MONITORING IN THE GEMENC PROTECTED LANDSCAPE AREA: hydrological, morphological, water quality and ecological data of the Vén-Duna and River Danube in 1998, after reopening the dam

Contractor:

RIZA, Institute for Inland Water Management and Waste Water Treatment of the Netherlands,
Ministry of Transport, Public Works and Water Management

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1. Introduction

According to the contract and scientific co-operation between the RIZA (Institute for Inland Water Management and Waste Water Treatment of the Netherlands) and some Hungarian Institutions (Eötvös József High School, Baja, Water Resources Research Centre, Budapest), a monitoring program was continued in the Vén-Duna side arm (u/s Baja) and River Danube in order to monitor the effect of the reopening of the side arm.

Hydrological, morphological, water quality and ecological monitoring was carried out in order to describe the most important abiotic and biotic processes following the hydraulic intervention. This report contains the results of the second year study carried out after reopening.

2. Hydrology

Author: J. Sziebert

2.1. Introduction

Within the framework of the rehabilitation of the water system of the Vén-Duna side branch and the connected floodplain dead branch-system, the partial removal of the cross closing dam of the side branch was completed in 1998, while certain stretches of the bed were dredged.
According to discussion with the project co-ordinator and verbal agreement the undertaker started working in February and March 1998

2.2. Methods of the survey

2.2.1. Discharge Measurement

Discharge measurements in given sections of the side branch, according to the velocity-area method, taking cross-sections by a rod and measuring the velocities in each point, according to the VMS 231/4 standard, applying the same method as before the opening.
Simultaneous velocity field and velocity measurements were carried out near the throat of the Vén-Duna side branch, in the side branch itself, and, more in the main bed of the river Danube, in 22 verticals, more points each.

We give the position of the verticals in a table, using the Unified Hungarian System, furthermore we indicate the velocity and angle values, point by point, as well as we give other data for identifying the measurement. We give the axonomethric and velocity- and angle distributions of the verticals on drawings. Mapping at a rate of M = 1 : 2500 , indicating the sampling points. Data provided in printed and digital format as well.

2.2.2. Bed Load Sampling

It is already impossible to discover, what method was used for sampling between the years 1951-65 in the main riverbed. Both bottle and pumping methods were used, the equipment and the size has changed more times. Nowadays ADUVIZIG uses pumping in most of the cases, but, sometimes they also have used an OTT brand electronical semi-automatic sediment sampler. Since the methods were not the same and the documentation was not always appropriate, the errors in data processing can be increased.

Our Department has taken suspended sediment samples from the side branch by pumping. The vertical of sampling is the same where we have measured velocities. The determination of the suspended sediment concentration was done by the same method as at VITUKI Co. We haven't determined the grain size distribution of the sample.

2.2.3. Velocity-field Survey

Synchronous velocity and velocity field measurements were carried out in 22 verticals mainly in the main riverbed but partly in the downstream throat of the Vén-Duna side branch, more points in each vertical. We provide the position of each vertical in a board, indicating them as co-ordinates according to the Unified Hungarian System, furthermore the velocities and angle data according to the measured quantities, and other data in order to identify the measurement. We also provide the axonomethric views of the velocity and direction distribution for each vertical.

We carried out the measurements by an electronic tachometer, measuring polar co-ordinates, by shooting at a round shaped prism placed at the vertical of the velocity field measuring equipment, while the boat being fixed in three directions to the bottom. We have stored the results in the memory of the tachometer and in a hand-written protocol as well. Distribution and density of the verticals: they were taken at the points considered to be significant for the particular water level and flow conditions. The utilised equipment were: OTT Delphin velocity field meter with a SEBA velocity meter, the software used for evaluation was BIBER, the evaluation took place in situ on a notebook PC. The measurements were 40 sec long each, the results were presented at the reliability of 1 degree and 1 cm/s each.

The definition of the angle: it is the angle between the North direction and the horizontal picture of the three-dimensional velocity vector. If the vector is pointing to the East, it is considered to be negative; if it is pointing to the West, it is considered as positive; if it's pointing to the North, the angle is zero; and if the vector is pointing to the South, then the angle is maximal, that means ± 180 degrees. The depth of the measuring points was determined by reading the display of the winch, at an accuracy of 1 cm.

2.3. Results

2.3.1. Discharge Measurement

The processing of the results of the measurements was carried out on PC using the VÍZHOZAM software. We provide the summarised results as a board in appendix no. 2.
We have, using the data obtained, determined the relations between the water level and the discharge in the Vén-Duna side branch, and we present it as a graph in appendix no. 3., also giving the conditions preliminary to the opening of the side branch.

The curve of the relation was achieved using the method of minimal squares, and can be described by the equation below:

$$Q = A * (H - H_k)^n, \text{ where}$$

A is a multiplicative constant=0,010045
H_k is the water level of the limit of flowthrough=170 cm (Baja gauging station)
n is an exponential constant=1,653757

We have developed and depicted in appendix no. 4. the graph showing the ratios between the discharge of the Danube main bed and that of the side branch.

2.3.2. Velocity-field Survey

Mapping at a rate of M=1:2500, indicating the place of the verticals. Data are provided in printed and digital format as well. The processing of the results of the measurements was done on PC with the EXCEL software. We have presented our results in a board as a sheet called SUMMARY1. The axonomethric pictures of the velocity vectors are presented on a sheet called EXPLANATORY. Furthermore we give the velocity and direction distribution diagrams of the 22 verticals on sheets f1-f22.

2.3.3. Bed Load Sampling

The sediment sampling in the Vén-Duna side branch was executed in the same section as the discharge measurement. It was timed at the first bigger flood wave after the opening of the closing dam. The intensity of the flood was very high. 200 meters upstream from the section of the measurement the deposited sandy material has heavily been eroded. (picture no. 1.). The result of this also can be seen in the measurement: the sediment concentration in the side verticals is higher than that of the middle verticals, though this would not have to be so according to the distribution of velocities in the section. A similar phenomenon can be observed in the Baja section of the river itself: near to the right side bank there is an exceptionally big increase of the sediment load, though the velocities do not give evidence of this. The reason is probably the dredged stretch upstream from the measurement, and the sediment transport of the Vén-Duna.

We have calculated the data using the computer software of the Water Authority that also gives the result of sediment calculation. The average sediment density and the distribution of the sediment concentration of the sections are given on pictures 4 to 6.

3. Morphology

Author: J. Sziebert

3.1. Introduction

Partial opening of the Vén-Duna side branch and introduction of the connected river training works carried out The Lower Danube Valley Water Authority (ADUVIZIG) informed us about the interventions as follows:

3.1.1. Main bed

Increasing the length of the cross dam at 1485,6 river km on the left bank
Building a divert structure at 1481,0 river km upstream of the throat on the right bank
Partial removal of the cross dam (shortening) at 1480,8 river km on the right bank. The building was made using the removed material.

3.1.2. Vén-Duna side branch

Partial removal of the closing cross dam (triangle-shaped opening planned, altitude 82,46 maB, side slope 1:3). Deposition of the removed stone in the eroded part behind the dam; Stone removal and deposition made using a CSELLA type dredge, transportation: shipping.
Dredging upstream the closing dam, (between the dam and the forestry road) sample cross-section planned with 20 m in width, side slope 1:2, bottom altitude 82,46 maB). The same machine made the dredging, the removed material was deposited on both sides in the bed. From the road to the closing dam a MASTER type pumping dredge was used, the removed material was deposited Northeast of the closing dam, on the left bank, in a low-lying area.

Downstream of the dam, in the left-bank channel, near the island an additional stretch has been dredged, in order to cut through the sand dune, that has already developed. The same cross-section sizes were established.

