

Macrozoobenthos of rivers of Nakhchivan Autonomous Republic of Azerbaijan

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The article deals with investigation of macrozoobenthos of some rivers of Nakhchivan Autonomous Republic (AR) of Azerbaijan. It is one of the regions, where the hydrographic network is dense and diversified. Historically, certain studies are conducted here in several decades of the 20th century. The first scientific information about macrozoobenthos of rivers of Nakhchivan AR was described in the works of Derzhavin (Derzhavin, 1938; 1951). Subsequent information was provided by A.V. Petrov (Petrov, 1938), O.A. Chernova (Chernova, 1938), A.V. Martynov (Martynov, 1938), A.N. Kirichenko (Kirichenko, 1938), A.H. Alizade (Alizade, 1938; 1951). The authors recorded 68 species of benthic organisms for the river fauna of the region.

In the following years, S.P. Sofiyev (Sofiyev, 1969) studied the benthic fauna of the rivers of Nakhchivan AR. He found 39 species of benthic organisms in Nakhchivanchay river, 42 species in Alinjachay river, 12 species in Gilanchay river, 20 species in Arpachay river, 18 species in Shahriyarchay river and 7 species in Darache river. The author notes that the species composition of benthic organisms dominates in 2 rivers (Nakhchivanchay and Alinjachay). The reason for the lack of species in other rivers is the high flow velocity of water in these rivers.

The most recent study of the status of benthic community, species composition and number of macrozoobenthos of the main rivers in the territory of Nakhchivan AR was realized by us during years of 2018-2019. During the investigation, 134 species of benthic organisms belonging to 18 taxonomical groups were recorded. Among these species, 102 were water invertebrates. The biomass of benthic organisms in different rivers varied within 0.20-6.62 g/m², while their densities ranged between 99 and 1205 individuals/m².

Keywords: Macrozoobenthos, Rivers, Nakhchivan AR, Azerbaijan.

Introduction

There is a dense hydrographic network in Nakhchivan AR of Azerbaijan. The region's water system, including rivers, lakes and reservoirs has been formed over a long period of time and has undergone several changes. Duylushchay, Venendchay, Eylischay and some other old rivers are characteristic examples of changes of their hydrographic basins (Rustamov, 1957). These networks are changing because of natural processes and human economic activity. The rivers occupy an important place in hydrographic network of the region. These are used for providing local population with water, for irrigating purposes, for obtaining energy, and fishery expansion (Fig. 1). At the same time these are ecosystems which serve for maintenance and protection of local populations of fish and invertebrates.

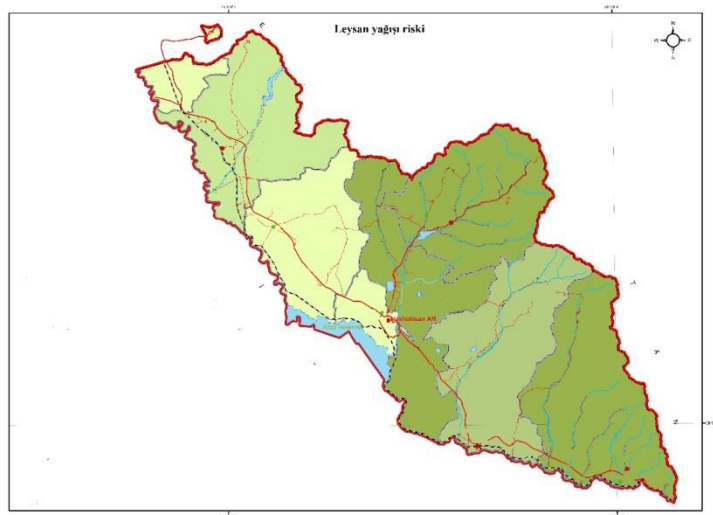


Fig. 1. Hydrographic map of Nakhchivan AR.

The hydro-fauna of rivers of the region is rich. Its study has large scientific and practical importance. Considering the importance of macrozoobenthos in hydro-fauna of rivers of the region it has been decided to study ecology and diversity of this group of animals in some local rivers, such as Nakhchivanchay, Selesuzchay, Jekhrichay, Bichenekchay, Arpachay, Gilanchay, and Alinjachay. It should be noted that the study of hydro-fauna of some of these rivers has been conducted 30 years ago, while others even 80 years ago. Since that time, certain changes have occurred in the river hydrological and hydrobiological regimes.

