An updated check-list of Italian amphibians and reptiles

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Abstract - This paper represents an update of the list of Italian amphibians and reptiles published 15 years ago by Razzetti et al. (2006) and of the checklist published in 1993 by the late Benedetto Lanza. At present, the Italian herpetofauna includes 100 species (41 amphibians and 59 reptiles) and an amphibian taxon of hybrid origin. Seven species and one subspecies are allochthonous and became naturalized within the last century. Since the last published list, a new species has been described (Vipera walseri), five taxa have been raised to species rank (Salamandrina perspicillata, Speleomantes sarrabusensis, Zootoca carniolica, Malpolon insignitus and Natrix helvetica) while three taxa have been downgraded to subspecies. All the relevant taxonomic changes based upon new research have been discussed, including tentative revisions and controversial taxa. Nine species reported or listed dubitatively in Lanza’s 1993 list are excluded here.

Key words: Amphibians, Italy, reptiles, subspecies, taxonomic inflation, taxonomy.

INTRODUCTION

“Checklists of species are invaluable tools in the fields of natural science. They serve to consolidate our level of knowledge and at the same time reveal areas in need of further investigation” (Parenti & Randall, 2000).

The last checklist of the Italian herpetofauna (with taxonomic remarks) dates back to fifteen years ago (Razzetti et al., 2006) and represents the updating of previous lists (e.g. Lanza in Amori et al., 1993). Since then, several taxonomic changes have occurred and markedly modified the picture of the species distributed in Italy.

Some of the name changes are updates resulting from taxonomic revisions, while some others represent just nomenclature amendments. A few species occurring in areas adjacent to the study area and included in previous Italian checklists have been excluded, whereas a number of alien taxa are now naturalised in the country.

However, most of the changes are the result of the considerable contributions given by the publication of phylogenetic and phylogeographic studies. The use of DNA in phylogenetic reconstructions allowed to distinguish cryptic taxa that were difficult to identify on the sole morphological basis, thus significantly increasing the number of recognized species (e.g. in the genera Bufo, Hyla, Anguis, etc.), and the knowledge on the genetic structure of the various taxa, with an impact on taxonomy, biogeography and conservation biology.

In recent decades, on a global level, the number of recognized taxa (including amphibians and reptiles) have increased to such an extent to speculate about a “taxonomic inflation” (Isaac et al., 2004). In support of this, a recent study on Eurasian vipers recognizes “15 taxa as valid species, three taxa which likely represent species complexes, 17 taxa of doubtful validity as species, and five taxa for which species status is maintained but further research is highly recommended to assess taxonomic arrangements” (Freitas et al., 2020).

The “taxonomic inflation” might be due to the tendency of recognizing as species the clades emerging from phylogenetic trees, and to the fact that the description of a “new” species has a greater “impact” than a subspecies.
Moreover, when negotiating with agencies deciding on conservation policies and their funding, species-targeted interventions are more likely to be funded than those targeting subspecies or local populations. This encourages the elevation to species rank of populations that need protection, regardless of whether there is scientific support for this status (Isaac et al., 2004). Although the conservation aims are acceptable, in our opinion the vulnerability of a not very diversified population cannot be the criterion for elevating it to a species.

To estimate species boundaries more precisely, many authors adopt an “integrative taxonomy” approach (Dayrat, 2005), which combines “different lines of evidence (e.g. genetic, morphological, ecological) and methodologies (e.g. phylogenetic inference, ordination methods, ecological modelling) to objectively identify taxa”.

Other than increasing knowledge about cryptic taxa and the genetic structure of species, phylogenetic studies have challenged the idea of “rigid” taxonomic categories of genus, species and subspecies in view of the continuum of differentiation that we observe in nature. Modern genetic studies not only provide elements of classification (taxa) but also hypotheses on the clades (lineages) and the phylogeny (relations between clades); therefore, the traditional taxonomic categories (e.g. taxa, genera, species) are often replaced by the terms “clades”, “lineages” and “Evolutionarily Significant Units” (ESUs).

Above all, the concept of subspecies has fallen into disuse, as currently many studies tend to raise subspecies to a specific rank (especially if geographically allopatric) if they show some genetic differentiation, even small, as long as it is statistically supported. On the other hand, many “classic” subspecies, described based on morphological variations or discrete distribution ranges (in particular the micro-island subspecies) have not been supported by the results of genetic studies and are therefore to be considered synonyms. Nonetheless, it is believed that the taxonomic category of subspecies is very useful, not only for describing the geographical peculiarities of populations, but also for highlighting the stages of incomplete speciation, which can be reversible when two only partially differentiated populations come into contact; the use of subspecies is beneficial both for communication among scientists and for conservation (Kindler & Fritz 2018).

**MATHERIALS AND METHODS**

This checklist is an updated picture of all the amphibians and reptile taxa naturally occurring, or introduced and naturalized within the Italian political territory. Two species of marine turtles have been listed here despite limited records of vagrant individuals in the study area. The checklist includes also several taxonomic and nomenclatural remarks about status and distribution of many taxa.

The present paper represents the subjective point of view of the authors. We are well aware that the recognition of a taxon is a scientific hypothesis and not an absolute truth, and therefore a taxon can, in some cases, be assessed differently based on the knowledge and opinions of each author.

At the species level, we mostly adopted the published results of the Taxonomic Committee of the Societas Europaea Herpetologica (Speybroeck et al., 2020), composed of 12 international experts. Any opinions diverging from those of the Taxonomic Committee of the S.E.H., as well as all the discrepancies with respect to the previous Italian check-lists (Lanza in Amori et al., 1993; Razzetti et al., 2006), are explained in the notes.

As for the subspecies, not covered by Speybroeck et al. (2020), we generally adopted geographically isolated populations (populations with disjoint or island ranges) showing some genetic differentiation, provided statistically supported, or populations of those “semi-species” showing restricted introgression areas.

