Muzeul Olteniei Craiova. *Oltenia. Studii şi comunicări. Ştiinţele Naturii*. Tom. 32, No. 1/2016 ISSN 1454-6914

# STUDIES UPON THE DYNAMICS OF THE MACROZOOBENTHIC INVERTEBRATE COMMUNITIES FROM VALEA ROȘIA RIVER (BIHOR COUNTY)

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**Abstract.** During the present study we examined the monthly dynamics of the macrozoobenthic invertebrate communities from Valea Roșia River, for three months (July-September) 2013. The sampling sites were chosen both in the spring area and along the river course in different point allowing us to investigate a great number of habitats. We followed the modifications of the macrozoobenthic invertebrate communities due to the hydrological characteristics of the river sectors, the monthly dynamics and those produced by the human impact. We calculated Shannon-Wienner diversity index and Hilsenhoff index to determine the pollution level in the analysed sectors.

**Keywords:** macrozoobenthos, Valea Roșia, dynamics, diversity, anthropic impact.

**Rezumat. Studii privind dinamica asociațiilor de nevertebrate macrozoobentice din râul Valea Roșia (Județul Bihor).** În cursul prezentului studiu am cercetat dinamica lunară a comunităților de nevertebrate macrozoobentice din râul Valea Roșia, pe o perioadă de trei luni (iulie-septembrie) 2013. Stațiile de prelevare a probelor au fost fixate în apropierea zonei de izvor, respectiv de-a lungul râului, astfel încât să surprindă o diversitate cât mai mare de habitate. Au fost urmărite modificările comunităților de nevertebrate macrozoobentice datorate caracteristicilor hidrologice ale sectoarelor de râu, cele lunare și cele datorate impactului antropic. S-a calculat indicele de diversitate Shannon-Wienner și indicele Hilsenhoff pentru a determina gradul de poluare a apei în sectoarele analizate.

**Cuvinte cheie:** macrozoobentos, Valea Roșia, dinamică, diversitate, impact antropic.

## INTRODUCTION

Macrozoobenthic invertebrates are present at the bottom of every natural body of water. This community represents an important part of the trophic web of the aquatic environment and very a useful bioindicator for characterising the pollution of natural waters **(**ROSENBERG & RESH, 1993). The structure of the macrozoobenthic community differs depending on the permanent or temporary character of the water, the flowing regime, chemical parameters, substratum type and aquatic vegetation.

Macrozoobenthic invertebrates are adapted to certain values of these parameters (CELIK, 2002), some of them to flowing waters (COOKSEY & HYLAND, 2007; CUPȘA et al., 2002a; CUPȘA et al., 2003a, b; CUPȘA & BANYAI, 2006; PRINCIPE et al., 2007) and cannot stand the profound modifications of the physico-chemical parameters (DOBRE & TATOLE, 2002; FLOREA & GRIGORAȘ, 2000; TULLOS & NEUMANN, 2006). Some of them are adapted to still waters, or clean and with high oxygen content (CUPȘA & BANYAI, 2006**)** or with great organic content and oxygen deficiency (CUPȘA et al., 2002b; CUPȘA et al., 2003b).

However, the use of macrozoobenthic invertebrates has some disadvantages and limits (DE PAUW et al., 2006). For example the flowing speed and the nature of the substratum can vary between wide limits along the watercourse, inducing modifications in the structure and functions of the macrozoobenthic communities (GILLER & MALMQVIST, 1998). Some of the invertebrate groups cannot be found in the benthos only in some periods of the year, because their adult stage is terrestrial (TACHET et al., 2002)

The achieved investigations were carried out along the Valea Roșia River, an important tributary of the Crișul Negru. This is a 38 km long river with a catchment surface of 308 km$^2$. Its spring is situated in Pădurea Craiului Mountains at Izbucul Roșia. This spring has the greatest debit from all karst springs in Roșia area. The river crosses Beiușului Depression and flows into the Crișul Negru near Petrani locality. The most important localities crossed by the river are: Roșia, Căbești, Josani, Gurbești, Remetea, Șoimuș, Pocola.

The aim of our study was to identify the monthly modifications of the macrozoobenthic invertebrate communities along the river and to identify the changes induced by human impact as the river crosses certain localities.

