Longitudinal Distribution of Ephemeroptera Communities for the Sasar River and its Major Tributaries

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Abstract. The Sasar River basin is located in the Baia Mare Depression; it covers an area of 311 sq km and it is located in NW Romania. Due to urbanization and industrialization, and to a lesser extent agriculture, Sasar Basin shows a simplification of the biocenosis, more or less brutal, the intensity of pollution. This paper summarizes the results of sampling campaigns that were carried out between 2003-2008, when a total of 10 stations of the investigated basin were identified and analyzed, according to the Normalized Global Biological Index (IBGN) methodology. Subsequent to the systematical study, 20 species belonging to 6 Ephemeroptera families (Leptophlebiidae, Ephemeridae, Ephemerellidae, Caenidae, Heptageniidae, Bäetidae) were identified. Ephemeroptera is a group of demanding environmental conditions; high specific abundance was recorded in the stations located in areas with minimal and moderate anthropogenic impact (upstream Blidari-10 species; Valley Măriuţii-10 species, upstream Baia Sprie – 9 species). The number of species is drastically reduced for the stations located downstream of the Baia Sprie and Baia Mare industrial centers (downstream Baia Sprie-3 species, downstream Baia Mare -1 species). Within the communities of Ephemeroptera high frequencies were performed by Bäetis rhodani (90%), considered in terms of the ecological valence, average tolerance to pollution. Pollution-sensitive species had low frequencies: Rhithrogena semicolorat (40%), Bäetis alpinus (40%).

Keywords: communities of mayfly, distribution, monitoring, anthropogenic pollution

INTRODUCTION

As an active and central component to the functioning of aquatic ecosystems, macrozoobenthos can serve as an indicator of the condition of aquatic life (Pavluk, 1997). Moreover, macroinvertebrates were adapted to specific hydromorphological conditions, so knowing these conditions during their evolution, thus one can appreciate the structure of populations, and vice versa, knowing the population structure one can appreciate the conditions under which they live. As a result, benthic macroinvertebrates are often used as indicators of water quality. In addition, they respond to a variety of parameters, such as altitude, substrate, water flow rate, etc., and being ubiquitous, less mobile, and relatively easily harvested, they offer numerous advantages in the biological assessment procedures of watercourses (Chiasson, 1999).

Ephemeroptera can be used as bioindicator group in the assessment of water quality, presenting a series of ecological and behavior specialization that enable them to colonize a wide range of aquatic biota. (Verneaux , 1973; Verneaux et al., 2003; Buffangi et al., 2003).

Ward et al., 1994, shows that the analysis of the zoobenthos gradient along a stream demonstrates a gradual change of the faunal communities towards downstream. These discontinuities are largely influenced by the altitude and temperature gradient, respectively, they correspond to the transition to the thermal conditions with rhithral and potamal characteristics.
The Sasar river basin is located in NW Romania and it occupies an area of 311 sq km (Boca, 1972), of which 8.08% has administrative function (represented by the cities of Baia Mare and Baia Sprie), 73.19% is occupied by forests and 18.73% is occupied by agricultural fund. Human pressure in the analyzed area is represented by the mining industry, mining, metallurgy, household utilities and transportation.

There are only a few brief and tangential hydrobiological research works in the Basin Sasar. Most of them come from studies and research works conducted on the Somes River and to a lesser extent in studies and research on the Lapus River. (Gâldean, 1992 and Szállasy, 1999 cited by Ardelean et al., 2007; Mare Rosca et al., 2008; Ardelean et al. 2009; Hordoş and Murany, 2008 cited by Ardelean and Beres, 2011).

This paper summarizes the results of sampling campaigns that were carried out during the years 2003-2008, for a total of 10 stations from the Sasar river hydrographic basin. They were analyzed aquatic mayfly larvae, being identified 20 species belonging to 6 families (Leptophlebiidae, Ephemeroidea, Ephemerellidae, Caenidae, Heptageniidae, Bæetidae).

