DPN DIREZIONE PER LA PROTEZIONE DELLA NATURA

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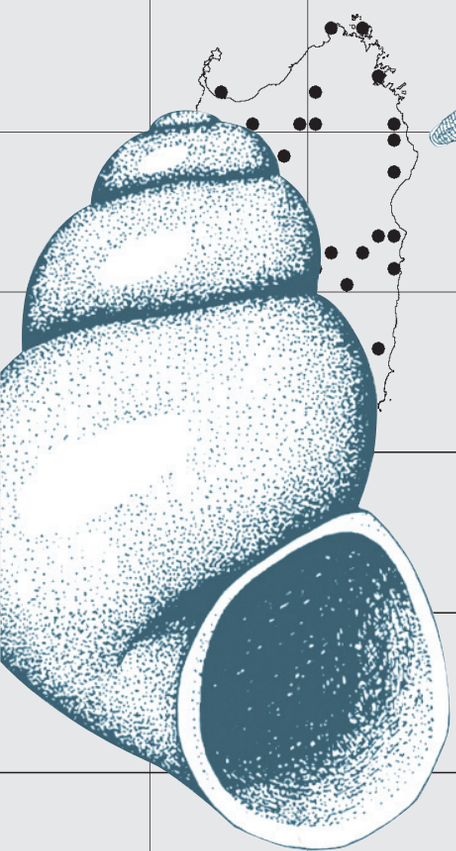
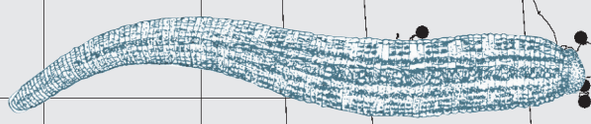
UNIVERSITÀ DELLA CALABRIA
Dipartimento di ECOLOGIA

Comitato Scientifico
per la Fauna d'Italia

CHECKLIST AND DISTRIBUTION OF THE ITALIAN FAUNA

10,000 terrestrial and inland water species





Ministero dell'Ambiente
e della Tutela del Territorio e del Mare

Amphibia and Reptilia

Emilio Balletto

Amphibia and Reptilia are two vertebrate orders widespread in all terrestrial habitats of Italy, and are all well known. The publication of the European Atlas (Gasc 1997) started a reorganisation of the taxonomy and chorology of these two groups which will be concluded in this decade. For Italy, several local atlases are available, mainly at regional level, and more are in preparation. The use of molecular biology techniques, together with morphological studies, clarified the taxonomy of numerous Amphibia, demonstrating how Italian species are very often taxonomically distinct from those of the rest of Europe.

Material and methods

Filing of the distribution data was based on the observation carried out by members of the Societas Herpetologica Italica, which started in the '90s (1st Conference SHI 1996), and on recent literature. Old citations were not always usable, because they were incomplete or not reliable; however, they could be related to the present taxonomy and chorology, even if some populations are now extinct. In the case of herpetofauna, the database was reduced to one point citation for each UTM square of 10x10 Km. New unpublished data entered in the database represent 50% of all the records.

Biodiversity

The herpethological fauna of Italy includes 38 genera belonging to 18 families (8 of Amphibia, and 10 of Reptilia). The 83 Italian species represent 36% of the entire European fauna (up to the Ural and Caucasus) which includes 233 species, and 20% of the entire Euro-Mediterranean area, which includes 423 species (nearly the same number recorded for North America). Italy has a higher number of species than other European country. The closest numbers are those of Spain (79 species) and Greece (69 species). Taking into account the entire Euro-Mediterranean area, the countries with richer fauna are Turkey (123 species), Morocco (101), Israel (Palestine included: 100 species) and Algeria (89). The case of Israel is remarkable: notwithstanding the small area, this country hosts a great number of eremic species, primarily with Turanic-East Mediterraean distribution, mainly in the Negev.

As happens for several other groups, the biodiversity pattern emerging from this work reveals higher species richness in the Northern regions, with 57 species, whereas 42 are present in the Apennines. As a consequence of the "peninsula effect", relatively few species reach Calabria (28), Sicily (27), and Sardinia (23). However, considering that Aosta Valley with 18 species is the Italian region with the poorest herpethological fauna (but it is also the smallest region), that Trentino-Alto Adige has 26 species, Emilia-Romagna, Tuscany and Piedmont have 36 species, this North-South trend is less strong than it seems. Opposite of what happens for other groups, the Alps represent a barrier which herpetofauna can pass only at the Eastern and Western margins. The two regions with highest species richness are therefore Liguria and Friuli Venezia Giulia, with respectively 38 and 37 species.

