


Molluscs of the Uplaz Nature Reserve (Moravian-Silesian Beskydy Mts., Czechia)

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The malacofauna of the Uplaz Nature Reserve (Moravian-Silesian Beskydy Mts., Czechia) was studied in 2018. Altogether, 56 mollusc species were recorded from 119 sampling sites, including 53 terrestrial gastropods, 2 freshwater gastropods, and one freshwater bivalve species. The most species-rich part was Uplaz I, with up to 35 species recorded at a single sampling site. Several species of conservation concern were recorded, including two critically endangered species (*Macrogastra borealis*, *Vestia gulo*), one endangered species, and three vulnerable species. The study area, together with adjacent reserves (Mionší NNR and Velký Polom NR), represents an important component of a forest malacofauna refugial complex in the Beskydy Mountains. The results suggest the importance of natural forest structure, spring habitats, and coarse woody debris for maintaining high mollusc diversity.

Key words: forest malacofauna, Beskydy Mountains, Uplaz Nature Reserve, Carpathians, refugial habitats, nature conservation

Introduction

The Beskydy Mountains are among the most extensively studied regions in the Czechia in terms of malacology, with a long tradition of research dating back to the works of LOŽEK (1954), BRABENEC (1954), and MÁCHA (1987, 1997). More recent studies have further contributed to the knowledge of mollusc assemblages in the Moravian-Silesian Beskydy Mountains, including the adjacent National Nature Reserve Mionší and surrounding forest habitats (e.g. HORSÁK et al. 2006, KUPKA 2007). Despite this long-term research effort, some parts of the Moravian-Silesian Beskydy Mts. remain less thoroughly documented. One such area is the Uplaz Nature Reserve. It forms a spatially discontinuous yet ecologically connected forest reserve system around the Mionší National Nature Reserve and adjoining the Velký Polom Nature Reserve. Although earlier records exist from the wider Mionší–Velký Polom area and may partly overlap with the present reserve boundaries or their immediate surroundings, no comprehensive inventory focused specifically on the present-day Uplaz Nature Reserve has been published so far to our knowledge.

Molluscs represent a well-established model group in nature conservation due to their sensitivity to environmental changes, limited active dispersal ability, and well-known ecological requirements. They are therefore suitable indicators of habitat quality, particularly in forest ecosystems.

The aim of this study was to provide a comprehensive inventory of the mollusc fauna of the Uplaz Nature Reserve and to evaluate its significance within the broader context of forest malacofauna in the Beskydy Mountains.

The Uplaz Nature Reserve is situated in the Moravian-Silesian Beskydy Mountains (Czechia), covers an area of 173 ha, and consists of three separate parts (Uplaz I–III) located at altitudes ranging from approximately 560 to 940 m a.s.l. The reserve is formed by natural and semi-natural montane forests dominated by beech, with admixture of fir, spruce, and sycamore maple. The area is characterized by heterogeneous relief with steep slopes, numerous springs and small watercourses, creating a mosaic of habitats including forest stands, spring habitats and locally more open sites (Fig. 1).

Material and methods

The malacological survey was carried out in 2018 within the Uplaz Nature Reserve, Moravian-Silesian Beskydy Mts., Czechia, as part of a detailed inventory survey of the reserve (KUPKA 2018). Molluscs were collected using a combination of standard methods, including hand collecting, litter sampling, sieving, and wet sieving of substrates. Hand collecting was applied especially for larger and dendrophilous species, while soil samples (approximately 5 litres per sample) were taken to detect small epigeic species.

In spring and wetland habitats, mollusc assemblages were additionally sampled by wet sieving of substrates (HORSÁK 2003).