MATERIALS AND METHODS

A faunistic inventory of Ephemeroptera aquatic larvae was conducted from 2003-2008, by following the IBGN (Normalized Global Biological Index) methodology (AFNOR NF Z 90-350, 1993). During these four years, ongoing evaluations were performed with a frequency of twice a year, in the rivers of Sasar, Valea Firiza and in the major tributaries of the Sasar river, in their upper and middle course: Valea Limpedea, Valea Morii, Valea Gordanului (Fig.1).

Sasar River was monitored in 5 sections that include areas of upper course (Valea Măriuții station, the station upstream of Baia Sprie), the middle course (the station downstream of Baia Sprie, the station upstream of Baia Mare) and the area of the lower course (the station downstream of Baia Mare). Valea Firiza stream was investigated in two sections corresponding to the upper course (upstream station Blidari) and the lower course (Valea Firiza station). Totally, 10 stations were explored, whose numbers and location are illustrated in Fig.1.
The physical-chemical monitoring data come from 2007 and were taken from the Chemical Laboratory of the Maramures County Water System Management.

Five classes of surface waters are known according to the Norms on surface water quality classification in Romania (M. Of. 511/2006), in relation to their chemical and physical-chemical quality. The classification in the five quality categories is made starting with the first grade corresponding to absent or minor alterations and it ends with the fifth grade, which corresponds to a high degree of contamination.

Thus, as about the oxygen regime, the stations fall in the first quality grade, excepting the Valea Morii, Valea Gordanului and Valea Firiza stations, which fall within the second quality grade. The nutrient regime of the basin Sasar stations fall into the first quality grade, excepting the stations: upstream of Baia Sprie, downstream of Baia Sprie, Valea Firiza, upstream of Baia Mare and downstream of Baia Mare, which fall within the second quality grade.

Analyzing the dynamics of heavy metals in Sasar river waters during the period 1998-2003, Rosca (2008) found that for the upstream section of Baia Sprie the biggest problems aroused due to the Pb and Cu indicators, and for the section downstream of Baia Mare, the values of the Zn, Cd and Mn indicators determine a high level of toxicity for the monitored section.

RESULTS AND DISCUSSIONS

The study was systematically carried out on a total of 20 species of Ephemeroptera, during 2003-2008.

For the Sasar river basin, the Bäetis rhodani species has a uniform and maximum frequency distribution (Fig.2) in the middle course section. More than that, the results of the research carried out by Neagu (2004) and Ristea (2009), on the distribution of the Bäetis alpinus species, are confirmed. Thus the mentioned species appear in the stations located at altitudes of 500-600m (Fig.2), characterized by high speed waters and hard – rocky substrate (stations: Valea Mariutii, upstream of Baia Sprie; upstream of Blidari and Valea Limpedea). Likewise, the species of the Ecdyonurus genus (E. dispers, E. insignis, E. venosus) have a constant distribution in the stations located at higher altitudes than 350m (stations: Valea Măriutii, upstream of Baia Sprie; upstream of Blidari and Valea Limpedea, Valea Morii and Valea Gordanului). Ephemerula danica was recorded in the areas of the superior course of the Sasar river, where it was highly abundant (station Valea Măriutii - 9 individuals) and in the stations Valea Limpedea and Valea Morii, but with reduced abundance (2-3 individuals). Epeorus sylvicolas had low frequency and reduced abundance, being recorded only in the stations located at high altitudes (stations: Valea Măriutii-3 individuals, upstream of Blidari- 2 individuals and Valea Limpedea-4 individuals). Ephemerella ignita, Rhithrogena semicolorata and Heptagenia sulfurea have an asimetric distribution. Thus, Ephemeroëlla ignita was recorded in the stations upstream of Baia Sprie, Valea Limpedea and upstream of Blidari, where it achieves high (8 respectively 12 individuals), excepting the last station (2 individuals). The species Rhithrogena semicolorata and Heptagenia sulfurea have similar distribution patterns, being recorded in the stations: Valea Măriutii, upstream of Baia Sprie and Valea Gordanului, being mentioned that the second species is more abundant. Electrogena lateralis and Bäetis vernus have sporadic appearance and achieve reduced abundances (2 respectively 4 individuals).
Fig. 2. Longitudinal distribution of Ephemeroptera in the hydrographic basin of the Sasar river

