FAUNISTICAL INVESTIGATIONS ON MACRO-INVERTEBRATES OF THE EGER-STREAM BETWEEN SZARVASKŐ (CENTRE) AND EGER (INDUSTRIAL ZONE) AND USING THE RESULTS IN HIGHER EDUCATION

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Abstract: Makroszkópikus gerinctelenek faunisztikai kutatása az Eger-patak mentén. Az eredmények hasznosítása a felsőoktatásban

Az Eger-patak Szarvaskő központi része és Eger Ipari Park közé eső szakaszán 2009 óta végzünk vízi makroszkópikus gerinctelenekre vonatkozó faunisztikai jellegű kutatásokat. A Víz Keretirányelv víztest tipológiája szerint ez a víztest a hármas víztípusba sorolható, vagyis hegyvidéki, meszes hidrogeokémiai jellegű, durva mederanyagú, közepes vízgyűjtőjű kisvízfolyás. Választásunkat nagy részben indokolta, hogy a szakasz mind az öt általunk kijelölt szakasza szembetűnően különbözik egymástól ökológiai adottságok és antropogén hatások tekintetében is. Ennek köszönhetően lehetőség adódik tudományos szintű és oktatási jellegű összehasonlító elemzésekre is az összegyűjtött adatokra támaszkodva. Összesen 58 fajt azonosítottunk, emellett legalább további 9 faj példányait tartósítottuk, melyek fajszintű határozása különböző határozási nehézségek miatt nem történt meg (alacsony lárvastádium, bizonytalan határozóbélyeg). Az adatokra támaszkodva több, oktató jellegű szemléltetőanyag is készült, melyek ugyancsak bemutatásra kerülnek a cikkben.

Introduction

Bio-indication by aquatic macro-invertebrates has a fundamental role in ecological water qualification to achieve the aims which are described in the Water Framework Directive (WFD). As a result of our research we can provide informative faunistical data for this kind of studies. The collected data has been analysed by different biotic water qualification indices which can be used efficiently in small streams (Oertel & Nosek, 2006). Our equally important goal is the fitting of the research results into education by newly made up visual aids. The Eger stream is considered appropriate by us as a research site for comparative tests because it is possible to investigate upper and middle stage characteristic stages as well. 56 macro-invertebrate species had been collected between the April of 2009 and summer of 2010. With the 176 gathered data we carried out preliminary surveys to research the stage over Szarvaskő as a potential reference site in the future.

Previous researches grant the basis of our investigations. Sándor Andrikovics and Ottó Kiss carried out remarkable researches on the stream. Both of them had been the teachers of the Eszterházy Károly College and played a significant role in the institute's scientific activity. They studied the benthos of the stream and the terrestrial area of it by light trap method. The results of the investigation were published in 1999 (Andrikovics & Kiss, 1999). They collected 56 macro-invertebrate species from 14 sampling sites.

Materials and Methods

The aquatic macro-invertebrates have been collected between the April of 2009 and summer of 2010. Our investigations have been carried out on the Eger stream between Szarvaskő (Centre) and Eger (Industrial Zone). 5 sampling sites have been assigned on this section taking into account the different anthropogenic effects on the points (Figure 1). According to the applied water-typology system the Eger stream is a mountainous, calcareous hydrogeochemical nature, coarse river-bed material small river with medium catchment area (KvVM, 2005).

The following lines present the sampling sites:

1. The first sampling site has been signed in Szarvaskő at the centre of the village. This is a fast-flowing stage, the mostly straight basin is rocky and gravel and runs on an open area. Most of the collected species are typically mountainous.
2. The second site is located in Almár between Szarvaskő and Eger. The fast-flowing stream is initially surrounded by forest then opens out to a ford. The substratum is diverse as well, from the rocks to the fine gravel. Accordingly, the covered species list is also composite.
3. The first stage in Eger is in the Housing estate of Felsőváros. The basin is heavily modified accordingly not as rich in species as the foregoing ones. But in the upper less artificial section ~~live~~ mayflies and stoneflies can be found, as well.
4. The next section runs in the Archbishop's Garden. The section is modified, almost straight. Hot water flows into the stream under the spa, hence special habitats evolve which are preferred by tropical species next to typical species from the temperate zone.
5. Human activity applies to a large extent at this stage. The river bed is straight; the velocity is less than along the upper sites, surrounded by introduced plant species (e.g. *Fallopia japonica*).

