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UNIONIDAE OF SZESZUPA RIVER AND OF THE LAKES ALONG ITS COURSE IN SUWALSKI LANDSCAPE PARK*

ABSTRACT: The occurrence of Unionidae in Szeszupa River and in five associated lakes in the Suwalski Landscape Park was investigated. Species composition, numbers, biomass, size and age structure as well as growth of the river- and lake-derived individuals were analysed.

KEY WORDS: river, lakes, Unionidae.

1. INTRODUCTION

There is relatively scarce information about the occurrence of bivalves of the family Unionidae in the Suwałki district. Publications of a faunistic character afford rather fragmentary data (e.g. Poliński 1917, 1922, Berger 1960). More detailed studies of the ecology of Unionidae have been performed for Masurian lakes (Widuto and Kompowski 1968, Lewandowski and Stańczykowska 1975), Leszczyńskie Lakeland (Kasprzak 1985), Goczałkowice dam reservoir (Krzyżanek 1976) and Grabia River (Piechocki 1969).

As concerns foreign geographic regions, there are relatively many papers dealing with the occurrence and ecology of Unionidae. They involve Unionidae of rivers (e.g. Björk 1962, Petrov 1964, Negus 1966, Nardi 1972), lakes (Økland 1963, Magnin and Stańczykowska 1971, Burla 1972, and others) as well as of other environments (e.g. Wolff 1968, Tudorancea 1972). In these papers stress is usually laid on the very great biomass

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attained by Unionidae in various environments and on their role in the matter turnover processes.

The aim of the present study was an analysis of the occurrence of Unionidae in the Szeszupa River and in the lakes along its course.

2. AREA AND METHODS

Szeszupa River is a left-bank tributary of Niemen River. The upper fragment of Szeszupa River (24 km) is situated in Poland, in the Suwalskie Lakeland; further on the river flows in the north-western direction and crosses the Lithuanian frontier.

Studies of Unionidae were performed in Szeszupa River and in five lakes situated in the Suwalski Landscape Park (Fig. 1). In total, ca. 10 km of the river course were investigated. Bathymetric data of the investigated lakes are recorded in Table 1.

Bivalves were collected in river current in August 1984, and in the lakes in August 1985. From the river bottom the animals were taken manually from a 0.25 m^2

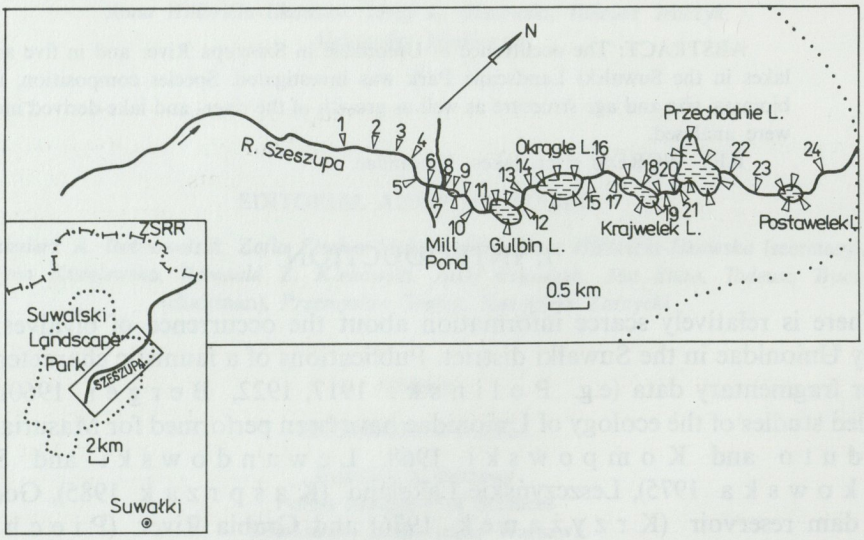

Fig. 1. Upper fragment of Szeszupa River, situated in the Suwalski Landscape Park. Distribution of sampling stations

Table 1. Bathymetric data of the investigated lakes

Lake	Surface area (ha)	Maximal depth (m)
Gulbin	9	8.0
Okrągłe	15	6.5
Krajwelek	10	6.0
Przechodnie	22	5.0
Postawelek	3	4.0

surface delimited by a frame. At each sampling station the frame was at random thrown down to the bottom from 2 to 10 times, in dependence on the numbers of Unionidae. In the lakes a bottom dredge dragged behind a boat along a definite fragment of the bottom was used for obtainment of estimative quantitative data. A similar method for collection of big bivalves has been applied by various authors (e.g. Stańczykowska 1964, Widuto and Kompowski 1968, Lewandowski and Stańczykowska 1975). In each lake samples were collected at 3–6 sampling stations, in dependence on its size (Fig. 1). At each sampling station samples were usually taken every 1 m of depth from an 1–m depth to the disappearance of Unionidae, using the above-mentioned bottom dredge. Apart from the lakes, study was made also in a small mill-pond situated between the Kamenduł Lake outflow and Gulbin Lake (located highest in the Szeszupa River system). At the laboratory the collected bivalves were measured and weighed in wet and dry state.

3. RESULTS

3.1. OCCURRENCE OF UNIONIDAE IN SZESZUPA RIVER

Along the whole investigated fragment, Szeszupa River is very diversified, with changes in its breadth and depth, kind of bottom and current rapidity; it happens to display a more "mountainous" character below fragments with slow flow and a muddy bottom. This diversity of the river was paralleled by very great variation of the density, biomass and species composition of Unionidae (Table 2, Fig. 2).

In the upper, spring fragment of the river, at a breadth smaller than 2 m, no Unionidae were present (sampling stations 1–5). At these stations river depth was between 0.2–0.4 m, the current was rapid and the bottom was sandy or gravelly.

