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# PHYTOPLANKTON COMPOSITION IN THE MALTAŃSKI RESERVOIR AND THE LOWEST PART OF THE CYBINA RIVER

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ABSTRACT. Phytoplankton composition was analysed in the Maltański Reservoir and the inlet and outlet of the Cybina River. Samples were collected from three sampling stations in November 2007, February, May and August 2008. Considerable changes in the qualitative and quantitative composition of the phytoplankton in the inflowing and outflowing water and in the central part of the reservoir were noted. Among 142 taxa chlorophytes were the most numerous group. There were also groups represented by the large values of phytoplankton abundance and biomass such as *Cyanobacteria* in autumn, chrysophytes in winter, diatoms and cryptophytes in spring and chlorophytes in summer. The differences in the qualitative and quantitative composition of the phytoplankton among the analysed sampling stations were noticed. The species composition of the potamoplankton was changing as it passed through the reservoir along the course of the river. With regard to all seasons the lowest number of taxa were noticed in samples from the inlet. The most diversified was phytoplankton composition in the reservoir. The highest similarity between the analysed stations was observed in the phytoplankton composition in the reservoir and outlet of the river from this reservoir.

KEY WORDS: inlet, outlet, phytoplankton abundance and biomass, restoration

## INTRODUCTION

This paper presents the results of the analyses of the phytoplankton community from the Maltański Reservoir and the Cybina River (the inflow and outflow of the Cybina River). In many papers the river-phytoplankton and the one from lakes and reservoirs are most often analysed separately (Descy et al. 2012, Napiórkowska-Krzebietke and Hutorowicz 2013). Disturbances in the river continuum system are caused by the lakes situated in the river course. Cybina is a typical lowland river, flowing through lakes and reservoirs. In lotic systems, biotic and chemical factors are indicated as the driving forces of potamoplankton dynamics. Riverine phytoplankton is determined by changes in many abiotic and biotic parameters in time and space (Reynolds 2000, Grabowska and Mazur-Marzec 2011). There is a general recognition that the potamoplankton is a composite of organisms, derived from several contributory sources such as bentic or limnetic. The prevalence is defined by organisms of high surface, volume ratio that allows high reproduction rates and captures low light intensities (Reynolds and Descy 1996). The Cybina River has quite a lot of phytoplankton, in spite of that it belongs to small rivers, which do not have its own potamoplankton. The aim of these studies was to establish seasonal changes in the taxonomic composition, the comparison of changes between river- and reservoir stations, the abundance and biomass of phytoplankton structure in the Maltański Reservoir and at the inlet and outlet of reservoir. The influence of the reservoir on the river-phytoplankton was also studied.

## STUDY AREA

The Maltański Reservoir is situated in Poznań (west Poland, 52°240'N, 16°580'E). It was built in 1952 by damming of the Cybina River, the right-bank tributary of the Warta River. The Maltański Reservoir covers an area of 67.46 ha, $2 \cdot 10^6$ m$^3$ of maximum capacity, 2.2 km in length and 480 m in width (Gołdyn and Grabia 1998). Its maximum depth is 5 m. It is the youngest reservoir in Poznań. In terms of the piscatorial classification, the Maltański Reservoir is categorized as a shallow, lowland, warm retention reservoir, and in relation to its functions it is classified as a sport, recreational and fishing reservoir (Andrzejewski et al. 2010).

Because of significant contamination of the reservoir with biogenic compounds in the early 90s the biomanipulation method (stocking with predatory fish) was implemented there (Kozak and Gołdyn 2004). It was supported by regular draining of water from the reservoir every four years, during which all the fish were removed. In 2005 the restoration procedure was enriched by chemical inactivation of phosphorus using iron treatment (Kozak et al. 2009).

## MATERIALS AND METHODS

Samples for the qualitative and quantitative analyses were taken four times: in autumn (November 2007), winter (February 2008), spring (May 2008) and summer (August 2008). Water samples were collected from three stations localized in the middle of the reservoir and the inlet and outlet from the reservoir (Fig. 1). Samples from the reservoir were collected from in the depth profile from the surface and depths of 1, 2, and 3 m using 5 l sampler and dark 200 ml bottles. Lugol's solution were added to preserve the samples. They were analysed in the laboratory using the Olympus CH-20 microscope and the magnification of 400×.

