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CHANGES IN THE STURUCTURE OF PLANKTONIC ROTIFERS IN SOME PONDS OF THE POLESKI NATIONAL PARK DURING THE YEARS 1997 AND 2009

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Summary. Studies of planktonic rotifers were conducted in two ponds, Perkoz and Głęboki, during the spring and autumn of 1997 and 2009. The ponds have existed for over 80 years. At the beginning both reservoirs were used for fishery purpose, then became overgrown by common reed. Since 1990 the ponds have been subjected to gradual restoration. In total – 29 rotifer species were observed in both ponds; mean density varied between 70 and 272 ind. · dm^{-3}.

Heleoplanktonic species dominated the rotifer assemblages. Highest species richness, but lower densities were noted in the Perkoz pond, characterized by a forest catchment. In 1997 the domination structure of planktonic rotifers was non-sustainable, but after restoration, the number of dominant rotifer species visibly increased. Rotifer assemblages have not shown significant seasonal variability; but the studied ponds differ significantly in terms of species richness and abundance of planktonic rotifers.

Key words: ponds, planktonic rotifers, Poleski National Park

INTRODUCTION

The Polesie region is characterized by a dense network of surface waters. Apart from lakes, rivers, swamps and peat pits in the Polesie National Park, there are two complexes of ponds: Burskie ponds and Pieszowolskie ponds. These small water bodies have a long history; in fact the ponds were created at the beginning of the 30's the XX century; for a considerable period of time were unused and overgrown with reeds. Between 1960–1970 the area of the ponds was drained, but after the inclusion of the ponds within the boundaries of the Polesie National Park in 1990; the Perkoz pond (Burskie ponds) and Głęboki pond (Pieszowolskie ponds) were restored [Radwan 2000].

Rotifers inhabiting small water bodies (ponds) constitute an important component of heleoplankton. They are consumers of microorganisms, such as: bacteria, algae, protozoans. So, rotifers are an important link in the trophic structure of ponds [Radwan 1973]. Some species are good indicators of water trophy [Karabin 1985, Paleolog *et al*. 1997, Radwan *et al*. 1998].

The studies were undertaken to recognize the structure of planktonic rotifers a few years after the restoration of these small water bodies and to trace the changes that could occur within the ponds during the 12 years of their functioning within the Polesie National Park.

It is worth noting that the biology and ecology of aquatic invertebrates inhabiting the ponds is still not well recognized and have been rarely investigated [Radwan 2000, Demetraki-Paleolog 2002, Radwan 2002].

STUDY AREA

The studied ponds Perkoz and Głęboki are situated in the Polesie National Park (Fig. 1). The Głęboki pond represents the group of Pieszowolskie ponds (north-east part of Poleski NP), the second pond, Perkoz (north-west part of Poleski NP) belongs to the complex of Burskie ponds.

These small water bodies were created on an area of meadows and transitional bogs at the beginning of 30's of the XX century. Until the 60's of the XX century Burskie ponds were supplied by the Mietiułka stream, and the Pieszowolskie ponds by the Pieszowolski stream.

Since the turn of the 60's and 70's of the XX century, all the ponds are supplied by the Mietiułka river [Demetraki-Paleolog 2002]. For years, Burskie ponds were excluded from fishery and then turned into: reeds, bushes and forested areas (birch, alder). Since 1990 the area of the ponds has been included in the Polesie National Park and since 1994 the ponds are gradually being restored [Radwan 2002]. The surface area of the Perkoz pond 44.01 ha; in the catchment area: rushes comprise 0.76 ha, shrubs – 0.76 ha and forests – 36.38 ha. The Głęboki pond is smaller: the surface area is 18.18 ha. The catchment area includs: dikes and rushes – 11.75 ha, arable lands – 10.53 ha, shrubs and bushes – 3.0 ha.

