
Joint Danube Survey 2

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International
Commission
for the Protection
of the Danube River

Internationale
Kommission
zum Schutz
der Donau



Full report on: Zooplankton

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1 Introduction

Zooplankton is the main link between small phytoplankton and larger carnivores, primarily young fish.

Several surveys have been organized in River Danube so far, which affected shorter or longer sections of the river. Rotatoria dominance and the similarly high proportion of nauplius and copepodit larvae among Crustacea were proved by Bothár (1974), Naidenow and Schewzowa (1990), Naidenow et al. (1991) and Gulyás (1994, 1995). The most frequent occurrence has been observed by species typical of still or slow-flowing eutrophic waters. According to the survey results, the dominant species of the river are: *Brachionus calyciflorus*, *Keratella*, *Synchaeta* spp., *Bosmina longirostris*, *Acanthocyclops robustus*. Bothár (1973) pointed out that the joining of Drava and Tisza did not have an effect on Crustacea plankton.

Naidenow (1998) laid the qualitative and quantitative proportions of Danube zooplankton in a comprehensive work, on the grounds of the results of 164 studies. In the aspect of individual number the Upper Section until Slovakia proved to be the poorest, the amount increased in Hungary, but then dropped in Yugoslavia and Bulgaria.

Gulyás (2002) reported the zooplankton survey made on the section between Neu-Ulm and Tulcea in 2001 summer (JDS1), 79 Rotatoria, 27 Cladocera and 14 Copepoda species were found. According to the results the stocks' individual numbers were the smallest on German, Austrian, Romanian and Bulgarian sections of the river, the highest on the section below Budapest and in Yugoslavia. Low rates of individual number were also observed at Neu-Ulm-Tass, as well as on the section between Iron Gate Reservoir and Danube Delta. The primary reasons for these results are the higher water flow velocity in the Upper Section, and the big amount of river load in the Lower Section.

2 Methods

During JDS2 96 samples were collected from the Danube and from its tributaries for the zooplankton investigations. Out of zooplankton the three main characteristic groups, Rotatoria, Cladocera and Copepoda community were investigated in details. For the analysis of zooplankton 50 litres of water were filtered through a plankton net of 50 µm mesh. The samples were preserved in the field in formaldehyde 4-5 % concentration. The quantity and qualitative composition of zooplankton was determined in laboratory with light- and stereomicroscope. For the purpose of exact identification of some Rotifera species their trophy were prepared with sodium hypochlorite solution. The abundance was given in ind/50 Lit. unit. We investigated the ratio of Rotatoria, Cladocera, Copepoda, and the characteristic, dominant species or taxa in the different reaches of the Danube. The biomass was estimated by works of Ruttner-Kolisko (1977), Mc. Cauley (1984), Bottrel et al. (1976), Dumont et al. (1975), Németh (1998). The calculation was made on the one hand by referred data, on the other hand with average body size. The values apply to wet biomass. The numbers and biomass are seen in [Annex excel table \(Table 1., 2.\)](#).

3 Results

In the catchment area of River Danube 129 zooplankton taxa have been discovered, 87 Rotatoria, 30 Cladocera and 9 Copepoda have been registered. The majority of the species maintain planktonic living, however, in some sampling areas tychoplanktonic elements, which penetrate the plankton from aquatic plant environment or from the surface of the sediment through mud-mixing, have been found.

In the main branch of River Danube 87 Rotatoria, 30 Cladocera and 9 Copepoda have been registered. In the upper Danube at the German, Austrian, Slovakian and Hungarian section the density of zooplankton is very low, the ratio of rotifers is fivefold-tenfold of the individual number of microcrustaceans. From the Rotifera *Brachionus angularis*, *Br. calyciflorus*, *Keratella cochlearis tecta*, and *Synchaeta* spp. are dominant, their ratio is changing. In the rapid streaming of the upper Danube the copepodites of Harpacticoida group were found also.

