Arch. Pol. Fish.	Archives of Polish Fisheries	Vol. 15	Fasc. 4	335-351	2007

CHANGES IN THE ABUNDANCE, SPECIES RICHNESS, AND SIZE STRUCTURE OF ZOOPLANKTON UNDER THE INFLUENCE OF ENVIRONMENTAL CONDITIONS IN THE SHALLOW LITTORAL ZONE OF A HEATED LAKE

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ABSTRACT. The aim of the study was to analyze the zooplankton abundance and species richness in 2001-2002 in the littoral zone of Lake Gosławskie and also to determine the impact of environmental conditions (temperature, oxygen content, macrophytes) on the studied zooplankton. The analysis of the biological samples indicated the occurrence of 64 zooplankton species, of which 42 were representatives of Rotifera and 22 of Crustacea. Species richness and biodiversity during the study period were high, while the zooplankton community structure, in additional to the form classified as littoral, also included pelagic species that often dominated the assemblages. The number of zooplankton species decreased as the area occupied by macrophytes increased as well as when water temperature rose. The abundance of zooplankton was low and remained at similar levels in the study years compared. The dominant taxonomic groups in the zooplankton assemblages throughout the study period were Rotifera or Copepoda naupli.

Key words: ZOOPLANKTON, LITTORAL ZONE, SEASONAL DYNAMICS, SPECIES RICHNESS, DIVERSITY, HEATED LAKE

INTRODUCTION

Changes in zooplankton abundance, biomass, and species structure in the environment are consequences of the impact of a variety of abiotic factors. Among these, water temperature, the intensity of water mixing, and water oxygen content are of decisive significance (Burks et al. 2002, O'Brien 2004). Elevated temperatures and increased current distinctly limit zooplankton development, increase mortality, and change the domination structure of the species (LaBerge and Hann 1990, Moore et al. 1996). Undoubtedly, the impact of temperature, insolence, and oxygen content on invertebrates in shallow basins is lesser in comparison to that in deep basins (Burks et

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al. 2002), and the presence of environmental niches in lake littoral zones is of fundamental importance to the occurrence and development of planktonic organisms. In shallow lakes pelagic zooplankton migrate vertically to the littoral zone, where they find refuge from planktivorous fish (Diehl and Eklöv 1995, Schriver et al.1995). The occurrence of organisms in a multi-dimensional space is, thus, not dependent on a single factor, but is a reflection of the range of tolerance in relation to many abiotic factors. The impact of competition and predation should also be considered (Weiner 2003).

Lake Gosławskie is a shallow basin subjected to a range of anthropogenic stress (hydrological, thermal, and trophic) (Socha and Zdanowski 2001) that shape the living conditions of the hydrobionts. The aim of the current work was to analyze zooplankton abundance and species diversity in 2001-2002 in the littoral zone of Lake Gosławskie and to determine the impact of environmental conditions (temperature, oxygen concentration, surface area occupied by macrophytes) had on these organisms.

MATERIALS AND METHODS

The study was performed in the 2001-2002 period in the littoral zone of Lake Gosławskie (52°18’N, 18°14’E). This is a pond-type lake with a surface area of 454.3 ha, located in the Wielkopolskio-Kujawskie Lakeland (Kondracki 2001). Since 1970, the lake has functioned as a water cooling reservoir as well as a receptacle of discharge waters from the Pątnów Power Plant.

Quantitative zooplankton samples were collected with a 2.5 l Patalas sampler from April to September at four sampling sites (Fig. 1). Ten random samples were taken in the littoral zone of each site. The samples from a given sites were combined, filtered through a 60 μm mesh net and preserved in Lugol’s solution and 96% ethyl alcohol. A total of 56 zooplankton samples were collected. During plankton sampling, the dissolved oxygen content of the water was also measured with a oximeter (HI9142, Hanna Instruments), and water temperature with a microprocessor meter (HI991001, Hanna Instruments). In order to determine the impact of submerged vegetation on zooplankton, the bottom surface area of the sampling site was measured and then the percentage of the area overgrown with macrophytes was determined visually with five-degree scale (Kapusta 2004). Zooplankton samples were identified according to

