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Application of the EPT-index for Ecological Status Assessment of the Riverine Water Bodies within the Basin of Kamchia River

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Abstract: Indexes based on the intolerance of the groups Ephemeroptera, Plecoptera and Trichoptera to pollution were used for assessment of the ecological status along the river system of Kamchia. The achieved data about the EPT-indexes were compared with standard biological indexes for water quality assessment of the surface running waters, according to Ordinance No.7/1986 (Appendix 1). The results from the survey illustrated that the values of the EPT-N and EPT-S indexes confirm the assessment for the sapro-biological conditions along the Kamchia river valley. These indexes efficiently establish the changes in the water quality and successfully can be used for the purposes of ecological categorization of the river water bodies.

Keywords: EPT-indexes, invertebrate community parameters, water quality, river ecological status assessment

1. INTRODUCTION

The present work presents the results obtained from the application of the index EPT-abundance and EPT- Taxa Richness (Plafkin et al. 1989; Wallace et al. 1996) for the assessment of the ecological status of the water bodies within the Kamchia river valley. They are proposed as a set of normatively defined factors, adopted by the Water Frame Directive 2000/60/EC (WFD), for ecological categorization and monitoring of the river status by the biological quality element "bottom invertebrates". These indexes are based on the variations in the proportion of the indicative representative of the orders of Ephemeroptera, Plecoptera and Trichoptera in the composition of the biocenose, as a response to the changes occurred in the ecological quality.

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In Bulgaria, only Russev, Yaneva (1987) have analyzed the changed participation of the sensitive species from the bio-indicative groups Ephemeroptera and Plecoptera, and they found out that in referent conditions even the rated participation of individuals from order Plecoptera can provide express information for the changes in water quality.

The purpose of the present report is to examine the applicability of these indexes for the purposes of the ecological categorization of the river water bodies in the meaning of the WFD. Data from the pilot survey on the ecological status of the Kamchia river valley were used, which was assessed by using the indexes of the bottom invertebrate fauna (Soufi and Uzunov, 2008).

2. MATERIALS AND METHODS

This survey was conducted in August 2005 on 16 sampling points within the Kamchia river system (Soufi, Uzunov, 2008). Based on the original data on the species composition and abundance (numbers) of the macrozoobenthos, the index EPT-N – the relative portion of the sensitive to pollution taxons from the orders Ephemeroptera, Plecoptera and Trichoptera, and the index EPT- S – the relative number of species by which these groups participate in the formation of the species richness in the community, were calculated. The data for the EPT-indexes were compared with the respective standard biological indexes of the water quality according to Ordinance No. 7/1986 (Appendix 1) and they were statistically processed by application of a regressive/correlation analysis. The correlation ration was assessed by using the Pearson's coefficient.

3. RESULTS AND DISCUSSIONS

The intolerance to pollution of the representatives of the orders of Ephemeroptera, Plecoptera and Trichoptera, allows by using the both indexes to be efficiently established the variations in the water quality (Lenat, Penrose 1996). Their high values are indicative for good water quality, and the low values are a signal for the water quality deterioration.

The regressive analysis as applied showed a very high degree of negative relationship of the values of the both analyzed indexes with

the dynamic rate of the two saprobic indexes - Pantle & Buck (SPUB) and Rotschein (SROT) within the Kamchiya river valley.

On Fig 1 and 2 are illustrated the linear relationship of the two indexes EPT-N and EPT-S towards SPUB, with values of the correlation coefficient: r = -0,897 and r = -0,948, respectively.

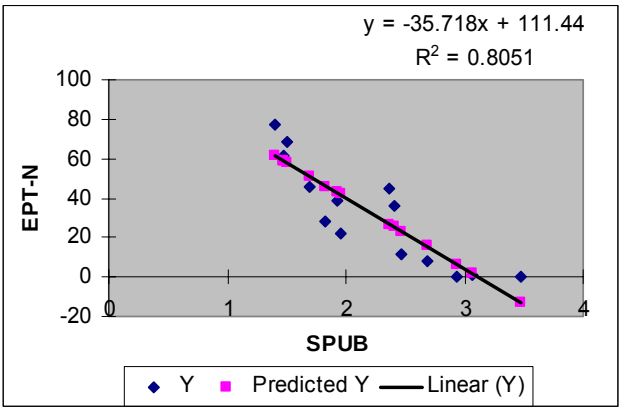

Fig. 1. Linear regression between SPUB and EPT-N

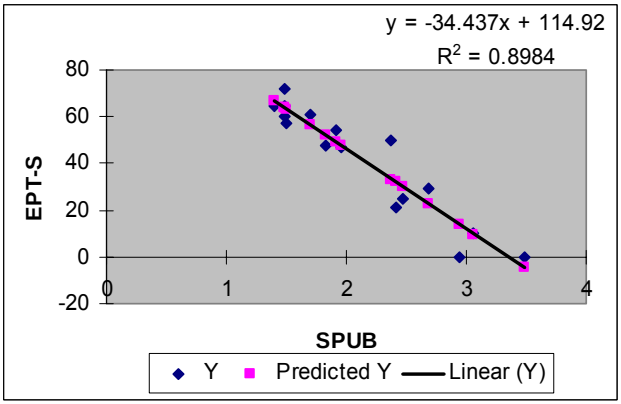

Fig. 2. Linear regression between SPUB and EPT-S

Along the gradient of the organic loading a clearly expressed tendency towards reduction of the relative abundance and number of the represented taxons (species diversity) of the intolerant to contamination orders was observed (Fig. 3 and 4). The indicative groups responded to the changes in the saprobic gradient, by changing its quality characteristics as well as its diversity of species.