First Unionidae were found below the outflow from Uzdziejek Lake, at river breadth of 3–4 m. At sampling station 6 there occurred only the species *Anodonta piscinalis* Nilsson, with very low density of 0.4 indiv. $\cdot$ m^{-2}. Above this station empty shells of species *Unio crassus* Philipsson were found. At the subsequent two sampling stations above the mill-pond, *Unio crassus* displayed fairly high numbers (20–36 indiv. $\cdot$ m^{-2}) and biomass up to 900 g $\cdot$ m^{-2}. Between the mill-pond and Gulbin Lake (sampling stations 9–11) maximal densities were up to 32 indiv. $\cdot$ m^{-2}. *Unio crassus* was most frequent, at station 10 attaining in some places the density of 32 indiv. $\cdot$ m^{-2} and wet biomass (with shells) of ca. 640 g $\cdot$ m^{-2}. *Anodonta piscinalis* was more frequent than at the former stations (up to 12 indiv. $\cdot$ m^{-2}). Moreover, there appeared *Anodonta* (*Pseudanodonta*) *complanata* Rossmässler (sampling station 10; 1 indiv. $\cdot$ m^{-2}). Here the breadth of the river was 4 m, its depth was up to 0.5 m, the current weakened from rapid at station 9 to moderate at station 11; the bottom was sandy-gravelly. Along the fragment between Gulbin and Okrągłe lakes (sampling stations 12–14) Szeszupa River displayed a greater breadth (6–8 m) and depth (0.6 m); the current was moderate and the bottom was sandy-muddy and even muddy. Under these conditions Unionidae attained very high densities

Table 2. Mean numbers and biomass of Unionidae at sampling stations in Szeszupa River

Sampling station	Numbers (indiv. · m^{-2})	Biomass with shells		Dry biomass without shells (g · m^{-2})	Shells (g · m^{-2})
		wet (g · m^{-2})	dry (g · m^{-2})		
1–5	0	–	–	–	–
6	0.4	1.7	0.6	0.1	0.5
7	20.0	632.0	445.0	22.0	423.6
8	36.0	899.6	639.6	35.2	604.4
9	0	–	–	–	–
10	17.0	334.9	230.1	14.3	215.8
11	6.4	96.5	63.7	3.7	60.0
12	200.0	5057.6	2987.2	272.4	2714.8
13	116.0	2456.4	1481.6	126.5	1355.1
14	2.0	26.2	15.9	1.8	14.1
15	308.0	7016.4	4709.6	358.8	4250.8
16	4.0	126.8	83.6	6.2	77.4
17	80.0	1092.6	629.5	68.7	560.8
18	344.0	6390.0	3902.4	322.0	3580.4
19	62.0	888.4	519.6	52.4	467.2
20	118.0	1813.2	1003.6	113.4	890.2
21	16.0	264.8	119.6	19.2	100.4
22	28.0	760.2	436.4	37.6	398.8
23	8.0	130.4	74.8	8.0	66.8
24	292.0	7112.4	4360.0	642.4	3717.6

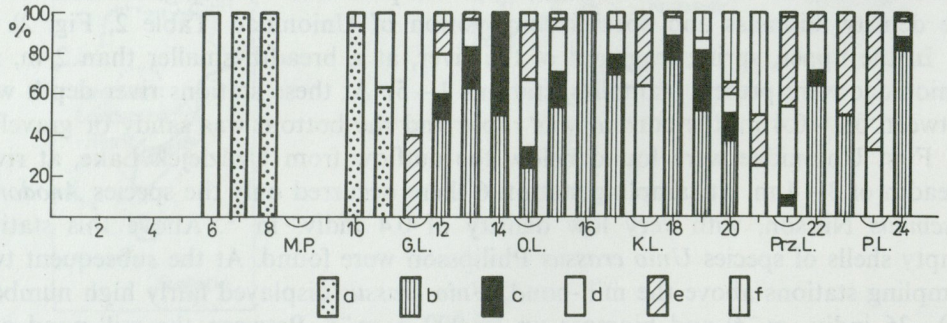

Fig. 2. Species composition of Unionidae at sampling stations in Szeszupa River (see Fig. 1) and associated lakes

a – *Unio crassus*, b – *U. tumidus*, c – *U. pictorum*, d – *Anodonta piscinalis*, e – *A. cygnea*, f – *A.* (*Pseudanodonta*) *complanata*, MP – Mill pond, GL – Gulbin Lake, OL – Okrągłe Lake, KL – Krajwelek Lake, PrzL – Przechodnie Lake, PL – Postawelek Lake

(100–200 indiv. · m^{-2}) and biomass exceeding 5 kg · m^{-2} (Table 2). Only at sampling station 14, with the bottom covered with remnants of shells, the densities were much lower. Along this fragment five Unionidae species occurred: *Unio tumidus* Philipsson (most abundant species), *U. pictorum* L., *Anodonta piscinalis*, *A. cygnea* L. and *A.* (*Pseudanodonta*) *complanata*. There was no *U. crassus*. At sampling station 15 (after Okrągłe Lake), species composition was identical as at stations 12–14 and the

density was very high (over 300 indiv. $\cdot m^{-2}$). Wet biomass with shells exceeded 7 kg $\cdot m^{-2}$. At this site Unionidae often burrowed themselves into the sandy bottom to a 20-cm depth. At the subsequent sampling station (16) with a gravelly bottom, only *U. tumidus* was present, with densities lower than 10 indiv. $\cdot m^{-2}$. Somewhat further, at station 17 with sandy bottom Unionidae density attained in some places 140 indiv. $\cdot m^{-2}$. As compared with sampling stations 14 and 15, at station 17 *A. cygnea* disappeared and *U. crassus* reappeared with low densities (up to 4 indiv. $\cdot m^{-2}$). Along the fragment between Krajwelek and Przechodnie Lakes, the course of Szeszupa River slows down. Its breadth fluctuated between 6–10 m, and maximal depth gradually increased from 0.5 to 1.0 m. The initially sandy-muddy bottom changed to a muddy one. In this fragment (stations 18–21) Unionidae densities were high, amounting up to 350 indiv. $\cdot m^{-2}$. In this fragment only *U. crassus* was absent. *Unio spp.* was dominant in the upper part of this fragment, and *Anodonta sp.* – in its lower part. Between Przechodnie and Postawelek Lakes (sampling stations 22, 23) the current was slow and muddy, and Unionidae densities were relatively low, not exceeding 40 indiv. $\cdot m^{-2}$. Four species were present: *U. tumidus*, *U. pictorum*, *A. piscinalis*, *A. cygnea*. The breath of Szeszupa River was 6–8 m and maximal depth – 1 m. Along the terminal investigated fragment from Postawelek Lake to the boundary of the Suwalski Landscape Park, Szeszupa River once again changed, getting shallow (0.4 m) and broad (8–10 m); the bottom was sandy-gravelly, and the current was again rapid. There occurred 6 species (including *U. crassus*), in total attaining nearly 300 indiv. $\cdot m^{-2}$.

