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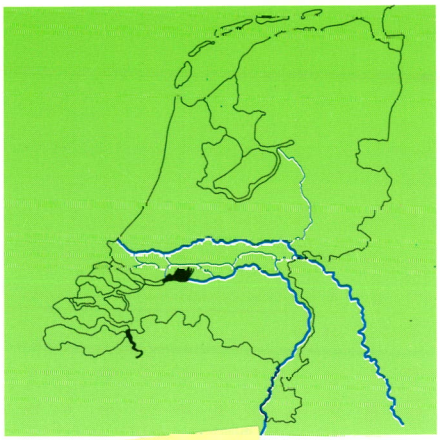
'Ecologisch Herstel Rijn en Maas'

Publications and reports of the project 'Ecological Rehabilitation of the Rivers Rhine and Meuse

PHYTO- AND ZOOPLANKTON DYNAMICS IN THE RIVER MEUSE DURING 1992



Report No. 64 - 1996

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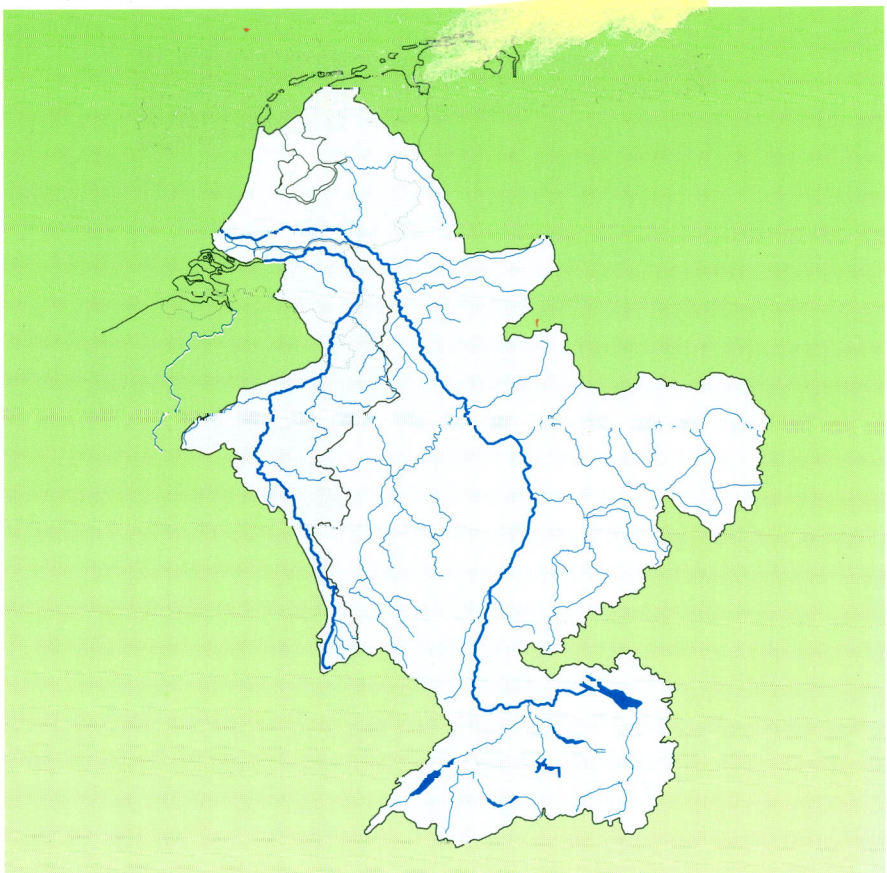

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RIJKSINSTITUUT VOOR VOLKSGEZONDHEID EN MILIEUHYGIENE

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The project 'Ecological rehabilitation of the rivers Rhine and Meuse' is a cooperation of:
- on behalf of the Ministry of Transport, Public Works and Water Management:
  Institute for Inland Water Management and Waste Water Treatment (RIZA)
- on behalf of the Ministry of Housing, Physical Planning and Environment:
  National Institute of Public Health and the Environment (RIVM)
- on behalf of the Ministry of Agriculture, Nature Management and Fisheries:
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PHYTO- AND ZOOPLANKTON DYNAMICS IN THE RIVER MEUSE DURING 1992

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ABSTRACT

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This report presents the results of the dynamics of phyto- and zooplankton species composition, and density, at the Belgium-Dutch border (Eysden station) and at the downstream reaches; about 60 km upstream of the discharge point of the river into the North Sea (Keizersveer station) during 1992. By comparing these 1992 results with older data (as far as these are available) an attempt is made to evaluate possible shifts in phyto- and zooplankton populations during this century. The role of possible controlling factors are discussed.

Keywords: river, Meuse, phytoplankton, zooplankton

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CONTENTS

SUMMARY

This study presents the results of a survey carried out in 1992 on phyto- and zooplankton's abundance and species composition in the River Meuse at the Belgium-Dutch border (Eysden station, km 615) and about 60 km upstream to the point of discharge of the river into the North Sea (Keizersveer station, km 855). Phytoplankton abundance and species composition showed an apparent seasonal pattern at both stations. Peak total cell numbers were observed in March, April and August. At Eysden maximum cell number and chlorophyll *a* concentration were higher than at Keizersveer. During most of the year diatoms (February - May) and chlorophytes (May - September) dominated the phytoplankton community in the Meuse by cell number. At Keizersveer bluegreen algae co-dominated during July - September, whereas at Eysden considerable numbers of bluegreen algae were found on only one sampling date, in September. The abundance of cryptophyceans and other algal groups was less than 10% at both stations. In terms of biovolume, however, diatoms were by far the most important contributors throughout 1992. Diatoms constituted over 90% of total phytoplankton volume in spring and about 70% during summer. The contribution of green algae during May - September averaged 21% at Eysden, and only 12% at Keizersveer. Dominant diatoms were the *Stephanodiscus* group *hantzschii*, *Cyclotella meneghiniana*, *Aulacoseira ambigua* and *Skeletonema potamos*; dominant chlorophytes were *Scenedesmus* spp. and small (2-5 μm) green algae. At Keizersveer, the spring bloom of the *S.* group *hantzschii* was succeeded by a bloom of *Skeletonema subsalsum*, indicating an influence of Rhine water. Phytoplankton biovolume corresponded well with the chlorophyll *a* concentration. Since 1955 the phytoplankton has shifted towards a more hypertrophic community with species characteristic of elevated salt levels.

At both stations, zooplankton (*e.g.* zooplankton $>50\,\mu$m) was characterized by low densities during the winter period and higher densities during the summer period, with a spring peak followed by a second, even higher, peak at Eysden at the end of July. Zooplankton was dominated by rotifers at both stations. The rotifers were dominated by *Brachionus angularis, B. calyciflorus*, *Keratella cochlearis* and *K. quadrata*; the copepods by cyclopoid nauplii; the cladocerans by small-sized species mainly belonging to *Bosmina*; and protozoans by *Arcella* sp, *Epistylis* sp and *Vorticella* sp. Additionally, during May - September, *Dreissena polymorpha* larvae were observed in most samples, with higher densities at Keizersveer than at Eysden. At Keizersveer station the relative contribution of copepods was slightly higher than at Eysden. Furthermore, the zooplankton at Keizersveer included the species *Eurytemora affinis*, characteristic for estuarine conditions. Comparison of the present data with older semi-quantitative data gave no information on possible shifts in zooplankton species during the last few decades as the older data are too scarce and too descriptive. The importance of a quantitative long-term plankton monitoring programme is stressed to allow both assessment of the present condition of the river plankton community and evaluation of possible effects of river management measures on the river ecosystem is stressed.

1 INTRODUCTION

The River Meuse system is strongly affected by human activities which has influenced the structure and functioning of the riverine ecosystem largely. There is a need for monitoring studies which allows firstly, assessment of the ecological condition of the River Meuse and secondly, evaluation of the efficacy of policy measures taken to achieve environmental improvements in the river.
Generally, in large eutrophic rivers, the phyto- and zooplankton communities are well developed and play an important role. In 1992, the National Institute of Public Health and the Environment (RIVM), and the firm Koeman en Bijkerk bv, carried out a survey commissioned by the RIVM of river plankton in the Dutch part of the River Meuse within the framework of the national research programme 'Ecological Rehabilitation of the Rivers Rhine and Meuse'. This survey took place also within the national biomonitoring programme for rivers of the National Institute of Inland Water Management and Wastewater Treatment (RIZA).
The main objectives of the present report are:
- firstly, to describe the results of the dynamics of phyto- and zooplankton species composition, and density, at the Belgium-Dutch border (Eysden station) and at the downstream reaches; about 60 km upstream of the discharge point of the river into the North Sea (Keizersveer station), and
- secondly, to evaluate possible shifts in phyto- and zooplankton populations during this century by comparing the 1992 results with older data (as far as these are available) and discussing the role of possible controlling factors.

2 MATERIALS AND METHODS

Surface water samples (65 l) were collected fortnightly with a 10-l bucket at the sampling stations Eysden (at km 615) and Keizersveer (at km 855). At the Keizersveer station samples were always taken about two hours before low tide. Phytoplankton subsamples (1 l) were preserved within three hours after sampling with Lugol's solution in glass bottles (1 l) and stored in a cool place in the dark until analysis. Phytoplankton was identified and enumerated by the Utermöhl method in 1-ml subsamples taken after gently remixing in the bottle by inversion. Subsamples were transferred to sedimentation chambers with a floor area of 1.13 cm^2 and a height:diameter ratio of 1 when filled with a 1-ml sample. Cells were allowed to settle overnight, thereby taking into consideration sedimentation rates of 4 $h.cm^{-1}$ of the smallest algae (Nauwerck, 1963).
The inverted microscope (Olympus IMT-2) was equipped with a long- working distance condensor, NA 0.55, 10x oculairs, an Olympus 20x SPlan Apo 0.70 objective and a Zeiss 63x Plan Apo 1.40 oil immersion objective. All identifications were performed directly on Lugol preserved material. On only one day, July 21, a living sample was analyzed for both stations. The counting effort was planned to yield a reliable number of observations (i.e. >20) for the common taxa. Usually the most abundant algal cells of sizes typically less than 20 μm were identified and counted at a magnification of 630x in a part of the sedimentation chamber, whereas less abundant taxa were counted at a magnification of 200x by scanning half, or the whole of, the chamber, depending on the total cell density. Total numbers of observations per sample ranged from about 200 in winter to 750 in the more diverse summer samples. The abundance of all taxa was expressed in the number of cells per ml, which implied, for instance, that a four-celled coenobium of *Scenedesmus opoliensis* was counted as '4' and a 120-celled colony of *Aphanocapsa elachista* as '120'. Only 'viable' algae, whose presence was signalled by the appearance of the chloroplasts, were counted. Biovolume was calculated per cell using average cell dimensions derived from measurements of populations from Dutch eutrophic rivers and lakes.
Zooplankton was counted in 20-l subsamples, concentrated on a 50 μm sieve and fixed in 8% formaldehyde. The sample was divided into fractions of three sizes: >316, 316-100 and 100 -50 μm. Depending on the size class and density of zooplankton, volumes of 20, 4-20 and 3-20 l were counted for the three fractions in sedimentation chambers, using an inverted microscope (magnification up to 125x). Biovolume was calculated assuming spherical, cylindrical, eclipse- and disc-shaped forms. The size (length, width and/or height) of at least 10 specimens per taxon was measured to determine the average biovolume of the individual organisms; the total per taxon was calculated. Rotifers, cladocerans, copepods, rhizopods and protozoans were identified and counted. The larvae of *Dreissena polymorpha* were also counted. The organisms were identified at species or genera level if identification to species was not possible. Data on daily water discharge, measured at Borgharen, and on chlorofyll *a* and nutrient concentrations, measured every two weeks at both stations, were obtained from the National Institute of Inland Water Management and Wastewater Treatment.

3 RESULTS

The basic results of the phytoplankton identifications and enumerations are listed in Appendix 1.

3.1 Total phytoplankton density and chlorofyll *a*

3.1.1 Seasonal variation of total cell densities

The seasonal variation of total phytoplankton cell density showed large fluctuations both at Eysden and Keizersveer stations (Figure 1). At Eysden peak densities of 30,000 cells per ml were observed in August while a smaller spring peak occurred in the beginning of March. Both peaks could hardly be recognized at Keizersveer, where, in May and July, maximum densities of only 20,000 cells per ml developed (when numbers at Eysden were relatively low). The two stations differed considerably in phytoplankton cell numbers per sampling date. Some mutual drops in cell density could, however, be recognized at the end of March, in mid-June and at the end of August. During the first half of October the cell densities at both stations were drastically reduced. Despite the obvious differences in phytoplankton abundance, a significant correlation of cell densities between the two sampling points could be demonstrated (Spearman rank correlation coefficient 0.71; $p < 0.005$; $n = 20$; Appendix 2).

3.1.2 Phytoplankton biovolume and chlorophyll *a*

Figure 2 shows the seasonal variation of chlorophyll *a* in the Meuse during 1992, as measured by the RIZA at Eysden and Keizersveer. At both stations the maximum chlorophyll *a* concentration was measured on April 14 (50 $\mu g.l^{-1}$ at Eysden and 40 $\mu g.l^{-1}$ at Keizersveer). During the summer months chlorophyll *a* concentrations hardly exceeded 20 $\mu g.l^{-1}$, although the total cell density reached concentrations far beyond those measured in April (Figure 1). Between the two stations differences in chlorophyll-*a* concentration proportional to for cell density were found.. Calculated phytoplankton biovolume corresponded reasonably well with measured chlorophyll-*a* values (Figure 3) and were significantly correlated (Table 1).

Table 1. Correlation between chlorofyll-*a* concentration and phytoplankton volume

	Coefficient	Significance level
Eysden	0.93	$p < 0.0005$
Keizersveer	0.84	$p < 0.0005$

Spearman rank correlation of monthly to bimonthly data from January-December 1992

The largest discrepancies occurred in the beginning of September at Eysden and in October/November at both stations. On these occasions chlorofyll-*a* peaks were not reflected in biovolume.

3.1.3 Phytoplankton density fluctuation and river discharge

The River Meuse is fed by rain and the daily average water discharge may strongly fluctuate in the short term. During 1992 the lowest levels of less than 20 $m^3.s^{-1}$ occurred in June - October, while peak discharges of 400-1200 $m^3.s^{-1}$ were frequently measured in November - March (Figure 4). A comparison of phytoplankton cell counts at Eysden with the corresponding biweekly values of water discharge suggests an inverse correlation (Figure 5).

3.2 Composition of the phytoplankton

3.2.1 Contribution of the main algal groups

During most of the year diatoms or chlorophytes dominated the phytoplankton community in the Meuse by cell number (Appendix 3, Figure 6). From February to May, phytoplankton consisted mainly of diatoms (55-90% of total cell numbers). Green algae dominated the community during May - September; at Eysden their contribution was 50-90% of total cell number, at Keizersveer 25-70%. At Keizersveer bluegreen algae co-dominated during July - September with 25-40%. At Eysden considerable numbers of bluegreen algae were only found on one sampling date in September. The abundance of cryptophyceans and other algal groups was less than 10% at both stations.
In terms of biovolume however, diatoms were by far the most important contributors throughout 1992 (Figure 7). The contribution of green algae during May-September averaged 21% at Eysden, and only 12% at Keizersveer (Appendix 3).

3.2.2 Species composition

The phytoplankton taxa detected are listed in Figure 8, with a representation of their annual variation in density. About 200 taxa were distinguished. Most species were found at Eysden as well as at Keizersveer. Several species, however, showed considerable differences in abundance between these two locations.
At Eysden the centric diatom *Stephanodiscus* group *hantzschii* (distinguishing between *S. hantzschii*, *S. incognitus*, *S. minutulus* and *Cyclostephanos invisitatus* is difficult in LM) was by far the most numerous alga, with the highest yearly average cell density. At Keizersveer *Stephanodiscus* co-dominated with another diatom, *Skeletonema subsalsum*. This latter species was only occasionally detected at Eysden. The related *Skeletonema potamos*, however, occurred at both stations in comparable numbers. Also abundant at both locations, from April to September, were *Aulacoseira ambigua*, *A. granulata* and *Cyclotella meneghiniana*. The pennate diatoms *Asterionella formosa*, *Diatoma tenuis*, and *Fragilaria ulna* var. *acus* were only abundant at Keizersveer, while *Nitzschia acicularis/draveillensis* was more common at Eysden. The diatom *Acanthoceras zachariasii* was transiently abundant only at Eysden during July - September. Densities of the - diatoms *Actinocyclus normanii* morphotype *subsalsus* and *Thalassiosira bramaputrae* were, on the contrary, considerably higher at Keizersveer, although these species did occur in the Meuse at Eysden.

The huge amount of Chlorophyta at Eysden during summer was to a large extent due to the abundance of small spherical cells (diameter 2–5 μm), either single or in small colonies. These 'Chlorophyta bolv.' in Figure 6 probably belonged to genera like *Choricystis*, *Chlorella*, (*Pseudo*)*dictyosphaerium* and *Dactylosphaerium*. Other abundant small chlorophytes with a yellowish cell wall with brown granules belonged to taxa- like *Siderocelis kolkwitzii* or *Marvania geminata* (denoted as '*Siderocelis* s.l ./*Marvania* sp' in Figure 6). The genus *Scenedesmus* also accounted for a large proportion of total cell densities during May - September. Most common were *S. opoliensis* (not separated from the less common *S. protuberans*), *S. denticulatus*, *S. communis*, *S.* group *armati* (the other *Scenedesmus* species with ripples and/or granules on the cell surface) and the related *Pseudodidymocystis inconspicua* (or probably *Scenedesmus costato-granulatus*, two-celled coenobia with brown ripples and without spines).
During summer the phytoplankton of the Meuse at Eysden was characterized by a diverse assemblage of Chlorophyceae and Xanthophyceae. Some less common but conspicious species were *Didymocystis lineata*, *Didymogenes anomala/-palatina* (the spines characteristic of *D. anomala* were found to disappear upon fixation with lugol solution), *Micractinium pusillum*, *Neodesmis danubialis*, *Nephrochlamys subsolitarum*, *Pseudotetrastrum punctatum* and *Tetraplektron* cf.*tribulus*.
Bluegreen algae of the genera *Microcystis*, *Aphanocapsa*, *Aphanizomenon* and *Pseudanabaena* were common at Keizersveer during the second half of the year. - At Eysden some oscillatorean species were abundant with members of the genus *Limnothrix* in spring and *Planktothrix agardhii* during summer. The latter species reached a maximum in September, during a peak in water discharge.

3.2.3 Important contributors to phytoplankton volume

Although about 200 algal taxa were detected, only 13, mostly diatoms, contributed more than 10% to the total phytoplankton volume on one or more occasions. These taxa are listed in Table 2. Almost throughout the year 2 to 4 of these taxa accounted for 40 to 90% of total phytoplankton biovolume. At Eysden the *Stephanodiscus* group *hantzschii* dominated from February to June and constituted 90% of biovolume in April. In the second half of the year this species was succeeded by *Cyclotella meneghiniana* and by *Aulacoseira* species. At Keizersveer *Stephanodiscus* group *hantzschii* co-dominated with *Aulacoseira ambigua* in the first half of the year. In the second half the latter species co-dominated with *Actinocyclus normanii* and again with *Cyclotella meneghiniana*. The highly abundant diatom *Skeletonema subsalsum* did not contribute more than 16% in May and August.

Table 2. Monthly biovolume contribution of dominant phytoplankton taxa (percentage) during 1992.

EYSDEN	j	f	m	a	m	j	j	a	s	o	n	d	Class
Aulacoseira ambigua	29	3	3	-	5	8	11	16	23	6	4	-	Diatom
Aulacoseira granulata	3	-	-	-	-	1	6	13	13	16	2	-	Diatom
Aulacoseira subarctica	3	-	7	-	-	-	-	-	-	-	-	1	Diatom
Cyclotella meneghiniana	6	-	1	-	4	9	10	32	14	7	17	3	Diatom
Fragilaria ulna	8	16	12	4	10	5	7	4	2	2	-	20	Diatom
Melosira varians	5	-	5	-	2	1	-	-	2	5	6	16	Diatom
Peridinium sp	-	-	-	-	2	8	8	2	5	8	-	17	Dinoflagellate
Planktothrix agardhii	-	-	-	-	-	-	-	1	12	5	-	-	Bluegreen
Stephanodiscus hantzschii-group	13	68	55	90	34	41	17	2	3	7	6	3	Diatom
Stephanodiscus rotula-group	-	-	-	-	-	-	-	-	-	3	40	10	Diatom
Total percentage of biovolume	67	87	83	94	57	73	58	71	75	59	75	70	

KEIZERSVEER	j	f	m	a	m	j	j	a	s	o	n	d	Class
Actinocyclus normanii	-	-	-	2	1	32	24	22	22	21	20	5	Diatom
Aulacoseira ambigua	27	16	7	13	17	24	9	4	17	16	16	35	Diatom
Aulacoseira granulata	4	3	-	-	2	3	2	-	10	2	2	-	Diatom
Cryptomonas sp l= 15-30um	4	5	2	3	1	1	4	1	3	6	11	2	Cryptophyte
Cyclotella meneghiniana	2	9	2	2	2	5	8	18	13	10	17	18	Diatom
Fragilaria ulna	2	5	19	7	3	1	-	-	-	-	-	8	Diatom
Melosira varians	-	-	4	9	1	3	-	-	1	1	3	5	Diatom
Peridinium sp	-	-	-	1	-	-	8	6	6	-	-	-	Dinoflagellate
Skeletonema subsalsum	-	-	-	-	15	5	9	16	3	4	2	-	Diatom
Stephanodiscus hantzschii-group	17	29	56	44	26	4	2	2	-	-	4	4	Diatom
Stephanodiscus rotula-group	4	-	-	1	1	1	4	6	2	25	-	1	Diatom
Total percentage of biovolume	60	67	89	82	69	79	70	75	76	85	75	78	

- = montly contribution < 1 %

3.2.4 Seasonal variation of common species at Eysden and Keizersveer

Several considerable differences were found between the seasonal abundance of some of the more common algae at Eysden and Keizersveer *i.e.* taxa with yearly average densities of more than 100 cells per ml).

Stephanodiscus group *hantzschii*
The spring peak at Eysden consisted, for 80%, of small *Stephanodiscus* species, predominantly *S. hantzschii* and to a lesser extent *S. parvus*. A dip in the density of *S. hantzschii* in the second half of March (Figure 9) was accompanied by relatively high numbers of periphytic and meroplanktonic diatoms such as *Melosira varians*, *Cymbella* sp., *Diatoma vulgaris*, *Fragilaria capucina*, *Gomphonema* sp., *Meridion circulare* and *Surirella* cf. *brebissonii*. This dip has been attributed to an increased discharge following prolonged rainfall (see 3.1.3). Later, the density of *Stephanodiscus* increased again to a maximum of 11,150 cells per ml, on April 28. This second peak partly consisted of chain-forming *Stephanodiscus* cells. Cell densities at Keizersveer largely followed the changes observed at Eysden but were considerably lower.

Skeletonema subsalsum
The density of this chain-forming diatom increased rapidly in the samples from Keizersveer from April onward (Figure 10). The highest cell numbers (4800 per ml) were found in May. A second, but smaller peak, was observed in August. *S. potamos* (not depicted) was only abundant during the summer months at both stations, reaching maximum densities of 400 (Keizersveer) to 1500 cells.ml^{-1} (Eysden) in July - August.

Aulacoseira ambigua
This important species in terms of biomass showed a different pattern of occurrence at each of the two sampling points (Figure 11). At Keizersveer peak densities reaching 2000 cells per ml were found during May. At Eysden on the contrary, the highest densities were found in August, while a spring peak was not observed.

Aulacoseira granulata
At both locations this diatom species was most abundant during the late summer months (Figure 12). The maximum density at Eysden, however, was three times higher than at Keizersveer.

Cyclotella meneghiniana
Just as all the diatom species mentioned above, *Cyclotella meneghiniana* was present in all samples year-round. From June its density increased, rapidly reaching a peak in August, with the highest numbers found at Eysden (Figure 13).

Nitzschia acicularis / draveillensis and *Asterionella formosa*
Of the common spring pennates only *Nitzschia acicularis / draveillensis* was abundant at Eysden (Figure 14). The observed maximum densities of this taxon at Keizersveer were four times lower. Here *Asterionella formosa* (Figure 15) and, to a lesser extent *Diatoma tenuis* (not depicted), were best represented in the spring peak.

Scenedesmus spp.
Representatives of the genus *Scenedesmus* were encountered in all samples and constituted, on average, 11% of total cell numbers, both at Eysden and Keizersveer (Figure 16). Within this genus 13 taxa or morphotypes were distinguished. Most common year-round were the highly variable ones, such as *S. opoliensis* (typical *protuberans* forms were sometimes seen during summer), *S. acuminatus* (most coenobia were of the *acuminatus* and *dimorphus* type) and *S.* group *sempervirens* (including *S. sempervirens*, *S. subspicatus* and *S. spinosus*).
Several taxa that could be identified with more certainty were also abundant during a large part of the year, as *S. intermedius* (more abundant at Keizersveer than at Eysden) and *S. denticulatus*, while *S. ellipticus* and *S. arcuatus* showed a temporally more restricted occurrence. Small unicells of *Scenedesmus* (or *Lagerheimia balatonica*) were abundant throughout the summer.

Rhodomonas and *Cryptomonas*
Both the smaller and larger flagellates of the Cryptophyceae class were more numerous at Keizersveer than at Eysden (Figure 17).

Planktothrix (= *Oscillatoria*) *agardhii* and *Microcystis*
High cell densities of *Aphanocapsa elachista* (July) and *Microcystis aeruginosa* (July - September) were present in the samples from Keizersveer (Figure 18). Densities of these species at Eysden were much lower. Here *P. agardhii* was abundant during a short period in September - October.

3.2.5 Structural composition

The phytoplankton species found at Eysden were classified into size classes based on the largest dimension of the prevailing planktonic unit (single cell, filament or colony). Three size classes were distinguished. Figure 19 illustrates that the phytoplankton community in spring consisted almost exclusively of organisms smaller than 20 μm, both in terms of cell numbers and biomass. The dominant organism at this time, *Stephanodiscus* group *hantzschii*, typically occurs as single cells during spring and may also appear in chains during April to September. Because more than 90% of the cells were either single (diameters 8-18 μm) or appeared in short, mostly two-celled chains (chain length $< 20\ \mu$m), this species was put into the size class $< 20\ \mu$m. From May onward the proportion of larger individuals increased. During the summer and autumn months, individuals larger than 20 μm made up the greatest part of total phytoplankton volume (e.g. *Aulacoseira* spp., *Dictyosphaerium pulchellum*, *Pediastrum* spp.). Measured in cell numbers, organisms of nanoplanktic sizes ($< 20\ \mu$m) were, however, equally abundant. (e.g. *Cyclotella meneghiniana*, *Crucigenia tetrapedia*, *Didymocystis* spp., *Pseudodidymocystis inconspicua*, *Scenedesmus* unicells, *and Tetrastrum staurogeniaeforme*, unidentified chlorophycean spheres $< 10\ \mu$m).

3.3 Comparison with historical data on phytoplankton

3.3.1 Data from the Eysden vicinity from 1955 and 1973-1981

From a comparison with the surveys by Wibaut-Isebree Moens (1956 and 1964) and by J. van der Hout of the National Institute for Inland Water Management and Wastewater Treatment (De la Haye 1994), one can conclude that most species found in 1992 were also present in the fifties and seventies. The most important 'new' species in the Meuse, found in 1992 but not mentioned before, are *Aulacoseira ambigua* and *Skeletonema potamos*. A number of species, however, apparently changed in abundance. Obvious changes in abundance could be noted both in the seasonal distribution (Appendix 4) and the maximum density (Appendix 5) of the species involved. To enable a comparison the results from 1992 had to be transformed to a semi-quantitative measure. Table 3 lists the most important species having clearly changed abundances.

