Contributions to the knowledge of the composition and geographical distribution of the Western Maramures County Herpetofauna

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Abstract. In western Maramures county we encountered 13 species of amphibians (*Salamandra salamandra, Triturus montandoni, Triturus cristatus, Triturus vulgaris, Bombina bombina, Bombina variegata, Pelobates fuscus, Bufo bufo, Bufo viridis Hyla arborea, Rana ridibunda, Rana dalmatina, Rana temporaria*), 7 species of reptile (*Lacerta agilis, Lacerta viridis, Zootoca vivipara, Anguis fragilis, Elaphe longissima, Coronella austriaca, Natrix, natrix*), as well as hybrids between *Bombina bombina* and *Bombina variegata* and also populations of *Rana esculenta*. The hybrids between the 2 species of Bombina are present at the same altitude as in the rest of western Romania in general. In this region are present plain species as well as species prone to higher areas. The Carpathian newt descends to a more reduced altitude then in general in Romania, but comparable to those at which it was noticed in the Oas region.

Key words: distribution, amphibians, reptiles, Western Maramures, Romania

Introduction

The herpetofauna of Baia Mare depression and of neighboring areas like Ignisului Mountains has been intensely studied lately, on this matter being published several scientific articles, by different collectives of authors (Dehelean & Ardelean 2000, Torok 1994, 1999, 2001). Thus, this is one of the Romanian regions where the herpetofauna has been much studied in the past few years, although in the past information referring to it was practically inexistent (Fuhn 1960, Fuhn & Vancea 1961). In spite of the large number of articles on this matter, after their publication, new species were discovered in the area, like *Triturus montandoni*, or lowland populations of *Zootoca vivipara* (Covaciu-Marcov et al 2007a, 2008a). The identification of these species in this area modifies many previous points of view, generally casting a new light on the herpetofauna of north-western Romania. These recent discoveries motivated us to investigate more thoroughly the herpetofauna of the western Maramures County. The purpose of the study was to establish as accurately as possible the composition and geographical ditribution of the herpetofauna, identifying its particularities and important sectors, as well as the main threats to it.

Materials and Methods

The study was accomplished between the years 2006 and 2007, but dispersed data of the herpetofauna from that area were accumulated since 2004. Practically the data from 2004 much enhanced the prior knowledge on that region's herpetofauna, and determined us to accomplish this detailed study. The field research took place between March and September, emphasized on the spring period when amphibians were easier to identify because of their presence in their aquatic habitat due to reproduction.

The researched area covers a small part of western Maramures County, spreading over 13 localities, for 10 of which prior data existed (Ghira et al 2002). The northern limit, the western limit and large part of the southern limit for the region where the herpetofauna was studied were extremely evident, and represented by the limit between Maramures county and Satu Mare county (Fig 1). After it

leaves the limit between the 2 counties, the southern border of the researched region follows the course of the Somes River, until the confluence point with the Sasar River. From here it heads north back towards Satu Mare County, passing through the localities Tautii Magherus and Baia Mare, the last one remaining outside the researched area (Fig. 1). Thus, in this region, we have plains at an altitude ranging from 150 m to 200 m and situated west of Seini and also alongside the Somes River, as well as mountain areas whit an altitude of over 1000 m belonging to the Ignisului Mountain.

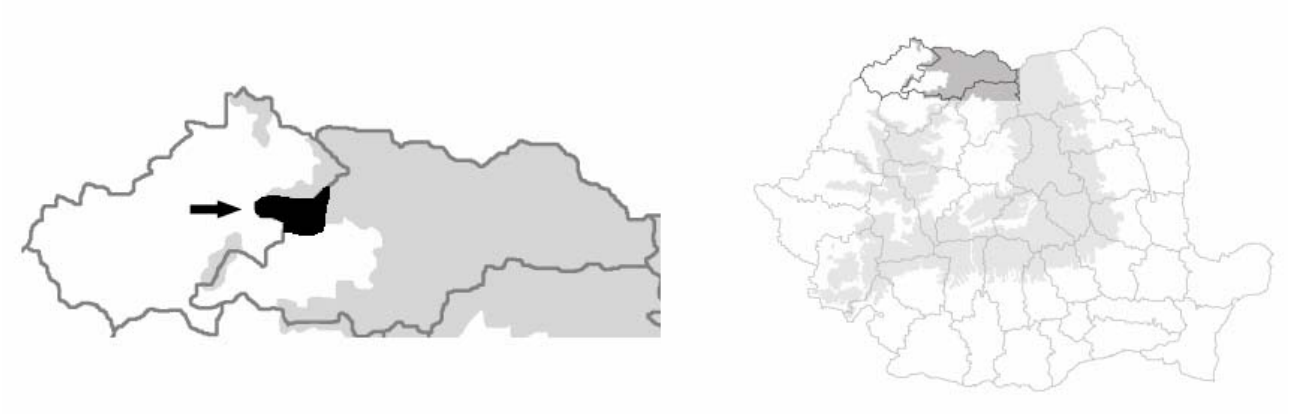

Figure 1. The study area in Western Maramures county, Romania

The method used is represented by the Transect Method (Cogalniceanu 1997). Performing several transects in all the habitats of the region, transects at which level we determined the species. This method has been recently used in other similar studies (Kati et al 2007). The animals were not usually captured, since the direct observation method was used (Brown 1997). In the situations in which the capture of some subjects was demanded, this was generally accomplished by hand. The 1.5 m long metal pole nets were used for capturing newts from murky waters in spring when the animals could not be visually identified, or for the capture of big size green fogs that have very fast movements. After identification the captured animals were released in their habitat, in some cases after they were photographed. In many situations we also used dead animals, killed by the locals, or by cars, when the animal's state permitted identification.