Ecology

Reptilia and Amphibia are poikilothermous. More than other vertebrates, their life cycles are strongly influenced by annual variations in temperature and rainfall; all Italian species interrupt their activity at least once per year. In most of Italy, this interruption occurs in winter but, moving towards the South, some species (for example, *Testudo hermanni*) estivate, mainly in August. In Calabria the interruption of the activity takes place in summer and the species of the genus *Triturus* start their courtship

in December-February (depending on the years and the elevation, even until May). Most of the amphibians try to maximize the survival of their larvae from changes in temperature, rainfall, and drying of their habitats. Species which colonize the driest habitats are often opportunistic (for instance, *Bufo viridis*), and can reproduce at different times of the year, as soon as it start to rain (March-June). Those which live at high altitude have to deal with short summers, during which the larvae have to reach metamorphosis and the adults have to accumulate enough trophic resources to survive the long winter, and to reproduce the following spring. Eggs are laid as soon as the environmental conditions allow it, often (*Rana temporaria*, *Triturus alpestris*) before the snow melts. Night frosting often kills hundreds of individuals. At intermediate altitudes, where water is relatively abundant and temperature is less extreme, eggs are laid in spring, in different times according to the species. In Northern Italy *Bufo bufo* is the first to lay its eggs (February), followed by newts and *Rana dalmatina*. The last species to lay their eggs (May) are usually green frogs and tree frogs. Few species live in the littoral, and among them only *Bufo viridis* can tolerate low brackish waters.

The areas where amphibians reproduce are very different as well. Toads, especially *B. viridis*, but also *Bufo bufo*, need wide and shallow waters, well warmed by the sun and never shaded, which allows for a good view of the sky. Green frogs prefer large ponds with aquatic vegetation. Red frogs, especially *R. italica* and *R. latastei* but also species of *Salamandra* and *Salamandrina tergiditata* are associated with small streams in wooded areas. With the exception of those species strictly associated with water (for instance, green frogs), adult amphibians are nemoral and are difficult to see after reproduction. Species of the genus *Speleomantes,* all endemic to Italy, live in small cavities. They are found in palaeo-landslides, rock cracks, but they are easier seen in caves. Their biologic cycle is still imperfectly known. The case of *Proteus anguinus*, is also strange: this animal lives in subterranean waters of the Karst in Trieste and Gorizia province, only rarely it can be seen, and only in those caves which reach groundwaters.

Almost all Italian reptiles are thermophyle and some xero-thermophyle. Mesophyle species are not abundant, even if at times they are relevant as biomass, such as *Natrix natrix*. Some taxa which are mesophyle in Northern Europe and typical of planitial areas, occupy instead the higher horizon of the mountains in Italy, at times above the tree-line. This happens, as already stated, also for *Rana temporaria*, but mostly for *Lacerta agilis*, *Zootoca vivipara* and *Vipera berus*. The progressive movements of mesophyle species towards higher elevations moving N-S is well known for several other animals.

We conclude this short chapter noting that, for reptiles, the structure of the vegetation is often more important than the vegetation itself. Few reptiles, in fact, are actually nemoral or typical of open areas, the remaining live in ecotones between the wooded areas (or scrubs) and meadows. In a very simplified manner, it can be stated that the narrow home-range of each individual must contain appropriate areas for thermal regulation (for the animals to warm up in the morning and to cool down in the afternoon), areas to lay eggs (i.e. sandy or fractured areas), and areas sheltered from the weather and from predators to spend the hibernation or the aestivation periods. The mesophylic or thermophylic preferences, together with different trophic needs, determine the presence and distribution of the different species on a microgeographic scale.

Zoogeography

Italian herpetofauna includes a high percentage of endemic species (15, representing 19.3% of the total). This datum does not encompass species such as *Salamandra lanzai* and *Speleomantes ambrosi*, which extend their distribution for a few kilometers into France and *Podarcis filfolensis* (present in Linosa and Lampione, in the Pelagie Islands, and in Malta), or *Discoglossus sardus* and *Hyla sarda*, both Sardinian-Corsican endemics. The status of *Natrix* [*natrix*] *cettii* is not yet clear but it is almost certain that it will be considered a distinct species. The same might apply to *Pelobates* [*fuscus*] *insubricus*. As stated elsewhere, the taxonomy of the Italian *Bufo viridis* populations will have to be evaluated with more attention. For the other European countries the global endemism rate is 21.8% (51 species). Only Spain has a higher endemism rate than Italy (22.8%), primarily due to the high number of endemic species in the Canary Islands (genera *Tarentola*, *Gallotia* and *Chalcides*). Greece is third, with 10 endemics (14.5%). The Euro-Mediterranean area as a whole has an endemism rate (calculated on the basis of the most recent political borders) of 21.3% (90 species), the highest endemic rates are recorded in the Southern countries. Besides Spain, Morocco represents the species richness hotspot, with 21 endemic species (20.8% of the total). Turkey, in spite of its wide extension and the numerous species (125), is placed after Greece, with 8 endemics (11.6%).