A total of 119 sampling sites were investigated to cover the full habitat heterogeneity of the reserve (Fig. 2). These sites were distributed across three main parts of the reserve (Uplaz I: 55, Uplaz II: 39, Uplaz III: 25). Uplaz I represents the largest part of the reserve (approximately 120 ha), whereas Uplaz II and III are considerably smaller (approximately 20 ha and 30 ha, respectively). The three reserve parts differ in area size, altitudinal range, and habitat heterogeneity. The number of sampling sites differed among the three parts of the reserve due to differences in area size, habitat heterogeneity, and accessibility; therefore, comparisons among reserve parts should be interpreted primarily as descriptive rather than statistically standardised. Sampling included both species-rich habitats and sites with expected lower diversity (e.g. managed spruce stands). Sampling sites were classified into two categories: sampling plots (>5 species recorded) and sampling points (1–5 species recorded). Sampling plots were defined as areas of approximately 20 × 20 m, where intensive sampling (usually 60 minutes or more) was performed using a combination of the methods mentioned above.

Species abundance was expressed as absolute numbers of individuals. Nomenclature follows HORSÁK et al. (2026).

Ecological groups (ecoelements) were assigned according to LOŽEK (1964) and LISICKÝ (1991). Ecological groups are provided in Table 1 to characterise the ecological structure of the assemblages. Conservation status follows BERAN et al. (2017). For regional comparison, published post-2000 records from NPR Mionší (HORSÁK et al. 2006) and Velký Polom NR (KUPKA 2007) were compiled and compared with the present dataset.

Results

Altogether, 56 species of molluscs were recorded during the survey, including 53 terrestrial gastropods, 2 freshwater gastropods, and 1 freshwater bivalve species, based on 2,470 individuals (Table 1).

The highest number of species was recorded in Uplaz I (51 species), followed by Uplaz III (50 species) and Uplaz II (38 species). The most species-rich sampling plot was located in Uplaz I, with a total of 35 species recorded at a single site.

No species recorded in the study area are listed in the Annexes of Decree No. 395/1992 Coll. However, several species of conservation concern were identified according to the Red List of Czech molluscs (BERAN et al. 2017). Two critically endangered species were recorded: *Macrogastra borealis* and *Vestia gulo* (Fig. 3). One endangered species