3.2. OCCURRENCE OF UNIONIDAE IN LAKES

Along the Szeszupa River course, a small mill-pond is the highest situated reservoir. In this shallow (1 m) muddy reservoir whose bottom was covered with tree branches, no bivalves of the family Unionidae occurred. Above this reservoir, in the Szeszupa River current 2 species of Unionidae were present, with dominance of *U. crassus*, being typical of rivers.

In the lower situated Gulbin Lake, Unionidae occurred in the zone 1–3 m in depth, their numbers being greatest at a 2–m depth. The biomass was maximal at a 3–m depth (Table 3); in this zone mean numbers were 3 indiv. $\cdot m^{-2}$. Only 2 species of the genus *Anodonta* (*A. piscinalis* and *A. cygnea*) were present.

In Okrągłe Lake, Unionidae appeared in the zone 1–3 m in depth, with relatively high densities. At the sites more shallow than 1 m, densely growing reeds limited the occurrence of Unionidae. At only one site reeds did not grow at the shore (wide beach), and Unionidae were also present at a 0.5–m depth in numbers of 28 indiv. $\cdot m^{-2}$ (Table 3). At a 2–m depth, mean density was high (15 indiv. $\cdot m^{-2}$). At this depth, maximal densities were up to 40 indiv. $\cdot m^{-2}$ (wet biomass with shells was 759.3 g $\cdot m^{-2}$, dry biomass with shells – 336.9 g $\cdot m^{-2}$, dry biomass without shells – 63.3 g $\cdot m^{-2}$). In the remaining lakes dealt with in this study, the biomass was lower. Within the whole zone of occurrence of Unionidae in Okrągłe Lake, their mean numbers were 12 indiv. $\cdot m^{-2}$. Five species were found: three of the genus *Anodonta* (*A. piscinalis*, *A. cygnea*, *A.* (*Pseudanodonta*) *complanata*) and two of the

Table 3. Mean numbers and biomass of Unionidae at different depths of the investigated water bodies

Water body	Depth (m)	Numbers (indiv. · m^{-2})	Biomass with shells		Dry biomass without shells (g · m^{-2})	Shells (g · m^{-2})
			wet (g · m^{-2})	dry (g · m^{-2})		
Mill pond	1.0	0	–	–	–	–
Gulbin Lake	1.0	1.5	35.5	13.0	3.3	9.8
	2.0	6.0	46.5	18.0	4.5	13.5
	3.0	3.0	95.7	42.7	4.3	38.4
	4.0	0	–	–	–	–
Okrągłe Lake	0.5*	28.0	398.1	227.4	23.4	204.0
	1.0	10.5	64.0	37.1	4.6	32.5
	2.0	15.0	230.8	100.8	18.7	82.1
	3.0	8.4	69.0	30.1	5.3	24.8
	4.0	0	–	–	–	–
Krajwelek Lake	1.0	12.0	164.7	74.5	11.4	63.1
	2.0	15.0	121.2	52.4	6.9	45.5
	3.0	5.2	90.7	35.1	4.8	30.3
	4.0	0	–	–	–	–
Przechodnie Lake	1.0	3.0	31.5	12.0	2.1	9.9
	2.0	22.2	288.8	124.5	19.7	104.8
	3.0	5.0	69.7	29.2	5.5	23.7
	4.0	0	–	–	–	–
Postawelek Lake	1.0	0	–	–	–	–
	2.0	3.0	35.4	13.8	2.5	11.3
	3.0	1.5	26.7	13.3	1.6	11.7
	4.0	0	–	–	–	–

*One sampling station.

genus *Unio* (*U. tumidus, U. pictorum*). *U. tumidus* was dominant in the lake, accounting for 33.4% of Unionidae; its numbers were highest at shallow sites.
In the next, downstream situated Krajwelek Lake, Unionidae occurred in the zone 1–3 m in depth and their mean numbers were 7 indiv. · m^{-2}; these numbers were highest (15 indiv. · m^{-2}) at a 2–m depth. Similarly as in Gulbin Lake, two species of the genus *Anodonta* were present.
Also in Przechodnie Lake, Unionidae occurred in the zone 1–3 m in depth, in mean numbers of 13 indiv. · m^{-2}. The density was highest at 2–m depth; mean density exceeded 22 indiv. · m^{-2} and maximal density was 48 indiv. · m^{-2}). In the case of maximal density, wet biomass with shells amounted to 608.5 g · m^{-2}. In this lake five species identical with those found in Okrągłe Lake were present. *A. cygnea* and *A. piscinalis* were dominant, each of these species accounting for 44% of all Unionidae. The remaining three species were found only sporadically.
In the last small Postawelek Lake, Unionidae occurred only in the zone 2–3 m in depth, in mean numbers of 2 indiv. · m^{-2}. In this lake *A. piscinalis* and *A. cygnea* were present. *A. cygnea* was dominant, representing 67% of Unionidae.

