

## Aquatic flora and ichthyofaunal diversity in upstream of the Vardar River

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### Abstract

Vardar River is the largest river in the country. Springs on the slopes of Shara, near the village Vërtok, a few kilometers from the town of Gostivar. Upstream of the Vardar River is characterized by a very interesting aquatic flora and ichthyofaun. Aquatic flora is mostly epilithic and epifaunal character. It is represented by mosses and algae. Encountered within *Fontinalis antipyretica* and *Rhynchostegium riparioides*. They are represented by algae *Cladophora glomerata* and species of genus *Voucheria* sp. In winter and early spring, rocky surfaces upstream of the river, covered with dense populations of mikroflora, mainly by blue green algae (*Cyanophyta*) and diatom (*Bacillariophyta*). As the most common kind of gender separated *Nitzschia* sp., which encountered next to the river, mainly as benthic forms. Ichthyofaun of Vardar River is very rich and is represented by 19 species and subspecies of fish, which can be distinguished: *Salmo trutta fario*, *Salmo macedonicus*, *Leuciscus cephalus vardarensis*, *Chondrostoma nasus vardarensis*, *Cobitis taenia vardarensis*, etc.

**Keywords:** River Vardar, aquatic flora, mosses, algae, ichthyofaun, fish.

### 1. Introduction

Vardar River is the largest river in the country. Springs on the slopes of Shara, near the village Vërtok, a few kilometers from the town of Gostivar. Source of the River Vardar is located at 683m altitude. Macedonian territory reaches a length of 301 km, while its overall length, to the Aegean Sea, totaling 388 km. Upstream of the Vardar River running through Pollog Valley. The annual average water temperature of the Vardar River is 11.8 °C, in July and August maximum of 17.8 °C, while the minimum recorded in January of 5.9 °C. Physico-chemical parameters entered and heavy metals, organic compounds and inorganic sediments, turbulence, etc.

It's upstream, characterized by a very interesting flora, mainly of epilithic character. These plants are found firmly attached to the rocks, covering almost entirely underwater rock surfaces. Adapted this way of life, being strengthened rocky substrate, manages to resist the rapid flow of the river. Aquatic flora of the Vardar River is primarily represented by aquatic

algae and mussels [2, 3]. Benthic flora and flora of algae, from the source to close to the town of Gostivar is quite developed, while in the further course of the river significantly reduced. All this can be justified by the permanent pollution of the river made by anthropogenic factors. Ecosystems of rivers in general, and for the Vardar River is almost common phytoplankton appear very weak or almost not at all, due to the speed of flow, while benthic algae, mainly from algae diatom, appearing with populations rather reduced.

In natural lakes and rivers of Macedonia, were found 65 taxa of freshwater fish or, more precisely, 49 species and 16 subspecies [4]. The level of endemism within this group of vertebrates is 74%. Nine species and subspecies are endemic to Macedonia, while 5 taxa are endemic to the Balkans. From this total number of fish, 19 of them are found in the Vardar River.

### 2. Material and Methods

For the realization of this study are applied standard methods for floristic and

ichthyofaunal research. Such studies involve the identification of individual species and also the assessment of abundance of species. The techniques applied are known as floristic methods of vegetation and ichthyofaunal description. Specimens of these species are deposited in the Department of Biology, State University of Tetova

### 3. Results and Discussion

Vardar River water mussels appear especially in its upper course, from the source to close to the town of Gostivar. In the further course, their numbers significantly reduced and are found in much reduced populations. These molds are encountered forms and reinforced epilite for surface reefs. Forms are interesting for science but also a real attraction for visitors, creating underwater imposing views. Populations are important aquatic moss *Fontinalis antipyretica*, which are widespread in its upstream. These mosses create a sensational underwater vegetation and offer very favorable living environment for nektonic organisms, especially fish, providing shelter for their eggs, as well as underwater epiphytes microflora. Body of these mosses, more or less can be found attached epiphytes some microscopic algae, diatoms mostly group [1, 2].