The main target of **our** research was surveying the macro-fauna of the chosen stream section. Hence we investigated all the existing microhabitats in the stream bed. The macro-invertebrate collection has been carried out by use of a hand net, 25cmx25cm with a mesh size of 0,95mm at least twice in spring and

summer during the same period each year. The specimens were sorted in groups **in the field on white trays the**n determined in laboratory conditions by BTC STM-9T stereomicroscope to species level as far as possible. The samples are conserved in 70% ethanol. An educational booklet and four rollups have been designed about the fauna of this stream section in the frame of a "Green Resource" project (Ministry of Rural Development) by the Kaptárkő Conservational and Cultural Association. Some students of the Eszterházy Károly College Department of Environmental Sciences and the members of the association **were i**nvolved in every part of the work as well. Next to the sophomores in 2010 and 2011 we have been using our visual aids successfully in field-works with younger students as well from the age of 11. We clarify the determinations (from order- to species level) and transfer the information to fit in with the knowledge level of the age-groups.

The identification of macro-invertebrates in education is based on the work of Kriska (2008) but next to it we use special keys regarding to each group for scientific assays.

Results

We recorded 176 data about 58 macro-invertebrate species (Table 1.) between the April of 2009 and summer of 2010 from 5 sampling sites.

A short description of a typical species assigned to each location is readable hereinafter:

1. Szarvaskő:

Nemoura cinerea (Retzius, 1783)

Stoneflies usually prefer fast-flowing mountainous streams and do not tolerate heavy human activity and pollution. This species occur in brooklets and channels as well.

2. Almár:

Dendrocoelum lacteum (O. F. Müller, 1774)

This flatworm species is mainly found on flat rocks' surface in clean slow flowing parts of mountainous and also in lowland streams.

3. Felsőváros:

Ephemera danica Müller, 1764

This mayfly sometimes occurs en masse in the gravel. Tree trunks (dead wood) and branches also means habitat for this species. It tolerates low level anthropogenic effects.

4. Archbishop's Garden:

Gammarus fossarum Koch, 1836*: G. fossarum* and *G. roeseli* considered a common species. Their specimens' number has been significant at this site and at the others as well. These are pollution-tolerant and basically wide tolerance species hence they prefer this site too.

5. Industrial Zone:

Haemopis sanguisuga: Next to the Industrial Zone the stream becomes slower and the bed is muddier. These substratum and velocity is appropriate for leeches. The Horse Leech feed on smaller animals and usually found under stones.

The Table solely shows the records with species level exactness.

