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# Macrozoobenthos of rivers of Nakhchyvan Autonomous Republic of Azerbaijan

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**Abstract**
The paper is dealing with investigation of macrozoobenthos of some rivers of Nakhchyvan AR of Azerbaijan. During investigation 134 species of benthic organisms belonging to 18 taxonomical groups were recorded. Among these 102 species were water invertebrates. The biomass of benthic organisms in different rivers varied within 0.20-6.62 g/m$^2$, while their densities ranged between 99 and 1205 individuals/m$^2$.

**Keywords:** macrozoobenthos, rivers, Nakhchyvan AR, Azerbaijan

## 1. Introduction
There is a dense hydrographic network in Nakhchivan AR (Autonomous Republic of Azerbaijan). The region's water system, including rivers, lakes and reservoirs has been formed over a long period of time and has undergone a number of changes. Duyluschay, Venendchay, Eylischay and some other old rivers are characteristic examples of changes of their hydrographic basins [1]. These networks are changing as a result 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. At the same time these are ecosystems which serve for maintenance and protection of local populations of fishes and invertebrates.
The hydrofauna of rivers of the region is rich. Its study has large scientific and practical importance. Considering the importance of macrozoobenthos in hydrofauna 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 Nakhchyvanchay, Selezsuchay, Jekhrichay, Bichenekchay, and Arpachay.
It should be noted that the study of hydrophauna of some of these rivers has been conducted 30 years ago, while others even 80 years ago. Since that time, some changes have occurred in the river hydrological and hydrobiological regimes.
The first and most important scientific information about macrozoobenthos of the rivers of Nakhchivan AR has been published in work by Derzhavin [2]. Additional data were given by Petrov [3], Chernova [4], Martynov [5], Kirichenko [6], and Alizadeh [7, 8, 9]. These authors recorded 68 species of benthic organisms for the fauna of rivers of Nakhchyvan AR.
Later, the benthic fauna of Nakhchyvan rivers was investigated by Sofiyev [10]. He recorded 39 species from Nakhchyvanchay, 42 from Alinjachay, 12 from Gilanchay, 20 from Eastern Arpachay, 18 from Shakhriyarchay and 7 from Darajachay. He noted that benthic organisms were prevailing by species number in two rivers, Nakhchyvanchay and Alinjachay. The fact of poor species diversity of zoobenthos in other rivers has been explained by rapid flow of water in these rivers. The researcher has also found that 49.4% of all recorded species were represented by chironomid larvae. In the studied rivers the biomass of benthic organisms constituted 22.73 g/m$^2$ in Gilanchay, 13.55 g/m$^2$ in Alinjachay, and 5.10 g/m$^2$ in Nakhchyvanchay. Further investigation of benthos of Nakhchyvan rivers was conducted by Farajev and Bayramov [11]. 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 phythophylous.

## 2. Material and Methods
Material for this investigation was collected in summer 2012 in different parts and biotopes of Nakhchyvanchay, Selezsuchay, Jekhrichay, Bichenekchay, and Arpachay rivers. The material was collected and treated according widely accepted methods in hydrobiology [12].

## 3. Results and Discussion

In result of our investigation conducted in five rivers of Nakhchyvan AR, 134 species of benthic organisms belonging to 18 systematical groups were found. Seventy seven species were found in Nakhchyvanchay, 27 in Selezsuchay, 21 in Jekhrichay, 35 in Bichenekchay, and 68 in Arpachay (Table 1).

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 (Fig. 1, Table 1).

Nakhchyvanchay river originates from the southern slope of Dereleyaz ridge of Lesser Caucasus. İt starts to run from Kechaldag Mt. at 3114 m above see level. It is a left tributary of Araks river and flows through the territories of Shakhbuz and Babek districts. Its length is 91 km and basin area is 1630 km$^2$. 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 m$^3$/sec and average water turbidity is 700 g/m$^3$. During the time of flooding it rises up to 1000 g/m$^3$. Water mineralization with hydrocarbonates is within 300-500 mg/l. Vaykhyr Reservoir is built on the river [13].

