

EFFECT OF THE „ŁĄKA” DAM RESERVOIR ON PLANKTONIC ROTIFERS (*ROTIFERA*) COMMUNITIES IN THE PSZCZYNKA RIVER

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Summary. The flow of the river through the dam reservoir contributed to changes in the communities of rotifers occurring in the Pszczynka River. Above the reservoir a great richness of rotifers species was noted – here, there occurred as many as 97 rotifers species, while below the reservoir the number of species decreased to 53. A considerable decrease was also observed in the value of the Shannon-Wiener species biodiversity index – from 2.68 above the reservoir to 1.61 below.

A very clear increase was observed in the density of rotifers in the river below the damming-up construction. In the Pszczynka River, above the dam, the mean annual density was 357 individuals \cdot dm⁻³. In the reservoir the mean density was 1145 individuals \cdot dm⁻³. These high numbers of rotifers in the reservoir was the cause of an increase in their density to over 1800 individuals \cdot dm⁻³ below the dam. As a result of the Pszczynka River flow through the eutrophic reservoir a higher percentage of species was noted which are the indicators of such waters – by over 8% in the river below the dam, as well as the reconstruction of rotifers communities with respect to the stability of occurrence and the domination coefficient.

Key words: *Rotifera*, river, dam reservoir

INTRODUCTION

A relatively large number of reports have been devoted to the rotifers fauna in Polish rivers and dam reservoirs. However, the effect of dam reservoirs on the communities of rotifers in the dammed up-river area is an insufficiently recognized problem. Few Polish reports contain quantitative and qualitative analyses of rotifers in dam reservoir, and the river above this reservoir and below the dam. Here, the studies by the following authors should be mentioned: Krzeczowska-Wołoszyn conducted in the Brynica River and reservoirs of Kozłowa Góra [1985]; Ejsmont-Karabin and Węgleńska carried out in the Narcew River, the Bug River and Zegrzyński Reservoir [1990]; Napiórkowski in the Vistula River and the Włocławski Reservoir [1997]; Radwan *et al.* conducted in the Bystrzyca River and Zemborzyce Reservoir [1988]. The aim of the study was determination of the effect of the „Łąka” Dam Reservoir on the communities of rotifers in the Pszczynka River with respect to species biodiversity, numbers, structure of domination and stability of occurrence, dynamics and numbers in an annual cycle.

STUDY AREA, MATERIAL AND METHODS

The Pszczynka River, with a length of 46.3 kilometres, is a left side tributary of the Upper Vistula River. The basin of the river covers a slightly wavy territory of the Pszczyna Plain and the Rybnicki Plateau. The Pszczynka River has been subject to hydrotechnical measures almost along its whole course, designed to regulate the pace of water flow and dehydration of the water meadows. During the years 1977-1986, along 24.3 kilometres of the river course, in the locality of „Łąka”, a multi-functional, low-flow dam reservoir was constructed with a capacity of 12 million m³.

Surface flow exerts an effect on the quality of water in the river (especially from the adjacent cultivated land), and sewage and communal inflow from the nearby city agglomerations.

The material was sampled every two weeks from March 2000 until March 2001. Five sampling stations were selected. One above the „Łąka” Dam Reservoir, three in the reservoir itself and one below the dam reservoir. Two types of samples: quantitative and qualitative were taken from each sampling station. The quantitative sample was obtained by straining 10 dm³ of water through a plankton net No. 25 with Patalas bathometer and condensed to 0.05 dm³. The samples were then fixed in 4% preservative liquid analysed by standard methods.

Simultaneously, a physical-chemical analysis of the water was performed by the determination of dissolved oxygen, nitrate nitrogen, and phosphate in water. Measurements were also carried out of electrolytic conductivity, pH, temperature, transparency (by means of Secchi's disk) and surface velocity of water in the river (float method).

RESULTS

A total number of 118 rotifers species were observed at all sampling stations, 92 of which occurred in the reservoir, and 102 rotifers species were discovered in the Pszczynka River. The occurrence of *Encentrum mucronatum* Wulf was noted – a species new to Polish fauna, 12 species new to the fauna of the Upper Silesian Region and 15 species of rotifers rare to Polish fauna.