Results

In the researched region we identified 20 species that belong to the herpetofauna and 2 categories of hybrids between different species of amphibians (Table 1, Fig. 2-23). Of the 20 species, 13 are amphibian, represented by *Salamandra salamandra, Triturus montandoni, Triturus cristatus, Triturus vulgaris, Bombina bombina, Bombina variegata, Pelobates fuscus, Bufo bufo, Bufo viridis, hyla arborea, Rana ridibunda, Rana dalmatina, Rana temporaria* and 7 are reptile species, namely *Lacerta agilis, lacerta viridis, Zootoca vivipara, Anguis fragilis, Elaphe longissima, Coronella austriaca, Natrix, natrix*. The amphibian hybrids are represented by hybrids between *Bombina bombina* and *Bombina variegata*, as well as populations of *Rana esculenta.*

We analyzed the distribution of the 20 species and the 2 hybrid forms of the herpetofauna in the 13 localities of the studied region. We identify 127 localities for the species encountered in the 13 localities of the field (Table 1, Fig. 2-23). Out of these, 86 represent new localities for the Romanian herpetofauna, demonstrating that in spite of the numerous articles on the herpetofauna of this region, its geographic spread has been mostly unknown. Two amphibian species (*Bombina bombina* and *Pelobates fuscus*) and one reptile species (*Coronella austriaca*) have been noticed for the first time in the investigated region. Alongside these, both categories of hybrids represent a first for the west of Maramures County.

Table 1. Locality records for the amphibian and reptile species in the studied area (North-Western Maramures county, Romania) (**Ss=***Salamandra salamandra,* **Tm=***Triturus montandoni,* **Tc=***Triturus cristatus,* **Tv=***Triturus vulgaris,* **Bb=***Bombina bombina,* **Bv=***Bombina variegata,* **BX=** *Bombina bombina***X***Bombina variegata,* **Pf=***Pelobates fuscus,* **Buf=***Bufo bufo,* **Buv=***Bufo viridis,* **Ha=***Hyla arborea,* **Rr=***Rana ridibunda,* **Re=***Rana esculenta,* **Rd=***Rana dalmatina,* **Rt=***Rana temporaria,* **La=***Lacerta agilis,* **Lv=***Lacerta viridis,* **Zv=***Zootoca vivipara,* **Af=***Anguis fragilis,* **El=***Elaphe longissima,* **Ca=***Coronella austriaca,* **Nn=***Natrix natrix*)

Species → / ***Localities ↓***	**Ss**	**Tm**	**Tc**	**Tv**	**Bb**	**Bv**	**BX**	**Pf**	**Buf**	**Buv**	**Ha**	**Rr**	**Re**	**Rd**	**Rt**	**La**	**Lv**	**Zv**	**Af**	**Ca**	**El**	**Nn**
Băiţa	S	X	S	S	-	S	-	-	S	O	O	O	-	S	S	S	O	-	S	-	S	O
Buşag	-	-	-	X	-	X	-	-	-	-	O	X	-	-	-	X	-	-	-	-	-	X
Bozânta Mare	-	-	-	X	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-	-	-	X
Cicârlău	X	S	S	X	-	S	-	-	X	-	S	S	-	X	X	X	X	-	X	-	-	S
Handalul Ilbei	X	S	X	X	-	X	-	-	X	-	-	-	-	X	X	X	-	-	-	X	-	X
Ilba	-	-	S	S	X	S	X	-	X	-	S	X	X	X	-	X	X	-	-	X	-	X
Merişor	-	-	O	-	-	O	-	-	O	S	O	S	-	O	-	S	-	-	-	-	-	S
Nistru	X	-	-	O	-	S	-	-	S	-	-	-	-	X	S	S	-	-	-	-	-	X
Săbişa	X	X	X	X	X	S	X	-	X	-	S	S	X	X	-	X	-	-	-	-	-	X
Seini	X	S	S	X	X	S	X	X	X	X	X	X	X	X	-	X	-	S	-	-	X	X
Tăuţii Măgheruş	-	-	X	X	-	X	-	-	X	-	-	X	-	S	X	S	S	-	O	-	-	X
Ulmoasa	X	X	-	-	-	S	-	-	X	-	-	-	-	S	X	X	-	-	X	-	X	-
Viile Apei	-	-	-	X	X	-	-	X	-	-	X	X	-	-	-	X	-	-	-	-	-	X
Σ X	6	3	3	8	4	3	3	2	7	1	2	6	3	6	4	9	2	-	1	2	2	9
Σ S	1	3	4	2	-	7	-	-	2	1	3	3	-	3	2	4	1	1	1	-	1	2
Σ O	-	-	1	1	-	1	-	-	1	1	3	1	-	1	-	-	1	-	1	-	-	1