## MATERIALS AND METODS

The macrozoobenthic invertebrates were sampled from the Valea Roșia River monthly during July-September 2013. The five sampling sites were chosen close to the spring where human influence is minimal and downstream the villages along the river (Table 1).

The macrozoobenthos was sampled by quantitative methods, using a Surber dredge with the dimensions of the mesh of 250 μm. The samples were preserved in the field in 4% formalin, sorted in the lab under a 40 magnifying stereomicroscope and transferred in 70% ethylic alcohol. The organisms were identified using specific keys (TACHET et al., 2002; BAUERNFEIND & HUMPESCH, 2001; WARINGER & GRAF, 2013; AUBERT, 1959; GIBBONS, 1986). For statistical analysis we used the following indexes: abundance, Shannon-Wienner index, equitability, Hilsenhoff index (DE PAUW et al., 1993; HILSENHOFF, 1987; LUDWIG & REYNOLDS, 1988; WASHINGTON, 1984).

Table 1. Sampling sites and their characteristics.

| Sampling site | Latitude N | Longitude E | Riverbed width (m) | Riverbed depth (m) | Substratum | Riverbank vegetation |
|---|---|---|---|---|---|---|
| Roșia spring area ($R_1$) | 46.83891$^0$ | 22.36986$^0$ | 2 | 0.25 | Pebbles and boulders covered by phytobenthos and allochthonous organic matter | Beech forest |
| Roșia downstream village ($R_2$) | 46.79330$^0$ | 22.39433$^0$ | 15 | 0.40 | Pebbles and sand, with sandy beaches near the shore and places with mud accumulations | Willows on the river banks and in the fields nearby |
| Josani ($R_3$) | 46.75700$^0$ | 22.35672$^0$ | 15 | 0.35-0.50 | Pebbles and sandy regions | Willows and poplars on the river banks |
| Remetea ($R_4$) | 46.73775$^0$ | 22.34215$^0$ | 10-15 | 0.50-1.00 | Mostly sandy, in some places pebbles | Willows and poplars on the river banks |
| Pocola ($R_5$) | 46.69545$^0$ | 22.29356$^0$ | 15–20 | 0.30-0.50 | Sandy with pebble regions | Willows on the river banks, very close to human settlement |

## RESULTS AND DISCUSSIONS

We have identified a number of 12 taxonomic groups in the macrozoobenthic samples (Table 2). The greatest number of specimens were collected in July in sample site $R_2$ (1,438 specimens), and the smallest number in site $R_5$ (240 specimens) (Fig. 1) Site $R_2$ is situated in the upper sector of the river downstream Roșia village. Here, the substratum is covered by pebbles and sand, the river crosses a region shadowed by trees. The river receives organic substances intake from the locality situated upstream. These nutrients nourish the aquatic communities and allow the existence of a richer macrozoobenthic community compared to the site situated near the river spring (Fig 1).

The organic substances intake is low, so it does not affect fundamentally the quality of the water as shown by the presence of the Ephemeroptera, Plecoptera and Trichoptera larvae, which are very sensitive to pollution (Table 2). The organic content is however showed by the presence of Gammarida, Oligochaeta and Chironomida larvae.

In August, we have observed a decrease of the number of specimens from each sampling site. The greatest number of specimens in August were found at site $R_4$ (372 specimens) and the smallest at $R_5$ (4 specimens) (Fig. 1). The decrease of the number of specimens can be caused by the emergence of the adults of some insects, which have aquatic larvae (CORBET, 2003; FRICK, 1998; ALHEJOJ et al., 2014) and also by the low water level and the high water temperature. In the period between samplings (July and August) the weather was very hot and the rainfall almost absent, so the water level dropped drastically and the high water temperature induced an oxygen deficit near the substratum (CELIK, 2002; COOKSEY & HYLAND, 2007). The drastic water level decrease left some of the macrozoobenthic invertebrates on the dried shore.

The high temperatures stimulate also the decomposing processes, which consume more oxygen from the water and eliminate toxic substances that can cause mortality of the macrozoobenthic invertebrates (CELIK, 2002; COOKSEY & HYLAND, 2007).

In September, the number of specimens is lower than in August. The greatest number of specimens was registered at site $R_1$ (40 specimens) and the smallest at site $R_2$ (5 specimens) (Fig. 1). Between August and September, it fell a large amount of rainfall. This large water amount washed heavily the riverbed and dislocated the macrozoobenthic invertebrates already affected by the drought period from the previous months.