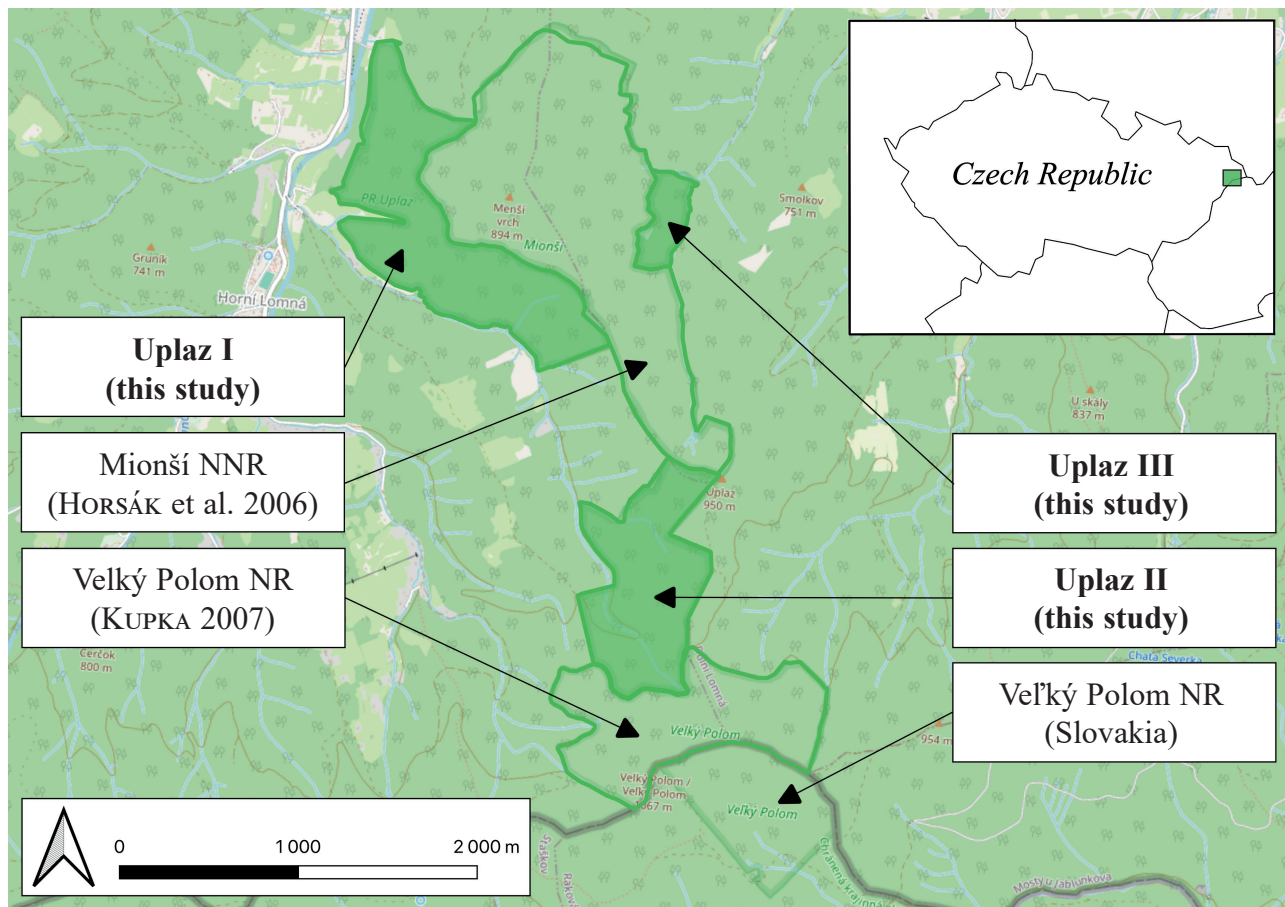


Fig. 1. Location of the Uplaz Nature Reserve in the Moravian-Silesian Beskydy Mountains, showing the three reserve parts (Uplaz I–III), adjacent protected areas (Mionší NNR, Velký Polom NR and Veľký Polom NR). Map data by OpenStreetMap under Open Database License (ODbL); Czechia outline by © EuroGeographics, Eurostat GISCO; modified by the authors.