X = Localities in which we identified the species for the first time = 86 localities
S = Localities in which we reconfirmed the presence of the species = 41 localities
O = Localities in which the species was previously mentioned but the data is not reconfirmed by us = 13 localities
Σ = The sum of localities

Discussions

The herpetofauna of the studied region is diverse, containing relatively numerous species. The diversity of the herpetofauna is geographically conditioned. Therefore the researched area is important because of the contact between Ignisului Mountains and Somesului Plain which reflects on the composition of the herpetofauna throw the mixture of plain species and mountain species. In the region are present plain species like *Bombina bombina* or *Pelobates fuscus*, but also species tied to higher altitude areas like *Triturus montandonii*, *Bombina variegata* or *Rana temporaria*, and species belonging to both regions. The plain species are found for the first time in this region, underlining the absence of exact studies on this sector of the studied region. Prior studies although covered this territory geographically they mainly focused on the higher zone. Proof to the mixture of herpetofauna elements is more clearly shown by the identification of several hybrid populations between *Bombina bombina* and *Bombina variegata*, the hybrid populations between these two species appear in general in western Romania at the contact points between plains and the first geographical elements of the higher regions (Covaciu-Marcov et al 2002, 2003 a, b, 2004, 2005 a, b, 2006 a, b, 2007b, 2008b).

The altitudinal limits reached by the different species identified in the area are in general those corresponding to the respective species in general in Romania (Fuhn 1960, Cogalniceanu et al 2000, Iftime

