

NOMENCLATURE

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Crocodylian Confusion: The Order-group Names *Crocodyli*, *Crocodilia*, *Crocodylia*, and the Authorship of the Family-group Name *Crocodilidae* or *Crocodylidae*

Despite years of use, the ordinal and family-group names of crocodylians continue to be misapplied and controversial. Even after attempts to clarify the nomenclature of crocodylians by Wermuth (1953) and Smith and Smith (1977), as followed by King and Burke (1989), confusion remains. My recent review of Cuvier's (1807) classic paper on the systematics of recent crocodiles revealed a serious misunderstanding by previous workers of the contents of this work that have unexpected nomenclatural repercussions. The issues involve the correct spelling of the ordinal name, emendations of several names, and the authorship of the family-group names Alligatoridae, *Crocodylidae*, and *Gavialidae*.

The generic name *Crocodylus* was first proposed by Gronovius (1763:10) and shortly thereafter Bertrand (1763:183) proposed the name *Crocodilus*. Both of these names are now unavailable, following the placement of these two works on the Official Index of Rejected Works in Zoology by the International Commission on Zoological Nomenclature (1925) and (1966) in Opinions 89 and 592, respectively. Yet, throughout the 19th and early 20th centuries Gronovius' and Bertrand's names were considered available, and Bertrand's spelling *Crocodilus* in particular was widely used. However, Gronovius' usage of *Crocodylus* in 1756 is pre-Linnaean and unavailable per the International Code of Zoological Nomenclature (International Commission of Zoological Nomenclature, 1999), hereafter the Code.

The first available generic name for crocodiles is *Crocodylus* Laurenti, 1768:53 (type species: *Crocodilus vulgaris* Cuvier, 1807 = *Crocodylus niloticus* Laurenti, 1768 by subsequent designation of Fitzinger, 1843). Scopoli (1777:463) introduced the unjustified emendation *Crocodillus* for *Crocodylus* Laurenti, 1768. As such, it is an available name and takes the same type species *Crocodilus vulgaris* Cuvier, 1807 = *Crocodylus niloticus* Laurenti, 1768. Laurenti's *Crocodylus*, as documented by Stejneger (1933), is a composite of several taxa and based *in partum* on Seba's (1724) plate 105, figs. 3–4. The type locality is given by Laurenti as East Indies and Egypt, thus the epithet *niloticus*. There is agreement

that Seba's figure 3 is of a specimen of the South American species currently known as *Paleosuchus trigonatus* (Schneider, 1801), and that Seba's fig. 4 is of a different, but unidentifiable crocodylian (Wermuth 1953; Smith and Smith 1977; King and Burke 1989).

Brown (1908) designated "*Crocodilus* [sic] *niloticus* Laur. (= *Lacerta crocodilus* Linn. part.)" as the type species. Stejneger and Barbour (1917) took a similar action by designating *Crocodylus* "*niloticus* = *Lacerta crocodilus* Linné in part" as the type species. In his 1933 paper, Stejneger clarified the latter designation as being that part of *Lacerta crocodilus* referring only to the Nile Crocodile. He did not include the taxon represented by Seba's plate 3 in his concept of *L. niloticus*, as Linnaeus (1758) did not mention that plate. These authors were apparently unaware of Fitzinger's (1843) earlier designation of *Crocodilus vulgaris* as the type species. Or perhaps they ignored that designation because *C. vulgaris* Cuvier, 1807 was not among the taxa originally included in *Crocodylus* by Laurenti (1768). However, they concluded that the type species of *Crocodylus* is the Nile Crocodile, *Crocodylus niloticus*.

In a recent paper, Van Tomme et al. (2015; hereafter TKR^[1]) raise a number of issues relating to the use of *Crocodylus* and its presumed synonym *Crocodilius*. TKR have missed several important publications (e.g., Brown 1908; Stejneger 1933) and some of their conclusions do not conform to the requirements of the Code. Among other points, they seem to think that *C. niloticus* Laurenti is based exclusively on the Seba plate, a conclusion previously rejected by Stejneger (1933). TKR confirm Stejneger's conclusion by pointing out that Laurenti almost certainly thought he was describing the Egyptian crocodile made famous by Peter Martyr d'Anghiera (1511). d'Anghiera's publication consists of three correspondence letters, in Italian, regarding his visit to Egypt. That work was translated subsequently into several other European languages. It was well known to scholars of the pre-Linnaean period because it includes a scandalous, but biologically inaccurate, account of copulation by Egyptian crocodiles.

TKR do present a reasonable suggestion (p. 23) as how to remove any ambiguity about the application of the name *Crocodylus* to the true crocodiles:

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[1] The citation of Dutch surnames bearing a prefix (e.g., Van Tomme) takes the form Van Tomme in text; however, in a bibliographic listing, the name is properly cited as Tomme, M. P. A. van. This also explains the derivation of TKR.

