

Amphibians of the Simbruini Mountains (Latium, Central Italy)

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Abstract. Little attention has been paid to the herpetological fauna of the Simbruini Mountains Regional Park, Latium (Central Italy). In this study, we surveyed 50 sites in the course of about ten years of field research, especially during the period 2005-2008. Nine amphibian species, four Caudata and five Anura, 60.0% out of the 15 amphibian species so far observed in Latium, were discovered in the protected area: *Salamandra salamandra*, *Salamandrina perspicillata*, *Lissotriton vulgaris*, *Triturus carnifex*, *Bombina pachypus*, *Bufo balearicus*, *Bufo bufo*, *Rana dalmatina*, *Rana italica*. Physiography of sites has been detailed together with potential threatening patterns. For each species the following topics have been discussed; ecology of sites, altitudinal distribution, phenology, sintopy. *Salamandra salamandra* and *Bombina pachypus* are at higher risk. The importance of the maintenance of artificial/natural water bodies for the conservation management of amphibian population of this territory is discussed.

Keywords. Monti Simbruini Regional Park, Italy, Amphibia, distribution, conservation.

INTRODUCTION

The Simbruini Mountains, recently acknowledged as an Italian Regional Park (the Simbruini Mountains Natural Regional Park, PNRMS), is one of the largest protected areas of Central Italy and preserves an high biodiversity of both animals and plants (e.g., 1508 species and subspecies of vascular plants among which 18.3% are rare or extremely rare in the territory of Latium (Attorre et al., 2000). Nevertheless, this chain of the Central Apennines is among those many areas that are still poorly studied by herpetological researches. So far, the knowledge on the Amphibians of the Simbruini was based on few scattered information found in other papers concerning wider areas (e.g., Bologna et al., 2000, 2007). We have been aimed at improving the knowledge of the herpetofauna distributive patterns of this area, with special emphasis to conservation and protection measures in decreasing populations and species.

MATERIALS AND METHODS

The surface area of the PNRMS extends for over 30,000 ha with northwest-southeast orientation according to the Apennine ridge, and is delimited north-eastward by the boundaries with the Abruzzi region. The chain of Simbruini (main peak, Monte Viglio 2156 m) is mainly constituted by limestone, and is considered the central ring of the sheltered system of Latium Apennine, joined with the bordering Lucretili and Ernici Mountains and directly linked with the urban and suburban area of Rome. Due to its remarkable orography, the annual thermal range is noticeable, ranging from -9.5 and -19.5°C in the coldest months (January / February) to 31.5-39.5°C in the hottest one (July); the pluviometric range is as much wide with yearly rainfall between 775.1 and 2376.0 mm. Among habitats, mesoxerophilous grassland, green pasture of middle and high mountains are prevailing, like uncultivated and mowing fields as much as the decayed areas on decalcified soils of karstic plateau; shrubs with *Genista* sp. are predominant. Pure or mixed formation of *Fagus sylvatica* and *Quercus ilex* are prevailing among mature woods. Field research was carried out from spring 1999 to spring 2008 during day and night shift. As a whole, we dedicated to field surveys 66 days. Yearly distribution of days was as follows: 4 (1999), 2 (2000), 4 (2005), 10 (2006), 25 (2007), 21 (2008); monthly distribution of the inspections to the sites was as follows (months of the year in roman characters): 1 (I), 2 (II), 11 (III), 22 (IV), 6 (V), 7 (VI), 6 (VII), 5 (VIII), 4 (IX), 1 (X), 1 (XI). Field research included: inspection of one site reported in literature (Romano et al., 2003) to check for species and breeding activities; cartographic recognition of further potential aquatic habitats, suitable for amphibian populations, and the inspection of these sites; the collection of information from local people, mainly park-keepers and shepherds. We have examined 101 sites within the PNRMS boundaries, 50 of which suitable to Amphibians according to the presence of at least one among the following features: larvae, sub-adults, adults, breeding and spawning activity. We considered as a single site all those biotopes very close to each other; consequently, 54 biotopes were numbered out of the 50 monitored sites. All sites were georeferenced and assigned to six following different freshwater typologies: river, stream or creek (C), spring- watering trough (F), artificial or natural cave (G), madicolous habitat (rock surface moistened by flowing water, overgrown with mosses) (P), lake and pond (S), and “*volubro*”, i.e. artificial or semi-artificial catch basin exploited by livestock breeder without water turnover (V). Sites were also distinguished between breeding and presence sites. All sites are listed in Table 1 and represented in Fig. 1.

