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Aquatic nematodes of Sakadaš lake (Kopački rit Nature Park, Croatia)

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Aquatic free-living nematode assemblages were investigated between January 1998 and November 2000. The investigation was conducted in the sandy sediment of the deepest part of the central area of Sakadaš lake (Kopački rit Nature Park, Croatia). A total of 24 nematode species belonging to 18 genera was found. The dominant species was *Tobrilus gracilis*, with the relative abundance ranging from 22.2% to 98.4% of the total nematofauna. Nematode abundance was correlated to the following environmental factors: water-level fluctuation, depth, transparency, seasonal temperature variations and concentration of dissolved oxygen. A correlation analysis showed that the abundance of *Mononchus aquaticus* depended on the concentration of dissolved oxygen in the water. Furthermore, significant correlations existed between the abundance of *Brevitobrilus stefanskii* and the water level, and between the abundance of *B. stefanskii* and the water depth. Significant correlations were also found between the dissolved oxygen concentration and the number of species recorded (S), as well as between the dissolved oxygen concentration and the Shannon-Wiener index of diversity (H'). Sakadaš lake, the deepest water depression in the Nature Park Kopački rit, is naturally eutrophicated. During the recorded periods of hypoxia a low number of species and their low abundance was determined, but there was a high relative abundance of the tolerant species *T. gracilis.* The shape of the nematode abundance – biomass comparative curve (ABC) indicates a moderately disturbed investigation site in the lake.

Key words: aquatic free-living nematodes, abiotic water parameters, lake, Croatia.

Introduction

Knowledge concerning the taxonomy and ecology of freshwater nematodes, especially eutrophic freshwater lakes and channels, is still limited. The data on the composition of the nematode species in aquatic sediments of Croatian lotic (the Drava river, the Hulovo channel and the Čonakut channel) and lenthic (the Borovik reservoir, Bilje fishpond, Sakadaš lake) freshwater ecosystems referring to sediment granulometry and environmental factors are known only from a few studies published in the last six years: Vidaković & Dupan (1996), Vidaković & Jakumetović (1998), Bogut & Vidaković (2002), Vidaković & Bogut (1999, 2000) and Vidaković et al. (2001). These investigations confirmed the presence of a small number of aquatic free-living nematode species in eutrophic freshwater habitats of E Croatia (between 14 in the Borovik reservoir and 45 species at eulittoral sites of Sakadaš lake), which is far fewer than the findings of ANDRÁSSY (1978), who reported about 605 species in the nematofauna checklist for European inland waters. The relatively small number of species that we found is closer to the data given by TRAUNSPURGER (2002), who reported on species richness in general which ranges between 30 and 70 in lakes and rivers. Also, in the research carried out in freshwater habitats in E Croatia nematofauna was influenced by an increase in the water depth, by low oxygen content in the water, and by the quantity of organic detritus in the sediment (VIDAKOVIĆ & BOGUT, 1999; BOGUT & VIDAKOVIĆ, 2002). That was to be expected because it is known that abiotic parameters of habitat (sediment type, water depth, water temperature, concentration of dissolved oxygen, quantity of food available) have a significant influence on nematode distribution and abundance (PEHOFER, 1989; TRAUNSPURGER, 1996).

Tobrilus gracilis was present at almost all investigated sites of E Croatia with varying abundances. The species is characteristic of highly reduced sediments with large amounts of organic detritus and high bacterial activity (SCHIEMER et al. 1969; PEHOFER, 1989; OCANA & PICAZO, 1991; VIDAKOVIĆ & BOGUT, 1999). Also, *T. gracilis* was suggested as an indicator of sediment oxygen condition, and the species can be of some importance in the decomposition of organic matter (PREJS, 1977a, b; PEHOFER, 1989). The species was dominant in two man-made lakes in the Osijek area which were characterized by highly reduced sediment (VIDAKOVIĆ, 1996).

Therefore, the aim of the study described in this paper was to get an insight into the recorded temporal changes of physico-chemical variables of Sakadaš lake which could influence the quality and quantity of aquatic free-living nematodes in the sandy sediment of the lake.