“We hope that the ICZN soon decides to set aside the two *Paleosuchus* individuals and then immediately replaces them with a neotype of *Crocodylus niloticus* Laurenti, 1768, which we currently and actively recommend should (in the best interests of parsimony and the preservation of general and common sense) be the individual specimen (or in this case its famous published picture) that we and the germane part of history have taken to be the lectotype of *Crocodylus vulgaris* Cuvier, 1807. This would be a good thing (preserving the predominant assumption of established usage), because when and if *Crocodylus niloticus* (the type species of *Crocodylus* Laurenti) and *Crocodylus vulgaris* (the type species of *Crocodylus* Cuvier) are both based on the same picture from 1807, then the two genus-group names (as those two historically important combinations) will become absolute synonyms because they actually share the exact same individual type specimen (the *niloticus* neotype equals the *vulgaris* lectotype), and of course also its wild from the Nile River individual provenance, which is wild (at the time when Napoleon’s army and scientists were there) near modern Luxor and ancient Thebes, Egypt.”

Several points raised by TKR warrant clarification and correction. First, the International Commission on Zoological Nomenclature (ICZN) does not make decisions unless an application is submitted upon which the commissioners may act. I urge Kischlat and Ross to prepare such an application (unfortunately Van Tomme is now deceased). Please note, as discussed below, *Crocodylus* Cuvier, 1807 is not an available generic name.

TKR indicate that Lacépède’s (1788:189) use of the name *Crocodylus* is older than any subsequent usage. That name is based on Laurenti’s *Crocodylus* and under different circumstances would stand as an incorrect subsequent emendation. Moreover, Lacépède’s work is irrelevant, as it has been placed on the Official List of Rejected Works in Zoology (1987) by the ICZN in Opinion 1463. TKR think that the first available use of *Crocodylus* for true crocodiles was by Bonnaterre (1789:32). His proposed name is definitely not an explicit emendation of Laurenti’s name, as Bonnaterre makes no reference to Laurenti. Bonnaterre’s use of *Crocodylus* is based on Lacépède’s usage (Savage 2003). The type species for Bonnaterre’s name is *Crocodylus caudiverbera* Bonnaterre, 1789 by subsequent designation of Smith and Smith (1977), a paper overlooked by TKR. As *C. caudiverbera* is not identifiable because neither the description (p. 35) nor illustration (pl. 3, fig. 1) provides diagnostic characteristics, *Crocodylus* Bonnaterre is unavailable and cannot be used as a valid name.

Neave (1939) indicates that the name *Crocodylus* was first proposed in the list of synonyms of *Lacerta crocodylus* by Gmelin (“1788,” 1789:1057) as an emendation of Gronovius’ *Crocodylus*. A name first published as a synonym is not available unless it is subsequently regarded as a valid name (Code, Article 11.6). *Crocodylus* is listed as a valid name by Brongniart (1800:89) in a paper overlooked by TKR. He includes three species in the genus: *Niloticus* (*Lac. Crocodylus* L.), *Gangeticus*, and *Alligator*. Brongniart’s action makes the generic name available and, following Article 11.6, it is to be credited to Gmelin, 1789. Cuvier’s (1817 [1816:17]) listing of the generic name as *Crocodylus* Br. is a reference to Brongniart (1800).

TKR assert that *Crocodylus* Gmelin, which is usually considered to have been published before Bonnaterre’s use, was actually published after the latter’s proposal. However, they present no evidence supporting that notion, stating only “we believe that” and

