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The effect of rehabilitation on the reed-biotecton (Periphyton) in Lake Velencei (Hungary)

G. Lakatos

Ecological Institute of L. Kossuth Lajos University, H-4010 Debrecen, Hungary

Abstract: The author reports on the results concerning the indicative role of the reed-biotecton-complex in Lake Velencei before the dredgig in 1979 and during the restoration process in 1984. It can be emphasized that the biotecton indicated remarkably the change of water quality. The indication was generally manifested in the larger mass, lower ash content and increasing Chlorophyll-a concentration of the biotecton. The results confirm that the restoration measures at the beginning of the eighties did result in an improvement of the water quality of Lake Velencei.

Kurzfassung: In der vorliegenden Arbeit werden Ergebnisse vorgestellt, die den Indikatorwert von Schilf-Biotecton im Hinblick auf Wasserqualität betonen. Anläßlich der Restauration des Velencer Sees wurde das Schilf-Biotecton 1979 und 1984 untersucht. Das Biotecton zeigte klar die Veränderung in der Wasserqualität an und zwar kam es zur Entwicklung von Periphyton mit einer größeren Trockenmasse, mit niedrigerem Aschegehalt und höherem Chlorophyll-a-Gehalt. Die Ergebnisse zeigen, daß die Restaurationsmaßnahmen zu einer Verbesserung der Wasserqualität des Velencer Sees geführt haben.

Introduction

The reed stands play an important role in life of shallow lakes where they occupy the largest area of the littoral zone and their submerged parts are covered by periphyton (Lakatos et al.., 1982; Lakatos, 1983; Lakatos & Hammer, 1989). Although the role of the reed-biotecton (periphyton) complex as an indication of changes in the water quality has been recognized, only a few papers deal with it in detail (Wetzel, 1960; Szczepanska, 1970; Kowalczewski, 1975; Ross, 1983; Meulemans & Ross, 1985; Lakatos, 1986; Meulemans, 1988)The reed-biotecton investigations in Lake Velencei were started at the end of the seventies; from the beginning of eighties their main objective was to reveal the effects of the lake restoration on the water quality. This paper presents the results concerning the indicative role of the reed-biotecton complex in Lake Velencei.

Materials and methods

14 sampling locations were selected at the open water side of reed stands. Taking into account our earlier results on water chemistry, phyto- and zooplankton we deemed it expedient to select different water quality areas (Bartha, 1977; Lakatos, 1978; Bartha & Hajdu, 1979).
We took samples from the "brown water" area, especially from the Vendel tisztás(Ve), Nagytó-Rigya (Na), Gallér (Ga), Vaskapu (V), Hollóstisztás (Ho), from the "grey water" area i.e. Nagytisztás (Nt), Felsötó (Fe), Nádastó (N), Belsö tisztás (B); from the "algal brown water" area, namely Öregtisztás (Ö) and Kárászos (K), from the "green water" area, i.e. Fürdetö (Fü) and from the "transition water quality

area" the Hosszútisztás (Ht) and Lángitisztás (L). In addition to the reed and biotecton samples water samples were taken and the water depth as well as the transparency were measured. The wet mass of biotecton was measured and its dry mass was determined after drying at 105 °C. The chlorophyll-a was extracted with methanol; the ash content was measured after burning at 450 °C. The concentration of nitrogen, phosporus and cations in the biotecton and reed samples was also determined. The autotrophic index (AI) expressing the ratio of the ash-free dry weight and the chlorophyll-a content was calculatd too. The valuation of the results followed the classification system of biotecton which was developed on the basis of our earlier studies on Pannonian shallow lakes (Lakatos, 1983, 1988).

Results and discussion

In both years a significant difference between the dry mass of biotecton on the green reed (g) and that of the old reed (o) became obvious (Table 1). The o/g ratio was significantly lower in 1984. It turned out that the dry mass of green reed-biotecton increased but that of the old reed decreased. The dry mass of biotecton increased only in plots of Gallér (G), Öregtisztás (Ö) and it remained constant in Felsötó (Fe). In contrary a decreasing tendency was observed in the parts of Hosszútisztás (Ht) and Vaskapu (V) dredged in 1980.