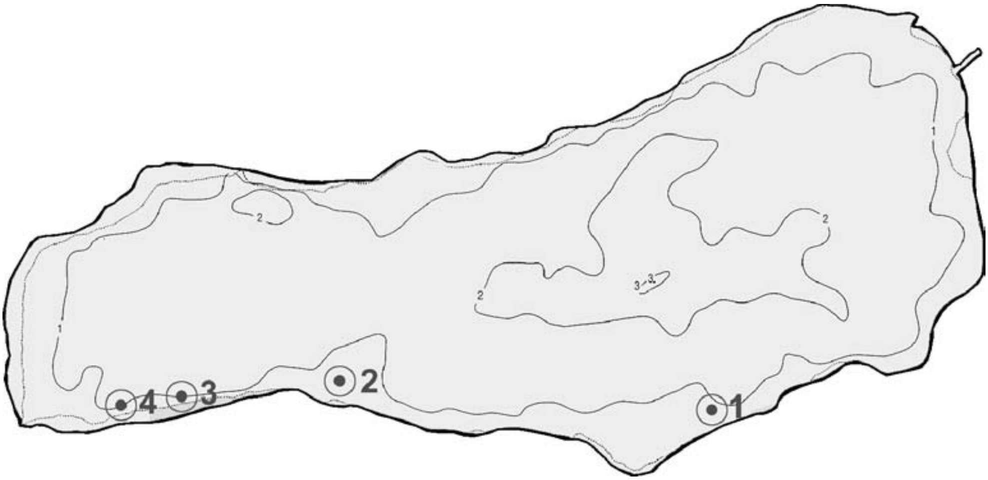

Fig. 1. Distirbution of sampling sites in Lake Goławskie.

the methodology proposed by Hillbricht-Ilkowska and Patalas (1967). The organisms were identified under a laboratory microscope to the species (Flössner 1972, Kiefer and Fryer 1978, Koste 1978, Radwan et al. 2004), the abundance of each taxon in the sample was determined (Starmach 1955), and measurements of their length and width were taken. Using the dependence between body length (width) and individual weight, the biomass of the planktonic organisms was determined (Bottrell et al. 1976, Ejsmont-Karabin 1998).

In order to determine the the structure and diversity of zooplankton assemblages in Lake Gosławskie, the species richness, which is understood as the number of species occurring in the sample and their diversity, was analyzed. The index of evenness was used (Pielou 1975). The size structure of the studied population of zooplankton was determined by subjectively classifying individual species based on their body length to separate groups (< 0.10 mm, 0.11-0.25 mm, 0.26-0.50 mm, > 0.51 mm). The significance of differences among the parameters describing zooplankton assemblages in the years compared was determined with the U Mann-Whitney test, and between months with the nonparametric ANOVA (Kruskal-Wallis test). Post-hoc analysis was performed after statistically significant values were obtained (Stanisz 1998). Determining the impact of environmental conditions on the zooplankton assemblages was done using principal factors analysis (Statistica 7.1, StatSoft). The results were interpreted with variables that were highly correlated with the first three factors (Stanisz 2000).

RESULTS

The quality composition of the zooplankton of Lake Gosławskie in the 2001-2002 period was rich and diverse. The analysis of biological samples identified the occurrence of 64 zooplankton species, 42 of which were representatives of Rotifera and 22 of Crustacea (Appendix 1). In addition to organisms that are classified as littoral, such as *Polyarthra dolichoptera dolichoptera*, *Philodina citrina*, *Eucyclops serrulatus*, and *Alona quadrangularis*, pelagic species were also noted, and sometimes even dominated the assemblage, for example *Synchaeta kitina*, *Brachionus angularis*, *Leptodora kindti*, and *Daphnia cucullata*.

Zooplankton species richness and biological diversity in Lake Gosławskie was high (Fig. 2). The values of Pielou's species evenness index ranged from 0.59 to 0.83. The highest species richness in the zooplankton assemblage was noted in April 2001. However, the lowest species diversity was recorded in May 2001, and this was despite the high concentration of organisms and species richness. The cause of this situation was the

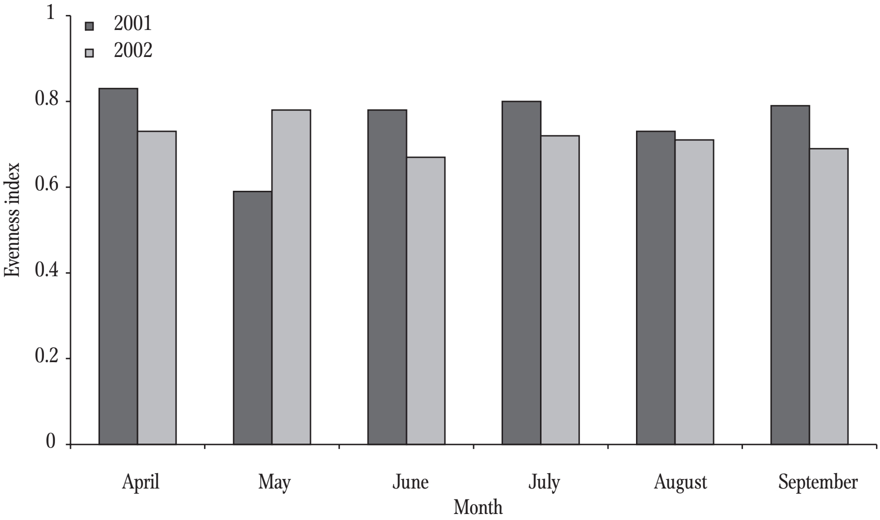

Fig. 2. Zooplankton biodiversity in the littoral zone of Lake Gosławskie in 2001-2002.

substantial dominance of the assemblage by one species (*Bosmina coregoni*), which, as a consequence, was reflected in the uneven spread of individuals among the other species.

