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## The distinction between family-series and class-series nomina in zoological nomenclature, with emphasis on the nomina created by Batsch (1788, 1789) and on the higher nomenclature of turtles

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**Abstract.** The *Code* only regulates the scientific names or *nomina* of zoological taxa from the rank subspecies to the rank superfamily, but not those of taxa at ranks above the latter (class-series nomina). It is shown here that its current Rules are somewhat ambiguous regarding the availability of family-series nomina and the distinction between the latter and class-series nomina, and it is again suggested that it should be improved in this respect. It should cover the whole nomenclatural hierarchy in zoology, which requires to expand it in order to incorporate Rules for the nomenclature of higher taxa. A detailed analysis is devoted to the poorly known work of Batsch (1788, 1789), and it is shown that 17 family-series nomina, 16 of which have remained unnoticed until now, are available and should replace the homonymous junior nomina currently considered valid in zootaxonomy. Particular attention is given to the higher nomenclature of turtles, and it is shown that the nomen *TESTUDINES* Batsch, 1788 is a family-series, not a class-series nomen. This nomen is therefore the valid one, as *TESTUDINIDAE* Batsch, 1788, of the family including the genus *Testudo* Linnaeus, 1758, but cannot apply to the order of turtles, tortoises and terrapins.

**Key words.** Zoological nomenclature, *Code*, availability, class, family, Batsch, turtles, *TESTUDINES*, *TESTUDINIDAE*.

### ABBREVIATIONS AND PRINTING CONVENTIONS

In this paper, “ICZN” designates the International Commission on Zoological Nomenclature and “the *Code*” the edition currently in force of the *International Code of Zoological Nomenclature* (Anonymous 1999). For reasons explained in details elsewhere (Dubois 2000, 2006a), some terms of the *Code* are here substituted by other terms, as follows (in the order of their first appearance in the text, indicated there by an asterisk\*): *nomen* (plural *nomina*) for “scientific name” (Dubois 2000); *nominal-series* for “groups of names” (Dubois 2000), with four such series (“groups”) being discussed here: the *species-*, *genus-*, *family-* and *class-series* (Dubois 2000); *anoplonym* for a “nomenclaturally unavailable name” (Dubois 2000); *sozonym* for a nomen that has had a universal or significant use in non-systematic literature after 31 December 1899 (Dubois 2005a–b); *distagmonym* for a nomen that has not had such a use (Dubois 2005a–b); *onomatophore* for “type” or “name-bearing type” (Simpson 1940); *nucleogenus* (plural *nucleogenera*) for “type genus” (Dubois 2005b); *nucleospecies* for “type species” (Dubois 2005b);

*monophory* for “monotypy” (Dubois 2005b); *neonym* for “new replacement name” or “*nomen novum*” (Dubois 2000); *autoneonym* for a neonym being an “unjustified emendation” (Dubois 2000); *archaeonym* for the nomen replaced by a neonym (Dubois 2005a); *hyponymous* for “nominotypical” (Dubois 2006c). The nomina belonging to the species-series and genus-series are printed, as usual, in lower case *italics*, whereas nomina of higher-ranked taxa are printed in small capitals, with the following distinction: family-series nomina are in *ITALICS*, whereas class-series nomina are in **BOLD**. Anoplonyms are printed “between quotation marks”.

### FAMILY-SERIES AND CLASS-SERIES NOMENCLATURE IN ZOOLOGY

The *Code* regulates the *nomina*\* of zoological taxa from the rank subspecies to the rank superfamily, but not those of taxa at ranks above the latter. Therefore the use and al-

location of nomina of taxa referred to the higher ranks of zoological nomenclature (order, class, phylum, etc.) are left to the freedom and opinions of individual zoologists, as no Rules exist in the *Code* for their availability, allocation to taxa and validity, the three basic steps of the nomenclatural process (Dubois 2005a–c, 2006a).

The nomina covered by the *Code* are distributed in three *nominal-series\**: the *species-\**, *genus-\** and *family-series\**. Any nomen, to be recognized as nomenclaturally available, must first be explicitly or implicitly referred to one of these nominal-series. No difficulty usually arises regarding the allocation of nomina to the species- and genus-series, but, in some cases, problems may be encountered to know whether a given nomen belongs in the family-series, and thus is governed by the nomenclatural Rules of the *Code*, or to a rank above the family-series, therefore in the *class-series\** and thus is outside the Rules of the *Code*.

The *Code* is not fully clear regarding the conditions of availability of family-series nomina. Only two conditions are clear for all nomina, concerning the stem of the nomen and the reference to a suprageneric taxon. Article 11.7.1.1 states that, to be available in its original publication, a family-series nomen must “*be a noun in the nominative plural formed from the stem of an available generic name*”, which is then its *nucleogenus\** (type-genus). Therefore, any higher taxon nomen *not* based on an available generic nomen is unavailable for a family-series nomen, but may under certain conditions be available for a class-series nomen. Article 11.7.1.2 adds that the new nomen must “*be clearly used as a scientific name to denote a supra-generic taxon and not merely as a plural noun or adjective referring to the members of a genus*”. Therefore, the explicit use of the rank family, or of another traditional rank of the family-series (subfamily, superfamily, tribe, subtribe, etc.), is not required for availability of nomina in the family-series. Two additional clear conditions, applying only to nomina published after 1999, are given in Articles 16.1 (the nomen “*must be explicitly indicated as intentionally new*”) and 16.2 (the nomen “*must be accompanied by citation of the name of the type genus*”). According to Article 11.7.1.1, before 2000, the type-genus may be indicated “*either by express reference to the generic name or by reference to its stem*”, i.e., by *implicit etymological designation* (Dubois 1984).

Three conditions are unclear in the current *Code* regarding the status of new family-series nomina: (C1) the date; (C2) the requirement for validity of the nomen of the nucleogenus; and (C3) the distinction between family-series and class-series nomina.

(C1) No starting date is given in the *Code* for the use of family-series nomina in zoological nomenclature. However, the rank family and related ones (superfamily, subfamily, tribe, subtribe, etc.) were not recognized by Linnaeus (1758, 1761, 1764, 1766, 1767), although this author made use of no less than seven ranks above the rank genus (Dubois 2007). Some authors of the 18<sup>th</sup> century used the ranks family and tribe, but not always for taxa above the rank genus and below the rank order, with family as a rank above tribe (Dubois 2006a). For example, some authors (e.g., De Geer 1778; Goeze & Donndorff 1797) used family as a rank below the rank genus, whereas others, including some quite recently, used tribe as a rank above the rank order (e.g., Scopoli 1777; de Blainville 1816; Huene 1952) or below the rank order but above the rank family (e.g., Oken 1821, 1833; Fitzinger 1826, 1843; Swainson 1835; Hogg 1841; Bonaparte 1845; de Blainville 1847; Stannius 1856). In zoological taxonomy, the first authors that are traditionally credited with the creation of family-series nomina for taxa above the rank genus are authors who published their works in the early 19<sup>th</sup> century: e.g., Lamarck (1801), Latreille (1802, 1824, 1825), Opperl (1811a–b), Rafinesque-Schmaltz (1814a–d), Rafinesque (1815), Vieillot (1816), Fischer (1817), Goldfuss (1820), Gray (1825) or Vigers (1825). However, a few authors in the second half of the 18<sup>th</sup> century already used the rank family for taxa at ranks between genus and order. This is the case of Batsch (1788, 1789), in a rather poorly known work discussed in detail below. Inasmuch as the familial nomina created by these authors were clearly based on the stems of available generic nomina considered valid by these authors, there is no reason for not crediting these authors with the creation of these familial nomina, even if this was ignored by most subsequent authors until now (Dubois 2010: 25).

(C2) Regarding the requirement for validity of the generic nomen used as stem (nucleogenus), Article 11.7.1.1 states that “*the generic name must be a name then used as valid in the new family-group taxon [Arts. 63, 64] (use of the stem alone in forming the name is accepted as evidence that the author used the generic name as valid in the new family-group taxon unless there is evidence to the contrary)*”. There are several questions with this unclear formulation. First, what does “*then*” mean in this context? This word would have a clear sense only if it meant “*in the work where the new family-series nomen is created*”, but then why not write it in full words? If it meant “*at the period of this work*”, this would be difficult to apply, because it is unclear how long the period to be considered should be (preferably it seems that it should not include more than ten or 20 years around the creation of the new family-series nomen), and second because at any given pe-

riod of taxonomy the same nomen may be accepted as valid by part of the authors then active, and invalid by others, as will be illustrated below with the example of the nomina *Lacerta* Linnaeus, 1758 and *LACERTAE* Batsch, 1788. Furthermore, the words “*used as valid in the new family-group taxon*” show that this condition cannot apply to works published *before* the creation of the latter taxon! Therefore, this part of Article 11.7.1.1 would be made clearer by choosing between the two following formulations: (F1) “*the generic nomen must be used as valid in the new family-group taxon in the work where its nomen is created*”; (F2) “*the generic nomen must be used as valid by all active taxonomists in the 10 years before and after creation of the new family-group nomen*” (or another span). Until this choice is made by the ICZN, this Article is not fully operational, as will be exemplified below. The French version of Article 11.7.1.1 in the current *Code* is not strictly equivalent to its English version, which is problematic as these two texts are deemed to be “*equivalent in force and meaning*” (Anonymous 1999: xiii). As a matter of fact, the French version of this Article ignores the term “*then*” (“*alors*”). In the previous edition of the *Code* (Anonymous 1985: 25), Article 11(f)(i)(1) wrote “*then used as valid for a genus contained in that family-group taxon*”. These elements suggest that formulation (F1) above corresponds to the real meaning of this article, and we follow this interpretation below.

(C3) Regarding the distinction between family-series and class-series nomina, it is unambiguous in the *Code* only in the case of suprageneric nomina that are *not* based on available generic nomina, which are unavailable in the family-series, but may be available in the class-series, at least in some cases (see below). But what is the status of nomina based on the stem of available generic nomina created for taxa at ranks clearly above the family-series (order, class, etc.), or for taxa of unusual ranks, not clearly referable to the family- or class-series (such as phalanx, cohort, gens, etc.), or for taxa of unspecified ranks? The *Code* does not provide any clue for decision in such cases, all the more that, as reminded above, the explicit use of the rank family, or of another rank of the family-series, is not required for availability of nomina in the family-series. A few clear situations exist: (1) when a nomen is created for a taxon that is explicitly originally referred to a rank higher than superfamily, or than order, class or another rank traditionally referred for the class-series in zoology, whatever this rank is, such a nomen belongs in the class-series; (2) in contrast, when a nomen is created for a suprageneric taxon of rank lower than superfamily or than any other traditional rank in the family-series (family, subfamily, tribe, etc.), and is based on the stem of a nucleogenus, it belongs in the family-series. But whenever a nomen is proposed for a taxon of any rank above the rank genus, and without clear hierarchical relationships

with other taxa of ranks unambiguously referable either to the family- or to the class-series, it may be treated either as a class-series nomen (this is the case for example of all suprageneric nomina created by Linnaeus: see Dubois 2007) or as a family-series nomen. In such cases, the etymology of the nomen may be a help for the decision: if the nomen is based on the stem of an available generic nomen, it may be treated as a family-series nomen, otherwise as a class-series nomen.

Another matter ignored by the *Code* is what could be called the *consistency problem*. In some publications of the 18<sup>th</sup>, 19<sup>th</sup> and even 20<sup>th</sup> centuries, some authors were not consistent regarding the mode of formation of their new familial nomina: some were based on the stem of available generic nomina, whereas others were not, being descriptive or geographical terms, terms based on the names of persons, etc. In such cases, the nomina of the first category could be accepted as available both as family-series and class-series nomina, but those of the second category can be considered available only in the class-series. However, a choice has to be made between these two nominal-series for *all* the nomina created together with the same rank, as it is not logical and conceivable to admit that the same author, in the same publication, created both family-series and class-series nomina for taxa of same rank (for details, see Dubois 2008b). Dubois (2006a: 178) proposed that, in such cases, for reasons of *consistency* in the taxonomic hierarchy, all these nomina be referred to the family-series, but that those which are incorrectly formed (not being based on available generic nomina, or formed through addition of a complex suffix unacceptable as a family-series suffix according to the *Code*), be considered nomenclaturally unavailable. These are of two kinds (Dubois 2006a: 178): *arhizonyms* are family-series nomina not based on generic nomina, and *caconyms* are family-series nomina based on generic nomina but with a complex suffix (such as *-forma*, *-morpha*, etc.). Examples of arhizonyms include “*BATRACINIA*”, “*GYMNODERMIA*” and “*PHRYNACINIA*”, coined by Rafinesque (1815) for taxa of ranks family or subfamily, along with available family-series nomina like *HYLARINIA*, *RANARINIA* and *TRITONIA*. Examples of caconyms include “*RANIFORMES*”, “*HYLAIFORMES*”, “*BUFONIFORMES*” and “*PIPAIFORMES*”, coined by Duméril & Bibron (1841) for taxa of rank family, along with available family-series nomina like *CÉCILIOÏDES*, *SALAMANDRIDES*, *AMPHIUMIDES* and *PROTÉIDES*.

