

Checklist of Amphibians and Reptiles in a hilly area of Southern Tuscany (Central Italy): an update.

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Abstract. We present the results of a two year field survey on the herpetofauna of the Poggi di Prata area in Central Italy. A total of 2,653 records were made on nine Amphibian and sixteen Reptile species. Eleven species had not been recorded before. *Bombina pachypus* has not been observed since 2004 and represents a conservation concern. Among the main threats to the local herpetofauna, we consider the filling-in of the ponds, the abandonment of the traditional agricultural practices, road kills, killings of snakes by lay people, fish introductions and, possibly, climate change.

Key words. Amphibians, Reptiles, “Poggi di Prata”, Central Italy, geographical distribution, conservation

Introduction

The use of the herpetofauna as an indicator of the negative effects of habitat loss/fragmentation and climate change has greatly increased in last decades (e.g. Kjoss and Litvaitis, 2001; Cushman, 2006; Gardner et al., 2007; D’Amen et al., 2011), when its worldwide decline emerged as an emblematic example of the sixth global biodiversity crisis (Wilson, 1999; Baillie et al., 2004). Gathering information about presence and distribution of Amphibians and Reptiles turns out to be of relevant interest in the promotion of correct management actions, with a special regard to areas characterized by a strong anthropic pressure (Hartel et al., 2010).

In Italy, many species belonging to these taxonomical classes are listed in the “Habitat” Directive (92/43/CEE) and protected by national and regional laws (e.g. National Law 157/1992; Tuscany Regional Law 56/2000; Latium Regional Law 18/1988): so, they are priority for conservation efforts. After the institution

of the National Law and the adoption of the European Directive (DPR 357/1997), several projects were developed to improve and update local herpetological knowledge, in areas of different geographical extensions (e.g. Lapini, 1983; Corsetti, 1994; Bologna et al., 2007; Piazzini et al., 2010;). Many species are characterized by high elusiveness, rarity and/or low detectability, so their observation requires time and experience. This emphasizes the importance of putting a strong effort in searching for Amphibians and Reptiles with a high effort, to reduce the number of overlooked species to a minimum (e.g. Romanazzi, 2012; Tedaldi, 2012). Herpetological knowledge of the Metalliferous Hills (Tuscany, Central Italy) is at present fragmentary. In particular, the high environmental heterogeneity and the low density of human settlements make the area of “Poggi of Prata” potentially suitable to host a large portion of Amphibians and Reptiles species recorded in Tuscany (Vanni and Nistri, 2006).

Therefore, aim of this study was to:

- (i) update the checklist of this area, in comparison with bibliographic data (Favilli et al., 2001; Vanni and Nistri, 2006; Mori and Giovani, 2012);
- (ii) provide a cognitive framework on local herpetofauna, considering the species diversity in each habitat type, to better address correct monitoring actions (Elzinga et al., 2001).

Materials and Methods

Study area

The study area has an extension of about 1.350 ha. It is located in a rural hilly landscape (475-903 m above

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sea level) in Southern Tuscany (Fig. 1). A proposed site of Communitary Importance (“Poggi di Prata”: Tuscany Regional Law 56/2000) and an International Waterbird Census (IWC) area (“Laghetto del Gabellino”) are part of it.

The climate has sub-mountain characteristics in terms of temperature and rainfall; the average annual rainfall is of approximately 1,000 mm, with occasional episodes of snowfall (Selvi and Stefanini, 2005). The average annual temperature is approximately 12°C, with average thermal excursions during the year of about 18°C (Selvi and Stefanini, 2005). The geological substrate is composed of Lias limestone massifs and Rhaetian *Aetavica contorta* limestones; on the south-eastern slopes it comes into contact with the formation of sandstone boulder (Selvi and Stefanini, 2005). A detailed map of the land use has been provided by a Grosseto Province hunting agency (ATC Gr6). Habitat types include mixed deciduous woods (*Quercus cerris*, *Ostrya carpinifolia*, *Carpinus betulus*, *Fraxinus ornus*, *Robinia pseudoacacia*-as allochthonous element-: 52.14%), fallows (19.49%), chestnut woods (14.89%), cultivated fields (7.78%), pinewood (*Pinus nigra* and *Cupressus arizonica*, result of artificial reforestation:

2.02%), built areas (1.97%) and scrubwoods (*Juniperus* sp., *Rubus* sp., *Erica scoparia* and *Spartium junceum*: 1.71%). Bioclimatically, this composition of habitat types fall into the definition of *Quercus-Tilia-Acer* forest range (Selvi and Stefanini, 2005). In particular, the little presence of urban settlements (< 2% of the total) is used to define our study area as “natural”, following the terms proposed by Blair (2004) and Dinetti (2010).