The abundance, biomass, and species diversity of zooplankton in Lake Gosławskie in the years compared remained at a similar level (U Mann-Whitney test, $P > 0.05$, Fig. 3). The analysis of abundance and diversity of zooplankton in particular months of the study also indicated the lack of statistically significant differences between these parameters (Kruskal-Wallis test, $P > 0.05$). Significant variation in the species richness of zooplankton assemblages were confirmed only in 2001 (Kruskal-Wallis test, $P = 0.012$). The highest number of species was noted in April, while the least (significantly fewer) were noted in August (Dunn's test, $P < 0.05$). In both years of the study, seasonal variability was noted with regard to the abundance and biomass of Cladocera and to the abundance of Rotifera in 2001 (Fig. 3, Kruskal-Wallis test, $P < 0.05$). The density and

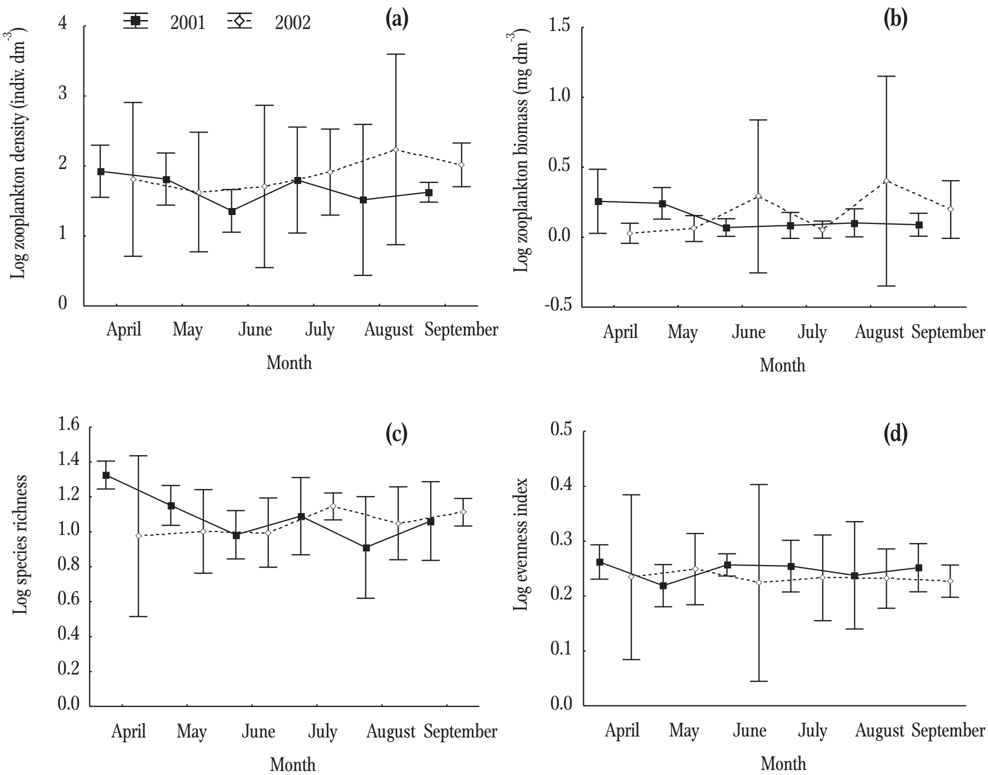

Fig. 3. Comparison of zooplankton density (a), biomass (b), species richness (c) and evenness (d) in Lake Gosławskie in 2001-2002 (mean ± 95% range).

biomass of Copepoda in all of the months remained at a similar level (Kruskal-Wallis test, P > 0.05).

In Lake Gosławskie in April the most abundant group was that of Rotifera (Fig. 4). Among them, small forms typical of eutrophic waters dominated, including *B. angularis angularis* (2001) and *Keratella cochlearis cochlearis* (2002). Copepods dominated by weight (60%) (Fig. 4), and among them the greatest share was of copepodit stages of *Acanthocyclops vernalis.* In May 2001, cladocerans dominated with more than a 60% share of zooplankton abundance and a nearly 91% share of its weight (Fig. 4). The highest zooplankton biomass of the entire study period was also noted in this month (0.82 mg dm^{-3}), and its main component were species from the genus Bosmina (47%). In May 2002, the zooplankton assemblage was dominated numerically by rotifers (59%), among which the greatest share was of the species *S.*

