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Best Practices: In the 21st Century, Taxonomic Decisions in Herpetology are Acceptable Only When Supported by a Body of Evidence and Published via Peer-Review

Taxonomy, the scientific process by which natural groups are identified, described, named, and classified is an exciting research pursuit, not only because it makes an indispensable contribution to biodiversity science but, at a more basic level, because it satisfies the human enjoyment of discovery. However, taxonomy has been an area of biological science in which errors, ethical transgressions, and clashes of egos have been particularly vicious and public, harkening back to the earliest days of the binomial system of nomenclature when Linnaeus (1737) named what he considered an insignificant weed (genus *Siegesbeckia*) after Johann Georg Siegesbeck, a contemporary and very vocal critic.

Taxonomy's Impact.—Taxonomy is a fundamental component of biology because it includes the subdiscipline of biology in which organismal groups are defined and named so that they may fittingly be included in the scientific discourse. Only with precise taxonomy can biologists, and those who apply biological principles, communicate effectively (Cotterill 1997). As a consequence, dubious taxonomy undermines the underpinnings of science as a whole, with potentially serious consequences in basic and applied research. As scientists, we are fully accountable for all elements of our research, especially when our findings have broad contemporary applications. This accountability extends to the taxonomies we create or use. We also believe this responsibility includes monitoring the evidence presented as justification for taxonomic decisions. Normally, this is a key function of peer review (McPeek et al. 2009; Perry et al. 2012; Thompson 2010), but when peer review is circumvented, biologists are forced to find other means to protect the integrity of their science.

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Taxonomy in Practice.—The problem with taxonomy arises when the data used to create taxonomic decisions are shoddily presented, derive from spurious research, or lack evidence. While it is true that taxonomic decisions invariably require detailed descriptive components, when these descriptions are built into a scientific framework, they strictly conform to the scientific method; the hypothesis tested is the existing taxonomy, and this hypothesis can be falsified and reformulated (Crother 2009). To perform the tasks that should define 21st Century taxonomic science, three main steps are key: (1) Generate hypotheses of group membership (e.g., a species, a clade) or evolutionary relationship (e.g., sister taxa) based on available primary sources (e.g., existing or new collections of specimens including whole animals, tissues, and DNA sequences) and the available literature; (2) test these hypotheses via appropriate, rigorous, and honest analysis of the relevant data; and (3) submit proposed taxonomic decisions (e.g., taxonomic rearrangements, descriptions of new species, elevation of subspecies to species rank) to peer-reviewed journals in the form of manuscripts that present the data and provide a rational justification for the proposed decisions. These three responsible steps constitute the information processing system that helps to ensure that taxon names, taxon concepts, and taxonomic arrangements are properly grounded in evidence.

21st Century Developments.—In the post-2000 explosion of electronic information, the rapid publication and quick dissemination of scientific information have been prominent and generally positive trends across all research fields, including taxonomy. In keeping with these developments, the International Commission on Zoological Nomenclature (ICZN) recently amended several articles of the *International Code of Zoological Nomenclature* (hereafter referred to as the *Code*) to allow publication of nomenclatural acts solely via electronic media (ICZN 2012). However, in addition to diverse online publishing channels, universally available desktop-publishing technology has also made production of high-quality booklets, pamphlets, and even journals easy for anyone. For taxonomists, this trend is both a curse and a blessing. Even as the path to publication has been simplified and the time to publication shortened by the emergence of reputable, rigorously scientific, peer-reviewed, and well-edited electronic or rapid-print journals (e.g., *ZooKeys*, *Zootaxa*), publishing is no longer a controlled environment and there are outlets where nonscientific and misguided taxonomy is presented as fact. Differentiating between science and non-science in taxonomy is a challenge. The *Official Register of Zoological Nomenclature* (online as ZooBank) is the authoritative ICZN register for nomenclature and can legitimize registered, electronic-only publications (ICZN 2012).

The authors of this paper understand that the right to freely interpret scientific data as it relates to taxonomic decisions must remain inviolate. Furthermore, we acknowledge that as scientists, we identify provisional truths, which are the best approximations of ultimate truths that we are able to produce at the time, and which remain subject to revision and discussion. However, we see a cautionary tale in the manner by which information is disseminated in the fast-paced world of modern science. We have learned that better placed or marketed falsehoods may supplant truths in public perception. Thus, a taxonomic fact can become obscured by nonscientific information, misleading those who are unable to discern whether the information was appropriately generated. To resist such occurrences, the practice of science in general (and taxonomy in particular) first requires adherence to certain standards for generating, analyzing, and disseminating data. Scientists also need to improve information flow regarding matters of taxonomy and nomenclature, and online registration of names (ICZN 2012) may be a suitable first step. While we accept that "bad" taxonomy remains a possible outcome even when researchers follow proper procedure, we feel that it has become necessary to defend taxonomy against misguided, unscientific practices, and to develop a set of principles to guide taxonomic herpetologists in their research, with the intent to promote (to the extent possible) reliable research that contributes to scientific progress.