Moreover, we refrained to list subspecies of highly variable species for which the available studies have only tentatively revised the infraspecific taxonomy (e.g. Podarcis siculus, P. muralis).

**DISCUSSION**

According to the present checklist, the Italian herpetofauna is represented by 100 species (41 amphibians and 59 reptiles) and an amphibian taxon of hybrid origin (Pelophylax kl. esculentus). Five species are marine turtles, of which only Caretta caretta breeds regularly (although in relatively small numbers) on Italian beaches; Dermochelys coriacea and Chelonia mydas are regularly observed along Italian coasts, while Lepidochelys kempi and Eretmochelys imbricata occur in the Mediterranean only with vagrant individuals.

Six species and a subspecies are aliens naturalized within the last century (Lithobates catesbeianus, Pelophylax ridibundus kurtmuelleri, Pelophylax cf. bedriagae, Xenopus laevis, Trachemys scripta, Chamaeleo chamaeleon, Indotyphlops braminus and, probably, Eryx jaculus). More difficult is to ascertain if some well-established species are really autochthonous or if their presence is due to ancient man-mediated introductions (the so-called “parautochthonous” species cf. VV.AA., 2007). Even if biogeographic and genetic data strongly support the introduction of some species in ancient times (i.e. Testudo marginata, T. graeca and Emys orbicularis in Sardinia), for other (Chalcidia chalcides, C. ocellatus, Podarcis siculus, Natrix maura and Hemorrhoids hippocrepis in Sardinia, Podarcis filfolensis on Linosa and Lampione, Mediodactylus kotschyi in Apulia and Basilicata) the last word has yet to be said.

Some species, native or putatively native in some regions of Italy, are present as alien species in other areas: it is the case of Tarentola mauritanica, Hemidactylus turcicus and Mediodactylus kotschyi in northern Italy, Podarcis siculus nigrivento (in the Garda Lake, Proteus anguinus in Veneto, Speleomantes strinatii in Venezia Giulia, Speleomantes amboinii and S. italicus in Siena province (Tuscany), Bufo bufo in Sardinia etc., and very likely of Algyroides nigropunctatus in Apulia. As for Hyla meridionalis, which is believed to be introduced in historical times in Europe, although with no definitive evidence (Recuero et al., 2007), its presence in Italy is probably due to its subsequent spontaneous expansion from southern France.
Comparing the new checklist with those of Lanza in Amori et al. (1993) and Razzetti et al. (2006), Vipera walser has been described, Salamandrina perspicillata, Speleomantes sarrabusensis, Zootoca carniolica, Malpolon insignitus and Natrix helvetica, have been raised to species rank, Bombina pachypus, Pelophylax bergeri and P. kurzmuelleri have been downgraded to subspecies.

Besides some species listed dubitatively by Lanza in Amori et al. (1993) have never been recorded in Italy (i.e. Rana arvalis, Pelophylax perezi, Pseudopus apodus, Lacerta trilineata, Platycnemis nudipes), some other, reported by Lanza as belonging to the Italian fauna, are here excluded: Mauremys caspica and M. leprosa since naturalized populations are unknown, Hierophis gemonensis (reported in Italy on the basis of misidentified juveniles of H. viridiflavus), and Zamenis scalaris (reported once in Italy close to the French border, but never confirmed again).

To better understand the origin of dubiously native species (cryptogenic species) and the taxonomic status of some Italian populations further investigations are needed, especially for the following taxa:
- the specific allocation of Speleomantes ambrosii bianchii alternatively regarded as a subspecies of S. italicus or of S. ambrosii by different authors;
- the taxonomic status of the Italian populations of Proteus anguinus;
- the infraspecific taxonomy of Rana temporaria in Italy;
- the taxonomy of Tarentola from Lampedusa Island and the nearby Isola dei Conigli;
- the actual specific distinction between Lacerta viridis and L. bilineata, and the status and taxonomy of the Adriatic lineage of the Lacerta viridis complex;
- the infraspecific taxonomy of Podarcis muralis;
- the infraspecific taxonomy of Podarcis siculus;
- the infraspecific taxonomy of Zootoca vivipara in Italy;
- the relationships of Psammodromus algirus from Isola dei Conigli;
- the origin of Sicilian Eryx jaculus;
- the specific allocation of the Macroprotodon population of Lampedusa;
- the infraspecific taxonomy of Coronella austriaca;
- the taxonomic status of Natrix helvetica and N. natrix, due to the wide hybridization area observed in northeastern Italy;
- the taxonomic status of Aesculapian snakes (Zamenis) from Apulia.

**CHECKLIST**

**Class Amphibia Linnaeus 1758**

**Order Urodela Duméril 1805**

**Family Salamandridae Goldfuss 1820**
Genus *Euproctus* Gené 1839

**Euproctus platycephalus** (Gravenhorst 1829)
Genus *Ichthyosaura* Sonnini & Lateille 1801
*Ichthyosaura alpestris* (Laurenti 1768)
*Ichthyosaura alpestris alpestris* (Laurenti 1768)
*Ichthyosaura alpestris apuana* (Bonaparte 1839)
*Ichthyosaura alpestris inexpectata* (Dubois & Breuil 1983)
Genus *Lissotriton* Bell 1839
*Lissotriton italicus* (Peracca 1898)
*Lissotriton vulgaris* (Linnaeus 1758)
*Lissotriton vulgaris vulgaris* (Linnaeus 1758)
*Lissotriton vulgaris meridionalis* (Boulenger 1882)
Genus *Salamandra* Garsault 1764
*Salamandra atra* (Laurenti 1768)
*Salamandra atra atra* (Laurenti 1768)
*Salamandra atra aurorae* (Trevisan 1982)
*Salamandra atra pasubiensis* (Bonato & Steinfartz 2005)
*Salamandra lanzai* (Nascetti, Andreone, Capula & Bullini 1988)
*Salamandra salamandra* (Linnaeus 1758)
*Salamandra salamandra salamandra* (Linnaeus 1758)
*Salamandra salamandra gigliolii* (Eiselt & Lanza 1956)
Genus *Salamandrina* Fitzinger 1826
*Salamandrina perspicillata* (Savi 1821)
*Salamandrina terdigitata* (Bonnaterre 1789)
Genus *Triturus* Rafinesque 1815
*Triturus carnifex* (Laurenti 1768)