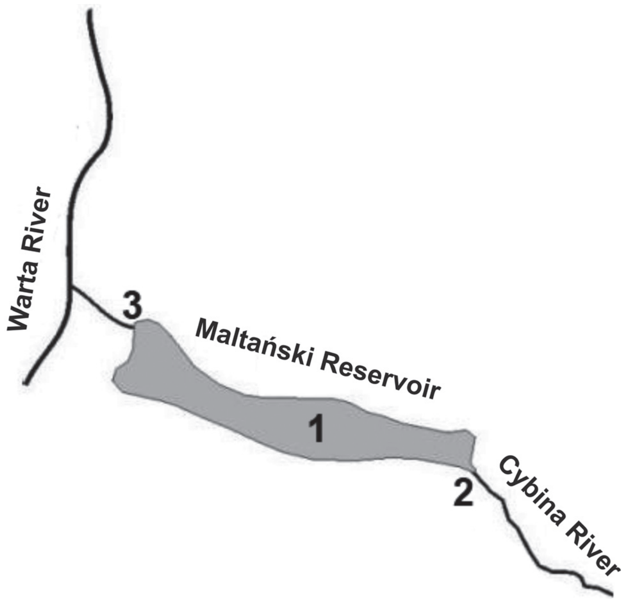


FIG. 1. Location of the sampling stations in the Maltański Reservoir (1), the inlet (2) and the outlet from Maltański Reservoir (3)

The abundance of the phytoplankton (cell number in 1 ml) was determined applying the Sedgwick-Rafter chamber. Its volume was 0.46 ml. The phytoplankton biomass was calculated by approximating the shape of the organisms or cells with geometric figures (WETZEL and LIKENS 1991, HUTOROWICZ 2006). The similarity of phytoplankton composition (S) between the stations were calculated according to the formula given by ROMANISZYN (1970).

## RESULTS

In the analysed period 141 phytoplankton taxa were noted including 72 genera and 108 species, which belonged to nine taxonomic groups (Table 1). In terms of taxa number, the *Chlorophyceae* was the dominant group. There were 68 phytoplankton taxa from these group noted in the Maltański Reservoir and the Cybina River. The *Bacillariophyceae* were placed as the second group (16 taxa), and the *Chrysophyceae* – the third (13 taxa, Table 2).

The abundance of phytoplankton varied from $3.5 \cdot 10^3$ cells·ml$^{-1}$ (winter in the inlet water) to $30.2 \cdot 10^3$ cells·ml$^{-1}$ (summer in the reservoir). The highest phytoplankton abundance was noted in summer and spring. In winter there was observed a decrease in the phytoplankton abundance (Fig. 2).

The biomass of the phytoplankton oscillated from 3.4 μg·ml$^{-1}$ (inlet in autumn) to 24.0 μg·ml$^{-1}$ (reservoir in spring). High phytoplankton biomass was noted in summer, specially at the depth of two and three meters, and in the outlet. The lowest biomass rates were observed in autumn (Fig. 3).

There were some groups represented by large values in the phytoplankton abundance and biomass such as *Cyanobacteria* (up to $19 \cdot 10^3$ cells·ml$^{-1}$, 1.69 μg·ml$^{-1}$), *Chrysophyceae* (over $10 \cdot 10^3$ cells·ml$^{-1}$, 5.29 mg·ml$^{-1}$), *Bacillariophyceae* (over $20 \cdot 10^3$ cells·ml$^{-1}$, 4.86 μg·ml$^{-1}$), *Cryptophyceae* ($6 \cdot 10^3$ cells·ml$^{-1}$, 6.22 μg·ml$^{-1}$) and *Chlorophyceae* ($23 \cdot 10^3$ cells·ml$^{-1}$, 7.76 μg·ml$^{-1}$). The other groups were less abundant in the studied period (Fig. 4-5).

*Cyanobacteria* were the most abundant in autumn and represented mostly by: *Planktothrix agardhi* (Gomont) Anagnostidis & Komárek, *Pseudanabaena limnetica* (Lemmermann) Komárek and *Microcystis viridis* (A. Braun) Lemmermann. In summer 2008 relatively numerous was also *M. aeruginosa* (Kützing) Kützing.

*Chrysophyceae* was the most important group both in respect of the abundance and the biomass of the phytoplankton in winter 2008. The most abundant were *Erkenia subaequciliata* Skuja, *Chrysococcus triporus* Matvienko and *Dynobryon sociale* Ehrenberg.

*Bacillariophyceae* was the most abundant group in spring 2008. The most abundant were *Asterionella formosa* Hassall, *Nitzschia acicularis* var. *closterioides* Grun. and centric diatoms such as *Cyclotella* and *Stephanodiscus*.

Also *Cryptophyceae*, represented mainly by *Cryptomonas marssonii* Skuja, *C. ovata* Ehrenberg, and also *C. rostrata* Skuja, *C. reflexa* Skuja, *Rhodomonas lacustris* Pascher & Ruttner and *C. rostratiformis* Troitzkaja achieved a high percentage in the phytoplankton biomass in spring 2008.

Chlorophytes were the most abundant group in summer 2008. The most numerous were: *Coelastrum reticulatum* (P.A. Dangeard) Senn, *Crucigeniella rectangularis* (Nägeli) Komárek, and *Desmodesmus spinosus* (Hegewald) Hegewald. However, in the biomass the most important were *Pediastrum boryanum* (Turpin) Meneghini, *Pediastrum duplex* Meyen, *Phacotus lenticularis* (Ehrenberg) Stein and *Tetrastrum triangulare* (Chodat) Komárek.