In his study of class-series nomenclature in zoology, Dubois (2006a: 228), after a detailed discussion of the problems mentioned above and others, proposed two new Rules to clarify this situation and to distinguish between family-series and class-series nomina in a simple, objective and automatic manner:

“(R4) **Allocation of nomina to the family-series or to the class-series.** Whenever a single new suprageneric nomen of a given taxonomic rank was established in a publication, this nomen must be referred to the family-series if both following conditions are fulfilled: (A) it was proposed for a taxon of a rank usual within the family-series or of an unusual rank but clearly presented as being hierarchically subordinate to a usual rank of that series although above the genus; and (B) it was coined by addition of a simple suffix denoting the plural to the stem of an available genus-series nomen. In all other cases, the nomen must be referred to the class-series. Whenever several new suprageneric nomina of the same rank were established in a publication, they must all be referred to the same nominal-series; if they were treated heterogeneously with regard to the criteria above, they must follow the Rule of Taxonomic Consistency (R5).

(R5) **Rule of Taxonomic Consistency.** All suprageneric nomina created in the same publication for taxa that were afforded the same taxonomic rank must be referred to the same nominal-series. In case of conflict between their allocation to nominal-series according to Rule (R4), the family-series takes precedence over the class-series, and nomina that, being incorrectly formed (arhizonyms or caconyms), cannot be considered as belonging to that series, must be treated as nomenclaturally unavailable (anoplonyms\*).

These proposed Rules should be studied carefully by the ICZN and incorporated into the *Code*, or others Rules should be proposed, but until this is done, ambiguity will exist and decisions regarding the status of some nomina of higher taxa will remain unclear, and will have to rely on arbitrary decisions on the part of some zoologists, as will now be shown.

In what follows, these general questions will be concretely studied in one zoological group: we will examine the status of the nomina used by the authors until now for (1) the order of reptiles including the turtles and (2) the family of turtles including the genus *Testudo* Linnaeus, 1758.

## THE HIGHER NOMENCLATURE OF TURTLES

Despite various works dealing with it, the higher nomenclature of turtles is not yet stabilized. The nomenclatural chaos is clearly emphasized by the use of different and incompatible nomenclatures over very short periods of times, not only by different authors, but sometimes by the same one (e.g., Vetter 2002, 2004; Vetter & van Dijk 2006). The last publications in this respect, by Rhodin et al. (2008, 2009), are not reliable references, as they display ignorance of several basic nomenclatural Rules of the

*Code*. For example, they do not follow the *Code*'s Principle of Coordination for superfamilies, which are credited to authors and dates different from those of their *hyponymous\** families (e.g., *KINOSTERNIDAE* Agassiz, 1857 and *KINOSTERNOIDEA* Joyce, Parham & Gauthier, 2004) and sometimes given incorrect endings (*TRIONYCHIA* Hummel, 1929). An important nomenclatural flaw, discussed in detail below, is to refer the same nomen (*TESTUDINES* Batsch, 1788) both to the family- and the class-series.

Table 1 (in Appendix 1) provides a survey of various nomina, with their authors and dates when they were specified, that have been used until now by a number of zoologists for the order of turtles and the family including the genus *Testudo* Linnaeus, 1758.

Several problems can be identified in this table. First, although the family including the genus *Testudo* has almost always been known as *TESTUDINIDAE*, the author and date of the latter nomen has not been consensual. Some authors (e.g., Hunt 1958: 150; Iverson 1992: 3; Xianrui 1994: 4) have credited a nomen “Testudines” to Linnaeus (1758: 194, 198). However, it is fully clear that, in this and other works of Linnaeus, the term *Testudines* was a plural noun referring to the members of the genus *Testudo*, not a family-series or class-series nomen (Article 11.7.1.2; Bour & Dubois 1985). This is stressed by the fact that Linnaeus (1758: 198–199) also mentioned this word as *Testudine* and *Testudinibus*. Others have credited the familial nomen *TESTUDINIDAE* to Gray (1825), until Bour & Dubois (1985) drew the attention to the fact that the nomen *TESTUDINES*, coined by Batsch (1788: 437) for a family including the single genus *Testudo* Linnaeus, 1758, was doubtless available in the family-series, where it has priority over all subsequent nomina coined on the basis of the stem of this generic nomen (including *TESTUDIA* Rafinesque-Schmaltz, 1814c, a nomen ignored by most authors until now). Following the *Code*, this nomen must simply be emended to *TESTUDINIDAE* Batsch, 1788 if used for a taxon of rank family, to *TESTUDINOIDEA* Batsch, 1788 for a taxon of rank superfamily, *TESTUDININAE* Batsch, 1788 for a subfamily, *TESTUDININI* Batsch, 1788 for a tribe and *TESTUDININA* Batsch, 1788 for a subtribe.

Still more confusion has been exhibited by the authors regarding the nomen of the order of turtles. The nomen *TESTUDINES* was used for this purpose, credited either to Linnaeus (1758) or to Batsch (1788), which is incorrect in both cases for the reasons given above (the former being a generic nomen in the plural, the latter a family-series nomen). The first valid creation of a nomen *TESTUDINES* for an order was by Wagler (1830: 130, 133), but this is subsequent to the other nomina discussed below. As a matter of fact, three other nomina were also widely used for the order, *CHELONII*, *CHELONIA* and *TESTUDINATA*.

Both **CHELONII** and **CHELONIA** are just subsequent latinizations of **CHÉLONIENS** Brongniart, 1800a. The spelling **CHELONIA** was first used by Ross & Macartney (and not Macartney alone, as wrongly stated by Loveridge 1957 or Romer 1966) in their 1802 translation of the work of Cuvier (1800). This latinization was posterior to that in **CHELONII** by Latreille (1800), used by many subsequent authors in the 19<sup>th</sup> century (Bour & Dubois 1985: 79) and resurrected by Bour (1981). Although the *Code* provides no guidelines for the authorship and date of class-series nomina, for reasons discussed in detail by Dubois (2006a, 2009), by simple consistency and parallelism with the Rules of the *Code* concerning family-series and genus-series nomina, it is justified to credit a class-series nomen published first in a non-latinized form to the author of this original nomen, so in this case to Brongniart (1800a). The spelling **CHELONII** being anterior to **CHELONIA**, and the latter being open to confusion because of hemihomonymy (Starobogatov 1991) with the generic nomen *Chelonia* Brongniart, 1800b, the use of **CHELONII** was supported by Bour (1981) and Bour & Dubois (1985), who noted that this nomen had priority over **TESTUDINATA**, an ordinal nomen coined by Oppel (1811b). In conclusion, Bour & Dubois (1985) proposed to use the nomen **CHELONII** Brongniart, 1800a for the order of turtles, a suggestion adopted by various subsequent authors (see Table 1).

As the *Code* provides no Rules or even guidelines for class-series nomenclature, this suggestion was based on the use of the Principle of *Onomatophores*\* (so-called “Principle of Typification”) in a way similar to its use in the three lower nominal-series recognized by the *Code*, a method explicitly presented by Dubois (1984). However, as was later shown by Dubois (2004, 2005a–b, 2006a–b, 2009; Dubois & Ohler 2009), because no Principle of Coordination is in force in class-series nomenclature, such a practice does not allow unambiguous allocation of a class-series nomen to a taxon as soon as several hierarchically subordinated taxa have the same onomatophore, so that more complete Rules had to be devised (Dubois 2006a). For the precise allocation of nomina to higher taxa, this system uses both the originally included genera or *conucleogenera* of the newly established taxon, and the genera originally expressly excluded from it, its *alienogenera*. Until these proposed Rules, or others, are incorporated into the *Code* in order to regulate class-series nomenclature, the latter will remain chaotic and left to “freedom” and “opinions” of individual zoologists, which will be a permanent nuisance for proper and unambiguous communication among all biologists.

This problem is made worse by the ambiguity, discussed above, regarding the distinction between class-series and family-series nomina in the *Code*. Although Batsch (1788) had clearly referred his new taxon *TESTUDINES* to the rank

family, there is nothing in the *Code* that imposes to refer this nomen to the family-series, all the more that Batsch (1788, 1789) was not consistent in his use of etymology for his familial nomina, some only being based on the stems of generic nomina he considered valid (see below).

Because of this ambiguity of the *Code*, it would be possible to refer the nomen *TESTUDINES* Batsch, 1788 either to the family-series (which clearly has our preference) or to the class-series. But it is fully unacceptable and impossible to refer it to *both*! This would be similar to accepting that a genus-series nomen, such as *Ranoidea* Tschudi, 1838 for example, can be considered available both as the nomen of a genus and of a superfamily! This is however what has been done by Fritz & Havaš (2006, 2007), followed by Vetter & van Dijk (2006) and Rhodin et al. (2008, 2009), who recognized, in the same classification, an order **TESTUDINES** Batsch, 1788 and a family *TESTUDINIDAE* Batsch, 1788, although both nomina are based on the one and single appearance of the nomen *TESTUDINES* in page 437 of Batsch (1788)! The fact that such incredible nomenclatural treatments can be accepted as valid by several contemporaneous taxonomists and periodicals points to the poor interest granted by many colleagues nowadays to nomenclatural Rules and to the chaotic situation created in zoological nomenclature by the incompleteness and ambiguity of the *Code*.

This exemplary case prompted us to undertake a detailed and complete survey of all suprageneric nomina created by Batsch (1788, 1789), which fully exemplifies these problems and allows to propose solutions to them.

#### **BATSCH’S (1788, 1789) SUPRAGENERIC NOMINA IN ZOOLOGY**

Batsch (1788, 1789) was one of the authors who, in the late 18<sup>th</sup> century, proposed a comprehensive classification of the animal kingdom and tried to improve the scheme of Linnaeus (1758, 1766, 1767) in this respect. In this classification, he used four ranks above the rank genus: family, order, class and an upper unnamed rank that we treat here for more simplicity as “superclass”. This classification is summarized here in our Table 2 (in Appendix 1).

Batsch (1788) was the first author to divide the animal kingdom in two main groups, his “superclasses” **OSSEA** and **CRUSTACEA**, which exactly correspond to the distinction between “*animaux à vertèbres*” and “*animaux sans vertèbres*” first proposed by Lamarck in his lectures (which were not published until 1801), and which Cuvier (1800) was the first author to formally name in a publication as **VERTÉBRÉS (VERTEBRATA)** and **INVERTÉBRÉS (INVERTEBRATA)**. Although Batsch’s (1788)

**OSSEA** has priority over **VERTEBRATA**, it would be inappropriate to replace the latter, which has been used millions of times in the scientific literature and therefore qualifies as a *sozonym*\*, by the former, which has been ignored and which is therefore a *distagmonym*\* (Dubois 2005a: 86, 2005b: 412).

In his **OSSEA**, Batsch (1788) recognized four classes, **MAMMALIA**, **AVES**, **AMPHIBIA** and **PISCES**, whereas in his **CRUSTACEA** he recognized two classes, **INSECTA** and **VERMES**. Although the nomina of these six classes are identical to those of the six zoological classes of Linnaeus (1758, 1766, 1767), their content is not always exactly the same. For example, Batsch (1789) removed from his **VERMES** the genus *Myxine* Linnaeus, 1758 placed in this class by Linnaeus, and which is in fact a chordate. Therefore, the nomina used by Batsch for these classes should be credited to him, not to Linnaeus. They are junior homonyms of Linnaeus' identical nomina (see Dubois 2006a).

