

## ECOLOGICAL POTENTIAL OF THE HYDROSYSTEM DANUBE-TISZA- DANUBE IN BANAT REGION (VOYVODINA) ACCORDING TO PHYTOPLANKTON ANALYSES AND WFD

NEMES Karolina, MATAVULY Milan

DEPARTMENT OF BIOLOGY AND ECOLOGY  
FACULTY OF SCIENCES OF THE UNIVERSITY OF NOVI SAD  
SERBIA AND MONTENEGRO

### ABSTRACT

*According to guidance of Anon 2003b [1] biological element - phytoplankton has been selected for establishing referral body of water with maximum ecological potential (MEP) of The Danube-Tisza-Danube hydrosystem (HS-DTD) also classified as artificial, heavily modified water [2]. In this paper the results of seasonal dynamics of phytoplankton as one of the carefully chosen ecological mode to the estimation of water's ecological classes [1] has been applied. Classification was made according to Sorensen indices of similarity [15]. Reference conditions with MEP were assigned to the hydro-system Danube-Tisza-Danube (HS-DTD), The Canal Novi Bechey - Banatska-Palanka; Novi Bechey – Melenci stretch. As determined by phytoplankton analyses, investigated canals and rivers could be classified into water bodies of good ecological potential, except the rivers: Zlatica (Aranka), Stari Begej (Old Begej), Moravica, and some sections of the Canal Plovni Begej (Navigable Begej) what was designated to moderate ecological potential.*

### Key words:

*Ecological potential, phytoplankton, HS-DTD, Banat, Voyvodina*

## 1. INTRODUCTION

According to WFD [4], phytoplankton investigation is important especially for lowland rivers as one of the reliable bioindicative parameters used in estimation of the ecological status/potential of all surface waters. A series of sub-steps are required to establish appropriate values for the chosen quality element - phytoplankton in identification and designation of reference conditions and for ecological classification [1]. The research of phytoplankton in waters of Hydrosystem DTD in Banat region has been carried out earlier [7, 9, 10, 14].

## 2. MATERIAL AND METHODS

The research of phytoplankton in waters of Hydrosystem DTD (complex of canals and rivers: Zlatica, Stari Begej (Old Begej), Tamiš (Tamish), Brzava, Moravica and Karaš (Karash) has been carried out

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seasonally in the course of 2003 and 2004. Identification of algae was based on both light microscopy (LM) and scanning electron microscopy (SEM). The saprobity indices were evaluated according to Pantle-Buck [13] using bioindicative values of species determined by Gulyás [6]. Chlorophyll *a* and chemical analyses were determined by use of standard methods (APHA, 1995). Consequently, the trophic potential was estimate according to Felföldi [5]. The amplitude of pressures to selected sections of the hydrosystem was estimated comparing selected sampling sites to maximum ecological potential (MEP).

The estimation of EQR was made using the diversity and biomass of the phytoplankton analyses, and final values were given descriptively. Classification of canals and rivers was made according to Sorensen indices of similarity [14]. According to saprobity indices the saprobic potential was characterized: <1.8 - high - (oligosaprobity - OS); 1.8-2.3 - good - ( $\beta$ -mesosaprobity - BMS); 2.3-2.8 - moderate ( $\beta$ - $\alpha$ -mesosaprobity - BAMS); 2.8-3.3 - poor ( $\alpha$ -mesosaprobity - AMS) and above 3.3 as bad potential (polysaprobity - PS). The classification of trophic potential was made according to trophic conditions and chlorophyll *a* content: high potential - 5 mg/l (oligotrophic - OS), good - 5-10 mg/l (oligo-mezotrophic - OMS), moderate - 10-20 mg/l (mesotrophic - MS), poor - 20-50 mg/l (meso-eutrophic - MES) and, finally, concentrations above 50 mg/l - bad potential - (eutrophic-hipertrophic) [14].

