Zootaxa 2447: 1–52 (2010)
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

The nomenclatural status of the nomina of amphibians and reptiles created by Garsault (1764), with a parsimonious solution to an old nomenclatural problem regarding the genus *Bufo* (Amphibia, Anura), comments on the taxonomy of this genus, and comments on some nomina created by Laurenti (1768)

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Accepted by A. Minelli: 16 Mar. 2010; published: 6 May 2010

Abstract

The nomenclatural consequences of the recent rediscovery of the works of Garsault (1764, 1765, 1767) in amphibians and reptiles are examined in detail. The 13 new nomina of these two groups created by Garsault (1764) distribute in three categories: (1) three of these nomina (*Lacertus*, *Rana viridis*, *Testudo marina*) cause no problem, being just junior synonyms of senior nomina created by Linnaeus (1758); (2) four of them (*Bufo*, *Salamandra*, *Scincus*, *Vipera*) become the valid nomina of taxa, in replacement of identical nomina created later by Laurenti (1768), thus entailing no change in the nomina of their included species and subspecies but changes in their complete nominal-complexes (including their authors and dates); (3) six of these nomina are here rejected as invalid senior synonyms (*Ranetta*, *Serpens*, *Lacertus aquatilis*, *Lacertus terrestris*) or homonyms (*Lacertus viridis*, *Testudo terrestris*) of nomina in current use, by virtue of Article 23.9.1 of the *Code*. A very positive result of the rediscovery of these works is that it allows to solve for the best an old nomenclatural problem, concerning the nucleospecies (type-species) of the genus *Bufo*: whereas the nucleospecies (type-species) of *Bufo* Laurenti, 1768 is *Bufo viridis* Laurenti, 1768, we hereby designate *Rana bufo* Linnaeus, 1758 as nucleospecies of *Bufo* Garsault, 1764. This case shows that it is sometimes possible, even in complex nomenclatural situations, to solve them through a proper use of the Rules of the *Code*, without having to appeal to the ICZN for the use of its Plenary-Powers. From a taxonomic point of view, we think the data published so far do not allow currently to stabilise the generic taxonomy of the *BUFONIDAE*. Pending additional data, we support a conservative attitude, maintaining in the genus *Bufo* most species traditionally referred to this genus. In particular, we think all Eurasian species of this family, which include several pairs of species known to be able to produce viable adult hybrids, should be kept in this genus, but in three distinct subgenera: *Bufo* Garsault, 1764 for the group including *Bufo bufo* (Linnaeus, 1758); *Bufotes* Rafinesque, 1815 for the group including *Bufo viridis* (Laurenti, 1768); and *Epidalea* Cope, 1864 for the group including *Bufo calamita* (Laurenti, 1768). This survey also allows to discuss the appropriateness of the current Article 11.9.5 dealing with specific trinomina, especially as they appear in Laurenti (1768), and to point again to the need to implement more drastic Rules regarding the conditions required for a nomen being compliant for protection through Article 23.9.1 of the *Code*.

Key words: Garsault (1764), Laurenti (1768), nomenclature, *Code*, Article 11.9.5, Article 23.9.1, synonymy, homonymy, priority, old publications, well-known nomina, subgenus, amphibians, reptiles, *Bufo*

Introduction

Welter-Schultes *et al*. (2008) "rediscovered" the long forgotten works of the French artist and naturalist Garsault (1764, 1765, 1767). Beside plates showing plants, a first book (1764) contains 87 plates illustrating animals, and a final table of plates, but no text. A second volume (1765, reproduced together with the plates in 1767) provides rather detailed explanatory texts of the plates of the first volume. In the latter, Garsault published, for the first time after 1757, and thus created, in nomenclatural terms, about 30 zoological scientific names or *nomina* (Dubois 2000). Among them, 5 apply to amphibians and 8 to reptiles (fig. 1–3). Although Welter-Schultes & Klug (2009) briefly discussed the status of some of these 13 nomina, they left several questions unanswered. We here clarify the status of these 13 nomina. Unexpectedly, this "rediscovery" allows to solve an irritating question, that of the "type-species" or *nucleospecies* (Dubois 2005*a*) of the amphibian genus *Bufo*. This generic nomen was until now credited to Laurenti (1768), but strict implementation of the Rules of the *International Code of Zoological Nomenclature* (Anonymous 1999), here referred to as the *Code*, resulted in a nomenclatural problem. Crediting this nomen to Garsault (1764), as suggested by Welter-Schultes & Klug (2009), allows to solve this problem without having to apply to the International Commission of Zoological Nomenclature (ICZN) for a use of its Plenary-Powers. This case fully justifies to pay a close attention to the amphibian and reptile nomina of Garsault (1764), some of which only "automatically disappear" as invalid synonyms of nomina in universal use.

Historical background

Welter-Schultes *et al.* (2008) presented a detailed history of the set of publications which led to the works of François Alexandre Pierre de Garsault (1691–1778). Actually, although Geoffroy's name was mentioned by the latter on the title page, and as author or co-author in some references, the physician Etienne François

Geoffroy (1672–1731) was not directly involved in the writing of these works. Louis Daniel Arnault de Nobleville (1701–1778) and François Salerne (1705–1760) published the volumes *Histoire Naturelle des Animaux – De Regno Animali* as a complement to the *Traité de Matière Médicale – Tractatus de Materia Medica* of Geoffroy (Arnault de Nobleville & Salerne 1756 [French edition], 1760 [Latin edition], respectively). The latter authors themselves mentioned several earlier authors and references, among which regularly appeared: Pierre Belon (ca. 1518–1564) and his illustrated book *De Aquatilibus* (Belon, 1553); Guillaume Rondelet (1507–1566) for his book *Libri de Piscibus Marinis...* and its supplement *Universae Aquatilium Historiae…* (Rondelet, 1554, 1555); Conrad Gessner (1516–1565) and his *Historiae Animalium* (1554, 1587); Ulisse Aldrovandi (1522–1605), whose *De Quadrupedibus Digitatis…* were posthumous (1637); Caspar Schwenckfeld (1563-1609) who wrote a fauna of Silesia, *Theriotropheum Silesiae* (1603); Johann Schröder (1600–1664), who published the *Pharmacopoeia Medico-Chymica* (1672, and many other editions); John Ray (1627–1705), author of a *Synopsis Methodica Animalium Quadrupedum et Serpentini Generis…* (1693); Samuel Dale (1659–1739), author of *Pharmacologia* (1693); James Petiver (ca. 1663–1718), author of fascicles in the series *Musei Petiveriani Centuria* (1695-1703); and Carl von Linné (1707-1778) for his well-known works including the *Fauna Suecica* (Linnaeus, 1746). These authors already used the generic nomina that appear in the works of Garsault (1764, 1765, 1767).

The zoological section of *Les Figures des Plantes et Animaux* by Garsault (1764, 1765, 1767) was obviously based on the *Tractatus de Materia Medica*, almost using the same lists of generic and specific nomina of animals as presented by Arnault de Nobleville & Salerne (1756: i, 1760: xxix–xxxii, 563–564) in the list of their plates, not only for the **AMPHIBIES**, but also for the other groups of animals. In the same year 1764, Jacques Christophe Valmont de Bomare (1731–1807), also referring to "Geoffroy" (i.e., *Histoire Naturelle des Animaux – De Regno Animali*), used the same nomenclature in his *Dictionnaire Raisonné Universel d'Histoire Naturelle* (Valmont de Bomare 1764), but the work was suppressed by the ICZN (Anonymous 1925; Hemming 1956*a*), its nomenclature not being always binominal for species. Similarly, the Principle of Binominal Nomenclature was not consistently applied to the nomina provided in the index published by Arnault de Nobleville & Salerne (1760), and this publication cannot be used for nomenclatural purposes. Garsault (1764) was the first to use some of these nomina within the frame of a binominal specific nomenclature (see discussion of this point in Welter-Schultes & Klug 2009: 227), and thus to provide nomenclatural availability to these nomina under the Rules of the *Code*.

Terminology and printing conventions

For reasons explained elsewhere (Dubois 2000, 2005*a*), we use below short technical terms for concepts usually designated by longer terms or multi-word formulae. This is particularly useful in a paper like the present one, as it allows to save considerable space and to clearly point to precise technical terms rather than vague concepts. For example, every time we use below the term *prenucleospecies* this avoids the use of the long and unpalatable formula "*originally included species*", or *neonym* and *archaeonym* avoid using "*new replacement name*" and "*original name replaced by a new replacement name*". For reasons explained by Dubois (2005*a*), we also refrained from using the Platonician term *type* for *onomatophore* (Simpson 1940), and we used replacement terms for all traditional terms and expressions based on the term *type* (e.g., *monophory* instead of *monotypy*). We provide in Appendix 1 a glossary of the unusual terms employed below, which are also defined in the text upon their first use.

In the text below, species-series and genus-series nomina (see Dubois 2000) are printed, as usual, in lower case *italics*, whereas nomina of higher ranked taxa are written in small capitals, with the following distinction: family-series nomina are in *ITALICS*, and class-series nomina in **BOLD**; those among the latter which are **UNDERLINED** were first published in a modern language, not in Latin. Nomina published but nomenclaturally unavailable under the Rules of the *Code* (anoplonyms) are presented here "between quotation marks".

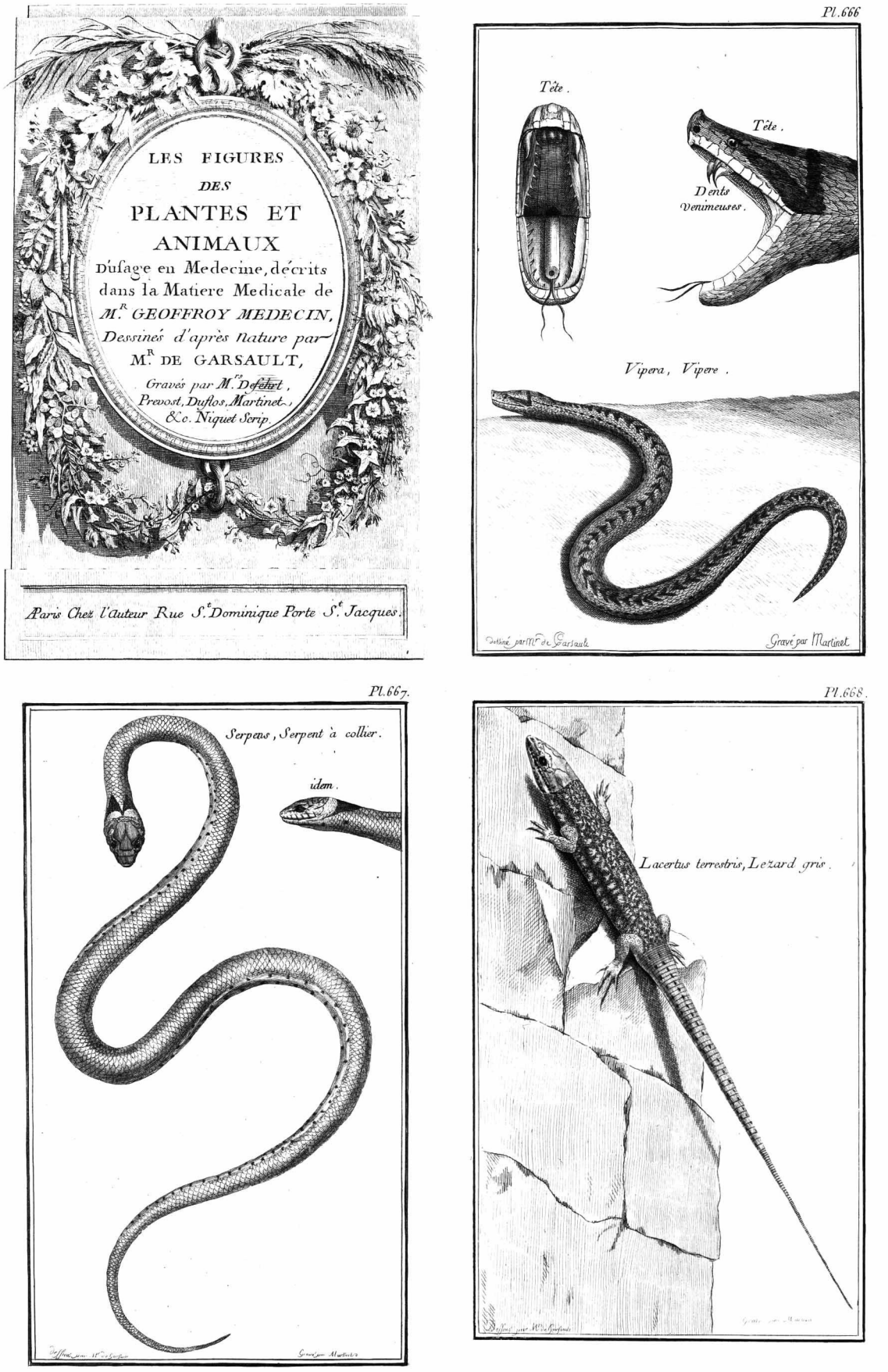


FIGURE 1. Reproductions of extracts from the work of Garsault (1764): title page, plates 666–668. See text for explanations.

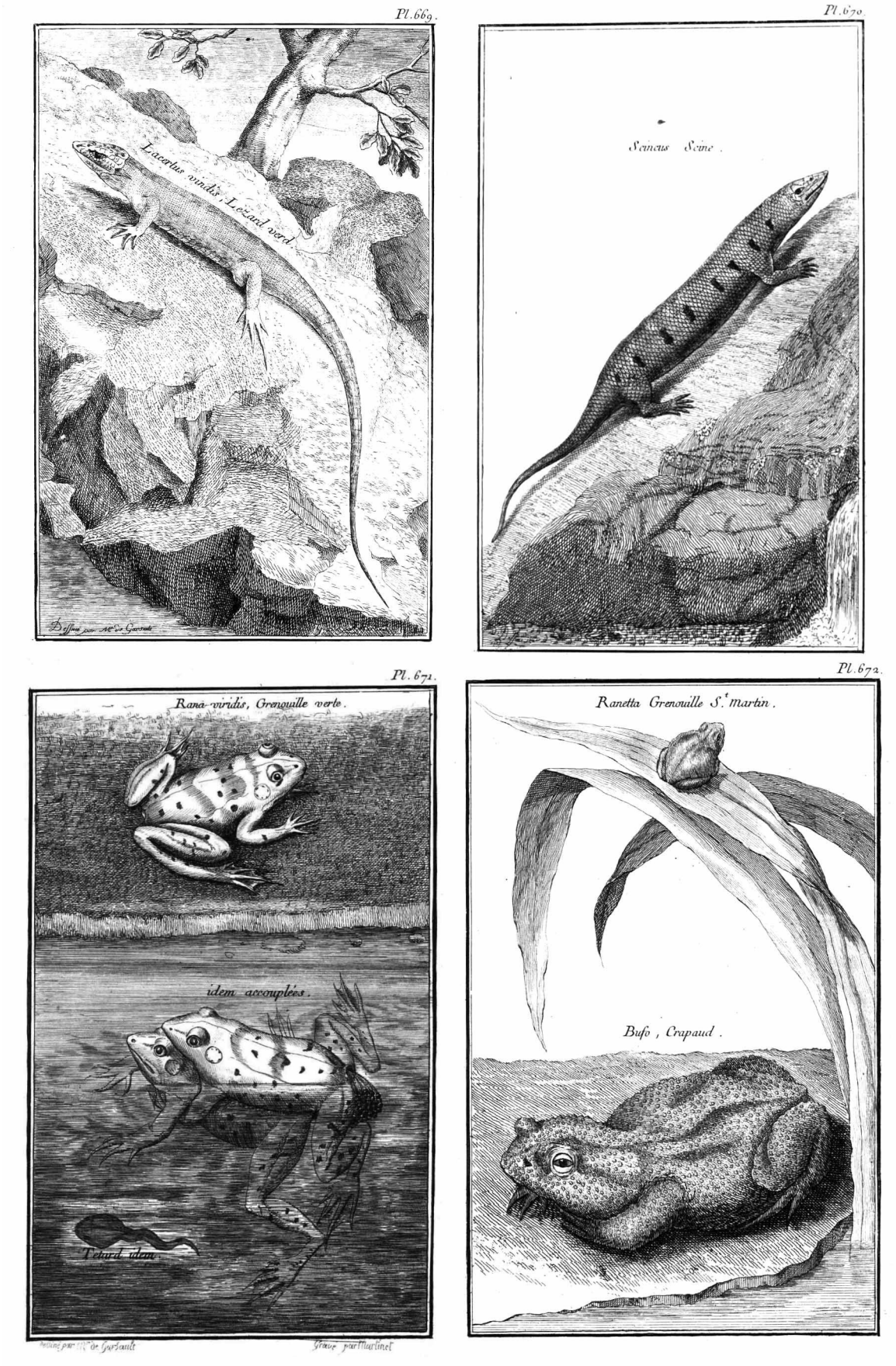


FIGURE 2. Reproductions of extracts from the work of Garsault (1764): plates 669–672. See text for explanations.

Nomenclatural methodology

At the time of publication of Garsault's (1764) first book, nomina of amphibians and reptiles had been made nomenclaturally available in only three publications: Linnaeus (1758, 1761) and Vandelli (1761) (see Bour & Dubois 1984). The next works in which nomina of these two groups were made available are those of Österdam (1766) (see Dubois 1991), Linnaeus (1766, 1767) and Laurenti (1768). The latter work is of great importance, as it proposed the first detailed classification of these groups, including many new genera and species. Most of the nomina in Laurenti (1768) are still in use nowadays. The "resurrection" of the work of Garsault (1764) results in the discovery that 9 nomina (6 genera, 3 species) in this publication are anterior to those created by Laurenti (1768) for the same taxa. As pointed out by Welter-Schultes & Klug (2009), in some cases this entails no change in the nomen of the taxon, and only in the need to credit Garsault (1764) with authorship of the nomen. But in a few other cases the nomen proposed by Garsault (1764) is different from that created by Laurenti (1768), which requires appropriate nomenclatural action in order not to disturb nomenclatural stability. Below we discuss successively all the amphibian and reptilian nomina created by Garsault (1764), and we take nomenclatural action whenever necessary.

Among the 13 new amphibian and reptilian nomina created by Garsault (1764), one, *Bufo*, allows solving a nomenclatural problem that had remained unsettled until now. We review this case in detail below. In three of the other cases, the new nomina of Garsault (1764) should simply replace those of Laurenti (1768), without any other nomenclatural consequence, and in five other cases they should be rejected as invalid synonyms of nomina in universal use. In order to obtain this latter result, and as suggested by Welter-Schultes & Klug (2009), we use below the Article 23.9.1 of the *Code* on *prevailing usage*, which allows to reject a senior synonym or homonym that has never been used as valid since 1899 (*nomen rejectum*) in favour of its junior synonym or homonym (*nomen protectum*) that has been used in at least 25 publications published by at least 10 authors in the immediately preceding 50 years. As all the nomina at stake are very well known of taxonomists and zoologists, we consider it superfluous in this case to provide a list of 25 references: in each of these cases except one, we just referred to a recent work where more than 25 references displaying this nomen in their titles appear in the final list of references.

As stressed by Welter-Schultes & Klug (2009), it is not certain, from the texts of the works of Garsault (1764, 1765, 1767), that this author had seen the tenth edition of Linnaeus' *Systema Naturae* (1758). However, it seems likely that he had had access to some earlier works of Linnaeus, or to works quoting them. At that time already, many nomina were borrowed from one author to the other. Linnaeus (1758) himself created few nomina but used many nomina already published by previous authors. Furthermore, Garsault's (1764, 1765, 1767) consistent use of binominal nomenclature for all his specific zoological nomina suggests acceptance of Linnaeus' (1758) binominal system. Therefore, in what follows, we consider that, whenever he used the exactly same nomina and spellings as in Linnaeus (1758), e.g., *Rana* or *Testudo*, he was just employing the Linnaean nomina. Otherwise, one should consider that in all these cases he created new nomina that would be invalid junior homonyms of Linnaeus's nomina. Fixing their nomenclatural status would then require some nomenclatural action, e.g., designation of nucleospecies (type-species) for the genera, as is done below for the new generic nomina really created by him. As anyway these nomina would have to remain forever invalid junior homonyms, this would only and unnecessarily complicate amphibian and reptilian nomenclature.

On the other hand, beside a few very limited exceptions discussed by Welter-Schultes & Klug (2009: 225–226), Garsault's (1764, 1765, 1767) works were ignored by all subsequent authors. In particular, they were ignored by Laurenti (1768: 6–17), who mentioned many works dealing with amphibians and reptiles prior to his, but nowhere the works of Garsault, which he most probably never saw. So, all the nomina of Laurenti (1768) must be considered distinct from those of Garsault (1764), even when they are identical to them. They are junior homonyms of the latter, and their nomenclatural status must be established independently. In some cases the nomina will have to be validated as of Garsault (1764), and in others as of Laurenti (1768), for reasons explained in detail below.