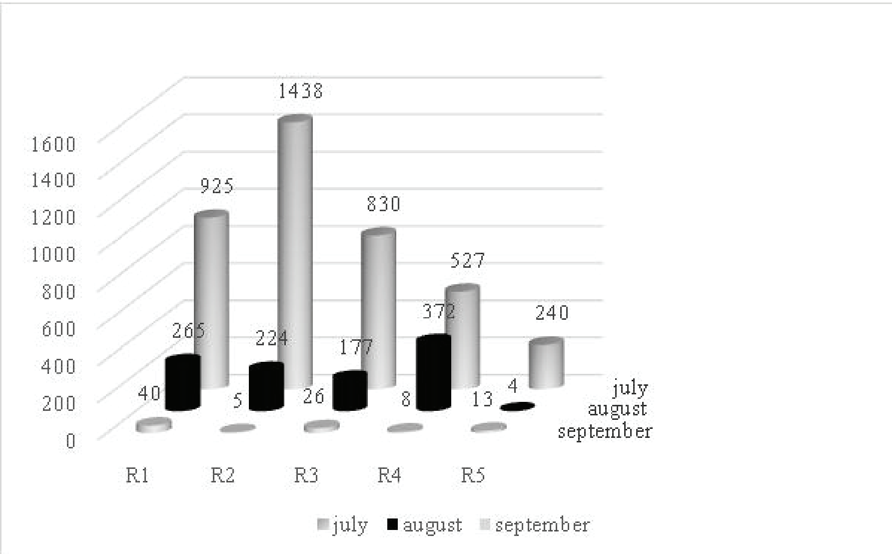


Figure 1. Number of individuals by sampling sites and months.

Abundances of macrozoobenthic invertebrates have great variations from site to site. At $R_1$ the community is dominated by Ephemeroptera larvae in July, by Gammarida in August and by Chironomida larvae in September. At $R_2$ the Ephemeroptera larvae are dominant in July, Coleoptera in August and Diptera and Trichoptera larvae in September. At $R_3$, in July and August, Gammarida are dominant and in September, Coleoptera. At $R_4$ Gammarida are dominant in July, Chironomida larvae in August and Ephemeroptera larvae in September. At $R_5$ Ephemeroptera larvae are dominant in July, Diptera larvae in August and Chironomida larvae in September.

The great abundance of Ephemeroptera larvae (50.05%) at $R_1$ in July (Table 2) is characteristic for this river sector because the substratum is covered by stones and pebbles, favourable for this group and the water flows fast. This insect group is found in clean, unpolluted waters and they are very sensitive to pollution (ALHEJOJ et al., 2014).

Table 2. Abundance of macrozoobenthic groups by sampling sites and months.