MATERIAL AND METHODS

Studies were conducted during the spring and autumn of years 1997 and 2009, in two ponds Perkoz and Głęboki. Planktonic samples were taken in the open water zone. Each time 10 litres of water were collected using sampler „Toń II".

Next, the water was sieved through a planktonic net no. 25 (∅ = 55 μm) and condensed to the constant volume of 100 cm^3. Samples were preserved by Lugol's liquid and after some hours by 4% formaldehyde with glycerine. In preserved samples planktonic rotifers were identified and counted. The number of individuals was counted per 1 dm^3 of water.

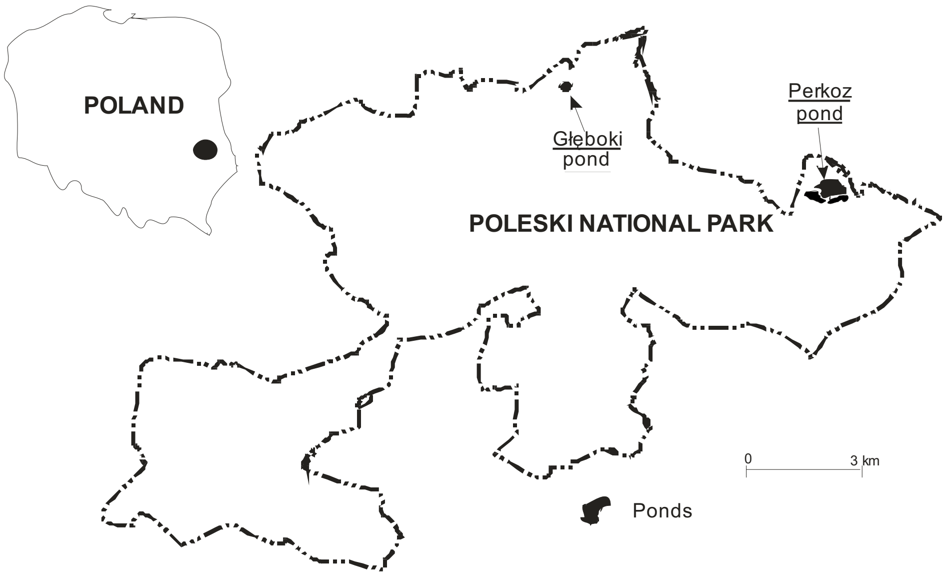

Fig. 1. Study area – situation plan

The significance of differences in rotifer densities between ponds and seasons were verified using the non-parametric rang test of Kruskal-Wallis using SAS Programme [2001]. The similarity of rotifer communities in particular zones and lakes were estimated using the Sorensen index and cluster analysis was performed by MVSP-3.1. The analysis of similarities was done using UPGMA method. The analysis included: index of domination, evaluation of sustainability of domination structure [Bielańska-Grajner 2005] and classification of rotifer species to ecological groups [Radwan 1973].

RESULTS AND DISCUSSION

Species structure

In the studied ponds, in 1997 and 2009, 29 species of planktonic rotifers were noted (Tab. 1). Higher species richness was observed in the Perkoz pond; in this pond, in the studied years the number of rotifer species was 13 to 14. In the Głęboki pond, the number of rotifer species was lower and ranged from 8 to 13 species (Fig. 2A). The number of rotifer species in the studied ponds of the Polesie

Table 1. Species structure and density (ind. · dm^{-3}) of planktonic rotifers in ponds of Poleski NP during the years 1997 and 2009