Table 3. Species at Eysden showing obvious changes in abundance

Increased between 1955 and 1973	**Increased between 1981 and 1992**
Anabaena sp. *Aphanizomenon flos-aquae* Chlorophyta spheres 2-5 µm *Cryptomonas* sp. *Cyclotella meneghiniana* *Scenedesmus opoliensis* *Stephanodiscus hantzschii*	*Aulacoseira ambigua* *Aulacoseira subarctica* *Crucigenia tetrapedia* *Crucigeniella apiculata* *Planktothrix agardhii* *Scenedesmus denticulatus* *Skeletonema potamos*
Decreased between 1955 and 1973	**Decreased since 1973**
Acanthoceras zachariasii *Asterionella formosa* *Cyclotella radiosa* *Diatoma tenuis* *Rhizosolenia eriensis/longiseta*	*Pandorina morum*

About 40 taxa, mostly small green algae, were more abundant in 1992 than in 1955. Although some apparently increased during 1955 to 1973, a greater number probably increased during 1981 to 1992. The fact that small individuals might have been underestimated in 1973 - 1981 (due to filtration over a 10-µm mesh) must, however, be considered. No change in abundance could be demonstrated for about 30 taxa, mostly larger green algae and diatoms. One of these, *Micractinium pusillum*, gradually became more common during 1973-1981 to end at the same abundance level as in 1955. About 10 taxa showed an obvious decrease in abundance, apparently between 1955 and 1973.
For some species the apparent changes in abundance can be verified by a comparison with quantitative data from the Meuse at Grave, collected by J. van der Hout (RIZA) during 1968 to 1972. Absolute densities of the most abundant algae at that time are reported by De la Haye (1994). Grave, however, is located about 160 km downstream from Eysden, a distance that takes 4 to 28 days of travelling time at discharges of 500 and 50 m^3/s respectively for the river water. Population densities may double during this time interval.
Maximum densities of *Stephanodiscus hantzschii* in spring 1992, however, showed a 30-fold increase in comparison with 1968 to 1972 (see Appendix 6). The Grave data also support the impression of decreased abundances in the pennate diatoms *Asterionella formosa* and *Diatoma tenuis* (some inverse relation between the two during 1968 - 1972 is apparent) and of the more-or-less unchanged densities of *Fragilaria ulna* var. *acus* and the green algae *Actinastrum hantzschii*, *Scenedesmus communis* and *S. acuminatus*. During a short period (1971 - 1973), however, the latter three species reached relatively high densities as compared to 1955 and 1992.

3.3.2 Data from the Keizersveer area from 1918 - 1992

Peelen (1975) analyzed the changes in phytoplankton composition of the Meuse, combining data from several locations along this river. Peelen himself studied the phytoplankton around Keizersveer from 1969 - 1972. His table of 'principal

components' is reproduced in Appendix 7a, with the results of the present study added. Apparently increased in this area are the bluegreen algae *Aphanizomenon*, *Planktothrix* and *Microcystis*, although the distinction Peelen made between nanoplankton and netplankton, using different scales of abundance, complicates a comparison for the latter category. Still common in 1969 - 1972, but very rare in 1992, is again, *Cyclotella radiosa*. Appendix 7b lists the species not mentioned by Peelen (1975) but common in 1955 and/or 1992. Some very abundant species in 1992 lacking in the selection made by Peelen were *Aphanocapsa* sp., *Aulacoseira ambigua*, *Cyclotella meneghiniana*, *Rhodomonas minuta*, *Cryptomonas* sp., *Skeletonema potamos* and *Skeletonema subsalsum*.
It is remarkable that Peelen (1975) observed maximum cell densities at Keizersveer of 10,000-30,000 cells.ml^{-1} in August 1971 - 1972, while the densities in August 1992 were considerably lower (by 8000-13,000 cells.ml^{-1}).

3.3.3 Changes in species frequency from 1959-1992

Peelen (1975), who clearly made a selection of taxa for his study of community changes, thereby offers a limited possibility for comparing this older data with our present data. A second comparison is, however, possible with the data of Dresscher (1969), who investigated the plankton from the Keizersveer area in 1960 - 1961, and with the data of Wibaut-Isebree Moens (1964), who sampled the Meuse and adjacent gravel pits in Zuid-Limburg on four occasions in the second half of 1959. Both researchers published an extensive species list. Unfortunate, at least for our purposes, is that cell densities are not given, but frequencies of occurrence in the samples are. For comparison with the data of Dresscher, who also sampled year-round, the same scale of frequency was adopted. For comparison with the data from Wibaut-Isebree Moens, who sampled four times during 1959, only the 1992 samples from corresponding data were included (June 11, August 4, October 13 and December 8).
Most taxa found in 1992 were also listed by Dresscher (Appendix 8) and by Wibaut-Isebree Moens, with largely comparable frequencies with older data. Here too, however, some of the very common taxa of 1992 were missing in the older lists (*Aulacoseira ambigua*, *Skeletonema* spp. and the cryptophyceans). *Skeletonema subsalsum* might have been identified as *Tribonema minus* by Dresscher. At Keizersveer the frequency of bluegreen algae and a number of green algae seemed to have increased (*e.g. Pediastrum* spp., *Scenedesmus* spp., *Tetraedron* spp.). A similar increase was not apparent in the Meuse in Limburg. At both locations pennate diatoms occurred more frequently in 1959 - 1961 than in 1992.

3.4 Zooplankton density and composition

The basic results of the zooplankton identifications and enumeration are listed in Appendix 9.

3.4.1 Seasonal variation of zooplankton density

Zooplankton density expressed as the sum of rotifers and crustaceans showed a clear seasonal pattern at both Eysden and Keizersveer stations (Figure 20). During the winter period (November - February), the zooplankton densities were low, generally less than 5 individuals per litre. In May, the zooplankton densities increased to a maximum of about 800 and 1900 individuals per litre at Eysden and Keizersveer, respectively. Thereafter, the zooplankton densities decreased, but remained much higher than during the winter period. At the end of July a second peak density (about 6000 individuals per litre) was observed at Eysden station Eysden. During spring and early summer (March - June), at station Keizersveer, the zooplankton densities at Keizersveer station were higher than those at Eysden station, while from July onwards, the highest zooplankton densities were observed at Eysden station. These high densities were mainly due to high rotifer numbers.
Mean annual protozoan density (e.g. protozoans $>50\,\mu$m) was about 80 and 200 individuals per litre at stations Eysden and Keizersveer, with maximum densities observed of about 500 and 700 individuals per litre, respectively.

3.4.2 Zooplankton density and composition

A very high percentage of the river zooplankton numbers was on average made up of rotifers, i.e. 92 and 84% at Eysden and Keizersveer, respectively. The relative contribution of copepods to total zooplankton was slightly higher at Keizersveer (10%) than at Eysden (6%). Cladocerans represented 2 and 6% at Eysden and Keizersveer, respectively (Figure 21). Due to the size differences between rotifers and crustaceans, rotifers at Eysden made up on average about 60% of the total zooplankton biovolume, at Keizersveer about 19% (Figure 22). In terms of biovolume, protozoans comprised $<5\%$ and $<1\%$ only of total zooplankton biovolume of rotifers, crustaceans and protozoans together at the Eysden and Keizersveer stations, respectively (Appendix 9).
Brachionus angularis, *B. calyciflorus*, *Keratella cochlearis* and *K. quadrata*, were the most common rotifers at both stations, comprising more than 70% of the total rotifers. Copepods were predominantly represented by cyclopoid nauplii and the cladocerans by small-sized species, mainly *Bosmina* sp. Dominant protozoans were *Arcella* sp., *Epystilis* sp. and *Vorticella* sp. In general, the species composition at the two sampling stations was largely similar, although some rotifer species were only found at Eysden (*Diurella* sp. and *Trichotria tertractis*) (Appendix 9). Furthermore, the estuarine calanoid *Eurytomora affinis* was regularly found at Keizersveer station and only once at low density at station Eysden.

3.4.3 Seasonal dynamics of dominant species

At both stations, the dominant rotifer species *K. cochlearis*, *K. quadrata*, *B. calyciflorus* and *B. angularis* varied markedly in their seasonal dynamics (Figure 23). They were found in considerable numbers during the April - September summer period. The seasonal dynamics of *B. angularis*, *B. calyciflorus* and *K. cochlearis* showed marked differences between the Keizersveer and Eysden stations. At both stations a peak value was observed during spring/early summer. At station Eysden, however, a second and much higher peak was observed in the

second half of the season, with maximum densities of 552, 274 and 2700 individuals per litre, respectively. These high densities of rotifers during the second half of the season might be explained by lower discharges and consequently a longer residence time of the water. The highest zooplankton densities at Eysden station coincided with the lowest discharge values during the season. Furthermore, the higher water temperatures in July/August are likely to have shortened the rotifer generation time, resulting in higher rotifer abundancies. The seasonal dynamics of *K. quadrata* showed less pronounced differences between the two sampling stations. The rotifers enumerated above are cosmopolitan species found in eutrophic environments.

3.4.4 Larvae of *Dreissena polymorpha*

In the period May - September, *Dreissena polymorpha* larvae were observed in most samples (Figure 24). At Keizersveer the densities were much higher than at Eysden with a maximum density of about 1000 individuals per litre observed in July. At Eysden station the maximum density observed was about 40 individuals per litre in August. The relatively high densities of *D. polymorpha* larvae observed at Keizersveer indicate an abundant population of *D. polymorpha* in the downstream parts of the River Meuse.

3.5 Comparison with historical data on zooplankton

3.5.1. Comparison with historical data on zooplankton

The composition and dynamics of the zooplankton community in the River Meuse, as presented in this study, are scarcely comparable with earlier data (Peelen, 1975; De la Haye, 1994), which are semi-quantitative. Furthermore, the sampling stations in this study are not the same as the ones in previous studies: these were located in the delta area (Peelen, 1975). Therefore, the question on whether the zooplankton composition and densities have changed during this century cannot be fully answered since well-documented historical data are too scarce. Nevertheless, when comparing the results of 1992, presented in the same semi-quantitative way as the older data (Appendix 10), some remarks can be made. Firstly, no apparent shifts in the composition of dominant zooplankton species seem to have occurred. In 1954 - 1955, the dominant species were *B. calyciflorus*, *B. angularis* and *K. cochlearis* (Peelen, 1975). Secondly, the mean densities of most species in 1992 seem to be lower than in the early seventies. This might, however, be due to differences in applied methods and/or sampling locations. From a comparison of the present results with the semi-quantitative data of 1973 to 1981 (De la Haye, 1994), it seems that no obvious shifts in species observed have occurred during the past decades. Due to the descriptive character of these older data, however, no conclusions can be drawn on possible shifts in species composition and/or abundances.

4 DISCUSSION

4.1 The present status of the Meuse phytoplankton

The phytoplankton of the River Meuse in 1992 was characterized by a dominance of centric diatoms (*Stephanodiscus hantzschii*, *Aulacoseira ambigua*, *A. granulata*, *Cyclotella meneghiniana*, *Skeletonema potamos* and *S. subsalsum*) throughout the year and a diverse assemblage of green algae during the summer months.
The species richness in 1992 was largely comparable to 1955, but some species show a considerable change in abundance during the past four decades. For diatoms, the species involved are listed in Table 4, with their indicator values for trophic state, saprobity and salinity, derived from Van Dam *et al.* (1994).

Table 4. Diatoms, increased or decreased since 1955, with indicator values

Decreased abundance	**Trophic state**	**Saprobity**	**Chlorinity (mg l^{-1})**
Acanthoceras zachariasii	eutraphentic	oligosaprobous	< 100
Asterionella formosa	meso-eutraph.	β-mesosaprob.	< 500
Cyclotella radiosa	eutraphentic	β-mesosaprob.	< 500
Diatoma tenuis	eutraphentic	α-mesosaprob.	500 - 1000
Fragilaria crotonensis	mesotraphentic	β-mesosaprob.	< 500
Rhizosolenia spp.	meso-eutraph.	oligosaprobous	< 100
Increased abundance	**Trophic state**	**Saprobity**	**Chlorinity (mg l^{-1})**
Actinocyclus normanii	eutraphentic	α-mesosaprob.	500 - 1000
Aulacoseira ambigua	eutraphentic	β-mesosaprob.	< 500
Cyclotella meneghiniana	eutraphentic	α-meso/polysapr.	500 - 1000
Skeletonema potamos	hypereutraphent.	β-mesosaprob.	500 - 1000
Skeletonema subsalsum	?	?	500 - 1000
Stephanodisc. hantzschii	hypereutraphent.	α-meso/polysapr.	< 500
No apparent change	**Trophic state**	**Saprobity**	**Chlorinity (mg l^{-1})**
Aulacoseira granulata	eutraphentic	β-mesosaprob.	< 500
Nitzschia acicularis/drav.	eutraphentic	α-mesosaprob.	< 500
Nitzschia fruticosa	eutraphentic	α-mesosaprob.	< 500
Fragilaria ulna var. *acus*	eutraphentic	α-mesosaprob.	< 500

The apparent increase of *Aulacoseira ambigua* might be due to confusion with the related species *A. granulata*. Even in a more recent study by Bij de Vaate & Van der Hout (1990) only *A. granulata* is mentioned, being the dominant species in terms of biovolume during an algal bloom in August 1990. Descy (1987), however, reported *A. ambigua* in his survey of the Belgian stretch of the Meuse in 1983-1984, together with *A. granulata* and *Cyclotella meneghiniana* this species showed a maximal development during the summer period. The replacement of *Cyclotella radiosa* by *Cyclotella meneghiniana* during 1955 - 1973 is obvious as both species were found by Wibaut-

Isebree Moens (1956 and 1964); the latter in relatively low densities at that time. The increase of the diatom *Skeletonema potamos* is also obvious. About ten years ago only one single individual was encountered in the Belgian Meuse (Descy & Willems, 1991). Apparently, the composition of the diatom community seems to have shifted to a community characteristic for more eutrophic-hypertrophic and α-mesosaprobic conditions with elevated salt levels. These observations are in agreement with present high nutrient and chloride concentrations (mean annual 1992 concentrations at Eysden: 3.21 mg NO_3-N l^{-1}, 0.42 mg P Tot-P $l^{-1}$and 53 mg Cl l^{-1}).

The question whether the phytoplankton composition of the River Meuse has also changed due to pollution with micropollutants during this century cannot be answered since well-documented historical data are too scarce, and too little information is available on the influence of toxicants on the development of river plankton under actual field conditions.

An experimental study with natural assemblages of river phytoplankton showed that green algae and some pennate diatoms seemed to be less affected by increased copper concentrations than centric diatoms and also that copper additions induced the development of smaller cell species (Tubbing *et al.*, 1993). The authors suggested that the present levels of copper in the River Meuse affect both the species and the structural composition of the phytoplankton. However, this statement cannot be confirmed by the present results showing a higher abundance of centric diatoms in 1992 than in 1955 at the expense of pennate diatoms. Apparently too little information is available to quantify the role of contamination with micropollutants on phytoplankton composition.

Phytoplankton composition and abundance is also likely to be affected by grazing of herbivorous zooplankton. In contrast to lake systems, however, relatively little experimental evidence is available on the role of herbivorous zooplankton grazing on phytoplankton in river systems. Grazing experiments showed that rotifers seem to be able to contribute significantly to phytoplankton losses over periods of several weeks during a low-flow summer episode (Gosselain *et al.*, 1995). Recently several authors have indicated that protozoans might play a role in terminating river algal blooms by grazing (Müller, 1991; Arndt *et al.*, 1993, Bijkerk, 1995).

A comparison of the phytoplankton communities between Eysden and Keizersveer stations showed substantial differences in cell densities and species composition. The high numbers of the diatoms *Skeletonema subsalsum* and *Actinocyclus normanii* at Keizersveer, species relatively rare at Eysden, indicated that the river water at Keizersveer is a mixture of Meuse and more saline waters. Both species have been demonstrated to be typical representatives of the summer plankton of the River Rhine (Bijkerk 1990 and unpublished data). The mixing of Meuse and Rhine water may occur as a consequence of tidal movements in the lower branches of the rivers. Water from the Hollands Diep downstream from Keizersveer (where the Meuse and part of the Rhine water meet) may regularly move upstream due to the tidal influence. Consequently, a comparison of the phytoplankton communities between the two sampling stations does not provide information on the wax and wane of species during downstream transport.

4.2 The present status of the Meuse zooplankton

The zooplankton of the River Meuse shows various characteristics typical for large lowland eutrophic rivers in the temperate zone: relatively low zooplankton densities compared to lake systems, a dominance of rotifers, with *Brachionus* and *Keratella* as dominant genera, and a seasonal pattern characterized by low densities in winter, a

spring peak, followed by relatively high densities during the summer period with some additional peaks (Van Dijk & Van Zanten, 1995). Compared with the River Rhine, the zooplankton density in the River Meuse is high: 4 and 35 crustaceans per litre and 115 and 400 rotifers per litre, at Lobith and Eysden, respectively. However, it is much lower than that trophic lakes. For example, the Loosdrecht lakes (The Netherlands) have crustacean peak of about 10-fold higher density (2000 individuals per litre), and a rotifer density of about fourfold higher (9000 individuals per litre) (Gulati, 1990; Gulati *et al.*, 1992) than in the River Meuse at Eysden. These much lower densities are largely ascribed to the relatively short residence time in rivers, preventing full development of a zooplankton community.

The apparent dominance of rotifers in eutrophic rivers is generally explained by their very brief generation times when compared with those of other large-sized zooplankton taxa, such as copepods and cladocerans. These differences in generation time might also explain the observed higher relative contribution of copepods to the total zooplankton at Keizersveer as compared to Eysden. However, other factors might be involved as well, such as differences between copepods and rotifers in tolerance to flow. Recently, Richardson (1992) observed that planktonic cladocerans and rotifers are unable to maintain their position in moving water and their potential for washout is high, whereas cyclopoid copepods can resist and avoid flowing water. As a result cyclopoid copepods may exhibit relatively large populations in flowing water.

Contamination with micropollutants is highly likely, a co-controlling factor for the zooplankton community. For example, rotifers are generally less sensitive to micropollutants than are crustaceans (e.g. Hanazato & Yasuno, 1990); for the River Guidalquivir contamination was found to favour a dominance of rotifers (Guisande & Toja, 1988). Hence, it cannot be ruled out that the present high pollution of the River Meuse with micropollutants favours a rotifer dominance.

Comparison of the present data with older data showed no information on possible shifts in zooplankton species composition and abundancies because the older data are too scarce and too descriptive. This once more stresses the importance of a well-organized quantitative long-term plankton monitoring programme to allow evaluation of the impact of possible changes in river characteristics such as water quality and hydrology on the river zooplankton community. The RIZA national biomonitoring programme for rivers does not only allow assessment of the present plankton community, but will also, in the long term, allow assessment of the effects of policy measures on the river ecosystem in terms of abundance and composition of the river plankton community.

REFERENCES

Arndt H, Krocker M, Nixdorf B & Köhler A (1993) Long-term annual and seasonal changes of meta- and protozooplankton in Lake Müggelsee (Berlin) : Effects of eutrophication, grazing activities, and the impact of predation. *Int Revue Ges Hydrobiol* **78** : 379-402.

Bij de Vaate A & Van der Hout J (1990) De samenstelling van het fytoplankton in de Maas tijdens een algenbloei in augustus 1990. Notitie nr. 90.16 AOBL, Dienst Binnenwateren/RIZA, Lelystad, The Netherlands, pp. 1-4.

Bijkerk R (1990) Phytoplankton in the river Rhine, 1989. RDD in commission of the RIVM. *Publications and Reports of the project Ecological Rehabilitation of the River Rhine*, Vol. 30. pp. 1-31.

Bijkerk R (1995) Dichtheid en voedsel van algivoor protozoöplankton in het Volkerak-Zoommeer, 1992. In commission of RIZA. Report 95-13, Koeman en Bijkerk bv, Haren, The Netherlands, pp. 1-14.

Breukel R, Silva W, Van Vuuren W, Botterweg J & Venema R (1991) De Maas, verleden, heden en toekomst. Nota nr. 91.052, Rijksinstituut voor Integraal Zoetwaterbeheer en Afvalwaterbehandeling, Lelystad,
The Netherlands, pp. 1-109.

Descy JP (1987) Phytoplankton composition and dynamics in the river Meuse(Belgium). *Arch Hydrobiol Suppl* **78,2** / *Algologic Studies* **47** : 225-245.

Descy JP & Willems C (1991) Contribution à la connaissance du phytoplancton de la Moselle (France). *Cryptogamie, Algol* **12** : 87-100.

De la Haye MAA (1994) Fyto- en zoöplankton in de Maas (1966-1982) (Eijsden, Grave en Lith). Aquasense in commission of RIZA. *Reports of the project Ecological rehabilitation of the River Meuse*, Vol. 25, pp. 1-45.

Dresscher TGN (1969) De soortencombinaties van de in het water zwevende plant-aardige micro-organismen van enkele plaatsen in de Brabantse Biesbosch en de omgeving. *Meded Hydrobiol Ver* **2** : 154-166. (with English summary).

Gosselain V, Joaquim-Justo C, Mena M, Metens A, Descy J-P & Thomé J-P (1996) Laboratory and *in situ* grazing rates of freshwater rotifers and their contribution to community grazing rates. *Arch Hydrobiol* (in press).

Guisande C & Toja J (1988) The dynamics of various species of the genus *Brachionus* (Rotatoria) in the Guadalquivir River. *Arch Hydrobiol* **112** : 579-595.

Gulati RD (1990) Zooplankton structure in the Loosdrecht lakes in relation to trophic status and recent restoration measures. *Hydrobiologia* **191** : 173-188.

Gulati RD, Ooms-Wilms AL, Van Tongeren OFR, Postema G & Siewertsen K (1992)The dynamics and role of limnetic zooplankton in Loosdrecht lakes (The Netherlands). *Hydrobiologia* **233** : 69-86.

Hanazato T & Yasuno M (1990) Influence of persistence period of an insecticide on recovery patterns of a zooplankton community in experimental ponds. *Environ Pollut* **67**: 109-122.

Ministry of Transport and Public Works and Water Management
(1993) Jaarboek 1992. RIZA/RIKZ, Lelystad/Den Haag, pp. 1-156 *(in Dutch).*

Müller H (1991) *Pseudobalanion planctonicum* (Ciliophorum, Prostomatida): ecological significance of an algivorous nanociliate in a deep mesoeutrophic lake. *J Plankton Res* **13** : 247-262.

Nauwerck A (1963) Die Beziehungen zwischen Zooplankton und Phytoplankton im See Erken. *Symb Bot Upsal* **17**(5).

Peelen R (1975) Changes in the composition of the plankton of the rivers Rhine and Meuse in the Netherlands during the last fifty-five years. *Verh Internat Verein Limnol* **19** : 1997-2009.

Richardson WB (1992) Microcrustacea in flowing water: experimental analysis of washout times and a field test. *Freshwater Biol* **28** : 217-230.

Tubbing GMJ, Dommering AE, Admiraal W, Balfoort H & Breebaart L. Effects of copper on planktonic communities from the river Rhine; changes in interacting populations of phytoplankton, zooplankton and bacteria (submitted).

Van Dam H, Mertens A & Sinkeldam J (1994) A coded checklist and ecological indicator values of freshwater diatoms from the Netherlands. *Neth J Aquat Ecol* **28** : 117-133.

Van Dijk GM & Van Zanten B (1995) Seasonal changes in zooplankton abundance in the lower Rhine during 1987-1991. *Hydrobiologia* **304** : 29-38.

Wibaut-Isebree Moens NL (1956) Rivierenonderzoek 1954-1955. Unpubl. Report on commission of Public Works (Rijkswaterstaat).

Wibaut-Isebree Moens NL (1964) Onderzoek van grindgaten langs de Maas. *Publ Natuurhist Genootsch Limb* ***14*** (with English summary).

FIGURES 1 to 24

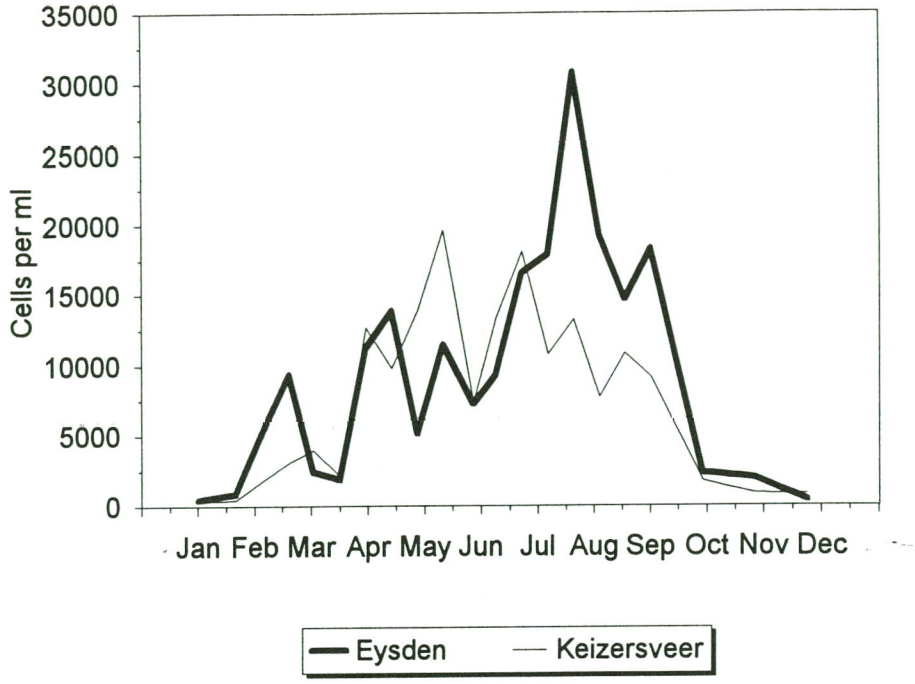


Figure 1. Time course of phytoplankton cell density in the Meuse during 1992.

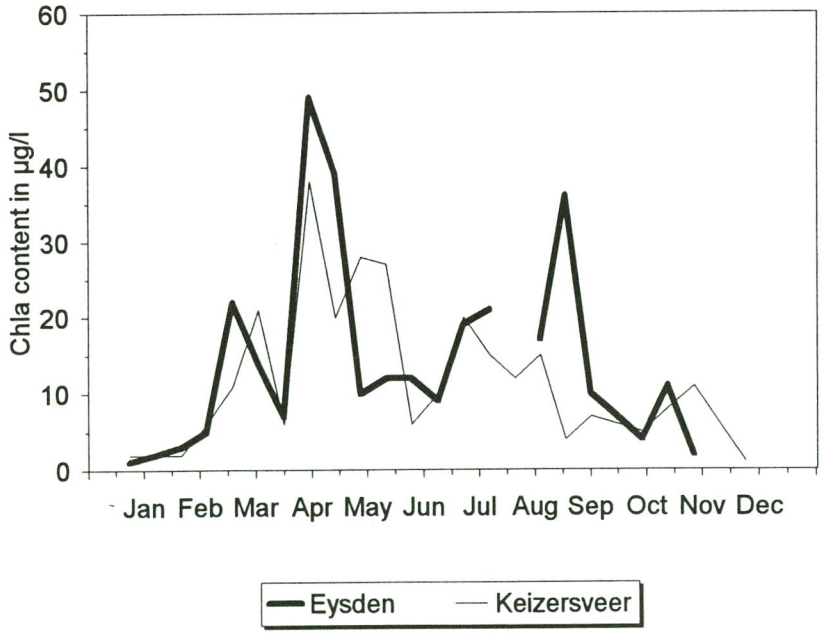


Figure 2. Time course of chlorofyl-a content in the Meuse during 1992.

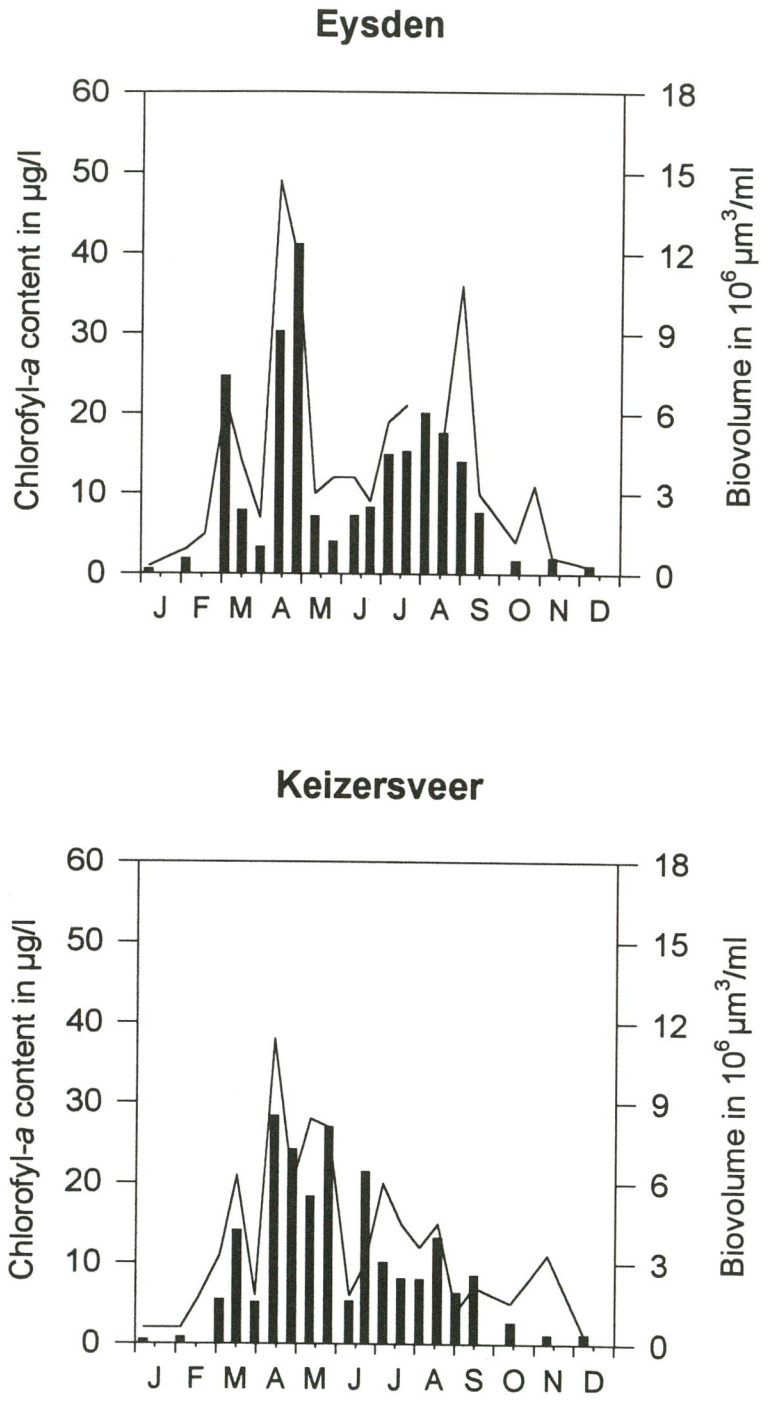


Figure 3. Comparison of chlorofyl-*a* content (line) and biovolume estimations (bars).