Table 1. List of sites with their freshwater typology.

Site	Locality name, a.s.l. (m)	Type
1	Fonte Martino, Cervara di Roma (RM), 938 m	F
2	Volubro di Camposecco, Camerata Nuova (RM), 1320 m	V
3	Cimitero di Cervara, Cervara di Roma (RM), 1053 m	V
4	Volubro di Pozzo Verardi, Camerata Nuova (RM), 1053 m	V
5	Colle Frassinio, Forestal Refuge, Fondi di Jenne (RM), 1346 m	V
6	Stadio di Cervara, Cervara di Roma (RM), 1217 m	V
7	Campaegli, Cervara di Roma (RM), 1423 m	V
8	Campaegli, Cervara di Roma (RM), 1411 m	V
9	Campo Buffone, Campo dell’Osso, Subiaco (RM) 1444 m	V
10	Campitelle, Fosso Fioio, Vallepietra (RM), 1355 m	P

Site	Locality name, a.s.l. (m)	Type
11	Campitelle, Fosso Fioio, Vallepietra (RM), 1347 m	V
12	Monte Calvo, Subiaco (RM), 1415 m	V
13	Campominio, Campo dell'Osso, Subiaco (RM), 1590 m	V
14	Canali, SP Subiaco-Livata 44/B km 6.900 Subiaco (RM), 1058 m	E,G
15	Ponte del Tartaro, Cimitero di Vallepietra, Vallepietra (RM), 813 m	G
16	Campo Ceraso, Filettino (FR), 1552 m	V
17	Fosse di Livata, Livata Sp 44/B, Subiaco (RM), 1245 m	V
18	Fonte della Radica o Roglioso, Filettino (FR), 1135 m	P
19	Fiume Aniene, Laghetto di San Benedetto, Subiaco (RM), 349 m	C
20	Fonte della Moscosa, Filettino (FR), 1410 m	F
21	Fontana della Scrofa, M.te Pratiglio, Jenne (RM), 1253 m	V
22.a.	San Giovanni dell'Acqua, Jenne (RM), 778 m	F
22.b.	San Giovanni dell'Acqua, Jenne (RM), 773 m	G
23.	Volubro Nuovo, Monte Pratiglio, Jenne (RM), 1405 m	V
24.a.	SP 45/A Subiaco-Jenne km 7.200, Jenne (RM), 838 m	F
24.b.	SP 45/A Subiaco-Jenne km 7.200, Jenne (RM), 830 m	F
25	SP 45/A Subiaco-Jenne km 7.200, Jenne (RM), 821 m	F
26	Fosso di Acqua Corore, Filettino (FR), 970 m	P
27	San Giovanni dell'Aniene, Subiaco (RM), 512 m	S
28	Fonte Canali, Jenne (RM), 1230 m	V
29	Fosso di Acqua Corore, Fiumata, Filettino (FR), 963 m	C
30	Monte Porcaro, parking area, SP 45/A, Jenne (RM), 907 m	F
31	Fiumata, Filettino (FR), 907 m	F
32	Fiume Simbrivio, ex Ponte Castello, Vallepietra (RM), 643 m	P
33	Fiumata, Filettino (FR), 949 m	C
34	Mola Vecchia, Jenne (RM), 527 m	G
35	Fontana Fossatello, ex Ponte Castello, Vallepietra (RM), 749 m	F
36	Campanile del Diavolo, Filettino (FR), 1067 m	P
37	Sentiero sotto Municipio, Jenne (RM), 804 m	F
38	Fontanile delle Sette Cannelle, Trevi nel Lazio (FR), 612 m	P
39	Colle dei Porcili, La Cimata, Jenne (RM), 915 m	F
40	Grotte di San Matteo, Trevi nel Lazio (FR), 652 m	P
41	Collerello, Fiume Aniene, Trevi nel Lazio (FR), 789 m	C
42	Le Fontane, Trevi nel Lazio (FR), 905 m	F
43	Fonte del Cardellino, Trevi nel Lazio (FR), 450 m	G,P
44	Fiume Aniene, SP 29/C km 0.500, Trevi nel Lazio (FR), 556 m	P
45	Fonte Suria, Trevi nel Lazio (FR), 761 m	G,P

