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Research Article

**COMPARISON OF SAPROBICAL ANALYSES USING PLANKTON IN
THE TRIBUTARIES OF THE UPPER TISA, HUNGARY IN 2001-2002***

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Abstract

Saprobiological investigation using plankton is a part of everyday monitoring practice for determination of water quality in Hungary. However there is an important question: Is this way of using plankton (mainly phytoplankton) good enough and bringing enough information?

We can hear, this method is too old and its result are not collateral with different chemical way's describing saprobity. Another problem of this biological method is being so labor-intensive, demanding a well qualified knowledge on algology and protozoology. To solve these problems and questions we examined saprobiological and the chemical results, describing water quality of tributaries of Hungarian Upper-Tisa, in years 2001-2002.

Summarizing results of our investigations, we can say: biological (saprobiological) method of analyses for saprobity is not worse than chemical ways and can give us more information about ecological parameters.

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INTRODUCTION

Saprobiological investigation using plankton is a part of everyday monitoring of water quality in Hungary and based mainly on phytoplankton analyses. However there are important questions: Is this method good enough? Is it bringing enough information? Some authors say this method to be old and its results are not collateral with chemical ways describing saprobity. Another problem of biological method is being labor-intensive, demanding a well qualified knowledge on algology and protozoology.

To solve these problems and questions we examined saprobiological and chemical results of water quality monitoring, describing saprobity of three rivers in most eastern county of Hungary in years 2001-2002.

MATERIAL AND METHODS

Samples were taken from 4 sampling points over the Hungarian Upper-Tisa's tributaries which belong to territory of our Inspectorate. (2 sampling point on river Szamos, 1-1 on rivers Túr and Kraszna). It means three heavily modified rivers smaller than Tisa in Szabolcs-Szatmár-Bereg county which is the eastest in Hungary (table 1).

Table 1

Investigated rivers

river	catchment area	length	sampling place(s) (which means the nearest town and river kilometer)
Szamos	15882 km ²	465 km	Csenger (46,40 rkm), Tunyogmatolcs (19,20 rkm)
Kraszna	3142 km ²	193,00 km	Mérk (42,20 rkm)
Túr	2418 km ²	146,5 km	Kishódos (23,70 rkm)

We took samples regularly every two weeks as it's prescribed by Hungarian law and standards. In this work we show result from analysis of two year monitoring of years 2001 and 2002. The total amount of investigated samples takes 208.

The saprobiological investigation was done on base of phytoplankton without filtration. We used conserved samples under inverse (Utermöhl 1958) microscope type "Leica DMIL". The calculation of results based on Pantle-Buck (Pantle and Buck 1955) method described in detail in "MSZ 12756:1998 - Determination of saprobity grade of surface waters" hungarian standard. This calculation allows for relative abundance of taxa, indicator value of taxa and

indicator weight of taxa. Indicator values and indicator weights are compiled in a booklet (Gulyás 1998). The calculation gives us an other number either, which is a statistical scatter. If this scatter is bigger than 0.2, than PB-index value will be meaningless.

Chemical oxygen demand was determined in two ways by using KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ for reagents to be oxygen resource as written in hungarian standard “MSZ 12750-21:1971 - Testing of surface waters. Determination of chemical oxygen demand (COD).”.

Biochemical oxygen demand was determined using incubators as it is written in hungarian standard “MSZ ISO 5815:1998 - Water quality. Determination of biochemical oxygen demand after 5 days (BOD_5). Dilution and seeding method.”.

Results were compared by converting table, which gave us saprobity grade as a number, so every result was transformed into a simple numerical value which means a saprobity grade. This table helps us to convert different values into a numerical grade of saprobity (table 1).

Most of indexes were transformed on base of Felföldy’s work (1987). To exchange BOD_5 values we used table from book of Turoboyski (1979) and we modified it on base of previously cited work (Felföldy 1987) using dates of both authors to determine treshold limits to every categories of saprobity.

