

Amphibians of the Ausoni Mountains (Latium, Central Italy)

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Abstract. In this study we searched for amphibians in 89 potential breeding sites within the Ausoni Mounts, which are among the less investigated areas of Latium. Sixty-nine spawning sites, and eight amphibian species (57.1% of the 14 amphibian species living in Latium region) were found. Reproductive activity was recorded for *Salamandrina perspicillata*, *Triturus carnifex*, *Lissotriton vulgaris*, *Lissotriton italicus*, *Bufo bufo*, *Hyla intermedia*, *Rana italica* and *Pelophylax synklepton hispanica*.

Keywords. Monti Ausoni, Latium, Amphibia, distribution.

INTRODUCTION

Despite in Latium (Central Italy) herpetological field researches have been carried out systematically (Bologna et al., 2000), there are large disproportion among data from different areas, and the southernmost portion of the region have been investigated only occasionally (cf. Bologna et al., 2000; see also Anonymo 2006a and maps therein). The Volsci Mountain Chain, the western portion of this area, comprises three karstic subgroups: the Lepini, Ausoni and Aurunci Mountains. The information gap on the herpetofauna of two out these chains is now partially filled in by studies on the Lepini (Corsetti and Capula, 1992) and, more recently, on the Aurunci Mountains (Romano et al., 2007). Conversely, previous knowledge on the herpetofauna occurring in the Ausoni Mountains was provided only by a preliminary account (Bonifazi and Carpaneto, 1990) and few other information scattered in some papers concerning wider areas (e.g. Bruno, 1973; Bologna et al., 2000; Corsetti, 2006).

During several years (1998-2007), field activities to update the checklist and to provide a breeding sites' census of the amphibians species of the Ausoni Mounts were carried out. The aim of this work is, therefore, to fill in the information gap on the herpetofauna of the Ausoni Mts and, consequently, to homogenise the herpetological data on the whole Volsci Chain.

MATERIAL AND METHODS

Since there is not a clear hydrographical or geological boundary between Ausoni and Aurunci Mounts, conventionally Ausoni Mounts are considered the mounts at the west of a line connecting Fondi-Lenola-Pico-S. Giovanni Incarico towns (Landi Vittorj, 1955). Furthermore, Ausoni Mounts are separated northward from the Ernici Mounts by the Sacco river, north-westward from the Lepini Mts by the Amaseno river and southward by the planitial and coastal zones before to arrive to the Tyrrhenian sea. The Ausoni Mounts are mainly constituted by limestone rocks. Altitudes vary from piedmont zones (10 m) to the 1,116 m of Monte Calvilli. Main peaks include Monte delle Fate (1,090 m), Monte Calvo (1,038 m), Monte Chiavino (1,028 m) and Cima del Nibbio (1,053 m). Due to karstic phenomena, natural small still freshwater ecosystems highly outnumber running waters. Other still freshwater ecosystems are artificial stony wells, a very common aquatic typology in whole Volsci Chain.

We limited the study area to the one at the north of Via Appia (statal road 7) because all areas to the south of this road belong to the planitial zone. On the whole we surveyed about 330 km² (see Fig. 1). Field researches were carried during 10 years (1998-2007) and included (i) the inspection of the sites reported in literature, (ii) cartographic recognition of further potential aquatic habitats suitable for amphibian populations and the inspection of these sites, (iii) collection of information from local peoples (mainly from shepherds).

Since several sites were very close to each other, two or more aquatic habitats less than 50 m apart and inhabited by the same species, have been considered as a single breeding site. We adopted, therefore, the same criterion used by Romano et al. (2007) for the Aurunci Mounts.

Sites were assigned to seven different freshwater typologies: (i) springs, (ii) drinking places for livestock grazing, (iii) natural ponds, (iv) stony wells, (v) caves, (vi) lakes and marshes and (vii) streams and creeks. Only breeding sites were considered in this study. Since variance among altitudes of anurans and caudatas breeding sites was not homogeneous (data not shown), non parametric Mann-Whitney U-test was applied to check for significant differences between altitudinal distributions showed by Anura and Caudata. Statistical analyses was performed using Statistica® rel. 5.0/W Statistica package (Statsoft Inc., USA).

The Sørensen's coefficient of similarity (Hayek 1994) was carried out among species and sites, using amphibian breeding sites to detect the affinity among species in their reproductive habitats. Amphibian scientific names are here reported following the systematic revision suggested by Frost et al. (2006).

