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OCCURRENCE OF FISH IN SHALLOW LITTORAL AND OPEN WATER ZONE OF LAKE SKOMIELNO

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Summary. Studies were conducted during the years 2007–2008 in the shallow lake Skomielno in the Łęczyńsko-Włodawskie Lake District. The aim of the study was to determine the composition of fish community and occurrence of particular fish species in the zones of shallow littoral and open water. Control fishing was made using multimesh gillnet. In general the lake was inhabited by 18 fish species, 10 species were noted in shallow littoral, 15 species in open water zone. In comparison to the shallow littoral, the pelagic zone was characterised by a higher number of fish and about three times higher fish biomass. The domination structure of fish density and biomass differed significantly between studied zones. In the density structure, rudd, bitterling and roach dominated in the shallow littoral, while in open water zone – roach, perch and ruffe. In the domination structure of fish biomass in shallow littoral there co-dominated six species: crucian carp, pike, roach, brown bullhead and rudd. In the second investigated zone, the highest percentage in the structure of biomass was reached by perch, Prussian carp and rudd. The zone of the lake influenced the share of predatory fish. At the depth of 0.5 m predatory species amounted to 8.4% in the density structure and 20.7% in the biomass structure. Whereas, at the depth of 2.5 m piscivorous fish constituted 25.1% in the total number of fish and over 46% in their total biomass.

Key words: zonal distribution of fish, special angling site, shallow littoral, middle lake

INTRODUCTION

Littoral is the most important zone of a lake, indispensable for normal functioning of the whole ecosystem. Due to the high specificity of habitats, littoral is a place inhabited by different ecological formations, as well as rare species of plants and animals, creating a place of fish spawning and refugee for the fry [Hillbricht-Ilkowska and Pieczyńska 1993, Pieczyńska 1994, Naiman and Decamps 1997]. In lakes with extensive and spatially diverse shallow littoral, the zone creates a living place (usually periodic) for many fish species. Taking into

consideration that water volume in the littoral zone is not large in relation to the whole lake, generally accepted methods of fish research cause that data on shallow littoral ichthyofauna are very scare.

The aim of the present study was to compare the density and biomass structure of fish communities in the shallow littoral and the open water zone of shallow eutrophic Lake Skomielno.

STUDY AREA, MATERIAL AND METHODS

The studies were conducted in three seasons (spring, summer and autumn) during the years 2007–2008 in two zones of Lake Skomielno. The control catches were performed using Norden S multimesh gillnet (10, 60, 30, 6,25, 43, 22, 50, 33, 12,5, 25, 8, 38, 75, 16,5 mm).

Lake Skomielno is a reservoir with surface area of 75 ha and maximum depth of 6.5 m, created on the basis of a natural lake. The reservoir is supplied by water from the Wieprz-Krzna Channel. According to the fishing classification the studied ecosystem represents the tench-pike type and is used as a special angling site [Radwan and Kornijów 1998]. Due to artificial increasing of the lake area, the shallow part of the reservoir is abundant in rush and submerged vegetation. For the effective use of the littoral area for cultivation purposes, among dense stands of rush vegetation gulfs and channels have been cut. Such an activity caused an increase of littoral complexity and possibility for fish penetration of the shallowest parts of the reservoir.

Two zones of the lake were chosen for control fishing: shallow littoral (depth 0.5 m) and unvegetated open water zone (depth from 2.5 to 3 m). Shallow littoral is densely infested by emergent, floating leaved and submerged macrophytes, dominated by *Typha angustifolia, Potamogeton natans, Numphar lutea, Ceratophyllum demersum* and *Myriophyllum spicatum*.

RESULTS AND DISCUSSION

In general, Lake Skomielno was inhabited by 18 fish species, 10 species were noted in shallow littoral, 15 species in open water zone. Among all collected species pikeperch, ruffe, catfish, bream, Prussian carp, white bream and asp appeared only in the zone of open water.