**Table 1:** The species composition of macrozoobenthos of some rivers of Nakhchyvan AR.

| № | Groups | Total number of species | Rivers | | | | |
|---|---|---|---|---|---|---|---|
| | | | Nakhchyvan chay | Arpachay | Selezsunchay | Jekhrichqay | Bichenekchay |
| 1. | *Nematoda* | 1 | 1 | 1 | 1 | - | - |
| 2. | *Oligochaeta* | 6 | 3 | 4 | - | - | - |
| 3. | *Hirudinea* | 5 | 2 | - | 3 | - | 2 |
| 4. | *Mollusca* | 5 | 5 | 4 | - | 2 | 1 |
| 5. | *Amphipoda* | 2 | 2 | 2 | - | 1 | 1 |
| 6. | *Ostracoda* | 8 | 3 | 6 | 1 | 1 | 1 |
| 7. | *Hydracarina* | 4 | 2 | 2 | 1 | 3 | - |
| 8. | *Plecoptera* | 2 | - | 2 | - | - | 2 |
| 9. | *Odonata* | 9 | 7 | 4 | 2 | 1 | 3 |
| 10. | *Ephemeroptera* | 8 | 3 | 3 | 1 | 1 | 3 |
| 11. | *Hemiptera* | 9 | 6 | 5 | 3 | 2 | 4 |
| 12. | *Coleoptera* | 14 | 10 | 7 | 5 | 3 | 3 |
| 13. | *Trichoptera* | 10 | 5 | 4 | 2 | 2 | 4 |
| 14. | *Diptera* | 9 | 6 | 7 | 2 | - | 3 |
| 15. | *Culicidae* | 2 | - | 2 | 2 | - | 2 |
| 16. | *Chironomidae* | 30 | 18 | 10 | 2 | 2 | 4 |
| 17. | *Simulidae* | 7 | 3 | 5 | - | 3 | 2 |
| 18. | *Ceratopogonidae* | 3 | 1 | - | - | - | - |
| 19. | Total | 134 | 77 | 68 | 27 | 21 | 35 |

During the period of investigation the water temperature was 17.2-21.4ºC, pH 7.1-7.4, and oxygen level 8.2-8.4 mg/l. In the river 77 species of benthic organisms belonging to 18 systematical groups were found. 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* Piguet, 1906, *Pisidium amnicum* (O. F. Muller, 1774), *Lymnaea auricularia* (L, 1758), *Baetis rhodani* (Pictet, 1843), *Caenis macrura* Stephens, 1835, *Coenagrion puella* (L, 1758), *Hydraticus semineger* (De Geer, 1778), *Berosus spinosus* (Steven, 1808), *Cricotopus silvestris* (Fabricius, 1794), *C. algarum* (Kieffer, 1911), *Procladus ferrugineus* (Kieffer, 1918), *P. choreus* (Meigen, 1804), *Chironomus plumosus* L, 1758. The biomass of benthic organisms constituted 2.13 g/m$^2$, while their density 802 individual/m$^2$.

Arpachay is the largest transit river in Nakhchyvan AR. This river originates from springs flowing from northern slope of Goychay and western slope of Zangezur ridge at the height of 3100 m a.s.l. The river length is 126 km, and basin area is 2630 km$^2$. Eastern Arpachay has 23 tributaries, 13 from right side and 10 from left side.

Eastern Arpachay river is widely used for irrigation and for water drinking. Water reservoir is built on the river with total volume of 150 mln. m$^3$ and useful volume of 140 mln. m$^3$. At the same time the Hydro Power Plant having an installed electric capacity of 25 megawatts was built on this reservoir. The chemical composition of water consist predominantly of hydrocarbonate and calcium. Sulfate ions (S $O_4$) constituted 7-16% eqv, while chlorine ions 1-8 % eqv [13].

During the period of investigation the water temperature was 19.4-21.6 ºC, pH 7.1-7.2 and oxygen level 8.1-8.4 mg/l. Sixty eight (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), followed by coleopterans and dipterans (both by 7 species). The rest groups were represented from 1 to 6 species. The most abundant species were *N. communis, Eiseniella tetraedra* (Savigny, 1826), *Planorbis planorbis* (L, 1758), *Lymnaea peregra* (O. F. Muller, 1774), *B. rhodani, Cloeon dipterum* (L, 1761), *Notonecta glauca* (L, 1758), *Lestes sponsa* (Hansemann, 1823), *Candona neglecta* G. O. Sars, 1887, *Helmis sp, O. distinetellata, Ecnomus tenellus* (Rambur, 1842), *Leptocerus tineiformis* Curtis, 1834, *P. ferrugineus, P.choreus, Diamesia prolongata* Lee, 1912, *Dixa amphibian* (De Geer, 1776).