Additional dredging was executed at the throat of the side branch, with similar section sizes. The removed material was deposited in the mainstream of the river Danube.
Duration of the works:

	Stone works	*Dredging*
Beginning	*22.07.1998.*	*22.07.1998.*
Finishing	*02.11.1998.*	*22.09.1998.*

Our results are shown on no.6. overview, and no. 7 and 8. detailed maps.

3.2. Methods of the survey

3.2.1. River Bed Survey

We only made riverbed surveys on the dredged stretches after the opening, using the baselines of the preliminary surveys, with the same method and equipment. The methods of data processing of these supplementary surveys are similar to those described in chapter no. 1. and 2.

3.2.2. River Bed Sampling

The opening, (partial opening of the cross closing dam and dredging) that was finished in 1998, has caused new bed material conditions. For their determination, we have taken samples at places of intervention, and present our results as grain size distribution diagrams.

3.3. Results

The data processing was similar to the preliminary methods.
Making comparison with the pre-action measurements or determination of the amount of dredged materials was not our task.
We present our results on maps and tables that are sent to the Dutch partner earlier already.

4. Water quality

Author: dr. B. Csányi

4.1 Introduction

Chemical and physical variables of macrocomponents and nutrients were investigated two times in the Vén-Duna and Danube (main channel) in 1998, after the reopening of the dam.

The aim of the investigations was to evaluate the quality of water in the sampling sites that are studied in the framework of the project. As a conclusion of the Preliminary Report, sediment was not investigated during this period of time.

4.2 Material and methods

Water samples were taken simultaneously with the hydrobiological studies in the different sites: on 14 September and 02 November. The numbers and names of the sampling sites are indicated in Table 5.2.1 and Figure 1.

Approximately 2 l of water samples were taken at each site from the surface of the water body. Analysis was done on the next day after storing samples in refrigerator also. The following standards were used during the analysis:

The standard series of MSZ 448, MSZ 12750, standards of MSZ ISO 7150-1, MSZ ISO 5813 and the accredited individual methods of ÁVL-2 and ÁVL-4.

4.3 Results

The results of the two measurements carried out during the preliminary study indicated such a hydrological situation when no direct flow was observed through the side arm (19.09.1997, 15.04.1998, see Preliminary Report). This hydrological condition influences directly the chemical and planktonic variables so that there were large differences among the values of several components measured at different locations.

Flowing conditions were observed both in September at lower flow rate (1960 m^3/sec) but at the reopened situation, and, in the beginning of November, at high flood and reopened situation, too (4470 m^3/sec). The values of the measured components indicate well, that during the flowing-through conditions there are no considerable variations in the values of the observed variables along the side arm and the River Danube (Table 4.3.1 and 4.3.2).

Table 4.3.1 Physical and chemical components measured and determined in the water in Vén-Duna and River Danube at 14 September 1998

	Number of sampling site				
Variable	**1**	**2**	**3**	**4**	**6**
pH	8.36	-	8.35	8.37	8.36
Specific conductivity (µS/cm)	371	-	351	351	351
Suspended solids (mg/l)	23	-	29	27	22
Total dissolved solids (mg/l)	281	-	298	324	293

BOD5 (mg/l)	1.3	-	<1.0	<1.0	<1.0
TOC (settled) (mg/l)	2.5	-	2.8	2.6	2.7
KOI k (original) (mg/l)	11.6	-	11.6	11.6	11.6
Dissolved oxygen (mg/l)	8.2	-	7.3	7.2	7.2
Ammonium N (mg/l)	0.04	-	0.05	0.05	0.05
Nitrite N (mg/l)	0.02	-	0.02	0.03	0.02
Nitrate N (mg/l)	1.6	-	1.7	1.6	1.6
Kjeldahl N (mg/l)	1.28	-	1.03	1.14	2.1
Total nitrogen N (mg/l)	2.9	-	2.8	2.8	2.8
Ortophosphate P (mg/l)	0.05	-	0.05	0.06	0.06
Total P (mg/l)	0.13	-	0.12	0.11	0.12

Table 4.3.2 Physical and chemical components measured and determined in the water in Vén-Duna and River Danube at 02 November 1998

	Number of sampling site				
Variable	**1**	**2**	**3**	**4**	**6**
pH	8.06	7.93	8.0	8.11	8.13
Specific conductivity (μS/cm)	382	380	375	375	380
Suspended solids (mg/l)	70	60	40	16	60
Total dissolved solids (mg/l)	252	252	230	240	240
BOD5 (mg/l)	2.0	-*	1.9	1.8	2.8
TOC (settled) (mg/l)	3.2	3.0	3.0	2.8	2.9
KOI k (original) (mg/l)	9.4	14.3	15.2	13.5	13.5
Dissolved oxygen (mg/l)	9.7	-*	9.6	9.7	10.0
Ammonium N (mg/l)	0.07	0.08	0.08	0.08	0.1
Nitrite N (mg/l)	0.03	0.03	0.03	0.03	0.03
Nitrate N (mg/l)	2.2	2.2	2.2	2.1	2.1
Kjeldahl N (mg/l)	1.76	2.00	1.51	1.15	1.59
Total nitrogen N (mg/l)	4.0	4.2	3.7	3.3	3.7
Ortophosphate P (mg/l)	0.08	0.07	0.06	0.06	0.08
Total P (mg/l)	0.4	0.12	0.11	0.07	0.11

4.4 Discussion

The further question referring to the effect of the side arm reopening is that how the new hydrological situation influences the sediment composition, its nutrient content, and, the chemical composition of the water body itself. Therefore the macrocomponent analysis of the sediment will be continued once a year. The chemical analysis of the water body is going to be done four times a year. The analysis most probably will show the further effects of the reopening to the water quality conditions of the Vén-Duna.

5. Hydrobiology

Authors: Németh J. (phytoplankton), dr. Gulyás P. (zooplankton), dr. Csányi B., Juhász P. (macrozoobenthon), dr. Guti G. (fish)

5.1 Introduction

The reopening of the dam on the Vén-Duna was planned early in 1998, at the time of the "green-flood" because the high water level provides appropriate conditions for the dredging work carried out by ship. Unfortunately, there were no such high water periods on the Hungarian Danube during the first half of 1998 (Figure 2, Preliminary Report). Therefore the results of the April and July sampling program have to be regarded as a base-line study before the reopening of the dam (20 August) and being published in the Base-line Report. Only those data are analysed in this report that were collected in September and early November, after the reopening.

5.2 Material and methods

The sampling methods used during the further monitoring program were the same as during the base-line study. Detailed description of the methodology is published in the Base-line Report in details. Therefore only a short summary of the applied methods is given in this Report.

Altogether four sites on the Vén-Duna (1, 2, 3, and 4) and one Danubian site (6) were investigated during the study of 1998, respectively (Table 5.2.1). Detailed description of the sampling sites is given in the Base-line Report, too.