Seven of the 13 new nomina of Garsault (1764) are generic nomina. In six of these cases, neither in the plate or the list of plates in 1764, nor in the text in 1765 and 1767, did Garsault associate specific nomina to

these generic nomina, apparently for the reason suggested by Welter-Schultes & Klug (2009: 227), namely that "*He considered specific epithets necessary only in case of doubt, otherwise he used the generic name alone*". Thus, these six new generic nominal taxa were created without prenucleospecies (originally included nominal species). In such cases, Art. 67.2.2 of the *Code* states that "*the nominal species that were first subsequently and expressly included in it are deemed to be the only originally included nominal species*", and are the only ones "*eligible to be fixed as the type-species*" of this nominal genus (Art. 67.2). Concerning the six generic nomina mentioned above, we are not aware that any subsequent express inclusion of nominal species was ever published before the paper by Welter-Schultes & Klug (2009), so we hereby designate nucleospecies for them, chosen in such a way as not to disturb nomenclatural stability.

The nomenclatural acts that we take below result in the invalidation of some of the generic nomina of Garsault (*Lacertus*, *Ranella*, *Ranetta*, *Serpens*) but in the validation of some others (*Bufo*, *Salamandra*, *Scincus*, *Vipera*). In the latter case, although the generic nomen apparently does not change (in fact, two homonyms are at stake), its nominal-complex (nomen + author + date; Dubois 2000) changes, and this has another consequence: any nominal species created by Laurenti (1768) himself, and referred by him to a genus created in his work, is now referred to a different nominal genus, so its author's name and date should now be included within parentheses (Art. 51.3 of the *Code*).

We need to stress here again (see also Dubois & Ohler, 1995: 146, 1997*a*: 312; Dubois & Raffaëlli 2009: 64) two important basic facts of zoological nomenclature, repeatedly ignored by some authors. First of all, onomatophores ("types") of nominal genera (nomina) are nominal species (nomina), not "biological" species (taxa): therefore, whenever a genus was created with several prenucleospecies (nominal species originally included, among which none was designated as "type"), only one of these nominal species can be subsequently chosen for designation of a nucleospecies ("type-species"), but their synonyms, whether objective (isonyms) or subjective (doxisonyms), that were not expressly mentioned in the original publication cannot. Second, the onymotope ("type locality") of a nominal species is the place where its onymophoront(s) ("type specimens") had been collected, but cannot be designated arbitrarily by "restriction" of a wider area if this restriction is not linked either to the rediscovery of evidence on the actual origin of the original onymophoront(s), or to the designation of a lectophoront or neophoront of known origin.

In two cases, for the nominal genera "*Calamitus*" Rafinesque, 1815 and "*Torrentophryne*" Rao & Yang, 1994, we designate below nucleospecies for anoplonyms (unavailable nomina). Although rather unusual, this action is not forbidden by the *Code* and it allows to clarify the nomenclatural status of these nomina and to place them properly in synonymies, because otherwise they would have to remain "*incertae sedis*" (see Dubois & Raffaëlli 2009: 28–29).

Garsault (1764, 1765, 1767) did not provide information on the origin of the specimens he showed in his plates. However, as he was a "*botanical artist and naturalist who worked in Paris*" (Welter-Schultes *et al.* 2008: 119), we assume that the European specimens he drew in his plates originated from France. In contrast, the few non-European specimens he described and figured must have been obtained from abroad and were possibly kept in captivity in Paris. We adopted a parsimonious attitude and, for all European animals, we cared in our nomenclatural actions below to apply his nomina to amphibian and reptilian taxa occurring in France, or in countries that were in regular contact with France at that time. However, in 1764, some of these taxa (species or subspecies) had not yet received scientific nomina. Therefore, we are bound to designate as nucleospecies of these nominal genera some species described after 1764. This is allowed by the *Code*, which does not put any restriction on the date of the nominal species subsequently included in a genus established without prenucleospecies (Article 67.2.2).

The question arises of the nomenclatural status of the specimens shown in the plates of Garsault (1764). Should they be considered holophoronts by monophory ("holotypes by monotypy") or symphoronts ("syntypes") of the species illustrated, or as non-onymophoront ("non-type") specimens? The situation is different whether the plates bear only a generic nomen or a binomen. For the plates in which only a generic nomen appears, the specimen cannot be an onymophoront, as genus-series nomina do not rely on specimens but on nominal species. In such cases, the specimen illustrated must be understood as a simple "representative" of the species, which was named in another, anterior or posterior, publication and has another

onomatophore. But for the plates which present a (new) species nomen, the specimen shown must be understood as supporting the new nomen. Except for one case (*Rana viridis*), Garsault (1764) only showed one specimen of each of the species he illustrated in his plates. Should these specimens be considered holophoronts or symphoronts? The 1764 work of Garsault does not provide any evidence that this author had more than one specimen of each species at hand. Sure, in his subsequent works, Garsault (1765, 1767) provided descriptions of these species. These texts show that all the species discussed by this author were known to him by several specimens. Although rather good for their epoch, these descriptions are general enough to be potentially considered to apply to several related species as distinguished in recent taxonomy. If published together with the plates, these descriptions would clearly point to the existence of symphoronts ("syntypes") for all these species, and each specimen shown in a plate would be only one among several symphoronts. Clarification of the nomenclatural status of these nomina would then require the designation of a lectophoront among them, and the best choice would then be that of the specimen shown in the plate. But the texts were published only two years after the plates, so that this reasoning does not apply. As well stated by Welter-Schultes & Klug (2009), the 1764 work is by itself enough to make all the new nomina it contains nomenclaturally available. The 1765 and 1767 works have no bearing on the nomenclature of these taxa, which can be stressed by the fact that if they had never been published this would have had no nomenclatural consequence. Therefore, for all species named on a plate that only shows one specimen, this specimen is the holophoront by original monophory. There is a single exception to this situation, that of the plate 671 devoted to *Rana viridis*, where an isolated adult, an amplecting pair and a tadpole are shown, that must be considered symphoronts of this nomen. This question is discussed are more length below under the nomen *Rana viridis*.

All the specimens shown in the plates of Garsault (1764), which are onymophoronts of nominal species created in this work, are now lost. However, in most cases, the taxonomic identification of the biological species at stake does not pose any problem, so that designation of neophoronts ("neotypes") to replace these lost holophoronts or symphoronts is not warranted. In the few cases where taxonomic allocation of the nomen might later appear to be problematic, the definitive allocation of this nomen to a taxon would require subsequent designation and description of a neophoront in agreement with the figure, following the procedure described in detail by Dubois & Ohler (1995, 1997*a*-*b*).

Before entering the discussion of the new nomina in Garsault (1764), we would like to offer some reflections on some of the nomina of Laurenti (1768) in the light of one Rule of the *Code*.

The Article 11.9.5 of the *Code* and the availability of nomina in Laurenti (1768)

A tricky nomenclatural problem regarding Laurenti's (1768) book concerns the nomenclatural availability of some of its specific nomina. As already remarked by David *et al.* (2002: 26), Dubois (2005*a*: 426) and Dubois & Raffaëlli (2009: 26), some of them are trinomina, which is not acceptable under the *Code* for taxa at species rank. These nomina are of two kinds. In one of them, *Hyla viridi-fusca* (p. 34), the two epithets are connected by a hyphen. In the seven other ones, they are not so connected: *Chamaeleo bonae spei* (p. 46), *Chalcides tridactyla Columnae* (p. 64), *Naja non Naja* (p. 92), *Coluber vipera Anglorum* (p. 98), *Vipera Francisci Redi* (p. 99), *Vipera Mosis Charas* (p. 100) and *Constrictor rex serpentum* (p. 107). The nomenclatural availability of these eight nomina under the *Code* is open to question, and needs to be considered in detail.

The situation is clear in the case of *Hyla viridi-fusca*. Article 32.5.2.3 of the *Code* reads: "*In a compound species-group name published as words united by an apostrophe or a hyphen, the words are to be united by removing the mark concerned*". The *Code* gives the example of the epithet *striato-radiatus*, which becomes *striatoradiatus*. So in the present case the nomen is clearly available and must be corrected into *Hyla viridifusca*, a justified emendation first published by Duellman (1977*a*: 109). This nomen was referred by Dubois (1995) to the synonymy of *Phrynohyas venulosa* (Laurenti, 1768).

Regarding the double epithets not connected by hyphens published by Laurenti (1768), the situation is less straightforward. Article 11.9.5 of the *Code* reads: "*If a species-group name is published as separate words that together represent or refer to a single entity (e.g. host species, geographical area) in a work in which the author has otherwise consistently applied the Principle of Binominal Nomenclature (…), the*

component words are deemed to form a single word and are united without a hyphen (…)". This article gives the examples of the epithets *novae hispaniae*, *terrae novae* and *quercus phellos*, as "*admissible because together they denote a single entity*", and Article 32.5.2.2 adds the example of *bonae spei*.

Implementation of this article in concrete situations is not as clear as it might appear at first reading, as it does not rely only on objective facts but implies *interpretations* of the author's *intentions*, a situation that is never good in a *Code*. Similar problems are posed in other articles of the *Code* that rest on subjective interpretations, such as some of the articles that require a distinction between different kinds of subsequent spellings of nomina (see Dubois 1987, 2010*a*).

First of all, the *Code* does not provide a working definition (e.g., quantitative) of the concept of "*consistently binominal*". If we exclude the nomen *viridi-fusca*, Laurenti's (1768) book still includes seven trinomina for taxa at species level, over 241 species nomina listed, i.e., a proportion of 2.9 %. This certainly is not trivial, and it could well be argued that this work is not *consistently* binominal. In fact, according to the detailed analysis of David *et al.* (2002: 25), this is similar to the proportion (4 over 115, i.e., 3.4 %) of trinominal specific nomina in de la Cepède's (1788*a-c*, 1789, 1790*a-b*) works that were suppressed by the ICZN (Anonymous 1987, 2005) for not being consistently binominal!

Now, if we *decide* to consider this work as consistently binominal and these seven nomina as unfortunate exceptions, the question is: how does the *Code* define the concept meant by the phrase "*together represent or refer to a single entity*"? Of course, when an author creates a species nomen, he considers that this nomen represents a single entity, namely the species! So, the nomen *Naja non Naja* was clearly considered by Laurenti (1768) as a single entity, but "*non Naja*" by itself does not mean anything and does not refer to "*a single entity*". In the mind of any taxonomist of the past, a plurinominal designation for a species was always referring to a single entity, not to a set or class of species. Even the long diagnoses in the books of Linnaeus published before 1758 (and some after) referred to single entities! So, why should this Rule be limited to trinomina? Why not consider that all the terms of the diagnosis, which in Linnaeus' mind clearly designated a single (and, in fact, very well defined!) species, could be "*deemed to form a single word and [be] united without a hyphen*" (Art. 11.9.5)? In fact, strictly speaking, there is nothing in this article as currently written to forbid this and to join three, four, five or more terms to make a single epithet, provided in this work the author "*has otherwise consistently applied the Principle of Binominal Nomenclature*" – which admittedly is quite unlikely. With such a reading, it is clear that none of the nomina in the books of de la Cepède invalidated by the Commission was unavailable (see David *et al.* 2002)!

So we do not think that the concept of "*single entity*" should be interpreted as meaning "a single entity in the mind of the taxonomist who created the nomen", because then all plurinominal designations of species will be covered by this definition. We rather think that the idea of "*single entity*" is meaningful in this context only if it designates a single identifiable entity *outside* the taxonomic and nomenclatural context. "*Francisci Redi*" or "*bonae spei*" qualify as such, but certainly not "*non Naja*".

Let us remind that scientific nomina are just meaningless labels allowing unambiguous designation of taxa (Dubois 2005*a*), so the epithets do not need to "mean" anything to be available. The Article 11.9.5 of the *Code* introduces a need for a nomen to have a certain meaning to be available, which is contradictory to the general treatment of nomina in the *Code*, e.g. in its Article 11.3 ("[*A name*] *may be an arbitrary combination of letters providing this is formed to be used as a word*") or in its Article 18 ("*The availability of a name is not affected by inappropriateness*").

We think that the current wording of Article 11.9.5 of the *Code* is not good, and should be replaced by a new wording relying only on *facts*, i.e., on the nomina as they were published themselves, not on interpretations about "*single entities*" or anything else. We can think of two possible ways to modify this ambiguous Rule.

The first one, the most straightforward, would be to maintain only a distinction between double epithets which were first published linked by a hyphen (that should remain available, but emended to suppress the hyphen) and double epithets that were published as separate words (that should never be considered nomenclaturally available). We would favour this solution.

A second, "milder", solution could be to keep the concept of "*single entity*", but to add a qualification, such as "traditionally linked and thus considered to designate together a single entity outside taxonomy", and furthermore to consider that, whenever the two epithets are, so to say, linked and dependent on each other to keep the same meaning as in the original trinomen, the nomen should be considered valid (and the two nomina united), but if they can be separated while keeping the original meaning, the nomen should be considered an invalid trinomen for being so to say "redundant". Laurenti's (1768) work provides examples of the two situations. The couple of terms "*bonae spei*" is indeed "traditionally considered as a single entity outside taxonomy". It has a different meaning if the two terms are kept together (meaning then "of Cape of Good Hope"), but neither "*Chamaeleo bonae*" ("of good", a meaningless isolated epithet) nor "*Chamaeleo spei*" ("of hope"), which would be strange but nomenclaturally acceptable species nomina, would convey the same meaning as "*Chamaeleo bonae spei*". So, if the "milder" rule was implemented, the nomen would be available but would have to be emended into *Chamaeleo bonaespei* (as in the present *Code*). On the other hand, nomina like *Vipera Francisci Redi* and *Vipera Mosis Charas* would keep their original meanings if restricted to one of their double epithets. This was indeed the case in the nomina *Coluber redi* Gmelin, 1789 and *Coluber charasii* Shaw, 1802, published subsequently to Laurenti (1768). In the two latter cases, implementing the "milder" rule would result in considering *Vipera Francisci Redi* and *Vipera Mosis Charas* as unavailable trinomina.

The ICZN would render service to the community of zootaxonomists in discussing this question and improving the current Article 11.9.5 to remove its ambiguity and make it fully operational. In the meanwhile, however imperfect the *Code* is (and it is so in many other respects as well; see Dubois 2008*c*), and unless zootaxonomists prefer a situation of chaos, they have to follow it as it is, in the hope that it will be improved in the future. So let us try and see what is the situation of the seven trinomina of Laurenti (1768) under the current Article 11.9.5.

The situation is straightforward for the nomen *Chamaeleo bonae spei*, as it exactly corresponds to one of the examples given in Article 32.5.2.2 of the *Code*. This nomen is therefore a hoplonym (available nomen), which must be emended into *Chamaeleo bonaespei*. De la Cepède (1788*a*: 338), with reference to Laurenti (1768: 64), wrote *Chamaeleo bonae-spei*, an invalid spelling adopted by Sherborn (1902: 136). To the best of our knowledge, the correct emendation was published only recently, by Kuzmin (*in* Thiesmeier 2005: 243), who considered it as a junior synonym of *Bradypodion pumilum* (Gmelin, 1789), as previously suggested by Klaver & Böhme (1997: 56). Let us note in passing here that, if this synonymy is warranted, the nomen of Laurenti (1768) has priority over that of Gmelin (1789), so that conservation of the latter could be possible only through use of Article 23.9.1 of the *Code* (see below).

Two other trinomina in Laurenti (1768) also refer clearly to "single entities" in the sense of the *Code*, as they are based on the names of well-identified persons: *Vipera Francisci Redi* and *Vipera Mosis Charas* refer to the names of the physician Francisco Redi (1627–1697) and the apothecary Moïse Charas (1619–1698), respectively, who both made experiments on vipers' venom. Under Article 11.9.5, these nomina must be considered available but the two epithets must be united. Kramer (1971) considered the first one as a subspecies of *Vipera aspis* (Linnaeus, 1758) and emended its nomen into *Vipera aspis francisciredi*. This subspecies is still considered valid nowadays (see Bruno 1985: 50; David & Ineich 1999: 330; Garrigues *et al.* 2005: 36). As for the second one, Sherborn (1902: 692) used the incorrect nominal combination *Vipera mosis-charas* and Kuzmin (*in* Thiesmeier 2005: 247) the correct emendation *Vipera mosischaras*. *Vipera Mosis Charas* was introduced in the synonymy of *Vipera ammodytes* (Linnaeus, 1758) by Merrem (1820: 151), but the correct nomen *Vipera mosischaras* is currently (Bruno 1985: 47; Günther 1996) considered a junior doxisonym of *Vipera aspis aspis* (Linnaeus, 1758).

Four specific trinomina in Laurenti (1768) remain to be assessed: *Chalcides tridactyla Columnae*, *Naja non Naja*, *Coluber vipera Anglorum* and *Constrictor rex serpentum*. Although these four nomina clearly designated, in Laurenti's mind, "*single entities*" (the species to which he applied them!), their double epithets cannot be considered to represent clear unique entities, traditionally and unambiguously recognized as such by all users outside taxonomy. It could be argued that in 1768 there was a single entity recognized by all zoologists as "the viper of the English" and one as "the king of snakes", but we know of no published evidence in this respect. As for the nomina "*tridactyla Columnae*" and "*non Naja*", they certainly cannot be

stated to refer to "*single entities*", although de la Cepède (1789: 89) suggested: "*Laurent [sic] a fait de la femelle du Naja une espèce distincte qu'il a nommée* Naja non Naja" ["Laurenti made of the female Naja a distinct species which he named *Naja non Naja*"]. In our opinion, these four trinomina cannot be considered as available under the Rules of the *Code*, however lax the latter are in this respect. They have had diverging fates regarding their nomenclatural status, so let us consider them successively.

The nomen "*Chalcides tridactyla Columnae*" was emended by Boulenger (1887: 403) into "*Chalcides tridactyla*" and by Mertens & Wermuth (1960: 160) into "*Chalcides tridactylus*". These nomina ignore the second epithet "*Columnae*" and are therefore invalid autoneonyms (new replacement nomina of same etymology) of the original nomen. Sherborn (1902: 990) proposed the invalid emendation "*Chalcides tridactyla-columnae*", which, under our interpretation of the *Code* (Articles 11.9.4, 32.5.2), is unjustified and unacceptable. Kuzmin (*in* Thiesmeier 2005: 243) used "*Chalcides tridactylacolumnae*", which is also invalid, as an unavailable nomen cannot be made available through emendation! This nomen is currently considered (Mertens & Wermuth 1960: 160; Kuzmin *in* Thiesmeier 2005: 243) as a junior synonym of *Chalcides chalcides* (Linnaeus, 1758).

The nomen "*Naja non Naja*" is currently considered a junior synonym of *Naja naja* (Linnaeus, 1768), at least since de la Cepède (1789: 89), and formally by Kuzmin (*in* Thiesmeier 2005: 245). It was emended into "*Naja non-naja*" by Sherborn (1902: 670), and into "*Naja nonnaja*" by Kuzmin (*in* Thiesmeier 2005: 108, 245). In our opinion, both these emendations are unavailable and invalid.

The nomen "*Coluber vipera Anglorum*" is currently considered a junior synonym of *Vipera berus berus* (Linnaeus, 1758) (see Mertens & Wermuth 1960: 198; Bruno 1985: 56; McDiarmid *et al.* 1999: 397; Kuzmin *in* Thiesmeier 2005: 244). Boulenger (1896: 476) proposed the emendation "[*Coluber*] *vipera*", Sherborn (1902: 1049) the emendation "*Coluber vipera-anglorum*" and Kuzmin (*in* Thiesmeier 2005: 244) the emendation "*Coluber viperaanglorum*". Under our interpretation, these three emendations are unavailable and invalid.

Finally, the nomen "*Constrictor rex serpentum*" is currently considered a junior synonym of *Boa constrictor constrictor* Linnaeus, 1758 (McDiarmid 1999: 183; Kuzmin *in* Thiesmeier 2005: 244). Boulenger (1893: 117) proposed the invalid emendation "[*Constrictor*] *rex-serpentum*", adopted by Sherborn (1902: 829), and Stimson (1969: 48) the invalid emendation "*Constrictor rexserpentum*".

Because of these four latter nomina, and despite the lax conditions of availability of specific trinomina of the current Article 11.9.5 of the *Code*, Laurenti's (1768) publication is not consistently binominal at species level. Following the Rules, which require that specific nomina be binomina, and that trinomina be used only for subspecies, these four trinomina coined to designate species are anoplonyms (nomenclaturally unavailable nomina). This is similar to the case of the quadrinomina proposed in the past for some taxa of rank "variety", below subspecies. The third epithets of such quadrinomina, sometimes designated as *nomina illegitima* (see e.g. Mertens & Wermuth 1960; McDiarmid *et al.* 1999), are clearly anoplonyms (nomenclaturally unavailable), i.e., they cannot be used as valid, even at a rank higher than subspecies, they do not preoccupy their spellings for homonymy, and they cannot be used as archaeonyms for the creation of neonyms ("new replacement names"), as a nomen that does not exist in zoological nomenclature cannot be the basis for a new nomen replacing it.