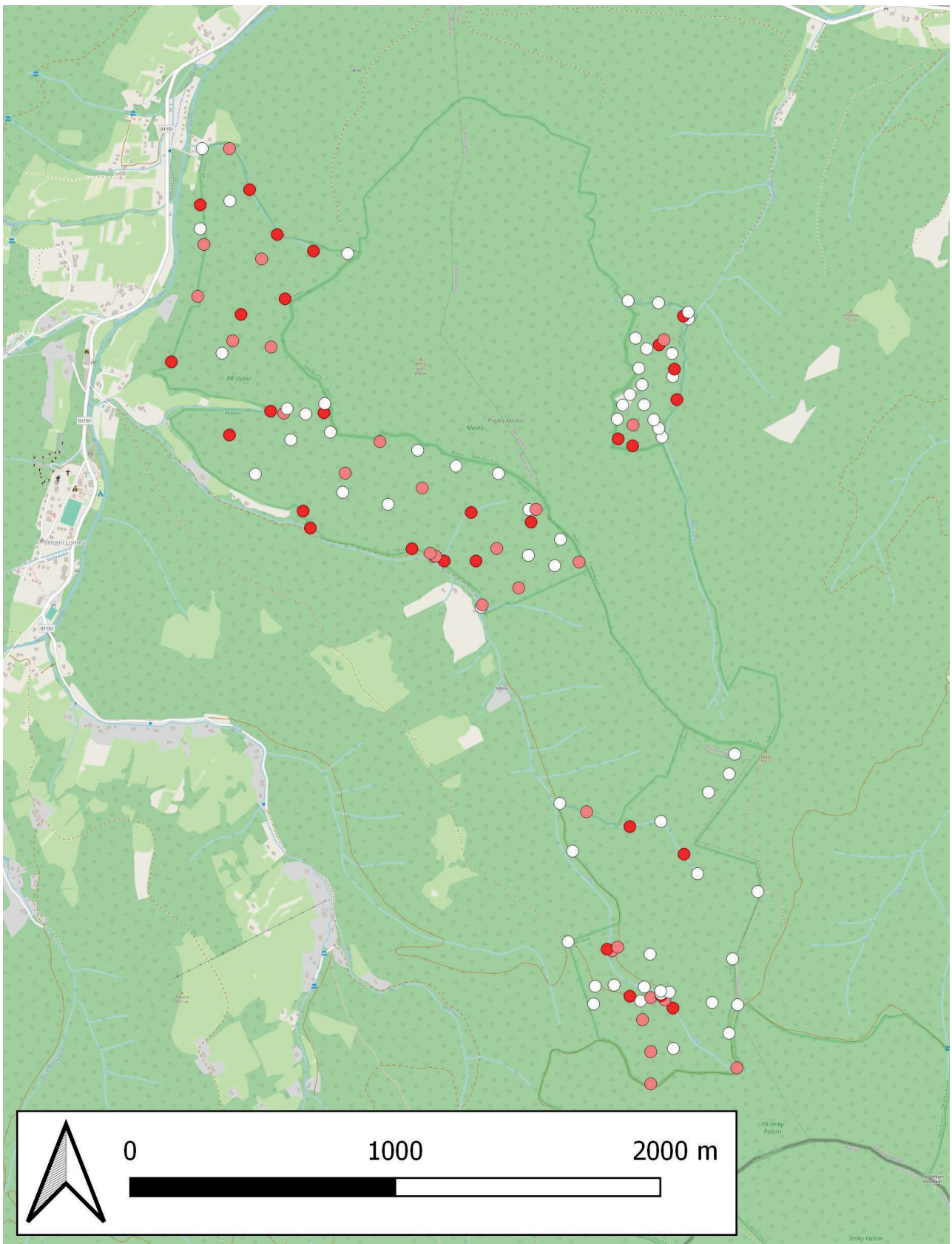


Fig. 2. Distribution of sampling sites in the Uplaz Nature Reserve. White points indicate sites with up to 5 recorded species, pink points sites with 6–10 species, and red points sites with more than 10 recorded species. Green lines indicate reserve boundaries. The background map data by OpenStreetMap under Open Database License (ODbL), modified.



Fig. 3. *Vestia gulo*, a Carpathian forest species with a western distribution limit in the Moravian-Silesian Beskydy Mountains.



Fig. 4. Well-preserved stream bed with abundant coarse woody debris in part Uplaz III, near the southern boundary adjacent to Mionší NNR. These habitats provide suitable conditions for forest molluscs, including species such as *Macrogastra borealis*.

(*Bulgarica cana*) and three vulnerable species (*Daudebardia brevipes*, *Eucobresia nivalis*, and *Vitrea transylvanica*) were also found. These species represent the most valuable component of the local malacofauna from a conservation perspective.

Descriptive differences in species composition and abundance were apparent among the three parts of the reserve. In Uplaz I, the most abundant species were *Cochlodina laminata*, *Macrogastra plicatula*, and *Arion fuscus*. In Uplaz II, *Euglesa casertana*, *Arion fuscus* and *Arianta arbustorum* were the most abundant species, while in Uplaz III, *Carychium tridentatum*, *Bythinella austriaca* and *Perpolita hammonis* were the most abundant species. The most frequently recorded species were *Cochlodina laminata*, *Limax cinereoniger* and *Macrogastra plicatula* in Uplaz I; *Arion fuscus*, *Limax cinereoniger* and *Arianta arbustorum* in Uplaz II; and *Perforatella incarnata*, *Perpolita hammonis* and *Carychium tridentatum* in Uplaz III.