Site	Locality name, a.s.l. (m)	Type
46	Laghetto del Pertuso, Trevi nel Lazio (FR), 693 m	S
47	Fonte Suria, Trevi nel Lazio (FR), 731 m	F
48	Comunacque, Fiume Aniene, Trevi nel Lazio (FR), 560 m	G
49	Caprareccia, Fiume Aniene, Trevi nel Lazio (FR), 500 m	P
50	Ponte delle Tartare, Fiume Aniene, Trevi nel Lazio (FR), 629 m	P

RESULTS

The Sørensen's coefficient of similarity (Hayek, 1994) was calculated among species and sites, using only amphibians breeding sites to detect the affinity among species in their reproductive habitats. Amphibians scientific names are here reported following the systematic revision suggested by Frost et al. (2006), Lanza et al. (2007, 2009), and Stöck et al. (2008).

Statistical analysis was performed using on-line Clustering Calculator package (web site: www2.biology.ualberta.ca/jbrzusto/cluster.php).

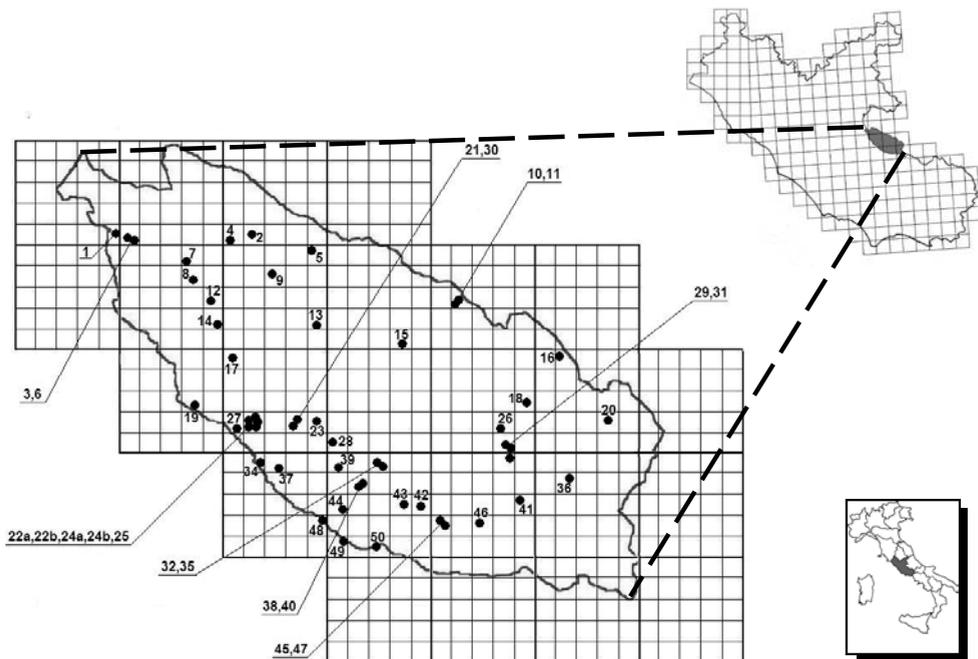


Fig. 1. The distribution of surveyed sites in the study area, the Simbruini Mountains Regional Park (bold squares; UTM 5 × 5 km) and their position in Latium, Central Italy. Low square; the position of Latium in the Italian Peninsula.