For Italy, the high endemisms rate is primarily due to amphibians, 42% of which are endemic, and it is related to the remarkable number of species belonging to the genus *Speleomantes*. Opposite of what happens in several other groups, the Alpine and pre-Alpine provinces do not have any endemic species. At European level, there are only two Alpine endemics: *Salamandra atra* (which reaches the Balkans) and *S. lanzai* (restricted to the South-Western Alps). The highest number of endemics is recorded for the Appennine area (9 species, 7 of which exclusive) in Sardinia (5) and in Sicily (2 species, with only one truly Sicilian species, *Podarcis wagleriana*,

whereas the other one, *P. raffonei*, is limited to the Eolian Islands). *Hyla intermedia* and the non-hybrid green frog of the Apennines and Sicily *Rana bergeri,* are endemic to Italy as well. The Apennine endemics are widespread: some in the entire Italian territory, from the Padana Plain to Sicily (such as *Hyla intermedia*), others from Liguria to Aspromonte (*Salamandrina terdigitata*, *Bombina pachypus*, *Rana italica*, *Chalcides chalcides*), or more rarely from the Central Apennines to Aspromonte (such as *Triturus italicus* and perhaps *Rana bergeri*, whose northern limit has not yet been defined). Italian herpetofauna does not include punctual endemics, such as it happens for instance with several invertebrates. The Sardinian endemics of the genus *Speleomantes* have the narrower distribution: the extreme case is *S. flavus* which is limited to the Albo Mountain massif, between the town of Posada and the Siniscola Stream.

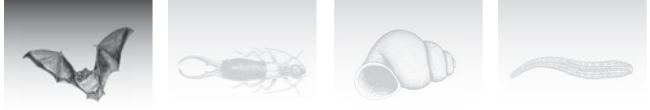
The biogeographic meaning of the endemism pattern of Italian herpetofauna is quite evident. Chromosomic, electrophoretic and biomolecular studies developed since 1980, showed that, at least for Amphibians, divergence time from their European vicariants occurred probably some millions of years ago. The exception is represented by the green frogs of the *Rana esculenta* complex, that are characterised by well-known processes of hybridisation and hybridogenesis, and that probably had shorter divergence times. The origin of most of the endemic Italian herpetofauna dates back to the cycles of glaciations and glacial regressions that occurred from the end of the Tertiary to the beginning of Pleistocene. During this last period, after the last glacial regression, the Alps ceased to represent a barrier, and areals could expand again: widespread European species expanded to the Padana Plain eliminating, at least for some cases, the species already living there, or colonising habitats wich had few reptiles and even fewer amphibians. *Rana latastei* is the only endemic species of the Padana Plain; this species reaches the southern tip of Switzerland following the Ticino River to the North, and Slovenia and Croatia to the East.

Rana latastei represents the only recognizable remain of how the ancient Padana herpetofauna before the reopening of a corridor in the Alps. *Pelobates* [*fuscus*] *insubricus* shares with the previous species the same distribution to the East, but almost certainly this latter species originated more recently, whichever might be its real taxonomic status. As a consequence of the Pleistocene opening, or re-opening of a passage through the Alps, Italian fauna was enriched with species that were exotic before. This happened, with the same amount of species, at the two extremities of the Alps. From the East several species entered in Venezia Giulia (*Bombina variegata, Hyla arborea, Coluber gemonensis, Algyroides nigropunctatus*, *Archaeolacerta horvathi*, *Podarcis melisellensis*, *Telescopus fallax*, *Vipera ammodytes* and *Lacerta viridis*, which has at least one population in Friuli. From the West, other species entered in Liguria (*Hyla meridionalis, Pelodytes punctatus, Timon lepidus, Chalcides striatus, Malpolon monspessulanum* and *Elaphe scalaris*). Some of those species changed or expanded their distribution Westward to Trentino (2), Veneto (2) and Lumbardy (1), and Eastward to Piedmont.