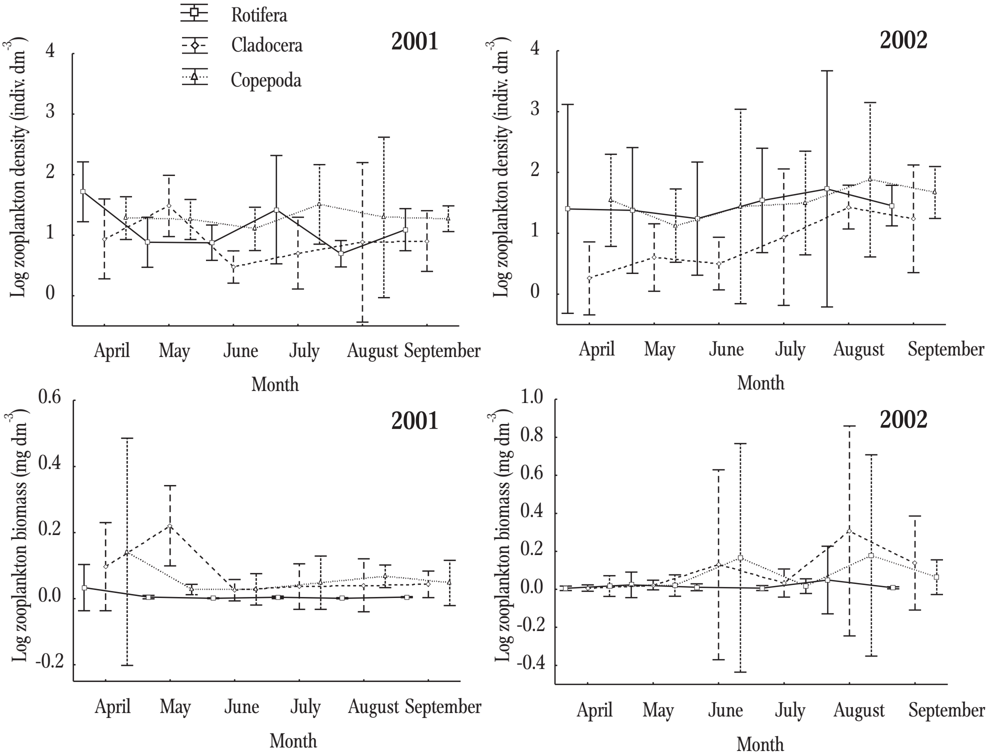

Fig. 4. Comparison of density and biomass of Rotifera, Cladocera, and Copepoda in Lake Gosławskie (mean ± 95% range).

kitina (51%). In June 2001, despite the very low density of Cladocera, the occurrence of large forms of *Sida crystallina* and *A. affinis* contributed to the domination of this taxonomic group in the overall zooplankton biomass (64%) (Fig. 4). Zooplankton density was at its lowest (73 indiv. dm^{-3}) in May 2002 (Fig. 3). This is apparent especially in the case of Cladocera, the abundance of which in this month did not exceed 3 indiv. dm^{-3}. In terms of abundance, the crustacean assemblage was dominated by copepods (55%). The zooplankton biomass was dominated by the species *Mesocyclops leuckarti* (52%) and *Eurycercus lamellatus* (36%). In July 2001, a summer peak was observed in the abundance of zooplankton (85 indiv. dm^{-3}) (Fig. 3). Subsequently, in August there was a substantial drop in both zooplankton abundance as well as in the number of species. This was evident especially in the rotifer group whose abundance was only 4 indiv. dm^{-3}, with just five taxa identified. A fully different situation was noted in 2002, when rotifers comprised 45% of the numerical share of the zooplankton in July and 52% in August (Fig. 4). It was precisely in August 2002 that zooplankton abundance and biomass were the highest noted during the entire study (300 indiv. dm^{-3}) (Fig. 3). Crustacea dominated by weight in the summer period with copepods in 2001 (62%) and cladocerans in 2002 (32%). The analysis of the summer species domination structure confirmed the high numerical share of detritivorous species such as *B. angularis* and algaevorous species such as *P. vulgaris vulgaris*, *S. kitina*, and naupli Copepoda. Copepods dominated in September (2001) in both numbers and by weight (Fig. 4) although they were represented only by *M. leuckarti* and Harpacticoida. One year later, Cladocera dominated by weight with the predominance of *Diaphanosoma brachyurum* (55%). In this month the occurrence was noted of species from this taxonomic group that had not been noted previously, *Disparalona rostrata* and *Leydiga quadrangularis*; however, they occurred in very small numbers and were classified as incidental species.

In both years of the Lake Gosławskie zooplankton assemblage study, organisms in size class II dominated (0.11-0.25 mm) with larger Rotifera such as *Trichocerca* sp. and *Polyarthra* sp., as well as small Cladocera such as *Ch. sphaericus*, *B. longirostris*, and *Alona* sp., and juvenile stages of copepods (Fig. 5). The decrease in organisms in size class II in 2001 corresponded to the increased abundance of organisms belonging to the other size classes (Fig. 5a). The share of the smallest planktonic forms increased in May, and in June the juvenile stage of *M. leuckarti* dominated, while in August the