3.3. ANALYSIS OF THE DIFFERENT SPECIES

3.3.1. *Unio crassus*

This species occurred exclusively in the river, under conditions of rapid current and sandy-gravelly bottom. Such conditions prevailed above Gulbin Lake (sampling stations 7, 8, 10, 11), above Krajwelek Lake (station 17) and below Postawelek

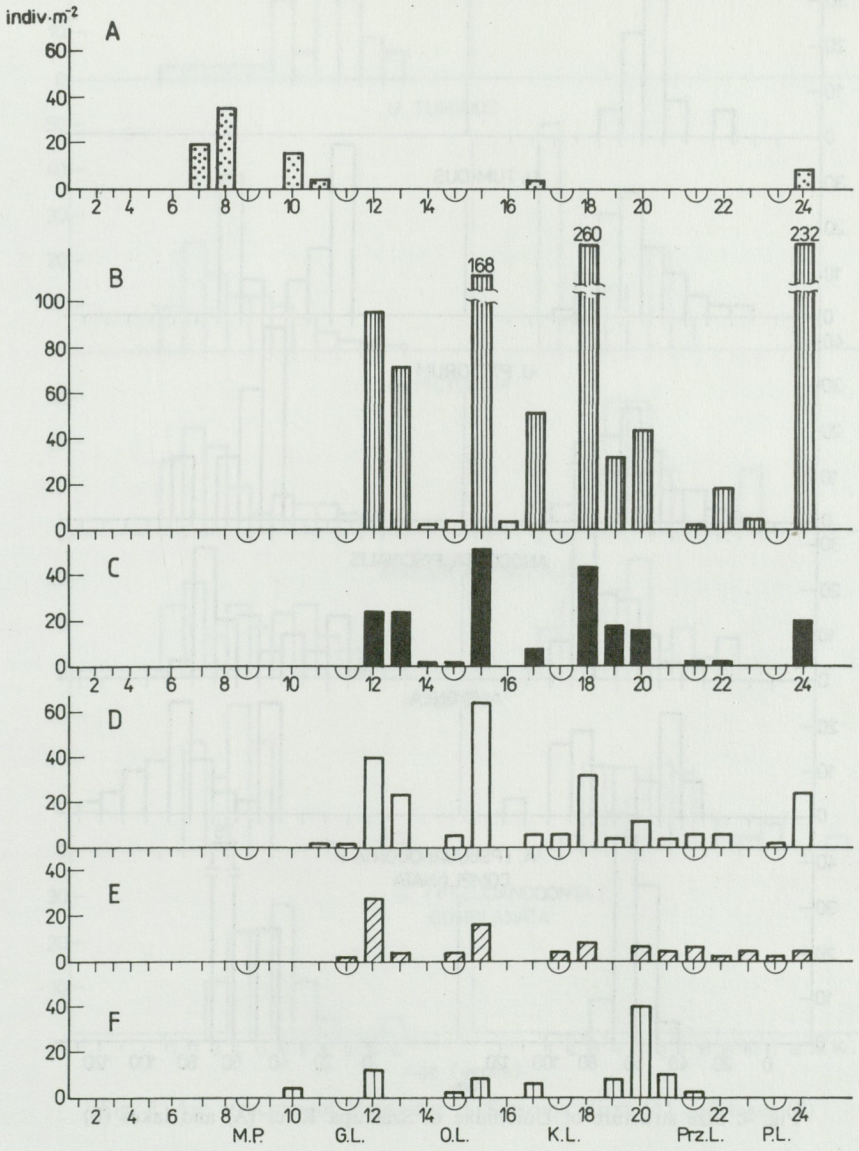

Fig. 3. Numbers of Unionidae at sampling stations in Szeszupa River (see Fig. 1) and associated lakes A — *Unio crassus*, B — *U. tumidus*, C — *U. pictorum*, D — *Anodonta piscinalis*, E — *A. cygnea*, F — *A.* (*Pseudanodonta*) *complanata*, MP — Mill pond, GL — Gulbin Lake, OL — Okrągłe Lake, KL — Krajwelek Lake, PrzL — Przechodnie Lake, PL — Postawelek Lake