Overall, 80 records of amphibians were collected and breeding activity was assessed in 38 sites (sites of reproductive activity SCAR 76% out of total sites). The most widespread species, occurring in high frequency were *Salamandrina perspicillata*, *Triturus carnifex*, *Bufo bufo*, and *Rana italica*, all present in more than the 50% of the monitored sites (Table 2).

Table 2. List of species and collecting localities; numbers of localities refer to Table 1; the frequency is calculated as the percentage of place of presence by respect to the sampled localities.

Species	Localities	Frequency
<i>Salamandra salamandra</i> (Linnaeus, 1758)	26	2%
<i>Salamandrina perspicillata</i> (Savi, 1821)	13, 22, 24a, 24b, 27, 38, 40, 42, 43, 45, 47.	62%
<i>Lissotriton vulgaris</i> (Linnaeus, 1758)	3, 10, 21, 27, 28	16%
<i>Triturus carnifex</i> (Laurenti, 1768)	3, 4, 5, 6, 8, 10, 11, 12, 15, 16, 17, 21, 22, 23, 24a, 28, 35, 49	60%
<i>Bombina pachypus</i> (Bonaparte, 1838)	35	8%
<i>Bufo bufo</i> (Linnaeus, 1758)	2, 3, 6, 8, 11, 12, 13, 14, 16, 17, 20, 21, 22, 23, 25, 27, 28, 30, 32, 33, 35, 36, 37, 39, 41, 44, 46, 49, 50	76%
<i>Bufo balearicus</i> Boettger, 1880	7, 9	4%
<i>Rana dalmatina</i> Bonaparte	22, 27, 43	6%
<i>Rana italica</i> Dubois, 1987	1, 13, 14, 18, 19, 22, 24b, 27, 29, 31, 33, 34, 41, 43, 45, 46, 48	60%

Italian and Smooth newts were mainly found in “volubri” (80% and 78% of sites respectively), located in small valley or high pastures along the border of dry grassland and beech-wood. The Common toad mainly frequented the “volubri” (37% of sites), spring-watering trough (24%) and ponds near river (17%), whereas 13 sites are inside or at the edge of oak-woods, 9 inside beech-woods, 5 in moist meadow at the border of river beds, and two inside a *Pinus nigra* reforestation. The two sites of the Italian green toad were a “volubro” in a meadow and grazing-land close to a suburban area where the species was already observed by park-keepers (L. Songini, *in verbis*, 2008), and a meadow with grazing-land near a beech wood (Fosso Fioio) just pointed out by Romano et al. (2003). The first one represents the absolute height record for this species, 1411 m a.s.l. The Agile frog was found in three sites only: an underground tunnel with flowing water and slimy-clayed substratum, a pond in a meadow nourished by waterfall in travertine rock and an artificial cave with a stream of water and “pearls of cave” substratum. The Italian stream frog mainly frequented limestone caves or galleries (47% of sites), whereas other sites were streams, small lakes, spring watering-troughs and madicolous habitats; nine sites are located inside or at the edge of mixed oak woods, five inside beech-woods, and two are riverine habitat and one is in *Pinus nigra* reforestation.

Finally, it is worth mentioning that other taxa reported in the neighbourhood have not been recorded in the Simbruini Mountains, namely the Green Frogs, *Pelophylax bergeri* / *P. klepton hispanicus* (Bonaparte, 1839) and *Pelophylax lessonae* (Camerano, 1882)