Site description

Sakadaš lake, which is located in Kopački rit Nature Park in the NE of Croatia, in the region called Baranja, is the deepest water depression in Kopački rit, with an oval shape and relatively steep slopes. Some important morphometric and hydrological data of this eutrophic lake are listed below (BOLŠEC, pers. com. – GIS Kopački rit Nature Park): geographic location 18°48′ E, 45°36′ N, altitude 80.5 m a.s.l., surface area about 9 ha, maximum depth between 9 m and 10 m, mean depth: about 6 m.

Material and methods

Water temperature, depth and transparency (using a Secchi disc) were measured monthly in the deepest part of the central area of Sakadaš lake, from January 1998 to November 2000. The samples for the analysis of the dissolved oxygen concentration, dissolved oxygen demand, chlorophyll-*a* concentration, conductivity, total P and total N were collected from the water near the bottom of the lake (APHA, 1985). The trophic classification system (TCS) presented in the paper is based on four parameters (SD, Chl-*a*, O_2 – % of saturation and total P) measured during lake monitoring activities. This index can be interpreted as an indicator of the lake water quality because it includes biological and chemical characteristics of eutrophication phenomena (COPETTI et al., 2000).

The water-level fluctuation data for the Danube and the Drava rivers were supplied by the Croatian Water Resource Management Osijek (Croatian Waters Zagreb).

The granulometric composition of sediment was analysed by sieving fractions $\geq 32\ \mu$m through standard mesh sizes (Fritsch, Germany) and by counting fractions $\leq 32\ \mu$m by Coulter Counter TA II (Coulter Electronic Ltd, England).

Two grab sediment samples covering 100 cm^2 were taken monthly in the deepest central part of the lake during the years of investigation. In December 1998 and 1999, in January 1998 and 2000, and in February 1998 and 1999 the lake was covered in ice and the sediment could not be sampled. Two sediment samples for meiofauna analysis were fixed in 4% neutralised formalin and stained with Rose bengal. The fauna were extracted in a laboratory by the elutration method (UHLIG et al., 1973). The sediment collected was sieved through the 60 μm mesh. The net with the mesh size of 60 μm sieve was suitable for the investigation since inspection of the fraction under the sieve did not reveal any nematode specimens. Nematodes were isolated under a stereoscopic microscope (x 100), then placed in glycerine solution, prepared on permanent slides (SEINHORST, 1959), and the species type or genera was identified under the microscope (oil immersion, 1000× magnification).

The community structure was described by the total number of individuals (N), the total number of species (S), the total biomass (B), and the diversity indices (Shannon-Wiener diversity index H', species richness as Margalef's d, equitability expressed as Pielou's evenness index J'). The categories of dominance were calculated according to ODUM (1971). The nematode biomass was measured and calculated according to ANDRÁSSY (1956).

The graphical analysis displayed as Box-and-Whisker plots based on the recorded physico-chemical parameters were used to evaluate whether there was a real difference between the seasons and years, and a *t*-test was performed (Statistica 5.5 by MICROSOFT CORP., 1999). Univariate techniques (diversity indices) were performed to determine the stress levels presumably caused by hypoxic periods. Distributional techniques (k-dominance curves according to LAMBSHED et al., 1983), and abundance-biomass comparison (ABC) curves (WARWICK, 1988), which provide useful information about disturbance effects, were also used (PRIMER-E v5.2.9, 2003). Based on the curve form and W-value (the extent to which the biomass curve lies above the abundance curve) given on the plot, ABC plot indicates site conditions as "unpolluted", "moderately polluted" or "grossly polluted". Positive values of W indicate undisturbed conditions, whereas negative values of W indicate a disturbed condition (CLARKE & GORLEY, 2001). Pearson's correlation coefficient r was calculated by Statistica 5.5 (MICROSOFT CORP., 1999) in order to assess the relationship between environmental factors and faunistic variables.

Results

According to the granulometric analysis, which showed that the sediment texture consisted of 95% sand and a low percentage of silt (4.2%) and clay (0.8%), the deepest central part of Sakadaš lake is characterized as a sandy sediment site.