The highest numbers of fish (from 3 to 57 ind. · 12 h^{-1} · the net^{-1}, mean 18 ind. · 12 h^{-1} · the net^{-1}) were caught in the open water zone (Fig. 1). A lower numbers of fish (mean 12 ind. · 12 h^{-1} · the net^{-1}) were obtained at the depth of 0.5 m. Significantly higher differences ($F = 2.649$, $p = 0.0087$, $N = 1528$) were observed in the general biomass of collected fish. Several times higher biomass was noted for fish from the open water zone – 1194g · 12 h^{-1} · the net^{-1} than in the shallow littoral.

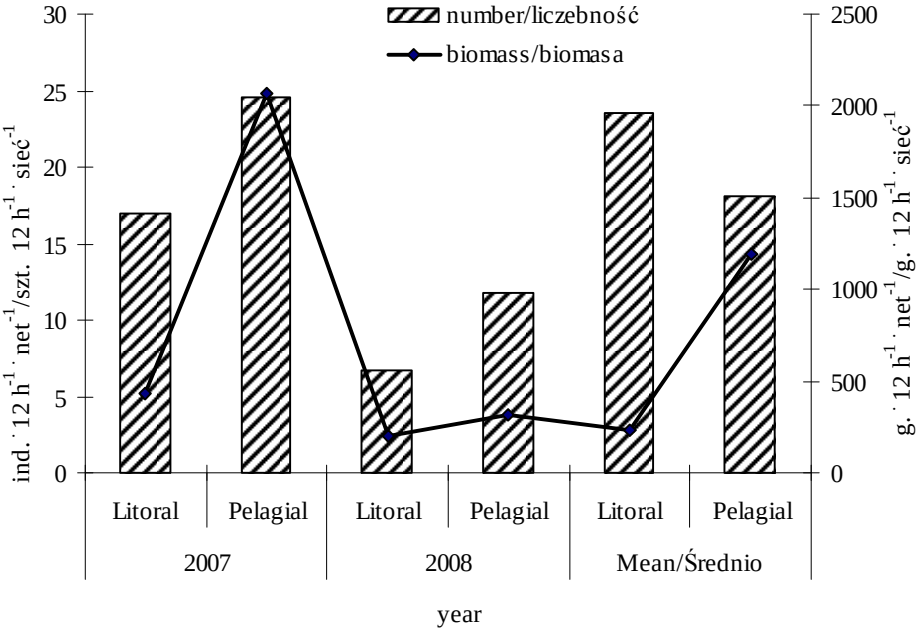

Fig. 1. Numbers and biomasses of fish (ind. and g · 12 h^{-1} · net^{-1}) in shallow littoral and pelagic zone in Lake Skomielno

In dependence on the zone of the lake, differences in the structure of the domination of the fish number and biomasses were obtained. In shallow littoral in the structure of the numbers there dominated rudd (about 41%), bitterling (22.6%) and roach (11.9), whereas in open water zone – roach (38.11%), perch (24.3%) and ruffe (10.5%).

In littoral zone in the structure of the biomass there was co-domination of six species: tench, crucian carp, pike, roach, brown bullhead and rudd. The other investigated zone was dominated by the perch, Prussian carp and rudd, and their participation in biomass of all caught fish was nearly 68% (Fig. 2).

The total body lengths and the biomass of piscivorous fish – perch and pike, and also the total length of the bitterling and the roach did not differ for fish from both lake zones, while the mean total body lengths of rudd, bleak and brown bullhead were statistically higher in the open water zone (Tab. 1).

Most of the fish species in the pelagic zone had higher values of biomass, only roach showed higher mean biomass in the littoral zone ($p = 0.00025$, $F = 32.08$, $N = 525$) – Tab. 1.

The zone of the lake affected the share of piscivorous fish. At the depth 0.5m their participation in the structure of the number amounted to 8.4%, and in the biomass to 20.7%. In the open water (depth of 2.5 m) predatory fish constituted 25.1% of the total number of fish and over 46% of their biomass.