Coleoptera	*Dytiscus marginalis* Linnaeus, 1758		*Odonata*	*Calopteryx splendens* Harris, 1780
	Gyrinus natator (Linnaeus, 1758)			*Calopteryx virgo* Linnaeus, 1758
Ephemeroptera	*Baetis rhodani* (Pictet, 1843)			*Coenagrion puella* (Linnaeus, 1758)
	Baetis vernus Curtis, 1834			*Gomphus vulgatissimus* (Linnaeus, 1758)
	Ephemera danica Müller, 1764			*Ischnura elegans pontica* Schmidt, 1938
	Isoperla tripartita Illies, 1954			*Onychogomphus forcipatus* (Linnaeus, 1758)
Gastropoda	*Bithynia tentaculata* (Linnaeus, 1758)			*Platycnemis pennipes* (Pallas, 1771)
	Galba truncatula (O. F. Müller, 1774)		*Plecoptera*	*Brachyptera risi* (Morton, 1896)
	Melanoides tuberculata(Müller, 1774)			*Capnia bifrons* Newman, 1839)
	Physa fontinalis (Linnaeus, 1758)			*Isoperla tripartite* Illies, 1966
	Physella acuta (Draparnaud, 1805)			*Nemoura cinerea* (Retzius, 1783)
	Pisidium amnicum (Müller, 1774)		*Trichoptera*	*Chaetopteryx fusca* Brauer, 1857
	Planorbis planorbis (Linnaeus, 1758)			*Glyphotaelius pellucidus* (Retzius, 1783)
	Potamopyrgus antipodarum (J. E. Grey, 1843)			*Halesus digitatus* (von Paula Schrank, 1781)
Haplotaxida	*Criodrilus lacuum* Hoffmeister, 1845			*Halesus tesselatus* Rambur, 1842
Heteroptera	*Gerris odontogaster* (Zetterstedt, 1828)			*Hydropsyche bulbifera* McLachlan, 1878
	Hesperocorixa linnaei (Fieber, 1848)			*Hydropsyche fulvipes* Curtis, 1834
	Nepa cinerea Linnaeus, 1758			*Hydropsyche pellucidula* (Curtis, 1834)
	Notonecta glauca Linnaeus, 1758			*Hydropsyche saxonica* McLachlan, 1884
	Sigara striata (Linnaeus, 1758)			*Ironoquia dubia* (Stephens, 1837)
Hirudinea	*Erpobdella octoculata* (Linnaeus, 1758)			*Limnephilus lunatus* Curtis, 1834
	Erpobdella vilnensis Liskiewicz, 1927			*Limnephilus rhombicus* Linnaeus, 1758)
	Glossiphonia complanata (Linnaeus, 1758)			*Lithax obscures* (Hagen, 1859)
	Haemopis sanguisuga (Linnaeus, 1758)			*Mystacides azurea* (Linnaeus, 1961)

Malacostraca	*Asellus aquaticus* (Linnaeus, 1758)			*Plectrocnemia conspersa* (Curtis, 1834)
	Gammarus balcanicus Schaferna, 1922			*Potamophylax nigricornis* (Pictet, 1834)
	Gammarus fossarum Koch, 1836			*Potamophylax rotundipennis* (Brauer, 1857)
	Gammarus roeseli Gervais, 1835			*Rhyacophila dorsalis csoport*
				Rhyacophila fasciata Hagen, 1859
				Silo pallipes (Fabricius, 1781)

Table 1. List of the recorded macro-invertebrate species

Except these at least 9 species had been found which are not determined on species level: Empididae, Rhagionidae, Simulidae, Thaumaleidae and Tipulomorpha (Diptera); Gordius sp. (Goriidea); Rhitrogena sp. (Ephemeroptera); Lestes sp. (Odonata); Leptoceridae (Trichoptera). The collected data has come from five ecologically different sampling sites especially from the aspect of anthropogenic disturbing. The numbers of species belonging to the different stages grouped by taxa are shown in–Table 2. It is important to mention that in Szarvaskő none of dragonflies have been collected but the imagos of the same species have occurred here as in Almár.

	Szarvaskő	Almár	Eger-Felsőváros	Eger- Archbishop's Garden	Industrial Zone
Coleoptera	3	2	1	0	0
Gastropoda	2	1	3	6	1
Ephemeroptera	5	5	1	2	0
Plecoptera	4	1	1	0	0
Hirudinea	3	3	2	2	2
Heteroptera	3	5	1	0	0
Malacostraca	3	4	2	2	2
Odonata	0	3	4	6	3
Trichoptera	12	12	3	4	1
Diptera	3	0	0	2	2
Haplotaxida	1	0	0	1	0
Goriidea	1	0	0	0	0
Summarized taxon number	40	36	18	25	11

Table 2. The numbers of species belonging to the different stages

From this simple Table the higher diversity level of the sampling sites above the city is clearly manifested. Due to these obvious differences between the sampling sites those are appropriate to carry out comparing analysis by BISEL in the frame of practical lessons. BISEL is a simple system for water qualification by a biotic index based on bio-indication (Borián et al. 2001; Borián, 2002). It is specially used for education.