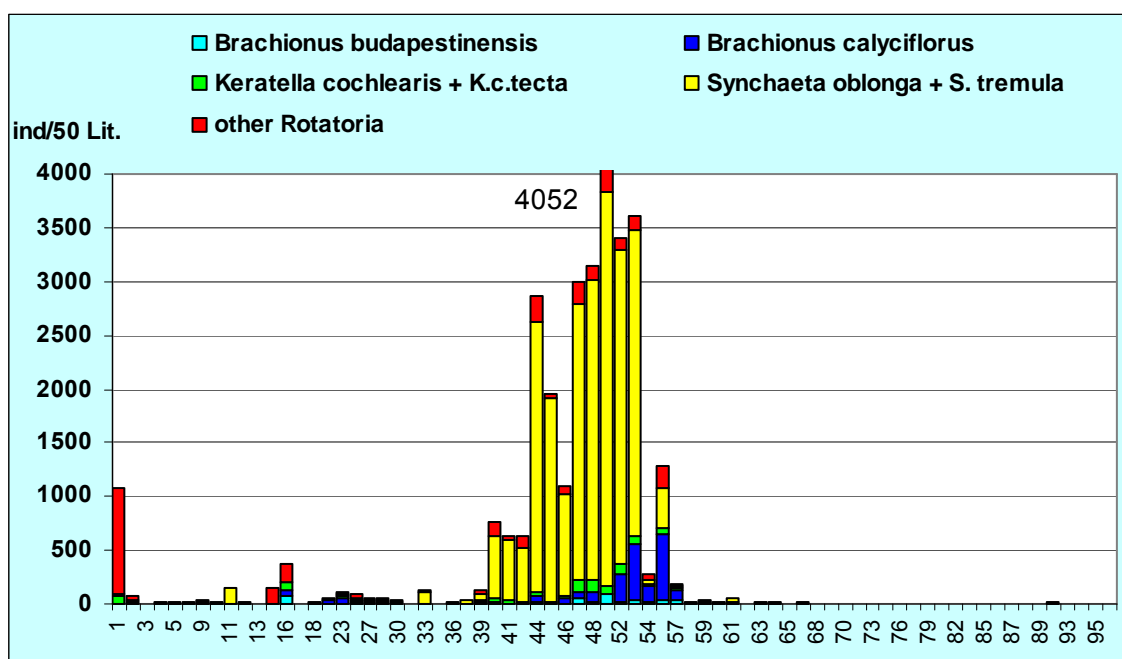


Figure 1: Composition of the Rotatoria community in the main branch of the Danube

In the Serbian reach between JDS40-JDS53 there is a big change. Increase of the abundance can be observed here, which is the most intensive between sampling areas JDS44 (Dalj) and JDS53 (downstream Pancevo). Along the whole river the highest individual numbers can be found in this section: at sampling points 50 (Belegis) and 53 (Figure 1.). Among the 3 main zooplankton groups Rotatoria is dominant; the ratio of microcrustaceans is under 10 %. Plankton composition also changes in proportion to the previous section. In the rotifers community the proportion of *Synchaeta tremula* and *S. oblonga* 80-95 %, they indicate the **eutrophic-polytrophic** state of River.

The density of cladocerans is highest at sampling point 53 (downstream Pancevo). Considering the fauna *Disparalona rostrata* becomes dominant replacing *Bosmina longirostris* (Figure 2.), which relate to the changed reach character. In the zooplankton biomass the wet biomass of rotifers is about 2,5-fold compared to cladocerans biomass, and circa 1,5-fold compared to copepods. This ratio is smaller in the other reaches, or the biomass of microcrustaceans is higher than rotifers biomass (Figure 3.).