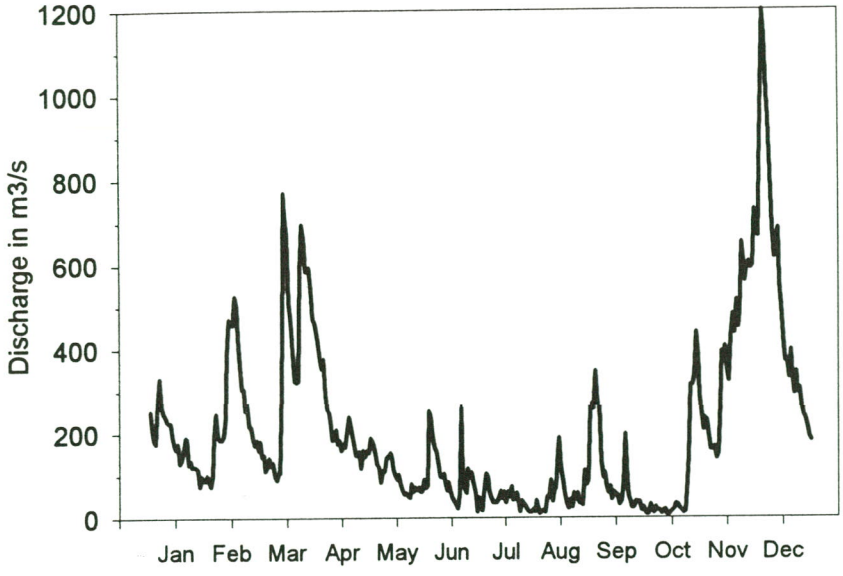


Figure 4. Daily average water discharge of the Meuse at Borgharen, 1992.

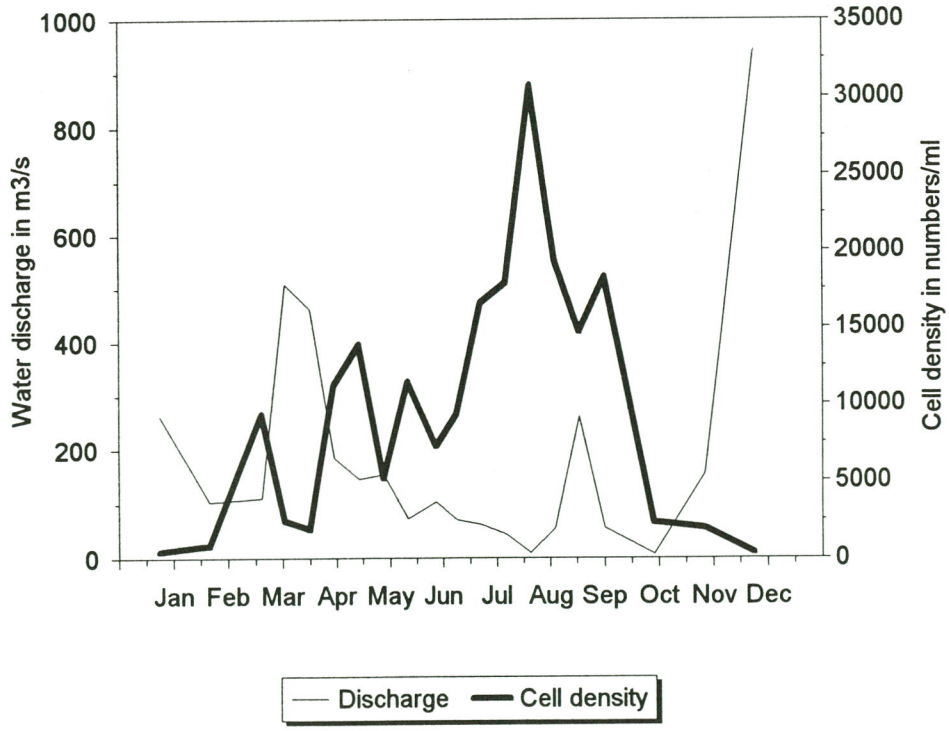


Figure 5. Comparison of water discharge and total cell numbers at Eysden 1992.

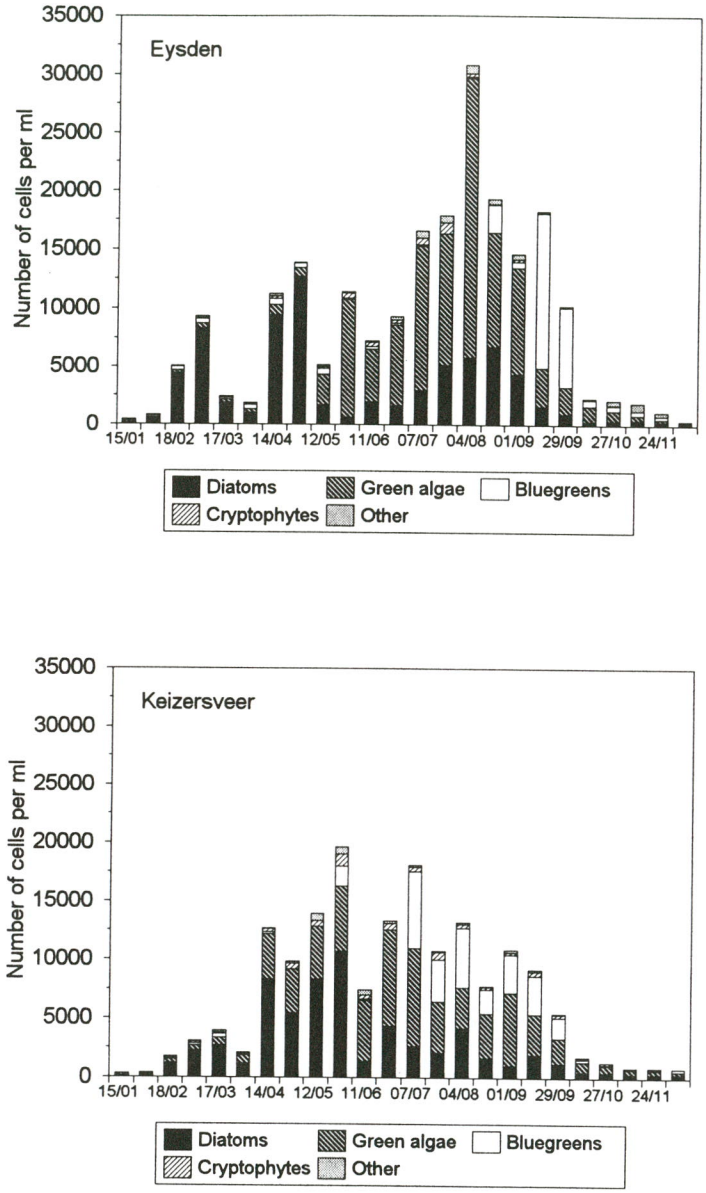


Figure 6. Variation of total cell densities and contribution of major phytoplankton groups in the Meuse during 1992, at two sampling stations.

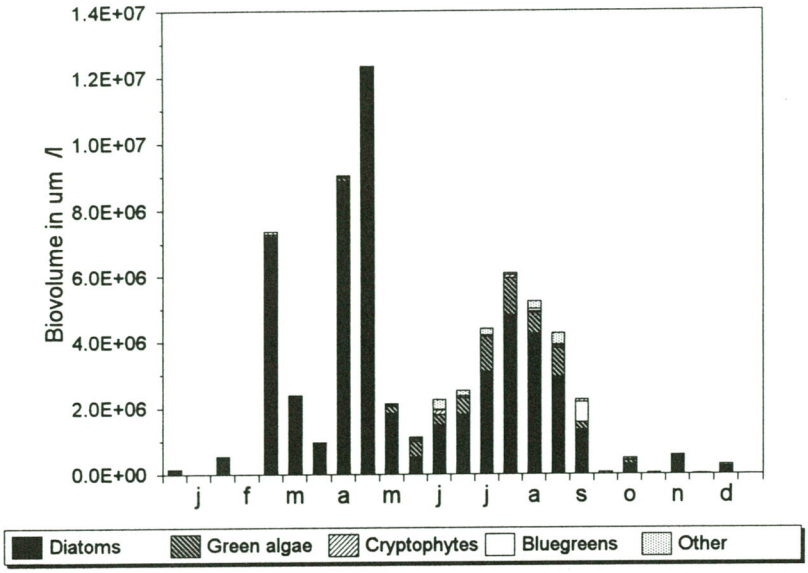


Figure 7a. Course and composition of phytoplankton biovolume at Eysden.

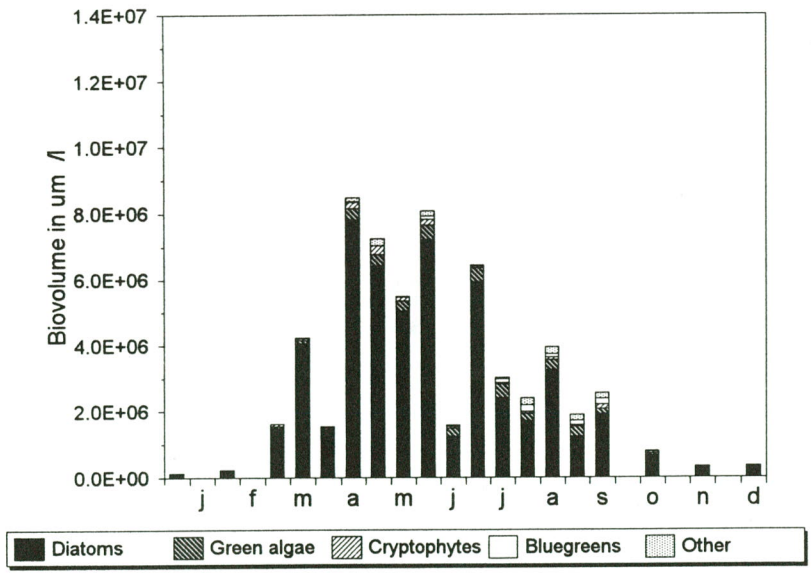


Figure 7b. Course and composition of phytoplankton biovolume at Keizersveer.

Figure 8. Kite diagram of species found in the River Meuse during 1992 with an indication of their annual density fluctuation.

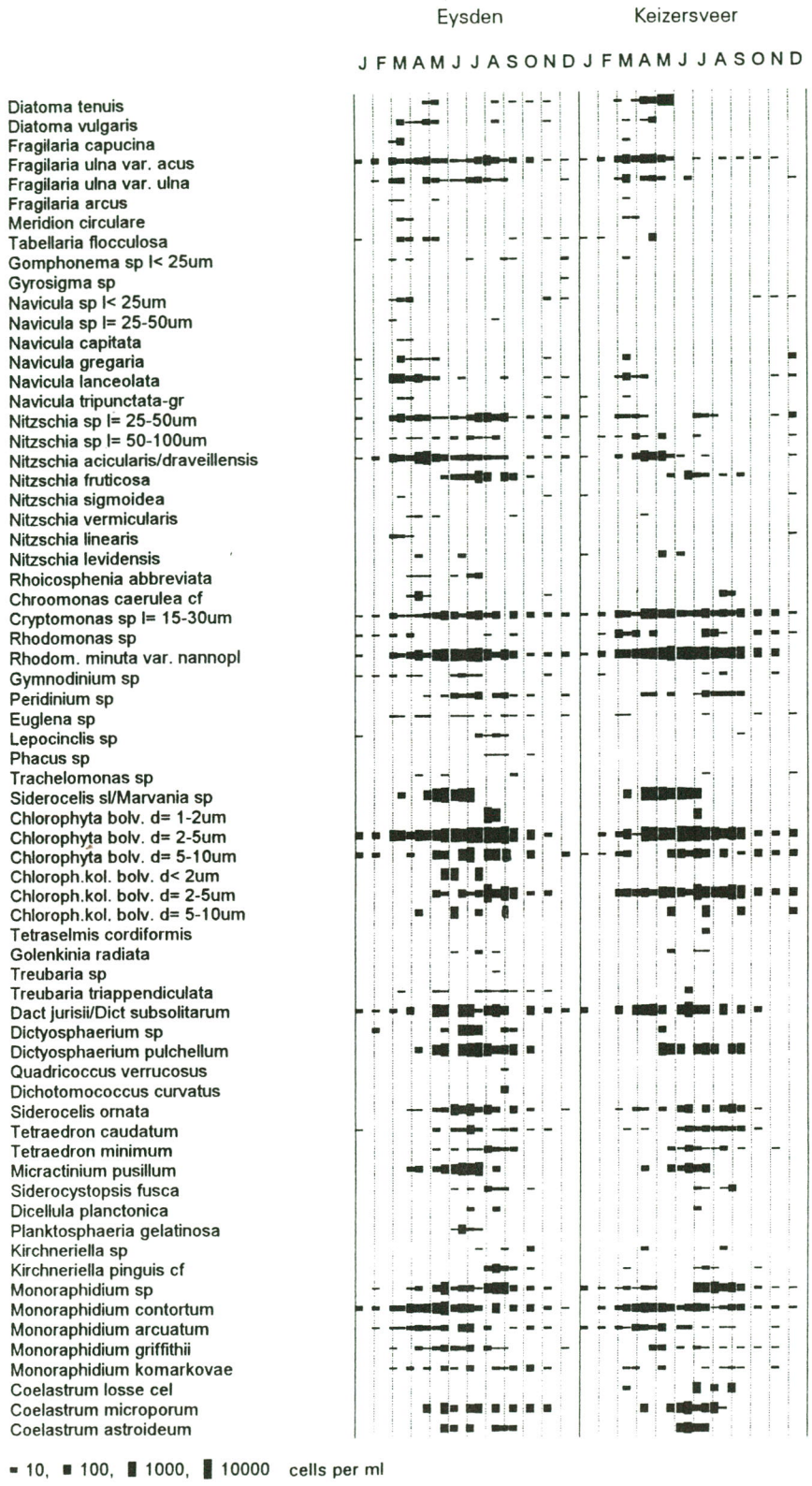


Figure 8. Kite diagram of species found in the River Meuse during 1992 with an indication of their annual density fluctuation. (continued)

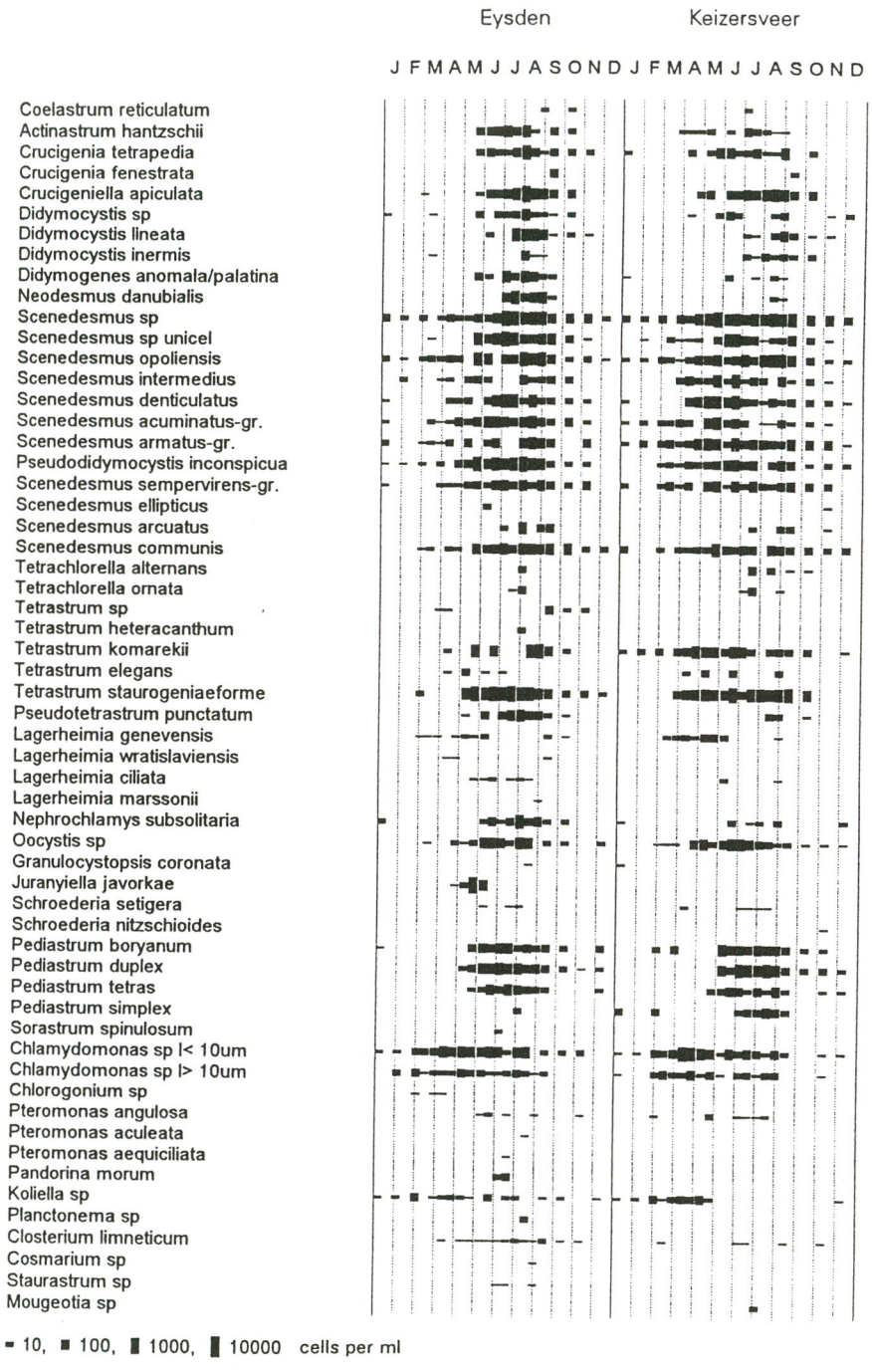


Figure 8. Kite diagram of species found in the River Meuse during 1992 with an indication of their annual density fluctuation. (continued)

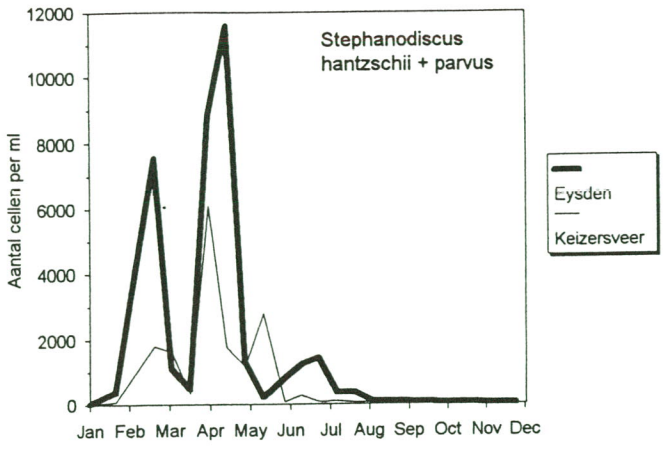


Figure 9. Abundance of Stephanodiscus gr. hantzschii in the Meuse, 1992.

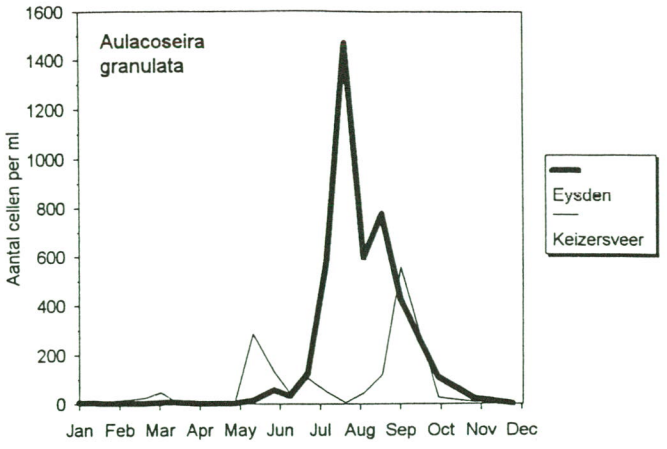


Figure 12. Abundance of Aulacoseira granulata in the Meuse, 1992.

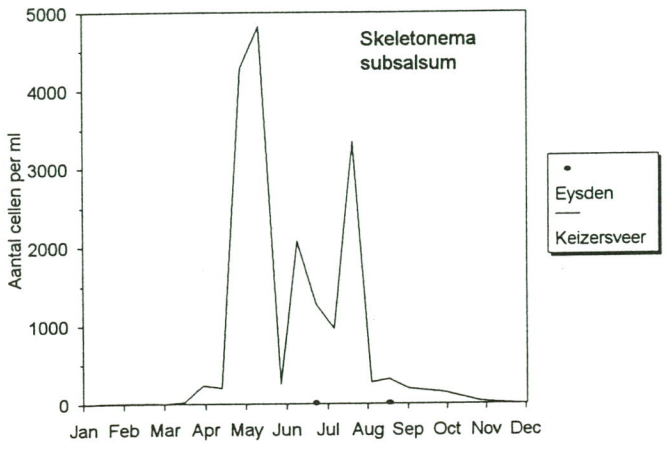


Figure 10. Abundance of Skeletonema subsalsum in the Meuse, 1992.

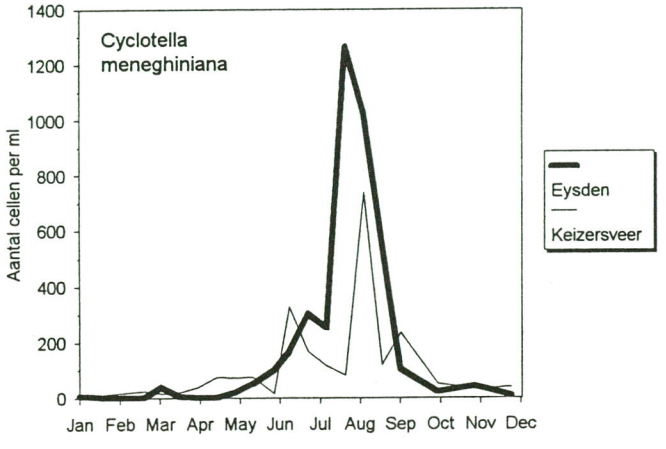


Figure 13. Abundance of Cyclotella meneghiniana in the Meuse, 1992.

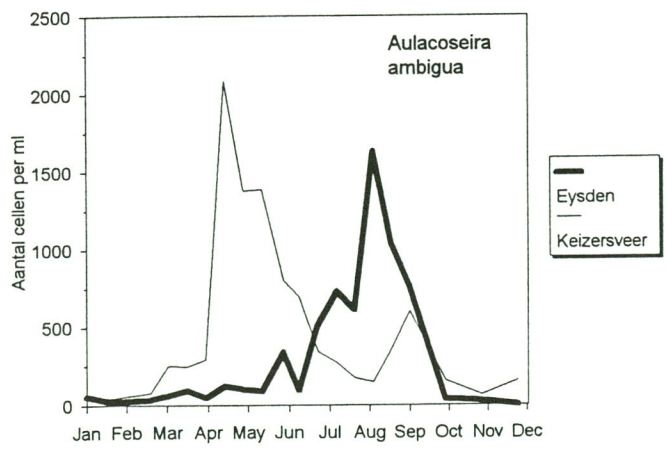


Figure 11. Abundance of Aulacoseira ambigua in the Meuse, 1992.

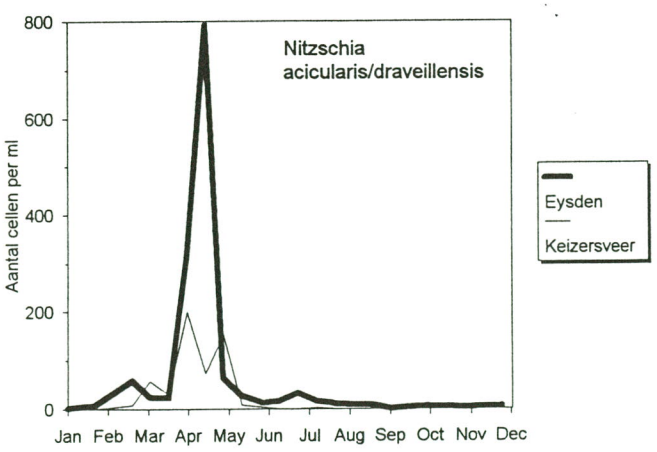


Figure 14. Abundance of Nitzschia gr. acicularis in the Meuse, 1992.

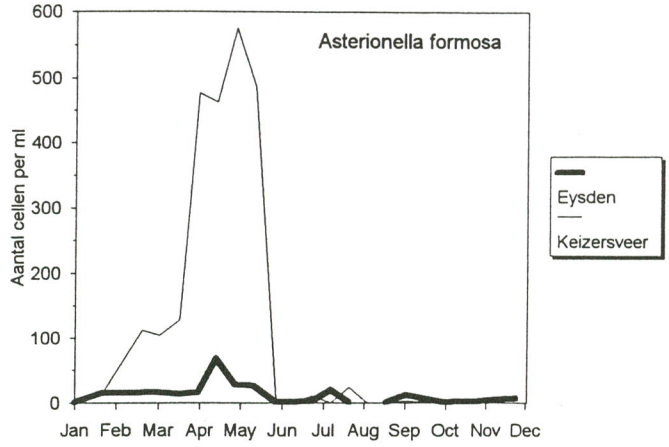


Figure 15. Abundance of Asterionella formosa in the Meuse, 1992.

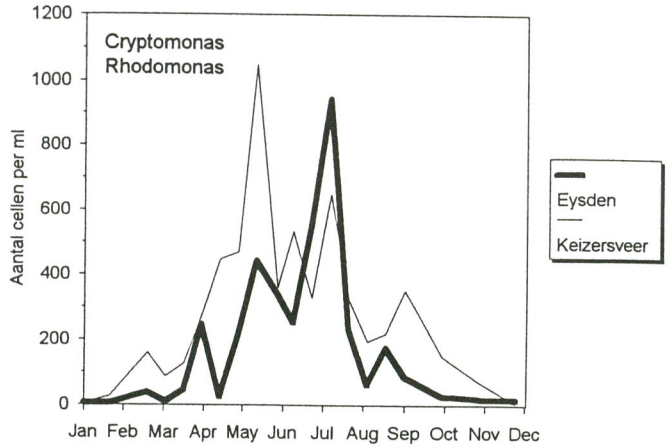


Figure 17. Abundance of Cryptophyceae in the Meuse, 1992.

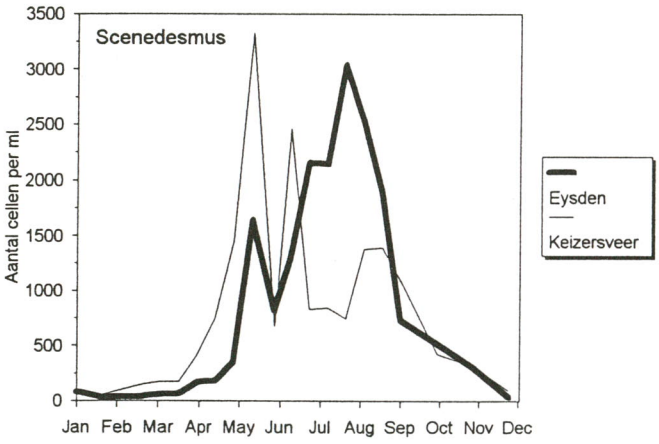


Figure 16. Abundance of Scenedesmus spp. in the Meuse, 1992.

