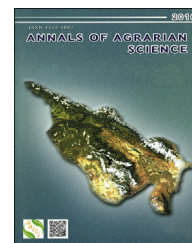


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## A review of benthic fauna biodiversity in Georgia



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### ABSTRACT

The paper summarizes information on diversity of benthic fauna of Georgia based on the literature sources. 126 publications were analyzed published after 1899. Our investigation showed that 15 lotic and 20 lentic ecosystems were studied out of which 21 (5 rivers and 16 lakes) belongs to the Caspian Sea basin and 14 (10 rivers and 4 lakes) to the Black Sea basin. As a result, 206 benthic animal taxa were described. From the described groups 81 are identified to the species level, 61 to the genus level, 28 to the family level, 16 to the order level, 10 to the class level, 10 to the phylum level. Since the most of observed freshwater systems are poorly studied, Paravani and Saghamo Lakes, Tsalka and Tbilisi Reservoirs and Kura (Mtkvari) and Rioni Rivers are rather well investigated. Our meta-analyses clearly show that in overall freshwater biodiversity of Georgia are significantly understudied.

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### Introduction

Benthic communities occur in a broad range of physical conditions, from the highly variable and turbulent hydrodynamic regimes associated with the rocky and coarse substrates of headwater streams and exposed coastal habitats to the less variable hydrodynamic regimes and fine-grained, muddy, or sandy sediments of deeper water habitats. In freshwater sediments, benthic invertebrates are diverse and abundant, but they are often patchily distributed and relatively difficult to sample [1,2]. Benthic communities are an important part of freshwater ecosystems and are easily affected by the environmental changes. Macroinvertebrates also serve as valuable indicators of stream degradation. Accordingly, the changes in benthic species composition and abundances could aid as an alarm system and even allow the quantification of environmental alterations [1–4]. That is why the benthic

communities are ultimate targets for bio-monitoring programs worldwide.

Georgia is rich by freshwater resources with up to 26,000 rivers, more than 850 lakes and 12 large reservoirs [5,6]. Georgia (the Caucasus) is plio-pleistocene refugia with very high biological diversity and the freshwater ecosystems are also expected to be very specious. However, the knowledge of biodiversity of Georgian freshwaters is fragmentary and frequently unreliable. Because of the absence of new data, old information is still widely used as a tool in environmental assessment programs. Research on benthic fauna of Georgia was started actively as late as 30th of nineteenth century. Before that time episodic studies have been done by Derjugin [7], Vereshagin [8], Arnoldi [9,10], Petrov [11], Sadovski [12] and Zhadin [13]. Unfortunately, the existing information on freshwater biodiversity of Georgia is not available except few old compendiums on some animal taxa [14,15]. This makes us unable to infer biodiversity of freshwaters of Georgia and even to detect the research trends and needs in the area.

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The goal of this paper is to summarize existing knowledge on the benthic invertebrate biodiversity in Georgian inland waters based on the all available sources published until now, to evaluate the level of the investigation of benthic communities, to identify knowledge gaps and future research needs.

## Materials and methods

In order to collate all existing information on freshwater benthic animals of Georgia, we conducted extensive search of literature published since 1899. For this purpose, any periodic issues or occasional monographs were analyzed. We made a bibliography of the publications and arrange them by the years, subject studied and regions investigated.

## Results and analysis

The final database of published sources includes 126 scientific publications. Some of them are not available and hence the content is unknown. There is strong asymmetry in studies of freshwater bodies. In particular, most frequently studied lentic systems are Paravani [12,16–18] and Saghamo Lakes [16,19,20], Tbilisi [4,21–24] and Tsalka (Khrami) Reservoirs [16,25] (Fig. 1), while most frequently studied lotic systems are Kura (Mtkvari) [26–29] and Rioni Rivers [30–32] (Fig. 2).

However, the term “most studied” here refers to 3–5 articles dealing with mostly single taxon which in reality indicate strong underrepresentation of our knowledge of true diversity. In total at least single samples are collected from 15 lotic and 20 lentic systems which in turn represent less than 1% of Georgian freshwater bodies (Fig. 3).