Table 5.2.1 List of the sampling sites and sample types during the baseline study (CH=chemistry; P=phytoplankton; Z=zooplankton; M=macrozoobenthon; F=fish)

No.	Localities	Date	Sample
1	Vén-Duna: u/s section (between the Danube and the rock dam)	14.09.98,02.11.98	**C, P, Z, M**
2	Vén-Duna: u/s section (600 m below the rock dam)	14.09.98,02.11.98	**C,P, Z, M, F**
3	Vén-Duna: middle section (400 m d/s Cserta-Duna confluence)	14.09.98,02.11.98	**C, P, Z, M**
4	Vén-Duna: d/s section (200 m u/s the lower confluence)	14.09.98,02.11.98	**C, P, Z, M**
6	Danube: u/s Baja (1482.5 river km)	14.09.98,02.11.98	**C, P, Z, M, F**
5	Vén-Duna:water body 10 m d/s the dam	14.09.98,02.11.98	**M**
7	Vén-Duna:side arm at the island d/s the dam	14.09.98,02.11.98	**M**

Altogether four sites on the 4.1 km long Vén-Duna (1, 2, 3, 4), one site on the Danube (6), and two locations in the neighbourhood of the dam (only for the macroinvertebrates) (5, 7) were investigated during the baseline study. The location of the sampling sites is indicated on the map of the Vén-Duna side arm, as well (Figure 1).

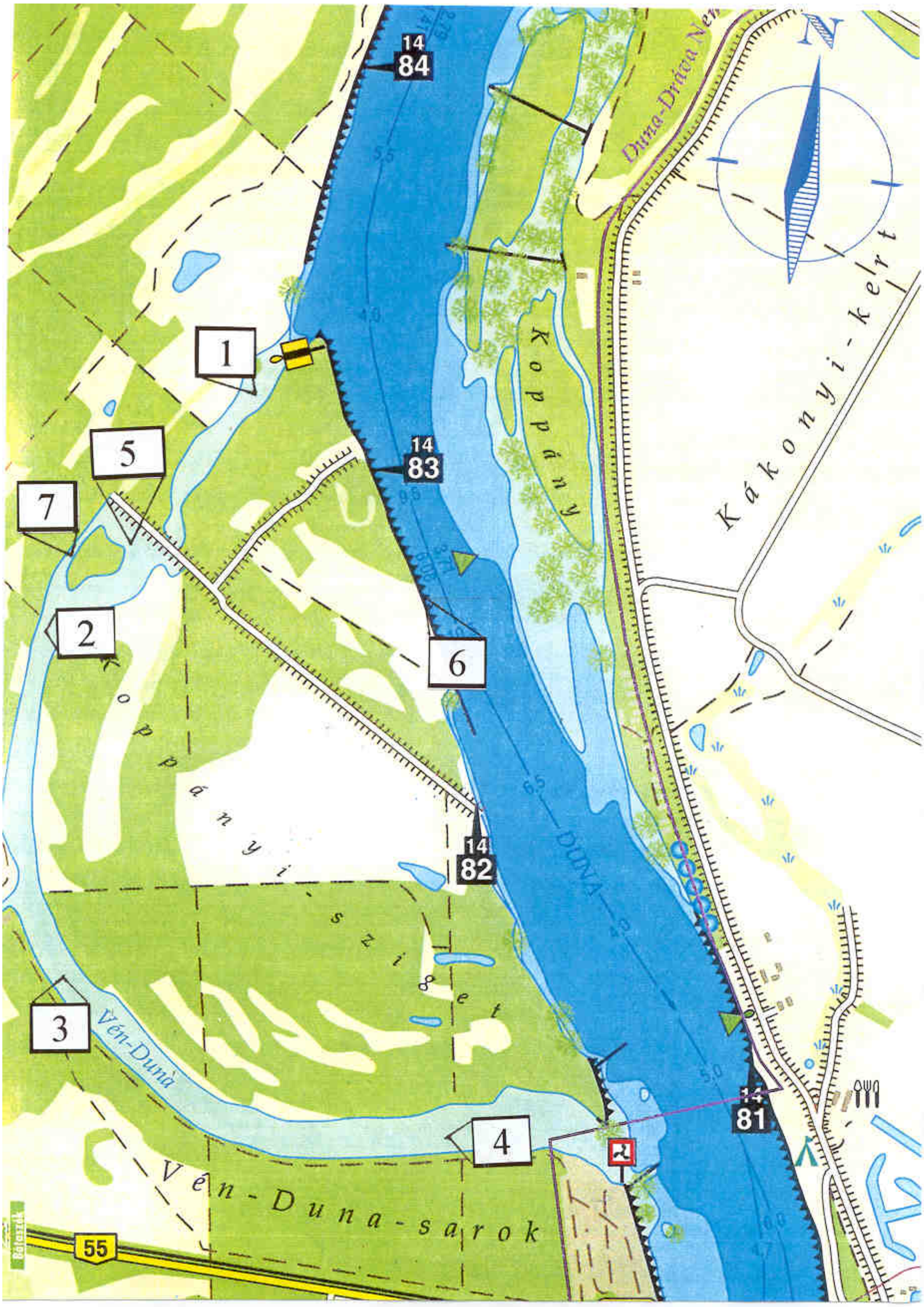

Figure 1. Map of the Vén-Duna indicating the sampling sites

Phyto- and **zooplankton** samples were taken from the surface of the open water bodies of the investigated river sections submerging the phytoplankton flask and filtering 50 l volume of water through a zooplankton net with 70 µm mesh size. All of these samples were fixed and preserved with Lugol`s - iodine and formaldehyde respectively. The **chemical** samples of the macrocomponents were taken also from the surface of the water.

The dominance conditions of phytoplankton was expressed by logarithmic interval scale, population density values of zooplankton are expressed as ind/100 l, and biomass according to BOTTRELL et al. (1976) in wet weight as mg/m^3 (see: Base-line Report).

One series of quantitative **macroinvertebrate** samples were collected in November by an Ekman-Birge grab sampler. Four cross sections were sampled following the opening of the dam. Individual numbers of the most dominant *Oligochaeta* and *Chironomidae* group of the **macroscopic invertebrate community** are calculated in each cross section. Two series of qualitative kick samples were taken at the same sites as the plankton and chemical samples were collected.

In order to detect long term changes of the fish fauna, three series of **fishing** data are presented. Electrofishing method was applied to collect fish specimens two times in July and one time in late August, respectively. Two sites are compared to each other in ichtyological point of view: the downstream side of the dam in the Vén-Duna where the reopening took place and the main channel of the River Danube at 1482.5 river km section.

5.3 Results

5.3.1 Phytoplankton

Population density as total number of individuals per ml and relative abundances of the dominant phytoplankton taxa measured on logarithmic interval scale (see Base-line Report, Table 2) are shown on the detailed taxon lists in the Appendix (Tables 5.3.1.1-5.3.1.2). The dominant taxa are included in the Report (Table 5.3.1.3 and 5.3.1.4)

Although the water flow was middle in September, but the dam reopening was finished. Extended water transport was observed through the side arm through the 40 m wide opening resulting in similar character of the Vén-Duna sites to the River Danube in the phytoplankton (Table 5.3.1.3). The population density has changed in a narrow range (54000-72000 i/ml) and the dominance structures also were very similar to each other (*Sceletonaema* spp: 5-6, *Coscinodiscaceae* spp: 2-3).

There was a high flood peak during the last sampling in early November when the water was flowing through the opening and over the dam itself. The population density of the plankton has dramatically decreased comparing to the earlier results and the values were nearly the same at all of the sampling sites (Table 5.3.1.4, 1470-1950 i/ml). The dominance structure of the whole side arm was almost the same, as well (Coscinodiscaceae spp. 3-4, Rhodomonas spp. 2-4).

Figure 4. Spatial and temporal changes in phytoplankton biomass of River Danube and Danube, 1998.