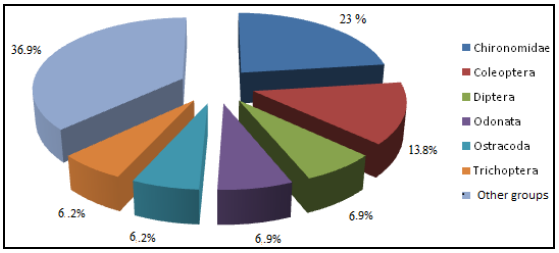


**Fig 1**: Species diversity in different groups of macrozoobenthos in rivers of Nakhchyvan AR.

The total biomass of benthic organisms in the river was 2.33 g/m$^2$, and density 1095 individuals/m$^2$. Within different groups the density varied between 14 and 146 individuals/m$^2$, while biomass between 0.01 and 0.38 g/m$^2$ (Table 2). As it is seen from the Table 2 the largest biomass and the highest density was observed in Culicidae. The biomass and density of leeches (Hirudinea) made up 0.35 g/m$^2$, and 128 individual/m$^2$. Minimal density was recorded for coleopterans, whereas minimal biomass for nematodes. The biomass of trichopterans constituted 0.12 g/m$^2$, oligochaetas – 0.35 g/m$^2$, mayfly larvae – 0.26 g/m$^2$, and chironomids – 0.33 g/m$^2$.

Selezsuchay is right tributary of Nakhchyvanchay flowing through the territory of Shakhbuz district. Its total length is 19 km with basin area being 66 km$^2$. The river mainly feeds on snow and underground waters. The famous “Badamly” mineral spring is situated within basin of this river.

During the period of investigation the water temperature was 15.4-16.2ºC, pH- 7.2-7.3 and oxygen regime 8.4-8.5 mg/l. In this river 27 species of benthic organisms were found. Of

these five species belong to Coleoptera (*B. spinosus, Platambus sp, P. maculatus* (L, 1758), *Dytiscus marginalis* L, 1758, *H. transversalis*). These species primarily inhabit stone biotopes.

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

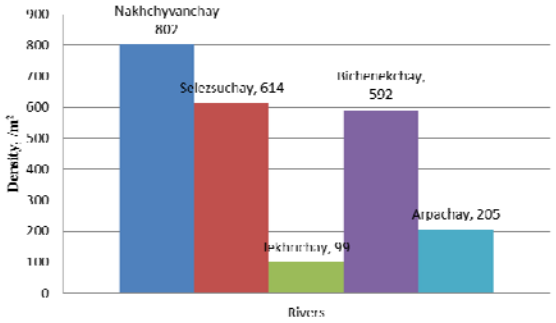


**Fig 2:** The density dynamics of macrozoobenthos in rivers of Nakhcnyvan AR.

Jekhrichay originates from southern slope of Dereleyaz ridge of Lesser Caucasus at the height of 2320 a.s.l. The length of the river is 45 km and basin area is 442 km$^2$. It has 7 main tributaries, 3 from right side, and 4 from left side.

During the period of investigation the water temperature was 17.4-19.2ºC, 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 Coleoptera, Hydracarina and Simulidae each group being represented by 3 species. The rest taxa were represented from 1 to 2 species. The most abundant species were *Sphaerium solidum* (Normand, 1844), *Gammarus matienus* Derzhavin, 1938 [2], *N. glauca, C. macrura, C. neglecta, B. spinosus, Aedes caspius* (Pallas, 1771). The total biomass of benthic organisms was 0.20 g/m$^2$ and density 99 individual/m$^2$. Within different groups the density varied between 1 and 37 individuals/m$^2$, while biomass between 0.01 and 0.05 g/m$^2$

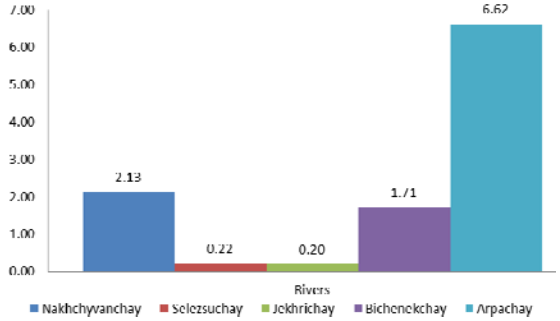


**Fig 3:** The biomass of macrozoobenthos in rivers of Nakhchyvan AR.

Bichenekchay is a left tributary of Nakhchyvanchay. Its length is 69 km. The river bed is clay with many stones.