All genera in Batsch (1788, 1789) are referred to families. Families are referred to orders and then to the class only in one class (**MAMMALIA**). The nomina of the orders of mammals also are in part borrowed from Linnaeus, but here also sometimes with a slightly different content, which requires to consider them as distinct, junior homonymous nomina. In the other five classes, the only rank used above genus is that of family. Because the rank family is expressly used by Batsch, is situated in the nomenclatural hierarchy above the rank genus and below the ranks class and order (when available), and because some at least of these nomina are coined by addition of an ending indicating plural to the stem of an available generic nomen considered valid by Batsch (1788, 1789), we hereby consider the nomina of Batsch's "families" to be indeed family-series nomina, some of which only are nomenclaturally available.

The available family-series nomina in Batsch (1788, 1789), that appear in Table 2, are the 17 familial nomina in his work based on available generic nomina listed by him as valid among the genera of the family. This is for example the case of *TESTUDINES* Batsch, 1788, a taxon expressly mentioned as including the genus *Testudo* Linnaeus, 1758.

As shown in Table 2, there are two categories of unavailable family-series nomina in Batsch (1788, 1789). The first one consists of arhizonyms, i.e., family-series that were not based on any then available zoological generic nomen. The second one consists of nomina that were indeed based on then available zoological generic nomina, but these nomina not being listed by Batsch (1788, 1789) as valid

among the members of the family, being presumably considered invalid synonyms of nomina used by Batsch as valid. As we here adopted the formulation (F1) above of Article 11.7.1.1 of the *Code*, these nomina must be considered as nomenclaturally unavailable, but if interpretation (F2) had to be followed these nomina would have to be treated as available. This small doubt is one of the consequences of the ambiguous writing of Article 11.7.1.1 in the current version of the *Code*.

The *Code* is silent about the nomenclatural status of familial nomina such as those created by Batsch (1788, 1789) but shown above to be unavailable in the family-series. In contrast, under the Rules proposed by Dubois (2006a) for class-series nomenclature, these nomina belong unambiguously in the family-series and are therefore clearly unavailable in the class-series as well, because of the Rule of Taxonomic Consistency presented above.

Except three, all the generic nomina listed by Batsch (1788, 1789) in his classification of the animal kingdom had previously been made available in zoological nomenclature by Linnaeus (1758) and in subsequent publications between 1758 and 1790. The only three exceptions are the nomina *Cylindrus* Batsch, 1789, *Hydrocantharus* Batsch, 1789 and *Turris* Batsch, 1789. The status of these three nomina is discussed below in Appendix 2.

Table 3 (in Appendix 1) lists the 17 familial nomina made nomenclaturally available in zoological nomenclature by Batsch (1788, 1789). Until now, only one (*TESTUDINIDAE*) has been credited to Batsch (1788), and the other 16 are traditionally credited to other authors at subsequent dates, but should now be credited to Batsch. This poses no problem of "nomenclatural stability", as none of these 16 familial nomina has to change, the change concerning only their author and date.

The familial nomen *LACERTIDAE*, that had previously (Dubois 2004; Dubois & Bour 2010) been credited to Batsch (1788), does not appear in Table 3. This is because this nomen could be considered available only under interpretation (F2) of Article 11.7.1.1. The genus *Lacerta* Linnaeus, 1758 was recognized by most authors of the end of the 18<sup>th</sup> century, but not by Laurenti (1768) who had split it into several genera and had not retained the nomen *Lacerta* for any of them (in contrast for what he had done in other cases, e.g. for *Rana*). He was apparently followed in this by Batsch (1788), who did not recognize or even mention the genus *Lacerta*. As we here adopted interpretation (F1) of Article 11.7.1.1, the family nomen *LACERTIDAE* cannot be credited to Batsch (1788). It must therefore be credited to the first subsequent author who used a family nomen based on the generic nomen *Lacerta* for

a family where the latter generic nomen was considered valid. This happens to be Opper (1811b: 16).

Establishing the proper nomen for the order of turtles (or “turtles, tortoises and terrapins”), i.e., including all recent turtles as well as a few additional Triassic groups, is beyond the scope of the present paper, and we just provide here a few comments in this respect. As discussed above, the nomen *TESTUDINES* Batsch, 1788, being available in the family-series, is not available in the class-series and cannot be used for an order. Under the nomenclatural Rules proposed by Dubois (2006a), the nomina **CHELONII** Brongniart, 1800a and **TESTUDINATA** Opper, 1811b are available in the class-series. However, they do not apply to the order of turtles, but to still higher taxa.

Under these Rules, the nomen **CHELONII** Brongniart, 1800a applies to the most inclusive class-series taxon containing the genera *Chelonia* Brongniart, 1800b and *Testudo* Linnaeus, 1758, and excluding the 19 nominal genera referred by Brongniart (1800b) to his orders **BATRACHIA**, **OPHIDIA** and **SAURIA**.

As for the nomen **TESTUDINATA** Opper, 1811b, it applies to the most inclusive class-series taxon containing the genera *Chelonia* Brongniart, 1800b, *Chelys* Opper, 1811b, *Emys* Duméril, 1806, *Testudo* Linnaeus, 1758 and *Trionyx* Geoffroy Saint-Hilaire, 1809, and excluding the 48 nominal genera referred by Opper (1811b) to his orders **SQUAMATA** and **NUDA**.

Opper (1811b) credited the nomina of his orders **TESTUDINATA** and **NUDA** to Klein (1751), a work which, being anterior to 1758, is not nomenclaturally available. However, Joyce et al. (2004: 998) recently drew the attention to Behn’s (1760) translation and adaptation of Klein’s (1751) book, which includes all the taxa and nomina of the latter work. These post-1758 nomina would be available, with the authorship “Klein in Behn, 1760”, if this book was nomenclaturally available, but, for reasons explained in detail in our Appendix 2 below, we consider that it should not be considered so.

Several other class-series nomina applying to turtles and related groups have been published after the works just mentioned. Establishing the class-series taxa to which these nomina apply under Dubois’s (2006a) proposed Rules requires a long and detailed survey that would take us far beyond the purpose of the present paper and will be presented elsewhere. For the time being, this work is not urgent, as the phylogenetic relationships among these groups, and with the other tetrapods, are currently highly controversial (e.g., Werneburg & Sánchez-Villagra 2009, and included references), and it will be possible to

settle a robust nomenclature of these groups only when some consensus emerges on these questions.

## CONCLUSION

The analysis presented above and the examples studied show that the current Rules of the *Code* are ambiguous regarding the allocation of nomina of higher zoological taxa to either the family-series or the class-series of nomina, and regarding the conditions of availability of family-series nomina. These Rules should be improved through modifications of Article 11.7.1.1 as suggested above, and mostly through incorporation of Rules for class-series nomina, as proposed in detail by Dubois (2006a).

A detailed study of all suprageneric nomina in the work of Batsch (1788, 1789) shows that this author proposed many family-series nomina, which belong in three categories: (C1) nomina clearly based on the stems of available generic nomina that were considered valid in this work: such nomina are available in the family-series; (C2) nomina apparently based on the stems of generic nomina nomenclaturally available at that time, but not treated as valid in this work: such nomina are unavailable both in the family-series and in the class-series; (C3) arhizonyms, i.e., nomina not based on the stems of any generic nomen nomenclaturally available at that time: such nomina are also unavailable both in the family-series and in the class-series. Nomina of the categories (C2) and (C3) are definitely unavailable and will never have to be used as valid in zoological nomenclature. But the nomina of category (C1) compete for priority with all other family-series subsequently proposed in zoological nomenclature. It so happens that these 17 nomina are identical with family-series nomina coined later on and based on the same nucleogenera. Therefore they must replace them, which entails no change in the nomina themselves (and therefore no disruption of nomenclatural stability) but only modifications regarding their authors and dates. These changes, listed in Table 3, should be implemented without delay in the respective zoological groups where they belong.

This analysis contributes to a clarification of the higher nomenclature of turtles. The nomen *TESTUDINES* Batsch, 1788 is not a class-series, but a family-series nomen. It cannot be used for the order of turtles, but is the valid nomen, under the spelling *TESTUDINIDAE*, of the family including the genus *Testudo* Linnaeus, 1758 and of all other coordinate taxa as recognized in any given classification. As for the order of turtles, establishing the valid nomen of this taxon and of its superordinate taxa under the Rules proposed by Dubois (2006a) is beyond the scope

of the present paper, but it is shown here that neither **TESTUDINES** Linnaeus, 1758, nor **TESTUDINATA** Klein *in* Behn, 1760, nor **TESTUDINES** Batsch, 1788, nor **CHELONII** Brongniart, 1800a, nor **TESTUDINATA** Oppel, 1811b apply to this taxon. As long as the *Code* does not provide formal Rules for the nomenclature of class-series taxa, the higher nomenclature of turtles (as well as that of all other zoological groups) will remain a matter of personal or collective tastes, opinions and arbitrary decisions of zootaxonomists. At any rate, whatever Rules or guidelines are followed, it is impossible and unacceptable under any nomenclatural philosophy to accept that the nomen *TESTUDINES* Batsch, 1788 could be available *both* for the order of turtles and for the family including the genus *Testudo* Linnaeus, 1758.

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## APPENDIX 1

**Table 1.** Chronological presentation of the family-series and class-series nomina used in various publications for the order of turtles and for the family including the genus *Testudo* Linnaeus, 1758. The authors and dates are mentioned below only when they were so in the works cited. Nomina connected by the sign ↔ are allelonyms (Dubois 2006a), i.e., alternative nomina proposed or used by an author in the same publication for the same taxon (same content and taxonomic rank), without choosing between them.

