

Remarkable records of aquatic molluscs in the Lipno Reservoir and its environs

Libor Dvořák^{1,*} & Luboš Beran²

¹Šumava NP and PLA Administration, Sušická 399, CZ-34192 Kašperské Hory, Czech Republic

²Kokořínsko PLA Administration, Česká 149, CZ-27601 Mětník, Czech Republic

*libor.dvorak@npsumava.cz

Abstract

This paper summarizes all published and unpublished data for aquatic Gastropods and Bivalves of the Lipno Reservoir and its environs (SW Bohemia, Šumava PLA). To date, 23 species of Mollusca (10 Gastropods, 13 Bivalves) were recorded from the area. The higher elevation of localities of *Unio tumidus*, *U. pictorum*, *Anodonta cygnea*, *Segmentina nitida*, and *Pisidium milium* are the most remarkable findings of this study.

Key words: Gastropoda, Bivalvia, faunistic studies, conservation and aquatic habitat alteration.

INTRODUCTION

In southern Bohemia, the year 2003 was very poor in precipitation compared to the annual average. In a dry year like this, evaporation was very high as well. Consequently, inflow of all streams into the Lipno Reservoir was ca. 1.6 m³.sec⁻¹, while outflow (mandated by law with respect to water flows on the Vltava River) was ca. 6 m³.sec⁻¹. The main consequence of these events was lowering of the water level in the Lipno Reservoir. During autumn of 2003 the water level was more than 3.5 m below the maximum stage (725.6 m a.s.l.). These circumstances facilitated the search for aquatic molluscs normally living on bottom beyond the water's edge vegetation. The search turned-up some very interesting findings. Together with historic data from this region, the results are presented in this paper.

MATERIAL AND METHODS

The main part of the field work was carried out by visual search in November 2003. Gastropods and bivalves were collected from sand and mud on the receded banks of the Lipno Reservoir. Collections were made with bowl-shaped sieve; with aquatic vegetation, sand and mud sieved through. Search was predominantly focused on larger bivalves. The material collected was determined in the field with the exception of specimens of the genus *Pisidium*. Those were determined under magnification in the laboratory.

LIST OF LOCALITIES

Published data (P)

1. Horní Planá, 7250, FRANKENBERGER (1913)
2. Pernek, stream flowing from Pernek to Vltava River, 7249–50, 766 m, LOŽEK (1951)