The first and most important scientific information about macrozoobenthos of rivers of Nakhchivan AR has been published in work by Derzhvain. Additional data were given by Petrov, Chernova, Martynov, Kirichenko, and Alizadeh. These authors recorded 68 species of benthic organisms for the fauna of rivers of Nakhchivan AR.

Later, the benthic fauna of Nakhchivan rivers was investigated by Sofiyev (Sofiyev, 1969). He explained the poor diversity of the species by high flow velocity of the water in those rivers. According to Sofiyev, 49.4% of all recorded species were represented by chironomid larvae. In the studied rivers the biomass of benthic organisms constituted 22.73 g/m² in Gilanchay, 13.55 g/m² in Alinjachay, and 5.10 g/m² in Nakhchivanchay. Further investigation of benthos of Nakhchivan rivers was conducted by Farajev and Bayramov (Farajev, Bayramov, 1988). They studied species composition, density dynamics and biomass of benthic organisms in Arpachay and Gilanchay rivers and recorded 43 and 29 species for each river respectively. Most species were phytophylous.

General characterization of the hydrographic network

The rivers of the Autonomous Republic are typical mountain rivers, which receive their flow from snow, rain, and groundwater. The total number of rivers here reaches 400. The length of 334 of them is up to 5 km, 31 of them are 6-10 km, 24 of them are 11-25 km, 7 of them are 26-50 km, 3 of them (Nakhchivanchay, Alinjachay, Gilanchay) are 51-100 km, 1 (Eastern Arpachay) is more than 100 km. The river network in the area is not evenly developed. Thus, the river network west of Nakhchivanchay river is extremely weak. To the east of it, the rivers flowing from the Zangazur range generate a dense network. As the mountains approach the Aras River from the north-west to the south-east of the area, the length of the rivers, catchment areas and currents in this direction decrease.

The sources of the major rivers of the region-Arpachay, Nakhchivanchay, Alinjachay, Gilanchay, etc. are located on the southern slopes of Daralayaz and Zangazur mountain ranges, 2700-3575 m above sea level. The share of surface water (snow and rain) in river nutrition is 47.0%, and the share of groundwater is 53%. The maximum flow is formed during spring precipitation.

The rivers that form the left tributaries of the Aras River define the general hydrographic network of the region. New and large water complexes built on the main riverbeds in recent 50 years, to use water resources more efficiently and fully meet the needs of the population and agriculture in water and electricity; those processes changed the hydrological network and created a completely new ecological environment for hydro-fauna.

Materials and Methods

Material for this investigation were collected from the above-mentioned rivers during 2018-2019, in all periods of the year. Benthic samples in water basins are carried out based on common methods adopted in hydrobiology (V.I. Jadin, 1956). Organisms that live on the soil at the bottom of the aquifers (epifauna) and inside it (infauna) and are visible to the naked eye generally form macro benthic organisms, or simply benthos. In benthos, motile forms or vagile creatures (river crustaceans, crabs, octopuses, starfish, etc.) lie on the ground, with noticeable immobile or sedimentary forms (ringworms, most mollusks, sea urchins, etc.) and live sedentary forms or sessile forms (sponges, bryozoans, polyps, etc.) that adhere to any solid substrate.

Results and Discussion

Results of our study conducted in 7 main rivers of Nakhchivan AR recorded 134 species of benthic organisms belonging to 18 systematical groups. 77 species were found in Nakhchivanchay river, 27 in Selesuzchay river, 21 in Jekhrichay river, 35 in Bichenekchay river, 68 in Arpachay river, 45 in Gilanchay river, and 55 in Alinjachay river.

Among revealed groups the most diverse were chironomid larvae (30 species-22.3%), followed by coleopterans (14-10.4%) and trichopterans (10-7.5%). Other groups were represented from 1 to 9 species (Table 1, Fig. 2).

Table 1. Species composition of macrozoobenthos in certain rivers of Nakhchivan AR.