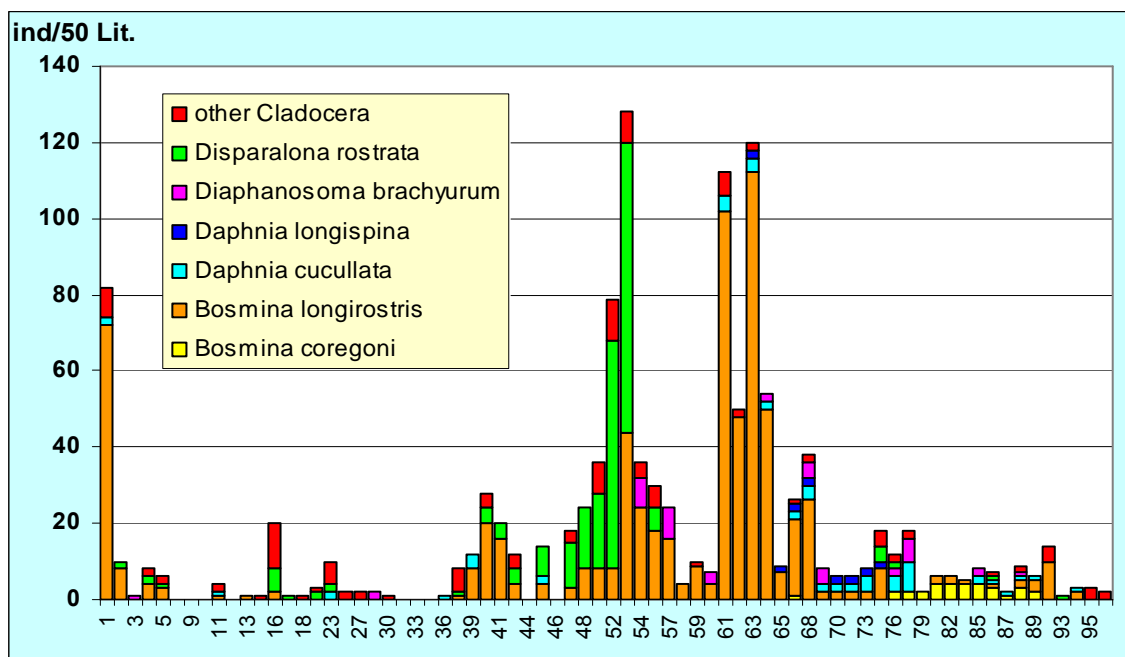


Figure 2: Composition of the Cladocera community in the main branch of the Danube

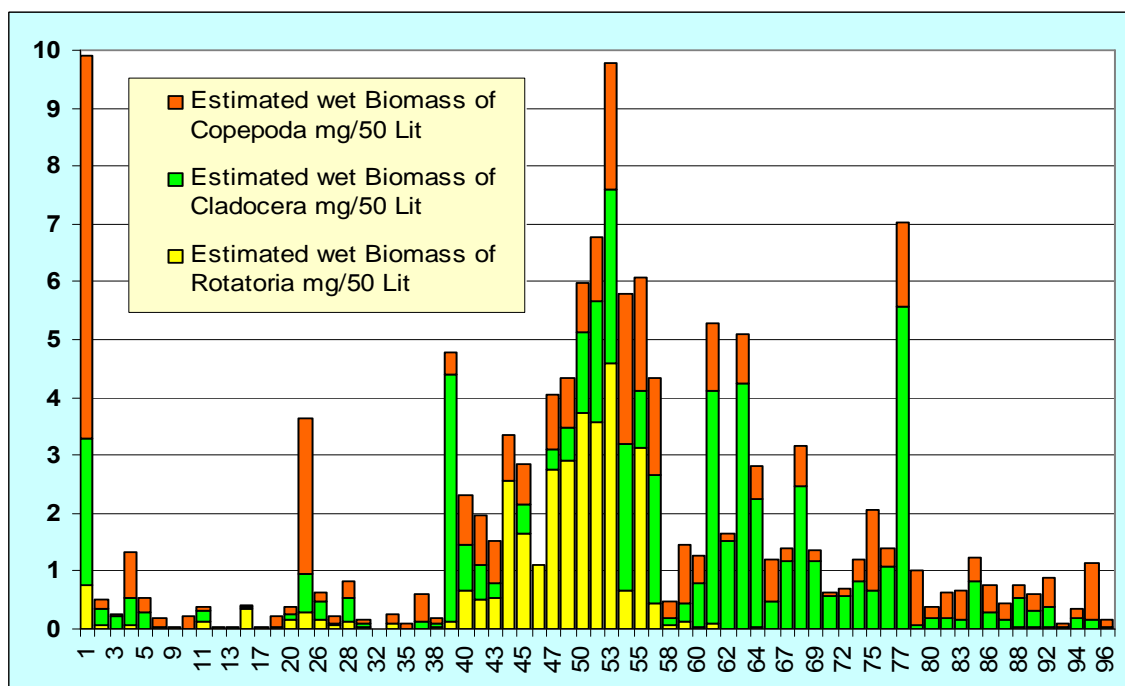


Figure 3: Estimated wet biomass of zooplankton in the main branch of the Danube

In the area of Iron Gate Reservoir the abundance was low, and the change of species composition can be registered. The ratio of *Synchaeta oblonga* and *S. tremula* reduce, *Brachionus calyciflorus* and *Keratella cochlearis tecta* become dominant species in the Rotatoria community. There is a change in cladocerans also, the tycho planktonic *Disparalona rostrata* disappears, but the high proportion of *Bosmina longirostris* is continued. At the same time the ratio of euplanktonic *Daphnia cucullata* and *Diaphanosoma brachyurum* increases in the River.

On the Lower Danube downstream to the Delta the abundance of all zooplankton group is low due to the effect of a flood wave. The individual number of rotifers is very small, we could not register them in the filtered water (50 Lit.) at several sampling sites. In this region the quantity of copepods is highest. *Daphnia cucullata* and *Diaphanosoma brachyurum* are dominant elements of cladocerans, and between JDS76-JDS89 sampling sites the *Bosmina coregoni* indicates the **eutrophic** environment. Among copepods *Thermocyclops crassus* and *T. oithonoides* are characteristic species, and the *Eurytemora velox* can be found in some sections also.

