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A method for the quantitative evaluation of the endangerment status of Trichoptera assemblages in Hungary

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With 1 figure and 2 tables

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An endangered species categorisation of the Hungarian Trichoptera has been proposed by NÓGRÁDI & UHERKOVICH (1999). However, their list did not allow a quantitative evaluation of the degree of endangerment. Here an attempt is made to calculate an index of endangerment among the different groups of the endangered species categorisation of NÓGRÁDI & UHERKOVICH (1999).

1 Introduction

Conservation ecology is an applied science connecting the science of ecology with the conservation practice. Among others, two major tasks of this scientific field is (1) the estimation of the ecological status value of different localities, and (2) indication of these changes in time (trends). Based on plant and animal communities a reference is given for the evaluation of their habitats. Obviously, the special characteristics of the communities (spectrum of species, number of species, number of individuals, diversity etc.) give no directly usable information to the unprofessional. Instead, conservation practice requires a quantitative method for evaluation of the conservation value of the given locality.

The conservation value of a site may be the number of the endemic and/or threatened species (BROOKS & al. 1999). EYRE & RUSHTON (1989) suggest the use of rarity indices and a typicalness measurement to estimate the conservation value of a site. By typicalness the authors meant the distance from the origo in an ordination space. In my opinion, conservation value of a site has to include many criteria, like rarity, diversity, threatened value, etc.

Actually, an index to be able to qualify the value of a community could be based on the number of the protected species. This number however, would show a crude value of the assemblage, because if, for instance, the number and the occurrence of the protected species are low, the sensitivity of this method can be insufficient for estimation, too. This is due to the low probability of rare species entering the sample. It is no good using this method in the case of Trichoptera in Hungary, because the number of protected caddisfly species is low.

There are altogether 10 species (Nógrádi & Uherkovich 1994), and all of them are very rare.

Here an attempt is made to suggest the degree of endangerment as a component of the conservation value, both at species and community levels, based on data of the studied caddisfly assemblages and on the endangered species categorisation of Nógrádi & Uherkovich (1999).

2 Interpretation of endangerment parameters and indices of endangement

Nógrádi & Uherkovich (1999 merely produced a list of species, wich did not allow a quantitative evaluation of endangerment of caddisfly assemblages. In this study, I propose endangerment parameters and indices, both at species and community levels as a method to quantitatify the status of caddisfly assemblages in Hungary.

The endangerment categorisation is a listing of the caddisfly fauna of Hungary into different groups that represents the endangerment of the species (e.g. extinct or vanished, endangered, vulnerable, presumed vulnerable and not-threatened). The endangerment parameters is frequency of species or individuals, expressed as percentage, among the given threatened species categories. I suggest to use a so-called "endangerment index" that quantifies the endangerment of the community and in which the endangered groups have different weights, based on their endangerment status.

3 Calculation of endangerment parameters

There are different ways to determine the endangerment categorisation (EC). Let mark the author and the description year with "a": EC[a]. Then the code of the EC of Nógrádi & Uherkovich (1999) is EC[NU1999].

There are degrees of endangering (= threatened species categories) in this EC. Let the total number of categories be "G", where the single categories are signed as "i" (i=1 to G): EC[a](i).

Nógrádi & Uherkovich (1999) described 6 threatened species categories: unknown, extinct or vanished, endangered, vulnerable, presumed vulnerable, not-threatened. 9 species have no evaluation, they are omitted from further calculation.

I give the following numerical values to these categories: i=1: not-threatened, i=2: presume vulnerable, i=3: vulnerable, i=4: endangered, i=5: extinct or vanished. For instance EC[NU1999](4) means the "endangered species-group" of the EC of Nógrádi & Uherkovich (1999).