During the period of investigation the water temperature was 14.1-15.7ºC, 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 (*E. tenellus, Hydropsyche ornatula* McLachlan, 1878, *H.pellicidula* Curtis, 1834, *Leptocerus tineiformis* Curtis, 1834), 3 ephemeropterans (*B. rhodani, C. dipterum, Acentrella lapponica* Bengtsson, 1912), 3 coleopterans (*Gaurodytes bipustulatus* (L, 1767), *Latelmis volckmari* (Panzer, 1793), *Hydrochus elongates* (Schaller, 1783)), and 3 dipterans (*Eusimilium keisleri, E. subcostatum* Dzhafarov, 1953, *Culex pipienus* L, 1758). The rest groups were represented by 1 – 2 species. The total biomass of benthic organisms was 0.97 g/m$^2$ and density 524 individual/m$^2$.

As it is seen from the Table 2 the chironomid biomass is 0.24 g/m$^2$, and density 134 individuals/m$^2$, while amphipods density is 80 individuals/m$^2$, and biomass 0.21 g/m$^2$.

**Table 2:** The density dynamics and biomass of macrozoobenthos in five rivers of Nakhchyvan AR ($\frac{\text{individual}}{\text{g}} \cdot \text{m}^2$)

| № | Groups | Rivers | | | | |
|---|---|---|---|---|---|---|
| | | Nakhchyvanchay | Arpachay | Selezsuchay | Jekhrichay | Bichenekchay |
| 1 | Nematoda | - | 18/0.01 | 6/0.01 | - | - |
| 2 | Oligochaeta | 23/0.15 | 107/0.35 | - | - | - |
| 3 | Hirudinea | 2/0.02 | 128/0.25 | - | - | - |
| 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 | 12/0.02 | - | - | - |
| 8 | Plecoptera | - | - | - | - | 5/0.01 |
| 9 | Odonata | - | 26/0.08 | - | - | - |
| 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 |
| 13 | Trichoptera | - | 80/0.12 | 36/0.10 | - | 41/0.61 |
| 14 | Diptera | 10/0.06 | 84/0.14 | 2/ 0.01 | - | 20/0.04 |
| 15 | Chironomidae | 195/0.23 | 125/0.33 | 23/0.02 | 18/0.03 | 134/0.24 |
| 16 | Simuliidae | 200/0.51 | - | - | 37/0.04 | 166/0.16 |
| 17 | Culicidae | | 146/0.38 | 10/0.01 | - | - |
| | Total: | 802/2.13 | 1035/2.33 | 118/0.29 | 99/0.20 | 524/0.97 |

By the species diversity, density and biomass the Arpachay is the most benthos rich river. The second is Nakhchyvanchay. The diversity of benthic organisms in the studied rivers varied between 21 (Jekhrichay) and 77 (Nakhchyvanchay) species. In the fauna of Arpachay 68 species were recorded. Among biotopes the most species rich are those that supporting phytophylous species, followed by stone biotopes.

Investigations have shown that benthic organisms were most abundant in Arpachay (2.33 g/$m^2$; 1035 individual/$m^2$), followed by Nakhchyvanchay (2.13 g/$m^2$, 802 individual/$m^2$). In general in the studied rivers the biomass of benthic organisms varied within 0.19-2.33 g/$m^2$ and their density ranged from 99 to1035 individual/$m^2$. It could be concluded that the rivers of Nakhchyvan region provide favorable conditions for life and development of benthic organisms.

## 4. Conclusion

The fauna of benthic organisms in five rivers of Nakhchyvan Autonomous Republic totals 134 species belonging to 18 taxonomical groups. Of these 102 species are invertebrates. In the studied rivers the biomass of benthic organisms varied within 0.19-2.33 g/$m^2$ and their density ranged from 99 to1035 individual/$m^2$. In the summer maximal abundance of macrozoobenthos was observed in Arpachay River.

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