. after a long pause in the study of oligochaetes. The study is of great importance in determining the food supply of fish in the given reservoir.
Keywords: *Oligochaeta*, seasonal development, distribution, biomass, species composition**.**

***Corresponding Author:** konul.ahmadova@outlook.com

Received: 16 June, 2023; **Accepted:** 19 November, 2023; **Published:** 12 December, 2023

DOI: 10.54414/XENW7423

Introduction:

Oligochaetes are a group of segmented worms that play an important role in aquatic ecosystems, especially in freshwater environments. Oligochaete worms are used as indicators of water quality. Some members of the class are particularly sensitive to changes in environmental factors such as oxygen levels, high concentrations of nutrients and water pollution. Monitoring the presence of certain species and abundance of oligochaetes allows us to assess the health of a water body (Kang et al., 2017).

Oligochaetes are known for their burrowing activities, which promote bioturbation, which involves moving sediment and mixing organic and inorganic materials in the substrate. This process has several environmental consequences, including nutrient cycling, sediment aeration, and stimulation of microbial activity (Adamek & Marsalek, 2013; Mermillod-Blondin, 2011).

Oligochaete worms play a critical role in nutrient cycling in aquatic ecosystems. Burrowing through sediments, they consume organic matter, detritus and bacteria. The absorbed material is then processed and excreted from the body in a more decomposed form, facilitating the availability of nutrients in the water column and sediments (Bartoszek, 2023).

Oligochaetes serve as an important food source for a variety of aquatic predators, including fish, amphibians, and some aquatic insects. Their abundance and distribution can influence the composition and dynamics of higher trophic levels of an ecosystem (Chapman, 2001).

The burrowing activity of oligochaetes contributes to the saturation of sediments with oxygen. By creating channels and voids in the sediment, they facilitate gas exchange between the sediment and the overlying water, which is important for the survival of many benthic organisms and microbial processes (Mermillod-Blondin, 2011).

Some species of oligochaetes are filter feeders, that is, they extract suspended particles, algae and detritus from the water column. This feeding behavior may contribute to water clarification and influence the composition of phytoplankton communities (Attrill et al., 2009).

Oligochaetes are detritivores, feeding mainly on decaying organic matter. Their feeding activities help break down and decompose dead plant material, facilitating nutrient recycling in aquatic ecosystems (Benbow et al., 2020).

Thus, the study of the qualitative and quantitative composition, as well as the distribution of oligochaetes in water bodies has a great practical importance, since they play an important role in nutrient cycling, sediment dynamics and the general condition of freshwater ecosystems. Their interactions with the environment make them important components of aquatic food webs and valuable indicators of water quality.

Mingachevir reservoir is the largest reservoir in Azerbaijan. It is located on the Kura River and was put into operation in 1953 - 1956. The reservoir is located in a depression between the Akhar-Bahar mountain ranges from the north, Bozdag from the south and Palantokan from the west. The reservoir serves for long-term regulation of the flow of the Kura River and the integrated use of water reserves (Aliyev et al., 2010).

The length of the reservoir is 75 km, the maximum width is 20 km, the average width is 8 km, the maximum depth is 75 m (in the part near the dam), the average depth is about 26 m. The length of the coastline is about 240-250 km, depending on the level fluctuations. The length of the reservoir dam is 1550 m, the width at the top is 16 m, and the maximum height is 80 m. With this dam, a hydropower station consisting of 6 hydrounits with a total capacity of 371 m kw was built.

Figure 1. Satellite view of reservoirs built on the Kura River (Shamkir, Yenikend, Mingachevir and Varvara) (Credit: Google Maps).

Starting from the reservoir, there are two main canals that have been put into operation since 1958: the Upper Karabakh and Upper Shirvan canals.

The Upper Karabakh canal (172 km long) provides irrigation of more than 100,000 hectares of cultivated land in the Mil-Karabakh plains. When there is a shortage of water in the Araz River, about 30 m^3/sec of water is discharged from the canal to the Bahramtepe hydrojunction to feed it with additional water.