Reference	Nomen used for the order (or for a class-series taxon of another rank) of turtles	Nomen used for the family including the genus <i>Testudo</i> Linnaeus, 1758
Batsch 1788: 437	–	<i>TESTUDINES</i>
Brongniart 1800a: 81	<b>CHÉLONIENS</b>	–
Latreille 1800: xi	<b>CHELONII</b>	–
Ross & Macartney in Cuvier 1802: tab. 3	<b>CHELONIA</b>	–
Duméril 1806: 76	<b>CHELONII</b>	–
Oppel 1811b: 4, 6	<b>TESTUDINATA</b> Klein, 1751	<i>AMYDAE</i>
Rafinesque-Schmaltz 1814c: 66	<b>PEROSTIA</b>	<i>TESTUDIA</i>
Rafinesque 1815: 74	<b>PEROSTIA</b>	<i>TESTUDIA</i>
Merrem 1820: 6, 7, 12, 17	<b>TESTUDINATA</b> Oppel, 1811	–
Latreille 1825: 91	<b>CHELONII</b>	<b>CRYPTOPODI</b>
Gray 1825: 194, 210	<b>CHELONII</b> Latreille, 1800	<i>TESTUDINIDAE</i>
Fitzinger 1826: 5	<b>MONOPNOA</b> [including tribe <b>TESTUDINATA</b> Klein, 1751]	<i>TESTUDINOIDEA</i>
Ritgen 1828: 269, 270	<b>CHELONII</b> ↔ <b>STERRICHROTES</b>	<b>CHERSOCHELONES</b> ↔ <b>DYSMYDAE</b>
Wagler 1828: 861	<b>CHELYNAE</b>	<b>TYLOPODAE</b>
Wagler 1830: 130	<b>TESTUDINES</b>	<b>HEDRAEOGLOSSAE</b>
Bonaparte 1831: 63, 68	<b>CHELONII</b>	<i>TESTUDINIDAE</i>
Griffith & Pidgeon 1831: 4, 6	<b>CHELONIA</b>	–
Gray 1831a: 2	<b>TESTUDINATA</b>	<i>TESTUDINIDAE</i>
Gray 1831b: 3, 7	<b>CHELONII</b>	<i>TESTUDINIDAE</i> Gray, 1825
Duméril & Bibron 1834: 346, 352	<b>CHÉLONIENS</b> Brongniart, 1800	“ <i>CHERSITES</i> ”
Duméril & Bibron 1835: 1	<b>CHÉLONIENS</b> Brongniart, 1800	“ <i>CHERSITES</i> ”
Fitzinger 1835: 107	<b>MONOPNOA</b>	<b>TYLOPODA</b>
Fitzinger 1843: 29	<b>TYLOPODA</b> Wagler, 1828	<i>TESTUDINES</i>
Rüppel 1843: 297	<b>CHELONII</b>	–
Wiegmann & Ruthe 1843: 166, 168	<b>CHELONII</b>	<i>CHERSINAE</i>
Gray 1844: 3	<b>CHELONIA</b>	<i>TESTUDINIDAE</i>
Bonaparte 1845: 3	<b>CHELONII</b>	<i>TESTUDINIDAE</i>
Bonaparte 1850: pl.	<b>CHELONII</b>	<i>TESTUDINIDAE</i>
Gray 1855: title page, 1, 4	<b>TESTUDINATA</b> Oppel, 1811 ↔ <b>CHELONIA</b> Gray, 1835 [sic]	<i>TESTUDINIDAE</i>
Agassiz 1857: 235, 249	<b>TESTUDINATA</b> Klein, 1751	<i>TESTUDININA</i> Bonaparte, 1831
Günther 1859: 379	<b>CHELONII</b>	–
Peters 1862: 271	<b>CHELONII</b>	<i>TESTUDINIDAE</i>
Strauch 1862: 19, 20	<b>CHELONIA</b>	<i>TESTUDINIDA</i>
Günther 1864: x, 1, 3	<b>CHELONIA</b>	<i>TESTUDINIDAE</i>
Strauch 1865: 205	–	<i>TESTUDINIDA</i>
Troschel 1866: 182	<b>CHELONII</b>	<i>TESTUDINIDA</i>
Fitzinger 1867: 85	<b>CHELONII</b>	<i>CHERSINAE</i>
Gray 1873: iv, 1	<b>TESTUDINATA</b>	<i>TESTUDINIDAE</i>
Cope 1875: 50, 54	<b>TESTUDINATA</b>	<i>TESTUDINIDAE</i>
Peters 1882: 2	<b>CHELONII</b> ↔ <b>TESTUDINATA</b>	<i>TESTUDININA</i>
Baur 1887: 96, 101	<b>TESTUDINATA</b>	<i>TESTUDINIDAE</i>
Boulenger 1889: 4, 48	<b>CHELONIA</b> Brongniart, 1800	<i>TESTUDINIDAE</i>
Strauch 1890: 9, 10	<b>CHELONIA</b>	<i>TESTUDINIDA</i>
Baur 1892: 419, 420	<b>TESTUDINATA</b>	<i>TESTUDINIDAE</i>
Boettger 1893: 2, 3	<b>CHELONIA</b>	<i>TESTUDINIDAE</i>
Barboza du Bocage 1895: 1	<b>CHELONIA</b>	<i>TESTUDINIDAE</i>
Stejneger 1907: 483, 488	<b>TESTUDINATA</b> Oppel, 1811	<i>TESTUDINIDAE</i>
Siebenrock 1909: 429	<b>TESTUDINATA</b> Oppel, 1811	<i>TESTUDINIDAE</i> Gray 1825
De Rooij 1915: 285, 288	<b>CHELONIA</b>	<i>TESTUDINIDAE</i>
Stejneger & Barbour 1917: 113	<b>TESTUDINATA</b> Oppel, 1811	<i>TESTUDINIDAE</i>
Boulenger 1923: 42	<b>CHELONIA</b>	<i>TESTUDINIDAE</i>

Reference	Nomen used for the order (or for a class-series taxon of another rank) of turtles	Nomen used for the family including the genus <i>Testudo</i> Linnaeus, 1758
Mertens & Müller 1928: 20	TESTUDINATA Oppel, 1811	TESTUDINIDAE
Smith 1933: 49, 136	TESTUDINES Batsch, 1788	TESTUDINIDAE Gray, 1825
Freiberg 1938: 7, 9	TESTUDINATA Oppel, 1811	TESTUDINIDAE Gray, 1825
Terente'v & Chernov 1949: 88, 95	CHELONIA [in subclass TESTUDINES]	TESTUDINIDAE
Smith & Taylor 1950: 12, 27	TESTUDINES Batsch, 1788	TESTUDINIDAE Gray, 1825
Schmidt 1953: 86, 104	CHELONIA	TESTUDINIDAE
Bergounioux 1955: 187, 508	CHELONIA [in subclass TESTUDINATA]	TESTUDINIDAE
Mertens & Wermuth 1955: 333, 370	TESTUDINES	TESTUDINIDAE
Romer 1956: 495, 504	CHELONIA ↔ TESTUDINATA	TESTUDINIDAE
Loveridge 1957: 163	TESTUDINATA Oppel, 1811	TESTUDINIDAE
Loveridge & Williams 1957: 175, 181	TESTUDINATA	TESTUDINIDAE Gray, 1825
Hunt 1958: 150	TESTUDINES Linnaeus, 1758	TESTUDINIDAE Gray, 1825
Wermuth & Mertens 1961: 1, 171	TESTUDINES	TESTUDINIDAE
Fuhn & Vancea 1961: 157, 158	TESTUDINES Batsch, 1788	TESTUDINIDAE Gray, 1825
Goin & Goin 1962: 73, 254	TESTUDINATA	TESTUDINIDAE
Yeh, 1963: 7, 27	CHELONIA	TESTUDINIDAE
Romer 1966: 365	CHELONIA Macartney, 1802	TESTUDINIDAE
Kuhn 1967: 114	TESTUDINES Batsch, 1788	TESTUDINIDAE Gray, 1825
Pritchard 1967: 27	CHELONIA	TESTUDINIDAE
Čkhikvazde 1970: 245	CHELONIA	TESTUDINIDAE
Auffenberg 1974: 140	TESTUDINATA Shaw, 1802	TESTUDINIDAE Gray, 1825
Gaffney 1975: 423	TESTUDINES Batsch, 1788	TESTUDINIDAE Gray, 1825
Młynarski 1976: 6	TESTUDINES Batsch, 1788	TESTUDINIDAE Gray, 1825
Webb et al. 1978: vii	CHELONIA	TESTUDINIDAE
Nutaphand 1979: 13, 55	CHELONIA ↔ TESTUDINES	TESTUDINIDAE
Bour 1981: 133	CHELONII	TESTUDINIDAE Batsch, 1788
De Broin 1982: 897	CHELONII Brongniart, 1800	TESTUDINIDAE
Welch 1982: 206, 207	CHELONIA	TESTUDINIDAE
Pritchard & Trebbau 1984: 11, 197	TESTUDINES	TESTUDINIDAE Gray, 1825
Bour & Dubois 1985: 78	CHELONII Brongniart, 1800	TESTUDINIDAE Batsch, 1788
Alderton 1988: 108	CHELONIA	TESTUDINIDAE
Dundee 1989: 403	TESTUDINES	–
Ernst & Barbour 1989: 3, 227	TESTUDINES	TESTUDINIDAE
King & Burke 1989: 16, 69	TESTUDINES Batsch, 1788	TESTUDINIDAE Gray, 1825
Jiufa & Ting, 1992: 1, 4	TESTUDINATA	TESTUDINIDAE
Iverson, 1992: 3,	TESTUDINES Linnaeus, 1758	TESTUDINIDAE Batsch, 1788
Zhao & Adler, 1993: 164, 171	TESTUDINES	TESTUDINIDAE
David 1994: 16, 18	CHELONII Brongniart, 1800	TESTUDINIDAE Batsch, 1788
Xianrui 1994: 4, 62	TESTUDINES Linnaeus, 1758	TESTUDINIDAE Gray, 1825
Richard 1999: 85	CHELONII Brongniart, 1800	TESTUDINIDAE
Boycott & Bourquin 2000: 32	CHELONIA ↔ TESTUDINES	TESTUDINIDAE
De Lapparent de Broin 2001: 166, 187	CHELONII Brongniart, 1800	TESTUDINIDAE Batsch, 1788
Noriega et al. 2000: 321	CHELONII	TESTUDINIDAE
Kuzmin 2002: 17, 84	TESTUDINES	TESTUDINIDAE Batsch, 1788
Vetter 2002: 3, 5	TESTUDINES Linnaeus, 1758	TESTUDINIDAE Batsch, 1788
Mickoleit 2004: 282, 294	CHELONIA ↔ TESTUDINES	TESTUDINIDAE
Pough et al. 2004: 97, 109	TESTUDINES ↔ CHELONIA	TESTUDINIDAE
Vetter 2004: 3, 8	TESTUDINES Linnaeus, 1758	TESTUDINIDAE Rafinesque, 1815
Vanni & Nistri 2006: 23	CHELONII Brongniart, 1800	TESTUDINIDAE Batsch, 1788
Fritz & Havaš 2006: 10, 122	TESTUDINES Batsch, 1788	TESTUDINIDAE Batsch, 1788
Vetter & van Dijk 2006: 3, 8	TESTUDINES Batsch, 1788	TESTUDINIDAE Batsch, 1788
Fritz & Havaš 2007: 163, 265	TESTUDINES Batsch, 1788	TESTUDINIDAE Batsch, 1788
Pritchard 2007: 46	CHELONII Latreille, 1800 ↔ CHELONIA Macartney, 1802 ↔ TESTUDINES [neither Linnaeus, 1758, nor Batsch, 1788]	–
Abbazzi et al. 2008: 123	CHELONII Brongniart, 1800	TESTUDINIDAE Batsch, 1788
Rhodin et al. 2008: 2, 12	TESTUDINES Batsch, 1788	TESTUDINIDAE Batsch, 1788
Rhodin et al. 2009: 42, 52	TESTUDINES Batsch, 1788	TESTUDINIDAE Batsch, 1788

**Table 2.** The supraspecific taxa of animals listed in Batsch (1788, 1789). The animals are distributed in two class-series taxa, **OSSEA** and **CRUSTACEA**, for which no ranks are given in this book; they are here referred to the rank “superclassis”. All other ranks are mentioned expressly in Batsch (1788, 1789). Nomina connected by the sign ↔ are *allelonyms* (Dubois 2006a), i.e., alternative nomina proposed by an author in the same publication for the same taxon (same content, onomatophore and taxonomic rank), without choosing between them. The generic nomina are given here under their original spelling (*protonym*; Dubois 2000), with mention between parenthesis of the subsequent spelling (*aponym*; Dubois 2000) used by Batsch, whenever relevant. All these generic nomina had been created by Linnaeus (1758) or in subsequent works published before those of Batsch, except three, followed here by the sign †, which were made nomenclaturally available by Batsch (1789), and the status of which is discussed below in Appendix 1. This appendix also discusses the status of three post-Linnean generic nomina, followed by the sign ‡, which we consider here nomenclaturally unavailable. The familial nomina created by Batsch (1788, 1789) are of three kinds: (1) a familial nomen underlined in this Table was clearly based on the nomen (also underlined) of a genus expressly referred by Batsch to the familia as a *valid* nomen, which is therefore its nucleogenus (type-genus) by implicit etymological designation (Dubois 1984), thus making this family-series nomen available under Art. 11.7.1.1; (2) a familial nomen followed by an asterisk \* can be considered derived from the nomen of a genus traditionally referred to the same taxonomic group, but not used as valid by Batsch, being probably considered a synonym of another nomen; this generic nomen is listed between square brackets, also followed by \*, after the list of the valid genera of the family according to Batsch; such a family-series nomen, being based on a generic nomen considered invalid by Batsch, is unavailable under Art. 11.7.1.1, thus shown “between quotation marks”; (3) a familial nomen followed by the sign ° is an *arhizonym* (Dubois 2006a: 178), i.e., cannot be construed as being based on a then available generic nomen and is therefore unavailable under Art. 11.7.1.1, thus also shown “between quotation marks”.

