

AQUATIC MOLLUSCS OF THE ZEMPLÍNSKÁ ŠÍRAVA DAM RESERVOIR (EAST SLOVAKIA)

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ABSTRACT: The mollusc communities of the Zemplínská Šírava dam reservoir were studied in 2019. The reservoir, built in 1961–1965, is situated in the eastern part of Slovakia near the boundary with Ukraine; with its area of 33 km² it is the second biggest dam reservoir in Slovakia. Nineteen species (13 gastropods, 6 bivalves) were recorded in the first more detailed inventory of its malacofauna. The mollusc communities in individual sites consisted of 8–14 species. The existence of littoral zone overgrown by macrophytes is important especially for populations of pulmonate snails while unionids were usually found on muddy or sandy bottom. Five non-native species were recorded. The abundant population of non-native *D. polymorpha* probably has a negative impact on unionids because of the shortage of suitable substrata (rocks, stones) for attachment, and as a result *D. polymorpha* uses shells of dead or live unionids.

KEY WORDS: dam reservoir, Zemplínská Šírava, aquatic molluscs

INTRODUCTION

Dams have been altering riverine ecosystems since humans started constructing them. They have a positive effect on civilisation through their various designed purposes, irrigation being the most important. At the same time, they exert an array of adverse effects on humans and they affect ecosystems in a negative way (HANKS 2020). On the other hand, the dams provide appropriate habitats for aquatic molluscs which prefer stagnant waters (e.g. DVOŘÁK & BERAN 2004, BERAN 2007, HORÁČKOVÁ et al. 2014).

The Zemplínská Šírava dam reservoir, 33 km² in area, is the second biggest dam reservoir in Slovakia. Though aquatic molluscs of the country have been studied for a long time, its fauna has not been inventoried yet. Only unpublished records of 10 species from this reservoir, without precise location data, exist from 1978 (leg. J. ŠTEPĚK). It was the reason for a more detailed survey done during the 22nd session of the Czech and Slovak malacologists (“MalacoDays 2019”) in Inovce. The results are presented here.

MATERIAL AND METHODS

Samples were taken by the author in 2019. In total, 7 sites were studied (Fig. 1, Appendix 1). The main method used was washing vegetation and sediments using a metal sieve (diameter 20 cm, 0.8 mm mesh) combined with hand-collecting from the surface of stones, wood and artificial materials (e.g. plastic bags and bottles). Snorkelling in shallow parts (up to ca. 3 m deep) was also used. The molluscs were

identified based on shell characters or genital structure whenever purely conchological identification was impossible. Specimens for dissection were killed in hot water and then fixed in 80% ethanol. Selected shells and alcohol-preserved specimens are deposited in the author’s collection. The classification used follows HORSÁK et al. (2019).

STUDY AREA

The Zemplínská Šírava dam reservoir is situated in the eastern part of Slovakia near the boundary with Ukraine, at an altitude of 113.7 m a. s. l. The dam was built in 1961–1965, and the reservoir is 33 km² in area. Its average depth is 9.5 m, with

the maximum depth 14 m. The reservoir is fed by a canal (Šíravský kanál) of the Laborec River (tributary of the Bodrog River, Danube river basin). The area is primarily used for recreation (it is also called “Slovak sea”).

RESULTS

In total, 19 aquatic molluscs (13 gastropods, 6 bivalves) were found at 7 sites of the Zemplínská Šírava reservoir (Fig. 1). The mollusc communities in individual sites consisted of 8–14 species (for the list of species and estimated population density see Table 1). *Physella acuta*, *Unio pictorum*, *U. tumidus* and *Dreissena polymorpha* were found in all the sites, *Bithynia tentaculata*, *Valvata piscinalis*, *Radix auricularia*, *Anisus spirorbis*, *Gyraulus* cf. *parvus* and *Anodonta anatina* were recorded in 4–6 sites while the remaining species were found at only 1–3 sites. *R. auricularia*, *P. acuta*, *G. cf. parvus* and *D. polymorpha* usually formed abundant populations.

Rich gastropod communities with abundant populations were found within the littoral zone overgrown by macrophytes (sites No. 3, 4, Fig. 2) while sites with sparse macrophyte vegetation were inhab-

ited by fewer species (e.g. sites No. 2, 5, 6, Fig. 3). Live unionids were usually found on muddy or sandy bottom at the depth of 1–3 m and probably occurred also in the deeper parts which were not investigated.