The Upper Shirvan Canal (123 km long) supplies water to 127,000 hectares of irrigated land in the Shirvan Plain, starting from the Khanabad Bay. The end of the channel ends near the city of Agsu.

The main source of the Mingachevir reservoir is the water of Kura, Ganikh, Gabirri, and partially Ganjachay (Aliyev et al., 2010).

The macrozoobenthos of the reservoir was studied by A.H. Gasimov in the first years (1956-1959) (Kasimov, 1965; Kasımov, 1972). As a result of his research, the number of species of macrozoobenthos in the reservoir changed from 21 to 35. Further studies belong to A. Khalilov. He recorded 77 species and forms for the reservoir in 1971-75.

One of the main groups of the bottom fauna of the reservoir are small-horned worms. Some characteristics of these worms allow them to develop even in deep areas. Oligochaetes are the favorite food of benthic and baby fish (sea bream, bream, sole fish, etc.). Therefore, our goal is to provide detailed information about these creatures and their place and importance in the composition of the benthic fauna of the Mingachevir reservoir.

As a result of his research conducted in 1955-59, A.H. Gasimov noted 3 species of oligochaetes (*Chaetogaster* sp., *Limnodrilus* sp. and *Tubifex tubifex*) for the reservoir (Kasimov, 1965). As a result of the research conducted by A. Khalilov during the years 1971-1975, he noted that olichochaetes were represented by only 6 species. However, his information does not list the name of the species (Khalilov & Akhmedov, 1972; Khalilov, 1980).

According to information from the 70s and 80s of the 20th century, 9 species of

oligochaetes were recorded in the Mingachevir reservoir. They played a leading role in the formation of benthos. Thus, according to 1961, the total biomass of benthos was 3.08-12.09 g/m^2, the number was 1478-3728 ind./m^2, and the share of oligochaetes and chironomid larvae was 97.2% (Khalilov, 1980).

Naturally, certain changes occur in the reservoir's fauna and benthic fauna over the years. This can be mainly explained by the change of the biocenoses in the reservoir in the first years, as well as the commissioning of the Shamkir and Yenikend reservoirs on the Kura River in 1982 and in 2000 (Figure 1).

Studying the hydrofauna of the Mingachevir reservoir under new environmental conditions and comparing the obtained results with the results of previous years and other reservoirs can be valuable material for clarifying the processes occurring in the reservoir. Our work was planned for this purpose.

Materials and Methods:

Starting from 2011, materials on macrozoobenthos were collected at permanent stations from different parts (upper, middle and lower), depths and biotopes of the reservoir by seasons (winter, spring, summer and autumn) (Figure 2). During the research period, 565 samples (242 qualitative and 323 quantitative samples) were collected.

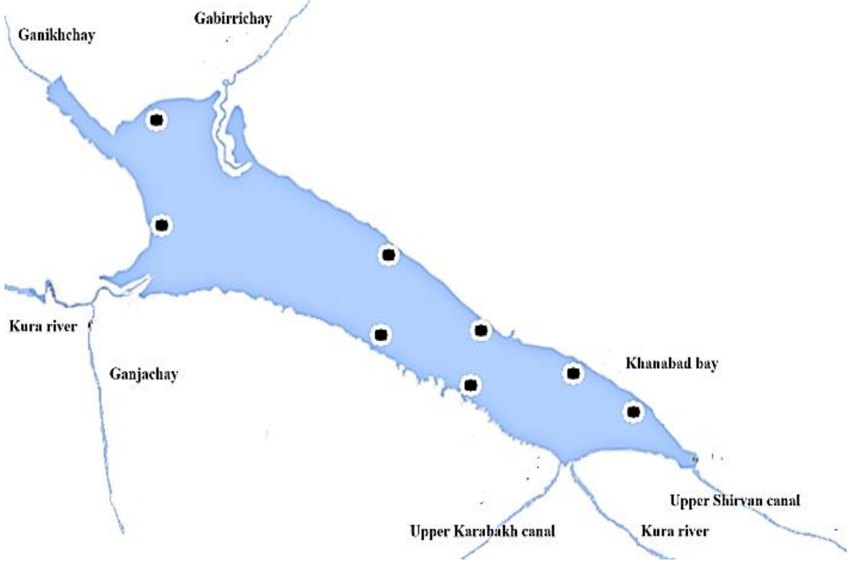


Figure 2. Map-scheme showing the location of permanent stations for collecting macrozoobenthos samples in the Mingachevir reservoir.