**Family Plethodontidae Gray 1850**
Genus *Soleeomantes* Dubois 1984
*Soleeomantes ambrosii* (Lanza 1955)
*Soleeomantes ambrosii ambrosii* (Lanza 1955)
*Soleeomantes ambrosii bianchii* Lanza, Cinamaruta, Forti, Bullini & Nascetti 2005
*Soleeomantes flavus* (Stefani 1969)
*Soleeomantes generi* (Temminck & Schlegel 1838)
*Soleeomantes imperialis* (Stefani 1969)
*Soleeomantes italicus* (Dunn 1923)
*Soleeomantes sarrabusensis* Lanza, Leo, Forti, Cinamaruta, Caputo & Nascetti 2001
*Soleeomantes striatii* (Aellen 1958)
*Soleeomantes supramontis* (Lanza, Nascetti & Bullini 1986)

**Family Proteidae Gray 1825**
Genus *Proteus* Laurenti 1768
*Proteus anguinus* Laurenti 1768

**Order Anura Duméril 1805**

**Family Alytidae Fitzinger 1843**
Genus *Discoglossus* Oth 1837
*Discoglossus pictus* Oth 1837
*Discoglossus sardus* Tschudi in Otth 1837

**Family Bombinatoridae Gray 1825**
Genus *Bombina* Oken 1816
*Bombina variegata* (Linnaeus 1758)
Family Pipidae Gray 1825
Genus *Bombina* Linnaeus 1758
*B. variegata* variegata (Linnaeus 1758)
*B. variegata* pachypus (Bonaparte 1838)

Family Pelobatidae Bonaparte 1850
Genus *Pelobates* Wagler 1830
*P. fuscus* (Laurenti 1768)

Family Pelodytidae Bonaparte 1850
Genus *Pelodytes* Bonaparte 1838
*P. punctatus* (Daudin 1802)

Family Bufonidae Gray 1825
Genus *Bufo* Garsault 1764
*Bufo bufo* (Linnaeus 1758)
*Bufo spinosus* (Daudin 1803)

Genus *Bufotes* Rafinesque 1815
*Bufo boulengeri* (Lataste 1879)
*Bufo boulengeri boulengeri* (Lataste 1879)
*Bufo boulengeri siculus* (Stöck, Sicilia, Belfiore, Buckley, Lo Brutto, Lo Valvo & Arculeo 2008)

Genus *Bufotes* viridis (Laurenti 1768)
*Bufo viridis viridis* (Laurenti 1768)
*Bufo viridis balearicus* (Boettger 1880)

Family Hylidae Rafinesque 1815
Genus *Hyla* Laurenti 1768
*Hyla arborea* (Linnaeus 1758)
*Hyla intermedia* Boulenger 1882

Family Ranidae Batsch 1796
Genus *Pelophylax* Fitzinger 1843
*Pelophylax cf. bedriagae* (Camerano 1882)
*Pelophylax lessonae* (Camerano 1882)
*Pelophylax lessonae lessorae* (Camerano 1882)
*Pelophylax lessonae bergeri* (Günther 1986)
*Pelophylax kl. escentus* (Linnaeus 1758)
*Pelophylax ridibundus* (Pallas 1771)
*Pelophylax ridibundus ridibundus* (Pallas 1771)
*Pelophylax ridibundus kurtmuelleri* (Gayda 1940)

Genus *Lithobates* Fitzinger 1843
*Lithobates catesbeianus* (Shaw 1802)
*Genus Rana* Linnaeus 1758
*Rana dalmatina* Fitzinger in Bonaparte 1838
*Rana italica* Dubois 1897
*Rana lactate* Boulenger 1879
*Rana temporaria* Linnaeus 1758

Family Cheloniidae Oppel 1811
Genus *Caretta* Rafinesque-Schmaltz 1814
*Caretta caretta* (Linnaeus 1758)
*Chelonia mydas* (Linnaeus 1758)

Genus *Eretmochelys* Fitzinger 1843
*Eretmochelys imbricata* (Linnaeus 1766)
*Eretmochelys kempii* (Garman 1880)

Family Dermochelyidae Fitzinger 1843
*Genus Dermochelys* de Blainville 1816
*Dermochelys coriacea* (Vandelli 1761)

Family Testudinidae Batsch 1788
*Genus Testudo* Linnaeus 1758
*Testudo graeca* Linnaeus 1758
*Testudo graeca nabeulensis* (Highfield 1990)
*Testudo hermanni* (Gmelin 1789)
*Testudo hermanni hermanni* (Gmelin 1789)
*Testudo hermanni boettgeri* (Mojsisovics 1889)

Genus *Lithobates* Laurenti 1768
*Lithobates catesbeianus* (Shaw 1802)
*Genus Rana* Linnaeus 1758
*Rana dalmatina* Fitzinger in Bonaparte 1838
*Rana italica* Dubois 1987
*Rana latastei* Boulenger 1879
*Rana temporaria* Linnaeus 1758

Class Reptilia Laurenti 1768
Order Testudines Linnaeus 1758

Family Cheloniidae Oppel 1811
Genus *Caretta* Rafinesque-Schmaltz 1814
*Caretta caretta* (Linnaeus 1758)
*Chelonia mydas* (Linnaeus 1758)

Genus *Eretmochelys* Fitzinger 1843
*Eretmochelys imbricata* (Linnaeus 1766)
*Eretmochelys kempii* (Garman 1880)