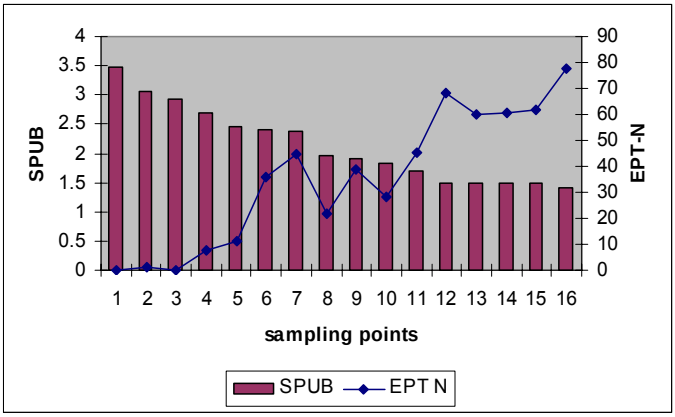

Fig.3. Variation of EPT-Nindex along the gradient of SPUB

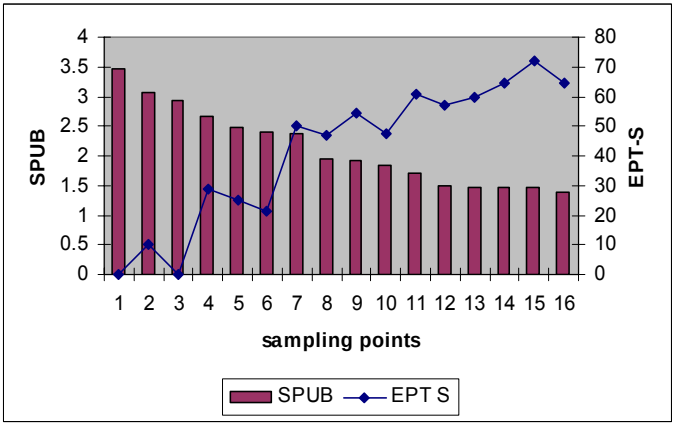

Fig.4. Variation of EPT-S index along the gradient of SPUB

As it might be expected, the maximum values of the relative EPT – abundance and species diversity of the sensitive taxons, being accompanied by an increase of the family richness as a whole, were registered within the oligosaprobic range. For example, the point at the Medvenska river located above the village of Medven, was distinguished by the biggest species diversity of intolerant to contamination groups – total of 72.22%, followed by point Luda Kamchia at Bilka, where the highest value of EPT-N – 77.5% of the total abundance was registered. Similar values were registered at the remaining points with oligosaprobic conditions established, where the relative portion of the orders Ephemeroptera, Plecoptera and Trichoptera, exceeded 50%.

On the contrary, a decrease in the portion of the sensitive taxons and the associated increase of the portion of the chironomid larvae were observed at the high values of the saprobic indexes. Within the α-mesosaprobic range, the values of both EPT-indexes were established to be at their minimum, and at the point – Poroyna River, located after the village of Radko Dimitrievo where polysaprobic conditions were established, no representatives of the sensitive groups in the composition of the community were found.

On Table 1 are shown the values of the correlation coefficient as derived for several cenotic and saprobic indexes, standardized for the water quality determination.

The results obtained show a low degree of correlation between the cenotic and saprobic indexes, on one hand, and between the cenotic and the EPT-N index and EPT-S index, on the other hand. These data confirm the fact, that under the conditions of moderate loading, some more tolerable to contamination species, can replace the more sensitive ones, so that the indexes of species diversity and the other cenotic indexes remain unchanged, and cannot give a real assessment of the ecological status (Soufi and Uzunov, 2008).

Table 1. Values of the correlation coefficients (R) assessed between EPT-indexes and standard indexes of the bottom community according to Ordinance No.7/1986.

	SDIV	*HIND*	*DOMN*	*EVNS*	*SPUB*	*SROT*	*EPTN*	*EPTS*
SDIV								
HIND	0.746**							
DOMN	-0.576*	-0.935**						
EVNS	0.416	0.876**	- 0.931**					
SPUB	-0.067	-0.296	0.156	-0.163				
SROT	0.110	0.283	-0.115	0.112	-0.975**			
EPTN	0.037	0.208	-0.055	0.098	-0.897**	0.843**		
EPTS	0.096	0.283	-0.111	0.098	-0.948**	0.925**	0.876**	

** Correlation is significant at the 0.01 level (2 - tailed)
* Correlation is significant at the 0.05 level (2 - tailed)

4. CONCLUSION

The achieved data illustrate that the values of the indexes EPT-N and EPT-S confirm the assessment for the sapro-biological conditions along the Kamchiya river valley and also they are not representative for the changes as occurred in the cenotic structure, established by some cenotic indexes. These indexes can be rather applied under the conditions of organic loading and the associated changes in the oxygen regime, then under the existence of any asaprobic impacts. With its whole diversity, this type of impacts affects mainly on the cenotic level but not on the taxonomic level. The two indexes efficiently establish the changes in the water quality and successfully can be applied for the purposes of ecological categorization of the river water bodies.

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