The materials were collected and analyzed based on Jadin's method (Jadin, 1956).

In the collection of the material, a mesh sieve and a scraper were used. With these tools, samples were collected from the coastal zones of water bodies. Samples from deep areas were collected with a Petersen type dredger. The materials collected with these tools are emptied into a bath, thoroughly washed with water, then sieved, the residual mass is filled into special containers, fixed with 4% formalin solution, labeled and prepared for processing in laboratory conditions. The samples brought to the laboratory were cleaned from the soil, the organisms were carefully removed with a knife and placed in special containers. Then the organisms were divided into groups and the species composition was investigated.

Samples were collected with a Petersen-type dredger (area 0.025 m^2) from the depths necessary to request the top and biomass of oligochaetes (Figure 3). The collected samples were cleaned from the soil, brought to the laboratory after the initial treatment. A magnifying glass is used for this purpose. The materials collected in this way were separated into species and their number and biomass were calculated.

A

B

Figure 3. Collection of benthic materials from the reservoir: A-Sovkhoz Kosa and B – Khanabad Bay

Before measuring the masses of organisms, they were dried on filter paper. Organisms were weighed on an electronic scale after the filter paper no longer shows signs of moisture.

O.V. Chekanovskaya's determination book and internet information were used to determine the species composition of oligochaetes (Chekanovskaya, 1962).

Results and discussions:

As a result of our research, 14 types of oligochaetes were recorded in the macrozoobenthos of the Mingachevir reservoir. 7 of these species belong to *Naididae* and 7 to *Tubificidae* families. Their species composition is given in table 1 below:

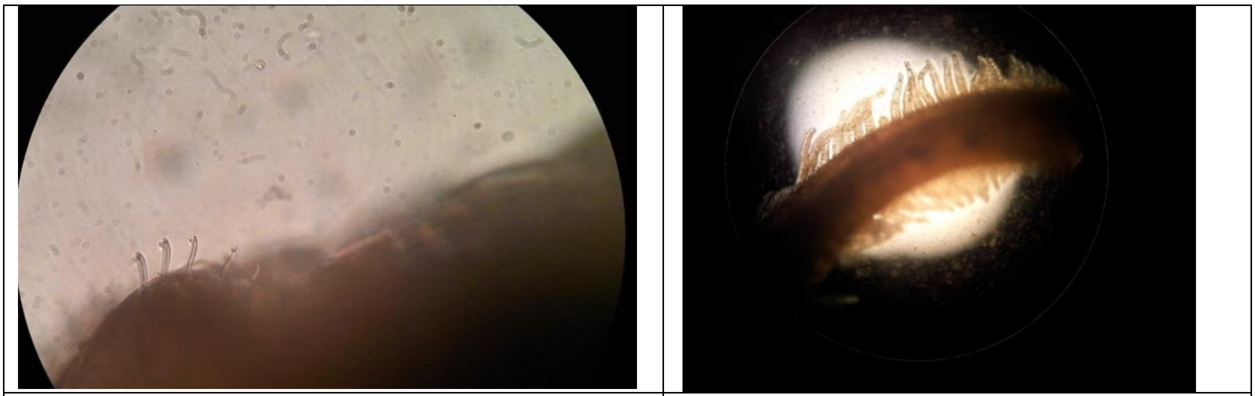
Table 1. Species composition of oligochaetes of the Mingachevir reservoir (comparative species composition)