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- “Superclassis” **OSSEA** Batsch, 1788: 81.  
 Classis **MAMMALIA** Batsch, 1788: 87.  
 Ordo **BRUTA** Batsch, 1788: 103.  
 Familia “*COLOSSI*”° Batsch, 1788: 107.  
 Genera (2): *Elephas* Linnaeus, 1758: 18; *Rhinoceros* Linnaeus, 1758: 19.  
 Familia “*CATAPHRACTA*”\* Batsch, 1788: 107.  
 Genera (2): *Dasyapus* Linnaeus, 1758: 18; *Manis* Linnaeus, 1758: 18. [*Cataphractus*\* Brisson, 1762: 12–13].  
 Familia *BRADYPODA* Batsch, 1788: 108.  
 Genera (2): *Bradyapus* Linnaeus, 1758: 18; *Myrmecophaga* Linnaeus, 1758: 18.  
 Ordo **PECORA** Batsch, 1788: 103.  
 Familia “*OVINA*”\* Batsch, 1788: 105.  
 Genera (2): *Camelus* Linnaeus, 1758: 19; *Capra* Linnaeus, 1758: 19. [*Ovis*\* Linnaeus, 1758: 19].  
 Familia *CERVINA* Batsch, 1788: 105.  
 Genera (4): *Antilope* Pallas, 1766b: 232; *Bos* Linnaeus, 1758: 19; *Cervus* Linnaeus, 1758: 19; *Moschus* Linnaeus, 1758: 19.  
 Ordo **GLIRES** Batsch, 1788: 103.  
 Familia *MURINA* Batsch, 1788: 115.  
 Genus (1): *Mus* Linnaeus, 1758: 19.  
 Familia *LEPORINA* Batsch, 1788: 115.  
 Genera (4): *Cavia* Pallas, 1766b: 30; *Lepus* Linnaeus, 1758: 19; *Marmota* Blumenbach, 1779: 79; *Spalax* Gueldenstaedt, 1770: 409.  
 Familia *SCIURINA* Batsch, 1788: 115.  
 Genera (3): *Dipus* Zimmermann, 1780: 354; *Glis* Brisson, 1762: 13, 113; *Sciurus* Linnaeus, 1758: 19.  
 Familia *CASTOREA* Batsch, 1788: 115.  
 Genera (2): *Castor* Linnaeus, 1758: 19; *Hystrix* Linnaeus, 1758: 19.  
 Ordo **PRIMATES** Batsch, 1788: 103.  
 Familia “*PRIMATES*”° Batsch, 1788: 108.  
 Genera (3): *Homo* Linnaeus, 1758: 18; *Lemur* Linnaeus, 1758: 18; *Simia* Linnaeus, 1758: 18.  
 Ordo **FERAE** Batsch, 1788: 103.  
 Familia *FELINA* Batsch, 1788: 110.  
 Genus (1): *Felis* Linnaeus, 1758: 18.  
 Familia *CANINA* Batsch, 1788: 110.  
 Genera (2): *Canis* Linnaeus, 1758: 18; *Hyaena* Brisson, 1762: 13, 168.  
 Familia *URSINA* Batsch, 1788: 110.  
 Genus (1): *Ursus* Linnaeus, 1758: 18.  
 Familia *MUSTELINA* Batsch, 1788: 110.  
 Genera (3): *Lutra* Brisson, 1762: 13, 201; *Mustela* Linnaeus, 1758: 18; *Viverra* Linnaeus, 1758: 18.  
 Ordo **BELLUAE** Batsch, 1788: 103.  
 Familia “*BELLUAE*”° Batsch, 1788: 105.  
 Genera (4): *Equus* Linnaeus, 1758: 19; *Hippopotamus* Linnaeus, 1758: 19; *Hydrochoerus* Brisson, 1762: 12, 80 (as *Hydrochaerus*); *Sus* Linnaeus, 1758: 18.  
 Ordo **ROSORES** Batsch, 1788: 103.  
 Familia *TALPINA* Batsch, 1788: 113.  
 Genera (3): *Erinaceus* Linnaeus, 1758: 18; *Sorex* Linnaeus, 1758: 18; *Talpa* Linnaeus, 1758: 18.  
 Familia “*PTEROPODA*”\* Batsch, 1788: 105.  
 Genus (1): *Vespertilio* Linnaeus, 1758: 18. [*Pteropus*\* Brisson, 1762: 13, 153].



- Familia “*MARSUPIALES*”\* Batsch, 1788: 105.  
 Genus (1): *Didelphis* Linnaeus, 1758: 18 (as *Didelphys*). [“*Marsupiale*”‡; Edward in Catesby, 1771].
- Ordo PINNIPEDA Batsch, 1788: 103.  
 Familia “*PINNIPEDA*”° Batsch, 1788: 116.  
 Genera (3): *Phoca* Linnaeus, 1758: 18; *Rosmarus* Brünnichius, 1771: 34; *Trichechus* Linnaeus, 1758: 18 (as *Trichechus*).
- Ordo CETACEA Batsch, 1788: 103.  
 Familia “*CETACEA*”\* Batsch, 1788: 116.  
 Genera (4): *Balaena* Linnaeus, 1758: 19; *Delphinus* Linnaeus, 1758: 19; *Monodon* Linnaeus, 1758: 19; *Physeter* Linnaeus, 1758: 19. [*Cetus*\* Brisson, 1762: 225].
- Classis AVES Batsch, 1788: 88.  
 Familia “*ANSERES*”\* Batsch, 1788: 276.  
 Genera (11): *Alca* Linnaeus, 1758: 84; *Anas* Linnaeus, 1758: 84; *Colymbus* Linnaeus, 1758: 135; *Diomedea* Linnaeus, 1758: 84; *Larus* Linnaeus, 1758: 84; *Mergus* Linnaeus, 1758: 84; *Pelecanus* Linnaeus, 1758: 84; *Phaeton* Linnaeus, 1758: 84; *Procellaria* Linnaeus, 1758: 84; *Rynchops* Linnaeus, 1758: 138 (as *Rhynchops*); *Sterna* Linnaeus, 1758: 84. [*Anser*\* Brisson, 1760: 262].
- Familia “*GRALLAE*”\* Batsch, 1788: 276.  
 Genera (11): *Ardea* Linnaeus, 1758: 84; *Charadrius* Linnaeus, 1758: 85; *Fulica* Linnaeus, 1758: 84; *Haematopus* Linnaeus, 1758: 85; *Phoenicopterus* Linnaeus, 1758: 84; *Platalea* Linnaeus, 1758: 84; *Rallus* Linnaeus, 1758: 84; *Recurvirostra* Linnaeus, 1758: 84; *Scolopax* Linnaeus, 1758: 84; *Tantalus* Linnaeus, 1758: 84; *Tringa* Linnaeus, 1758: 84. [“*Gralla*”‡; Eberling in Sonnerat, 1777].
- Familia *STRUTHIONES* Batsch, 1788: 276.  
 Genera (3): *Didus* Linnaeus, 1766: 119; *Otis* Linnaeus, 1758: 85; *Struthio* Linnaeus, 1758: 85.
- Familia “*TENUIROSTRES*”° Batsch, 1788: 276.  
 Genera (4): *Certhia* Linnaeus, 1758: 83; *Merops* Linnaeus, 1758: 83; *Trochilus* Linnaeus, 1758: 83; *Upupa* Linnaeus, 1758: 83.
- Familia “*CUNEIROSTRES*”° Batsch, 1788: 276.  
 Genera (2): *Alcedo* Linnaeus, 1758: 83; *Picus* Linnaeus, 1758: 83.
- Familia “*GALLINAE*”\* Batsch, 1788: 276.  
 Genera (7): *Columba* Linnaeus, 1758: 85; *Crax* Linnaeus, 1758: 85; *Meleagris* Linnaeus, 1758: 85; *Numida* Linnaeus, 1764: 27; *Pavo* Linnaeus, 1758: 85; *Phasianus* Linnaeus, 1758: 85; *Tetrao* Linnaeus, 1758: 85. [*Gallus*\* Brisson, 1760: 45].
- Familia “*ACCIPITRES*”\* Batsch, 1788: 277.  
 Genera (3): *Falco* Linnaeus, 1758: 83; *Strix* Linnaeus, 1758: 83 (as *Stryx*); *Vultur* Linnaeus, 1758: 83. [*Accipiter*\* Brisson, 1760: 310].
- Familia “*LEVIROSTRES*”° Batsch, 1788: 27.  
 Genera (4): *Buceros* Linnaeus, 1758: 83; *Crotophaga* Linnaeus, 1758: 83; *Psittacus* Linnaeus, 1758: 83; *Ramphastos* Linnaeus, 1758: 83.
- Familia *CORACES* Batsch, 1788: 277 ↔ “*PASSERES*”° Batsch, 1788: 277.  
 Genera (20): *Alauda* Linnaeus, 1758: 85; *Ampelis* Linnaeus, 1766: 119; *Caprimulgus* Linnaeus, 1758: 85; *Coracias* Linnaeus, 1758: 83; *Corvus* Linnaeus, 1758: 83; *Cuculus* Linnaeus, 1758: 83; *Emberiza* Linnaeus, 1758: 85; *Fringilla* Linnaeus, 1758: 85; *Gracula* Linnaeus, 1758: 83; *Hirundo* Linnaeus, 1758: 85; *Jynx* Linnaeus, 1758: 83 (as *Iynx*); *Lanius* Linnaeus, 1758: 83; *Loxia* Linnaeus, 1758: 85; *Motacilla* Linnaeus, 1758: 85; *Oriolus* Linnaeus, 1766: 117; *Paradisaea* Linnaeus, 1758: 110; *Parus* Linnaeus, 1758: 85; *Sitta* Linnaeus, 1758: 83; *Sturnus* Linnaeus, 1758: 85; *Turdus* Linnaeus, 1758: 85.
- Classis AMPHIBIA Batsch, 1788: 88.  
 Familia *TESTUDINES* Batsch, 1788: 437.  
 Genus (1): *Testudo* Linnaeus, 1758: 196.
- Familia “*BATRACHI*”° Batsch, 1788: 437.  
 Genera (4): *Bufo* Laurenti, 1768: 25; *Hyla* Laurenti, 1768: 32; *Pipa* Laurenti, 1768: 24; *Rana* Linnaeus, 1758: 196.
- Familia “*LACERTAE*”\* Batsch, 1788: 437.  
 Genera (13): *Basiliscus* Laurenti, 1768: 50; *Caudiverbera* Laurenti, 1768: 43; *Chamaeleo* Laurenti, 1768: 45 (as *Chamaeleon*); *Cordylus* Laurenti, 1768: 51; *Crocodylus* Laurenti, 1768: 53; *Draco* Linnaeus, 1758: 196; *Gekko* Laurenti, 1768: 43; *Iguana* Laurenti, 1768: 47; *Salamandra* Laurenti, 1768: 41; *Scincus* Laurenti, 1768: 55; *Seps* Laurenti, 1768: 58; *Stellio* Laurenti, 1768: 56; *Triton* Laurenti, 1768: 37. [*Lacerta*\* Linnaeus, 1758: 196].
- Familia “*SERPENTES*”\* Batsch, 1788: 437.  
 Genera (16): *Amphisbaena* Linnaeus, 1758: 196; *Anguis* Linnaeus, 1758: 196; *Aspis* Laurenti, 1768: 105; *Boa* Linnaeus, 1758: 196; *Caecilia* Linnaeus, 1758: 229; *Caudisona* Laurenti, 1768: 92; *Cerastes* Laurenti, 1768: 81; *Cobra* Laurenti, 1768: 103; *Coluber* Linnaeus, 1758: 196; *Constrictor* Laurenti, 1768: 106; *Coronella* Laurenti, 1768: 84; *Dipsas* Laurenti, 1768: 89; *Laticauda* Laurenti, 1768: 109; *Naja* Laurenti, 1768: 90; *Natrix* Laurenti, 1768: 73; *Vipera* Laurenti, 1768: 99. [*Serpens*\* Garsault, 1764: pl. 667].
- Classis PISCES Batsch, 1788: 88.  
 Familia “*MULTIFORI*”° Batsch, 1788: 483.  
 Genera (3): *Petromyzon* Linnaeus, 1758: 196; *Raja* Linnaeus, 1758: 196; *Squalus* Linnaeus, 1758: 196.
- Familia “*MONSTROSI*”° Batsch, 1788: 483.  
 Genera (2): *Chimaera* Linnaeus, 1758: 196; *Lophius* Linnaeus, 1758: 196.
- Familia “*GLOBATI*”° Batsch, 1788: 484.  
 Genera (3): *Diodon* Linnaeus, 1758: 243; *Ostracion* Linnaeus, 1758: 243; *Tetrodon* Linnaeus, 1758: 243.
- Familia “*ARTICULATI*”° Batsch, 1788: 484.