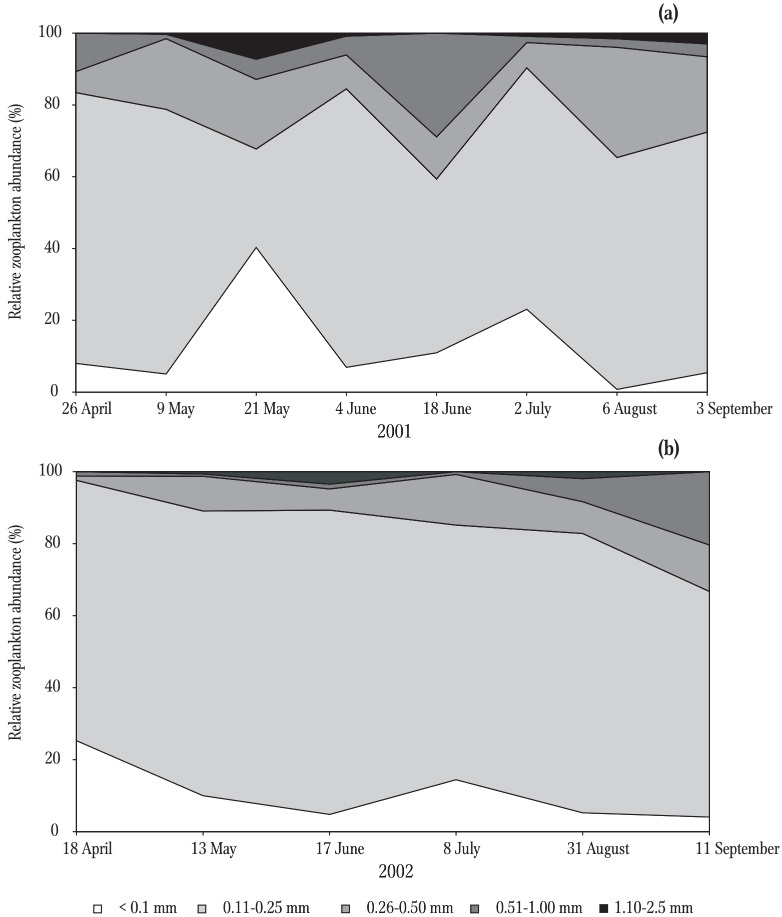

Fig. 5. Zooplankton size structure in Lake Gosławskie in 2001 (a) and 2002 (b).

dominant was the large cladoceran *D. brachyurum*. In 2002, the size structure of planktonic organisms was not highly variable. Throughout the year the dominant organisms were those from size class II (0.11-0.25 mm). The remaining size groups comprised only a small share of the zooplankton structure (Fig. 5b).

Water temperature in Lake Gosławskie in 2002 was higher than in 2001 (U Mann-Whitney test, $P < 0.01$). The lowest water temperature was noted in April 2001 (13.4°C), while the highest was in May 2001 (29.0°C) (Fig. 6a). The mean content of dissolved oxygen in the water throughout the study period was similar (Kruskal-Wallis test, $P > 0.05$). In April (2002) the mean content of dissolved oxygen in the water was the highest (20.0 $mgO_2\ dm^{-3}$), and it was the lowest in August (7.2 $mgO_2\ dm^{-3}$) (Fig. 6b). Substantial variation in the mean oxygen content was confirmed at the designated sampling stations (Fig. 7a) with the highest oxygen concentrations noted at sites that were thickly overgrown with submerged vegetation (Kruskal-Wallis test, $P < 0.05$). The development of macrophytes in the littoral zone of Lake Gosławskie began in early May and reached its peak in late June and early July. In the years compared, the bottom area overgrown with submerged vegetation was similar in size (U Mann-Whitney test, $P = 0.23$) and also differed statistically significantly at particular sites (Kruskal-Wallis test, $P < 0.0001$) (Fig. 7b). The following species of submersed vegetation were noted: *Chara* sp., *Ceratophyllum demersum* L., *Myriophyllum spicatum* L., *Nuphar lutea* (L.) Sibth. & Sm., and *Potamogeton* sp.

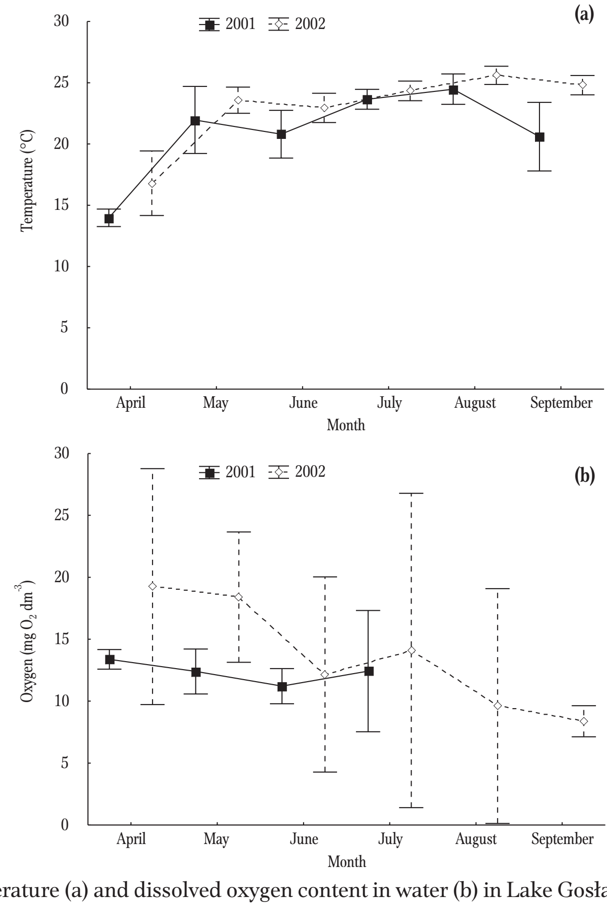

Fig. 6. Water temperature (a) and dissolved oxygen content in water (b) in Lake Gosławskie in 2001-2002 (mean ± 95% range).

