MONITORING IN THE GEMENC PROTECTED LANDSCAPE AREA:
Hydrological, morphological water quality and ecological data of the Vén-Duna and River Danube in 1999, one year after reopening the dam

Contractor:

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CONTENT

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.

Hydrological, morphological, water quality and ecological monitoring was carried out in order to describe the most important abiotic and biotic processes following the reopened situation in the side arm. This report contains the results of the water quality and ecological monitoring research carried out by the VITUKI Plc. during the second year after reopening. The Reports on the Discharge measurements and Bed load sampling carried out by the Technical Faculty of the Eötvös József College are presented in two separate volumes.

2. Water quality

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2.1 Introduction

Chemical and physical variables of macro-components and nutrients were investigated five times in the Vén-Duna and Danube (main channel) in 1999.

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. A detailed analysis of macro- and micro-components occurring in the sediment will be taken only during the last year of the monitoring program (in 2000). The sampling sites are indicated in Figure 1. Monthly average, minimum and maximum values of the water level measured in the Baja water gauge station in 1999 is illustrated in Figure 2.

2.2 Material and methods

Water samples for the chemical analyses were taken simultaneously with the hydrobiological studies along the long axis of the Vén-Duna (VD1 - 4) as well as the Danube at Baja (D6) on 05 May, 18 June, 09 September, 20 October and 11 November.

Approximately 2 l of water samples was 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.

2.3 Results

The results of analyses are summarised in **Table 2.3.1-5** (see in the Appendix).

In **May** the physical and chemical characteristics of the water as well as the chlorophyll-a concentration were highly similar between the main and the side arm. The *total-N* concentration varied between 1.96 and 2.15 mg/l. The *nitrate-N* (86.0 -93.9 %) was the dominant component in the *N-spectrum* as a characteristic feature of large rivers (FELFÖLDY 1987).

In **June** some differences were observed between the main- and side arm in the values of several chemical components. The value of the chemical oxygen demand was varied between 12 and 16 mg/l in the Vén-Duna and was 23 mg/l in the Danube. The *chlorophyll-a* concentration was higher (5.9 - 8.9 mg/m^3) in the side arm than that of the value in the main-arm (4.4 mg/m^3).

The concentration of the **total-N** varied between 2.35 and 3.09 mg/l. The **nitrate-N** (58.3-76.6 %) was the dominant component in the **N-spectrum** with subdominance of **organic-N** (18.2-36.9 %).

In **September** the minimal values were observed in the middle part of the Vén-Duna (VD 3) concerning the following variables: total *suspended solids*, *chemical oxygen demand*, *biological oxygen demand*, *total organic carbon*, *total-N*, *organic-N*, *total-P*. At the same time the maximum value of the *chlorophyll-a* concentration (and *phytoplankton biomass*) as well as the *percentage saturation of dissolved oxygen* was registered. The concentration of the *total-N* varied between 2.36 and 3.27 mg/l. The main components of the *N-spectrum* were the nitrate-N (48.9-63.6%) and the *organic-N* (34.3-49.8 %).

In **October** significant difference was observed between the main and the side arms in the concentration of the *total suspended solids* and the *chlrophyll-a*. The maximum of the former and the minimum in the latter were observed in the Danube.

The concentration of the *total-N* varied between 1.97 and 2.26 mg/l. The *nitrate-N* (76.1-79.6 %) was the dominant component in the *N-spectrum*, with subdominance of *organic-N* (13.8-16.8 %). The proportion of *ammonia-N* (4.9-7.3 %) was slightly higher than that of the values in the previous period.

In **November** the physical and chemical characteristics of the water were nearly identical both the Vén-Duna and Danube with the exception of the total suspended solids. The value of this component varied between 7 and 14 mg/l in Vén-Duna and was 21 mg/l in the Danube.

The concentration of the *total-N* varied between 2.82 and 3.08 mg/l. The main components of the *N-spectrum* were the *nitrate-N* (64.8-71.3 %) and the *organic-N* (19.1-24.0 %). The proportion of *ammonia-N* was higher (6.0-10.4 %) in the Vén-Duna than in the Danube (4.3 %).

3. Hydrobiology

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

3.1 Introduction

Phytoplankton, zooplankton and macrozoobenthon samples were collected in the Vén-Duna and the River Danube using the same methods as earlier. The tables containing the data are presented in the Appendix.

3.2 Material and methods

The sampling methods used during the further monitoring program were the same as during the former (base line and follow up) studies. 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 five series of samples were taken in the year of 1999 as follows:
05. May, 18 June, 07 September, 20 October and 11 November.

Four sites on the Vén-Duna (1, 2, 3, and 4) and one Danubian site (6) were investigated during the study of 1999, respectively (Table 3.2.1). Detailed description of the sampling sites is given in the Base-line Report, too.

Table 3.2.1 List of the sampling sites and sample types during the baseline study (C=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)	05 May, 18 June, 07 Sept, 20 Oct, 11 Nov	**C, P, Z, M**
2	Vén-Duna: u/s section (600 m below the rock dam)	05 May, 18 June, 07 Sept, 20 Oct, 11 Nov	**C,P, Z, M, F**
3	Vén-Duna: middle section (400 m d/s Cserta-Duna confluence)	05 May, 18 June, 07 Sept, 20 Oct, 11 Nov	**C, P, Z, M**
4	Vén-Duna: d/s section (200 m u/s the lower confluence)	05 May, 18 June, 07 Sept, 20 Oct, 11 Nov	**C, P, Z, M**
6	Danube: u/s Baja (1482.5 river km)	05 May, 18 June, 07 Sept, 20 Oct, 11 Nov	**C, P, Z, M, F**
5	Vén-Duna:water body 10 m d/s the dam	07 Sept.	**M**

Altogether four sites on the 4.1-km long Vén-Duna (1, 2, 3, and 4), one site on the Danube (6) was investigated during the study in 1999. The location of the sampling sites is indicated on the map of the Vén-Duna side arm, as well (Figure 1).

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).

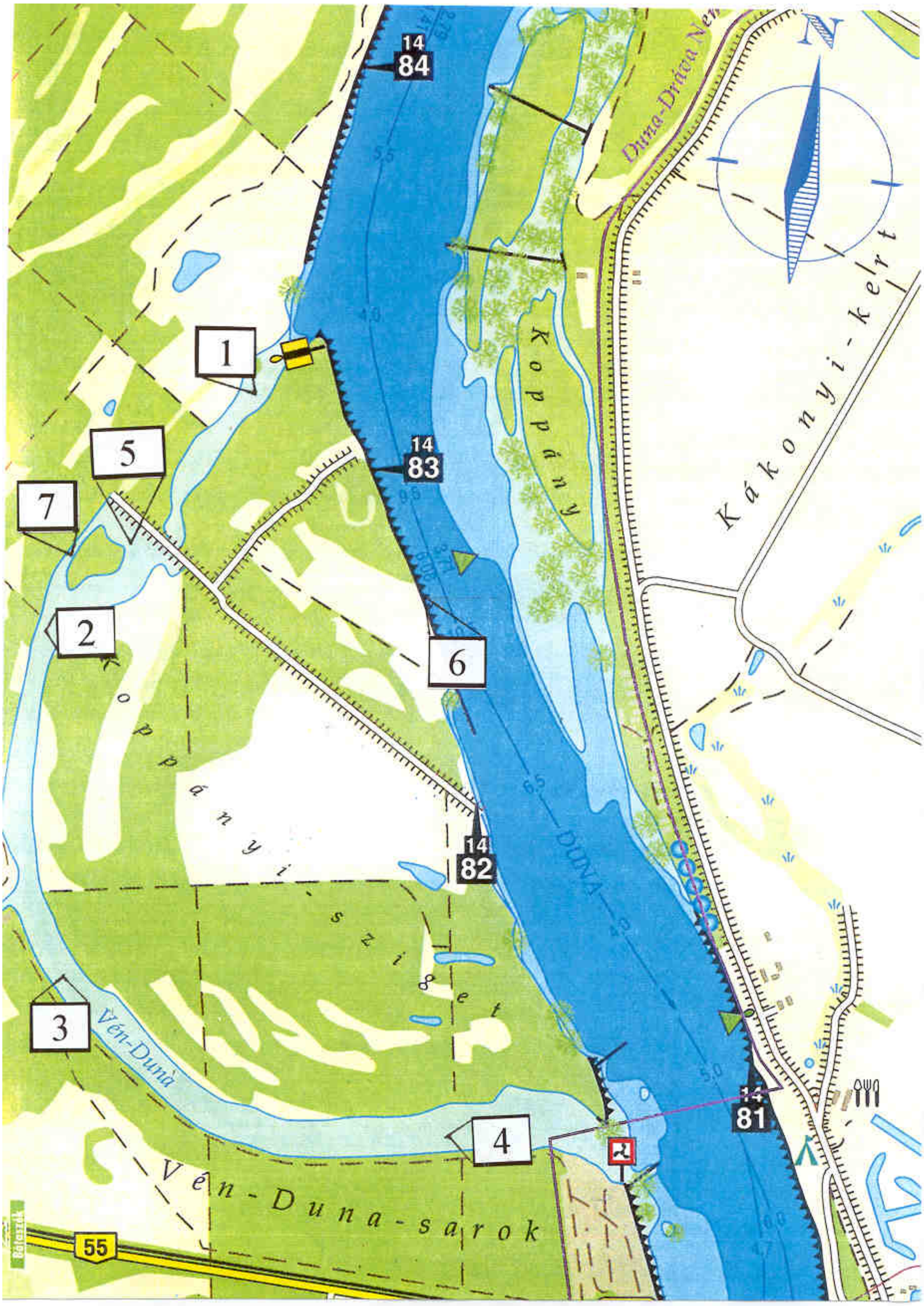


Figure 1. Map of the Vén-Duna indicating the sampling sites

Five 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. Qualitative kick samples were also taken at the same sites as the plankton and chemical samples were collected.

Fish sampling was performed from boat by using electrofishing equipment having 500 W electric capacity. The fish caught during sampling were measured; standard body length was determined at field conditions. All specimens were released after species determination and measurement.

Sampling site 1 is situated at the upper section of the side arm just around the reopened rock dam. There was a limited amount of flow in the side arm during only peak flood conditions before the reopening took place. Approximately a 150-m long stony substrate was checked on the bank side.

Sampling site 2 in on the right bank of the River Danube at 1483 river km section, site 3 is found on the opposite side, at the left bank in the same section. Fishing was carried out from boat by electrofishing apparatus in the marginal side waters along the banks.

3.3 Results

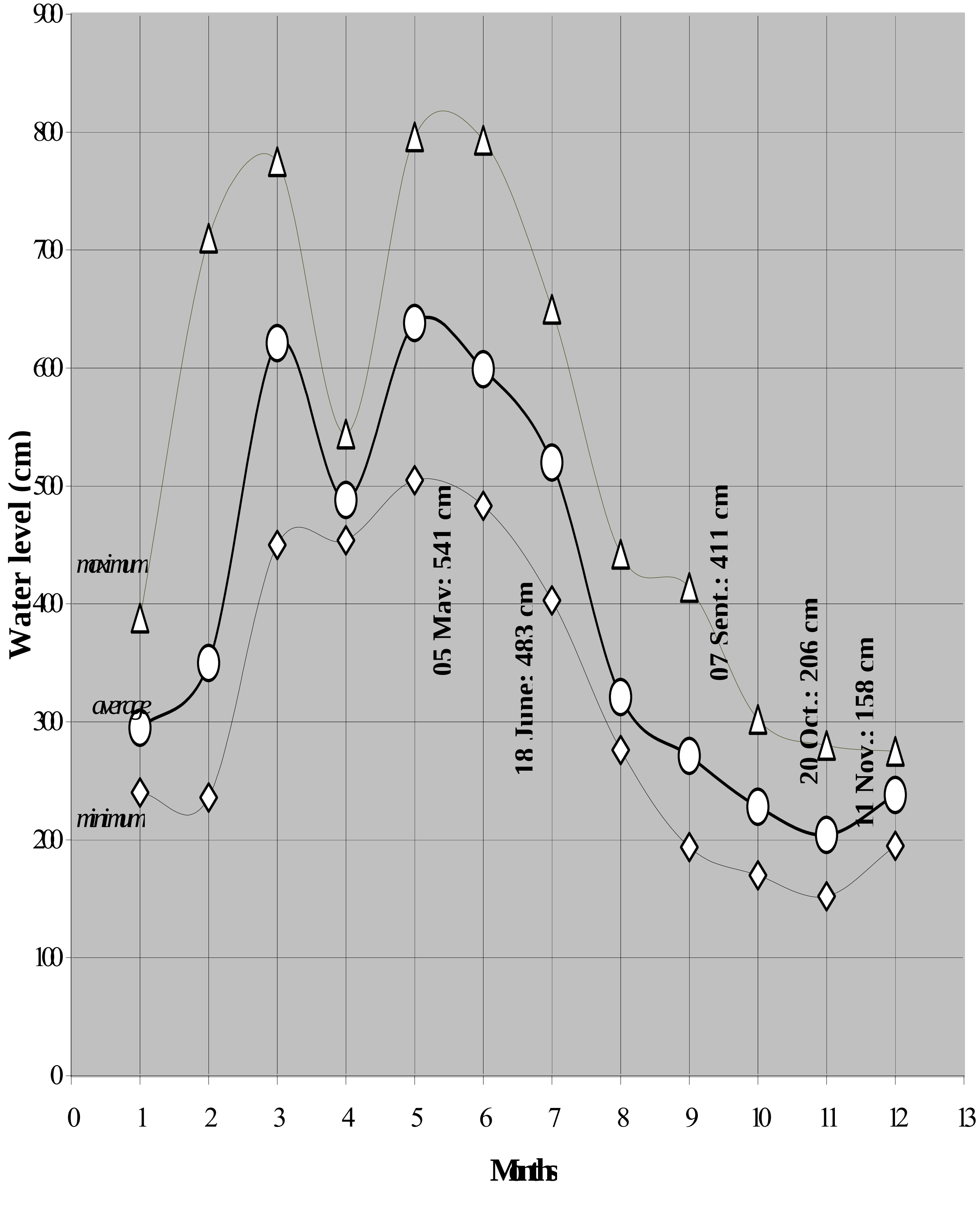
In order to analyse the hydrobiological results the monthly average, minimum and maximum water level data are introduced together with the actual water level (in cm) measured on the Baja gauge at the same day when the sampling was done (Table 2)

