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Amphibians and Reptiles in Ponor Special Protection Area (Natura 2000), Western Bulgaria: Species Diversity, Distribution and Conservation

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Abstract: We present the first comprehensive review of the diversity of the herpetofauna of the Natura 2000 site Ponor Special Protection Area. We compiled data from 22 publications covering 20 species and carried out multiple field visits between 1998–2012, recording 375 locations confirming all previously reported species and reporting four new species. These are *Hyla arborea* complex, *Bufotes viridis* complex, *Coronella austriaca* and *Zamenis longissimus*; we exclude *Anguis fragilis* complex due to recent taxonomic changes in this group. The presence of three additional potential species (*Emys orbicularis*, *Testudo hermanni* and *Darevskia praticola*) remains to be confirmed. All collected localities fall within 60 of 113 2×2 UTM squares, providing > 53% coverage. The elevation ranges for the species generally conform with their expected distributions in Bulgaria. Nine habitat types are of particular importance for the herpetofauna in Ponor Special Protection Area (Shannon diversity index $H' \geq 2.00$), containing 77% of the locations for the observed species and 100% of the species. Four are either open habitats with high level of naturalness or small-scale extensive agricultural lands and four are natural broad-leaf forests. The currently obtained herpetological data can be used in the development of future management plans for this protection area and should be included in the update of the Natura 2000 Standard Data Form. Ponor Special Protection Area is demonstrated as a site of substantial local importance for the conservation of amphibian and reptile communities.

Keywords: Natura 2000, herpetofauna, Amphibia, Reptilia, spatial arrangement

Introduction

The Ponor Mountain has been well-recognized as an area of high importance for the avifauna by being designated as Important Bird Area [BG005]. By this reason, it is also declared as a Natura 2000 site, i.e. Ponor Special Protection Area (further referred to as Ponor SPA, BG0002005) in order to ensure its legal conservation (Nikolov *et al.* 2007; Dyulgerova, Nikolov 2014). However, the remaining groups in the fauna of Ponor SPA are generally poorly studied, which is also valid for amphibians and reptiles. There is a limited number of publications for the area that usually present incidental observations (e.g. Westerström 2005), while most of the major contributions are outdated (e.g. Buresch, Zonkow 1933, 1934, 1941, 1942; Beškov, Beron 1964; for a complete list, see Table 1). The most recent and comprehensive review on the Bulgarian herpetofauna (Stojanov *et al.* 2011) covers the territory of the entire country and generally does not provide detailed information for geographically limited areas such as Ponor SPA.

This paucity in knowledge prompted us to review the available literature, compile and assess unpublished data for the region and collect additional field observations. These data constitute a crucial basis for development of a future SPA management plan, given the present dearth of herpetological data for inclusion in the Standard Data Form of the SPA. Therefore, this study provides the first comprehensive survey of the herpetofauna of Ponor SPA, presenting much needed information on the amphibian and reptilian diversity and distribution in the region, with the purpose of aiding appropriate comprehensive management plans and conservation measures.

Materials and Methods

Study area

The scope of this study focuses on the Natura 2000 site Ponor SPA (BG0002005; Fig. 1), with an area of 31,424 ha (measured at WGS 84 UTM 35N) and the bordering territory (specifically the Petrohan Pass; see section "Mapping, analyses and software"). The SPA covers to a large extent the geographic area of Ponor Mountain, which is part of the Western Stara Planina (Balkan Mountain Range). It is located some 55 km north-west of the capital city of Sofia and borders with Serbia.

The region's name comes from the numerous and sometimes enormous pot-holes, called in Bulgarian "ponor". Whirlpools, hollows, ovals and rivers disappearing in sinkholes are also characteristic of the karst regions, where rivers disappear underground. Ponor Mountain is formed by limestone and dolomites and represents one of the most extensive karst areas in Bulgaria (Nikolov *et al*. 2007). The landscape is mainly characterized by flat and at points table-land bare ridges, but there are also numerous prominent cliff faces and the eastern slopes of the mountain are very steep. The altitude span of the SPA is ca. 380-1600 m a.s.l.

The climate is temperate-continental and of marked mountainous character: relatively cool summers and cold winters; the precipitation maximum occurs during the spring and summer, and the minimum is in the winter. The January average temperature varies between –2 and –4ºC, and the July average temperature is between 13 and 17ºC (Nikolov, Jordanova 2002). The Ponor Mountain landscape is dominated by open grass terrain, i.e. pastures and meadows with calciphile and mesophyte grass vegetation. Among the most important and widely distributed habitat types is the NATURA 2000 "6520 Mountain hay meadows" (Tzonev *et al*. 2014). Generally, the grasslands are bordered by broad-leaved forests of *Fagus sylvatica* L. (in places inter-