All physico-chemical parameters measured during the period of investigation are presented in Table 1. Box-and-Whisker plot for the dissolved oxygen concentration recorded the seasons and years of investigation (1998, 1999 and 2000) showed that the real difference exists between seasons (spring – summer: $t = 2.559$, df = 8, $P < 0.05$; summer – winter: $t = 8.186$, df = 6, $P < 0.001$; autumn – winter: $t = 5.942$, df = 8, $P < 0.001$), but not between years (Figs 1a, b). Box-and-Whisker plot for the Chl-a concentration (spring – autumn: $t = 6.117$, df = 7, $P > 0.05$; autumn – winter: $t = 11.995$, df = 9, $P < 0.001$), as well as for Secchi depth (spring – autumn: $t = 3.177$, df = 11, $P < 0.01$; autumn – winter: $t = 5.340$, df = 9, $P < 0.001$) display the same pattern (Figs 2a, b, Figs 3a, b).

The TSI values (Tab. 1) of the Secchi depth, the concentration of Chl-a and the total P indicate a high level of eutrophication with a tendency for hypertrophication of the lake. Also, according to the trophic classification system (TCS), the water of Sakadaš lake belongs to the eutrophic/hypertrophic class (TCS index 4–5).

The number of nematodes shown in Table 2 are the mean values of the two grab samples. The lowest nematode density was recorded in July 1998 (2 ind. 100 cm^{-2}) and the highest in May 2000 (199 ind. 100 cm^{-2}). Despite the high range in nematode abundance, no statistical differences exist between months and seasons. The k-dominance curve of nematode abundance during four seasons and three years shows no differences

Table 1. Physical and chemical water parameters of the central area of Sakadaš lake.

	W. lev. (cm)	Depth (cm)	SD (cm)	T (°C)	Diss. ox. (mg $O_2 L^{-1}$)	Ox. dem. (mg $O_2 L^{-1}$)	Tot-P (mg L^{-1})	Con. (μS cm^{-1})	Chl-a (μg L^{-1})	TSI-SD	TSI-Chl	TSI-P	TSI-s
1998													
Min	74.03	300	70	4.5	0.83	15.66	–	–	12.18	55.68	55.12	–	58.09
Max	452.93	600	135	20	13.17	418.72	–	–	73.94	65.14	72.81	–	68.36
Mean	183.95	438.90	97.60	14.80	4.87	68.67	–	–	48.58	60.47	67.61	–	64.04
1999													
Min	61.43	280	59	7	0.91	3	0.23	332	6.89	46.12	49.53	82.63	47.83
Max	464.07	610	262	25	13.29	46	0.23	747	86.85	67.60	74.39	82.63	74.05
Mean	269.08	466.30	118.30	16.30	5.22	28.01	0.23	584.13	52.59	58.73	66.74	82.63	63.27
2000													
Min	80.04	312	62	5.5	2.04	10	0.11	405	8.25	53.23	51.30	71.93	52.26
Max	408.33	800	160	25.5	11.03	82	1.02	619	126.21	66.89	78.06	104.06	81.55
Mean	231.19	517.13	104.50	15.10	6.17	36.71	0.43	506.14	55.95	59.99	66.67	86.65	67.82

Table 2. Nematode species composition and densities (mean number of ind. 100 cm^{-2}) in the sandy sediment of the central area of Sakadaš lake.