Table 2

Month	Average	Minimum	Maximum
January	295	240	388
February	350	236	710
March	621	450	775
April	488	454	544
May	638	505	796
5 May:	**541 cm**		
June	599	483	793
18 June:	**486 cm**		
July	520	403	650
August	321	276	442
September	271	194	414
7 September:	**411 cm**		
October	228	170	302
20 October:	**206 cm**		
November	204	152	280
11 November:	**158 cm**		
December	238	195	275

Figure 2.

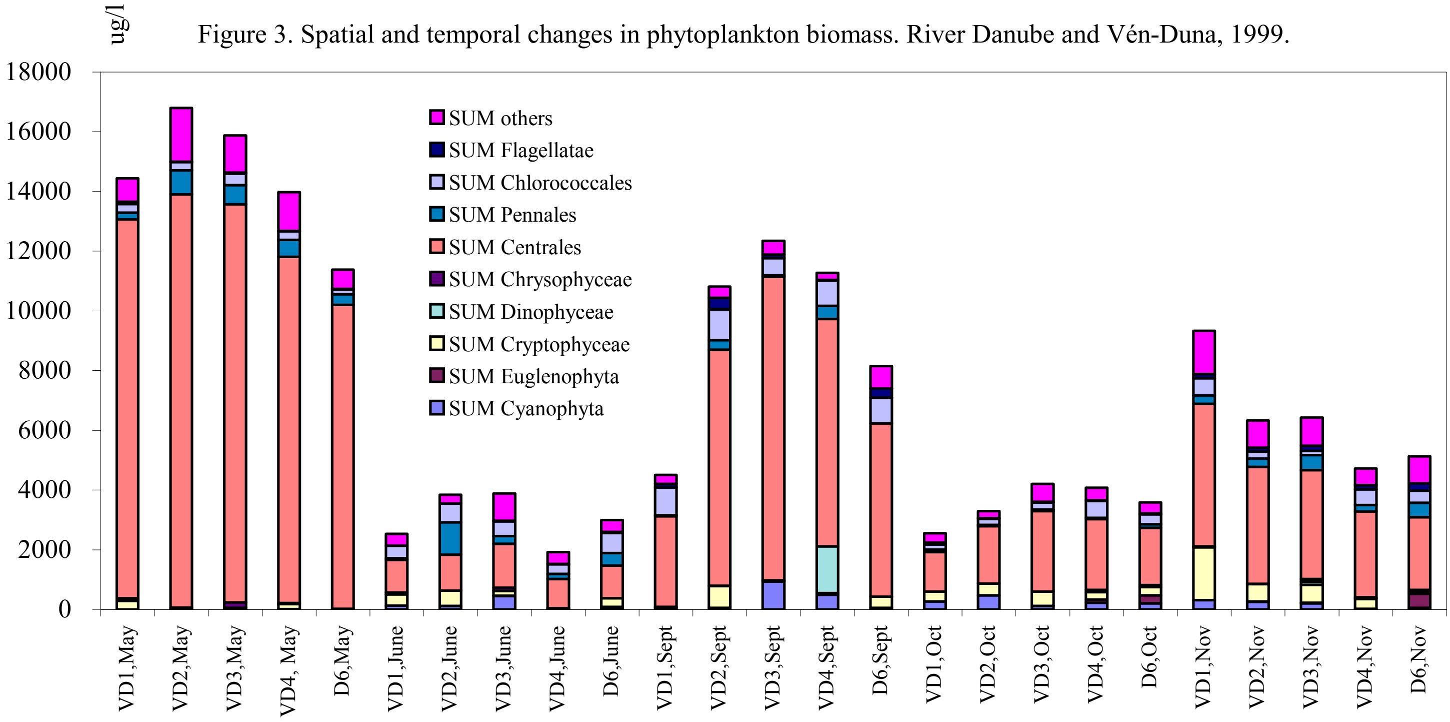
Water level data of the Danube River at Baja in 1999 (monthly average, minimum and maximum)



3.3.1 Phytoplankton

The community size of the phytoplankton and the abundance of the different taxa were characterised by the biomass (µg/l). The data are summarised in **Table 3.3.1-5** according to the main taxonomic groups. The spatial and temporal changes in phytoplankton biomass measured in the River Danube and the Vén-Duna side arm are shown in the Figure 3.

Figure 3. Spatial and temporal changes in phytoplankton biomass. River Danube and Vén-Duna, 1999.



The biomass of the phytoplankton varied between 11.4 (Danube) and 16.8 mg/l (Vén-Duna: VD 2) in **May**. The phytoplankton was dominated by centric-diatoms (*Thalassiosiraceae* spp.: 82.4-89.4 %).

In **June** the biomass of the phytoplankton varied between 1.9 and 3.9 mg/l. Both extreme values were observed in the Vén-Duna (VD 4 and VD 3 sampling points respectively). The phytoplankton was dominated by centric-diatoms (*Thalassiosiraceae* spp.: 31.1 [VD 2] - 50.8 % [VD 4]) with subdominance of chlorococcal green algae (12.7 [VD 3] - 22.7 % [D 6]), pennate diatoms (max. 28.3 % [VD 2]), *Cryptophyceae* (max. 14.8 % [VD 1] or other algae (max. 23.6 % [VD 3]).

In **September** both extreme values of biomass were observed in the Vén-Duna (VD 1: 4.5 mg/l; VD 3: 12.3 mg/l). The centric-diatoms were dominant in phytoplankton, its proportion relative to the total biomass varied between 67.5 % (VD 1) to 82.4 % (VD 3). The maximal relative abundance of chlorococcal green algae and dinoflagellates were 20.6 % (VD 1) and 13.8 % (VD 4) respectively.

In **October** the biomass of the phytoplankton varied between 2.5 (VD 1) and 4.2 mg/l (VD 3). The phytoplankton was dominated by the centric-diatoms (51.9 [VD 1] - 64.2 % [VD 3]) with subdominance of chlorococcal greens (max. 13.8 % [VD 4]), filamentous blue-green algae (max. 14.2 % [VD 2]), *Cryptophyceae* (max. 13.1 [VD 1]), or other algae (max. 14.2 % [VD 3]).

In **November** both extreme values of biomass were observed in Vén-Duna (VD 4: 4.7 mg/l; VD 1: 9.3 mg/l). The centric diatoms were dominant in phytoplankton, its proportion relative to the total biomass varied between 47.5 % (Danube) to 62.0 % (Vén-Duna: VD 2).

A comparison of the spatial means of the phytoplankton biomass during the year reveals increases in May (12.1 mg/l), in September (7.8 mg/l), and in November (5.3 mg/l). The average values of biomass in June and in October were 2.5 and 2.9 mg/l respectively in accordance with the high water periods.

There are characteristic spatial changes in the mean values of the *trophic state variables*.

The following longitudinal alterations the averages of the *chloropyll-a* concentration relative to the mean value of the Danube were determined:

VD1: 110 % → VD 2: 118 % → VD 3: 112 % → VD 4: 106 % → D 6: 100 %

The longitudinal alterations of the mean values of the *phytoplankton biomass*:

VD1: 107 % → VD 2: 132 % → VD 3: 137 % → VD 4: 115 % → D 6: 100 %

On the basis of the *chloropyll-a* and quantitative *phytoplankton* investigations it can be stated that the trophic grade is significantly higher in the Vén-Duna than in the main arm of the Danube.

It was concluded that the population density and taxonomic composition of the phytoplankton was influenced primarily by the seasonal dynamics. The different flow regime did not effect seriously the phytoplankton composition and abundance because the side arm and the Danube were very similar to each other during the whole year.

3.3.2 Zooplankton

Altogether 30 species of *Rotatoria*, 10 *Cladocera* and 6 *Copepoda* species were present in the investigated water bodies during 1999. Abundance and biomass values of the taxa are shown in Tables 3.3.2.1-10 in the Appendix. It can be recognised that most of them belong to the eutrophic taxa that prefer the lenitic or slow flowing conditions. Several taxa form an identical group that are dominant in other eutrophic water bodies of Hungary also: *Asplanchna priodonta, Brachionus angularis, B. budapestinensis, B. calyciflorus, B. diversicornis, B. quadridentatus brevispinus, Euchlanis dilatata, Filinia longiseta, Keratella cochlearis, K. c. tecta, Polyarthra vulgaris, Bosmina longirostris, Daphnia longispina, Diaphanosoma brachyurum, Acanthocyclops robustus.*

Another group contains those species that are usually common among the aquatic macrovegetation and on the surface layer of the sediment deposited in stagnant waters: *Brachionus leydigi tridentatus, B. urceolaris, Keratella quadrata, Pompholyx complanata, Synchaeta pectinata, Alona rectangula, A. quadrangularis, Chydorus sphaericus,* *Disparalona rostrata, Pleuroxus aduncus, Eucyclops serrulatus, Mesocyclopos leuckarti*. Their abundance is not very big but they are common species, too.

The third group of taxa is consisting of the rare species: *Brachionus quadridentatus cluniorbicularis, Dipleuchlanis propatula, Filinia opoliensis, Trichocerca capucina, Trichotria truncata, and Eurytemora velox.* They occur also among the aquatic plants usually. We found the last one few years ago on the Upper Hungarian Danube in side arms. Since that time it came out from other slow flowing rivers, too. These taxa prefer the slow flowing conditions, as well.

There are some rheophilous zooplankton species among the others that tolerate well the current of the River Danube: *Brachionus angularis, Filinia longiseta, Keratella cochlearis cochlearis, K. c. tecta, K. quadrata, Polyarthra vulgaris, Bosmina longirostris, Chydorus sphaericus, Daphnia longispina, Disparalona rostrata, Acanthocyclops robustus, Mesocyclops leuckarti.*

The comparison of the species list of the year 1999 with the former one indicates that there is a small decrease in the number of species found in the Danube (27 instead of 36). The possible explanation could be that the weather became richer in precipitation resulting in increasing water flow and its dilution effect. Even bigger decrease is experienced in the Vén-Duna as far as the species number is concerned. Number of Rotifer species decreased from 37 to. 30, Cladocerans from 16 to 8. The possible reason is that the increased flow rate in the side arm effected the taxa preferring stagnant water conditions more than the rheophilous ones. This could be the reason of the decrease of the species number of rare taxa, as well.

The results of the quantitative investigations are summarised in Tables 3.3.2.11-12. The abundance values varied between 88-2892 ind./100 l. These figures used to be common in the Hungarian Danube section. The largest individual number of the zooplankton was observed in May that corresponds to the normal yearly reproduction rate of Rotatoria and Crustacea. The biomass values are the highest in May and lowest in November, too. The abundance values detected in 1999 are some magnitude lower than that of the values measured during 1997-98. The abundance of zooplankton community in the Vén-Duna was bigger only in May than in the River Danube. The values of the biomass measured in the two different water bodies were similar to each other. These phenomena indicate better water transport through the side arm during the year of 1999 than before.

Summarising the results of the zooplankton investigations it can be concluded that after dredging of the side arm and reopening the rock dam the abundance of the zooplankton is lower than in the previous years. The magnitude of the stocks in the side arm is similar to that values determined in the main river arm. The species occurring in the water bodies are good indicators of the eutrophic, slow flowing surface water types in Hungary.