A river (Merse), five rivulets (Botro Rosso, Botro ai Ponti, Carsia, Mersino, Rigagnolo), and some ponds (natural and artificial) are also present. Most of these torrents and ponds are rain-fed and water extraction is limited to the irrigation of small private vegetable gardens. Some of these waterways dry up if summers are particularly dry.

Human activities are limited to the downstream portion (“Il Gabellino”) and the immediate surroundings of the village of Prata, and include agriculture (cereals and sunflowers farmings in addition to vegetable gardens), sheep and cattle breeding and lumber trade.

Survey methods

Survey was carried out between 1st January 2011 and 31st December 2012. Sampling was carried out once a week during the winter and three times a week during

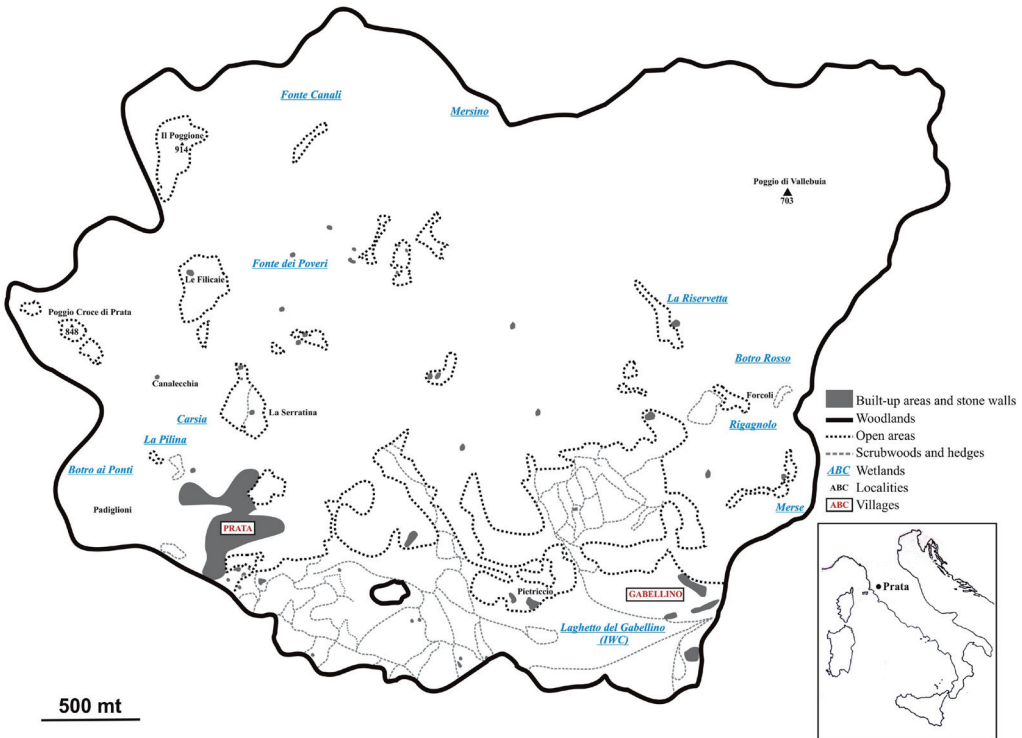


Figure 1. Location of the study area. Blue italic names refers to wet areas (rivers, rivulets and ponds) and black ones refers to main localities, where most of observations are concentrated.

spring, summer and autumn, for a total of 240 days.