The Value of EC, based on data [a], in the case of the i-th group and j-th species is coded as: VEC[a](i,j), where j=1 to S. (S is the total number of the

Trichoptera species in Hungary: presently 207, see NÓGRÁDI & UHERKOVICH 1999.) The value of VEC[a](i,j) can be zero or one, denoting whether or not a species (j) belongs to the i-th group. One species can belong to one group only: VEC[a](i,j)= 0 or 1, with the limit:

$$\sum_{i=1}^{C} VEC\,[a](i,j) = 1$$

The next step is the formulation of endangerment parameters both for species and community levels. The species level (1) shows only the occurrence of the given species among the different groups. The community level (2) shows the occurrence of individuals among the different groups. Let n_j the number of the individuals of the j-th species and I decode "species level occurrence" of the i-th group in the case of the EC[a] as follows: SO(i)EC[a]. It may be calculated as:

$$\mathrm{SO(i)EC[a]\%} = \frac{\sum_{j=1}^{S} (VEC[a](i,j) * k) * 100}{\sum_{i=1}^{C}\sum_{j=1}^{S} (VEC[a](i,j) * k)}$$

where "k" shows the presence/absence of the j-th species. The value of k=1, if $n_j > 0$ and k=0, if $n_j = 0$.

The "community level occurrence" of the i-th group in the case of the VEC[a](i,j) is: CO(i)EC[a]. Similarly, it can be calculated as:

$$\mathrm{CO(i)EC[a]\%} = \frac{\sum_{j=1}^{S} (VEC[a](i,j) * n_j) * 100}{\sum_{i=1}^{C}\sum_{j=1}^{S} (VEC[a](i,j) * n_j)}$$

As a result, the endangerment parameters of a community can be expressed by the help of SO(i)EC[a] % that shows a frequency distribution of sampled species and by the help of CO(i)EC[a] % that shows a frequency distributions of the members of the community (individuals) among the given threatened species categories.

4 Calculation of endangerment indices

At the species level I denote the indices as EI(s) and at the community level as EI(c).

$$\mathrm{EI(s)} = \frac{\sum_{i=1}^{C}(SO(i)EC[a]\% * i)}{100}, \text{ and}$$

$$\mathrm{EI(c)} = \frac{\sum_{i=1}^{C}(CO(i)EC[a]\% * i)}{100}$$

The value of EI(s) and EI(c) ranges from one to five. Theoretically, number five denotes a community represented by only extinct or vanished species, whereas number one refers to a community having only no threatened species. The larger the value of the index, the higher the endangerment of the community.

5 Application

The applicability of the endangerment parameters and indices was tested on light trap-collected caddisfly assemblages. Different areas and habitats were represented, based on own and literature data (Table 1). The endangerment indices were calculated for each site (Table 2). If only qualitative data were available, the species level EI was used.

Figure 1 shows the endangerment parameters of two caddisfly assemblages at Bernecebaráti and Pacsa. Bernecebaráti is a nature area in the Börzsöny Mountains without human disturbance. The light trap was situated near the Bernecei stream. The other site at Pacsa is a typical agriculture area with significant human disturbance. The endangerment parameters are based on caddisfly communities.

At species level endangerment parameters at Pacsa (Fig. 1/A) show a high value (more than 60 %) of the not-threatened species-group. The presumed vulnerable species-group is represented by less than 40 %. No other EC species-group is represented at Pacsa. At the community level endangerment parameters at Pacsa (Fig. 1/B) are represented by a higher value of the not-threatened, and by a lower value of the presumed vulnerable species-group. Based on these endangerment of the community at Pacsa seems to be low.

At the other site at Bernecebaráti the species-level endangerment parameters (Fig. 1/C) are represented by 4 species-groups (not-threatened, presumed vulnerable, vulnerable and endangered). The proportions of not-threatened and presumed vulnerable species are over 30 %, of the vulnerable species over 20 %