However, stating that quadrinomina for varieties are anoplonyms does not mean that the work where they were published should be considered nomenclaturally unavailable: this work may contain other nomina at other ranks that are fully available and may long have been considered valid. To take just one example, Camerano's (1884) monograph contains both available new subspecific nomina in the species *Discoglossus pictus* Otth, 1837 and *Bufo viridis* Laurenti, 1768, and unavailable new varietal nomina in the subspecies *Rana esculenta lessonae* Camerano, 1882 (see e.g. Mertens & Wermuth 1960: 41, 48, 55). Invalidating nomenclaturally such a work because it contains anoplonyms would be fully unjustified and inappropriate. We think that the same mode of reasoning should have been adopted regarding de la Cepède's (1788*a-c*, 1789, 1790*a-b*) books, which contain a few specific nomina unavailable for not being binominal. It would have been fully sufficient to regard the latter as anoplonyms but not to invalidate the whole books (Anonymous 1987, 2005), as this resulted in invalidating also several hoplonyms, published as binomina and considered as valid

by all authors for more than two centuries, thus sometimes creating new nomenclatural problems (see e.g. Dubois & Raffaëlli 2009: 27). As had already been stressed, even before the ICZN decisions, by Bour & Dubois (1984), the "suppression" of these books can in no way be considered to have "*promoted stability in zoological nomenclature*" (*Preamble* of the *Code*), a goal that is often *claimed* to be pursued in its actions by the ICZN.

At the beginning of the 20th century, shortly after the implementation of the *Règles Internationales de la Nomenclature Zoologique* (Blanchard 1905) that preceded the *Code*, it was certainly useful to invalidate nomenclaturally a number of old books posterior to 1758 that did not follow the basic Rules, in particular the Principle of Binominal Nomenclature. This allowed to firmly establish in the international community of zootaxonomists the idea that, to be available, a new species nomen had to follow this Principle. By discouraging the repetition of such actions, it played a "pedagogical" role towards the authors of that time. The Principle of Binominal Nomenclature is one of the safeguards or "rails" that allow to separate zoological nomenclature following the *Code* from other nomenclatural systems not respecting these Rules. Similarly, authors who nowadays decide to apply uninomina to species (e.g., Graybeal 1995; Pleijel 1999; Dayrat *et al.* 2004; Béthoux 2008, 2009; Béthoux *et al.* 2009), or who use additional ranks in the genus-series below subgenus (e.g., Hillis *et al.* 2001; Hillis & Wilcox 2005), or between genus and subgenus (e.g., Deuve 2004), or nomina not based on available generic nomina for "unranked" taxa between superfamily and family (e.g., Guayasamin *et al.* 2009), or who base their new nomina on intensional definitions rather than on ostension through onomatophores (e.g., Hillis & Wilcox 2005), cannot ignore that they place themselves outside the *Code* and cannot complain if others provide correct *Code*-compliant nomenclatures for the same taxa (Dubois 2006*d*, 2007*b*; Muona 2006). However, invalidating nowadays old work of the 18th and early 19th centuries that have been used as source of nomina considered valid for about 200 years is not an appropriate action, as this cannot now play a "pedagogical" role towards their authors and clearly disserves nomenclatural robustness.

For these reasons, we think it would be a very bad idea to suggest "suppressing" Laurenti's (1768) publication for not being consistently binominal at species level. But we think that the four specific trinomina listed above, that cannot be "saved" through Article 11.9.5, should be considered *nomina illegitima*, i.e. anoplonyms, and cannot therefore be used as valid nomina. The same applies to the emendations, listed above, that were proposed for these unavailable nomina.

Bufo Garsault, 1764

The nominal genus *Bufo* was created by Garsault (1764) in the lower half of his plate 672, which shows a specimen of toad ("*Crapaud*") clearly resembling the "common toad" *Bufo bufo* (Linnaeus, 1758) from France. No origin was given for this specimen in the text of Garsault (1765, 1767). The generic nomen *Bufo* may have been derived from the specific nomen *Rana bufo* Linnaeus, 1758 or from any of the numerous non-Linnaean uses of the same term as uninomen. In agreement with the figure in his plate 672, we hereby designate the nominal species *Rana bufo* Linnaeus, 1758 as nucleospecies (type-species) of *Bufo* Garsault, 1764.

This finding has an important, unexpected and happy consequence: it allows solving for the best the problem of the nucleospecies of the genus *Bufo*. This genus has been universally considered a valid generic nomen of anurans since its "second creation" by Laurenti (1768), who clearly had used the same etymology as Garsault. For the reason explained above, the nomen *Bufo* Laurenti, 1768 must be considered a distinct nomen, invalid junior homonym of *Bufo* Garsault, 1764, and the nomenclatural status of which must be established independently. In particular, its nucleospecies must be clarified, a point that has been controversial until now, and that we therefore examine in detail here, in the light of the discovery of Garsault's works.

In his new genus *Bufo*, Laurenti (1768) included 13 nominal species, none of which was designated as "type". Presumably because he did not accept tautonymy, he did not mention anywhere in his book the nominal species *Rana bufo* Linnaeus, 1758, but he redescribed this species under the nomen *Bufo vulgaris*.

Had he mentioned the nomen *Rana bufo* as its senior synonym, this latter nomen would have been the nucleospecies of *Bufo* Laurenti, 1768 by absolute tautonymy (Article 68.4 of the *Code*). As he did not, the nucleospecies must have been fixed by subsequent designation, and only the 13 species originally listed in this genus are eligible for this designation, which excludes the nominal species *Rana bufo*. Therefore, Stejneger (1936: 134) was in error when he stated that the latter species was the "type-species" of *Bufo* Laurenti, 1768 by absolute tautonymy simply because *Bufo vulgaris* was a synonym of it. This error was first pointed out by Leviton & Anderson (1970: 38) and recognized as such by Dubois (1984: 14, 19). The nucleospecies designation for this genus must therefore be traced in the literature subsequent to Laurenti (1768), which is problematic.

Fleming (1822: 305) wrote: "*The common toad (which the ignorant and the prejudiced persecute, though harmless), is the type of the genus*." Unfortunately, Fleming (1822) used only vernacular nomina in his book and nowhere mentioned the nomen *Bufo vulgaris* Laurenti, 1768. Throughout his work, he referred to the book of Pennant (1769), who mentioned Latin nomina, but used for this species the nomen *Rana bufo*, which is not eligible for nucleospecies fixation of *Bufo* Laurenti, 1768. For these reasons, Dubois (1992: 342) considered this designation as invalid.

The next author to consider here is Tschudi (1838: 50), who wrote: "*Von ältern* [sic] *Naturforschern immer mit* Rana *verbunden, trennte Laurenti das Genus* Bufo*, dessen Typus in Europa,* Bufo vulgaris*, auch in Japan vorkömmt , und von der europäischen nur in der Schädelform abweicht*" ["Still referred to *Rana* by the older naturalists, it is Laurenti who separated the genus *Bufo*, whose type in Europe *Bufo vulgaris* is found also in Japan, and which differs from the European only by the shape of the skull"]. The mention of a "type in Europe" cannot qualify as a valid nucleospecies designation under the *Code*, which states: "*The term 'designation' in relation to fixation of a type species (…) must be rigidly construed; the following are not designations under the Code: (…) 67.5.3. one made in an ambiguous or conditional manner*" (Article 67.5). A nucleospecies for a genus only makes sense if it applies fully to the whole genus. It cannot be restrictive. It is not acceptable to have a single genus with several nucleospecies, one in Europe, one in Africa, one in America, or one in ponds, one in rivers, or one in spring, one in summer, etc. A survey of the whole volume of Tschudi (1838) shows that the term "*Typus*" does not appear anywhere else than in the sentence above, suggesting that his author did not have a concept of "type-species". In our opinion, "type in Europe" does not refer to the concept of "type-species" of a genus, but means "typical form among the European species", leaving open the possibility that other species may be considered "typical" of the genus in other parts of the world. Tschudi's (1838) statement is unclear and ambiguous, and as such does not qualify as a valid nucleospecies designation. Nevertheless, it has been accepted as valid by a few authors (Frost 1985: 34; Dubois 1992: 342). The reason why they did so is that if this was not accepted as valid, one had to accept the next designation, which is formally correct but raises another problem.

As a matter of fact, in a work which contains hundreds of valid formal nucleospecies designations (using the term "*Typus*") for new or older generic nomina, Fitzinger (1843: 32) designated *Bufo viridis* as "type-species" of *Bufo*. Fitzinger (1843) was one of the first authors (after Oken 1816) to place the nominal species *Bufo viridis* and *Bufo vulgaris* in different genera, restraining the use of the nomen *Bufo* to the group containing the former and using Oken's (1816) nomen *Phryne* for the group including the latter. The species *Bufo viridis* being part of those originally included by Laurenti (1768) in his new genus *Bufo*, it is eligible for nucleospecies fixation in this genus, as accepted by Leviton & Anderson (1970: 38) and Dubois (1984: 14, 19), although not by Mertens (1971*b*). For 163 years, this designation did not create any problem, as both the species *Rana bufo* Linnaeus, 1758 and *Bufo viridis* Laurenti, 1768 were referred to a single genus *Bufo*, without subgenera. But this situation changed with the publication of Frost *et al.*'s (2006) work.

From 1768 to 2006, the genus *Bufo* has been considered a world-distributed genus of the family *BUFONIDAE* Gray, 1825, with about 250 species (Dubois 2004*b*). This genus, although long known to include various subunits or "species groups" (Blair 1972), had only very rarely been divided into formally named subgenera, let alone split into several taxa. Frost *et al.* (2006), on the basis of preliminary molecular data, decided to split this genus into no less than 14 genera, while leaving 27 species unallocated to genera. Given the highly incomplete coverage of their taxonomic sampling and the preliminary nature of their molecular

data, this action appeared premature to some (e.g., Vences 2007; Lescure 2008; Pauly *et al.* 2009), inasmuch as some of these species had been known for about 200 years or more under the generic nomen *Bufo*. However, this reason alone is not sufficient to reject this proposal: taxonomy is a science in permanent progress, and it is normal to implement changes in the nomina of taxa when new data are obtained (Dubois 1998). But this must be done with caution.

Changing the generic allocation of well-known species may of course be fully justified if based on robust phylogenetic and solid biological information, but is premature if there is a strong possibility that a reversal to the original situation might result from further analyses. This indeed happened in the case of Frost *et al.*'s (2006) work, as emphasized by the quasi-immediate lumping by Chaparro *et al.* (2007) of Frost *et al.*'s (2006) bufonid genera *Chaunus* Wagler, 1828, *Rhamphophryne* Trueb, 1971 and *Rhinella* Fitzinger, 1826 in a single genus *Rhinella*: in this case, some of the many new combinations in the genus *Chaunus* listed in Frost *et al.* (2006: 364) had a life span of one year only. Other instabilities resulted from an incomplete or incorrect nomenclatural survey prior to creating new combinations, as exemplified by the saga of the generic nomina *Cranopsis* Cope, 1876, *Ollotis* Cope, 1876 and *Incilius* Cope, 1863, all used successively for the same genus in no more than 3 years by the same research team (see Frost *et al.*, 2009*a*). But other, more serious, problems are also met if Frost *et al.*'s (2006) purely "cladistic" generic concept is considered, as discussed below.

There are many reasons why cladistic trees should be considered with caution when it comes to using them to build supraspecific taxonomies. Dubois & Raffaëlli (2009: 8–9) listed some of them, and Frost *et al.* (2009*b*: 141) stressed another one, the incompleteness of our inventory of species, a problem which will not be solved soon (Gónzalez-Oreja 2008). This *taxonomic gap* (Dubois 2010*b-c*) is particularly relevant in amphibians: "*in the 1970's (…) the number of species known was less that half that known today*" (Frost *et al.* 2009*b*: 141). For these reasons, when basing a taxonomy on a tree, Dubois & Raffaëlli (2009: 9) suggested "*recognizing taxonomically all the robust specific clusters, but some only of the nodes of the trees obtained, those that appear constant in all analyses*". This is particularly relevant if these different analyses used different sets of characters and different methods of analyses for the building of the trees, and if the support values for the nodes are high.

Furthermore, even if some of the taxa erected after their analysis appear warranted in view of the data presented, a basic question arises concerning the "genus concept" used by Frost *et al.* (2006). Not all sets of species supposed or shown to be holophyletic (monophyletic *sensu* Hennig 1950) should be given the rank genus, otherwise any two pair of sister-species should be given the rank genus, adding a third external species would require erecting a new genus for it, etc. *The topology of a tree alone does not provide a taxonomy.* Some criteria, or at least guidelines, are needed to decide which "clades" should be given the rank genus instead of species-group, subgenus, subtribe, tribe, subfamily, etc. This problem is complex (Dubois 2007*b*; Dubois & Raffaëlli 2009) and cannot be discussed in detail here.

In our opinion, the proposal by Dubois (1981*a-b*, 1982, 1983, 1988*a-b*, 2004*c*) to use hybridization data as a help for the recognition of genera, although it until now rose interest only from few authors (e.g., Böhme & Köhler 2005), should be considered seriously. This proposal is simple: whenever two species are liable to produce, either in natural or in artificial conditions, viable adult hybrids (either fertile or sterile), these should never be included in different genera, although they can be placed in different subgenera of the same genus. The reverse is not true of course, for reasons explained in detail by Dubois (1988*a-b*): two species may belong in the same genus even if they cannot hybridize successfully.

Applying this criterion to the traditional genus *Bufo* definitely precludes to split it in as many genera as suggested by Frost *et al.* (2006), as fully viable hybrid adults are known to be sometimes produced between species placed by these authors in different genera. Dubois & Dinesh (2007) provided references to works where such successful hybridization has been reported between Frost *et al.*'s (2006, 2009*b*) "genera" *Anaxyrus* Tschudi, 1845 and *Bufo*, *Anaxyrus* and *Incilius*, *Bufo* and *Pseudepidalea* Frost *et al.*, 2006, and *Epidalea* Cope, 1864 and *Pseudepidalea* (for details, see the legends of our figures 4–6). According to Dubois's (2004*c*) guidelines, in order to apply the crossability criterion and in order not to recognize paraphyletic genera, the two species of any hybridizable pair must be included in a single genus, and this genus must be expanded so as to include all the other species necessary to make this genus holophyletic. This

may in some cases require to include in the genus several "subclades" that may show rather strong phenotypic differentiation. It is however possible, if one wishes to recognize taxonomically these "subclades" as taxa, to give them the status of subgenera. Strangely enough, although this rank is widely used in the taxonomy of many animal groups, e.g. in entomology, it has been little used in the amphibians and reptiles, presumably as a result of Dunn' (1943) personal opinion on this matter (see also Duellman 1977*b*), but this point of view is fully questionable: for example, recently, Smith & Chiszar (2006) and Wallach *et al.* (2009) gave good arguments for a more frequent use of the rank subgenus in taxonomy.

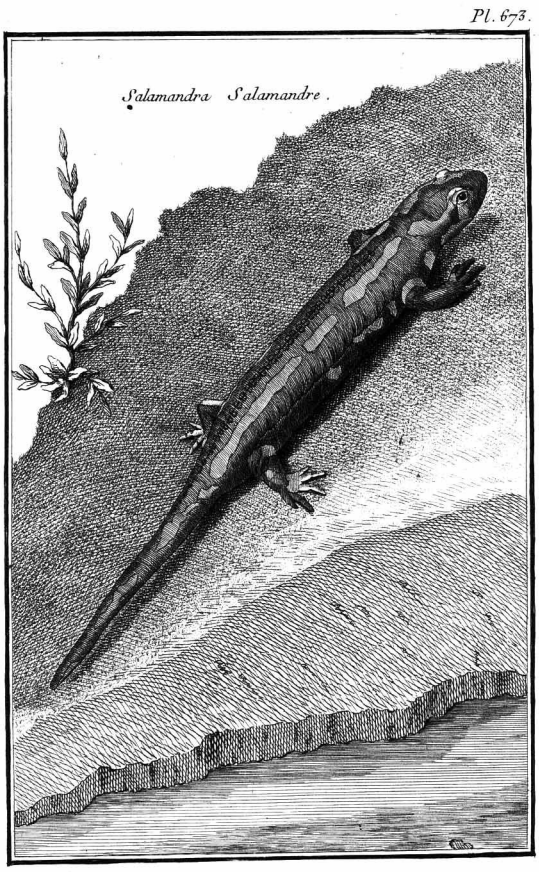
In the case of the genus *Bufo*, despite the multiplication of recent molecular phylogenetic works, no consensus exists among them (e.g., Graybeal & Cannatella 1995; Graybeal 1997; Pauly *et al.* 2004, 2009; Frost *et al.* 2006, 2009*b*; Pramuk 2006; Chaparro *et al.* 2007; Pramuk *et al.* 2008; Van Bocxlaer *et al.* 2009). The most recent of these studies (Van Bocxlaer *et al.* 2009) no doubt presents a much better set of data than all of the previous ones in this group: the tree presented by these authors (see our figure 6) is well resolved and based on a comprehensive set of nuclear and mitochondrial genes, equivalent to data sets that have recently produced well-supported phylogenies in many other amphibian groups. However, the sample of species sequenced is small, compared to the whole family, and many groups are not represented. It is predictable that when more species and nuclear genes are added, the topology of this tree will change, at least in some of its "details", but these "details" may have important taxonomic consequences, for example if sister-taxa relationships between species and groups change.

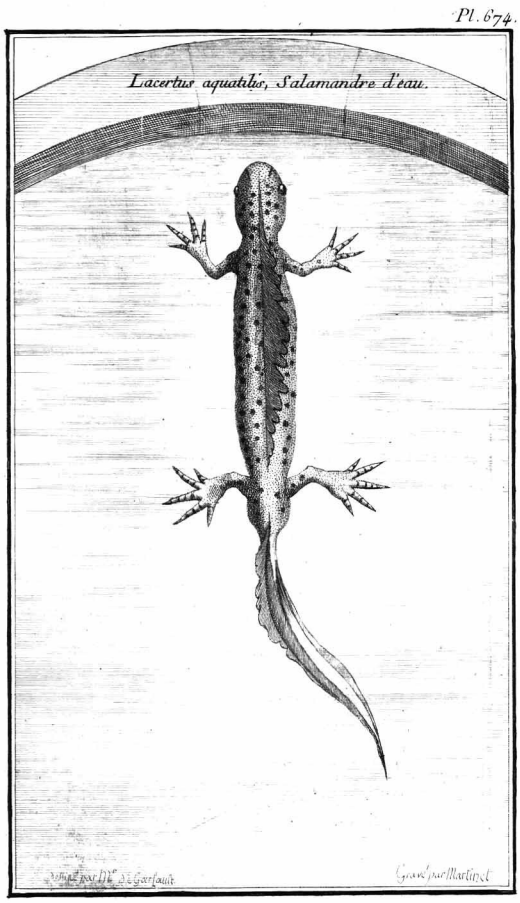
In such a situation, a prudent, conservative attitude is warranted, and it is not warranted to recognize as many genera as in Frost *et al.* (2006). Several clusters of "genera", as recognized by Frost *et al.* (2006) or other recent authors, seem well established as they appear to constitute exclusive holophyletic groups according to all the recent analyses that dealt with them. A first step at this stage, which would not result in the recognition of any paraphyletic group, might be to recognize them as provisional taxa, e.g. genera (here presented by alphabetic, not phylogenetic, order), including two or more subgenera: (1) *Anaxyrus*, with the subgenera *Anaxyrus* and *Incilius*; (2) *Bufo* Garsault, 1764, with the subgenera *Bufo* (including *Torrentophryne* Yang *in* Yang *et al*., 1996) and *Epidalea*; (3) *Leptophryne* Fitzinger, 1843, with the subgenera *Ingerophrynus* Frost *et al*., 2006 and *Leptophryne*; (4) *Sclerophrys* Tschudi, 1838[1], with the subgenera *Capensibufo* Grandison, 1980 and *Sclerophrys* (including *Amietophrynus* Frost *et al*., 2006, *Mertensophryne* Tihen, 1960, *Stephopaedes* Channing, 1979 and *Vandijkophrynus* Frost *et al*., 2006); (5) *Nectophryne* Buchholz & Peters *in* Peters, 1875 with the subgenera *Nectophryne*, *Werneria* Poche, 1903 and *Wolterstorffina* Mertens, 1939; and (6) *Nectophrynoides* Noble, 1926, with the subgenera *Churamiti* Channing & Stanley, 2002 and *Nectophrynoides*.

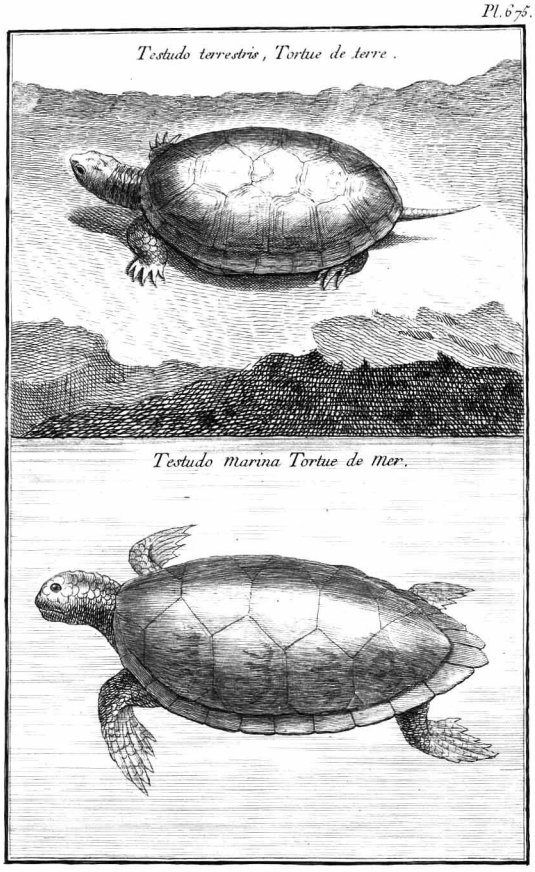
But this is not enough. If we consider the data from successful hybridization until the adult stage, we realize, first, that they are on the whole very congruent with the phylogenetic data, but, second, that they suggest recognition of slightly more inclusive genera.

