

OPINION¹

On the generic classification of the rattlesnakes, with special reference to the Neotropical *Crotalus durissus* complex (Squamata: Viperidae)

The generic-level classification of the rattlesnakes has been almost entirely stable throughout the 20th and 21st centuries: virtually all authors recognise two genera, *Sistrurus* Garman, 1884 for species with large, regular head shields, and *Crotalus* Linnaeus, 1758 for the species with fragmented head scales (STEJNEGER 1895, BOULENGER 1896, GLOYD 1940, KLAUBER 1956, CAMPBELL & LAMAR 2004). The only recent alteration has been the recognition that the taxon *Crotalus ravus* Cope, 1865, long placed in *Sistrurus* on account of its large head shields, shares a more recent common ancestor with species of *Crotalus* than with the other two *Sistrurus*, leading to its transfer to *Crotalus* (MURPHY *et al.* 2002, CAMPBELL & LAMAR 2004).

The rattlesnakes of South America and tropical Central America have consistently been placed in *Crotalus*, although the delimitation of species and subspecies within the *Crotalus durissus* complex has been a lengthy process that is still ongoing (VANZOLINI & CALLEFFO 2002, CAMPBELL & LAMAR 2004, WÜSTER *et al.* 2005).

Recently, HOSER (2009a) published a reclassification of the rattlesnakes, which included the resurrection of three previously described genera (*Aechmophrys* Coues, 1875, *Caudisona* Laurenti, 1768, and *Uropophrys* Wagler, 1830) and the description of four new genera and seven new subgenera. Hoser provided no new data or analyses, but defined his taxa on the basis of the published phylogeny of MURPHY *et al.* (2002). His actions have been ignored in most of the herpetological literature, and ZAHER *et al.* (2009) recommended against using Hoser's taxonomy.

Since 2004, the Brazilian Society of Herpetology maintains on the World Wide Web a constantly updated checklist of reptile species occurring in Brazil (BÉRNILS 2010). In order to accommodate the diversity of views among the herpetologists who cooperate in the maintenance of this checklist while maintaining the checklist as up to date as possible, it was necessary to assume a nonaligned attitude toward the adoption of taxonomic proposals as they are published monthly in the specialized literature. Consequently, every herpetological taxonomic change is immediately incorporated into the list without consideration of its merits, and is retained until its rejection in a subsequent paper. Therefore, from HOSER (2009a) to the present, the Brazilian List adopted the name *Caudisona durissa* for South American rattlesnakes, and this listing has resulted in the use of that name in non-taxonomic papers published by some Bra-

zilian herpetologists (e.g. ARAÚJO *et al.* 2010, LOEBMANN & HADDAD 2010, NOGUEIRA *et al.* 2010, OLIVEIRA *et al.* 2010, ROCHA & PRUDENTE 2010, SANTOS 2010, SOUZA *et al.* 2010; but see COSTA *et al.* 2010), as well as a number of web pages, in spite of the lack of acceptance of Hoser's proposal outside Brazil.

This situation creates a problematic artefact with unexpected consequences because of a number of problems associated with Hoser's reclassification and the recognition of *Caudisona* Laurenti. These problems relate to the question of whether *Crotalus* should be subdivided at all, whether our understanding of the phylogeny of the rattlesnakes is sufficient to allow a reclassification if it were felt to be useful, and the status of Hoser's publication under the International Code of Zoological Nomenclature (ICZN).

All the available evidence from multiple analyses of the phylogeny of the Viperidae strongly supports the monophyly of the rattlesnakes as a whole (GUTBERLET & HARVEY 2002, CASTOE & PARKINSON 2006). Moreover, several analyses have confirmed the reciprocal monophyly of *Crotalus* (including *C. ravus*) and *Sistrurus* (MURPHY *et al.* 2002, CASTOE & PARKINSON 2006). There is thus no objective phylogenetic basis for dividing either of these genera: such an act would merely disturb the stability of the nomenclature (MURPHY *et al.* 2002).

