

STRUCTURE OF ICHTHYOFAUNA OF SOME SMALL WATER RESERVOIRS OF POLESIE LUBELSKIE¹

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Summary. Structure of fish communities of five small water reservoirs of Polesie Lubelskie was investigated during the years 2006–2010. Studied reservoirs were inhabited by nine fish species representing five families. Species structure was dominated by roach (Czarny Las N, Jabłoń, Miejskie), German carp (Czarny Las E) as well tench and brown bullhead (Kolonja Dratów). In all the reservoirs German carp dominated in total fish biomass. Moreover, one of the purposes of the study was searching for new stands of swamp minnow. However, the species was not recorded in fish communities of any of the reservoirs, despite the ecological state of reservoirs indicating potential habitat for swamp minnow.

Key words: ichthyofauna, small water reservoir, Polesie Lubelskie

INTRODUCTION

Till the end of the 70s of the 20th century small water reservoirs were at the intersection of hydrobiological research. Only in the 70s, Drwal and Lange [1985] as well Drwal *et al.* [1976] described small water bodies, including post excavation pits, as those with surface area of 1 ha and depth of no more than 3 m.

Such reservoirs are anthropogenic, created as a result of excavation of mineral and organic resources. In the area of Polesie Lubelskie, that type of water ecosystems is represented by a large number of peatbog reservoirs [Wolnicki and Kolejko 2008]. The reservoirs show a wide spectrum of ecological characteristic – mid-forest, mid-meadow, mid-peat bog or their combinations [Kolejko *et al.* 2006].

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In areas of intensive land use these reservoirs constitute the only stands of rare and endangered fish species, such as swamp minnow, loach, bitterling [Kolejko and Wolnicki 2006].

Small surface area and depth make the reservoirs vulnerable for disappearance. On the one hand it is the final phase of ecological succession, and on the other the process is accelerated by human activity, such as reclamation of wetlands [Hillbricht-Ilkowska and Pieczyńska 1993, Sugier 2006, Urban 2007, Wolnicki and Kolejko 2008].

The main purpose of the present study was evaluation of the structure of ichthyofauna of some small post-excavation reservoirs of different ecological state.

STUDY AREA

The studies were conducted in five small water reservoirs of Polesie Lubelskie: Czarny Las E, Czarny Las N, Miejskie, Jabłoń and Wagnanka. All the reservoirs are shallow, and their surface area does not exceed 0.5 ha. The reservoirs Czarny Las E, Czarny Las N and Miejskie were created in the middle of the last century, their age is estimated at 60 to 80 years. The remaining two reservoirs – Jabłoń and Kolonia Dratów – were formed about 10 years ago (Tab. 1).

Table 1. Limnological and morphometric parameters and mean values of selected abiotic factors of investigated reservoirs

Reservoir	Geographical situation	Study site type	Surface area, ha	Depth, m	Age	Mean temp., °C	Mean pH	Mean conductivity, $\mu\text{S cm}^{-1}$
Czarny Las E	N 51° 23' 31" E 23° 04' 36"	mid-forest, mid-peat bog	0.4	1.5	80	12.5	8.2	340
Czarny Las N	N 51° 23' 29" E 23° 03' 54"	mid-meadow	0.1	1	60	13.3	8.5	467
Miejskie	N 51° 30' 25" E 23° 52' 26"	mid-peat bog	0.2	1.5		14.3	7.7	350
Jabłoń	N 51° 71' 84" E 23° 09' 13"	mid-meadow	0.2	2	10	14.2	7.9	575
Kolonia Dratów	N 51° 22' 46" E 22° 56' 12"	mid-meadow	0.2	1.5	7	13.9	6.8	224

MATERIAL AND METHODS

Faunistic and ecological structure of ichthyofauna were investigated in two seasons, spring and autumn, during the years 2006–2010. Fish were collected by means of power generator type Samus 750 and a modified trap with one catching cage (frame size 30 × 70 cm, mesh size 0.5 × 05 cm) with bait inside. Collected

fish were identified to species level according to the ichthyobiological key [Brylińska 2000]. Density and biomass of the fish were calculated per one hour of catching.