First of all, *Bufo* and *Pseudepidalea*, between which successful hybridizations have been reported, should be kept as subgenera of a single genus *Bufo*. The same applies to *Epidalea* and *Pseudepidalea*, which requires to include also *Epidalea* in *Bufo*, and to *Anaxyrus* and *Incilius*, which implementation of the crossability criterion demands to place in a single genus *Anaxyrus*. However, as explained and illustrated in detail by Dubois (2004*c*), this is not enough, as use of this criterion must remain compatible with cladistic data. Whenever two groups are united in a genus because of this criterion, in order for this genus to remain holophyletic it often needs to be expanded to include several other groups as well. In the case of the genus *Bufo*, the final extension of this genus will depend on the phylogeny finally considered robust for the whole bufonids. Several incompatible cladistic hypotheses have been published in the recent years, and the last published one is still liable to change. On the basis of such provisional data, no straightforward decision is possible.

1. Reexamination of the holophoront (holotype) of *Sclerophrys capensis* Tschudi, 1838, still kept in the Paris Museum collection (MNHN 742; Guibé 1950), shows that it is a young male (43 mm in snout-vent length) that belongs in this group. More details on this question will be provided elsewhere.







414 ANIMAUX.

PLANCHE 671.

Rana viridis, Grenouille verte.

C'Eſt un Reptile amphibie, plus aquatique que terreſtre, long de deux pouces & demi, large d'un pouce, verd en deſſus, tacheté de points bruns, blanchâtre en deſſous; l'iris jaune doré, la prunelle noire, les oreilles derriere les yeux, rondes, recouvertes de peau & quelques trous autour, la mâchoire ſupérieure garnie d'une rangée de petites dents, l'anus ſitué vers le dos.

La Grenouille ſaute ſur terre, juſqu'à quatre & cinq pieds en avant, en déployant tout-à-coup ſes grandes cuiſſes & jambes de derriere, qui lui ſervent auſſi à avancer en nageant.

L'accouplement ſe fait dans l'eau où le mâle féconde les œufs que la femelle fait ſortir, enveloppés par tas dans une humeur gluante & tranſparente. C'eſt ce qu'on nomme le frai; les œufs ſont noirs; ces œufs éclosent d'abord en un inſecte noir, qu'on nomme l'étard; car il eſt tout en tête & en queue: voyez l'eſtampe. Il nage très-vivement au moyen de ſa queue; il devient gros comme une ceriſe, & au bout de quelque temps il ſe tranſforme petit à petit en Grenouille parfaite; les jambes de derriere ſortent les premieres, puis de jour à autre celles de devant; la queue diſparoît & le voilà Grenouille pour toute ſa vie.

Cette eſpece de Grenouille ſe tient quelquefois ſur terre, aux bords de l'eau, dont elle ne s'écarte guere; elle a un chant ou croaſſement fort importun, principalement dans les jours chauds du printemps.

On la trouve dans toutes les eaux, ſoit vives, ou dormantes, ou marécageuſes; elle vit d'herbes aquatiques, de petits inſectes.

PLANCHE 672.

Ranetta, Grenouille Saint-Martin.

ON ſe ſert de l'animal entier & de ſon ſang.

C'eſt un petit Reptile terreſtre, qui a à peine un pouce & demi de long & preſque auſſi large; il eſt totalement verd gai

FIGURE 3. Reproductions of extracts from the works of Garsault (1764, 1767): plates 673–675 (1764); text page 414 (1767). See text for explanations.

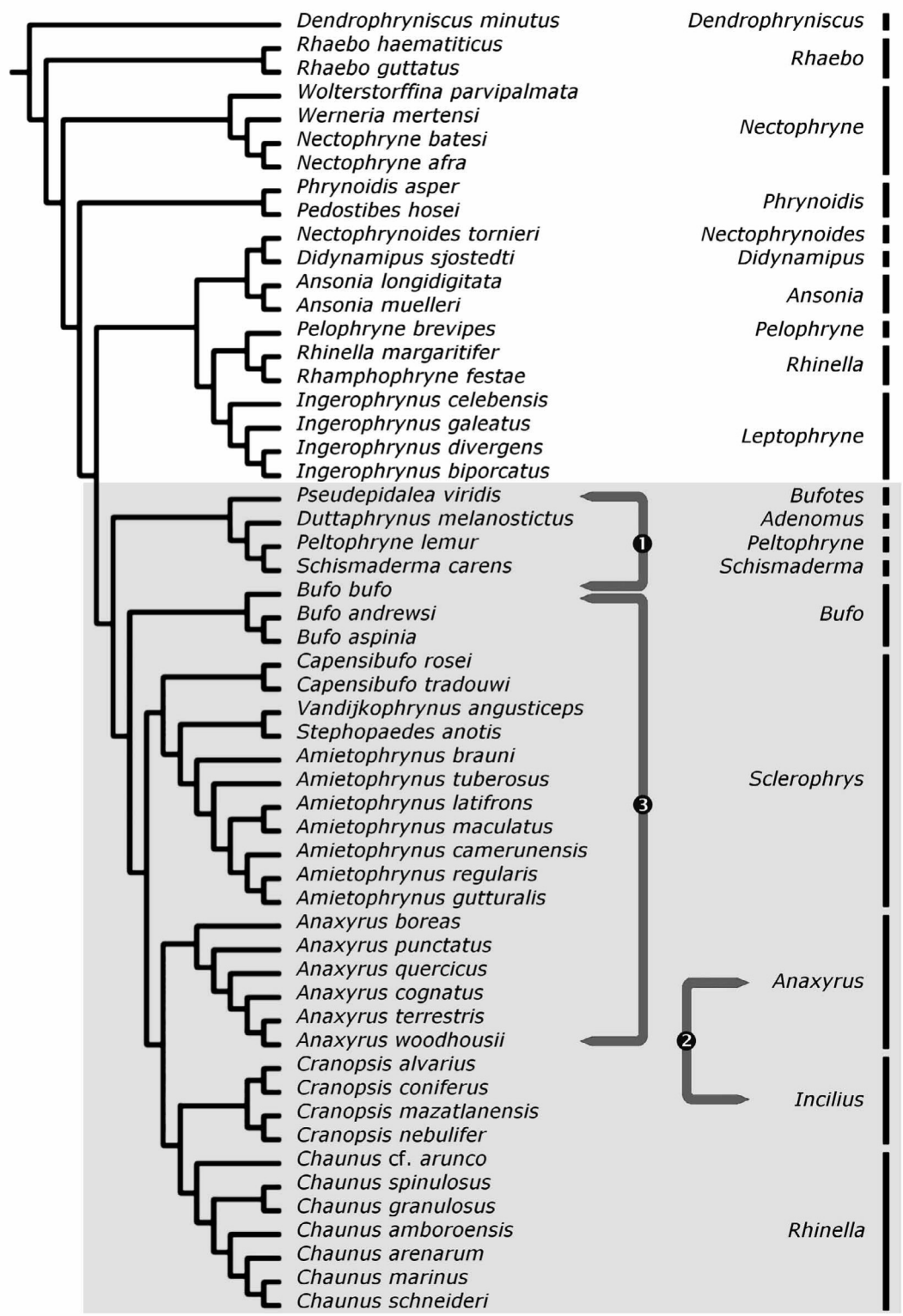


FIGURE 4. Reproduction of part of the general tree of amphibians in Frost *et al*. (2006: 129; 2009*b*: 144) including their *BUFONIDAE*. The specific nomina are those used by these authors, whereas the generic nomina in the column on the right are those supported here, either for genera or subgenera (see text for details). Bidirectional arrows point to reported cases of successful hybridization resulting in adult specimens: (1) between *Bufo bufo* and *Bufo viridis* (Hemmer & Böhme 1974; Duda 2008); (2) between *Bufo terrestris* and *Bufo valliceps* (Blair 1941; Moore 1955) and between *Bufo fowleri* and *Bufo valliceps* (Blair *in* Moore 1955); (3) between *Bufo bufo* and *Bufo woodhousii* (Blair 1972: 420). The grey rectangle includes all the species that must be maintained in the genus *Bufo* according to these data if the crossability criterion of Dubois (1988*a*-*b*, 2004*c*) is implemented. See text for explanations.

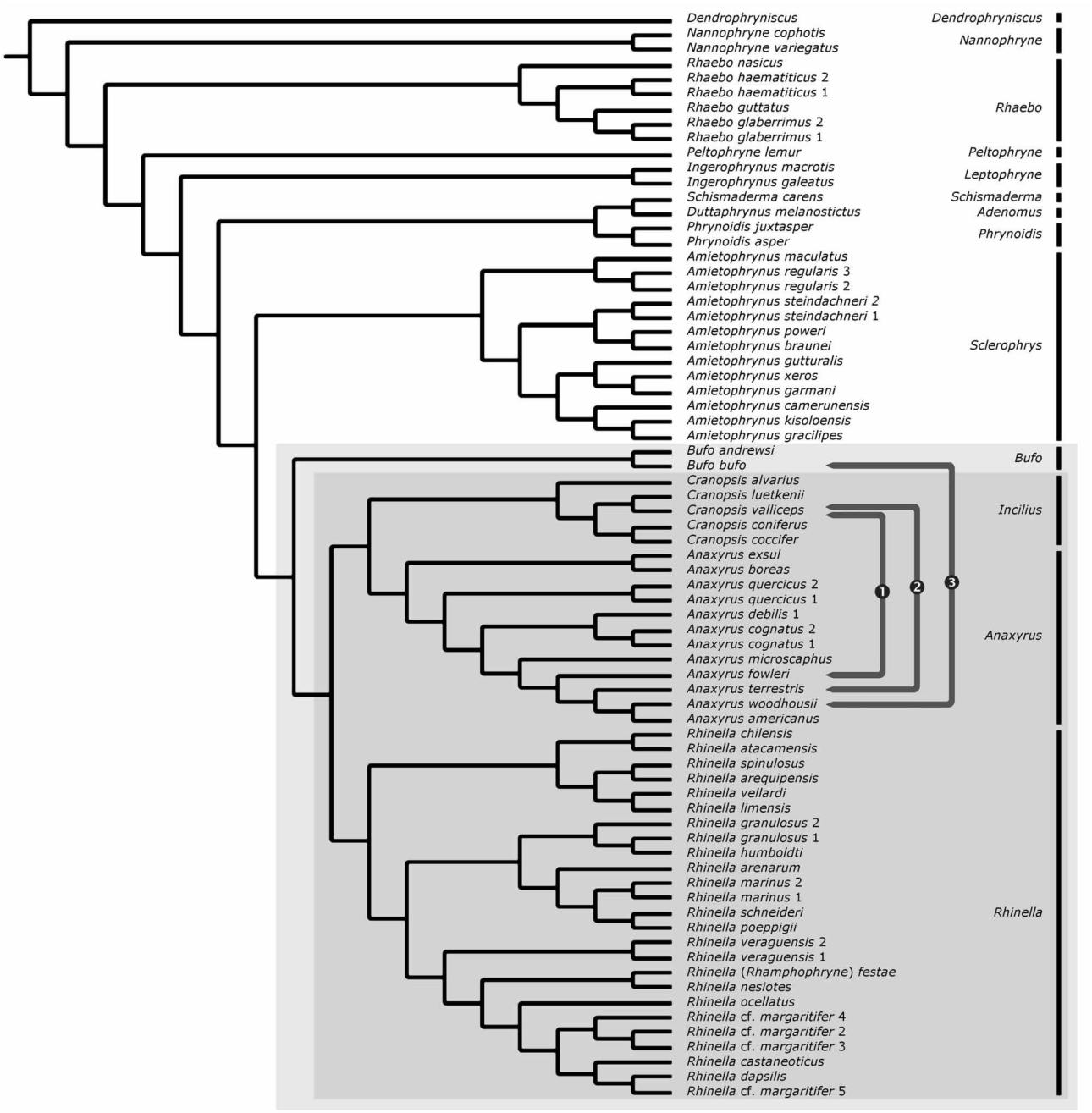


FIGURE 5. Reproduction of part of the tree of vertebrates in Pramuk *et al.* (2008: 76) including their *BUFONIDAE*. The specific nomina are those used by these authors, whereas the generic nomina in the column on the right are those supported here, either for genera or subgenera (see text for details). Bidirectional arrows point to reported cases of successful hybridization resulting in adult specimens: (1) between *Bufo fowleri* and *Bufo valliceps* (Blair *in* Moore 1955); (2) between *Bufo terrestris* and *Bufo valliceps* (Blair 1941; Moore 1955); (3) between *Bufo bufo* and *Bufo woodhousii* (Blair 1972: 420). The larger grey rectangle includes all the species that must be maintained in the genus *Bufo* according to these data if the crossability criterion of Dubois (1988*a*-*b*, 2004*c*) is implemented. The darker grey rectangle includes species that could be excluded from this genus if the only reported case between *Bufo bufo* and *Bufo woodhousii* proved to be in error. See text for explanations.

For example, if the tree of Frost *et al*. (2006) was accepted, then the genus *Bufo* would correspond to the grey rectangle in fig. 4, with the following subgenera: *Bufo*, *Peltophryne* Fitzinger, 1843 (including *Duttaphrynus* Frost *et al.*, 2006, *Peltophryne*, *Pseudepidalea* and *Schismaderma* Smith, 1849 in fig. 4), *Rhinella* (including *Anaxyrus*, *Chaunus* and *Incilius* in fig. 4) and *Sclerophrys* (including *Amietophrynus*, *Capensibufo*, *Mertensophryne*, *Stephopaedes* and *Vandijkophrynus* in fig. 4). But then, the subgenera listed

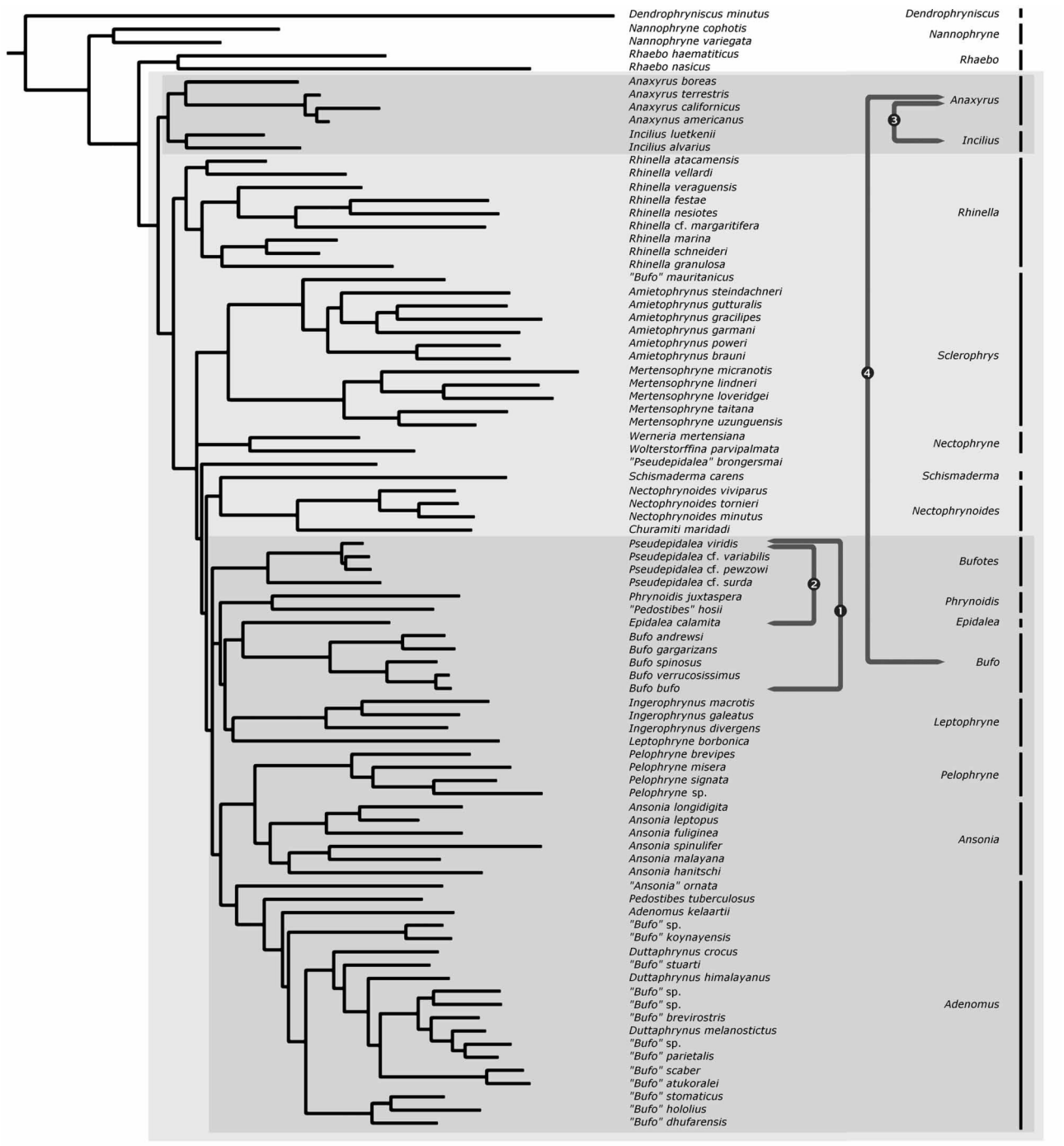


FIGURE 6. Reproduction of part of the tree of anurans in Van Bocxlaer *et al*. (2009: 3) including their *BUFONIDAE*. The specific nomina are those used by these authors, whereas the generic nomina in the column on the right are those supported here, either for genera or subgenera (see text for details). Bidirectional arrows point to reported cases of successful hybridization resulting in adult specimens: (1) between *Bufo bufo* and *Bufo viridis* (Hemmer & Böhme 1974; Duda 2008); (2) between *Bufo calamita* and *Bufo viridis* (Flindt & Hemmer 1967; Hemmer 1973; Schlyter *et al*. 1991); (3) between *Bufo terrestris* and *Bufo valliceps* (Blair 1941; Moore 1955) and between *Bufo fowleri* and *Bufo valliceps* (Blair *in* Moore 1955); (4) between *Bufo bufo* and *Bufo woodhousii* (Blair 1972: 420). The larger grey rectangle includes all the species that must be maintained in the genus *Bufo* according to these data if the crossability criterion of Dubois (1988*a*-*b*, 2004*c*) is implemented. The darker grey rectangles includes species that could be placed in two distinct genera if the only reported case between *Bufo bufo* and *Bufo woodhousii* proved to be in error; in this latter case, several genera should be recognized for the species remaining in the lighter grey area. See text for explanations.

above in these groups should be downgraded to the rank of species-groups or supraspecies, simply because the *Code* does not accept additional ranks below subgenus, like infragenus of hypogenus (Dubois 2006*b*; Dubois & Raffaëlli 2009). This latter limitation does not have any theoretical justification and is only a nuisance for the development of a modern phylogenetic taxonomy at low levels (between genus and species) in zoology (Dubois 2006*b,d*, 2007*b*; Dubois & Raffaëlli 2009), so let us hope that the ICZN will soon consider its abrogation.

If the alternative tree of Pramuk *et al.* (2008) was adopted (fig. 5), the genus *Bufo*, as limited by the data on successful hybridization, would not need to include the genus *Sclerophrys*, and could be slightly less inclusive.

Finally, if the tree of Van Bocxlaer *et al*. (2009) was accepted (fig. 6), in order to remain holophyletic the genus *Bufo* would have to correspond to almost the whole family *BUFONIDAE*. It would contain many other "genera", including the *ADENOMINAE* Cope, 1861 as recognized by Van Bocxlaer *et al.* (2009), and it would exclude only the genus *Rhaebo* Cope, 1862 and a few other South American genera, formerly known as the *ATELOPODIDAE* Fitzinger, 1843 or *ATELOPODINAE*. At any rate, even if the crossability criterion is not implemented, but the phylogeny of these authors adopted, their taxonomy is not acceptable, as it recognizes a subfamily (*ADEMONINAE*) whose sister-group includes two genera (*Ansonia* Stoliczka, 1870 and *Pelophryne* Barbour, 1938) but is not recognized as a subfamily, and as no further subfamily is recognized for all the other genera of the family. It would be unacceptable to group all these genera in a subfamily *BUFONINAE*, as the latter would be paraphyletic relative to the *ADENOMINAE*. If taxonomy is to reflect the hypothesized cladistic relationships between taxa, a basic requirement is that sister-taxa be always afforded the same rank, and that any optional subordinate rank like subfamily be used only if at least two sister-taxa are given this rank (for details, see Dubois 2007*a*, 2008*d*).