S.No	Groups	Total number of species	Rivers						
			Nakhchi vancay	Arpa chay	Selesuz chay	Jaekhrich hay	Bichenek chay	Gilanchay	Alinjachay
1.	<i>Nematoda</i>	1	1	1	1	-	-	-	-
2.	<i>Oligochaeta</i>	6	3	4	-	-	-	-	4
3.	<i>Hirudinea</i>	5	2	-	3	-	2	-	3
4.	<i>Mollusca</i>	5	5	4	-	2	1	1	5
5.	<i>Amphipoda</i>	2	2	2	-	1	1	-	1
6.	<i>Ostracoda</i>	8	3	6	1	1	1	1	1
7.	<i>Hydracarina</i>	4	2	2	1	3	-	1	1
8.	<i>Plecoptera</i>	2	-	2	-	-	2	1	2
9.	<i>Odonata</i>	9	7	4	2	1	3	-	1

10.	<i>Ephemeroptera</i>	8	3	3	1	1	3	4	-
11.	<i>Hemiptera</i>	9	6	5	3	2	4	3	1
12.	<i>Coleoptera</i>	14	10	7	5	3	3	2	3
13.	<i>Trichoptera</i>	10	5	4	2	2	4	3	11
14.	<i>Diptera</i>	9	6	7	2	-	3	5	4
15.	<i>Culicidae</i>	2	-	2	2	-	2	7	9
16.	<i>Chironomidae</i>	30	18	10	2	2	4	13	6
17.	<i>Simulidae</i>	7	3	5	-	3	2	2	3
18.	<i>Ceratopogonidae</i>	3	1	-	-	-	-	2	-
	Total	134	77	68	27	21	35	45	55

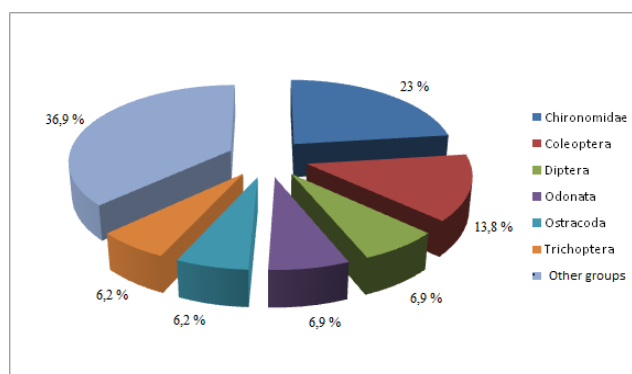


Fig. 2. Species diversity in different groups of macrozoobenthos in rivers of Nakhchivan AR.

Results

Nakhchivanchay river originates from the southern slope of Dereleyaz ridge of Lesser Caucasus. It starts to run from Kechaldag mountain at 3114 m above sea level. It is a left tributary of Aras River flows through the territories of Shakhbuz and Babek districts. Its length is 91 km and basin area is 1630 km². The river has 16 tributaries, 9 from left side and 7 from right side.

An average discharge of water in the river is 3.67 m³/sec, and average water turbidity is 700 g/m³. During the time of flooding, it rises to 1000 g/m³. Water mineralization with hydro carbonates is within 300-500 mg/l. Vaykhyr Reservoir is built on the river (Mammadov, 2012).

Coordinates

Origin: 39°48'29.15" Northern latitude, 45°73'59.19" Eastern longitude.

Mouth: 39°14'07.88" Northern latitude, 45°40'25.26" Eastern longitude.

During the study period, average water temperature was 17.2-21.4°C, pH 7.1-7.4, and oxygen level 8.2-8.4 mg/l. 77 species of benthic organisms belonging to 18 systematical groups were found in the river. Among these, 18 species were represented by chironomid larvae, 10 by coleopterans, 7 by dragonfly larvae, and 6 by dipterans. The rest groups were represented from 1 to 5 species.

The most abundant species were *Nais communis*, *Pisidium amnicum*, *Lymnaea auricularia*, *Baetis rhodani*, *Caenis macrura*, *Coenagrion puella*, *Hydraticus seminiger*, *Berosus spinosus*, *Cricotopus silvestris*, *C. algarum*, *Procladius ferrugineus*, *P. choreus*, *Chironomus plumosus*. The most abundant were water invertebrates. Their total biomass was 2.13 g/m², and density-802 individual/m².

Arpachay (Eastern Arpachay) is the largest transit river of the region. This river originates from springs flowing from northern slope of Goychay and western slope of Zangezur ridge at the altitude of 3100 m above sea level. The river length is 126 km, and basin area is 2630 km². Eastern Arpachay has 23 tributaries, 13 from right side and 10 from left side.