Table 2

Converting table for investigated parameters into a numerical saprobity grade

	Saprobity grade	PB-index (Felföldy 1987)	COD (KMnO_4) ($\text{O}_2\text{mg/l}$) (Felföldy 1987)	COD ($\text{K}_2\text{Cr}_2\text{O}_7$) ($\text{O}_2\text{mg/l}$) (Felföldy 1987)	BOD_5 ($\text{O}_2\text{mg/l}$) (Turoboyski 1979 and Felföldy 1987)
1	katarobic	<0,50	<1,0	no value	
2	oligosaprobic	0,50-1,30	1,0-1,5	<2	<2
3	oligo-beta-mezosaprobic	1,31-1,80	1,5-2,5	2-6	2-3
4	beta-mezosaprobic	1,81-2,30	2,5-5,0	6-10	3-5
5	alpha-beta-mezosaprobic	2,31-2,80	5-10	10-20	5-7
6	alpha-mezosaprobic	2,81-3,30	10-30	20-70	7-20
7	mezo-polisaprobic	3,31-3,80	30-60	70-200	20-120
8	polisaprobic	3,81-4,00	>60	>200	>120
9	eusaprobic	Over all those over, non evaluable parameters.			

After this converting into numerical form, we could compare the results depending to every sampling place and take conclusions.

RESULTS

Taxonomical plankton analyses as a part of determination process for index by Pantle-Buck gave us the next results: 157 taxa (129 algae) came to be exactly defined as species or varia or subspecies; 17 taxa (13 algae) were possible to describe them just as genus or taxonomically higher, because of our abilities (samples conserved, using of light microscopes with maximalized magnifying to 1000x).

List of all identified elements:

Schizophyta: *Bacteria*, *Beggiatoa alba*, *Spirillum kolkwitzii*, *Zoogloea ramigera*

Mycophyta: *Apodya lactea*, *Fusarium aquaeductum*, *Mycophyta (hypha)*

Cyanobacteria: *Anabaena affinis*, *A. flos-aquae*, *A. solitaria*, *Aphanizomenon flos-aquae*, *Microcystis flos-aquae*, *Oscillatoria* sp., *O. limosa*, *O. putrida*, *O. limnetica*, *O. limosa*, *Synechocystis aquaticus*

Chrysophyceae: *Dinobryon* sp., *D. sertularia*, *Mallomonas caudata*, *Synura uvella*

Bacillariophyceae: *Amphora ovalis*, *Asterionella formosa*, *A. gracillima*, *Aulacoseira granulata*, *A. granulata v. angustissima*, *Caloneis amphisbaena*, *Ceratoneis arcus*, *Cocconeias placentula*, *Cyclotella* sp., *C. comta*, *C. meneghiniana*, *Cymatopleura elliptica*, *C. solea*, *C. elliptica*, *Cymbella ventricosa*, *C. lanceolata*, *Diatoma hiemale*, *D. vulgare*, *Epithemia turgida*, *Fragilaria crotonensis*, *F. capucina*, *Gomphonema acuminatum*, *G. olivaceum*, *G. parvulum*, *Gyrosigma acuminatum*, *Hantzschia amphioxys*, *Melosira varians*, *Meridion circulare*, *Navicula* sp., *N. cryptocephala*, *N. cuspidata*, *N. rhynchocephala*, *N. viridula*, *Nitzschia* sp., *N. acicularis*, *N. actinastroides*, *Nitzschia linearis*, *Nitzschia longissima*, *Nitzschia palea*, *Nitzschia paleacea*, *N. sigma*, *Rhoicosphaenia curvata*, *Skeletonema potamos*, *Stephanodiscus hantzschii*, *S. minutulus*, *Surirella biseriata*, *S. ovata*, *Synedra acus*, *S. ulna*, *Tabellaria fenestrata*

Xanthophyceae: *Centritractus belenophorus*

Pyrrophyta: *Cryptomonas* sp., *C. erosa*, *C. ovata*, *C. reflexa*, *Gymnodinium* sp.