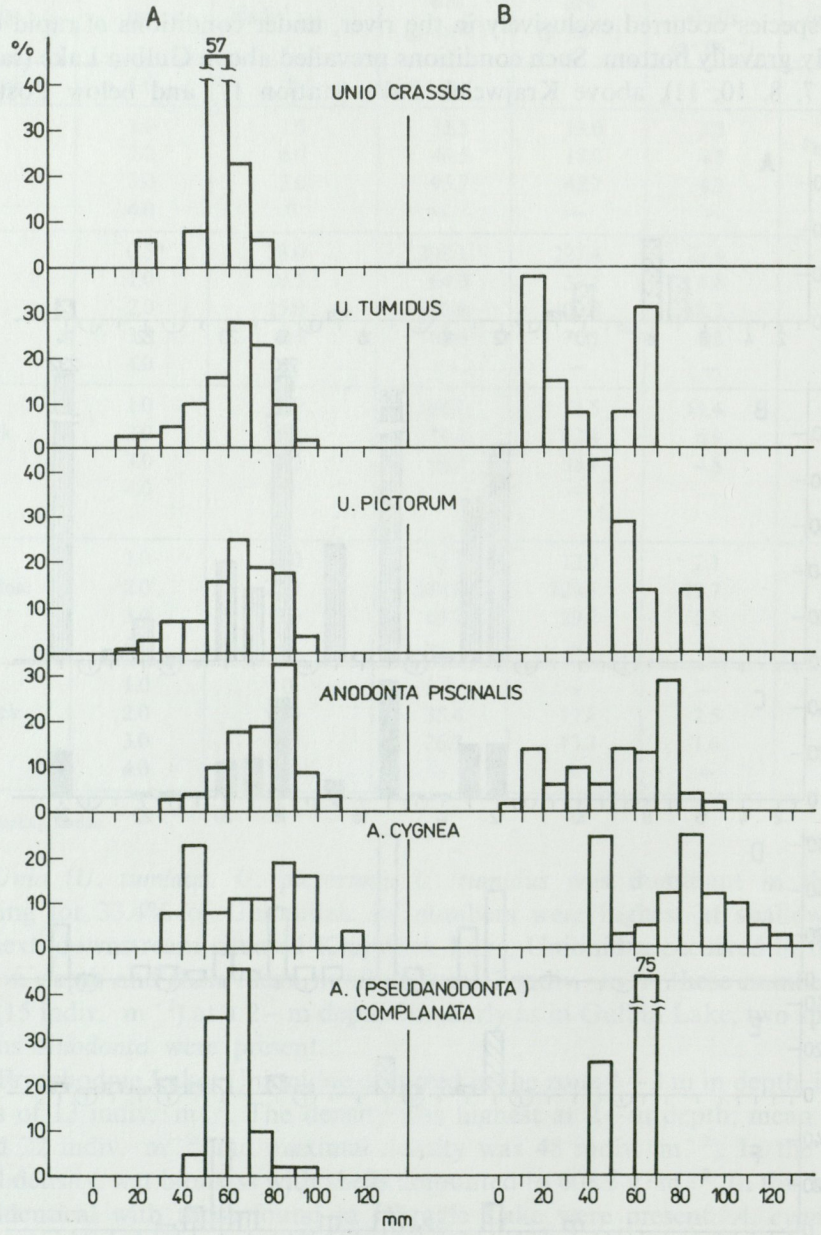

Fig. 4. Size structure of Unionidae in Szeszupa River (A) and lakes (B)

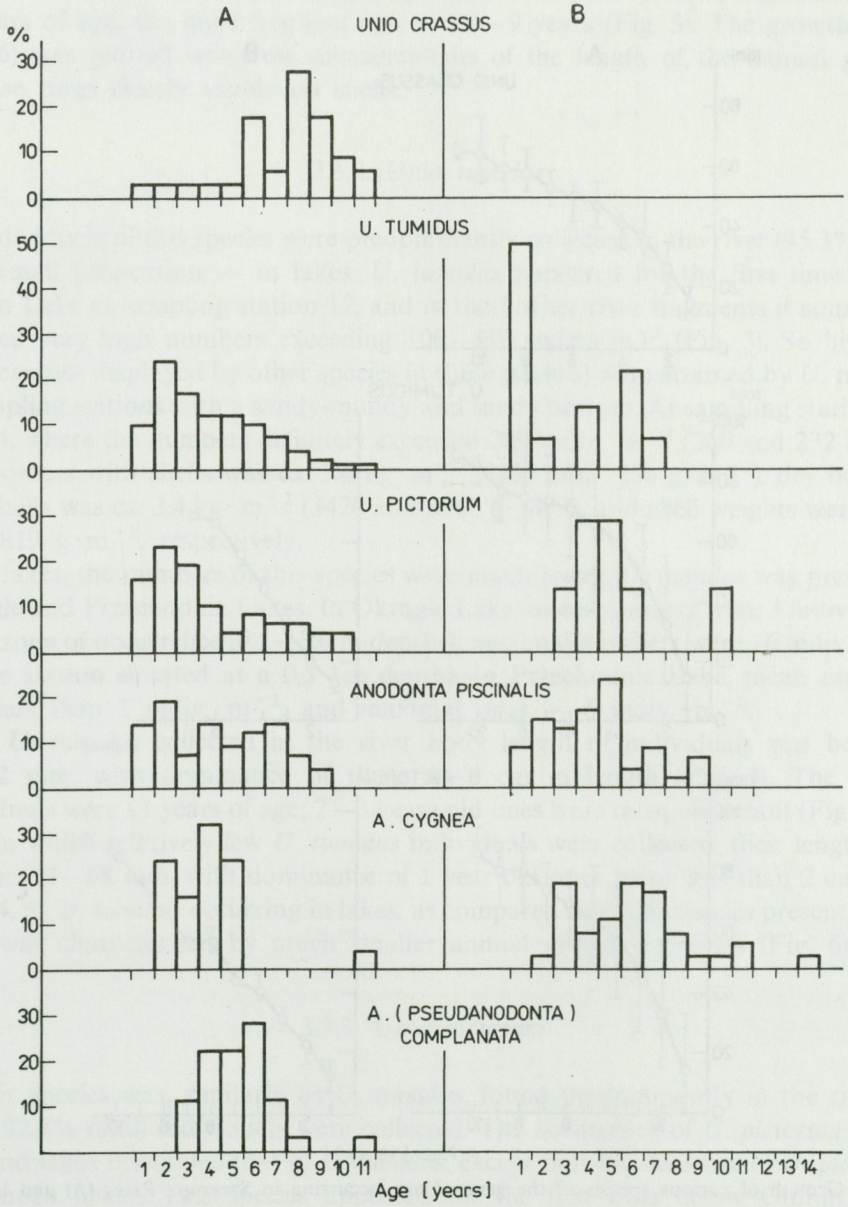

Fig. 5. Age structure of Unionidae in Szeszupa River (A) and lakes (B)