Family Dermochelyidae Fitzinger 1843
*Genus Dermochelys* de Blainville 1816
*Dermochelys coriacea* (Vandelli 1761)

Family Testudinidae Batsch 1788
*Genus Testudo* Linnaeus 1758
*Testudo graeca* Linnaeus 1758
*Testudo graeca nabeulensis* (Highfield 1990)
*Testudo hermanni* (Gmelin 1789)
*Testudo hermanni hermanni* (Gmelin 1789)
*Testudo hermanni boettgeri* (Mojsisovics 1889)

Genus *Lithobates* Laurenti 1768
*Lithobates catesbeianus* (Shaw 1802)
Genus *Rana* Linnaeus 1758
*Rana dalmatina* Fitzinger in Bonaparte 1838
*Rana italica* Dubois 1987
*Rana latastei* Boulenger 1879
*Rana temporaria* Linnaeus 1758

Order Squamata Oppel 1811

Family Chamaeleonidae Rafinesque 1815
Genus *Chamaeleo* Laurenti 1768
*Chamaeleo chamaeleon* (Linnaeus 1758)
*Chamaeleo chamaeleon* (Linnaeus 1758)

Genus *Euleptes* Fitzinger 1843
*Euleptes europaea* (Gené 1839)

Family Gekkonidae Oppel 1811
*Genus Hemidactylus* Oken 1817
*Hemidactylus turcicus* (Linnaeus 1758)
*Genus Mediodactylus* Szczepanek & Golubev 1977
*Mediodactylus kotschyi* (Steindachner 1870)
*Mediodactylus kotschyi kotschyi* (Steindachner 1870)
Family Phyllocladylidae Gamble, Bauer, Greenbaum & Jackman 2008
Genus Tarentola Gray 1825
Tarentola mauritanica (Linnaeus 1758) 50

Family Lacertidae Batsch 1788
Genus Algyroides Bibron & Bory de Saint-Vincent 1833
Algyroides nigropunctatus (Duméril & Bibron 1839)
Algyroides nigropunctatus nigropunctatus (Duméril & Bibron 1839) 51
Genus Archaeolacerta Mertens 1921
Archaeolacerta bedriagae (Camerano 1885) 52
Genus Iberolacerta Arribas 1997
Iberolacerta horvathi (Méhely 1904)
Genus Lacerta Linnaeus 1758
Lacerta agilis Linnaeus 1758
Lacerta bilineata chloronota (Daudin 1802)
Lacerta bilineata bilineata (Daudin 1802)
Lacerta bilineata bilineata (Camerano 1891)
Lacerta bilineata chloronota Rafinesque 1810
Lacerta sp. 45
Genus Podarcis Wagler 1830
Podarcis filfolensis (Bedriaga 1876) 46
Podarcis melisellensis (Braun 1877)
Podarcis melisellensis fumanus (Werner 1891) 47
Podarcis muralis (Laurenti 1768) 48
Podarcis rafeonii (Mertens 1952) 49
Podarcis siccus (Rafinesque-Schmaltz 1810) 50
Podarcis tiglietra (Gmelin 1789) 51
Podarcis wagnerianus Gistel 1868 52
Podarcis wagnerianus wagnerianus Gistel 1868
Podarcis wagnerianus wagnerianus Gistel 1868
Genus Psammomimus Fitzinger 1826
Psammomimus algirus (Linnaeus 1758) 53
Genus Timon Tschudi 1836
Timon lepidus (Daudin 1802)
Timon lepidus lepidus (Daudin 1802)
Genus Zootoca Wagler 1830
Zootoca carniolica Mayer, Böhme, Tiedemann & Bischoff 2000 54
Zootoca vivipara (Lichtenstein 1823) 55

Family Scincidae Oppel 1811
Genus Chalcides Laurenti 1768
Chalcides chalcides (Linnaeus 1758)
Chalcides chalcides chalcides (Linnaeus 1758)
Chalcides chalcides vittatus (Leuckart 1828) 56
Chalcides ocellatus (Forskal 1775)
Chalcides ocellatus linosae Boulenger 1920
Chalcides ocellatus tiglugu (Gmelin 1789)
Chalcides ocellatus zavattarin Lanza 1954
Chalcides striatus (Cuvier 1829)

Family Anguidae Gray 1825
Genus Anguis Linnaeus 1758 57
Anguis veronensis Pollini 1818 58

Family Tylotolophidae Merrem 1820
Genus Indotyphlops Hedges, Marion, Lipp, Marin & Vital 2014
Indotyphlops braminus (Daudin 1803) 59

Family Erycidae Bonaparte 1840
Genus Eryx Daudin 1802
Eryx jaculus (Linnaeus 1758) 60

Family Psammophiidae Boie 1827
Genus Malpolon Fitzinger 1826
Malpolon insignitus (Geoffroy Saint-Hilaire 1827) 61
Malpolon insignitus insignitus (Geoffroy Saint-Hilaire 1827)
Malpolon monspessulanus (Hermann 1804) 62
Malpolon monspessulanus monspessulanus (Hermann 1804)

Family Natricidae Bonaparte 1840
Genus Natrix Laurenti 1768
Natrix helvetica (Lacépède 1789) 63
Natrix helvetica cetti Linnaeus 1758
Natrix helvetica sicula (Gené 1839)
Natrix maura (Linnaeus 1758)
Natrix natrix (Linnaeus 1758)
Natrix natrix persa (Pallas 1814) 65
Natrix tessellata (Laurenti 1768)