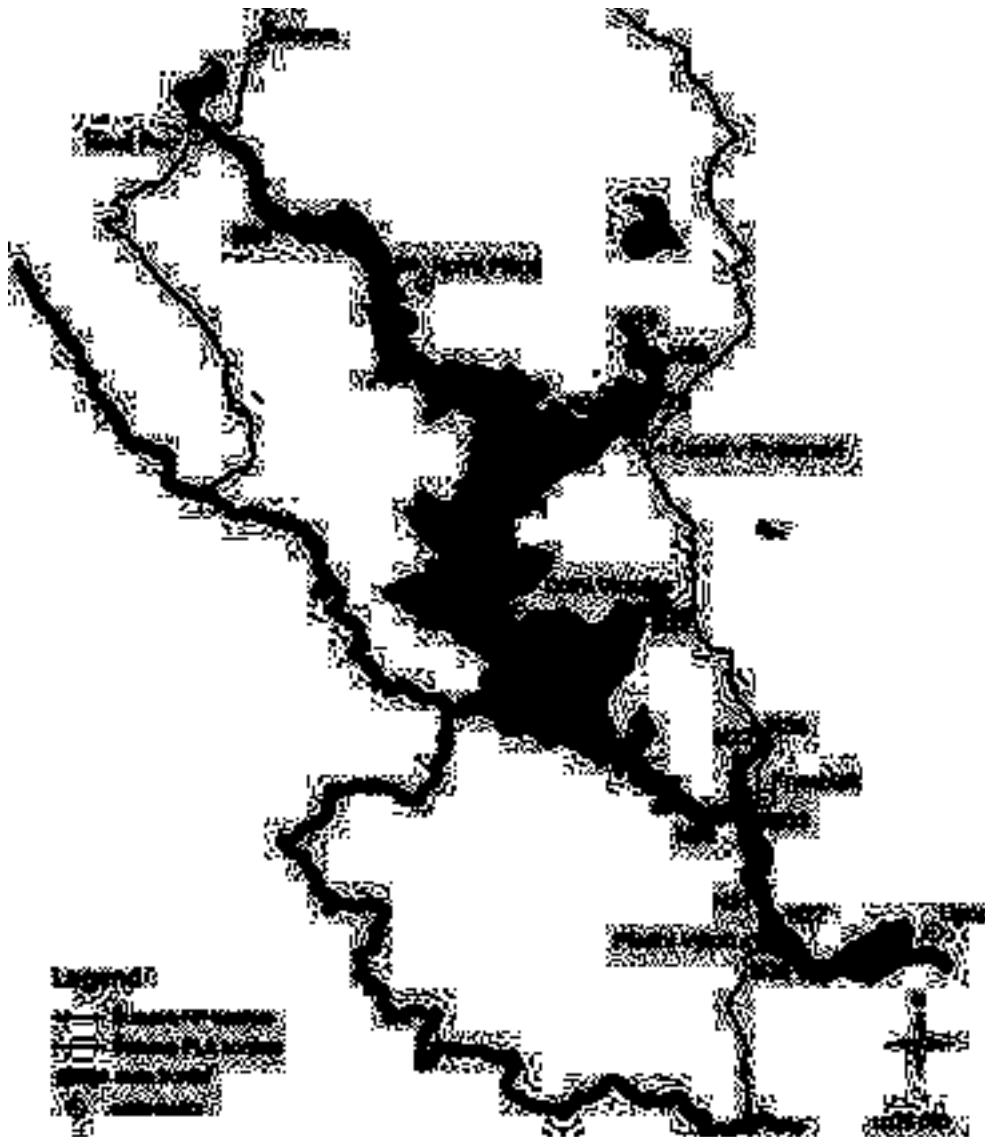


Fig. 1. Schematic map of newly surveyed localities in the Lipno reservoir.

3. Černá v Pošumaví, riparian marshes along Olšina streams between villages Černá v Pošumaví and Hůrka, 7250, 728 m, LOŽEK (1951)
4. Dolní Vltavice, an oxbow lake of Vltava River ca. 1.5 km SW of village Radslav, 7350, 720 m, LOŽEK (1951)
5. Dolní Vltavice, an oxbow lake of Vltava River SW of village Radslav, 7350, 720 m, LOŽEK (1951)
6. Dolní Vltavice, a pool near a small mining SW of village Radslav, 7350, 720 m, LOŽEK (1951)