The differences in the qualitative and quantitative composition of the phytoplankton among the analysed sampling stations were also noted. The most numerous in the respect of the number of taxa were phytoplankton composition from the reservoir (Fig. 6). With regard to all seasons the lowest number of taxa were noticed in samples from the inlet. The highest similarity factor was stated between the reservoir and outlet in winter (S = 66%). The lowest similarity factor was stated between the inlet and the outlet in spring (S = 30%).

The number of taxa in the inlet was usually lower in comparison with the taxa found in the reservoir (Fig. 6).

TABLE 1. Taxonomic structure of phytoplankton in the Maltański Reservoir and the Cybina River

| Taxa | Autumn | Winter | Spring | Summer |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| **Cyanobacteria** | | | | |
| *Anabaena* sp. | + | | | + |
| *Anabaenopsis elenkini* Miller | | | | + |
| *Anabaenopsis mülleri* Voronichin | | | | + |
| *Microcystis aeruginosa* (Kützing) Kützing | + | | | + |
| *Microcystis viridis* (A. Braun in Rabenhorst) Lemm. | + | | | |
| *Planktothrix agardhi* (Gom.) Anagn. et Komárek | + | | | |
| *Pseudanabaena limnetica* (Lemm.) Komárek | + | + | + | + |
| *Snowella lacustris* (Chod.) Komárek et Hindák | + | | | + |
| *Woronichinia naegeliana* (Unger) Elenkin | + | | | + |
| **Euglenophyceae** | | | | |
| *Euglena* sp. | + | | | + |
| *Euglena viridis* Ehrenberg | + | | | |
| *Monomorphinia pyrum* (Ehrenberg) Mereschkowsky | | | + | |
| *Phacus longicauda* (Ehr.) Dujardin | | | + | |
| *Phacus mirabilis* Pochmann | + | | | + |
| *Trachelomonas hispida* (Perty) Stein | + | + | | + |
| *Trachelomonas intermedia* Dangeard | | + | | |
| *Trachelomonas volvocina* Ehrenberg | + | + | + | + |
| **Cryptophyceae** | | | | |
| *Cryptomonas erosa* Ehrenberg | + | + | + | + |
| *Cryptomonas gracilis* Skuja | + | | | |
| *Cryptomonas marssonii* Skuja | + | + | + | + |
| *Cryptomonas ovata* Ehrenberg | + | + | + | |
| *Cryptomonas reflexa* (Marsson) Skuja | + | | | |
| *Cryptomonas rostrata* (Troitzkaja) Kiselev | + | + | + | + |
| *Cryptomonas rostratiformis* Skuja | + | + | + | + |
| *Cryptomonas woloszynskae* Czosnowski | + | | | |
| *Rhodomonas lacustris* Pascher et Ruttner | + | + | + | + |
| *Rhodomonas lens* Pascher et Ruttner | + | + | + | + |
| **Dinophyceae** | | | | |
| *Ceratium furcoides* (Lavender) Langhans | | | | + |
| *Ceratium hirudinella* (Müll) Bergh | | | | + |
| *Gymnodinium* sp. | + | + | | + |
| *Peridinium aciculiferum* Lemm. | | + | | |
| *Peridinium* sp. | + | | | + |
| *Peridiniopsis* sp. | | | + | |
| **Chrysophyceae** | | | | |
| *Bicoeca planktonca* Kiselev | | | + | |
| *Chrysococcus minutus* (Fritsch) Nygaard | + | | | |
| *Chrysococcus* sp. | + | | | |
| *Chrysococcus triporus* Matvienko | | + | + | + |
| *Dinobryon divergens* Imhof | | + | | |
| *Dinobryon sociale* Ehrenberg | | + | | |
| *Erkenia subaequciliata* Skuja | + | + | + | + |