					1998									1999								2000						
Species	J	M	A	M	J	J	A	S	O	N	M	A	J	J	A	S	O	N	F	M	M	J	J	S	O	N	Mean ± SD	%D
Tobrilus gracilis	4	7.5	20.5	38	50.5	1	52	92.5	5.5	7	38.5	7.5	44	38	55	67.5	51.5	51.5	46.5	45	171	102	44.5	63	16.5	17.5	43.77 ± 36.98	63.43 ED
Eumonhystera fil. vul.	9.5	10.5	11.5	23	20		5.5				9.5	0.5	0.5		1.5	19			0.5	27	3	2.5	1.5				5.60 ± 8.19	8.11 SR
Brevitobrilus stefanskii	1	0.5	1.5	1	1.5	0.5		1	0.5	1	5		4.5	1	0.5	2.5	0.5	2	5.5	29.5	23	6	1		2.5	1	3.58 ± 6.95	5.18 SR
Mononchus aquaticus	1	2.5			0.5			0.5		0.5	1		0.5	1	1		0.5		0.5	2.5	0.5		1.5			1	0.58 ± 0.72	0.84 SR
Tripyla papillata	0.5	0.5								0.5	0.5				0.5												0.10 ± 0.20	0.14 SR
Monhystera fasciculata	2	1	1.5	1							2					0.5				0.5	0.5	1.5		0.5			0.42 ± 0.66	0.61 SR
Prodorylaimus sp. 1		1.5									1				1	1						0.5					0.19 ± 0.43	0.28 SR
Ethmolaimus pratensis		0.5			0.5		0.5													0.5							0.08 ± 0.19	0.12 SR
Wilsonema sp.		0.5			0.5																						0.04 ± 0.14	0.06 SR
Mesodorylaimus sp.			1	0.5																							0.06 ± 0.22	0.09 SR
Raritobrilus steineri			0.5				0.5			2.5	2.5																0.25 ± 0.71	0.36 SR
Dorylaimus stagnalis			0.5		0.5		1		0.5										0.5			0.5			0.5		0.18 ± 0.28	0.26 SR
Eudorylaimus centrocercus				0.5																							0.02 ± 0.10	0.03 SR
Pelagonema sp.						0.5																					0.02 ± 0.10	0.03 SR
Tobrilus sp. 3									4.5	1.5	103		6.5	40.5	19.5	5	1	1	0.5			55.5	60	43	8.5	5.5	13.67 ± 25.68	19.81 ED
Eumonhystera dispar				0.5							1																0.06 ± 0.22	0.09 SR
Rhabditis sp.													0.5														0.02 ± 0.10	0.03 SR
Tobrilus wesenbergi														0.5					2	1.5			0.5		0.5		0.19 ± 0.49	0.28 SR
Aphanolaimus aquaticus																0.5											0.02 ± 0.10	0.03 SR
Paramononchus sp.																				0.5				0.5			0.04 ± 0.14	0.06 SR
Diplogaster rivalis																					0.5						0.02 ± 0.10	0.03 SR
Monhystera sp.																					0.5	1					0.06 ± 0.22	0.09 SR
Dorylaimus sp.																									0.5		0.02 ± 0.10	0.03 SR
Indet.																							0.5				0.02 ± 0.10	0.03 SR
S	6	9	7	7	7	3	5	3	4	6	10	2	6	5	7	7	4	3	7	8	7	8	7	4	6	4	5.85	
N	18	25	37	64.5	74	2	59.5	94	11	13	164	8	56.5	81	79	96	53.5	54.5	56	107	199	169.5	109.5	107	29	25	68.94	
D	1.73	2.49	1.66	1.44	1.39	2.9	1.0	0.4	1.3	1.9	1.77	0.48	1.24	0.91	1.37	1.32	0.75	0.50	1.49	1.5	1.13	1.36	1.28	0.64	1.49	0.93	1.32	
J'	0.75	0.71	1.60	0.47	0.43	0.9	0.3	0.01	0.7	0.7	0.49	0.34	0.43	0.52	0.44	0.47	0.14	0.23	0.34	0.62	0.26	0.46	0.47	0.53	0.62	0.61	0.52	
$H'_{(2)}$	1.93	2.26	1.68	1.33	1.20	1.5	0.70	0.1	1.4	1.9	1.63	0.34	1.11	1.21	1.22	1.33	0.29	0.36	0.97	1.86	0.73	1.38	0.31	1.05	1.59	1.21	1.18	

Key: ED – eudominant species; D – dominant species; R – recendent species; SR – subrecedent species.

Appendix to Table 2. Latin names of species and authors: *Tobrilus gracilis* (Bastian, 1865), Andrássy, 1959; *Eumonhystera filiformis-vulgaris* group (de Man, 1880), Andrássy, 1981; *Brevitobrilus stefanskii* (Micoletzky, 1925), Andrássy, 1971; *Mononchus aquaticus* Coetzee, 1968; *Tripyla papillata* Bastian, 1865; *Monhystera stagnalis* Bastian, 1865; *Ethmolaimus pratensis* de Man, 1880; *Raritobrilus steineri* (Micoletzky, 1925), Tsalolitkhin, 1981; *Dorylaimus stagnalis* Dujardin, 1845; *Eudorylaimus centrocercus* (de Man, 1880), Andrássy, 1959; *Eumonhystera dispar* (Bastian, 1865), Andrássy, 1981; *Aphanolaimus aquaticus* de Man, 1880; *Tobrilus wesenbergi* (Micoletzky, 1925), Andrássy, 1971; *Diplogaster rivalis* (Leydig, 1854), Bütchli, 1873;