Coordinates

Origin: 39°57'5.27" Northern latitude, 45°39'52.36" Eastern longitude.

Mouth: 39°46'85.77" Northern latitude, 44°94'67.71" Eastern longitude.

During the period of investigation, the water temperature was 19.4-21.6°C, pH-7.1-7.2, and oxygen level 8.1-8.4 mg/l. 68 species of benthic organisms belonging to 16 systematical groups were recorded in the river. Among these the most diverse were chironomid larvae (10 species), following by coleopterans and dipterans (both by 7 species). The rest groups were represented from 1 to 6 species. The most abundant species were *Nais communis*, *Eiseniella tetraedra*, *Planorbis planorbis*, *Lymnaea peregra*, *Baetis rhodani*, *Cloeon dipterum*, *Notonecta glauca*, *Lestes sponsa*, *Candona neglecta*, *Helmis sp.*, *Oxyethira distinctellata*, *Ecnomus tenellus*, *Leptocerus tineiformis*, *Procladius ferrugineus*, *P.choreus*, *Diamesia prolongata*, *Dixa amphibia*.

The total biomass of benthic organisms in the river was 2.33 g/m², and density 1095 individuals/m². Within different groups the density varied between 14 and 146 individuals/m², while biomass between 0.01 and 0.38 g/m² (Table 2). As it is seen from the Table the largest biomass and the highest density was observed in Culicidae. The biomass and density of leeches (Hirudinea) made

up 0.35 g/m², and 128 individual/m². Minimal density was recorded for coleopterans, whereas minimal biomass for nemathodes. The biomass of trichopterans constituted 0.12 g/m², oligochaetas-0.35 g/m², mayfly larvae-0.26 g/m², and chironomids-0.33 g/m².

Table 2. The density dynamics and biomass of macrozoobenthos in some rivers of Nakhchivan AR ($\frac{\text{individual}}{q} \cdot \text{m}^2$).

S.No.	Groups	Rivers						
		Nakhchivan chay	Arpachay	Selesuzchay	Jekhrichay	Bichenek chay	Gilanchay	Alinjachay
1	Nematoda	-	18/0.01	6/0.01	-	-	9	10
2	Oligochaeta	23/0.15	107/0.35	-	-	-	-	$\frac{10}{0.03}$
3	Hirudinea	2/0.02	128/0.25	-	-	-	-	$\frac{66}{0.10}$
4	Mollusca	-	72/0.12	-	-	2/0.01	-	-
5	Amphipoda	-	15/0.02	-	-	80/0.21	-	-
6	Ostracoda	40/0.25	47/0.11	14/0.06	12/0.03	-	-	-
7	Hydrocarina	3/0.01	15/0.02	-	-	-	-	-
8	Plecoptera	-	-	-	-	5/0.01	$\frac{10}{0.38}$	-
9	Odonata	-	26/0.08	-	-	-	9	10
10	Ephemeroptera	320/0.90	130/0.26	12/0.05	20/0.04	71/0.12	-	-
11	Hemiptera	4/0.02	28/0.06	10/0.02	11/0.05	-	-	-
12	Coleoptera	5/0.01	14/0.09	5/0.02	1/0.01	5/0.02	-	$\frac{28}{0.09}$
13	Trichoptera	-	80/0.12	36/0.10	-	41/0.16	-	$\frac{14}{0.05}$
14	Diptera	10/0.06	84/0.14	2/0.01	-	20/0.04	-	$\frac{46}{0.08}$
15	Chironomidae	195/0.23	125/0.33	23/0.02	18/0.03	134/0.24	9	10
16	Simuliidae	200/0.51	-	-	37/0.04	166/0.16	-	$\frac{18}{0.05}$
17	Culicidae	-	146/0.38	10/0.01	-	-	-	-
	Total:	802/2.13	1035/2.33	118/0.29	99/0.20	524/0.97	-	-
							$\frac{58}{0.07}$	-
							$\frac{70}{0.46}$	$\frac{306}{0.72}$

As can be seen from the table, the biomass of chironomid larvae was 0.24 g/m², the number was 164 individuals/m², the number of crayfish was 80 individuals/m², and the biomass was 0.21 g/m².

Selesuzchay is right tributary of Nakhchivanchay river flowing through the territory of Shakhbuz district. Its total length is 19 km with basin area being 66 km². The river is mainly fed by snow and underground waters. The famous "Badamly" mineral spring is situated within basin of this river.

