

The Gastropod fauna of an unstabilised dam reservoir in Southern Poland

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Abstract. The observed dam reservoir in Przeczyce (the Upper Silesia, Southern Poland) differs from most lowland dam reservoirs in very unstable hydrological conditions during its existence period. In last two decades twice-repeated dam repairs were the cause of almost total drying up of the reservoir and in consequence of disappearance of water plants. This last event caused the permanent paucity of snail fauna in which six common and ubiquitous species dominated.

Kurzfassung. Die Gastropoden-Fauna einer Talsperre mit schwankendem Wasserspiegel in Südpolen. Die untersuchte Talsperre in Przeczyce (Oberschlesien, Südpolen) unterscheidet sich von den meisten Talsperren des Flachlandes durch stark schwankende hydrologische Bedingungen. Zwei Reparaturen der Staumauer in den letzten zwei Jahrzehnten führten zur völligen Austrocknung der Talsperre und damit zum völligen Verschwinden von Wasserpflanzen, was die permanent geringe Zahl der Gastropodenarten bedingt, unter denen sechs häufige und ubiquistische Arten dominieren.

Key words. Gastropods, dam reservoir, unstabilised conditions.

Introduction

The dam reservoirs are popular objects of hydrobiological studies, because they enable the observations of such events as the rate of flora and fauna successions, the influence of fluctuations in water level on the formation of vegetation, the variation of water chemistry and the accumulation of bottom sediments. Nevertheless SCHARF (2002) has recently said: "There is a scarcity of studies... concerning the filling of new reservoirs and examples of complete emptying and refilling..."

The dam reservoir in Przeczyce (the Upper Silesia, Southern Poland) which was the object of our study on gastropod fauna, differs from most lowland reservoirs in respect to its unstable environmental conditions (JAGU 1996). In result, during two last decades the twice-repeated dam repairs were necessary and in these periods the waste bottom areas were dried and in consequence the large part of vegetation was destroyed.

Five times repeated investigations, carried out during twenty years would explain the influence of such disturbance on the qualitative and quantitative structure of the gastropod community.

Study area

The dam reservoir in Przeczyce is situated in central area of the Silesian Upland. It was built in 1959–1961 in result of damming up the river Czarna Przemsza by dam 744 m long, and then filled with water in 1963. The area of dam reservoir is about 470 ha, and maximal depth near the dam about 11 m (WAJDOWICZ 1963).

After several years the water percolation through the dam has taken place.

In 1970 the reservoir ceased practically to exist. After two years lasting dam repair the reservoir has been refilled with water. Some years later the rich vascular vegetation has developed. In this period the fluctuations in water level were unimportant.

In July 1996 the next dam rebuilding was initiated and in consequence the reservoir became partly dried. It has been refilled in spring 1997.

Tab. 1. The vegetation in particular years.

Species	1977	1982	1988	1996	1997
<i>Polygonum amphibium</i> L.			+	+	+
<i>Ceratophyllum demersum</i> L.			+	+	+
<i>Hottonia palustris</i> L.	+				
<i>Typha latifolia</i> L.	+	+	+	+	+
<i>Alisma plantago-aquatica</i> L.	+	+	+	+	+
<i>Sagittaria sagittifolia</i> L.	+	+	+	+	+
<i>Potamogeton natans</i> L.	+	+	+	+	
<i>Potamogeton lucens</i> L.				+	+
<i>Elodea canadensis</i> Michx.	+	+	+	+	+
<i>Phragmites australis</i> (Cav.) Trin. Ex. Steud.	+	+	+	+	+
<i>Glyceria maxima</i> (Hartm.) Holmb.			+	+	+
<i>Carex elata</i> All.	+				
<i>Schoenoplectus lacustris</i> (L.) Palla.	+	+			
<i>Acorus calamus</i> L.	+	+	+	+	+
<i>Lemna minor</i> L.	+	+	+	+	+
Species number	11	9	10	12	11

The bottom in the reservoir is mainly sandy one in some places covered with thin layer of silt, and in other with gravel addition. The vegetation is rather of lacustrine then riverine type. The occurrence of particular plant species in successive years is shown in Table 1.

Material and methods

Investigations were carried out in growing seasons of 1977, 1982, 1986, 1996 and 1997. Materials from 10 constant sites (1 m^2 each) were gathered by hand from living and dead plants, from bottom sediments, stones and anthropogenic wastes.

Nomenclature of snail species is applied after GLÖER and MEIER-BROOK (1998).

In each collection the domination pattern was estimated as well as the similarity of plant associations by means of the Sørensen's (1948) formula and the similarity of snails' communities according to the following formula:

$$S = 1 - \frac{\sum_{i=1}^2 p_1 - p_2}{200}$$

where: p_1 and p_2 designate the percentage of particular species in confronted collections (as p_1 in all cases the greater value is accepted).

Results

The realised investigations have shown that regardless of hydrological fluctuation taking place in the Przeczyce dam reservoir the number of snail species was rather constant and amounted to 9–12 species in particular years whereas the faunistic composition was different in respect to occurrence or absence of some species. In the whole study period 16 snail species were found, but only five of them, characteristic for highly eutrophicated water bodies (namely *Lymnaea stagnalis*, *Radix peregra*, *Planorbis planorbis*, *Gyraulus albus* and

Tab. 2. Occurrence of snail species in particular years.