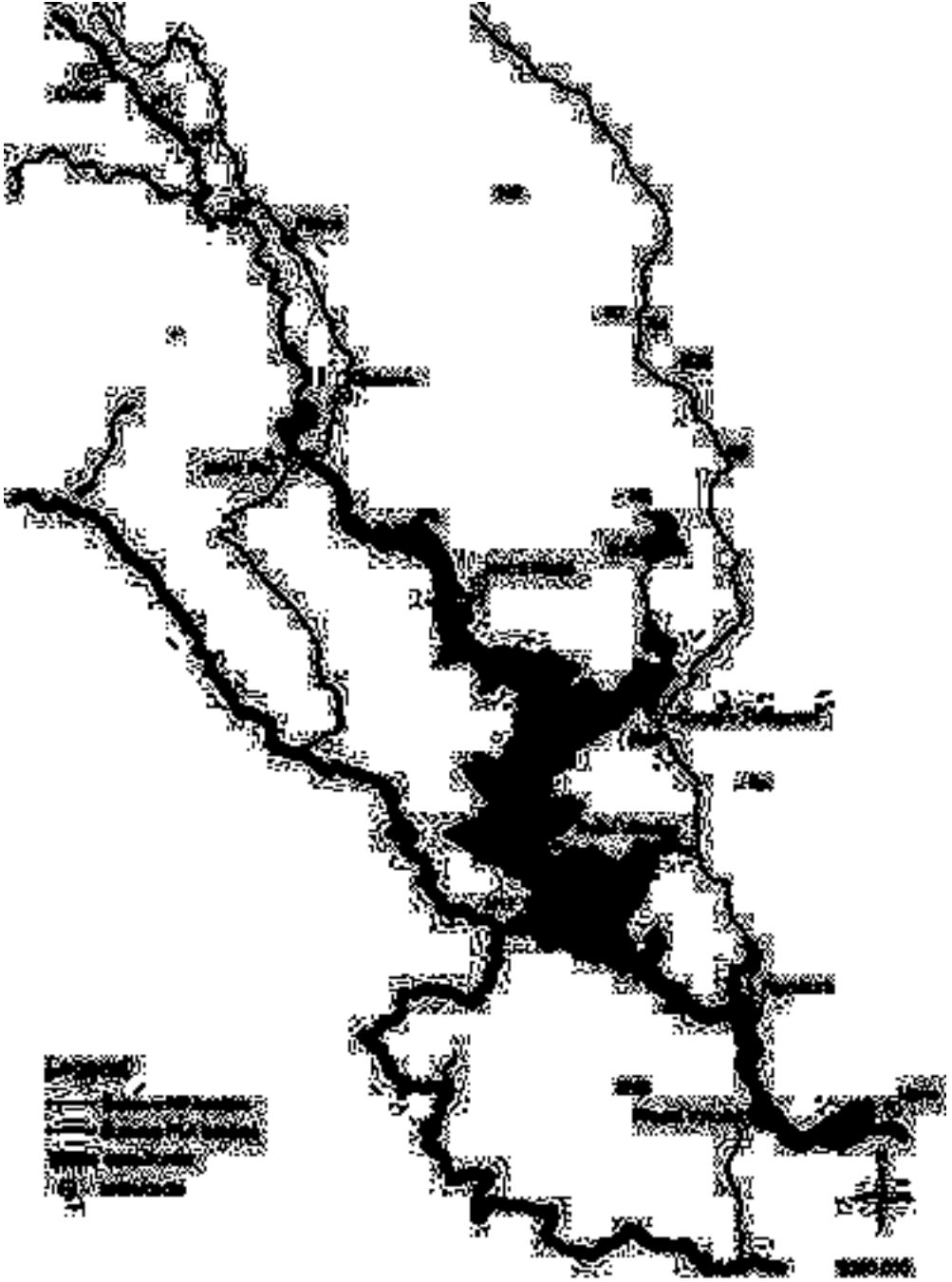


Fig. 2. Schematic map of newly surveyed localities in the environs of the Lipno reservoir plus of all published and museum specimen localities.

Unpublished museum data (M)

1. Černá v Pošumaví, riparian marshes, 7250, 728 m, 20 Sep 1954, Táborský lgt., NMP; a) Kuchař det.; b) Beran det.
2. Lipno nad Vltavou, Lipno Reservoir, 7351, 776 m, Jul 1961, Brabenec lgt. et det.

New unpublished data (N)