The Sasar river, totalizes 4 Ephemeroptera families (families: Ephemeridae, Ephemerellidae, Heptageniidae and Bäetidae) in the superior course section (stations: Valea Măriuții and upstream of Baia Sprie), this situations correspond to similar regions/sections of Europe (Weigand and Tokner, 1996; Weigand, 1998; Bauernfeind and Moog, 2000). But the structure of the Ephemeroptera communities is affected in the middle course section (stations: downstream of Baia Sprie and upstream of Baia Mare). As a result, for this section can be reported 2 families of Ephemeroptera (families: Bäetidae and Ephemerellidae), given that, for the same type of section in Central Europe, Bauernfeind and Moog (2000) report 7 to 9 Ephemeroptera families. Only one Ephemeroptera family (Bäetidae family) was recorded for the inferior section of the Sasar river. This is due to the serious issues generated by the industrial activity within the Baia Mare industrial perimeter.

Five Ephemeroptera families (Families: Leptophlebiidae, Ephemeridae, Ephemerellidae, Heptageniidae and Bäetidae) were identified at the Valea Limpedea station, where apparently the anthropic influence is minimum.

An occurrence of some taxa extreme sensitive to the anthropogenic pollution is found - Paraleptophlebia sp., Ecdyonurus venosus, Epeorus sylvicola and Bäetis alpinus.

Three Ephemeroptera families (Families: Ephemeridae, Heptageniidae, and Bäetidae) were identified at the Valea Morii station. High numeric abundance for taxa - Ephemera danica, Ecdyonurus dispar- with medium tolerance to the anthropogenic pollution was found.

Three Ephemeroptera families (Families: Caenidae, Heptageniidae and Bäetidae) were identified at the Valea Gordanului station. Also, taxa with medium tolerance to the anthropogenic pollution dominate.

As about Valea Firiza, the Ephemeroptera communities are well shaped only for the superior section (station upstream of Blidari), where 4 Ephemeroptera families were identified (Families: Leptoflebiidae, Ephemerellidele, Heptageniidae and Bäetidae), taxa sensitive to the anthropogenic influences being dominant (Paraleptophlebia sp., Leptophlebia sp., Ecdyonurus insignis, Epeorus sylvicola, Bäetis alpinus). The structure of the Ephemeroptera communities is compromised for the inferior section of the river (Valea Firiza station). This section is under a strong anthropic impact due to the human agglomerations of
the region (without waste water collection systems) and due to the mining units that discharge hazardous substances.

CONCLUSIONS

Subsequent to the systematical study, 20 species belonging to 6 Ephemeroptera families (Leptophlebiidae, Ephemeridae, Ephemerellidae, Caenidae, Heptageniidae, Bâetidae) were identified.

Constant distribution was recorded for the Bâetis rhodani species in the Sasar river basin. Also, constant distribution was recorded for the species of the Ecdyonurus (E. dispar, E. insignis, E. venosus) genus. Ephemera ignita, Rhithrogena semicolorata and Heptagenia sulfurea have an asimetric distribution; as Electrogena lateralis and Bâetis vernus have sporadic appearances.

The Sasar river presents a good structure of the Ephemeroptera communities in the superior section of the river (4 families), the taxonomic diversity of these communities is significantly reduced (2 families) starting with the middle course section, as only one Ephemeroptera family to be recorded in the inferior section.

Valea Limpedea presented a high taxonomic diversity of the Ephemeroptera communities, as Valea Morii and Valea Gordanului recorded a reduction of the Ephemeroptera taxonomic spectrum.

As about Valea Firiza, the Ephemeroptera communities are well shaped only for the superior section, while the Ephemeroptera communities structure is compromised for the inferior section.

The most important environment issues for the Sasar river basin are mainly due the mining industry.

REFERENCES


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