Does Unscientific Taxonomy Matter?

In herpetology, unscientific taxonomy, under the guise of science, has been presented with increasing frequency in nonprofessional outlets since the year 2000 (Table 1). The many taxon names proposed in these outlets can have serious negative ramifications: they destabilize taxonomy, and in so doing they confound conservation and legislative efforts, medical herpetology, academic processes, grant administration, and the public perception of herpetology as a whole. As a result, the negative practical impact of needlessly destabilizing taxonomy is likely to be more profound than any other type of fraud or error in herpetology.

Information Storage and Retrieval.—The proliferation of superfluous or dubious names can lead to a breakdown in the information storage and retrieval functions of the taxonomy. A change in the name of a genus, for instance, may lead to the establishment of parallel listings for all the species in that genus.

Professional Communication.—Fear of taxonomic piracy, where one author deliberately expropriates the naming intentions of another, creates an atmosphere of mistrust, stifles collegiality, and promotes insular research. In particular, it discourages communication about unnamed taxa, thus delaying research progress and even conservation action (Oliver and Lee 2010).

Bona fide Taxonomic Research.—Unscientific taxonomic acts have several impacts on genuine taxonomic research. For example, scientists are forced to trace unwarranted or bogus taxonomic accounts in potentially hard-to-locate publications during literature inquiries on synonyms, and they must examine type material in potentially difficult-to-access collections. This not only wastes time and resources, it dilutes legitimate taxonomy with unscientific materials. Taxonomists are relegated to "redescribing" valid taxa that were named prematurely in acts of mass naming or in deliberate acts of intellectual kleptoparasitism (e.g., Aplin and Donnellan 1999; Rawlings et al. 2008). Furthermore, graduate students may have to reformulate thesis proposals or thesis conclusions, and their subsequent publications may be redundant. Nomenclature in grant applications may conflict with unscientific taxonomic publications, resulting in needless delays to ascertain the veracity of the information. In addition, institutional managers not well versed in the details of herpetological research may be unable to follow the mix of validly and unscientifically proposed names or classifications.

Applications of Herpetological Taxonomy.—Confusion about names may cause genuine harm in endeavors relying upon accurate taxonomy of organisms. At the broadest scale, taxonomic confusion will increase the taxonomic impediment to characterizing and managing Earth's biodiversity (Wilson 1985, 2004), including the assessment and protection of threatened taxa and the direction of conservation efforts (Georges and Thomson 2010; Georges et al. 2011; Parham et al. 2006; Pillon and Chase 2007). For example, in the case of species protected by CITES or listed in the IUCN Red List of Threatened Species, dubious taxonomic changes may produce loopholes, where species remain protected according to the rules of these lists, but are not recognized by enforcement agencies. Other areas of particular concern include clinical toxinology, especially the production and use of antivenoms as treatment for the bites of venomous snakes (Fry et al. 2003; Williams et al. 2011; Wüster and McCarthy 1996). In the case of clinical toxinology this may literally be a matter of life and death, when name changes spread via media outlets by attention-seeking authors may cause uncertainty among medical personnel as to which antivenom is appropriate in cases where the name of the source snake species has changed (Sutherland 1999). Wholesale nomenclatural changes at the genus level, especially among medically important snakes, must be carefully considered (even when taxonomically justified) because of the confusion that can arise when the names of relevant species become inconsistent with the names quoted on antivenom products.

Science and the Public.—The public perception of and trust in science is eroded when decisions lacking evidence are presented as fact and permeate what is assumed to be a scientific discourse. The often-strident tone of exchanges surrounding unethical and unscientific taxonomic acts (Borrell 2007) further diminishes the entire scientific discipline in the eyes of the public. In cases where unethical behavior involves illegal activities, international relations, or other similarly sensitive dynamics, the resulting backlash can make it more difficult to conduct *bona fide* research even when good science is demonstrably needed for initiatives such as biodiversity management and conservation.

Unscientific Taxonomy, Embodied

We here present two cases to illustrate unscientific practice. These stand out in the herpetological discipline by the sheer number of taxonomic proposals presented, and the manner in which the authors use the *Code* in contravention of the spirit, if not the letter, of the rules. We use these examples as the departure point for a more general discussion of the scientific

Table 1. List of herpetofaunal taxa published on or after 1 January 2000 that can be objectively classed as unscientific, non-peer reviewed, misguided in intent or presentation, fraudulent, or lacking evidence. These names *should not be used* in herpetological nomenclature, pending suitable action by the ICZN. Instead, we urge that these names be treated as listed in the column titled Recommendations by reverting to the older name of record, or by another suitable name as indicated. To avoid confusion, in the Recommendation column we list subgenera in parentheses along with the genus name according to standard nomenclatural usage. All other capitalized, italicized names are genera. Where these recommendations are based on previously published taxonomic decisions or errors, citations and explanations are referenced as superscripts and listed at the end of the table. These recommendations are not formal nomenclatural proposals according to articles of the *Code*, but temporary treatments until the ICZN has developed a suitable response to actions of taxonomic vandals.

