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BIOCENOTIC CONDITIONS OF SOME LAKE MINNOW HABITATS IN THE POLESIE LUBELSKIE REGION

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Summary. A comprehensive natural survey was carried out in three post-bog reservoirs (Jelino, Sumin, Siedliszcze 1) of Polesie Lubelskie in 2006–2008. The comparative analysis was focused on evaluation of water physical and chemical factors, as well as selected biocenotic elements in those reservoirs (macrophyte, bottom fauna, and zooplankton structure). Values of determined physical and chemical factors in waters of studied post-bogs were quite strongly associated with genetic and ecological type of areas adjacent to the reservoirs. On that basis, they were classified in view of their trophy as follows – Jelino as distrophic, Sumin as slightly eutrophic, Siedliszcze 1 as eutrophic. Moreover, study results revealed that lake minnow found the best habitat conditions in eutrophic Sumin reservoir, while the worst – in dystrophic Jelino. Despite the great natural assets and low threat level, there is a possibility of their disappearance.

Key words: post-bog, reservoir, lake minnow, habitat conditions

INTRODUCTION

Lake minnow (*Eupallasella percnurus*) (Pallas, 1814) is one of the rarest and most endangered fish species from cyprinid (carp or minnow) family (*Cyprinidae*) found in Polish inland waters; it has been under species protection since 1983 [Danilkiewicz 1985], and in 1999 it was considered to be one of the most endangered species in Poland [Witkowski *et al.* 1999], and then registered in the Polish release of IUCN Red List, where it has the status of critically endangered species [Kusznierz 2001].

At the end of 90's of the 20th century, fewer and fewer stands of the species were found in Polesie Lubelskie [Piotrowski 1994, Kusznierz 1995, 1996, Kotusz

and Kusznierz 1999, Danilkiewicz 1997, 2001, Kusznierz *et al.* 2002, Radwan *et al.* 2002, Wolnicki 2005].

The latest survey results from Polesie Lubelskie revealed that the species occurred in 41 water reservoirs among about 200 ones studied [Kolejko *et al.* 2006a, 2006b, Wolnicki *et al.* 2006, Kolejko *et al.* 2007, Sikorska *et al.* 2007, Wolnicki *et al.* 2007, Wolnicki and Kolejko 2008], and indicated a dramatic decrease of swamp minnow stand number in that region. In view of these data, there was a need to perform a complex survey taking into account both biotic and abiotic conditions within the most valuable stands of lake minnow.

STUDY AREA, MATERIAL AND METHODS

A comprehensive biocenotic survey was carried out in 2006–2008 in three post-bog water reservoirs with different biocenotic characters. They were: Jelino, Sumin, and Siedliszcze 1 (Tab. 1).

Table 1. General characteristic of investigation stands

Feature	Stand		
	Jelino	Sumin	Siedliszcze 1
Geographical situation	N 51° 25' 29" E 23° 02' 14"	N 51° 22' 33" E 23° 10' 21"	N 51° 11' 56" E 23° 09' 04"
The number of lakes	8	4	1
Number of reservoirs occupied by *Eupallasella perenurus*	3	3	1
Max. depth (m)	1.4	1.2	1.5
Average depth (m)	0.6	0.7	0.8
Total water surface (ha)	0.8	1	0.3
Origin	peat exploitation		unknown
Ecological succession	advanced	developing	developing
Ecological characteristic of habitat	peat-bog, forest	meadow, arable, peat-bog, forest	meadow, arable
Soil type	to create from the peat and hardly clayish sands		
The dominant type of catchement area using	arable and forest	water meadow, arable	water meadow

Water physical and chemical factors were measured using pH-meter

SP300, conductometer SC3000, oxygen-meter So3000, and photometer LF300 (Slandi).

Floristic survey was made by means of the phyto-sociological method [Braun-Blanquet 1951]. Units were distinguished applying systematic system and Matuszkiewicz's nomenclature [2001]. Qualitative macrophyte samples were taken from along transects selected on the basis of the reservoir floristic map. Two representative transects were designed, in which samples were taken according to Bernatowicz's methodology [1960].

Biocenotic examinations of zooplankton community and bottom fauna included only the principal systematic groups.

The plankton samples of 10 litres each were poured through plankton net No. 25 (55 μ mesh). They were concentrated to constant volume of 100 cm^3 and fixed with Lugol agent as well as 5% formaldehyde solution. Samples prepared in this way were analysed under the reversed microscope and then the results were converted to 1 dm^3 of water.