RESULTS

Physical and chemical water parameters

Mean water temperature in spring and autumn showed small differences in the studied reservoirs and ranged from 12.6 to 14.2°C. Mean values of pH were typical for slightly alkaline (Miejskie, Jabłoń) or alkaline waters (Czarny Las E, Czarny Las N). Only the newly formed reservoir Kolonia Dratów showed slightly acid pH = 6.8. Conductivity in most of the studied reservoirs, excluding Kolonia Dratów (224 $\mu\text{S cm}^{-1}$), was high and indicated high degree of mineralisation of organic compounds (Tab. 1).

Species structure of ichthyofauna

In the studied reservoirs nine fish species were noted, representing five families: *Cyprinidae* (5 species), *Percidae* (1 species), *Ictaluridae* (1 species), *Esocidae* (1 species) and *Cobitidae* (1 species). In the structure of collected fish one protected species was present (loach), and two alien species (carp and German carp) (Tab. 2).

Table 2. Species structure of ichthyofauna of investigated reservoirs

Species \ Reservoir	Czarny Las E	Czarny Las N	Jabłoń	Miejskie	Kolonia Dratów
<i>Esox lucius</i> L.			+		+
<i>Cyprinus carpio</i> L.			+		+
<i>Carassius carassius</i> (L.)	+			+	+
<i>Carassius auratus gibelio</i> (Bloch)	+	+	+	+	+
<i>Tinca tinca</i> (L.)	+	+	+	+	+
<i>Rutilus rutilus</i> (L.)		+	+	+	
<i>Ictalurus nebulosus</i> (Le Sueur)			+	+	+
<i>Misgurnus fossilis</i> (L.)			+		
<i>Perca fluviatilis</i> L.			+	+	+
Number of species in the reservoir	1	3	8	6	7
Total number of species	9				

The studied reservoirs differed in terms of species diversity of ichthyofauna. The lowest values of the index of species diversity were noted in reservoirs Czarny Las N and Czarny Las E; the highest in reservoirs Miejskie, Jabłoń and Kolonia Dratów. During the first year of the study in reservoirs Czarny Las and Kolonia Dratów only one fish species was observed (Fig. 1).

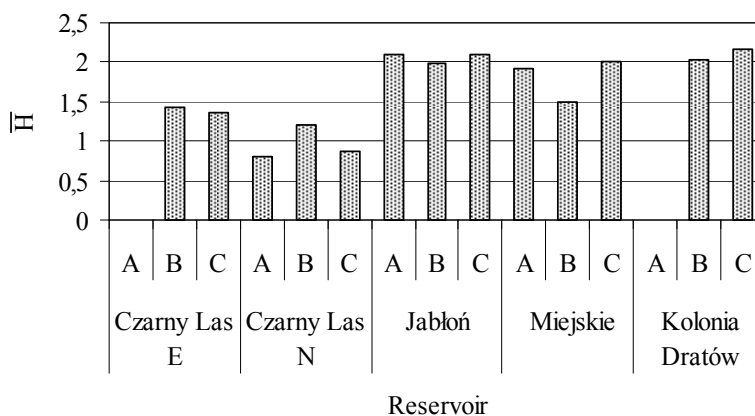


Fig. 1. Values of Shannon-Wiener index of investigated reservoirs: A – 2006, B – 2008, C – 2010

Domination structure

The domination structure of ichthyofauna of the studied reservoirs showed visible differences. In reservoir Czarny Las E in both studied seasons there dominated German carp with a high share of common carp. In reservoirs Czarny Las N, Jabłoń and Miejskie the most numerous was roach, with a high percentage of German carp. Also, in reservoir Jabłoń a high share of brown bullhead and perch was noted, and in reservoir Miejskie – common carp. In reservoir Kolonia Dratów during the first year of the study tench was the dominant species, and in next year – brown bullhead and German carp, while common carp and perch showed much lower abundances (Fig. 2).