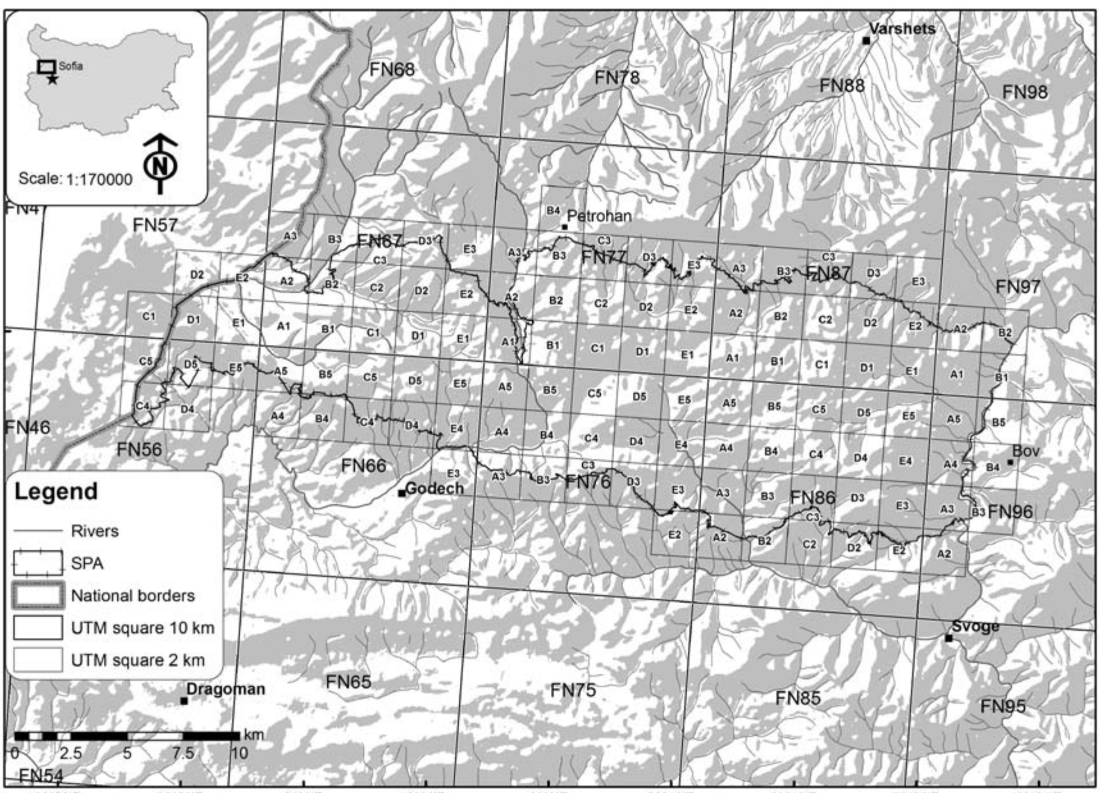

Fig. 1. Location of Ponor SPA, including labelled cells in the 10×10 and 2×2 national UTM grid mixed with *Carpinus betulus* L.) (> 1000 m a.s.l.), mixed oak-hornbeam forests (between 600 and 1000 m a.s.l.), and oak forests extending up to 600 m a.s.l. (Bondev 1991; Nikolov *et al*. 2007; Dimitrov, Petrova 2014). In some areas, there are also relatively large patches of coniferous plantations as well as agricultural lands.

Data acquisition

We collected locality data on the species of herpetofauna (classes Amphibia and Reptilia) in Ponor SPA. We primarily present personal unpublished data, supplemented with information provided by colleagues. Data were collected mostly opportunistically during the active season (March–October) between 1998 and 2012. The authors carried out more thorough sampling specifically to map the herpetofaunal distribution in 2009 and 2012. However, the overall sampling effort was uneven (temporally, spatially, number of investigators); some regions were not visited due to time constraints, and some were visited at suboptimal weather conditions, which might have led to decreased herptile activity and thus lowered the detection rates.

We actively searched for species, primarily through visual surveys, focusing on suitable habitats and microhabitats (e. g. under rocks and logs). Anurans were also located audibly. In addition, specifically for newts and amphibian larvae we sampled wetlands and water bodies by setting funnel traps overnight and by seining using dip nets. If possible, each observed amphibian and reptile was identified at the species level; we could not identify only a limited number of individuals (< 10), which are not included in analyses. Exact geographic coordinates of each identified individual were marked *in situ* using a hand-held GPS unit (Garmin, Olathe, Kansas, USA); if a GPS was not available, coordinates were obtained through a publicly available, geographically referenced high-resolution satellite imagery from 2001–2011 (Google Earth 7; Google, Mountain View, California, USA). For the analyses, a location is defined as one or more individuals of the same species found within 20 m of each other.

Furthermore, we reviewed all available published data for localities of herpetofaunal species in the Ponor Mountain area and its surroundings.

Mapping, analyses and software

Standard 10×10 km UTM grid was employed for mapping, while more detailed representations were produced by further subdivision into 2×2 km grid. The territory of the SPA encompasses 112 2×2 km squares (48 complete and 64 partial); an additional square [FN77B4] was included containing the Petrohan Pass because of substantial literature records from that area (e.g. Buresch, Zonkow 1941, 1942; Beškov, Beron 1964; Beshkov, Nanev 2002; Stoyneva, Michev 2007a).

Data from the literature were assigned to cells in the 2×2 km UTM grid; they were excluded from all analyses besides those including mapping because of lack of sufficient details provided.

The precise geographic locations for each unpublished field observation were associated with a respective habitat on a digital map. The map is a compilation of several digital vector layers: physical blocks (for open and agricultural habitats), forest database (for forest habitats) and CORINE Land Cover 2006 (for supplementing missing data). The land use types were equated to the CORINE Land Cover nomenclature. The detailed description of map generation was given in the reports for the reptile and amphibian species in the project "Mapping and identification of conservation status of natural habitats and species – Phase I" (the map was compiled by G. Popgeorgiev; available online at: http://natura2000.moew.government.bg/Home/Documents). The elevation for each species location (a point with exact geographic coordinates) was identified by data extraction from a raster Digital Elevation Model (DEM) with 20 m grid resolution.

To establish an objective measure of the diversity of species by habitat, as well as the diversity of the used habitats by the different species we used the Shannon diversity index ($\boldsymbol{H'}$), calculated as:

$$\boldsymbol{H' = -\sum(p_i \cdot \ln(p_i))},$$

where $\boldsymbol{p_i}$ is defined as proportion of the locations of species "*i*" to the total number of locations for all species. In theory, $\boldsymbol{H'}$ increases with the species richness, but for all practical purposes does not exceed 5.0 in biological communities (Krebs 1998).