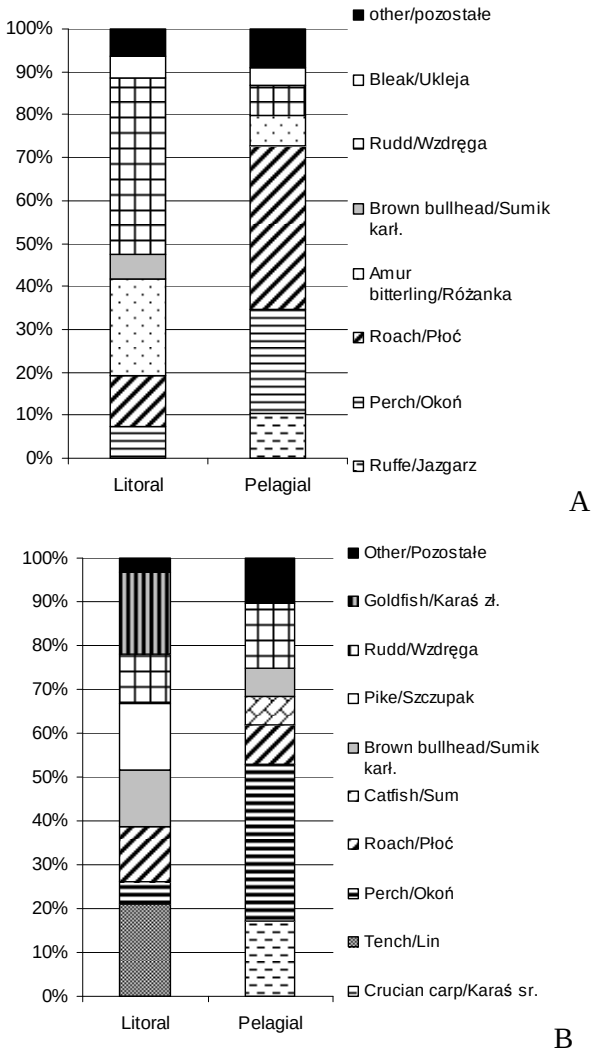

Fig. 2. Structure of numbers (A) and biomass (B) of fish from shallow littoral and pelagic zone in Skomielno Lake

The obtained results showed distinct separateness of fish community in the shallow zone in comparison to the middle part of the lake. The slightly higher amounts of fish in the zone of open water were mostly related to the small water volume in the shallow littoral. Consequently, the food base is poorer (consisting mainly of zooplankton). Only during the spawning period and early juvenile stages the density of fish can be higher. Fishing, however, are not performed during such periods, and the youngest fry is not caught by the nets used in present study.

Table 1. Total length (in cm) and body biomass (in g) of selected species from littoral and pelagial zone in Skomielno Lake

Species	N	Total length (cm)				Body mass (g)			
		Littoral	Pelagial	F	p	Littoral	Pelagial	F	p
		$\bar{x}$ ±SD	$\bar{x}$ ±SD			$\bar{x}$ ±SD	$\bar{x}$ ±SD		
Perch	322	11,31 ±2,78	14,43 ±7,04	6,44	0,049	20,10 ±19,04	67,19 ±106,10	31,05	0,048
Pike	11	37,00 ±9,16	36,09 ±11,80	1,66	0,907	384,33 ±238,16	316,24 ±195,03	1,491	0,636
Roach	525	10,03 ±4,42	10,01 ±2,56	2,98	0,964	$24,44^{A}$ ±67,88	$10,83^{B}$ ±11,98	32,08	0,00025
Amur bitterling	149	6,16 ±1,25	6,03 ±0,65	3,68	0,417	$2,97^{A}$ ±1,36	$2,41^{B}$ ±0,86	2,52	0,0028
Break	74	$6,47^{B}$ ±2,45	$10,38^{A}$ ±2,41	1,039	0,00005	$3,23^{B}$ ±1,86	$8,51^{A}$ ±4,34	5,44	0,00018
Rudd	204	$8,20^{B}$ ±2,37	$16,87^{A}$ ±6,56	7,56	0,00001	$7,45^{B}$ ±11,73	$13,38^{A}$ ±107,15	83,50	0,00001
Brown bullhead	58	$16,99^{B}$ ±2,76	$19,70^{A}$ ±3,64	1,73	0,0137	$63,78^{B}$ ±31,28	$108,31^{A}$ ±60,65	3,76	0,0113