- Genera (3): *Fistularia* Linnaeus, 1758: 243; *Pegasus* Linnaeus, 1758: 243; *Syngnathus* Linnaeus, 1758: 243.  
 Familia “*LORICATI*” Batsch, 1788: 484.  
 Genera (4): *Acipenser* Linnaeus, 1758: 196; *Centriscus* Linnaeus, 1758: 243; *Cyclopterus* Linnaeus, 1758: 242; *Loricaria* Linnaeus, 1758: 243.  
 Familia “*SPECULARES*” Batsch, 1788: 484.  
 Genera (7): *Callionymus* Linnaeus, 1758: 242 (as *Callyonimus*); *Cottus* Linnaeus, 1758: 242; *Gobius* Linnaeus, 1758: 242; *Scorpaena* Linnaeus, 1758: 242; *Trachinus* Linnaeus, 1758: 242; *Uranoscopus* Linnaeus, 1758: 242; *Zeus* Linnaeus, 1758: 242.  
 Familia “*SOLEATI*” Batsch, 1788: 484.  
 Genera (3): *Balistes* Linnaeus, 1758: 243; *Chaetodon* Linnaeus, 1758: 242; *Pleuronectes* Linnaeus, 1758: 242. [“*Solea*” †; Edwards in Catesby, 1771].  
 Familia “*FERI*” Batsch, 1788: 485.  
 Genera (11): *Coryphaena* Linnaeus, 1758: 242; *Esox* Linnaeus, 1758: 243; *Gasterosteus* Linnaeus, 1758: 242; *Labrus* Linnaeus, 1758: 242; *Mullus* Linnaeus, 1758: 243; *Perca* Linnaeus, 1758: 242; *Salmo* Linnaeus, 1758: 243; *Sciaena* Linnaeus, 1758: 242; *Scomber* Linnaeus, 1758: 243; *Sparus* Linnaeus, 1758: 242; *Trigla* Linnaeus, 1758: 243.  
 Familia “*BRACTEATI*” Batsch, 1788: 485.  
 Genera (5): *Clupea* Linnaeus, 1758: 243; *Cyprinus* Linnaeus, 1758: 243; *Exocoetus* Linnaeus, 1758: 243; *Mugil* Linnaeus, 1758: 243; *Polynemus* Linnaeus, 1758: 243.  
 Familia “*NUDI*” Batsch, 1788: 485.  
 Genera (7): *Anarhichas* Linnaeus, 1758: 242; *Blennius* Linnaeus, 1758: 242; *Cobitis* Linnaeus, 1758: 243; *Echeneis* Linnaeus, 1758: 242; *Gadus* Linnaeus, 1758: 242; *Silurus* Linnaeus, 1758: 243; *Xiphias* Linnaeus, 1758: 242.  
 Familia “*SERPENTINI*” Batsch, 1788: 485.  
 Genera (4): *Ammodytes* Linnaeus, 1758: 242; *Gymnotus* Linnaeus, 1758: 242; *Muraena* Linnaeus, 1758: 242; *Trichiurus* Linnaeus, 1758: 242.  
 “Superclassis” CRUSTACEA Batsch, 1788: 84.  
 Classis INSECTA Batsch, 1788: 89.  
 Familia “*COLEOPTERA*” Batsch, 1789: 539.  
 Genera (21): *Attelabus* Linnaeus, 1758: 342; *Buprestis* Linnaeus, 1758: 342; *Byrrhus* Linnaeus, 1766: 537; *Cantharis* Linnaeus, 1758: 342; *Carabus* Linnaeus, 1758: 342; *Cassida* Linnaeus, 1758: 342; *Cerambyx* Linnaeus, 1758: 342; *Chrysomela* Linnaeus, 1758: 342; *Cicindela* Linnaeus, 1758: 342; *Coccinella* Linnaeus, 1758: 342; *Curculio* Linnaeus, 1758: 342; *Dermestes* Linnaeus, 1758: 342; *Elater* Linnaeus, 1758: 342; *Hydrocantharus*+ Batsch, 1789: 550; *Lampyrus* Geoffroy, 1762: 165; *Mordella* Linnaeus, 1758: 342; *Necydalis* Linnaeus, 1758: 342; *Nicrophorus* Fabricius, 1775: 71; *Scarabaeus* Linnaeus, 1758: 342; *Silpha* Linnaeus, 1758: 342; *Tenebrio* Linnaeus, 1758: 342.  
 Familia “*HEMIPTERA*” Batsch, 1789: 539.  
 Genera (5): *Blatta* Linnaeus, 1758: 342; *Forficula* Linnaeus, 1758: 342; *Gryllus* Linnaeus, 1758: 342; *Meloe* Linnaeus, 1758: 342; *Staphylinus* Linnaeus, 1758: 342.  
 Familia “*NEUROPTERA*” Batsch, 1789: 539.  
 Genera (7): *Ephemera* Linnaeus, 1758: 343; *Hemerobius* Linnaeus, 1758: 343; *Libellula* Linnaeus, 1758: 543; *Myrmeleon* Linnaeus, 1767: 539 (as *Myrmeleo*); *Panorpa* Linnaeus, 1758: 343; *Phryganea* Linnaeus, 1758: 343; *Raphidia* Linnaeus, 1758: 343.  
 Familia “*HYMENOPTERA*” Batsch, 1789: 540.  
 Genera (9): *Apis* Linnaeus, 1758: 343; *Chrysis* Linnaeus, 1761: xlii; *Cynips* Linnaeus, 1758: 343; *Formica* Linnaeus, 1758: 343; *Ichneumon* Linnaeus, 1758: 343; *Sirex* Linnaeus, 1761: xli; *Sphex* Linnaeus, 1758: 343; *Tenthredo* Linnaeus, 1758: 343; *Vespa* Linnaeus, 1758: 343.  
 Familia “*DIPTERA*” Batsch, 1789: 540.  
 Genera (10): *Asilus* Linnaeus, 1758: 344 (as *Asylus*); *Bombylius* Linnaeus, 1758: 344; *Conops* Linnaeus, 1758: 344; *Culex* Linnaeus, 1758: 344; *Empis* Linnaeus, 1758: 344; *Hippobosca* Linnaeus, 1758: 344; *Musca* Linnaeus, 1758: 344; *Oestrus* Linnaeus, 1758: 344; *Tabanus* Linnaeus, 1758: 344; *Tipula* Linnaeus, 1758: 344.  
 Familia *CIMICARIA* Batsch, 1789: 540.  
 Genera (3): *Cimex* Linnaeus, 1758: 343; *Nepa* Linnaeus, 1758: 343; *Notonecta* Linnaeus, 1758: 343.  
 Familia *CICADINA* Batsch, 1789: 540.  
 Genera (6): *Aphis* Linnaeus, 1758: 343; *Chermes* Linnaeus, 1758: 343; *Cicada* Linnaeus, 1758: 343; *Coccus* Linnaeus, 1758: 343; *Fulgora* Linnaeus, 1766: 538; *Thrips* Linnaeus, 1758: 343.  
 Familia “*LEPIDOPTERA*” Batsch, 1789: 540.  
 Genera (10): *Alucita* Linnaeus, 1758: 496; *Bombyx* Linnaeus, 1758: 495; *Geometra* Linnaeus, 1758: 496; *Papilio* Linnaeus, 1758: 343; *Phalaena* Linnaeus, 1758: 343; *Pyralis* Linnaeus, 1758: 496; *Sphinx* Linnaeus, 1758: 343 (as *Sphynx*); *Tinea* Linnaeus, 1758: 496; *Tortrix* Linnaeus, 1758: 496; *Zygaena* Fabricius, 1775: 550.  
 Familia “*HEXAPODA*” Batsch, 1789: 540.  
 Genera (4): *Lepisma* Linnaeus, 1758: 344; *Pediculus* Linnaeus, 1758: 344; *Podura* Linnaeus, 1758: 344; *Pulex* Linnaeus, 1758: 344.  
 Familia “*POLYPODA*” Batsch, 1789: 540.  
 Genera (10): *Acarus* Linnaeus, 1758: 344; *Aranea* Linnaeus, 1758: 344; *Cancer* Linnaeus, 1758: 344; *Gammarus* Fabricius, 1775: 418; *Julus* Linnaeus, 1758: 344 (as *Iulus*); *Monoculus* Linnaeus, 1758: 344; *Oniscus* Linnaeus, 1758: 344; *Phalangium* Linnaeus, 1758: 344; *Scolopendra* Linnaeus, 1758: 344; *Scorpio* Linnaeus, 1758: 344.  
 Classis VERMES Batsch, 1788: 89.  
 Familia “*INTESTINA*” Batsch, 1789: 664.

- Genera (8): *Ascaris* Linnaeus, 1758: 644; *Cucullanus* Müller, 1777: pl. 38 fig. 1–7; *Echinorhynchus* Müller, 1776: 214 (as *Echinorhynchus*); *Gordius* Linnaeus, 1758: 644; *Hirudo* Linnaeus, 1758: 644; *Hydatigena* Goeze, 1782: 192; *Taenia* Linnaeus, 1758: 646; *Trichuris* Roederer, 1761: 243.
- Familia “*SETIPEDA*”° Batsch, 1789: 664.
- Genera (4): *Aphrodita* Linnaeus, 1758: 644; *Lumbricus* Linnaeus, 1758: 644; *Nais* Müller, 1771: 6; *Nereis* Linnaeus, 1758: 644.
- Familia “*UBERES*”° Batsch, 1789: 665.
- Genera (6): *Argonauta* Linnaeus, 1758: 645; *Clio* Linnaeus, 1767: 1072; *Lernaea* Linnaeus, 1758: 644; *Nautilus* Linnaeus, 1758: 645; *Scyllaea* Linnaeus, 1758: 644; *Sepia* Linnaeus, 1758: 644.
- Familia *LIMACINA* Batsch, 1789: 665.
- Genera (25): *Aplysia* Linnaeus, 1767: 1072 (as *Laplysia*); *Buccinum* Linnaeus, 1758: 645; *Bulla* Linnaeus, 1758: 645; *Cassis* Scopoli, 1777: 393; *Chiton* Linnaeus, 1758: 645; *Conus* Linnaeus, 1758: 645; *Cylindrus*+ Batsch, 1789: 692; *Cymbium* Mendes da Costa, 1776: 182; *Cypraea* Linnaeus, 1758: 645; *Doris* Linnaeus, 1758: 644; *Fasciola* Linnaeus, 1758: 644; *Haliotis* Linnaeus, 1758: 645; *Helix* Linnaeus, 1758: 645; *Limax* Linnaeus, 1758: 644; *Murex* Linnaeus, 1758: 645; *Nerita* Linnaeus, 1758: 645; *Orthoceras* Bruguière, 1789: xvi; *Patella* Linnaeus, 1758: 645; *Purpura* Bruguière, 1789: xv; *Serpula* Linnaeus, 1758: 645; *Strombus* Linnaeus, 1758: 645; *Tethys* Linnaeus, 1758: 644; *Turbo* Linnaeus, 1758: 645; *Turris*+ Batsch, 1789: 691; *Voluta* Linnaeus, 1758: 645.
- Familia “*SYPHONATA*”° Batsch, 1789: 665.
- Genera (17): *Anomia* Linnaeus, 1758: 645; *Arca* Linnaeus, 1758: 645; *Ascidia* Linnaeus, 1767: 1072; *Cardium* Linnaeus, 1758: 645; *Chama* Linnaeus, 1758: 645; *Mactra* Linnaeus, 1767: 1073; *Mya* Linnaeus, 1758: 670; *Mytilus* Linnaeus, 1758: 645; *Ostrea* Linnaeus, 1758: 645; *Pecten* Müller, 1776: 248; *Perna* Philipsson, 1788: 20; *Pholas* Linnaeus, 1758: 645; *Pinna* Linnaeus, 1758: 645; *Solen* Linnaeus, 1758: 645; *Spondylus* Linnaeus, 1758: 645; *Tellina* Linnaeus, 1758: 645; *Venus* Linnaeus, 1758: 645.
- Familia “*CRISTATA*”° Batsch, 1789: 665.
- Genera (6): *Actinia* Pallas, 1766b: 152; *Balanus* Mendes da Costa, 1778: 249; *Holothuria* Linnaeus, 1758: 644; *Lepas* Linnaeus, 1758: 645; *Medusa* Linnaeus, 1758: 644; *Triton* Linnaeus, 1758: 644.
- Familia “*CRUSTOSA*”° Batsch, 1789: 665.
- Genera (2): *Asterias* Linnaeus, 1758: 644; *Echinus* Linnaeus, 1758: 644.
- Familia “*FRONDOSA*”° Batsch, 1789: 665.
- Genera (2): *Astrophyton* Schultze, 1760: 53; *Pennatula* Linnaeus, 1758: 646.
- Familia “*POLYPINA*”° Batsch, 1789: 666.
- Genera (10): *Alcyonium* Linnaeus, 1758: 646; *Eschara* Linnaeus, 1758: 646; *Gorgonia* Linnaeus, 1758: 646; *Hydra* Linnaeus, 1758: 646; *Isis* Linnaeus, 1758: 646; *Madrepora* Linnaeus, 1758: 646; *Millepora* Linnaeus, 1758: 646; *Sertularia* Linnaeus, 1758: 646; *Spongia* Linnaeus, 1759: 1317; *Tubularia* Linnaeus, 1758: 646.
- Familia “*FIMBRIATA*”° Batsch, 1789: 666.
- Genera (3): *Brachyonus* Pallas, 1766a: 89; *Trichoda* Müller, 1773: 71; *Vorticella* Linnaeus, 1767: 1074.
- Familia “*CHAOTICA*”\* Batsch, 1789: 666.
- Genera (10): *Burfaria* Müller, 1773: 62; *Cercaria* Müller, 1773: 64; *Cyclidium* Müller, 1773: 49; *Enchelis* Müller, 1773: 33; *Gonium* Müller, 1773: 60; *Kolpoda* Müller, 1773: 56; *Monas* Müller, 1773: 25; *Paramaecium* Müller, 1773: 54; *Vibrio* Müller, 1773: 39; *Volvox* Linnaeus, 1758: 646. [*Chaos*\* Linnaeus, 1767: 1074].