### 3.RESULTS AND DISCUSSION

According to system A of WFD [4, 2] all bodies of surface water within Autonomous Province of Voyvodina belong to ecoregion XI, while HS DTD in Banat region could be, according to surface water body typology, characterised as lowland catchmant area with predominantly calcareous geology. Reference conditions were assigned to HS DTD Banatska Palanka - Novi Bechey - sampling site: Melenci (the middle Banat region).

Calculated similarity between two distant sampling sites: Hetin locality - The River Old Begey and Sayan locality - Canal of the DTD hydrosystem - (close to the river Tisza) is low -  $C_s \% = 0.64$ , and when both of them are compared to sampling site Melenci, the value was  $C_s \% = 0.75$ . Alternatively, other referral conditions such as those in Kikinski canal - Novo Miloshevo in North Banat region were not accepted because algal composition pointed out greater amount of nutrients, especially ammonia. Near Melenci, high ammount of nitrates could be attributed to nitrification processes, and in general, it points to the good water quality.

We find important to mention here the presence of halophyl diatoms found earlier in some other freshwater bodies [3] such as: *Bacillaria paradoxa* Gmelin, *Entomoneis paludosa* (Wm. Smith), *Nitzschia constricta* Kützing Ralfs, *N. levidensis* (Wm. Smith) Grunow, *N. reversa* (Wm. Smith) which are present in cold period in north and middle part of the HS DTD [10]. Diatoms were less abundant in canals and the rivers in southern part

of Banat. They began to appear in October of 2003, but in the river Zlatica lately in December, what was in correspondence with the dynamics of  $Cl^-$  and  $Na^+$  ions content (fig. 1-2).

TABLE 1. EVALUATION OF ECOLOGICAL POTENTIAL OF HS DTD IN NORTH AND MIDDLE BANAT REGION (2003/2004).

	Cs %	Number of species	Saprobic potential	Trophic potential
<b>MELENCI - MEP Canal</b>	1 (100%)	127	2.20 BMS	5.00
<b>The River Zlatica (EQR)</b>	<b>moderate</b>			
Values of indicative par. and description	0.69 (69%) good	(0.82)104 high	2.33 BAMS moderate	15.28 MES moderate
<b>Hetin - Old Begey (EQR)</b>	<b>moderate</b>			
Values of indicative par. and description	0.75(75%) good	(0.88)115 good	2.34 BAMS moderate	14.32 MES moderate
<b>Yankov Most - Old Begey (EQR)</b>	<b>moderate</b>			
Values of indicative par. and description	0.77(77%) good	(0.87)111 good	2.31 BAMS moderate	26.46 MES poor
<b>Srpski Itebey - Navigable Begey (EQR)</b>	<b>good</b>			
Values of indicative par. and description	0.72 (76%) good	(0.93) 120 high	2.23 BMS good	6.28 OMS good
<b>Klek - Navigable Begey (EQR)</b>	<b>good</b>			
Values of indicative par. and description	0.74 (74%) good	(0.90)117 high	2.22 BMS good	8.75 OMS good
<b>Stajicyevo - Navigable Begey (EQR)</b>	<b>moderate</b>			
Values of indicative par. and description	0.90 (90%) high	(0.96)124 high	2.30 BAMS moderate	15.75 moderate
<b>Sajan - Kikindski Canal (EQR)</b>	<b>good</b>			
Values of indicative par. and description	0.75 (75%) good	(1)136 high	2.24 BMS good	6.65 OMS good
<b>Novo Miloshevo - Kikindski Canal (EQR)</b>	<b>good</b>			
Values of indicative par. and description	0.70 (70%) good	(0.91)118 high	2.17 BMS good	3.40 OS high
<b>Novi Bechey - The Canal (EQR)</b>	<b>good</b>			
Values of indicative par. and description	0.80 (80%) good	(0.86)111 high	2.23 BMS good	3.20 OS high
<b>Lazarevo - The Canal (EQR)</b>	<b>good</b>			
Values of indicative par. and description	0.70 (70%) good	(0.98) 128 high	2.20 BMS good	5.49 OMS good