In order to evaluate the general structure of bottom fauna, bottom sediments were sampled using a tubular corer of 15.2 cm^2 area. Sediments were washed out on a benthos net of 250 μm mesh; a single sample consisted of 5 sediment cores.

RESULTS AND DISCUSSION

Studied post-bog reservoirs were characterised by quite a high variability of water physical and chemical parameters. Significant differences were found for mean values of electrolytic conductivity and water acidity for the whole examination period. Average water electrolytic conductivity was as follows: Jelino – 34 μS cm^{-1}, Sumin – 175 cm μS^{-1}, and Siedliszcze 1 – 469 μS cm^{-1}. Water reaction in Jelino reservoir was acidic 5.1 pH, in Sumin neutral 7.1 pH, and in Siedliszcze 1 alkaline 8.2 pH. Concentrations of mineral nitrogen and phosphorus compounds were low. Only in Siedliszce 1, higher nitrate (autumn) and phosphate concentrations (summer, autumn) were recorded (Tab. 2).

The number of communities occupying the studied complexes of water spots was similar, oscillating from 5 to 7 (Tab. 3). In a majority of the water spots, reed communities dominated. The best developed macrophytes were soaked in the water spot complex of Sumin reservoir, where also charales were present – plants playing the role of pure water indicator. The worst developed plants were soaked into the water spot complex in Jelino reservoir. The level of settlement by soaked plants in any water reservoir is a measure of light conditions. Therefore, potentially, soaked plants that develop in such a type of water reservoirs may be a refuge for settling organisms, including fish. The area occupied by macrophytes in studied complexes as well as their biomass can also prove variable habitat conditions (Tab. 4).

Table 2. Physicochemical paramaters of water

Station Season Parameters	Jelino			Sumin			Siedliszcze 1		
	spring	summer	autumn	spring	summer	autumn	spring	summer	autumn
Temperature °C	16	29	15	17	29	14	18	24	12
Conductivity ($\mu S\ cm^{-1}$)	31	33	39	150	179	196	460	464	482
pH	4.9	5.1	5.4	7	7.2	7.3	8.1	8.2	8
NH_3/NH_4^+ ($mg\ dm^{-1}$)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NO_2^- ($mg\ dm^{-1}$)	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05
NO_3^- ($mg\ dm^{-1}$)	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
PO_4^{-3} ($mg\ dm^{-1}$)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.2	< 0.2

Table. 3. Structure of plant communities in the studied post-bog complexes

Stations Plant communities	Sumin	Jelino	Siedliszcze
Caricetun rostratae Rubel 1926		+	
Caricetum vesicariae BR-BL. Et Denis 1926		+	
Caricetum elatae W.Koch. 1926		+	
Caricetum gracilis (Graebn. Et Hueck 1931)			
Scirpetum lacustris Allorge 1922, Chouard 1924		+	
Typhetul latifoliae Soo 1927	+	+	+
Thelypteridi-Phragmitetum Kuiper 1957	+		
Salicetum pentandro-cinereae (Almq 1929) Pass 1961	+		+
Phragmitetea			+
Sparganietu erecti Roll 1938			
Equisetetum limosi Steffen 1931			+
Charetum aspere	+		
Charetum fragilis	+		
Potametum natantis Soo 1923	+	+	+
Nupharo-Nymphaeetum albae Tomasz 1977	+		
Potentilletum palustris Kłosowski, Tomasz. 1995		+	
Phalaridetum arundinaceae (Koch 1926 nn) Libb 1931			
Total	7	7	5

Zooplankton population structure was poor in all examined reservoirs: it ranged from 112 ind./dm^{-3} in Jelino to 230 ind./dm^{-3} in Siedliszcze 1. In Jelino, *Rotatoria* dominated, while *Cladocera* were characterised by the lowest population. In reservoirs Sumin and Siedliszcze 1, *Cladocera* were distinguished by the highest population, whereas *Copepoda* by the lowest. *Rotatoria* reaching up to 70%, dominated in Jelino, while in Sumin and Siedliszcze 1, *Cladocera* made up about 60% and 50%, respectively (Fig. 1, 2).