1. Dobrá, an oxbow lake of the Teplá Vltava River above railway crossing near the station Dobrá, 7149, 767 m, 16 Aug 1994, Beran lgt.
2. Dobrá, the Teplá Vltava River in ca. 2 km long part under railway crossing near Dobrá, 7149, 767 m, 17 Aug 1994, Beran lgt.
3. Pěkná, Vltava River by confluence of Teplá Vltava and Studená Vltava Rivers, 7149, 753 m, 18 Aug 1994, Beran lgt.
4. Loutka, puddles in open landscape, 7150, 800 m, 12 Apr 1996, Dvořák lgt.
5. Zlatá, craters with water in open landscape, 7150, 990 m, 30 Sep 1997, Dvořák lgt.
6. Polečnice, fish-pond, 7150, 766 m, 16 Apr 1998 (a), 7 Nov 2003 (b), Dvořák lgt.
7. Jablonec, puddles in open landscape, 7150, 820 m, 16 Apr 1998, Dvořák lgt.
8. Olšina, a stream, 7250, 730 m, 26 May 1995, Dvořák lgt.
9. Horní Planá, Lipno Reservoir, 7250, 725 m, 1 Oct 1997, Dvořák lgt.
10. Žlábek, Lipno Reservoir, 7250, 725 m, 14 Nov 1998 (a), 30 Jun 1999 (b), 4 Nov 2003 (c), Dvořák lgt.
11. Černá v Pošumaví, Lipno Reservoir – Malé Lipno, 7250, 725 m, 30 Jun 1999 (a), 2 Nov 2003 (b), Dvořák lgt.
12. Olšina-Hodňov, puddles in forest, 7250, 775 m, 20 Sep 1999, Dvořák lgt.
13. Hůrka, Lipno Reservoir, 7250, 725 m, 20 Sep 1999 (a), 15 Sep 2001 (b), Dvořák lgt.
14. Černá v Pošumaví, Lipno Reservoir, 7250, 725 m, 14 Sep 2001 (a), 1 Nov 2003 (b), Dvořák lgt.
15. Jestřábí, Lipno Reservoir, 7250, 725 m, 16 Sep 2001 (a), 5 Nov 2003 (b), Dvořák lgt.
16. Dolní Vltavice, Lipno Reservoir, S of a village, 7350, 725 m, 12 Jun 1996 (a), 4 Nov 2003 (b), Dvořák lgt.
17. Kyselov, a flooded pit, 7350, 735 m, 1 Oct 1997, Dvořák lgt.
18. Linda, fen of “Linda II”, 7350, 840 m, 13 May 2003, Horsák et Dvořák lgt.
19. Vápenný vrch, flat puddles in limestone quarry, 7250, 765 m, 28 Jun 2000, Dvořák lgt. (a), 12 May 2003, Dvořák et Horsák lgt. (b)
20. Černá v Pošumaví, Lipno Reservoir 1 km N of camp “V Olšinách”, 7250, 725 m, 1 Sep 2003, Majer lgt.
21. Černá v Pošumaví, Lipno Reservoir by the camp “V Olšinách”, 7250, 725 m, 1 Sep 2003, Majer lgt.
22. Vřesná, Lipno Reservoir, W bank 0.5 km S of a village, 7350, 725 m, 1 Oct 2003, Majer lgt. (a), 6 Nov 2003, Dvořák lgt. (b)
23. Nová Pec – “Tábory”, Lipno Reservoir, 7249, 725 m, 13 Oct 2003, Majer lgt. (a), 3 Nov 2003, Dvořák lgt. (b)
24. Bližší Lhota, Lipno Reservoir, N of a village, 7250, 725 m, 3 Nov 2003, Dvořák lgt.
25. Jenišov, Lipno Reservoir, W–S of a village, 7250, 725 m, 3 Nov 2003, Dvořák lgt.
26. Hůrka, Lipno Reservoir – Malé Lipno, NE of village, 7250, 725 m, 4 Nov 2003, Dvořák lgt.
27. Kobylnice II, Lipno Reservoir, 7351, 725 m, 5 Nov 2003, Dvořák lgt.
28. Kobylnice, Lipno Reservoir, 7351, 725 m, 5 Nov 2003, Dvořák lgt.
29. Radslav, Lipno Reservoir, 7250, 725 m, 5 Nov 2003, Dvořák lgt.
30. Frýdava, Lipno Reservoir, W of a village, 7350, 725 m, 6 Nov 2003, Dvořák lgt.

31. Přední Výtoň, Lipno Reservoir, N of a village, 7351, 725 m, 6 Nov 2003, Dvořák lgt.
32. Přední Výtoň, Lipno Reservoir, E of a village, 7351, 725 m, 6 Nov 2003, Dvořák lgt.
33. Frymburk, Lipno Reservoir, E of a village (Náhlovský Potok stream), 7351, 725 m, 6 Nov 2003, Dvořák lgt.
34. Vřesná, Lipno Reservoir, E bank 0.5 km S of a village, 7351, 725 m, 6 Nov 2003, Dvořák lgt.
35. Hůrka, Lipno Reservoir, SW of Hůrka hill, 7250, 725 m, 6 Nov 2003, Dvořák lgt.
36. Loutka, an army water reservoir, 7150, 810 m, 7 Nov 2003, Dvořák lgt.
37. Kovářov, Lipno Reservoir, 1.5 km N of a village, 7250, 725 m, 7 Nov 2003, Dvořák lgt.
38. Karlovy Dvory, Lipno Reservoir, S of a village, 7250, 725 m, 4 Dec 2003, Majer lgt.

RESULTS AND DISCUSSION

List of recorded species

The classification followed in this paper is according to Juříčková et al. (2001). For each species, a brief statement regarding zoogeographical distribution and its affinity to the typical biotopes is given (after Beran 2002); followed by listing of localities where each particular species was found. A statement on abundance concludes each species account.

For explanation of the abbreviations of localities used see the text above.

