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DISTRIBUTION OF PLANKTONIC ROTIFERS COMMUNITIES IN SPECIAL ANGLING SITE LAKE SKOMIELNO

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Sumary. Lake Skomielno is situated in the central part of Łęczyńsko-Włodawska Plain and belongs to the catchment area of River Tyśmienica. At the beginning it was a small and shallow lake. After embankment and merging to the system of Wieprz-Krzna Canal the lake has changed the status to a retention reservoir. At present it is used for angling purposes. In spring, summer and autumn of 2005–2006 a study was undertaken to identify the abundance and species diversity of planktonic rotifers. The results showed the presence of 47 rotifers species with mean density ranging from 185 to 245 ind. dm $^{-3}$. The group of dominants included common rotifers species. The obtained results indicate a strong influence of dense macrophytes beds in littoral zone on the species and ecological structure of planktonic rotifers in the studied lake ecosystem. Despite the merging to the Wieprz-Krzna Canal and transformation into retention reservoir the Lake Skomielno maintains the main features of a natural lake.

Key words: eutrophic lake, special angling site, planktonic rotifers, Lake Skomielno

INTRODUCTION

Rotifers inhabiting lake ecosystems constitute the major component of small zooplankton. They are consumers of microorganisms, such as: bacteria, algae, ciliates; some species are detritivorous. Thus, rotifers play an important role in the trophic structure in freshwater ecosystems [Radwan 1973]. Some rotifer species are also used as indicators of water trophy [Radwan 1973, Karabin 1985, Radwan *et al.* 1988, Paleolog *et al.* 1997].

Lake Skomielno has the status of a special angling site. In the past it was a small, polymictic and eutrophic natural lake with surface area of 30 ha. At present the lake has been merged to the water system of the Wieprz-Krzna

Canal, and has become an embanked and enlarged retention reservoir. Under such conditions investigations on the species structure and abundance of planktonic rotifers (*Rotatoria*) were undertaken in different zones of the lake.

STUDY AREA

Lake Skomielno has the status of a special angling site. It is situated in Parczew District in Sosnowica Commune, in the central part of Łęczyńsko--Włodawska Plain and belongs to the catchment area of River Tyśmienica. After embankment and merging to the system of Wieprz-Krzna Canal the lake has changed the status to a retention reservoir. All of those activities resulted in enlargement of the surface area of the lake from 3 to 52 ha [Grzywna 2007]. At present the lake is used for angling purposes. Due to the presence of many rare and protect species, the lake together with surrounding peatbogs, constitutes an area of high ecological value. Lake Skomielno represents class III of the suppleness for degradation and class II of water purity. The waters are characterised by high concentration of mineral compounds which results in high conductivity [Grzywna 2007]. The maximum depth of the lake is 6 m (3.2 m before merging). It is a polymictic, eutrophic lake, representing tench-pike fishery type and high water transparency (SD visibility in the summer period 2.2–3.0 m) [Harasimiuk e*t al.* 1998].

MATERIAL AND METHODS

Samples of planktonic rotifers were collected at 4 sampling sites. Three sites were situated in littoral zone: L1, L2 and L3, and one site in pelagic zone: P. (Fig. 1) Site L1 was characterised by the highest number of submerged macrophytes and biomass of vegetation. At sites L2 and L3 the biomass of vegetation was much lower. At each site samples were taken in spring (IV), summer (VII) and autumn (X) during the years 2005–2006. Samples were collected at the depth of 0.5 m by means of the Toń II apparatus. Each time 20 dm^3 of water was taken, than it was strained through planktonic net No. 25 and condensed to the constant volume of 100 cm^3. All samples were preserved by Lugol liquid and after some hours by 4% formaldehyde with glycerine.

Planktonic rotifers were identified and counted under inverted microscope. The number of individuals was calculated per 1 dm^3 of water. The test of Shapiro-Wilk was used to verify normal distribution of collected data. The significance of differences between particular zones and seasons was determined by non-parametric rang test of Kruskal-Wallis.

