

ASSESSMENT ON FISH COMMUNITIES' STATE BY SEVERAL BIODIVERSITY INDICES IN THE RIVER CASIN (ROMANIA) IN 1998-2008

Marius Nadejde, Petronela Bran, Dorel Ureche, Camelia Ureche, Iuliana Lazar

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INTRODUCTION

River Oituz and River Casin were the subject of some researches aimed to study the trophic spectra of fish species (Nicoară et al., 2006, Ureche et al., 2008). Also, comparisons were made between trophic spectra and feeding behavior of the four fish species commonplace in the basins of the two rivers, Oituz and Casin: *Alburnoides bipunctatus* Bloch, *Barbus petenyi* Heckel, *Barbatula barbatula* L. and *Phoxinus phoxinus* L. (Bănărescu, 1964; Matei et al., 1990; Nicoară et al., 2006). In this study there were made some speculation on some indexes like the relative abundance, the ecological similarity coefficient (Sørensen coefficient). There were identified common invertebrate species in the trophic spectrum of the fish in the two rivers (Nicoară et al., 2006, Ureche et al., 2008).

Based on ecological indices, one can assess the state of the aquatic ecosystem, but also the diversity of the ecosystem, its level of pollution, the dominant species and their evolution over time. In the same time one can establish correlations between the ecological indices and the physico-chemical factors, in order to observe how they influence each other (Bayhan et al., 2008; Ureche, 2006).

The purpose of this study is to assess the state of fish communities in the River Casin, based on biodiversity indices Alpha, Berger-Parker, Simpson. In this respect was performed the synecological analysis of fish communities and the analysis of the interrelation between the biodiversity indices and the abiotic factors.

To assess the water quality, different groups of bioindicator organisms are used, but many studies show preferences for the macroinvertebrates for the following reasons: they are more abundant and varied, they are sensitive but, at the same time, they have a high tolerance for different types of pollution, they may be sampled relatively easily with a sieve that has a mesh of 250-1000 mm, they are ubiquitous and abundant throughout the whole river course (Illies, 1961).

The fish fauna is less used to evaluate, from a biological point of view, the water quality. This is

because fish have a higher mobility than macroinvertebrates, fish sampling requires greater effort, especially on deep rivers (Hellawell, 1986). However there were many authors that highlighted the advantages of using the data about fish fauna to determine the condition of an aquatic ecosystem: fish communities are good indicators of long-term effects, they can be easily identified in the field. In the same time, the pollution can often induce morphological changes and thus fish can be used as indicators of a certain state. The fish stock is considered a good indicator of overall human impact (Lasne et al., 2007).

The first attempts on monitoring the fish fauna were made in Europe in the 1990s, in countries like France, Poland and then Romania. One of the proposed methods to monitor fish is the method EFI (European Fish Index). To establish this index over 10,000 samples from European Union countries have been processed and 254 fish species have been considered (The Synthesis of Management Plans for river basins/ hydrographic areas-2009). In order to calculate EFI index, salmonid and cyprinid waters have been considered.

The literature shows that the Shannon-Wiener index, calculated for fish assemblage in the River Bistrita in the period 2007-2009, ranged between 0.632 and 2.104, indicating a high biodiversity, even if the actual size of the communities is declining (Păsărin, 2009).

The Shannon-Wiener index calculated for fish populations in the River Sinos from Brazil ranged between 0 and 2.59. The sampling sites where the fish was missing were located exclusively in urban areas (Costa & Schulz, 2010).

MATERIAL AND METHODS

The researches were conducted in the basin of the River Casin. The River Casin runs out on a surface of 308 km² and a length of 54 km (Ujvári, 1972). It has its origin in the Paleogene flysch area, but downstream of the Scutaru rivulet it penetrates the Subcarpathian depression Casin-Tazlau, which continues with Soveja depression to the south. The

River Casin has small tributaries and elongated basin. Among tributaries includes: Zboina (S = 11 km², L = 5 km), Bucies (S = 29 km², L = 8 km), Marmora (S = 12 km², L = 8 km), Halosul Mic (S = 13 km², L = 7 km), Halosul Mare (S = 20 km², L = 8 km), Curita (S = 31 km², L = 17 km) and Buciumi (S = 18 km², L = 11 km) (Badea et al., 1992).

The sampling of the biological material was performed using the electric fishing machine EGF 5000 (Reynolds, 1983), in 16 sampling sites (two in 1998, six in 1999, three in 2004, five in 2008). There were collected a total of 2929 individuals, with a total weight of 1,893,485 g. There were identified nine fish species. The fish samples were biometrically processed after the species identification.

The analysis of physico-chemical characteristics of the water (temperature, oxygen, pH) was performed using a multiparameter device.