Species \ Researches	Research done before us (1955 – 1980)	Our research (2011 – 2018)
Oligochaeta		
Naididae		
1. *Stylaria lacustris* L.	+	+
2. *Nais communis* Piguet	+	+
3. ***N.elinguis* Müll.**	**-**	**+**
4. *N.iorensis* Patar	+	+
5. *Chaetogaster diastrophus* Grube	+	+
6. *Ophidonais serpentina* (Müll.)	+	+
7. ***Pristina rosea* (Piguet)**	**-**	**+**
Tubificidae		
8. ***Limnodrilus udekemianus* Clap.**	**-**	**+**
9. *L.hoffmeisteri* Clap.	+	+
10. *L.claparedianus* Ratz.	+	+
11. ***İlyodrilus hammoniensis* (Mich.)**	**-**	**+**
12. *Tubifex tubifex* (Müll.)	+	+
13. ***Peloscolex ferox* (Eisen.)**	**-**	**+**
14. *Branchiura sowerbyi* Bed.	+	+
Total:	9	14

As we can see, 5 new species were recorded for reservoir fauna. Among these species, there are only 2 more common species, *Nais elinguis* and *Limnodrillus udekemianus*.

Table 2.Occurrence of species of oligochaetes in the Mingachevir reservoir by year

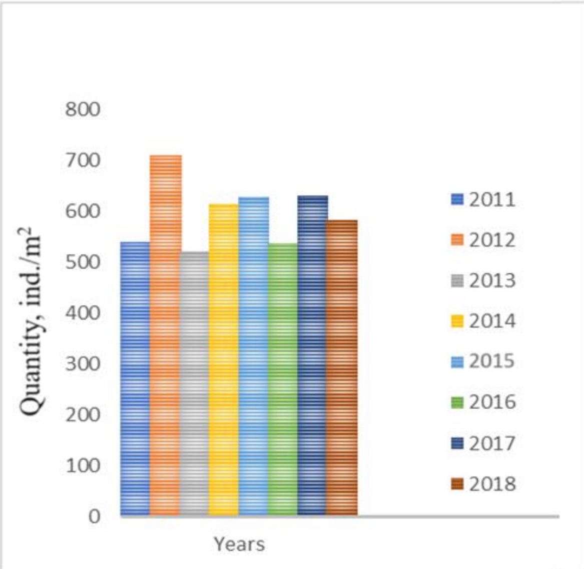
№	Species \ Years	2011	2012	2013	2014	2015	2016	2017	2018
1	*Stylaria lacustris*	+	+	-	+	+	+	+	+
2	*Nais communis*	+	+	+	-	+	+	+	+
3	*N.elinguis*	-	+	-	+	-	-	-	+
4	*N.iorensis*	+	-	+	+	-	-	-	-
5	*Chaetogaster diastrophus*	-	+	-	+	-	+	+	-
6	*Ophidonais serpentina*	+	+	+	+	-	-	-	-
7	*Pristina rosea*	-	+	-	-	-	-	+	+
8	*Limnodrilus udekemianus*	-	-	+	+	-	-	+	+
9	*L.hoffmeisteri*	+	+	+	+	+	+	+	+
10	*L.claparedeanus*	+	-	-	-	+	-	-	-
11	*Potamothrix hammoniensis*	-	-	-	+	-	-	+	+
12	*Tubifex tubifex*	+	+	+	+	+	+	++	++
13	*Peloscolex ferox*	-	+	-	+	+	+	+	+
14	*Branchiura sowerbyi*	++	++	++	++	++	+	++	+
	Total:	8	10	7	11	7	7	10	10



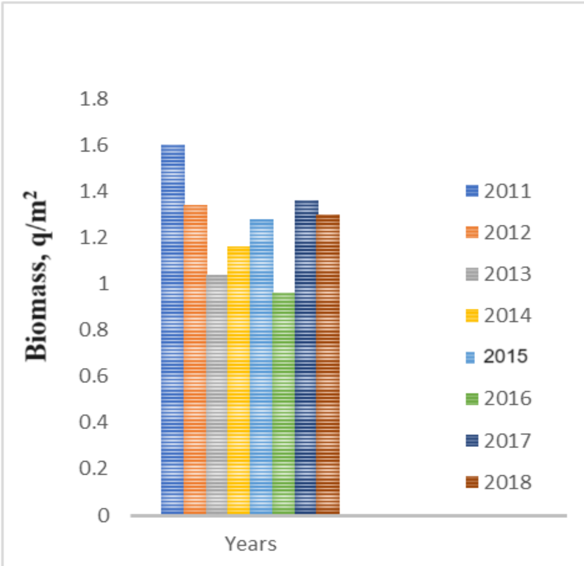
Limnodrilus hoffmeisteri Claparede, 1862	*Branchiura sowerbyi* Beddard, 1892

Figure 4. Photos of oligochaetes which were taken during the research

Information about the number and biomass dynamics of oligochaetes in the Mingachevir reservoir is given in the following diagrams (Figure 5).