Gastropoda

Lymnaeidae

1. *Galba truncatula* (O.F. Müller, 1774) – a holarctic species; typically found on banks of standing and/or flowing waters, temporary stagnant marshes. Localities: N5, N18, N19a,b. Specimens of this species were found in low numbers.
2. *Radix auricularia* (Linnaeus, 1758) – a predominantly palaeartic species; typically found in large standing waters and slowly flowing watercourses. Localities: P4, P5, N13b, N14b, N15a, N26, N35, N36. A few specimens were found overall, but relatively more common at localities N13–15. Found in large numbers at locality N36.
3. *Radix peregra* (O.F. Müller, 1774) s. str. – a palaeartic species; typically found in springs, rivulets, flowing and standing waters. Localities: P1, N4, N5, N7, N9, N11a, N12, N13a,b, N14a, N16a, N18, N19a,b. Found in low numbers.
4. *Lymnaea stagnalis* (Linnaeus, 1758) – a holarctic species; typically found in slowly flowing watercourses, ponds, oxbow lakes and pools. Localities: P4, N6a,b, N9, N11b. Only a few specimens of this species were found, more abundant only at locality N11.

Physidae

5. *Physa fontinalis* (Linnaeus, 1758) – a holarctic species; overgrown oxbow lakes and pools, ponds and slowly flowing watercourses. Localities: P4, 5, M1b. These localities are from places before the Lipno Reservoir was constructed, new localities for this species were not found.

Planorbidae

6. *Anisus leucostoma* (Millet, 1813) – an European-west Siberian; typically found in marshes, predominantly temporal. P3, N19a,b. Eudominant species at locality N19. In 20 minutes of sampling more than 11,000 specimens were counted.
7. *Gyraulus albus* (O.F. Müller, 1774) – a palaeartic species; typically found in ponds, oxbow lakes and pools, slowly flowing watercourses. Localities: P1, 4, 5, M1b, N10b, N19a. Found in relatively large numbers.
8. *Segmentina nitida* (O.F. Müller, 1774) – a palaeartic species; typically found in densely

overgrown pools and/or banks of ponds or other reservoirs. Localities: M1b. This record is from a locality before the Lipno Reservoir was constructed. Not found at this time.

9. *Planorbarius corneus* (Linnaeus, 1758) – an European-west Siberian species; typically found in oxbow lakes, pools, ponds and slowly flowing watercourses. Localities: N6a,b, N10a,c, N11a,b, N14a,b, N35. A relatively common species at localities N6 and N11.

10. *Ancylus fluviatilis* O.F. Müller, 1774 – an European; typically found in flowing waters. Localities: P2, N3, N8. This species was found in larger numbers.

Bivalvia

Margaritiferidae

11. *Margaritifera margaritifera* (Linnaeus, 1758) – a holarctic species; typically found in cool and nutrient-poor flowing waters. Localities: N2, 3. More than 70 individuals were found at locality N2 and only 7 specimens at locality N3.

Unionidae

12. *Unio pictorum* (Linnaeus, 1758) – an European species; typically found in rivers, oxbow lakes and pools, water reservoirs, ponds. Localities: N11b, N14b, N20, N21, N22a, N23a, N24, N26, N35, N38. The largest found shell found at locality N23a measured 97 mm in length. Found at more localities than *U. tumidus*, but in lower numbers. A common species, especially at locality N35.

13. *Unio tumidus* Philipsson, 1788 – an European species; typically found in larger rivers, oxbow lakes and pools, water reservoirs, sandpits, and in ponds. Localities: N11b, N14b, N21, N26. The largest shell was found at locality N11b measured 99 mm in length. Found at fewer localities, but in higher numbers than previous species. It was the most common species at locality N11.

14. *Anodonta anatina* (Linnaeus, 1758) – an eurosiberian species; typically found in brooks, rivers, channels, oxbow lakes and pools, sandpits, ponds and other water bodies. Localities: N1, N10c, N11b, N14b, N15b, N16b, N20, N21, N22a,b, N23a,b, N24, N25, N26, N27, N28, N29, N30, N31, N32, N33, N34, N35, N37, N38. The most common species in Lipno Reservoir. It occurs in large numbers, at times several dozen specimens per 1 m².

15. *Anodonta cygnea* (Linnaeus, 1758) – an eurosiberian species; typically found in oxbow lakes and pools, ponds, large rivers. Localities: N10c, 11b, 14b, 16b, 22b, 23a,b, 24, 25, 26, 30, 31, 33, 34, 35. The largest found shell found at locality N23b measured 159 mm in length. Occurred at fewer localities than *A. anatina*, but in similarly large numbers.