A troubling fact is the report (Blair 1972: 420) of a single case of adult male hybrid obtained between a male *Bufo bufo* and a female *Anaxyrus woodhousii* (Girard, 1854). This unique case needs confirmation, in order to be sure that the adult reported was a true diploid hybrid with one genome of each parental species, and not a gynogenetic or triploid specimen (for more details, see Dubois 1988*a-b*). If the possibility of successful (until adult stage) hybridization between some species, at least, of *Bufo* and *Anaxyrus*, was confirmed, this would require, for those who wish to implement the crossability criterion, to downgrade both these groups to the rank of subgenera of a single genus *Bufo*, as shown in the lighter grey rectangles of our figures 4–6. If this possibility was refuted, this would have no consequence on the limits of the genus *Bufo* in our figure 4. However, in our figures 5 and 6, *Rhinella* could remain as a genus distinct from *Bufo* and from *Anaxyrus* (which would include two subgenera *Anaxyrus* and *Incilius*).

Even if we ignore at this stage the case of the American species, uncertainties remain. Several species of the genus *Pseudepidalea*, erected by Frost *et al.* (2006) for *Bufo viridis* and its close allies, are well known to hybridize successfully among them in nature, sometimes giving birth to stable polyploid hybrid species (Stöck *et al.* 1999, 2001*c*, 2002, 2005, 2009; Stöck & Grosse 2003), but also to produce not rarely adult hybrids with species of the genera *Bufo* and *Epidalea*. This requires to include also *Pseudepidalea* as a third subgenus of the genus *Bufo*, along with *Bufo* and *Epidalea*, but for the time being it is impossible to know where this genus should "stop" until we have a robust phylogeny of the whole family. Just considering the successful hybridization between *Bufo* and *Pseudepidalea* (and ignoring the case of *Anaxyrus*), the content of *Bufo* would be very different according to the tree adopted as phylogenetic hypothesis for the bufonids.

Considering all these uncertainties, we think the situation is not ripe for a robust generic taxonomy of the *BUFONIDAE*. More work must be done, in three directions at least: (1) rapidly increasing our survey, discovery and description of the species of this group in all parts of the world, before they are extinct (Dubois 2009*b*); (2) ascertaining better the cladistic relationships of all identified groups and subgroups of species of this family at least, if not of all known species; and (3) obtaining more reliable data on interspecific hybridization within this huge assemblage of species. The latter work had been remarkably started by Blair (1972) and his co-workers, but has unfortunately largely been abandoned nowadays, in our "*all-cladistic age*" (Dubois & Raffaëlli 2009: 13). As stressed by Dubois (1988*a-b*), the advantage of the hybridization data used at genus level as a *nonarbitrary criterion for taxonomic inclusion* (Simpson 1961: 115) is that, if the original works are

methodologically good (ascertaining that the adult obtained were true biparental diploid hybrids), their conclusions are not liable to be changed later on. In zoological groups of biparental species, this can be a strong factor for stabilizing generic taxonomy, a goal that many authors *claim* to pursue (e.g., Pauly *et al.* 2009; Frost *et al.* 2009*b*). For this reason, we think that at least two groups of "genera" as recognized by Frost *et al*. (2006) should be considered as single genera, namely *Anaxyrus-Incilius* and *Bufo-Epidalea-Pseudepidalea*. These two groups might further have to be aggregated as a single genus, and most probably other groups, considered by Frost *et al.* (2006) as distinct genera, should also join them.

In what follows, we only consider the nomenclatural status of the three later nomina, in the light of the rediscovery of the book of Garsault (1764). The discussion above suggests that the Palaearctic species of *Bufo* should be referred to three distinct subgenera, including respectively *B. bufo*, *B. calamita* and *B. viridis*. With such an arrangement, crediting the nomen *Bufo* to Laurenti (1768) and its valid nucleospecies designation to Fitzinger (1843), would result in having the species *B. viridis* in the nominative subgenus *Bufo*, and in having to refer the species *B. bufo* to another subgenus, for which the nomen that has priority would be either *Palaeophrynos* Tschudi, 1838 or *Pegaeus* Gistel, 1868, according to the subgeneric allocation of † *Bufo gessneri* (Tschudi, 1838) (see below). Although nomenclaturally formally correct, this situation would be strange and likely to be confusing for many zoologists.

Contrary to what some seem to believe or to wish (see e.g. Jennings *et al.* 1994; Webb *et al.* 1994; Bour *et al*. 2009; Takahashi *et al.* 2009), zoological nomenclature is not, cannot and should not be, regulated by "usage", "consensus", "majority", "poll", "lobbying" or by a "principle of authority" (Dubois 2010*c*), but must be so by an international system of stringent and automatic Rules, accepting only very few exceptions, in *really exceptional* cases. Misunderstanding this opens the door to problems of various kinds, and is not doing a service to taxonomy at the time of the biodiversity crisis and of the taxonomic impediment (for details, see Dubois 2010*c*). Even if most zoologists would certainly agree that it would be "better" to apply the subgeneric nomen *Bufo* to the group including the species *B. bufo*, this cannot be obtained by simply *ignoring* the Rules, as suggested by Mertens (1971*b*), or, in another recent case, by Swingland (2009). If some zootaxonomists decided to "consider valid" Tschudi's (1838) "designation" of nucleospecies for *Bufo*, and to ignore Fitzinger's (1843) valid designation, others would certainly be entitled not to accept this and to continue to consider *Bufo viridis* as the nucleospecies of *Bufo*, which would open a period of instability and confusion in the use of these well-known nomina. As Tschudi's (1838) sentence is ambiguous, clarifying definitively its meaning cannot result from discussing his text at length, but could only be obtained by a Ruling of the ICZN using its Plenary-Powers. This is why, after the publication of Frost *et al*.'s (2006) work, one of us had planned to apply to the ICZN for a Ruling on this matter. The fortunate discovery of Garsault's publications allows to disentangle this situation, and such an action by the ICZN is not necessary any more.

The nomen *Bufo* Garsault, 1764, nucleospecies by present designation *Rana bufo* Linnaeus, 1758, is now the valid nomen for the subgenus including *Bufo bufo* ("true toads"). It has six junior invalid synonyms (see below). It accommodates about 20 species (including a fossil one) and eight non-hyponymous (non-nominotypical) subspecies currently recognized at least by some authors, but no consensus exists among taxonomists regarding either the species or the subspecies (see e.g. Speybroeck & Crochet 2007). This subgenus is in bad need of taxonomic revision based on a large sampling of Palaearctic populations and on morphological, caryological, molecular, bioacoustic and etho-ecological data.

The earliest synonym of *Bufo* Garsault, 1764 is *Phryne* Oken, 1816, which deserves a short discussion. This nomen is a junior homonym of *Phryne* Meigen, 1800 (Diptera), published in a work which was suppressed by the ICZN (Anonymous 1963). *Phryne* Oken, 1816 itself was made nomenclaturally unavailable for having been published in a book also suppressed by the ICZN (Hemming 1956*b*). Oken (1816: 210–213) applied both this nomen and the nomen *Bufo* to a genus in which he mentioned 16 nominal species. However, his nomen *Phryne* cannot be considered a neonym for *Bufo*, as in page 207 he also mentioned *Bufo* as a "synonym" of his genus *Bombina*: the most logical interpretation seems to be that he split the former genus *Bufo* in two genera, one for which he provided the nomen *Bombina* (which included, among others, the species *Bufo viridis* Laurenti, 1768) and one for which he provided the nomen *Phryne*. Fitzinger (1843: 32) used the nomen *Phryne*, which he expressly credited to Oken, and for which he designated *Bufo vulgaris*

Laurenti, 1768 as nucleospecies. As this species was one of the 16 originally included species of *Phryne*, this designation is valid, but as the work where the nomen *Phryne* Oken, 1816 was published was invalidated by the ICZN, the latter cannot be the valid nomen of a genus.

The nomen *Bufo* Garsault, 1764 still has five other junior synonyms, including two based on fossil material, and which do not require special discussion (see the synonymy of this generic nomen below).

The nomen *Epidalea* Cope, 1864 applies to the single species *Bufo calamita* Laurenti, 1768 ("natterjack"). As discussed below, the species *Bufo raddei* Strauch, 1876, and possibly also the American † *Bufo alienus* Tihen, 1962, might have to join this subgenus when more data are available. The generic nomen *Epidalea* has at least two senior synonyms. The first one is "*Calamitus*" Rafinesque, 1815 (a nomen overlooked by all authors until now), which is a gymnonym (*nomen nudum*), as it appeared without any diagnostic character nor included nominal species. In order to fix its place in synonymies, we hereby designate *Bufo calamita* Laurenti, 1768 (on which specific nomen it was clearly based) as its nucleospecies. The second senior synonym of *Epidalea* Cope, 1864 is *Calamita* Oken, 1816, but the latter nomen is twice invalid: first, as noted by Frost *et al.* (2006: 359), for having being published in a book suppressed for nomenclatural purposes by the ICZN (Hemming 1956*b*), but also for being a junior homonym of *Calamita* Schneider, 1799, a junior doxisonym (subjective synonym) of *Hyla* Laurenti, 1768 (see e.g. Dubois & Ohler 2009). Three other possible senior synonyms of *Epidalea*, based on fossil material, are *Palaeophrynos* Tschudi, 1838 and its two neonyms *Palaeophryne* Fitzinger, 1843 and *Troglobates* Gistel, 1848 (a nomen overlooked by all authors until now). According to Sanchíz (1998: 77), the nucleospecies of the genus *Palaeophrynos*, † *Bufo gessneri* (Tschudi, 1838), is similar to *Bufo calamita*, but differs from it and all other European species of *Bufo* by several characters. The possibility exists that this species be in fact a member of the subgenus including *B. calamita*, which should therefore take the nomen *Palaeophrynos*. Unless or until this point is clarified, for the time being it is better, for the sake of nomenclatural stability, to leave † *Bufo gessneri*, as well as its close relative † *Bufo priscus* Špinar, Klembara & Meszároš, 1993, as an *incertae sedis* at subgeneric level in the genus *Bufo*.

The third subgenus, accommodating *Bufo viridis* ("green toads"), contains about 15 species (including a doubtful fossil one) and four non-hyponymous subspecies. Despite several important revisionary works recently devoted to this complex and interesting group (Stöck *et al.* 2001*b*, 2006, 2008*b*), the status of some taxa (species, subspecies or synonyms) is still controversial (see e.g. Speybroeck & Crochet 2007). Five nomina apply to this subgenus. The first available one is *Bufo* Laurenti, 1768, type-species *Bufo viridis* Laurenti, 1768 by subsequent designation of Fitzinger (1843). This nomen is however invalid for being a junior homonym of *Bufo* Garsault, 1764. Three neonyms were subsequently published for *Bufo* Laurenti, 1768: *Buffo* de la Cepède, 1788*a,c*; *Batrachus* Rafinesque-Schmaltz, 1814; and *Bufotes* Rafinesque, 1815: 78. Let us consider them successively.

De la Cepède (1788*a-c*) adopted the genus *Bufo*, which he clearly credited to Laurenti (1768), as he mentioned his work on many occasions, but never the works of Garsault (1764, 1765, 1767). In the text in the first part of his work, de la Cepède (1788*a*: 568, 620; 1788*b*: 22) used for all species of the genus the spelling *Bufo*. However, in the *Synopsis Methodica* which provides a table of Latin nomina at the end of this work (de la Cepède 1788*a*: tab.; 1788*c*: 460), he used the orthography *Buffo*, which was clearly intentional and based on the patronym of the Comte de Buffon, and was therefore an autoneonym for *Bufo* Laurenti, 1768 (see David *et al.* 2002: 24; Dubois & Ohler 2009: 8). However, the nomen *Buffo* cannot be resurrected for the subgenus including *B. viridis*, because it was published in a book recently invalidated by the ICZN (Anonymous 2005) despite its having been used as a reference for valid nomina in thousands of publications for two centuries.

The next nomen proposed to replace *Bufo* Laurenti, 1768 was *Batrachus* Rafinesque-Schmaltz, 1814. This is without any possible doubt an alloneonym, as Rafinesque-Schmaltz (1814: 102) wrote: "*Hò cambiato il nome generico di* Bufo *in* Batrachus*, il primo nome essendo compreso in* Buffonia" ["I have changed the generic name *Bufo* in *Batrachus*, the former name being comprised in *Buffonia*"]. Rafinesque-Schmaltz (1814) did not mention the author of the nomen *Bufo*. In his paper, he did not mention anywhere the work of Laurenti (1768), but several other sources, and especially on many occasions the book of Daudin (1803),

which he credited (incorrectly) with authorship of most amphibian nomina, including the species of the genus *Bufo*. In this book, Laurenti's book was often quoted, but never the works of Garsault (1764, 1765, 1767). *Batrachus* Rafinesque-Schmaltz, 1814 is therefore a neonym for *Bufo* Laurenti, 1768. However, it cannot be the valid nomen for the taxon at stake here, as it is a junior homonym of three available generic nomina, all proposed for "fishes": *Batrachus* Schaeffer, 1760; *Batrachus* Walbaum, 1792; and *Batrachus* Schneider, 1801.

Shortly after the publication just discussed, Rafinesque (1815) proposed a second neonym for *Bufo*. He wrote: "G. 4. *Bufotes* R. *Bufo* Daud.". This mode of writing is similar to that he used to introduce many neonyms in the same work, for example *Triturus* for *Triton* Laurenti, 1768, a case discussed in detail by Dubois & Raffaëlli (2009: 27–29). In all his publications, and particularly in his 1815 work, Rafinesque rigorously used a very precise way of proposing his new generic nomina, followed by the letter "R.", which means that he claimed authorship for them. Some of these new nomina were immediately followed by another generic nomen. This mode of notation, very common in taxonomic works at the beginning of the 19th century, means that the new nomen was proposed as a neonym for the following one. Thus, Rafinesque (1815) expressly presented his new nomen *Bufotes* as a replacement nomen for "*Bufo* Daud.", so it is in fact a neonym for *Bufo* Laurenti, 1768. The nomen *Bufotes* is the first one available and not preoccupied applying to the taxon here discussed, so it is the valid nomen of this subgenus.

Finally, *Pseudepidalea* Frost *et al*., 2006, which has the same nucleospecies by original designation as *Bufotes* Rafinesque, 1815, is its junior isonym (objective synonym) and should be abandoned.

In conclusion, we recommend maintaining the species *B. bufo*, *B. calamita* and *B. viridis* in three distinct subgenera of a single genus *Bufo* (which most probably should include other subgenera, not discussed here). Their synonymies are given below. They also apply if, following Frost *et al.* (2006), these three groups are recognized as genera. We also provide tentative lists of their species and subspecies, although this is still a controversial matter, as mentioned above. It should be stressed that because all taxa described in the past in the genus *Bufo* Laurenti, 1768 are now transferred into the genus *Bufo* Garsault, 1764, their authors and dates now appear between parentheses.

A final note of interest is warranted. In genera that include several subgenera, the subgeneric nomen does not have to be mentioned every time the species is cited, especially in non-taxonomic works (Dubois 1988*a-b*). Citing the most important combination, including the generic substantive and the specific epithet, is often enough. Furthermore, an often overlooked advantage of the rank subgenus is that it is optional. Whenever, for lack of data, some species cannot be allocated to one of the subgenera of the genus, they can be left "outside" of them, being just referred to the genus. For the time being, this applies at least to two species of Palaearctic toads, *Bufo raddei* Strauch, 1876 and *Bufo brongersmai* Hoogmoed, 1972. As for *B. raddei*, the bioacoustic data of Stöck *et al.* (2001*a*) pointed to mating calls (MCs) similarities between this species and *B. calamita*, that distinguish them from the species of the *B. viridis* group. They wrote: "*we consider the resemblance of the* B. calamita *and* B. raddei *MCs to be caused by synapomorphic anatomic and functional structures which are not only phenetic similarities*" (p. 222). However, the molecular results of Stöck *et al.* (2006), although confirming that both these species are not closely related to the other green toads, also suggested that they are not closely related to each other. They seem to be relicts of early radiations previous to that of the green toads. For the time being, we refrain from formally referring *B. raddei* to the subgenus *Epidalea*. This question will have to be explored further. As for *B. brongersmai*, both Stöck *et al.* (2006) and Van Bocxlaer *et al.* (2009) suggested that it does not belong in the green toads radiation, but its position is still controversial, so here also more work should be done before its allocation to a subgenus. A third species, † *Bufo alienus* Tihen, 1962, is here referred to *Bufo* as *incertae sedis* at subgeneric level: according to Sanchíz (1998: 76), although its ilium resembles that of *B. calamita*, "*more material would be necessary to demonstrate the presence of this Old World group in the North American Miocene*". Finally, we already mentioned above the cases of the species † *Bufo gessneri* (Tschudi, 1838) and † *Bufo priscus* Špinar, Klembara & Meszároš, 1993.

Genus *Bufo* Garsault, 1764

(1) Subgenus *Bufo* Garsault, 1764

Bufo Garsault, 1764: pl. 672, list of plates p. 19 [nec *Bufo* Laurenti, 1768: 25]. – **Nucleospecies**, by present designation, *Rana bufo* Linnaeus, 1758: 210.

Phryne Oken, 1816: 210 [nec *Phryne* Meigen, 1800: 16, exoplonym (see Anonymous 1963); nec *Phryne* Herrich-Schäffer, 1843: 90]. – **Exoplonym**, as having been published in a book placed on the *Official Index of Rejected and Invalid Works in Zoological Nomenclature* (Hemming 1956*b*). – **Nucleospecies**, by subsequent designation of Fitzinger (1843: 32), *Bufo vulgaris* Laurenti, 1768: 28. – **New invalid junior doxisonym**.

Pegaeus Gistel, 1868: 161. – **Nucleospecies**, by original monophory, *Rana bufo* Linnaeus, 1758: 210. – **New invalid junior isonym**.

Platosphus de l'Isle, 1877: 472. – **Nucleospecies**, by original monophory, † *Platosphus gervaisii* de l'Isle, 1877: 472, junior doxisonym of *Rana bufo* Linnaeus, 1758: 210 according to Sanchíz (1998: 121). – **New invalid junior doxisonym**.

Bufavus Portis, 1885: 1182. – **Nucleospecies**, by original monophory, † *Bufavus meneghinii* Portis, 1885: 1182, junior doxisonym of *Rana bufo* Linnaeus, 1758: 210 according to Sanchíz (1998: 125). – **New invalid junior doxisonym**.

"*Torrentophryne*" Rao & Yang, 1994: 142. – **Anoplonym**, as having been published with two included nominal species but without designation of a nucleospecies. – **Nucleospecies**, by present designation, *Torrentophryne aspinia* Rao & Yang, 1994: 142. – **New invalid junior doxisonym**. – **Comment**: see Dubois *et al.* (2005: 32).

Torrentophryne Yang *in* Yang, Liu & Rao, 1996: 353. – **Nucleospecies**, by original designation, *Torrentophryne aspinia* Rao & Yang, 1994: 142. – **New invalid junior doxisonym**. – **Comment**: see Dubois *et al.* (2005: 32) and Frost *et al.* (2006: 215, 220).

Content. *Bufo (Bufo) ailaoanus* (Kou, 1984); *Bufo (Bufo) aspinius* (Rao & Yang, 1994); *Bufo (Bufo) bankorensis* (Barbour, 1908); *Bufo (Bufo) bufo* (Linnaeus, 1758), including *Bufo (Bufo) bufo bufo* (Linnaeus, 1758), *Bufo (Bufo) bufo gredosicola* (Müller & Hellmich, 1935) and *Bufo (Bufo) bufo spinosus* (Daudin, 1802); *Bufo (Bufo) cryptotympanicus* (Liu & Hu, 1962); *Bufo (Bufo) eichwaldi* (Litvinchuk, Borkin, Skorinov & Rosanov, 2008); *Bufo (Bufo) gargarizans* (Cantor, 1842), including *Bufo (Bufo) gargarizans andrewsi* (Schmidt, 1925), *Bufo (Bufo) gargarizans gargarizans* (Cantor, 1842), *Bufo (Bufo) gargarizans miyakonis* (Okada, 1931) and *Bufo (Bufo) gargarizans popei* (Matsui, 1986); *Bufo (Bufo) japonicus* (Temminck & Schlegel, 1838), including *Bufo (Bufo) japonicus formosus* (Boulenger, 1883) and *Bufo (Bufo) japonicus japonicus* (Temminck & Schlegel, 1838); *Bufo (Bufo) kabischi* (Herrmann & Kühnel, 1997); † *Bufo (Bufo) linquensis* (Yang, 1977); *Bufo (Bufo) luchunnicus* (Yang & Rao, 2008); *Bufo (Bufo) menglianus* (Yang *in* Yang & Rao, 2008); *Bufo (Bufo) minshanicus* (Stejneger, 1926); *Bufo (Bufo) pageoti* (Bourret, 1937); *Bufo (Bufo) tibetanus* (Carevskij, 1926); *Bufo (Bufo) torrenticola* (Matsui, 1976); *Bufo (Bufo) tuberculatus* (Carevskij, 1926); *Bufo (Bufo) tuberospinius* (Yang & Liu *in* Yang, Liu & Rao, 1996); *Bufo (Bufo) verrucosissimus* (Pallas, 1814), including *Bufo (Bufo) verrucosissimus circassicus* (Orlova & Tuniyev, 1989), *Bufo (Bufo) verrucosissimus turowi* (Krasovsky, 1933) and *Bufo (Bufo) verrucosissimus verrucosissimus* (Pallas, 1814); *Bufo (Bufo) wolongensis* (Herrmann & Kühnel, 1997).