The data processing and mapping were done with software ArcGIS 10.1 (ESRI, Redlands, California, USA), and the statistical procedures (descriptive statistics, outliers calculation and Shannon diversity index) – with PAST 2.17 (Hammer *et al.* 2001).

Taxonomical framework

Taxonomical nomenclature and species identification mainly follow that of Stojanov *et al.* (2011). However, we adopted the following recent taxonomical revisions pertaining to the Bulgarian herpetofauna:

Triturus ivanbureschi replaces the previously recognized taxon *T. karelinii* in Bulgaria (Wielstra *et al*. 2013).

Table 1. Species reported in the literature in and around Ponor SPA, by UTM 2×2 km

Species	UTM 2×2 km	Source
Salamandra salamandra	FN77B4	Buresch, Zonkow (1941); Stoyneva, Michev (2007a)
	FN66D4	Westerström (2005)
Ichthyosaura alpestris	FN77B4	Beškov, Beron (1964); Stoyneva, Michev (2007a)
Lissotriton vulgaris	FN77B4	Beškov, Nanev (2002)
	FN77C2	Stoyneva, Michev (2007c)
	FN76B4	Stoyneva, Michev (2007b)
Triturus ivanbureschi	FN77C2	Beshkov, Nanev (2002); Stoyneva, Michev (2007c)
	FN76B4	Stoyneva, Michev (2007b)
	FN86B5	Tzankov, Stoyanov (2008)
Bombina variegata	FN77C2	Stoyneva, Michev (2007c)
	FN77B4	Stoyneva, Michev (2007a)
Bufo bufo	FN66D4	Westerström (2005)
Hyla arborea complex	FN76B4	Stoyneva, Michev (2007b)
Pelophylax ridibundus	FN76B4	Stoyneva, Michev (2007b)
Rana dalmatina	FN76B4	Stoyneva, Michev (2007b)
	FN66D4	Westerström (2005)
Rana temporaria	FN77D2	Belcheva *et al*. (1982)
	FN77C2	Stoyneva, Michev (2007c)
	FN77B4	Buresch, Zonkow (1942); Stoyneva, Michev (2007a)
Anguis colchica	FN97B2	Beschkov (1966)
	FN97B2	Vamporov (1973)
	FN96A4	Kovachev (1912); Vamporov (1973)
	FN96A3	Vamporov (1973)
Ablepharus kitaibelii	FN97B2	Beshkov (1961)
Lacerta agilis	FN67B2	Duhalov (1999)
	FN66D4	Duhalov (1999); Westerström (2005)
Lacerta viridis	FN86B2	Blagoev (1987)
Podarcis muralis	FN86B2	Buresch, Zonkow (1933); Buresch, Zonkow (1933)
	FN97B2	Buresch, Zonkow (1933)
	FN66D4	Westerström (2005)
Zootoca vivipara	FN77B4	Stoyneva, Michev (2007a)
Dolichophis caspius	FN86B2	Buresch, Zonkow (1934)
	FN97B2	Beshkov (1978)
Natrix natrix	FN77C2	Stoyneva, Michev (2007c)
	FN77B4	Stoyneva, Michev (2007a)
Natrix tessellata	FN97B2	Naumov *et al.* (2011)
	FN96A3	Naumov *et al.* (2011)
	FN66D4	Naumov *et al.* (2011)
Vipera ammodytes	FN86B4	Beshkov, Dushkov (1981)
	FN96A3	Beshkov, Dushkov (1981); Christov, Beshkov (1999)
	FN97B2	Buresch, Zonkow (1934)
	FN77A1	Christov, Beshkov (1999)
Vipera berus	FN77B4	Beshkov, Nanev (2002); Stoyneva, Michev (2007a)

Bufo viridis was split into *B. viridis* and *B. variabilis* (see Stöck *et al*. 2006); thereafter, generic name changes to *Pseudepidalea* and most recently to *Bufotes* have affected the taxon (Frost *et al*. 2006, Dubois, Bour 2010).

Hyla arborea was split by Stöck *et al*. (2008) into *H. arborea* and *H. orientalis.*

Lack of sufficient samples from Bulgaria still precludes a precise geographic delineation to be made between these recently defined species that would allow us to properly separate previously collected data. Therefore, we chose to present these taxa tentatively as *Bufotes viridis* complex and *Hyla arborea* complex, respectively.

In a recent revision, the two subspecies of *Anguis fragilis* were elevated to species rank, i.e. *A. fragilis* and *A. colchica* (Gvoždik *et al*. 2010); some of the collected data has no diagnostic description or identified subspecies, and, therefore, such records have been combined into *A. fragilis* complex*,* unless otherwise stated.

The latest phylogeographic studies on the species *Natrix natrix* demonstrate discrepancies with the currently utilized taxonomic scheme (Kindler *et al*. 2013); the unclear geographic boundaries between the proposed species necessitates presenting the taxon as *N. natrix* complex.

Results and discussion

For the study area, 20 species of herptiles from 52 localities have been reported in 22 publications (including the square next to Petrohan [FN77B4], outside of the borders of the SPA; Table 1).

We collected 375 exact locations for 24 herptile taxa (25, if *Anguis fragilis* is included), or 41% (43%) of the recognized 58 species in Bulgaria (Stojanov *et al.* 2011). We confirmed all previously reported species (Table 2) and report four new species: *Hyla arborea* complex, *Bufotes viridis* complex, *Coronella austriaca* and *Zamenis longissimus;* we exclude *A. fragilis* complex due to the recent taxonomic changes in the taxon.