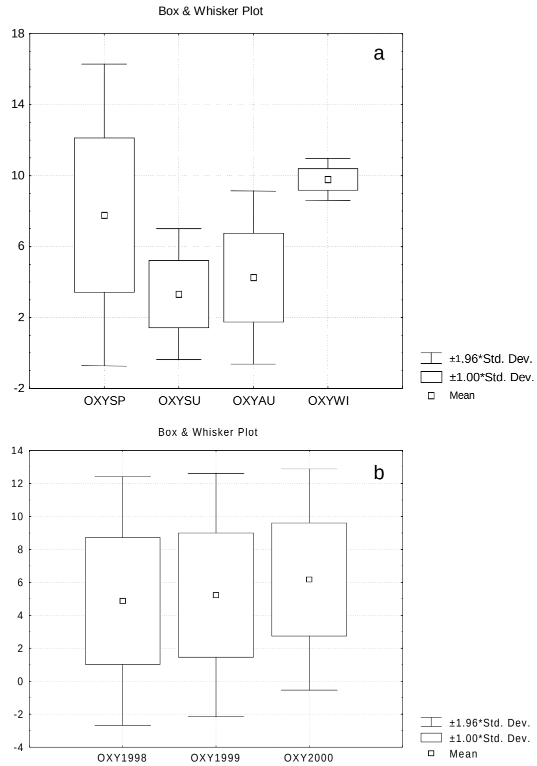

Fig. 1. Box-and-Whisker plot for water dissolved oxygen concentration: a – seasonal variations; b – three years of investigation. SP – spring, SU – summer, AU – autumn, WI – winter.

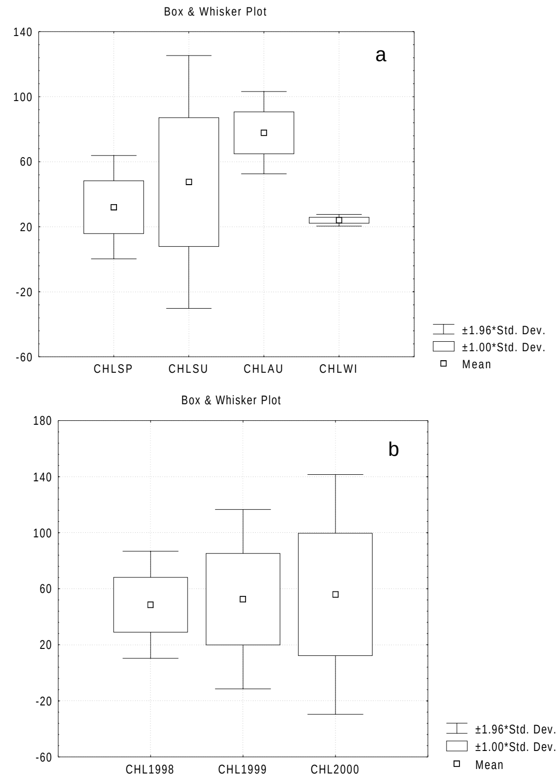

Fig. 2. Box-and-Whisker plot for chlorophyll-*a* concentration: a – seasonal variations; b – three years of investigation. For others see Fig. 1.

(Figs 4a, b). The form of nematode abundance-biomass comparative curves (ABC) for three different years indicate a moderately disturbed study site of Sakadaš lake: $W = -0.038$ for the first year of investigation, $W = -0.029$ for the second year, and $W = -0.011$ for the third year (Figs 5a, b, c).

In total, 24 aquatic free-living nematode species belonging to 18 genera were found in the sandy sediment of Sakadaš lake during the years of investigation (Tab. 2). *Tobrilus gracilis* was the most abundant species with the relative abundance between 22.2% and 98.4% of the total nematofauna. Only 1 ind. 100 cm^{-2} of *T. gracilis* was found in July 1998. The highest densities of *T. gracilis* were recorded in May (171 ind. 100 cm^{-2}) and June 2000 (102 ind. 100 cm^{-2}). *T. gracilis* was the eudominant species throughout the investigation period, except in January and March 1998 when *Eumonhystera filiformis-vulgaris* group was eudominant with 52.8% and 42%, respectively. *Mononchus aquaticus* was found only sporadically, its abundance ranging between 0 and 2.5 ind. 100 cm^{-2} (Tab. 2). *Brevitobrilus stefanskii* was also found sporadically (from 0 to 29.5 ind. 100 cm^{-2}). *Tobrilus* sp. 3 was registered in almost every sample. It was, on average, the eudominant species having the dominance of 19.8%. Its lowest density was recorded in February 2000 (only 0.5 ind. 100 cm^{-2}) and the highest (103 ind. 100 cm^{-2}) in March 1999. Other species (Tab. 2) were found only sporadically and were characterised as subrecendent species (relative abundance $< 1\%$).