(2) Subgenus *Bufotes* Rafinesque, 1815

Bufo Laurenti, 1768: 25 [nec *Bufo* Garsault, 1764: pl. 672, list of plates p. 19]. – **Nucleospecies**, by subsequent designation of Fitzinger (1843: 32), *Bufo viridis* Laurenti, 1768: 27. – **New invalid senior isonym**. – **Comment**: see text above.

Buffo de la Cepède, 1788*a*: tab.; 1788*c*: 460. – **Exoplonym**, as having been published in a book placed on the *Official Index of Rejected and Invalid Works in Zoological Nomenclature* (Anonymous 2005). – **Autoneonym** of *Bufo* Laurenti, 1768: 25. – **New invalid senior isonym**. – **Comment**: see text above.

Batrachus Rafinesque-Schmaltz, 1814: 26 [nec *Batrachus* Schaeffer, 1760: 20; nec *Batrachus* Walbaum, 1792: 580; nec *Batrachus* Schneider, 1801: xxvi]. – **Alloneonym** of *Bufo* Laurenti, 1768: 25. – **New invalid senior isonym**. – **Comment**: see text above.

Bufotes Rafinesque, 1815: 78. – **Autoneonym** of *Bufo* Laurenti, 1768: 25. – **Comment**: see text above.

Pseudepidalea Frost, Grant, Faivovich, Bazin, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy,

Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, Green & Wheeler, 2006: 10, 219. – **Nucleospecies**, by original designation, *Bufo viridis* Laurenti, 1768: 27. – **New invalid junior isonym.**

Content. *Bufo (Bufotes) balearicus* (Boettger, 1880); *Bufo (Bufotes) boulengeri* (Lataste, 1879); *Bufo (Bufotes) latastii* (Boulenger, 1882); *Bufo (Bufotes) luristanicus* (Schmidt, 1952); *Bufo (Bufotes) oblongus* (Nikolsky, 1896), including *Bufo (Bufotes) oblongus danatensis* (Pisanets, 1978) and *Bufo (Bufotes) oblongus oblongus* (Nikolsky, 1896); *Bufo (Bufotes) pewzowi* (Bedriaga, 1898); *Bufo (Bufotes) pseudoraddei* (Mertens, 1971*a*), including *Bufo (Bufotes) pseudoraddei baturae* (Stöck, Schmid, Steinlein & Grosse, 1999) and *Bufo (Bufotes) pseudoraddei pseudoraddei* (Mertens, 1971*a*); *Bufo (Bufotes) siculus* (Stöck, Sicilia, Belfiore, Buckley, Lo Brutto, Lo Valvo & Arculeo, 2008); † *Bufo (Bufotes) stranensis* (Němec, 1972); *Bufo (Bufotes) surdus* (Boulenger, 1891) including *Bufo (Bufotes) surdus annulatus* (Schmidtler & Schmidtler, 1969) and *Bufo (Bufotes) surdus surdus* (Boulenger, 1891); *Bufo (Bufotes) turanensis* (Hemmer, Schmidtler & Böhme, 1978); *Bufo (Bufotes) variabilis* (Pallas, 1769), including *Bufo (Bufotes) variabilis kermanensis* (Eiselt & Schmidtler, 1971) and *Bufo (Bufotes) variabilis variabilis* (Pallas, 1769); *Bufo (Bufotes) viridis* (Laurenti, 1768); *Bufo (Bufotes) zamdaensis* (Fei, Ye & Huang *in* Fei *et al*., 1999); *Bufo (Bufotes) zugmayeri* (Eiselt & Schmidtler, 1973).

(3) Subgenus *Epidalea* Cope, 1864

"Calamitus" Rafinesque, 1815: 78. – **Anoplonym (gymnonym)**, as having been published without a description or diagnosis and without any included nominal species. – **Nucleospecies**, by present designation: *Bufo calamita* Laurenti, 1768: 27. – **New invalid senior doxisonym**.

Calamita Oken, 1816: v, 209 [nec *Calamita* Schneider, 1799: i, 151]. – **Exoplonym**, as having been published in a book placed on the *Official Index of Rejected and Invalid Works in Zoological Nomenclature* (Hemming 1956*b*). – **Nucleospecies**, by absolute tautonymy, *Bufo calamita* Laurenti, 1768: 27. – **Comment**: see text above.

Epidalea Cope, 1864: 181. – **Nucleospecies**, by original monophory, *Bufo calamita* Laurenti, 1768: 27.

Content. *Bufo (Epidalea) calamita* (Laurenti, 1768).

(4) *Incertae sedis* at subgeneric level

(a) Genus-series nomina:

Palaeophrynos Tschudi, 1838: 52. – **Nucleospecies**, by original monophory, † *Palaeophrynos gessneri* Tschudi, 1838: 89. – **Comment**: see text above.

Palaeophryne Fitzinger, 1843: 32. – **Autoneonym** of *Palaeophrynos* Tschudi, 1838: 52.

Troglobates Gistel, 1848: xi. – **Alloneonym** of *Palaeophrynos* Tschudi, 1838: 52.

(b) Species-series nomina:

† *Bufo alienus* (Tihen, 1962).

Bufo brongersmai (Hoogmoed, 1972).

† *Bufo gessneri* (Tschudi, 1838).

† *Bufo priscus* (Špinar, Klembara & Meszároš, 1993).

Bufo raddei (Strauch, 1876).

Lacertus Garsault, 1764

The spelling *Lacertus* used by Garsault (1764: pl. 668, 669, 674; table, p. 14) for his genus accommodating the "Lézards" is distinct from *Lacerta* Linnaeus, 1758. It was consistently used by the author in this work and the following ones (Garsault 1765, 1767) and therefore cannot be considered as an incorrect subsequent

spelling as stated by Welter-Schultes & Klug (2009: 234) or a typographical error. The spelling *Lacertus* had a common pre-Linnaean usage and appeared in particular in sources of Garsault that we identified above (e.g. Gessner 1554, 1587; Schröder 1672; Ray 1693). This spelling was also used by de la Cepède (1788*c*: 447), to whom this neonym was previously credited (David *et al.* 2002: 24). Following the criteria provided by Dubois (1987), we consider it as an autoneonym of *Lacerta* Linnaeus, 1758 (family *LACERTIDAE* Batsch, 1788[2]). Therefore, the nominal species *Lacerta agilis* Linnaeus, 1758, being the nucleospecies of *Lacerta* by subsequent designation of Fitzinger (1843: 20), is also that of *Lacertus*.

Garsault (1764) illustrated three nominal species, easily identifiable, in the genus *Lacertus*: *Lacertus aquatilis*, *Lacertus terrestris* and *Lacertus viridis*. These are discussed successively below.

Lacertus aquatilis Garsault, 1764

The plate 674 of Garsault (1764) shows his species *Lacertus aquatilis* or "Salamandre d'eau". The plate provides a good drawing of a breeding male of the newt species currently known (e.g., Raffaëlli 2007, Dubois & Raffaëlli 2009) as *Triturus cristatus* (Laurenti, 1768) (family *SALAMANDRIDAE* Goldfuss, 1820). Given the quality of the drawing, showing the dorsal fins on the body and tail, it was most likely drawn from a living specimen, probably from the Paris region, where this subspecies was then common, although nowadays it is rarer there (Dubois & Ohler 1988). Simply following priority, the species currently known as *Triturus cristatus* should now be known as *Triturus aquatilis*, a nomen that has never been used since 1764. This change would no doubt be disturbing for communication among zoologists, as since its creation and for almost 200 years, the nomen *Triturus cristatus* has been associated with the crested newt of western Europe (for a list of more than 25 recent references, see e.g. Arntzen 2003: 482–514). We therefore use Article 23.9.1 of the *Code* to reject the nomen *Lacertus aquatilis* Garsault, 1764 in favour of its junior doxisonym *Triton cristatus* Laurenti, 1768.

Lacertus terrestris Garsault, 1764

As stated by Welter-Schultes & Klug (2009: 234), the plate 668 in Garsault, 1764 shows the *Lacertus terrestris* or "Lézard gris", which is undoubtedly the species presently named *Podarcis muralis* (Laurenti, 1768), the "wall lizard" (see Arnold, 1973) (family *LACERTIDAE* Batsch, 1788). The latter specific nomen having been in wide and universal use (for a list of more than 25 recent references, see e.g. Gruschwitz & Böhme 1986: 201–208) for more two centuries and Garsault's nomen having been ignored since its description, the prevailing usage must be maintained according to Article 23.9.1 of the *Code*. The nomen *Lacertus terrestris* Garsault, 1764 remains however nomenclaturally available and could possibly be resurrected in the future, e.g. for a subspecies. This would require to designate a neophoront (neotype) for this nominal taxon, which should preferably have originated from the Paris region.

Lacertus viridis Garsault, 1764

The plate 669 in Garsault (1764) shows his *Lacertus viridis* or "Lézard verd", which is undoubtedly a species of the group of *Lacerta viridis* (Laurenti, 1768) (family *LACERTIDAE* Batsch, 1788). However, if we suppose that the specimens drawn by Garsault were from the Paris region or at least from France (see above), the specimen of plate 669 could not be a *Lacerta viridis*, but must have belonged in the species now named *Lacerta bilineata* Daudin, 1802, a nomen formerly considered a synonym of *Lacerta viridis* (Laurenti, 1768) (e.g. Mertens & Wermuth 1960: 151) but now considered to apply to a distinct species, the "western green lizard" (see Amann *et al.* 1997).

The nomen *Lacertus viridis* Garsault, 1764 is a senior asthenomonym (secondary homonym) of *Lacerta*

2. For the valid author and date of this family nomen, see Dubois (2004*a*).

viridis (Laurenti, 1768), originally described as a member of the genus *Seps* Laurenti, 1768. Its allocation to the species now known as *Lacerta bilineata* would require that another nomen be given to the species currently known as *Lacerta viridis*. According to Mertens & Wermuth (1960: 151), the first three available junior doxisonyms of the latter are three nomina created by Laurenti (1768: 61–62) for species that he referred to his genus *Seps*, now an invalid junior doxisonym of *Lacerta* Linnaeus, 1758 (Stejneger 1936: 138). Acting as First-Revisers, we hereby choose the following order of priority among these three nomina: *Seps varius* Laurenti, 1768, then *Seps sericeus* Laurenti, 1768, then *Seps terrestris* Laurenti, 1768. Consequently, the species long known as *Lacerta viridis* should now be known as *Lacerta varia*, and the nomen *Lacerta viridis* should now apply to the species currently known as *Lacerta bilineata*. We think this change would have a disruptive effect on communication among zoologists, as the nomen *Lacerta varia* has never been used as valid, and as, since its creation and for about 250 years, the nomen *Lacerta viridis* has been associated with the common green lizard present in most of Europe (for a list of more than 25 recent references, see e.g. Nettmann & Rykena 1984: 173–180). We therefore use Article 23.9.1 of the *Code* to reject the nomen *Lacertus viridis* Garsault, 1764 in favour of its junior asthenomonym *Lacerta viridis* (Laurenti, 1768). Being rejected under this Article, *Lacertus viridis* Garsault, 1764 becomes an exoplonym and it does not threaten its junior doxisonym *Lacerta bilineata* Daudin, 1802.

Rana viridis Garsault, 1764

The plate 671 of Garsault (1764) shows his *Rana viridis* or "Grenouille verte". For the reasons discussed above in the *Nomenclatural methodology*, we consider that the generic nomen *Rana* is simply that of Linnaeus (1758: 196). The plate shows an apparently adult specimen (presumably male) on land, a male and a female *in copula* in water, and a tadpole in water. These specimens are altogether symphoronts (syntypes) of this nominal species. In order to avoid potential ambiguities due to the fact that the tadpole cannot be allocated to a species or even to a genus, we hereby designate the female specimen shown in amplexus, now lost, as the lectophoront (lectotype) of the nomen *Rana viridis* Garsault, 1764. The drawings on this plate are not of good quality, especially if compared with other drawings of Garsault, but nevertheless they clearly apply to the group of "green frogs" or "water frogs", currently referred to *Pelophylax* Fitzinger, 1843 (family *RANIDAE* Rafinesque-Schmaltz, 1814), a taxon considered by some (e.g., Dubois 1992, 1998, 2005*b*; Dubois & Ohler 1995) as a subgenus of *Rana* Linnaeus, 1758, and by others (e.g., Fei *et al.* 1990; Frost *et al.* 2006; Speybroeck & Crochet 2007; Lescure 2008; Bour *et al.* 2008) as a distinct genus.

Two taxa of green frogs at least were present in the Paris region in historical times. The first one is a species, currently known as *Pelophylax lessonae* (Camerano, 1882), and the second one is a klepton (see Dubois & Günther 1982; Dubois 2008*b*, 2009*c*), currently known as *Pelophylax* kl. *esculentus* (Linnaeus, 1758). Other taxa of green frogs, including *Pelophylax ridibundus* (Pallas, 1771) and triploid hybrids of uncertain taxonomic status (Polls Pelaz 1991, 1994), were found in this region in the recent decades, but they might result from transportation and introduction by man, so it seems more reasonable and preferable to consider that the frogs observed by Garsault (1764) belonged in one of the first two taxa listed above.

Although simple morphometric characters measured on specimens allow a good distinction between the two taxa *esculentus* and *lessonae* (Berger 1964, 1966, 1970), they cannot be applied here because the frogs shown on the figure stand at an oblique angle, and cannot be measured even roughly, not been orthogonal relative to the observer (see Hayek *et al.* 2001). Nevertheless, the hind legs of the three adults shown in this plate appear rather long, more similar to those of *esculentus* than those of *lessonae*. Besides, the spotted dorsums of the two males remind more *esculentus* than breeding males of *lessonae* which usually are little spotted. Finally, the amplecting female shows no dark lines on the flanks, whereas such lines are usually well-marked in *lessonae* females. These characters tend to support allocation of the nomen *Rana viridis* Garsault, 1764 to the synonymy of *Rana esculenta* Linnaeus, 1758. The last character mentioned is probably the most reliable one, which explains our choice of lectophoront.

There is a second reason for adopting this interpretation. If this nomen was referred to the synonymy of

Rana esculenta var. *lessonae* Camerano, 1882, it would have priority over the latter, that has been in wide use in the literature in hundreds of publications. Validation of the latter nomen would then require to make use of Article 23.9.1 of the *Code*. On the other hand, if *Rana viridis* Garsault, 1764 is sunk in the synonymy of *Rana esculenta* Linnaeus, 1758, it does not create any nomenclatural problem. So we here adopt provisionally the latter solution. This allows to place this nomen in synonymy, but it is provisional as based only on interpretations that could be challenged by other colleagues. In order for it to become definitive, a female specimen of *Pelophylax* kl. *esculentus* from the Paris region will have to be described and designated as neophoront of *Rana viridis* Garsault, 1764.

The nomen *Rana viridis* Garsault, 1764 is a senior hadromonym (primary homonym) and doxisonym of *Rana viridis* Duméril & Bibron, 1841, an invalid junior isonym of *Rana esculenta* Linnaeus, 1758 (see Dubois & Ohler 1995: 160).

Ranella Garsault, 1764 and *Ranetta* Garsault, 1764

The upper half of plate 672 of Garsault (1764) shows a small tree-frog, sitting on a leaf of reed (*Typha* sp.). On the plate, it bears the nomen *Ranetta* or "Grenouille St Martin" ("Grenouille Saint-Martin" in p. 18 of the list of plates). This new generic nomen is not associated with a specific nomen. A fact that has escaped the attention of Welter-Schultes & Klug (2009) is that this generic nomen was spelt differently, as *Ranella*, in the table of the plates at the end of the same book (Garsault 1764: 18). In the subsequent editions of Garsault (1765, 1767), both these original spellings are repeated in the plate and in the table of plates, but in the account for plate 672 (p. 414), the spelling used is *Ranetta*. This situation qualifies as that of *multiple original spellings* as described in Article 19.3 and in the *Glossary* (p. 116) of the *Code*, or more briefly *symprotographs* (Dubois & Ohler 2009, Dubois 2010*a*). In such a case, according to Article 32.2 of the *Code*, the *correct original spelling* among these alternative original nomina is that chosen by the First-Reviser. After this choice has been published, only the spelling chosen is nomenclaturally available, the rejected nomen becoming an *incorrect original spelling*, which "*has no separate availability and cannot enter into homonymy or be used as a substitute name*" (Article 39).

In the present case, the situation is different for the two spellings, because of problems of homonymy. The nomen *Ranetta* has apparently never been used for any other generic nomen in zoology. Neave (1940: 11) credited "Geoffroy, 1767" with a nomen *Ranetta*, but his brief reference ("*Descr. Plant etc*. p. 414") points in fact to the 1767 book of Garsault. As for *Ranella*, a homonymous nomen was created by Lamarck (1816: pl. 412) for a genus of molluscs that has been in permanent use since its creation and is the nucleogenus (type-genus) of the family *RANELLIDAE* Gray, 1854 and of its subfamily *RANELLINAE* (see Bouchet & Rocroi 2005: 253). Validating *Ranella* as of Garsault (1764) would uselessly threaten the molluscan nomina. For this reason, acting as First-Revisers, we hereby select *Ranetta* as the correct original spelling of the generic nomen created in plate 672 by Garsault (1764).

This nomen was clearly created for a small tree-frog of the genus currently known as *Hyla* Laurenti, 1768 (family *HYLIDAE* Rafinesque, 1815). The nucleospecies of this genus, by subsequent designation of Stejneger (1907: 75), is *Hyla viridis* Laurenti, 1768, a junior doxisonym of *Hyla arborea* (Linnaeus, 1758) (see Dubois & Ohler 1997*b*). Two species of this genus occur in France (Stöck *et al.* 2008*a*): *Hyla arborea* (Linnaeus, 1758) in northern France and *Hyla meridionalis* Boettger, 1874 in southern France. As Garsault was working in the northern part of France, we hereby designate *Rana arborea* Linnaeus, 1758 as nucleospecies (type-species) of *Ranetta* Garsault, 1758, as already suggested by Welter-Schultes & Klug (2009: 235). The generic nomen *Hyla* having been in wide and universal use for about two centuries (for a list of more than 25 recent references, see e.g. García-París *et al.* 2004: 481–588), and Garsault's nomen having been ignored since its creation, the prevailing usage must be maintained according to Article 23.9.1 of the *Code*, and *Ranetta* Garsault, 1764 is an invalid senior doxisonym of *Hyla* Laurenti, 1768.

Salamandra Garsault, 1764

The plate 673 of Garsault (1764) shows a common salamander of Europe (family *SALAMANDRIDAE* Goldfuss, 1820), under the nomen *Salamandra* or "Salamandre". No specific nomen is associated to this generic nomen. The nomen *Salamandra*, borrowed from the Latin, was in common use in pre-Linnaean times to designate all urodelans or just the terrestrial species of this group. Its first use after 1758 was by Gronovius (1763: 12), but his "*Salamandra*" is an anoplonym, having been published in a work which is not binominal for species (Dubois & Raffaëlli 2009: 64). The generic nomen in current use is *Salamandra* Laurenti, 1768, the nucleospecies of which, by subsequent designation of Fitzinger (1843: 33) is *Salamandra maculosa* Laurenti, 1768, a doxisonym of *Lacerta salamandra* Linnnaeus, 1758 (see Dubois & Raffaëlli 2009: 64). As remarked by Welter-Schultes & Klug (2009: 238), replacement of *Salamandra* Laurenti, 1768 by *Salamandra* Garsault, 1764 does not raise any nomenclatural problem and should not be avoided or opposed.

Three taxa of the genus *Salamandra* occur in France (Raffaëlli 2007), all being members of the subgenus *Salamandra* (see Dubois & Raffaëlli 2009) and subspecies of *Salamandra salamandra* (Linnaeus, 1758): *Salamandra salamandra terrestris* (Bonnaterre, 1789), in most of the country, *Salamandra salamandra fastuosa* (Schreiber, 1912) in the western Pyrenees, and *Salamandra salamandra salamandra* (Linnaeus, 1758) in the southern Alps. In the Paris region, only the former of these three subspecies occurs, and the pattern of coloration shown in plate 673 of Garsault (1764), with long clear spots on both sides on the back, tending to the formation of two longitudinal bands, is a common one in this subspecies (Thorn & Raffaëlli 2001: 179; Raffaëlli 2007: 154). Therefore, we hereby designate the nominal species *Salamandra terrestris* Bonnaterre, 1789 (onymotope: Saint-Geniez-d'Olt, Aveyron, France), as nucleospecies (type-species) of *Salamandra* Garsault, 1764, the now valid nomen of this genus (for a clarification of the nomenclatural status of this nominal species, see Dubois & Raffaëlli 2009: 27). This change in authorship and date of this generic nomen has no other nomenclatural consequence, and all the taxa included in this genus (Dubois & Raffaëlli 2009: 68–69) keep their nomina unchanged, but the nominal-complexes of most of them must change as the author's name and date must now be placed between parentheses.

