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The Impact of Climate Change on the Aquatic Macroinvertebrates in the Debed River

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Introduction

The Southern Caucasus countries show a rather different energy profile, with Azerbaijan consuming mainly its oil and gas resources, Georgia relying on hydropower production, and Armenia with a more diversified supply system of hydro and nuclear power (Figure 1) [1]. All three countries have embarked on the development of renewable energy resources supported by many international agencies, but only a few projects have actually started [2].While the climate change research and the water quality monitoring of three countries' rivers.

Climate change is already occurring in Armenia show statistically increasing trends in mean annual temperature mean daily minimum temperature and mean daily maximum temperature over the last century, though there are no trends in mean annual precipitation, nor the number of wet days per year. The evidence for trends in annual precipitation is less convincing, although there are stations in Armenia that have experienced precipitation declines. All the climate models are in accord that the mean annual temperature will increase significantly by the end of the century: 4 ºC - 5.1 ºC in Armenia. By 2050, the projected change in mean annual temperature is: 1.1 ºC – 1.9 ºC, 1.0 ºC – 1.6 ºC, 0.9 ºC – 1.9 ºC for Armenia [3]. While in Vanadzor, Vanadzor is an urban municipal community and the third-largest city in Armenia serving as the capital of Lori Province in the northern part of the country. It is located about 128 kilometres north of the capital Yerevan [4]. Vanadzor is located in the valley of Pambak River [4]. The vanadzor city is most polluted than other city near the Debed river in Lori Province [4]. However, there needs to be more research into the current level of acclimation in these cities and how this urban heat stress may translate into increased mortality.

Figure 1: The location of the three trans-boundary river basins in the South Caucasus

A general characteristic of water quality are river's biodiversity. The research has been indicated the impact sources of benthic macroinvertebrate numbers reduction and water quality formation factors, hydrogeological characteristic one of the Armenian resources which is in impacting of global warming is the geological mining industry. For this reason Geological modelling is increasingly playing an important role in various areas of hydro sciences and earth sciences.

Several years of experience of investigations with macrozoobenthos in the Debed river, a biological assessment system has been developed to indicate pollution levels caused by easily degradable organic substances from sewers.

All the research was carried out to determine the effects of anthropogenic addition to the impact of geological changes. For example, geological mining industry, underground water's radioactive pollution and pollution of chemical residues are influence on the environment [5]. A mining and geological engineer is someone who designs mines for the safe and efficient removal of minerals.

The macroinvertebrates are good indicators for aquatic ecosystems, chromic pollution, hydrogeochemical and water temperature.

This research is most important for ecological monitoring and related environmental scientific disciplines such as biogeography, soil science, geomorphology and biodiversity of water. Coverage is wide-ranging and includes plant and animal physiology, animal behaviour, pollution, conservation, habitat management, evolution, environmental pollution and water pollution.

Hydroecological and geological circle are connect from regional position and environment. The water resources are important for economic development of RA. But we know that the surface water quality falls along with economic recovery, because from emissions, geological of mining, underground water's radioactive pollution and pollution of chemical residues are influence on the environment.

Geoecological study of the Debed river and Material

The Debed River is the biggest river of the Kur River watershed and the deeper mountain river in Armenia. It is the confluent of the Zoraget and the Pambak Rivers, which join at 2 km northward from Tumanyan Railway Station, and then flows into the Kharam

River. The Debed length, starting from the Pambak River head, makes up 178 km, 152 km of which is on the territory of Armenia, the rest of it is on Georgia area [5]. The watershed surface area

- Watershed area – 3790 km^2
- Length – 158 km
- Average annual flow – 38 m^3 /sec
- Average annual water volume – 1086 mln. m^3 [6].

In the figure 2 and table1 is observation network of surface water monitoring of the Debed River following places [3].

Table 1: The sampling observation network of the Debed river

Numberofvantage-ground	Locationofvantage-ground
1	Khnkoyanvillage
2	0.5 km under from Spitak city
12	Estuary
4	0.5 km under from Vanadzor city
13	Estuary
7	Nearborder

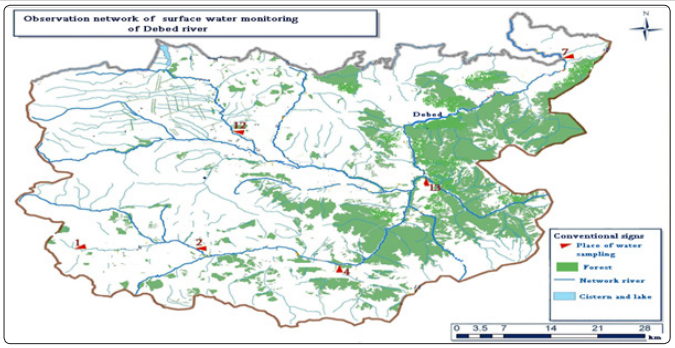

Figure 2: Map of observation network of surface water monitoring of the Debed River

Studying macroinvertebrate diversity is one of the most effective and inexpensive ways to estimate the ecological quality of the waters. The study was conducted mainly of six sampling stations of the Debed river. Selection of the sampling stations was based on the possible pollutant loads and the magnitude of human activities along the rivers. Benthic macroinvertebrates, especially aquatic insects, represent a choice group of organisms used in biological monitoring programs. This research is important water quality of all water resources. Despite detailed data quality objectives, field methodology, and laboratory analysis and data presentation, if often requires extensive professional experience and skill and knowledge of the scientific literature to draw defensible conclusions from a data set. Every research helps other researching processes.