3.3.3 Macrozoobenthon

Results of quantitative and qualitative sampling program are illustrated in different tables. Table 3.3.3.1 contains abundance data of the dominant taxa (*Oligochaeta* and *Chironomidae*) as number of individuals/m^2 at various sampling periods and sampling sites (Appendix). The maximum individual numbers of *Oligochaeta* were measured in the second half of the Vén-Duna stretch (at site 3 and 4) in May and June. The abundance conditions were changed during the autumn period because the largest amount of worms was detected in both the beginning and the final section (site 1, 2 and 4), respectively. The overall maximum of Oligochaets was estimated as around 20 thousands/m^2 at site 2, left side, in October.

The number of Chironomids was much lower than that of the worms. It varied between values less than 100 and few hundreds till almost 100 thousand per m^2. Much lower values were detected in May and June than in the later sampling period. The overall maximum value per m^2 of midge fly larvae was found in the beginning section of the side arm at left side (more than 88000).

Data indicate that huge differences were experienced between sites. The most probable explanation of that phenomenon is the patching of the sediment composition. The worms and the Chironomid larvae prefer the fine fraction of the sediment that is rich in organic material. Such kind of sediment depositions is available basically along the whole side arm due to the variable current conditions at the different cross sections. VD2 on the left side seems to be such a place having usually higher individual number values concerning Oligochaets. Similarly, the upper end of the Vén-Duna has an extended plate of fine sediment deposition connected immediately to the right bank.

Table 3.3.3.2 shows the list of macroscopic invertebrate taxa detected in the Vén-Duna and the River Danube during 1999 (see Appendix). Altogether 47 taxa (without species names of determined *Chironomidae*) are shown. Most of the species occurred in both water bodies during 1999. There are 9 taxa detected only in the Vén-Duna, and altogether 8 of the only Danubian taxa were identified. This result indicates that there is a wide overlap in the yearly distribution of the species.

The cumulative list of *Chironomidae* taxa are shown in the Table 3.3.3.3 indicating the taxa occurred in the two water bodies. It is shown that 22 of the 23 taxa characterise the Vén-Duna. One of them (*Cardiocladius capucinus* was found only in the Vén-Duna). There was one among the 6 species detected in the River Danube that was described only from the main arm (*Chironomus aprilinus*). The side arm has far richer *Chironomidae* fauna than the River Danube at that section.

Generally it can be stated that most of the benthic species detected in both the side arm and the River Danube belonged to the group of Mollusca. This group contains 26 species. The mussels represent 10 species, including the invading *Corbicula fluminea* and *C. fluminalis* originating from the River Rhine system. The large species number of mussels generally characterises the main arm of the Lower Hungarian Danube section and the Hungarian side arms, respectively. During the monitoring most of the mussel species were common in the River Danube also.

These data are the first *Corbicula* records in Hungary. At first juveniles of these species occurred in the samples collected in June at the sampling site VD1, in the middle of the side arm (Table 3.3.3.5). The depth of the water exceeded 12 m where an Ekman grab was used for the quantitative sampling of the benthic community. Another location was registered in September (Table 3.3.3.6): The side arm of the island situated below the reopened rock dam proved to be the second point of these species from which adults were observed also colonising the river bed along the Vén-Duna arm. The first Danubian record came from the October sampling when only the *Corbicula fluminea* was detected at the 1483 river km section on the right bank. Finally both species were found at the same site in November at extreme low water level. At that time VD2 and VD3 proved to be new locations for these mussels in the Vén-Duna.

The first Hungarian record of *Theodoxus fluviatilis* is presented among the results of the October and November sampling period (Tables 3.3.3.7-8). The lowest point of the distribution of this species was described in the section of Paks, at 1526 river km by CSÁNYI (1997). Now it is known from the section of Baja (1483 river km), as well.

One of the river dragonfly species (*Gomphus flavipes*) was detected in the Vén-Duna in September, October and November. It was found in the River Danube in November, too. The colonisation of the Vén-Duna by caseless caddis larvae was experienced in 1999, since summer time (Table 3.3.3.5-8). The large overlap of the species distribution and the increasing occurrence of Danubian species in the Vén-Duna side arm are evidently initiated by the reopening of the side channel.

The analysis of species number at each sampling occasion leads to the following conclusions. Largest number of benthic species were found in September and October in case of the Vén-Duna, and in October and November in the main arm of the River Danube, respectively (Table 3.3.3.9). The earlier peak experienced in the side arm might have the seasonal reason whereas the later one in the main river arm should be explained with the very low water flow and water level. Benthic organisms can be collected with very high efficiency in those circumstances.

Table 3.3.3.9 Number of species in different water bodies.

Date of sampling	***Water level at Baja (cm)***	**Number of species**		
		Total	**Vén-Duna**	**River Danube**
05 May	***541***	**19**	**12**	**6**
18 June	***483***	**24**	**16**	**14**
07 September	***411***	**33**	**27**	**5**
20 October	***206***	**30**	**24**	**18**
11 November	***158***	**22**	**10**	**16**

3.3.4 Fish

3.3.4.1 On-site survey

The aim of the fishing was to detect the effects of the water training works on the natural habitats of the fish stock in the Vén-Duna side arm. Therefore the investigation of two different sampling sites was performed. The surrounding of the reopened rock dam of the Vén-Duna and both sides of the main arm of the River Danube around 1483 river km were involved in the fish study.

Based on the fish sampling 16 species were detected altogether during the study period of 1999 (Table 3.3.4.1). Comparing to the results of the previous year the species number is smaller.

The bleak (*Alburnus alburnus*) was the most abundant species in the samples collected in the end of July in the Vén-Duna and the River Danube, too. Most probably the turbidity of water played an important role in that phenomenon. The bleak escapes from danger mostly by visual orientation that had limited use during flooding.

At the end of August the roach (*Rutilus rutilus*), as a lenitic species occurred in the biggest amount in the Vén-Duna catch. The burbot (*Lota lota*) became the most abundant fish species in the River Danube at the same time at both (right and left) sides of the river. Several specimens of the new river goby species (*Neogobius kessleri*) were caught in the Danube recently. Its number is increasing nowadays along the whole Hungarian section. The other, also ponto-caspic species (*Neogobius fluviatilis*) started to be common in Hungary since the beginning of the 1970s whereas *N. kessleri* was found first in the Danube in 1996 (ERŐS and GUTI).

The former limnophilous rudd (*Scardinius erythrophthalmus*) was not detected in the Vén-Duna side arm in 1999 but the number of rheophilous species (*Aspius aspius, Leuciscus leuciscus, Lota lota, Neogobius kessleri*) increased. These animals are characterising the main arm principally. Their presence in the Vén-Duna indicates the better trans-passing possibilities of the rock dam for fishes due to the rehabilitation works.

Based on personal communication with local fishermen a taxon list was formed in order to characterise the relative abundance of the different Danubian fish species living in the investigated section of the river (Table 3.3.4.2). However, the overall decrease of abundance of fishes was told by them mentioning few possible reason of this phenomenon.

3.3.4.2 On-site interviews (based on personal communication)

Based on information collected from local fishermen and nature conservationists the following current problems have to be mentioned concerning the fish stock of the relevant Danube section: the sharp decrease of stock in the main arm and in the side arms, as well. The size of fish population present in any of the side arms is highly depending on the actual stock size of the main Danube arm

The main arm contains smaller and smaller amount of fish stocks each year, according to the catch results of the fishermen living in the Lower Hungarian Danube area. They estimate that the stock started to decrease since the end of the 80s sharply. The rate of decrease is between one-tenth and one-twentieth of its original value. This figure was given on the basis of the yearly catch data of several individual fishermen working on the Danube section between 1580 and 1440 river km (Dunaföldvár-Mohács).

The reasons of the recent decrease are different according to the opinion of local people. Several fishermen emphasis one specific reason for explaining that. They say that the main Danube arm is over fished in this region. There are too many people dealing with fishing either in official way (i.e. having perfect licence) or in unofficial fishing activity.

The amount of fish entering the side arms along the whole Lower Hungarian Danube is decreasing also. There are several observations specifically in the side arms when huge amount of cormorants (*Phalacrocorax carbo*) was experienced, especially in early winter periods. Several thousands of these birds are appearing in the side arms and stagnant water bodies of the Gemenc area just before the ice formation. Local nature conservationists observed that the birds used to fish in this back waters in very big groups with extremely high efficiency. At that time all of the fishes which were already wintering in the deeper sections of side arms had been driven out from their resting-place. In the mean time the birds made enormous slaughtering among the stock. The destroying of the yearly natural replacement of several fish species is common phenomenon in this region. For example a strong stock of pikeperch (average size approximately 25 cm) was extinct from a side arm by the cormorants in 1998 during the wintertime. Many other observations showed that the most delicate food resource was the 1-2 years old stock of sturgeon (*Acipenser ruthenus*) in the main Danube arm for these fishing birds.

These facts (i.e. the over fishing of the Danube by fishermen and by the cormorants) consequently can result in dramatic change of the fish stock in long time scale. According to the recent information collected from the local residents both the main Danube arm and the adjacent side arms are lacking in healthy stocks of different fish species since several years. In that case the estimation of the effect of the reopening action carried out in the Vén-Duna arm in 1998 on the natural fish population can be very difficult. Therefore these experimental fishing results enclosed to the report should be evaluated carefully.

4. General discussion and conclusions

Based on the physical and chemical characteristics of the water very similar values were measured in the Vén-Duna and the River Danube during May in high water flow conditions. In **June** small differences were observed between the main- and side arm in the values of several chemical components (i.e. *chemical oxygen demand*, *chlorophyll-a*). Several variables became lower In **September** in the Vén-Duna the minimal values were observed in the middle part. In **October** significant difference was observed between the main and the side arms only in the concentration of the *total suspended solids* and the *chlrophyll-a*. The maximum of the former and the minimum in the latter were observed in the Danube. In **November** the physical and chemical characteristics of the water were nearly identical in both the Vén-Duna and Danube with the exception of the total suspended solids. The value of this component was higher in the Danube again.

It was concluded that the population density and taxonomic composition of the phytoplankton was influenced primarily by the seasonal dynamics. The different flow regime did not effect seriously the phytoplankton composition and abundance because the side arm and the Danube was very similar to each other during the whole year. The abundance of the zooplankton is lower than in the previous years. The magnitude of the stocks in the side arm is similar to that values determined in the main river arm.

The colonisation of the Vén-Duna by several benthic species was experienced in 1999. Two new *Mollusca* species for the Carpathian Basin were identified in the region. The large overlap of the species distribution in the two water bodies and the increasing occurrence of Danubian species in the Vén-Duna side arm are evidently initiated by the reopening of the side channel.

It can be demonstrated that the differences between the values of the detected chemical and biological variables in the two water bodies are gradually increasing together with the decrease of the flow. However, in case of very low Danubian flow the measured components became again similar to each other in the main and the side arm. This case the character of the main Danube arm becomes similar to the side arm that has a well-defined flow rate due to the reopened situation. The formerly experienced remarkable individualisation of the different sections of the side arm disappeared after the rehabilitation measures have taken.

Some of the rheophilous fish species (*Aspius aspius, Leuciscus leuciscus, Lota lota, Neogobius kessleri*) increased in the Vén-Duna in 1999 but the number of detected species decreased These experimental fishing data should be handled carefully, including other opinions about the fish stock, as well. Based on personal communication with local fishermen and nature conservationists there are recent experiences of the sharp decrease referring to the fish stock both in the Danube and the Danubian side arms. Two reasons are mentioned: over-fishing by human action and by the wintering Cormorants.

APPENDIX

Basic measured data during the monitoring of the Vén-Duna and River Danube in 1999

December 1999

Table 2.3.1 Physical and chemical characteristics of the water. Vén-Danube and Danube, 1999.

		VD1	**VD2**	**VD3**	**VD4**	**D6**	**min**	**max**	**avg.**
		05. May	**05. May**	**05. May**	**05. May**	**05. May**			
Water temperature	^{o}C	14,6	14,7	14,6	14,8	14,3	14,3	14,8	14,6
pH		8,32	8,33	8,32	8,31	8,32	8,31	8,33	8,32
Specific conductivity	uS/cm	403	405	401	403	397	397	405	401,8
Total dissolved material	mg/l	312	298	306	302	300	298	312	303,6
Total suspended solids	mg/l	24	24	21	23	24	21	24	23,2
Chemical oxygen demand (COD-Cr)	mg/l	19,3	14,7	14,7	21,0	14,7	14,7	21	16,9
Total organic carbon (TOC)	mg/l	6,1	5,7	5,5	6,3	5,5	5,5	6,3	5,8
Dissolved oxygen	mg/l	10,50	10,50	10,50	10,30	10,40	10,30	10,50	10,44
Biochemical oxygen demand	mg/l	3,00	3,10	3,10	3,10	3,00	3,00	3,10	3,06
Chlorophyll-a	mg/l	40	43	40	39	44	39	44	41,2
Ammonia-N	mg/l	0,10	0,09	0,07	0,09	0,05	0,05	0,10	0,08
Nitrite-N	mg/l	0,020	0,020	0,020	0,020	0,020	0,020	0,020	0,020
Nitrate-N	mg/l	1,84	1,85	1,87	1,84	1,87	1,84	1,87	1,85
Organic-N	mg/l	0,00	0,19	0,08	0,11	0,10	0	0,19	0,096
Total-N	mg/l	**1,96**	**2,15**	**2,04**	**2,06**	**2,04**	1,96	2,15	2,05
Ammonia-N	%	5,1	4,2	3,4	4,4	2,5	2,5	5,1	3,9
Nitrite-N	%	1,0	0,9	1,0	1,0	1,0	0,9	1,0	1,0
Nitrate-N	%	**93,9**	**86,0**	**91,7**	**89,3**	**91,7**	86,0	93,9	90,5
Organic-N	%	0,0	8,8	3,9	5,3	4,9	0,0	8,8	4,6
Total-N	%	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Dissolved ortho-phosphate-P	mg/l	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
Total-P	mg/l	0,13	0,12	0,12	0,11	0,12	0,11	0,13	0,12

Table 2.3.2 Physical and chemical characteristics of the water. Vén-Danube and Danube, 1999.