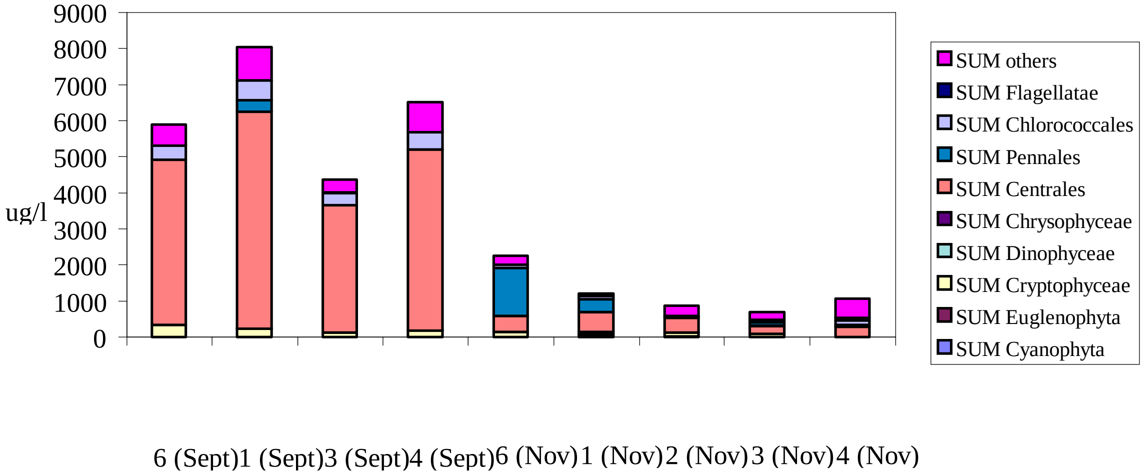

Figure 4 represents flowing situation during both time periods. In September a mass production of algae was observed. The biomass of the phytoplankton was sharply decreased in November in the main arm of the Danube as well as in the side arm of the Vén-Duna, according to the ordinary seasonal pattern. The values were varied between 2.3 mg/l (Danube) and 0.7 mg/l (Vén-Duna). The phytoplankton was dominated by *Pennales* diatomes in Danube and Centric species in the Vén-Duna side arm.

Table 5.3.1.3 Population density (i/ml) and relative abundances of the dominant phytoplankton taxa in the Vén-Duna (1-4) and River Danube (6),14.09.1998

	Number of sampling sites				
	1	**2**	**3**	**4**	**6**
Cell number	**54005**		**54005**	**72002**	**65003**
Dominant taxa					
CYANOPHYTA					
Oscillatoria spp.			**1**		
PYRROPHYTA					
Cryptomonas spp.	**1**		**1**		**1**
Rhodomonas spp.	**1**			**1**	
CHRYSOPHYCEAE					
Chrysococcus sp.					**1**
DIATOMOPHYCEAE					
Sceletonema spp.	**5**		**6**	**5**	**6**
Coscinodiscaceae spp.	**3**		**3**	**2**	**3**
Melosira granulata	**1**				
Nitzschia cf. acicularis + Synedra cf. acus					
Nitzschia (Lanceolatae) spp.	**1**		**1**	**3**	
Synedra spp.				**1**	
CHLOROPHYCEAE					
Chlorococcales spp.			**1**	**1**	**1**
Ankistrodesmus angustus	**1**		**1**		**1**
Dictyosphaerium spp.				**1**	
Golenkinia radiata	**1**				

Kirchneriella spp.				**1**	
Pediastrum duplex	**1**			**1**	
Scenedesmus spp.			**1**	**1**	**1**

Table 5.3.1.4 Population density (i/ml) and relative abundances of the dominant phytoplankton taxa in the Vén-Duna (1-4) and River Danube (6), 02.11.1998

	Number of sampling sites				
	1	**2**	**3**	**4**	**6**
Cell number	**1530**	**1600**	**1670**	**1950**	**1470**
Dominant taxa					
CYANOPHYTA					
Aphanizomenon issatschenkoi			**1**		
Microcystis flos aquae			**1**		
Microcystidaceae spp.					**1**
Oscillatoria spp.	**1**				**1**
Pseudanabaena spp.	**1**	**1**	**1**		**2**
EUGLENOPHYTA					
Euglena spp.			**1**		
PYRROPHYTA					
Cryptomonas spp.	**1**	**1**	**2**	**1**	**1**
Rhodomonas spp.	**4**	**2**	**3**	**3**	**3**
CHRYSOPHYCEAE					
Dinobryon sp.	**1**				
Synura spp.		**2**			
DIATOMOPHYCEAE					
Sceletonema spp.	**1**		**1**	**1**	**2**
Coscinodiscaceae spp.	**3**	**4**	**4**	**4**	**3**
Melosira cf. distans			**1**		
Melosira varians				**1**	
Navicula spp.	**1**				**1**
Nitzschia cf. acicularis + Synedra cf. acus	**1**		**2**	**1**	
Nitzschia (Lanceolatae) spp.	**1**			**1**	
CHLOROPHYCEAE					
Chlorococcales spp.	**2**	**2**		**2**	**2**
Actinastrum hantzschii				**1**	
Ankistrodesmus angustus	**1**	**1**			**1**
Crucigenia tetrapedia				**1**	
Hyaloraphidium contortum		**2**			
Nephrochlamys allanthoidea	**1**				
Pediastrum duplex			**1**		
Scenedesmus spp.	**1**	**1**	**1**	**2**	**2**
Tetraedron minimum					**1**
Koliella longiseta					**1**
FLAGELLATAE					
Flagellatae spp.	**1**	**2**	**1**	**1**	**2**

5.3. Zooplankton

Altogether 39 *Rotatoria*, 16 *Cladocera* and 8 *Copepoda* species were detected in the Vén-Duna and the River Danube during 1998. The detailed species list is shown in Table 5.3.2.1-5.3.2.4 (Appendix). Results indicate that both the River Danube and the Vén-Duna side arm contained those taxa that are characteristic to the slow flowing eutrophic water bodies: *Brachionus angularis, B. budapestinensis, B. calyciflorus, B. diversicornis, B. quadridentatus brevispinus, Keratella cochlearis, K. c. tecta, Bosmina longirostris, Chydorus sphaericus, Disparalona rostrata, Acanthocyclops robustus, Thermocyclops oithonoides.* Rare species that are frequently found in the biotekton and the aquatic macrophyton stock were the following ones: *Brachionus falcatus, B. rubens, Keratella testudo, K. tropica, Lecane quadridentata, Platyas quadricornis, Testudinella parva, Alona costata, Pleuroxus trigonellus, Eurytemora velox.* The last species was detected in Hungary first only few years ago on the Upper Hungarian Danube.

Comparing the species list to other Danubian check lists it can be stated that the side arm has especially rich *Rotatoria* and *Cladocera* fauna (63 *Rotatoria* and *Crustacea* taxa in the side arm, 36 taxa in the River Danube).

Abundance values and biomass data indicate the direct flow through the Vén-Duna in September (after reopening) at medium Danube flow rate and in November, during flooding (over 4000 m^3/sec). The number of individuals and the biomass values are in similar magnitude in both the side and the main arm (Table 5.3.2.5 and 5.3.2.6).

Table 5.3.2.5 Zooplankton abundance (number of individuals per 100 l) during the preliminary study at various sampling sites

	Sampling sites				
Date	**1**	**2**	**3**	**4**	**6**
14.09.1998	882	496	1034	777	1276
02.11.1998	508	456	505	419	301

Table 5.3.2.6 Zoolpankton biomass (mg/m^3) during the preliminary study at various sampling sites

	Sampling sites				
Date	**1**	**2**	**3**	**4**	**6**
14.09.1998	210	133	210	195	255
02.11.1998	159	222	197	132	64

The slightly exponential relationship between the Danube flow rate and the Danubian zooplankton abundance and biomass is indicated on Figure 5 and 6. Such picture was not found in case of the Vén-Duna because the flow rates of the side arm are not known yet.