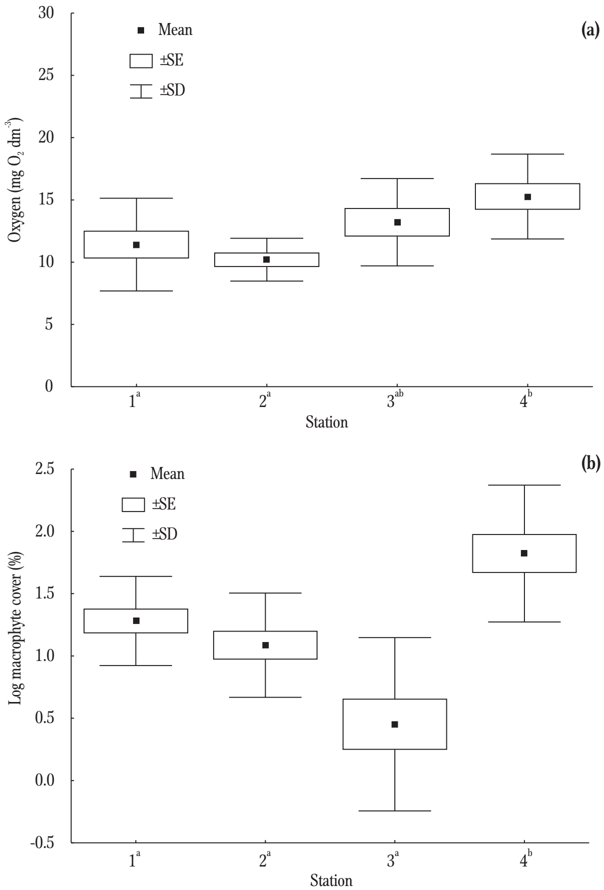

Fig. 7. Mean dissolved oxygen content in water (a) and bottom macrophyte cover (b) at study sites (1-4) in Lake Gosławskie in 2001-2002. Homogeneous classes (Dunn's test, $P < 0.05$) are designated with the same letter index.

The principal factors analysis conducted on the zooplankton assemblage variables and selected environmental parameters of Lake Gosławskie permit identifying three significant factors (Table 1). They explain approximately 60% of the variance in the variables fitted to the model. The first factor, which explains about 22% of the variance, indicated a strong, negative correlation between Cladocera abundance and biomass and the species diversity of the zooplankton assemblage. The second factor bearing a high variable load (about 18%) described species richness as well as water temperature and the bottom area covered by macrophytes at the zooplankton sampling sites. This factor indicates that the number of zooplankton species in Lake Gosławskie decreased as water temperature and the bottom area overgrown with submersed vegetation both increased. The third factor, which explained about 22% of the variance, indicates that there is a strong dependence between the abundance and biomass of Rotifera and the abundance and biomass of Copepoda (positive correlation index). This allows for the assertion that there is a strong dependency between Rotifera and Copepoda. In Lake Gosławskie as the abundance and biomass of rotifers increased, so did the abundance and biomass of copepods.

TABLE 1

Correlation among variables describing the zooplankton assemblages and environmental conditions in Lake Gosławskie and constituents identified by principal component analysis (normal varimax rotation); correlations > 0.60 were used to interpret factors

Variable	PCA 1	PCA 2	PCA 3
Species richness	-0.635	0.169	-0.178
Zooplankton density	0.453	0.665	0.197
Rotifera density	0.173	0.342	0.788
Cladocera density	0.888	0.134	-0.006
Copepoda density	0.427	-0.044	0.689
Rotifera biomass	0.137	0.097	0.758
Cladocera biomass	0.751	0.035	0.153
Copepoda biomass	-0.085	-0.110	0.719
Water temperature	0.325	-0.784	-0.006
Dissolved oxygen	-0.257	0.360	-0.305
Macrophyte bottom cover	-0.106	-0.639	-0.064
Variance explained (%)	23.8	17.8	21.8

DISCUSSION

There is a strong relationship between the shore zone and the open water zone in shallow basins. The lack of a hypolimnion, which provides refuge for zooplankton, means that the predatory pressure of planktivorous fish is greater than it is in stratified lakes (Jeppesen et al. 1997, Burks et al. 2002). In shallow basins it is the submersed vegetation that provides refuge for invertebrates (Diehl and Eklöv 1995, Schriver et al.1995). The analysis of the zooplankton species structure indicated that in the Lake Gosławskie littoral zone, along with species such as *P. dolichoptera*, *P. citrina*, *E. serrulatus*, and *E. lamellatus*, which are typical inhabitants of this type of macrophyte aggregation, other pelagic species also occurred, including *S. kitina*, *B. angularis*, *L.*