Family Colubridae Oppel 1811
Genus Coronella Laurenti 1768
Coronella austriaca Laurenti 1768
Coronella austriaca austriaca Laurenti 1768 66
Coronella girentica (Daudin 1802)
Genus Elaphe Fitzinger 1833
Elaphe quatuorlineata (Bonnaterre 1790) 67
Elaphe quatuorlineata quatuorlineata (Bonnaterre 1790)
Elaphe quatuorlineata quatuorlineata (Bonnaterre 1790)
Genus Hemorrhois Boie 1826
Hemorrhois hippocrepis (Linnaeus 1758) 68
Genus Hierophis Fitzinger in Bonaparte 1834
Hierophis viridiflavus (Lacépède 1789) 69
Hierophis viridiflavus viridiflavus (Lacépède 1789)
Hierophis viridiflavus carbonarius (Bonaparte 1833)
Genus Macroprotodon Guichenot 1850
Macroprotodon cf. cucullatus (Geoffroy Saint-Hilaire 1827) 70
Genus Telescopus Wagler 1830
Telescopus fallax (Fleischmann 1831)
Telescopus fallax fallax (Fleischmann 1831)
Genus Zamenis Wagler 1830 71
Zamenis lineatus (Camerano 1891) 72
Zamenis longissimus (Laurenti 1768)
Zamenis situla (Linnaeus 1758)

Family Viperidae Oppel 1811
Genus Vipera Garsault 1764
Vipera ammodytes (Linnaeus 1758) 73
Vipera ammodytes ammodytes (Linnaeus 1758)
Vipera aspis (Linnaeus 1758) 74
Vipera aspis aspis (Linnaeus 1758)
Vipera aspis francisciredi (Laurenti 1768)
Vipera aspis hugyi (Schinz 1834)
Vipera berus (Linnaeus 1758)
Vipera berus marasso (Pollini 1818) 75
NOTES

1 Ichthyosaura alpestris inexpectata - The taxonomic status of I. a. inexpectata (Dubois & Breull 1983) from Calabria is debated: Speybroeck et al. (2010), Sotiropoulos et al. (2007) and Recuero et al. (2014) considered I. a. inexpectata as a synonym of I. a. apauna, while Chiocchio et al. (2017) consider it a valid taxon.

2 Lisserolobus vulgaris meridonialis - The subspecific rank is confirmed by Papjian et al. (2015, 2017).

3 Salamandra - Dubois & Bour (2010) proved that the genera Salamandra, Bufo and Viperica were created by Garsault (1764) have priority over the genera with the same name created by Laurenti (1768). Therefore, Salamandra Laurenti 1768 and Salamandra Garsault 1764 should be considered different genera and brackets around the author’s name and date of description (if before Dubois & Bour paper) should be used accordingly, see also article 51.3 of the code of nomenclature (ICZN, 1999).

4 Salamandra salamandra gigliolii - The Apennine populations (usually considered S. s. gigliolii), between the eastern Liguria and Campania, are introgressed, with a geographic discordance exceeding 600 km between groups identified with mtDNA and nuDNA. “Pure” populations of S. s. salamandra inhabit the Alps and western Liguria, while “pure” S. s. gigliolii are confined to Calabria (Bisconti et al., 2018).

5 Salamandrina perspicillata - Species status according to Mattoccia et al. (2005) and Romano et al. (2009).

6 Triturus carnifex - Monotypic if T. macedonicus is recognised at species rank (Arntzen et al., 2007). Recent mtDNA-based phylogeographic study observed a basal split between the Italian and the Balkan populations with a restricted admixture at the contact and an admixture over a broader area at the contact between the northern and southern Italian lineages (Wielstra et al., 2014, 2021).

7 Speleomantes - American authors support the use of Speleomantes as a subgenus of Hydromantes, while many European authors support the generic rank for Speleomantes. For a summary of the debate, see Frost (2020).

8 Speleomantes ambrosii bianchii - Taxonomic assessment uncertain. According to the phylogeographic study by Carranza et al. (2008) S. a. bianchii would be closer to S. italicus than to S. ambrosii. On the contrary, S. ambrosii would be closer to S. italicus than to S. a. bianchii in the phylogeny by van der Meijden et al. (2009).

9 Speleomantes genei - Some authors assigned this species to the genus Athylodes (Vieites et al., 2007), but later they re-assigned it to the genus Speleomantes (Vieites et al. 2011).

10 Speleomantes italicus - Ruggi (2007) has shown that S. italicus populations introgressed with genes of S. ambrosii bianchii occur in Tuscany (Florence, Lucca and Pistoia provinces) and Emilia-Romagna (Modena and Bologna provinces); pure populations of S. italicus are present in Emilia-Romagna (Reggio Emilia province), Marche, Umbria, Latium and Abruzzo.

11 Speleomantes sarrabusensis - Elevated to species rank by Carranza et al. (2008).

12 Prostom anguinus - The status of the subspecies of Prostom anguinus, including P. a. parkelj Sket & Arntzen 1994, is still uncertain. Goricki & Trontelj (2006), Goricki et al. (2017) and Trontelj et al. (2009) found six lineages but refrained from assigning them scientific names.

13 Discoglossus pictus - Monotypic according to Zangari et al. (2006): “The little genetic differentiation detected among Algerian and Tunisian D. p. auritus with respect to Maltese and Sicilian D. p. pictus suggested a very recent isolation of Sicilian populations and did not support the necessity of a subspecific rank for D. p. auritus”. Also, Stöck et al. (2015) recorded very close relationships between Sicilian and North African populations.

14 Bombina variegata pachypus - The specific rank of Bombina pachypus is not supported by phylogenetic studies (Hofman et al., 2007; Zheng et al., 2009; Fijarczyk et al., 2011), while Hofman et al. (2007) and Fijarczyk et al. (2011) consider it as a subspecies.

15 Xenopus laevis - Taxonomy of Italian populations according to Lillo et al. (2013).

16 Pelobates fuscus - The validity of the subs. insitricus Cornalia 1873 is not supported by phylogenetic studies (Crottini et al., 2007; Litvinchuk et al., 2013) based on allozyme, genome content and mtDNA data.