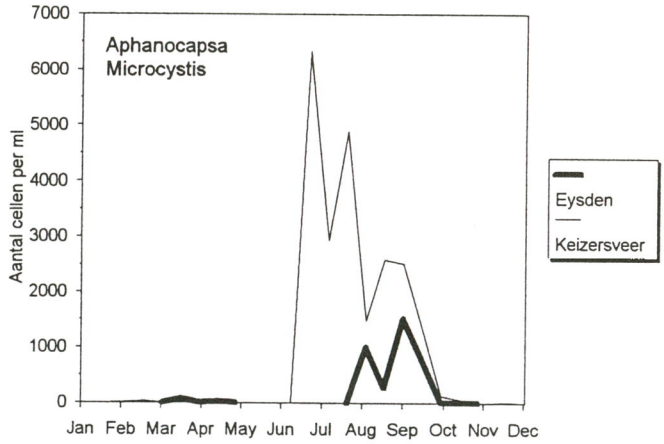
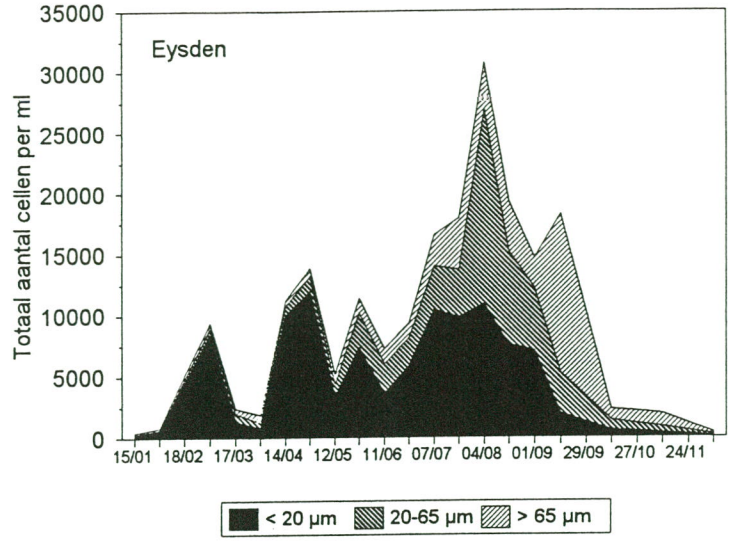


Figure 18. Aphanocapsa and Microcystis in the Meuse, 1992.



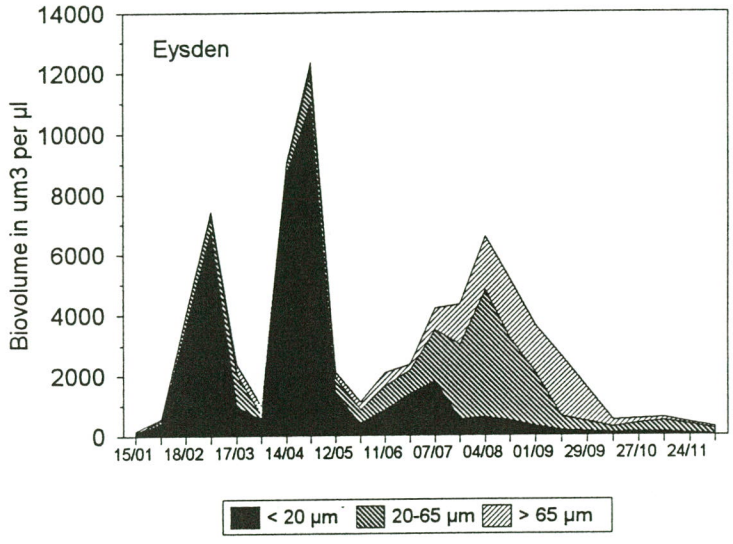


Figure 19. Structural composition of phytoplankton number and biomass at Eysden, 1992.

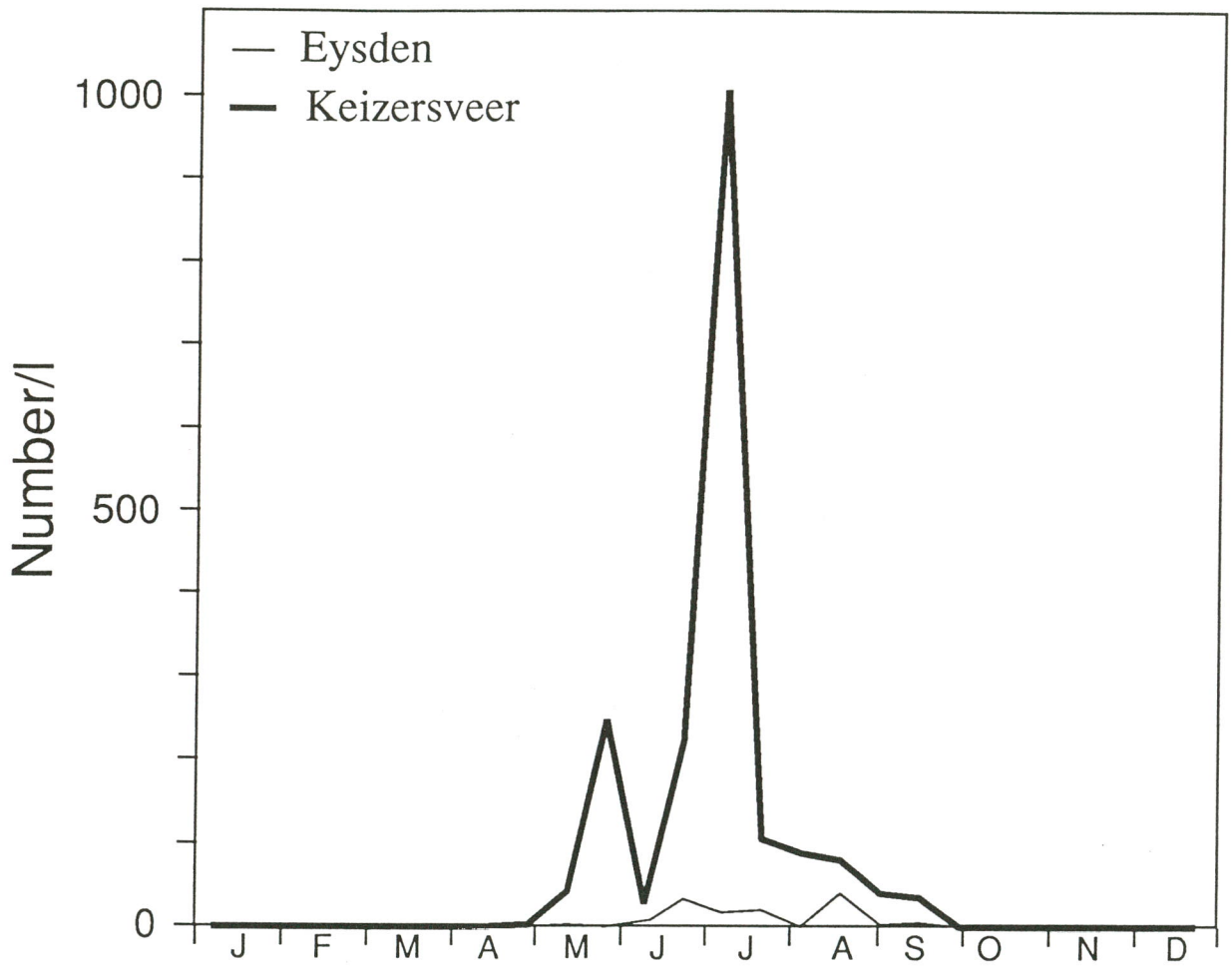


Figure 20.
Time course of zooplankton density expressed as the sum of rotifers and crustaceans in the Meuse at Eijsden and Keizersveer in 1992.

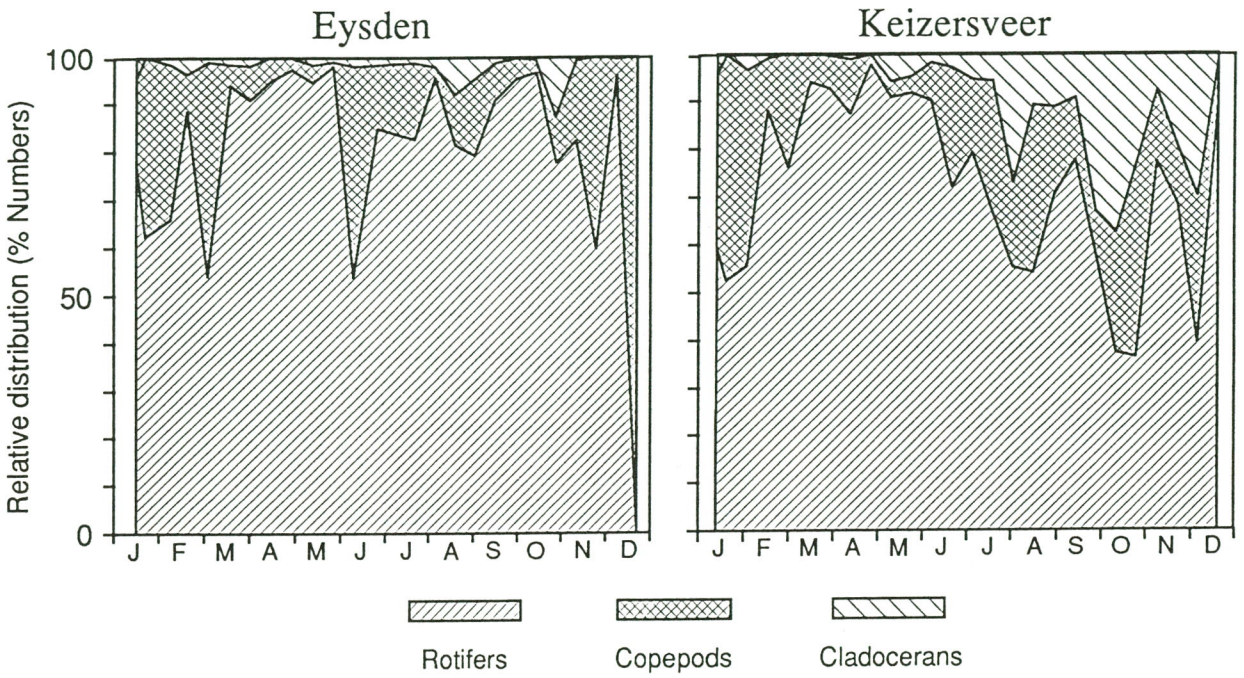


Figure 21.
Relative contribution of rotifers copepods and cladocerans to total zooplankton number in the Meuse at Eijsden and Keizersveer during 1992.

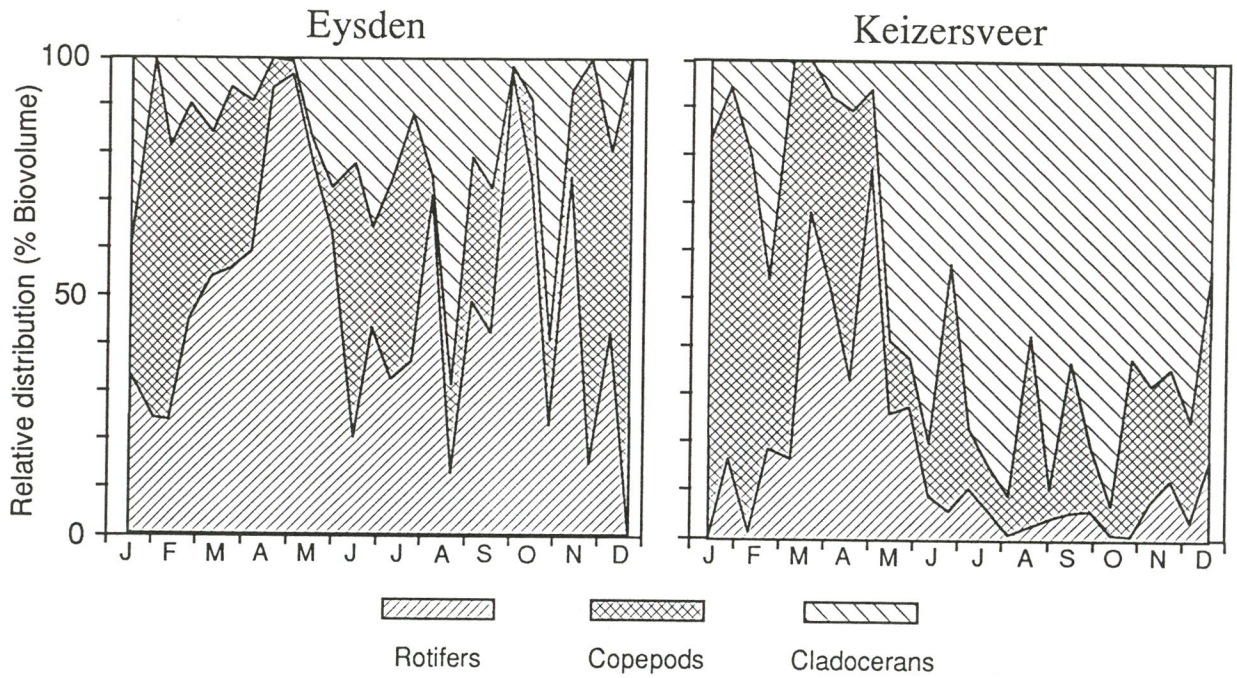


Figure 22.
Relative contribution of rotifers copepods and cladocerans to total zooplankton biovolume in the Meuse at Eijsden and Keizersveer during 1992.

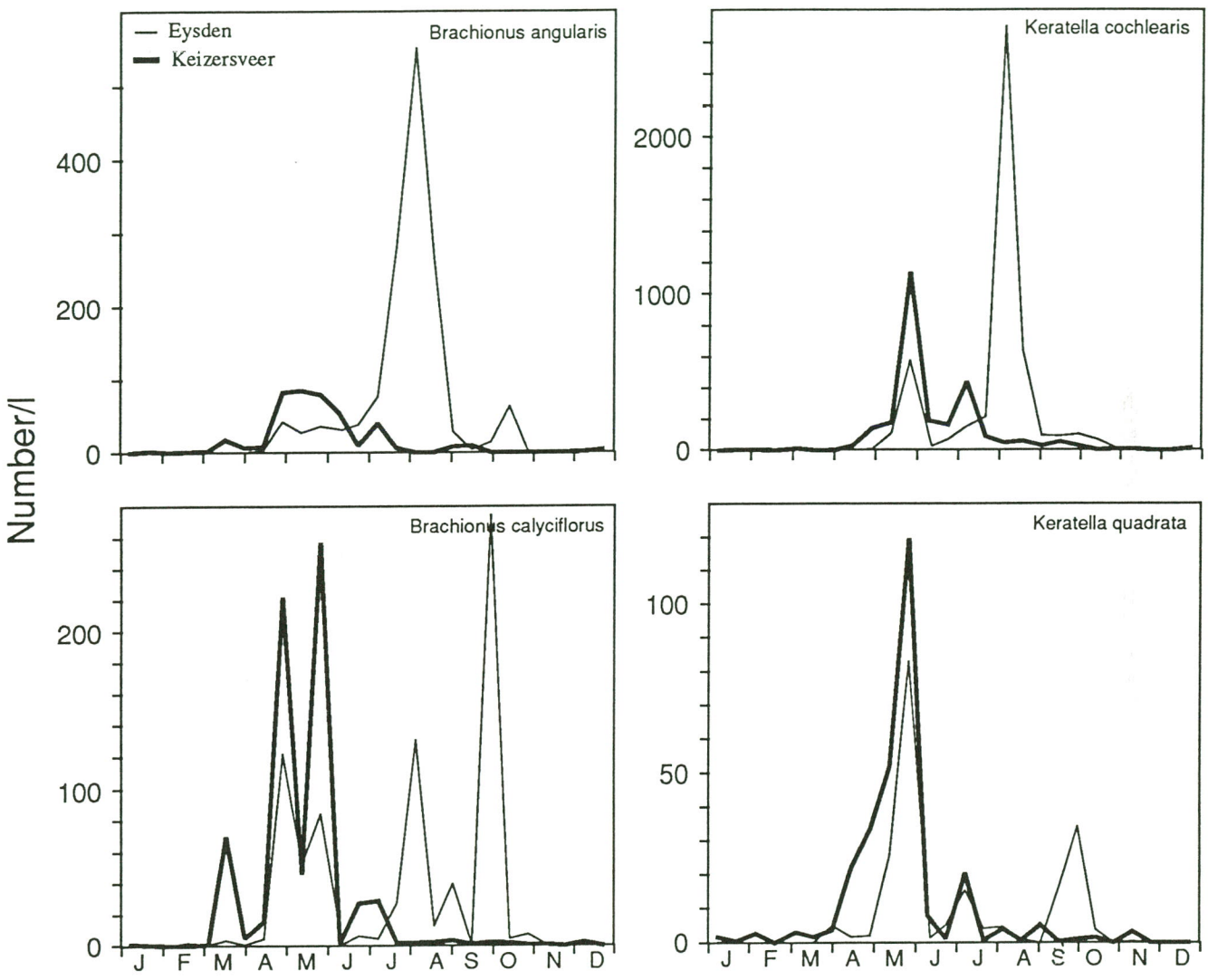


Figure 23.
Seasonal variation in density of four dominant rotifers in the Meuse at Eijsden and Keizersveer during 1992.

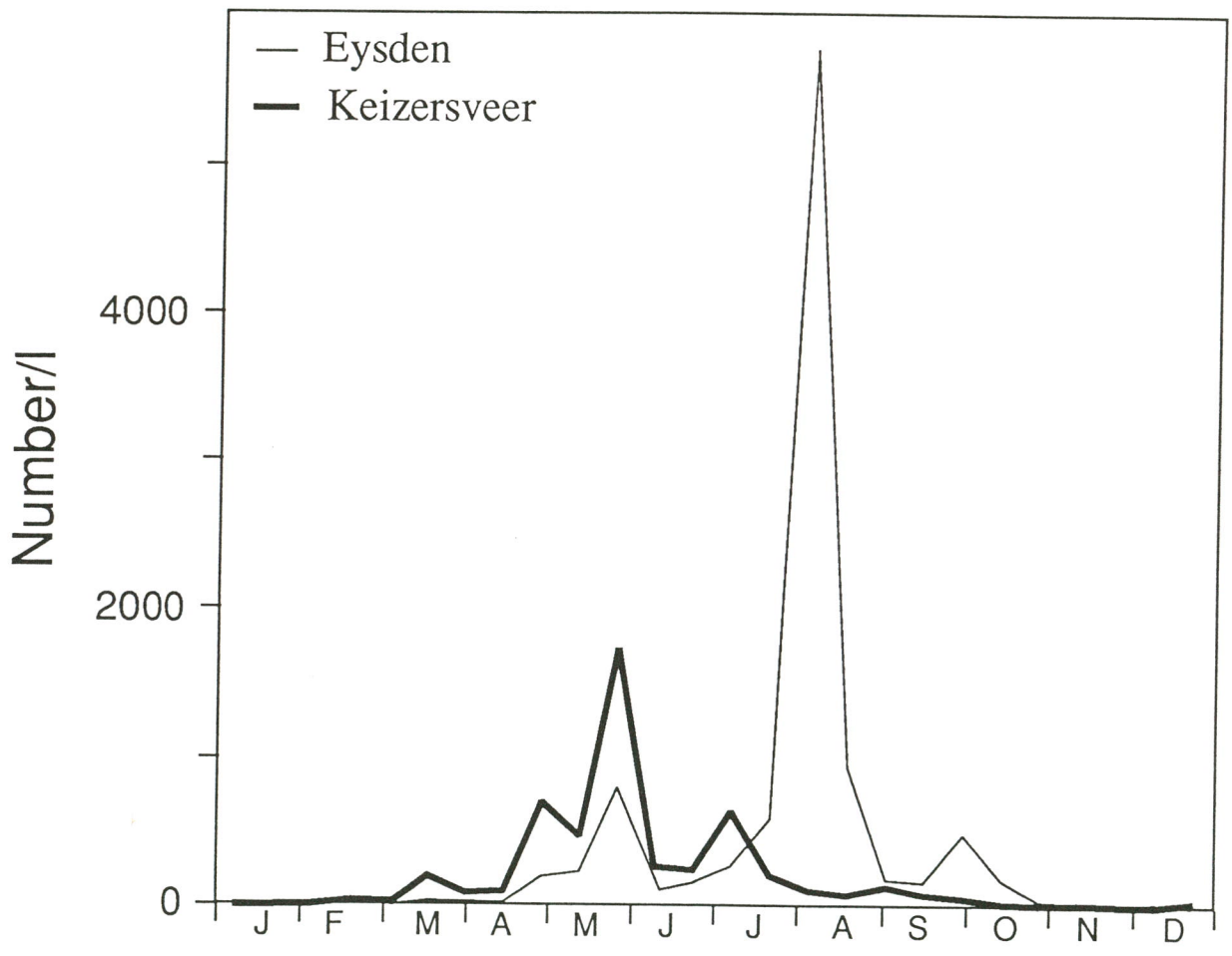


Figure 24.
Seasonal variation in density of Dreissena polymorpha larvae in the Meuse at Eijsden and Keizersveer during 1992.

APPENDIX 1 to 9

Appendix 1.

Results of the phytoplankton sampling of the River Meuse, conducted during 1992 at the sampling stations Eysden and Keizersveer (NB. listed are the densities per species in number of cells per ml)

Meuse at Eysden 1992	jan	feb	mch	mch	mch	apr	apr	may	may	jun	jun	jul	jul	aug	aug	sep	sep	oct	nov	dec
cells per ml	7	4	4	17	31	14	28	12	26	11	23	7	21	4	18	1	15	13	10	8
BACILLARIOPHYCEAE CENTRALES																				
Acanthoceras zachariasii												1	2	92			2			
Actinocyclus normanii													+							1
Aulacoseira ambigua	58	18	36	60	94	46	122	102	86	338	96	516	728	609	1626	1042	760	41	28	
Aulacoseira granulata	6			6	4				14	54	32	128	572	1469	591	768	425	111	20	
Aulacoseira islandica						4														
Aulacoseira subarctica	6	4	19	82	230	4	4	14	9	4									3	4
Aulacoseira cf alpigena	4	8	8	8	14	2		32	10	304	16	52	98	199	640	172	31	11	5	4
Cyclostephanus dubius				2										6	33	18			1	
Cyclotella cf atomus								18	80	50		152	684	912	228	826				
Cyclotella meneghiniana	6		2	39	4			18	50	101	168	304	253	1265	1026	565	104	21	42	6
Melosira varians	2			26		6	9		12	10		6	8	9	14	18	7	6	8	12
Skeletonema potamos									8	203	16	248	456	288	1483	695	76	3	4	6
Skeletonema subsalsum												4				6				
Stephanodiscus gr hantzschii	21	304	6130	1000	424	8619	11154	1197	182	761	1217	1368	152	178	76	63	82	38	30	10
Stephanodiscus parvus		82	1380	94	48	196	406	120	30	51		60	203	178		21	7			
Stephanodiscus gr rotula																	4	3	46	6
Thalassiosira bramaputrae															2		4			
Centrales < 5 um													1293	89	570			7	134	4
Centrales 5-10 um	2		230		8	20							50	155	342	43	22		2	2
Centrales 10-20 um	3	38	226		40	60		8			8				16		4	14	22	2
Centrales 20-30 um																				
Centrales > 30 um																				
BACILLARIOPHYCEAE PENNALES																				
Amphora libyca/ovalis											4					1				1
Asterionella formosa	1	15	16	16	13	16	68	28	26			4	20				12		4	7
Cymatopleura solea					1										1	1				
Cymbella sp				63	1														1	
Diatoma tenuis							6	12							4		1	1	2	
Diatoma vulgaris				18	2	4	18	8							6				1	
Fragilaria arcus			1	1				1												
Fragilaria capucina			4	39																
Fragilaria crotonensis																				
Fragilaria ulna		2	10	22			26	11	2	4	4	20	32	7	4	5				2
Fragilaria ulna var acus	8	20	44	12	13	30	62	12	10	6	3	8	36	146	26	6	16	15	2	2
Gomphonema sp			2	16	2							1				4	2			6
Meridion circulare				6	4															
Navicula capitata				1	2															
Navicula gregaria	1			24	1	4	1	6											1	
Navicula lanceolata	2		96	87	22	64	12	8			4					4			2	1

Meuse at Eysden 1992 cells per ml	jan 7	feb 4	mch 4	mch 17	mch 31	apr 14	apr 28	may 12	may 26	jun 11	jun 23	jul 7	jul 21	aug 4	aug 18	sep 1	sep 15	oct 13	nov 10	dec 8
Navicula margalithii/tripunctata	1			4	3														1	
Navicula sp < 25 µm			2	8	12														5	1
Navicula sp > 25 µm			1												1					
Nitzschia acicularis/draveillensis	1	7	58	24	22	318	792	64	26	12	16	32	16	10	8	8		5	3	6
Nitzschia fruticosa									9	20	32	24	456	111	8	81	35	4		
Nitzschia levidensis						6					8									
Nitzschia linearis/heufleriana			8	6	1														1	
Nitzschia sigmoidea				1																
Nitzschia vermicularis				1	2	4		2									2			
Nitzschia sp < 50 µm	3		22	71	11	26	20	4	4	8	4	20	84	89	28	52	2	6	5	8
Nitzschia sp > 50 µm	2		2		1	2		4		6		8	4	2	8				5	1
Rhoicosphenia abbreviata					2	2	1			2		8	16							
Surirella cf brebissonii	1	1	8	79	5	8					4	4			2				2	
Tabellaria cf flocculosa	2			10	8		8	8									2		2	2
Pennales < 25 µm				17				8	4											2
Pennales 25-50 µm	3		4		4	6	8		8	4	12	1	4							
Pennales > 50 µm						4		10			4				1		1			1
CHLOROPHYCEAE CHLORELLALES																				
Actinastrum hantzschii									40	64	96	240	64	214	9		48	17		
Coelastrum astroideum									64	32		36			32	16	16			
Coelastrum microporum							56		184	32		72	102		64		38	68	34	
Coelastrum reticulatum																8		8		
Crucigenia fenestrata																	56			
Crucigenia tetrapedia									32	56	32	16	104	886	56	8	42	32	20	
Crucigeniella apiculata			2						8	52	64	96	382	1456	184	166	54	68		
Dactylosphaerium jurisii								36				164		176	406	102				8
D jurisii/D subsolitarum	8	4	8		44			16	8			160			8			52		
Dicellula planctonica												8			12					
Dichotomococcus curvatus																48				
Dictyosphaerium pulchellum						16		176	432		320	784	1114	612	76	86	260	43		
Dictyosphaerium subsolitarum								370	324		512	260	8					48	20	
Dictyosphaerium sp		12							8		256	192	154			12	8			
Didymocystis inermis				2										88	4	2				
Didymocystis lineata										12			456	310	406	124	4	14	4	
Didymocystis sp	4			2					28		32	24	34	266	20	12	4	10		
Didymogenes anomala/palatina									40	12		244	38	244	112	16	12			
Golenkinia radiata										2			8		1					
Granulocystopsis coronata															1					
Juraniella javorkae/Raphidocelis sigmoidea							2	16	2129	152										
Kirchneriella cf pinguis														22	100	20	8	4		
Kirchneriella sp													2			4		18		

Meuse at Eysden 1992 cells per ml	jan 7	feb 4	mch 4	mch 17	mch 31	apr 14	apr 28	may 12	may 26	jun 11	jun 23	jul 7	jul 21	aug 4	aug 18	sep 1	sep 15	oct 13	nov 10	dec 8
Lagerheimia ciliata									4	4	8		4	6	1					
Lagerheimia genevensis			1	1	1		4	8	6	10							8	2		
Lagerheimia marsonii																1				
Lagerheimia wratislaviensis						1	2										4			
Micractinium pusillum					10	32		16	112	144	448	324	840		16					
Monoraphidium arcuatum		2	4	4	8	16	10	8	18		40	72		7			2	8	3	
Monoraphidium contortum	10	9	22	16	88	65	100	185	649	50	96	52	18		152		27	40	8	2
Monoraphidium griffithii			1			8	2	8	30	10	8	24		10	2	2				1
Monoraphidium komarkovae			1		6		4		12	4		18			6	4	12	30	3	
cf Monoraphidium sp		1			3	10		44	599	8	24	32	4	158	380	304	24	13	5	
Neodesmis danubialis												82	608	66	152	260	8			
Nephrochlamys subsolitaria	12									12	64	8	48	532	44	104	12	12		
Oocystis sp				1			10	4	20	140	144	80	21	244	120		14	8		8
Planktosphaeria gelatinosa										1		6	4							
Pseudodidymocystis inconspicua	2	2	6		14	8	50	74	730	128	486	182	558	1022	354	208	28	10	10	
Pseudotetrastrum punctatum								4		48		40	138	232	76	56	10	4		
Quadricoccus verrucosus																4				
Scenedesmus gr acuminatus	6			14	2	8	54	32	80	220	240	120	70	132	304	72	28	70	8	
Scenedesmus arcuatus												12		266		48	68			
Scenedesmus gr armatus	16		4	8	4	24		64		28	80			176	304	146	68		62	
Scenedesmus communis			4	8		12	8	32	162	64	80	182	70	220	254	124	230	250	16	22
Scenedesmus denticulatus	4					16	16	32		40	192	426	500	24	406	24	28	20	8	
Scenedesmus ellipticus										16										
Scenedesmus intermedius		12			4	8		32	40	16				88	16	24	34	32		
Scenedesmus opoliensis	18	4	14	28	20	48	24	48	528	248		80	104	666	354	688	96	14	30	4
Scenedesmus gr sempervirens	4				8	8	8	24	40	20	80	120	34	134	32	146	48	20	62	
Scenedesmus spp	36	12	16		14	40	20	16	60	40	144	1034	810	310	508	428	100	100	108	10
Scenedesmus sp single cell				1					330	100	334	1064	456	111	101	217	203	40	3	
Schroederia setigera										2			1	4						
Siderocelis ornata					2	2		8	12	200	64	304	18	111	18		34	5		2
Siderocelis < 5 µm/Marvania geminata				20			100	507	1064	250	540	912								
Siderocystopsis fusca										2		4		17	6	6		1		
Tetrachlorella alternans														28						
Tetrachlorella ornata													4	41						
Tetraedron caudatum	1							8		8	8	90	8		4	6	7	2	4	
Tetraedron minimum								4		4		4	4	37	12	8	10			
Tetrastrum elegans						4		32		4		4								
Tetrastrum heteracanthum														16						
Tetrastrum komarekii						8			270		120				500	695	110	12		
Tetrastrum staurogeniaeforme			12					208	648	404	852	486	1014	442	508	174	110	24	26	8
Tetrastrum sp					4	4											55	8	14	
Treubaria triappendiculata				1				4	2				4	3	1	4	2	1	2	
Treubaria sp															2					