		VD1	VD2	VD3	VD4	D6	min	max	avg
		18. June	**18. June**	**18. June**	**18. June**	**18. June**			
Water temperature	oC	22,0	22,2	21,8	22,0	22,0	21,8	22,2	22,0
pH		7,81	7,91	7,98	7,94	7,95	7,81	7,98	7,92
Specific conductivity	US/cm	354	352	355	353	350	350	355	352,8
Total dissolved material	mg/l	266	255	253	238	239	238	266	250,2
Total suspended solids	mg/l	80	67	61	36	76	36	80	64
Chemical oxygen demand (COD-Cr)	mg/l	13,0	15,0	12,0	16,0	23,0	12	23	15,8
Total organic carbon (TOC)	mg/l	2,6	0,5	3,2	2,7	2,7	0,5	3,2	2,3
Dissolved oxygen	mg/l	6,81	7,71	7,72	7,84	7,90	6,81	7,90	7,60
Percentage saturation	%	90,7	90,5	89,9	91,6	90,7	89,9	91,6	90,7
Biochemical oxygen demand	mg/l	1,63	3,61	1,53	1,63	2,10	1,53	3,61	2,10
Chlorophyll-a	mg/l	7,4	5,9	6,7	8,9	4,4	4,4	8,9	6,7
Ammonia-N	mg/l	0,11	0,10	0,12	0,09	0,06	0,06	0,12	0,10
Nitrite-N	mg/l	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030
Nitrate-N	mg/l	1,80	1,80	1,80	1,70	1,90	1,70	1,90	1,80
Organic-N	mg/l	0,50	0,43	1,14	0,53	0,49	0,43	1,14	0,62
Total-N	mg/l	**2,44**	**2,36**	**3,09**	**2,35**	**2,48**	2,35	3,09	2,54
Ammonia-N	%	4,5	4,2	3,9	3,8	2,4	2,4	4,5	3,8
Nitrite-N	%	1,2	1,3	1,0	1,3	1,2	1,0	1,3	1,2
Nitrate-N	%	**73,8**	**76,3**	**58,3**	**72,3**	**76,6**	58,3	76,6	71,4
Organic-N	%	**20,5**	**18,2**	**36,9**	**22,6**	**19,8**	18,2	36,9	23,6
Total-N	%	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Dissolved ortho-phosphate-P	mg/l	0,07	0,06	0,07	0,06	0,06	0,06	0,07	0,064
Total-P	mg/l	0,25	0,23	0,21	0,20	0,23	0,20	0,25	0,224

Table 2.3.3 Physical and chemical characteristics of the water. Vén-Danube and Danube, 1999.

		VD1	VD2	VD3	VD4	D6	min	max	avg
		07. Sept	07. Sept	07. Sept	07. Sept	07. Sept			
Water temperature	oC	19,0	19,0	18,9	19,0	18,9	18,9	19,0	19,0
pH		8,02	8,11	8,13	8,20	8,06	8,02	8,2	8,10
Specific conductivity	uS/cm	360	355	357	358	350	350	360	356
Total dissolved material	mg/l	276	270	260	260	260	260	276	265,2
Total suspended solids	mg/l	33	32	18	20	32	18	33	27
Chemical oxygen demand (COD-Cr)	mg/l	12,1	12,1	10,1	12,1	12,1	10,1	12,1	11,7
Total organic carbon (TOC)	mg/l	2,7	2,7	2,2	2,7	2,7	2,2	2,7	2,6
Dissolved oxygen	mg/l	8,74	7,69	8,83	8,94	8,40	7,69	8,94	8,52
Percentage saturation	%	96,2	84,6	96,9	98,4	92,2	84,6	98,4	93,7
Biochemical oxygen demand	mg/l	2,22	2,30	1,65	2,10	2,17	1,65	2,30	2,09
Chlorophyll-a	mg/l	17,0	12,6	17,0	14,1	11,1	11,1	17,0	14,4
Ammonia-N	mg/l	0,02	0,01	0,03	0,02	0,03	0,01	0,03	0,02
Nitrite-N	mg/l	0,020	0,020	0,020	0,020	0,010	0,010	0,020	0,018
Nitrate-N	mg/l	1,60	1,60	1,50	1,50	1,50	1,50	1,60	1,54
Organic-N	mg/l	1,63	1,22	0,81	1,37	1,46	0,81	1,63	1,30
Total-N	mg/l	**3,27**	**2,85**	**2,36**	**2,91**	**3,00**	2,36	3,27	2,88
Ammonia-N	%	0,6	0,4	1,3	0,7	1,0	0,4	1,3	0,8
Nitrite-N	%	0,6	0,7	0,8	0,7	0,3	0,3	0,8	0,6
Nitrate-N	%	**48,9**	**56,1**	**63,6**	**51,5**	**50,0**	48,9	63,6	54,0
Organic-N	%	**49,8**	**42,8**	**34,3**	**47,1**	**48,7**	34,3	49,8	44,5
Total-N	%	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Dissolved ortho-phosphate-P	mg/l	0,04	0,04	0,03	0,03	0,04	0,03	0,04	0,036
Total-P	mg/l	0,11	0,12	0,07	0,09	0,08	0,07	0,12	0,094

Table 2.3.4 Physical and chemical characteristics of the water. Vén-Danube and Danube, 1999.

		VD1	VD2	VD3	VD4	D6	min	max	avg
		20. Oct	20. Oct	20. Oct	20. Oct	20. Oct			
Water temperature	oC	12,3	12,2	11,9	12,2	11,7	11,7	12,3	12,06
pH		8,00	8,00	7,90	7,80	7,90	7,80	8,00	7,92
Specific conductivity	uS/cm	473	469	470	469	461	461	473	468,4
Total dissolved material	mg/l	266	290	298	294	300	266	300	289,6
Total suspended solids	mg/l	0,4	7,2	4,4	4,0	18	0,4	18	6,8
Chemical oxygen demand (COD-Cr)	mg/l	14,2	12,2	13,2	14,2	12,2	12,2	14,2	13,2
Total organic carbon (TOC)	mg/l	4,1	4,3	4,1	4,6	3,8	3,8	4,6	4,2
Dissolved oxygen	mg/l	9,43	9,51	9,74	9,25	9,53	9,25	9,74	9,49
Biochemical oxygen demand	mg/l	1,21	1,65	1,68	3,86	1,82	1,21	3,86	2,04
Chlorophyll-a	mg/l	14,0	19,0	16,0	18,0	12,0	12,0	19,0	15,8
Ammonia-N	mg/l	0,16	0,15	0,11	0,12	0,10	0,1	0,16	0,13
Nitrite-N	mg/l	0,020	0,030	0,020	0,020	0,020	0,02	0,03	0,02
Nitrate-N	mg/l	1,70	1,60	1,80	1,50	1,60	1,50	1,80	1,64
Organic-N	mg/l	0,30	0,29	0,33	0,33	0,33	0,29	0,33	0,32
Total-N	mg/l	**2,18**	**2,07**	**2,26**	**1,97**	**2,05**	1,97	2,26	2,11
Ammonia-N	%	7,3	7,2	4,9	6,1	4,9	4,9	7,3	6,1
Nitrite-N	%	0,9	1,4	0,9	1,0	1,0	0,9	1,4	1,0
Nitrate-N	%	**78,0**	**77,3**	**79,6**	**76,1**	**78,0**	76,1	79,6	77,8
Organic-N	%	**13,8**	**14,0**	**14,6**	**16,8**	**16,1**	13,8	16,8	15,0
Total-N	%	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Dissolved ortho-phosphate-P	mg/l	0,13	0,11	0,11	0,09	0,13	0,09	0,13	0,11
Total-P	mg/l	0,13	0,12	0,12	0,13	0,16	0,12	0,16	0,13

Table 2.3.5 Physical and chemical characteristics of the water. Vén-Danube and Danube, 1999.

		VD1	**VD2**	**VD3**	**VD4**	**D6**	**min**	**max**	**avg**
		11. Nov	**11. Nov**	**11. Nov**	**11. Nov**	**11. Nov**			
Water temperature	oC	10,5	10,5	10,0	9,5	10,0	9,5	10,5	10,1
pH		7,89	7,92	7,93	7,82	7,99	7,82	7,99	7,91
Specific conductivity	uS/cm	551	525	528	533	512	512	551	529,8
Total dissolved material	mg/l	276	270	276	280	268	268	280	274
Total suspended solids	mg/l	12	14	7,0	7,5	21	7,0	21	12,3
Chemical oxygen demand (COD-Cr)	mg/l	11,1	11,1	10,1	9,1	11,1	9,1	11,1	10,5
Total organic carbon (TOC)	mg/l	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/l	9,97	9,79	9,50	8,63	10,05	8,63	10,05	9,59
Percentage saturation	%	90,7	89,1	85,4	76,6	90,4	76,6	90,7	86,4
Biochemical oxygen demand	mg/l	1,46	2,07	1,50	1,52	1,70	1,46	2,07	1,65
Chlorophyll-a	mg/l	16,0	20,0	16,0	11,0	14,0	11,0	20,0	15,4
Ammonia-N	mg/l	0,18	0,24	0,25	0,29	0,13	0,13	0,29	0,22
Nitrite-N	mg/l	0,039	0,036	0,035	0,033	0,032	0,032	0,039	0,035
Nitrate-N	mg/l	2,10	2,11	2,08	1,83	2,18	1,83	2,18	2,06
Organic-N	mg/l	0,64	0,61	0,56	0,67	0,74	0,56	0,74	0,64
Total-N	mg/l	**2,95**	**3,00**	**2,91**	**2,82**	**3,08**	2,82	3,08	2,95
Ammonia-N	%	6,0	8,0	8,4	**10,4**	4,3	4,3	10,4	7,4
Nitrite-N	%	1,3	1,2	1,2	1,2	1,0	1,0	1,3	1,2
Nitrate-N	%	**70,9**	**70,4**	**71,3**	**64,8**	**70,7**	64,8	71,3	69,6
Organic-N	%	**21,8**	**20,4**	**19,1**	**23,6**	**24,0**	19,1	24,0	21,8
Total-N	%	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Dissolved ortho-phosphate-P	mg/l	0,09	0,07	0,06	0,04	0,07	0,04	0,09	0,066
Total-P	mg/l	0,11	0,12	0,11	0,1	0,11	0,1	0,12	0,11

Table 3.3.1.1 Biomass of phytoplankton: Vén-Duna and River Danube, 1999.

TAXA	VD1	VD2	VD3	VD4	D6	min	Max	avg
	05. May	05. May	05. May	05. May	05. May			
	Biomass [ug/l]							
SUM Cyanophyta	0	0	0	13	0	**0**	**13**	**3**
SUM Euglenophyta	0	1	0	0	3	**0**	**3**	**1**
SUM Cryptophyceae	289	15	59	174	0	**0**	**289**	**107**
SUM Dinophyceae	0	0	0	0	0	**0**	**0**	**0**
SUM Chrysophyceae	89	52	182	27	17	**17**	**182**	**73**
SUM Centrales	12686	13835	13327	11593	10178	**10178**	**13835**	**12324**
SUM Pennales	229	803	642	567	362	**229**	**803**	**521**
SUM Chlorococcales	289	279	388	299	160	**160**	**388**	**283**
SUM Flagellatae	69	11	38	11	19	**11**	**69**	**29**
SUM others	784	1803	1240	1294	647	**647**	**1803**	**1153**
SUM	**14435**	**16798**	**15876**	**13978**	**11386**	**11386**	**16798**	**14495**
	Relative abundance [%]							
SUM Cyanophyta	0,0	0,0	0,0	0,1	0,0	**0,0**	**0,1**	**0,0**
SUM Euglenophyta	0,0	0,0	0,0	0,0	0,0	**0,0**	**0,0**	**0,0**
SUM Cryptophyceae	2,0	0,1	0,4	1,2	0,0	**0,0**	**2,0**	**0,7**
SUM Dinophyceae	0,0	0,0	0,0	0,0	0,0	**0,0**	**0,0**	**0,0**
SUM Chrysophyceae	0,6	0,3	1,1	0,2	0,1	**0,1**	**1,1**	**0,5**
SUM Centrales	**87,9**	**82,4**	**83,9**	**82,9**	**89,4**	**82,4**	**89,4**	**85,3**
SUM Pennales	1,6	4,8	4,0	4,1	3,2	**1,6**	**4,8**	**3,5**
SUM Chlorococcales	2,0	1,7	2,4	2,1	1,4	**1,4**	**2,4**	**1,9**
SUM Flagellatae	0,5	0,1	0,2	0,1	0,2	**0,1**	**0,5**	**0,2**
SUM others	5,4	**10,7**	7,8	9,3	5,7	**5,4**	**10,7**	**7,8**
SUM	100,0	100,0	100,0	100,0	100,0			**100,0**

Table 3.3.1.2. Biomass of phytoplankton: Vén-Duna and River Danube, 1999.