| | | **R1** | | | **R2** | | | **R3** | | | **R4** | | | **R5** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | July | Aug | Sept | July | Aug | Sept | July | Aug | Sept | July | Aug | Sept | July | Aug | Sept |
| Turbelaria | 0 .97 | 0 | 0 | 0 .07 | 0 | 0 | 0 .24 | 0 | 0 | 0 .00 | 0 | 0 | 0 .00 | 0 | 0 |
| Oligochaeta | 0 .11 | 0 | 0 | 1 .18 | 0 | 0 | 0 .00 | 0 | 0 | 0 .19 | 0 | 0 | 0 .00 | 0 | 0 |
| Hirudinea | 0 .00 | 0 | 0 | 0 .00 | 0 | 0 | 0 .24 | 0 | 0 | 0 .00 | 0 | 0 | 0 .00 | 0 | 0 |
| Gastropoda | 0 .54 | 0 | 0 | 0 .21 | 0 | 0 | 0 .00 | 0 | 0 | 0 .00 | 0 | 0 | 0 .00 | 0 | 0 |
| Hydrachnidia | 0 .00 | 0 | 0 | 0 .00 | 0 .44 | 0 | 0 .00 | 0 .56 | 0 | 0 .00 | 0 | 0 | 0 .00 | 20 | 0 |
| Gammaridae | 23 .14 | 49 .43 | 20 | 23 .57 | 22 .22 | 0 | 52 .77 | 49 .44 | 3 .85 | 43 .64 | 7 .80 | 0 | 4 .58 | 0 | 7 .69 |
| Ephemeroptera larvae | 50 .05 | 4 .53 | 25 | 51 .95 | 4 .89 | 0 | 12 .89 | 20 .22 | 0 | 36 .62 | 30 .65 | 75 | 59 .17 | 0 | 7 .69 |
| Odonata larvae | 0 .00 | 0 | 7 .5 | 0 .00 | 0 | 20 | 0 .00 | 0 | 3 .85 | 0 .38 | 0 .81 | 0 | 0 .83 | 0 | 0 |
| Plecoptera larvae | 7 .35 | 6 .04 | 0 | 0 .49 | 0 | 0 | 3 .73 | 0 .56 | 50 | 2 .85 | 0 | 0 | 1 .25 | 0 | 0 |
| Coleoptera | 11 .14 | 30 .94 | 2 .5 | 0 .97 | 66 .67 | 0 | 0 .60 | 2 .81 | 26 .92 | 0 .19 | 0 | 0 | 7 .08 | 20 | 7 .69 |
| Trichoptera larvae | 3 .24 | 5 .66 | 5 | 0 .90 | 1 .78 | 40 | 1 .93 | 1 .12 | 11 .54 | 4 .36 | 0 .27 | 0 | 0 .42 | 0 | 0 |
| Diptera larvae* | 2 .70 | 3 .40 | 2 .5 | 0 .70 | 4 | 40 | 0 .12 | 1 .12 | 3 .85 | 0 .95 | 0 .81 | 0 | 0 .00 | 40 | 0 |
| Chironomida larvae | 0 .76 | 0 | 37 .5 | 19 .96 | 0 | 0 | 27 .47 | 24 .16 | 0 | 10 .82 | 59 .68 | 25 | 26 .67 | 20 | 76 .92 |
| **H** | 1 .69 | 1 .29 | 1 .76 | 1 .4 | 0 .86 | 1 .05 | 1 .22 | 1 .24 | 1 .32 | 1 .28 | 0 .96 | 0 .56 | 1 .1 | 1 .01 | 0 .79 |
| **E** | 0 .74 | 0 .72 | 0 .91 | 0 .61 | 0 .48 | 0 .96 | 0 .56 | 0 .6 | 0 .74 | 0 .58 | 0 .6 | 0 .81 | 0 .57 | 0 .73 | 0 .57 |
| * other than Chironomida | | | | | | | | | | | | | | | |

In July, the smallest abundance at this sample site (Table 2) is reached by Gastropoda (0.54%). We have identified Ancylidae from Class Gastropoda, which are characteristic to the upper sector of the rivers but do not have great abundances in their habitats (MIENIS & RITTNER, 2013).

An important proportion is represented also by Gammarida because this sector despite the fact it is situated near the spring is very rich in submerged aquatic vegetation, especially mosses; this habitat is very favourable for Gammarida (YEMELYANOVA et al., 2002). Trichoptera and Plecoptera larvae are also abundant in this sector with fast running water, low temperature and high oxygen content.

At sample site $R_2$ the greatest abundance is registered by Ephemeroptera larvae (51.95%) in July and the lowest by Triclads - Turbelariata (0.07%) (Table 2). At this sample site, we can observe an increase of Chironomida larvae abundance as a consequence of detritus accumulation in the substratum. This detritus is a good trophic base for Chironomidae larvae (HENRIQUES-OLIVIERA et al., 2003; GOMEZ MACHADO et al., 2015). Trichoptera and Plecoptera larvae are also present in the sample but with a smaller abundance. This situation is according to the hydrology of this sector, characterised by a slower current, the substratum covered by pebbles and sand, the decrease of the oxygen content, the increase of the temperature and the organic content. At this sample site we can find also Oligochaeta in the sandy and muddy portions of the substratum.

At $R_3$, in July, Gammarida have a great abundance (52.77%), followed by Chironomida larvae (27.47%) and the lowest values are reached by Diptera larvae (0.12%) (Table 2). The great abundance of Gammarida is due to the abundance of the organic substances and the presence of the well-developed phytobenthos. The characteristic groups for the upper sector - Trichoptera, Plecoptera and Ephemeroptera have a reduced abundance compared to the upstream sites. This is a consequence of the hydrological modifications in the hilly sector of the river and of the different substratum (STOYANOVA et al., 2014; FRICK, 1998).