Euglenophyta: *Euglena* sp., *E. acus*, *E. deses*, *E. oxyuris*, *E. pisciformis*, *E. viridis*, *Lepocinclis texta*, *Phacus longicauda*, *P. pleuronectes*, *P. pyrum*, *Trachelomonas* sp., *T. granulata*, *T. hispida*, *T. intermedia*, *T. oblonga*, *T. verrucosa*, *T. volvocina*

Phytomonadina: *Carteria multifilis*, *Chlamydomonas* sp., *C. ehrenbergii*, *C. monadina*, *C. simplex*, *Chlorogonium euchlorum*, *Eudorina elegans*, *Gonium pectorale*, *Pandorina morum*

Chlorococcales: *Actinastrum hantzschii*, *Ankistrodesmus acicularis*, *A. convolutus*, *A. falcatus*, *A. longissimus*, *Chlorella* sp., *C. vulgaris*, *Chodatella quadriseta*, *Coelastrum microporum*, *Crucigenia fenestra*, *C. rectangularis*, *C. tetrapedia*, *Dictyosphaerium ehrenbergianum*, *D. pulchellum*, *Hyaloraphidium arcuatum*, *H. contortum*, *Micractinium pusillum*, *Oocystis* sp., *O.s borgei*, *O. lacustris*, *Pediastrum boryanum*, *P. duplex*, *P. tetras*, *Scenedesmus acuminatus*, *S. acutus*, *S. bicaudatus*, *S. denticulatus*, *S. ecornis*, *S. opoliensis*, *S. quadricauda*, *S. spinosus*, *Schroederia setigera*, *Selenastrum bibraianum*, *S. gracile*, *Tetraedron caudatum*, *T. minimum*, *T. trigonum*, *Tetrastrum staurogenieforme*

Zygothryx: *Closterium acerosum*, *C. ehrenbergii*, *C. moniliferum*, *Cosmarium botrytis*, *Staurastrum paradoxum*

Flagellata apochromatica: *Anthophysa vegetans*, *Astasia klebsii*, *Bodo putrinus*, *Chilomonas paramecium*, *Flag.apochromatica*, *Monas* sp., *Polytoma uvella*

Testacea: *Arcella vulgaris*, *Tachysoma pellionella*

Ciliata: *Aspidisca costata*, *A. lynceus*, *Chilodonella cucullus*, *Ciliata*, *Coleps hirtus*, *Colpidium colpoda*, *Cyclidium citrullus*, *Glaucoma scintillans*, *Halteria grandinella*, *Litonotus fasciola*, *Loxophyllum helus*, *Podophrya fixa*, *Stentor coeruleus*, *Vorticella campanula*, *V. convallaria*

Saprobity by different ways

Table 3 shows the saprobic indexes calculated by method Pantle-Buck and their transformed values into a numerical saprobity grade too.

Results of index by method of Pantle-Buck were oscillating between 1.97 (Túr - 17.09.2001.) and 3.18 (Kraszna - 07.01.2002.) which means that saprobity in investigated tributaries could belong to three zones beta-mesosaprobic, alpha-beta-mesosaprobic and alpha -mesosaprobic.

Numerical saprobity grades by transformation of index by method of Pantle-Buck analysis, shows the same results belonging to three grades from 4 till 6.

Table 4 shows results of COD(KMnO₄) analyses and their transformed values into a numerical saprobity grade too. Those were oscillating between 1.4 (Túr - 13.05.2002.) and 29.6 (Szamos - 05.03.2001.) O₂ mg/l, which means that saprobity in investigated rivrs could belong to five zones from oligosaprobic to alpha-mesosaprobic. The table 4 shows the same results as these are transformed into a numerical saprobity grade too. Numerical saprobity grades by transformation of COD(KMnO₄) analysis shows the same results belonging to five grades from 2 till 6.