RESULTS AND DISCUSSION

One hundred and thirteen records of amphibians were collected, and breeding activity was recorded in 69 sites, that is 77.5% of the surveyed potential spawning sites (n = 89), including 83 single aquatic habitats (see Materials and Methods). Eight amphibian species were recorded within the Ausoni Mounts (57.1% of the species inhabiting Latium): Northern spectacled salamander, *Salamandrina perspicillata* (Savi, 1821); Italian crested newt, *Triturus carnifex* (Laurenti, 1768); Smooth newt, *Lissotriton vulgaris* (Linnaeus, 1758); Italian newt, *Lissotriton italicus* (Peracca, 1898); Common toad, *Bufo bufo* (Linnaeus, 1758); Italian tree frog, *Hyla intermedia* (Boulanger, 1882); Italian stream frog, *Rana italica* (Dubois, 1987) and *Pelophylax synklepton hispanica* which includes Berger's green frog, *Pelophylax bergeri* (Günther, 1986) and its hybridogenetic hybrid *Pelophylax* kl. *hispanica* (Bonaparte, 1839). Their distribution in the study area is shown in Fig. 1 and

Fig. 2. Compared to published data (Table 1), the Smooth newt and the Northern spectacled salamander showed the highest increments (900% and 360% respectively). The mean altitude of records (Fig. 3) was 461 ± 217 m (average \pm SD; $n = 65$) for caudatas and 295 ± 193 m for anurans ($n = 48$), and this difference was highly significant (Mann Whitney U test = 882.5, $P < 0.0001$; see also Fig. 3).

Excluding the Green frog which has been recorded only in three sites, our survey revealed that the amphibian species are widespread in the Ausoni Mountains, where anurans seem to prefer the Southwest side while urodeles the Northeast portion (Fig. 1 and Fig. 2). Our check list did not improve that reported by Bonifazi and Carpaneto (1990), but the knowledge on the amphibians' distribution in the study area widely increased.

We did not find the spring in the locality "Madonna della Rocca" quoted by Bonifazi and Carpaneto (1990), but we retain that this site corresponds to a spring called San Mau-