Taxon	Taxon Level	Citation	Recommendation
Abilenea	gen. nov.	Wells 2007c	*Aprasia*
Acanthophiina	subtrib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Acanthophis antarcticus cliffrosswellingtoni	ssp. nov.	Hoser 2002b	*Acanthophis antarcticus*
Acanthophis groenveldi	sp. nov.	Hoser 2002b	*Acanthophis laevis*
Acanthophis macgregori	sp. nov.	Hoser 2002b	*Acanthophis laevis*
Acanthophis wellsei donnellani	ssp. nov.	Hoser 2002b	*Acanthophis wellsi*
Acanthophis yuwoni	sp. nov.	Hoser 2002b	*Acanthophis laevis*
Acetyphlops	subgen. nov.	Hoser 2012as	*Typhlops*
Adelynhoserea	gen. nov.	Hoser 2012o	*Trimeresurus*
Adelynhoserserpenae	gen. nov.	Hoser 2012c	*Atropoides*
Adelynhoserserpenina	subtrib. nov.	Hoser 2012d	Viperidae, Crotalinae
Adelynhoserserpinini	trib. nov.	Hoser 2012d	Viperidae, Crotalinae
Adelynkimberleyea	gen. nov.	Hoser 2012ao	*Laudakia*
Adrasteia	gen. nov.	Wells 2002f	*Lampropholis*
Adrasteiascincus[1]	nom. nov.	Wells 2010	*Lampropholis*
Agamatajikistanensis	subgen. nov.	Hoser 2012ao	*Laudakia*
Agkistrodonini	trib. nov.	Hoser 2012d	Viperidae, Crotalinae
Agressiserpens	gen. nov.	Wells 2002d	*Acanthophis*
Aipysurini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Aiselfakharius	gen. nov.	Hoser 2012am	*Salvadora*
Alanbrygelus	subgen. nov.	Hoser 2012ah	*Tropidonophis*
Alcisius	gen. nov.	Wells 2012	*Lerista*
Alexteesus	gen. nov.	Hoser 2012ai	*Rhadinaea*
Allengreerus	gen. nov.	Hoser 2009b	*Lampropholis*
Allengreerus delicata jackyhoserae	ssp. nov.	Hoser 2012ab	*Lampropholis delicata*
Allengreerus ronhoseri	sp. nov.	Hoser 2009b	*Lampropholis delicata*
Altmantyphlops	gen. nov.	Hoser 2012as	*Typhlops*
Altmantyphlops (*Goldsteintyphlops*) *kirnerae*	sp. nov.	Hoser 2012as	*Typhlops brongersmianus*
Altmantyphlops (*Goldsteintyphlops*) *kirnerae wellingtoni*	ssp. nov.	Hoser 2012as	*Typhlops brongersmianus*
Altmantyphlops reticulatus wellsi	ssp. nov.	Hoser 2012as	*Typhlops reticulatus*
Anelytropsinae	subfam. nov.	Hoser 2012ar	Dibamidae
Anomalepididoidea	superfam. nov.	Hoser 2012as	Anomalepididae
Anomalepiini	trib. nov.	Hoser 2012as	Anomalepididae
Antaresia maculosus brentonoloughlini	ssp. nov.	Hoser 2004	*Antaresia maculosa*[2]
Antaresia saxacola campbelli	ssp. nov.	Hoser 2000a	*Antaresia stimsoni*
Antaresiina	subtrib. nov.	Hoser 2012b	*Antaresia*
Aphroditia	gen. nov.	Wells 2012	*Lerista*
Argyophiini	trib. nov.	Hoser 2012as	*Argyophis*
Arnoldtyphlops	gen. nov.	Hoser 2012as	*Typhlops*
Asianatrix	gen. nov.	Hoser 2012ah	*Amphiesma*
Aspidites melanocephalus adelynensis	ssp. nov.	Hoser 2000a	*Aspidites melanocephalus*[2]
Aspidites melanocephalus davieii	ssp. nov.	Hoser 2000a	*Aspidites melanocephalus*[2]
Aspidites melanocephalus rickjonesii	ssp. nov.	Hoser 2009a	*Aspidites melanocephalus*[2]
Aspidites ramsayi neildavieii	ssp. nov.	Hoser 2009a	*Aspidites ramsayi*[2]
Aspidites ramsayi panoptes	ssp. nov.	Hoser 2000a	*Aspidites ramsayi*[2]
Aspidites ramsayi richardjonesi	ssp. nov.	Hoser 2000a	*Aspidites ramsayi*[2]
Aspiditesina	subtrib. nov.	Hoser 2012b	*Aspidites*
Aspidomorphina	subtrib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Atractaspini	trib. nov.	Hoser 2012l	*Atractaspis*
Australiasis funki	sp. nov.	Hoser 2012b	*Morelia amethistina*
Barrygoldsmithus	gen. nov.	Hoser 2012ai	*Rhadinaea*
Billmacordus	gen. nov.	Hoser 2012as	*Gerrhopilus*
Binghamus	subgen. nov.	Hoser 2012f	*Micrurus*