Meuse at Eysden 1992 cells per ml		jan 7	feb 4	mch 4	mch 17	mch 31	apr 14	apr 28	may 12	may 26	jun 11	jun 23	jul 7	jul 21	aug 4	aug 18	sep 1	sep 15	oct 13	nov 10	dec 8
CHLOROPHYCEAE	PROTOSIPHONALES																				
Pediastrum boryanum		1								44	100	64	132	124	32	56	32	42	16		25
Pediastrum duplex									12	48	160	128	272	130	236	77	92	42	15	2	8
Pediastrum simplex															16						
Pediastrum tetras										8	16	128	36	209	84	44	27	22			7
Sorastrum spinulosum													8								
CHLOROPHYCEAE	ULOTRICHALES																				
Koliella sp		3	6	40		3	8	12	8	2		24		8	7			3	5		1
Planctonema sp																22					
CHLAMYDOPHYCEAE	CHLAMYDOMONADALES																				
Chlamydomonas	< 10 µm	5	6	32	31	34	217	100	202	127	100	212	152	14	152	228		14	10	20	
Chlamydomonas	> 10 µm		20	46	4	10	14	14	52	26	25	8	8	20	44	16	4	10			
Chlorogonium sp				2		2	1														
Pteromonas aculeata																1					
Pteromonas angulosa											2	8		2			2			2	
Pteromonas aequiciliata														2							
CHLAMYDOPHYCEAE	VOLVOCALES																				
Pandorina morum/smithii													16	48							
Volvox aureus														+							
XANTHOPHYCEAE																					
Goniochloris mutica				1					4	16	12	8	4	14	44	8	2	7	4		
Ophiocytium capitatum var longispinum											2	8	12		4	2	2	7			
Tetraplektron cf tribulus										2	18	24	6	6	1	8	2	2	2		
Trachydiscus sp					1				4	100	50	182	245	528	244	127	391	21	19		
Tribonema monochloron/Gloeotila sp			16	16		18	18		19		32		14		422	252	47		36	632	
ZYGNEMAPHYCEAE	DESMIDIALES																				
Closterium limneticum							1		1		1	2	1	3	8	3	1	12	1	1	
Closterium sp										2											
Cosmarium sp																	2				
Staurastrum sp													1	1			1				
EUGLENOPHYCEAE																					
Euglena sp				4	1		4	4			2	1	1		2		3	2	2		1
Lepocinclis sp		1												8	2	8	4				
Phacus sp															1	1	2		1		
Trachelomonas sp							1			1								5			

Meuse at Eysden 1992		jan	feb	mch	mch	mch	apr	apr	may	may	jun	jun	jul	jul	aug	aug	sep	sep	oct	nov	dec
cells per ml		7	4	4	17	31	14	28	12	26	11	23	7	21	4	18	1	15	13	10	8
CRYPTOPHYCEAE																					
cf Chroomonas caerulea						4	87	2												1	
Cryptomonas sp			3	17	3	4	6	12	28	78	34	8	48	80	10	42		41	22	10	8
Rhodomonas minuta var nannoplanctica		4		16	7	32	152	10	185	365	304	243	502	862	221	20	174	41	5	8	10
Rhodomonas sp		3	2	6		7									1			3			
Cryptophyceae non det																					
CHRYSOPHYCEAE																					
Chrysochromulina cf parva																					
Chrysococcus sp	6-10 µm	2	15	72	31	24	92	15	93			60			2	1		21		5	2
Chrysococcus sp	3-6 µm				16											1					
Dinobryon bavaricum						1															
Dinobryon divergens				3	1	5	1		4												1
Dinobryon sertularia							4	4	4	4											
Dinobryon sp											2		2								
Kephyrion cf inconstans			2	2		2		2	12												
Kephyrion cf rubi-claustri				1																	
Mallomonas akrokomos						2															
Mallomonas sp			2	16		3															
Pseudokephyrion/Kephyrion sp							76	1													
Synura sp																					
Aloricate chrysophyceae non det		9	3	30	2	15	6				+		300			2				15	
Loricate chrysophyceae non det																			2	21	
DINOPHYCEAE	PERIDINIALES																				
Amphidinium sp																					
Gymnodinium sp		1	1	4		1	2				4	8	3	4						4	
Peridinium/Peridiniopsis sp								2		4	20	8	11	42		14	22	4	3		4
CYANOPHYCEAE	CHROOCOCCALES																				
Aphanocapsa elachista						64		16						+		1000	96	1264			
Chroococcus limneticus								16								18					
Chroococcus minutus																8		8			
Merismopedia minima						24	144									16					
Microcystis sp 3-6 µm	single cells																174	254	13		
Microcystis sp 3-6 µm	colonies																				
Chroococcales non det			2																		36

Meuse at Eysden 1992	jan	feb	mch	mch	mch	apr	apr	may	may	jun	jun	jul	jul	aug	aug	sep	sep	oct	nov	dec
cells per ml	7	4	4	17	31	14	28	12	26	11	23	7	21	4	18	1	15	13	10	8
CYANOPHYCEAE HORMOGONALES																				
Anabaena sp				16	20	13	10			9				30		80	78			
Aphanizomenon flos-aquae	7														36					
Aphanizomenon issatschenkoi															74					
Limnothrix planctonica			64	26	46	120	214	285	48											
Limnothrix redekei	16	18	20		172	236	160	165						10						
Lyngbya sp	+			+															350	
Oscillatoria sp s.l. d=1-2 µm	58	100	278	36																48
Oscillatoria limosa				40																
Planktothrix agardhii				62					42	212		14	32		1128	192	11248	528		20
Pseudanabaena cf catenata		32	54		67							136			60		342			
Pseudanabaena mucicola																				
Spirulina major																			1	
Hormogonales non det								32			150			58						16
CHLOROPHYTA NOT IDENTIFIED																				
Spheres green < 5 µm	40	33	194	170	40	240	122	268	735	656	594	1824	2736	4865	2712	3345	845	157	8	
Spheres green > 5 µm	20	10			8			24	76	304	304	1824		333	380			54		10
Flagellates > 5 µm	8	2	4		1							1								12
Colonies cells < 5 µm						16		48	414	608	160	8	42	8740	84	1216	396	8	20	
Colonies cells > 5 µm						16							32							
BACILLARIOPHYCEAE CENTRALES	108	454	8031	1317	866	8957	11695	1509	481	1876	1553	2839	4499	5449	6647	4237	1528	255	345	57
BACILLARIOPHYCEAE PENNALES	25	45	278	526	132	494	1022	186	89	62	95	130	668	365	97	162	73	31	37	40
CHLOROPHYCEAE CHLORELLALES	121	58	95	106	232	338	470	2016	8713	2639	5364	8058	7806	9377	6124	4377	1930	1108	450	65
CHLOROPHYCEAE PROTOSIPHONALES	1							12	100	276	320	448	463	368	177	151	106	31	2	40
CHLOROPHYCEAE ULOTRICHALES	3	6	40		3	8	12	8	2		24		8	7	22		3	5		1
CHLAMYDOPHYCEAE CHLAMYDOMONADALES	5	26	80	35	46	232	114	254	153	127	228	160	38	196	245	6	24	10	22	
CHLAMYDOPHYCEAE VOLVOCALES												16	48							
XANTHOPHYCEAE		16	17	1	18	18		27	118	114	222	281	548	715	397	444	37	61	632	
ZYGNEMAPHYCEAE DESMIDIALES						1		1	2	1	2	2	4	8	3	4	12	1	1	
EUGLENOPHYCEAE	1		4	1		5	4		1	2	1	1	8	5	9	9	7	3		1
CRYPTOPHYCEAE	7	5	39	10	47	245	24	213	443	338	251	550	942	232	62	174	85	27	19	18
CHRYSOPHYCEAE	11	22	124	50	52	179	22	113	4	2	60	302		2	4		21	2	41	3
DINOPHYCEAE PERIDINIALES	1	1	4		1	2	2		4	24	16	14	46		14	22	4	3	4	4
CYANOPHYCEAE CHROOCOCCALES		2			88	144	32								1042	270	1526	13		36
CYANOPHYCEAE HORMOGONALES	81	150	416	180	305	369	384	482	90	221	150	150	32	98	1298	272	11668	528	351	84
CHLOROPHYTA NOT IDENTIFIED	68	45	198	170	49	272	122	340	1225	1568	1058	3657	2810	13938	3176	4561	1241	219	28	22
Total number of cells per ml	432	830	9326	2396	1839	11264	13903	5161	11425	7250	9344	16608	17920	30760	19317	14689	18265	2297	1932	371

Meuse at Keizersveer 1992 cells per ml	jan 7	feb 4	mch 4	mch 17	mch 31	apr 14	apr 28	may 12	may 26	jun 11	jun 23	jul 7	jul 21	aug 4	aug 18	sep 1	sep 15	oct 13	nov 10	dec 8
BACILLARIOPHYCEAE CENTRALES																				
Acanthoceras zachariasii																				
Actinocyclus normanii					1	4	32		16	20	368	127	25	20	161	56	46	18	7	2
Aulacoseira ambigua	46	48	82	252	248	294	2088	1376	1384	804	696	343	271	176	148	356	600	157	66	159
Aulacoseira granulata	7	11	24	47		12			288	132	48	105	50	6	48	122	554	27	7	3
Aulacoseira islandica				8		118	112		80											
Aulacoseira subarctica	13	15	20	126	148	336	80	128	16	20	80						6	2		1
Aulacoseira cf alpigena			4	32	28	148	88	24			24	6	10		15		6		20	10
Cyclostephanus dubius		2	17	63		10	14	24		8		6	2		12		10	2	6	
Cyclotella cf atomus													50			20				
Cyclotella radiosa					4						8									1
Cyclotella meneghiniana	2	14	25	16	20	40	76	72	76	16	328	167	115	82	738	120	238	50	34	40
Cyclotella sp											8									
Melosira varians		2		56	24	102	232	16	32	24		2	1		12		15	2	2	4
Skeletonema potamos			32			12			76		80	442	385	304	108	20	146	24	4	1
Skeletonema subsalsum		4	8		20	232	200	4288	4824	256	2072	1272	961	3346	277	320	192	149	32	
Stephanodiscus gr hantzschii	24	70	964	1459	320	5628	1749	1166	2662	64	274	83	54	54	46		46	6	12	16
Stephanodiscus parvus		18	820	156	20	456			114	4			38		10					
Stephanodiscus gr rotula	1					10	18	24		4	8	20	23	44	19	6		38		1
Thalassiosira bramaputrae				2		2	8		8		8	10	5	30	15	10	5			
Centrales < 5 um		4	8	16	4	10		152					54	50					134	
Centrales 5-10 um	4	8	34	16	12				114		122		23				15			2
Centrales 10-20 um	4	2			4				228		91		23		41			8	8	2
Centrales 20-30 um		2			28															
Centrales > 30 um																				

BACILLARIOPHYCEAE PENNALES																				
Amphora libyca/ovalis																				4
Asterionella formosa	2	13	112	104	128	478	464	576	488	4		11		24			4		1	
Cymatopleura solea							16							1						
Cymbella sp				8															1	1
Diatoma tenuis			4		4	38	32	184	264											
Diatoma vulgaris				2		2	16													
Fragilaria arcus				2																
Fragilaria capucina				4																
Fragilaria crotonensis																				
Fragilaria ulna			4	56		10	16	8			8									1
Fragilaria ulna var acus	2	7	32	88	25	106	80	40	8			1			4		4	3	1	
Gomphonema sp				4																
Meridion circulare				4	4															
Navicula capitata																				
Navicula gregaria				16																16

Meuse at Keizersveer 1992 cells per ml	jan 7	feb 4	mch 4	mch 17	mch 31	apr 14	apr 28	may 12	may 26	jun 11	jun 23	jul 7	jul 21	aug 4	aug 18	sep 1	sep 15	oct 13	nov 10	dec 8
Navicula lanceolata			4	48	4	8													1	4
Navicula margalithii/tripunctata	1			2																
Navicula sp < 25 µm																		1	1	1
Navicula sp > 25 µm																				
Nitzschia acicularis/draveillensis	2		8	56	28	200	72	152	8	4			2							1
Nitzschia fruticosa									8		96	10	8		4		8			
Nitzschia levidensis	1							24		8										
Nitzschia linearis/heufleriana				2																1
Nitzschia sigmoidea	1																			1
Nitzschia vermicularis						2														
Nitzschia sp < 50 µm	1		8	8	8	4						14	8	4					2	16
Nitzschia sp > 50 µm		1	2		16	2		16				4								2
Rhoicosphenia abbreviata																				
Surirella cf brebissonii	1		8	8	4	4		16	8	4	8					1		1		
Tabellaria cf flocculosa	2	2					40													
Pennales < 25 µm			4	8					16								5			12
Pennales 25-50 µm			4		12															
Pennales > 50 µm			2		20															
CHLOROPHYCEAE CHLORELLALES																				
Actinastrum hantzschii					8	8	8	16		8		52	32	12	1	4				
Coelastrum astroideum										88	240	64	64							
Coelastrum microporum						64			76	128	480	32	116	194	4					
Coelastrum reticulatum												8								
Coelastrum sp single cell				8								203		26		91				
Crucigenia fenestrata																	12			
Crucigenia tetrapedia	8					32		16	128	160	16	24	92	8	8	198		16		
Crucigeniella apiculata							32	64		64	64	168	100	216	323	208	56	56		
Dactylosphaerium jurisii												112			28					
D jurisii/D subsolitarum	16		52		144	256	280	96		128	832		92					16		
Dicellula planctonica												8								
Dictyosphaerium pulchellum								448	232	176		128	272	128		128	246			
Dictyosphaerium subsolitarum											638				162		64			
Dictyosphaerium sp								32												
Didymocystis inermis												20	4	40	14	24	14	16		
Didymocystis lineata												8	4		30	140	30	4	4	
Didymocystis sp						4			16	56	16				14	40			2	10
Didymogenes anomala/palatina	2									16			4		12	2				
Golenkinia radiata									8			2	1							
Granulocystopsis coronata	4																			
Juraniella javorkae/Raphidocelis sigmoidea																				
Kirchneriella cf pinguis				2								2	8	2				1		
Kirchneriella sp						8									8					

Meuse at Keizersveer 1992 cells per ml	jan 7	feb 4	mch 4	mch 17	mch 31	apr 14	apr 28	may 12	may 26	jun 11	jun 23	jul 7	jul 21	aug 4	aug 18	sep 1	sep 15	oct 13	nov 10	dec 8
Lagerheimia ciliata										8						1				
Lagerheimia genevensis				8	12	20	8	40	48	16						1				
Lagerheimia wratislaviensis																				
Micractinium pusillum						16			40	16	120	48	84							
Monoraphidium arcuatum	6	4	6	2	24	22	8	40		8	8		2		2	1			1	
Monoraphidium contortum		6	12	40	56	136	96	112	48	12	40	55	38	2	8	30	23	6	6	4
Monoraphidium griffithii							16	16		4		6	1		1		1	1	1	
Monoraphidium komarkovae				4	4			8					1		1	4	2		4	
cf Monoraphidium sp	14	4	2	8	2	12	8					138	130	304	54	152	46	6	1	1
Neodesmis danubialis															10	4				
Nephrochlamys subsolitaria	4										16		4	8		16				8
Oocystis sp			2	4	4		70	144	16	60	192	221	100	40	30	8	14	4	4	1
Pseudodidymocystis inconspicua			8	16	8	48	32	48	76	120	243	54	100		46	166	76	8	16	10
Pseudotetrastrum punctatum															32	22		4		
Scenedesmus gr acuminatus	6	12	20	16	48	30		144	408	48	104	24		2	2	40	8	12	4	
Scenedesmus arcuatus													12			24	28		4	
Scenedesmus gr armatii	8	24	28	64	16	48	240	352	256	32	456	54	118	104	72	40	184	100	88	4
Scenedesmus communis	24		10		16	16	32	32	520	56	48	102	52	70	170	80	46	44	20	28
Scenedesmus denticulatus	6					74	128	320	336	152	486	40	24	8	62	16	46	24	16	4
Scenedesmus ellipticus																			4	
Scenedesmus intermedius					24	88	32	32	376	16	548	12	60	24		80	8	24	4	
Scenedesmus opoliensis	8	8	32	16	4	24	96	96	256	48	88	388	76	324	446	520	188	36	8	8
Scenedesmus gr sempervirens	12		12	64	8	48		96	120	8	120	20	123	28	16	60	92	36	24	
Scenedesmus spp	28	16	42		52	50	192	336	976	200	365	136	282	188	564	364	414	136	124	38
Scenedesmus sp single cell		2		16	4	6	8		48	456	456	83	54	2	15	30	152	24	4	
Schroederia nitzschioides																			1	
Schroederia setigera						6						2	2	2	1					
Siderocelis ornata			2		8	6		8		28	72		46		23	115	28	2		
Siderocelis < 5 µm/Marvania geminata				72		456	456	507	228	274	183	152								
Siderocystopsis fusca												6	1		1	25				
Tetrachlorella alternans													60		24		4	4		
Tetrachlorella ornata												4	52			4				
Tetraedron caudatum				2		2				8	30	10	23	14	15	10	15	4		
Tetraedron minimum									8	4	30	9	1	2	10		1		1	
Tetrastrum elegans						8		32			32					16				
Tetrastrum komarekii	8	16	30		48	64	288	128	160	48	232	176	28		32	40	30	24		4
Tetrastrum staurogeniaeforme					48	88	152	256	128	112	730	40	276	400	220	400	460	136		
Tetrastrum sp																				
Treubaria triappendiculata											30									

Meuse at Keizersveer 1992 cells per ml		jan 7	feb 4	mch 4	mch 17	mch 31	apr 14	apr 28	may 12	may 26	jun 11	jun 23	jul 7	jul 21	aug 4	aug 18	sep 1	sep 15	oct 13	nov 10	dec 8
CHLOROPHYCEAE	PROTOSIPHONALES																				
Pediastrum boryanum				16		44					240	96	104	54	158	80	116	38	10	8	
Pediastrum duplex											152	40	510	359	218	482	186	34	16	31	7
Pediastrum simplex		31		26									16	36	38	126	68	21			
Pediastrum tetras										16	32	80	76	12	64	12	134	13		6	5
Sorastrum spinulosum																					
CHLOROPHYCEAE	ULOTRICHALES																				
Koliella sp		3	6	46	4	16	42	32	64	8											1
Planctonema sp																					
CHLAMYDOPHYCEAE	CHLAMYDOMONADALES																				
Chlamydomonas	< 10 µm	4	4	36	32	56	912	532	254	114	8	122	28	85	51	7	60	14		4	4
Chlamydomonas	> 10 µm	2		18	56	20	22	88	8	48	4		18	30	6	30	30			1	
Chlorogonium sp																					
Phacotus sp																					
Pteromonas aculeata																					
Pteromonas angulosa				4						16			4	1	2	5					
Pteromonas aequiciliata																					
CHLAMYDOPHYCEAE	VOLVOCALES																				
Pandorina morum/smithii																					
Volvox aureus																					
PRASINOPHYCEAE	TETRASELMIDALES																				
Tetraselmis cordiformis														15							
XANTHOPHYCEAE																					
Goniochloris mutica										48			6	3	4	7	6	7	1		
Ophiocytium capitatum var longispinum													1	2			20				
Tetraplektron cf tribulus							2		8	16										1	
Trachydiscus sp										152	425	213	152	54	101	50	183	62	14	4	
Tribonema monochloron/Gloeotila sp					84				560	344					60						
ZYGNEMAPHYCEAE	DESMIDIALES																				
Closterium limneticum					1								1	1				2		1	
Cosmarium sp																					
Mougeotia sp															10						
Staurastrum sp																					

Meuse at Keizersveer 1992 cells per ml	jan 7	feb 4	mch 4	mch 17	mch 31	apr 14	apr 28	may 12	may 26	jun 11	jun 23	jul 7	jul 21	aug 4	aug 18	sep 1	sep 15	oct 13	nov 10	dec 8
EUGLENOPHYCEAE																				
Euglena sp			2	2									1					1		1
Lepocinclis sp																	1			
Phacus sp																				
Trachelomonas sp													1							1
CRYPTOPHYCEAE																				
cf Chroomonas caerulea															24	10				
Cryptomonas sp	4	8	40	24	8	122	168	64	80	24	16	24	115	20	46	20	72	32	24	4
Rhodomonas minuta var nannoplanctica	4	16	68	56	88	152	264	406	969	335	517	304	454	254	123	188	277	102	40	
Rhodomonas sp		2	52	8	32		16						77	50	1			14	8	1
Cryptophyceae non det																				
CHRYSOPHYCEAE																				
Chrysochromulina cf parva																				
Chrysococcus sp 6-10 µm	4	4	28	24	16	26	138	16	48							2	30		1	
Chrysococcus sp 3-6 µm				40																
Dinobryon divergens				1																
Dinobryon sertularia							16													
Dinobryon sp			18		4	10														
Mallomonas sp					2														1	
Ochromonas sp				8		46	16	16												
Pseudokephyrion/Kephyrion sp		6	2	8	8	8		8									30	1		
Synura sp												2	6	4			30	5	4	1
Aloricate chrysophyceae non det			2	16	2														1	1
Loricate chrysophyceae non det																				
DINOPHYCEAE PERIDINIALES																				
Amphidinium sp																				
Gymnodinium sp		1											2		5				4	
Peridinium/Peridiniopsis sp						8	8		8			2	27	14	14	10	10			
CYANOPHYCEAE CHROOCOCCALES																				
Aphanocapsa elachista												4918	250	1200	32	100		50		
Chroococcus limneticus													24		32					
Microcystis sp 2-3 µm single cells			32												290		70	10		
Microcystis sp 2-3 µm colonies																				
Microcystis sp 3-6 µm single cells												1268	2484	3700	854	2464	2129	60		14
Microcystis sp 3-6 µm colonies												152	200		306	30	318	5		
Chroococcales non det									76			10								

Meuse at Keizersveer 1992 cells per ml	jan 7	feb 4	mch 4	mch 17	mch 31	apr 14	apr 28	may 12	may 26	jun 11	jun 23	jul 7	jul 21	aug 4	aug 18	sep 1	sep 15	oct 13	nov 10	dec 8
CYANOPHYCEAE HORMOGONALES																				
Anabaena sp									304			28			60			86		
Aphanizomenon flos-aquae												154	360	136	280	76	212			14
Aphanizomenon issatschenkoi																				
Limnothrix planctonica					22	56														
Limnothrix redekei					14	88														3
Lyngbya sp		+		+	+							+	+							+
Oscillatoria sp s.l. d=1-2 µm	26		128	320																41
Planktothrix agardhii					48		32		1300	64			138		65	52	480			100
Pseudanabaena cf catenata		32											16	16	28					30
Pseudanabaena mucicola												122	115	32	77	521	62	6		
Hormogonales non det				18	+									12						
CHLOROPHYTA NOT IDENTIFIED																				
Spheres green < 5 µm		8	18	168	4	1203	624	480	390	1974	942	2180	435	606	163	518	276	20	12	40
Spheres green > 5 µm	2	2	12	24					76	91	30	152	62		54		6	34	10	24
Flagellates > 5 µm							228		76										1	
Colonies cells < 5 µm			40	64	48	112	32	352	256	112	32	2636	368	200	370	1947	716	52	32	64
Colonies cells > 5 µm									88				330				56			32
BACILLARIOPHYCEAE CENTRALES	101	200	2038	2249	881	7414	4697	7270	9918	1352	4215	2583	2090	4112	1650	1030	1879	483	332	242
BACILLARIOPHYCEAE PENNALES	13	23	192	420	253	854	736	1016	800	20	112	40	18	29	8	1	21	5	7	60
CHLOROPHYCEAE CHLORELLALES	154	92	258	342	538	1640	2182	3419	4508	2558	6915	2611	2539	2148	2461	3104	2288	744	341	120
CHLOROPHYCEAE PROTOSIPHONALES	31		42		44				16	424	216	706	461	478	700	504	106	26	45	12
CHLOROPHYCEAE ULOTRICHALES	3	6	46	4	16	42	32	64	8											1
CHLAMYDOPHYCEAE CHLAMYDOMONADALES	6	4	58	88	76	934	620	262	178	12	122	50	116	59	42	90	14		5	4
PRASINOPHYCEAE TETRASELMIDALES													15							
XANTHOPHYCEAE				84		2		568	560	425	213	159	59	165	57	209	69	15	5	
ZYGNEMAPHYCEAE DESMIDIALES				1								1	1	10			2		1	
EUGLENOPHYCEAE			2	2									2				1	1		2
CRYPTOPHYCEAE	8	26	160	88	128	274	448	470	1049	359	533	328	646	324	194	218	349	148	72	5
CHRYSOPHYCEAE	4	10	50	97	32	90	170	40	48			2	6	4		2	90	6	7	2
DINOPHYCEAE PERIDINIALES		1				8	8		8			2	29	14	19	10	10		4	
CYANOPHYCEAE CHROOCOCCALES			32						76			6347	2958	4900	1514	2594	2517	125		14
CYANOPHYCEAE HORMOGONALES	26	32	128	338	84	144	32		1604	64		304	629	196	510	649	754	92		188
CHLOROPHYTA NOT IDENTIFIED	2	10	70	256	52	1315	884	832	886	2177	1004	4968	1195	806	587	2465	1054	106	55	160
Total number of cells per ml	348	404	3076	3969	2104	12717	9809	13941	19659	7391	13330	18101	10764	13245	7742	10876	9154	1751	874	810

Appendix 2. Results of Spearman rank correlation analyses of water discharge and phytoplankton parameters during 1992.

parameter	unit	Chlorophyll-a at Eysden	Total cells at Eysden	Total biovolume at Eysden	Chlorophyll-a at Keizersveer	Total cells at Keizersveer	Total biovolume at Keizersveer	legend
Discharge at Borgharen	m3/s	-0.2146	-0.6421	-0.2812	-0.2521	-0.3729	-0.182	coefficient
		25	25	25	25	25	25	# observations
		0.3141	0.0051	0.2203	0.2169	0.104	0.4277	significance level
Chlorophyll-a at Eysden	µg/l	1	0.7375	0.9289	0.6779	0.6216	0.6716	coefficient
		23	23	23	23	23	23	# observations
		1	0.0018	0.0001	0.0015	0.0084	0.0044	significance level
Total cell density at Eysden	cells/ml	0.7375	1	0.7654	0.4814	0.7053	0.5865	coefficient
		23	20	20	20	20	20	# observations
		0.0018	1	0.0008	0.0359	0.0021	0.0106	significance level
Total biovolume at Eysden	µm3/ml	0.9289	0.7654	1	0.5996	0.5624	0.6511	coefficient
		23	20	20	20	20	20	# observations
		0.0001	0.0008	1	0.0090	0.0142	0.0045	significance level
Chlorophyll-a at Keizersveer	µg/l	0.6779	0.4814	0.5996	1	0.6953	0.8369	coefficient
		23	20	20	25	25	25	# observations
		0.0015	0.0359	0.009	1	0.0024	0.0003	significance level
Total cell density at Keizersveer	cells/ml	0.6216	0.7053	0.5624	0.6953	1	0.8195	coefficient
		23	20	20	25	20	20	# observations
		0.0084	0.0021	0.0142	0.0024	1	0.0004	significance level
Total biovolume at Keizersveer	µm3/ml	0.6716	0.5865	0.6511	0.8369	0.8195	1	coefficient
		23	20	20	25	20	20	# observations
		0.0044	0.0106	0.0045	0.0003	0.0004	1	significance level
Chlorophyll-a at Lobith (Rhine)	µg/l	0.8137	0.6166	0.7431	0.7805	0.7756	0.8081	coefficient
		23	20	20	25	20	20	# observations
		0.0002	0.0089	0.0016	0.0003	0.0010	0.0006	significance level

Appendix 3. Relative density and biovolume contribution (percentage) of main algal groups in the River Meuse at Eysden during 1992.