Once the main habitat types have been identified, linear transects were opportunistically selected to better represent all the environmental heterogeneity, including woodlands, scrubwoods, cultivated fields, fallows and wetlands (ponds, rivulets). Such transects were subsequently investigated through active research over a 24h period, depending on the circadian rhythms of each species. Each transect was visited once a month. Opportunistic data (photos) collected by amateurs, volunteers groups (that rescue toads and agile frogs when crossing roads during breeding migrations: Bonardi et al., 2011), hunters and mushroom pickers was also considered.

To check Amphibians in the ponds, we used a tight meshed landing net.

Reference to the most recent monographs (Lanza et al., 2008; Speybroeck et al., 2010; Corti et al., 2011) for the species names was necessary, due to the numerous revisions in the systematics of these taxa.

Sites were differentiated according to the location and to the main habitat types, as in Romanazzi (2012).

Results

During this survey, 2,653 contacts were collected, belonging to eight species of Amphibians and sixteen species of Reptiles (Tab. 1).

Table 1. Amphibians and Reptiles detected in the study area. Numbers represent the number of data collected for each species in each month of this survey. * not reported in Vanni and Nistri (2006) for this area.

SPECIES	2011												2012												TOT
Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
<i>Triturus carnifex</i>			19	14	7	22	20	19	16	16	11			7	15	26	29	34	31	33	33	15	8	3	378
<i>Lissotriton vulgaris</i>			4	2	8	9	7	5	6	-					3	4	9	8	6	8	12		6	3	100
<i>Bufo bufo</i>	4	3		46	54	38	67	54	112	48	24	8		2	29	84	68	18	2	9	49	27	6	2	687
<i>Pseudepidalea balearica*</i>																1		5		1	1				3
<i>Rana italica</i>			4	2		3		4	6										3		2	2			26
<i>Rana dalmatina</i>				5	7	9	2		4		4	3	13		14	9	8		8	6	3	6			101
<i>Hyla intermedia*</i>														2											2
<i>Pelophylax ssp.</i>				19	24	12	21	16	18	22					12	22	34	43	36	28	25	9	2	1	310
<i>Trachemys scripta*</i>						1											1								2
<i>Testudo hermanni*</i>						2	1	2							3										8
<i>Tarentola mauritanica*</i>							3	2											6	4	6	1			21
<i>Chalcides chalcides*</i>						9	4	6							1		4	1	7						32
<i>Anguis fragilis*</i>					1			1											1	2		3			8
<i>Podarcis muralis</i>	2	7	31	24	29	43	74	43	41	28	1		4		2	12	26	32	59	63	47	33	12	1	614
<i>Podarcis sicula</i>		2	14	17	27	39	21	11	7	3			3		4	3	15	9	21	23	18	3		2	242
<i>Lacerta bilineata</i>				4	7	3	5	4	4	3						2	4	2	6	8	6	1			59
<i>Natrix natrix</i>					1	1		1								1	2	1							7
<i>Natrix tessellata*</i>																				1					1
<i>Coronella austriaca*</i>									1								1								2
<i>Coronella girondica*</i>								1										1							2
<i>Zamenis longissimus*</i>					2	3	2										1	1	1	3	3	5			21
<i>Hierophis viridiflavus</i>				1												1	2	1		6					11
<i>Elaphe quatuorlineata</i>								1	1								1								3
<i>Vipera aspis</i>			1			4	2											1		1	3	2			14

Table 2. Number of sites inside each habitat type for all the recorded Amphibians and Reptiles. Habitat types: 1) Rivulets, ponds and wetlands; 2) Mixed deciduous woods; 3) Chestnut woods; 4) Pinewoods; 5) Cultivated areas; 6) Fallows/prairies; 7) Built areas and stone walls; 8) Scrubwoods; 9) Ecotones. Altitude range is also reported.