Field surveys revealed the presence of 11 amphibian species, four of the order Caudata and seven representatives of the Anura (57% and 58% of the Bulgarian batrachofaunal diversity, respectively). Reptiles were represented by 13 species (14, including the *Anguis fragilis* complex) – six (seven) of the suborder Sauria and seven of the suborder Serpentes, 43% (50%) and 39%, respectively, of their diversity of Bulgaria. One species with more than one possible subspecies in Ponor SPA is the Sand lizard; all the individuals we found were identified as *Lacerta* *agilis bosnica*. We did not find any representatives of the order Testudines.

Three species (*Emys orbicularis*, *Testudo hermanni* and *Darevskia praticola*) have high potential to be discovered within the SPA. Habitats with seemingly suitable characteristics are present and extend with limited degree of fragmentation outside of the study area (for general species requirements, see Stojanov *et al.* 2011). In addition, we have observed the aforementioned species in the immediate vicinity of SPA.

All collected localities fall within 60 of the 113 2×2 squares, providing > 53% coverage. Relatively high richness is found in 18 squares (six or more species), and the highest number of species per square is 11 (Fig. 2; Fig. 3).

The assessment of species richness per UTM square suggests that three areas of Ponor SPA provide suitable habitats for multiple species: 1) the eastern portion along the Iskar River, 2) the north-central region near the Petrohan Pass, and 3) the region situated north of the town of Godech. Although there might be a bias resulting from historically unequal sampling effort, these general areas combine various geographic and climatic conditions as well as habitats, supporting potentially higher diversity. However, the areas near the Iskar River and Godech are experiencing increased anthropogenic pressure. Therefore, these areas warrant more extensive surveys to be carried out in the future in order to assess and delineate more precisely potential herpetologically important sites and to aid in identifying more specific measures to protect the biodiversity.

The vertical distribution of the herpetofauna (383-1562 m a.s.l.) coincides almost completely with the elevations in Ponor SPA (380-1600 m a.s.l.; Fig. 4). The widest range is for *Hyla arborea* complex, and the most restricted is for *Ichthyosaura alpestris.* The elevation ranges for the species generically conform to the expected distributions for the species in Bulgaria (Stojanov *et al.* 2011). Two groups are well separated and stand out: a 'low elevation' (consisting of *Bufotes viridis* complex and *Dolichophis caspius*) and a 'high elevation' (*Ichthyosaura alpestris*, *Vipera berus* and *Zootoca vivipara*). As expected, the remaining species show a much wider range, and deviations from the expected elevation range are probably due to insufficient sampling effort.

We consider nine habitat types to be of particular importance for the herpetofauna in Ponor SPA ($H' \geq 2.00$): they contain 77% of the locations for the observed species and 100% of the species (Table 3).

Four of the top nine are either open habitats with high level of naturalness or small-scale agricultural lands with low-impact ("2.4.3. Land principally occupied by agriculture, with significant areas of natural vegetation", "2.3.1. Pastures", "3.2.2. Moors and heathland", "2.4.2. Complex cultivation patterns"), while four others are natural broad leaf forests ("3.1.1. Broad-leaved forest", "Oriental hornbeam forests", "3.2.4. Transitional woodland/shrub", "European beech forests"). These results suggest the local importance of both natural / semi-natural open landscapes and broad leaf forests for the herpetofaunal diversity. The high diversity noted in category "1.2.2. Road and rail networks and associated land" likely reflects observer bias by increased sampling and detectability along such habitats coupled with the fact that these man-made alterations of the landscape provide suitable micro-habitats for multiple species (Benayas *et al.* 2006). "Natural grasslands" (3.2.1.) exhibit low diversity ($H' = 0.64$) with only two species (*Bombina variegata* and *Lissotriton vulgaris*), most likely because of the very small area of this habitat and the limited sampling.

We did not detect herpetofauna in the following habitat categories (total area of 130.51 ha, 0.42%): "2.1.1. Non-irrigated arable land" (19.43 ha, 0.06%), "2.1.2. Permanently irrigated land" (67.22 ha, 0.21%), "2.2.2. Fruit trees and berry plantations" (2.53 ha, 0.01%), "3.3.4. Burnt areas" (2.63 ha, 0.01%), "Macedonian pine" (17.94 ha, 0.06%), "Fir" (0.82 ha, 0.00%), and "Poplar forests" (5.51 ha, 0.02%). Because these habitats occupy a very small area in Ponor SPA, we carried only limited sampling within. In addition, based on our prior field experience around Bulgaria, we have identified these habitats to generally harbour limited herpetofaunal abundance and diversity (in relation to territories subjected to fires, see Popgeorgiev 2008, Popgeorgiev, Kornilev 2009).

Species that are of conservation importance and/or potentially locally endangered include those that are present in a limited number of habitats and in a limited number of localities. For species such as *Dolichophis caspius, Natrix tessellata* and *N. natrix* complex that are common in surrounding areas, the low number of localities likely reflects bias in the search effort and not true rarity; additional sampling should aid in revealing the underlying reasons. However, especially for amphibian species such as *Truturus ivanbureschi*, *Bufotes viridis* complex, *Ichthyosaura alpestris* this is due to the limited number of suitable waterbodies, making them species of high local conservation importance. Therefore, a cost-effective action with