TAXA	VD1	VD2	VD3	VD4	D6	min	Max	avg
	18. June	18. June	18. June	18. June	18. June			
	biomass [ug/l]							
SUM Cyanophyta	128	119	456	13	85	**13**	**456**	**160**
SUM Euglenophyta	1	0	1	0	0	**0**	**1**	**0**
SUM Cryptophyceae	375	516	163	3	286	**3**	**516**	**269**
SUM Dinophyceae	0	0	5	0	0	**0**	**5**	**1**
SUM Chrysophyceae	69	0	100	28	0	**0**	**100**	**40**
SUM Centrales	1084	1195	1477	977	1103	**977**	**1477**	**1167**
SUM Pennales	63	1089	256	165	410	**63**	**1089**	**397**
SUM Chlorococcales	418	633	493	323	681	**323**	**681**	**510**
SUM Flagellatae	0	0	19	11	29	**0**	**29**	**12**
SUM others	398	292	916	404	403	**292**	**916**	**482**
SUM	**2537**	**3845**	**3884**	**1924**	**2997**	**1924**	**3884**	**3037**
	relative abundance [%]							
SUM Cyanophyta	5,1	3,1	**11,7**	0,7	2,8	**0,7**	**11,7**	**4,7**
SUM Euglenophyta	0,1	0,0	0,0	0,0	0,0	**0,0**	**0,1**	**0,0**
SUM Cryptophyceae	**14,8**	**13,4**	4,2	0,1	9,6	**0,1**	**14,8**	**8,4**
SUM Dinophyceae	0,0	0,0	0,1	0,0	0,0	**0,0**	**0,1**	**0,0**
SUM Chrysophyceae	2,7	0,0	2,6	1,5	0,0	**0,0**	**2,7**	**1,4**
SUM Centrales	**42,7**	**31,1**	**38,0**	**50,8**	**36,8**	**31,1**	**50,8**	**39,9**
SUM Pennales	2,5	**28,3**	6,6	8,6	**13,7**	**2,5**	**28,3**	**11,9**
SUM Chlorococcales	**16,5**	**16,5**	**12,7**	**16,8**	**22,7**	**12,7**	**22,7**	**17,0**
SUM Flagellatae	0,0	0,0	0,5	0,6	1,0	**0,0**	**1,0**	**0,4**
SUM others	**15,7**	7,6	**23,6**	**21,0**	**13,4**	**7,6**	**23,6**	**16,3**
SUM	100,0	100,0	100,0	100,0	100,0			**100,0**

Table 3.3.1.3. Biomass of phytoplankton: Vén-Duna and River Danube, 1999.

TAXA	VD1	VD2	VD3	VD4	D6	min	Max	avg
	07. Sept	07. Sept	07. Sept	07. Sept	07. Sept			
	Biomass [ug/l]							
SUM Cyanophyta	54	55	936	490	49	**49**	**936**	**317**
SUM Euglenophyta	0	0	0	1	0	**0**	**1**	**0**
SUM Cryptophyceae	30	733	15	58	382	**15**	**733**	**243**
SUM Dinophyceae	0	0	21	1561	0	**0**	**1561**	**316**
SUM Chrysophyceae	0	1	0	0	0	**0**	**1**	**0**
SUM Centrales	3039	7908	10173	7615	5803	**3039**	**10173**	**6908**
SUM Pennales	35	320	39	440	1	**1**	**440**	**167**
SUM Chlorococcales	928	1036	579	849	853	**579**	**1036**	**849**
SUM Flagellatae	117	388	119	20	311	**20**	**388**	**191**
SUM others	300	374	466	236	748	**236**	**748**	**425**
SUM	**4503**	**10815**	**12347**	**11272**	**8147**	**4503**	**12347**	**9417**
	Relative abundance [%]							
SUM Cyanophyta	1,2	0,5	7,6	4,3	0,6	**0,5**	**7,6**	**2,8**
SUM Euglenophyta	0,0	0,0	0,0	0,0	0,0	**0,0**	**0,0**	**0,0**
SUM Cryptophyceae	0,7	6,8	0,1	0,5	4,7	**0,1**	**6,8**	**2,6**
SUM Dinophyceae	0,0	0,0	0,2	**13,8**	0,0	**0,0**	**13,8**	**2,8**
SUM Chrysophyceae	0,0	0,0	0,0	0,0	0,0	**0,0**	**0,0**	**0,0**
SUM Centrales	**67,5**	**73,1**	**82,4**	**67,6**	**71,2**	**67,5**	**82,4**	**72,4**
SUM Pennales	0,8	3,0	0,3	3,9	0,0	**0,0**	**3,9**	**1,6**
SUM Chlorococcales	**20,6**	9,6	4,7	7,5	**10,5**	**4,7**	**20,6**	**10,6**
SUM Flagellatae	2,6	3,6	1,0	0,2	3,8	**0,2**	**3,8**	**2,2**
SUM others	6,7	3,5	3,8	2,1	9,2	**2,1**	**9,2**	**5,0**
SUM	100,0	100,0	100,0	100,0	100,0			**100,0**

Table 3.3.1.4. Biomass of phytoplankton: Vén-Duna and River Danube, 1999.

TAXA	VD1	VD2	VD3	VD4	D6	min	Max	avg
	20. Oct	20. Oct	20. Oct	20. Oct	20. Oct			
	Biomass [ug/l]							
SUM Cyanophyta	263	467	118	226	209	**118**	**467**	**257**
SUM Euglenophyta	1	8	0	110	261	**0**	**261**	**76**
SUM Cryptophyceae	333	393	481	242	278	**242**	**481**	**345**
SUM Dinophyceae	0	2	0	0	69	**0**	**69**	**14**
SUM Chrysophyceae	0	0	1	76	0	**0**	**76**	**16**
SUM Centrales	1323	1920	2697	2370	1913	**1323**	**2697**	**2045**
SUM Pennales	82	37	47	45	123	**37**	**123**	**67**
SUM Chlorococcales	180	209	242	564	329	**180**	**564**	**305**
SUM Flagellatae	64	20	19	30	35	**19**	**64**	**33**
SUM others	303	231	596	412	361	**231**	**596**	**381**
SUM	**2549**	**3288**	**4201**	**4074**	**3578**	**2549**	**4201**	**3538**
	relative abundance [%]							
SUM Cyanophyta	**10,3**	**14,2**	2,8	5,5	5,8	**2,8**	**14,2**	**7,7**
SUM Euglenophyta	0,1	0,2	0,0	2,7	7,3	**0,0**	**7,3**	**2,1**
SUM Cryptophyceae	**13,1**	**12,0**	**11,4**	5,9	7,8	**5,9**	**13,1**	**10,0**
SUM Dinophyceae	0,0	0,1	0,0	0,0	1,9	**0,0**	**1,9**	**0,4**
SUM Chrysophyceae	0,0	0,0	0,0	1,9	0,0	**0,0**	**1,9**	**0,4**
SUM Centrales	**51,9**	**58,4**	**64,2**	**58,2**	**53,5**	**51,9**	**64,2**	**57,2**
SUM Pennales	3,2	1,1	1,1	1,1	3,4	**1,1**	**3,4**	**2,0**
SUM Chlorococcales	7,1	6,4	5,8	**13,8**	9,2	**5,8**	**13,8**	**8,4**
SUM Flagellatae	2,5	0,6	0,5	0,7	1,0	**0,5**	**2,5**	**1,1**
SUM others	**11,9**	7,0	**14,2**	**10,1**	**10,1**	**7,0**	**14,2**	**10,7**
SUM	100,0	100,0	100,0	100,0	100,0			**100,0**

Table 3.3.1.5. Biomass of phytoplankton: Vén-Duna and River Danube, 1999.

TAXA	VD1	VD2	VD3	VD4	D6	min	Max	avg
	11. Nov	11. Nov	11. Nov	11. Nov	11. Nov			
	biomass [ug/l]							
SUM Cyanophyta	311	263	200	20	49	**20**	**311**	**169**
SUM Euglenophyta	3	7	23	0	478	**0**	**478**	**102**
SUM Cryptophyceae	1767	582	605	337	60	**60**	**1767**	**670**
SUM Dinophyceae	33	1	101	0	72	**0**	**101**	**41**
SUM Chrysophyceae	1	0	87	54	0	**0**	**87**	**28**
SUM Centrales	4772	3924	3651	2869	2432	**2432**	**4772**	**3529**
SUM Pennales	277	280	505	220	477	**220**	**505**	**352**
SUM Chlorococcales	584	233	143	528	412	**143**	**584**	**380**
SUM Flagellatae	140	124	162	137	249	**124**	**249**	**162**
SUM others	1449	913	944	559	895	**559**	**1449**	**952**
SUM	**9337**	**6327**	**6421**	**4724**	**5123**	**4724**	**9337**	**6386**
	relative abundance [%]							
SUM Cyanophyta	3,3	4,2	3,1	0,4	1,0	**0,4**	**4,2**	**2,4**
SUM Euglenophyta	0,0	0,1	0,4	0,0	9,3	**0,0**	**9,3**	**2,0**
SUM Cryptophyceae	**18,9**	9,2	9,4	7,1	1,2	**1,2**	**18,9**	**9,2**
SUM Dinophyceae	0,4	0,0	1,6	0,0	1,4	**0,0**	**1,6**	**0,7**
SUM Chrysophyceae	0,0	0,0	1,4	1,1	0,0	**0,0**	**1,4**	**0,5**
SUM Centrales	**51,1**	**62,0**	**56,9**	**60,7**	**47,5**	**47,5**	**62,0**	**55,6**
SUM Pennales	3,0	4,4	7,9	4,7	9,3	**3,0**	**9,3**	**5,8**
SUM Chlorococcales	6,3	3,7	2,2	**11,2**	8,0	**2,2**	**11,2**	**6,3**
SUM Flagellatae	1,5	2,0	2,5	2,9	4,9	**1,5**	**4,9**	**2,7**
SUM others	**15,5**	**14,4**	**14,7**	**11,8**	**17,5**	**11,8**	**17,5**	**14,8**
SUM	100,0	100,0	100,0	100,0	100,0			**100,0**

Table 3.3.2.1 Abundance values of the zooplankton (05. 05. 1999.).

TAXA	**Sampling sites**				
	VD1	**VD2**	**VD3**	**VD4**	**D**
ROTATORIA					
Ascomorpha ecaudis	*16*	*130*	*86*	*260*	*86*
Asplanchna priodonta	*520*	*520*	*608*	*434*	
Bdelloidea sp.	*434*	*348*	*260*	*174*	*260*
Brachionus angularis	*86*	*86*	*260*	*174*	*130*
B. calyciflorus calyciflorus	*520*	*304*	*348*	*520*	*86*
B. leydigi tridentatus		*4*			
B. quadridentatus quadridentatus		*2*			
B. urceus	*260*	*174*	*174*	*174*	*86*
Euchlanis dilatata		*4*	*4*		
Keratella cochlearis cochlearis	*260*	*174*	*86*	*130*	*130*
K. c. tecta	*86*	*174*	*130*	*174*	*86*
K. quadrata	*346*	*434*	*86*	*174*	*86*
Notholca acuminata				*4*	*4*
Polyarthra vulgaris	*44*	*44*	*174*	*86*	*130*
Trichotria truncata	*4*				
CLADOCERA					
Bosmina longirostris	*4*	*4*		*8*	*2*
Chydorus sphaericus		*4*	*2*	*8*	
Daphnia longispina	*2*	*4*		*2*	*4*
COPEPODA					
Acanthocyclops robustus	*24*	*24*	*16*	*16*	*4*
Cyclops vicinus		*8*	*2*		
Cyclops sp.			*4*	*6*	
Eucyclops serrulatus				*2*	
Mesocyclops leuckarti	*16*	*12*	*4*	*8*	
nauplius larvae	*260*	*346*	*434*	*348*	*174*
kopepodit larvae	*16*	*32*	*36*	*30*	*12*
Total	**2898**	**2832**	**2714**	**2732**	**1280**

Legend: i - individuum/100 liter

Table 3.3.2.2 Results of biomass determinations of the zooplankton (05. 05. 1999.).