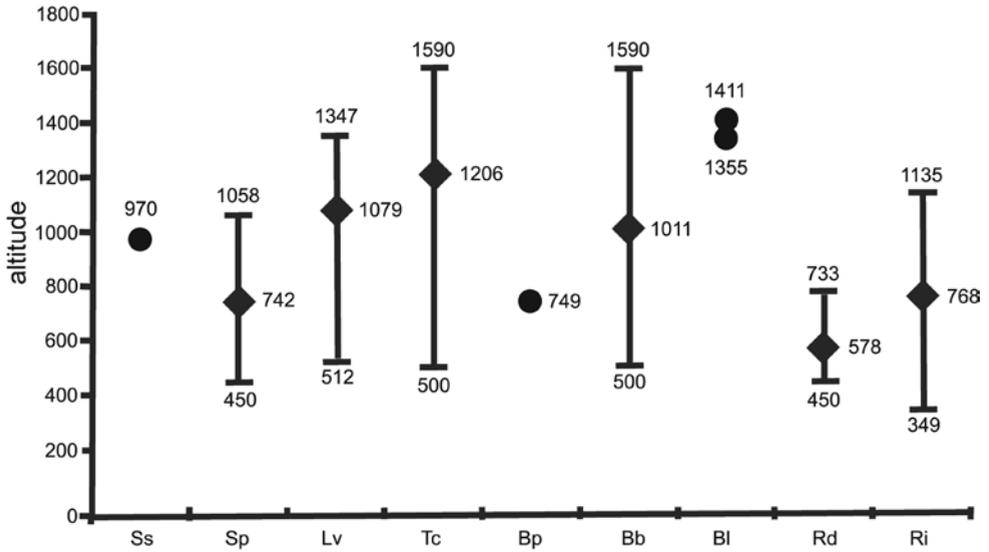


Fig. 2. Altitudinal ranges of Amphibians in the Simbruini Mountains Regional Park; mean altitude of six species is indicated by values within each bars; for three species, single data are reported (circles and numbers). Ss, *Salamandra salamandra*; Sp, *Salamandrina perspicillata*; Lv, *Lissotriton vulgaris*; Tc, *Triturus carnifex*; Bp, *Bombina pachypus*; Bb, *Bufo bufo*; Bl, *Bufo balearicus*; Rd, *Rana dalmatina*; Ri, *Rana italica*.

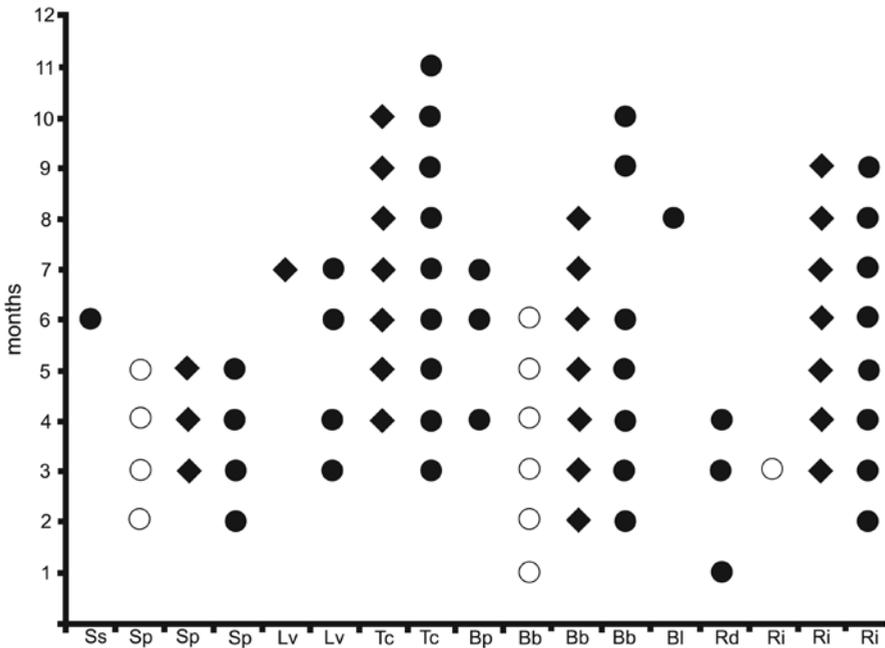


Fig. 3. Phenology of Amphibians observed in water biotopes of the Simbruini Mountains Regional Park. Eggs, empty circles; sub-adults, squares; adults, full circles. Abbreviations of species as in Fig. 2.