Table 4. Percentage share (%) and biomass of particular associations in phytolitoral area

Stations Percentage share, biomass	Sumin	Jelino	Siedliszcze
Average surface of phytolitoral (%)	75.1	7.6	36
Average biomass of emergent macrophytes ($g \circ m^{-2}$)	71.3	44.3	70.6
Average biomass of submerged macrophytes ($g \circ m^{-2}$)	86	27	35

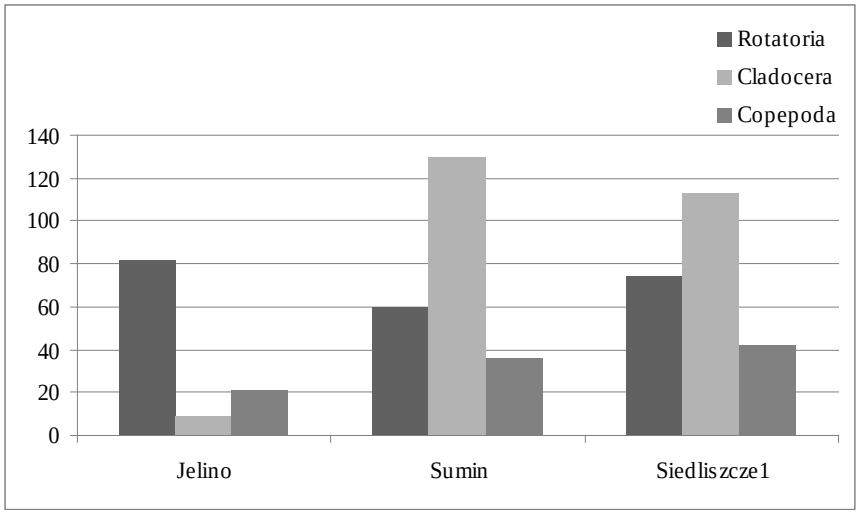

Fig. 1. Mean densites of zooplankton communities

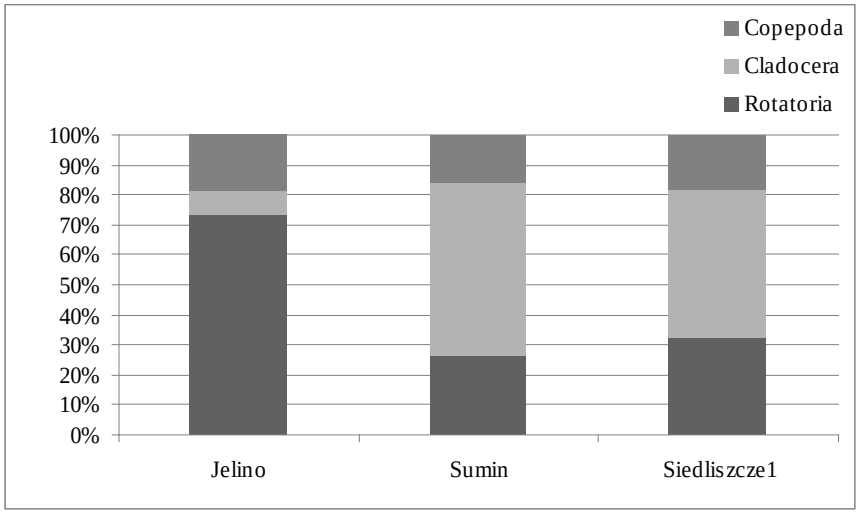

Fig. 2. Mean dominance structure of zooplankton

Density of bottom fauna in the studied reservoirs was quite high, reaching

from about 3200 ind. · dm^{-3} in Jelino to over 4300 ind. · dm^{-3} in Sumin, and 6200 ind. · dm^{-3} in Siedliszcze 1. In all examined reservoirs, *Chironomidae* larva dominated, making up about 80% among all bottom organisms (Fig. 3). Jelino reservoir was characterised by extremely high fauna values.