Species	Habitat type									TOT	Altitude range
	1	2	3	4	5	6	7	8	9		
<i>Triturus carnifex</i>	9	0	0	0	0	0	1	0	1	11	497-778
<i>Lissotriton vulgaris</i>	4	0	0	0	0	0	0	0	0	5	579-778
<i>Bufo bufo</i>	8	3	0	0	2	1	1	1	0	16	475-785
<i>Pseudepidalea balearica</i>	1	0	0	0	0	1	0	0	0	2	484-512
<i>Rana italica</i>	3	0	0	0	0	0	0	0	0	3	516-525
<i>Rana dalmatina</i>	6	3	0	0	0	0	0	0	0	9	495-778
<i>Hyla intermedia</i>	1	0	0	0	0	0	0	0	0	1	477-483
<i>Pelophylax bergeri/hispanica</i>	10	0	0	0	0	0	0	0	0	10	474-778
<i>Trachemys scripta</i>	1	0	0	0	0	0	1	0	0	2	474-588
<i>Testudo hermanni</i>	0	1	0	0	1	1	1	2	2	8	508-592
<i>Tarentola mauretanica</i>	0	0	0	0	0	0	2	0	0	2	547-617
<i>Chalcides chalcides</i>	0	0	0	0	0	1	0	0	3	4	555-912
<i>Anguis fragilis</i>	0	1	1	0	1	0	0	0	2	5	613-765
<i>Podarcis muralis</i>	1	4	4	1	5	3	2	2	5	27	475-903
<i>Podarcis sicula</i>	2	1	0	0	2	3	2	2	4	16	497-631
<i>Lacerta bilineata</i>	1	2	2	1	2	3	2	3	2	18	490-870
<i>Natrix natrix</i>	2	0	1	0	0	0	0	0	0	3	572-695
<i>Natrix tessellata</i>	1	0	0	0	0	0	0	0	0	1	477
<i>Coronella austriaca</i>	0	0	0	0	1	0	1	0	0	2	572-594
<i>Coronella girondica</i>	0	0	0	0	1	0	0	0	0	1	572
<i>Zamenis longissimus</i>	1	2	2	0	1	2	2	2	1	13	484-738
<i>Hierophis viridiflavus</i>	0	0	0	0	0	6	3	1	2	12	498-702
<i>Elaphe quatuorlineata</i>	1	1	0	0	1	0	0	0	0	3	561-695
<i>Vipera aspis</i>	1	2	1	0	1	2	1	1	3	12	481-662

Discussion and conclusions

“Poggi di Prata” represents a hilly area of Southern Tuscany of notable importance for herpetofauna: in facts, this territory hosts at least eight species of amphibians and sixteen species of reptiles, including all of the snake species recorded in Tuscany.

A total of 2,653 presence data were collected on 240 days. This amount (eleven records a day on average) is for sure an underestimation, because we took into account only those observations which specific determination was 100% sure, to avoid incorrect considerations. Moreover, detection of Reptiles and Amphibians is very low during the cold season.

Fourteen of all the detected species are listed in the “Habitat” Directive: *Elaphe quatuorlineata*, *Testudo hermanni*, *Triturus carnifex* (Annex II, IV); *Coronella austriaca*, *Hierophis viridiflavus*, *Hyla intermedia*, *Lacerta bilineata*, *Natrix tessellata*, *Podarcis muralis*, *Podarcis sicula*, *Pseudepidalea balearica*, *Rana italica*, *Rana dalmatina*, *Zamenis longissimus* (Annex IV).

During this two-years survey, the presence of all but one (see below) species reported by the Regional Atlas (Vanni and Nistri, 2006) has been confirmed. Moreover, evidence of three Amphibians and nine Reptiles species never reported in this area (Vanni and Nistri, 2006) was found.

Among Amphibians, *Pseudepidalea balearica* and *Hyla intermedia* were spotted for the first time during this survey, both through direct observation and audio transects, in the IWC area “Il Gabbellino”. The evidence about *P. balearica* is of particular interest, as in Tuscany it is mainly observed in coastal areas. Another Italian endemic species not reported in the Tuscan Regional Atlas (Vanni and Nistri, 2012) once occurred in this area: the Apennine yellow-bellied toad *Bombina pachypus*, apparently disappeared from this site since 2004 (Mori and Giovani, 2012).