Table 1. Continued

Taxon	Taxon Level	Citation	Recommendation
Bitisini	trib. nov.	Hoser 2012d	Viperidae, Viperinae
Bobbottomus	gen. nov.	Hoser 2012as	*Leptotyphlops parkeri*
Bothriechisina	subtrib. nov.	Hoser 2012d	Viperidae, Crotalinae
Bothrocophiina	subtrib. nov.	Hoser 2012d	Viperidae, Crotalinae
Bothropina	subtrib. nov.	Hoser 2012d	Viperidae, Crotalinae
Bothropoidina	subtrib. nov.	Hoser 2012d	Viperidae, Crotalinae
Broghammerini	trib. nov.	Hoser 2012b	Pythonidae
Broghammerus	gen. nov.	Hoser 2004	*Python*
Broghammerus reticulatus dalegibbonsi	ssp. nov.	Hoser 2004	*Python reticulatus reticulatus*[2]
Broghammerus reticulatus euanedwardsi	ssp. nov.	Hoser 2004	*Python reticulatus reticulatus*[2]
Broghammerus reticulatus haydenmacphiei	ssp. nov.	Hoser 2004	*Python reticulatus reticulatus*[2]
Broghammerus reticulatus neilsonnemani	ssp. nov.	Hoser 2004	*Python reticulatus reticulatus*[2]
Broghammerus reticulatus patrickcouperi	ssp. nov.	Hoser 2004	*Python reticulatus reticulatus*[2]
Broghammerus reticulatus stuartbigmorei	ssp. nov.	Hoser 2004	*Python reticulatus reticulatus*[2]
Brucerogersus	gen. nov.	Hoser 2012y	*Thamnophis*
Calloselasma	trib. nov.	Hoser 2012d	Viperidae, Crotalinae
Cannia australis aplini	ssp. nov.	Hoser 2001	*Pseudechis australis*
Cannia australis burgessi	ssp. nov.	Hoser 2001	*Pseudechis australis*
Cannia australis newmani	ssp. nov.	Hoser 2001	*Pseudechis australis*
Carettochelys insculpta canni	ssp. nov.	Wells 2002a	*Carettochelys insculpta*
Carrytyphlopea	gen. nov.	Hoser 2012as	*Ramphotyphlops*
Cerastini	trib. nov.	Hoser 2012d	Viperidae, Viperinae
Cerrophidionina	subtrib. nov.	Hoser 2012d	Viperidae, Crotalinae
Charlespiersonserpens	gen. nov.	Hoser 2012ac	*Dendrelaphis*
Charlespiersonserpens (*Downieea*) *papuensis lizelliottae*	ssp. nov.	Hoser 2012ac	*Dendrelaphis papuensis*
Charlespiersonserpens (*Macmillanus*) *jackyhoserae*	sp. nov.	Hoser 2012ac	*Dendrelaphis lorentzi*
Charlespiersonserpens gastrostictus tyeipperae	ssp. nov.	Hoser 2012ac	*Dendrelaphis gastrostictus*
Chlamydosaurus kingii mickpughi	ssp. nov.	Hoser 2012ap	*Chlamydosaurus kingii*
Chlamydosaurus kingii pughae	ssp. nov.	Hoser 2012ap	*Chlamydosaurus kingii*
Chondropython viridis adelynhoserae	ssp. nov.	Hoser 2009a	*Morelia viridis*[2]
Chondropython viridis shireenae	ssp. nov.	Hoser 2004	*Morelia viridis*[2]
Coniophanes	subgen. nov.	Hoser 2012aj	*Coniophanes*[7]
Copelandtyphlops	subgen. nov.	Hoser 2012as	*Typhlops*
Costinisauria couperi	sp. nov.	Wells 2009b	*Lampropholis couperi*
Cottonkukri	gen. nov.	Hoser 2012ag	*Oligodon*
Cottonserpens	subgen. nov.	Hoser 2012aj	*Coniophanes*
Cottontyphlopini	trib. nov.	Hoser 2012as	*Letheobia*
Cottontyphlops	gen. nov.	Hoser 2012as	*Letheobia*
Cottonus	subgen. nov.	Hoser 2009d	*Crotalus*[3,4]
Crishagenus	gen. nov.	Hoser 2012as	*Epictia*
Crocodylini	trib. nov.	Hoser 2012an	Crocodylidae
Crossmanus	subgen. nov.	Hoser 2012x	*Leptodeira*
Crotalina	subtrib. nov.	Hoser 2012d	Viperidae, Crotalinae
Crottykukrius	subgen. nov.	Hoser 2012ag	*Oligodon*
Crottyreedus	gen. nov.	Hoser 2012ak	*Calamaria*
Crottytyphlopini	trib. nov.	Hoser 2012as	Typhlopidae
Crottytyphlops	gen. nov.	Hoser 2012as	*Typhlops*
Crutchfieldus	subgen. nov.	Hoser 2009d	*Crotalus*[3,4]
Cryptophis edwardsi	sp. nov.	Hoser 2012ad	*Cryptophis nigrescens*
Cummingea	gen. nov.	Hoser 2009d	*Crotalus*[3,4]
Cybelia	gen. nov.	Wells 2012	*Lerista*
Cyclotyphlopini	trib. nov.	Hoser 2012as	*Cyclotyphlops*
Cyrilhoserini	trib. nov.	Hoser 2012as	*Gerrhopilus*
Cyrilhoserus	gen. nov.	Hoser 2012as	*Gerrhopilus*
Cyrtodactylus abrae	sp. nov.	Wells 2002c	*Cyrtodactylus tuberculatus*
Dalegibbonsus	gen. nov.	Hoser 2012ar	*Dibamus*
Dannyelfakharikukri	gen. nov.	Hoser 2012ag	*Oligodon*
Dannyleeus	subgen. nov.	Hoser 2012q	*Pareas*
Dannytyphlops	subgen. nov.	Hoser 2012as	*Typhlops*
Daraninserpens	subgen. nov.	Hoser 2012aj	*Coniophanes*