From studied freshwater systems, 21 (5 lotic and 16 lentic) belongs to Caspian Sea basin and 14 (10 lotic and 4 lentic) to Black Sea basin. The analyzed results showed that in overall 206 benthic animal taxa were collected belonging to 20 main groups, among which Oligochaeta were the most thoroughly studied (Fig. 4).

From the described taxa 81 are identified to the species level, 61 to the genus level, 28 to the family level, 16 to the order level, 10 to the class level, 10 to the phylum level. In total, 39.3% taxon were identified to the species level and 29.6% to the genus level (Fig. 5). Only animal group detected in all investigated water bodies was subclass Oligochaeta.

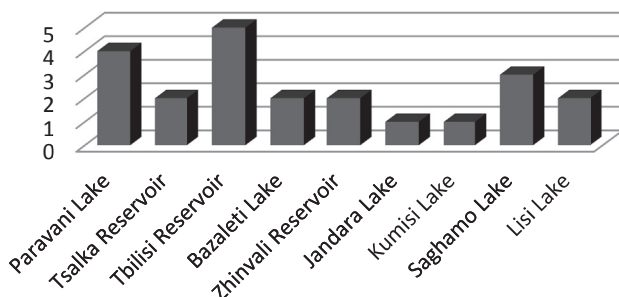


Fig. 1 – Number of published researches on benthic fauna of Lakes and Reservoirs.

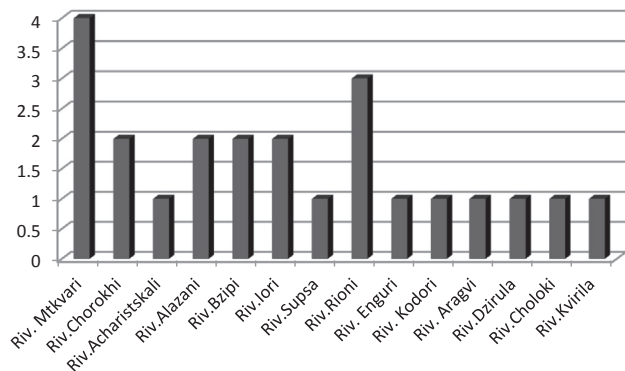


Fig. 2 – Number of published researches on benthic fauna of the Rivers.

The investigation shows that diversity of benthic forms is much higher in lakes and reservoirs than in rivers: in Tsalka Reservoir were identified 76 benthic forms, in Paldo Reservoir - 32, in Bazaleti Lake -29, in Marabda Reservoir - 17, in Kumisi Lake -17, in Paravani Lake-14, in Saghamo Lake -13, in Zhinvali Reservoir -13 (Fig. 6).

## Conclusion

From 1940th to 1980th is the period when the study of benthic animal was moderately active [3,16,17,21,22,25,27–54]. In next decades researches carried out in all these directions were gradually decreased [18,24,55–60]. Recently several publications appeared, but all of them are based on the data collected much earlier [4,20,24,60,61]. The research analysis dealing with the benthos study showed that the lakes are more thoroughly investigated than the rivers.

However, any inference based on published sources for Georgian freshwater animals would be strongly speculative, as the number of recorded species (or higher taxa) are very low compared to any other relatively well studied regions [62,63]. Using of freshwater communities in long term bio-monitoring programs where bibliographic sources are used as baseline data is not possible. Even initiating new programs is even difficult as the expertise in freshwater invertebrate taxonomy is very limited in Georgia. In other hand, effective biodiversity

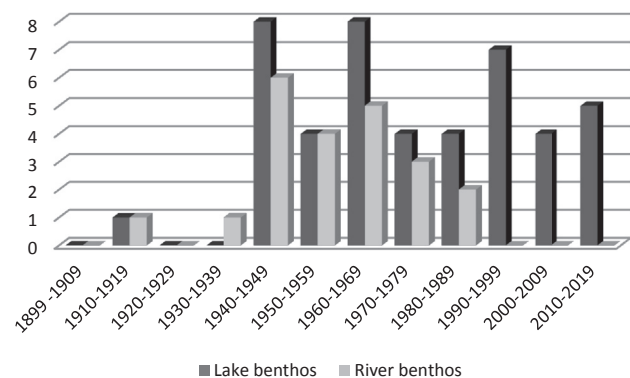


Fig. 3 – Zoobenthos studies in Lakes and Rivers of Georgia by decades.