**Table 3.** The family-series nomina made available in Batsch (1788, 1789), with the authors and dates traditionally credited to them in zootaxonomy. The traditional nomina of families and higher taxa given in the third and last columns are those recognized in the site of the Taxonomicon (<http://taxonomicon.taxonomy.nl/>). For the only one for which authorship and date are not given in this site, marked by an asterisk\*, we give those recognized in the site Wikipedia (<http://en.wikipedia.org/wiki/>). The publication credited in the Taxonomicon site to “Fischer de Waldheim” is actually signed by the single name “Fischer” and should be cited under this name (Dubois 2008a).

Family nomen appearing in Batsch (1788, 1789)	Nucleogenus	Nomen traditionally used for this family	Protonym of nomen traditionally used for this family	Valid nomen of this family	Traditional higher taxa: phylum, classis, ordo
<i>BRADYPODA</i> Batsch, 1788	<i>Bradypus</i> Linnaeus, 1758	<i>BRADYPODIDAE</i> Gray, 1821	<i>BRADYPODIDAE</i> Gray, 1821: 304	<i>BRADYPODIDAE</i> Batsch, 1788	<b>CHORDATA, MAMMALIA, PILOSA</b>
<i>CANINA</i> Batsch, 1788	<i>Canis</i> Linnaeus, 1758	<i>CANIDAE</i> “Fischer de Waldheim”, 1817	<i>CANINI</i> Fischer, 1817: 372	<i>CANIDAE</i> Batsch, 1788	<b>CHORDATA, MAMMALIA, CARNIVORA</b>
<i>CASTOREA</i> Batsch, 1788	<i>Castor</i> Linnaeus, 1758	<i>CASTORIDAE</i> Henrich, 1820	<i>CASTORINA</i> Henrich, 1820: 33	<i>CASTORIDAE</i> Batsch, 1788	<b>CHORDATA, MAMMALIA, RODENTIA</b>
<i>CERVINA</i> Batsch, 1788	<i>Cervus</i> Linnaeus, 1758	<i>CERVIDAE</i> Goldfuss, 1820	<i>CERVINA</i> Goldfuss, 1820: 374	<i>CERVIDAE</i> Batsch, 1788	<b>CHORDATA, MAMMALIA, ARTIODACTYLA</b>
<i>CICADINA</i> Batsch, 1789	<i>Cicada</i> Linnaeus, 1758	<i>CICADIDAE</i> Westwood, 1840	<i>CICADAE</i> Westwood, 1840: 422	<i>CICADIDAE</i> Batsch, 1789	<b>ARTHROPODA, INSECTA, HEMIPTERA</b>
<i>CIMICARIA</i> Batsch, 1789	<i>Cimex</i> Linnaeus, 1758	<i>CIMICIDAE</i> Latreille, 1802	<i>CIMICIDES</i> Latreille, 1802: 240	<i>CIMICIDAE</i> Batsch, 1789	<b>ARTHROPODA, INSECTA, HEMIPTERA</b>
<i>CORACES</i> Batsch, 1788	<i>Coracias</i> Linnaeus, 1758	<i>CORACIDAE</i> Vigors, 1825	<i>CORACIANA</i> Vigors, 1825: 399	<i>CORACIDAE</i> Batsch, 1788	<b>CHORDATA, SAUROPSIDA, CORACIFORMES</b>
<i>FELINA</i> Batsch, 1788	<i>Felis</i> Linnaeus, 1758	<i>FELIDAE</i> “Fischer de Waldheim”, 1817	<i>FELINI</i> Fischer, 1817: 372	<i>FELIDAE</i> Batsch, 1788	<b>CHORDATA, MAMMALIA, CARNIVORA</b>
<i>LEPORINA</i> Batsch, 1788	<i>Lepus</i> Linnaeus, 1758	<i>LEPORIDAE</i> “Fischer de Waldheim”, 1817	<i>LEPORINI</i> Fischer, 1817: 372	<i>LEPORIDAE</i> Batsch, 1788	<b>CHORDATA, MAMMALIA, LAGOMORPHA</b>
<i>LIMACINA</i> Batsch, 1789	<i>Limax</i> Linnaeus, 1758	<i>LIMACIDAE</i> Lamarck, 1801	<i>LIMACIERS</i> Lamarck, 1801: 62	<i>LIMACIDAE</i> Batsch, 1789	<b>MOLLUSCA, GASTROPODA, PULMONATA</b>
<i>MURINA</i> Batsch, 1788	<i>Mus</i> Linnaeus, 1758	<i>MURIDAE</i> Illiger, 1815	<i>MURINA</i> Illiger, 1815: 46	<i>MURIDAE</i> Batsch, 1788	<b>CHORDATA, MAMMALIA, RODENTIA</b>
<i>MUSTELINA</i> Batsch, 1788	<i>Mustela</i> Linnaeus, 1758	<i>MUSTELIDAE</i> “Fischer de Waldheim”, 1817	<i>MUSTELINI</i> Fischer, 1817: 372	<i>MUSTELIDAE</i> Batsch, 1788	<b>CHORDATA, MAMMALIA, CARNIVORA</b>
<i>SCIURINA</i> Batsch, 1788	<i>Sciurus</i> Linnaeus, 1758	<i>SCIURIDAE</i> “Fischer de Waldheim”, 1817	<i>SCIURI</i> Fischer, 1817: 372	<i>SCIURIDAE</i> Batsch, 1788	<b>CHORDATA, MAMMALIA, RODENTIA</b>
<i>STRUTHIONES</i> Batsch, 1788	<i>Struthio</i> Linnaeus, 1758	<i>STRUTHIONIDAE</i> “Fischer de Waldheim”, 1817	<i>STRUTHIONIDAE</i> Vigors, 1825: 402	<i>STRUTHIONIDAE</i> Batsch, 1788	<b>CHORDATA, SAUROPSIDA, STRUTHIONIFORMES</b>
<i>TALPINA</i> Batsch, 1788	<i>Talpa</i> Linnaeus, 1758	<i>TALPIDAE</i> “Fischer de Waldheim”, 1817	<i>TALPINI</i> Fischer, 1817: 372	<i>TALPIDAE</i> Batsch, 1788	<b>CHORDATA, MAMMALIA, ERINACEOMORPHA</b>
<i>TESTUDINES</i> Batsch, 1788	<i>Testudo</i> Linnaeus, 1758	<i>TESTUDINIDAE</i> Batsch, 1788*	<i>TESTUDINES</i> Batsch, 1788: 437	<i>TESTUDINIDAE</i> Batsch, 1788	<b>CHORDATA, SAUROPSIDA, TESTUDINES</b>
<i>URSINA</i> Batsch, 1788	<i>Ursus</i> Linnaeus, 1758	<i>URSIDAE</i> “Fischer de Waldheim”, 1817	<i>URSINI</i> Fischer, 1817: 372	<i>URSIDAE</i> Batsch, 1788	<b>CHORDATA, MAMMALIA, CARNIVORA</b>

## APPENDIX 2

## THE NOMENCLATURAL STATUS OF A FEW PROBLEMATIC ZOOLOGICAL NOMINA

## THE ZOOLOGICAL NOMINA CREATED IN THE BOOK OF BEHN (1760)

Klein (1751) published a comprehensive classification of his “QUADRUPEDIA”, i.e., roughly, the tetrapods without the cecilians, snakes, birds and whales. This book in Latin being pre-1758, the nomina it contains are nomenclaturally unavailable. Joyce et al. (2004) pointed out the existence of Behn’s (1760) German translation and adaptation of Klein’s (1751) book, where all the taxa and nomina of the latter work are reproduced. These post-1758 nomina would be available, with the authorship “Klein *in* Behn, 1760”, if this book had to be considered nomenclaturally available, but it should not. The nomenclatural hierarchy used in this book is unclear and inconsistent. It includes the ranks ordo (Ordnung) and familia (Familie), the taxa at these ranks being designated by uninomina (nomina consisting of a single term). The ranks used below the rank Familie are denominated in German Geschlecht, then Art, then Gattung. Considering their hierarchy and content, they could be construed to correspond respectively to the ranks tribe, genus and species, but this would probably be misleading. Each of these ranks can contain a various numbers of unnamed subranks, and the number of terms used to designate taxa is variable, from one to two and more, some of these nomina being plurinominal diagnoses borrowed without change from various pre-1758 works. This work clearly does not comply with the requirement of Article 11.4 of the *Code* for the availability of species-, genus- and family-series nomina. However, this might not preclude considering the class-series nomina in this work, or some of them, as available, since Article 11.4 implicitly states that “*this Article does not apply to the availability of names of taxa above the family group*”.

If it was possible to establish objectively where lays the separation between the family-series and the class-series nomenclature in Behn (1760), and if all these nomina were uninomina, it could be possible to recognize as available the class-series nomina proposed in this work, but this is difficult if not impossible.

The nomina of the three orders of “QUADRUPEDIA” recognized in Behn (1760) are plurinomina, as follows: (O1) “*Pilosa et Ungulata (vivipara) sive* “Ζωοτοκᾶ”; (O2) “*Pilosa et Digitata sive sint tota coriacea, sive cataphracta; omnia vivipara*”; (O3) “*Depilata, sive tecta, sive nuda, nequicquam pilosa, omnia ovipara, sive* “Ωοτοκᾶ”. Such designations are in fact diagnoses, and cannot qualify as

nomina of zoological taxa. They are unavailable in zoological nomenclature. It can be noted that, in the original text of Klein (1751), the same taxa were designated by uninomina (“UNGULATA”, “DIGITATA” and “DEPILATA”), but as this text is pre-Linnaean, these nomina also are unavailable.

In contrast, the nomina of the 13 “families” recognized by Behn (1760) are all uninomina. They are distributed as follows in the three orders: (O1) “MONOCHELON”, “DICHELON”, “TRICHELON”, “TETRACHELON” and “PENTACHELON”; (O2) “DIDACTYLON”, “TRIDACTYLON”, “TETRADACTYLON”, “PENTADACTYLON” and “ANOMALAPES” (instead of “ANOMALOPES” in Klein, 1751); (O3) “TESTUDINATA”, “CATAPHRACTA” and “NUDA”. Except possibly for one, these nomina are not based on the stems of included nominal genera. “TESTUDINATA” could be construed to be based on the stem of the only included genus of the family, *Testudo* Linnaeus, 1758, but this is highly improbable. The other twelve familial nomina are clearly based on characters that are considered diagnostic for the taxa they designate, and the nomen “TESTUDINATA” can also be understood as based on the Latin adjective *testudinatus*, meaning “of turtle, vaulted, arched”. Therefore, all nomina of “families” in Behn (1760) appear to be arhizonyms. Under the Rules of Dubois (2006a), such nomina cannot be accepted as family-series nomina and qualify as class-series nomina. This case is not unique. Other examples were discussed by Dubois (2006a, 2009) and Dubois & Ohler (2009): for example, the nomina of “families” in Ritgen (1828), which are also arhizonyms, must be treated as available class-series nomina.