In the Arms and tributaries of River Danube 70 Rotatoria, 21 Cladocera and 5 Copepoda have been registered. The zooplankton abundance is more hundreds times as much in the Mosoni Danube Arm (JDS19) and at the end of the Rackeve-Soroksar Danube Arm (JDS34) than in the main branch. The conditions that are similar to standing water, the slower flow speed, the available large amount of nutrients make possible the considerable increasing of filtering zooplankton community. The species composition indicates **polytrophic environment**, this is supported also by the high concentration of a-chlorophyll. The Mosoni Danube Arm had 26 rotifer taxons, but the diversity was low on account of very high (73%) rare of dominant species *Brachionus calyciflorus*. In the RSD Arm the number of taxa is low, the dominant rotifer species is *Pompholyx sulcata*.

From the tributaries the Morava (JDS15), Sio (JDS37) and Velika-Morava (JDS56) have high individual numbers, especially the number of rotifers is considerable (**Figure 4.**). The dominant species *Brachionus angularis*, *Brachionus calyciflorus*, *Brachionus budapestinensis*, *Keratella cochlearis*, *K.c. tecta* indicate **polytrophic conditions**, similarly to chlorophyll content. The rotifer population of Ipoly (JDS25) and Timok (JDS66) is in a middle range, while its amount in the other tributaries similar to the abundance level measured in the main branch.

The density of cladocerans generally is low (0-200 ind/50 Lit), only at the end of RSD Arm, and in the rivers Ipoly and Olt was higher (600-1100 ind/50 Lit). The dominant species are *Bosmina longirostris*, *Daphnia cucullata*, *Diaphanosoma brachyurum*. The abundance of copepods was low, only at the end of RSD Arm and River Sio is significantly high, because of high number of nauplii.

The biomass is high in the eutrophic arms and tributaries, the ratio of the three main zooplankton group is changing (**Figure 5.**). The cladocerans biomass were significant only in the end of RSD Arm (JDS34), Sio (JDS37), and Olt (JDS74), in these rivers can we found big size cladocerans (*Daphnia cucullata*, *Diaphanosoma brachyurum*, *Leptodora kindtii*). The high copepods biomass was given by the small, but numerous nauplii.

There were not zooplankton samples from some tributaries.

Characteristic *veligera larvae* were found in **high proportion** in several sections of the Danube, but their species identification is not done. We suggest investigating the *veligera larvae* in zooplankton of the River Danube, because of the importance of spreading and invasive mussel species (i.e. Corbicula) along the Danubian water way.