17 Bufo - For the brackets around authors names see note 3.

18 Bufo bufo - Monotypic if B. b. verrucosissimus Pallas 1814 is regarded at the species rank (Arntzen et al., 2013). The recently discovered Sardinian population (Cossa et al., 2018) is likely introduced.

19 Bufo spinosus - The Western Ligurian populations of the genus Bufo, from the French border up to Calice Ligure, have been recently assigned to this species based on genetic evidence (Recuero et al., 2012; Arntzen et al., 2020).

20 Bufoates boulengeri siculus - Subspecific status according to Speybroeck et al. (2020) and Dufresnes et al. (2019).

21 Bufoates viridis balearicus - We follow Speybroeck et al. (2020) to consider B. balearicus as a subspecies of B. viridis, due to the wide hybrid zone in north-east Italy (Dufresnes et al., 2014).

22 Hyla arborea - Verardi et al. (2009) found neither F, and F hybrids nor backcrosses between H. intermedia and H. arborea in north-east Italy.

23 Hyla intermedia perrini - Subspecific status according to Speybroeck et al. (2020).

24 Pelophylax - A single genetically identified specimen of Pelophylax shugipericus (Hotz, Uzzell, Günther, Tunner & Heppich 1987) was recorded in Umbria in syntopy with P. ridibundus (Domeneghetti et al. 2013). At the moment it is not known if there is a viable population, or if it is an atypical introduction that will not lead to a naturalization of the species.

25 Pelophylax cf. bedriagae - Introduced in Sardinia, Tuscany and possibly in Emilia Romagna (Bellati et al., 2019) with at least two distinct lineages: “P. cf. bedriagae sensu stricto” (native to Anatolia, Greece, Russia) in Northern Sardinia and Tuscany and “P. cf. bedriagae Cilician West” (native to SE Anatolia) in Southern Sardinia.

26 Pelophylax kl. esculentus - Subspecific status according to Cane-strelli & Nascetti (2008). The hemiclinal hybrid of P. bergieri is called Pelophylax kl. hispanicus (Bonaparte 1839).

27 Pelophylax ridibundus kurzmuelleri - Not recognised at the species rank by Speybroeck et al. (2010, 2020).

28 Lithobates catesbeianus - Included in the genus Lithobates according to Amphibian Species of the World 6.0. Yuan et al. (2016) consider catesbeiana belonging to Rana (Aguarana), while Dubois (2007) considers Aquarana as a synonym of Lithobates.

29 Rana temporaria - “The European common frog contains deep mitochondrial lineages, some of which are given the rank of subspecies (Veith et al., 2002, 2003, 2012; Polo et al., 2004; Teacher et al., 2009), but the exact geographic distribution of these lineages is unknown, as a range-wide comprehensive phylogeographic study for this species is missing so far” (Vences et al., 2013). The phylogeographic study by Stefani et al. (2012) does not support any taxonomic distinction at the subspecific level for R. temporaria in Italy.

30 Eredmocheles imbricata - A very rare vagrant species in the Mediterranean; a single individual has been ascertainment from Italian waters, close to the southern Sicilian coast (http://www.seaturtle.org/ mtn/archives/mtn54/mtn54p12.shtml). The subspecific status of this vagrant individual is unknown.

31 Lepidochelys kempii - A very rare vagrant species in the Mediterranean; it is known as a single individual from Italian waters, captured near Messina (Inascco & Spadola, 2010).

32 Testudo graeca nabeulensis - Fritz et al. (2009) assigned specimens from Sardinia to “subspecies uncertain”, although all examined Sardinian specimens belong to the Tunisian clade (ssp. T. g. nabeulensis), according the same authors.

33 Testudo hermanni - In Italy T. h. hermanni is widespread in the peninsula and islands, except in two northern Adriatic populations (Bosco Nordico and Bosco Mesola), where T. h. boettgeri prevails (Perez et al., 2014; Biello et al., 2021).

34 Emys orbicularis - The lack of genetic differentiation of pond turtles from Sardinia (and Corsica) supports the view that the subspecies described from these islands (respectively E. o. capolongoi
Fritz 1995 and E. o. lanrai Fritz 1995) are not valid (Pedall et al., 2010).

Emys orbicularis galloitalica - E. orbicularis ingauna Jesu, Piombo, Salviod, Lamagni, Ortale & Genta 2004 is a taxon of uncertain validity (Manfredi et al., 2013) occurring in western Liguria, within the range of E. o. galloitalica.

Trachemys scripta - Several terrapin species and subspecies are distributed in natural environments in Italy but currently there is proof of naturalization for two subspecies only (Ficetola et al., 2003; Ferri & Soccini, 2010; Crescente et al., 2014).

Chamaeleo chamaeleon - Populations from Apulia show genetic affinities both with the North African populations (C. c. chamaeleon) and with populations of two areas in the Middle East (C. c. rectifrons Boettger 1890, and C. c. musae Steindachner 1901) (Basso et al., 2019). Specimens from Calabria are genetically similar to Tunisian ones (Andreone et al., 2016). Therefore we refrain from assessing the subspecific status of the introduced Italian populations.

Hemidactylus turcicus - Monotypic, since H. t. spinalis Buchholz 1954 is a synonym (Smid et al., 2015) and other subspecies (e.g. H. t. lavadeserti Moravec & Böhme 1997) have been raised to the species rank (Moravec et al., 2011).

Mediodactylus kotschyi kotschyi - Italian populations have been attributed to M. k. bibronii (Beutler & Gruber 1977), recently put in synonymy with the nominate subspecies (Kotsakiou et al., 2018).