Sample date	Diatoms		Chlorophytes		Cryptophytes		Cyanophytes		Other		Total	
	cells/ml	volume/ml	cells/ml	volume/ml	cells/ml	volume/ml	cells/ml	volume/ml	cells/ml	volume/ml	cells/ml	volume/ml
07-Jan-92	30.6	80.2	43.8	10.9	1.8	1.4	18.7	1.0	5.1	6.6	100.0	100.0
04-Feb-92	60.3	91.3	16.1	5.4	0.6	0.9	18.1	0.4	5.0	2.0	100.0	100.0
04-Mar-92	89.1	97.7	4.4	1.0	0.4	0.4	4.5	0.1	1.6	0.9	100.0	100.0
17-Mar-92	76.8	97.2	13.1	1.0	0.4	0.2	7.6	1.1	2.2	0.4	100.0	100.0
31-Mar-92	54.3	91.1	17.9	3.9	2.6	0.9	21.4	1.5	3.9	2.6	100.0	100.0
14-Apr-92	84.0	97.9	7.5	1.3	2.2	0.3	4.6	0.2	1.8	0.4	100.0	100.0
28-Apr-92	91.5	98.8	5.2	0.6	0.2	0.2	3.0	0.2	0.2	0.3	100.0	100.0
12-May-92	33.4	85.8	50.2	9.8	4.2	2.4	9.5	0.8	2.8	1.2	100.0	100.0
26-May-92	5.0	42.8	89.2	40.2	3.9	11.3	0.8	0.3	1.1	5.4	100.0	100.0
11-Jun-92	26.7	67.8	63.6	15.4	4.7	3.1	3.0	0.5	2.0	13.2	100.0	100.0
23-Jun-92	17.6	72.7	74.9	19.8	2.7	1.0	1.6	0.0	3.2	6.5	100.0	100.0
07-Jul-92	17.9	69.0	74.3	24.4	3.3	2.2	0.9	0.1	3.6	4.3	100.0	100.0
21-Jul-92	28.8	69.3	62.4	12.7	5.3	3.6	0.2	0.0	3.4	14.4	100.0	100.0
04-Aug-92	18.9	79.8	77.7	18.8	0.8	0.4	0.3	0.1	2.3	0.9	100.0	100.0
18-Aug-92	34.9	80.3	50.5	12.4	0.3	1.2	12.1	1.4	2.2	4.7	100.0	100.0
01-Sep-92	29.7	69.7	62.4	20.9	1.2	0.2	3.6	0.6	3.2	8.6	100.0	100.0
15-Sep-92	8.8	58.5	18.2	9.8	0.5	2.8	72.2	26.0	0.4	3.0	100.0	100.0
13-Oct-92	12.5	55.9	59.8	23.1	1.2	6.5	23.6	5.2	3.0	9.3	100.0	100.0
10-Nov-92	24.1	83.3	31.8	6.2	1.2	2.6	0.1	0.0	42.8	7.9	100.0	100.0
08-Dec-92	26.1	73.0	31.3	3.7	4.9	4.1	32.3	0.5	5.4	18.6	100.0	100.0

Appendix 3. Relative density and biovolume contribution (percentage) of main algal groups in the River Meuse at Keizersveer during 1992.

Sample date	Diatoms		Chlorophytes		Cryptophytes		Cyanophytes		Other		Total	
	cells/ml	volume/ml	cells/ml	volume/ml	cells/ml	volume/ml	cells/ml	volume/ml	cells/ml	volume/ml	cells/ml	volume/ml
07-Jan-92	32.8	80.1	56.3	14.5	2.3	4.5	7.5	0.0	1.1	0.8	100.0	100.0
04-Feb-92	55.2	89.3	27.7	3.3	6.4	5.6	7.9	0.5	2.7	1.4	100.0	100.0
04-Mar-92	72.5	91.5	15.4	3.4	5.2	4.5	5.2	0.0	1.7	0.6	100.0	100.0
17-Mar-92	66.7	96.2	17.7	2.4	2.3	1.0	8.7	0.0	4.7	0.4	100.0	100.0
31-Mar-92	53.9	93.1	34.5	4.7	6.1	1.4	4.0	0.2	1.5	0.6	100.0	100.0
14-Apr-92	65.0	92.1	30.9	4.1	2.2	2.3	1.1	0.1	0.8	1.5	100.0	100.0
28-Apr-92	55.4	88.8	35.6	4.8	4.6	3.7	0.3	0.0	4.1	2.7	100.0	100.0
12-May-92	59.4	91.8	32.8	5.6	3.4	2.1	0.0	0.0	4.4	0.5	100.0	100.0
26-May-92	54.5	89.1	28.1	5.6	5.3	2.1	8.5	1.1	3.5	2.0	100.0	100.0
11-Jun-92	18.6	77.9	70.0	15.8	4.9	3.4	0.9	0.2	5.8	2.7	100.0	100.0
23-Jun-92	32.5	91.8	61.9	7.1	4.0	0.8	0.0	0.0	1.6	0.3	100.0	100.0
07-Jul-92	14.5	79.4	46.1	13.8	1.8	1.7	36.7	3.6	0.9	1.5	100.0	100.0
21-Jul-92	19.6	50.1	40.2	17.9	6.0	8.7	33.3	7.6	0.9	15.7	100.0	100.0
04-Aug-92	31.4	70.9	26.0	9.7	2.5	2.2	38.7	8.7	1.4	8.6	100.0	100.0
18-Aug-92	21.4	82.4	49.0	7.8	2.5	2.0	26.1	2.6	1.0	5.2	100.0	100.0
01-Sep-92	9.5	64.9	56.7	17.0	2.0	2.2	29.8	7.4	2.0	8.5	100.0	100.0
15-Sep-92	20.8	74.8	37.8	6.5	3.8	4.8	35.7	6.6	1.9	7.2	100.0	100.0
13-Oct-92	27.9	83.9	50.0	6.8	8.5	7.1	12.4	1.3	1.3	0.9	100.0	100.0
10-Nov-92	38.8	72.6	51.0	10.7	8.2	12.2	0.0	0.0	1.9	4.5	100.0	100.0
08-Dec-92	37.3	87.9	36.7	7.4	0.6	1.7	24.9	2.3	0.5	0.7	100.0	100.0

Appendix 4. Changes in the monthly abundance of phytoplankton species in the Eysden area.

		1955						1992					
Apparently increased since 1955	Algal class	Apr	May	Jun	Jul	Aug	Sep	Apr	May	Jun	Jul	Aug	Sep
Actinocyclus normanii	diatoms										+		
Aphanocapsa elachista	bluegreen algae					+		+			+	+	+
Aulacoseira ambigua	diatoms							+	+	+	+	++	+
Aulacoseira subarctica	diatoms							+	+	+			
Chlorophytes spheres 2-10 µm	green algae		++	++	++			++	++	++	++	++	++
Chrysococcus sp	golden algae							+	+	+	+	+	+
Crucigenia tetrapedia	green algae			+					+	+	+	++	+
Crucigeniella apiculata	green algae				+	+			+	+	+	++	+
Cryptomonas sp	cryptophyte							+	+	+	+	+	+
Cyclotella meneghiniana	diatoms								+	++	++	++	++
Diatoma vulgaris	diatoms		+					+	+			+	
Didymocystis lineata	green algae									+	++	++	+
Euglena sp	euglenophyte							+		+	+	+	+
Goniochloris mutica	xanthophyte					+			+	+	+	+	+
Lagerheimia ciliata/citriforme	green algae					+			+	+	+	+	
Lagerheimia genevensis	green algae			+	+	+		+	+	+			+
Limnothrix redekei	bluegreen algae							+	+			+	
Monoraphidium/Ankistrodesmus	green algae	+	++	+	+	+		++	++	++	+	++	++
Neodesmis danubialis	green algae										++	+	+
Oocystis sp	green algae			+	+	+		+	+	++	+	++	+
Ophiocytium capitatum longispinum	xanthophyte									+	+	+	+
Planktothrix agardhii	bluegreen algae								+	+	+	+	++
Pseudodidymocystis inconspicua	green algae							+	+	++	++	++	+
Rhodomonas minuta nannoplanctica	cryptophyte							+	++	++	++	++	++
Scenedesmus arcuatus	green algae				+						+	+	+
Scenedesmus communis	green algae	+	+	+	+	+	+	+	+	+	++	++	++
Scenedesmus denticulatus	green algae					+	+	+	+	+	++	+	+
Scenedesmus gr armatii	green algae		+					+	+	+	+	+	+
Scenedesmus opoliensis	green algae							+	+	+	+	++	+
Scenedesmus spp	green algae		+			+		+	+	+	++	++	+
Siderocelis ornata	green algae							+	+	++	++	++	+
Skeletonema potamos	diatoms								+	+	++	++	++
Stephanodiscus gr hantzschii	diatoms	+	++	+	++	+	+	++	++	++	++	++	+
Tetraedron caudatum	green algae			+		+			+	+	+	+	+
Tetraedron minimum	green algae					+			+	+	+	+	+
Tetrastrum komarekii	green algae								+	+		+	+
Tetrastrum staurogeniaeforme	green algae		+	+	+	++	+		++	++	++	++	+
Trachydiscus sp	xanthophyte								+	++	++	++	++

Conversion of 1992 data : + = < 100 individuals per ml

++ = > 100 individuals per ml

Appendix 4. Changes in the monthly abundance of phytoplankton in the Eysden area. (continued)

		1955						1992					
No obvious change since 1955	Algal class	Apr	May	Jun	Jul	Aug	Sep	Apr	May	Jun	Jul	Aug	Sep
Actinastrum hantzschii	green algae		+	++	+	+	+		+	+	+	+	+
Chlamydomonas sp	green algae	++	++	++	+	+	+	++	++	++	+	++	+
Coelastrum astroideum/microporum	green algae		+	+	++	+	+		+	+	+	+	+
Dictyosphaerium pulchellum	green algae		+	+	++	+	+	+	+	+	+	+	+
Fragilaria ulna var acus	diatoms		++	+	++	++	++	+	+	+	+	++	+
Golenkinia radiata	green algae				+	+				+	+	+	
Micractinium pusillum	green algae		+	+	++	+	+	+	+	+	++	+	
Pediastrum boryanum	green algae	+	+	+	+	+	+		+	+	+	+	+
Pediastrum duplex	green algae		+	+	+	+	+		+	+	+	+	+
Pediastrum tetras	green algae			+	+	+	+		+	+	+	+	+
Scenedesmus gr acuminatus	green algae	+	+	+	+	+	+	+	+	+	+	+	+
Dinobryon sp	golden algae		+	+	+			+	+	+	+		
Microcystis sp	bluegreen algae			++									++
Aulacoseira granulata	diatoms	+	+	+	++	++	++		+	+	+	++	+
Fragilaria ulna	diatoms	+		+	+	+	+	+	+	+	+	+	+
Melosira varians	diatoms	+	+	+	+	+	+	+	+	+	+	+	+
Nitzschia acicularis/draveillensis	diatoms	++	++	+	+	+		++	+	+	+	+	+
Stephanodiscus gr rotula	diatoms					+							+

		1955						1992					
Apparently decreased since 1955	Algal class	Apr	May	Jun	Jul	Aug	Sep	Apr	May	Jun	Jul	Aug	Sep
Eudorina elegans	green algae	+	+			+	+						
Pandorina morum	green algae		+	+	+	+					+		
Acanthoceras zachariasii	diatoms		+	+	+	+	+				+	+	+
Asterionella formosa	diatoms	++	+	+	++	+	++	+	+		+		+
Cyclotella radiosa	diatoms	++	+	+	++	++	+						
Diatoma tenuis	diatoms	++	++	+	++	+	++	+	+			+	+
Fragilaria capucina/construens	diatoms				+	+	+						
Fragilaria crotonensis	diatoms		+	+	+	+	+						
Rhizosolenia sp	diatoms				+	+	+						

Source 1955 data : Wibaut-Isebree Moens (1956)

Conversion of 1992 data : + = < 100 individuals per ml
++ = > 100 individuals per ml

Appendix 5. Changes in the annual abundance of phytoplankton species in the Eysden area since 1955.

Phytoplankton species with an apparently increased abundance since 1955

	1955	1973	1974	1977	1978	1979	1980	1981	1992	Algal class
Cyclotella meneghiniana		2	1	1	1	2	1	3	4	diatoms
Stephanodiscus gr hantzschii	3	2	1	2	2	4	2	4	4	diatoms
Chlorophyta spheres 2-10 µm	3								4	green algae
Chrysococcus sp		1	1	1	1	1	1	1	2	golden algae
Didymogenes anomala/palatina		1	1	1	1	1	1		2	chlorophyte
Limnothrix planctonica	1	1		1	1	1	1	1	2	bluegreen algae
Limnothrix redekei			1	1	1	1	1	1	2	bluegreen algae
Monoraphidium arcuatum		1			1	1	1	1	2	green algae
Pseudotetrastrum punctatum	1	1	1		1				2	green algae
Tetrastrum komarekii		1	1	1	1	1	1	1	2	green algae

Phytoplankton species with apparently increased abundance between 1955 and 1973

	1955	1973	1974	1977	1978	1979	1980	1981	1992	Algal class
Scenedesmus opoliensis		3	2	3	4	3	2	2	3	green algae
Cryptomonas sp		3	2	1	1	1	1	1	2	cryptophyte
Actinocyclus normanii/Coscinodiscus sp				1	1	1			1	diatoms
Anabaena sp						1	1		1	bluegreen algae
Aphanizomenon flos-aquae		1	1		1				1	bluegreen algae
Cosmarium sp				1	1	1	1	1	1	green algae
Crucigenia fenestrata		1			1	1	1	1	1	green algae
Euglena sp		1	1	1	1	1	1	1	1	euglenophyte
Mallomonas sp				1	1	1	1	1	1	golden algae
Pediastrum simplex				1	1			1	1	green algae
Peridinium sp				1	1	1			1	dinoflagellate
Schroederia setigera					1	1			1	green algae
Tabellaria flocculosa				1	1	1	1	1	1	diatoms

Phytoplankton species with apparently increased abundances between 1981 and 1992

	1955	1973	1974	1977	1978	1979	1980	1981	1992	Algal class
Aulacoseira ambigua									3	diatoms
Crucigenia tetrapedia	1	1	1	1	1	1	1	1	3	green algae
Crucigeniella apiculata/rectangularis	1	2	1	1	1	1	1	1	3	green algae
Didymocystis lineata									3	green algae
Neodesmus danubialis									3	green algae
Nephrochlamys subsolitaria	1								3	green algae
Pseudodidymocystis inconspicua									3	green algae
Rhodomonas minuta var nannoplanctica									3	cryptophyte
Scenedesmus denticulatus	1	1	1	1	2	1	1	1	3	green algae
Skeletonema potamos									3	diatoms
Trachydiscus sp									3	xanthophyte
Aulacoseira subarctica									2	diatoms
Aphanocapsa sp	1								2	bluegreen algae
Goniochloris mutica	1	1	1	1	1	1	1	1	2	xanthophyte
Monoraphidium griffithii/komarkovae	1				1				2	green algae
Planktothrix agardhii	1		1	1	1	1	1	1	2	bluegreen algae
Scenedesmus gr armatii	1	1	1	1	1	1	1	1	2	green algae
Scenedesmus gr sempervirens	1	1	1	1	1	1	1	1	2	green algae
Scenedesmus intermedius	1	2	1	1	1	1	1	1	2	green algae
Tetraedron minimum	1	1	1	1	1	1	1	1	2	green algae

Scale based on frequency and maximum density,
1992 data transformed as denoted behind the slash :

1 = occasionally present or with few individuals
2 = regularly present / maximum density below 100 individuals per ml
3 = abundant / maximum density between 100 and 1000 individuals per ml
4 = dominant / maximum densities above 1000 individuals per ml

Appendix 5. Changes in the annual abundance of phytoplankton species in the Eysden area. (continued)

Phytoplankton species with no apparent changes in abundance in 1992 compared to 1955.

	1955	1973	1974	1977	1978	1979	1980	1981	1992	Algal class
Aulacoseira granulata	3	3	2	2	1	2	2	2	3	diatoms
Chlamydomonas sp	3	1	1	1	2	3	2	1	3	green algae
Dictyosphaerium pulchellum	3	2	1	1	2	2	2	2	2	green algae
Micractinium pusillum	3	1	1	1	2	2	2	3	3	green algae
Monoraphidium contortum	3	3	3	1	1	1	1	1	3	green algae
Nitzschia acicularis/draveillensis	3	2	3	1	2	2	1	1	3	diatoms
Nitzschia fruticosa	3	2	1	1	2	2	2	3	3	diatoms
Tetrastrum staurogeniaeforme	3	1	1	1	1	1	1	1	3	green algae
Actinastrum hantzschii	2	3	1	2	2	3	3	3	2	green algae
Coelastrum astroideum/microporum	2	2	2	2	2	2	2	2	2	green algae
Fragilaria ulna	2	1	1	1	2	1	2	1	2	diatoms
Fragilaria ulna var acus	3	2	3	3	3	2	2	1	2	diatoms
Melosira varians	2	1	1	1	1	2	1	1	2	diatoms
Microcystis sp	2			1		1	1	1	2	bluegreen algae
Oocystis sp	2	1	1	1	1	1	1	2	2	green algae
Pediastrum boryanum	2	3	1	2	2	2	2	2	2	green algae
Pediastrum duplex	2	2	2	3	2	2	1	2	2	green algae
Pediastrum tetras	2	1	1	2	2	1	1	1	2	green algae
Scenedesmus communis	2	3	1	2	2	1	1	1	2	green algae
Scenedesmus gr acuminatus	2	3	2	2	2	2	2	2	2	green algae
Tetraedron caudatum	2	1	1	1	1	1	1		2	green algae
Chroococcus limneticus	1			1	1	1	1	1	1	bluegreen algae
Closterium sp	1	1	1	1	1	1	1	1	1	green algae
Diatoma vulgaris	1	1	1	1	1	1	1	1	1	diatoms
Lagerheimia ciliata	1	1	1	1	1	1	1	1	1	green algae
Lagerheimia wratislaviensis	1	1	1		1	1			1	green algae
Meridion circulare	1	1	1	1	1	1	1	1	1	diatoms
Ophiocytium capitatum longispinum	1	1	1	1	1	1	1	1	1	xanthophyte
Pteromonas angulosa	1		1	1		1	1		1	green algae
Stephanodiscus gr rotula	1								1	diatoms
Tetrastrum elegans	1								1	green algae
Thalassiosira bramaputrae	1				1	1			1	diatoms

Phytoplankton species with apparently decreased abundances between 1955 and 1973.

	1955	1973	1974	1977	1978	1979	1980	1981	1992	Algal class
Asterionella formosa	3	1	1	2	2	1	2	1	2	diatoms
Cyclotella radiosa	3								1	diatoms
Diatoma tenuis	3	1	1	2	2	1	1	1	1	diatoms
Dinobryon sp	2		1	1	1	1	1	1	1	golden algae
Golenkinia radiata	2	1		1	1	1	1	1	1	green algae
Acanthoceras zachariasii	2	1		1	1	1	1	1	1	diatoms
Rhizosolenia sp	2									diatoms
Lagerheimia genevensis	2	1	1	1	1	1	1	1	1	green algae
Fragilaria capucina	2		1	1	1	1	1	1	1	diatoms

Phytoplankton species with apparently decreased abundances since 1973.

	1955	1973	1974	1977	1978	1979	1980	1981	1992	Algal class
Pandorina morum	2		2	1	1	1	1	1	1	green algae

Scale based on frequency and maximum density,
1992 data transformed as denoted behind the slash :

1 = occasionally present or with few individuals
2 = regularly present / maximum density below 50 individuals per ml
3 = abundant / maximum density between 100 and 1000 individuals per ml
4 = dominant / maximum densities above 1000 individuals per ml

Source 1955 data : Wibaut-Isebree Moens (1956) (transformed)
Source 1973-1981 data : De la Haye (1994)

Appendix 6. Changes in the seasonal abundance of some diatoms and green algae in the Meuse.

Individuals per ml	Location Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Stephanodiscus hantzschii	Eysden 1955	-	-	-	+	++	+	+	+	+	-	-	-
	Grave 1955	-	-	-	+	++	+	++	+	+	-	-	-
	Grave 1968	< 1	4	20	389	87	12	35	24	68	91	74	39
	Grave 1969	1	2	15	38	260	111	22	3	10	16	74	1
	Grave 1970	3	< 1	< 1	82	130	7	45	82	65	65	68	35
	Grave 1971	5	1	16	71	16	31	102	39	56	46	24	54
	Grave 1972	23	15	312	273	286	68	3	9	6	28	74	97
	Eysden 1992	19	267	5108	8923	950	966	1086	141	68	32	26	10

Individuals per ml	Location Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Asterionella formosa	Eysden 1955	-	-	-	+	++	++	++	++	+	-	-	-
	Grave 1955	-	-	-	++	++	++	++	+	++	-	-	-
	Grave 1968	1	< 1	11	18	2	16	41	45	20	3	< 1	4
	Grave 1969	< 1	6	7	65	3	2	17	10	6	24	17	< 1
	Grave 1970	2	2	< 1	39	30	< 1	224	65	37	94	68	2
	Grave 1971	4	4	23	565	6	15	122	97	87	12	16	24
	Grave 1972	20	14	176	57	32	55	18	18	35	77	< 1	1.7
	Eysden 1992	1	8	9	24	24	< 1	8	< 1	3	< 1	3	4

Individuals per ml	Location Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Diatoma tenuis	Eysden 1955	-	-	-	++	++	++	++	++	++	-	-	-
	Grave 1955	-	-	-	++	++	++	++	+	+	-	-	-
	Grave 1968	3	2	4	102	156	60	78	34	9	3	< 1	< 1
	Grave 1969	< 1	< 1	5	3	128	16	9	2	4	< 1	2	1
	Grave 1970	< 1	4	4	30	43	6	< 1	6	10	4	1	< 1
	Grave 1971	< 1	< 1	< 1	23	3	< 1	6	5	< 1	< 1	< 1	< 1
	Grave 1972	< 1	< 1	4	20	52	28	3	3	1	2	4	< 1
	Eysden 1992	< 1	< 1	< 1	4	12	< 1	< 1	4	1	1	1	< 1

Cells per ml	Location Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fragilaria ulna var. acus	Eysden 1955	-	-	-	+	++	+	++	++	++	-	-	-
	Grave 1955	-	-	-	+	++	++	+	+	+	-	-	-
	Grave 1968	4	7	18	526	66	19	71	46	7	4	< 1	< 1
	Grave 1969	3	4	14	24	82	10	23	10	10	8	2	2
	Grave 1970	3	13	9	82	56	14	58	111	24	23	3	1
	Grave 1971	1	4	5	102	33	8	117	97	36	43	4	4
	Grave 1972	3	14	130	96	41	34	8	13	9	7	18	3
	Eysden 1992	8	20	44	62	12	6	36	146	16	15	2	2

- = no data available

Remark : An individual was defined as the entity of the species in the plankton sample, either a single cell or an aggregation of cells (coenobium, colony or chain). A species like Stephanodiscus hantzschii may appear in the sample as a single cell or as a chain of cells. In this case both the single cell and the chain were counted as one individual. The 1992 data were recalculated using the observed number of individuals or, in the case of S. hantzschii, an average cell number per individual estimated per sample out of 25 (January) to 65 (April) observations.

Appendix 6. Changes in the seasonal abundance of some diatoms and green algae in the Meuse. (continued)

Coenobia per ml	Location Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Actinastrum hantzschii	Eysden 1955	-	-	-	+	+	++		+	+	-	-	-
	Grave 1955	-	-	-	+	+	++	+	+	+	-	-	-
	Grave 1968	< 1	< 1	< 1	2	9	17	8	4	< 1	< 1	< 1	< 1
	Grave 1969	< 1	< 1	< 1	< 1	4	11	3	11	6	3	< 1	< 1
	Grave 1970	< 1	< 1	< 1	< 1	< 1	2	31	7	18	5	7	< 1
	Grave 1971	< 1	< 1	< 1	4	40	65	286	111	74	29	49	1
	Grave 1972	1	< 1	20	82	35	143	65	39	78	34	< 1	1
	Eysden 1992	< 1	< 1	< 1	< 1	4	24	32	26	4	2	< 1	< 1

Coenobia per ml	Location Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Scenedesmus communis	Eysden 1955	-	-	-	+	+	++		+	+	-	-	-
	Grave 1955	-	-	-	+	+	++	+	+	+	-	-	-
	Grave 1968	< 1	< 1	< 1	2	9	17	8	4	< 1	< 1	< 1	< 1
	Grave 1969	< 1	< 1	< 1	< 1	4	11	3	11	6	3	< 1	< 1
	Grave 1970	< 1	< 1	< 1	< 1	< 1	2	31	7	18	5	7	< 1
	Grave 1971	< 1	< 1	< 1	4	40	65	286	111	74	29	49	1
	Grave 1972	20	15	56	43	78	130	111	63	117	58	26	15
	Eysden 1992	< 1	< 1	2	3	40	20	46	64	58	63	4	5

Coenobia per ml		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Scenedesmus acuminatus	Eysden 1955	-	-	-	+	+	++		+	+	-	-	-
	Grave 1955	-	-	-	+	+	++	+	+	+	-	-	-
	Grave 1968	< 1	< 1	< 1	2	9	17	8	4	< 1	< 1	< 1	< 1
	Grave 1969	< 1	< 1	< 1	< 1	4	11	3	11	6	3	< 1	< 1
	Grave 1970	< 1	< 1	< 1	< 1	< 1	2	31	7	18	5	7	< 1
	Grave 1971	< 1	< 1	< 1	4	40	65	286	111	74	29	49	1
	Grave 1972	20	15	56	43	78	130	111	63	117	58	26	15
	Eysden 1992	2	< 1	3	12	18	54	24	72	14	6	2	< 1

- = no data available

Appendix 7a. Comparison of phytoplankton records of the River Meuse over the past 75 years.

Algal species	net/nanno	Data selected by Peelen (1975)					This study	
		Romijn 1918	Wibaut 1954-55	RIZA 1966-67	Peelen 1969-70	Peelen 1971-72	Keizersveer 1992	Eysden 1992
		net	nanno-net	net	nanno-net	nanno-net	nanno	nanno
Acanthoceras zachariasii	na		c	rr	+	+		r
Actinastrum hantzschii	na	r	cc	c	cc	c	r	c
Aphanizomenon flos-aquae	na			rr	+	r	c	rr
Asterionella formosa	na	+	cc	cc	cc	cc	cc	+
Aulacoseira granulata	na		cc	c	cc	cc	c	cc
Coelastrum gr. microporum	na	rr	c	+	+	r	c	c
Crucigenia tetrapedia	na		+	+	c	c	c	c
Crucigeniella apiculata	na	rr	+	rr	c	c	c	cc
Cyclotella radiosa	na		cc	cc	cc	c	rr	rr
Cymatopleura solea	na	+	r	c	r	+	rr	rr
Diatoma tenuis	na	+	cc	c	c	cc	c	r
Diatoma vulgaris	ne	+	r	+	+	+	cc	cc
Dictyosphaerium pulchellum	na	rr	cc	rr	r	c	c	cc
Dinobryon sertularia	ne		cc				+	+
Eudorina elegans	na		+	rr	+	r		
Euglena sp	na		rr	r	r	r	rr	rr
Fragilaria capucina/construens	na	+	c	rr	rr	rr	rr	rr
Fragilaria crotonensis	ne	+	+	c	c	c		
Fragilaria ulna	ne	r	+	r	rr	rr	cc	cc
Fragilaria ulna var acus	ne	r	cc	cc	cc	cc	cc	cc
Melosira varians	na	r	+	cc	cc	cc	c	r
Micractinium pusillum	na	rr	cc	+	rr	rr	+	c
Microcystis aeruginosa	na		rr	rr	+	c	cc	+
Monoraphidium contortum	na		cc	+	+	cc	c	c
Nitzschia gr. acicularis	na	cc	cc	rr	+		c	c
Pandorina morum	ne		+	r	rr	c		cc
Pediastrum boryanum	na	rr	+	c	+	c	c	c
Pediastrum duplex	ne	rr	+	c	+	c	cc	cc
Pediastrum tetras	na		c	r	+	+	+	c
Planktothrix agardhii	ne		r	+	+	+	cc	cc
Scenedesmus gr acuminatus	na	r	c	cc	cc	cc	c	c
Scenedesmus communis	na	+	c	cc	cc	cc	c	c
Stephanodiscus gr rotula	na		rr	c	cc	cc	+	r
Stephanodiscus gr hantzschii	na	c	cc	c	cc	cc	cc	cc
Tetrastrum komarekii	na	rr		cc	cc	c	c	c
Number of cc-taxa		1	12	7	11	10	8	10
Number of c-taxa		1	6	9	4	11	14	11
Number of +-taxa		7	9	6	12	5	4	3
Number of r-taxa		5	3	4	3	4	1	4
Number of rr-taxa		7	3	8	4	3	4	5
Total number of taxa		21	33	34	34	33	31	33

Legend for nanno-plankton (na) in cells/l

rr	= 500 - 2,500
r	= 2,500 - 10,000
+	= 10,000 - 25,000
c	= 25,000 - 100,000
cc	= more than 100,000

Legend for net-plankton (ne) in cells/l

rr	= 5 - 25
r	= 25 - 100
+	= 100 - 250
c	= 250 - 1,000
cc	= more than 1,000

Legends after Peelen (1975)

Appendix 7b. List of taxa common in the Meuse in 1955 and/or 1992 and not mentioned by Peelen (1975)

Algal species	Peelen (1975)		Wibaut	This study	
	near Keizersveer		Eysden	Keizersveer	Eysden
	1969-1972		1954-55	1992	1992
	nannoplankton		nanno	nanno	nanno
Aphanocapsa sp			+	+	+
Centric diatoms < 5 µm			cc	r	cc
Chlamydomonas sp			cc	cc	cc
Chlorophyta spheres 2-10 µm			cc	cc	cc
Cyclotella meneghiniana			rr	cc	cc
Goniochloris mutica			r	c	c
Lagerheimia ciliata/citriforme			r	r	r
Lagerheimia genevensis			+	c	r
Lagerheimia wratislaviensis			r		r
Nitzschia fruticosa			c	c	cc
Oocystis sp			c	c	c
Rhizosolenia spp			+		
Scenedesmus denticulatus			r	c	cc
Scenedesmus gr armatii			r	cc	c
Tetrastrum staurogeniaeforme			cc	cc	cc
Westella botryoides			c	+	+
Actinocyclus normanii				c	rr
Aulacoseira ambigua				cc	cc
Aulacoseira subarctica				c	c
Cryptomonas sp				c	+
Dact jurisii/Dict subsolitarum				cc	cc
Didymocystis lineata				+	c
Juraniella javorkae					cc
Neodesmis danubialis				rr	c
Pseudanabaena mucicola				c	
Pseudodidymocystis inconspicua				c	cc
Scenedesmus opoliensis				cc	cc
Scenedesmus sp unicel				c	cc
Scenedesmus spp				cc	cc
Skeletonema potamos				c	cc
Skeletonema subsalsum				cc	rr
Stephanodiscus parvus				c	cc
Trachydiscus sp				c	c
Tribonema / Gloeotila				c	c
Number of cc-taxa			4	11	17
Number of c-taxa			3	13	8
Number of +-taxa			2	3	3
Number of r-taxa			5	2	2
Number of rr-taxa			1	1	1
Total number of taxa			15	30	31

Legend for nanno-plankton (na) in cells/l

rr	= 500 - 2,500
r	= 2,500 - 10,000
+	= 10,000 - 25,000
c	= 25,000 - 100,000
cc	= more than 100,000

Legends after Peelen (1975)

Appendix 8. Comparing the frequency of phytoplankton species in monthly samples from the Meuse near Keizersveer, 1960/1961 and 1992.