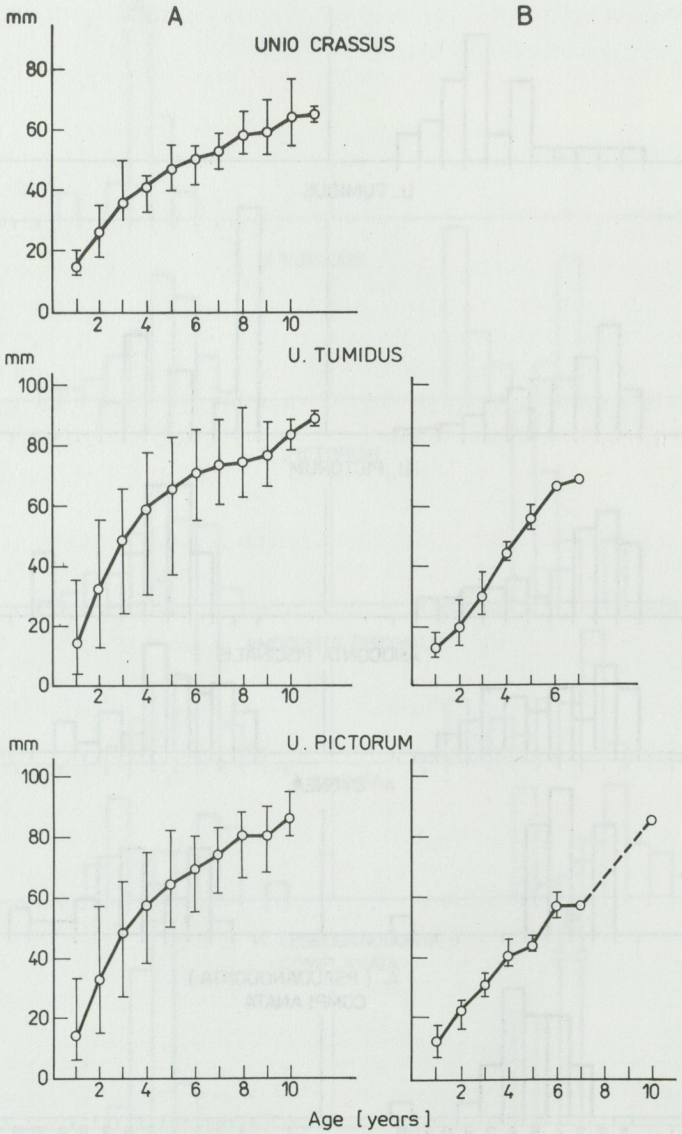

Fig. 6. Growth of various species of the genus *Unio*, occurring in Szeszupa River (A) and lakes (B)

Lake (station 24). *Unio crassus* attained no high numbers; the highest ones were found in the upper part of the investigated river fragment (maximal density was 36 indiv. $\cdot m^{-2}$) (Fig. 3). The length of individuals was between 26–77 mm, with dominance of 5–6 cm long bivalves (Fig. 4). The oldest *U. crassus* individuals were 11 years of age, the most frequent age was 6–9 years (Fig. 5). The growth curve (Fig. 6) was plotted using the measurements of the length of the annual growth increase rings clearly visible on shells.

3.3.2. *Unio tumidus*

Individuals of this species were predominantly collected in the river (95.3%), and their small proportion – in lakes. *U. tumidus* appeared for the first time below Gulbin Lake at sampling station 12, and in the further river fragments it sometimes attained very high numbers exceeding 100–200 indiv. $\cdot m^{-2}$ (Fig. 3). So high the numbers (not displayed by other species in these studies) were attained by *U. tumidus* at sampling stations with a sandy-muddy and sandy bottom. At sampling stations 18 and 24, where the numbers definitely exceeded 200 indiv. $\cdot m^{-2}$ (260 and 232 indiv.), wet biomass with shells was ca. 5.4 kg $\cdot m^{-2}$ (5432 and 5396 g $\cdot m^{-2}$), dry biomass with shells was ca. 3.4 kg $\cdot m^{-2}$ (3420 and 3362 g $\cdot m^{-2}$), and shell weights were 3163 and 2819 g $\cdot m^{-2}$, respectively.

In lakes, the numbers of this species were much lower. *U. tumidus* was present in Okrągłe and Przechodnie Lakes. In Okrągłe Lake, mean numbers were 3 indiv. $\cdot m^{-2}$ in the zone of occurrence (0.5–3.0 m depths); maximal numbers were 16 indiv. $\cdot m^{-2}$ (at one station situated at a 0.5–m depth). In Przechodnie Lake, mean numbers were less than 1 indiv. $\cdot m^{-2}$, and maximal ones – 6 indiv. $\cdot m^{-2}$.

In *U. tumidus* collected in the river body length of individuals was between 10–92 mm, with dominance of those 6–8 cm in length (Fig. 4). The oldest individuals were 11 years of age; 2–3 years old ones were most abundant (Fig. 5). In lakes in which relatively few *U. tumidus* individuals were collected, their length was between 14–68 mm, with dominance of 1 year old ones being less than 2 cm long (Figs. 4, 5). *U. tumidus* occurring in lakes, as compared with this species present in the river, was characterized by much smaller annual growth increases (Fig. 6).

3.3.3. *Unio pictorum*

This species was, similarly as *U. tumidus*, found predominantly in the river in which 92.9% of all individuals were collected. The occurrence of *U. pictorum* in the river and lakes resembled that of *U. tumidus*, except that the densities of *U. pictorum* were much lower. This species appeared for the first time below Gulbin Lake (sampling station 12); its density was highest (52 indiv. $\cdot m^{-2}$) at station 15 (Fig. 3). *U. pictorum* was present in two lakes: Okrągłe and Przechodnie; in its occurrence zone mean densities were ca. 1 indiv. $\cdot m^{-2}$, whereas maximal density amounted in Okrągłe and Przechodnie Lakes to 6 and 3 indiv. $\cdot m^{-2}$, respectively. In the river,

body length of *U. pictorum* was between 13–95 mm; large individuals were dominant (Fig. 4). The oldest individuals were 10 years of age; relatively young individuals were most common (Fig. 5). In lakes, *U. pictorum* individuals were 42–85 mm long and 3–10 years old (Figs. 4 and 5). Individuals collected in the river, as compared with those derived from lakes, were characterized by better growth (Fig. 6).

3.3.4. *Anodonta piscinalis*

Anodonta piscinalis was the most common species of the family Unionidae in the investigated region. It occurred in all lakes, and was the first species to appear in the upper fragment of the river. The percentage of individuals collected in the river and lake was 55 and 45%, respectively. In the river this species was most abundant at sampling station 15 where it attained 64 indiv. $\cdot m^{-2}$ (wet biomass with shells was 2600 $g \cdot m^{-2}$, dry biomass with shells – 1454 $g \cdot m^{-2}$, shell weight – 1307 $g \cdot m^{-2}$). In the occurrence zones in the lakes, mean numbers of *A. piscinalis* amounted to several individuals per 1 m^2 (Fig. 3); locally, at a 2–m depth they attained ca. 20 indiv. $\cdot m^{-2}$ (Okrągłe and Przechodnie Lakes). In the river, body length of *A. piscinalis* was between 34–107 mm, with dominance of 60–90 mm long individuals (Fig. 4). In the river, the oldest individuals were 9 years of age; both – young (1–2 years) and middle-aged (4–7 years) individuals occurred frequently (Fig. 5). In lakes, *A. piscinalis* individuals were smaller (9–90 mm). The oldest were also 9 years of age. The size (Fig. 4) and age structures (Fig. 5) were relatively equalized in the river and lakes. Growth of this species in the river and lakes is compared in Figure 7.