Tarentola mauritanica - The taxonomy of the T. mauritanica complex is debated. Harris et al. (2009) found that specimens from Lampedusa and the adjacent Conigli islet belong to two clades, one occurring on Lampedusa and Conigli islet, related to Libyan specimens [where T. fascialis (Daudin 1802) and T. deserti Lataste 1891 occur] and the other representing “a further subclade, distinct from all other known mtDNA lineages”, found only in Conigli island. Conversely Stöck et al. (2016) found that Lampedusa specimens are closely related to Cap Bon specimens, where T. mauritanica occurs (Tili et al., 2012).

Algyroides nigropunctatus nigropunctatus - The population of Venezia Giulia belongs to the nominal subspecies, as well as the Apulian introduced populations (Carlino & Pauwels, 2016).

Archaeolacerta bedriagae - The validity of the sp. A. b. sardoa (Peracca 1903), A. b. paesleri (Mertens 1927), and A. b. ferrerae (Stemmler 1962) is not supported by genetic (Salvi et al., 2009, 2010) nor by morphological data (Salvi et al., 2008).

Lacerta agilis agilis - According to morphology (Bischoff, 1988), populations from western Alps are assigned to L. a. agilis, while those of eastern Alps to L. a. argus (Laurenti 1768). The cytochrome-b trees did not recover the subspecies L. a. agilis and L. a. argus as separate evolutionary lineages (Kalyabina et al., 2001; Andres et al., 2014).

Lacerta bilineata - The study of Marzhan et al. (2016) “could not answer whether L. bilineata and L. viridis represent distinct species without extensive gene flow”. Intraspecific taxonomy according to Marzhan et al. (2016). The same authors support the validity of two subspecies only: L. b. bilineata and L. b. chloronota.

Lacerta sp. - Based on genetic evidence, Marzhan et al. (2016) assigned three specimens from Pordenone and Udine provinces to the ‘Adriatic’ (or ‘Western Balkan’) lineage. Joss et al. (2021) included in this lineage also an enigmatic specimen from Calambrone (Pisa, Tuscany). According to Jauss et al. (2021) “the lineages [of the L. viridis complex] have reached the level of distinct taxa, but to determine whether they have become fully independent lineages on the species level requires further research”. In both the mentioned studies the Adriatic clade seems closer to L. bilineata than to L. viridis. Therefore L. viridis s.s. is not a member of the Italian fauna, and at present the status of Italian populations formerly assigned to L. bilineata is uncertain. The possible available name for the Adriatic lineage are L. v. istriensis Werner 1897 or L. v. intermedia Méhely 1905 (Marzhan et al., 2016).

Podarcis filfolensis - Capula (1994a), Salvi et al. (2014) and Rodriguez et al. (2014) suggest that P. filfolensis colonized the Pelagian islands from the Maltese archipelago in historical times, therefore the Pelagian sp. P. f. laurentiniumelleri (Fejérvary 1924) is not valid.

Podarcis melisellensis fuchsiae - The subspecies fuchsiae is supported by mtDNA (Podnar et al., 2004), electrophoretic data (Gorman et al., 1975), as well as with morphological analysis (Thorpe, 1980).

Podarcis muralis - The observed phylogeographic structure of P. muralis does not match the current subspecific division of this species in Italy (Giovannotti et al., 2010; Salvi et al., 2013). Pending a comprehensive revision of the status of the Italian populations, at the moment we refrain from adopting any subspecies.

Podarcis rafonei - Taxonomic status according to Capula (1994b).

The genetic distance found between P. rafonei and P. wagnerianus is relatively small for Podarcis species (Podnar & Mayer, 2005; Senčuk et al., 2019). Depending on the markers used the divergence between rafonei and wagnerianus is not that different than for other sister species of Podarcis (e.g. lilfordi and pityusensis, tauricus and ionicus) (Salvi et al., 2021). The validity of the subspecies rafonei (Mertens 1952), alveari (Mertens 1955), cuccharai Di Palma 1980 and antoninoi (Mertens 1955) is not supported by genetic data (Capula, 2004).

Podarcis siculus - This species shows many mitochondrial lineages both in the continent and in some large islands (Podnar et al., 2005; Silva-Rocha et al., 2012; Senčuk et al., 2018) whose ranges and extent of hybridization are not known (D. Salvi in litt.). One of the main branches includes specimens from Sicily, Sardinia and part of Calabria, the other branch the remnant Italian populations (both with campestris or siculus phenotypes). According to Podnar et al. (2005) P. s. cettii (Cara 1872) from Sardinia was introduced in historical times and originated from Sicily, and it is therefore a synonym of P. s. siculus. Recently the populations of P. siculus from western Pontine Islands have been raised to species rank Podarcis latasei (Bedriaga 1879) by Senčuk et al. (2019). This proposal has been rejected by Speybroeck et al. (2020) but defended by Castriglia et al. (2021). Pending a thorough revision of the species, we adopt the more conservative opinion by Speybroeck et al. (2020).

Podarcis tiliguerta - The identity of spp. ranzii (Lanza 1967) from Molarotto Island doesn’t seem supported by mtDNA (Vasconcelos et al., 2006).

Podarcis wagnerianus - The subspecies P. w. marettimeinsis is supported by having only private haplotypes (Senčuk et al., 2018).

Psammodromus algirus - According to Carretero et al. (2009) a single individual from Conigli islet near Lampedusa grouped with those from Morocco (ssp. algirus) and not with the closer Tunisian ones, suggesting a recent, human-mediated, colonization, although a transport between Morocco and the uninhabited Conigli islet seems unlikely. Moreover, the taxonomic value of the two other North African subspecies, P. a. nollii (Fischer 1887) and P. a. doiriae (Bedriaga 1866) has not yet been tested by genetic studies.

Zootoca vivipara - Species rank after Cornetti et al. (2015a, 2015b).

Zootoca vivipara - Authorship according to Schmidt & Böhme (2011). The phylogeographic study by Horreo et al. (2018) seems not to support the current infraspecific taxonomy. The authors identified six clades of Zootoca (one of which is currently Z. carniiola); the Italian populations belong to the clade E, while the type locality is inhabited by the clade C. Waiting for further studies resolving the complicated relationships of the subspecies we do not adopt any subspecific name for the Italian populations.