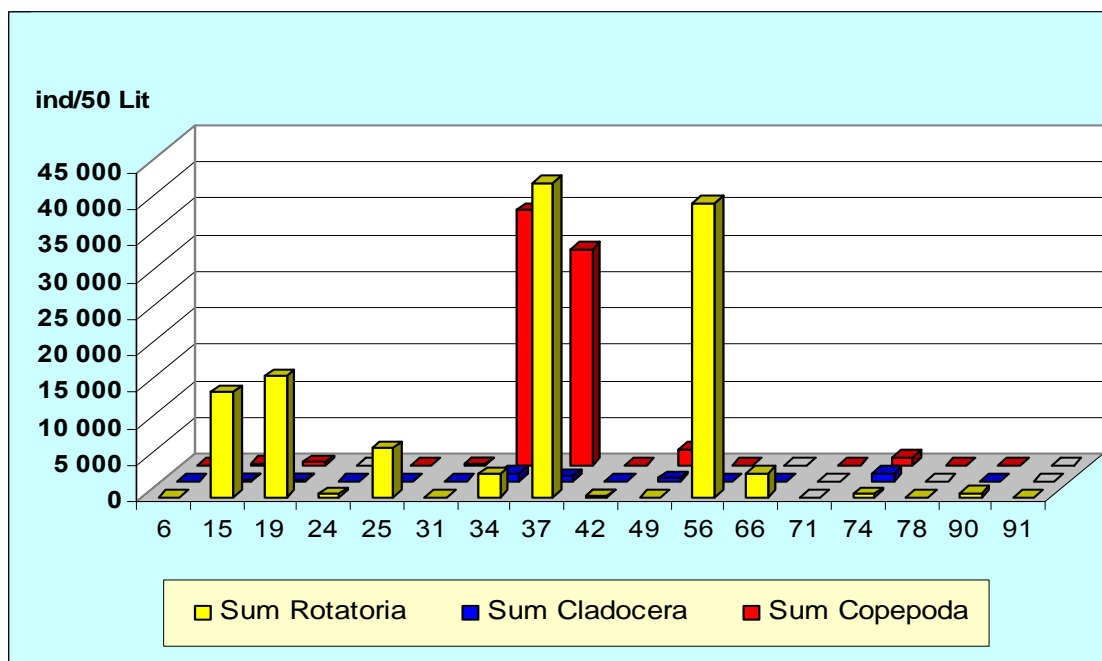


Figure 4: Zooplankton abundance in the Arms and tributaries of the Danube

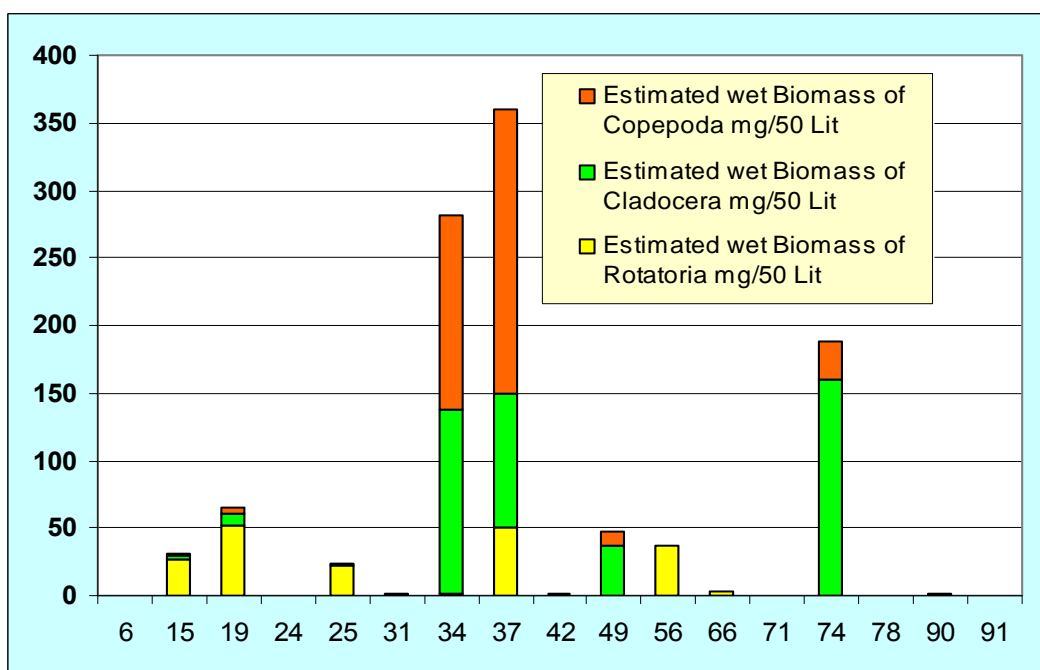


Figure 5: Estimated wet biomass of zooplankton in the Arms and tributaries of the Danube

4 Conclusions

In the River Danube the individual species composition of zooplankton varied very much. Water velocity and the amount of river load both had significant effects on the density. The high numbers have evolved in the slow flowing middle reach. Different sections can be divided along the river, whose zooplankton abundances considerably differ from each other. In addition, there are quantitative and qualitative changes within one main section as well.

In the catchment area of River Danube 129 zooplankton taxons have been discovered, 94 Rotatoria, 30 Cladocera and 9 Copepoda have been registered. There are tychoplanktonic elements among planktonic community, coming from aquatic plant stocks or from the sediment. **The dominant species indicate eu- and polytrophic environment** (*Brachionus calyciflorus*, *Keratella cochlearis tecta*, *Synchaeta oblonga*, *S. tremula*, *Bosmina longirostris*, *Daphnia cucullata*, *Diaphanosoma brachyurum*, *Thermocyclops crassus*, *T. oithonoides*).

There was no increased abundance or species number observed in reservoir sections. Only the effect of Morava was registered in the Danubian zooplankton composition, other tributaries did not influence the community of the large river.

The proportion of the dominant species was the same as in former researches. The density of zooplankton was less than in 2001 generally, the maximum individual number could be registered in the Serbian reach, where the most eutrophic-polytrophic environment was found. There was no further increase of abundance in Danube Delta.

The further investigation of veligera larvae in zooplankton is suggested along the River Danube, due to the importance of invasion of alien species.

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