Table 5 shows results of COD(K₂Cr₂O₇) analyses were oscillating between 4 (Túr - 13.05.2002.) and 63 (Szamos – 04.03.2002.) O₂ mg/l, which means

Table 3

Indexes by method of Pantle-Buck and transformed into numerical saprobity grades

Sampling date	Kraszna-river		Szamos-river		Túr-river	
	Index	Grade	Index	Grade	Index	Grade
2001.01.08	2.78	5	2.58	5	2.58	5
2001.01.22	3.05	6	2.45	5	2.53	5
2001.02.05	2.74	5	2.41	5	2.71	5
2001.02.19	2.51	5	2.45	5	2.31	5
2001.03.05	2.61	5	2.64	5	2.51	5
2001.03.19	2.75	5	2.64	5	2.88	6
2001.04.02	2.51	5	2.53	5	2.35	5
2001.04.17	2.57	5	2.14	4	2.42	5
2001.05.02	2.66	5	2.29	4	2.47	5
2001.05.14	2.67	5	2.42	5	2.48	5
2001.05.28	2.58	5	2.46	5	2.59	5
2001.06.11	2.46	5	2.54	5	2.46	5
2001.06.25	2.56	5	2.55	5	2.31	5
2001.07.09	2.44	5	2.39	5	2.19	4
2001.07.23	2.69	5	2.49	5	2.36	5
2001.08.06	2.46	5	2.46	5	2.72	5
2001.08.21	2.66	5	2.65	5	2.2	4
2001.09.03	2.7	5	2.43	5	2.46	5
2001.09.17	2.33	5	2.58	5	1.97	4
2001.10.08	2.5	5	2.52	5	2.3	5
2001.10.15			2.42	5	2.55	5
2001.10.29			2.58	5	2.37	5
2001.11.12			2.49	5	2.43	5
2001.11.26			2.69	5	2.44	5
2001.12.10			2.53	5	2.4	5
2001.12.17			2.85	6	2.7	5
2002.01.07	3.18	6			2.71	5
2002.01.21	2.9	6			2.62	5
2002.02.04	2.61	5	2.66	5	2.49	5
2002.02.18	2.88	6	2.78	5	2.79	5
2002.03.04	2.82	6	2.73	5	2.69	5
2002.03.18	2.76	5	2.41	5	2.5	5
2002.04.02	2.52	5	2.58	5	2.43	5
2002.04.15	2.73	5	2.81	6	2.5	5
2002.04.29	2.64	5	2.5	5	2.4	5
2002.05.13	2.41	5	2.6	5	2.39	5
2002.05.27	2.66	5	2.59	5	2.53	5
2002.06.10	2.5	5	2.64	5	2.24	4
2002.06.24	2.49	5	2.54	5	2.35	5
2002.07.08	2.44	5	2.51	5	2.5	5
2002.07.22	2.34	5	2.48	5	2.45	5
2002.08.05	2.41	5	2.53	5	2.38	5
2002.08.21	2.8	6	2.55	5	2.45	5
2002.09.09	2.62	5	2.57	5	2.23	5
2002.09.16	2.35	5	2.56	5	2.43	5
2002.09.30	2.55	5	2.68	5	2.26	4
2002.10.14	2.5	5	2.72	5	2.16	4
2002.10.28	2.63	5	2.53	5	2.47	5
2002.11.11	2.64	5	2.63	5	2.57	5
2002.11.25	2.76	5	2.54	5	2.63	5
2002.12.09	2.49	5	2.65	5	2.52	5
2002.12.16	2.52	5	2.65	5	2.46	5