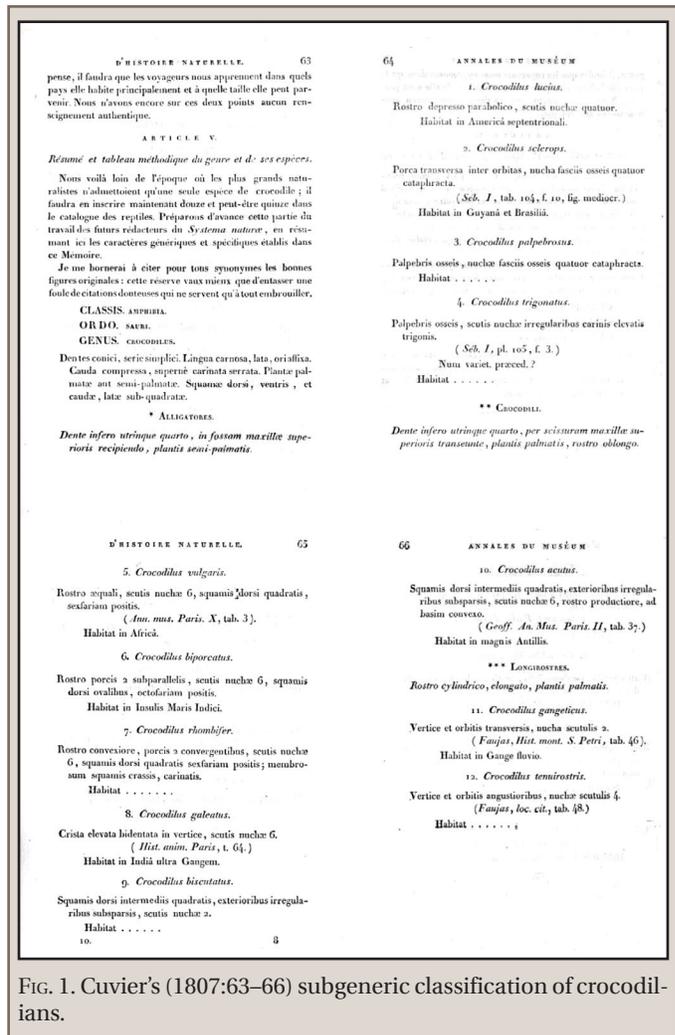


FIG. 1. Cuvier’s (1807:63–66) subgeneric classification of crocodylians.

citing a series of dates without documentation (p. 23). However, this point is moot because Bonnaterre’s name is not available because of the type species designation of Smith and Smith (1977).

TKR argue the case that the first use of the generic name *Crocodylus*, which makes it an available name, is by Merck (1785). But Merck used the name *Crocodyli Gangetici* in a footnote (3:81). The Code is very specific in Article 11.8 that a genus name must, when first proposed, be in the nominative singular. Without citing any Article in the Code, TKR (p. 25) arbitrarily convert Merck’s spelling to *Crocodylus*. They indirectly infer that such a change is allowed. However, they appear to be confusing authorship of some vernacular family-group names, which may be recognized when converted into Latin names and have been in general usage (Code, Article 11.7.2). However, that article does not apply to generic names. Under special circumstances (Code, Article 11.8), a generic name proposed as a Latin nominative plural in a Latin text may be available with its spelling corrected to the singular. In the Merck case, this does not apply as the plural *Crocodyli* is used in the German text. Consequently, Gmelin’s 1789 *Crocodylus* is the first usage of that spelling and any subsequent proposal of *Crocodylus* as a new name is preoccupied by it and is, therefore, objectively invalid (Code, Article 52.2).

Besides *Crocodylus* Gmelin, TKR list a series of usages of *Crocodylus* that they presume to be new names: *Crocodylus* Gronovius, 1756; *Crocodylus* Bertrand, 1763; *Crocodylus* (not *Crocodylus* per TKR) Meuschen, 1778; *Crocodylus* Cuvier [sic],

1788; *Crocodylus* Browne, 1789; *Crocodylus* Bonnaterre, 1789; *Crocodylus* Schneider, 1801; *Crocodylus* Latreille, in Sonnini and Latreille, 1801; and *Crocodylus* Cuvier, 1807. Of these names, *Crocodylus* Gronovius, 1756 is not available as it is a pre-Linnaean name. *Crocodylus* Meuschen, 1778 is unavailable as his work is not binominal. The works containing *Crocodylus* Bertrand, 1763, *Crocodylus* Gronovius, 1763, and *Crocodylus* Lacépède, 1788 have been suppressed by action of the ICZN and names in them are unavailable. As pointed out above, *Crocodylus* Bonnaterre is also unavailable because its type species is unidentifiable. None of the remaining names on the list is a new name, as they are not indicated as new (new, mihi, etc.) in their original usage, nor are they regarded as new by Neave (1939) in the *Nomenclator Zoologicus* or any other 19th or 20th century authors. They are based on the usage of *Crocodylus* by Gronovius, Bertrand, Gmelin, Bonnaterre, and Cuvier. TKR (p. 23) further suggest that the *Crocodylus* of Lacépède (already suppressed and unavailable), Latreille, and Schneider are *nomina oblita*, but for those names to fit into that category, action would have to be taken under Article 23.9 of the Code. Regardless, this point is moot as these names are unavailable. Lacépède's name is suppressed and the other two are not new names.

TKR also assert that the *Crocodyli* of Linnaeus (1758) and Gmelin (1789) is another new generic name that they arbitrarily convert to *Crocodylius*. However, Linnaeus does not use *Crocodyli* in his text or extensive synonymy of pre-Linnaean names for *Lacerta crocodylus*. (See the discussion of order-group names below for a clarification of the actual status of *Crocodyli* as used by Gmelin.) Finally, TKR contend (p. 26) that Gmelin's is not the 13th edition of the *Systema Naturae*. However, the ICZN (1954) in Opinion 296 recognized Gmelin's work as the official 13th edition rather than the pirate, page-for-page reprint of the 12th edition published in Vienna (1766–1768).