In Table 2 the classification of the green reed-biotecton by means of the values of their dry mass is presented. A remarkable change appeared between 1979 and 1984. In 1984 the number of categories decreased and all the sampling plots corresponded with the large and medium mass categories, whereas in 1979 periphyton of all categories was present. Table 3 shows the distribution of sampling plots and the biotecton types established on the basis of the ash content. In 1979 periphyton of type I and II was prevailing, in 1984 the one of type II and III. In table 4 the trends of changes in dry mass are given, for the years 1979 and 1984. The most significant reduction was established in Hosszútisztás (Ht).

Table 5 reveals that among the macroelements the concentration of sodium and magnesium had an increasing tendency between 1979 and 1984, on the other hand there was a decrease in concentration of calcium which remained near 10 % due to the incrustration.

Table 6 illustrates the mean values of the Chlorophyll-a concentrations of reed-biotecton and AI indices for the two years. An increasing tendency was characteristic for the chlorophyll-a concentration in almost all the sampling sites of the lake. It is worth mentioning that the proportion of phytotecton increased in Fürdetó due to the reduction of pelagic eutrophication. Furthermore we can also state that the AI index of the green reed-biotecton increased but the one of the old reed remained at the same level.

Summing up it can emphasized that the biotecton remarkably indicated the change of water quality under the influence of restoration of the lake. The indication was generally manifested in the formation of the biotecton of larger mass, lower ash content and increasing chlorophyll-a concentration. Our results confirm that the human activities at the beginning of the eighties has resulted in an advantageous change of water quality in Lake Velencei.

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Table 1: Dry mass of biotecton on green reed and the old reed and their ratio ($R = \frac{o}{g}$)

dry mass, g. reed stem m^{-2}

		green reed		old reed		their ratio
	min.	13,1	Fü	57,7	Ö	4,4
1979	max.	92,6	Ht	155,9	V	1,7
	mean value	37,5		91,4		2,4
	min.	30,1	K	34,1	K	1,1
1984	max.	76,2	Nt	127,3	Nt	1,7
	mean value	50,2		78,4		1,6

Table 2: Classification of biotecton on the basis of its dry mass (green reed)

Type		dry mass $g.m^{-2}$
I.	biotecton of large mass	40
II.	biotecton of medium mass	20-40
III.	biotecton of small mass	20

Category

	1979	1984
I.	V, Nt, Ht, Fe	V, Ga, Nt, Fe, N, B, Ö, Ht, L
II.	Ve, N, Ga, N, B, Ö, L	Ve, N, Ho, K, Fü
III.	Ho, K, Fü	

Table 3: Distribution of sample plots among the biotecton types established on the basis of ash content

	Type	Ash content (%)
I.	inorganic biotecton type	75
II.	inorganic-organic biotecton type	51-75
III.	organic-inorganic biotecton type	25-50
IV.	organic biotecton type	25

Types	1979	1984
I.	Na, Ga, V, Ho, N, Ht	Nt
II.	Ve, Nt, Fe, B, K, Fü, L	Ga, V, Fe, N, B, Ö, Fü, Ht, L
III.	Ö	Ve, Na, Ho, K
IV:		

Table 4: Groups of sampling plots established on the basis of the trend in changes (± 20 %) of the biotecton dry mass between 1979 and 1984

Increasing trend in the dry mass of biotecton:
green reed: Ve, Na, Ga, Ho, Nt, N, B, Ö, K, Fü, L
old reed: Ga, Ö

Constand dry mass of biotecton:
green reed: Fe
old reed: Nt, Fe, N, B

Decreasing trend in the dry mass of biotecton:
green reed: V, Ht
old reed: Ve, Na, N, Ho, K, Fü, Ht, L, V

Table 5: Trends in change of cation concentration measured in 1979 and 1984

increasing trend:	sodium, magnesium, manganese
constant:	potassium, ferrum, zinc
decreasing trend:	calcium, cuprum

Table 6: Mean values of Chlorophyll-a concentrations and AI of reed-biotecton

	green reed	Chlorophyll-a % biotecton	old reed
1979	0,105		0,088
1984	0,115		0,104

	green reed	Mean values of AI biotecton	old reed
1979	330,9		400,8
1984	350,8		402,3