TABLE 1 – cont.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| *Kephyrion globosum* (Czosnowski) Bourrelly | | | + | |
| *Kephyrion monilipherum* (Schmid) Bourrelly | | | + | |
| *Kephyrion* sp. | | + | + | |
| *Mallomonas* sp. | | + | | |
| *Ochromonas* sp. | + | + | + | + |
| *Synura uvella* (Ehrenberg) Koršikov | | + | | |
| **Bacillariophyceae** | | | | |
| *Amphora ovalis* Kütz. | | | | + |
| *Asterionella formosa* Hass. | | + | + | |
| *Aulacoseira granulata* var. *angustissima* (Müller) Simonsen | + | + | | + |
| *Aulacoseira granulata* m. *curvata* (Ehrenberg) Simonsen | | | | + |
| *Cyclotella* sp. | + | + | + | + |
| *Cymbella* sp. | + | + | + | |
| *Fragilaria* sp. | | + | + | + |
| *Melosira* sp. | + | + | + | + |
| *Navicula capitata* Ehrenberg | | + | | + |
| *Navicula* sp. | + | + | | |
| *Nitzschia acicularis* Smith | + | + | + | |
| *Nitzschia acicularis* var. *closterioides* Grunov | + | + | + | + |
| *Stephanodiscus hantzschii* Grunov | + | + | + | + |
| *Stephanodiscus* sp. | + | + | + | + |
| *Ulnaria ulna* (Nitzsch) Compère | + | + | | |
| **Chlorophyceae** | | | | |
| *Actinastrum gracillimum* Smith | | | + | |
| *Actinastrum hantzschii* Lagerh. | + | | + | + |
| *Carteria* sp. | | | + | |
| *Cenochloris* sp. | | | | + |
| *Chlamydomonas* sp. | | + | | |
| *Chlorella* sp. | + | | | + |
| *Chlorotetraedron bitridens* (Beck-Mannag.) Kovačik | | | | + |
| *Chodatellopsis elliptica* Korš | | | | + |
| *Closteriopsis acicularis* (Smith) Belcher et Swale | + | | | + |
| *Closteriopsis longissima* (Lemm.) Lemm. | + | | | |
| *Coelastrum astroideum* De Notaris | + | | + | + |
| *Coelastrum microporum* Nägeli in A. Braun | | | | + |
| *Coelastrum reticulatum* (Dang.) Senn | | | | + |
| *Coenochloris* sp. | | | | + |
| *Coenocystis* sp. | | | + | |
| *Crucigenia tetrapedia* (Kirchner) W. et West | + | | + | + |
| *Crucigeniella crucifera* (Wolle) Kom. | | | | + |
| *Crucigeniella rectangularis* (Näg.) Kom. | + | | | + |
| *Desmodesmus communis* (Hegewald) Hegewald | + | + | + | + |
| *Desmodesmus intermedius* (Chodat) Hegewald | + | | + | + |
| *Desmodesmus opoliensis* (P. Richter) Hegewald | + | + | + | + |
| *Desmodesmus sempervirens* Chodat | + | | | |

TABLE 1 – cont.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| *Desmodesmus spinosus* (Chodat) E. Hegewald | + | | + | + |
| *Desmodesmus subspicatus* (Chodat) E. Hegewald | | + | + | + |
| *Elakatothrix gelatinosa* Wille | + | | | + |
| *Eudorina elegans* Ehrenberg | | + | | |
| *Eutetramorus globosus* Walton | + | | | |
| *Golenkinia radiata* Chod. | | + | + | + |
| *Golenkiniopsis parvula* (Woron.) Korš. | | | | + |
| *Granulocysyis* sp. | | | + | |
| *Hyaloraphidium* sp. | + | | | |
| *Keratococcus suecicus* Hindák | | | | + |
| *Kirchneriella contorta* (Schmidle) Bohlin | | | | + |
| *Kirchneriella* sp. | | + | | + |
| *Koliella longiseta* (Vischer) Hindák | | + | | |
| *Koliella spiculiformis* (Vischer) Hindák | | + | + | + |
| *Lagerheimia genevensis* Chod. | + | + | + | + |
| *Lagerheimia marssonii* Lemm. | | | | + |
| *Monoraphidium arcuatum* (Korš.) Hindák | + | + | | |
| *Monoraphidium contortum* (Thur.) Kom.-Legn. | | | + | + |
| *Monoraphidium irregulare* (Smith) Kom.-Legn. | + | + | | + |
| *Monoraphidium minutum* (Näg.) Kom.-Legn. | + | + | + | + |
| *Oocystis lacustris* Chod. | + | + | + | + |
| *Pediastrum boryanium* var. *longicorne* Reinsch | + | + | + | + |
| *Pediastrum boryanum* (Turp.) Menegh. | | | + | + |
| *Pediastrum duplex* Meyen | + | | | + |
| *Pediastrum simplex* Meyen | | | | + |
| *Pediastrum tetras* (Ehrenb.) Ralfs | | | | + |
| *Phacotus lenticularis* (Ehrenb.) Stein | + | | + | + |
| *Pteromonas aculeata* Lemm. | | | | + |
| *Pteromonas cordiformis* Lemm. | | | | + |
| *Scenedesmus acuminatus* (Lagerh.) Chod. | + | + | + | + |
| *Scenedesmus ecornis* (Ehrenb. ex Ralfs) Chod. | + | | | + |
| *Scenedesmus obliquus* Turp. | | | | + |
| *Scenedesmus obtusus* Meyen | + | | + | + |
| *Scenedesmus raciborski* Wolosz. | + | + | + | + |
| *Shroederia setigera* (Schroed.) Lemm. | + | + | + | + |
| *Siderocelis* sp. | | | | + |
| *Tetraedron incus* (Teil) Smith | | | + | + |
| *Tetraedron minimum* (A.Br.) Hansg. | + | | + | + |
| *Tetraedron triangulare* (Chod.) Komárek | + | + | + | + |
| *Tetraedron triangulare* Korš. | | | + | |
| *Tetraselmis* sp. | | + | | |
| *Tetrastrum glabrum* (Roll) Ahlstr. et Tiff. | | | | + |
| *Tetrastrum staurogeniaeforme* (Shroeder) Komárek | | + | | |
| *Tetrastrum triangulare* (Chod.) Komárek | + | | + | + |
| *Treubaria planctonica* (Smith) Korš. | | + | | |
| *Treubaria triappendiculata* Bern | | | + | |