Coordinates

Origin: 39°45'06.27" Northern latitude, 45°53'89.40" Eastern longitude.

Mouth: 39°38'52.22" Northern latitude, 45°50'69.87" Eastern longitude.

During the study period, the water temperature was 15.4-16.2°C, pH-7.2-7.3 and oxygen regime 8.4-8.5 mg/l. 27 species of benthic organisms were found in the river. Of these, five species belong to Coleoptera (*Berosus spinosus*, *Platambus sp.*, *P. maculatus*, *Dytiscus marginalis*, *Hydraticus transversalis*). These species primarily inhabit stone biotopes.

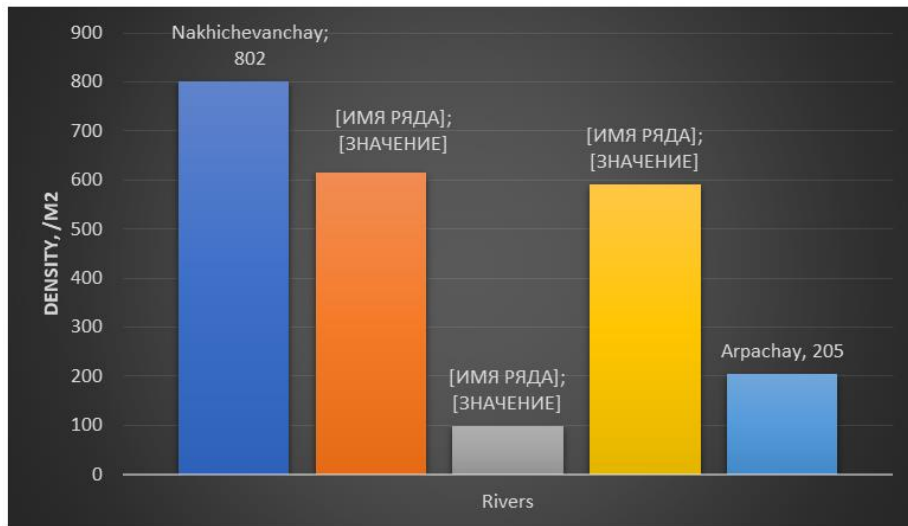


Fig. 3. The density dynamics of macrozoobenthos in rivers of Nakhchivan AR.

The biomass of benthic organisms was 0.29 g/m², and density 118 individual/m². Within different groups the density varied between 2 and 36 individuals/m², while biomass between 0.01 and 0.10 g/m² (Table 2).

Jekhrichay originates from southern slope of Dereleyaz ridge of Lesser Caucasus at the altitude of 2320 meter above sea level. The length of the river is 45 km, basin area is 442 km². It has 7 main tributaries, 3 from right side, and 4 from left side.

Coordinates

Origin: 39°61'42.03" Northern latitude, 45°30'03.32" Eastern longitude

Mouth: 39°29'84.50" Northern latitude, 45°45'11.15" Eastern longitude

During the period of investigation, the water temperature was 17.4-19.2°C, pH 7.1-7.3, and oxygen regime 8.1-8.3 mg/l.

Twenty-one species of benthic organisms were recorded in this river. Among these the most diverse were coleopterans (7 species), followed amphipods and dragonfly larvae (Odonata) each group being represented by 4 species. The rest taxa were represented from 1 to 3 species. The most abundant species were *Sphaerium solidum*, *Gammarus matienus*, *Notonecta glauca*, *Caenis macrura*, *Candona neglecta*, *Berosus spinosus*, *Aedes caspicus*. The total biomass of benthic organisms was 0,20 g/m², and density 99 individual/m². Within different groups the density varied between 1 and 37 individuals/m², while biomass between 0.01 and 0.05 g/m².

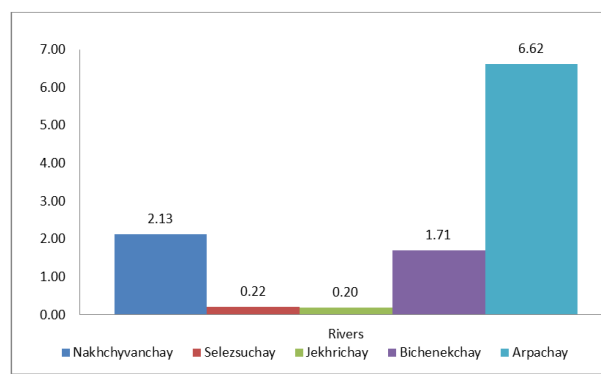


Fig. 4. The biomass of macrozoobenthos in rivers of Nakhchivan AR.