TAXA	**Sampling sites**				
	VD1	**VD2**	**VD3**	**VD4**	**D**
ROTATORIA					
Ascomorpha ecaudis	0,03	0,26	0,17	0,52	0,17
Asplanchna priodonta	26,00	26,00	30,40	21,70	
Brachionus angularis	3,44	3,44	1,82	1,22	0,91
B. calyciflorus calyciflorus	20,80	12,16	13,92	20,80	3,44
B. leydigi tridentatus		0,16			
B. quadridentatus quadridentatus		0,04			
B. urceus	10,40	3,48	3,48	3,48	1,72
Euchlanis dilatata		0,16	0,16		
Keratella cochlearis cochlearis	1,56	1,04	0,52	0,78	0,78
K. c. tecta	0,34	0,7	0,52	0,7	0,34
K. quadrata	2,77	3,47	0,69	1,39	0,69
Notholca acuminata				0,01	0,01
Polyarthra vulgaris	0,40	0,40	1,57	0,77	1,17
Trichotria truncata	0,02				
CLADOCERA					
Bosmina longirostris	0,32	0,32		0,64	0,16
Chydorus sphaericus		0,50	0,25	1,00	
Daphnia longispina	0,30	0,60		0,30	0,60
COPEPODA					
Acanthocyclops robustus	8,40	8,40	5,60	5,60	1,40
Cyclops vicinus		2,80	0,70		
Cyclops sp.			0,40	0,60	
Eucyclops serrulatus				0,70	
Mesocyclops leuckarti	4,80	3,60	1,20	2,40	
nauplius larvae	2,60	3,46	4,34	3,48	1,74
kopepodit larvae	0,80	1,60	1,80	1,50	0,60
Total	**82,98**	**72,59**	**67,54**	**67,59**	**13,73**

Legend: b-biomass/100 liter wet weight

Table 3.3.2.3 Abundance values of the zooplankton (18. 06. 1999.).

TAXA	**Sampling sites**				
	VD1	**VD2**	**VD3**	**VD4**	**D**
ROTATORIA					
Ascomorpha ecaudis	20				8
Asplanchna priodonta		26	8		8
Bdelloidea sp.	32	20	24	22	30
Brachionus angularis	30	40	22	16	20
B. budapestinensis		20			
B. calyciflorus calyciflorus	12	62	10		10
B. urceus		26	10		
Keratella cochlearis cochlearis	20	22	10	10	22
K. c. tecta	10	20	12	20	8
K. quadrata		10		8	
Polyarthra vulgaris		20		8	10
Pompholyx complanata		20	10		12
Synchaeta pectinata	10	12			10
CLADOCERA					
Bosmina longirostris	12			6	16
Chydorus sphaericus		6	4		6
Daphnia longispina		4		4	4
COPEPODA					
Acanthocyclops robustus	8	6		6	4
nauplius larvae	90	140	60	32	42
kopepodit larvae	16	32	8	10	20
Total	**240**	**486**	**178**	**142**	**222**

Legend: i - individuum/100 liter

Table 3.3.2.4 Results of biomass determinations of the zooplankton (18.06. 1999.).

TAXA	**Sampling sites**				
	VD1	**VD2**	**VD3**	**VD4**	**D**
ROTATORIA					
Ascomorpha ecaudis	0,04				0,01
Asplanchna priodonta		1,30	0,40		0,40
Brachionus angularis	0,21	0,28	0,15	0,11	0,14
B. budapestinensis		0,12			
B. calyciflorus calyciflorus	0,48	2,48	0,40		0,40
B. urceus		0,52	0,20		
Keratella cochlearis cochlearis	0,12	0,13	0,06	0,06	0,13
K. c. tecta	0,04	0,80	0,05	0,8	0,03
K. quadrata		0,08		0,06	
Polyarthra vulgaris		0,18		0,07	0,09
Pompholyx complanata		0,06	0,03		0,04
Synchaeta pectinata	0,10	0,12			0,10
CLADOCERA					
Bosmina longirostris	0,96			0,48	1,28
Chydorus sphaericus		0,75	0,50		0,75
Daphnia longispina		0,60		0,60	0,60
COPEPODA					
Acanthocyclops robustus	2,80	2,10		2,10	1,40
nauplius larvae	0,90	1,40	0,60	0,32	0,42
kopepodit larvae	0,80	1,60	0,40	0,50	1,00
Total	**6,45**	**12,52**	**2,79**	**5,1**	**6,79**

Legend: b-biomass/100 liter wet weight

Table 3.3.2.5 Results of the zooplankton investigations (07. 09. 1999)

TAXA	Sampling sites				
	VD1	**VD2**	**VD3**	**VD4**	**D**
ROTATORIA					
Asplanchna priodonta	4		4		
Brachionus angularis		4	4	4	8
B. budapestinensis	4	4	4	8	4
B. calyciflorus calyciflorus	20	44	20	16	24
B. c. anuraeiformis	24	40	22	24	20
B. diversicornis	2				
B. quadridentatus brevispinus		2			
B. q. cluniorbicularis					4
B. urceus	2	4	4	8	4
Euchlanis dilatata		4			4
Filinia opoliensis	2				
Keratella cochlearis cochlearis	16	20	8	12	8
K. c. tecta	16	12	4	8	4
Lecane lunaris		4			
Polyarthra vulgaris	4	8		4	
Pompholyx complanata		8		4	
CLADOCERA					
Bosmina longirostris	2	4	4	4	4
Chydorus sphaericus	2			2	2
Daphnia longispina		2	2	2	
Diaphanosoma brachyurum					2
Disparalona rostrata				2	
Moina micrura					2
COPEPODA					
Acanthocyclops robustus	2	2			2
Eucyclops serrulatus				2	2
nauplius larvae	36	32	20	24	16
Kopepodit larvae	8	8	4	8	8
Total	**144**	**202**	**100**	**132**	**118**

Legend: i - individuum/100 liter

Table 3.3.2.6 Results of the zooplankton investigations (07. 09. 1999)

TAXA	**Sampling sites**				
	VD1	**VD2**	**VD3**	**VD4**	**D**
ROTATORIA					
Asplanchna priodonta	0,20		0,20		
Brachionus angularis		0,03	0,03	0,03	0,06
B. budapestinensis	0,02	0,02	0,02	0,04	0,02
B. calyciflorus calyciflorus	0,80	1,76	0,80	0,64	0,96
B. c. anuraeiformis	0,96	1,60	0,88	0,96	0,80
B. diversicornis	0,08				
B. quadridentatus brevispinus		0,04			
B. q. cluniorbicularis					0,08
B. urceus	0,04	0,08	0,08	0,16	0,08
Euchlanis dilatata		0,16			0,16
Filinia opoliensis	0,03				
Keratella cochlearis cochlearis	0,10	0,12	0,05	0,05	0,04
K. c. tecta	0,06	0,05	0,02	0,05	0,04
Lecane lunaris		0,03			
Polyarthra vulgaris	0,04	0,07		0,04	
Pompholyx complanata		0,02		0,01	
CLADOCERA					
Bosmina longirostris	0,16	0,32	0,32	0,32	0,32
Chydorus sphaericus	0,25			0,25	0,25
Daphnia longispina		0,30	0,30	0,30	
Diaphanosoma brachyurum					0,15
Disparalona rostrata				0,12	
Moina micrura					0,12
COPEPODA					
Acanthocyclops robustus	0,70	0,70			0,70
Eucyclops serrulatus				0,70	0,70
Nauplius larvae	0,36	0,32	0,20	0,24	0,16
Kopepodit larvae	0,40	0,40	0,20	0,40	0,40
Total	**4,20**	**6,02**	**3,10**	**4,31**	**5,04**

Legend: b-biomass/100 liter wet weight

Table 3.3.2.7 Results of the zooplankton investigations (20. 10. 1999)

TAXA	**Sampling sites**				
	VD1	**VD2**	**VD3**	**VD4**	**D**
ROTATORIA					
Asplanchna priodonta	8	12	8	4	
Brachionus budapestinensis	44	86	260	86	
B. calyciflorus calyciflorus		8	8	4	8
B. diversicornis	4				
B. quadridentatus cluniorbicularis				4	
B. urceus			8	4	
Filinia longiseta	174	86	174	44	
Keratella cochlearis cochlearis	520	260	348	434	260
K. c. tecta	608	348	390	520	260
K. quadrata			4		4
Lecane lunaris	44	24			
Lepadella patella			4		
Notholca squamula			4		
Polyarthra vulgaris	86	86	86	196	86
Pompholyx complanata	10	4			8
Synchaeta pectinata			4	6	4
Trichocerca capucina	8				
CLADOCERA					
Alona rectangula		4	8	4	
Bosmina longirostris	64	24	70	8	4
Chydorus sphaericus	8				
Daphnia longispina	8	4	4		2
Disparalona rostrata	12	4	36	4	
Moina micrura	4				
COPEPODA					
Eudiaptomus gracilis		2			
Acanthocyclops robustus	4		4		
Mesocyclops leuckarti			2		
nauplius larvae	24	20	24	16	12
kopepodit larvae	8	12	14	8	4
Total	**1638**	**984**	**1460**	**1342**	**652**

Legend: i - individuum/100 liter

Table 3.3.2.8 Results of the zooplankton investigations (20. 10. 1999)

TAXA	**Sampling sites**				
	VD1	**VD2**	**VD3**	**VD4**	**D**
ROTATORIA					
Asplanchna priodonta	0,40	0,60	0,40	0,20	
Brachionus budapestinensis	0,26	0,52	1,56	0,52	
B. calyciflorus calyciflorus		0,32	0,32	0,16	0,32
B. diversicornis	0,16				
B. quadridentatus cluniorbicularis				0,08	
B. urceus			0,16	0,80	
Filinia longiseta	2,78	1,38	2,78	0,70	
Keratella cochlearis cochlearis	3,12	1,56	2,09	2,6	1,56
K. c. tecta	2,43	1,39	1,56	2,08	1,04
K. quadrata			0,03		0,03
Lecane lunaris	0,35	0,19			
Lepadella patella			0,03		
Notholca squamula			0,01		
Polyarthra vulgaris	0,77	0,77	0,77	1,76	0,77
Pompholyx complanata	0,03	0,01			0,02
Synchaeta pectinata			0,04	0,06	0,04
Trichocerca capucina	0,03				
CLADOCERA					
Alona rectangula		0,20	0,40	0,20	
Bosmina longirostris	5,12	1,92	5,60	0,64	0,32
Chydorus sphaericus	1				
Daphnia longispina	1,20	0,60	0,60		0,30
Disparalona rostrata	0,72	0,24	2,16	0,24	
Moina micrura	0,24				
COPEPODA					
Eudiaptomus gracilis		1,50			
Acanthocyclops robustus	1,40		1,40		
Mesocyclops leuckarti			0,60		
nauplius larvae	0,240	0,200	0,240	0,160	0,120
kopepodit larvae	0,40	0,60	0,70	0,40	0,20
Total	**20,65**	**12,00**	**21,45**	**10,60**	**4,72**

Legend: b-biomass/100 liter wet weight

Table 3.3.2.9 Results of the zooplankton investigations (11. 11. 1999)

TAXA	Sampling sites				
	VD1	**VD2**	**VD3**	**VD4**	**D**
ROTATORIA					
Asplanchna priodonta	8	4	8		4
Bdelloidea sp.	24	32	24	8	10
Brachionus angularis	12	8	8	4	4
B. calyciflorus calyciflorus		12	12	4	6
B. urceus		12	8		4
Cephalodella gibba		8			
Diplechlanis propatula	4				4
Euchlanis dilatata	4				
Filinia longiseta	8			4	4
Keratella cochlearis cochlearis	12	16	8	12	8
K. c. tecta	12	16	12	8	6
K. quadrata	4		8		4
Polyarthra vulgaris	12	20	16	4	6
Synchaeta oblonga	4		4	8	
CLADOCERA					
Alona quadrangularis					2
Bosmina longirostris	4		4		4
Disparalona rostrata	4	4	8	4	4
Iliocryptus agilis	2	4			
Pleuroxus aduncus			24		
COPEPODA					
Eurytemora velox					2
Acanthocyclops robustus			2		
Nauplius larvae	24	20	28	16	12
Kopepodit larvae	4	8	4	4	4
Total	**142**	**164**	**178**	**419**	**88**

Legend: i - individuum/100 liter

Table 3.3.2.10 Results of the zooplankton investigations (11. 11. 1999)