Table 4

Results of COD(KMnO₄) (O₂ mg/l) and transformed into numerical saprobity grades

Sampling date	Kraszna-river		Szamos-river		Túr-river	
	mg/l	Grade	mg/l	Grade	mg/l	Grade
2001.01.08	10.6	6	8.6	5	2.6	4
2001.01.22	12.5	6	8.8	5	2.2	3
2001.02.05	9.4	5	12	6	7.8	5
2001.02.19	8.6	5	10.2	6	6.2	5
2001.03.05	9	5	29.6	6	10.6	6
2001.03.19	7.3	5	8.7	5	4.6	4
2001.04.02	8.7	5	9.7	5	3.6	4
2001.04.17	10	6	7.9	5	4.4	4
2001.05.02	7	5	4.6	4	3.2	4
2001.05.14	8.2	5	7.2	5	4.6	4
2001.05.28	9.3	5	8	5	3.7	4
2001.06.11	9	5	7.5	5	2.3	3
2001.06.25	13.9	6	25.8	6	14.4	6
2001.07.09	8.2	5	6.6	5	2.4	3
2001.07.23	8.7	5	6.7	5	2.5	3
2001.08.06	10.1	6	6.4	5	2.1	3
2001.08.21	6.1	5	8.2	5	2.1	3
2001.09.03	7	5	6.6	5	2.6	4
2001.09.17	8.3	5	9.9	5	3.8	4
2001.10.08			3.2	4	1.5	3
2001.10.15			5.8	5	3.2	4
2001.10.29			6.1	5	2.9	4
2001.11.12			8	5	6.1	5
2001.11.26			6.1	5	3.8	4
2001.12.10			6.9	5	4.4	4
2001.12.17			8.4	5	4	4
2002.01.07	3.7	4	0		1.8	3
2002.01.21	7.2	5	0		2.8	4
2002.02.04	11.4	6	13.4	6	5.1	5
2002.02.18	4.4	4	5.2	5	3.2	4
2002.03.04	7.6	5	26.8	6	4.8	4
2002.03.18	3.8	4	4.1	4	2.7	4
2002.04.02	4	4	3.3	4	2.5	4
2002.04.15	7.2	5	3.3	4	1.8	3
2002.04.29	8.3	5	4.3	4	1.7	3
2002.05.13	6.1	5	3.4	4	1.4	3
2002.05.27	6.7	5	3.8	4	1.8	3
2002.06.10	7.9	5	5.4	5	3	4
2002.06.24	8.8	5	5.2	5	2.9	4
2002.07.08	7.8	5	5.4	5	3.8	4
2002.07.22	7.3	5	4.8	4	2.8	4
2002.08.05	8.9	5	14.3	6	4.2	4
2002.08.21	5.8	5	4.8	4	3	4
2002.09.09	5.7	5	4.2	4	3.1	4
2002.09.16	5.4	5	6.2	5	3.4	4
2002.09.30	7	5	6.3	5	3.4	4
2002.10.14	9	5	7.8	5	4.1	4
2002.10.28	10.7	6	9	5	5.4	5
2002.11.11	9.2	5	7.3	5	4.2	4
2002.11.25	7.8	5	5.8	5	3.6	4
2002.12.09	9.8	5	5.9	5	3.7	4
2002.12.16	8.8	5	5.9	5	3.8	4

Table 5

Results of COD($K_2Cr_2O_7$) (O_2 mg/l) and transformed into numerical saprobity grades

Sampling date	Kraszna-river		Szamos-river		Túr-river	
2001.01.08	28	6	20	6	6	4
2001.01.22	34	6	26	6	6	4
2001.02.05	25	6	31	6	20	6
2001.02.19	21	6	28	6	14	5
2001.03.05	25	6	56	6	23	6
2001.03.19	20	6	21	6	13	5
2001.04.02	20	6	25	6	9	4
2001.04.17	29	6	20	6	12	5
2001.05.02	25	6	11	5	9	4
2001.05.14	22	6	18	5	13	5
2001.05.28	25	6	23	6	8	4
2001.06.11	26	6	18	5	6	4
2001.06.25	41	6	56	6	40	6
2001.07.09	25	6	16	5	5	3
2001.07.23	17	5	17	5	7	4
2001.08.06	29	6	17	5	5	3
2001.08.21	15	5	23	6	5	3
2001.09.03	20	6	14	5	6	4
2001.09.17	24	6	24	6	8	4
2001.10.08			8	4	5	3
2001.10.15			13	5	8	4
2001.10.29			16	5	7	4
2001.11.12			22	6	15	5
2001.11.26			15	5	7	4
2001.12.17			22	6	11	5
2002.01.07	10	5	0		5	3
2002.01.21	20	6	0		6	4
2002.02.04	30	6	38	6	12	5
2002.02.18	13	5	16	5	7	4
2002.03.04	26	6	63	6	16	5
2002.03.18	8	4	13	5	6	4
2002.04.02	10	5	9	4	7	4
2002.04.15	18	5	8	4	5	3
2002.04.29	22	6	11	5	5	3
2002.05.13	16	5	9	4	4	3
2002.05.27	18	5	10	5	5	3
2002.06.10	18	5	13	5	6	4
2002.06.24	23	6	13	5	8	4
2002.07.08	19	5	14	5	11	5
2002.07.22	20	6	11	5	7	4
2002.08.05	20	6	32	6	9	4
2002.08.21	15	5	12	5	8	4
2002.09.09	14	5	11	5	8	4
2002.09.16	14	5	13	5	11	5
2002.09.30	18	5	16	5	18	5
2002.10.14	25	6	20	6	11	5
2002.10.28	25	6	22	6	14	5
2002.11.11	25	6	20	6	10	5
2002.11.25	20	6	15	5	8	4
2002.12.09	20	6	14	5	20	6
2002.12.16	20	6	14	5	8	4