TABLE 1 – cont.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| **Conjugatophyceae** | | | | |
| *Closterium aciculare* West | + | | + | |
| *Closterium acutum* Brébisson in Ralfs | | | | + |
| *Closterium limneticum* Lemm. | | | | + |
| *Cosmarium punctulatum* Bréb. | | | | + |
| *Cosmarium* sp. | | | | + |
| *Staurastrum gracile* Ralfs | | | + | + |
| *Staurastrum tetracerum* Ralfs | + | + | | |
| **Xantophyceae** | | | | |
| *Goniochloris fallax* Fott | | | | + |
| *Goniochloris smithii* (Bourrelly) Fott | | | | + |
| *Pseudostaurastrum hastatum* (Reinch) | | | | + |
| *Pseudostaurastrum* sp. | | | | + |

TABLE 2. Number of taxa identified in the Maltański Reservoir and at the intlet and outlet

| Phytoplankton group | Number of taxa in the studied period | | | | General taxa amount in seasons |
|---|---|---|---|---|---|
| | November 2007 | February 2008 | May 2008 | August 2008 | |
| *Cyanobacteria* | 7 | 1 | 1 | 7 | 9 |
| *Euglenophyceae* | 5 | 3 | 3 | 4 | 8 |
| *Cryptophyceae* | 10 | 7 | 7 | 6 | 10 |
| *Dinophyceae* | 2 | 2 | 1 | 4 | 6 |
| *Chrysophyceae* | 4 | 8 | 7 | 3 | 13 |
| *Bacillariophyceae* | 10 | 13 | 9 | 10 | 16 |
| *Chlorophyceae* | 31 | 22 | 31 | 51 | 68 |
| *Conjugatophyceae* | 2 | 1 | 2 | 5 | 7 |
| *Xanthophyceae* | 0 | 0 | 0 | 4 | 4 |
| Total | 71 | 57 | 61 | 94 | 141 |

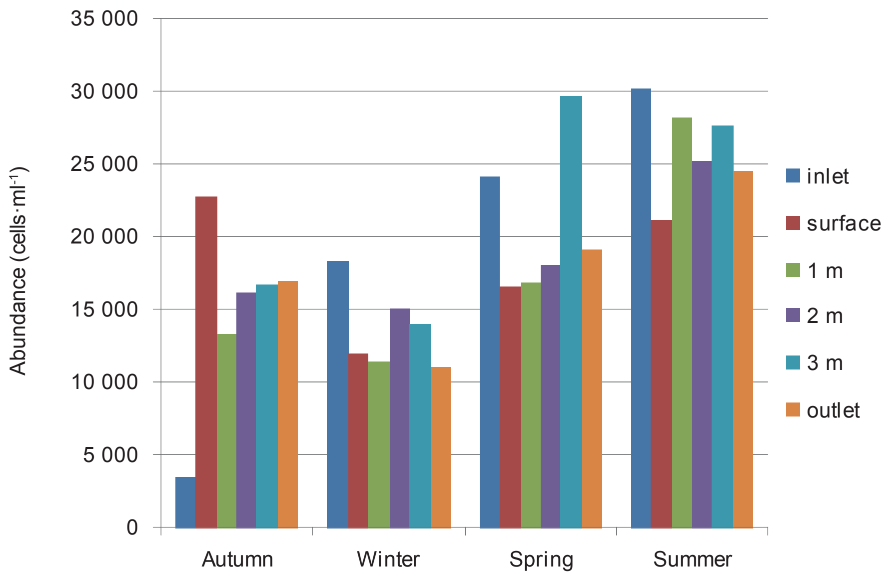


FIG. 2. Abundance of phytoplankton in particular seasons

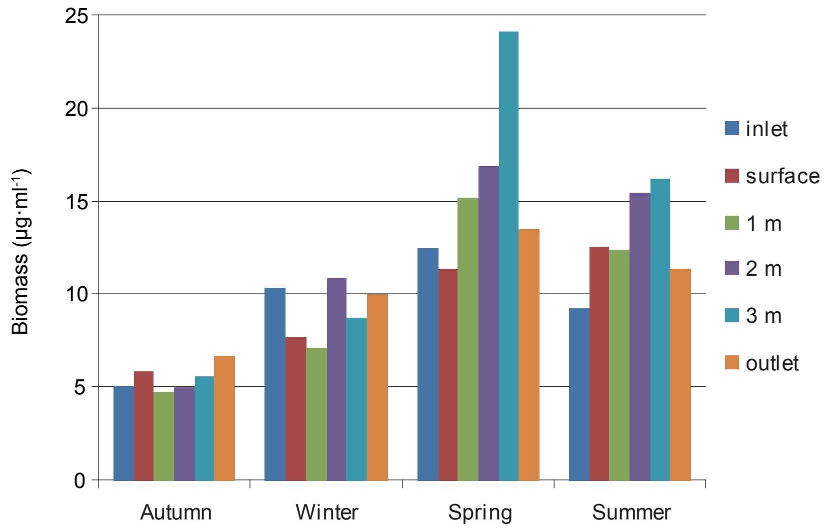


FIG. 3. Biomass of phytoplankton in the Maltański Reservoir, at the inlet and the outlet