Increasing levels of environmental stress are generally considered to: decrease diversity (H'), decrease species richness (d) and also decrease evenness (J'), i.e. increase dominance. The minimum values for diversity were recorded during late summer (0.13 in August 1998) and early autumn (0.29 in October 1999). The maximum values for diversity were recorded in March of all three years: 2.26 (1998), 1.63 (1999) and 1.86 (2000). In 1998 Margalef's d values were between 0.44 and 2.89, in 1999 between 0.48 and 1.77, and in 2000 between 0.64 and 1.50 (Tab. 2). The greatest varia-

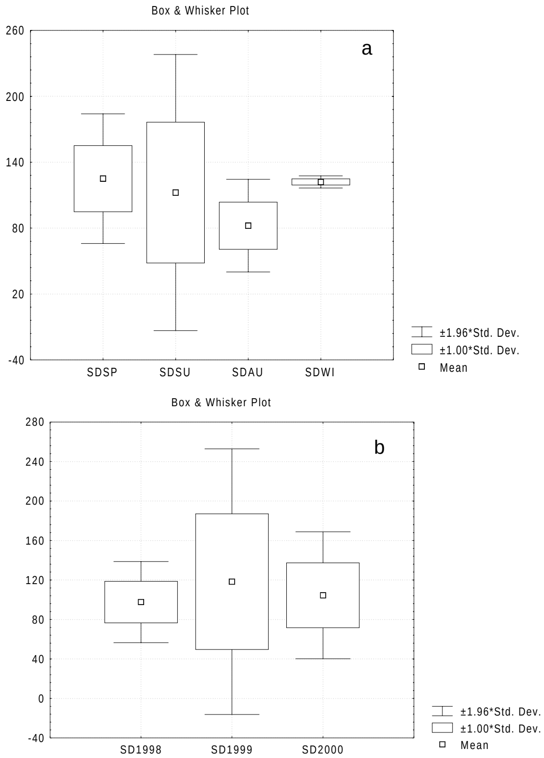

Fig. 3. Box-and-Whisker plot for Secchi depth: a – seasonal variations; b – three years of investigation. For others see Fig. 1.

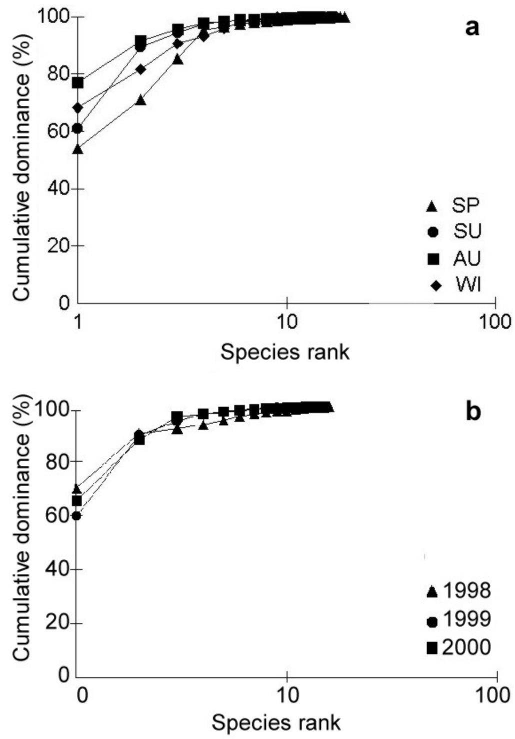

Fig. 4. k-dominance curve for nematode abundance: a – seasons; b – three years of investigation.

tion in evenness values were recorded during 1998, whereas during 1999 and 2000 these variations were very small. The values of evenness in 1998 were between only 0.01 and 1.60, in 1999 between 0.14 and 0.52, and in 2000 between 0.26 and 0.62 (Tab. 2).