Bichenekchay is a left tributary of Nakhchivanchay. Its length is 69 km. The riverbed is clay with many stones.

Coordinates

Origin: 39°50'09.50" Northern latitude, 45°76'02.97" Eastern longitude.

Mouth: 39°48'29.11" Northern latitude, 45°73'59.15" Eastern longitude.

During the period of investigation, the water temperature was 14.1-15.7°C, pH-7.1-7.4, and oxygen regime 8.4-8.6 mg/l. In the river 35 benthic organisms were recorded. Of these 4 species were representatives of trichopterans (*Ecnomus tenellus*, *Hydropsyche ornatula*, *H.pellicidula*, *Leptocerus tineiformis*), 3 ephemeropterans (*Baetis rhodani*, *Cloeon dipterum*, *Acentrella lapponica*), 3 coleopterans (*Gaurodytes bipustulatus*, *Latelmis volckmari*, *Hydrochus elongatus*), and 3 dipterans (*Eusimilium keisleri*, *E. subcostatum*, *Culex pipienus*). The rest groups were represented by 1-2 species. The total biomass of benthic organisms was 0.97 g/m², and density 524 individual/m².

Gilanchay flows on the south-western slope of the Gilenchay-Zangazur range, and its source is at an altitude of 2700 m above sea level. It joins the Aras River at an altitude of 375 km and 678 m above sea level (M. Mammadov, 2002). Its length is 53 km, the area of the basin is 426 km².

Coordinates

Origin: 39°21'36.31" Northern latitude, 45°76'02.97" Eastern longitude.

Mouth: 38°91'12.74" Northern latitude, 45°81'19.41" Eastern longitude.

During the observations, the water temperature was 19.8-20.29°C, the pH was 7.1-7.3, and the oxygen regime was 8.4-8.5 mg/l.

During the study, 45 species of benthic organisms belonging to 13 systematic groups were found in the river. Of these species, 13 are chironomid larvae and 7 are two-winged insects. The remaining groups are represented by 1-4 species. Of the species found, 36 species (80%) are aquatic insects. The species such as *Epallage fatime*, *Cloeon simile*, *Corixa punctata*, *Laccophilus sp.*, *Tabanus bovinus*, *Limnobia sp.*, *Tipula sp.*, *Athirex sp.*, *Cricotopus silvestris*, *Orthocladius saxicola*, *Ablamesmia cilus*, *Ablamesmiya monilis* differ because of their formation intensity.

The biomass of benthic organisms in the river is 0.46 g/m², and the number is 370 individuals/m². The total biomass of organisms by groups is 0.06-0.38 g/m², and the number is 10-58 individuals/m². Chironomid larvae (58 individuals/m², 0.07 g/m²) predominated in terms of biomass and number. Minimal development (2 individuals/m²; 0.01 g/m²) is observed in heleids.

Alinjachay was formed from the confluence of the Khaznadera and Yeketsu rivers near the village of Arafa, formed by the confluence of springs flowing from the southern slope of Demirlidag (3363 m), a peak of the Alinjachay-Zangazur range. The source of the river is 2800 m above sea level. The length of the river is 62 km, the area of the basin is 599 km².

Coordinates

Origin: 39°27'76.97" Northern latitude, 45°82'96.46" Eastern longitude.

Mouth: 38°97'53.33" Northern latitude, 45°58'48.43" Eastern longitude.

During the observations, the water temperature in the river is 20.4-21.10°C, pH 7.1-7.2, oxygen regime 8.1-8.2 mg/l (Table 3).

During the study, 55 species belonging to 15 systematic groups were found in the river. Of the species found, 1 belongs to the hard-winged insects, 9 to the two-winged insects, and 6 to the chironomid larvae. The remaining groups are represented by 1-4 species.

From the species, *Pallage fatime*, *Cordula aenea*, *Cloeon simile*, *Baetis rhodani*, *Hydroporus palustris*, *Hydrous piceus*, *Brychius elevatus*, *Latelmus wolkmar*, *Adapetus comatus*, *Tabanus autumnalis*, *T. bovinus*, *Limnobia sp.*, *Dixa maculata*, *Cricotopus silvestris*, *C. bififormis*, *Procladius choereus*, *Culicoides nubeculosum*, *C. salinarius* etc., differ according to their detection intensity.