Chalcides chalcides vittatus - The Sardinian populations would have colonized this island in historical times, by passive transportation, starting from Tunisian or Libyan populations, as is suggested by the morphological and genetic resemblance between these populations (Caputo, 1993).

Anguis - A hybrid A. fragilis x A. cinerea (= veronensis) is reported in Friuli - Venezia Giulia by Gvoždík et al. (2013). The occurrence of A. fragilis is expected in north-east Italy, but has yet to be dem-
**Eryx jaculus** - The morphological characters of the Sicilian population resemble those of African populations (ssp. *jaculus*), but molecular studies are needed to confirm this hypothesis (Faraone et al., 2019). According to Tokar (1991) the species is monotypic.

**Malpolon insignitus** - Species rank after Carranza et al. (2006). The date of publication of the description is listed here according to Opinion 1416 (ICZN, 1987).

**Malpolon monspessulanus** - Besides the nominate subspecies, *M. m. saharatlanticus* Geniez, Cluchet & de Haan 2006 has been described on morphological basis, but its validity has not yet been tested by genetic data.

**Natrix helvetica** - Species rank and infraspecific taxonomy according to Schultz et al. (2020). Moreover, the paper does not report any *Natrix helvetica helvetica* in Italy albeit at least one sample (MSNV 684) from Taggia (IM) shows *Natrix helvetica helvetica* introgression (cf. supplementary materials).

**Natrix helvetica sicula** - Including *calabra* Vanni & Lanza, in Lanza 1983 and *lanzai* Kramer 1970. See Fritz & Schmidttler (2020) for a complete discussion about scientific names erected for *N. natrix* and *N. helvetica*.

**Natrix natrix persa** - Italian populations are tentatively attributed to *N. n. persa* according to Kindler et al. (2017). Schultz et al. (2020) found in northeastern Italy a hybrid zone 70-90 km wide between *N. n. helvetica* and *N. n. helvetica*, already observed by Thorpe (1979) based on morphology. The westernmost records come from close to the Po estuary and Ferrara (Emilia-Romagna).

**Coronella austriaca austriaca** - “The current taxonomy of *C. austriaca […] requires a thorough revision” (Jablonski et al., 2019). The subspecies described from Sicily, *C. a. fitzingeri* (Bonaparte 1840), is not generally accepted, but the phylogenetic studies by Santos et al. (2008) and Jablonski et al. (2019) place the Sicilian specimens in a separate mtDNA clade. Its taxonomic status can only be clarified by analyzing enough material from all over the Italian range.

**Elaphe quatuorlineata** - *Coluber quatro-lineatns* Lacépède 1789 was declared nomen conservandum in Opinion 1463 (ICZN, 1987) that ruled *Lacépède, 1789* as a non-binomial work.

**Hemorrhoids hippocrepis** - Probably introduced in Sardinia and possibly also in Pantelleria (Luiselli et al., 2010 [2011]). According to Luiselli et al. (2010) the species is monotypic. A recent study shows that specimens of Pantelleria (ssp. *nigrrescens* Cattaneo 1985) and Sardinia belong to the “eastern mitochondrial clade”, and it supported the hypothesis of an ancient human-mediated introduction in Sardinia, and a recent colonization (human-mediated or through a recent passive dispersion mechanisms) in Pantelleria (Faraone et al., 2020).

**Hierophis viridiflavus** - *Mezzalirma* et al. (2015) raised *H. carbonarius* to the species rank. Speybroeck et al. (2020) recommend maintaining *Hierophis viridiflavus carbonarius* as a subspecies for the time being, since the amount of divergence in mtDNA between *H. v. carbonarius* and *H. v. viridiflavus* is much lower than between the closely related *H. gemonensis* and *H. viridiflavus* (Rato et al., 2009).

**Macroprotodon cucullatus** - The specific assignment of the Italian population (Lampedusa island of *Macroprotodon*, usually referred to *M. cucullatus*, is still uncertain according to Faraone et al. (2020).

**Zamenis** - A specimen of *Zamenis scalaris* (Schinz 1822) was reported in Italy close to France (Calmonte & Ferri, 1987), but despite intensive research it was not possible to confirm the presence of the species in Italy, which is therefore excluded from the Italian fauna.

**Zamenis lineatus** - There is “pervasive introgressive hybridization with *Z. longissimus* in the eastern contact zone.” (Salvi et al., 2017, 2018). Therefore the status of Apulian populations remains to be evaluated.

**Vipera ammodytes** - Intraspecific taxonomy follows Ursenbacher et al. (2008), according to which *V. a. ruffoi* Bruno 1968 is a synonym of the nominate subspecies.

**Vipera aspis** - Intraspecific taxonomy according to Ursenbacher et al. (2006) and Barbanera et al. (2009). For the brackets around author names see note 3.

**Vipera berus marasso** - According to Schmidtler (2019) the available name for the Alpine (and Italian) populations is *Vipera berus berus* (Pollini, 1818), with type locality Legnago, province of Verona, in the Po plain.

**Vipera berus walser** - Species status debated. Previously considered an isolated population of *V. berus* (Capra, 1954; Sindaco et al., 2006), according to the phylogeny by Ghielmi et al. (2016) *V. walser* seems surprisingly related to the Caucasian species of the *V. urssii* complex. Speybroeck et al. (2020) consider premature the acceptance of the new species due to the possible existence of cito-nuclear discordance and tentatively regard it as a subspecies of *Vipera berus*. Freitas et al. (2020) consider *V. walser* a valid species (Boettger 1889). Doniol-Valcroze et al. (2021) confirm the cito-nuclear discordance suspected by Speybroeck et al. (2020). Therefore, following these authors, we consider *V. walser* as a subspecies of *V. berus*.

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