RESULTS AND DISCUSSION

Quality structure

During the two-year study in Lake Skomielno, 47 planktonic rotifer species were noted. Among them 9 indicators of eutrophic reservoirs, 1 indicatory species of oligotrophy, and 2 rare species inhabiting littoral zone. The total number of species amounted to 35 in 2005 and 34 in 2006 and did not differ much between the studied sites. The highest number of species was observed in littoral zone, ranging from 23 to 34 species. In pelagic zone the number of species was

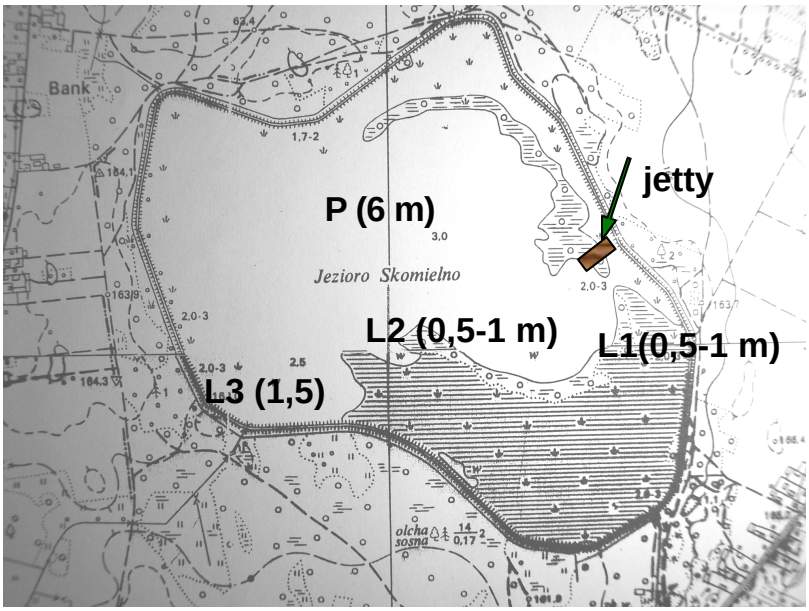

Fig. 1. Situation plan of Lake Skomielno with location of sampling sites

lower and amounted to 23 on average (Fig. 2A). High numbers of rotifer species observed in littoral zone are probably a result of dense macrophytes cover in comparison to the open water zone. A strong influence of densely vegetated littoral on the other zones in shallow lakes was observed by other researchers [Pawłowski 1980, Bielańska-Grajner 1987, Radwan *et al*. 2004]. The number of planktonic rotifer species showed seasonal changes. In spring (in both studied years) it amounted to 26 and rose gradually up to 36 in autumn (Fig. 2A).

The species diversity calculated by Shannon-Wiener index was the highest in the littoral zone and ranged from 1.78 to 2.46. In pelagic zone the Shannon-Wiener index showed a lower value of H = 1.57 (Fig. 2B). Species diversity changed seasonally. The highest value of H = 2.22 was noted in summer, lower in autumn, H = 2.00, and the lowest in spring – H = 1.67 (Fig. 2B).