Viviparus acerosus and *Pseudanodonta complanata* are listed as Vulnerable in the Red List of molluscs of Slovakia (ŠTEFFEK & VAVROVÁ 2006) while the other species are common and widespread. *P. complanata* was recorded in three sites while *V. acerosus* only in one site (No. 5, only few specimens).

P. acuta, *G. parvus*, *Ferrissia californica*, *Sinanodonta woodiana* and *D. polymorpha* are non-native invasive species. In the case of *G. parvus* the identification is only preliminary due to its similarity to *G. laevis* (Alder, 1838) so this taxon is mentioned only as *G. cf. parvus* in this study (see Discussion).

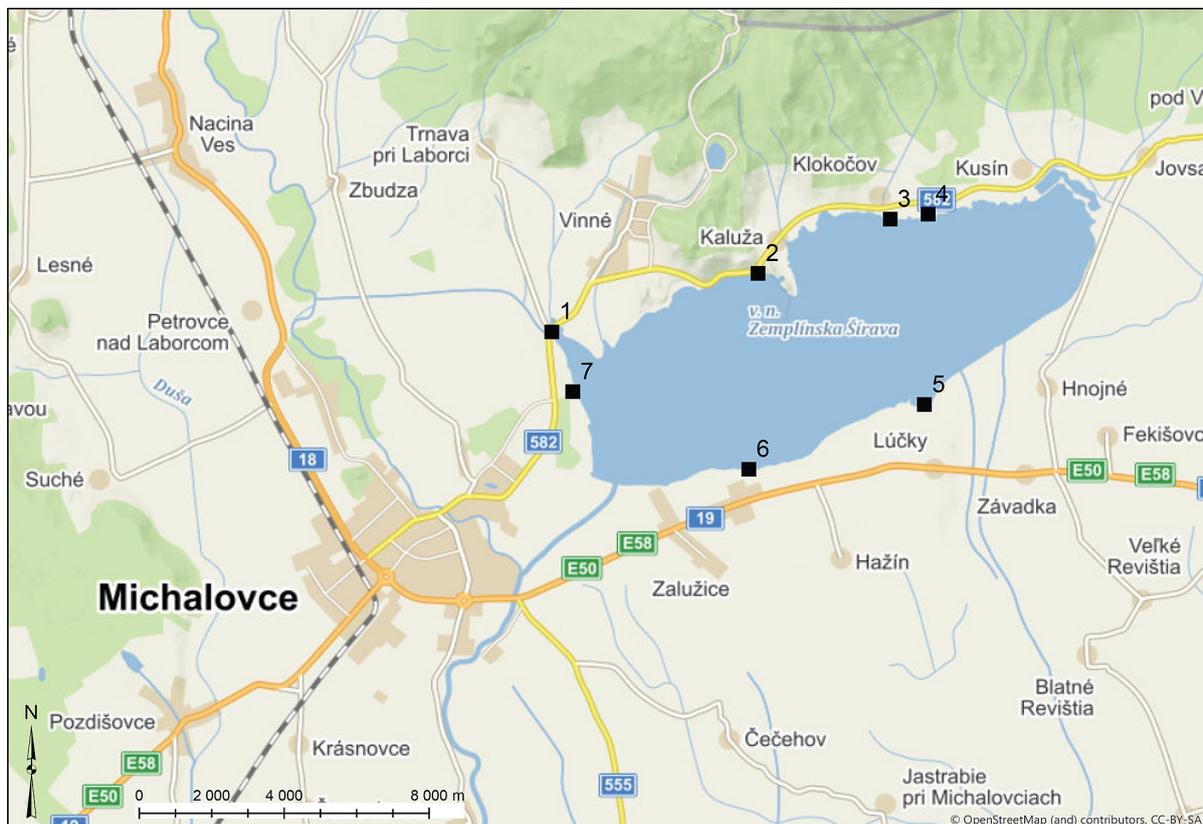


Fig. 1. Map of the Zemplínská Šírava reservoir with the distribution of the sampling sites