RESULTS AND DISCUSSIONS

Alpha Index provides informations relative to the species richness in the studied area. Thus studying the sampling periods on the River Casin one can observe that the highest value of the index was recorded in 1999 and the lowest in 1998. The species richness fluctuates in each sampling sites. The

highest Alfa index value on the river Casin was recorded on one of its sides near Scutaru village, followed by Casin / Parvulesti village bridge, while the lowest was recorded in Bucies, upstream the confluence with the River Casin. From the graphical representation one can observe that there are oscillations regarding the value of this index, namely the diversity of the species varies from one sampling site to another (Figure 1).

Berger-Parker index is a biotic index that provides informations about the pollution with organic substances from a studied area and the connection between this phenomenon and the abundance of fish communities from the sampling sites. This index is used typically to assess the dominance of species in a community and to compare differences in species abundances across communities within the same ecosystem, where community composition may remain relatively constant but where abundance of individuals of each species may vary (Ingram, 2008).

Thus, calculating the index for the area under study (the River Casin), it was found that in some sampling sites there were recorded some quite high values, which indicate a certain level of organic pollutants and, at the same time, may indicate good conditions for less sensitive fish species.

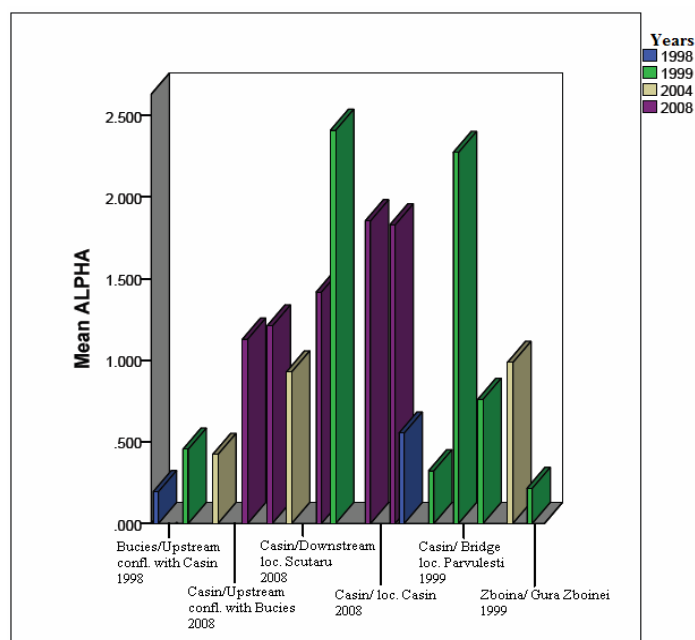


Fig. 1. Alpha index values in sampling sites during the period 1998-2008

Analyzing the situation on a range of years, it appears that the Berger-Parker index values showed a gradual increase from 1998 to 2008 (Figure 2). This is explained by the presence of pollution sources near the river (fecal pollution, domestic sewage, chemical

pollution). Also it can be seen from the graph that the values of this index varie dependent on the sampling sites, the highest values were recorded in 2008 at Casin point, Casin village and in 2004 at Buciumi point / upstream Buciumi village. These high values

are due to the presence of pollution sources, that also determine the development of resistant species to pollution.

Simpson index highlights the relationship between each species and the total number of individuals. The higher the value of this index, the lower the diversity of species. Looking at the graph it can be seen that this index also records a variation in the sampling sites per year.

Thus, in 2008 at Casin village this index had a maximum value, then we can say that in that year and in that area the diversity was at a low level. It is also noted that the lowest index values were recorded at the point Zboina, Gura Zboinei in 1999, Casin / Bucies Bridge in 1999 and Bucies / Upstream the confluence with Casin in 1998, which means that the diversity of these points is high (Figure 3).