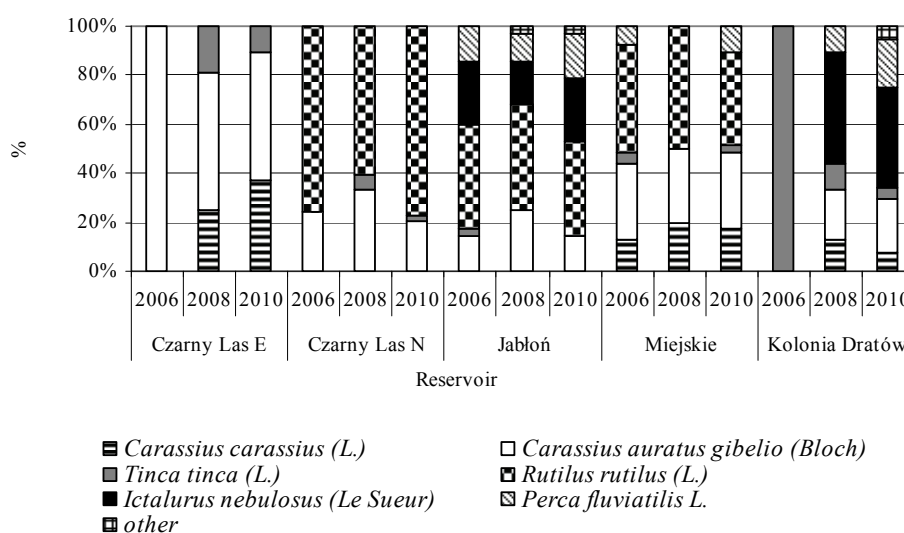


Fig. 2. Abundance structure of fish in investigated reservoirs

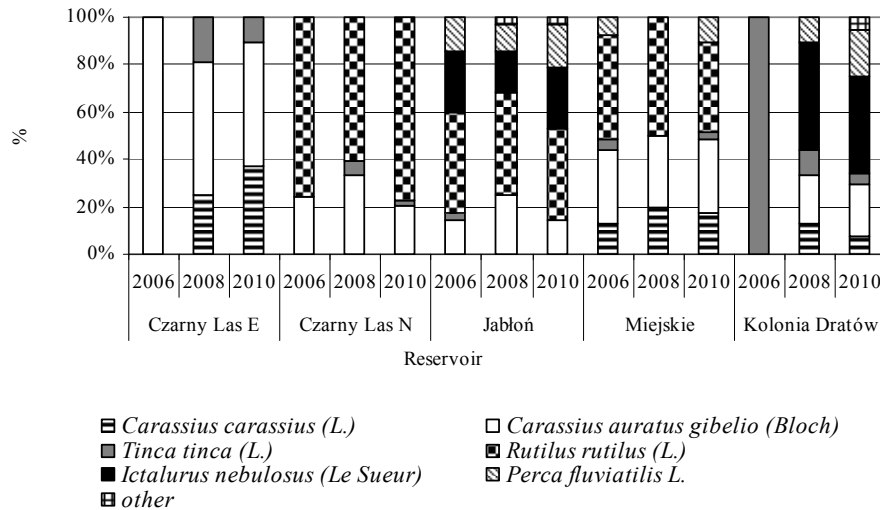


Fig. 3. Biomass structure of fish of investigated reservoirs

Contribution of individual fish species in total fish biomass

The domination structure of total fish biomass differed from the density structure. In most of the studied reservoirs German carp dominated, its share ranging from 40% in reservoir Jabłoń up to 80% in reservoir Miejskie. Also, in reservoir Jabłoń about 40% of total fish biomass was constituted by pike, and in reservoir Kolonia Dratów about 30% was accounted for by carp (Fig. 3).

DISCUSSION

In the area of Polesie Lubelskie the structure of ichthyofauna of small water bodies is affected by ecological state, succession phase and fish management [Kolejko and Bojar 2010]. The results of the present studies showed the highest values of species diversity index in the newly created reservoirs Kolonia Dratów and Jabłoń – reservoirs with different intensity of fish management. Only in those reservoirs carp and pike were present as an evidence of deliberate restocking. During the first year of the study in reservoir Kolonia Dratów only tench was observed, but in the next year the reservoir was intensively stocked and the number of fish species increased to seven. In both reservoirs brown bullhead had a high share in the domination structure. The species is still commonly introduced to most of the water ecosystems of Polesie Lubelskie [Kolejko 1998, Kornijów *et al.* 2003]. Brown bullhead is present even in poor, dystrophic and difficult to access peat pools in the catchment area of Lake Zagłębcze [Kolejko *et al.* 2006].

The high value of species diversity of fish in reservoir Miejskie probably resulted from periodical water supply from Lake Miejskie, which enhances fish migration. In Lake Miejskie, similarly to the adjacent reservoir, the fish community was dominated by roach [Rechulicz 2008]. In the lake there is a numerous presence of brown bullhead, but in the reservoir only single specimens were noted.