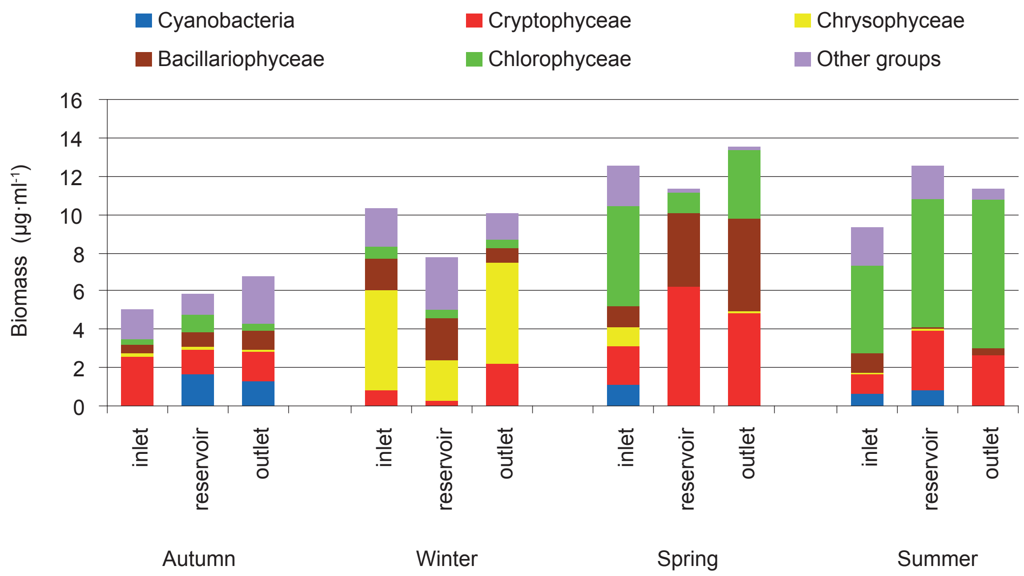


FIG. 4. Participation of main taxonomic groups in the total biomass of phytoplankton at the Cybina River: inlet and outlet and the Maltański Reservoir (example from the surface)

However, in one case in the spring the number of taxa in inlet water was higher than in reservoir and outlet. In the outflowing water the number of taxa decreased in comparison with the number of phytoplankton taxa noted in the reservoir.

The composition of phytoplankton at the individual stations was most differentiated in respect of its abundance and participation of taxonomical groups. Especially in autumn and in spring the quantitative composition of phytoplankton in the inflow differed from those in the reservoir and in the outflow (Fig. 5). In autumn in the inflow the phytoplankton abundance consisted mainly of cryptophytes (58%), diatoms (16%) and chrysophytes (15%). In the reservoir and in the outflow the most abundant were cyanobacteria (76-82%). Also in spring the participation of individual groups of the phytoplankton on the inflow was clearly different than in the reservoir and in the outflow. In the inflowing water the highest participation in the phytoplankton abundance had chrysophytes (48%) and chlorophytes (38%). In the reservoir and in the outflow mainly diatoms (71-77%) and cryptophytes (14-20%) were noted then.

In season of winter in all sampling stations chrysophytes constituted 60-71% in the phytoplankton abundance. Chlorophytes were less abundant and their proportional participation amounted 12-19%.

In summer the most abundant were chlorophytes (37-74%) and sometimes cyanobacteria (11-43%). Diatoms constituted the essential participation only in the inflow water (6%) and cryptophytes in the reservoir and in the outflow (9-15%).