Table 6

Results of BOD₅ (O₂ mg/l) and transformed into numerical saprobity grades

Sampling date	Kraszna-river		Szamos-river		Túr-river	
2001.01.08	7	6	5.5	5	2	3
2001.01.22	8.2	6	5.6	5	1.5	2
2001.02.05	6.9	5	8.4	6	5.9	5
2001.02.19	5.6	5	7	6	3.7	4
2001.03.05	6.5	5	15.4	6	7	6
2001.03.19	4.9	4	5.5	5	3	4
2001.04.02	6.1	5	7	6	3	4
2001.04.17	7	6	5.2	5	3.2	4
2001.05.02	5	5	3.2	4	2.6	3
2001.05.14	5.9	5	5.2	5	3	4
2001.05.28	7.4	6	6.1	5	2.9	3
2001.06.11	7	6	5.4	5	1.9	2
2001.06.25	8.5	6	13	6	10.4	6
2001.07.09	5.9	5	4.9	4	1.9	2
2001.07.23	6	5	5.4	5	2	3
2001.08.06	7	6	4	4	1.8	2
2001.08.21	3.9	4	6.1	5	1.7	2
2001.09.03	4.4	4	4.1	4	1.9	2
2001.09.17	6	5	5.9	5	2.4	3
2001.10.08			2.7	3	1.3	2
2001.10.15			3.9	4	2.5	3
2001.10.29			5.1	5	2.1	3
2001.11.12			6.1	5	4.1	4
2001.11.26			4.6	4	5.3	5
2001.12.10			4.4	4	3.7	4
2001.12.17			6.3	5	3	4
2002.01.07	3.1	4	0		1.4	2
2002.01.21	4.7	4	0		2.2	3
2002.02.04	7.1	6	8	6	3.6	4
2002.02.18	3.6	4	4	4	2.5	3
2002.03.04	5	5	16.1	6	3	4
2002.03.18	3	4	3	4	2.2	3
2002.04.02	3.4	4	3	4	2	3
2002.04.15	5	5	2.8	3	1.4	2
2002.04.29	6	5	3	4	1.2	2
2002.05.13	5	5	2.8	3	1.2	2
2002.05.27	4.9	4	3.1	4	1.6	2
2002.06.10	4	4	4	4	2	3
2002.06.24	6.9	5	4.2	4	2	3
2002.07.08	4.9	4	3.2	4	3.1	4
2002.07.22	4	4	3.2	4	2	3
2002.08.05	5.1	5	9.4	6	3.7	4
2002.08.21	4.1	4	3.4	4	2.4	3
2002.09.09	3.7	4	3.7	4	2.5	3
2002.09.16	4	4	4.2	4	2.2	3
2002.09.30	5	5	4.4	4	2.8	3
2002.10.14	6.6	5	5	5	3	4
2002.10.28	7	6	6.6	5	3.6	4
2002.11.11	7.1	6	5.5	5	3.2	4
2002.11.25	4.1	4	3.6	4	2.8	3
2002.12.09	6.3	5	4.4	4	2.8	3
2002.12.16	6	5	4	4	2.9	3

that saprobity in investigated rivers could belong to four zones from oligo-beta-mezosaprobic to alpha-mezosaprobic. The table shows the same results as these are transformed into a numerical saprobity grade too. Numerical saprobity grades by transformation of $\text{COD}(\text{K}_2\text{Cr}_2\text{O}_7)$ analysis shows the same results belonging to four grades from 3 till 6.