TAXA	Sampling sites				
	VD1	VD2	VD3	VD4	D
ROTATORIA					
Asplanchna priodonta	0,40	0,20	0,40		0,20
Brachionus angularis	0,08	0,06	0,06	0,03	0,03
B. calyciflorus calyciflorus		0,48	0,48	0,16	0,24
B. urceus		0,24	0,16		0,08
Cephalodella gibba		0,20			
Diplechlanis propatula	0,10				0,10
Euchlanis dilatata	0,16				
Filinia longiseta	0,13			0,06	0,06
Keratella cochlearis cochlearis	0,07	0,09	0,05	0,07	0,05
K. c. tecta	0,05	0,06	0,05	0,03	0,02
K. quadrata	0,10		0,20		0,10
Polyarthra vulgaris	0,11	0,18	0,14	0,03	0,05
Synchaeta oblonga	0,04		0,04	0,08	
CLADOCERA					
Alona quadrangularis					0,10
Bosmina longirostris	0,32		0,32		0,32
Disparalona rostrata	0,24	0,24	0,48	0,24	0,24
Iliocryptus agilis	0,30	0,60			
Pleuroxus aduncus			1,20		
COPEPODA					
Eurytemora velox					1,50
Acanthocyclops robustus			0,70		
Nauplius larvae	0,24	0,20	0,28	0,16	0,12
Kopepodit larvae	0,20	0,40	0,20	0,20	0,20
Total	**2,54**	**2,95**	**4,76**	**1,06**	**3,41**

Legend: b-biomass/100 liter wet weight

Table 3.3.2.11 Abundance of zooplankton in Vén-Duna and River Danube (individual number/100 liter)

Date	VD1	VD2	VD3	VD4	D
05. 05. 1999	2898	2832	2714	2732	1280
18. 06. 1999	240	486	178	142	222
07. 09. 1999	144	202	100	132	118
20. 10. 1999	1638	984	1460	1342	652
11. 11. 1999	142	164	178	419	88

Table 3.3.2.12 Biomass of zooplankton in Vén-Duna and River Danube (mg wet weight/100 liter)

Date	VD1	VD2	VD3	VD4	D
05. 05. 1999	82,98	72,59	67,54	67,59	13,73
18. 06. 1999	6,45	12,52	2,79	5,10	6,79
07. 09. 1999	4,20	6,02	3,10	4,31	5,04
20. 10. 1999	20,65	12,00	21,45	10,60	4,72
11. 11. 1999	2,54	2,95	4,76	1,06	3,41

Table 3.3.3.1 Abundance of the dominant taxa as number of individuals/m^2 at various sampling periods and sites

Sampling sites	**Location in the cross section (5 May)**					
	Oligochaeta			***Chironomidae***		
	right	***middle***	***Left***	***right***	***middle***	***left***
VD1	207	148	222			
VD2	148	30	5925		30	
VD3	7110	14072	3703	119		74
VD4	5925	1777	829	193	148	59
River Danube	104					
Sampling sites	**Location in the cross section (18 June)**					
	Oligochaeta			***Chironomidae***		
	right	***middle***	***Left***	***right***	***middle***	***left***
VD1		267	44			
VD2	267		2666		44	44
VD3	7999	978	400	89		
VD4	2400	8888	444			978
River Danube				267		
Sampling sites	**Location in the cross section (7 September)**					
	Oligochaeta			***Chironomidae***		
	right	***middle***	***Left***	***right***	***middle***	***left***
VD1	2666	8888	578	533	400	311
VD2	356	133	755	133		978
VD3	711		1155	89	44	755
VD4	6666	3555	667	533	577	711
River Danube	89					
Sampling sites	**Location in the cross section (20 October)**					
	Oligochaeta			***Chironomidae***		
	right	***middle***	***Left***	***right***	***middle***	***left***
VD1	2266		444	4444		88920
VD2	1200		20442	10665		2844
VD3	2000	2977	2666	1511	2666	4000
VD4	89	2755	13332	978	1600	10666
River Danube	222			2000		
Sampling sites	**Location in the cross section (11 November)**					
	Oligochaeta			***Chironomidae***		
	right	***middle***	***Left***	***right***	***middle***	***left***
VD1	4000	8888	3333	2844	2889	2222
VD2	6666	17776	6666	3555	4666	4222
VD3	7110	2666	1778	2133		7555
VD4	5333	4000	4888	2222	4400	5777
River Danube	2222					

Table 3.3.3.2 Cummulative list of macrozoobenthic taxa (Vén-Duna and River Danube, 1999)

	Taxa	Sampling sites	
		Vén-Duna	**River Danube**
	Oligochaeta		
1	*Oligochaeta* sp.	1	1
	Polychaeta		
2	*Hypania invalida* (GRUBE, 1860)	1	1
	Hirudinea		
3	*Piscicola geometra* (LINNAEUS, 1761)	1	1
4	*Glossiphonia complanata* (LINNAEUS, 1758)		1
5	*Helobdella stagnalis* (LINNAEUS, 1761)		1
6	*Erpobdella octoculata* (LINNAEUS, 1758)		1
7	*Dina punctata* JOHANSSON, 1927		1
	Mollusca		
8	*Theodoxus danubialis* (C. PFEIFFER, 1828)	1*	
9	*Theodoxus fluviatilis* (LINNAEUS, 1758)		1
10	*Viviparus acerosus* (BOURGUIGNAT, 1862)	1	1
11	*Valvata cristata* O.F. MÜLLER, 1774	1	
12	*Valvata naticina* (MENKE, 1845)	1	1
13	*Valvata piscinalis* (O. F. MÜLLER, 1774)		1
14	*Potamopyrgus jenkinsi* (SMITH, 1889)	1*	1
15	*Lithoglyphus naticoides* (C. PFEIFFER, 1828)	1	1
16	*Bithynia tentaculata* (LINNAEUS, 1758)	1	1
17	*Lymnaea auricularia* (LINNAEUS, 1758)		1
18	*Lymnaea peregra* (O.F. MÜLLER, 1774)	1	
19	*Lymnaea peregra var.ovata* (DRAPARNAUD)	1	
20	*Lymnaea truncatula* (O.F. MÜLLER, 1774)	1	
21	*Physa acuta* DRAPARNAUD, 1805	1	1
22	*Unio pictorum* (LINNAEUS, 1758)	1	1
23	*Unio tumidus* RETZIUS 1788	1	1
24	*Anodonta anatina* (LINNAEUS, 1758)	1	1
25	*Sinanodonta woodiana* (LEA, 1834)	1	1
26	*Dreissena polymorpha* (PALLAS, 1771)	1	1
27	*Corbicula fuminea* (O. F. MÜLLER, 1774)	1	1
28	*Corbicula "fluminalis"* (O. F. MÜLLER, 1774)	1	1
29	*Sphaerium corneum* (LINNÉ, 1758)	1	
30	*Sphaerium rivicola* (LAMARCK, 1799)	1	1
31	*Spaerium lacustre* (O.F. MÜLLER, 1774)	1	
32	*Pisidium amnicum* (O.F. MÜLLER, 1774)		1
33	*Pisidium henslowanum* (SHEPPARD, 1823)	1	1
	Crustacea		
34	*Obesogammarus obesus* (SARS, 1894)	1	1
35	*Limnomysis benedeni* CZERNIAVSKY, 1882	1	1
36	*Corophium curvispinum* SARS,1895	1	1
37	*Dikerogammarus villosus* (SOVINSKY, 1894)	1	1
38	*Jaera istri* VIEUILLE, 1979		1
	Ephemeroptera		
39	*Cloeon dipterum* (LINNAEUS, 1761)	1	
	Odonata		
40	*Calopteryx splendens* (HARRIS, 1782)		1
41	*Platycnemis pennipes* (PALLAS, 1771)	1	1
42	*Gomphus flavipes* (CHARPENTIER, 1825)	1	1
	Heteroptera		
43	*Notonecta sp.*	1	
44	*Aquarius paludum* (FABRICIUS, 1794)	1	

	Trichoptera		
45	*Hydropsyche bulgaromanorum* MALICKY, 1977	1	1
46	*Hydropsyche contubernalis* MCLACHLAN, 1865	1	1
	Diptera		
47	*Chironomidae sp.*	1	1

Table 3.3.3.3 Cummulative list of *Chironomidae* taxa (Vén-Duna and River Danube, 1999)

	Name of species	Vén-Duna	River Danube
1	*Cardiocladius capucinus* (Zetterstedt, 1850)	1	
2	*Chironomidae sp.*	1	1
3	*Chironomus acutiventris* Wülker, Ryser & Scholl, 1983	1	1
4	*Chironomus annularis* (nec De Geer, 1776)	1	
5	*Chironomus anthracinus* Zetterstedt, 1860	1	1
6	*Chironomus aprilinus* Meigen		1
7	*Chironomus balatonicus*	1	
8	*Chironomus dorsalis* (Meigen,1818)	1	
9	*Chironomus nudiventris*	1	1
10	*Chironomus plumosus* (Linnaeus, 1758)	1	
11	*Chironomus riparius* (Meigen, 1804)	1	1
12	*Cryptochironomus defectus* (Kieffer, 1913)	1	
13	*Cryptochironomus cf. pallidivittatus*	1	
14	*Dicrotendipes nervosus* (Staeger, 1839)	1	
15	*Harnischia sp.*	1	
16	*Microchironomus tener* (Kieffer, 1918)	1	
17	*Orthocladiinae sp.*	1	
18	*Polypedilum cultellatum* Goetghebuer, 1921	1	
19	*Polypedilum nubeculosum* (Meigen, 1804)	1	
20	*Procladius choreus* (Meigen, 1804)	1	
21	*Procladius ferrugineus* (Kieffer, 1919)	1	
22	*Prodiamesa olivacea* (Meigen,1818)	1	
23	*Tanypus punctipennis* Meigen, 1818	1	
	Number of taxa	**22**	**6**

Table3.3.3.4 Macrozoobenthic taxa of the Vén-Duna and River Danube (05.05.1999)

Taxa	**Sampling sites**												
	1			**2**			**3**			**4**			**Danube**
	l	m	r	L	m	R	l	m	r	l	M	R	
Oligochaeta													
Oligochaeta sp.	15	10	14	400	2	10	250	950	480	56	120	400	7
Hirudinea													
Erpobdella octoculata (LINNAEUS, 1758)													2
Mollusca													
Theodoxus danubialis (C. PFEIFFER, 1828)											1*		
Viviparus acerosus (BOURGUIGNAT, 1862)												1	3
Valvata naticina (MENKE, 1845)							1				1	1	1*
Valvata piscinalis (O. F. MÜLLER, 1774)													3
Lithoglyphus naticoides (C. PFEIFFER, 1828)											1		11*
Lymnaea auricularia (LINNAEUS, 1758)													1
Lymnaea peregra var.ovata (DRAPARNAUD)												1	
Dreissena polymorpha (PALLAS, 1771)				4*			5*				25		100*
Sphaerium rivicola (LAMARCK, 1799)								7					
Spaerium lacustre (O.F. MÜLLER, 1774)			3				1	1					
Pisidium amnicum (O.F. MÜLLER, 1774)													1
Pisidium henslowanum (SHEPPARD, 1823)	2												
Crustacea													
Limnomysis benedeni CZERNIAVSKY, 1882													
Corophium curvispinum SARS,1895	2	6					2				6		
Dikerogammarus villosus (SOVINSKY, 1894)			4				1				20		
Odonata													
Platycnemis pennipes (PALLAS, 1771)								1					
Diptera													
Chironomidae sp.					2		5		8	4	10	13	

Table3.3.3.5 Macrozoobenthic taxa of the Vén-Duna and River Danube (06.18.1999)

Taxa	**Sampling sites**												
	1			**2**			**3**			**4**			**Danube**
	l	m	r	l	m	r	l	M	r	l	m	r	
Oligochaeta													
Oligochaeta sp.	1	6		60		6	9	22	180	10	200	54	
Polychaeta													
Hypania invalida (GRUBE, 1860)							1		40	50	19		
Hirudinea													
Glossiphonia complanata (LINNAEUS, 1758)													1
Erpobdella octoculata (LINNAEUS, 1758)													1
Mollusca													
Viviparus acerosus (BOURGUIGNAT, 1862)									1*	3	1*		2
Valvata naticina (MENKE, 1845)		1											3
Potamopyrgus jenkinsi (SMITH, 1889)													9
Lithoglyphus naticoides (C. PFEIFFER, 1828)		1*											
Bithynia tentaculata (LINNAEUS, 1758)									1				12
Lymnaea peregra var.ovata (DRAPARNAUD)													4
Anodonta anatina (LINNAEUS, 1758)										1			2
Dreissena polymorpha (PALLAS, 1771)										5	3*		
Corbicula fuminea (O. F. MÜLLER, 1774)		5											
Corbicula "fluminalis" (O. F. MÜLLER, 1774)		3											
Pisidium henslowanum (SHEPPARD, 1823)									1				
Crustacea													
Obesogammarus obesus (SARS, 1894)			2										
Limnomysis benedeni CZERNIAVSKY, 1882													3
Corophium curvispinum SARS,1895		1	4			3					3		17
Dikerogammarus villosus (SOVINSKY, 1894)			1										25
Odonata													
Calopteryx splendens (HARRIS, 1782)													1
Heteroptera													
Notonecta sp.					1								
Trichoptera													
Hydropsyche bulgaromanorum MALICKY, 1977			1			1							1
Hydropsyche contubernalis MCLACHLAN, 1865			1										
Diptera													
Chironomidae sp.				1	1				2	22			6