At this sample site we have found Hirudineea specimens, which indicate a greater organic content compared to the upstream sites (GRANTHAM & HANN, 1994; KAZANCI et al., 2015). The increase of the organic content is due to the fact that the river flows through several localities from were a certain quantity of household waste is discharge.

These accumulate more and more downstream because the mentioned localities do not have sewage plants and some of the household waste are evacuated directly in the river.

At $R_4$ the greatest abundances are reached by Gammarida (43.64%) followed by Ephemeroptera larvae (36.62%) and the smallest by Oligochaeta and Coleoptera (0.19%) (Table 2). At this sample site the structure of the macrozoobenthic community shows an improved water quality due to the decrease of the organic content. This fact is certified by the increase of the abundance of Ephemeroptera, Plecoptera and Trichoptera larvae. Their greater abundance is the result of the increase of the quantity of dissolved oxygen in the water and lower temperature (STOYANOVA et al., 2014; FRICK 1998). The river in this sector crosses a forest area and the shade of the trees do not allow the water to warm as much as at upstream sites, so the oxygen content of the water due to temperature will be higher.

In this sector we have identified Oligochaeta, which have sandy and muddy patches where they can settle. We have also identified Odonata larvae, which are not very sensitive to the water quality and find enough food to develop in this sector. Another sign of the improvement of the water quality is the lack of Hirudineea in this sector. The greater water volume of the river dilutes the organic substances and also some of them settle in the riverbed upstream before reaching this sector.

At $R_5$ the greatest abundance is reached by the Ephemeroptera larvae (59.17%) in July, followed by Chironomida larvae (26.67%). Trichoptera larvae have the smallest abundance (0.42%) at this site in July (Table 2). Gammarida abundance decreases because of the lack of the submerged vegetation and phytobenthos in this sector (YEMELYANOVA et al., 2002).

Oligochaeta are absent despite the existence of the sandy regions where they can settle, but probably if they exist they are very rare and they escaped from sampling. Chironomida larvae are very abundant and this fact proves a high organic content in the riverbed (HENRIQUES-OLIVIERA et al., 2003; GOMEZ MACHADO et al., 2015). The abundance of Odonata increases in this river sector with a slow flow.

Gammarida (49.43%) and Coleoptera (30.94%) register the greatest abundances at $R_1$ in August and the smallest Ephemeroptera larvae (4.53%) and Diptera larvae (3.40%) (Table 2). The decrease of Ephemeroptera abundance may be the result of the emergence of a generation of adults. Gammarida are more abundant than in July probably due to the reproduction and emergence of a new generation. There can be observed an important increase of the abundance in case of Coleoptera also, probably due to the reproduction.

At $R_2$, in August, the greatest abundance was reached by Coleoptera (66.67%), followed by Gammarida (22.22%). Trichoptera larvae have the smallest abundance (0.44%) (Table 2). Chironomida and Ephemeroptera larvae decrease significantly their abundance. This fact may be caused by the reduced water volume and the high temperature in this month affecting the sensitive macrozoobenthic taxa.

At $R_3$, in August, the highest abundance is reached by Gammarida (49.44%), followed by Chironomida larvae (24.16%) and Ephemeroptera larvae (20.22%). Plecoptera larvae have the smallest abundance (0.56%) (Table 2). At this sampling site, the abundance of the first three groups remains almost the same as in the previous month. During the three months of study this site showed the greatest stability in the composition of the macrozoobenthic community along the whole river.

At $R_4$, in August, the most abundant group is Chironomida larvae (59.68%) and the smallest abundance was reached by Trichoptera larvae (0.27%) (Table 2). Chironomida probably increase as a result of the accumulation of organic substances and water warming which stimulates the riverbed microbiota decomposing activity. As a result of the organic substratum decay the oxygen content decrease, toxic substances are released and inhibit the development of most macrozoobenthic taxa, so Chironomida larvae have no competitors in the substratum (HENRIQUES-OLIVIERA et al., 2003; GOMEZ MACHADO et al., 2015).