3.3.5. *Anodonta cygnea*

This species occurred in greatest numbers in lakes where 60.6% of individuals were collected. It was present in all lakes with mean densities of several individuals per 1 m^2 in the occurrence zone (Fig. 3). *A. cygnea* was most abundant in Przechodnie Lake where locally at a 2–m depth it attained 27 indiv. $\cdot m^{-2}$. In the river, this species appeared below Gulbin Lake (sampling station 12) and occurred with relatively low densities. In the river, the densities were highest in the regions of Szeszupa River outflow lakes (stations 12, 15, 18). Wet biomass with shells was greatest (655.2 $g \cdot m^{-2}$) at station 12, with density of 28 indiv. $\cdot m^{-2}$ (dry biomass with shells was 324.4 $g \cdot m^{-2}$, shell weight – 280.8 $g \cdot m^{-2}$). Body length was between 37–112 mm. Individuals 40–49 mm and 80–89 mm long were most abundant (Fig. 4). There was dominance of 4 years old individuals (Fig. 5). In lakes, body length of this species was between 40–125 mm. Size structure resembled that found for the river animals (Fig. 4). Individuals aged 3 and 6 years were dominant; the oldest were 14 years of age (Fig. 5). Individuals collected in the river, as compared with those taken in lakes, exhibited better growth (Fig. 7).

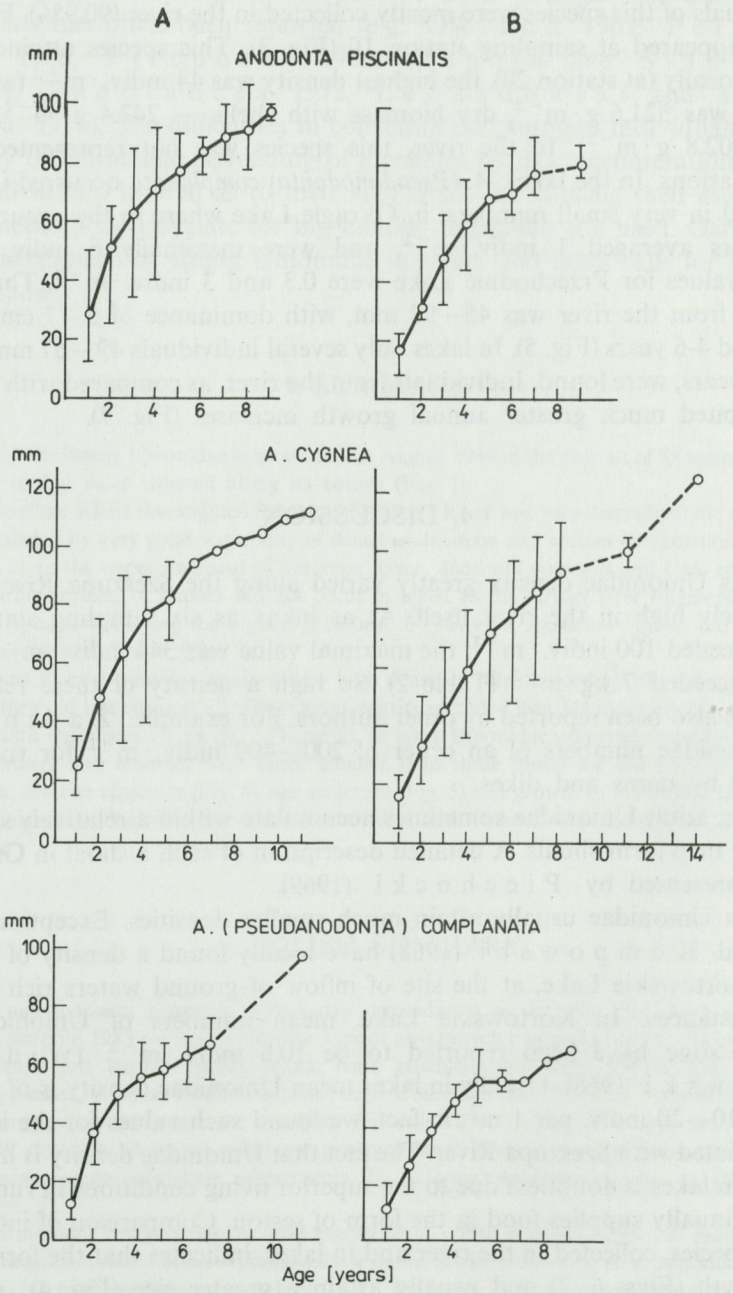

Fig. 7. Growth of various species of the genus *Anodonta*, occurring in Szeszupa River (A) and lakes (B)

3.3.6. *Anodonta* (*Pseudanodonta*) *complanata*

Individuals of this species were mostly collected in the river (90.9%). For the first time they appeared at sampling station 10 (Fig. 3). This species attained no high numbers. Locally (at station 20), the highest density was 44 indiv. $\cdot m^{-2}$ (wet biomass with shells was 521.6 $g \cdot m^{-2}$, dry biomass with shells — 242.4 $g \cdot m^{-2}$, weight of shells — 202.8 $g \cdot m^{-2}$). In the river, this species was not represented at many sampling stations. In the lakes, *A.* (*Pseudanodonta*) *complanata* occurred in only two of them and in very small numbers: in Okrągłe Lake where in the occurrence zone the numbers averaged 1 indiv. $\cdot m^{-2}$, and were maximally 6 indiv. $\cdot m^{-2}$; the respective values for Przechodnie Lake were 0.3 and 3 indiv. $\cdot m^{-2}$. The length of individuals from the river was 45—98 mm, with dominance of 5—7 cm long ones (Fig. 4), aged 4-6 years (Fig. 5). In lakes only several individuals 49—67 mm in length, aged 3—8 years, were found. Individuals from the river, as compared with those from lakes, exhibited much greater annual growth increases (Fig. 7).