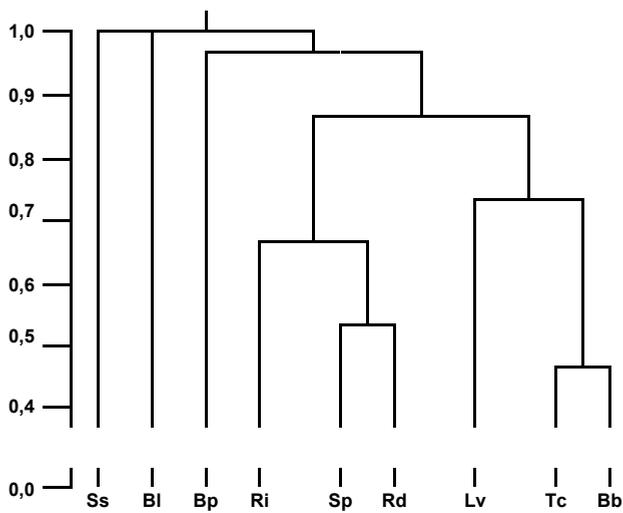


Fig. 4. Sintopy of Amphibians observed in the Simbruini Mountains Regional Park; for details see the text. Abbreviations of species as in Fig. 2.

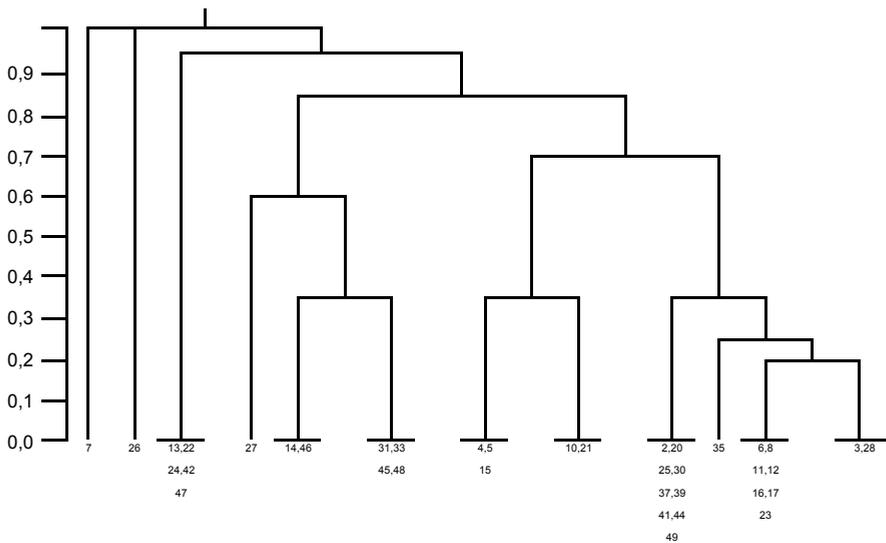


Fig. 5. Sites of Amphibians reproductive activity in the Simbruini Mountains Regional Park; for details see the text. Abbreviations of species as in Fig. 2.

and especially the Italian Tree Frog *Hyla intermedia* Boulenger 1882, whose occurrence on the Altipiano di Arcinazzo at the south-western border of the PNMRS was already noticed (F. Bubbico, D. Cicuzza, IV.1999, pers. com.).

For some species, altitudinal distribution as min.-max. values (m a.s.l.) were detailed: *S. perspicillata*, 450-1058; *L. vulgaris*, 512-1347; *T. carnifex*, 500-1590; *B. bufo*, 500-1590; *R. italica*, 349-1135. Range of altitudinal records was 450-1590 for Caudata and 349-1590 for Anura (Fig. 2). *T. carnifex*, *B. bufo* and *R. italica* were found in water during the whole year (Fig. 3). In 27 sites (54% out of sites) only one species was found, while in 14 sites (28%) two species were found: eight sites with *T. carnifex* and *B. bufo*, four with *B. bufo* and *R. italica*; in seven sites (14%), three species were found: *L. vulgaris*, *T. carnifex* and *B. bufo* were observed together in three sites. In two sites only, syntopy of five species was observed, though not in a single inspection exclusively.