At $R_5$, in August, the most abundant are Diptera larvae (40%) and the other two identified groups, Chironomida larvae and Coleoptera, have the same abundance (20%) (Table 2) At this site, the macrozoobenthic community is profoundly modified so we suppose there were other influences not just the temperature and oxygen which affected the benthic community.

We suppose that an pollution phenomena occurred, which affected the most macrozoobenthic groups. The small number of taxa represented by small number of specimens is typical for an environment affected by anthropogenic pollution.

In September, at $R_1$ the greatest abundance is reached by Chironomida larvae (37.50%) and the smallest by Diptera larvae and Coleoptera (2.50%) (Table 2). The great increase of Chironomida larvae abundance is due to the decomposing activity of the bacteria from the substratum stimulated by the high water temperatures during the summer period. Plecoptera larvae are absent from the site in September and Gammarida and Ephemeroptera larvae have great abundances. An interesting fact is the presence of Odonata larvae at this site, probably resulted from the eggs laid by the adults during summer. Odonata adults are good flyers and they can fly to long distances from the place they have emerged. As a result they can lay their eggs far from their emergence place (CORBET, 2003).

At $R_2$, in September, the greatest abundance is reached by Diptera and Trichoptera larvae (40%) and the smallest by Odonata larvae (20%) (Table 2). The structure of the macrozoobenthic community at this site is very different from the previous months. This can be caused by the heavy rains fallen at the beginning of the month, which washed the substratum at this site, where the water is shallow and the submerged vegetation is absent, so the macrozoobenthic invertebrates were probably moved downstream.

At $R_3$, in September, the greatest abundance was reached by Plecoptera larvae (50%) and the smallest by Gammarida and Diptera larvae (3.84%) (Table 2). The increase of the Plecoptera is probably due to the reproduction and the specimens which were washed away from upstream. We also identified Odonata larvae resulted from the reproduction in summer.

At $R_4$, in September, the greatest abundance is reached by Ephemeroptera larvae (75%) followed by Chironomida larvae (25%) (Table 2). The changing of the abundance of the groups in this month in behalf of the Ephemeroptera larvae is a consequence of the heavy rains, which washed out from the substratum the organic debris which favoured the settlement of Chironomida larvae, so their abundance decreased compared to the previous months.

At $R_5$ the greatest abundance is reached by Chironomida larvae (76,92%) and the smallest by Gammarida, Ephemeroptera larvae and Coleoptera (7,69%) (Table 2). Chironomida larvae are very abundant compared to the previous months because this site is the most affected by anthropogenic pollution. In the substratum, during the summer period, a great amount of organic debris accumulated, which favoured the settlement of Chironomida larvae (HENRIQUES-OLIVIERA et al., 2003; GOMEZ MACHADO et al., 2015).

The values of the Shannon-Wiener diversity index were the greatest at $R_1$ in September (1.76) and July (1.70). At the rest of the sample sites the value of this index decreases reaching the smallest values at $R_4$ (0.56) an $R_5$ (0.79) (Table 2).

The greatest value of the index is near the spring because this sector is the less affected by anthropogenic impact. During the study period, the minimum value of the index was reached in August when the community is affected probably by high temperature values.

In the next two sample sites, the values of the index are smaller with the same decrease in August. From these two sites at $R_3$ the variations of the index values between the months is smaller showing a more stable community due to the low human impact and greater water volume.

At the last two sites, the values of the index are smaller than upstream; during the study period there was also a progressive decrease of the diversity. This is due to the raised temperature of the water, decomposing processes and the increase of the oxygen deficiency.

The equitability index has the greatest values at $R_2$ (0.96) and $R_1$ (0.91). The smallest values are at $R_2$ in August (0.48) and $R_3$ in July (0.56) (Table 2). The values of the equitability are relatively great especially at the two sites upstream. At the next three sample sites the values decrease but have close values between the three study months.

The Hilsenhoff index shows that the water quality is between excellent and good and the degree of pollution is from inexistent to poor (Fig. 2).

In July, the quality of the water in all sites is excellent (HBI< 3.75) with site $R_5$ situated exactly at the limit value. In August, the water quality is very good at $R_3$ (HBI 3.76 – 4.25) with a very small degree of organic pollution and in the rest of the sites is excellent (HBI < 3.75) with no pollution.