Table 1. List of aquatic molluscs recorded from the Zemplínská Šírava reservoir

Species/Site No.	1	2	3	4	5	6	7	Σ
<i>Viviparus acerosus</i> (Bourguignat, 1862)					×			1
<i>Bithynia tentaculata</i> (Linnaeus, 1758)	×	×		×	×			4
<i>Valvata piscinalis</i> (O. F. Müller, 1774)			×	×	×	×		4
<i>Galba truncatula</i> (O. F. Müller, 1774)			×					1
<i>Radix auricularia</i> (Linnaeus, 1758)	×	×	×	×	×		×	6
<i>Lymnaea stagnalis</i> (Linnaeus, 1758)			×	×				2
<i>Physella acuta</i> (Draparnaud, 1805)	×	×	×	×	×	×	×	7
<i>Anisus spirorbis</i> (Linnaeus, 1758)	×		×	×			×	4
<i>Gyraulus albus</i> (O. F. Müller, 1774)	×	×						2
<i>Gyraulus crista</i> (Linnaeus, 1758)				×				1
<i>Gyraulus cf. parvus</i> (Say, 1817)	×		×	×		×	×	5
<i>Hippeutis complanatus</i> (Linnaeus, 1758)				×				1
<i>Ferrissia californica</i> (Rowell, 1863)			×					1
<i>Unio pictorum</i> (Linnaeus, 1758)	×	×	×	×	×	×	×	7
<i>Unio tumidus</i> Philipsson, 1788	×	×	×	×	×	×	×	7
<i>Anodonta anatina</i> (Linnaeus, 1758)	×		×	×		×	×	5
<i>Pseudanodonta complanata</i> (Rossmässler, 1835)				×	×	×		3
<i>Sinanodonta woodiana</i> (Lea, 1834)	×	×					×	3
<i>Dreissena polymorpha</i> (Pallas, 1771)	×	×	×	×	×	×	×	7
Number of species	11	8	12	14	9	8	9	

× – few specimens, ×× – scattered occurrence, ××× – abundant occurrence.



Fig. 2. Bank with overgrown bight (site No. 4); littoral zone overgrown by macrophytes. Photo: LUBOŠ BERAN



Fig. 3. Bank with a beach and boat mooring site nearly devoid of vegetation (site No. 2). Photo: LUBOŠ BERAN

DISCUSSION

This survey is the first more detailed inventory of aquatic molluscs of this extensive reservoir built more than 50 years ago, therefore it is impossible to compare its results with any previous research. Only records of 10 species from the reservoir exist, albeit with no precise location data. J. ŠTEFFEK (unpublished) made the records in 1978. He mentioned the occurrence of *Borysthenia naticina* (Menke, 1845), *V. piscinalis*, *G. truncatula*, *R. auricularia*, *R. labiata* (Rossmässler, 1835), *G. albus*, *G. crista*, *G. laevis*, *U. pictorum* and *A. anatina*. All species except *B. naticina*, *R. labiata* and *G. laevis* were found during the present survey. Previously, *B. naticina* was known in Slovakia only from the Danube River and its floodplain (LOŽEK 1956, LISICKÝ 1991, HORSÁK et al. 2019) and its occurrence in the dam reservoir is doubtful; the record probably resulted from misidentification of *V. piscinalis*. *R. labiata* is common and widespread, it inhabits especially nutrient-poor habitats and its occurrence in the reservoir 10–15 years after its filling is possible. The abundant occurrence of *G. cf. parvus* was documented during this survey instead of *G. laevis* mentioned by J. ŠTEFFEK in 1978. Both species (*G. laevis*,

G. parvus) are very similar and the difference between them is hardly perceptible, so it is not certain which species occurred in the reservoir on the previous occasion. The status of the two forms is still uncertain, hence material was collected for genetic analysis.

The malacofauna of the Zemplínská Šírava reservoir includes only 13 species of freshwater snails out of the 52 aquatic snail species known in Slovakia (HORSÁK et al. 2019). Similarly, few gastropod species were found in other dam reservoirs in Slovakia, e. g. in the Oravská Priebrada reservoir (13–14 species; ŠTEFFEK & NAGEL 2004), in the Věstonice reservoir (14 species; BERAN 2013) and in small dam reservoirs in the Slovak Carpathians – a maximum of 12 species (ČEJKA 2011). Similar numbers of freshwater snail species were found in most of dam reservoirs in Poland in Upper Silesia (STRZELEC 2005, STRZELEC et al. 2005) while 21 gastropods were recorded in the Słapy reservoir built on the Vltava River in the Czech Republic (BERAN 2007).

There was a positive dependence between the presence of macrophytes on the one hand, and the abundance and species richness of pulmonate snails

on the other. A similar dependence was observed by JURKIEWICZ-KARNKOWSKA (2002) who studied mollusc communities of the Sulejów dam reservoir in Poland.