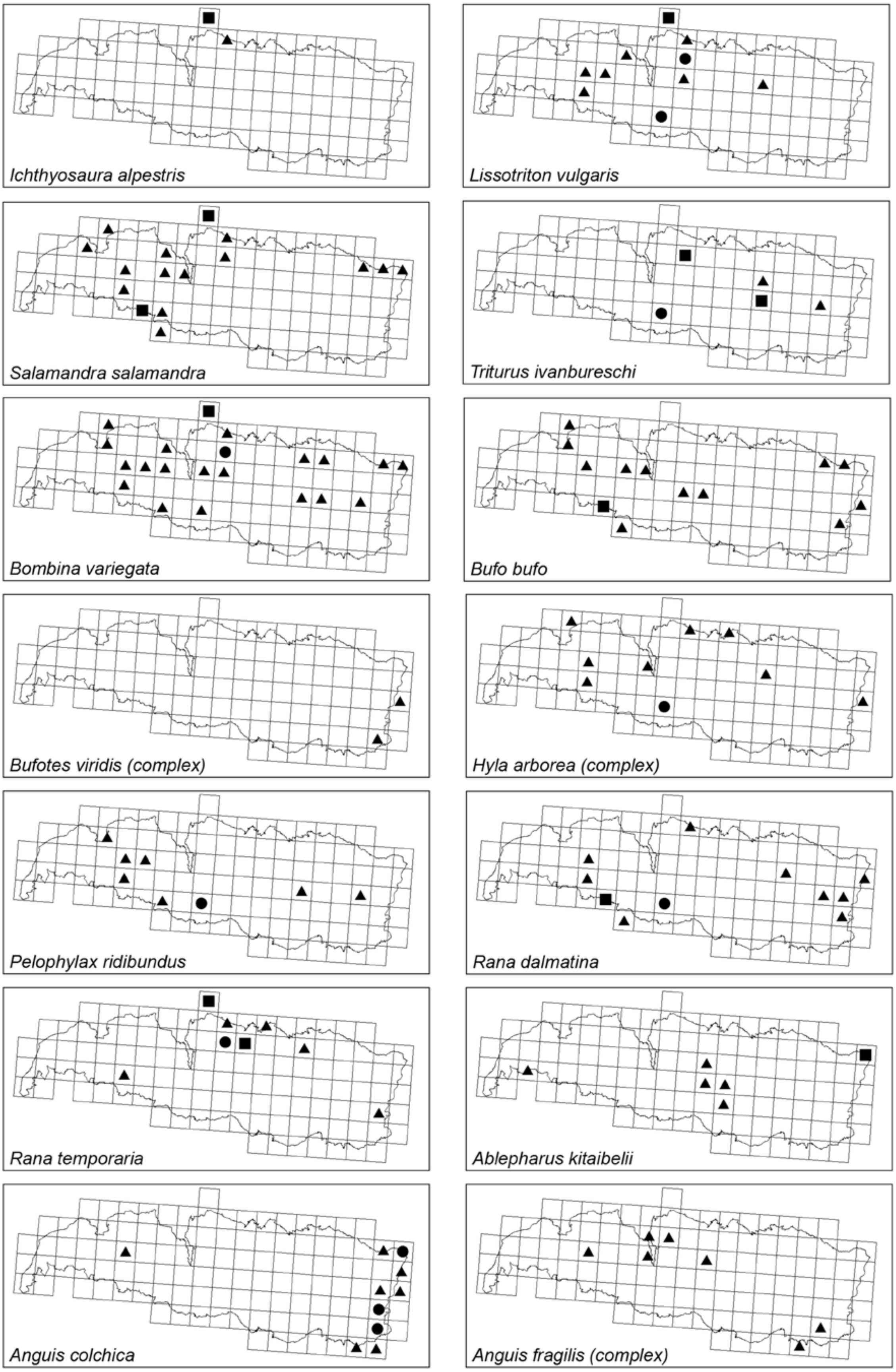

Fig. 2. Amphibian and reptilean species distribution in Ponor SPA, western Bulgaria, superimposed on the national 2×2 km UTM grid. Triangles represent previously unpublished location records; squares – previously published location not confirmed by this study; circles – previously published location, confirmed by this study