No.	Species	Perkoz pond				Głęboki pond			
		1997		2009		1997		2009	
		spring	autumn	spring	autumn	spring	autumn	spring	autumn
1	*Asplanchna priodonta* Gosse	4				1	10		
2	*Brachionus angularis* Gosse		2	4	2	4	31		
3	*Brachionus diversicornis* (Daday)			3	1				
4	*Brachionus rubens* Ehrb.							2	2
5	*Brachionus quadridentatus* Herm.		4	1	5				
6	*Conochilus unicornis* Rouss.	2							
7	*Colurella adriatica* Ehrb.			6	2				
8	*Colurella uncinata* (Müller)				4				
9	*Elosa spinifera* Wiszn.	2		31	13	6			
10	*Filinia longiseta* (Ehrb.)		2						
11	*Kellicottia longispina* (Kell.)			2	4				
12	*Keratella cochlearis* (Gosse)	148	67			13	450		
13	*Keratella cochlearis* f. *tecta* (Gosse)	1	2	8	14	1	4		
14	*Keratella quadrata* (Müll.)	17		3	1	18	2	39	17
15	*Lecane bulla* (Gosse)			3	7			20	32
16	*Lecane closterocerca* (Schm.)					1		10	2

17	*Lecane crenata* Harr.								2
18	*Lecane luna* (Müll.)							2	
19	*Lecane lunaris* (Ehrb.)							1	3
20	*Lecane quadridentata* (Ehrb.)	1		1	1				
21	*Lepadella ovalis* (Müll.)							15	5
22	*Lepadella rhomboides* (Gosse)							2	
23	*Mytilina mucronata* (Müll.)							12	8
24	*Platyias polyacanthus* (Ehrb.)	1							
25	*Polyarthra vulgaris* Carl.	3	27	6	10		3		
26	*Testudinella patina* (And. et Shep.)							1	3
27	*Trichocerca rattus* (Müll.)	2	1						
28	*Trichocerca similis* (Wierz.)				6				2
29	*Trichotria tetractis* (Lucks.)			2				2	
Number of species		10	7	12	13	7	6	11	10
Abundance		181	105	70	70	44	500	106	76

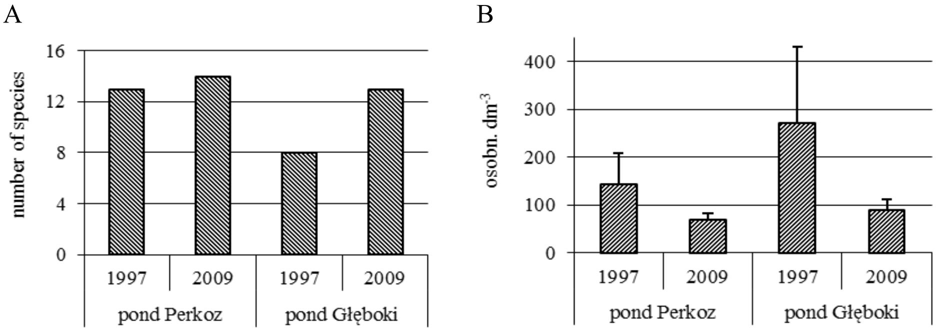

Fig. 2. Structure of rotifer assemblages in ponds of Poleski NP during the years 1997 and 2009, A – number of species, B – density

National Park was similar to values observed in ponds in the area of „Lasy Janowskie" Landscape Park [Paleolog *et al.* 1997] and visibly lower than in fish pond in Żeromin near Łodź [Kulamowicz 1956]. In general, the number of rotifer species in carp ponds is usually lower than in the studied ponds of Polesie National Park [Klimczyk 1964, Kyselowa 1973, Ferańska 1974]. Usually in ponds which are extensively used or unused, species richness of plankton may be related to the structure of land use [Paleolog *et al.* 1997]. Planktonic rotifer assemblages in both ponds, directly after restoration, in 1997, showed lower species richness than 12 years later (Fig. 2A).

In the studied ponds 7 indicatory species for eutrophic waters was noted. Proposed by Ejsmont-Karabin *et al.* [2004] *tecta* index (the percentage of the form *tecta* in *Keratella cochlearis* population) as a good indicator of the water trophy; in pond Perkoz showed an increase in 2009 as compared to the results of 1997 and its reduced in pond Głęboki (Tab. 1).