The lowest species diversity of fish was observed in reservoirs Czarny Las E and N. These are typical reservoirs at the final phase of ecological succession, shallow and densely overgrown. In the area of Polesie Lubelskie, due to natural or anthropogenic reasons, a vast majority of artificial water bodies created at the beginning and the first half of the 20th century are not in existence any longer [Wolnicki and Kolejko 2008].

The domination structure of fish community differed visibly in the studied reservoirs. The group of dominants was constituted by four species: roach (Czarny Las N, Jabłoń, Miejskie), German carp (Czarny Las E), tench and brown bullhead (Kolonia Dratów). However, the highest share in total fish biomass was reached by German carp. Habitat conditions in the studied reservoirs seem to be optimal for the species and it can constitute a serious competitor for domestic populations of tench and common carp in water ecosystems of Polesie Lubelskie [Radwan *et al.* 1987, 1992, 2002, Kolejko 2006].

Protected species were represented by loach in reservoir Jabłoń. The reservoir is periodically supplied from an adjacent drainage ditch; during spring thaws that species probably migrates between the habitats. The ecological conditions of the studied reservoirs are optimal for swamp minnow, but it was not observed in any of the reservoirs. Until the end of the 70s of the last century swamp minnow was present in most post excavation reservoirs in the area of Polesie Lubelskie. However, large scale reclamations led to the draining of swamps and peatbog areas [Chmielewski and Sielewicz 1996] and to the disappearance of most stands of this species [Danilkiewicz 1973].

CONCLUSIONS

The studied reservoirs were inhabited by nine fish species, representing five families: *Cyprinidae* (5 species), *Percidae* (1 species), *Ictaluridae* (1 species), *Esocidae* (1 species) and *Cobitidae* (1 species). Among observed species one protected species was noted – loach, and two alien species – carp and German carp.

The highest species diversity of fish was noted in intensively stocked, newly created reservoirs; the lowest values of diversity index were obtained for reservoirs at final succession phase, shallow and densely overgrown.

The domination structure of fish communities of the studied reservoirs showed visible differences, dependent on the reservoir there dominated roach (Czarny Las N, Jabłoń, Miejskie), German carp (Czarny Las E) as well tench and brown bullhead (Kolonia Dratów).

In total fish biomass German carp dominated, which indicates that habitat conditions in all studied reservoirs are optimal for that species.

Swamp minnow was not present in any of the reservoirs, although the ecological state of the studied reservoirs suggests their potential role as a habitat for that species.

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STRUKTURA ICHTIOFAUNY W WYBRANYCH MAŁYCH ZBIORNIKACH POWYROBISKOWYCH POLESIA LUBELSKIEGO

Streszczenie. Małe zbiorniki wodne Polesia Lubelskiego w większości są pochodzenia antropogenicznego, powstałych w wyniku eksploatacji surowców organicznych i mineralnych. Są one bardzo zróżnicowane ekologicznie, bowiem mogą mieć charakter: śródpolny, śródłukowy, śródleśny, śródtorowiskowy, bądź będący ich kombinacją. Badania struktury faunistycznej ichtiofauny przeprowadzono w latach 2006–2010 w sezonie wiosennym i jesiennym w 5 małych zbiornikach. W wyniku przeprowadzonych badań stwierdzono łącznie 9 gatunków ryb, należących do 5 rodzin. Różnorodność gatunkowa ichtiofauny w badanych zbiornikach była dość zróżnicowana. Największe wartości wskaźnika różnorodności gatunkowej miały zbiorniki nowo powstałe i użytkowane rybacko, najmniejsze zaś zbiorniki w końcowym stadium sukcesji ekologicznej wypłycone i silnie zarośnięte. Struktura dominacji badanych zbiorników była bardzo zróżnicowana, dominowały płóc (Czarny Las N, Jabłoń, Miejskie), karaś srebrzysty (Czarny Las E), a także lin i sumik karłowaty (Kolonja Dratów). Z kolei w ogólnej masie ryb we wszystkich zbiornikach dominował karaś srebrzysty co świadczy, iż gatunek ten znajduje bardzo dobre warunki siedliskowe we wszystkich zbiornikach, niezależnie od ich charakteru ekologicznego. W zespole ichtiofauny nie stwierdzono strzebli błotnej, mimo iż charakter ekologiczny tychże zbiorników potencjalnie mógłby być jej siedliskiem.

Słowa kluczowe: ichtiofauna, małe zbiorniki wodne, Polesie Lubelskie