Increased frequencies

Algal species	Class	1960	1961	1992
Aphanizomenon flos-aquae	Bluegreen	-	-	2
Aphanocapsa sp	Bluegreen	-	-	1
Microcystis sp	Bluegreen	1	0	3
Planktothrix agardhii	Bluegreen	0	0	1
Pseudanabaena mucicola	Bluegreen	-	-	2
Cryptomonas sp	Cryptophyte	-	-	5
Rhodomonas minuta var nannoplanctica	Cryptophyte	-	-	5
Aulacoseira ambigua	Diatoms	-	-	5
Aulacoseira islandica	Diatoms	1	1	2
Aulacoseira subarctica	Diatoms	-	-	4
Skeletonema potamos	Diatoms	-	-	4
Skeletonema subsalsum	Diatoms	2 ?	2 ?	5
Stephanodiscus gr rotula	Diatoms	0	1	4
Thalassiosira bramaputrae	Diatoms	-	-	3
Peridinium/Glenodinium sp	Dinoflagellate	1	0	3
Dinobryon sertularia	Golden algae	1	1	3
Chlorophyta spheres 2-10 µm	Green algae	-	-	5
Coelastrum astroideum/microporum	Green algae	2	2	3
Crucigenia tetrapedia	Green algae	2	2	4
Crucigeniella apiculata/rectangularis	Green algae	2	2	3
Dact jurisii/Dict subsolitarum	Green algae	-	-	3
Dictyosphaerium pulchellum	Green algae	2	2	3
Didymocystis lineata	Green algae	1	0	3
Monoraphidium contortum	Green algae	4	2	5
Neodesmis danubialis	Green algae	1	0	2
Oocystis sp	Green algae	2	2	5
Pediastrum boryanum	Green algae	2	2	4
Pediastrum duplex	Green algae	2	2	3
Pediastrum simplex	Green algae	-	-	3
Pseudodidymocystis inconspicua	Green algae	4	4	5
Pteromonas angulosa	Green algae	1	1	2
Scenedesmus communis	Green algae	3	4	5
Scenedesmus denticulatus	Green algae	2	2	5
Scenedesmus gr acuminatus	Green algae	4	3	5
Scenedesmus opoliensis	Green algae	3	3	5
Siderocelis s.l./Marvania geminata	Green algae	-	-	3
Tetraedron caudatum	Green algae	2	2	3
Tetraedron minimum	Green algae	2	1	3
Tetrastrum komarekii	Green algae	4	3	5
Tetrastrum staurogeniaeforme	Green algae	3	3	4

Legend

0 = Not detected ; - = Not mentioned
1 = Present in 1-19 % of the samples
2 = Present in 20-39 % of the samples
3 = Present in 40-59 % of the samples
4 = Present in 60-79 % of the samples
5 = Present in 80-100 % of the samples

Source 1960 and 1961 data : Dresscher (1969)

Appendix 8. Comparing the frequency of phytoplankton species in monthly samples from the Meuse near Keizersveer, 1960/1961 and 1992. (continued)

Similar frequencies	Aulacoseira granulata	Diatoms	5	5	5
	Cyclotella/Stephanodiscus	Diatoms	4	5	5
	Diatoma vulgaris	Diatoms	2	1	1
	Fragilaria ulna var acus	Diatoms	5	4	4
	Melosira varians	Diatoms	4	4	4
	Meridion circulare	Diatoms	1	0	1
	Nitzschia acicularis/draveillensis	Diatoms	4	3	3
	Nitzschia fruticosa	Diatoms	2	2	2
	Tabellaria flocculosa/fenestrata	Diatoms	1	1	1
	Chrysococcus sp	Golden algae	4	4	4
	Actinastrum hantzschii	Green algae	2	3	3
	Lagerheimia genevensis	Green algae	3	3	3
	Lagerheimia wratislaviensis	Green algae	0	1	0
	Micractinium pusillum	Green algae	2	2	2
	Pediastrum tetras	Green algae	3	2	3
	Pseudotetrastrum punctatum	Green algae	1	1	1
	Scenedesmus gr armatii	Green algae	4	5	5
	Goniochloris mutica	Xanthophyte	3	2	3
	Ophiocytium capitatum	Xanthophyte	1	1	1
Decreased frequencies	Acanthoceras zachariasii	Diatoms	1	0	0
	Actinocyclus normanii	Diatoms	5	5	4
	Asterionella formosa	Diatoms	5	5	4
	Cymatopleura solea	Diatoms	2	2	1
	Diatoma tenuis	Diatoms	5	3	2
	Fragilaria capucina/construens	Diatoms	2	2	1
	Fragilaria crotonensis	Diatoms	2	2	-
	Fragilaria ulna	Diatoms	3	4	2
	Euglena sp	Euglenophyte	3	3	2
	Eudorina elegans	Green algae	0	0	-
	Pandorina morum	Green algae	1	1	0

Legend
0 = Not detected ; - = Not mentioned
1 = Present in 1-19 % of the samples
2 = Present in 20-39 % of the samples
3 = Present in 40-59 % of the samples
4 = Present in 60-79 % of the samples
5 = Present in 80-100 % of the samples

Source 1960 and 1961 data : Dresscher (1969)

Appendix 9 Zooplankton species abundance (number per species per liter and biovolume per species per liter) during 1992 at station Eysden and Keizersveer.

NUMBER/LITER
EYSDEN 1992

	07-Jan-92	24-Jan-92	04-Feb-92	18-Feb-92	04-Mar-92	17-Mar-92	31-Mar-92	14-Apr-92	28-Apr-92	12-May-92	26-May-92	11-Jun-92	23-Jun-92	07-Jul-92	21-Jul-92	04-Aug-92
CRUSTACEANS:	0.80	1.68	1.88	2.64	1.96	1.80	2.08	0.80	4.92	12.88	14.60	95.52	27.68	51.56	123.71	259.44
CLADOCERANS:	0.16	0.00	0.08	0.80	0.04	0.44	0.40	0.00	0.24	3.80	7.00	3.72	3.04	4.20	7.92	118.56
COPEPODS:	0.64	1.68	1.80	1.84	1.92	1.36	1.68	0.80	4.68	9.08	7.60	91.80	24.64	47.36	115.79	140.88
BOSMINA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	3.60	6.92	3.48	2.76	4.08	7.84	116.12
CYCLOPS SP.	0.16	0.32	0.04	1.04	0.08	0.12	0.48	0.08	1.68	0.88	2.64	1.80	2.44	5.96	19.52	8.88
DAPHNIA SP.	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.12	0.12	0.08	1.72
EURYTEMORA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NAUPLIUS	0.48	1.36	1.76	0.80	1.84	1.24	1.20	0.72	3.00	8.20	4.96	90.00	22.20	41.40	96.27	132.00
ALONA SP.	0.16	0.00	0.08	0.80	0.00	0.44	0.00	0.00	0.04	0.00	0.04	0.00	0.12	0.00	0.00	0.00
CERIODAPHNIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.04	0.00	0.00	0.00
CHYDORUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.00	0.08	0.00	0.00	0.00	0.00
DIAPTOMUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EURYCERCUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MACROTHRIX LATICORNIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SIDA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72
ROTIFERS:	2.80	2.80	3.68	20.80	2.32	29.20	21.20	15.76	191.55	229.43	800.32	111.76	158.16	269.57	593.12	5769.39
ASPLANCHNA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.48	0.20	0.96	0.00	0.00	0.08	0.00	17.92
BRACHIONUS ANGULARIS/BIDENS	0.48	0.40	0.00	0.00	0.24	0.00	0.40	2.32	42.00	26.87	35.52	30.88	37.87	77.17	280.53	552.00
BRACHIONUS CALYCIFLORIS	0.00	0.00	0.00	1.60	0.40	3.20	0.40	4.48	121.87	51.96	84.00	0.64	6.24	4.48	27.20	130.67
BRACHIONUS LEYDIGI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRACHIONUS QUADRIDENTATIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60	0.00	1.68	0.32	0.32	0.32	0.00	0.00
BRACHIONUS SP.	0.00	0.00	0.00	0.00	0.08	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRACHIONUS URCEOLARIS	0.00	0.00	0.08	0.00	0.08	3.20	0.00	0.16	2.40	1.20	0.48	2.56	2.48	0.00	1.28	0.00
BR. LEYDIGI F TRIDENTATIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	2.40	0.48	0.00	0.00	0.00	0.00	0.00
BR. QUADRIDENTATIS F CLUNIORBICULARIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.16	0.32	0.00
EUCHLANIS DILATATA	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00	1.20	0.00	0.48	0.24	0.00	0.00	0.00
FILINIA LONGISETA	0.00	0.00	0.00	0.00	0.08	0.00	0.80	0.08	1.00	0.60	0.88	2.32	0.16	0.00	0.80	1.20
KELLICOTTIA LONGISPINA	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
KERATELLA COCHLEARIS	2.00	0.40	0.80	0.00	0.80	8.00	12.00	2.80	5.00	109.33	576.00	24.40	68.00	150.67	213.33	2700.00
KERATELLA QUADRATA	0.16	0.00	0.00	0.00	0.00	0.00	5.20	1.60	2.00	26.13	83.20	1.28	5.31	15.57	4.32	4.80
LECANE BULLA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LECANE INOPINATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LECANE SP.	0.00	0.00	1.20	0.00	0.00	0.00	0.00	0.16	0.20	0.00	0.00	0.00	0.08	0.00	0.00	0.00
LEPADELLA OVALIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTHOLCA ACUMINATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTHOLCA SQUAMULA	0.00	0.00	0.00	1.60	0.08	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTOMMATA SP.	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POLYARTHRA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.08	1.12	0.00	22.80
TRICHOTRIA TETRACTIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00
ROTIFER SP.	0.00	1.60	1.60	16.80	0.40	13.60	1.20	2.80	11.00	9.33	16.80	48.48	37.23	4.00	6.67	2320.00
DIURELLA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.36	0.00	0.00	0.00	0.00	0.00	16.00	58.67	20.00
SYNCHEATA SP.	0.16	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.16	0.16	0.00	0.00	0.00
PROTOZOANS:	61.76	36.96	27.24	232.04	10.80	71.72	116.00	12.00	503.00	8.59	8.80	13.84	12.67	7.33	22.72	18.00
RHIZOPODA:	32.32	2.80	10.72	172.80	3.60	68.00	101.60	2.32	9.00	3.07	4.16	4.96	5.65	6.61	22.72	18.00
DIFLUGIA SP.	4.00	0.40	2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ARCELLA SP.	6.00	1.20	6.80	8.00	2.00	20.00	40.00	1.20	9.00	0.00	0.00	1.60	0.00	2.67	0.00	0.00
CENTROPYXIS ACULEATA	0.00	0.00	0.64	36.00	0.80	0.80	0.00	0.16	0.00	0.40	0.16	2.16	0.32	3.31	1.60	1.20
CENTROPYXIS SP.	22.32	1.20	0.08	104.80	0.80	47.20	61.60	0.96	0.00	2.67	4.00	1.20	5.33	0.64	21.12	16.80
NEBELA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYPHODERIA	0.00	0.00	0.40	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CILIATES:	29.44	34.16	16.52	59.24	7.20	3.72	14.40	9.68	494.00	5.52	4.64	8.88	7.01	0.72	0.00	0.00
EPYSTYLIS SP.	29.44	34.16	16.52	59.24	7.20	3.72	14.40	9.68	14.00	5.52	4.64	8.88	7.01	0.72	0.00	0.00
VORTICELLA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	480.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VAGINICOLA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUCTORIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CODONELLA LACUSTRIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DREISSENA POLYMORPHA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.67	0.00	8.00	32.64	16.77	19.95	0.00
TOTAAL	65.36	41.44	32.80	255.48	15.08	102.72	139.28	28.56	699.47	253.56	823.72	229.12	231.15	345.24	759.49	6046.83

NUMBER/LITER
EYSDEN 1992

	18-Aug-92	01-Sep-92	15-Sep-92	29-Sep-92	13-Oct-92	27-Oct-92	10-Nov-92	24-Nov-92	08-Dec-92	22-Dec-92	gem.	max
CRUSTACEANS:	210.40	47.00	16.12	23.63	6.08	10.28	4.80	5.37	0.96	0.36	35.73	259.44
CLADOCERANS:	90.64	10.24	2.20	1.19	0.88	5.84	0.16	0.00	0.08	0.00	10.06	118.56
COPEPODS:	119.76	36.68	13.84	22.44	5.20	4.44	4.64	5.37	0.88	0.36	25.66	140.88
BOSMINA SP.	89.64	9.00	2.04	1.19	0.84	4.96	0.16	0.00	0.08	0.00	9.73	116.12
CYCLOPS SP.	10.96	13.48	2.80	1.64	1.12	0.40	0.00	5.37	0.04	0.12	3.16	19.52
DAPHNIA SP.	0.36	0.08	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.10	1.72
EURYTEMORA SP.	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.04	0.00	0.00	0.04
NAUPLIUS	108.80	23.20	11.04	20.80	4.08	4.00	4.64	0.00	0.80	0.24	22.50	132.00
ALONA SP.	0.00	0.00	0.16	0.00	0.00	0.84	0.00	0.00	0.00	0.00	0.10	0.84
CERIODAPHNIA SP.	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.40
CHYDORUS SP.	0.00	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.84
DIAPTOMUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EURYCERCUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MACROTHRIX LATICORNIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SIDA SP.	0.24	0.32	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.05	0.72
ROTIFERS:	936.64	180.00	160.40	486.67	181.23	36.00	22.72	8.00	24.00	0.00	394.52	5769.39
ASPLANCHNA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77	17.92
BRACHIONUS ANGULARIS/BIDENS	265.60	28.00	4.08	14.40	63.73	1.20	0.56	0.00	0.80	0.00	56.35	552.00
BRACHIONUS CALYCIFLORIS	12.48	39.20	0.96	274.67	4.48	7.20	0.16	0.00	0.00	0.00	29.86	274.67
BRACHIONUS LEYDIGI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRACHIONUS QUADRIDENTATIS	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	1.68
BRACHIONUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	1.20
BRACHIONUS URCEOLARIS	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.55	3.20
BR. LEYDIGI F TRIDENTATIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	4.00
BR. QUADRIDENTATIS F CLUNIORBICULARIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.32
EUCHLANIS DILATATA	0.00	0.00	0.00	0.00	0.08	0.00	0.32	0.00	0.00	0.00	0.12	1.20
FILINIA LONGISETA	0.32	0.80	0.16	0.80	34.19	0.00	0.00	0.00	0.00	0.00	1.70	34.19
KELLICOTTIA LONGISPINA	0.00	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.05	0.48
KERATELLA COCHLEARIS	640.00	96.00	90.00	101.33	68.00	16.00	10.00	0.00	0.00	0.00	188.26	2700.00
KERATELLA QUADRATA	0.96	0.00	16.00	34.67	4.00	0.00	0.32	0.00	0.00	0.00	7.90	83.20
LECANE BULLA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LECANE INOPINATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LECANE SP.	16.96	0.00	0.00	0.00	0.00	8.00	0.00	0.00	20.00	0.00	1.79	20.00
LEPADELLA OVALIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTHOLCA ACUMINATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTHOLCA SQUAMULA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	1.60
NOTOMMATA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.16
POLYARTHRA SP.	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.94	22.80
TRICHOTRIA TETRACTIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.20
ROTIFER SP.	0.00	16.00	34.00	42.13	6.67	3.60	11.04	8.00	2.80	0.00	100.61	2320.00
DIURELLA SP.	0.00	0.00	14.00	18.67	0.00	0.00	0.00	0.00	0.00	0.00	4.95	58.67
SYNCHEATA SP.	0.00	0.00	0.40	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.05	0.40
PROTOZOANS:	1.60	116.80	31.80	0.00	108.00	266.40	25.36	61.33	182.40	146.28	80.90	720.40
RHIZOPODA:	1.60	86.40	20.56	0.00	0.00	226.40	6.00	61.33	102.40	50.16	39.35	226.40
DIFLUGIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	4.00
ARCELLA SP.	0.00	40.00	14.00	0.00	0.00	112.00	0.00	8.00	0.80	26.72	11.54	112.00
CENTROPYXIS ACULEATA	0.32	1.60	0.00	0.00	0.00	0.00	0.00	10.67	1.60	0.48	2.39	36.00
CENTROPYXIS SP.	1.28	44.80	4.56	0.00	0.00	114.40	4.00	42.67	100.00	22.96	24.05	114.40
NEBELA	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.08	2.00
CYPHODERIA	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02	24.00
CILIATES:	0.00	30.40	11.24	0.00	108.00	40.00	19.36	0.00	80.00	96.12	41.55	494.00
EPYSTYLIS SP.	0.00	6.40	1.16	0.00	0.00	0.00	1.36	0.00	80.00	65.32	14.21	80.00
VORTICELLA SP.	0.00	24.00	10.00	0.00	108.00	40.00	18.00	0.00	0.00	30.80	27.34	480.00
VAGINICOLA	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
SUCTORIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CODONELLA LACUSTRIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DREISSENA POLYMORPHA	40.16	2.40	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.87	40.16
TOTAAL	1188.80	346.20	212.32	510.29	295.31	312.68	52.88	74.71	207.36	146.64	516.02	6046.83

BIOVOLUME (ug/l)
EYSDEN 1992

	07-Jan-92	24-Jan-92	04-Feb-92	18-Feb-92	04-Mar-92	17-Mar-92	31-Mar-92	14-Apr-92	28-Apr-92	12-May-92	26-May-92	11-Jun-92	23-Jun-92	07-Jul-92	21-Jul-92	04-Aug-92	18-Aug-92	01-Sep-92
CRUSTACEANS:	1.90	2.63	3.21	18.76	1.93	10.47	7.16	0.98	13.22	51.33	115.32	90.05	63.32	94.24	246.46	873.34	906.78	238.60
CLADOCERANS:	1.11	0.00	0.79	3.26	0.66	1.44	1.60	0.00	2.61	40.45	85.84	24.90	39.78	35.33	44.93	755.51	713.92	95.80
COPEPODS:	0.78	2.63	2.42	15.50	1.27	9.03	5.56	0.98	10.61	10.87	29.48	65.15	23.54	58.92	201.53	117.83	192.86	141.46
BOSMINA SP.	0.00	0.00	0.00	0.00	0.00	0.00	1.60	0.00	0.00	38.89	80.54	24.12	27.13	31.67	42.78	728.52	702.23	65.65
CYCLOPS SP.	0.48	1.55	0.46	14.85	0.39	6.02	4.95	0.14	8.84	7.16	24.81	10.88	15.86	43.66	131.69	62.73	123.81	132.47
DAPHNIA SP.	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.00	0.00	4.19	0.00	10.43	3.66	2.15	11.89	2.32	8.99
EURYTEMORA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NAUPLIUS	0.30	1.07	1.96	0.66	0.88	3.01	0.60	0.84	1.78	3.72	4.67	54.27	7.68	15.25	69.84	55.10	69.05	8.99
ALONA SP.	1.11	0.00	0.79	3.26	0.00	1.44	0.00	0.00	1.81	0.00	1.11	0.00	1.41	0.00	0.00	0.00	0.00	0.00
CERIODAPHNIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.81	0.00	0.00	0.00	3.50	0.00
CHYDORUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	1.56	0.00	0.37	0.00	0.00	0.00	0.00	0.00	11.46
DIAPTOMUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EURYCERCUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MACROTHRIX LATICORNIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SIDA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.10	5.87	9.70
ROTIFERS:	0.95	0.84	1.00	15.40	2.27	13.20	10.52	14.48	378.56	192.26	201.95	22.97	48.77	45.41	140.19	2162.19	134.06	228.28
ASPLANCHNA SP.	0.00	0.00	0.00	0.00	0.00	0.00	4.39	0.00	5.58	2.94	5.02	0.00	0.00	0.33	0.00	178.51	0.00	0.00
BRACHIONUS ANGULARIS/BIDENS	0.23	0.10	0.00	0.00	0.11	0.00	0.15	0.65	14.57	8.95	11.25	5.00	8.84	14.50	48.56	132.26	31.09	6.11
BRACHIONUS CALYCIFLORIS	0.00	0.00	0.00	1.81	1.59	6.67	2.29	11.44	341.49	146.06	108.50	1.50	19.72	11.15	65.69	408.35	61.50	211.78
BRACHIONUS LEYDIGI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRACHIONUS QUADRIDENTATIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30	0.00	1.47	0.42	0.46	0.34	0.00	0.00	0.00	0.00
BRACHIONUS SP.	0.00	0.00	0.00	0.00	0.05	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRACHIONUS URCEOLARIS	0.00	0.00	0.20	0.00	0.09	2.87	0.00	0.37	3.72	2.12	0.98	3.92	4.74	0.00	2.26	0.00	0.00	0.00
BR. LEYDIGI F TRIDENTATIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.35	5.51	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BR. QUADRIDENTATIS F CLUNIORBICULARIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.31	0.74	0.00	0.00	0.00
EUCHLANIS DILATATA	0.00	0.00	0.00	2.87	0.00	0.00	0.00	0.00	0.00	3.53	0.00	0.70	0.33	0.00	0.00	0.00	0.00	0.00
FILINIA LONGISETA	0.00	0.00	0.00	0.00	0.04	0.00	0.33	0.02	0.32	0.28	0.33	0.69	0.04	0.00	0.16	0.15	0.04	0.12
KELLICOTTIA LONGISPINA	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
KERATELLA COCHLEARIS	0.28	0.03	0.12	0.00	0.10	0.51	1.44	0.32	0.51	10.58	36.86	1.64	4.66	10.88	15.37	236.42	39.12	8.17
KERATELLA QUADRATA	0.07	0.00	0.00	0.00	0.00	0.00	1.04	0.51	0.90	9.40	33.90	0.57	1.68	5.78	1.94	2.72	0.43	0.00
LECANE BULLA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LECANE INOPINATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LECANE SP.	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.13	0.07	0.00	0.00	0.00	0.03	0.00	0.00	0.00	1.84	0.00
LEPADELLA OVALIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTHOLCA ACUMINATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTHOLCA SQUAMULA	0.00	0.00	0.00	1.31	0.05	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTOMMATA SP.	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POLYARTHRA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.17	0.00	2.39	0.03	0.00
TRICHOTRIA TETRACTIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROTIFER SP.	0.00	0.68	0.62	9.41	0.16	2.68	0.31	0.69	1.75	2.74	2.01	8.38	7.99	1.15	0.87	1200.39	0.00	2.10
DIURELLA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.80	4.61	1.00	0.00	0.00
SYNCHEATA SP.	0.37	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.13	0.27	0.00	0.00	0.00	0.00	0.00
PROTOZOANS:	5.92	1.83	1.72	30.87	0.56	12.75	11.85	1.04	16.06	1.49	0.60	0.82	1.89	2.39	7.29	6.54	1.93	14.66
RHIZOPODA:	4.59	0.23	1.01	28.88	0.29	12.55	11.16	0.53	0.25	1.05	0.54	0.78	1.38	2.38	7.29	6.54	1.93	12.35
DIFLUGIA SP.	0.59	0.05	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ARCELLA SP.	0.26	0.05	0.31	0.22	0.07	1.59	2.04	0.08	0.25	0.00	0.00	0.07	0.00	0.17	0.00	0.00	0.00	1.43
CENTROPYXIS ACULEATA	0.00	0.00	0.34	9.10	0.18	0.53	0.00	0.22	0.00	0.82	0.11	0.30	0.55	1.33	3.01	2.46	0.60	1.84
CENTROPYXIS SP.	3.74	0.14	0.07	17.20	0.04	10.43	9.12	0.23	0.00	0.23	0.43	0.41	0.83	0.88	4.28	4.08	1.32	9.07
NEBELA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYPHODERIA	0.00	0.00	0.02	2.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CILIATES:	1.33	1.60	0.71	1.99	0.27	0.21	0.69	0.51	15.81	0.43	0.06	0.04	0.51	0.00	0.00	0.00	0.00	2.31
EPYSTYLIS SP.	1.33	1.60	0.71	1.99	0.27	0.21	0.69	0.51	0.45	0.43	0.06	0.04	0.51	0.00	0.00	0.00	0.00	0.20
VORTICELLA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.11
VAGINICOLA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUCTORIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CODONELLA LACUSTRIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DREISSENA POLYMORPHA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.59	3.15	4.31	3.74	0.00	5.92	1.27
TOTAAL	8.77	5.30	5.94	65.03	4.75	36.42	29.53	16.50	407.83	245.66	317.87	114.43	117.13	146.35	397.67	3042.07	1048.69	482.80