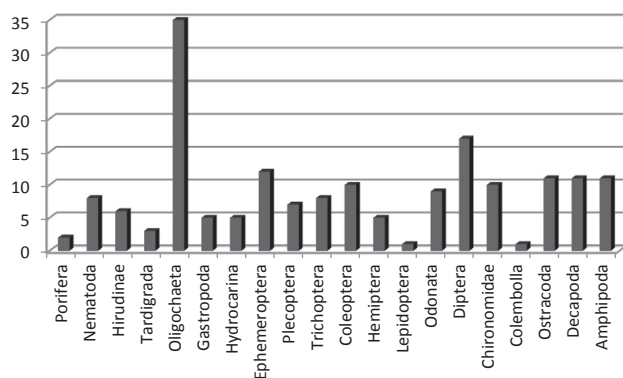


Fig. 4 – Basic forms of benthic organisms.

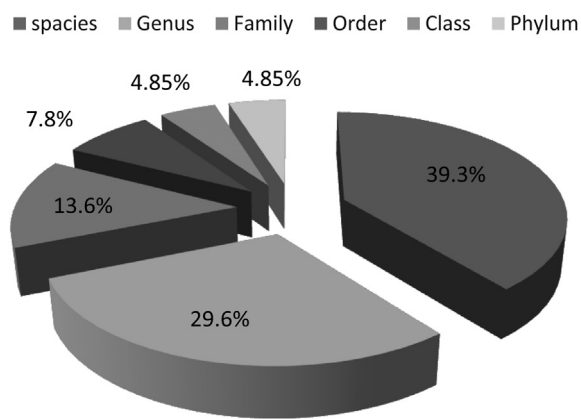


Fig. 5 – Quantitative composition of identified taxa.

conservation needs well informed conservation decisions to be made. That is a thorough understanding of the community composition and species distributions among the freshwater ecosystems. Clearly only way to protect our freshwater environment is to made blind decisions which could not be an effective tool.

Our short review clearly shows current problems associated to freshwater biodiversity studies in Georgia. As a whole Georgian freshwater ecosystems are strongly understudied. We have only a marginal understanding about the diversity of benthic animals and their role in freshwater ecosystems of Georgia. Freshwater benthic species evolved from many phyla over millions of years and represent a rich fauna. Many

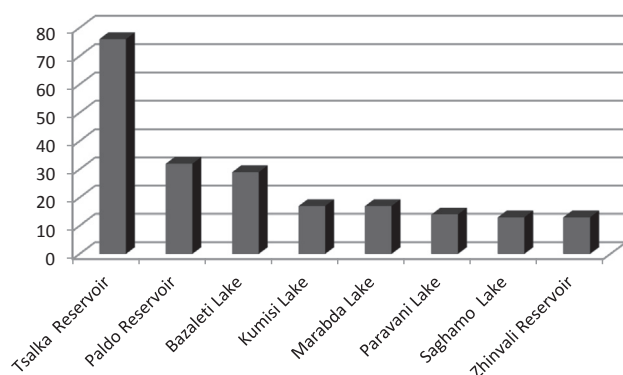


Fig. 6 – Quantitative composition of Benthic forms in lakes.

species still remain undescribed, both taxonomically and ecologically [1,2,64,65]. Protecting diverse benthic communities will require more thorough understanding of long-term functional relationships among these species in an ecosystem context [66]. There is an expertise deficiency as well as financial support to research organizations which may be able to develop some freshwater research facilities.

The present study is the first attempt to analyze existing information on benthic fauna in Georgia. It is clear that our understanding of freshwater biodiversity of Georgia is in its infancy and the much effort has to be made if we want to use and protect our freshwater ecosystems.

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