Due to the flow through the dam reservoir, the quality of water in the river changed: the level of nitrates and phosphates was reduced, as well as the value of electrolytic conductivity of water, whereas the concentration of oxygen dissolved in water and the value of water pH increased (Tab. 1). The river flow through the dam reservoir also contributed to changes among the communities of rotifers occurring in the Pszczynka River. At the sampling station located above the reservoir a great richness of rotifers species was confirmed; here, there occurred as many as 97 rotifer species. As a result of the flow through the reservoir the number of rotifer species decreased to 53. The value of the Shannon-Wiener species biodiversity index also decreased considerably – from the value of 2.68 above the „Łąka” Reservoir to 1.61 below (Fig. 1). In addition, a clear increase in the density of rotifers was observed in the river below the damming-up construction. In the Pszczynka River, above the dam, the mean annual density

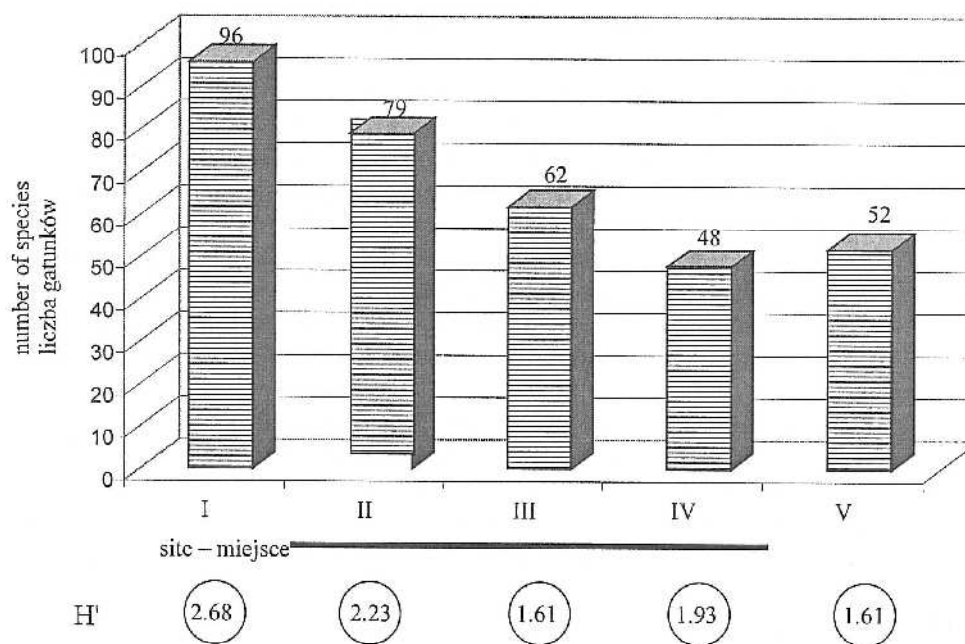


Fig. 1. Number of species of rotifers and Shannon-Wiener diversity index (H')
(black line show stations in the reservoir)

Rys. 1. Liczba gatunków Rotifera oraz wartości współczynnika Shannona-Wienera (H')
(czarną linią zaznaczone stanowiska w zbiorniku)

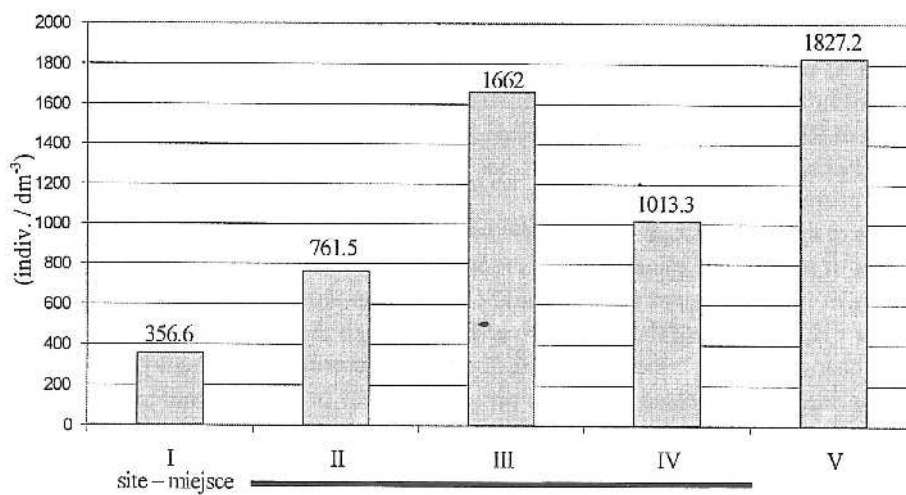


Fig. 2. Mean yearly density of Rotifers in the river and reservoir

Rys. 2. Średnie roczne zagęszczenie Rotifera w rzece i zbiorniku

Table 1. Physical and chemical parameters of the water at examined stations
 Tabela 1. Właściwości fizyczno-chemiczne wody na stanowiskach badań