The changes in the nematode biomass across the period of investigation are shown in Fig. 6. The lowest nematode biomass (0.889 μg wet weight 100 cm^{-2}) was recorded in July 1998, and the highest (37.104 μg w.w. 100 cm^{-2}) in March 1999. *T. gracilis* had the highest average biomass (12.914 μg w.w. 100 cm^{-2}), whereas *Tobrilus* sp. 3 had the second highest average biomass (2.891 μg w.w. 100 cm^{-2}).

Since abiotic parameters influence nematode abundance and species composition, the recorded variations were correlated with some of them. A computed Pearson's correlation between the abundance of *T. gracilis* and the dissolved oxygen concentration ($r = -0.335$, df $= 24$, $P > 0.05$), and between the same species and the water temperature, was not significant ($r = 0.223$, df $= 24$, $P > 0.05$). The correlation analysis showed that the dissolved oxygen concentration was the factor influencing the abundance of *Mononchus aquaticus* ($r = 0.655$, df $= 24$, $P < 0.05$). Statistically significant correlations were found between the abundance of *B. stefanskii* and the water level fluctuations ($r = 0.475$, df $= 24$, $P < 0.05$), and between the same species and the depth ($r = 0.659$, df $= 23$, $P < 0.05$). No significant correlations were found between the abundance of *Tobrilus* sp. 3 and the environmental factors. A significant positive correlation ($r = 0.475$, df $= 24$, $P < 0.05$) was found between the dissolved oxygen concentration and the number of species (S), and another between the dissolved oxygen concentration and H' ($r = 0.493$, df $= 24$, $P < 0.02$).

Discussion

The recorded values of physico-chemical parameters during our research, and the trophic classification system index for the water of the lake suggested eutrophication in progress. The repetition of hypoxic/anoxic conditions during summer/early autumn periods recorded during lake

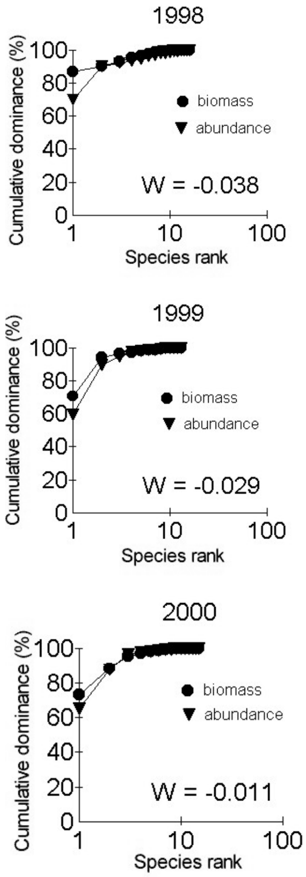

Fig. 5. ABC curves for nematode assemblages in 1998, 1999 and 2000.

monitoring in the last five years, along with the other data from Kopački rit Nature Park Monitoring Project between 1997 and 2001 (Vidaković et al., 2002), and during 2002 (Bogut et al., 2003), characterize Sakadaš lake as a eutrophic water body with a tendency for hypertrophication. Also, the important factor for the lake is the water level fluctuation influenced by the inflow of water mass from two rivers – the Dunav and the Drava, which flood the area of Kopački rit in irregular temporal frames (Vidaković et al., 2002).

Nematodes are the most abundant meiobenthic organism group in the littoral and eulittoral sediments of Sakadaš lake (Vidaković et al., 2001). According to Traunspurger (2002), nematodes can reach very high abundances in lakes: 1300 ind. 10 cm^{-2} in an oligotrophic, 3,464 ind. 10 cm^{-2} in a mesotrophic and 600 ind. 10 cm^{-2} in an eutrophic lake. However, the recorded density of nematodes in the sediment of the central area of Sakadaš lake was only between 2 and 199 ind. 100 cm^{-2}. The recorded nematode abundance corresponds more with the data for shallow profundal sites of lakes (Kajak, 1983; Prejs & Papinska, 1983), than those for a littoral zone to which the sandy site belongs.

No clear temporal pattern in the nematofauna was found. The highest nematode densities in the sediment of Sakadaš lake were recorded during spring and summer 2000, whereas the lowest were found during summer (July 1998). The low number of nematodes is probably caused by low oxygen content. In accordance with our findings, some other authors reported highest abundances in summer (Traunspurger, 1996; Nalepa & Quigly, 1983).