However, in the case of the new familial nomina appearing in Behn (1760), difficulties would arise if they were to be treated as available class-series nomina. In the system of Dubois (2006a), the allocation of class-series nomina to taxa is made through their included (conucleogenera) and excluded (alienogenera) nominal genera, and to be usable in this respect, conucleogenera and alienogenera must be nomenclaturally available. If all the nomina of taxa just below the rank family in Behn (1760), designating taxa of rank “Geschlecht”, were considered to be genus-series nomina, part of them could not be used for taxonomic allocation of their nomina, because they are unavailable in Behn’s (1760) work. In his order (O3), corresponding to the traditional amphibians and reptiles, only three generic nomina then available are mentioned as valid nomina: *Testudo* Linnaeus, 1758 for a “Geschlecht” of his family “TESTUDINATA”; *Lacerta* Linnaeus, 1758 for a “Geschlecht” of his family “NUDA”; *Rana* Linnaeus, 1758 for an “Art” of his “Geschlecht” “*Batrachus*” (then an unavailable nomen) of his family “NUDA”; and none in his family “CATAPHRACTA”. In order to allocate the nomen “NUDA” to a class-series taxon, one would have

to take an arbitrary decision, considering that either the rank “Geschlecht” or the rank “Art” corresponds to the rank genus in the current *Code*. If the rank “Geschlecht” was considered to correspond to the rank genus, and “Art” to the rank species, the nomen “NUDA” would apply, in a modern classification, to the most inclusive taxon including the genus *Lacerta* and excluding the genus *Testudo*. But if the rank “Geschlecht” was considered to correspond to the rank tribe, and “Art” to the rank genus, the nomen “NUDA” would apply, in a modern classification, to the most inclusive taxon including the genus *Rana* and excluding all the mammalian genera, bearing then available Linnaean generic nomina, mentioned by Behn (1760) in his orders (O1) and (O2). Therefore, according to the arbitrary decision taken, the same nomen could apply to widely distinct higher taxa.

Because of these uncertainties, many other examples of which could be given, we here argue that Behn’s (1760) should not be considered as an available work in zoological nomenclature, even for class-series nomina. We suggest that this book should be invalidated as a whole by the ICZN, and that all the new nomina it contains should be considered unavailable in zoological nomenclature.

#### “*Marsupiale*” Edwards in Catesby, 1771

According to Sherborn (1902: 593), there exists a genus *Marsupiale*, based on the following reference: “G. Edwards in M. Catesby, Carol. I. 1771, xxix”. Actually this refers to Catesby (1771a: xxix), in “An account...” added by George Edwards, where the binomen *Marsupiale americanum* appears, with a diagnosis. However, this item follows another one entitled *Vulpi affinis americana* and many others where the nomenclature is not consistently binominal. Consequently the ICZN (Anonymous 1954) has suppressed the whole work (Catesby 1771a-b) for nomenclatural purposes, except for the nomina employed by Edwards in accordance with the Linnean system in his “Catalogue of the Animals and Plants” (i.e., Catesby 1771a: 1–2, 1771b: 1–2), usually referred as George Edwards’ “Appendix”.

#### “*Solea*” Edwards in Catesby, 1771

According to Sherborn (1902: 593), there exists a genus *Solea*, based on the following reference: “G. Edwards in M. Catesby, Carol. II. 1771, 27”. Actually this refers to Catesby (1771b: 27), where appears the combination *Solea lunata et punctata*, with a diagnosis and a plate; however, this is not a binomen, and therefore it has no status in nomenclature. The ICZN (Anonymous 1954) has suppressed the whole work (Catesby 1771a-b) for nomenclat-

ural purposes, except for the nomina employed by Edwards in accordance with the Linnean system in his “Catalogue of the Animals and Plants” (i.e., Catesby 1771a: 1–2, 1771b: 1–2), usually referred as George Edwards’ “Appendix”. Edwards (in Catesby 1771b: 1) linked this description with the binomen *Pleuronectes lunatus* Linnaeus, 1758.

#### “*Gralla*” Eberling in Sonnerat, 1777

According to Sherborn (1902: 431), there exists a genus *Gralla*, based on the following reference: “J. P. Ebeling in Sonnerat, Reise Neuguinea, 1777, 31”. Actually this refers to Sonnerat (1777: 31 [and 45]), where appears the combinations *gralla parra* and *gralla fulica*. Wieland (2010) admitted the nomenclatural availability of both, which he treated as binomina, and also of the genus *Gralla* Sonnerat, 1777, but with this comment: “The basic data of this taxon were not entered consulting the original description, but from secondary sources”. On the other hand, *The Richmond Index*, published by the Division of Birds at the National Museum of Natural History, Washington, D.C (Anonymous 2010), states that *Gralla* Ebeling in Sonnerat is not nomenclaturally a valid generic name: “*Gralla fulica* p. 45; *Gralla parra* p. 31, Ebeling, in Sonnerat, Reise Neu Guinea, 1777. These have no standing! being simply Ebeling’s way of writing Order *Grallae*, Genus *Fulica* + *Parra*!!”. Actually Ebeling (in Sonnerat 1777) put a capital at the start of the generic name of his binomina, but neither at *gralla parra* nor at *gralla fulica*. We follow here *The Richmond Index* statement and do not recognize the nominal genus “*Gralla* Ebeling in Sonnerat, 1777”.

#### *Cylindrus* Batsch, 1789: 692

Three homonymous nominal genera *Cylindrus* are available in zoological nomenclature: *Cylindrus* Batsch, 1789: 692; *Cylindrus* Deshayes, 1824: 236; and *Cylindrus* Fitzinger, 1833: 107.

*Cylindrus* Batsch, 1789 has apparently been ignored by all authors until now. It was introduced with a diagnosis that makes it nomenclaturally available and that clearly points to marine cone shells.

*Cylindrus* Deshayes, 1824 is an *autoneonym*\* (unjustified emendation) of *Cylinder* Denys de Montfort, 1810: 390, a nomen established for a genus of marine cone shells. Its *nucleospecies*\* (type-species) is *Conus textile* Linnaeus, 1758: 717, by original designation. The original nomen of this genus was preceded in zoological nomenclature by *Cylinder* Voet, 1793 and *Cylinder* Voet, 1806, but both

these nomina are unavailable, as published in books that are not consistently binominal. Strangely enough however, the nomen *Cylinder* Denys de Montfort, 1810 is currently not considered valid, but its autoneonym *Cylindrus* Deshayes, 1824 is so, being currently treated as a subgenus of the genus *Conus* Linnaeus, 1758 (e.g., Keen 1971; Pitt et al. 1986).

*Cylindrus* Fitzinger, 1833 was established with a single valid species included, *Pupa obtusa* Draparnaud, 1805: 63, which is therefore its nucleospecies by original specific monophory\* (monotypy). This generic nomen is currently (e.g., Frank 2006) considered valid for a genus of terrestrial snails.

The current nomenclatural situation concerning the use of the term *Cylindrus* in zoological nomenclature is not compliant with the Rules of the *Code*, for two distinct reasons: (R1) the autoneonym *Cylindrus* Deshayes, 1824 of *Cylinder* Denys de Montfort, 1810 is considered valid instead of its *archaeonym*\*, although the latter should be so, not being preoccupied by an available homonymous generic nomen; (R2) two homonymous genus-series nomina, *Cylindrus* Deshayes, 1824 and *Cylindrus* Fitzinger, 1833, are currently both considered valid in zoology, although the second one, being a junior homonym of the former, should be considered invalid (even if the former one was not so). The two nomina are listed as valid in several current online databases, but apparently never in the same one: *Cylindrus* Deshayes, 1824 appears as the valid nomen of a subgenus of *Conus* Linnaeus, 1758 in the databases *Catalogue of recent and fossil Conus* (Alan J. Kohn) [[http://biology.burke.washington.edu/conus/recordview/specieslist\\_P.html](http://biology.burke.washington.edu/conus/recordview/specieslist_P.html)], *The sea shells (Nauka Bulgarie)* [[http://theseashells.nauka.bg/Conus\\_Cylindrus\\_textile\\_textile.html](http://theseashells.nauka.bg/Conus_Cylindrus_textile_textile.html)] and Hardy's *Internet Guide to marine Gastropods* (Eddie Hardy) [[http://jeh-temp.co.uk/Taxon\\_pages/Family\\_CONIDAE\\_CONINAE.shtml](http://jeh-temp.co.uk/Taxon_pages/Family_CONIDAE_CONINAE.shtml)], whereas *Cylindrus* Fitzinger, 1833 appears as the valid nomen of a genus of terrestrial snails in the databases *Molluscs of central Europe (Dr. Vollrath Wiese, Cismar, D-23743 Grömitz-Cismar)* [<http://www.mollbase.de/list/liste.php>], *Animalbase Goettingen* [<http://www.animalbase.uni-goettingen.de/zooweb/servlet/AnimalBase/search>] and *Biolib.cz* [<http://www.biolib.cz/en/taxon/id18384>].

The rediscovery of the nomen *Cylindrus* Batsch, 1789, created for a genus of marine cone shells, allows to clarify this nomenclatural situation. We hereby designate *Conus textile* Linnaeus, 1758 as its nucleospecies (type-species). The nomen *Cylindrus* Batsch, 1789 therefore replaces both *Cylinder* Denys de Montfort, 1810 and *Cylindrus* Deshayes, 1824 as the valid nomen of the subgenus of *Conus* Linnaeus, 1758 including the latter species. As for *Cylindrus* Fitzinger, 1833, it is an invalid junior ho-

monym of both *Cylindrus* Batsch, 1789 and *Cylindrus* Deshayes, 1824 and it must be abandoned.

The homonymy between *Cylindrus* Deshayes, 1824 and *Cylindrus* Fitzinger, 1833 was pointed out by Kennard (1942), in a work that seems to have been overlooked by most subsequent authors. This author rightly concluded that the nomen *Cylindrus* Fitzinger, 1833 is invalid, and pointed to the existence of its senior objective synonym *Cochlopupa* Jan, 1830: 5. The nucleospecies of this nominal genus is *Pupa obtusa* Draparnaud 1805 by original specific monophory. The single species currently referred to the genus *Cylindrus* Fitzinger, 1833 and known as *Cylindrus obtusus*, must therefore bear the nomen *Cochlopupa obtusa* (Draparnaud, 1805).

#### ***Hydrocantharus* Batsch, 1789: 550**

The nomen *Hydrocantharus* Batsch, 1789, created for an aquatic beetle (dytiscid) is identical to several pre-1758 uses of the same nomen, which are nomenclaturally unavailable. For the same genus, Linnaeus (1758: 342) used the nomen *Dytiscus*. In this genus, he listed (p. 411–413) 15 nominal species, among which Latreille (1810: 426) designated *Dytiscus marginalis* Linnaeus, 1758: 411 as nucleospecies. We hereby designate the same nominal species as nucleospecies (type-species) of *Hydrocantharus* Batsch, 1789, which therefore becomes an invalid junior objective synonym of *Dytiscus* Linnaeus, 1758.

#### ***Turris* Batsch, 1789: 691**

A generic nomen *Turris* was created for a gastropod genus by Statius Müller (1766: 129), but this nomen is unavailable as having been published in a book invalidated by the ICZN (Anonymous 1964) as not applying the principle of binominal nomenclature. A homonymous nomen *Turris* was later created by Röding (1798: 123) also for a gastropod genus, and this nomen is currently considered valid. However, the present rediscovery of *Turris* Batsch, 1789 makes *Turris* Röding, 1798 its invalid junior synonym.

As reckoned by Winckworth (1945), the nucleospecies of *Turris* Röding, 1798 is *Murex babylonius* Linnaeus, 1758: 753, by subsequent designation of Bucquoy et al. (1883: 86). In order not to upset nomenclatural stability, we hereby designate *Murex babylonius* Linnaeus, 1758 as nucleospecies (type-species) of *Turris* Batsch, 1789. The latter must now replace its junior objective synonym *Turris* Röding, 1798 as the valid nomen of the genus.