4. DISCUSSION

Whereas Unionidae density greatly varied along the Szeszupa River course, it was relatively high in the river itself. At as many as six sampling stations mean density exceeded 100 indiv. $\cdot m^{-2}$; the maximal value was 344 indiv. $\cdot m^{-2}$. Maximal biomass exceeded 7 $kg \cdot m^{-2}$ (Table 2). So high a density of these relatively big animals has also been reported by other authors. For example, Žadin (1938) has found Unionidae numbers of an order of 200—400 indiv. $\cdot m^{-2}$ for rivers greatly partitioned by dams and dikes.

In rivers, adult Unionidae sometimes accumulate within a relatively small space; in this case they form shoals. A detailed description of such a shoal in Grabia River has been presented by Piechocki (1969).

In lakes Unionidae usually attain much smaller densities. Exceptionally, Widuto and Kompowski (1968) have locally found a density of 256 indiv. $\cdot m^{-2}$ in Kortowskie Lake, at the site of inflow of ground waters rich in alkaline humic substances. In Kortowskie Lake, mean numbers of Unionidae in the occurrence zone have been reported to be 10.6 indiv. $\cdot m^{-2}$ (Widuto and Kompowski 1968). Usually in lakes mean Unionidae density is of an order of several to 10—20 indiv. per 1 m^2; in fact, we found such values for the investigated lakes associated with Szeszupa River. The fact that Unionidae density is higher in the river than in lakes is doubtless due to the superior living conditions in running water which continually supplies food in the form of seston. Comparison of individuals of the same species, collected in the river and in lakes, indicates that the former display better growth (Figs. 6, 7) and usually attain a greater size (Fig. 4).

The picture of age structure, obtained for different species in river and lake environment, is fairly characteristic (Fig. 5). There is usually dominance of middle-aged individuals, with a very slight proportion of the youngest ones. The

dominance of 1 year old individuals among *Unio tumidus* collected in lakes is a rather exceptional fact (Fig. 5). The absence of the younger Unionidae in various environments has often been reported (e.g. Ökland 1963, Petrov 1964, Negus 1966, Piechocki 1969, Magnin and Stańczykowska 1971, Tudorancea 1972, Lewandowski and Stańczykowska 1975). The difficulties in collecting the youngest individuals are due to the biology of Unionidae (spreading of glochidia by fish; accumulation of sexually mature individuals) as well as to their very small size causing their escaping when catching methods appropriate for big benthic organisms are used. Gaining insight into the distribution of young Unionidae in rivers and lakes calls for undertaking detailed studies.

5. SUMMARY

Bivalves of the family Unionidae were studied in August 1984 in the current of Szeszupa River, and in August 1985 in five lakes situated along its course (Fig. 1).

Throughout the whole investigated fragment, Szeszupa River was very diversified; the diversity of the river was paralleled by very great variability of densities, biomass and species composition of Unionidae (Table 2, Fig. 2). In the upper fragment of Szeszupa River, *Anodonta piscinalis* and *Unio crassus* were the earliest appearing species. *U. crassus* did not occur in lakes. In the further river fragments and in lakes *Unio tumidus* (species displaying the highest densities), *U. pictorum*, *Anodonta cygnea* and *A.* (*Pseudanodonta*) *complanata* were found (Fig. 3).

In Szeszupa River Unionidae attained very high densities, often exceeding 100 indiv. $\cdot m^{-2}$, whereas at some sites they did not occur at all. The highest density recorded was 344 indiv. $\cdot m^{-2}$, and the greatest wet biomass with shells was 7.1 kg $\cdot m^{-2}$ (Table 2). In lakes Unionidae occurred down to a 3—m depth, and their numbers and biomass were much smaller than those found for the river (Table 3).

Moreover, the size structure (Fig. 4), age structure (Fig. 5) and growth of Unionidae (Figs. 6, 7) were analysed. Individuals collected in the river, as compared with those derived from lakes, exhibited much better growth.

6. POLISH SUMMARY

Badania nad małżami z rodziny Unionidae prowadzono w sierpniu 1984 roku w nurcie rzeki Szeszupy, a w sierpniu 1985 roku — w obrębie 5 jezior związanych z tą rzeką (rys. 1). Na całym badanym odcinku Szeszupa jest bardzo zróżnicowana; temu zróżnicowaniu rzeki towarzyszyła bardzo duża zmienność zagęszczeń, biomasy i składu gatunkowego Unionidae (tab. 2, rys. 2). Najwcześniej w górnym odcinku Szeszupy pojawiły się gatunki: *Anodonta piscinalis* i *Unio crassus*. *U. crassus* nie była notowana w jeziorach. W dalszych odcinkach rzeki i w jeziorach stwierdzono także występowanie *Unio tumidus* — gatunku osiągającego największe zagęszczenia, *U. pictorum*, *Anodonta cygnea* i *A.* (*Pseudanodonta*) *complanata* (rys. 3).

W rzece Unionidae osiągały bardzo duże zagęszczenia, często przekraczające 100 osobn. $\cdot m^{-2}$, choć w niektórych miejscach małże te nie występowały w ogóle. Stwierdzone najwyższe zagęszczenie wynosiło 344 osobn. $\cdot m^{-2}$, a biomasa świeża z muszlami 7,1 kg $\cdot m^{-2}$ (tab. 2). W jeziorach Unionidae występowały do głębokości 3 m a ich liczebność i biomasy były znacznie mniejsze niż w rzece (tab. 3).

Analizowano ponadto strukturę wielkościową (rys. 4), strukturę wiekową (rys. 5) i wzrost Unionidae (rys. 6, 7). Stwierdzono, że osobniki wyłowione z rzeki charakteryzowały się dużo lepszym wzrostem niż osobniki jeziorne.

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