The wet weight biomass of nematodes ranged from 0.89 μg 100 cm^{-2} (July 1998) to 37.10 μg 100 cm^{-2} (March 1999). The recorded nematode biomass of the littoral of Sakadaš lake was significantly lower than the biomass determined in other lakes: between 1 and 61 mg m^{-2} in Balaton lake (Biro, 1972), about 240 mg m^{-2} in Lake Pääjarvi (Holopainen & Paasivirta, 1977) and between 0.2 and 1.7 mg 100 cm^{-2} in Königssee lake (Traunspurger, 1996). The low biomass, as well as low abundance, is a probable consequence of disturbed site conditions.

The total number of 24 nematodes species was found in the littoral sediment of Sakadaš lake. Vidaković et al. (2001) reported about 26 nematodes species identified in the sandy submerged eulittoral site of the lake. Bogut & Vidaković (2002) found a total of 46 nematodes species at three eulittoral sites of Sakadaš lake (submerged, at a land-water interface and emerged), and Vidaković & Dupan (1996) found 23 species in Bilje fishpond in Kopački rit Nature Park. At eulittoral sites in Sakadaš lake the lowest diversity was recorded in autumn, and the highest in winter/spring time (Bogut & Vidaković, 2002). Research in the lotic and lenthic ecosystems in E Croatia revealed two distinct nematode assemblages, one with the highest diversity at river banks of the Drava and Karašica rivers, and the other with significantly lower diversity at lenthic sites of the Borovik reservoir, Belje fishponds and two man-made lakes in the city of Osijek.

The lowest diversity of nematodes in the central part of Sakadaš lake could be caused by an increase in stressful habitat conditions (Warren et al., 1995), the lowest values of dissolved oxygen concentration. Highest diversity was recorded during late winter and early spring when habitat

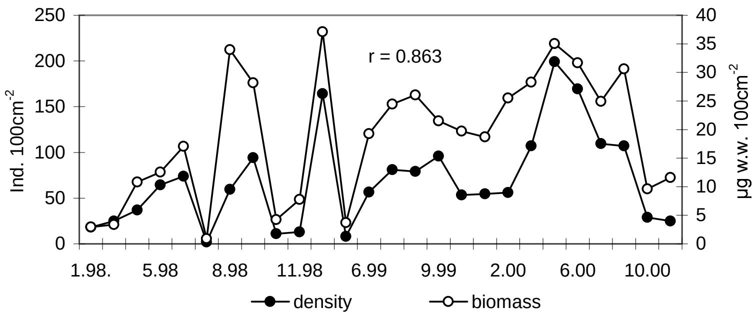

Fig. 6. Correlation between nematode density and biomass in the sandy sediment of the deepest part of Sakadaš lake.

conditions were aerobic. Further, a significant positive correlation was found between dissolved oxygen concentration and the number of species (S), and between dissolved oxygen concentration and the Shannon-Wiener diversity index (H'). According to WASILEWSKA (1973), an increase in water level can cause a decrease in the number and abundance of nematode species.

The most abundant species in the littoral of Sakadaš lake was *Tobrilus gracilis* with a relative abundance of 63.4%. Pearson's correlation between the abundance of *T. gracilis* and the dissolved oxygen concentration, and between the same species and the water temperature, was not significant. However, the correlation analysis showed that the dissolved oxygen concentration was a factor influencing the abundance of *Mononchus aquaticus*. This means that *M. aquaticus* is more sensitive to oxygen than *T. gracilis*. Thus lower densities of *Mononchus* in poor oxygen habitat. *T. gracilis* is considered typical of eutrophic lotic and lenthic environments and tolerant of low oxygen conditions (PREJS, 1977a; PREJS & PAPINSKA, 1983). Also, *T. gracilis* was recorded in anaerobic conditions of reduced sediments (SCHIEMER et al., 1969; PEHOFER, 1989; OCANA & PICAZO, 1991). The individuals of *Tobrilus* genera are represented at a high density in the sediments of lenthic ecosystems, especially in eutrophic lakes (TRAUNSPURGER, 2002).

It seems that temporal variations of the dissolved oxygen concentration has a strong influence on nematode assemblage in Sakadaš lake. The diversity indices and species composition recorded were much closer to species composition and diversity of shallow profundal than to those of littoral (PREJS & PAPINSKA, 1983).

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