Table 6 shows results of BOD_5 analyses, which were ranging between 1.2 (Túr - 29.04.2002. and 13.05.2002.) and 16.1 (Szamos - 04.03.2002.) O_2 mg/l. This fact means that saprobity in investigated rivers could belong to five zones from oligosaprobic till alpha-mezosaprobic. The table shows the same results as these are transformed into a numerical saprobity grade too. Numerical saprobity grades by transformation of BOD_5 analysis shows the same results belong to five grades from 2 till 6.

There are some blank cells on the tables, caused by environmental conditions like very high flood level or ice on surface, which made sampling impossible.

The next diagrams (fig. 1,2 and 3) are compiled using the numerical forms of saprobity grades from each sampling place and each sampling time. Each diagram shows comparisons of results of different methods independently in every sampled rivers.

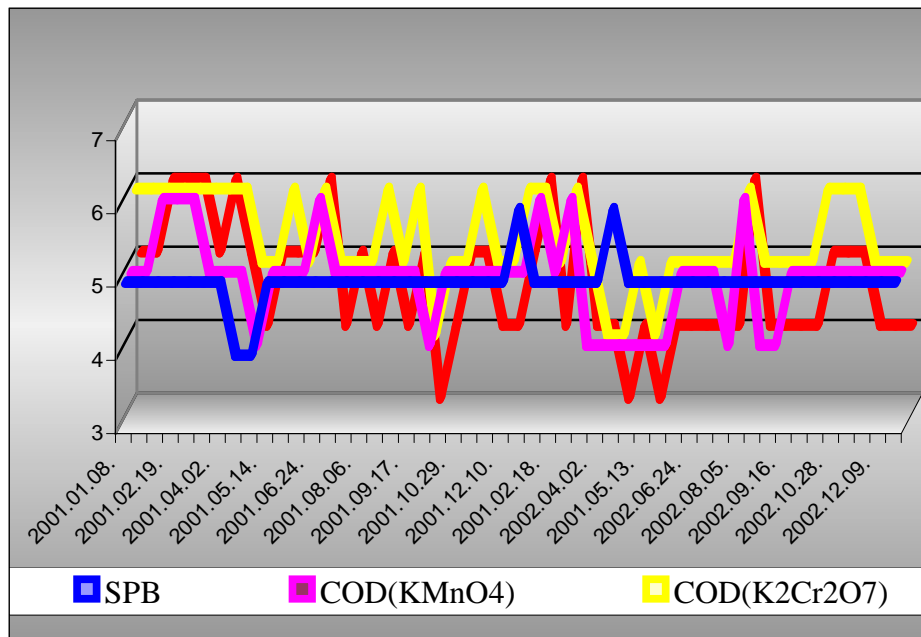


Fig. 1. Diagram showing comparisons of results of different methods, transformed into saprobity grade values from Szamos-river.