Table 1. Continued

Taxon	Taxon Level	Citation	Recommendation
Daraninus	subgen. nov.	Hoser 2012g	*Bothrops*
Daviekukri	gen. nov.	Hoser 2012ag	*Oligodon*
Demansiini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Dendroaspini	trib. nov.	Hoser 2012e	Elapidae, Elapinae
Denisonini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Desburkeus	subgen. nov.	Hoser 2012ah	*Tropidonophis*
Desmondburkeus	subgen. nov.	Hoser 2012ai	*Rhadinaea*
Dibaminae	subfam. nov.	Hoser 2012ar	Dibamidae
Dorisious	gen. nov.	Hoser 2012ac	*Boiga*
Downieea	subgen. nov.	Hoser 2012ac	*Dendrelaphis*
Dudleyserpens	subgen. nov.	Hoser 2012ai	*Rhadinaea*
Dugitophis	gen. nov.	Wells 2002e	*Pseudonaja*
Echiini	trib. nov.	Hoser 2012d	Viperidae, Crotalinae
Echiopsis curta martinekae	ssp. nov.	Hoser 2012ad	*Echiopsis curta*
Edwardstyphlops	gen. nov.	Hoser 2012as	*Typhlops*
Edwardsus	subgen. nov.	Hoser 2009d	*Crotalus*[3,4]
Eippertyphlopea	gen. nov.	Hoser 2012as	*Typhlops*
Eipperus	gen. nov.	Hoser 2012u	*Psammophis*
Eksteinus	gen. nov.	Hoser 2012z	*Lampropeltis*
Elapsoidini	trib. nov.	Hoser 2012e	Elapidae, Elapinae
Elfakhariscincus	gen. nov.	Hoser 2012aq	*Chalcides*
Elliottnatrix	gen. nov.	Hoser 2012ah	*Amphiesma*
Elliotttyphlopea	gen. nov.	Hoser 2012as	*Typhlops*
Elliottus	subgen. nov.	Hoser 2012u	*Psammophis*
Elseya dorriani	sp. nov.	Wells 2002b	*Myuchelys bellii*
Elseya jukesi	sp. nov.	Wells 2002b	*Elseya dentata*
Ephalophina	subtrib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Eristicophina	subtrib. nov.	Hoser 2012d	Viperidae, Viperinae
Euanedwardsserpens	gen. nov.	Hoser 2012p	*Coelognathus*
Evanwhittonus	gen. nov.	Hoser 2012as	*Rena*
Freudreedus	subgen. nov.	Hoser 2012ak	*Calamaria*
Freudtyphlops	gen. nov.	Hoser 2012as	*Typhlops*
Funkelapidus	gen. nov.	Hoser 2012n	*Sinomicrurus*
Funkikukri	gen. nov.	Hoser 2012ag	*Oligodon*
Funkityphlops	gen. nov.	Hoser 2012as	*Ramphotyphlops*
Funkus	gen. nov.	Hoser 2012h	*Nerodia*
Furinini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Gaia	gen. nov.	Wells 2012	*Lerista*
Gavialini	trib. nov.	Hoser 2012an	Crocodylidae
Geddykukrius	subgen. nov.	Hoser 2012ag	*Oligodon*
Gerrhopilidini	trib. nov.	Hoser 2012as	Gerrhopilidae
Gerrhopilus carolinehoserae	sp. nov.	Hoser 2012as	*Gerrhopilus hedraeus*
Ginafabaserpenae	gen. nov.	Hoser 2012x	*Leptodeira*
Gleesontyphlops	gen. nov.	Hoser 2012as	*Letheobia*
Goldneyia	gen. nov.	Wells 2012	*Lerista*
Goldsteintyphlops	subgen. nov.	Hoser 2012as	*Typhlops*
Greernatrix	gen. nov.	Hoser 2012ah	*Amphiesma*
Gregshwedoshus	gen. nov.	Hoser 2012y	*Thamnophis*
Gryptotyphlopidini	trib. nov.	Hoser 2012as	*Letheobia*
Guystebbinsus	gen. nov.	Hoser 2012aa	*Natrix*
Harrigankukriae	subgen. nov.	Hoser 2012ag	*Oligodon*
Hawkeswoodus	subgen. nov.	Hoser 2012as	*Liotyphlops*
Helioscincus	gen. nov.	Wells 2002f	*Lampropholis*
Helminthophiini	trib. nov.	Hoser 2012as	Anomalepidae
Hemachatusina	subtrib. nov.	Hoser 2012e	Elapidae, Elapinae
Hemiaspini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Homoroselapidae	fam. nov.	Hoser 2012e	*Homoroselaps*
Homoroselapiini	trib. nov.	Hoser 2012e	*Homoroselaps*
Hoplocephalina	subtrib. nov.	Hoser 2012e	Elapidae, Hydrophiinae