In a broader regional context, the studied area can be compared with adjacent protected areas. The combined area of Mionší NNR, Velký Polom NR and Uplaz NR hosts a total of 66 mollusc species recorded after 2000. Within the post-2000 dataset compiled from published records from Mionší NNR, Velký Polom NR and Uplaz NR, several species were recorded only within the Uplaz Nature Reserve, including *Arion obesoductus*, *Vertigo pusilla*, *Valtonia costata*, *Boettgerilla pallens*, *Plicuteria lubomirski* and *Succinea putris*.

Discussion

The Uplaz Nature Reserve represents an important component of a forest malacofauna refugial complex within the Moravian-Silesian Beskydy Mountains. The recorded number of terrestrial species (53, representing approximately 31% of the terrestrial mollusc fauna of the Czechia) indicates a diverse forest mollusc assemblage comparable to other well-preserved forest localities in the Beskydy Mountains.

The importance of the locality is further emphasised by the occurrence of several species of conservation concern, including critically endangered taxa. These species are typically associated with well-preserved montane forest habitats and relatively stable microclimatic conditions. The results therefore suggest that the studied area forms part of a broader network of refugial forest habitats connected with the adjacent reserves Mionší NNR and Velký Polom NR. Similar patterns were previously documented from the adjacent virgin forest reserve Mionší NNR (HORSÁK et al. 2006).

The studied area represents a relatively oligotrophic mountain environment, where calcium availability may be an important limiting factor for many mollusc species. The diversity and structure of mollusc assemblages appear to be closely related to habitat heterogeneity and the presence of key ecological factors. Particularly important are spring habitats and wet microhabitats, which are likely to provide

favourable conditions for hygrophilous species. The three parts of the reserve differ in altitude and hydrological conditions, which may partly explain the observed differences in mollusc assemblages. Another important factor is the presence of coarse woody debris, which can provide humid microhabitats for dendrophilous species and refuges for epigeic taxa (Fig. 4). In oligotrophic mountain environments such as the Beskydy Mountains, decaying wood may contribute significantly to the maintenance of local mollusc diversity (cf. SVOBODOVÁ & HORSÁK 2025).

Tree species composition also appears to play an important role. Natural mixed forests with the presence of broadleaved trees may contribute to higher calcium availability in otherwise acidic environments. Deciduous trees such as maple and ash are generally associated with higher calcium availability in forest litter, whereas beech-dominated stands may provide less accessible calcium for molluscs.

Comparison with historical data and previous studies from adjacent areas reveals both continuity and changes in the malacofauna of the region. Historical data from the broader Mionší–Velký Polom area (BRABENEC 1954; MÁCHA 1987, 1997; HORSÁK et al. 2006) indicate a generally comparable composition of forest malacofauna, particularly with respect to Carpathian and montane forest species. However, direct comparison is partly limited because older records were usually not related to the present-day boundaries of the Uplaz Nature Reserve, and sampling intensity differed substantially among studies. Nevertheless, several species recorded in the present survey, including *Vestia gulo*, *Bulgarica cana* and *Euobresia nivalis*, confirm the long-term continuity of valuable forest habitats in the broader Mionší–Uplaz–Velký Polom complex.

The currently recorded number of species is higher than in earlier studies (e.g. BRABENEC 1954), although some historically reported species, such as *Clausilia cruciata*, were not confirmed during the present survey. This pattern may partly reflect long-term changes in forest structure, air pollution, and historical forest management in parts of the Beskydy Mountains.

The overall species richness recorded in the Uplaz Nature Reserve is comparable to that reported from the adjacent Mionší NNR, where 58 species were confirmed during surveys conducted between 1998 and 2005 (HORSÁK et al. 2006). The neighbouring Velký Polom NR also hosts several Carpathian and conservation-significant forest species (KUPKA 2007). Together, these protected areas form an important forest refugial complex within the Moravian-Silesian Beskydy Mountains.

At the same time, the occurrence of several regionally rare species within the Uplaz Nature Reserve underlines its importance as a complementary habitat within the broader forest complex of the area. Species such as *Succinea putris* and *Plicuteria lubomirski* are probably associated with lower-altitude and more humid habitats that are less represented in adjacent reserves.