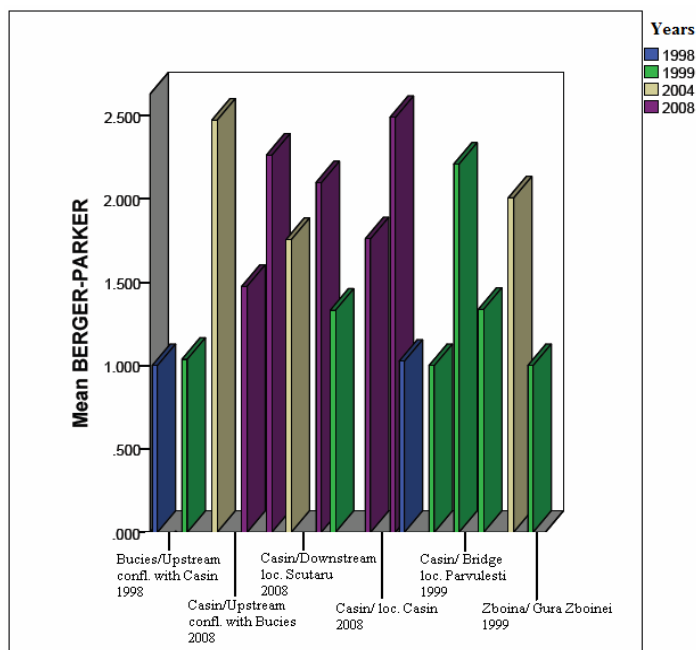


Fig. 2. Berger-Parker index values in sampling sites during the period 1998-2008

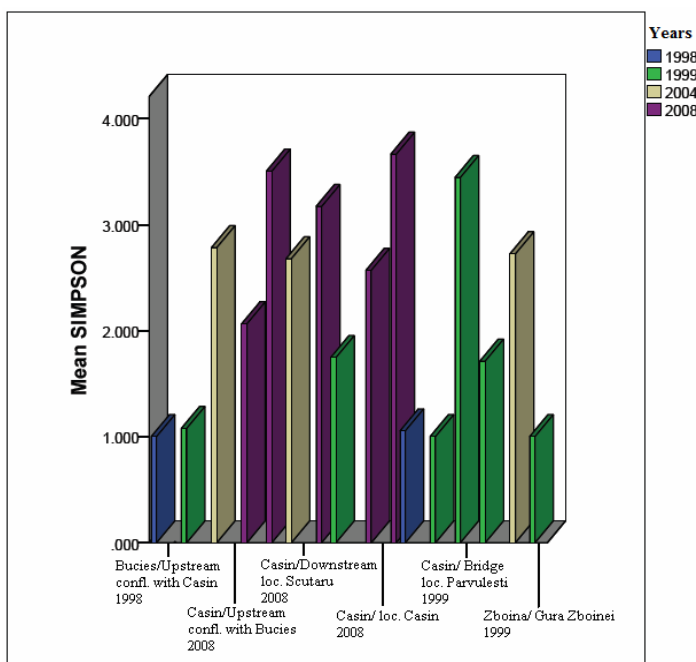


Fig. 3. Simpson index values in sampling sites during the period 1998-2008

CONCLUSIONS

The evaluation of diversity indices can be very useful when we want to find the status of a river or river basin and to take action to fix the problems, where they exist.

The values of these indices are different from a sampling site to another, as the highs and the lows of the values of these indices are different from one station to another, depending on environmental conditions. Thus, it can be seen that the maximum Alpha index was recorded at the point Casin, Scutaru village side, in 1999, which means that this point had the highest species richness. The minimum value of this index was recorded at the Bucies point/ Upstream the confluence with the River Casin in 1998, which indicates a small number of species, which can be influenced by the presence of certain environmental factors, such as organic or inorganic pollution, that determined the regression of species.

Berger-Parker index peaked at Buciumi point/ upstream Buciumi village in 2004. This is due to the fact that the industry has evolved in that area and the pollution in the sampling areas increased, probably due to the discharge of pollutants into the water. So this value calls our attention to the low abundance of species existing at these sampling sites. The minimum value of this index was reached at the points where the minimum value of Simpson index also was reached. These points are: Zboina /Gura Zboinei in 1999, Casin / Bucies Bridge also in 1999 and Bucies / upstream the confluence with River Casin in 1998. The values of the index Berger - Parker shows the same thing as the Simpson index: great diversity when the value is minimal. Taking this into account we can conclude that during the sampling periods the pollution was relatively low in the area, which led to a greater diversity of species.

The maximum value of the Simpson index was recorded at point Casin, Casin village in 2008, which indicates that in that year the number of species in the sampling site was reduced, a fact determined by the environmental factors, such as the fecal pollution that may cause the disappearance of sensitive species and the acclimation of those less sensitive to environmental conditions, the latter increasing their population.

Thus it is noted that the values of the indices differ not only according to ambient conditions, but also dependent on the sampling site. The minimum value of this index was reached at Zboina point/ Gura Zboinei in 1999, Casin / Bucies Bridge also in 1999 and Bucies / upstream the confluence with River Casin in 1998. These values indicate that the environmental conditions at the time in the mentioned sampling points were favorable to the development of a greater number of species, thus increasing diversity.

ABSTRACT

This study aims to estimate the state of fish communities in the basin of River Casin in 1998-2008 based on some indices of biodiversity (Alpha, Berger-Parker, Simpson). There were established some physic-chemical factors of the water and there were made some correlations between biodiversity indicators and some abiotic factors. It was observed that the value of biodiversity indices varies in time and depends on the sampling sites, suggesting a clear influence of the anthropic factors on the biodiversity within fish communities.

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AUTHOR'S ADDRESSES

NADEJDE MARIUS, LAZAR IULIANA, University "Vasile Alecsandri" of Bacau, Department of Mechanical Engineering, and Environmental Engineering, 157 Marasesti Street, 600115 Bacau, nadejdemariusionel@yahoo.ro, ilazar@ub.ro.

BRAN PETRONELA, URECHE DOREL, URECHE CAMELIA, University "Vasile Alecsandri" of Bacau, Department of Biology, Ecology, and Environment Protection, 157 Marasesti Street, 600115 Bacau, petronelabran@yahoo.com, dureche@ub.ro, urechec@ub.ro.