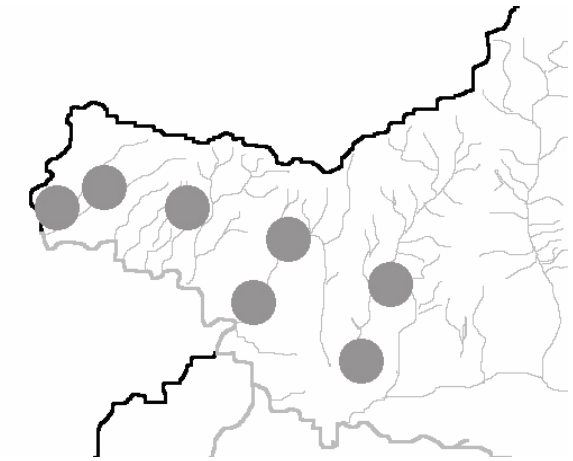

Figure 2. Distribution of *Salamandra salamandra* in the study area

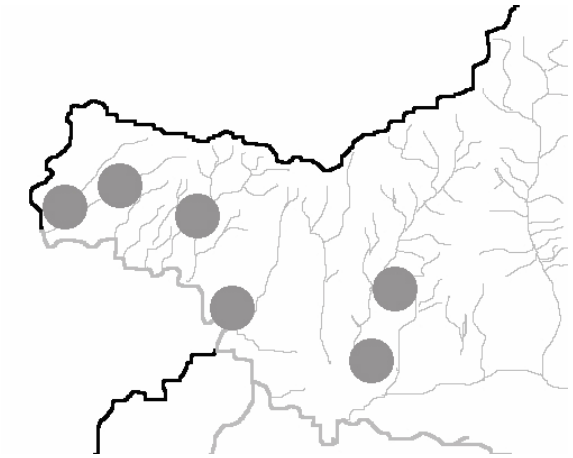

Figure 3. Distribution of *Triturus mntandoni* in the study area

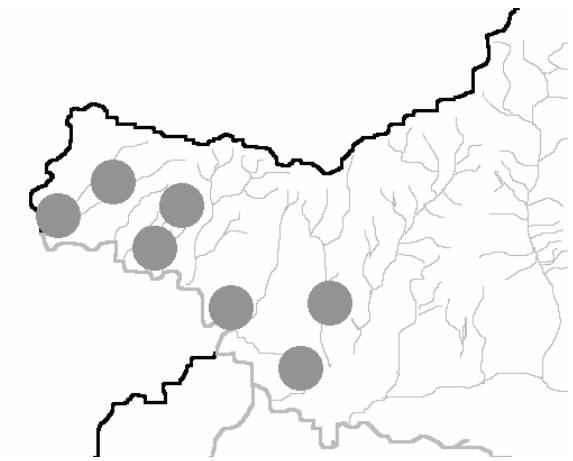

Figure 4. Distribution of *Triturus cristatus* in the study area

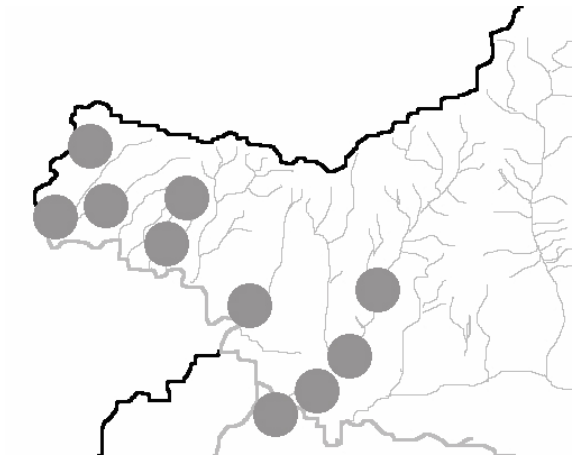

Figure 5. Distribution of *Triturus vulgaris* in the study area

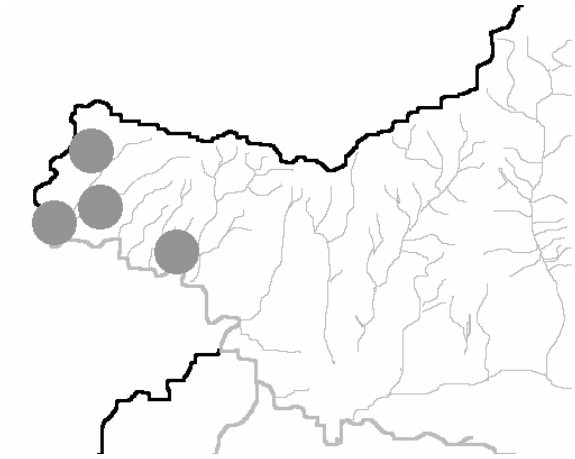

Figure 6. Distribution of *Bombina bombina* in the study area

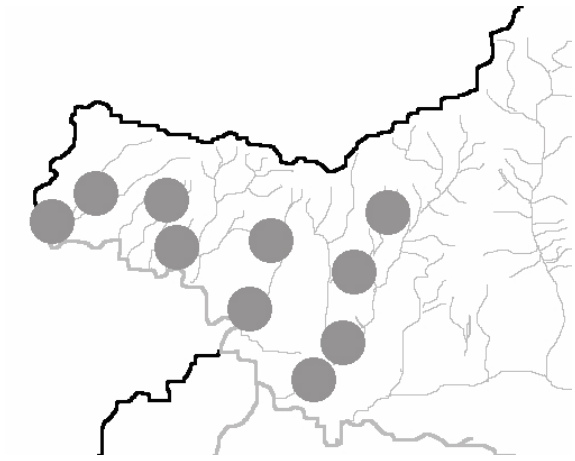

Figure 7. Distribution of *Bombina variegata* in the study area

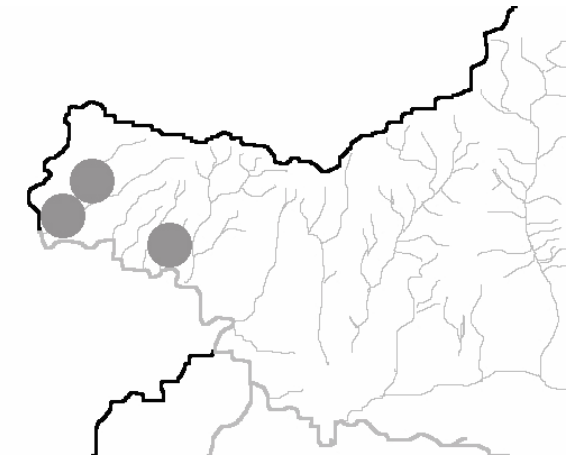

Figure 8. Distribution of *Bombina* hybrids in the study area

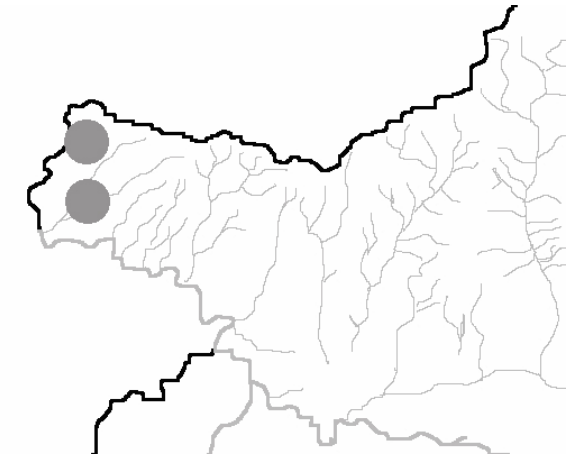

Figure 9. Distribution of *Pelobates fucsus* in the study area

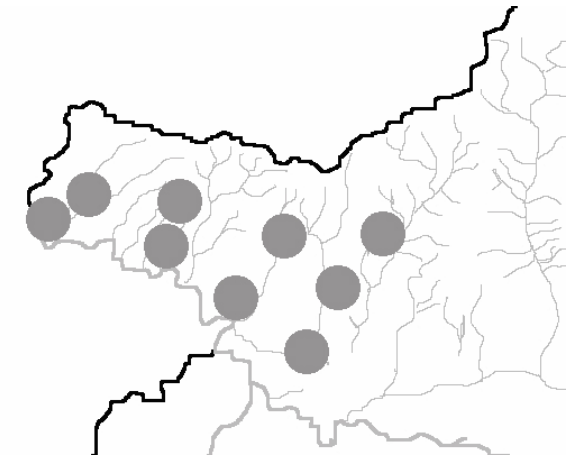

Figure 10. Distribution of *Bufo bufo* in the study area

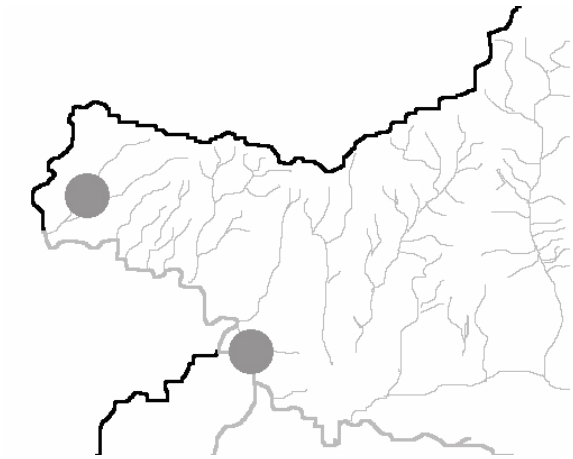

Figure 11. Distribution of *Bufo viridis* in the study area

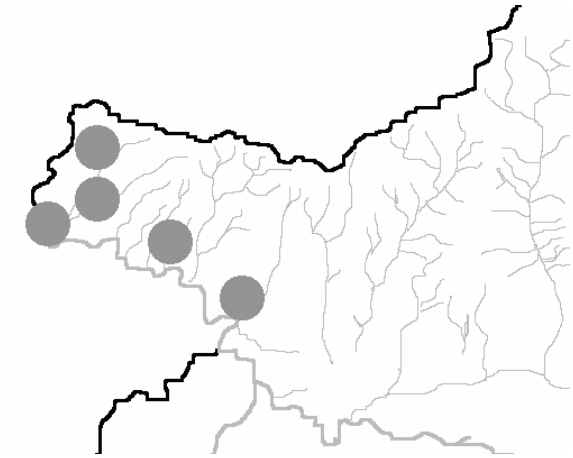

Figure 12. Distribution of *Hyla arborea* in the study area

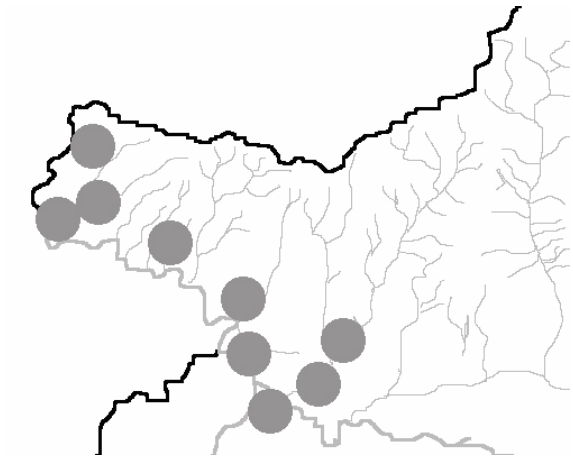

Figure 13. Distribution of *Rana ridibunda* in the study area