Species	Year				
	1977	1982	1988	1996	1997
<i>Valvata piscinalis</i>				+	+
<i>Physa fontinalis</i>	++		++		
<i>Lymnaea stagnalis</i>	++++	++++	++++	++++	+++
<i>Radix peregra</i>	+++	+++	+++	+++	++++
<i>Radix auricularia</i>				+	+
<i>Stagnicola corvus</i>			+++	+	+
<i>Stagnicola palustris</i>				+	+
<i>Galba truncatula</i>				+	+
<i>Planorbis planorbis</i>	+++	+++	+++	++++	++++
<i>Anisus spirorbis</i>	+	+	+		+
<i>Anisus vortex</i>	++	++	++		
<i>Bathyomphalus contortus</i>	+++	+++	++		
<i>Gyraulus albus</i>	+	+	++	++++	++++
<i>Gyraulus crista</i>				+	+
<i>Planorbarius corneus</i>	++	++	++	++	++
<i>Segmentina nitida</i>	++	++	++		
Species number	10	9	11	11	12

++++ percentage of species in the collection > 20%
 +++ percentage of species in the collection 10.1–20.0%
 ++ percentage of species in the collection 1.0–10.0%
 + percentage of species in the collection < 1%

Planorbarius corneus) were the permanent fauna components. They occurred in like manner in all study years, except *Gyraulus albus*, which reached the dominant position only when the drastic fluctuations in water level have appeared, and after the refilling of the reservoir. In the first decade of dam existence *Gyraulus albus* occurred in small number. The other 11 snail species were rare during the whole study period (Table 2).

In the first investigation period i.e. from 1977 to 1988, when the hydrological conditions were relatively constant some phytophilous snail (*Anisus spirorbis*, *Anisus vortex*, *Bathyomphalus contortus*, *Segmentina nitida*) were numerously collected. In later years these species (except *Anisus spirorbis*) were absent in the reservoir.

The similarity of later snail communities to the collection of 1977 declines in successive study years. These changes were paralleled to the changes in plant associations and the similarities amounted in % to:

year	plants	snails
1982	90.9	99.5
1988	73.0	81.5
1996	66.7	57.6
1997	60.0	55.5

During the whole study period (except in the collection of 1996) the dominant species was *Lymnaea stagnalis*, occurring both in stability period as well as during environmental perturbations in similar number. Similarly permanent however less abundant species was *Planorbarius corneus* which has persisted all the fluctuations in water level. *Radix peregra* occurred numerously during the whole period of investigations, on all kinds of substratum, both mineral and vege-

table and on concrete banks, but became the dominant only after refilling of reservoir. In the drying time individuals of *Radix peregra* assembled around the puddles or digged in silt layer, nevertheless the great mortality of adults was observed in this period, whereas the survival of many young individuals was the cause of *Radix peregra* success after the second refilling of the reservoir.

Similar regularities were observed in *Planorbis planorbis* occurrence, which most abundantly appeared in the early stage of water disappearance, similarly as *Gyraulus albus* occurring numerously in such conditions.

Noteworthy is the appearance in the course of dam reconstruction and after the refilling of some snail species characteristic for shallow water bodies and rivers, namely *Galba truncatula* and *Stagnicola palustris*, as well as of snail connected with floating leaves – *Gyraulus crista*. After nine years of absence appeared then *Anisus spirorbis* again.

All above-mentioned species, collected in very small number were probably introduced by birds feeding on exposed reservoir bottom.

Discussion

In dam reservoirs, which are exploited in various ways and the fluctuations of water level are their natural peculiarity, the impact of hydrotechnic works on the formation of gastropod communities is rather difficult to estimation, but perceptible one.

The first observable event is the progressive impoverishment of water vegetation on drying up parts of the bottom, what is the significant limiting factor for most freshwater snail species.

In previous papers (STRZELEC 1988, 1993) the occurrence of 23 snail species in dam reservoirs situated in industrial region was recorded, while in particular habitats their number amounted to 10–21. In these conditions only 6 species, namely *L. stagnalis*, *R. peregra*, *P. planorbis*, *A. vortex*, *B. contortus* and *P. corneus* occurred commonly and abundantly. In most dam reservoirs permanently co-occurred the phytophilous snails, *A. vortex*, *B. contortus*, and common but nonabundant *G. albus*. This was not observed in the Przeczyce dam reservoir, in which above-mentioned species occurred in the period of environmental stability only.

Our results have confirmed the conditioning of snail abundance by plant luxuriance, as reported by PIP (1978), BRÖNMARK (1985), STRZELEC (1993), except the case of *Phragmites australis* (SOSZKA 1968, STRZELEC 1993). In Przeczyce reservoir the richest snail communities occurred in rush belts composed of *Typha latifolia*, *Acorus calamus* and *Glyceria aquatica*, where the bottom was covered with decayed plant detritus and water was stagnant and warm. But in periods of water disappearance the reduction in snail abundance has taken place in this habitat as well, similar to reported by LODGE & KELLY (1985) and THOMAS & DALDORPH (1991).

The survival of some snails in unstable freshwater habitats is enabled by physiological mechanisms or special life strategies. E.g. *Planorbis planorbis* is resistant to drying up and according to KLEKOWSKI (1959) can survive several months beyond water habitat. In the early period of water disappearance the number of *P. planorbis* increases, and after the refilling it outnumbers the other species, from which only single individuals have survived so unfavourable conditions. Similar observations refer to *G. albus*.

The poor gastropod fauna of the Przeczyce dam reservoir, composed of only six numerously occurring species and in particular years supplemented by some species introduced in small number probably by birds, is among other things the effect of sandy bottom in most part of reservoir which is avoided by snails, what was observed by many authors.

The comparison of the Przeczyce dam reservoir with other dam reservoirs in the Upper Silesia of the same age, origin and physiographical traits (STRZELEC et al. 1999) shows that repeated drying up was the main cause of impoverishment of the snail fauna there.

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