Density and domination structure

The mean density of planktonic rotifers in ponds of the Polesie National Park varied between 44 ind. · dm^{-3} (spring 1997, Głęboki pond) and 500 ind. · dm^{-3} (autumn 1997, Głęboki pond) (Tab. 1). In general abundances of planktonic rotifers were higher in the Głęboki pond (mean 275 ind. · dm^{-3} in 1997 and 90 ind. · dm^{-3} in 2009). In the Perkoz pond mean abundances of rotifers amounted to 143 ind. · dm^{-3} in 1997 and 70 ind. · dm^{-3} in 2009 (Fig. 2B). Differences between the studied ponds may be related to the structure of land use in the catchment area [Radwan *et al.* 1995, Paleolog *et al.* 1997]. Observed densities of planktonic rotifers were significantly affected by pond and season. Densities of planktonic rotifers in the studied ponds of the Polesie National Park were visibly lower than those noted in carp ponds in other regions of Poland [Klimczyk 1964, Kyselowa 1973, Ferańska 1974, Kowalczyk *et al.* 1985] or similar to values observed in ponds on the area of „Lasy Janowskie" Landscape Park [Paleolog *et al.* 1997, Demetraki-Paleolog 2002].

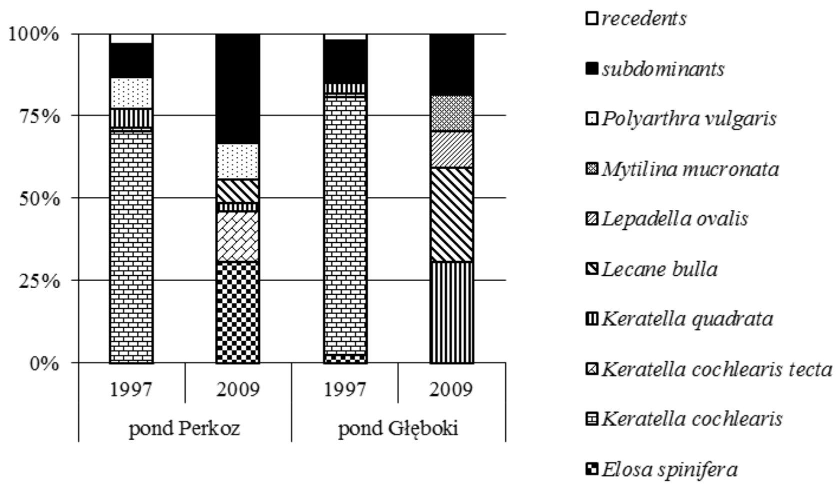

Fig. 3. Domination structure of planktonic rotifers in ponds of Poleski NP during the years 1997 and 2009

Domination structure of planktonic rotifers depended on the pond and season (Fig. 3). In 1997 common, heleoplanktonic species, *Keratella cochlearis* became domiant in both the studied ponds. The relative abundance of the species amounted to 75% (Perkoz pond) and 85% (Głęboki pond) of the total density of planktonic rotifers. In 2009, in the Perkoz pond, the group of dominants included *Elosa spinifera*, *Keratella cochlearis* f. tecta. *Polyarthra vulgaris* and *Lecane bulla*, and in the Głęboki pond, *Keratella quadrata*, *Lecane bulla*, *Lepadella ovalis* and *Mytilina mucronata* (Fig. 3).

Rotifer communities were classified according to Bielańska-Grajner [2005] as sustainable and non-sustainable domination structure. The assemblage is classified as sustainable when it can be distinguished by three domination classes (dominants, subdominants and recedents), at least three species belong to dominants and none of them exceed 45% of in the total density. According to these criteria, the domination structure of rotifers, in both ponds in studied seasons was non-sustainable. Although the structure of rotifer assemblages in 2009 was very close to sustainable. At time, in rotifer assemblages have been observed only the lack of recedents (Fig. 3). Visible improvement in the sustainability of domination structure of rotifers in both ponds during the 12 years may indicate the long term improvement of ecological conditions after the restoration of the ponds.