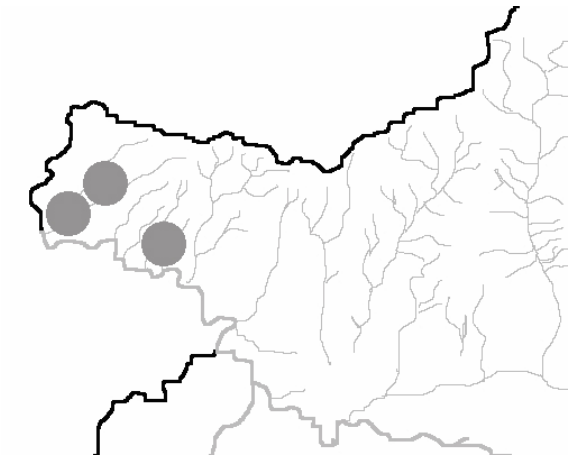

Figure 14. Distribution of *Rana* kl. *sculenta* in the study area

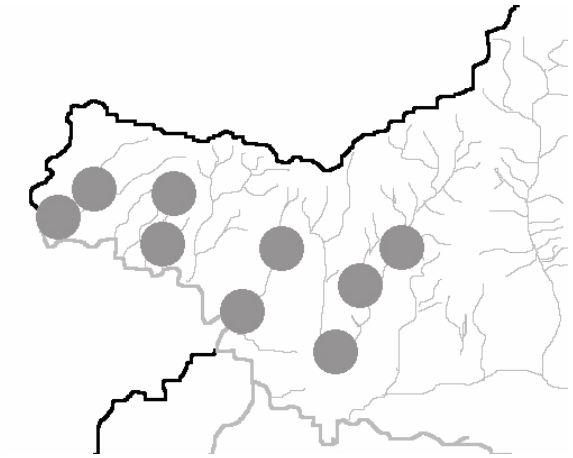

Figure 15. Distribution of *Rana dalmatina* in the study area

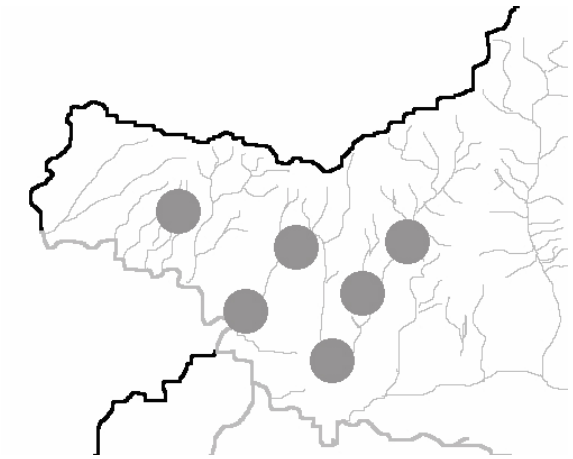

Figure 16. Distribution of *Rana temporaria* in the study area

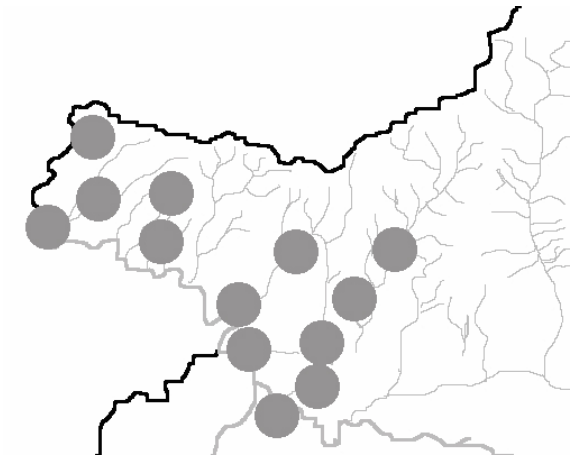

Figure 17. Distribution of *Lacerta agilis* in the study area

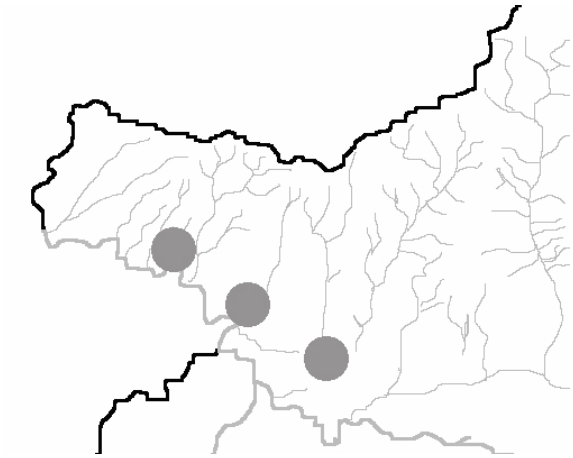

Figure 18. Distribution of *Lacerta viridis* in the study area

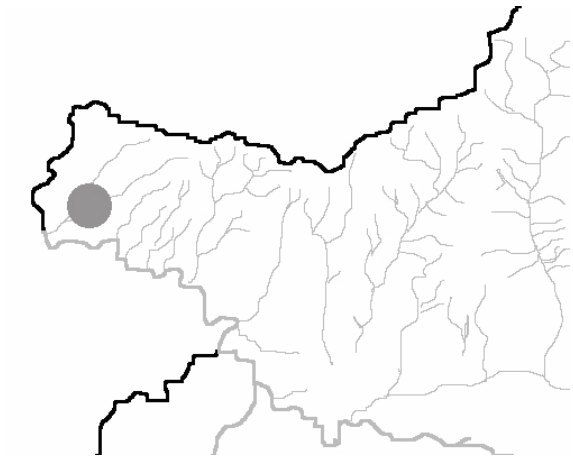

Figure 19. Distribution of *Zootoca vivipara* in the study area

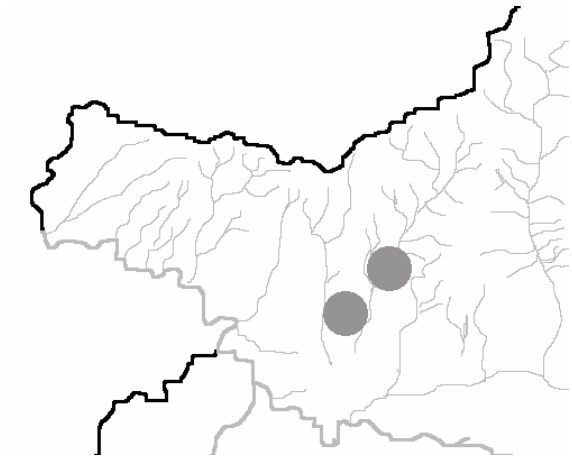

Figure 20. Distribution of *Anguis fragilis* in the study area

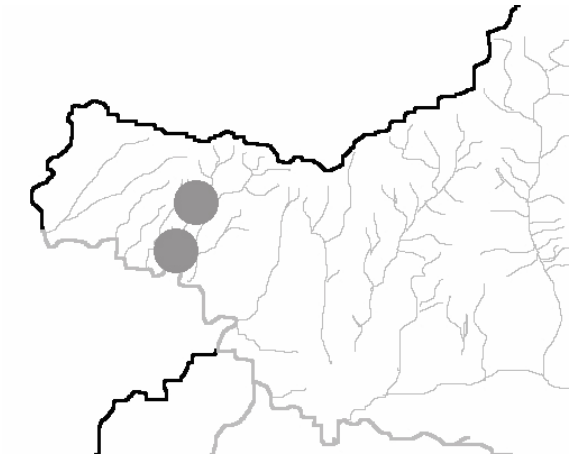

Figure 21. Distribution of *Coronella austriaca* in the study area

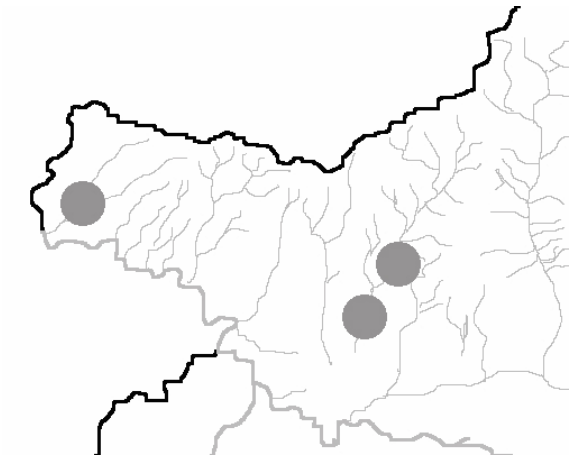

Figure 22. Distribution of *Elaphe longissima* in the study area

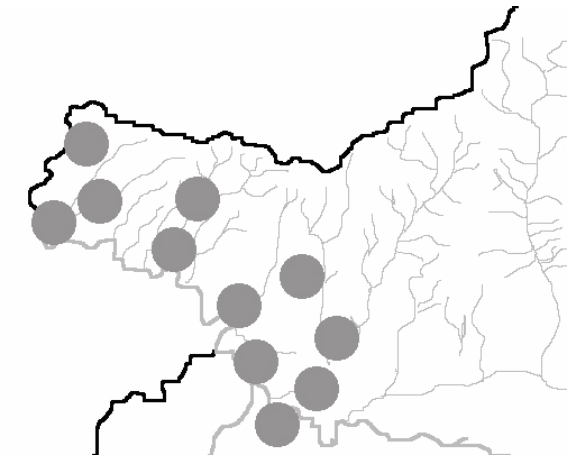

Figure 23. Distribution of *Natrix natrix* in the study area