The number of striae in species *Entomoneis paludosa* 26-30/10 $\mu$ m (fig. 1 B) was a bit greater compared to taxonomical data 24/10 $\mu$ m [8] and in Japan, this species has 22.5/10 $\mu$ m [12]. Consequently, we suppose that the unique variety thrives in the Banat region. The greater number of striae supports the existence of *Entomoneis paludosa* in Banat waters, which have high amount of suspended solids, compared to the sea waters - the natural habitat of algae *Entomoneis paludosa*.

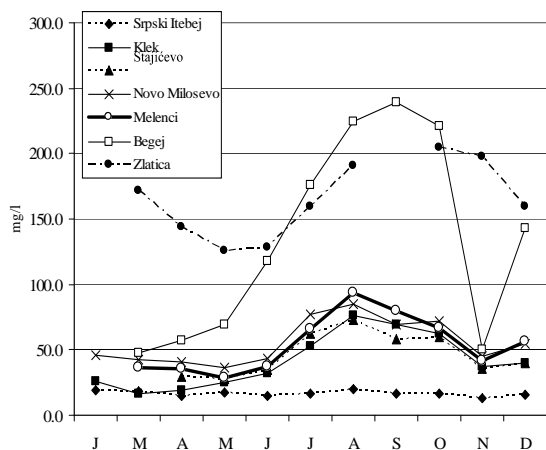


FIG. 1. ANNUAL CURVES OF ONE OF THE MAJOR CATION- $\text{Na}^+$  IN INVESTIGATED SAMPLING SITES: THE CANAL NAVIGABLE BEGEJ (SRPSKI ITEBEJ, KLEK, STAJICEVO LOCALITIES), THE RIVER ZLATICA, THE RIVER OLD BEGEJ - HETIN, AND IN CANALS - NOVO MILOSEVO AND MELENCI (2003).

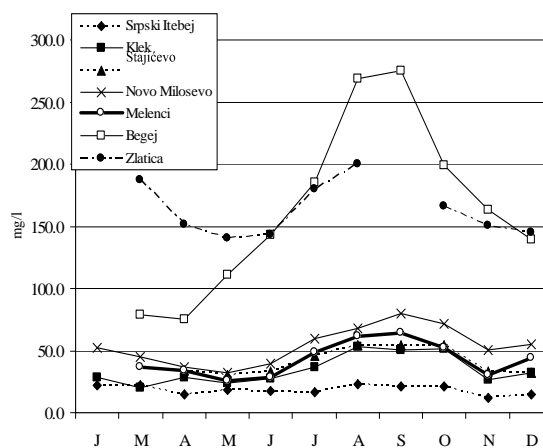


FIG. 2. ANNUAL CURVES OF THE MAJOR ANION- $\text{Cl}^-$

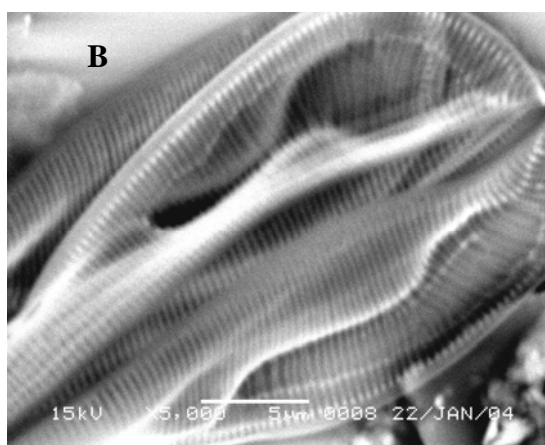
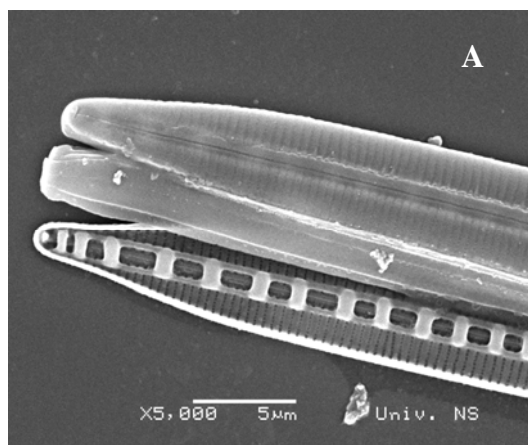