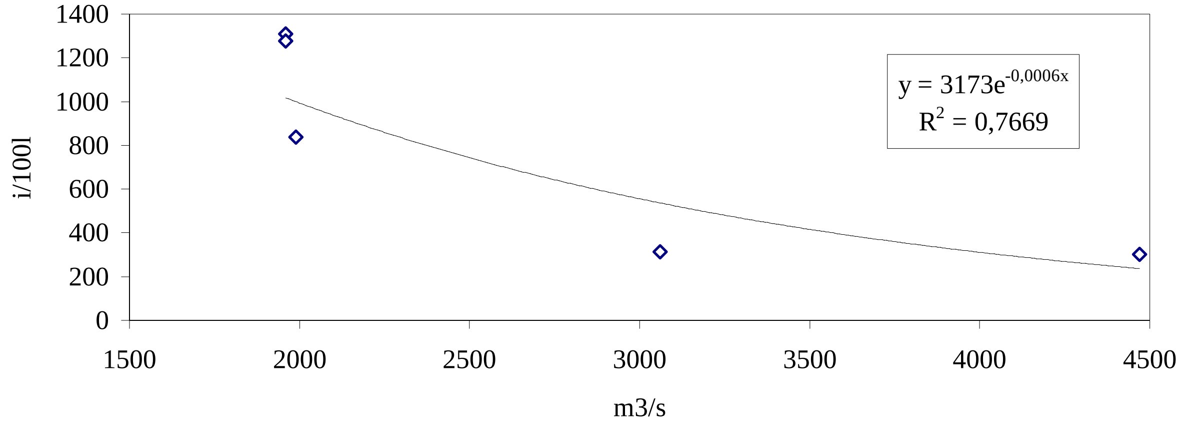

Figure 5. The relationship between Danube flow rate and zooplankton abundance (1997-1998)

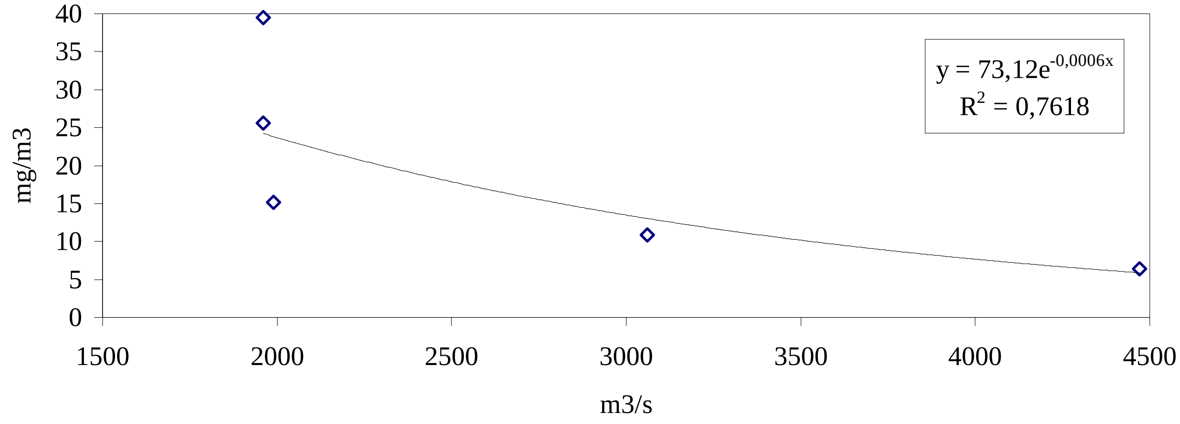

Figure 6. The relationship between Danube flow rate and zooplankton biomass (1997-1998)

5.3.3 Macrozoobenthon

Results of the quantitative macrozoobenthon survey carried out during the early November 1998 indicated that the number of worms usually belonged to the magnitude of thousand along the whole side arm. The upper section contained the smaller amount of both investigated groups. Only one sample was taken at site 1 (at the left side) due to the increased flow rate and fast flow. The longitudinal distribution of the worms and midge larvae is shown in Table 5.3.3.1. There was the maximum number of worms per m^2 3 in the middle section (11 110). Almost the same value was detected in the deep water body (site 5, near site 2, 9628 i/m^2). The number of the *Chironomidae* was 1259 (the largest) in the right side of the island, in the small arm that is situated just below the dam having usually stagnant water. These figures indicate that the continuos study of the sites 5 and 7 being situated near the reopened dam might be interesting in the future, too.

Table 5.3.3.1 Abundance of the dominant taxa as number of individuals/m^2 at various sampling sites, 2 November 1998

Sampling sites	***Oligochaeta*** **Location in the cross section**			***Chironomidae*** **Location in the cross section**		
	right	middle	left	right	middle	left
1	-	-	1022	-	-	222
2	5925	1274	8295	102	59	563
3	2222	11110	2962	148	415	518
4	29	8147	9628	15	622	815
5		2962			1259	
7		9628			89	

Decreasing numbers of macroinvertebrate taxa were detected during the autumn period of sampling in both the Vén-Duna and the River Danube. Table 5.3.3.2 (see Appendix) shows 25 taxa, all of them have been found earlier in the area. Only 22 taxa were described in November (Table 5.3.3.3, Appendix) probably due to the season.

Characteristic change in the longitudinal distribution of the two malacostracan species (*Corophium curvispinum, Dikerogammarus villosus*) can be observed after the reopening. Both of them are common along the Vén-Duna. On the other hand it can be concluded that the species composition was very similar during the two sampling times. However, the time since the reopening works were completed was too short to evaluate more detailed effects on the biota of the side arm.

5.3.4 Fish

There were 18 species registered in the Vén-Duna during 1998 (see Table 5.3.4.1 in the Appendix). 272 individuals and 16 species were caught in the beginning of June, 168 individuals and 15 species in the end of the same month and 291 individuals belonging to 11 species were present in the late August sample. During this last fish sampling the reopening works were done resulting in high turbidity. The disturbation may be the reason of the lowest species number.

The dominant species in the beginning of June were as follows: *Rutilus rutilus, Blicca bjoerkna, Alburnus alburnus*. *Rutilus rutilus* was dominant in the late June, too, together with *Leuciscus idus*. Stagnant water conditions were observed in June, so that this is the reason of the majority of limnophilous species (*Esox lucius, Lepomis gibbosus, Rhodeus sericeus, Scardinius erythrophthalmus*). Only one of the species was belonging to the rheophilous ones (*Aspius aspius*). The diverse predator fish community (Anguilla anguilla, Aspius aspius, Esox lucius, Silurus glanis) indicates the ecological integrity of the water body. The spawning of the white bream (*Blicca bjoerkna*) was observed in the Vén-Duna during June, explaining its large individual number.

There were 18 species registered in the River Danube during 1998 (see Table 5.3.4.2 in the Appendix). 180 individuals and 13 species were caught in the beginning of June and 195 individuals and 15 species in the end of the same month.

The dominant species in the beginning of June were as follows: *Alburnus alburnus, Rutilus rutilus*. *Alburnus alburnus* and *Leuciscus idus* were dominant in the late August, respectively. The ecological integrity of the water body is indicated by the diverse predator fish community (*Anguilla anguilla, Aspius aspius, Lota lota, Silurus glanis, Stizostedion lucioperca*). According to the permanent flowing conditions one-third of the species belonged to the rheophilous group (*Aspius aspius, Barbus barbus, Chondrostoma nasus*, *Gymnocephalus baloni, Leuciscus cephalus, Lota lota*, *Neogobius kessleri*, etc.).