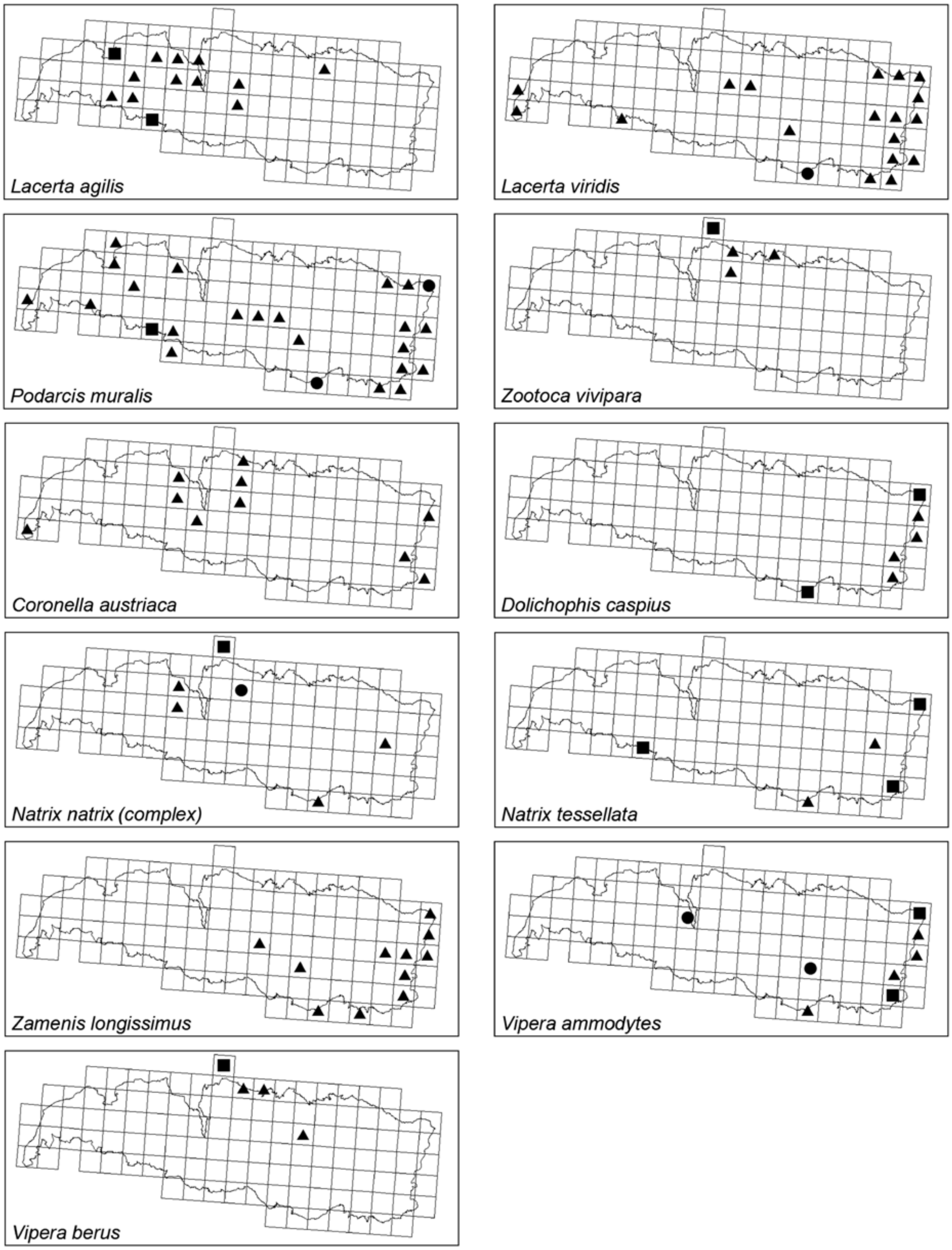

Fig. 2. Continued

Table 2. Species composition, distribution and conservation status of amphibians and reptiles in Ponor SPA. UTM refers to the number of 2×2 km squares; BPA – to the Appendix number in the Biodiversity Protection Act of Bulgaria; DIR – to the Appendix number in the Council Directive 92/43/EEC; BER – to the Appendix number in the Convention on the Conservation of European Wildlife and Natural Habitats, Bern, 1979

Species	UTM	BPA	DIR	BER
Ichthyosaura alpestris (Laurenti, 1768)	1	3	–	3
Lissotriton vulgaris (Linnaeus, 1758)	9	3	–	3
Salamandra salamandra (Linnaeus, 1758)	15	3	–	3
Triturus ivanbureschi Arntzen et Wielstra, 2013	5	2, 3	2, 4	2
Bombina variegata (Linnaeus, 1758)	20	2, 3	2, 4	2
Bufo bufo (Linnaeus, 1758)	13	3	–	3
Bufotes viridis complex*	2	3	4	2
Hyla arborea complex*	9	3	4	2
Pelophylax ridibundus (Pallas, 1771)	8	4	5	3
Rana dalmatina Fitzinger in Bonaparte, 1838	11	–	4	3
Rana temporaria Linnaeus, 1758	7	4	5	3
Ablepharus kitaibelii Bibron et Bory de Saint-Vincent, 1833	6	3	4	2
Anguis fragilis complex*	16**	3	–	3
Lacerta agilis Linnaeus, 1758	13	3	4	2
Lacerta viridis (Laurenti, 1768)	19	3	4	2
Podarcis muralis (Laurenti, 1768)	24	3	4	2
Zootoca vivipara (Lichtenstein, 1823)	3	3	–	3
Coronella austriaca Laurenti, 1768	10	3	4	2
Dolichophis caspius (Gmelin, 1789)	6	3	4	2
Natrix natrix (Linnaeus, 1758)	5	–	–	3
Natrix tessellata (Laurenti, 1768)	5	3	4	2
Zamenis longissimus (Laurenti, 1768)	11	3	4	2
Vipera ammodytes (Linnaeus, 1758)	8	3	4	2
Vipera berus (Linnaeus, 1758)	3	–	–	3

* See comments in Material and Methods.
** The presence of *A. colchica* was proven in 10 of the squares.

high conservation impact for amphibians would be the artificial creation of small (ca. 100 m^2) pools around the SPA.

The limited distribution and the few observations of *Zootoca vivipara* are most likely linked with the vertical range of *Z. vivipara* that falls between 1400-2500 m a.s.l. in Bulgaria, with the lowest extreme at 1200 m a.s.l. (Stojanov *et al.* 2011); this places the SPA in the species' extreme range. In addition, the vertical range of species such as *Z. vivipara* is also constrained by elevated humidity as part of their microhabitat requirements. The large-scale human induced conversion of broad leaved forests (especially the beech forests) into open grasslands that occurred within the last centuries in the Ponor region decreases the overall humidity of habitats, further reinforced by the karst nature of the area.

Conclusions

Open habitats in Ponor SPA such as "2.3.1. Pastures", "2.4.3. Land principally occupied by agriculture, with significant areas of natural vegetation", and "3.2.2. Moors and heathland" are of great importance for amphibians and reptiles. They not only occupy major portion of the area (especially "Pastures"), but they are characterized by their high abundance and diversity. This necessitates these habitats' sustainable use and a planned management of the territory.

The currently obtained herpetological data can be used in the development of future management plans for Ponor SPA, and should be included in the update of the Natura 2000 Standard Data Form for the site.