Sphaeriidae

16. *Sphaerium corneum* (Linnaeus, 1758) s.lat. – palaeartic species; typically found in nutrient-rich flowing waters, channels, oxbow lakes, pools, ponds. Localities: M1a,b, N11b, N14b. A common species at these localities.

17. *Musculium lacustre* (O.F. Müller, 1774) – holarctic species; slowly flowing watercourses, but predominantly oxbow lakes, pools and ponds. Localities: N17, 19a,b. Found in small numbers only.

18. *Pisidium casertanum* (Poli, 1791) – cosmopolitan species; found in different types of water biotopes from springs to large rivers. Localities: N18. Only several specimens at this locality.

19. *Pisidium henslowanum* (Sheppard, 1823) – a holarctic species; typically found in flowing waters with sand-mud bottom, standing waters as well. Locality: N33. A very common species at this locality.

20. *Pisidium hibernicum* Westerlund, 1894 – a palaeartic species; typically found in ponds, oxbow lakes, pools, flowing waters (predominantly flowing slowly). Locality: M1a. Recorded before creation of Lipno Reservoir only.

21. *Pisidium milium* Held, 1836 – a holarctic species; typically found in slowly flowing watercourses, oxbow lakes, pools, ponds. Localities: M1a. This species was recorded at this before creation of Lipno Reservoir.

22. *Pisidium personatum* Malm, 1855 – an eurosiberian species; predominantly found in cool small standing water bodies, springs and rivulets, small watercourses, water reservoirs and ponds. Localities: N18, N19b. This is not a common species here, only few specimens were found.

23. *Pisidium subtruncatum* Malm, 1855 – a holarctic species; typically found in flowing watercourses, oxbow lakes, pools. Localities: N11b. A relatively common species at this locality.

Discussion

To date, 23 species of aquatic mollusc (10 gastropods, 13 bivalves) have been recorded from the Lipno Reservoir and its surroundings. Eleven species were found in the Šumava National Park and PLA for the first time (see Table 1). Several previously recorded species (*Physa fontinalis*, *Segmentina nitida*, *Pisidium hibernicum*, *P. milium*) were found here only before the creation of the Lipno Reservoir. The main reason for their absence today is probably the change in the water quality and other environmental conditions after the Lipno Reservoir was constructed. In 1960 a standing water reservoir of 4870 ha replaced a slowly flowing Vltava River.

For Czech Republic, the highest altitudinal occurrence for 14 of the 23 recorded species was found in this area for the first time (see Table 1). In case of *Planorbarius corneus*, *Unio pictorum*, and *U. tumidus*, the highest documented elevation is more than 200m higher and in the case of *Pisidium henslowanum* more than 100m higher than the highest previously recorded elevation (BERAN 2002).

Records of some species, especially of *Unio tumidus* and *U. pictorum*, are remarkable from the distributional point of view. The nearest localities for both species were the alluvia of larger rivers at lower elevations, e.g. Otava River in Písek and Vltava River in České Budějovice, both several dozen kilometres away.

According to the Red List for aquatic molluscs of the Czech Republic, 65% (61 species respectively) species fall into the category of the Least Concern; the other 35% (39 species respectively) molluscs fall into the categories Near Threatened, Vulnerable, Endangered and Critically Endangered (see Tables 1–2). The difference in numbers and categories is compared with two previously published studies (JUŘICKOVÁ et al. 2001, BERAN 2002). Especially noteworthy are the records of decreasing and endangered categories of molluscs *Margaritifera margaritifera*, *Unio tumidus* and *Anodonta cygnea*. While the occurrence of *M. margaritifera* derives from the natural habitat of Vltava River upstream of the Lipno Reservoir, the occurrence of *Unio tumidus* and *Anodonta cygnea* (and several other species) is probably due to the building of the Lipno Reservoir because these two species prefer nutrient-rich slowly flowing or standing water bodies.