6. General discussion and conclusions

It was concluded earlier that active water transport was only possible if the Danubian flow rate was above 2500 m3/sec. Following the reopening of the dam direct flowing conditions were established in the side arm of the Vén-Duna from the middle of August 1998. Table 6.1 shows the flow rate of the Danube during the sampling time.

Table 6.1 Calculated flow rates in the River Danube at Baja during the sampling campaign

Date	**Danube flow (m^3/sec)**
14.09.1998	1960
02.11.1998	3562

Flowing conditions were observed in the Vén-Duna both in September at lower flow rate (1960 m^3/sec) and, in the beginning of November, at high flood (4470 m^3/sec). The values of the measured **chemical components** indicate well, that during the flowing-through conditions there are no considerable variations in the values of the observed variables along the side arm and the River Danube.

A mass production of **algae** was observed in September. The biomass of the phytoplankton was sharply decreased in November in the main arm of the Danube as well as in the side arm of the Vén-Duna, according to the ordinary seasonal pattern. The abundance and biomass values do not differ very much from each other at the various sites. Abundance values and biomass data of the **zooplankton** community also indicate the direct flow through the Vén-Duna in September and in November, respectively. The number of individuals and the biomass values are in similar magnitude in both the side and the main arm. The two malacostracan species of the **macrozoobenthon** are distributed the whole side arm section since the reopening was completed. However, the **fish fauna** needs probably more time to indicate any effect of the changed hydrological situation on its distribution and reproduction.

APPENDIX

Basic measured data during the monitoring the Vén-Duna and River Danube
After reopening

September - November 1998

Table 5.3.1.1 Population density (i/ml) and relative abundances of the dominant phytoplankton taxa in the Vén-Duna (1-4) and River Danube (6),14.09.1998

	Number of sampling sites				
	1	**2**	**3**	**4**	**6**
Cell number	**54005**		**54005**	**72002**	**65003**
Dominant taxa					
CYANOPHYTA					
Anabaena spp.					
Aphanizomenon issatschenkoi					
Aphanocapsa sp.					
Merismopedia sp.					
Microcystis flos aquae					
Microcystidaceae spp.					
Oscillatoria spp.			**1**		
Pseudanabaena spp.					
EUGLENOPHYTA					
Euglena spp.					
PYRROPHYTA					
Cryptomonas spp.	**1**		**1**		**1**
Rhodomonas spp.	**1**			**1**	
Peridinium spp.					
CHRYSOPHYCEAE					
Chrysococcus sp.					**1**
Dinobryon sp.					
Synura spp.					
DIATOMOPHYCEAE					
Sceletonema spp.	**5**		**6**	**5**	**6**
Coscinodiscaceae spp.	**3**		**3**	**2**	**3**
Melosira granulata	**1**				
Melosira cf. distans					
Melosira varians					
Asterionella formosa					
Navicula spp.					
Nitzschia cf. acicularis + Synedra cf. acus					
Nitzschia (Lanceolatae) spp.	**1**		**1**	**3**	
Synedra spp.				**1**	
Pennales spp.					
CHLOROPHYCEAE					
Volvocales spp.					
Chlorococcales spp.			**1**	**1**	**1**
Actinastrum hantzschii					
Ankistrodesmus acicul. var. acicularis					
Ankistrodesmus angustus	**1**		**1**		**1**
Crucigenia tetrapedia					
Crucigeniella apiculata					
Chodatella quadriseta					
Dictyosphaerium spp.				**1**	
Didymocystis planctonica					
Golenkinia radiata	**1**				
Hyaloraphidium contortum					
Kirchneriella spp.				**1**	

Lagerheimia genevensis					
Micractinium pusillum					
Nephrochlamys allanthoidea					
Pediastrum boryanum					
Pediastrum duplex	**1**			**1**	
Scenedesmus spp.			**1**	**1**	**1**
Schroederia setigera					
Schroederia spiralis					
Tetraedron incus					
Tetraedron minimum					
Tetrastrum punctatum					
Tetrastrum staurogeniaeforme					
Treubaria triappendiculata					
Koliella longiseta					
Closterium sp.					
FLAGELLATAE					
Flagellatae spp.					

Table 5.3.1.2 Population density (i/ml) and relative abundances of the dominant phytoplankton taxa in the Vén-Duna (1-4) and River Danube (6), 02.11.1998

	Number of sampling sites				
	1	2	3	4	6
Cell number	**1530**	**1600**	**1670**	**1950**	**1470**
Dominant taxa					
CYANOPHYTA					
Anabaena spp.					
Aphanizomenon issatschenkoi			**1**		
Aphanocapsa sp.					
Merismopedia sp.					
Microcystis flos aquae			**1**		
Microcystidaceae spp.					**1**
Oscillatoria spp.	**1**				**1**
Pseudanabaena spp.	**1**	**1**	**1**		**2**
EUGLENOPHYTA					
Euglena spp.			**1**		
PYRROPHYTA					
Cryptomonas spp.	**1**	**1**	**2**	**1**	**1**
Rhodomonas spp.	**4**	**2**	**3**	**3**	**3**
Peridinium spp.					
CHRYSOPHYCEAE					
Chrysococcus sp.					
Dinobryon sp.	**1**				
Synura spp.		**2**			
DIATOMOPHYCEAE					
Sceletonema spp.	**1**		**1**	**1**	**2**
Coscinodiscaceae spp.	**3**	**4**	**4**	**4**	**3**
Melosira granulata					
Melosira cf. distans			**1**		
Melosira varians				**1**	
Asterionella formosa					
Navicula spp.	**1**				**1**
Nitzschia cf. acicularis + Synedra cf. acus	**1**		**2**	**1**	
Nitzschia (Lanceolatae) spp.	**1**			**1**	
Synedra spp.					
Pennales spp.					
CHLOROPHYCEAE					
Volvocales spp.					
Chlorococcales spp.	**2**	**2**		**2**	**2**
Actinastrum hantzschii				**1**	
Ankistrodesmus acicul. var. acicularis					
Ankistrodesmus angustus	**1**	**1**			**1**
Crucigenia tetrapedia				**1**	
Crucigeniella apiculata					
Chodatella quadriseta					
Dictyosphaerium spp.					
Didymocystis planctonica					
Golenkinia radiata					
Hyaloraphidium contortum		**2**			

Kirchneriella spp.					
Lagerheimia genevensis					
Micractinium pusillum					
Nephrochlamys allanthoidea	**1**				
Pediastrum boryanum					
Pediastrum duplex			**1**		
Scenedesmus spp.	**1**	**1**	**1**	**2**	**2**
Schroederia setigera					
Schroederia spiralis					
Tetraedron incus					
Tetraedron minimum					**1**
Tetrastrum punctatum					
Tetrastrum staurogeniaeforme					
Treubaria triappendiculata					
Koliella longiseta					**1**
Closterium sp.					
FLAGELLATAE					
Flagellatae spp.	**1**	**2**	**1**	**1**	**2**

Table 5.3.2.1 Individual numbers of the zooplankton community, (14.09.1998)

