TAXONOMIC SPECTRUM OF MACROINVERTEBRATE COMMUNITIES IN SÅSAR RIVER (NW ROMANIA)

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Abstract. The following article analyses the taxonomic composition of benthic macroinvertebrates in Săsar river, which flows in the North West of Romania in a highly industrialized area. According to prior studies, increased biological unbalances have been observed due to mining activities, meaning that Săsar river, out of its 31 kilometers from the spring to the flow, has 17 kilometers which are completely downgraded. According to the systematic research done between 2003-2006, 41 taxa were identified. After working with the physical-chemical monitoring data, it was noticed that the low diversity of zoobenthic communities was due to the toxic pollutants from the mining and metallurgic industries.

Keywords: macrozoobenthic communities, mining activities, Săsar river, Romania.

INTRODUCTION

The life of zoobenthic communities which populate water flows is influenced by environment factors [15], but also by anthropogenic influence [12]. Thus, the toxic impact of inorganic origin from industry determines the fall of the most frail taxa belonging to the ephemeroptera, pecopteris and trichoptera communities [10].

The action of capitalizing nonferrous ores has direct effects on zoobenthic communities by modifying habitats with consequences on: diversity and abundance of species [8, 16, 21], respectively by eliminating frail species [5], reducing the number of families and the biomass [21]. The indirect toxic actions of heavy metals on benthic invertebrate communities are also done through: water quality [18], inorganic sediments [3] or through contaminated food supplies [7, 9, 17], leading to structure modifications of the affected biocenosis [4].

The area subjected to research is mainly included in the industrial premises of Baia Mare, a place characterized by an old tradition in extracting and exploiting nonferrous metals. Săsar river represents the main axis of draining of the industrial perimeter in the

area, springing from Gutai Mountains, from over 1000 meters, and until its confluence with Lapus river, at 154 meters, has a total length of 31 km [2]. There are few biographical studies on larvae of aquatic insects from Săsar river, and they are also brief and tangential.

According to the French Environment Agency [25], the most sensitive insects to toxic pollution belong to groups: Plecoptera, Ephemeroptera (with the exception of the Bäetidae Family), Coleoptera, Crustacean, Mollusc and Trichoptera, and from the category of tolerant species we mention Diptera chironomida and simulida, Odonata and Oligochaeta.

MATHERIALS AND METHODES

The sampling was done according to the methodology of the Normalized Global Biological Index (NGBI) [25] between 2003-2006 at a rate of twice a year. Two sampling stations were set up on the upper sector of Săsar river (Măriuții Valley and upstream Baia Sprie), two stations for the middle sector (downstream Baia Sprie, upstream Baia Mare), and one station for the lower sector of the river (downstream Baia Mare) (Fig. 1).



Figure 1. Location of the sampling stations within Săsar River.

RESULTS

The samples at the rate of twice a year between 2003-2006 illustrate the presence of the following benthic groups: ephemeroptera, plecoptera, trichoptera, diptera, coleoptera, oligochaeta and amphipoda.

Analyzing the composition of the zoobenthic communities in Săsar river (Table 1) we can notice that the ephemeroptera and the chironomida have the highest frequency (100%), being followed by

oligocheta and the group of other diptera (60%). Plecoptera, trichoptera and amphipoda have a frequency of 40%. The lowest frequencies are for hirudinea and coleopteran (20%).

For Săsar river, the highest number of zoobenthic taxons reported to the total number of sampled individuals are: chironomids (32%), oligochaeta (23%). ephemeroptera (20%), trichoptera (10%) and plecoptera (6%) are not that well represented.

Taxons	Frecuency		Minimum	Maximum	Std.
	Number of cases	%	of species	of species	deviation
Ephemeroptera	5	100	1	10	4.38
Chironomidae	5	100	1	4	1.30
Oligochaeta	4	80	0	1	0.45
Other Diptera	3	60	0	4	1.82
Trichoptera	2	40	0	13	5.87
Plecoptera	2	40	0	5	2.30
Amphipoda	2	40	0	1	0.55
Hirudinea	1	20	0	1	0.45
Coleoptera	1	20	0	1	0.45

 Table 1. Frequency of zoobenthic communities in Săsar river between 2003-2006.

On the upstream section, four families of ephemeropterae were identified Ephemeridae, Ephemerellidae, Heptageniidae and Bäetidae. Among the taxons mentioned above, we add: plecoptera (Taeniopterygidae, Nemouridae and Perlidae), (Rhyacophilidae, trichoptera Glossosomatidae. Philopotamidae, Hydropsychidae, Limnephilidae and Sericostomatidae), diptera (Blepharoceridae, Tipulidae, Simuliidae, Ceratopogonidae, Athericidae Chironomidae). coleoptera (Hydraenidae), and oligochaeta (Naididae), hirudinea (Erpobdellidae) and amphipoda (Gammaridae) (Fig. 2). The number of

species is quite low on the middle section, existing large numbers of individuals (chironomida - 96 individuals; oligochaeta - 64 individuals). Two families of ephemeroptera were identified (*Bäetidae* and *Ephemerellidae*), *Tipulidae* and *Chironomidae* diptera, *Tubificidae* and *Naididae* oligocheta (Fig. 2). For the lower section we find an increased decession of zoobenthic communities due to intensifying the anthropic impact, leading to the domination of chironomida and tubificidae oligocheta. Starting with 2005, ephemeroptera *Bäetidae* have been identified (Fig. 2).