CONCLUSIONS

It is evident that the construction of the Lipno Reservoir strongly influenced the composition of the aquatic mollusc faunal assemblage of this part of the Šumava PLA. Some species formerly inhabiting the pools of the Vltava River are probably now extirpated or extinct. On the other hand, the distribution range of some species has increased by the presence of large standing waterbody. At present, the Lipno Reservoir is a very valuable habitat for many aquatic molluscs, including some rare species. From the diversity point of view, the most valuable

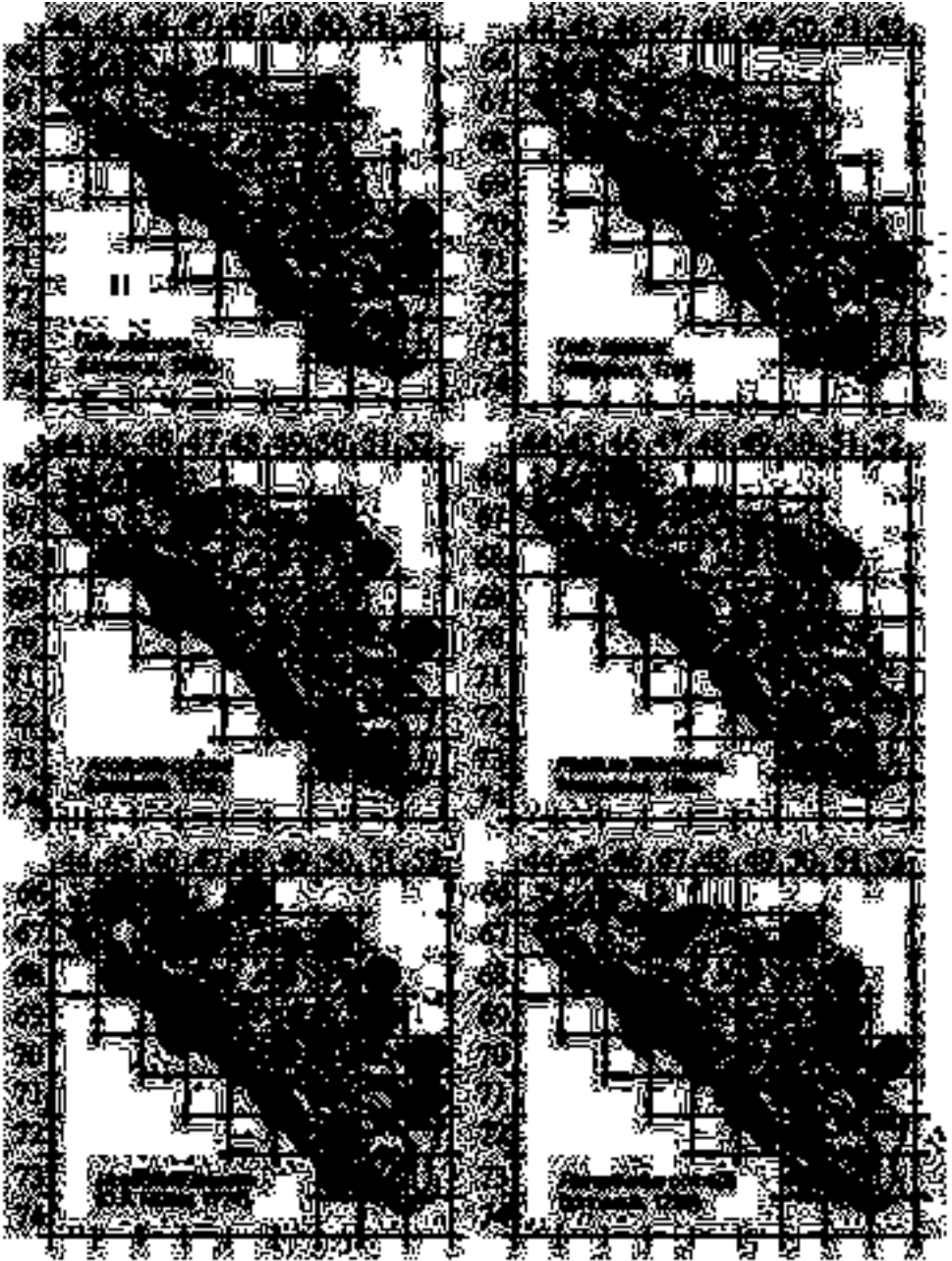


Fig. 3. Distribution of selected rare or spreading aquatic mollusc species in the Bohemian Forest and its foothills. Used data: BERAN (2002), HLAVAC (1998), and authors' data.

Table 1. An Annotated List of Aquatic Molluscs species from Lipno Reservoir, Šumava National Park, Czech Republic (2003).