2005). Still, in some cases these limits are a lot lower than the national average, but they are included in the regional average valid in western Romania (Covaciu-Marcov et al 2002, 2004, 2007a, 2008a). Maybe the most unusual situation is that of the Carpathian newt, *Triturus montandoni*, a species considered to be traditionally spread from 500 m or even 700 m upwards (Fuhn 1960, Cogalniceanu et al 2000). Just recently the species was noticed in the west of Ignisului Mountains and oasului Mountains, at an altitude of 200 m (Covaciu-Marcov et al 2007a). In this study we observed this species in three new localities. Included in the general context of low altitude populations of north-western Romania, in some cases the Carpathian newt descends to an altitude of 300 m. These results complete the priory sketched scenario regarding the distribution of this species in the Ignisului Mountains. Technically the Carpathian newt descends in this region up to the last mountain hills covered in woods, reaching the area nearby Somesului flood plain. It is a different situation then that existing in other parts of Romania, for example in Moldova, at similar altitudes the species descends just to 450 m (Covaciu-Marcov et al 2008 c, Gherghel et al 2008).

Even more interesting in this context is the absence of the other mountain area newt, *Triturus*

alpestris, especially when this is present at an altitude of 200 m on the southern bank of Somes River, in Magura Codrului, at just 30 km of the studied area (Covaciu-Marcov et al 2005b). Normally in other areas of Romania the two species are found together, even at lower altitudes (Gherghel & Ile 2006). These results seem to confirm previous speculations (Covaciu-Marcov et al 2007a) regarding the existence of an glacial refuge in the Oas-Ignis area for a group of *Triturus montandoni* population, refuge from which *Triturus alpestris* was missing. These assumptions seem to be reinforced by the fact that also in the case of the newly discovered localities were *Triturus montandoni* was identified, it did not appear alongside *Triturus vulgaris*, the closest species to it (Rafinski & Arntzen 1987, Babik et al 2005), whit which it frequently hybridized (Fuhn 1963, Babik et al 2003). In all this cases *Triturus montandoni* can either be found alone in its habitat or, in a one case, alongside *Triturus cristatus*. Even if we can find in the same locality *Triturus vulgaris*, it always occupies different habitats. All of the above seem to be confirmed by the similar distribution of the species in the neighboring areas in Ukraine (Litvinchuk et al 2003).