kindti, *D. cucullata,* and *C. vicinus.* Although in shallow basins vertical zooplankton migrations are less common, they can undertake diel horizontal migrations to the littoral zone that is overgrown with vegetation (Lauridsen and Buenk 1996, Stansfield et al.1997, Okun and Mehner 2005). Balayla and Moss (2003) in their investigation of the shallow basin Little Mere in England, reported that organisms which preferred vegetation habitats, such as *S. vetulus* and *S. crystallina*, were as abundant in the open water zone. Burks et al. (2001) maintained the in the case of Crustacea, submersed vegetation provide refuge from fish and that the effectiveness of this shelter increases with macrophyte density. Cladocerans that occur in vegetation are not under as strong predation pressure as those that occur in open waters since they are harder for the fish to see (Beklioglu and Moss 1996). Thus, it follows that as macrophytes develop in a basin, it can be anticipated that there will be higher zooplankton species richness. However, in Lake Gosławskie, the results of factor analysis indicated that the number of zooplankton species decreased as the area occupied by submersed hydrophytes increased and as water temperature increased. This could have resulted from a correlation of these variables. The surface area occupied by hydrophytes increased as the vegetative season progressed and reached its developmental peak in summer. Changes of the thermal regime of the water progressed in the same manner. This provides the basis for the assumption that the impact of temperature is often masked by other environmental factors that are often correlated with thermal regime.

The main factor which determines the occurrence and abundance of zooplankton in the aquatic biocenoses is temperature (Radwan 1984). In most basins in the temperate zone zooplankton biomass and species richness exhibit seasonal variation, but this was not observed in Lake Gosławskie. The thermal regime of water plays a significant role in the ecology of zooplankton from species physiology to population dynamics (Burks et al. 2002), and the intensity of life processes of organisms increases as temperature rises (Mourelatos and Lacroix 1990). However, above the thermal optimum, the filtration rate of plankters decreases, which leads to less effective feeding, lower growth rates and smaller body sizes (at which individuals attain sexual maturity) and this is observed even when other factors, such as food availability, are not limited (Moore et al. 1996). Water temperature in Lake Gosławskie was high at an observed maximum of 29°C. Moore et al. (1996) reported that temperature close to or slightly higher than 20°C are optimal for Cladocera. In general, the survival of many zooplankton species decreases at temperatures exceeding 25°C. Low zooplankton abundance and biomass (especially of cladocerans) in Lake Gosławskie throughout the study period can be explained by the immediate impact of water temperature. The results of factor analysis indicated that the elevated water temperature is also a limiting factor in species richness. This is confirmed by the results of zooplankton studies performed in the other Konin lakes which confirm that the elevated water temperature destroys populations of large forms of phytoplankton, and that thermal jumps have a greater impact on Cladocera and Copepoda mortality than they do on that of Rotifera (Tunowski 1988, 1994). Donze (1978), who studied the impact of elevated temperature on zooplankton populations reported that cladocerans are one group whose mortality was significantly impacted by jumps in temperature. Populations of copepods did not exhibit developmental disturbances, although the mortality of rotifers was most likely caused by an infection of protozoa and fungi, which both developed faster at higher temperatures.

The body size of the individuals of a chosen zooplankton population is negatively correlated with water temperature even if predators do not occur and good quality food is available in sufficient quantities. In the case of *Daphnia* sp., smaller organisms are more adept at surviving increases in temperature and low oxygen concentrations than are larger ones (LaBerge and Hann 1990). The results of the current study confirm this observation. From April to June (2002), cladocerans occurred only in small numbers (1-5 indiv. dm^{-3}). According to Tunowski (2001), elevated water temperatures not only impede development, they change the domination structure in heated basins, and the author noted the elimination of large cladocerans and copepods in Lake Licheńskie, while the dominants were small rotifers of the genus Synchaeta. Similar results were obtained in the Konin lake system by Hillbricht-Ilkowska and Simm (1988), and Paturej et al. (2007), who confirmed that small forms, especially rotifers, dominated. The study results presented herein indicate that the large phytoplanktivorous cladocerans of the genus Daphnia occurred in low numbers, while rotifers or juvenile stages of Copepoda dominated. The low level of predation in relation to zooplankton resulted from the domination of large Cladocera through competition with other large zooplankton species (Gliwicz 1990), or through the influence of predatory invertebrates (Cottenie et al. 2001). However, when there are no planktivorous fish in a basin, the conditions for the development of predatory invertebrates are good, which can heavily impact the structure of small zooplankton (Arnott and Vanni 1993). Water temperature has an indirect impact on the life processes of zooplankton through the changes it can effect in oxygen content (Moore et al. 1996). Oxygen deficits reduce the size of the zone inhabited by zooplankton since many species exhibit variable tolerance to low oxygen contents. Some species of the genus Daphnia, for example, *D. pulex*, can survive short periods in total anoxia and still produce hemoglobin (Burks et al. 2002, O'Brien et al. 2004). Throughout the current study period, no oxygen deficits were noted in Lake Gosławskie, the quantity of dissolved oxygen in the water was high, and the areas that were overgrown with macrophytes had higher oxygen concentrations. Additionally, during the day this submersed vegetation provided refuge and supplied excellent oxygen conditions.