The results of this study highlight the importance of preserving natural forest structure and ecological processes in the studied area. In particular, spring habitats should

remain undisturbed, and coarse woody debris should be retained. The future persistence and development of mollusc assemblages in the Uplaz Nature Reserve will depend both on the continuation of appropriate management practices and on the natural dynamics of forest ecosystems.

Conclusion

The Uplaz Nature Reserve hosts a diverse assemblage of forest molluscs, including several species of conservation concern. The results suggest the importance of natural forest habitats, particularly spring habitats and coarse woody debris, for maintaining mollusc diversity in mountain environments.

Together with adjacent protected areas, the Uplaz Nature Reserve represents an important component of a broader forest malacofauna refugial complex in the Beskydy Mountains.

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Table 1. List of mollusc species recorded in the Uplaz Nature Reserve in 2018, showing the numbers of recorded individuals in the individual parts of the reserve (Uplaz I–III) and conservation status. Conservation status: CR – Critically Endangered, EN – Endangered, VU – Vulnerable, NT – Near Threatened, LC – Least Concern, NE – Not Evaluated. Ecological groups (ecoelements) follow LOŽEK (1964) and LISICKÝ (1991), modified: SI – silvicolous species (forest species), SI(p) – petrophilous forest species, SI(HG) – hygrophilous forest species, SI(MS) – mesophilous forest species, SIth – thamnophilous forest species, SIh – strongly hygrophilous forest species, PT – open-habitat species, PT(SI) – open-habitat species occasionally occurring in sparse forest habitats, MS – mesophilous species, HG – hygrophilous species, PD – wetland species, FN – spring-dwelling freshwater species, RV – running-water species, SG – stagnant-water species, RV-PDt – species of temporary wet habitats associated with running waters, SG-PD(-t) – species of stagnant or periodically drying wetland habitats. Compound categories indicate transitional ecological affinities between major ecological groups; ~ = species not recorded in the respective part of the reserve.