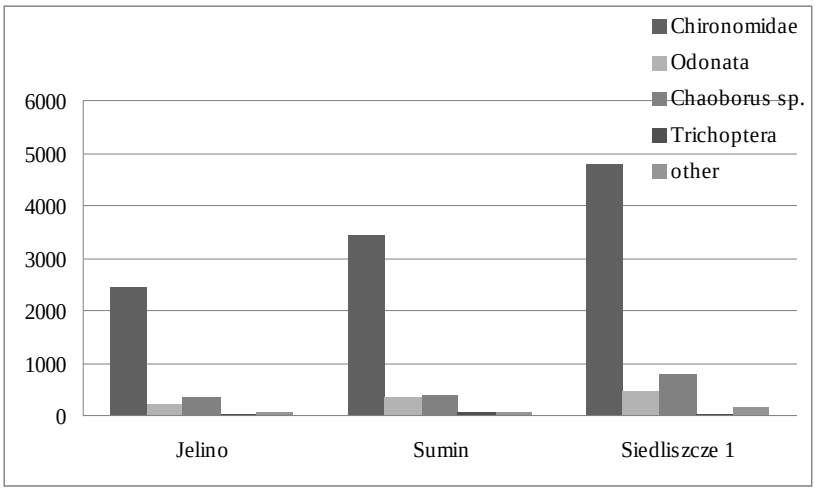

Fig. 3. Mean densities of bottom fauna

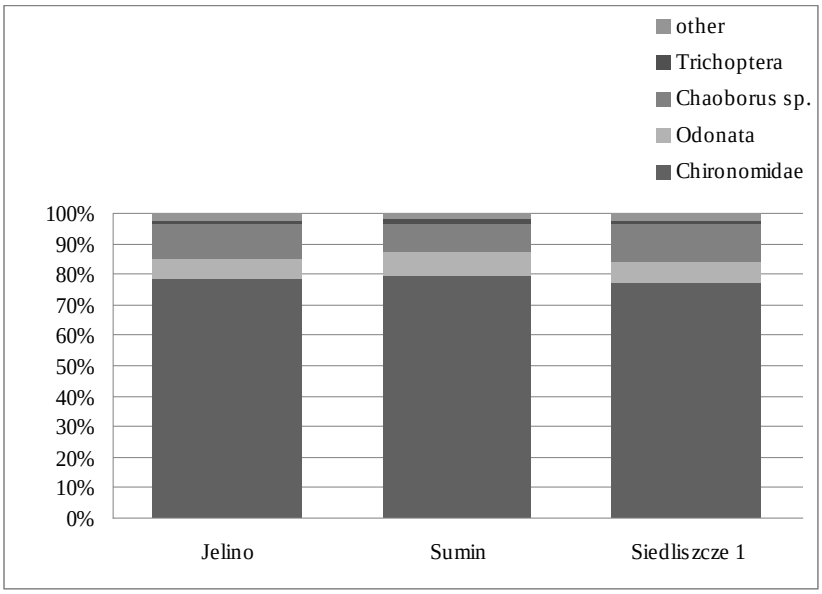

Fig. 4. Mean dominance structure of bottom fauna

CONCLUSIONS

Values of water physical and chemical factors in studied post-bog reservoirs were quite strongly associated with genetic and ecological type of adjacent areas. On that basis, the reservoirs were classified in view of their trophy: Jelino – dystrophic, Sumin – slightly eutrophic, and Siedliszcze 1 – eutrophic.

Those reservoirs created by a man at the end of 19th and the beginning of 20th century, due to peat exploitation, have small areas and are shallow; they are strongly mudded and overgrown by macrophytes, which makes them typical habitat for swamp minnow.

It seems that the most favourable conditions for swamp minnow (macrophytes, bottom fauna, zooplankton) can be found in the eutrophic Sumin, while the least beneficial in the dystrophic Jelino reservoir.

Despite the fact that all examined reservoirs are located near farms and are easily accessible, no symptoms of devastation were found. Maybe the reason is that they are situated near large recreational reservoirs, and thus they are not the point of interest.

Despite their great natural value and low level of threat to the species and habitat, those stands may be exposed to degradation in future.

REFERENCES

Bernatowicz S., 1960. Investigation methods of plant vegetation in lakes (in Polish). Roczn. Nauk. Roln. 77, b, 1, 79–100.

Braun-Blanquet J., 1951. Pflanzenoziologie. Springer Erlang, Wien.

Danilkiewicz Z., 1985. The problem of protection of swamp-minnow *Phoxinus percnurus* (in Polish). Chrońmy Przyrodę Ojczystą, 1, 10–15.

Danilkiewicz Z., 1997. Lampreys and fishes of the River Bug and its tributaries (in Polish). Arch. Ryb. Pol., 5. Supl. 2, 5–82.

Danilkiewicz Z., 2001. Regional species protection of fish, the state of threats and directions of protection (in Polish). Rocz. Nauk. PZW., 14, 157–172.

Kolejko M., Wolnicki J., Radwan S., 2006. Preliminary studies on the occurrence of swamp-minnow *Eupallasella perenurus* (Pallas, 1814) in the aquatic ecosystems of Polesie Lubelskie (Poland). Acta Agrophisica, 1, 395–399.

Kolejko M., Wolnicki J., Sikorska J., Różycki A., 2007. Disappearance of lake minnow *Eupallasella percnurus* (Pallas, 1814) sites in the Poleski Park Narodowy. Teka Kom. Kszt. Środ. Przyr., 4, 87–92.