BIOVOLUME (ug/l)
EYSDEN 1992

	15-Sep-92	29-Sep-92	13-Oct-92	27-Oct-92	10-Nov-92	24-Nov-92	08-Dec-92	22-Dec-92	gem.	max
CRUSTACEANS:	41.50	25.04	13.37	81.58	1.41	39.89	6.58	1.95	113.50	906.78
CLADOCERANS:	19.35	12.48	4.58	62.51	0.39	0.00	2.21	0.00	74.98	755.51
COPEPODS:	21.56	12.56	8.78	19.08	1.02	39.89	4.37	1.95	38.45	201.53
BOSMINA SP.	18.80	12.48	3.48	56.16	0.39	0.00	2.21	0.00	70.64	728.52
CYCLOPS SP.	15.92	6.15	4.00	13.03	0.00	39.89	1.03	1.81	25.87	132.47
DAPHNIA SP.	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00	1.72	11.89
EURYTEMORA SP.	0.00	0.00	0.00	2.11	0.00	0.00	2.51	0.00	0.18	2.51
NAUPLIUS	5.64	6.40	4.78	3.94	1.02	0.00	0.83	0.15	12.40	69.84
ALONA SP.	0.55	0.00	0.00	5.95	0.00	0.00	0.00	0.00	0.67	5.95
CERIODAPHNIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	3.50
CHYDORUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	11.46
DIAPTOMUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EURYCERCUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MACROTHRIX LATICORNIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SIDA SP.	0.00	0.00	1.11	0.00	0.00	0.00	0.00	0.00	1.22	15.10
ROTIFERS:	30.04	782.34	40.09	24.29	4.28	6.91	4.81	0.00	173.31	2162.19
ASPLANCHNA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.57	178.51
BRACHIONUS ANGULARIS/BIDENS	0.74	2.94	12.01	0.46	0.23	0.00	0.39	0.00	11.51	132.26
BRACHIONUS CALYCIFLORIS	2.97	743.44	13.70	19.61	0.10	0.00	0.00	0.00	83.82	743.44
BRACHIONUS LEYDIGI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRACHIONUS QUADRIDENTATIS	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	4.30
BRACHIONUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.46
BRACHIONUS URCEOLARIS	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.84	4.74
BR. LEYDIGI F TRIDENTATIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	5.51
BR. QUADRIDENTATIS F CLUNIORBICULARIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.74
EUCHLANIS DILATATA	0.00	0.00	0.14	0.00	0.36	0.00	0.00	0.00	0.30	3.53
FILINIA LONGISETA	0.04	0.22	5.77	0.00	0.00	0.00	0.00	0.00	0.33	5.77
KELLICOTTIA LONGISPINA	0.05	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.05
KERATELLA COCHLEARIS	7.98	11.27	5.42	1.02	0.97	0.00	0.00	0.00	15.14	236.42
KERATELLA QUADRATA	8.99	14.98	1.91	0.00	0.18	0.00	0.00	0.00	3.27	33.90
LECANE BULLA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LECANE INOPINATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LECANE SP.	0.00	0.00	0.00	0.80	0.00	0.00	3.51	0.00	0.25	3.51
LEPADELLA OVALIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTHOLCA ACUMINATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTHOLCA SQUAMULA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	1.31
NOTOMMATA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
POLYARTHRA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	2.39
TRICHOTRIA TETRACTIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.16
ROTIFER SP.	6.46	8.27	0.87	2.40	1.75	6.91	0.87	0.00	48.82	1200.39
DIURELLA SP.	1.01	1.22	0.00	0.00	0.00	0.00	0.00	0.00	0.35	4.61
SYNCHEATA SP.	1.25	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.10	1.25
PROTOZOANS:	2.82	0.00	1.57	23.08	1.69	42.23	16.87	15.74	8.62	58.04
RHIZOPODA:	2.63	0.00	0.00	21.33	1.18	42.23	14.31	6.60	7.00	42.23
DIFLUGIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.59
ARCELLA SP.	0.61	0.00	0.00	6.15	0.00	2.00	0.35	1.52	0.66	6.15
CENTROPYXIS ACULEATA	0.00	0.00	0.00	0.00	0.00	5.33	1.79	0.66	1.12	9.10
CENTROPYXIS SP.	1.82	0.00	0.00	15.18	1.02	34.90	12.17	4.42	5.08	34.90
NEBELA	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.01	0.16
CYPHODERIA	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	2.36
CILIATES:	0.18	0.00	1.57	1.75	0.51	0.00	2.56	9.14	1.62	15.81
EPYSTYLIS SP.	0.06	0.00	0.00	0.00	0.04	0.00	2.56	5.04	0.64	5.04
VORTICELLA SP.	0.12	0.00	1.57	1.75	0.47	0.00	0.00	4.10	0.98	15.36
VAGINICOLA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUCTORIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CODONELLA LACUSTRIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DREISSENA POLYMORPHA	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77	5.92
TOTAAL	74.87	807.39	55.03	128.95	7.38	89.03	28.26	17.69	296.21	3042.07

NUMBER/LITER
KEIZERSVEER 1992

	07-Jan-92	21-Jan-92	04-Feb-92	18-Feb-92	04-Mar-92	17-Mar-92	31-Mar-92	14-Apr-92	28-Apr-92	12-May-92	26-May-92	09-Jun-92	23-Jun-92	07-Jul-92	21-Jul-92	04-Aug-92	18-Aug-92	01-Sep-92
CRUSTACEANS:	3.15	6.37	7.23	4.64	7.65	12.52	6.80	14.21	16.55	48.25	155.25	29.27	95.58	167.55	102.46	84.88	67.16	55.89
CLADOCERANS:	0.32	0.04	0.55	0.36	0.00	0.00	0.57	1.43	1.60	30.27	91.20	5.40	10.16	43.90	17.75	51.36	15.84	21.44
COPEPODS:	2.83	6.33	6.68	4.28	7.65	12.52	6.23	12.79	14.95	17.99	64.05	23.87	85.42	123.65	84.71	33.52	51.32	34.45
BOSMINA SP.	0.32	0.00	0.40	0.32	0.00	0.00	0.57	1.43	1.40	29.99	60.80	3.60	4.48	26.55	10.92	32.28	9.04	19.64
CYCLOPS SP.	0.27	0.36	0.36	0.44	1.31	3.64	0.24	2.49	3.20	6.71	18.35	4.00	19.64	13.35	2.17	1.52	12.52	0.92
DAPHNIA SP.	0.00	0.04	0.15	0.04	0.00	0.00	0.00	0.00	0.20	0.28	30.40	1.80	4.88	17.35	6.79	19.04	6.80	1.80
EURYTEMORA SP.	0.48	0.00	0.56	0.00	0.08	0.08	0.12	0.08	0.16	0.04	0.37	0.00	3.32	6.10	0.88	3.20	1.40	0.04
NAUPLIUS	2.08	5.97	5.76	3.84	6.27	8.80	5.87	9.60	11.47	11.20	45.33	19.87	62.46	104.20	81.67	28.80	37.40	33.49
ALONA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CERIODAPHNIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHYDORUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.00	0.04	0.00	0.00	0.00
DIAPTOMUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.12	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EURYCERCUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MACROTHRIX LATICORNIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SIDA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
ROTIFERS:	4.64	7.09	9.09	34.24	24.53	197.60	86.40	97.87	704.00	473.07	1724.60	267.47	246.57	641.87	205.63	104.80	79.60	134.72
ASPLANCHNA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.07	1.60	1.60	52.80	0.20	0.00	1.80	3.13	1.20	0.40	0.00
BRACHIONUS ANGULARIS/BIDENS	0.00	1.49	0.21	0.64	1.33	17.60	6.40	8.27	82.40	84.80	78.93	54.13	9.20	39.47	6.25	0.20	0.00	8.16
BRACHIONUS CALYCIFLORIS	0.80	0.16	0.00	0.00	0.40	69.60	4.80	15.47	221.87	45.87	257.00	1.40	26.86	28.13	1.67	1.80	2.00	3.04
BRACHIONUS LEYDIGI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00
BRACHIONUS QUADRIDENTATIS	0.00	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRACHIONUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRACHIONUS URCEOLARIS	0.00	0.00	0.00	0.32	0.13	2.40	1.07	0.53	5.33	10.13	1.20	2.00	0.80	0.40	0.00	0.00	0.00	0.00
BR. LEYDIGI F TRIDENTATIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BR. QUADRIDENTATIS F CLUNIORBICULARIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EUCHLANIS DILATATA	0.00	0.00	0.00	0.00	0.00	0.00	8.00	0.00	0.00	0.00	5.33	0.00	0.00	20.33	2.08	4.00	4.00	0.00
FILINIA LONGISETA	0.00	0.00	0.00	0.00	0.13	0.00	10.13	4.80	5.60	0.53	4.27	0.40	0.00	7.33	0.00	0.00	0.00	0.00
KELLICOTTIA LONGISPINA	0.00	0.53	0.67	0.00	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
KERATELLA COCHLEARIS	0.00	3.20	2.00	0.00	9.33	0.00	0.00	29.33	142.13	173.33	1133.33	184.00	160.00	436.33	87.50	48.00	56.00	29.33
KERATELLA QUADRATA	1.71	0.48	2.77	0.00	3.07	1.60	3.73	22.40	33.87	52.27	119.73	8.13	1.20	20.60	0.63	4.20	0.60	5.33
LECANE BULLA	0.00	0.16	0.00	8.00	0.00	0.00	0.00	2.67	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LECANE INOPINATA	0.00	0.00	0.00	0.00	0.00	0.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LECANE SP.	0.80	0.00	0.11	0.00	0.00	16.00	16.00	0.00	0.00	0.00	0.00	0.00	0.00	3.67	4.17	0.00	0.00	2.67
LEPADELLA OVALIS	0.00	0.00	0.00	0.00	0.00	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTHOLCA ACUMINATA	0.00	0.00	0.00	0.00	0.13	0.80	0.53	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTHOLCA SQUAMULA	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTOMMATA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POLYARTHRA SP.	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRICHOTRIA TETRACTIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROTIFER SP.	1.33	1.07	2.67	25.28	10.00	72.80	27.20	12.80	208.00	104.53	72.00	17.00	48.51	83.80	100.21	45.40	16.60	38.19
CHEPHALODELLA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.00
DIURELLA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SYNCHEATA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PROTOZOANS:	193.81	233.87	93.33	248.96	67.07	686.40	423.23	85.60	293.33	90.67	697.38	83.67	200.40	151.40	141.88	117.80	162.20	90.99
RHIZOPODA:	184.11	222.29	84.11	218.88	58.00	388.00	322.13	39.20	42.67	40.00	35.07	67.67	183.26	85.93	50.21	60.40	72.20	66.99
DIFLUGIA SP.	0.00	1.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ARCELLA SP.	182.67	220.00	83.33	209.28	54.93	320.00	296.00	37.33	37.33	34.67	29.73	48.40	120.00	44.00	35.42	36.00	54.20	45.33
CENTROPYXIS ACULEATA	0.00	0.00	0.11	1.28	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CENTROPYXIS SP.	1.44	0.16	0.00	8.00	0.00	18.40	9.60	1.33	0.00	2.67	0.00	3.27	22.86	8.13	0.21	0.40	4.00	5.33
NEBELA	0.00	0.00	0.00	0.32	0.13	17.60	16.53	0.53	2.67	2.67	2.67	8.00	11.83	8.13	4.17	0.00	0.00	0.32
CYPHODERIA	0.00	1.07	0.67	0.00	1.33	32.00	0.00	0.00	2.67	0.00	2.67	8.00	28.57	25.67	10.42	24.00	14.00	16.00
CILIATES:	9.71	11.57	9.23	30.08	9.07	298.40	101.09	46.40	250.67	50.67	662.31	16.00	17.14	65.47	91.67	57.40	90.00	24.00
EPYSTYLIS SP.	4.37	7.84	2.56	14.08	7.73	9.60	51.49	42.40	24.00	8.00	659.64	13.33	0.00	6.80	66.67	9.40	44.00	0.00
VORTICELLA SP.	4.00	3.73	6.67	16.00	1.33	288.80	49.07	4.00	210.67	18.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VAGINICOLA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.67	0.00	0.00	0.00	0.00	0.00	0.00
SUCTORIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.00	2.67	0.00	2.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CODONELLA LACUSTRIS	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.33	24.00	0.00	0.00	17.14	58.67	25.00	48.00	46.00	24.00
DREISSENA POLYMORPHA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.67	42.67	246.27	27.67	221.43	1004.60	105.21	88.80	80.00	40.32
TOTAAL	201.60	247.33	109.65	287.84	99.25	896.52	516.43	197.68	1016.55	654.65	2823.50	408.07	763.98	1965.42	555.17	396.28	388.96	321.92

NUMBER/LITER
KEIZERSVEER 1992

	15-Sep-92	29-Sep-92	13-Oct-92	27-Oct-92	10-Nov-92	24-Nov-92	08-Dec-92	22-Dec-92	gem.	max
CRUSTACEANS:	23.47	40.28	35.36	22.33	4.40	5.15	6.13	3.44	39.46	167.55
CLADOCERANS:	9.64	31.67	21.08	8.09	1.48	3.19	3.02	0.43	14.26	91.20
COPEPODS:	13.83	8.61	14.28	14.24	2.92	1.96	3.12	3.01	25.20	123.65
BOSMINA SP.	9.40	11.20	18.96	7.20	1.44	2.33	0.10	0.39	9.72	60.80
CYCLOPS SP.	1.60	1.28	0.40	0.73	0.16	0.08	0.10	0.88	3.72	19.64
DAPHNIA SP.	0.24	1.80	1.80	0.36	0.04	0.32	0.25	0.04	3.63	30.40
EURYTEMORA SP.	0.56	0.88	0.76	2.37	0.36	0.28	0.35	0.00	0.86	6.10
NAUPLIUS	11.67	6.45	13.12	10.93	2.40	1.60	2.67	2.13	20.58	104.20
ALONA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CERIODAPHNIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHYDORUS SP.	0.00	0.00	0.32	0.27	0.00	0.53	0.00	0.00	0.08	0.80
DIAPTOMUS SP.	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.04	0.61
EURYCERCUS SP.	0.00	18.67	0.00	0.00	0.00	0.00	0.00	0.00	0.72	18.67
MACROTHRIX LATICORNIS	0.00	0.00	0.00	0.00	0.00	0.00	2.67	0.00	0.10	2.67
SIDA SP.	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.01	0.27
ROTIFERS:	82.40	55.73	21.12	12.80	15.12	11.20	4.00	30.67	202.95	1724.60
ASPLANCHNA SP.	0.00	3.36	0.16	0.27	0.08	0.53	0.00	0.27	2.63	52.80
BRACHIONUS ANGULARIS/BIDENS	9.00	0.00	0.16	0.00	0.16	0.00	0.67	3.20	15.87	84.80
BRACHIONUS CALYCIFLORIS	1.00	2.08	1.81	0.53	0.24	0.00	2.00	0.00	26.48	257.00
BRACHIONUS LEYDIGI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.20
BRACHIONUS QUADRIDENTATIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.80
BRACHIONUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.01	0.27
BRACHIONUS URCEOLARIS	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.94	10.13
BR. LEYDIGI F TRIDENTATIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BR. QUADRIDENTATIS F CLUNIORBICULARIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EUCHLANIS DILATATA	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	1.73	20.33
FILINIA LONGISETA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.28	10.13
KELLICOTTIA LONGISPINA	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.08	0.80
KERATELLA COCHLEARIS	53.33	30.67	2.67	4.00	7.20	0.00	0.00	8.80	100.02	1133.33
KERATELLA QUADRATA	0.20	0.96	1.49	0.00	3.20	0.00	0.00	0.00	11.08	119.73
LECANE BULLA	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.45	8.00
LECANE INOPINATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	8.00
LECANE SP.	0.00	0.00	1.49	4.00	0.00	0.00	0.00	0.27	1.89	16.00
LEPADELLA OVALIS	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.65	16.00
NOTHOLCA ACUMINATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.80
NOTHOLCA SQUAMULA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.53
NOTOMMATA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POLYARTHRA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	1.60
TRICHOTRIA TETRACTIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROTIFER SP.	13.33	12.00	10.67	4.00	3.20	10.67	1.33	17.87	36.94	208.00
CHEPHALODELLA	5.33	5.33	2.67	0.00	0.00	0.00	0.00	0.00	2.36	48.00
DIURELLA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SYNCHEATA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PROTOZOANS:	115.87	40.16	34.29	117.33	24.88	251.69	395.92	209.27	201.98	1050.31
RHIZOPODA:	42.67	22.83	21.49	61.33	13.68	148.27	249.50	125.33	111.78	388.00
DIFLUGIA SP.	0.00	2.67	0.00	24.00	1.60	40.00	69.42	8.80	5.68	69.42
ARCELLA SP.	37.33	18.83	16.00	24.00	9.60	72.53	138.83	105.60	88.90	320.00
CENTROPYXIS ACULEATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	1.60
CENTROPYXIS SP.	0.00	0.00	1.49	1.07	0.08	3.20	0.00	2.13	3.61	22.86
NEBELA	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.00	2.93	17.60
CYPHODERIA	5.33	1.33	4.00	12.27	2.40	32.00	41.25	8.80	10.56	41.25
CILIATES:	73.20	17.33	12.80	56.00	11.20	103.43	146.42	83.93	90.20	662.31
EPYSTYLIS SP.	14.53	0.00	0.80	0.00	1.60	3.16	47.50	30.60	41.16	659.64
VORTICELLA SP.	2.67	0.00	0.00	0.00	1.60	51.73	2.67	44.53	27.16	288.80
VAGINICOLA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	2.67
SUCTORIA SP.	0.00	0.00	0.00	0.00	0.00	0.53	13.75	0.00	0.78	13.75
CODONELLA LACUSTRIS	56.00	17.33	12.00	56.00	8.00	48.00	82.50	8.80	21.00	82.50
DREISSENA POLYMORPHA	34.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.86	1004.60
TOTAAL	256.40	136.17	90.77	152.47	44.40	268.04	406.05	243.37	517.25	2823.50

BIOVOLUME (ug/l)
KEIZERSVEER 1992

	07-Jan-92	21-Jan-92	04-Feb-92	18-Feb-92	04-Mar-92	17-Mar-92	31-Mar-92	14-Apr-92	28-Apr-92	12-May-92	26-May-92	09-Jun-92	23-Jun-92	07-Jul-92	21-Jul-92	04-Aug-92	18-Aug-92	01-Sep-92
CRUSTACEANS:	35.34	12.57	93.62	25.92	34.14	67.31	43.22	165.06	242.14	616.86	5038.02	461.00	571.25	2055.17	771.35	2377.15	921.90	681.74
CLADOCERANS:	6.02	0.82	19.03	14.55	0.00	0.00	6.90	25.76	61.64	487.56	4325.20	405.45	256.39	1764.42	693.04	2182.79	541.34	637.26
COPEPODS:	29.32	11.75	74.59	11.37	34.14	67.31	36.32	139.29	180.50	129.29	712.82	55.55	314.85	290.75	78.31	194.36	380.57	44.48
BOSMINA SP.	6.02	0.00	9.43	6.29	0.00	0.00	6.90	25.76	32.27	416.03	1096.45	96.50	86.78	675.81	140.22	741.35	206.51	389.35
CYCLOPS SP.	11.45	4.77	29.75	6.90	24.78	49.66	20.83	51.41	139.45	99.85	594.97	42.76	210.26	163.47	31.77	46.10	317.15	26.11
DAPHNIA SP.	0.00	0.82	9.60	8.26	0.00	0.00	0.00	0.00	29.37	71.53	3228.76	308.94	163.75	1088.61	549.54	1433.58	334.83	247.92
EURYTEMORA SP.	15.06	0.00	38.71	0.00	1.08	4.09	5.17	9.72	10.06	3.67	45.07	0.00	53.31	80.29	9.17	119.18	47.57	2.65
NAUPLIUS	2.80	6.98	6.13	4.48	8.29	13.55	10.33	22.14	13.42	21.29	72.77	12.79	51.28	46.99	37.37	29.08	15.85	15.72
ALONA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CERIODAPHNIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHYDORUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.86	0.00	3.28	0.00	0.00	0.00
DIAPTOMUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.02	17.57	4.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EURYCERCUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MACROTHRIX LATICORNIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SIDA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.86	0.00	0.00
ROTIFERS:	0.96	2.53	1.41	6.01	6.81	146.37	47.62	82.50	828.91	219.27	1932.97	46.87	36.51	245.87	49.83	27.88	27.27	31.45
ASPLANCHNA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.77	36.00	21.08	975.12	0.43	0.00	24.37	14.88	10.78	8.66	0.00
BRACHIONUS ANGULARIS/BIDENS	0.00	0.94	0.08	0.32	0.64	1.98	3.28	3.05	17.11	21.32	21.51	15.64	4.38	10.98	1.11	0.08	0.00	2.29
BRACHIONUS CALYCIFLORIS	0.90	0.79	0.00	0.00	1.27	119.62	22.70	46.70	721.24	99.27	738.49	2.70	10.20	144.13	7.66	5.52	11.06	16.68
BRACHIONUS LEYDIGI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00
BRACHIONUS QUADRIDENTATIS	0.00	0.00	0.00	0.00	0.00	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRACHIONUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRACHIONUS URCEOLARIS	0.00	0.00	0.00	1.04	0.13	3.74	2.44	1.73	3.12	29.38	2.74	4.91	2.31	1.13	0.00	0.00	0.00	0.00
BR. LEYDIGI F TRIDENTATIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BR. QUADRIDENTATIS F CLUNIORBICULARIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EUCHLANIS DILATATA	0.00	0.00	0.00	0.00	0.00	0.00	1.04	0.00	0.00	0.00	0.75	0.00	0.00	4.32	0.36	1.08	0.63	0.00
FILINIA LONGISETA	0.00	0.00	0.00	0.00	0.15	0.00	4.12	2.07	1.92	0.33	2.07	0.11	0.00	1.91	0.00	0.00	0.00	0.00
KELLICOTTIA LONGISPINA	0.00	0.05	0.06	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
KERATELLA COCHLEARIS	0.00	0.33	0.18	0.00	1.02	0.00	0.00	3.06	14.09	13.40	129.85	17.69	13.74	39.45	7.22	3.84	4.92	2.76
KERATELLA QUADRATA	0.05	0.17	0.73	0.00	0.98	0.56	2.12	8.71	14.83	19.37	52.82	3.31	0.61	9.84	0.23	2.05	0.45	0.89
LECANE BULLA	0.00	0.10	0.00	0.50	0.00	0.00	0.00	0.29	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LECANE INOPINATA	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LECANE SP.	0.02	0.00	0.04	0.00	0.00	1.56	2.12	0.00	0.00	0.00	0.00	0.00	0.00	0.72	0.23	0.00	0.00	1.73
LEPADELLA OVALIS	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTHOLCA ACUMINATA	0.00	0.00	0.00	0.00	0.07	0.00	0.52	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTHOLCA SQUAMULA	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOTOMMATA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POLYARTHRA SP.	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TRICHOTRIA TETRACTIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROTIFER SP.	0.00	0.15	0.25	4.14	2.54	15.39	8.12	4.55	19.26	15.12	9.62	1.80	5.27	9.02	18.14	4.53	1.55	3.16
DIURELLA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.93
SYNCHEATA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PROTOZOANS:	9.04	12.67	4.25	14.35	3.94	37.84	22.97	3.35	8.57	4.50	11.02	10.20	18.15	14.73	5.71	9.76	8.67	7.14
RHIZOPODA:	8.75	12.51	4.11	14.07	3.81	30.15	19.47	3.17	2.87	3.04	3.26	9.62	17.53	12.49	4.00	7.61	6.13	6.04
DIFLUGIA SP.	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ARCELLA SP.	8.41	11.73	3.87	10.48	2.87	15.71	13.10	2.28	2.10	1.88	2.36	2.55	7.54	2.05	1.87	1.89	2.85	2.42
CENTROPYXIS ACULEATA	0.00	0.00	0.15	1.42	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CENTROPYXIS SP.	0.34	0.18	0.00	2.05	0.00	5.02	2.39	0.45	0.00	0.68	0.00	0.67	4.42	2.87	0.23	0.63	1.30	0.92
NEBELA	0.00	0.00	0.00	0.13	0.08	2.30	3.98	0.44	0.22	0.47	0.31	4.02	1.84	3.63	0.60	0.00	0.00	0.17
CYPHODERIA	0.00	0.20	0.09	0.00	0.40	7.12	0.00	0.00	0.55	0.00	0.59	2.38	3.73	3.94	1.30	5.10	1.97	2.53
CILIATES:	0.28	0.16	0.14	0.27	0.14	7.69	3.50	0.18	5.69	1.46	7.76	0.58	0.62	2.25	1.71	2.15	2.55	1.10
EPYSTYLIS SP.	0.11	0.08	0.03	0.18	0.10	0.26	1.07	0.12	0.26	0.09	7.26	0.09	0.00	0.06	0.66	0.04	0.04	0.00
VORTICELLA SP.	0.10	0.08	0.11	0.09	0.03	7.43	0.87	0.06	4.54	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VAGINICOLA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00
SUCTORIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	1.56	0.00	0.35	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CODONELLA LACUSTRIS	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.98	0.00	0.00	0.62	2.19	1.05	2.11	2.51	1.10
DREISSENA POLYMORPHA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	5.31	58.95	4.18	27.64	227.34	10.92	12.72	7.75	6.75
TOTAAL	45.34	27.77	99.28	46.27	44.89	251.52	113.81	250.90	1080.07	845.93	7040.96	522.25	653.56	2543.12	837.81	2427.51	965.59	727.08

BIOVOLUME (ug/l)
KEIZERSVEER 1992

	15-Sep-92	29-Sep-92	13-Oct-92	27-Oct-92	10-Nov-92	24-Nov-92	08-Dec-92	22-Dec-92	AVG	MAX
CRUSTACEANS:	225.34	540.40	408.51	379.85	50.36	88.30	183.29	38.74	620.33	5038.02
CLADOCERANS:	149.72	463.35	383.48	237.05	37.09	64.77	143.25	20.04	497.19	4325.20
COPEPODS:	75.62	77.05	25.03	142.80	13.28	23.52	40.03	18.70	123.14	712.82
BOSMINA SP.	141.55	234.41	237.80	142.87	34.86	22.27	6.52	8.80	183.26	1096.45
CYCLOPS SP.	38.07	18.64	5.71	21.09	0.27	4.78	9.84	16.33	76.39	594.97
DAPHNIA SP.	8.17	228.94	143.53	90.04	2.23	38.34	136.73	11.24	312.87	3228.76
EURYTEMORA SP.	28.31	50.10	11.68	95.26	10.87	16.35	27.67	0.00	26.35	119.18
NAUPLIUS	9.25	8.31	7.64	5.44	2.14	2.39	2.52	2.37	16.59	72.77
ALONA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CERIODAPHNIA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHYDORUS SP.	0.00	0.00	2.15	2.34	0.00	4.17	0.00	0.00	0.68	5.86
DIAPTOMUS SP.	0.00	0.00	0.00	21.02	0.00	0.00	0.00	0.00	3.81	56.02
EURYCERCUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MACROTHRIX LATICORNIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SIDA SP.	0.00	0.00	0.00	1.80	0.00	0.00	0.00	0.00	0.37	7.86
ROTIFERS:	13.48	35.54	4.79	3.24	4.41	12.69	7.37	7.72	147.32	1932.97
ASPLANCHNA SP.	0.00	19.49	0.45	1.31	0.31	9.34	0.00	0.84	43.65	975.12
BRACHIONUS ANGULARIS/BIDENS	3.42	0.00	0.05	0.00	0.07	0.00	0.47	2.24	4.27	21.51
BRACHIONUS CALYCIFLORIS	2.30	9.48	2.75	1.11	1.35	0.00	5.41	0.00	75.82	738.49
BRACHIONUS LEYDIGI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.27
BRACHIONUS QUADRIDENTATIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	3.20
BRACHIONUS SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	0.05	1.17
BRACHIONUS URCEOLARIS	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.06	29.38
BR. LEYDIGI F TRIDENTATIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BR. QUADRIDENTATIS F CLUNIORBICULARIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EUCHLANIS DILATATA	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.33	4.32
FILINIA LONGISETA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	4.12
KELLICOTTIA LONGISPINA	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.08
KERATELLA COCHLEARIS	5.20	3.21	0.15	0.29	0.75	0.00	0.00	1.14	10.09	129.85
KERATELLA QUADRATA	0.14	0.55	0.30	0.00	1.31	0.00	0.00	0.00	4.62	52.82
LECANE BULLA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.87
LECANE INOPINATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.69
LECANE SP.	0.00	0.00	0.17	0.31	0.00	0.00	0.00	0.13	0.27	2.12
LEPADELLA OVALIS	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.02	0.33
NOTHOLCA ACUMINATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.58
NOTHOLCA SQUAMULA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.47
NOTOMMATA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POLYARTHRA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.40
TRICHOTRIA TETRACTIS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROTIFER SP.	1.33	1.65	0.81	0.22	0.27	3.35	1.49	2.20	5.15	19.26
DIURELLA SP.	0.21	0.68	0.11	0.00	0.00	0.00	0.00	0.00	0.19	3.93
SYNCHEATA SP.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PROTOZOANS:	5.73	2.60	1.99	9.68	1.78	27.82	29.71	14.62	11.57	39.27
RHIZOPODA:	2.98	1.86	1.61	7.96	1.34	21.05	20.58	11.70	9.14	30.15
DIFLUGIA SP.	0.00	0.54	0.00	3.85	0.25	6.61	8.91	1.56	0.85	8.91
ARCELLA SP.	2.52	1.15	0.86	1.03	0.53	5.06	9.33	4.67	4.66	15.71
CENTROPYXIS ACULEATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	1.42
CENTROPYXIS SP.	0.00	0.00	0.40	1.32	0.05	3.37	0.00	3.39	1.18	5.02
NEBELA	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.73	4.02
CYPHODERIA	0.47	0.18	0.35	1.76	0.50	5.18	2.34	2.08	1.64	7.12
CILIATES:	2.75	0.74	0.38	1.72	0.43	6.77	9.13	2.92	2.43	9.13
EPYSTYLIS SP.	0.10	0.00	0.00	0.00	0.02	0.05	0.50	0.66	0.45	7.26
VORTICELLA SP.	0.06	0.00	0.00	0.00	0.03	3.43	0.57	1.82	0.75	7.43
VAGINICOLA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.50
SUCTORIA SP.	0.00	0.00	0.00	0.00	0.00	0.35	4.12	0.00	0.26	4.12
CODONELLA LACUSTRIS	2.59	0.74	0.37	1.72	0.38	2.94	3.94	0.44	0.93	3.94
DREISSENA POLYMORPHA	3.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.08	227.34
TOTAAL	248.53	578.53	415.29	392.77	56.55	128.80	220.36	61.08	793.29	7040.96