Scincus Garsault, 1764

The plate 670 of Garsault (1764) shows a specimen named *Scincus* or "Scine" (the correct vernacular "Scinc" is used in p. 18 of the list of plates, as well as in the subsequent accounts in Garsault 1765, 1767), a lizard which obviously belongs in the genus currently known as *Scincus* Laurenti, 1768 (family *SCINCIDAE* Oppel, 1811*b*[3]).

Laurenti's genus *Scincus* was described with two prenucleospecies and Fitzinger (1843: 23) designated *Scincus officinalis* Laurenti 1768 (onymotope: "*in Ægypto*") as nucleospecies. The latter nomen is a subjective synonym of *Lacerta scincus* Linnaeus, 1758, and this species is now known as *Scincus scincus* (Linnaeus, 1758). The genus *Scincus* includes three to five species, according to the authors. In the last partial revision of this genus (Carranza *et al.* 2008), the former subspecies *Scincus scincus albifasciatus* Boulenger, 1890 was recognized as a full species, including the subspecies *Scincus albifasciatus laterimaculatus* Werner, 1914. We follow here this taxonomy. The specimen shown by Garsault (1764) fully agrees with this latter taxon, known from central Morocco and north-western Algeria. Its main external character is a set of lateral bands interrupted on the back (Werner 1914: 13, pl.; Schleich *et al.* 1996: 363; Bons & Geniez 1996: 200–201; Geniez *et al.* 2004: 135), which are conspicuous in Garsault's (1764) plate.

We hereby designate *Scincus scincus* var. *laterimaculatus* Werner, 1914 (onymotope: western Algeria), as nucleospecies of *Scincus* Garsault, 1764. The distinct nomina *Scincus* Garsault, 1764 and *Scincus* Laurenti,

3. The nomen of this family is traditionally (e.g., Dowling & Duellman 1978: 86.1; Ananjeva *et al.* 1988: 232; Mecke *et al*. 2009) credited to Gray (1825), but it was in fact created, as *SCINCOIDES*, by Oppel (1811*b*: 76), and used again later, as *SCINCIDIA*, by Rafinesque (1815: 76).

1768 are therefore now doxisonyms, and the first one is now the valid nomen of the genus. The three to five species currently referred to this genus (Arnold & Leviton 1977; Carranza *et al.* 2008) keep their nomina unchanged, but the nominal-complex is modified for those here transferred from *Scincus* Laurenti, 1768 to *Scincus* Garsault, 1764, the author's name and the date being now between parentheses: *Scincus albifasciatus* (Boulenger, 1890), *Scincus conirostris* (Blanford, 1881), *Scincus hemprichii* (Wiegmann, 1837), *Scincus mitranus* (Anderson, 1871) and *Scincus scincus* (Linnaeus, 1758), and their subspecies.

Serpens Garsault, 1764

The figure of the plate 667 shows a snake named *Serpens* or "Serpent à collier", which is beyond any doubt a specimen of the species currently known as *Natrix natrix* (Linnaeus, 1758), the "grass snake" (family *COLUBRIDAE* Oppel, 1811*a*).

The genus *Natrix* was established by Laurenti (1768: 73) with 22 prenucleospecies. Stejneger (1936: 139) stated that the nominal species *Coluber natrix* Linnaeus, 1758 was the "type-species" of *Natrix* Laurenti, 1768, "both" by absolute tautonymy, because *Natrix vulgaris* Laurenti, 1768 was its synonym, and by subsequent designation of Fleming (1822). Just like for the genus *Bufo* discussed above, this statement is incorrect, as *Coluber natrix* was not a prenucleospecies of this nominal genus. As for the subsequent designation by Fleming (1822: 29 [sic]) evoked by Stejneger (1936: 139), it is also wrong. Actually Fleming (1822: 291) mentioned only one species, *Coluber torquatus*, in the genus *Natrix* Laurenti, 1768, but did not designate it as "type" as he did for some other genera, and at any rate this nominal species was not eligible for nucleospecies designation, not being one of the prenucleospecies of *Natrix* Laurenti, 1768. The nomen *Coluber torquatus* was first established by de la Cepède (1789: 100) in a work invalidated by the ICZN (Anonymous 1987), so that authorship of this nomen was then shifted to Bonnaterre (1790: 53). However, the species described by the latter author is different from that described by de la Cepède (1789: 100), a "detail" which has escaped the attention of the ICZN and of other recent authors, but this point needs not be discussed further here. Fitzinger (1843: 27) designated *Tropidonotus quincunciatus* Schlegel, 1837 as nucleospecies of *Natrix*, but this designation is also invalid as this species was not among the prenucleospecies. The valid designation of a nucleospecies for *Natrix* Laurenti, 1768 was made by Mertens & Müller (1928: 49), who chose *Natrix vulgaris* Laurenti, 1768.

The generic nomen *Serpens* Garsault, 1764 is therefore a senior doxisonym of *Natrix* Laurenti, 1768. *Serpens* having been ignored since its description, and *Natrix* having been in general use (for a list of more than 25 recent references, see e.g. Kabisch 1999: 564–580), the prevailing usage must be maintained according to Art. 23.9.1 of the *Code*. Therefore, *Natrix* Laurenti, 1768 remains the valid generic nomen for *Coluber natrix* Linnaeus, 1758 and its allies, i.e., three species only nowadays (see Rossman & Eberle 1977): *Natrix maura* (Linnaeus, 1758), *Natrix natrix* (Linnaeus, 1758) and *Natrix tessellata* Laurenti, 1768, and their subspecies. We follow Jandzík (2005), Kasparek (2005) and Venchi & Sindaco (2006), who recommended not to recognize *Natrix megalocephala* Orlov & Tuniyev, 1987 as a valid species.

According to its probable origin (France), the snake depicted by Garsault (1764) belongs in the subspecies currently known as *Natrix natrix helvetica* (Bonnaterre, 1790), actually also first named by de la Cepède (1789: 100) in one of his publications suppressed by the ICZN (Anonymous 1987). This subspecies was based on the specimens from "Jorat"[4] described by Razoumowsky (1789: 121) under the nomen *Coluber vulgaris* Linnaeus, 1758. For this reason, we hereby designate the nominal species *Coluber helveticus* Bonnaterre, 1790 (onymotope: "*parmi les buissons & dans les bois du Jorat*") as nucleospecies of the genus *Serpens* Garsault, 1764, invalid senior doxisonym of *Natrix* Laurenti, 1768.

4. Wooded upland in the county of Vaud, north of Lausanne (Switzerland).

Testudo marina Garsault, 1764

Under the nomen *Testudo marina* or "Tortue de Mer", the lower half of plate 675 in Garsault (1764) shows a sea turtle, identified as such by its flippers and its heart-shaped shell. Contrary to most of the drawings in Garsault (1764), this figure is not especially accurate, notably for the head and the limbs scutellation, and for the free fingers and toes. However, the first supernumerary costal on the elongated carapace allows to attribute this specimen to the "loggerhead turtle", currently known as *Caretta caretta* (Linnaeus, 1758) (family *CHELONIIDAE* Oppel, 1811*b*). This is consistent with the probable French origin of Garsault's specimens (see above), as this species was the only shelled turtle to regularly frequent the southern (Mediterranean) French sea shore at Garsault's time (de la Cepède 1788*a*: 97–98; Bonnaterre 1789: 21) and is still the commonest species of sea turtle in the western Mediterranean (Angel 1946: 180; Scaravelli & Tripepi 2006: 400). We here consider *Testudo marina* Garsault, 1764 as an invalid junior doxisonym of *Testudo caretta* Linnaeus, 1758.

Testudo terrestris Garsault, 1764

The upper half of plate 675 in Garsault (1764) shows his *Testudo terrestris* or "Tortue terrestre", which is undoubtedly a freshwater turtle, precisely a European pond turtle, currently known as *Emys orbicularis* (Linnaeus, 1758) (family *EMYDIDAE* Rafinesque, 1815). Therefore *Testudo terrestris* Garsault, 1764 is a junior doxisonym of *Testudo orbicularis* Linnaeus, 1758. Two subspecies of *Emys orbicularis* are presently recognized among the French continental populations: *Emys orbicularis orbicularis* (Linnaeus, 1758) and *Emys orbicularis galloitalica* Fritz, 1995, with large zones of intergradation (Rogner 2009: 44). It is probably impossible to identify at the subspecific level the turtle figured by Garsault (1764). In the northern half of France, the occurring subspecies is or was *Emys orbicularis orbicularis* (Linnaeus, 1758) (e.g. Rogner 2009), so we refer *Testudo terrestris* Garsault, 1764 to this subspecies.

Testudo terrestris Garsault, 1764 is a senior hadromonym of *Testudo terrestris* Forskål, 1775 (author's name often misspelt "Forsskål", but see Dubois 2008*a*). The latter nomen was "rediscovered" by Wermuth (1956), who first planned to ask the ICZN for its suppression, but a little latter (1958: 152) attributed it to a population of tortoises living in "*Südwestliches Asien (Syrien und Israel) und nordwestliches Afrika (vom nördlichen Ägypten westwärts bis Libyen)*". In order to clarify and stabilize the nomenclatural status of this nomen, Perälä & Bour (2004) designated a neophoront for it. Although less than the other nomina for which we used the "*reversal of precedence*" Rule in this paper, the nomen *Testudo terrestris* Forskål, 1775 has been commonly used since Wermuth's (1958) publication. We were able to find more than 25 publications by more than 10 different authors in the immediately preceding 50 years (see Appendix 2). Therefore, the prevailing usage must be maintained according to Art. 23.9.1 of the *Code*. The nomen *Testudo terrestris* Garsault, 1764 is thus now an exoplonym and will not be available in the future if the need appears to recognize a taxon corresponding to this nomen, e. g. a subspecies of *Emys orbicularis* (Linnaeus, 1758).

Vipera Garsault, 1764

The plate 666 of Garsault (1764) shows his *Vipera* or "Vipere", clearly an "asp viper", a common species in western Europe, currently known as *Vipera aspis* (Linnaeus, 1758) (family *VIPERIDAE* Oppel, 1811*a*). In agreement with this figure, we hereby designate *Coluber aspis* Linnaeus, 1758 as nucleospecies of *Vipera* Garsault, 1764. As discussed below, the latter generic nomen is both a senior hadromonym and senior doxisonym of *Vipera* Laurenti, 1768.

Laurenti's (1768: 99) genus *Vipera* was described with ten prenucleospecies. The nomina of two of them, *Vipera Francisci Redi* and *Vipera Mosis Charas*, are trinomina, but, as discussed above, they can be "saved" through the use of Article 11.9.5, and must now be spelt *Vipera franciscirediand* and *Vipera mosischaras*.

Gmelin (1789: 1091) created the nomen *Coluber redi*. He mentioned the nomen *Vipera Francisci Redi* in its synonymy, so his nomen must be considered an autoneonym of *Vipera franciscirediand* Laurenti, 1768, as

acknowledged by Mertens & Wermuth (1960: 195) and McDiarmid *et al.* (1999: 393). The nomen *Coluber redi* Gmelin, 1789 is an invalid junior isonym of *Vipera francisciredi* Laurenti, 1768, therefore a nomen distinct from the latter. It was not part of the prenucleospecies of the genus *Vipera* Laurenti, 1768, and is therefore not eligible for nucleospecies designation for the latter.

As a consequence, Fitzinger's (1843: 28) designation of this nominal species (as "*Vip. Redii* Latr.") as nucleospecies of *Vipera*, is invalid. It is therefore in error that Stejneger (1936: 140) wrote: "*This being Laurenti's* Vipera francisci redi *which equals* [sic] Coluber aspis *Linnaeus, the latter becomes the genotype of* Vipera". This statement is twice wrong because neither *Coluber redi* nor *Coluber aspis* were members of the prenucleospecies of *Vipera* Laurenti, 1768. However, some subsequent authors (Mertens & Müller 1940: 54; McDiarmid *et al.* 1999: 389) followed this error and considered *Coluber redi* Gmelin, 1789 as the nucleospecies of *Vipera* Laurenti, 1768. Mertens & Wermuth's (1960: 194) subsequent mention of *Vipera francisci redi* as "*species typica*" of *Vipera* Laurenti, 1768 was the first to cite this biological species under the nomen used by Laurenti (1768). This statement was repeated by Bruno (1985: 40). Although based on a wrong interpretation, this would indeed be the valid designation of a nucleospecies for this genus if it was not predated by another designation. As a matter of fact, and even if they ignored it later, Mertens & Müller (1928: 51) had previously designated *Vipera illyrica* Laurenti, 1768 as nucleospecies of *Vipera* Laurenti, 1768. This nominal species was part of the prenucleospecies of the genus, so this designation, which is the first *Code*-compliant one to have been published, is valid. The nomen *Vipera illyrica* is a junior doxisonym of *Vipera ammodytes* (Linnaeus, 1758) (see Mertens & Wermuth 1960: 194).

Vipera Laurenti, 1768 is therefore an invalid junior doxisonym of *Vipera* Garsault, 1764. As both taxa *Coluber aspis* Linnaeus, 1758 and *Vipera illyrica* Laurenti, 1768 are currently referred by all authors to the same genus *Vipera* and even to the same "group" (e.g., Obst 1983) or subgenus *Vipera* (e.g., Mallow *et al.*, 2003), the shift of authorship and date of the nomen of this genus has no disturbing nomenclatural consequences and must be implemented, as already suggested by Welter-Schultes & Klug (2009: 238). Therefore no change is required in the binomina of the 27 species currently recognized in this genus (Mallow *et al*. 2003) and their subspecies. The only change needed in their nominal-complexes is the inclusion of the author's name and date between parentheses, to point to the transfer from *Vipera* Laurenti, 1768 to *Vipera* Garsault, 1764.

AMPHIBIA Garsault, 1764

In the plates of his book, Garsault (1764) only mentioned generic and specific nomina for the taxa he illustrated. But in the *Table des Noms* at the end of the book (p. 1–20), which recapitulates the contents of all the plates, the animals (**ANIMAUX**) are listed under five headings, **INSECTES** (p. 17), **POISSONS** (p. 18), **AMPHIBIES** (p. 18), **OISEAUX** (p. 19) and **QUADRUPEDES** (p. 19). We consider these five headings as class-series nomina (as defined by Dubois 2000, 2006*a*), probably of rank class. Although the *Code* does not provide Rules for the allocation of such nomina, such Rules exist, as proposed by Dubois (2006*a*), and the allocation of these five nomina under these Rules is easy to ascertain.

We deal here only with the nomen **AMPHIBIES**. In Garsault (1764), this nomen applies to a higher taxon that includes all the taxa discussed above in this paper, i.e., all reptiles and amphibians (in the current senses of these terms, e.g. in Dubois 2006*a*) illustrated in this book, and excludes all mammals, birds, "fishes" and "invertebrates". In particular, it excludes 17 genera of "fishes", some of which designate marine mammals, including the genus *Acipenser* Linnaeus, 1758 (consistently spelt *Accipenser* in Garsault, 1764, both in the pl. 660 and in the list of plates p. 18, thus qualifying as an autoneonym), now a member of the **ACTINOPTERYGII ACIPENSERIFORMES**. This genus was included, among others, by Linnaeus (1758: 196) in his order **NANTES**, which was part of his class **AMPHIBIA**. According to the Rules proposed by Dubois (2006*a*), whereas the nomen **AMPHIBIA** Linnaeus, 1758 applies to the taxon now known as **VERTEBRATA** Cuvier, 1800 (Dubois 2006*a*: 189), the nomen **AMPHIBIES** Garsault, 1764 applies to the taxon now known as **NEOTETRAPODA** Gaffney, 1979. In other words, Garsault's (1764) **AMPHIBIES** was the first post-Linnaean higher taxon

recognized for a group including all amphibians and reptiles, but excluding all other vertebrates. It is thus a strict senior synonym of the nomen **AMPHIBIA** Batsch, 1788, that had previously been identified as the earlier use of this nomen for this taxon (Dubois 2006*a*: 190, 2009*a*: 4), but which must now be considered a simple aponym (subsequent avatar of a nomen) and the eunym (correct avatar of a nomen) of **AMPHIBIES** Garsault, 1764. Anyway, both Linnaeus's (1758) and Garsault's (1764) **AMPHIBIA** are obsolete, being rejected as invalid senior homonyms of **AMPHIBIA** de Blainville, 1816 for the class including all amphibians but excluding all other vertebrates. This question does not need to be developed here, as it was explained in full detail by Dubois (2006*a*: 189–190).

Conclusion

Contrary to what could have been feared at first thought, the rediscovery by Welter-Schultes *et al.* (2008) of the works of Garsault (1764, 1765, 1767) does not have a disturbing effect on the nomenclature of early taxa of amphibians and reptiles, much to the contrary. As a matter of fact, it allows to solve an old nomenclatural problem caused by the valid nucleospecies (type-species) of the genus *Bufo* Laurenti, 1768. This nucleospecies has long been uncertain and happens to be a species (*Bufo viridis* Laurenti, 1768) placed by some authors in another genus (*Pseudepidalea* Frost *et al.*, 2006).

The 13 new nomina of amphibians and reptiles created by Garsault (1764) distribute in three categories (Tables 1–2): (1) three of these nomina (*Lacertus*, *Rana viridis*, *Testudo marina*) simply "disappear" as junior synonyms of senior nomina created by Linnaeus (1758); (2) four of them (*Bufo*, *Salamandra*, *Scincus*, *Vipera*) become the valid nomina of taxa, in replacement of identical nomina created later by Laurenti (1768), thus entailing no change in the nomina of their included species and subspecies but changes in their complete nominal-complexes (placing their authors' names and dates between parentheses); (3) finally, six of these nomina are here rejected as invalid senior synonyms (*Ranetta*, *Serpens*, *Lacertus aquatilis*, *Lacertus terrestris*) or homonyms (*Lacertus viridis*, *Testudo terrestris*) of nomina in current use, by virtue of Article 23.9.1 of the *Code*.

TABLE 1. The genus-series nomina of amphibians and reptiles created by Garsault (1764) and their current status. Higher taxonomic allocation of genera is given only at the ranks order and family. *Autoneonym*, new replacement nomen for an existing nomen, based on the same etymological root; *kyronym*, valid nomen for the taxon designated by this nomen; *nucleospecies*, type-species. The sign → indicates that, whenever a genus-series nomen is a neonym of another genus-series nomen, they both have the same nucleospecies and mode of designation.

Generic nomen created by Garsault (1764)	Nucleospecies	Kyronym of genus	Higher taxonomic allocation of genus
Bufo Garsault, 1764	*Rana bufo* Linnaeus, 1758, by present designation	*Bufo* Garsault, 1764	**ANURA** Duméril, 1806 *BUFONIDAE* Gray, 1825
Lacertus Garsault, 1764	Autoneonym of *Lacerta* Linnaeus, 1758 → *Lacerta agilis* Linnaeus, 1758, by subsequent designation of Fitzinger (1843: 20)	*Lacerta* Linnaeus, 1758	**SQUAMATA** Oppel, 1811*b* *LACERTIDAE* Batsch, 1788
Ranetta Garsault, 1764	*Rana arborea* Linnaeus, 1758, by present designation	*Hyla* Laurenti, 1768	**ANURA** Duméril, 1806 *HYLIDAE* Rafinesque, 1815
Salamandra Garsault, 1764	*Salamandra terrestris* Bonnaterre, 1789, by present designation	*Salamandra* Garsault, 1764	**URODELA** Duméril, 1806 *SALAMANDRIDAE* Goldfuss, 1820
Scincus Garsault, 1764	*Scincus scincus* var. *laterimaculatus* Werner, 1914, by present designation	*Scincus* Garsault, 1764	**SQUAMATA** Oppel, 1811*a* *SCINCIDAE* Oppel, 1811*b*
Serpens Garsault, 1764	*Coluber helveticus* Bonnaterre, 1790, by present designation	*Natrix* Laurenti, 1768	**SQUAMATA** Oppel, 1811*a* *COLUBRIDAE* Oppel, 1811*a*
Vipera Garsault, 1764	*Coluber aspis* Linnaeus, 1758, by present designation	*Vipera* Garsault, 1764	**SQUAMATA** Oppel, 1811*a* *VIPERIDAE* Oppel, 1811*a*

This case shows that it is sometimes possible, even in complex nomenclatural situations, to solve them through a proper use of the Rules of the *Code*, without having to appeal to the ICZN for the use of its Plenary-Powers, a solution that clearly is not ideal in many cases (see Dubois 2010*b-c*). We think that zootaxonomists should do their best to solve most nomenclatural problems this way, as a frequent recourse to the ICZN amounts to a frequent implementation of exceptions to the *Code*, a recent trend in zoological nomenclature which tends to weaken the legislative value and strength of this text in the eyes of many zoologists and encourages a lax attitude regarding its application in zootaxonomy (Hołynski 1994; Dubois & Ohler 1997*a*; Dubois 2005*a*, 2006*a,c*, 2007*b*, 2010*b-c*). In fact, a good knowledge and use of the *Code* allows to solve many difficult nomenclatural cases without having to violate its Rules.