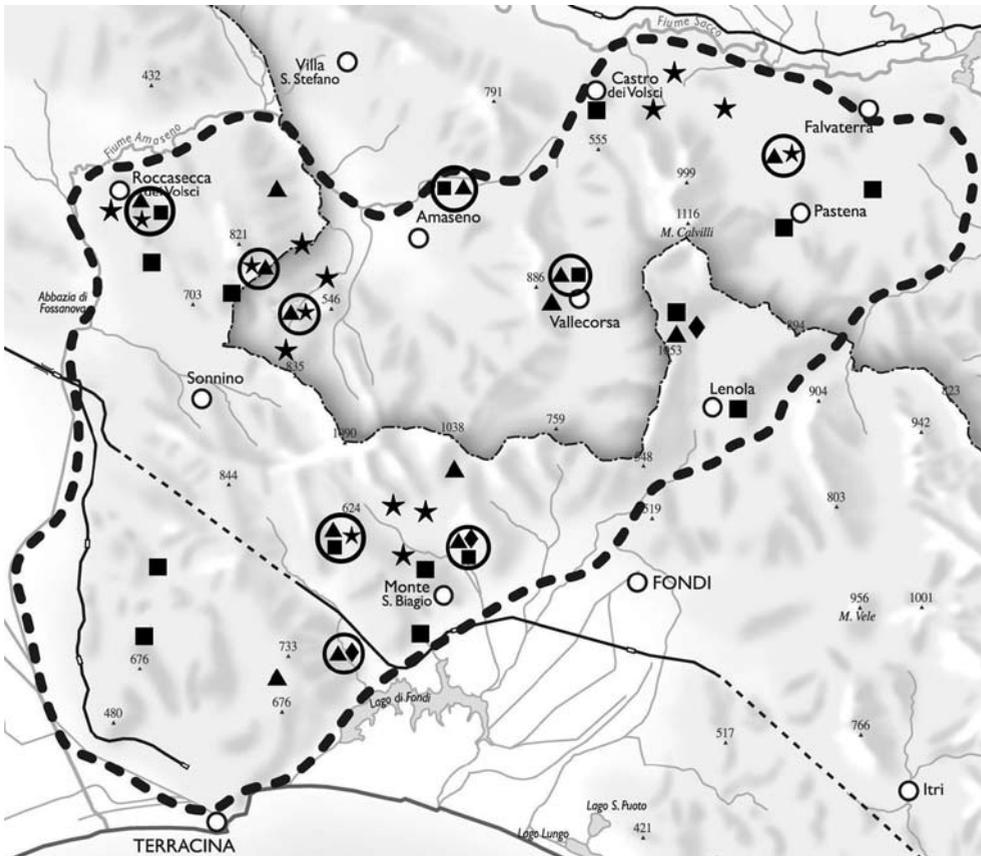


Fig. 1. Distribution of anurans in the Ausoni Mountains (Latium). Triangles = *Bufo bufo*; stars = *Rana italica*; squares = *Pelophylax synkl. hispanica*; rhombuses = *Hyla intermedia*. Sites where two or more species are syntopics are indicated by a circle including the symbols of the species.

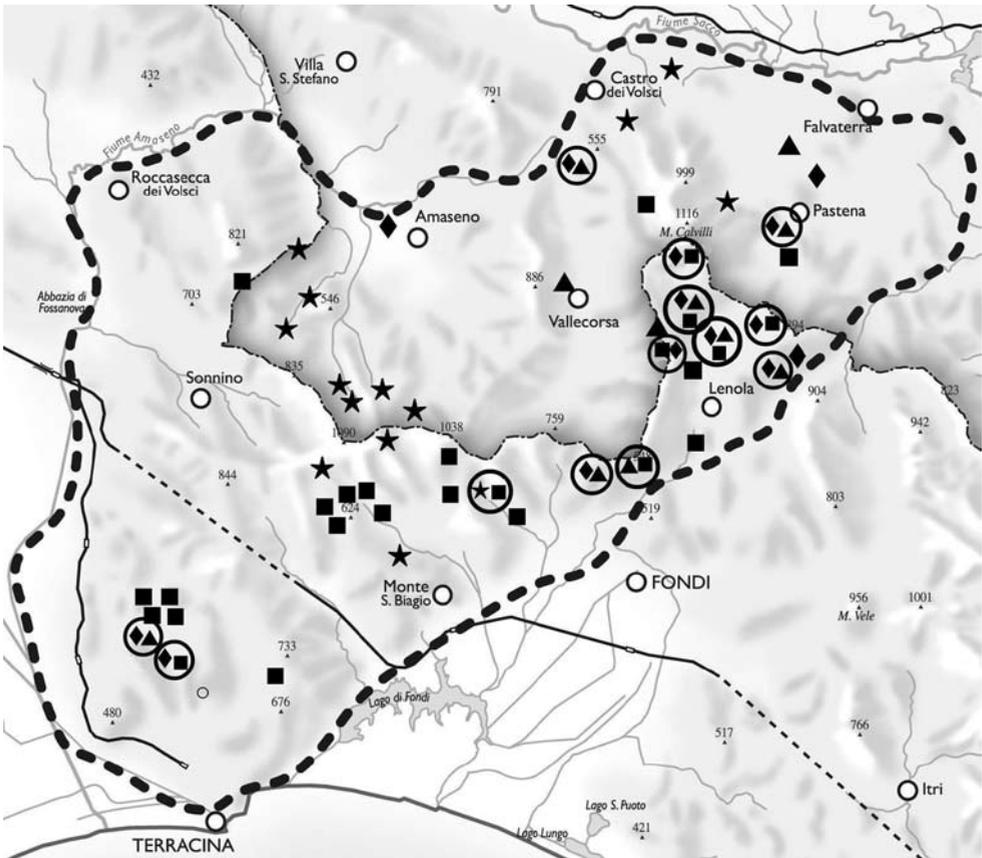


Fig. 2. Distribution of Caudata in the Ausoni Mountains (Latium). Rhombuses = *Triturus carnifex*; squares = *Lissotriton italicus*; triangles = *Lissotriton vulgaris*; stars = *Salamandrina perspicillata*. Sites where two or more species are syntopics are indicated by a circle including the symbols of the species.

ro's spring which is close to the above mentioned locality. Excluding this doubtful site, we surveyed all sites previously investigated by Bonifazi and Carpaneto (1990) and no species loss was recorded. Moreover, our observations after the year 2004 (the last observation on April 2007) permit to assert that *L. italicus* still breeds in "Fontana S. Stefano" site, although Scillitani et al. (2004) suggested that the Italian newt become probably extinct in this site.