Two newt species (*Triturus ivanbureschi* and *Ichthyosaura alpestris*) are with critically low number

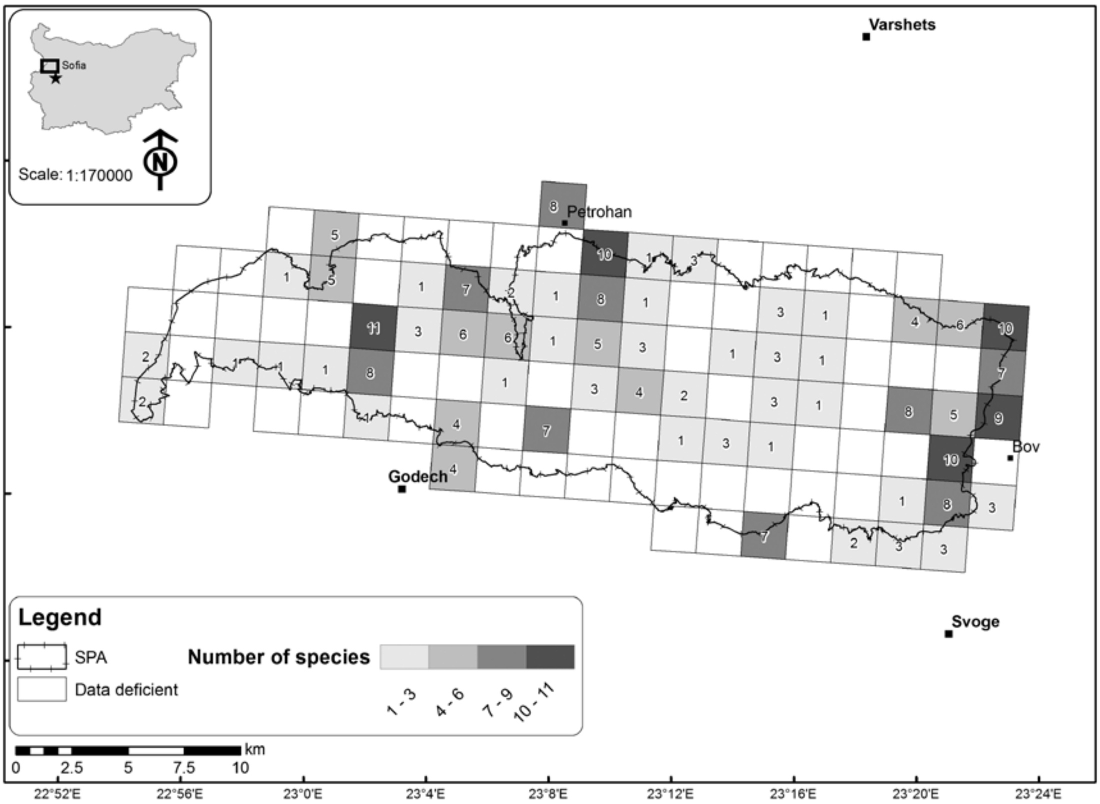

Fig. 3. Amphibian and reptilean species richness in Ponor SPA, western Bulgaria, superimposed on the national 2×2 km UTM grid. The number of species in each square is based on data from this study with published records that could be attributed to the 2×2 km UTM grid. Data deficiency reflects a lack of sufficient sampling effort, and likely does not correspond to true absence of herpetofauna

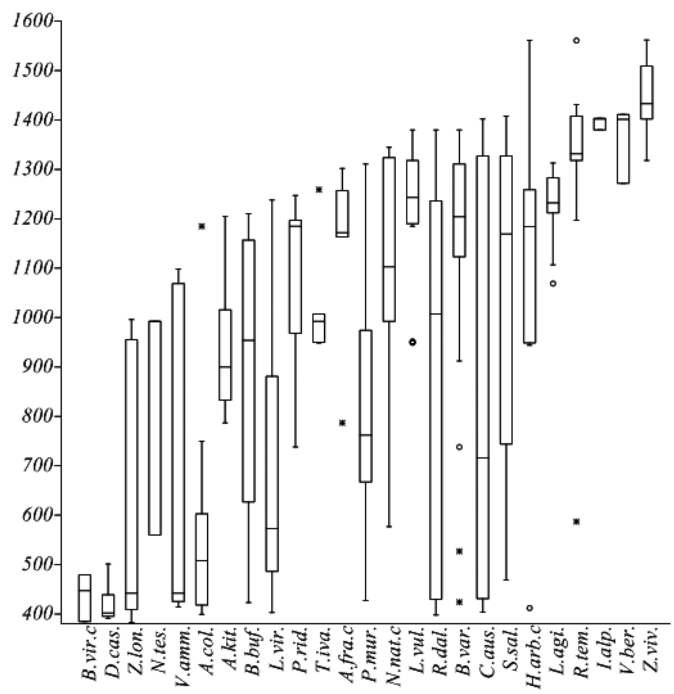

Fig. 4. Amphibian and reptilian vertical distribution in Ponor SPA, western Bulgaria, in meters above sea level, based on data from this study. Thin lines represent minimum and maximum values, with stars and circles being outliers; the thick bars are 95% confidence interval (CI) of the observations; horizontal lines in each thick bar represent the mean. Scientific names are represented by acronyms – capital letter of the genus and the initial three letters of the species name. "c" stands for "complex"

Table 3. Diversity of herpetofauna vs. habitats in Ponor SPA. *H'* is Shannon's diversity index. Scientific names are represented by acronyms – capital letter of the genus and the initial three letters of the species name. "c" stands for "complex"