TABLE 2. The species-series nomina of amphibians and reptiles created by Garsault (1764) and their current status. Higher taxonomic allocation of genera is given only at the ranks order and family. *Kyronym*, valid nomen for the taxon designated by this nomen.

Specific nomen created by Garsault (1764)	Kyronym of species	Kyronym of genus	Higher taxonomic allocation of genus
Lacertus aquatilis Garsault, 1764	*Triturus cristatus* (Laurenti, 1768)	*Triturus* Rafinesque, 1815	**URODELA** Duméril, 1806 *SALAMANDRIDAE* Goldfuss, 1820
Lacertus terrestris Garsault, 1764	*Podarcis muralis* (Laurenti, 1768)	*Podarcis* Wagler, 1830	**SQUAMATA** Oppel, 1811*a* *LACERTIDAE* Batsch, 1788
Lacertus viridis Garsault, 1764	*Lacerta bilineata* Daudin, 1802	*Lacerta* Linnaeus, 1758	**SQUAMATA** Oppel, 1811*a* *LACERTIDAE* Batsch, 1788
Rana viridis Garsault, 1764	*Pelophylax* kl. *esculentus* (Linnaeus, 1758)	*Pelophylax* Fitzinger, 1843	**ANURA** Duméril, 1806 *RANIDAE* Rafinesque-Schmaltz, 1814
Testudo marina Garsault, 1764	*Caretta caretta* (Linnaeus, 1758)	*Caretta* Rafinesque-Schmaltz, 1814	**CHELONII** Brongniart, 1800 *CHELONIIDAE* Oppel, 1811*b*
Testudo terrestris Garsault, 1764	*Emys orbicularis orbicularis* (Linnaeus, 1758)	*Emys* Duméril, 1806	**CHELONII** Brongniart, 1800 *EMYDIDAE* Rafinesque, 1815

In the present work, on six occasions we had recourse to the Article 23.9.1 of the *Code* to "protect" some very well-known nomina, used for more than two centuries in all the literature. This article is indeed very useful in such cases, but we think it should be modified because, as has already been stressed on several occasions (Dubois & Ohler 1997*a*; Dubois 2000, 2005*a*), the quantitative conditions it puts regarding the past use of a nomen for its being potentially protected are much too lax. These conditions are as follows: "*23.9.1.1. the senior synonym or homonym has not been used as a valid name after 1899, and 23.9.1.2. the junior synonym or homonym has been used for a particular taxon, as its presumed valid name, in at least 25 works, published by at least 10 authors in the immediately preceding 50 years and encompassing a span of not less than 10 years*". In fact, 25 citations over 10–50 years are very easily obtained, even for virtually "unknown" nomina, through checklists, faunistic and taxonomic catalogues, if not through publications by the author of the nomen him/herself or his/her research team. Such conditions allow to protect nomina that are virtually unknown to all zoologists, just in order "*to please the egos of some individual zoologists*" (Dubois 2010*c*). We insist once more that the ICZN would render a great service to zoological nomenclature if it considered implementing much stricter conditions for allowing a nomen to be treated as a *nomen protectum*.

We think that the conditions proposed by Dubois (2006*a*: 230–231) for validation of well-known nomina threatened by senior synonyms or homonyms are much preferable and should be implemented in Article 23.9.1 of the *Code*. According to this proposal, a nomen could be protected only if it has been used either "*(A) in the* titles *of at least* twenty-five *non-purely systematic* books*, written by at least* twenty-five independent-authors *and published in at least* ten different countries *after 31 December 1899, or (B) in the* titles *of at least* one hundred *non-purely systematic* publications *(books, book chapters or periodical articles) written by* one hundred independent-authors *and published in at least* ten different countries *after 31 December 1899*".

Dubois (2006*a*) provided a detailed discussion of this question and justification of the choice of the figures proposed. We note that, although they may seem high, these requirements are indeed met as soon as *really well-known* nomina are at stake. Thus, in the present case, protection of four nomina of Laurenti (1768) discussed above would pose no problem at all under these stricter conditions, but these would allow refusing the status of *nomen protectum* to obscure zoological nomina like *HEMIDACTYLIINI*, *Synapturanus*, *Tomopterna cryptotis* or *Rana megapoda* (for details, see Dubois & Ohler 1997*a*; Dubois 2010*b*), not to mention the recent case of *Testudo gigantea* (see Iverson 2009; Dubois *et al.* 2010). The case of the nomen *Testudo terrestris* Forskål, 1775 is a borderline one. Although we were able to find 25 references using this nomen in the last 50 years, we would probably not have been able to find 100 references of publications using it in their title. This nomen cannot seriously be considered "well-known" in zoology. Although, following the current *Code*, we provided here a nomenclatural action assuring its validation, we are not convinced this was really necessary, as the real threat to "nomenclatural stability" was very weak indeed.

Acknowledgements

We are grateful to Alessandro Minelli (Padova), Salvador Carranza (Barcelona), Pierre-André Crochet (Montpellier) and three anonymous referees for their very constructive comments on a previous version of this paper. For their bibliographic help during its preparation, we are grateful to Myrianne Brival (Paris), Patrick David (Paris), Thierry Frétey (Saint-Maugan), Andrea Kourgli (Wien) and Victoire Koyamba (Paris).

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APPENDIX 1. Some technical terms here used for concepts and tools of zoological nomenclature.

For each term, this list provides: the etymology [G, Greek; L, Latin]; a definition; the reference to creation of the term; the equivalent term or expression used in the *Code* for the same concept, if available.

Alloneonym. – G: ἄλλος (*allos*), "other"; νέος (*neos*), "new"; ὄνομα (*onoma*), "name". – Neonym not directly derived from an archaeonym through unjustified emendation. – Dubois 2000: 52. – *Code*: new replacement name, *nomen novum*.

Anoplonym. – G: ἄνοπλος (*anoplos*), "unarmed"; ὄνομα (*onoma*), "name". – Published but nomenclaturally unavailable nomen according to the Rules of the *Code*. – Dubois 2000: 50. – *Code*: unavailable name.

Aponym. – G: ἀπό (*apo*), "away from, far from"; ὄνομα (*onoma*), "name". – Any subsequent paronym of a protonym (modified in spelling, rank and/or, if relevant, onymorph). – Dubois 2000: 51. – *Code*: no term.

Archaeonym. – G: ἀρχαῖος (*arkhaios*), "ancient"; ὄνομα (*onoma*), "name". – Original nomen that has been replaced by a neonym. – Dubois 2005*a*: 88, 2006*a*: 166. – *Code*: no term.

Asthenomonym. – G: ἀσθενής (*asthenes*), "weak"; ὁμός (*homos*), "the same"; ὄνομα (*onoma*), "name". – Any of two or more identical (or "deemed to be identical" under Article 58 of the *Code*) species-series epithets established for distinct nominal taxa and originally combined with different generic substantives but subsequently combined with the same generic substantive. – Dubois 2000: 57. – *Code*: secondary homonym.

Author. – Person(s) to whom a published work, protonym, protaxon or nomenclatural act is attributed. – Traditional term in zootaxonomy. – *Code*: author.

Autoneonym. – G: αὐτός (*autos*), "same"; νέος (*neos*), "new"; ὄνομα (*onoma*), "name". – Neonym directly derived from an archaeonym through unjustified emendation. – Dubois 2000: 52. – *Code*: unjustified emendation.

Binomen. – L: *bis*, "twice"; *nomen*, "name". – Nomen of rank species, composed of two terms, the generic *substantive* and the specific *epithet*. – Traditional term in zoological nomenclature. – *Code*: binomen.

Binomina. – Plural of *binomen.*

Class-series. – In the nomenclatural hierarchy, the set of nomina ranked above the family-series, which are not fully regulated by the *Code.* It includes nomina of taxa at the ranks of phylum, class, order, and any additional ranks that may be required. – Dubois 2000: 40. – *Code*: no term.

Doxisonym. – G: δόξα (*doxa*), "opinion"; ἴσος (*isos*), "equal"; ὄνομα (*onoma*), "name". – Any of two or more nomina based on different onomatophores but considered, for subjective (taxonomic) reasons, to denote the same taxon, whose inclusive extension includes both their onomatophores. – Dubois 2000: 57. – *Code*: subjective synonym.

Epithet. – Specific or subspecific nomen, never bearing a capital, being part of a binomen or trinomen. – Traditional term in zoological nomenclature. – *Code*: species-group name [English]; nom du niveau espèce [French].

Ergotaxon. – G: ἔργον (*ergon*), "work, action"; τάξις (*taxis*), "order, arrangement". – Any taxon recognized as valid by a given author or in a given ergotaxonomy. – Dubois 2005*a*: 405. – *Code*: no term.

Ergotaxonomy. – G: ἔργον (*ergon*), "work, action"; τάξις (*taxis*), "order, arrangement"; νόμος (*nomos*), "law, rule". – Any taxonomy considered valid at a certain time by a given author. – Dubois 2005*a*: 406. – *Code*: no term.

Eunym. – G: εὖ (*eu*), "well, easily"; ὄνομα (*onoma*), "name". – Correct paronym of a nomen for a given taxon in a given ergotaxonomy. – Dubois 2000: 54. – *Code*: no term.

Exclusive extension. – System of extension by exclusion, listing all non-members of a class (such as a taxon). – Dubois 2005*a*: 379. – *Code*: no term.

Exclusive ostension. – System of ostension by exclusion, pointing to a non-member of a class (such as a taxon). – Dubois 2006*c*: 25. – *Code*: no term.

Exoplonym. – G: ἔξοπλος (*exoplos*), "disarmed"; ὄνομα (*onoma*), "name". – Hoplonym permanently invalidated, either as a result of the Rules of the *Code* or of a specific action of the ICZN under its Plenary-Powers. – Dubois 2000: 51. – *Code*: no term.

Extension. – System of allocation of a nomen to a concept or class (such as a taxon) through providing a list of all objects that satisfy the intensional definition of a concept (*inclusive extension*), or that do not satisfy it (*exclusive ostension*). – Traditional term in philosophy, logics and didactics (see Dubois 2005*a*: 379). – *Code*: no term.

Family-series. – In the nomenclatural hierarchy, the highest-ranking set of nomina fully regulated by the *Code*. It includes nomina of taxa at the ranks of family, subfamily, tribe, superfamily, and any additional ranks that may be required. – Dubois 2000: 40. – *Code*: family group [English]; niveau famille [French].

Genus-series. – In the nomenclatural hierarchy, the set of nomina ranked between the species-series and the family-series. It includes taxa at the ranks of genus and subgenus. – Dubois 2000: 40. – *Code*: genus group [English]; niveau genre [French].

Gymnonym. – G: γυμνός (*gymnos*), "naked"; ὄνομα (*onoma*), "name". – A particular case of anoplonym: published but nomenclaturally unavailable nomen according to the *Code*, for not being conform to the provisions of Articles 12 or 13. – Dubois 2000: 49–50. – *Code*: *nomen nudum*.

Hadromonym. – G: ἁδρός (*hadros*), "robust"; ὁμός (*homos*), "the same"; ὄνομα (*onoma*), "name". – Any of two or more nomina established for distinct nominal taxa and having either (1) in the family-series, exactly the same stem, or (2) in the genus-series, exactly the same spelling, or (3) in the species-series, spellings or onymorphs exactly identical or "deemed to be identical" under Article 58 of the *Code*, and originally combined with the same generic substantive. – Dubois 2000: 57. – *Code*: (1) and (2) homonym; (3) primary homonym.

Holophoront. – G: ὅλος (*holos*), "complete, entire"; φέρω (*phero*),"I bear"; ὄν, ὄντος (*on*, *ontos*), "being, individual". – Single specimen originally designated as onomatophore of a species-series nomen. – Dubois 2005*a*: 403. – *Code*: holotype.

Holophyletic. – G: ὅλος (*holos*), "complete, entire"; φυλή (*phulé*), "tribe, race, class". – *Holophyletic taxon*: taxon including all the descendants of its most recent common ancestor. – Ashlock 1971: 63. – *Code*: no term.

Hoplonym. – G: ὅπλον (*hoplon*), "tool, arm, weapon"; ὄνομα (*onoma*), "name". – Nomenclaturally available nomen according to the Rules of the *Code*. – Dubois 2000: 50. – *Code*: available name.

Hyponym. – G: ὑπό (*hupo*), "below"; ὄνομα (*onoma*), "name". – In a given nominal-series, nomen of a subordinate taxon bearing the same nomen (with the same author, date and onomatophore) as its superordinate taxon. – Dubois 2006*c*: 319. – *Code*: nominotypical.

Inclusive extension. – System of extension by inclusion, listing all members of a class (such as a taxon). – Dubois 2005*a*: 379. – *Code*: no term.

Inclusive ostension. – System of ostension by inclusion, pointing to a member of a class (such as a taxon). – Dubois 2006*c*: 25. – *Code*: no term.

Intension. – Set of properties or attributes that characterize a concept or class. – Traditional term in philosophy, logics and didactics (see Dubois 2005*a*: 379). – *Code*: no term.

Isonym. – G: ἴσος (*isos*), "equal"; ὄνομα (*onoma*), "name". – Any of two or more nomina based on the same onomatophore. – Dubois 2000: 57. – *Code*: objective synonym.

Klepton. – G: κλέπτης (*kleptes*), "thief". – Biological species of hybrid origin and with clonal or hemiclonal heredity, which at each generation parasitizes sexually another species, (see Dubois 2008*b*, 2009*c*). – Dubois & Günther 1982: 290. – *Code*: no term.

Kyronym. – G: κύριος (*kurios*), "proper, correct"; ὄνομα (*onoma*), "name". – Valid nomen for a given taxon in a given ergotaxonomy. – Dubois 2000: 54. – *Code*: no term.

Lectophoront. – G: λεκτός (*lektos*), "chosen, picked out", from the verb λέγω (*lego*), "I choose, I pick"; φέρω (*phero*),"I bear"; ὄν, ὄντος (*on*, *ontos*), "being, individual". – Single specimen chosen in a series of symphoronts for designation as onomatophore of a species-series nomen. – Dubois 2005*a*: 403. – *Code*: lectotype.

Monophory. – G: μόνος (*monos*), "single, unique", and φέρω (*phero*),"I bear". – Qualification of a nomen created with and supported by a single onomatophore. – Dubois 2005*a*: 404. – *Code*: monotypy.

Neonym. – G: νέος (*neos*), "new"; ὄνομα (*onoma*), "name". – Nomen established expressly to replace an already established nomen (its *archaeonym*), and having the same onomatophore. – Dubois 2000: 52. – *Code*: new replacement name, *nomen novum*.

Neophoront. – G: νέος (*neos*), "new"; φέρω (*phero*),"I bear"; ὄν, ὄντος (*on*, *ontos*), "being, individual". – Single specimen designated as onomatophore of a species-series nomen when the original onymophoront has been lost or destroyed. – Dubois 2005*a*: 403. – *Code*: neotype.

Nomen. – L: *nomen*, "name". – Scientific name as defined by the *Code*. – Dubois 2000: 39. – *Code*: scientific name.

Nomina. – Plural of *nomen*.

Nominal-series. – Any of the sets of coordinated nomina interacting for priority regarding synonymy and homonymy (*species-series*, *genus-series*, *family-series* or *class-series*). – Dubois 2000: 40. – *Code*: group of names [English]; niveau nomenclatural [French].

Nucleogenera. – Plural of *nucleogenus*.

Nucleogenus. – L: *nucleus* (from *nux*, "nut"), "nucleus, core, stone"; *genus*, "kind, family, race". – Generic nomen used as onymophoront of a family-series or class-series nomen. – Dubois 2005*a*: 404. – *Code*: type genus.

Nucleomen. – L: *nucleus* (from *nux*, "nut"), "nucleus, core, stone"; *nomen*, "name". – Onomatophore of a nomen of a nominal-series above the species-series: see *nucleospecies* and *nucleogenus*. – Dubois 2005*a*: 403. – *Code*: no term.

Nucleomina. – Plural of *nucleomen*.

Nucleospecies. – L: *nucleus* (from *nux*, "nut"), "nucleus, core, stone"; *species*, "idea, kind, species". – Species-series nomen used as onymophoront of a genus-series nomen. – Dubois 2005*a*: 404. – *Code*: type species.

Onomatophore. – G: ὄνομα (*onoma*), "name"; φέρω (*phero*), "I bear, I carry". – Objective standard of reference of inclusive ostension whereby the taxonomic allocation of a nomen can be determined: the nomen can be potentially applied to any taxon that includes the onomatophore. In the species-series, onomatophores are specimens

(*onymophoronts*), whereas in the genus-, family- and class-series they are nomina (*nucleomina*). – Simpson 1940: 421. – *Code*: name-bearing type.

Onymophoront. – G: ὄνομα (*onoma*), "name"; φέρω (*phero*),"I bear"; ὄν, ὄντος (*on*, *ontos*), "being, individual". – Onomatophore of a nomen of the species-series, which may be either a specimen (*holophoront*, *lectophoront* or *neophoront*) or a series of specimens (*symphoronts*). – Dubois 2005*a*: 403. – *Code*: type specimen.

Onymorph. – G: ὄνομα (*onoma*), "name"; μορφή (*morphe*), "form, shape". – Any particular association between genus-series substantive(s) and species-series epithet(s). – Smith & Pérez-Higareda 1986: 422. – *Code*: no term.

Onymotope. – G: ὄνομα (*onoma*), "name"; τόπος (*topos*), "place". – Place of collection of the onymophoront(s) of a species-series nominal taxon. – Dubois 2005*a*: 404. – *Code*: type locality.

Ostension. – System of allocation of a nomen to a concept or class (such as a taxon) through pointing to an object being an example or member of the class (*inclusive ostension*), or a non-example or non-member of the class (*exclusive ostension*), without providing an intensional or extensional definition, or information on the limits of the class. – Traditional term in philosophy, logics and didactics (see Keller *et al.* 2003: 99; Dubois 2005*a*: 380). – *Code*: no term.

Paronym. – G: παρά (*para*), "near, beside, along"; ὄνομα (*onoma*), "name". – Any of the avatars (spellings, ranks or onymorphs) of a nomen. – Dubois 2000: 53. – *Code*: no term.

Prenucleospecies. – L: *prae*, in the sense of "before"; *nucleus*,"nucleus, core, stone" (from *nux*, "nut"); *species*, species. – One of several nominal species originally included in a new nominal genus or subgenus at its first publication, before subsequent designation among them of a single nucleospecies. – Dubois 2005*a*: 404. – *Code*: originally included nominal species.

Protaxon. – G: προ- (*pro*-), in the sense of "first, primitive, original"; τάξις (*taxis*), "order, arrangement". – Original extension of a taxon. – Dubois 2005*a*: 405. – *Code*: no term.

Protonym. – G: πρῶτος (*protos*), "first, earliest"; ὄνομα (*onoma*), "name". – Original spelling, rank and, if relevant, onymorph of a nomen. – Dubois 2000: 51. – *Code*: synonym.

Quadrinomen. – L: *quattuor*, "four"; *nomen*, "name". – Nomen of rank variety, composed of four terms, the generic substantive, the specific, subspecific and varietal epithet. – Traditional term in zoological nomenclature. – *Code*: no term.

Quadrinomina. – Plural of *quadrinomen.*

Species-series. – In the nomenclatural hierarchy, the lowest-ranking set of nomina which are fully regulated by the *Code*, ranked below the genus-series. It includes nomina of taxa at the ranks of species, subspecies, species aggregate and subspecies aggregate. – Dubois 2000: 40. – *Code*: species group [English]; niveau espèce [French].

Substantive. – Generic or subgeneric nomen, always bearing a capital, being part of a binomen or trinomen. – Traditional term in zoological nomenclature. – *Code*: genus-group name [English]; nom du niveau genre [French].

Symphoront. – G: σύν (*syn*), "together"; φέρω (*phero*),"I bear"; ὄν, ὄντος (*on*, *ontos*), "being, individual". – One of several specimens originally used collectively as onomatophore of a species-series nomen. – Dubois 2005*a*: 403. – *Code*: syntype.

Symprotonym. – G: σύν (*syn*), "together"; πρῶτος (*protos*), "first, earliest"; ὄνομα (*onoma*), "name". – One of two or more alternative original protonyms of a nomen. – Dubois & Ohler 2009: 4. – *Code*: one of the multiple original spellings.

Trinomen. – L: *tres*, "three"; *nomen*, "name". – Nomen of rank subspecies, composed of three terms, the generic substantive and the specific and subspecific epithets. – Traditional term in zoological nomenclature. – *Code*: trinomen.

Trinomina. – Plural of *trinomen.*

Uninomen. – L: *unus*, "one"; *nomen*, "name". – Nomen of any rank composed of a single term. – Traditional term in zoological nomenclature. – *Code*: no term.

Uninomina. – Plural of *uninomen.*

APPENDIX 2. List of references of works using the nomen *Testudo terrestris* Forskål, 1775 during the 50 years 1961–2010.

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