The geological research work has covered all the geological and seismological aspects, which is impacted on the aquatic macroinvertebrates, including regional geology, regional geomorphology, environmental geology, and natural construction materials. A variety of techniques and methods have been employed, including surface geology, aerogeophysical prospecting, engineering geophysics, high precision deformation observation.

Method of Biological Analysis

The analytical methods of water quality parameters were followed by the Standard Method. The sampling of benthic macroinvertebrates is important for the replication, therefore we have chosen in the spring (abundant flow of the river, the begining of the vegetation season) and autumn (the flow of river is scarce).

The sampling protocol of macroinvertebrates we are used by sampling procedure according AQEM Consortium.

AQEM enables water managers in eight European countries to assess the Ecological Quality of streams with benthic macroinvertebrates using a system [3].

Aims of the AQEM system are:

- to classify a stream stretch into an Ecological Quality Class from 5 (high) to 1 (bad) based on a macroinvertebrate taxa list, which has been obtained from sampling the stretch using a harmonised method
- to give information about the possible causes of degradation in order to help di-rect future management practices [3].

ASTERICS (AQEM / STAR Ecological River Classification System) is software for the calculation of the ecological quality of rivers according to the specifications of the EC Water Framework Directive (WFD) based on macroinvertebrates. The program is able to read from Excel Taxalisten (alternatively, also in the form of a text file), and the results of the calculation back to Excel and / or Access to exportie-ren. Addition: Since version 3.3 of Export file is also possible [3].

Result and Discussion

We in basically discovered during the research in the following insects, Trichoptera, Ephemeroptera, Simulidae, Chironomidae, Coleoptera, Blepharoceridae, Rhagionidae, Gammaridae, Hirudinea. In bottom fauna of Debed river's under flowing is decrying, that the number of individuals and biomass population decrease.

In the bottom fauna of the Debe driver is found nearly 46 species in. The other dominant characteristic of the Debed river assemblages was the relative lack of sensitive and delicate taxa, particularly those in the indicator groups mayflies (Ephemeroptera), flies (Diptera), and caddisflies (Trichoptera) (Figure 3.).

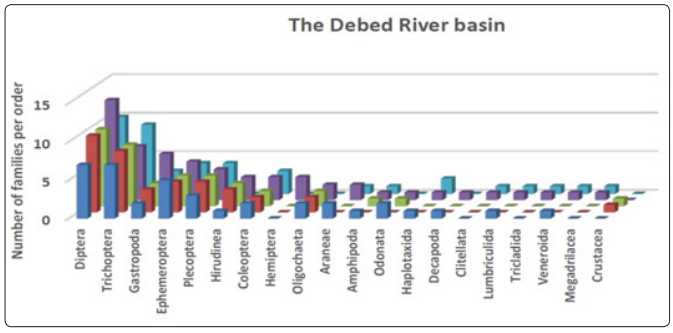

Figure 3: Number of macroinvertebrate taxa in taxonomic groups for the Debed River basin

The relative sensitivity of specific indicator species to pollution and the diversity of species present. The index value varies from 0 (extremely bad quality) to 10 (extremely good quality). Initially, the invertebrates present are divided into 7 main faunal groups (at order, family and/or genus level), then the number of systematic units is counted. The division of taxa into systematic units is undertaken predominantly at family and genus level.

For the Debed river type modelling and expert judgement will be applied later to establish reference conditions values for the macroinvertebrates taxa (no locations were found without human impact on the given water body type).

Conclusion

In addition to the key factors - water temperature, abiotic and biotic factors which will not be covered within this system, such as climate change, geology, topography, discharge, habitat structure, and competition. The study is based on the quality control of river water, which is caused by the chemical composition of the water as well as aquatic benthic macroinvertebrates. Geological changes of the river also had an impact on the development and propagation of invertebrates.

- In conclusion the water quality does have a positive effect on the quantity of macroinvertebrates in the river.
- Aquatic macroinvertebrates can be used as Bioindicators for freshwaters.

To meet obligations under the Convention on Biological Diversity (CBD), introduce climate adaptation for planning, design and implementation of biodiversity conservation, such as protected areas and species programmes [7-9].

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