Ecological groups	Species	Status	Uplaz I	Uplaz II	Uplaz III	Total	
1	SI	<i>Acanthinula aculeata</i> (O. F. Müller, 1774)	LC	1	~	5	6
		<i>Aegopinella nitens</i> (Michaud, 1831)	LC	18	6	19	43
		<i>Aegopinella pura</i> (Alder, 1830)	LC	2	2	10	14
		<i>Arion obesoductus</i> Reischütz, 1973	LC	6	1	~	7
		<i>Arion silvaticus</i> Lohmander, 1937	LC	19	6	10	35
		<i>Bielzia coerulans</i> (M. Bielz, 1851)	NT	26	7	11	44
		<i>Bulgarica cana</i> (Held, 1836)	EN	13	1	2	16
		<i>Cochlodina laminata</i> (Montagu, 1803)	LC	86	9	32	127
		<i>Cochlodina orthostoma</i> (Menke, 1828)	NT	~	8	~	8
		<i>Daudebardia brevipes</i> (Draparnaud, 1805)	VU	9	~	5	14
		<i>Daudebardia rufa</i> (Draparnaud, 1805)	LC	11	6	6	23
		<i>Discus ruderratus</i> (Hartmann, 1821)	LC	10	38	2	50
		<i>Eucobresia nivalis</i> (Dumont & Mortillet, 1854)	VU	26	12	6	44
		<i>Faustina faustina</i> (Rossmässler, 1835)	LC	39	~	4	43
		<i>Isognomostoma isognomostomos</i> (Schröter, 1784)	LC	20	7	3	30
		<i>Macrogastrea borealis</i> (Boettger, 1878)	CR	7	~	3	10
		<i>Macrogastrea plicatula</i> (Draparnaud, 1801)	LC	83	56	13	152
		<i>Malacolimax tenellus</i> (O. F. Müller, 1774)	LC	9	3	2	14
		<i>Petrasina unidentata</i> (Draparnaud, 1805)	LC	2	~	1	3
		<i>Ruthenica filograna</i> (Rossmässler, 1836)	LC	12	~	~	12
<i>Vertigo pusilla</i> O. F. Müller, 1774	LC	~	~	2	2		
<i>Vitrea diaphana</i> (Studer, 1820)	LC	10	~	2	12		
<i>Vitrea transsylvanica</i> (Clessin, 1877)	VU	1	~	1	2		
SI(p)	<i>Lehmannia marginata</i> (O. F. Müller, 1774)	LC	37	18	8	63	
2	SI(HG)	<i>Vitrea crystallina</i> (O. F. Müller, 1774)	LC	4	6	10	20
	SIth	<i>Aegopinella minor</i> (Stabile, 1864)	LC	5	~	3	8
	SI(MS)	<i>Alinda biplicata</i> (Montagu, 1803)	LC	28	~	27	55
		<i>Arianta arbustorum</i> (Linnaeus, 1758)	LC	41	62	15	118
		<i>Arion fuscus</i> (O. F. Müller, 1774)	LC	66	80	13	159
		<i>Gonyodiscus rotundatus</i> (O. F. Müller, 1774)	LC	37	17	2	56
		<i>Limax cinereoniger</i> Wolf, 1803	LC	52	51	10	113
		<i>Perforatella incarnata</i> (O. F. Müller, 1774)	LC	56	21	14	91
		<i>Oxychilus glaber</i> (Rossmässler, 1835)	LC	12	~	1	13
		<i>Semilimax kotulae</i> (Westerlund, 1883)	LC	35	8	18	61
3	SIh	<i>Deroceras praecox</i> Wiktor, 1966	LC	20	13	5	38
		<i>Macrogastrea tumida</i> (Rossmässler, 1835)	LC	8	4	8	20
		<i>Macrogastrea ventricosa</i> (Draparnaud, 1801)	LC	57	61	28	146
		<i>Perforatella vicina</i> (Rossmässler, 1842)	LC	36	~	9	45
		<i>Urticicola umbrosus</i> (C. Pfeiffer, 1828)	LC	35	~	~	35
		<i>Vestia gulo</i> (E. A. Bielz, 1859)	CR	3	4	11	18
<i>Vestia turgida</i> (Rossmässler, 1836)	NT	3	12	~	15		
5	PT(SI)	<i>Vallonia costata</i> (O. F. Müller, 1774)	LC	~	~	5	5
7	MS	<i>Boettgerilla pallens</i> Simroth, 1912	LC	5	3	2	10
		<i>Cochlicopa lubrica</i> (O. F. Müller, 1774)	LC	14	1	10	25
		<i>Euconulus fulvus</i> (O. F. Müller, 1774)	LC	11	14	13	38
		<i>Perpolita hammonis</i> (Strøm, 1765)	LC	24	2	32	58
		<i>Plicuteria lubomirski</i> (Ślósarski, 1881)	LC	5	~	~	5
		<i>Punctum pygmaeum</i> (Draparnaud, 1801)	LC	12	1	12	25
		<i>Vitrina pellucida</i> (O. F. Müller, 1774)	LC	7	13	6	26
8	HG	<i>Carychium tridentatum</i> (Risso, 1826)	LC	66	20	121	207
		<i>Columella edentula</i> (Draparnaud, 1805)	LC	4	1	5	10
		<i>Vertigo substriata</i> (Jeffreys, 1833)	LC	2	~	17	19
9	PD	<i>Succinea putris</i> (Linnaeus, 1758)	LC	~	~	6	6
10	FN	<i>Bythinella austriaca</i> (von Frauenfeld, 1857)	LC	24	26	58	108
	RV-PDt	<i>Euglesa casertana</i> (Poli, 1791)	LC	44	89	8	141
	SG-PD(-t)	<i>Galba truncatula</i> (O. F. Müller, 1774)	LC	~	1	1	2