DISCUSSION

Our surveys increased the knowledge on the amphibians' distribution in the study area. Nine amphibians species, four Caudata and five Anura, that is 60.0% of the species of Latium, were recorded within the hinterland and isolated area of the Simbruini Mountains. In accordance with the adequate biological conditions of water, as suggested by the presence of certain invertebrate taxa (Mancini and Arcà, 2000), amphibians are represented by many species, some of which are locally (*S. perspicillata*) or generally (*T. carnifex*, *B. bufo*) abundant. For the whole territory of Latium, the ratio between Caudata and Anura species (r) is quoted as 6 : 9 (Bologna et al., 2000) and in many, highland and large, protected areas, $r \leq 1$, i.e. balanced or hardly favourable to Anura: PNRMS, 4 : 5; Lepini Mountains, 4 : 4 (Corsetti, 1994; Bologna et al., 2007); Ausoni Mountains, 4 : 4 (Corsetti and Romano, 2007); Aurunci Mountains, 4 : 5 (Romano et al., 2007); for lowland and small protected areas, $r \ll 1$, i.e. heavily favourable to Anura; "Nomentum" and "Macchia di Gattaceca and Macchia del Barco", 1 : 5 - 1 : 6 (Crucitti et al., 2004, 2009 and unpublished data). Uncommon levels of species richness i.e. sinthopic presence of five species, were observed in the south-western belt of the area, conversely to the harshness conditions of the inner and higher territories; all that in accordance with observations made in other areas of Central Apennine, e.g. the Majella National Park (Scalera et al., 2006). Height distribution of Caudata and Anura largely overlap, however the range of records for Caudata is restricted to the highest belt, a datum that agrees to the one reported for wider Italian areas (Romano et al., 2007). The abundance of Caudata in the Simbruini Mountains is chiefly due to the widespread presence of newts, especially *T. carnifex*, in the "volubri" and the Italian spectacled salamander, *S. perspicillata*, in spring-watering trough. The district of Simbruini Mountains represents a refugial area for *S. salamandra* (Linnaeus, 1758), a strongly localised species in the whole territory of Latium (Bologna et al., 2000, Caldonazzi et al., 2007), as much as *B. pachypus* a species in dramatic decline in most of the Italian territory (Guarino et al., 2007). *B. balearicus* is mainly localised to piedmont areas (Balletto et al., 2007) as much as *R. dalmatina* which is especially found in hygrophilous woods of planitial zones; besides, the Agile frog is not widespread in Central Italy (Bernini et al., 2007). *L. vulgaris*, though eurytopic species, is mostly found in planitial and hilly areas and rarely at higher altitude (Razzetti et al., 2007). The relative abundance of *S. perspicillata* populations in some hilly areas, as appointed by recent herpetological atlas for the Italian territory (Bologna et al., 2000, 2007; Sindaco et al., 2006;

see also Romano et al., 2009), is corroborated. Inside the PNRMS territory, natural or artificial lakes and ponds are uncommon, conversely to extensive fluvial habitat such as the high watercourse of the River Aniene and its main tributary (River Simbrivio). In this last environments, it is possible to check the presence of *B. bufo* along the perfluvial vegetation belt; inside the river bed, where waters show a laminar flow allowing the development of a thick periphyton and macrofite, there are favourable conditions for the presence of *S. perspicillata*, *B. bufo* and *R. italica*. Widespread water point are “volubri” and spring-watering trough; in the first, the fauna is represented by the association *T. carnifex*-*B. bufo*; in the second, by *S. perspicillata*, also sinthopic with the previous one and with *R. italica*. Artificial cave, especially near the entrance, together with underground tunnel, house *R. italica* adults and offspring and, rarely, *R. dalmatina*. Thirteen out of 50 sites (26% of total sites) are strongly threatened, particularly the spring-watering trough of rural farm in which the periodic cleaning, especially if carried out inadequately, arousing the disappearance of the whole communities (cf. Scocianti, 2001). Sites characterised by an elevated number of species (sites 22, 27) are considered strategic for the purpose of conservation. Nevertheless, the species considered in this paper are strictly protected inside the territory of PNRMS and formally protected inside the whole territory of Latium (Regional Law 18/1988). In the light of these data, the importance of artificial/natural water bodies for the appropriate conservation management of the amphibian population in the Simbruini Mountains Regional Park cannot be underestimated.

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