Table 1. Continued

Taxon	Taxon Level	Citation	Recommendation
Hoseraspea	gen. nov.	Hoser 2012l	*Atractaspis*
Hoseraspini	subtrib. nov.	Hoser 2012l	*Atractaspis*
Hoserea	gen. nov.	Hoser 2009d	*Crotalus*[3,4]
Hoserelapidea	gen. nov.	Hoser 2012f	*Micrurus*
Hoserelapidea	subgen. nov.	Hoser2012f	*Micrurus*
Hoserkukriae	gen. nov.	Hoser 2012ag	*Oligodon*
Hugheskukri	gen. nov.	Hoser 2012ag	*Oligodon*
Hulimkai	gen. nov.	Hoser 2012i	*Suta*
Hulimkini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Hydrelapini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Hydrophiina	subtrib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Jackyhoserea	gen. nov.	Hoser2012g	*Bothrops*
Jackyhoserina	subtrib. nov.	Hoser 2012d	Viperidae, Crotalinae
Jackyhoserini	trib. nov.	Hoser 2012d	Viperidae, Crotalinae
Jackyhosernatrix	gen. nov.	Hoser 2012aa	*Natrix*
Jackyindigoea	gen. nov.	Hoser 2012ao	*Laudakia*
Jackypython	subgen. nov.	Hoser 2009a	*Morelia*[2]
Jacobclarkus	subgen. nov.	Hoser 2012af	*Lycophidion*
Jockpaullus	subgen. nov.	Hoser 2012ai	*Rhadinaea*
Johnwilsontyphlops	gen. nov.	Hoser 2012as	*Ramphotyphlops*
Judywhybrowea	subgen. nov.	Hoser 2012as	*Typhlops*
Karimdaouesus	gen. nov.	Hoser 2012as	*Leptotyphlops*
Karma	gen. nov.	Wells 2009b	*Eulamprus*
Katrinahoserea	gen. nov.	Hoser 2012r	*Rhadinophis*
Katrinahoserserpenea	gen. nov.	Hoser 2012q	*Pareas*
Katrinahosertyphlopini	trib. nov.	Hoser 2012as	Typhlopidae
Katrinhosertyphlops	gen. nov.	Hoser 2012as	*Typhlops*
Katrinina	subtrib. nov.	Hoser 2012b	Pythonidae, Moreliini
Katrinus	gen. nov.	Hoser 2000a	*Liasis*[2]
Katrinus fuscus jackyae	ssp. nov.	Hoser 2004	*Liasis fuscus*[2]
Kirnerea	subgen. nov.	Hoser 2012ah	*Tropidonophis*
Kraussus	subgen. nov.	Hoser 2012as	*Liotyphlops*
Krishna	gen. nov.	Wells 2012	*Lerista*
Laidlawserpens	subgen. nov.	Hoser 2012aj	*Coniophanes*
Laidlawtyphlops	gen. nov.	Hoser 2012as	*Letheobia*
Laidlawus	subgen. nov.	Hoser 2012k	*Macrovipera*
Leiopython albertisi barkeri	ssp. nov.	Hoser 2000a	*Leiopython albertisii*[2,5]
Leiopython albertisi barkerorum	ssp. nov.	Hoser 2009a	*Leiopython albertisii*[2]
Leiopython albertisi bennetti	ssp. nov.	Hoser 2000a	*Leiopython benettorum*[2,5]
Leiopython hoserae	sp. nov.	Hoser 2000a	*Leiopython hoserae*[2,5]
Lenhosertyphlopini	trib. nov.	Hoser 2012as	*Typhlops*
Lenhosertyphlops	gen. nov.	Hoser 2012as	*Typhlops*
Lenhoserus	gen. nov.	Hoser 2000a	*Morelia*[2]
Leptotyphlopoidea	superfam. nov.	Hoser 2012as	Leptotyphlopidae
Leswilliamsus	gen. nov.	Hoser 2012ar	*Dibamus*
Libertadictiini	trib. nov.	Hoser 2012as	Typhlopidae
Lokisaurus	gen. nov.	Wells 2012	*Lerista*
Longinidis	subgen. nov.	Hoser 2012as	*Myriopholis*
Loveridgelapina	subtrib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Lukefabaserpens	gen. nov.	Hoser 2012x	*Leptodeira*
Maclachlanus	gen. nov.	Hoser 2012x	*Imantodes*
Macmillanus	subgen. nov.	Hoser 2012ac	*Dendrelaphis*
Maconchieus	gen. nov.	Hoser 2012x	*Imantodes*
Macphieus	subgen. nov.	Hoser 2012as	*Anomalepis*
Magmellia	gen. nov.	Wells 2009b	*Eulamprus*
Mariolisus	gen. nov.	Hoser 2012h	*Regina*
Marrunisauria	gen. nov.	Wells 2012	*Lerista*
Martinekea	gen. nov.	Hoser 2012m	*Orthriophis*
Martinwellstyphlopini	trib. nov.	Hoser 2012as	*Acutotyphlops*
Martinwellstyphlops	gen. nov.	Hoser 2012as	*Acutotyphlops*