The Caudata preferences for highest altitudes we found in this research agree with that reported for other and wider Italian areas (Anonymous, 2006b) as well for the remaining subgroups of the Volsci chain (Corsetti, 1994; Romano et al., 2007).

On the Ausoni Mts, altitudinal range showed by *S. perspicillata*, *Rana* synkl. *hispanica* and *H. intermedia* is similar in comparison with the analogous range recorded on the Aurunci Mountains (Romano et al., 2007), while for *T. carnifex*, *L. vulgaris* and *R. italica* the altitudinal range is extended remarkably. Conversely, on the Ausoni Mts, the *L. italicus* and

Table 1. Sørensen's coefficients between amphibian species on the Ausoni Mounts (Latium) and numbers and typology of breeding sites for each species. *Sp* = *Salamandrina perspicillata*; *Tc* = *Triturus carnifex*; *Lv* = *Lissotriton vulgaris*; *Li* = *Lissotriton italicus*; *Bb* = *Bufo bufo*; *Hi* = *Hyla intermedia*; *Ri* = *Rana italica*; *Rsh* = *Rana synklepton hispanica*. Number of breeding sites for each species is reported in square brackets. Number of sites already known in literature is reported in round brackets. Breeding site typology for each species on the Ausoni mountains is indicated by an alphabetic code following a decreasing order of frequency: C = caves; D = drinking places for livestock grazing; L = lakes and marshes; P = natural ponds; R = stream and creeks; S = springs; W = stony well.

	<i>Sp</i> [14] (3) S, D, P, R, C	<i>Tc</i> [15] (4) W, P, R	<i>Lv</i> [10] (1) W, P, R	<i>Li</i> [26] (7) W, S, P, R, L	<i>Bb</i> [14] (8) R, P, S, L	<i>Hi</i> [3] (2) L, P	<i>Ri</i> [15] (6) R,S,W,P
<i>Tc</i>	0						
<i>Lv</i>	0	0.583					
<i>Li</i>	0.050	0.263	0.111				
<i>Bb</i>	0	0	0.166	0.200			
<i>Hi</i>	0	0.111	0	0	0.235		
<i>Ri</i>	0.345	0	0.080	0.098	0.345	0	
<i>Rsh</i> [16] (10)	0	0.194	0.230	0.190	0.333	0.105	0.129

B. bufo breed at lower altitudes and show a shorter altitudinal range although the mean altitude of spawning sites is similar to those reported for Aurunci Mts (cf. Romano et al., 2007).

Caudata were more abundant than anurans, similarly to nearby Aurunci Mts, although, in the Ausoni Mts, frogs and toads occurred more frequently than on the Aurunci. Indeed the ratio between Anura records and Caudata records on the Ausoni is 0.74 while on the Aurunci is near one half (0.47).

The Sørensen's coefficients of similarity among amphibian populations of Ausoni Mts, number and typology of breeding sites for each species are shown in Table 1. *Lissotriton italicus* is the most widespread amphibian on the area (26 breeding sites) with the highest number of syntopies which are of the same rank then those of green frogs (Table 1).

The Sørensen's index shows that *T. carnifex* and *L. vulgaris* have similar habitat preferences, as reported for other Italian areas (e.g. Barbieri and Cavagnini, 1999; Gentili and Scali, 1999) and for the nearby Aurunci mountains as well (Romano et al., 2007). An higher index value for the sintopy between these two newts was reported for the Albani Hills, a extinct volcanic complex very close to Rome (Angelini and Cari, 2004). However this high value (the maximum possible for the Sørensen's index) should be compared with caution because only one breeding site for each species (Pantani della Doganella for both species) was recorded by the authors. Sintopy among *T. carnifex*, *L. italicus* and *L. vulgaris* was previously known usually in artificial water bodies (stony wells) of Aurunci Mountains (Lanza, 1983; Bonifazi and Carpaneto, 1990; Romano et al., 2007), in a site near Campobasso, Molise region (Lanza, 1977), in a few site within Majella National Park, Abruzzi (Scalera et al., 2006) and in a few sites on the Ausoni Mountains (Corsetti, 1999). So far sintopy among three newts into a natural water body was known only for the Ticino Lake (Scalera