Species/ Habitats	**2.4.3. Land principally occupied by agriculture, with significant areas of natural vegetation**	**3.1.1. Broad-leaved forest**	**2.3.1. Pastures**	**3.2.2. Moors and heathland**	**Oriental hornbeam forests**	**1.2.2. Road and rail networks and associated land**	**2.4.2. Complex cultivation patterns**	**3.2.4. Transitional woodland/ shrub**	**European beech forests**	**Scots pine forests**	**1.1.2. Discontinuous urban fabric**	**5.1.1. Water courses**	**3.3.3. Sparsely vegetated areas**	**Black pine forests**	**3.2.3. Sclerophylous vegetation**	**2.4.1. Annual crops associated with permanent crops**	**3.1.3. Mixed forest**	**Hornbeam forests**	**3.1.2. Coniferous forest**	**3.2.1. Natural grassland**	**3.3.2. Bare rock**	**1.3.1. Mineral extraction sites**	**Oak forests**	**1.1.1. Continuous urban fabric**	**Lime forests**	**Soil and forest roads**	**Spruce forests**	**Habitats**	**Locations**	**H'**
Area (ha)	221	803	11162	4157	1700	103	111	374	3934	881	1032	93	1458	538	1241	1387	94	646	25	122	363	203	414	14	1	41	171	31288		
Area (%)	0.7	2.6	35.5	13.2	5.4	0.3	0.4	1.2	12.5	2.8	3.3	**0.3**	**4.6**	**1.7**	**4.0**	**4.4**	**0.3**	**2.1**	**0.1**	**0.4**	**1.2**	**0.7**	**1.3**	**0.1**	**0.0**	**0.1**	**0.5**	**99.6**		
P. mur.	2	5			6	1	1				2	2		4	2			1			1	3	1					13	31	**2.4**
C. aus.	2		1	1	2	2		1	1	2				3					2									10	17	**2.2**
B. buf.	2	2	3	1		3			1	1	1		1												2			10	17	**2.2**
S. sal.	1	3	8	4	2	1			2		1	2			1			1						1				12	27	**2.2**
A. kit.		1		1	1		1	1		1			1		1											1		9	9	**2.2**
L. vir.	6	2	3	2	4	2		2						1								1	3					10	26	**2.2**
B. var.	2	8	19	4	1	4		1	9	1	1	3	3			1				1								14	58	**2.1**
L. agi.		2	3			1			4			1	2				1		1									8	15	**1.9**
P. rid.	3	1	7			3	1		2				2			1												8	20	**1.9**
A. col.	3	1			3			1		1	1			1														7	11	**1.8**
***A. fra.* c**	2	1	2				1	1	2																			6	9	**1.7**
***H. arb.* c**	2		4	2			2				1		1															6	12	**1.7**
Z. lon.	7	1	3		2	1		1						1														7	16	**1.6**
R. dal.	5	2	2	2			1	1																				6	13	**1.6**
L. vul.		3	11	2			1		3			1								2								7	23	**1.6**
Z. viv.			1	2					1	1																	1	4	6	**1.6**
V. amm.		6			2	1					1			4														5	14	**1.4**
R. tem.			5	4					1	1							1											5	12	**1.4**
D. cas.		4			2							2									2							4	10	**1.3**
T. kar.	3	4	2				1																					4	10	**1.3**
***N. nat.* c**	3	1	3																									3	7	**1**
N. tes.	1				2																							2	3	**0.6**

Table 3. Continued

Species/ Habitats	2.4.3. Land principally occupied by agriculture, with significant areas of natural vegetation	3.1.1. Broad-leaved forest	2.3.1. Pastures	3.2.2. Moors and heathland	Oriental hornbeam forests	1.2.2. Road and rail networks and associated land	2.4.2. Complex cultivation patterns	3.2.4. Transitional woodland/ shrub	European beech forests	Scots pine forests	1.1.2. Discontinuous urban fabric	5.1.1. Water courses	3.3.3. Sparsely vegetated areas	Black pine forests	3.2.3. Sclerophylous vegetation	2.4.1. Annual crops associated with permanent crops	3.1.3. Mixed forest	Hornbeam forests	3.1.2. Coniferous forest	3.2.1. Natural grassland	3.3.2. Bare rock	1.3.1. Mineral extraction sites	Oak forests	1.1.1. Continuous urban fabric	Lime forests	Soil and forest roads	Spruce forests	Habitats	Locations	H'
V. ber.			1							3																		2	4	**0.6**
B. vir. c	4																											1	4	**0**
I. alp.				1																								1	1	**0**
Species	16	17	17	12	11	10	8	8	10	8	7	6	6	6	3	2	2	2	2	2	2	2	2	1	1	1	1			
Locations	48	47	78	26	27	19	9	9	26	11	8	11	10	14	4	2	2	2	3	3	3	4	4	1	2	1	1		375	
H'	**2.63**	**2.6**	**2.48**	**2.35**	**2.26**	**2.16**	**2.04**	**2.04**	**2**	**1.97**	**1.91**	**1.72**	**1.7**	**1.61**	**1.04**	**0.69**	**0.69**	**0.69**	**0.64**	**0.64**	**0.64**	**0.56**	**0.56**	**0**	**0**	**0**	**0**			

of locations detected. This calls for urgent conservation measures to be taken, such as protection of the currently known wetlands and artificial creation of additional ones; these measures would additionally benefit other amphibians as well.

The present study provides data that demonstrate the importance of the Ponor SPA for the conservation of amphibian and reptile communities, especially in key regions such as the valleys of the Zimevishka River and Iskar River, the Petrohan Pass, and the surroundings of the village of Gubesh. Additionally, further surveys could bolster its significance, especially if the presence of two more species of high conservation value is confirmed – *Emys orbicularis* and *Testudo hermanni*.

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