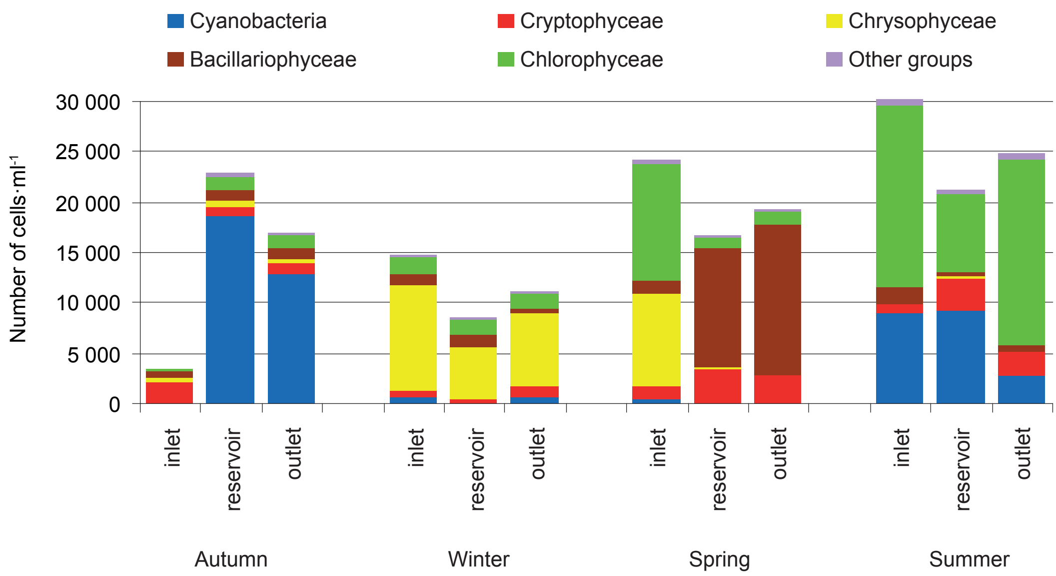


FIG. 5. Participation of main taxonomic groups in the total abundance of phytoplankton at the inlet and outlet of the Cybina River to the Maltański Reservoir and in the reservoir

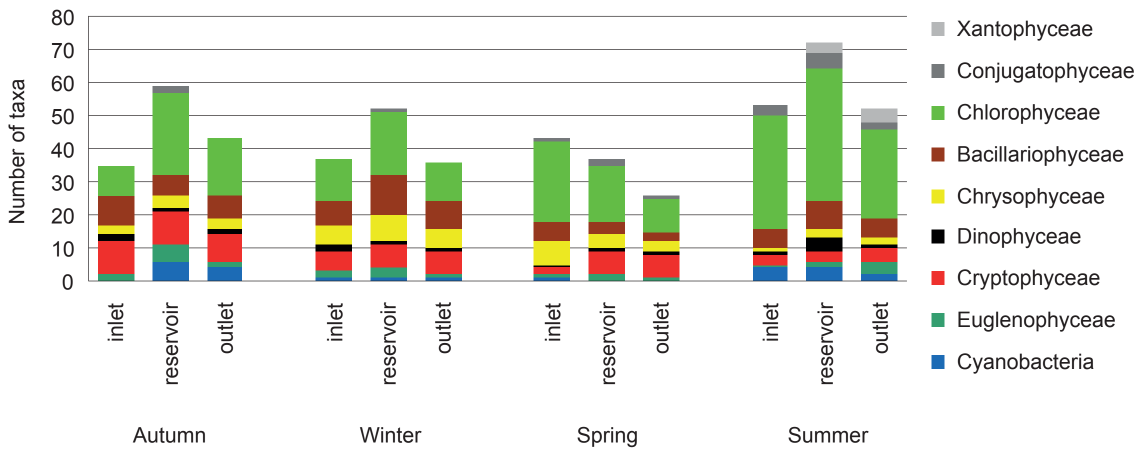


FIG. 6. Number of taxa noted in the sampling sites with the participation of taxonomic groups

## DISCUSSION

Analysing the taxonomic composition of phytoplankton of the Maltański Reservoir in the studied period the essential qualitative and quantitative changes between individual seasons were noted. Every species reacts otherwise on changing environmental conditions, therefore, every population is characterized by the specific rate of change. This contributes to some changes in the composition of phytoplankton and the dominance of individual species in the phytoplankton community (KAWECKA and ELORANTA 1994).

During the entire period of research one found maximum abundance of the phytoplankton in the Maltański Reservoir reaching 30.2 $10^3$ cells·ml$^{-1}$ in summer. Maximum biomass 24.11 μg·ml$^{-1}$ was noted in spring. In winter maximum values was 11.6·$10^3$ cells·ml$^{-1}$ for the abundace and 10.9 μg·ml$^{-1}$ for the biomass. The rise of temperature influences the phytoplankton growth and due to this it is significantly more abundant in summer than in winter (GOŁDYN 2000). In winter the qualitative and quantitative composition of phytoplankton is significantly lower (TOPOROWSKA et AL. 2010).

The restoration measures in 2005-2008 in the Maltański Reservoir, both the biomanipulation and the inactivation of the phosphorus with iron sulphate, had influence on the qualitative and quantitative composition of phytoplankton. The successful effect of restoration was observed especially in the year 2006 and 2008. However, the increase of phytoplankton abundance especially cyanbacteria were noted in 2005 and 2007 (KOZAK et AL. 2009, KOZAK 2010).