Tab. 1. The studied sites

Place	Year	Data	Reference
Bernecebaráti	1998	quantitative	unpublished
Szarvaskõ	1989, 1990, 1997	qualitative	Kiss & al. 1999
Fertõrákos	1976-1980	qualitative	Andrikovics & Ujhelyi 1983
Magyarszombatfa	1984	quantitative	Uherkovich & Nógrádi 1992
Nagyvisnyó	1984	qualitative	Kiss 1987
Pacsa	1986	quantitative	Schmera 1999
Pilismarót	1984-1986	quantitative	Nógrádi & al. 1991
Verõce	1980	qualitative	Chantaramongkol 1983
Vöröskõ Valley	1981	qualitative	Kiss 1984

Tab. 2: Endangerment index of the different sites

Place	Note	EI(s)	EI(c)
Bernecebaráti	natural area without human disturbance, stream ecosystem	1.96	2.39
Szarvaskõ	natural area without human disturbance, stream ecosystem	2.08	---
Fertõrákos	Lake Fertõ	1.58	---
Magyarszombatfa	natural area	2.11	1.98
Nagyvisnyó	natural area without human disturbance, stream ecosystem	2.20	2.65
Pacsa	agriculture area, heavy human disturbance	1.33	1.19
Pilismarót	natural area slight human disturbance, stream ecosystem	2.10	1.80
Verõce	Danube, heavy human disturbance	1.72	1.00
Vöröskõ Valley	natural area without human disturbance, stream ecosystem	2.09	2.55

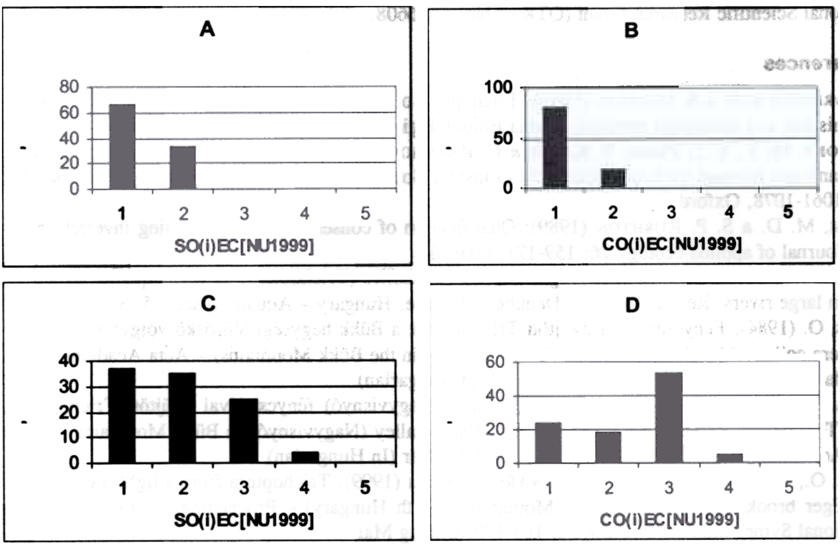

Fig 1.: Endangerment parameters of the caddisfly communities at Pacsa (A and B) and Bernecebaráti (C and D). A and C species level, B and D the community level

and of the endangered species under 10 %. The community level endangerment parameters at Bernecebaráti are shown in fig. 1/D. Percentages of the not-threatened and presumed vulnerable species are about 20 %, of the vulnerable species-groupabout 50 % and of the endangered species-group about 5 %. Figures 1/C and D demonstrate that endangerment of the caddisfly community at Bernecebaráti is higher than at Pacsa. On the other hand, the results of the species- and community-level endangerment parameters at Bernecebaráti show large differences, because the species-level evaluation of endangerment represents only the percentage of the species within the different endangered species-groups.

The evaluation of data from literature and from my own collection (Table 1) illustrates that the highest value of EI(c) is 2.65 and of EI(s) is 2.2 at Nagyvisnyó, whereas the lowest values were found communities are at Verõce and Pacsa. In the case of Verõce the result refers to the caddisfly community of the Danube, in the case of Pacsa to agriculture areas.

It seems that the endangerment of caddisfly communities, based on endangerment parameters and indices yield a negative correlation with the value of the human disturbance. This result supports the validity of the EC of NÓGRÁDI & UHERKOVICH (1999) and the method suggested above.

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