A



B

Figure 5. Dynamics of quantity (A) and biomass (B) of oligochaetes in the Mingachevir reservoir in 2011-2018

The materials collected by us covered a depth of up to 27 m. As a result of the research, oligochaetes were found at all depths, but their high development was observed in coastal zones. In the deep zones, mainly *T. tubifex*, *L. hoffmeisteri* and *Branchiura sowerbyi* species were found, albeit in small numbers. In the samples we collected, the frequency of occurrence of oligochaetes was close to 70%. As for individual species, *Nais communis*, *Chaetogaster diastrophus*, *Ophidonais serpentina*, *Tubifex tubifex* and *B. sowerbyi* are dominant in terms of number and biomass.

Oligochaetes were mostly found at depths of 0.5-3 m and on plants. Sometimes we recorded up to 20 oligochaetes on one plant. Even now, oligochaetes play a leading role in the formation of macrozoobenthos in the reservoir.

The study of water quality in water catchments is of great importance. As we know, water quality assessment is performed by chemical, bacteriological and biological methods. But the first two methods are relevant only when we get the water sample.

The biological balance of aquatic ecosystems is maintained because of various dynamic relationships of organisms, but this balance is sometimes disturbed as a result of anthropogenic influence. It is more appropriate to use macrobenthic animals during biological analysis because their life is longer, and their existence characterizes a longer period.

Oligochaetes are one of the main indicators of the condition of the water body. Their abundant development in wastewater is considered by most hydrobiologists as an indicator of pollution.

As a result of the research, it was revealed that the water of the Mingachevir reservoir is slightly polluted.

References:

Adamek Z., Marsalek B. (2013) Bioturbation of sediments by benthic macroinvertebrates and fish and its implication for pond eco-systems. A review. Aquaculture Interna-tional 21: 1-7 https://doi.org/10.1007/s10499-012-9527-3

Attrill M, Rundle S.D, Fraser A., Power M. (2009) Oligochaetes as a possible entry route for terrigenous organic carbon into estuarine benthic food webs. Marine Ecology Progress Series 384: 147-157. https://doi.org/10.3354/meps08019

Bartoszek L. (2023) The effect of natural organic matter (NOM) on the distribution and resources of mobile phosphorus in the bottom sediments of small retention reservoirs. Aquatic sciences: 85: 107

Benbow M.E., Receveur J., Lamberti G.A. (2020) Death and Decomposition in Aquatic Ecosystems. Front. Ecol. Evol., Sec. Population, Community, and Ecosystem Dynamics 8: https://doi.org/10.3389/fevo.2020.00017

Chapman P.M. (2001) Utility and relevance of aquatic oligochaetes in Ecological Risk Assessment. Hydrobiologia 463(1): 149-169 https://doi.org/10.1023/A:1013103708250

Əliyev A.R., Bağırova Ş.M. və b. (2010) Kür silsilə su anbarlarının biologiyası. Bakı, “Elm”, 317 s.

Kang H., Bae M.J., Lee D.S., Hwang S.J., Moon J.S., Park Y.S. (2017) Distribution Patterns of the Freshwater Oligochaete Limnodrilus hoffmeisteri Influenced by Environmental Factors in Streams on a Korean Nationwide Scale. Water 9(12): 921. https://doi.org/10.3390/w9120921

Mermillod-Blondin F. (2011) The functional significance of bioturbation and biodeposition on biogeochemical processes at the water–sediment interface in freshwater and marine ecosystems. Journal of the North American Benthological Society 30(3): 770-778 https://doi.org/10.1899/10-121.1