Present studies showed a high participation of cyanobacteria (*Pseudanabaena limnetica* and *Planktothrix agardhii*) in the autumn of 2007, opposite to the year before the reservoir drainage in October and November 2008. In summer 2008 the abundance of cyanobacteria was low. There was an exchange in the qualitative composition within this group. In 2005 (the first year after filling the reservoir with water) the dominant species was *Aphanizomenon flos-aquae* (Kozak 2006, 2010). In the following year *Limnothrix redeckei* was especially noted (Kozak 2007). Those are common species noted in eutrophic lakes or reservoirs, often causing water bloom e.g. in the Rusałka Reservoir (Gołdyn et al. 2010), in six lakes on the Iława Lake District (Dembowska 2011) and in the Goczałkowice Reservoir (Czaplicka-Kotas et al. 2012). *Planktothrix agardhii* can be noted in all seasons (Budzyńska et al. 2009). In the year 2008 the summer abundance of cyanobacteria was low. Representants of this group were noted mainly in the surface water layer of the Maltański Reservoir and in the inflow. Ascertained species were *Pseudanabaena limnetica* and *Microcystis aeruginosa,* however they did not constitute the large biomass. Also the occurrence of rare species such as *Anabaenopsis elenkini* Miller, which was not noted earlier in the studied reservoir. In the same year this species was noted also in small water body – Lake Baba (Kozak and Kowalczewska-Madura 2009).

In respect of the number of taxa in all samples the most important and dominated group was *Chlorophyceae*. Their presence can indicate the increased content of nitrogen in relation to phosphorus in the water (Lampert and Sommer 2001). Also previous studies showed that this is the most numerous group in respect of number of taxa in the reservoir (Stefko 1976, Kozak 2005, 2010, Niedźwiedzińska 2011).

The number and the biomass of *Chlorophyceae* increased especially in summer 2008. The most abundant were *Coelastrum reticulatum*, *Crucigeniella rectangularis*, and *Desmodesmus spinosus*. Quite numerous were also *Coelastrum astroideum*, *Desmodesmus communis*, *Oocystis lacustris*, *Pediastrum boryanum* and *Scenedesmus obliguus*. The same tendency were noted in 2005--2006 (Kozak 2007).

Green algae are one of the richest group in respect to the number of taxa in qualitative structure of phytoplankton in many lakes e.g. in the Lake Żur (Wiśniewska 2010) or even a small garden pond (Celewicz-Gołdyn and Boryca 2012).

The second place in respect of the number of taxa, both in previous research led by Stefko (1976) and Kozak (2010) and present analyses, had *Bacillariophyceae.* Diatoms are often noted as an important group in respect of the number of taxa in reservoirs and lakes in spring (Kawecka and Eloranta 1994) e.g. Lake Chańcza (Czerwik-Marcinkowska and Ziętarski 2011), Lake Uzarzewskie (Gołdyn et al. 2008) or Lake Kortowskie (Jaworska and Zdanowski 2011).

In the present research the most abundant were *Asterionella formosa, Aulacoseira* sp., *Nitzschia acicularis* var. *closterioides* and centric diatoms. Centric diatoms were also the most abundant representatives of potamoplankton in the Danube River, the second largest river in Europe (Mihaljević et al. 2013). The highest number and biomass in the Maltański Reservoir reached *Asterionella formosa,* particularly at depth of 3 m as a result of sedimentation and slow cell decay, therefore one can find it in significant amounts in deeper layers of water (Lampert and Sommer 2001).

In winter 2008 the most abundant group was *Chrysophyceae* and was represented mainly by *Chrysococcus triporus*, *Dynobryon sociale*, *Erkenia subaeqiuciliata* and *Ochromonas* sp. The occurrence of *Mallomonas* sp. has not been given till today in the qualitative composition of the Maltański Reservoir. In 1969-1970 *Chrysophyceae* were less abundant (Stefko 1976). The numerous occurrence of this group was noted in the investigated reservoir at the beginning of spring 2005 and 2006 (Kozak 2007). What is more this group was the most abundant in December 1995, because of the *E. subaeqiuciliata* (Kozak 2005).

The abundance of *Cryptophyceae* significantly increased in spring 2008. According to Kawecka and Eloranta (1994) taxa from the genus of *Cryptomonas* can also cause the water blooms. Dominant species were *Cryptomonas marssonii*, *C. ovata*, *C. erosa* and *Rhodomonas lacustris.* Similar results was obtained earlier by Kozak (2007) within the late spring 2006.

The high participation in the biomass of the phytoplankton, particularly in winter 2008 had *Dinophyceae* due to their large sizes. A falling tendency of heavier organisms can be noticed here. *Dinophyceae* were noted mainly at the depth of 2 m and 3 m, while near the surface and at the depths of 1 m were less numerous. The most abundant was *Peridinium aciculiferum*, typical species for the winter season (Rengefors and Legrand 2001). Another species such as *Ceratium hirundinella* and *C. furcoides* were noted in summer 2008.

The phytoplankton at the studied stations differed in respect of qualitative and quantitative composition, while from the reservoir and the outflow the composition was similar. New species grew in the reservoir and flowed out from the Cybina River so they were noted also in the outflow. The coefficient of the similarity for these stations was highest in autumn (60%) and in spring (58%). The phytoplankton in the inflow, however, differed with the qualitative and quantitative composition from remaining sites. This testifies that the individual species found good conditions for their growth in stagnant or running water.

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