The habitats where *Triturus montandoni* is found are usually reduced in dimensions, represented by natural permanent springs that form streams. In this kind of habitats the species is found alongside salamandra larva. Another category of habitat used by the Carpathian newt is represented by ephemeral pools formed after forest vehicles passed. These habitats at the beginning of spring are full of brown frog eggs.

Throw the researched area passes a segment of the hybrid zone for the two species of Bombina. *Bombina variegata* is obviously more distributed than *Bombina bombina*, due to the extent of the higher areas in the region. *Bombina bombina* is more scarce, mainly occupying the sector found to the west of Seini town, as well as a narrow sector upstream and alongside of Somes River. The hybrid populations surround, like a belt, the lower limit of the mountains spreading to the west and south of them. The hybridization area is found at altitudes ranging from 150 m to 180 m, thus corresponding to the general situation of Satu Mare County and of the north-western Romania in generally (Covaciu-Marcov et al 2002, 2003a,b, 2005a,b, 2006a, 2007b, Ferenti 2008, Sas et al 2005). These results confirm the unitary functionality referring to altitudinal disposition of the hybrid zone in the north-western Romania, and all together its location at much lower altitudes than in other areas of Romania like Moldova or Transylvania (Ghira et al 2003, Vines et al 2003, Covaciu-Marcov et al 2008c, Gherghel et al 2008). On the other side, for the second time, in Maramures County populations of *Bombina bombina* are found, previously the species was mentioned first in 2007 but in an area neighboring Salaj county (Covaciu-Marcov et al 2007 b). Thus, it is one more time suggested that the species' access way into the Transylvanian basin was alongside the Somes River.

From among the green frogs, only two forms are present. *Rana ridibunda* is the most comun and is found constantly throughout the region, *Rana esculenta* is not so well represented, and is found only in the eastern sector of the region. *Rana* lessonae could not be found in the area, although it is present in Satu Mare County, a little to the west of the analyzed area (Covaciu-Marcov et al 2007c). The absence of this species (*Rana* lessonae) is a consequence of the relatively narrow Somes River, which much reduces the permanent swampy habitats typical for this species (Covaciu-Marcov et al 2007c). The proof is the fact that also the hybrid, *Rana esculenta*, which is more enduring, is scarce and strictly located in the researched area. *Rana ridibunda* is the same, as in the west of Romania in generally, (Covaciu-Marcov et al 2002, 2003 a, 2004, 2005 a, b, 2006 a, b) present in a wide range of habitats, and represented by numerous individuals.

Specific for the researched region, and important for conservation reasons, is the presence of large populations of reptiles representing the majority of the reptile species. So, for example, *Elaphe longissima* is generally scars in western Romania (Covaciu-Marcov et al 2003 a, b, 2005 a, 2007 b, 2008 b) but in the studied area is better represented, being

observed in 3 localities. We identified several individuals, including some measuring over 1.5 m (Foto 1). This indicates that in the area still exist little anthropic stressed habitats, fact suggested by the relatively vast forest areas in the Ignisului Mountains. The other reptile species also have generally large populations in this area, and were identified in several localities. The exception is *Zootoca vivipara*, which was recently encountered and only in one locality, in Seini (Covaciu-Marcov et al 2008a). In Seini the species is present in humid areas, occupying the strip of vegetation from the sides of the canals. The population in Seini belongs to the large group of *Zootoca vivipara* populations from the plains, which are spread in the plain sectors of north-western Romania. In the researched region this group of populations is at its eastern limit of expansion. It seems that like *Rana lessonae*, *Zootoca vivipara* does not go upstream alongside the Somes River for the same reasons, namely, the lack or limited favorable habitats in the region.

The anthropic impact on the herpetofauna of this region is plenty pronounced in spite of the relatively good general situation. A characteristic of the area which directly affects the amphibians is their consumption by the locals, a habit that gravely affects the brown frogs. In spring we encountered several situations in which entire populations were butchered. This type of impact is not just direct and drastic, but is also complete, affecting all the individuals present in the water for laying eggs. The increase in human communities, manifested throw an increase in population and an increase of residential areas, will amplify this kind of impact, probably irreversibly affecting some populations. The anthropic impact is also manifested through road kills, which can be observed on the main road, as well as on the forest roads due to forest equipment or mining equipment. Road kills affects almost all the species of the herpetofauna, but mostly accidently and not quantitative. Small scale clearing of the woods especially affects the habitats of the amphibians.

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