Means with different letters – significant differences ($p < 0.05$)

Considerably more typical is the differentiation in biomass and total body length of the fish in both studied zones. The shallowest parts of the lake are typical habitat for fry and small fish, only a few species of higher size classes (e.g. predatory or typical littoral fish) appear in such shallow water [Pieczyńska (ed.) 1976, Johansson and Persson 1986]. The pike is supposed to treat the shallows as a preying place and most of the population stays at the edge of the littoral or the deeper water (depending on the season of the year).

Visible preferences of juvenile forms for the shallows were displayed by the rudd, bleak, and brown bullhead. This is of crucial importance in the case of the rudd, being the main dominant in the density structure in the shallow littoral.

In the case of biomass structure, considerably larger size classes typical for the littoral such as the tench, the crucian carp, and the pike outnumbered the rudd. Such distinct differences in the structure of domination and size classes of the fish communities between the two studied zones of the lake confirm high diversity of the zones. Domination of species other than roach and perch proves good structure of fish community and considerable habitat complexity of the lake [Pieczyńska 1994, Horppila *et al*. 2000, Okunand and Mehner 2005, Kahl and Radke 2006].

CONCLUSIONS

1. In total 18 fish species were collected in Lake Skomielno – 10 species in shallow littoral and 15 species in open water zone. A little higher numbers of fish were caught in the pelagic zone; much bigger differences were observed in the total biomass of the caught fish. It proves the preferences of larger fish for deeper zones of the lake.

2. The typical species for the shallow littoral was small rudd which dominated together with the roach and bitterling. In the zone of open water there dominated roach, perch and ruffe. In the biomass structure, shallow littoral was dominated by typical species for the zone tench, crucian carp, pike and roach; the middle lake was inhabited mostly by perch, Prussian carp and rudd.

3. The mean total body lengths of rudd, bleak and brown bullhead were significantly higher in the open water zone. Such observations, together with the high abundances of these fish species, prove the preference of juvenile fish for inhabiting the shallowest parts of the lake.

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WYSTĘPOWANIE RYB W STREFIE PŁYTKIEGO LITORALU I OTWARTEJ WODY JEZIORA SKOMIELNO

Streszczenie. Badania przeprowadzono w latach 2007–2008 w płytkim jeziorze Skomielno na Pojezierzu Łęczyńsko-Włodawskim. Celem pracy było ustalenie składu gatunkowego ryb i ich występowania w strefie płytkiego litoralu i w strefie wody otwartej. Odłowy kontrolne wykonano przy użyciu sieci typu wonton multimesh gillnet. Ogółem w jeziorze stwierdzono występowanie 18 gatunków ryb, z czego 10 gatunków w płytkim litoralu, a 15 w strefie otwartej wody. W tej strefie również zanotowano nieco większą liczebność ryb niż w płytkim litoralu oraz trzy razy większą ich biomasę. Wyraźne różnice stwierdzono także w strukturze dominacji liczebności i biomasy. W strukturze liczebności w litoralu dominowały wzdręga, różanka i płoć, natomiast w strefie otwartej wody płoć, okoń i jazgarz. W strukturze biomasy w litoralu zanotowano współdominację sześciu gatunków: lina, karasia pospolitego, szczupaka, płoci, sumika karłowatego i wzdręgi. W drugiej badanej strefie dominowały okoń, karaś srebrzysty i wzdręga. Strefa jeziora wpłynęła na zróżnicowany udział gatunków drapieżnych ryb. Na głębokości 0,5 m ich udział w strukturze liczebności wynosił 8,4%, a w biomasie 20,7%. Natomiast na głębokości 2,5 m drapieżniki stanowiły 25,1% ogólnej liczebności ryb i ponad 46% w ich ogólnej biomasie.

Słowa kluczowe: zróżnicowanie strefowe ichtiofauny, łowisko specjalne, płytki litoral, śródjezierze