The biomass of benthic organisms in the river is 0.72 g/m², and the number is 306 individuals/m². The total biomass of organisms varied between 0.03-0.10 g/m² and the number between 10-66 individuals/m². The maximum development of benthic organisms (0.18 g/m², 66 individuals/m²) is observed in moths, and the minimum development (14 individuals/m², 0.05 g/m²) is observed in hemispheres.

During the studies, certain water samples were taken from the stations over the rivers and sent to the Central Laboratory of the Ministry of Ecology and Natural Resources. Based on the results, the average indicators for physical-chemical elements in water are as follows (Table 3):

Table 3. Certain parameters of water quality in the rivers of Nakhchivan AR.

Indicators, by rivers

Parameter	Nakhchivanchay	Arpachay	Selesuzchay	Jekhrichay	Bichenekchay	Gilanchay	Alinjachay
Average temperature	17.2-21.4°C	19.4-21.6°C	15.4-16.2°C	17.4-19.2°C	14.1-15.7°C	19.8-20.29°C	20.4-21.10°C
pH	7.1-7.4	7.1-7.2	7.2-7.3	7.1-7.3	7.1-7.4	7.1-7.3	7.1-7.2
Oxygen level	8.2-8.4 mg/l	8.1-8.4 mg/l	8.4-8.5 mg/l	8.1-8.3 mg/l	8.4-8.6 mg/l	8.4-8.5 mg/l	8.1-8.2 mg/l
Conductivity, µs/cm	298	228	321	309	267	335	274
Ammonia (NH⁴⁺), mg/L	<0.01	<0.03	<0.02	<0.05	<0.02	<0.06	<0.02
Fluoride (F⁻), mg/L	0.13	0.09	0.15	0.21	0.05	0.17	0.11
Chloride (Cl⁻), mg/L	4.3	<3	5.8	3.9	<4	7.1	4.29
Nitrite (NO₂⁻), mg/L	<0.01	<0.03	<0.02	<0.09	<0.11	<0.05	<0.07
Bromide (Br⁻), mg/L	<0.05	<0.02	<0.09	<0.05	<0.05	<0.05	<0.05

Nitrate (NO₃⁻), mg/L	3	1.9	2.1	2	0.9	3.1	4
Sulphate (SO₄²⁻), mg/L	41.25	30	68.5	51.6	40	72.5	39.7
Phosphate (PO₄³⁻), mg/L	0.38	<0.09	<0.7	0.44	<0.04	<0.5	0.28
COD, mg/L	14	<5	23.3	20	<7	38.3	12
BOD5, mg/L	5	2	9.8	4	3.7	11.2	4
TSS, mg/L	86	<2	612	106	<6	481	99

With the help of the experts involved in UNDP-GEF Kura 2 Project, the initial assessment was conducted to determine the status of benthic community in the rivers. The obtained result from chemical analysis enables us to summarize that most rivers own normal conditions for the development of organisms (Table 4).

Table 4. The status of benthic community in the rivers of Nakhchivan AR.

Benthic Community state assessment	Status, by rivers						
	Nakhchivanchay	Arpachay	Selesuzchay	Jekhrichay	Bichenekchay	Gilanchay	Alinjachay
February 2018	Moderate	Moderate	Moderate	Moderate	Poor	Moderate	Moderate
April 2018	Good	Moderate	Good	Good	Moderate	Good	Moderate
July 2018	Moderate	Good	Moderate	Moderate	Good	Moderate	Moderate
October 2018	Moderate	Good	Moderate	Moderate	Good	Moderate	Good
January 2019	Poor	Moderate	Poor	Moderate	Moderate	Moderate	Moderate

Conclusion

Our study has shown that each river ecosystem of the autonomous republic has its own groups of bottom invertebrates and various biotopes with ecological conditions that can be considered favorable for their survival.

The study of the impact of habitat-biotope replacement in rivers on changes in species composition, quantitative indicators and ecological affiliation of bottom organisms allows to determine the patterns of spatial distribution in the ecosystem of fauna. Our goal was to determine the relationship between the taxonomic and ecological structure of the main rheophilic cenoses of zoobenthos formed in the rivers of the region and the types of biotopes.