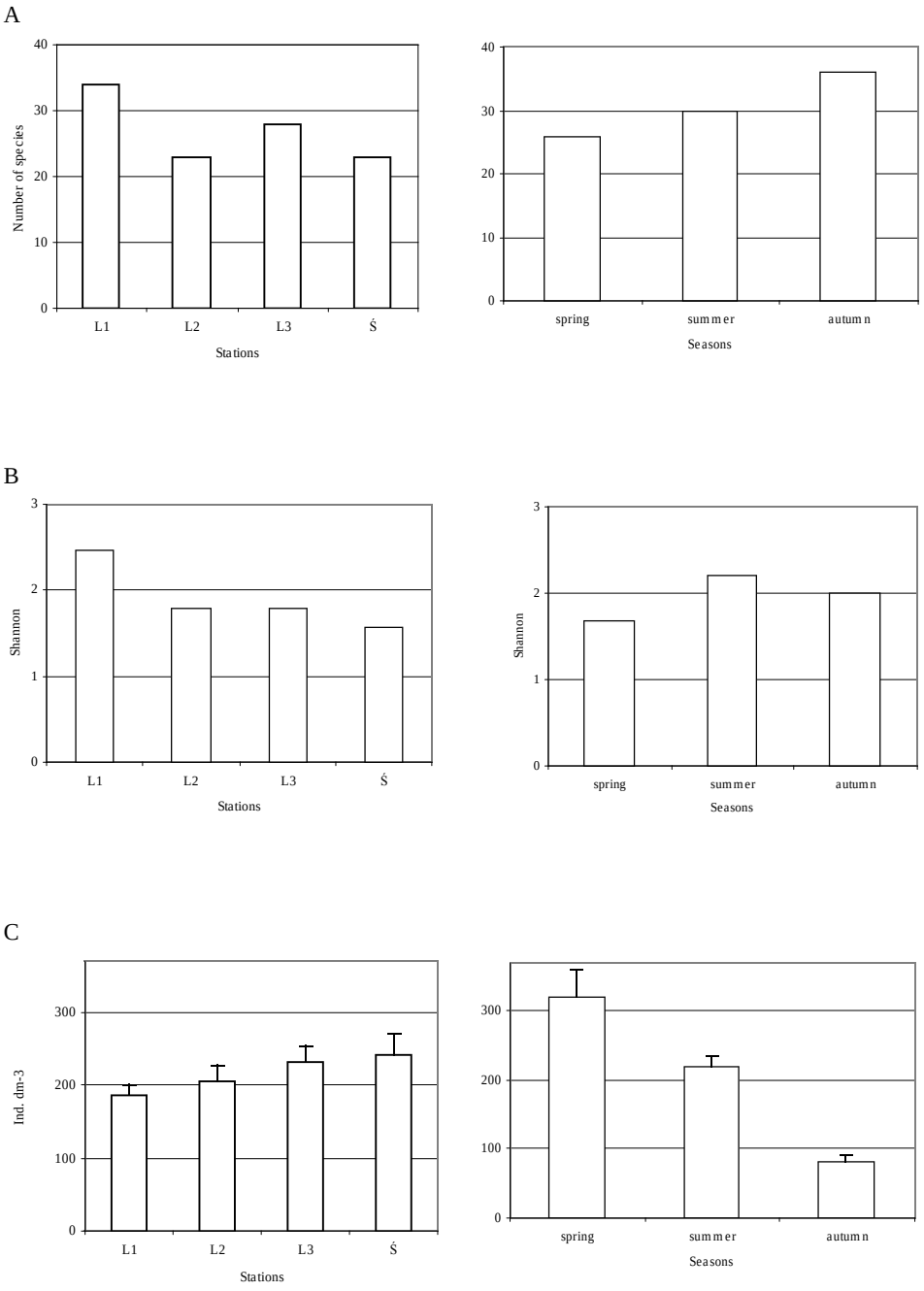

Fig. 2. Characteristic of rotifer communities in particular zones and seasons in lake Skomielno during the years 2005–2006: A – species richness, B – species diversity, C – density

Quantity structure

Mean density of planktonic rotifers in Lake Skomielno ranged from 185 ind. dm^{-3} in 2006 to 245 ind. dm^{-3} in 2005. Total number of individuals differed between lake zones. The lowest density of 187 ind. dm^{-3} was noted in the littoral zone with dense macrophytes cover (Fig. 2C). In the two remaining littoral sites density of planktonic rotifers ranged from 206 to 233 ind. dm^{-3}, while in pelagic zone it amounted to 240 ind. $dm^{-3.}$

Densities of planktonic rotifers inhabiting littoral and pelagic zones showed very high similarity. Significant differences were noted only between sites L1 and L3, and L1 and P (Fig. 2C).

The densities of rotifers differed significantly in particular seasons. The highest density was observed in spring – 322 ind. dm^{-3} and the lowest in autumn – 82 ind. dm^{-3} (Fig. 2C).

The group of dominants included common rotifers species ***Keratella cochlearis*** and ***Polyartchra vulgaris***; additionally, in particular littoral sites, there dominated ***Anuraeopsis fissa, Keratella cochlearis tecta*** and ***Pompholyx sulcata*** (Fig. 3A).

Rotifer communities were classified according to Łuczak and Wierzbowska [1981], Müller [1984] and Bielańska-Grajner [2005] as communities of sustainable or unsustainable domination structure. Those authors classify a community as sustainable if it is possible to distinguished three domination classes (dominants, subdominants and recedents), at least 3 species belong to the dominants, and any of the dominants does not exceed 45% of total density. According to the classification, the rotifer communities in all studied littoral sites were sustainable (Fig. 3A). The domination structure of planktonic rotifers showed seasonal changes. In spring and autumn the share of ***Keratella cochlearis*** and ***Polyartchra vulgaris*** ranged in very high values **(**80–83%), in the summer the domination of both species was higher (Fig. 3A).