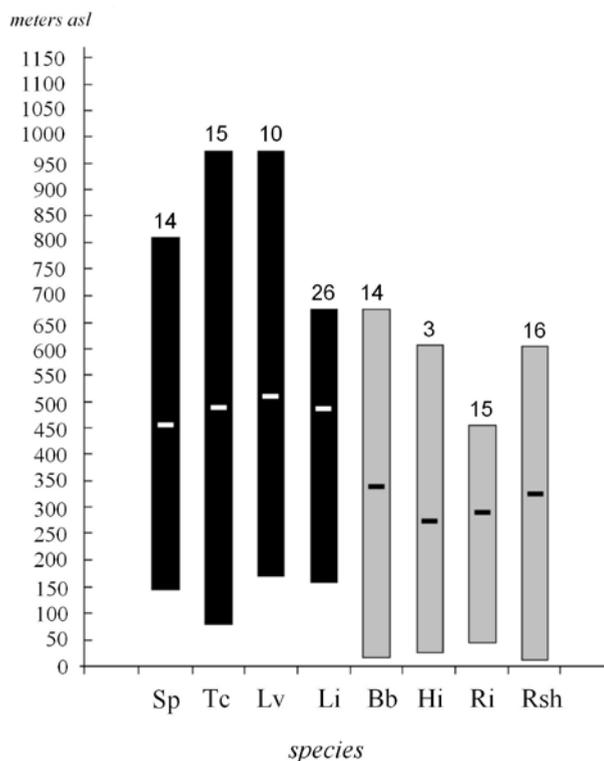


Fig. 3. Altitudinal ranges of amphibian species in the Ausoni Mounts (Latium). Black bars = Caudata; grey bars = Anura. Codes of species as reported in Tab. 1. Number of sites of each species is reported above the bar. Mean altitude for each species is indicated by an horizontal segments within the bar.

et al., 2006) and for two sites in the “Gola della Rossa e di Frasassi” Regional Park, in the Marche Region (Fiacchini, 2003). We found on the Ausoni Mountains also a natural pond inhabited by the three newt species, which represent the only natural small aquatic body where this sintopy was recorded so far, because the sintopic natural sites recorded previously were marsh, lakes or streams.

Salamandrina perspicillata have been found in 14 sites, which concentrated along a line connecting Monte S. Biagio to Roccasecca dei Volsci towns. This salamander breeds also in an artificial cave, an unusual spawning site typology for this species that was previously reported by Razzetti et al. (2001) and Angelini and Cari (2004). As reported for the Albani Hills (Angelini and Cari, 2004) and the neighbour Aurunci Mountains (Romano et al., 2007), in the Northern spectacled salamander the Sørensen’s index value is generally zero and an habitat partitioning among this salamander and other amphibians is a deep evidence. Relevant sintopy was recorded only with *Rana italica* (Romano et al., 2007).

The occurrence of Green toad, *Pseudepidalea viridis* (Laurenti, 1768), was reported by Bonifazi and Carpaneto (1990) and Bologna (2000) only in the planitial coastal zones which were, therefore, excluded from our survey.

Other anurans which were found on the Ausoni Mts showed syntopies comparable to the ones reported for the Aurunci Mts (cf. Romano et al., 2007) while, generally, the Sørensen's index values between species are lower than the ones reported by Angelini and Cari (2004) for the Albani Hills.

Other two anurans, *Bombina pachypus* (Bonaparte, 1838) and *Rana dalmatina* (Bonaparte, 1840) which are widespread in the Latium, were not recorded on the Ausoni Mountains. The occurrence of *B. pachypus* on the Ausoni in few suitable habitats as vernal and residual ponds, cannot be ruled out completely, although also an updated census on the close Aurunci Mts did not revealed any occurrence of this species (Romano et al., 2007). On the Volsci Chain, therefore, *B. pachypus* seems relegated to the northernmost portion of the Lepini Mts (Angelini et al., 2004) while the absence of hygrophilous woods, which are suitable habitats for *Rana dalmatina*, probably explains the lacking of this frog.

Considering the high number of stony wells and through used by amphibians for spawning, the adequate management of these artificial water bodies appears a crucial prerequisite for an effective conservation of the amphibian populations in the Ausoni Mountains.

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