Classisication of rotifer assemblages

The analysis of faunistic similarity of rotifer assemblages showed the highest similarity between rotifers within each of the studied ponds (Fig. 4); values of Sorensen index varied between 0.73 and 0.88. The only exception was the Perkoz pond in 1997; at that time faunistic similarity between seasons was much lower (Sorensen index = 0.43). The obtained results indicate a slight seasonal va-

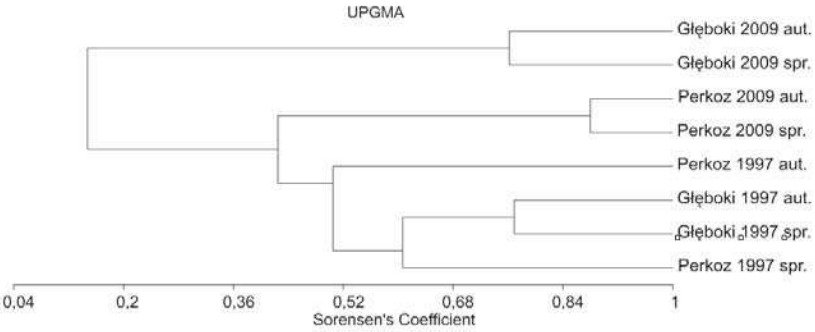

Fig. 4 Similarity structure of planktonic rotifer assemblages in ponds of Poleski NP during the years 1997 and 2009

riation in rotifer clusters. Rotifer inhabited individual ponds were much more diverse between themselves than between seasons. In 1997, the similarity index amounted 0.50 and in 2009 only 0.15. This points to a significant distinction in the fauna in the comparable ponds as well as the fact that this distinction has significantly increased during the last 12 years. The faunistic similarity of rotifer assemblages between 1997 and 2009 amounted 0.41 (Fig. 4).

CONCLUSIONS

1. Higher species diversity and lower densities of planktonic rotifers were observed in the large Perkoz pond, which is characterized by a forest catchment.
2. In both ponds, in the studied years domination structure of planktonic rotifers was um-ustainable, although 12 years after restoration number of dominants increased.
3. Faunistic differences between seasons were low and not significant.
4. Faunistic dissimilarity between studied ponds was marked and 12 years after restoration, observed differences significantly increased.

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ZMIANY W STRUKTURZE PLANKTONU WROTKOWEGO W WYBRANYCH STAWACH POLESKIEGO PARKU NARODOWEGO W LATACH 1997 I 2009

Streszczenie. Badania wrotków planktonowych prowadzono wiosną i jesienią 1997 i 2009 roku w stawach: Perkoz i Głęboki. Są to ciekawe zbiorniki znajdujące się w granicach Poleskiego Parku Narodowego. Istnieją ponad 80 lat. Początkowo były użytkowane rybacko, następnie zarosły trzcinowiskiem, a od 1990 zostały poddane stopniowej renaturalizacji. Ogółem w dwu badanych stawach stwierdzono 29 gatunków wrotków w średniej liczebności wahającej się od 70 do 272 osobn. · dm^{-3}. Dominowały typowe gatunki heleoplanktonowe. Większym bogactwem gatunkowym i mniejszą liczebnością wrotków charakteryzował się większy staw Perkoz. W przeciwieństwie do stawu Głębokiego, miał on bardziej leśną niż rolniczą zlewnię. W badanych stawach w obu latach badań struktura dominacji wrotków była niezrównoważona, jednak 12 lat po przeprowadzonej renaturalizacji równocenność zasiedlających stawy gatunków znacznie wzrosła. Faunistyczne zróżnicowanie sezonowe było niewielkie, natomiast zróżnicowanie pomiędzy porównywanymi stawami było znaczne i w ciągu 12 lat od przeprowadzonej renaturalizacji znacznie się pogłębiło.

Słowa kluczowe: stawy, wrotki planktonowe, Poleski Park Narodowy