	Rate of threat	Trend	First record in the Šumava NP and/or PLA	highest altitude in the CR	
				previous	Now
<i>G. truncatula</i>	LC	0	ULIČNÝ 1892–1895	1020	–
<i>R. auricularia</i>	LC	0↑	LOŽEK 1951	733	810
<i>R. peregra</i>	LC	0↓	FRANKENBERGER 1910	1000	–
<i>L. stagnalis</i>	LC	0	LOŽEK 1951	733	766
<i>P. fontinalis</i>	NT	↓	LOŽEK 1951	728	728
<i>A. leucostoma</i>	LC (NT)	?	LOŽEK 1951	733	765
<i>G. albus</i>	LC	0↑	FRANKENBERGER 1913	820	–
<i>S. nitida</i>	VU	0↓	This study	728	728
<i>P. corneus</i>	LC	0	This study	568	766
<i>A. fluviatilis</i>	LC	↑	LOŽEK 1951	855	–
<i>M. margaritifera</i>	CR	↓	SLAVÍK 1868	855	–
<i>U. pictorum</i>	LC	0	This study	548	725
<i>U. tumidus</i>	VU	↓	This study	548	725
<i>A. anatina</i>	LC	0	This study	767	767
<i>A. cygnea</i>	VU	↓	This study	630	725
<i>S. corneum</i> s. lat.	LC	?	This study	728	728
<i>M. lacustre</i>	NT	↓	PFLERGER 1981	1000	–
<i>P. casertanum</i>	LC	0	ULIČNÝ 1892–1895	1070	–
<i>P. henslowanum</i>	LC	0	This study	600	725
<i>P. hibernicum</i>	EN	?	This study	728	728
<i>P. milium</i>	VU	?	This study	749	–
<i>P. personatum</i>	LC	0	FRANKENBERGER 1910	1070	–
<i>P. subtruncatum</i>	LC	0	This study	715	725

Legend: Rate of threat: LC – Least Concern, NT – Near Threatened, VU – Vulnerable, EN – Endangered, CR – Critically Endangered; categories were adopted from JURÍČKOVÁ et al. (2001) (in parenthesis) and BERAN (2002). Trends (according to BERAN 2002): 0 – species without visible changes of their distribution; 0↓ – species without visible changes of their distribution except a decrease in the last investigated period (1990–2000), 0↑ – species without visible changes of their distribution except an increase in the last investigated period; ↓ – declining species; ↑ – spreading species; ? – species with unclear trends. Highest altitude in the CR: former – the highest known altitude in the CR according to BERAN (2002); Now – elevation recorded for localities during this survey.

Table 2. Number of species in particular categories according to BERAN (2002) and JURÍČKOVÁ et al. (2001) (in parenthesis).

Category	Number of species	% of species
LC	15 (14)	65 (61)
NT	2 (3)	9 (13)
VU	4	17
EN	1	4
CR	1	4

part of the Lipno Reservoir is its NE part between settlements Černá v Pošumaví, Hůrka, and Žlábek.

Acknowledgements. Authors would like to thank to J. Majer (Šumava PLA Administration, Horní Planá) for the help with field research and for making available his collection for study. We also thanks to M. Horskák (Masaryk University, Brno) for determination of some specimens of the genus *Pisidium*.

REFERENCES

- BERAN L., 2002: Vodní měkkýši České republiky – rozšíření a jeho změny, stanoviště, šíření, ohrožení a ochrana, červený seznam [Aquatic molluscs of the Czech Republic – distribution and its changes, habitats, dispersal, threat and protection, Red List]. *Sborník přírodovědného klubu v Uh. Hradišti*, Supplementum 10, 258 pp.
- FRANKENBERGER Z., 1913: Doplnky k měkkýší fauně Šumavy [Additions to the mollusc fauna of the Bohemian Forest]. *Věstník Klubu přírodovědeckého v Prostějově*, 16: 109–112. (in Czech)
- HLAVÁČ J., 1998: *Malakofauna Plánického hřebene* [Molluscs of the Plánický Hřeben ridge]. Diploma thesis, Charles University, Prague, 334 pp. (Zoological library of Faculty of Science, Charles University, Prague) (in Czech)
- JUŘÍČKOVÁ L., HORSÁK M. & BERAN L., 2001: Check-list of the molluscs (Mollusca) of the Czech Republic. *Acta Societatis Zoologicae Bohemiae*, 65: 25–40.
- LOŽEK V., 1951: Vodní měkkýši na Šumavě [Aquatic molluscs in the Bohemian Forest]. *Akvaristické listy*, 23, 7: 97. (in Czech)