A high percentage of periphytic and benthic-periphytic rotifers species in relation to euplanktonic forms was observed in Lake Skomielno (Fig. 3B). The highest share of periphytic and benthic-periphytic species was noted at site L1 and L3, lower in pelagic zone. Particular ecological forms did not show visible seasonal changes (Fig. 3B).

Lake Skomielno is classified as eutrophic [Harasimiuk *et al.* 1998, Grzywna 2007]. The high number of eutrophic rotifers species (9) and stray occurrence of oligotrophic species (1) confirmed that classification. Skomielno is a very interesting lake ecosystem. Despite the merging to the water system of the Wieprz-Krzna Canal and periodic role as a retention reservoir, the lake is characterised by intensive development of submerged vegetation [Grzywna 2007], fish stock is dominated by predatory species, such as pike (*Esox lucius*) [Girsztowtt 2002, Biernacki 2006], and studies on planktonic rotifers showed the presence of two rare species for Polish fauna, as well a strong influence of littoral zone on the species and ecological structure of planktonic rotifer communities. Such high

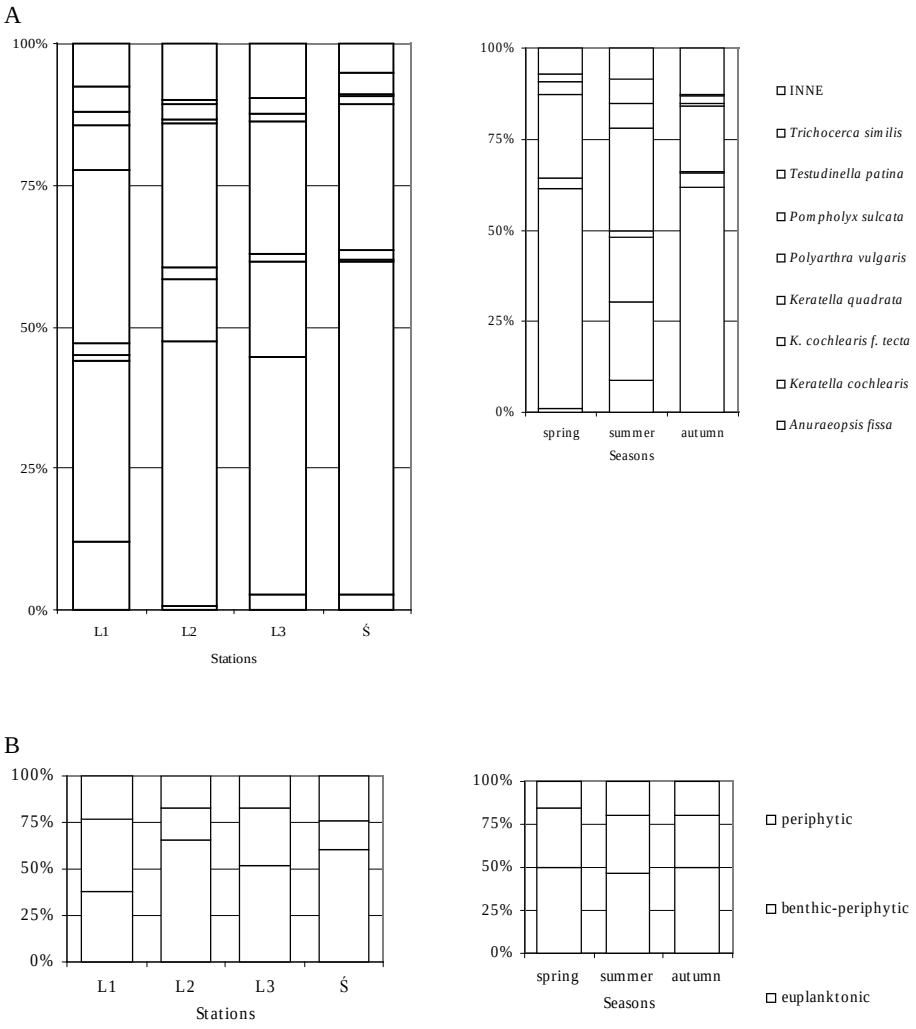

Fig. 3. Characteristic of rotifer communities in particular zones and seasons in Lake Skomielno during the years 2005–2006: A – relative abundance of particular species, B – percentage of ecological forms