Table 1. Continued

Taxon	Taxon Level	Citation	Recommendation
Maticorini	trib. nov.	Hoser 2012e	Elapidae, Elapinae
Matteoea	gen. nov.	Hoser 2009d	*Crotalus*[3,4]
Maxhoserboa	subgen. nov.	Hoser 2012w	*Eunectes*
Maxhoserini	trib. nov.	Hoser 2012as	*Ramphotyphlops*
Maxhoserus	gen. nov.	Hoser 2012as	*Ramphotyphlops*
Maxhoservipera	gen. nov.	Hoser 2012k	*Daboia*
Maxhoserviperina	subtrib. nov.	Hoser 2012d	Viperidae, Viperinae
Mecistopsini	trib. nov.	Hoser 2012an	Crocodylidae
Michaelnicholsus	subgen. nov.	Hoser 2012t	*Leioheterodon*
Micropechiina	subtrib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Micropechiini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Morelia harrisoni	sp. nov.	Hoser 2000a	*Morelia spilota harrisoni*[2]
Morelia macburniei	sp. nov.	Hoser 2004	*Morelia spilota imbricata*[2]
Morelia mippughae	sp. nov.	Hoser 2004	*Morelia spilota*[2]
Morelia wellsi	sp. nov.	Hoser 2012b	*Morelia spilota*
Moreliina	subtrib. nov.	Hoser 2012b	Pythonidae, Moreliini
Moseselfakharikukri	gen. nov.	Hoser 2012ag	*Oligodon*
Mosestyphlops	subgen. nov.	Hoser 2012as	*Typhlops*
Mullinsus	subgen. nov.	Hoser 2009d	*Crotalus*[3,4]
Mulvanyus	gen. nov.	Hoser 2012ac	*Boiga*
Najina	subtrib. nov.	Hoser 2012e	Elapidae, Elapinae, Najini[6]
Ndurascincus	gen. nov.	Wells 2002f	*Lampropholis*
Neilsimpsonus	subgen. nov.	Hoser 2012x	*Imantodes*
Neilsonnemanus	subgen. nov.	Hoser 2012y	*Thamnophis*
Nindibamus	subgen. nov.	Hoser 2012ar	*Dibamus*
Ninkukri	gen. nov.	Hoser 2012ag	*Oligodon*
Nintyphlops	gen. nov.	Hoser 2012as	*Typhlops*
Notechiina	subtrib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Notopseudonaja	gen. nov.	Wells 2002e	*Pseudonaja*
Notopseudonajini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Oceanius	gen. nov.	Wells 2007d	*Aipysurus*
Oopholis (*Philas*) *adelynhoserae*	sp. nov.	Hoser 2012an	*Crocodylus novaeguineae*
Oopholis (*Philas*) jackyhoserae	sp. nov.	Hoser 2012an	*Crocodylus johnsoni*
Ophiophagini	trib. nov.	Hoser 2012e	Elapidae, Elapinae
Ottobreus	subgen. nov.	Hoser 2012as	*Leptotyphlops*
Oxycrocodylus	gen. nov.	Hoser 2012an	*Crocodylus*
Oxykukrius	gen. nov.	Hoser 2012ag	*Oligodon*
Oxynatrix	gen. nov.	Hoser 2012ah	*Tropidonophis*
Oxynatrix	subgen. nov.	Hoser 2012ah	*Tropidonophis*
Oxyreedus	subgen. nov.	Hoser 2012ak	*Calamaria*
Oxytyphlops	gen. nov.	Hoser 2012as	*Ramphotyphlops*
Oxyuranini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Oxyuranus scutellatus adelynhoserae	ssp. nov.	Hoser 2009c	*Oxyuranus scutellatus canni*