*Fontinalis antipyretica* moss that is found only in clean water and its sensational appearance, upstream of the Vardar River, clearly testifies to the quality and purity of water. Displayed especially in shaded areas and its presence is considered as a very important bio-indicators of clean water. Not by chance, the course follows the river, the emergence of populations of this moss becomes more and more reduced, which testifies to the permanent contamination and loss of water quality, primarily as a result of the impact of anthropogenic factors.



**Figure 1.** *Fontinalis antipyretica*. Underwater views of epilite populations of moss.

Another important moss, spread upstream of the Vardar River, is *Rhynchostegium riparioides*. Green moss is deciduous. He lives fully or partially immersed in water, reinforced limestone. There stalk branched that grows 5-25 cm. It is interesting that the size of musk varies significantly, depending of living conditions, namely the purity of the water. Clean water creates long branches, while in the most polluted waters are found in much smaller form.



**Figure 2.** *Rhynchostegium riparioides*.

Besides the aforementioned mosses, upstream of the Vardar River also faces a considerable number of algae. They are very widespread algae *Cladophora glomerata* populations and species of genus *Voucher sp.* These algae are epilite and encountered forms of strengthened rocks, especially limestone [3]. These algae create a sensational underwater vegetation and provide favorable living environment for nektonic organisms, especially fishes, providing

shelter for their eggs, as well as underwater epiphytes microflora.

In winter and early spring, rocky surfaces upstream of the river, covered with dense populations microflorae [3], mainly by blue green algae (*Cyanophyta*) and diatom (*Bacillariophyta*). As the most prevalent are species of genus *Nitzschia sp.*, which encountered next to the river, mainly as bentosale forms.

Nekton in Vardar River is characterized by multiple forms of relict and endemic, occurring especially fish. Polog Region, in the course of the Vardar River from its source, depending on the annual season meet on the 19 species, subspecies of fish respectively marrow [4].



**Figure 3.** *Cladophora glomerata*.



**Figure 4.** *Vaucheria sp.*

Subspecies: *Salmo trutta fario* - is a fish of gender *Salmo sp.*, *Salmonidae* family, that lives in cold water and clean mountain rivers and streams. Species: *Salmo gairdneri* - he lives in fresh water. Body weight can reach even several kilograms. Species: *Salmo macedonicus* - it is an

endemic fish living upstream of the Vardar River. It can reach up to 3 kg weight. It can reach up to 40 cm body length [5, 6].



**Figure 5.** *Salmo macedonicus*



**Figure 6.** *Leuciscus cephalus vardarensis*

Subspecies: *Leuciscus cephalus vardarensis* - he lives in cold waters and fast, but meet in small groups in waters with slower flow. It can be found at the sources of rivers such as the case with the Vardar River. Subspecies: *Chondrostoma nasus vardarensis* - he lives in rivers with clean water and mountain streams. Subspecies: *Rhodeus sericeus meridionalis* - he lives in clean waters of Vardar, especially upstream to sandy substrate.



**Figure 7.** *Chondrostoma nasus vardarensis*



**Figure 8.** *Rhodeus sericeus meridionalis*

Other species and subspecies that are found in the Vardar River are also: *Pachychilon macedonicum*, *Phoxinus phoxinus*, *Tinca tinca*, *Romanogobio uranoscopus*, *Carssius carassius*, *Cyprinus carpio*, *Noemacheilus barbatulus vardarensis*, *Cobitis taenia vardarensis*, *Alburnus alburnus macedonicus*, *Alburnoides bipunctatus bipunctatus*, *Vimba vimba melanops*, *Barbus barbus macedonicus*, *Gobio kessleri kessleri*, [4].

#### 4. Conclusions

Based on what was said above, we can conclude that:

1. Aquatic flora upstream of the Vardar River is represented with the very interesting mosses and algae.
2. More prevalent are aquatic molds populations *Fontinalis antipyretica* and *Rhynchostegium riparioides*, while the population of algae

dominate *Cladophora glomerata* and species of genus *Vaucheria sp.*

3. Fish are represented by 19 species and subspecies, many of them are endemic to Macedonia or the Balkans, as *Salmo macedonicus*, *Leuciscus cephalus vardarensis*, *Chondrostoma nasus vardarensis*, *Cobitis taenia vardarensis*, etc.

#### 5. Acknowledgements

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