Parameter Parametry	Stations – Stanowiska				
	I	II	III	IV	V
Temperature (°C) Temperatura	14.37	15.74	15.61	15.73	14.48
pH	7.08	7.17	7.68	8.29	7.36
Oxygen (mg·dm ⁻³) Tlen rozpuszczony	5.96	6.55	8.66	10.01	7.95
PO ₄ ³⁻ (mg·dm ⁻³)	1.04	1.13	0.71	0.53	0.68
NO ₃ ⁻ (mg·dm ⁻³)	29.64	31.14	27.5	31.31	26.69
Conductivity (μS·cm ⁻¹) Przewodnictwo	637.33	562.67	568.67	566	561.33

was 357 individuals · dm⁻³. Large numbers of rotifers in the reservoir resulted in an increase in their density to over 1800 individuals · dm⁻³, as this was the mean density of rotifers at the sampling station situated below the dam (Fig. 2). The flow of the Pszczynka River through „Łąka” also exerted some influence on the seasonal dynamics of the number of rotifers.

DISCUSSION

The flow of the river through the reservoir caused a reduction in the number of rotifers species occurring in this river, according to the results carried by Markič [1983] and Krzeczowska-Wołoszyn [1985].

During the flow of the Pszczynka River through the dam reservoir the composition of rotifers communities in the river was subject to constant reconstruction. The values of Shannon-Wiener index are evidence of the decrease in the rotifers species richness in the Pszczynka River below the „Łąka” Dam Reservoir. Such a regularity was also observed in the Cybina River, as a result of its flow through five subsequent dam reservoirs [Gołdyn 2000].

Reports in literature often present an opposing situation manifested by an increase in the species richness of rotifers due to the river flow through a dam reservoir. Such a regularity was noted mainly in mountain rivers [Kyselowa and Krzeczowska-Wołoszyn 1974] and oligotrophic rivers [Pinel-Alloul *et al.* 1982], in which the number of rotifers species above the reservoir was very low. The Pszczynka River, however, similar to the Brynica River [Krzeczowska-Wołoszyn 1985], is a fertile river and carries with it a large amount of nutrients. The nutritional base for rotifers in the upper course of these rivers is rich, and the number of rotifer species occurring in these rivers is also large.

An increase in the density of rotifers in the river below the damming-up construction is a fact well-documented both in Polish literature [Kowalczewski *et al.* 1985, Krzeczowska-Wołoszyn 1985, Ejsmont-Karabin and Węgleńska 1990], and international literature [Pourriot *et al.* 1997, Akopian *et al.* 1999]. This increase was also clear in the Pszczynka River below the dam.

CONCLUSIONS

The flow of the Pszczyńska River through the dam reservoir resulted in the decrease of the biodiversity of rotifers communities and their reconstruction with respect to the stability of occurrence and structure of domination. An increase was noted in the density of rotifers below the dam. The effect of flow of the Pszczyńska River through the eutrophic reservoir was an increase in the percentage of species which are indicators for such waters.

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WPŁYW ZBIORNIKA ZAPOROWEGO „ŁĄKA” NA ZGRUPOWANIA
PLANKTONOWYCH WROTKÓW (*ROTIFERA*) RZEKI PSZCZYNKI

Streszczenie. Przepływ rzeki przez zbiornik zaporowy przyczynił się do zmiany zgrupowań wrotków planktonowych występujących w Pszczynce. Powyżej zbiornika stwierdzono duże bogactwo gatunkowe *Rotifera* – wystąpiło tutaj aż 97 gatunków wrotków, poniżej zbiornika liczba gatunków spadła do 53. Znacznemu obniżeniu uległa również wartość współczynnika różnorodności gatunkowej Shannona-Wienera – z 2,68 powyżej zbiornika „Łąka” do 1,61 poniżej. Zaobserwowano bardzo wyraźny wzrost zagęszczenia *Rotifera* w rzece poniżej budowli piętrzącej. W Pszczynce powyżej zapory średnie roczne zagęszczenie wynosiło $357 \text{ os.} \cdot \text{dm}^{-3}$. W zbiorniku średnie zagęszczenie wynosiło $1145 \text{ os.} \cdot \text{dm}^{-3}$. Ta duża liczebność wrotków w zbiorniku była przyczyną wzrostu zagęszczenia *Rotifera* do przeszło $1800 \text{ os.} \cdot \text{dm}^{-3}$ poniżej zapory. Skutkiem przepływu Pszczynki przez zeutrofizowany zbiornik było również zwiększenie procentowego udziału gatunków będących wskaźnikami takich wód o przeszło 8% w rzece poniżej zapory oraz przebudowa zgrupowań *Rotifera* pod względem stałości występowania i współczynnika dominacji.

Słowa kluczowe: *Rotifera*, rzeka, zbiornik zaporowy