Simultaneously to the local extinction of *B. pachypus* (Mori and Giovani, 2012), an increase in the population of *Pelophylax* ssp. has been observed, both in relation to the number of individuals and to the number of sites where it has been detected. This phenomenon has been observed in other areas of Tuscany (e.g. Monte Labbro: authors, personal observation) but, even if aggressive behavior has rarely been recorded (Jablonski and Vlček, 2012), there is no evidence to support a competition hypothesis or a cause-effect relationship. In other words, there is a possibility of a secondary colonization by pond frogs, who could have taken advantage of the habitat vacancy caused by the yellow-bellied toads disappearance. However, even if such hypothesis can not be completely ruled out, additional research and observation are needed to comment any further.

Salamandrina perspicillata has been reported in the east of study area (Vanni and Nistri, 2006). No evidence of this last species was found, despite many transects along the banks of the Merse river and rivulets. However, its presence can not be excluded and further research is needed.

Among Reptiles, new reports concern particularly elusive species, with nocturnal/crepuscular habits, low detectability (*Coronella austriaca*, *Coronella girondica*, *Anguis fragilis*, *Chalcides chalcides*) or particularly demanding habitat selection (*Natrix tessellata*); for these species, even such an intense local sampling effort has produced little data.

The situation of *Tarentola mauretanica* is similar to what was described before about *P. balearica*, as it is reported especially in lowland and coastal areas. In recent times, the species has spread in hilly areas (Municipalities of Montieri, Massa Marittima and

Roccastrada: Mori, unpublished), most likely due to the transport of building materials and/or climate change (Mori and Plebani, 2012). A few kilometers downstream of the study area, specimens of *Hemidactylus turcicus* (Mori and Plebani, 2012) and of *Emys orbicularis* (Vanni and Nistri, 2006) were also recently observed.

Zamenis longissimus, not detected by Vanni and Nistri (2006), resulted to be the most encountered snake in the study area, with observations in various habitat types (ecotones, built areas, chestnut woods, mixed deciduous woods).

Testudo hermanni is present and surely breeds in the study area. Some specimens have been accidentally trapped in the framework of a research project that contemplates captures of crested porcupines, *Hystrix cristata*, and immediately set free. Others have been found by hounds during hunting periods and some young individuals have been captured by feral cats. Due to the lack of knowledge about their taxonomic status, it can not be assumed with certainty that it is a native population.

Finally, two specimens of the alien *Trachemys scripta* (one belonging to the subspecies *T. s. elegans*) that had been released in the study area, one in an artificial pool inside the village of Prata and the other in the IWC area, have been removed and kept in captivity.

From a pathological point of view, the detection of a specimen of *R. dalmatina* affected by a possible *Herpesvirus* (Fig. 2) is noteworthy; the individual remained in an artificial tank for at least one week, until the blisters disappeared.

It seems clear that a continuous baseline monitoring is recommended to detect any possible recrudescence

of this virus group, as it could infect many Amphibian species (e.g. Davison et al. 2005).

Further observed threats include the progressive fill-in of the aquatic sites, the abandonment of traditional silvo-pastoral practices as well as those of artificial watering sites maintenance (Torta et al., 2004). Wetlands and ecotones hosts 55.76% of all the observations and so they represent crucial habitat types for the conservation of the local herpetofauna. Future management projects should be developed and corrected also in light of this consideration.

Road kills are also locally relevant, especially to the detriment of *Bufo bufo* and *Rana dalmatina*, in the surroundings of the IWC area “Il Gabellino”.

Many Amphibians (*B. bufo*, *R. dalmatina*, *Pelophylax* spp., *Triturus carnifex* and *Lissotriton vulgaris*) have been found trapped or drowned in a cement pool with vertical walls. Finally, some voluntary killings of different species of snakes were recorded, confirming a sort of persecution trend.

The introduction of alien fishes (*Carassius auratus*, detected in an artificial pond, and other species for sport fishing, released in “Laghetto del Gabellino”) is particularly dangerous for Amphibians (Hamer and McDonnell, 2008), while it may favor fish-eating species such as *N. tessellata* (Luiselli et al., 2007).

The increase of the average winter temperatures (see Mori and Plebani, 2012), may be a major contributor in the shifting of the herpetological communities (local extinction of *B. pachypus* and colonization of more thermophilic species such as *P. balearica* and *T. mauretanica*).



Figure 2. *Rana dalmatina* affected by *Herpesvirus*.

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