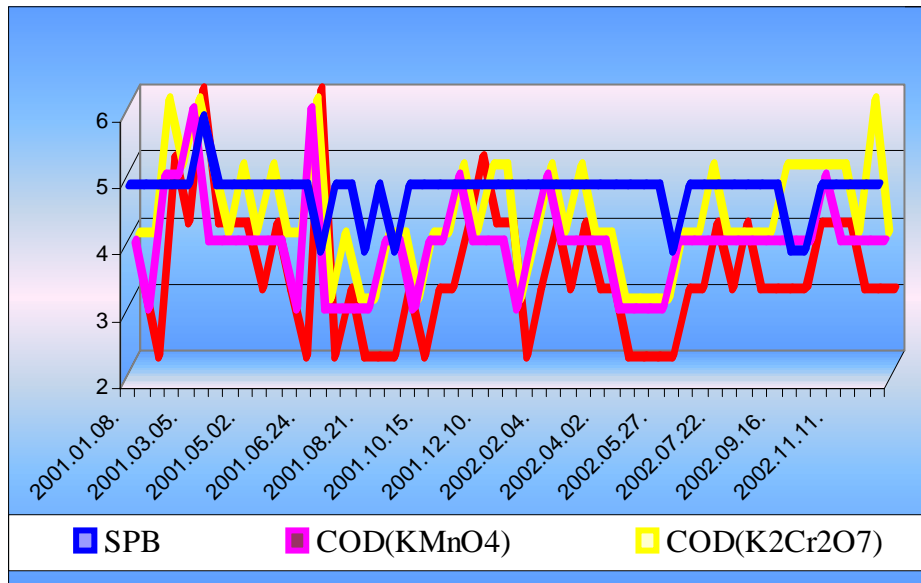


Fig. 2. Diagram showing comparisons of results of different methods, transformed into saprobity grade values from Túr-river.

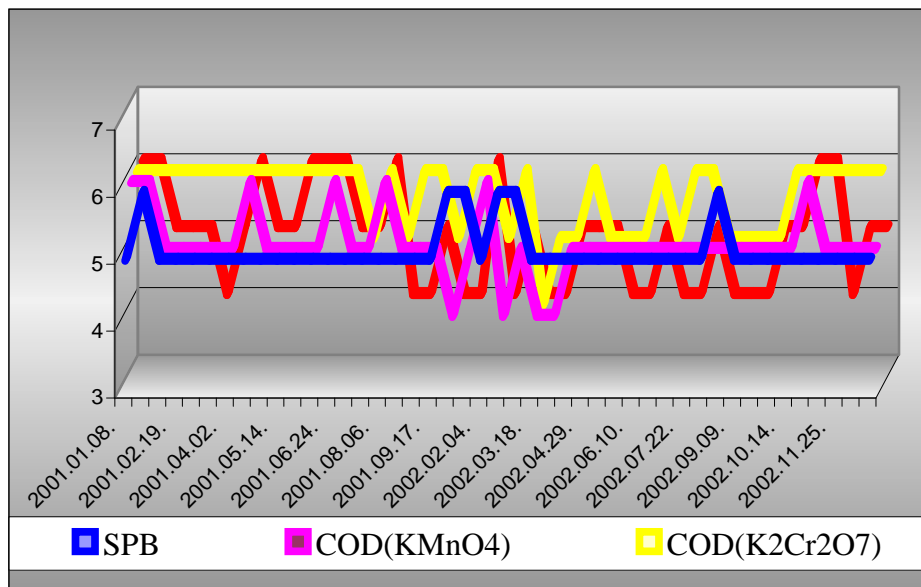


Fig. 3. Diagram showing comparisons of results of different methods, transformed into saprobity grade values from Kraszna-river.

DISCUSSION

As we can see at the list of taxa, majority of identified species belongs to algae, which could mean the saprobiological analyses are mainly algological.

We can make the next conclusions on base of previous results:

- chemical oxygen demand and biochemical oxygen demand usually were paralell only rarely were a small difference, but in these cases the difference was maximally one degree
- according to independent rivers the index Pantle-Buck values were so constant with little ranging by small absolute differences, maximally two degrees in saprobity grades
- the saprobial results didn't show as high oscillation as chemical results, which suggests this method for determination of water quality is less sensitive
- this stability of saprobiological results suggests us other maybe more important idea, the planctonical communities of these rivers show the water quality for longer period than it seems for a first time according to short life cycle of planctonic organisms

So saprobity index using plankton (index Pantle-Buck) describes water quality for a longer period, but chemical and biochemical demand for oxygens describe momentary water quality on organic contents in water.

To make sure our previous statement we have do meticulous analyses on planctonic composition and it's diversity in the future, making repetitions on the same water bodies every day.

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MSZ 12756:1998 - *Determination of saprobity grade of surface waters*