Legend					
i - individuum/100 liter	**Sampling sites**				
TAXON	**1**	**2**	**3**	**4**	**6**
ROTATORIA					
Anuraeopsis fissa		12			
Ascomorpha ecaudis			16		
Asplanchna priodonta	12	16	12	12	44
Brachionus angularis	24	32	112	86	172
B. budapestinensis	86	44	72	43	86
B. calyciflorus calyciflorus	44	48	80	86	86
B. c. anuraeiformis	44	72	112	86	44
B. diversicornis			48	8	
B. falcatus	4				
B. quadridentatus brevispinus			8	8	8
B. urceus		8			
Cephalodella gibba	8				
Euchlanis dilatata		8	10		
Filinia longiseta	8	12	12	12	130
Keratella cochlearis cochlearis	44	64	48	43	86
K. c. tecta	260	56	256	86	130
K. testudo	12		8	43	
K. tropica	24		8		
Lecane bulla	8				4
L. luna	8	16	8		44
L. lunaris					86
L. quadridentata					8
Notholca squamula			8	22	
Polyarthra vulgaris	64	32	86	132	86
Pompholyx complanata	12		22		44
Testudinella patina					44
Trichocerca pusilla					12
T. similis			12		
T. stylata	8	8			
CLADOCERA					
Alona rectangula	8		4	4	
Bosmina longirostris	8	8	8	4	8
Chydorus sphaericus		4			
Daphnia cucullata			4		
D. longispina		4			4
Diaphanosoma brachyurum	4		4		4
Disparalona rostrata				4	
COPEPODA					
Acanthocyclops robustus			4	4	
Eucyclops serrulatus				4	
Thermocyclops oithonoides	8	4			8
nauplius larvae	172	40	64	86	130
kopepodit larvae	12	8	8	4	8
Total	**882**	**496**	**1034**	**777**	**1276**

Table 5.3.2.2 Individual numbers of the zooplankton community, (02.11.1998)

Legend					
i - individuum/100 liter	**Sampling sites**				
TAXON	**1**	**2**	**3**	**4**	**6**
ROTATORIA					
Ascomorpha ecaudis				43	
Asplanchna priodonta		22		11	11
Brachionus angularis	43	22	22	22	22
B. calyciflorus calyciflorus		22			11
B. leydigi tridentatus	22				
B. urceus	22				11
Filinia longiseta			22	43	22
Keratella cochlearis cochlearis	43	22	86	66	66
K. c. tecta			22		
K. quadrata	86	66	86		22
Notholca acuminata				22	
Polyarthra vulgaris	22	66	43	43	66
Pompholyx complanata	86				
Synchaeta pectinata				11	
Testudinella mucronta					11
T. patina		22			
Trichocerca elongata		22			
T. similis			12		
CLADOCERA					
Alona costata		2			
A. quadrangularis	8	4			
A. rectangula	4				
Alonella nana	4				
Bosmina longirostris	8	8	6	4	6
Chydorus sphaericus	12	8	6		
Disparalona rostrata	4	4	4	4	4
Macrothryx hirsuticornis		2			
Pleuroxus trigonellus	4				
P. uncinatus			2		
Simocephalus vetulus		4			
COPEPODA					
Eudiaptomus gracilis			2		
Eurytemora velox		4	4	2	
Acanthocyclops robustus	8	4			
A. vernalis		4			
Eucyclops serrulatus			6	4	
nauplius larvae	126	136	172	136	43
kopepodit larvae	6	12	10	8	6
Total	**508**	**456**	**505**	**419**	**301**

Table 5.3.2.3 Biomass of the zooplankton community (14.09.1998)

Legend					
b=biomass mg/100 l wet weight	**Sampling sites**				
TAXON	**1**	**2**	**3**	**4**	**6**
ROTATORIA					
Anuraeopsis fissa		0,1			
Ascomorpha ecaudis			0,2		
Asplanchna priodonta	0,6	0,8	0,6	0,6	2,2
Brachionus angularis	0,2	0,2	0,8	0,6	1,2
B. budapestinensis	0,5	0,3	0,4	0,3	0,5
B. calyciflorus calyciflorus	1,8	1,9	3,2	3,4	3,4
B. c. anuraeiformis	1,8	2,9	4,5	3,4	1,8
B. diversicornis			1,7	0,2	
B. falcatus	0,1				
B. quadridentatus brevispinus			0,2	0,2	0,2
B. urceus		0,1			
Cephalodella gibba	0,2				
Euchlanis dilatata		0,3	0,4		
Filinia longiseta	0,1	0,2	0,2	0,2	2,1
Keratella cochlearis cochlearis	0,3	0,4	0,3	0,3	0,5
K. c. tecta	1,0	0,2	0,5	0,4	0,5
K. testudo	0,1		0,1	0,5	
K. tropica	0,3		0,1		
Lecane bulla	0,1				0,1
L. luna	0,1	0,1	0,1		0,4
L. lunaris					0,8
L. quadridentata					0,1
Notholca squamula			0,1	0,1	
Polyarthra vulgaris	0,6	0,3	0,7	1,2	0,8
Pompholyx complanata	0,1		0,1		0,2
Testudinella patina					0,2
Trichocerca pusilla					0,1
T. similis			0,1		
T. stylata	0,1	0,1			
CLADOCERA					
Alona rectangula	0,3		0,2	0,2	
Bosmina longirostris	0,6	0,6	0,6	0,3	0,6
Chydorus sphaericus		0,5			
Daphnia cucullata			0,4		
D. longispina		0,6			0,3
Diaphanosoma brachyurum	0,3		0,3		0,3
Disparalona rostrata			0,2	0,2	
COPEPODA					
Acanthocyclops robustus			1,4	1,4	
Eucyclops serrulatus				1,4	
Thermocyclops oithonoides	2,2	1,1			2,2
nauplius larvae	8,6	2,0	3,2	4,3	6,5
kopepodit larvae	1,0	0,6	0,6	0,3	0,6
Total	**21,0**	**13,3**	**21,0**	**19,5**	**25,6**

Table 5.3.2.4 Biomass of the zooplankton community (02.11.1998)

Legend					
b=biomass mg/100 l wet weight	Sampling sites				
TAXON	**1**	**2**	**3**	**4**	**6**
ROTATORIA					
Ascomorpha ecaudis				0,1	
Asplanchna priodonta		1,1		0,6	0,6
Brachionus angularis	0,3	0,2	0,1	0,1	0,1
B. calyciflorus calyciflorus		0,9			0,4
B. leydigi tridentatus	0,9				
B. urceus	0,4				0,2
Filinia longiseta			0,3	0,7	0,4
Keratella cochlearis cochlearis	0,3	0,1	0,5	0,4	0,4
K. c. tecta			0,1		
K. quadrata	0,9	0,7	1,0		0,2
Notholca acuminata				0,1	
Polyarthra vulgaris	0,2	0,6	0,4	0,4	0,6
Pompholyx complanata	0,2				
Synchaeta pectinata				0,1	
Testudinella mucronta					0,1
T. patina		0,1			
Trichocerca elongata		0,1			
T. similis			0,1		
CLADOCERA					
Alona costata		0,1			
A. quadrangularis	0,3	0,2			
A. rectangula	0,2				
Alonella nana	0,2				
Bosmina longirostris	0,6	0,6	0,5	0,3	0,5
Chydorus sphaericus	1,5	1,0	0,7		
Disparalona rostrata	0,2	0,2	0,2	0,2	0,2
Macrothryx hirsuticornis		0,1			
Pleuroxus trigonellus	0,2				
P. uncinatus			0,1		
Simocephalus vetulus		4,0			
COPEPODA					
Eudiaptomus gracilis			1,5		
Eurytemora velox		1,4	3,0	1,5	
Acanthocyclops robustus	2,8	1,4			
A. vernalis		1,6			
Eucyclops serrulatus			1,8	1,2	
nauplius larvae	6,2	6,8	8,6	6,8	2,2
kopepodit larvae	0,5	1,0	0,8	0,7	0,5
Total	**15,9**	**22,2**	**19,7**	**13,2**	**6,4**

Table 5.3.2.7 Zooplankton (Rotatoria, Cladocera, Copepoda) taxa occurring in the Danube and Vén-Duna in 1998