The pollution downstream $R_4$ had anthropogenic origins. At this site, the river has passed through several localities, which increased the organic content of the water and probably have polluted it with different chemical substances, which eliminate the most sensitive taxa from the macrozobenthic community.

In September, at $R_5$ the quality of the water is good (HBI 4.26 – 5.0) moderately polluted, at $R_4$ the water quality is very good (HBI 3.76 – 4.25) and at the rest of the sample sites is excellent (HBI < 3.75) (Fig. 2).

The increase of the pollution level at $R_5$ in September is probably caused by anthropogenic influences, which are not permanent and are accidental.

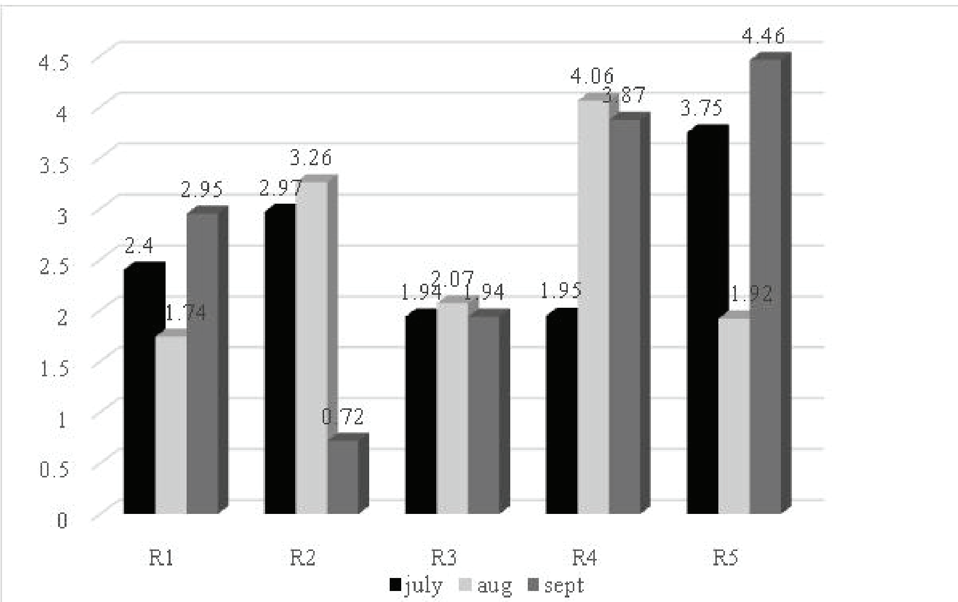


Figure 2. Hilsenhoff index by sampling sites and months.

## CONCLUSIONS

As a result of our study in the Valea Roșia River, we can affirm the following: at $R_1$ the macrozoobenthic community is typical for the mountainous region and has a pronounced dynamics depending on the environmental conditions in each month. The variations of the community structure are due to the fluctuations of the water level, dissolved oxygen, water temperature and intensity of debris decay.

At $R_2$ the community is modified as a result of the hydrological modification of the river, the human impact from Roșia village and the fish pond from this locality.

The next three sites are typical for the hilly region and are under anthropogenic influence because the river passes through several localities. Between the localities, there is possible that the river undergoes through a self-purification process which is in favour of macrozoobenthic invertebrate communities. The human impact is not very pronounced as emphasized by the Hilsenhoff index values.

In order to maintain or even to improve the water quality the periodically monitoring is recommended. The river sectors where the shading of the water is pronounced it will be necessary to prevent the raising of the water temperature during summer period, especially in the portions where the water is shallow and flows slowly. Here during the summer period the decomposing processes consume the oxygen from the water and the raised temperature will deplete more the oxygen content, so the macrozoobenthic invertebrate development will be limited.

It will be important to control the pollution with domestic residues from the localities along the river. In the households a great amount of washing powders and other chemicals are used and because of the lack of the sewerage system they reach directly or indirectly the river, generating eutrophication. This phenomenon also modifies the structure of the benthic community.

We can state that the investigated river has clean, unpolluted water in the spring sector, in the rest of the course the human impact is still low, but it is necessary to monitor its evolution permanently in order to be able to act as soon as the water quality will be affected by anthropogenic activities.

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Received: March 31, 2016
Accepted: June 3, 2016