numbers of periphytic and benthic-periphytic rotifer species have been usually found in slightly eutrophic lakes with very high degree of naturalness [Radwan 1973, Demetraki-Paleolog 2007]. For better evaluation of the ecological status of Lake Skomielno, a comparison of features of planktonic rotifer communities responsible for water trophy [Karabin 1985] with features of planktonic rotifer communities inhabited Lake Skomielno was performed (Tab. 1). The obtained results showed that density of rotifers and tecta (% of ***Keratella cochlearis*** f. ***tecta*** among population of ***Keratella cochlearis***) indicator confirmed slightly eutrophic or eutrophic character of the studied lake, while the ratio of biomass

of

Table 1. Characteristic of rotifer communities in waters of different trophic status and values of particular features in Lake Skomielno

Feature	Mesotrophy	Meso-eutrophy	Eutrophy	Skomielno
density ind. dm^{-3}	< 400		400–2000	10–551
tecta index, %t	0.5	5–20	20–60	0–19 (usually 0–4)
B-eut:B-poz	< 10	10–90	> 90	0.3–2.0
B:N			< 0.00015	0.2–0.6

B – biomass; N – density, B – eut. – biomass of eutrophobionts
B-poz – biomass of remaining rotifers.
Ranges for particular features according to Karabin [1985].

eutrophobionts to other species and the ratio of rotifers biomass to rotifers density is typical for less fertile waters (Tab. 1).

CONCLUSIONS

1. Planktonic rotifers community in Lake Skomielno included 47 species; 9 of them are indicators of eutrophic waters, 1 indicator of oligotrophy and two rare species for Polish fauna. Mean density of rotifers ranged from 185 ind. dm^{-3} to 245 ind. dm^{-3}.
2. Species richness, diversity and density of rotifers in littoral and pelagic zones were slightly differentiated, which showed a strong influence of littoral zone on planktonic rotifers communities in the whole lake ecosystem.
3. The group of dominants represented common rotifer species: *Keratella cochlearis*, *Polyartchra vulgaris*, *Anuraeopsis fissa*, *Keratella cochlearis tecta* and *Pompholyx sulcata*.
4. The high percentage of periphytic and benthic-periphytic species, the presence of rare species and low value of ratio of the biomass of eutrophobionts to the biomass of remaining species and quite high mean biomass of rotifers individuals (B:N) confirmed the high level of naturalness of the ecosystem and low degree of eutrophication of this shallow lake.

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ROZMIESZCZENIE ZGRUPOWAŃ WROTKÓW PLANKTONOWYCH W ŁOWISKU SPECJALNYM JEZIORO SKOMIELNO

Streszczenie. Jezioro Skomielno leży w centralnej części Równiny Łęczyńsko-Włodawskiej i należy do zlewni rzeki Tyśmienicy. W pierwotnej postaci było niewielkim, płytkim jeziorem. Po obwałowaniu i włączeniu w system wodny Kanału Wieprz-Krzna stało się zbiornikiem retencyjnym, zachowującym pewne cechy naturalnego jeziora. Obecnie jezioro wykorzystywane jest jedynie wędkarsko. W jeziorze Skomielno w okresie wiosenno-letnio-jesiennym 2005 i 2006 r. przeprowadzono badania nad składem jakościowym i zagęszczeniem wrotków planktonowych. Badania te pozwoliły na stwierdzenie 47 gatunków w średnim zagęszczeniu wahającym się od 185 ind. dm^{-3} do 245 ind. dm^{-3}. Wśród dominantów znalazły się pospolite gatunk wrotków: *Keratella cochlearis*, *Polyartchra vulgaris*, *Anuraeopsis fissa*, *Keratella cochlearis tecta* i *Pompholyx sulcata*. Badania wskazują na duży wpływ bogatego w makrofity litoralu na strukturę gatunkową i ekologiczną zgrupowań wrotków planktonowych w całym jeziorze. Pomimo połączenia jeziora z systemem

wodnym Kanału Wieprz-Krzna i przekształcenia go w zbiornik retencyjny, zachowało dużo cech naturalnego zbiornika niepoddanego wpływom antropopresji.

Słowa kluczowe: jeziora eutroficzne, łowiska specjalne, wrotki planktonowe, jezioro Skomielno