A peculiar and not yet well-investigated case is represented by the *Rana ridibunda* species-complex. This species was introduced in various parts of Italy (similar to the introduction in Liguria of the balkanic species *R. kurtmuelleri*, but it must be ascertained if this is the case for Venezia Giulia and Trentino, where *Rana ridibunda* might have originated from the North. There are populations of this same group in Liguria and Piedmont which might belong to *Rana perezi* (W-Mediterranean) but have not been studied yet. Such a marginal penetration of species occurred, in a way still not well understood, for the Pelagie Islands, which host the Italian populations of *Psammodromus algirus*, *Podarcis filfolensis* and of the Maghrebin "subspecies" of *Malpolon monspessulanum*. The remains of older faunas can still be found in the Sicilian lizards of the genus *Podarcis* (*P. wagleriana* from Sicily; *P. filfolensis*, from Linosa and Lampione, in the Pelagie Archipelago, and Malta; *P. raffonei*, in the Eolian Islands). The first two species are very close sibling-species, therefore it is possibile that *P. filfolensis* originated from ancestors coming from Sicily. *Podarcis raffonei* is sibling-species of the Sardinian-Corsican species *P. tiliguerta*, therefore it belongs to an oldest thyrrenian species complex which might have originated in the Miocene (Oliverio et al., 2000). A similar situation is represented by species with high divergence belonging to the genus *Euproctus* (*E. asper* in the Pyrenées, *E. montanus* in Corsica, *E. platycephalus* in Sardinia), which might represent a paleothyrrenic complex (Caccone et al., 1997). It must be remembered that the Pletodontidae of the European genus *Speleomantes* were included until recently in the genus *Hydromantes* together with three species from Claifornia (*H. brunus, H. shastae, H. platycephalus,*). The separation between the American Pletodontidae, which include 26 genera, and the European ones, can be dated back to the Jurassic. A similar dating was hypothesised for the Urodela of the genus *Proteus* (1 or 2 European species), which family (Proteidae) would be sister to the American Sirenidae (2 genera, *Pseudobranchus* and *Siren*, with 4 species).

Alien species

The introduction of allochthonous species is a very important problem, recognised at international level. Just for Florida the exotic herpetofauna increased from 3 species in 1958, to 23 species in 1991, represented primarily by Sauria, but a small crocodile (*Caiman crocodilus*) and a blind snake (*Ramphotyphlops braminus*) were recorded



as well. The situation is slightly better in Europe, with 4 (at least for now) non-European species (*Bufo mauritanicus*, *Rana catesbiana*, *Trachemys picta*, *Teira perspicillata*). The continuous import of tropical species as pets will certainly increase the number of allochthonous species in Italy as well (Lanza & Corti, 1993). Several other species were introduced in Italy from other European countries. In Italy, there are 7 established exotic species (*Rana kurtmulleri*, *Rana catesbiana*, *Trachemys picta*, *Mauremys caspica*, *M. leprosa*, *Testudo graeca*, *Chamaeleo chamaeleon*), whereas the situation of *Rana ridibunda*, as stated before, is less clear. Other problems are reported for tortoises of the genus *Testudo*, including *T. hermanni*, which is typical of Italian fauna, but allochthonous to several Italian regions. There are also doubts on the presence of *T. marginata* in Sardinia, where it is considered introduced, although it is morphologically different from all the other known populations. A similar case is probably represented by *Podarcis* [*sicula*] *cettii* from Sardinia, for long time considered to be introduced, but recently hypothesised to be a distinct species (Oliverio et al., 2000). Among lizards, *Podarcis sicula* expanded its distribution, damaging the endemic species of Sardinia (*P. tiliguerta*) and Sicily (*P. wagleriana*). Nesting of *Trachemys scripta* was recorded several times in Italy, and this species could compete with *Emys orbicularis*, a species threatened toextinction, at least in Northern Italy.

Conservation

Herpetofauna represents a well-known case among European conservationists, which was discussed in numerous meetings, including the "Standing Committee" of the Bern Convention. The first attempt to focus the attention of European herpetologists on the problems linked to conservation of reptiles and amphibians was represented by the constitution of Societas Europaea Herpetologica (SEH) and, during its first Conference, the establishment of the Conservation Committee (1981). The "Experts Group on Amphibians and Reptiles" of the European Council originated from that. The Habitat Directive of the European Union lists 22 species of amphibians and reptiles, including the 3 Italian vertebrates whose conservation is considered a priority by the EU (*Salamandra atra aurorae*, *Pelobates* [*fuscus*] *insubricus* and *Caretta caretta*) in appendix 2. It was known from the 1980s that amphibians are among the groups at highest extinction risk and that entire populations and even species can disappear in a short time, at times without apparent cause. With the exception of marine turtles, which are similar to amphibians in their ecological requirements (nesting on the land and adult life in aquatic habitats), for reptiles the cause of extinction is related with habitat loss. For amphibians, instead, there are more connected causes. Because their life cycle includes aquatic and terrestrial habitats, they are subject to the negative impact affecting both habitats. In recent years it was demonstrated that they are affected by the use of herbicides and fertilizers, the attack of certain viruses, the increase in UV radiation, etc. In several other cases, a limiting factor is represented by the introduction of fishes, mostly salmonids, for fishing purposes. There is still a lot to study and discover.

Relevant Literature

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