Additionally, our understanding of the phylogeny of the rattlesnakes remains insufficient to justify taxonomic action at the present time. Although Hoser's classification is based on, and thus consistent with, one published phylogeny of the rattlesnakes (MURPHY *et al.* 2002), it is inconsistent with a more recent phylogeny that included the same species (CASTOE & PARKINSON 2006). Under the latter phylogeny, three of the genera and one of the subgenera recognised by Hoser would be non-monophyletic (see also ZAHER *et al.* 2009). Moreover, in both phylogenies, many basal nodes lacked support. Even if the division of *Crotalus* were deemed desirable, the lack of consensus between recently published studies shows that we still lack the evidential basis for a robustly supported, objective splitting of.

Finally, additional problems arise from the nature of Hoser's publication. The Australasian Journal of Herpetology is published by Hoser's own publishing company, Kotabi Pty Ltd., with eight published issues since January 2009. Hoser is the journal's sole editor and remains its only author. WALLACH *et al.* (2009) analysed the availability of this publication, with par-

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ticular reference to Issue 7 (HOSER 2009b), dealing with elapids of *Naja*. The “published” issues of this periodical do not constitute published work according to the ICZN: Hoser’s claims notwithstanding, WALLACH *et al.* (2009) found no evidence for the existence of a printed edition consisting of multiple copies, as required by Article 8.1.3 of the ICZN. Only a single printed copy of Issue 7 was located, in the Australian National Library (ANL), whereas there were none for the preceding issues 1-6, including HOSER (2009a), which only seem to be available on the internet. Hard copies supplied later appear to have been printed on demand, and do not qualify as published work (Article 9.7 of the ICZN). Consequently, none of the scientific names coined by Hoser in Issues 1-7 of the Australasian Journal of Herpetology are published under the provisions of the ICZN, and all are thus unavailable. The named taxa include a number of Australasian elapids and skinks as well as cobras and rattlesnakes.

The unavailability of Hoser’s names under the ICZN does not affect the status of the name *Caudisona* Laurenti, 1768, resurrected from synonymy by him. However, it does render its recognition problematic in the context of the phylogeny of the rattlesnakes: recognition of *Caudisona* would make *Crotalus* paraphyletic in any published phylogeny. A strictly phylogenetic classification recognising *Caudisona* would therefore require the division of *Crotalus* into multiple genera, including the resurrection of *Uropsophus* and *Aechmophrys*, and would leave one or several clades in need of scientific names. Moreover, the phylogenies of MURPHY *et al.* (2002) and CASTOE & PARKINSON (2006) would have different implications for the classification of the remaining rattlesnakes if *Caudisona* were to be recognised.

In summary, we therefore recommend the continued use of the generic name *Crotalus* for the Neotropical rattlesnake, *Crotalus durissus*, as well as all other rattlesnakes not currently included in *Sistrurus*, both as the best reflection of our current understanding of the phylogeny of these animals, and as the best means for ensuring the stability of the nomenclature.

This episode also serves to illustrate how rapidly unwarranted taxonomic changes published outside the peer-reviewed scientific literature can, under some circumstances, result in unnecessary nomenclatural instability and confusion, even when the lack of merit of the proposed classification is clear to other taxonomists. It also highlights the difficulties faced by the authors of checklists in their attempts to make their lists up-to-date, yet consensual. Uncritical listing of unwarranted taxonomic work in an attempt to maintain neutrality can result in nomenclatural confusion, as shown here. On the other hand, a checklist that seeks to represent only consensus views is likely to remain severely out of date, as consensus on many taxonomic issues is often slow to arise. The problem is exacerbated by the fact that such checklists are often misinterpreted by other authors as “official” or mandatory listings (PAULY *et al.* 2009). While there can be no simple and comprehensive solution to this problem, we suggest that the best approach for such lists would be to annotate the entries of taxonomically

controversial taxa, providing a brief summary of any problems, and taking care to avoid generating a misguided perception of taxonomic certainty.

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