Kotusz J., Kusznierz J., 1999. The state of ichtyofauna of the River Tarasienka and small water bodies (in Polish) [in:] W. Wojciechowska (ed.) Aquatic and terrestrial ecosystems of Sobiborski Landscape Park and their protection. Wyd. KUL, Lublin, 87–91.

Kusznierz J., 1995. The preliminary estimation of present localities of Polish populations of a swamp-minnow *Moroco* (= *Phoxinus*) *percnurus* (Pall.) (*Cyprynidae*, *Osteichthyes*). Acta Univ. Wratisl. 1744. Prz. Zool. 29, 59–69.

Kusznierz J., 1996. Present state of Polish populations of a swamp-minnow *Moroco* (= *Phoxinus*)

percnurus (Pallas) and perspectives of its protection. Zool. Poloniae, Suppl., 143–146.

Kusznierz J., 2001. Swamp-minnow *Eupallasella perenurus* (Pallas, 1814) [in:] Polish Red Book of Animals (in Polish) [in:] Red Data Book of Animals (red. Z. Głowaciński). PWRiL, Warszawa, 301–303.

Kusznierz J., Kamiński R., Myszkowski L., Wolnicki J., 2002. Swamp-minnow *Eupallasella perenurus* (Pallas) – history, threats and perspectives of protection (in Polish). Kom Ryb., 2, 11–13.

Matuszkiewicz W., 2001. Guide for marking of Polish plant communities (in Polish). Wyd. Nauk. PWN, Warszawa, 537.

Piotrowski W., 1994. Swamp-minnow *Moroco* (= *Phoxinus*) *percnurus* in Poleski National Park (in Polish). Chrońmy Przyrodę Ojczystą, 5, 91–93.

Radwan S., Kowalik W., Wojciechowska W., Kornijów. R., Sender J., Kolejko M., 2002. Ecosystems of Poleski National Park. Aquatic ecosystems [in:] S. Radwan (ed.) Poleski National Park. The nature monograph. Wyd. Morpol, Lublin, 133–160.

Witkowski A., Błachuta J., Kotusz J., Heese T., 1999. Red List of freshwater ichtyofauna of Poland. Chrońmy Przyrodę Ojczystą, (55), 4, 5–19.

Wolnicki J., Kolejko M., Sikorska J., 2006. Present state of the occurrence of lake minnow *Eupallasella perenurus* (Pallas, 1914) in the Lubelskie Voivodeship (Poland). Teka Kom. Ochr. Środ. Przyr. 3, 250–256.

Wolnicki J., Sikorska J., Kolejko M., Kamiński R., Radtke G., 2007. Newest discoveries of lake minnow *Eupallasella percnurus* (Pallas, 1814) stations in Poland. Teka Kom. Ochr. Kszt. Środ. Przyr., 4, 314–321.

Wolnicki J., Kolejko M., 2008. Status of lake minnow *Eupallasella perenurus* (Pallas, 1814) populations in ecosystems of Polesie Lubelskie and programme of their protection in this region. Wyd. Liber Duo, Lublin, pp. 90.

BIOCENOTYCZNE WARUNKI NIEKTÓRYCH SIEDLISK STRZEBLI BŁOTNEJ W REJONIE POLESIA LUBELSKIEGO

Streszczenie. W latach 2006–2008 przeprowadzono kompleksowe badania przyrodnicze w trzech zbiornikach (Jelino, Sumin, Siedliszcze 1) potorfowych na obszarze Polesia Lubelskiego. Analiza porównawcza skupiła się na ocenie czynników fizycznych i chemicznych wody, jak również wybranych elementów biocenotycznych tych zbiorników (struktura makrofitów, fauny dennej i zooplanktonu). Wartości czynników fizycznych i chemicznych wód badanych torfianek były dość mocno związane z genetycznym i ekologicznym typem obszarów bezpośrednio przylegających do zbiorników. Na tej podstawie sklasyfikowano je pod względem troficznym. I tak, Jelino uznano za zbiornik dystroficzny, Sumin lekko eutroficzny, zaś Siedliszcze 1 eutroficzny. Ponadto wyniki badań wykazały, iż najdogodniejsze warunki siedliskowe strzebla błotna znajduje w eutroficznym zbiorniku Sumin, zaś najmniej korzystne w dystroficznym zbiorniku Jelino. Są to siedliska o dość wysokich walorach przyrodniczych i niskim stopnia zagrożenia, jednak istnieje realna możliwość ich zaniku w niedalekiej przyszłości.

Słowa kluczowe: torfianki, strzebla błotna, warunki siedliskowe