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Received – 04 September 2007

Accepted – 18 December 2007

STRESZCZENIE

ZMIANY OBFITOŚCI, RÓŻNORODNOŚCI GATUNKOWEJ I STRUKTURY WIELKOŚCIOWEJ ZOOPLANKTONU POD WPŁYWEM WARUNKÓW ŚRODOWISKOWYCH W LITORALU PŁYTKIEGO, PODGRZEWANEGO JEZIORA

Celem pracy była analiza obfitości i różnorodności gatunkowej zooplanktonu w latach 2001-2002 w litoralu Jeziora Gosławskiego (rys. 1) oraz określenie wpływu warunków środowiskowych (temperatury, zawartości tlenu i makrofitów) na badaną faunę planktonową. Analiza prób biologicznych wykazała występowanie 64 gatunków zooplanktonu, spośród których 42 było przedstawicielami Rotifera i 22 Crustacea (Appendix 1). Bogactwo gatunkowe i różnorodność biologiczna zooplanktonu w okresie prowadzonych badań były wysokie, a strukturę gatunkową tworzyły obok form klasyfikowanych jako „litoralowe" także organizmy pelagiczne, które często dominowały w zespole. Liczba gatunków zooplanktonu malała w miarę powiększania się powierzchni zajmowanej przez hydrofity oraz wzrostu temperatury wody. Obfitość zooplanktonu była niska i utrzymywała się porównywanych latach na podobnym poziomie. W zespole zooplanktonu przez cały okres prowadzonych badań dominującą grupą taksonomiczną były Rotifera lub naupli Copepoda.

APPENDIX 1

List of zooplankton species recovded in the littoral zone of Lake Gosławskie in 2001-2002

Rotifera
Anuraeopsis fissa (Gosse)
Ascomorpha sp.
Asplanchna priodonta priodonta Gosse
Brachionus angularis angularis (Gosse)
Brachionus calyciflorus f. amphiceros (Ehrenberg)
Brachionus calyciflorus f. anuraeiformis (Brehm)
Brachionus calyciflorus calyciflorus Pallas
Brachionus calyciflorus var. dorcas (Wierzejski)
Brachionus quadridentatus Hermann
Brachionus patulus patulus (O.F. Müller)
Brachionus urceolaris urceolaris (O.F. Müller)
Cephalodella gibba gibba (Ehrenberg)
Colurella colurus (Ehrenberg)
Filinia longiseta longiseta (Ehrenberg)
Euchlanis dilatata (Ehrenberg)
Keratella cochlearis cochlearis (Gosse)
Keratella cochlearis var. tecta (Gosse)
Keratella cochlearis var. typica (Lauterborn)
Keratella cruciformis (Thompson)
Keratella quadrata quadrata (O.F. Müller)
Lecane closterocerca closterocerca (Schmarda)
Lecane luna luna (O.F. Müller)
Lecane lunaris lunaris (Ehrenberg)
Lepadella ovalis (O.F. Müller)
Mytilina ventralis (Ehrenberg)
Notholca acuminata (Ehrenberg)
Notholca squamula (O.F. Müller)
Philodina citrina Ehrenberg
Proales sp. Gosse
Polyarthra dolichoptera dolichoptera Idelson
Polyarthra euryptera (Wierzejski)
Polyarthra major Burckhardt
Polyarthra remata (Skorikov)
Polyarthra vulgaris vulgaris Carlin
Pompholyx sulcata (Hudson)
Ptygura sp. Ehrenberg
Synchaeta kitina Rousselet
Synchaeta litoralis Rousselet
Synchaeta oblonga Ehrenberg
Synchaeta pectinata Ehrenberg
Testudinella patina patina (Hermann)
Trichocerca pusilla (Lauterborn)
Trichotria pocillum (O.F. Müller)

Cladocera
Acroperus harpae (Baird)
Alona affinis (Leydig)
Alona quadrangularis (O.F. Müller)
Alona rectangula Sars
Alonella nana (Baird)
Bosmina coregoni Baird
Bosmina longirostris (O.F. Müller)
Ceriodaphnia quadrangula (O.F. Müller)
Chydorus sphaericus (O.F. Müller)
Daphnia cucullata Sars
Daphnia longispina O.F. Müller
Diaphanosoma brachyurum (Liévin)
Disparalona rostrata (Koch)
Eurycercus lamellatus (O.F. Müller)
Leptodora kindti (Focke)
Leydiga quadrangularis (Leydig)
Moina micrura Kurz
Monospilus dispar Sars
Sida crystallina (O.F. Müller)
Simocephalus vetulus (O.F. Müller)

Copepoda
Acanthocyclops vernalis (Gurney)
Cyclops kolensis Lilljeborg
Cyclops vicinus Uljanin
Eudiaptomus gracilis (Sars)
Eucyclops serrulatus (Fischer)
Macrocyclops albidus (Jurine)
Mesocyclops leuckarti (Claus)
Thermocyclops crassus (Fischer)