Figure 2. Distribution of zoobenthic taxa in Săsar river between 2003-2006, mean values.

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Figure 3. Dynamics of macroinvertebrate communities in Săsar river between 2003-2006.

When it comes to the dynamics of the zoobenthic communities in Săsar river (Fig. 3) for 2003-2006, it is noticed that it stayed at high levels throughout the research just at the stations situated on the upstream. For Măriuții Valley, out of the analysed zoobenthic communities, the ones which prevail are the ephemeroptera, plecoptera and trichoptera, indicating a better quality of water. In 2005-2006 a growing tendency of number of taxons at the station upstream Baia Sprie, the plecoptera with 3% in 2005 increasing to 13% in 2006, illustrating a better quality of water. In the middle sector chironomida dominate the benthic communities with the exception of 2003 at the downstream Baia Sprie station and of 2006 at the upstream Baia Mare station, when oligocheta are dominant (43% respectively 44%). Ephemeroptera have a constant presence at the downstream Baia Sprie station, while at upstream Baia Mare station they appear only in 2005. For the lower sector of Săsar river, chironomida appear in 87% for 2003 and in 82% in 2004. In 2005 and 2006, we notice a decrease to 25%, respectively 50% in favour of ephemeroptera with significant percentages: 53% respectively 31%. Data shown in Figure 3 are annual averages.

DISCUSSIONS

Analyzing the dynamics of heavy metals in the water of Săsar river a high level of toxicity for Zn, Cd and Mn was noticed in downstream Baia Mare section [13].

The diversity of benthic macroinvertebrate communities in Săsar river is highly reduced, just 8 groups of organisms being found, comparatively with Buzau river where 11 groups of benthic organisms [19], 12 groups of invertebrates organisms in Cibin River [6], or 15 groups of invertebrate organisms in Somesul Mic [20].

On the upstream section, the instability of the sublayer is caused by erosion, and, as a consequence, a low number of taxa are cited. There is a low number of ephemeroptera families on the upstream section. [23] as well as [22] show that the diversity for the ephemeroptera in the mountaneous regions in Austria does not go beyond 3 families, and in Switzerland, no more than five [24]. There are four families identified on the upper course of Săsar river: *Ephemeridae*, *Ephemerellidae*, *Heptageniidae* and *Bäetidae* (Fig. 2).

[11] shows that the middle areas are mainly characterized by high diversity, the amplitude being reduced when it comes to: water temperature, speed of current, flow, etc. Thus, these areas are mainly colonized by ephemeroptera species (Bäetis rhodani, Caenis sp.) and eurythermal diptera (Simulium pseudequinum, S. Intermedium). [1] report a number of 30 ephemeroptera species belonging to 7-9 families for the middle section of Central European rivers. For this sector the diversity of macroinvertebrates in Săsar river is diminished. For example in the middle section just 2 of ephemeroptera: families Bäetidae and Ephemerellidae can be reported.

For the lower section, we can notice a strong decrease of zoobenthic communities due to

intensifying the anthropic impact, with the domination of chironomida and oligochaeta.

The ephemeroptera is well represented until downstream Baia Sprie. The trichopetra and plecoptera fauna, considered some of the most sensitive to anthropic pressures, are well represented at the station in Măriuții Valley. From downstream Baia Sprie, the communities mentioned so far gradually disappear, sign of a powerful degradation of water quality.

Anyhow, the species richness of the zoobenthic fauna suffers serious changes beginning with the middle section of Săsar River. The reduction number of species is caused by water quality degradation and by the mining and metallurgical industry.

A good structure of the benthic communities is visible until downstream Baia Sprie. From upstream Baia Mare it has been noticed a serious degradation of the analysed communities. For Săsar river we have maximum frequencies with ephemeroptera and chironomida (appearing in the analysed stations), and low frequencies have been noticed for the: trichoptera, plecoptera, amphipoda, coleoptera and hirudinea.

We may conclude that beginning with 2005 taxa sensitive to pollution start to appear, signifying an increase in water quality (the Normalized Global Biological Index – NGBI was: 14 for Mriutii Valley, 8 for upstreram Baia Sprie and 6 for downstream Baia Sprie) [13, 14]. Reducing the industrial activity, adequate filtering of used waters as well as the hydrological characteristics of Săsar river (high flow speed, slope gradient, sublayer heterogenity) have favourised the improvement in water quality.

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