Table3.3.3.6 Macrozoobenthic taxa of the Vén-Duna and River Danube (07 September, 1999)

Taxa	**Sampling sites**													
	1			**2**			**3**			**4**			**5**	**Danube**
	l	m	r	l	m	r	l	m	r	l	m	R		
Oligochaeta														
Oligochaeta sp.	13	200	60	17	3	8	26	30	16	15	80	150	5	2
Polychaeta														
Hypania invalida (GRUBE, 1860)		400				2								
Hirudinea														
Piscicola geometra (LINNAEUS, 1761)						1								
Erpobdella octoculata (LINNAEUS, 1758)		1												
Mollusca														
Viviparus acerosus (BOURGUIGNAT, 1862)												4		
Valvata cristata O.F. MÜLLER, 1774					1*									
Valvata naticina (MENKE, 1845)			41											6
Potamopyrgus jenkinsi (SMITH, 1889)									1*					
Lithoglyphus naticoides (C. PFEIFFER, 1828)	1	70	1											3
Bithynia tentaculata (LINNAEUS, 1758)		1							1*					
Lymnaea truncatula (O.F. MÜLLER, 1774)					1*				1					
Physa acuta DRAPARNAUD, 1805		2							1		1*			
Unio pictorum (LINNAEUS, 1758)									2*					
Unio tumidus RETZIUS 1788													1	
Anodonta anatina (LINNAEUS, 1758)						1			3*					
Sinanodonta woodiana (LEA, 1834)		1							1*					
Dreissena polymorpha (PALLAS, 1771)		4				14						13		4*
Corbicula fuminea (O. F. MÜLLER, 1774)		5	1										8	
Corbicula "fluminalis" (O. F. MÜLLER, 1774)		1												
Sphaerium corneum (LINNÉ, 1758)		20												
Sphaerium rivicola (LAMARCK, 1799)												1		
Spaerium lacustre (O.F. MÜLLER, 1774)									2*					
Pisidium sp.												1		
Pisidium henslowanum (SHEPPARD, 1823)		7												
Crustacea														
Obesogammarus obesus		5										1		
Limnomysis benedeni CZERNIAVSKY, 1882									100					
Corophium curvispinum SARS,1895									2					
Dikerogammarus villosus (SOVINSKY, 1894)		1				6			2				1	4
Ephemeroptera														
Cloeon dipterum (LINNAEUS, 1761)									1					
Odonata														
Gomphus flavipes (CHARPENTIER, 1825)		1	1			1								
Heteroptera														
Aquarius paludum FABRICIUS, 1794)									1					
Trichoptera														
Hydropsyche bulgaromanorum MALICKY, 1977													1	1
Diptera														
Chironomidae sp.	7	9	12	22		3	17	1	2	16	13	12		

Table3.3.3.7 Macrozoobenthic taxa of the Vén-Duna and River Danube (20 October, 1999)

Taxa	**Sampling sites**												
	1			**2**			**3**			**4**			**Danube**
	l	m	r	l	m	r	L	m	r	l	m	r	
Oligochaeta													
Oligochaeta sp.	10		51	460		27	60	67	45	300	62	2	5
Polychaeta													
Hypania invalida (GRUBE, 1860)	30												12
Hirudinea													
Piscicola geometra (LINNAEUS, 1761)			2										
Glossiphonia complanata (LINNAEUS, 1758)													2
Helobdella stagnalis (LINNAEUS, 1761)													1
Erpobdella octoculata (LINNAEUS, 1758)													2
Mollusca													
Theodoxus fluviatilis (LINNAEUS, 1758)													2
Viviparus acerosus (BOURGUIGNAT, 1862)			8	1						1		2	8
Valvata naticina (MENKE, 1845)			5										5
Lithoglyphus naticoides (C. PFEIFFER, 1828)	5		234	1		9	1		1*		1*		200
Bithynia tentaculata (LINNAEUS, 1758)			2					1*					8
Lymnaea peregra (O.F. MÜLLER, 1774)						6							
Lymnaea peregra var.ovata (DRAPARNAUD)													15
Physa acuta DRAPARNAUD, 1805						1							
Unio tumidus RETZIUS 1788	3			1*		1						1	
Anodonta anatina (LINNAEUS, 1758)	2		3										3
Dreissena polymorpha (PALLAS, 1771)	7		35			3		1*	1*		1*	35	15
Corbicula fuminea (O. F. MÜLLER, 1774)	100												12
Corbicula "fluminalis" (O. F. MÜLLER, 1774)			22						1*				
Sphaerium corneum (LINNÉ, 1758)	10												6
Spaerium lacustre (O.F. MÜLLER, 1774)			4							1*			
Pisidium amnicum (O.F. MÜLLER, 1774)												4	
Crustacea													
Obesogammarus obesus (SARS, 1894)	50		2									8	15
Corophium curvispinum SARS,1895	5		19									15	
Dikerogammarus villosus (SOVINSKY, 1894)	36		28							3		10	4
Jaera istri VIEUILLE, 1979												2	
Odonata													
Gomphus flavipes (CHARPENTIER, 1825)			5										
Trichoptera													
Hydropsyche bulgaromanorum MALICKY, 1977	3		7										3
Hydropsyche contubernalis MCLACHLAN, 1865			3										
Diptera													
Chironomidae sp.	20		100	240		64	90	60	34	240	36	22	45

Table3.3.3.8 Macrozoobenthic taxa of the Vén-Duna and River Danube (11 November, 1999)

Taxa	**Sampling sites**												
	1			**2**			**3**			**4**			**Danube**
	l	m	r	l	m	r	l	m	r	l	m	r	
TAXONOK													
Oligochaeta													
Oligochaeta sp.	75	200	90	150	400	150	40	60	160	110	90	120	50
Hirudinea													
Glossiphonia complanata (LINNAEUS, 1758)													2
Erpobdella octoculata (LINNAEUS, 1758)													1
Mollusca													
Theodoxus fluviatilis (LINNAEUS, 1758)													2
Viviparus acerosus (BOURGUIGNAT, 1862)					1	3*							
Lithoglyphus naticoides (C. PFEIFFER, 1828)	5	4	21					3*	1*				
Bithynia tentaculata (LINNAEUS, 1758)								1*					14
Unio tumidus RETZIUS 1788			2									1	1
Anodonta anatina (LINNAEUS, 1758)	1*												
Dreissena polymorpha (PALLAS, 1771)			6			1	1	3*	2	1	1	2*	25
Corbicula fuminea (O. F. MÜLLER, 1774)	1*				1	1	1						14
Corbicula "fluminalis" (O. F. MÜLLER, 1774)													8
Sphaerium rivicola (LAMARCK, 1799)													24
Spaerium lacustre (O.F. MÜLLER, 1774)										1			
Pisidium henslowanum (SHEPPARD, 1823)											1		
Crustacea													
Obesogammarus obesus (SARS, 1894)													4
Corophium curvispinum SARS,1895						6							15
Dikerogammarus villosus (SOVINSKY, 1894)													30
Jaera istri VIEUILLE, 1979													2
Odonata													
Gomphus flavipes (CHARPENTIER, 1825)				1						1			1
Trichoptera													
Hydropsyche bulgaromanorum MALICKY, 1977													12
Diptera													
Chironomidae sp.	50	65	64	95	105	80	170		48	130	100	50	

Table 3.3.4.1 Taxon list of fish species detected in the Vén-Duna and River Danube in 1999.

	Name of species	**Vén-Duna**				**River Danube right**				**River Danube left**			
		29 July		**30 August**		**29 July**		**30 August**		**29 July**		**30 August**	
		N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
1	Alburnus alburnus	51	77,3	7	9,6	172	93,5	33	13,8	79	78,2	4	2,2
2	Aspius aspius	2	3	6	8,2	2	1,1	6	2,5	7	6,9	1	0,6
3	Carassius auratus	1	1,5										
4	Chondrostoma nasus					4	2,2	1	0,4				
5	Esox lucius	6	9,1	11	15,1					3	3	5	2,8
6	Lepomis gibbosus			5	6,9								
7	Leuciscus cephalus							3	1,3	1	1		
8	Leuciscus idus	2	3			2	1,1	5	2,1			1	0,6
9	Lota lota									2	2	9	5
10	Neogobius fluviatilis	1	1,5	4	5,5			14	5,8			27	15
11	Neogobius kessleri			4	5,5			2	0,8	1	1	4	2,2
12	Perca fluviatilis											2	1,1
13	Proterorhinchus marmoratus			2	2,7			170	70,8	2	2	105	58,3
14	Rhodeus sericeus			1	1,4								
15	Rutilus rutilus	3	4,6	33	45,2	4	2,2	6	2,5				
16	Stizostedion lucioperca									1	1		
	Sum of individuals	***66***		***73***		***184***		***240***		***101***		***180***	
	Sum of species	***7***		***9***		***9***		***9***		***8***		***9***	

Table 3.3.4.2 The estimated relative abundance of fish species in the Middle and Lower Hungarian Danube river (local fishermen, personal communication 1999)

(1 = present; 2 = common; 3 = very common)

	Name of species	**Relative abundance**
	PTEROMYZONTIDAE	
1	Eudontomyzon mariae (BERG, 1931)	**1**
	ACIPENSERIDAE	
2	Huso huso (LINNAEUS, 1758)	**1**
3	Acipenser ruthenus LINNAEUS, 1758	**2**
	ANGUILLIDAE	
4	Anguilla anguilla (LINNAEUS, 1758)	**2**
	CYPRINIDAE	
5	Rutilus rutilus (LINNAEUS, 1758)	**3**
6	Rutilus pigus virgo (HECKEL, 1852)	**1**
7	Ctenopharyngodon idella (VALENCIENNES, 1844)	**2**
8	Scardinius erythrophthalmus (LINNAEUS, 1758)	**1**
9	Leuciscus leuciscus (LINNAEUS, 1758)	**1**
10	Leuciscus cephalus (LINNAEUS, 1758)	**1**
11	Leuciscus idus (LINNAEUS, 1758)	**2**
12	Aspius aspius (LINNAEUS, 1758)	**2**
13	Leucaspius delineatus (HECKEL, 1843)	**1**
14	Alburnus alburnus (LINNAEUS, 1758)	**2**
15	Blicca bjoerkna (LINNAEUS, 1758)	**3**
16	Abramis brama (LINNAEUS, 1758)	**3**
17	Abramis ballerus (LINNAEUS, 1758)	**2**
18	Abramis sapa (PALLAS, 1811)	**1**
19	Vimba vimba (LINNAEUS, 1758)	**1**
20	Pelecus cultratus (LINNAEUS, 1758)	**2**
21	Chondrostoma nasus (LINNAEUS, 1758)	**2**
22	Tinca tinca (LINNAEUS, 1758)	**1**
23	Barbus barbus (LINNAEUS, 1758)	**3**
24	Gobio gobio (LINNAEUS, 1758)	**1**
25	Gobio albipinnatus LUKASH, 1933	**1**
26	Pseudorasbora parva (TEMMINCK & SCHLEGEL, 1842)	**2**
27	Rhodeus sericeus amarus (PALLAS, 1776)	**2**
28	Carassius carassius (LINNAEUS, 1758)	**1**
29	Carassius auratus (LINNAEUS, 1758)	**3**
30	Cyprinus carpio LINNAEUS, 1758	**2**
31	Hypophthalmichthys molitrix (VALENCIENNES, 1844)	**2**
32	Hypophthalmichthys nobilis (RICHARDSON, 1845)	**2**
	COBITIDAE	
33	Cobitis taenia LINNAEUS, 1758	**2**
34	Sabanajewia aurata (FILIPPI, 1865)	**1**
	SILURIDAE	
35	Silurus glanis LINNAEUS, 1758	**2**
	ICTALURIDAE	
36	Ictalurus nebulosus (LE SEUR, 1819)	**1**
	ESOXIDAE	
37	Esox lucius LINNAEUS, 1758	**2**
	COTTIDAE	
38	Cottus gobio LINNAEUS, 1758	**2**
	GADIDAE	

39	Lota lota (LINNAEUS, 1758)	**2**
	CENTRARCHIDAE	
40	Lepomis gibbosus (LINNAEUS, 1758)	**2**
	PERCIDAE	
41	Perca fluviatilis LINNAEUS, 1758	**2**
42	Gymnocephalus cernuus (LINNAEUS, 1758)	**2**
43	Gymnocephalus baloni HOLCIK& HESSEL, 1974	**2**
44	Gymnocephalus schraetzer (LINNAEUS, 1758)	**2**
45	Stizostedion lucioperca (LINNAEUS, 1758)	**1**
46	Stizostedion volgensis (GMELIN, 1788)	**2**
47	Zingel zingel (LINNAEUS, 1766)	**1**
	GOBIIDAE	
48	Proterorhinus marmoratus (PALLAS, 1811)	**2**
49	Neogobius fluviatilis (PALLAS, 1811)	**2**
50	Neogobius kessleri BERG, 1949	**3**