FIG 3. SEM: HALOPHYL DIATOMS *BACILLARIA PARADOXA*- A AND *ENTOMONEIS PALUDOSA*-B MAGN. 5000X

During the investigations, a decrease in number of species in waters from middle to south Banat region was observed. Comparing with higher content of suspended solids of these waters, we pointed out negative impact on algal compositions that were found in the river Tisza, too [8]

It could be concluded that HS DTD is subjected to the pressure from The River Old Begej, from The Canal Navigable Begej, and The Moravica River too and therefore, maximal ecological potential could not be sustained downstream of the reference site.

Estimated by comparison, qualitative and quantitative analyses of phytoplankton in HS DTD in north-middle Banat region with south Banat region revealed significant differences in algal communities. Halophyl diatoms are scarce and this indicates lower salinity, i.e. better quality of the canal waters for irrigation purposes. Algal community of Banat region also differs greatly when compared with the results of investigations of Bachka region [11] Therefore, reference conditions were assigned to HS DTD Vrbas - Bezdán, Bezdán - Shebesh Fok - Bayski Canal section (near Hungarian border) [16].

TABLE 2. EVALUATION OF EQR OF HS DTD IN SOUTH BANAT REGION (2004).

	Cs %	Number of species	Saprobic potential	Trophic potential
DTD MELENCI- MEP	1 (100%)	127	2.20 BMS	5.00
<i>Yasha Tomicy</i> -The River Tamis (EQR)	good			
Values of indicative par. and description	0.70(70%) moderate	(0.68) 89 good	2.17 BMS good	4.00 OS high
<i>Botosh</i> - The River Tamish (EQR)	good			
Values of indicative par. and description	0.80 (80%) good	(0.73) 96 good	2.13 BMS good	5.98 OMS good
<i>Botosh</i> - The DTD Canal (EQR)	good			
Values of indicative par. and description	0.68 (68%) good	0.63 (78) moderate	2.15 BMS good	2.45 OS high
The Brzava River (EQR)	good			
Values of indicative par. and description	0.80 (80%) good	0.76 (100) good	2.32 BAMS moderate	5.34 OMS good
<i>Yermenovci</i> – The DTD Canal (EQR)	good			
Values of indicative par. and description	0.73(73%) good	0.63 (81) good	2.03 BMS good	4.51 OS high
The Moravica River (EQR)	moderate			
Values of indicative par. and description	0.73 (73%) good	0.64 (82) good	2.40 BAMS poor	204.9 HS bad
Vlaykovac – The DTD Canal (EQR)	moderate			
Values of indicative par. and description	0.57 (57%) moderate	0.41(51) moderate	2.20 BMS good	6.79 OMS good
The Karash River (EQR)	good			
Values of indicative par. and description	0.71(71%) good	0.63(79) good	2.25BMS good	7.43 OMS good

#### 4. CONCLUSSION

Reference conditions with MEP were assigned to HS DTD Novi Bechey – Banatska Palanka, sector Novi Becey - Melenci. According to phytoplankton analyses, investigated waters in Banat region could be classified into water bodies of moderate and good ecological potential.

Investigated waters have an unique type-specific community, and consist of some rare algal species, and what is worrying, is that they will be eliminated due to human impact.

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