	Danube	**Vén-Duna**
ROTATORIA		
Anuraeopsis fissa		+
Ascomorpha ecaudis		+
Asplanchna priodonta	+	+
Brachionus angularis	+	+
B. budapestinensis	+	+
B. calyciflorus calyciflorus	+	+
B. c. anuraeiformis	+	+
B. diversicornis	+	+
B. falcatus		+
B. leydigi tridentatus	+	+
B. quadridentatus brevispinus	+	+
B. rubens	+	+
B. urceus	+	+
Cephalodella gibba		+
Euchlanis dilatata	+	+
Filinia longiseta	+	+
Keratella cochlearis cochlearis	+	+
K. c. tecta	+	+
K. quadrata	+	+
K. testudo		+
K. tropica		+
Lecane bulla	+	+
L. closterocerca		+
L. luna	+	+
L. lunaris	+	+
L. quadridentata	+	
Notholca acuminata	+	+
N. squamula	+	+
Platyas quadricornis		+
Polyarthra vulgaris	+	+
Pompholyx complanata	+	+
Synchaeta pectinata	+	+
Testudinella mucronata	+	
T. parva		+
T. patina	+	+
Trichocerca elongata		+
T. pusilla	+	+
T. similis		+
T. stylata		+
CLADOCERA		
Alona affinis		+
A. costata		+
A. quadrangularis	+	+
A. rectangula		+
Alonella nana		+
Bosmina longirostris	+	+
Chydorus sphaericus	+	+

Daphnia cucullata		+
D. longispina	+	+
Diaphanosoma brachyurum	+	+
Disparalona rostrata	+	+
Macrothryx hirsuticornis		+
Pleuroxus aduncus		+
P. trigonellus		+
P. uncinatus		+
Simocephalus vetulus		+
COPEPODA		
Eudiaptomus gracilis		+
Eurytemora velox		+
Acanthocyclops robustus	+	+
A. vernalis		+
Cyclops strenuus		+
Eucyclops serrulatus		+
Mesocyclops leuckarti	+	+
Thermocyclops oithonoides	+	+
Total	**36**	**60**

Table 5.3.3.2 Macrozoobenthic taxa of the Vén-Duna and River Danube, 14.09.1998

	TAXA	**Sampling sites**				
		1	**2**	**3**	**4**	**6**
	Mollusca					
1	Anodonta anatina	1	1	1	1	
2	Bithynia tentaculata					1
3	Dreissena polymorpha	1	1	1	1	1
4	Lithoglyphus naticoides	1		*		
5	Physella acuta					1
6	Pisidium sp.	1				1
7	Pseudanodonta complanata	1				
8	Radix ovata					1
9	Sinanodonta woodiana	1				
10	Sphaerium corneum	1				1
11	Sphaerium rivicola	1				1
12	Unio pictorum		1	1	1	
13	Unio tumidus		1	1	1	
14	Valvata piscinalis	1				
15	Viviparus acerosus	1	1	1	1	1
	Annelida					
16	Criodrillus lacuum					1
17	Dina lineata	1				1
18	Erpobdella octocullata	1				1
19	Glossiphonia complanata	1				
20	Helobdella stagnalis				1	1
21	Oligochaeta sp.	1	1	1	1	1
	Crustacea					
22	Corophium curvispinum	1	1		1	1
23	Dicerogammarus villosus	1	1	1	1	1
	Insecta					
24	Ceratopogonida sp.			1		
25	Chironomidae sp.	1	1	1	1	1
	Taxa/sampling site	**17**	**9**	**9**	**10**	**16**

*1=presence; *=empty shell only*

Table 5.3.3.3 Macrozoobenthic taxa of the Vén-Duna and River Danube, 02.11.1998

	TAXA	Sampling sites				
		1	**2**	**3**	**4**	**6**
	Mollusca					
1	Anodonta anatina	1	1	1	1	
2	Dreissena polymorpha	1	1	1	1	1
3	Gyraulus albus			1		
4	Lithoglyphus naticoides	1				
5	Pisidium sp.					1
6	Radix ovata					1
7	Sphaerium corneum	1	1			1
8	Sphaerium rivicola			1		
9	Unio pictorum	1		1	1	
10	Unio tumidus	1	1		1	
11	Valvata piscinalis	1				
12	Viviparus acerosus	1			1	
	Annelida					
13	Criodrillus lacuum					1
14	Dina lineata	1				
15	Erpobdella octocullata					1
16	Helobdella stagnalis		1			
17	Oligochaeta sp.	1	1	1	1	1
	Crustacea					
18	Corophium curvispinum	1	1	1	1	1
19	Dicerogammarus villosus	1	1	1	1	1
	Insecta					
20	Ceratopogonida sp.		1		1	
21	Chironomidae sp.	1	1	1	1	1
22	Platycnemis pennipes			1		
	Taxa/sampling site	**13**	**10**	**10**	**10**	**10**

*1=presence; *=empty shell only*

Table 5.3.4.1 Abundance (number of individuals) and dominance (%) of captured fish species in the Vén-Duna during the sampling of 1998

Name	03.06.1998		29.06.1998		27.08.1998	
	Abund.	Domin.	Abund.	Domin.	Abund.	Domin.
ANGUILLIDAE						
Eel	1	0.37	-	-	-	-
ESOCIDAE						
Pike	2	0.74	2	1.19	2	0.69
CYPRINIDAE						
Carp	6	2.21	-	-	-	-
Bream	1	0.37	1	0.6	1	0.34
Bleak	42	15.44	9	5.36	109	37.46
White bream	77	28.31	3	1.79	-	-
Asp	4	1.47	-	-	7	2.41
Goldfish	1	0.37	10	5.95	-	-
Ide	2	0.74	1	0.6	21	7.22
Chinese rasbora	1	0.37	1	0.6	9	3.09
Bitterling	12	4.41	7	4.17	9	3.09
Roach	87	31.99	92	54.76	93	31.96
Rudd	1	0.37	7	4.17	8	2.75
SILURIDAE						
Wels	-	-	3	1.79	-	-
PERCIDAE						
Sunfish	10	3.68	21	12.5	19	6.53
Perch	16	5.88	6	3.57	13	4.47
Ruffe	9	3.31	4	2.38	-	-
GOBIIDAE						
Tubenose goby	-	-	1	0.6	-	-
	272	100	168	100	291	100
18 species	**16 spp.**		**15 spp.**		**11 spp.**	

Table 5.3.4.2 Abundance (number of individuals) and dominance (%) of captured fish species in the River Danube during the sampling of 1998

	03.06.1998		29.06.1998	
Name	Abund.	Domin.	Abund.	Domin.
ANGUILLIDAE				
Eel	1	0.56	-	-
CYPRINIDAE				
Bream	2	1.1	-	-
Bleak	85	47.22	91	46.67
White bream	3	1.67	-	-
Asp	6	3.33	6	3.08
Barb	4	2.22	8	4.1
Nase	6	3.33	6	3.08
Chub	1	0.56	5	2.56
Dace	18	10	41	21.03
Chinese rasbora	-	-	10	5.13
Roach	43	23.89	18	9.23
GADIDAE				
Burbot	7	3.89	2	1.03
SILURIDAE				
Wels	-	-	2	1.03
GOBIIDAE				
River goby	-	-	2	1.03
Kessler's goby	-	-	1	0.51
PERCIDAE				
Balon`s ruffe	3	1.67	1	0.51
Perch	-	-	4	2.05
Pikeperch	1	0.56	-	-
	180	100	195	100
18 species	**13 spp.**		**15 spp.**	