Dam reservoirs provide favourable habitats for abundant populations of unionids preferring standing waters (e.g. DVOŘÁK & BERAN 2004, ŠTEFFEK & NAGEL 2004, BERAN 2007, GOŁĄB et al. 2010, HORÁČKOVÁ et al. 2014). On the other hand, human-induced transformation of running into standing waters favours common unionids, and dramatically reduces habitat for species which inhabit mostly streams and rivers (BURLAKOVA et al. 2011). Five unionid species (*U. pictorum*, *U. tumidus*, *A. anatina*, *P. complanata*, *S. woodiana*) out of the seven species known from Slovakia were recorded from the Zemplínská Šírava reservoir. Only *U. crassus* Philipsson, 1788, a typical inhabitant of running waters (e.g. BERAN 2019) was missing, as was *A. cygnea* (Linnaeus, 1758), which on the other hand prefers standing waters including dam reservoirs. *P. complanata*, declining in most European countries and listed in the IUCN Red List of Threatened Species as Vulnerable (VAN DAMME 2011) was found in the Zemplínská Šírava. The species is a typical inhabitant of rivers (e.g. BERAN 2002, KILLEEN et al. 2004, BERAN 2019) but it is also known to occur in lakes (e.g. VAN DAMME 2011, PIECHOCKI & WAWRZYNIAK-WYDROWSKA 2016) and dam reser-

voirs (HORÁČKOVÁ et al. 2014). This unionid usually occurs in low densities and belongs to the rarest native unionids (e.g. ZETTLER 1998, 1999, KILLEEN et al. 2004, BERAN 2019); also in the Zemplínská Šírava it is rare and only 1–3 specimens per site were found. The species is rare in Slovakia and is known mostly from lowland rivers along the Danube (Podunajská nížina) and in the south-eastern part of Slovakia (Východoslovenská nížina) (LISICKÝ 1991, ČEJKA et al. 2015, HORSÁK et al. 2019).

Dam reservoirs, especially those used for recreation, are often a place of mass occurrence of alien invasive molluscs which often dominate in such habitats (STRZELEC 2005, STRZELEC et al. 2005), for example *P. acuta* in the Věstonice dam reservoir (BERAN 2013). This also applies to Zemplínská Šírava, where the dominants are *P. acuta*, *G. cf. parvus* and *D. polymorpha*. The abundant population of *D. polymorpha* probably has a negative impact on the unionid populations including the vulnerable *P. complanata*, because of the deficit of suitable attachment substrata (rocks, stones) and as a result *D. polymorpha* uses valves of dead or live unionids (Fig. 4). The populations of native unionids can also be negatively affected by the invasive Chinese giant mussel *S. woodiana*. This bivalve can compete with native unionids for food, increase resistance to glochidia in potential host fishes and serve as a vector for introduction of new parasites and diseases (LOPES-LIMA et al. 2017,



Fig. 4. Live *Unio tumidus* (left) and *Pseudanodonta complanata* (right) with sessile specimens of *Dreissena polymorpha*. Photo: LUBOŠ BERAN



DONROVICH et al. 2017, DOUDA & ČADKOVÁ 2018). An abundant occurrence of *G. cf. parvus* was observed in most of the sites but without any obvious effect on the native species; the same was true of *P. acuta* and *F. californica*.

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APPENDIX 1

List of sampling sites, data as follows: site number, geographical co-ordinates, name of the nearest settlement, site description, date of sampling.

1. 48°47'19.6"N, 21°56'47.5"E, Vinné, Zemplínská Šírava dam reservoir at the inflow of the Šíranský kanál canal, 25.06.2019;
2. 48°47'55.6"N, 22°00'02.8"E, Kaluža, north-western edge of Zemplínská Šírava reservoir, 27.06.2019;
3. 48°48'29.6"N, 22°01'45.5"E, Klokočov, northern edge of Zemplínská Šírava reservoir by the church, 25.06.2019;
4. 48°48'31"N, 22°02'19.7"E, Klokočov, overgrown bight of Zemplínská Šírava reservoir (Fig. 2), 24.06.2019;
5. 48°46'37.8"N, 22°02'24.7"E, Lúčky, south-eastern edge of Zemplínská Šírava reservoir, 26.06.2019;
6. 48°46'00.1"N, 21°59'35.8"E, Malé Zalužice, southern edge of Zemplínská Šírava reservoir, 26.06.2019;
7. 48°46'40.1"N, 21°57'14.3"E, Michalovce, western edge of Zemplínská Šírava reservoir, 25.06.2019.