The anthropogenic effects are increasing from Szarvaskő to the Industrial Zone. The hydro morphological quality is on lower level in Eger especially in

Felsőváros and at the Industrial Zone and the stream is more polluted as well. We are trying to recompense it also with civil actions in Eger. Four waste collecting days have organized altogether in 2010 and 2011 on the whole stream section in Eger. 1,5-6 ton of waste had been collected per occasion by members and other dwellers of Eger.

The designed educational booklet describes the investigated sites and the routine of the research. It also explains how the stereomicroscope works and it shows the parts of it. The mostly representative species are emphasized and described shortly. It is illustrated by drawings and photos as it is shown below (Figure 2). The different taxa are signed by different colours on the vignette (Szitta et al., 2010).

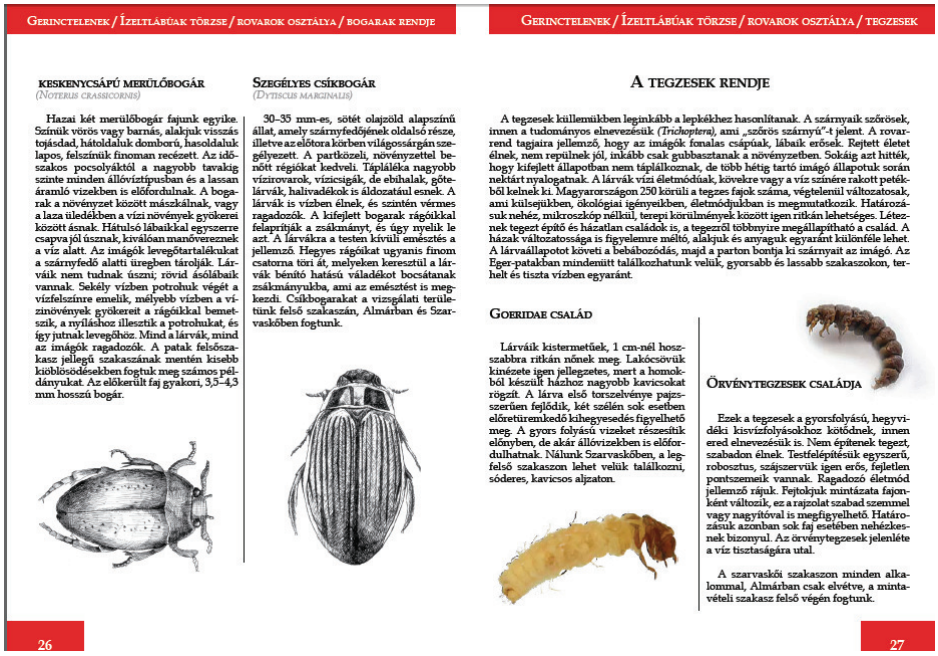

Figure 2. Excerpt from the booklet

Two rollups shows the differences of the fauna of pool and riffle habitats, next to it there are two other rollups about the fauna living on dead wood, tree trunks, branches and roots "Xylal" as it is mentioned in the methodology of WFD (BioAqua Pro Kft., 2008) and next to it the fauna of the emerse and submerse macro-vegetation. We can use these visual aids in field-works and on public programs.

Two informative boards have been also designed; these have been placed to Eger, Klapka György Street and Szarvaskő, Centre. These contain information about wildlife and the history of the stream.

Summary

Using aquatic macroscopic invertebrates for determining the ecological qualification of a surface water body is an accepted assessment method for implementing the European Water Framework Directive (WFD). Our faunistical results from the Eger-stream are providing additional works for further investigations and an information base for education. The five ecologically different sampling sites have designated between Szarvaskő and Eger. On the Eger stream it is possible to investigate upper and middle stage characteristic stages as well. Based on the collected 176 data about 58 aquatic macro-invertebrate species we are able to research the stream over Szarvaskő as a potential reference site and a benchmark in the future. Next to it we carry out comparative analysis in education and have designed a booklet about the fauna of the stream for secondary and tertiary students. Four rollups for educationally use have been also carried out.

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