The family-group names *Crocodylidae* and *Alligatoridae* are cited by most authors as having been proposed by Cuvier (1807). A careful reading of that work shows that Cuvier never once used the term *famille*, *familie*, or other variants for any of his taxa. Previous workers have apparently interpreted his use of the French vernaculars, *Alligatores*, *Crocodyli*, and *Longirostres*, as being family-group names. Under Article 11.7.2 of the Code, some French vernacular family names, if later latinized and attributed to the original author, are to be considered available. However, the three names at issue are cited by Cuvier (1807:63–66) as subdivisions of the genus *Crocodylus*, ranking below genus and above species (Fig. 1). These divisions are exactly equivalent to Cuvier's subgenera *Les Caimans*, *Les Crocodiles*, and *Les Gavials*, respectively, described earlier in his monograph of crocodiles (pp. 25–28). The three afore-listed names are clearly coined French vernaculars for his subgeneric groups and cannot be considered family-group names under Article 11.7.1.2 of the Code.

The first use of the name *Alligatoridae* (type genus: *Alligator* Cuvier, 1807) consequently dates from Gray (1844:195). The situation with *Crocodylidae* is more complicated. The first use of a family-group name for crocodiles is *Crocodylini* Opperl, 1811:21 (type genus: *Crocodylus* "Linné" = *Crocodylus* Gmelin, 1789). Gray (1825:195) also proposed the name *Crocodylidae* based on *Crocodylus* Bonnaterre, 1789, but credits the generic name to Cuvier. As pointed out above, *Crocodylus* Bonnaterre is based on an unidentifiable type species and cannot be the basis for a valid family-group name. Consequently, the first use of *Crocodylidae* (as *Crocodylinae*) dates from Deraniyagala, 1930:90 (type genus:

Crocodylus Laurenti, 1768). Under Article 40.2 of the Code, this name should be cited as *Crocodylidae* Deraniyagala, 1930 (1811), with priority dating from Opperl (1811). The third family of living crocodylians is *Gavialidae* Adams, 1854:20 (type genus *Gavialis* Opperl, 1811).

According to Wermuth (1953) and Smith and Smith (1977), as followed by King and Burke (1989), the oldest available order-group name for crocodylians is *Crocodyli* Gmelin, 1789:1037. Unfortunately, that is not the case. *Crocodyli* was used by Gmelin for a subgroup of the genus *Lacerta*. It is simply a collective Latin vernacular (= crocodiles) for three species of *Lacerta*, equivalent perhaps to a species group, but without nomenclatural standing. Similar vernacular Latin names used by Gmelin for other clusters of *Lacerta* species include *Cordyli*, *Stelliones*, *Gekkones*, etc.

The first proposed order-group name for crocodylians is *Loricata* Merrem, 1820:34. That name is sometimes considered a homonym of *Loricati* Vicq-d'Azyr, 1792:82, but the latter name was proposed as a genus for armadillos. Note that Wermuth (1953) indicates that *Crocodylini* Opperl, 1811:19, is an ordinal name, but it was proposed as a family name.

Wagler (1830:130) explicitly uses *Crocodyli* as an ordinal name. Wermuth (1953) regards Wagler's usage as based on Gmelin (1789), but Wagler makes no reference to the latter work. Later ordinal-group names based on *Crocodylus* or *Crocodylus* include *Crocodylia* Owen, 1842:65, *Crocodylida* Strauch, 1866:8, *Crocodyloidea* Deraniyagala, 1939:308 (as a suborder), and *Crocodylia* Loveridge, 1945:9. Wermuth (1953:430) proposed *Crocodylia* as an emendation of *Crocodyli* Gmelin, 1789, apparently unaware of Loveridge's (1945) earlier usage of that spelling.

The Code does not stipulate that order-group names are regulated by the principle of priority or are required to have type genera. Wermuth (1953) wanted to recognize the priority of Gmelin's (1789) *Crocodyli*, but preferred an emended spelling based on *Crocodylus* and the suffix *-ia*, as in Owen's (1842) *Crocodylia*. Because *Crocodyli* Gmelin is not an order-group name, Wermuth's (1953) proposal is unjustified. Consequently, Deraniyagala's (1939) *Crocodyloidea* is the earliest order-group name based on the generic name *Crocodylus*. Inasmuch, as *Crocodylia* is now in prevailing usage, and has been for many decades, it seems best to retain that spelling and to ignore the older order name *Loricata* of Merrem (1820). The preferred citation for the order name of crocodylians, by analogy with Article 40.2 of the Code relating to family-group names, is *Crocodylia* Deraniyagala, 1939 (1830), with priority, if an issue, dating from Wagler (1830).

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