Zoobenthos samples were collected from various soils and biotopes of rivers and their major tributaries. The material has been developed using generally accepted methods and tools in hydrobiological research. According to the frequency of occurrence ($P=m/n \gg 100\%$), the degree of dominance of the species included in the macrozoobenthos in the rivers was calculated. Here: m is the total number of specimens found in the species, n is the total number of specimens covering the biocenosis.

Research has shown that typical lithoreophilic and oxyphilic larvae (nymphs) belonging to the Ephemeroptera (22 species), Plecoptera (10 species) and Trichoptera (40 species) groups have higher incidence ($P>50\%$) in the upper and middle reaches of rivers, making up 55-7% of the total number of collected macrobenthic invertebrates. In the process of long evolution, they have made several adaptations to make efficient use of the sharp flow of water (1-2 m/s) and to live safely. The relative stability of the composition of the seasons in the same biocenoses on the rivers was determined. According to the frequency of encounters in these streams, the species composition of organisms belonging to the groups we consider secondary and random is different.

In the upper and middle reaches of the rivers, the larvae of the Mayfly, Caddisfly, Stonefly and blood-sucking simuliids (Simuliidae family) form the nucleus of the bottom fauna, Eukiefferiella, Orthocladius, etc.) are actively involved in the formation of lithoreophilic biocenosis, which has a rich species diversity. Predominance of Glossosomatidae (56%) and Heptageniidae (68%) families has been established.

In the ordinary streams of the lower reaches of the Arpachay, Nakhchivanchay and Gilanchay, the Lymnaeidae family (21%) and the Chironominae (48%) subfamily predominate in small areas with sandy, silty-sandy, silty, vegetative detritus and aquatic vegetation. Such biotopes include the classes Hirudinea and Ostracoda, Naididae, Tubificidae, Ephemerae, Dytiscidae, Dryopidae, Ceratopogonidae, Tipulidae, Tabanidae, and others. The types of seasons differ in the high frequency of occurrence.

The macrobenthic fauna of the psammophilic biocenosis in rivers is very simple in terms of species composition and other indicators. The flow of water constantly mixes the sand, changes its location, washes away the organic matter. Some species of the genus Ostracoda, Pisidium, Gammarus, Ephemera, Ophiogomphus, Cryptochironomus, Polypedulum, and others are permanent elements of the sand biotope. The biocenosis, which is mainly distributed in the form of small spots in the lower reaches, is of little importance in the biogeological life of rivers.

Due to the physical and geographical features of the region, the peioreophilic biocenosis in the rivers has a small area and is widespread in the lower reaches. Sludge biocenosis differs in species diversity and quantitative indicators; species of Tubificidae, Sphaeriidae, Hydrachnidae, Baetidae, Caenidae, Cordulidae, Chironomidae, Ceratopogonidae and individuals of other systematic

groups can be found here. Calculations have shown that in the biocenosis, the specific weight of Oligochaeta worm populations in the benthic topium is not high (3-5%).

The presence of plants in the water creates a completely new, adaptable habitat for the bottom fauna. Vegetation acts as a shelter and substrate for organisms, providing nutrients and oxygen. Stylaria, Nais, Eiseniella, Glossiphonia, Herpobdella, Limnea, Planorbis, Gammarus individuals, water mites (Hydrachnidae), insects and their larvae-Odonata, Ephemeroptera, Trichoptera, Coleoptea, Cryophore, Entera, Pterosaurs, Diptera (Diptera) Ablabesmyia, Diamesa, Microtendipes, Stictochironomus, Micropsectra, Polypedilum, Chironomus, Eusimulium, Odagmia, Tabanus, Psychoda and other species differ in the high frequency of occurrence in the phytoepihlic biocenosis. Biocenosis is very rich in quality (451 species) and quantity of chironomid larvae.


By the species diversity, density, and biomass the Arpachay is the most benthos rich river. Investigation has shown that the benthic organisms were most abundant in Arpachay (2.33 g/m²; 1035 individual/m²), following by Nakhchivanchay (2.13 g/m², 802 individual/m²). In general, in the studied rivers the biomass of benthic organisms varied within 0.19-2.33 g/m², and their density ranged from 99 to 1035 individual/m². It could be concluded that the rivers of Nakhchivan region provide favorable conditions for life and development of benthic organisms.

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