Oxyuranus scutellatus andrewwilsoni	ssp. nov.	Hoser 2009c	*Oxyuranus scutellatus scutellatus*
Oxyuranus scutellatus barringeri	ssp. nov.	Hoser 2002a	*Oxyuranus scutellatus scutellatus*
Oxyus	gen. nov.	Hoser 2012j	*Trimeresurus*
Pailsus rossignolii	sp. nov.	Hoser 2000b	*Pseudechis rossignolii*
Panacedechis papuanus trevorhawkeswoodi	ssp. nov.	Hoser 2009c	*Pseudechis papuanus*
Parahydrophina	subtrib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Parapistocalamini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Paulwoolfinae	subfam. nov.	Hoser 2012ar	Dibamidae
Paulwoolfus	gen. nov.	Hoser 2012ar	*Dibamus*
Pelamiidae	fam. nov.	Wells 2007d	Elapidae, Hydrophiinae
Pelamiina	subtrib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Piersonina	subtrib. nov.	Hoser 2012d	Viperidae, Crotalinae
Piersontyphlops	gen. nov.	Hoser 2012as	*Ramphotyphlops*
Piersonus	gen. nov.	Hoser 2009d	*Crotalus*[3,4]
Pillotttyphlops	gen. nov.	Hoser 2012as	*Typhlops*
Pillotus	subgen. nov.	Hoser 2009d	*Crotalus*[3,4]
Placidaserpens	gen. nov.	Wells 2002e	*Pseudonaja*

Table 1. Continued

Taxon	Taxon Level	Citation	Recommendation
Plumridgeus	gen. nov.	Hoser 2012af	*Aparallactus*
Porthidiumina	subtrib. nov.	Hoser 2012d	Viperidae, Crotalinae
Proatherini	trib. nov.	Hoser 2012d	Viperidae, Viperinae
Pseudechini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Pseudechis porphyriacus eipperi	ssp. nov.	Hoser 2003d	*Pseudechis porphyriacus*
Pseudechis porphyriacus rentoni	ssp. nov.	Hoser 2003d	*Pseudechis porphyriacus*
Pseudocerastina	subtrib. nov.	Hoser 2012d	Viperidae, Viperinae
Pseudocerastini	trib. nov.	Hoser 2012d	Viperidae, Viperinae
Pseudonaja affinis charlespiersoni	ssp. nov.	Hoser 2009c	*Pseudonaja affinis*
Pseudonaja elliotti	sp. nov.	Hoser 2003c	*Pseudonaja textilis*
Pseudonaja gowi	sp. nov.	Wells 2002e	*Pseudonaja aspidorhyncha*
Pseudonaja guttata whybrowi	ssp. nov.	Hoser 2009c	*Pseudonaja guttata*
Pseudonaja textilis cliveevatti	ssp. nov.	Hoser 2009c	*Pseudonaja textilis*
Pseudonaja textilis jackyhoserae	ssp. nov.	Hoser 2009c	*Pseudonaja textilis*
Pseudonaja textilis leswilliamsi	ssp. nov.	Hoser 2009c	*Pseudonaja textilis*
Pseudonaja textilis pughi	ssp. nov.	Hoser 2003a	*Pseudonaja textilis*
Pseudonaja textilis rollinsoni	ssp. nov.	Hoser 2009c	*Pseudonaja textilis*
Pseudonajini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Pughus	subgen. nov.	Hoser 2012y	*Thamnophis*
Ramphotyplopini [sic]	trib. nov.	Hoser 2012as	*Ramphotyphlops*
Rattlewellsus	gen. nov.	Hoser 2012f	*Crotalus*
Rawlingspython	subgen. nov.	Hoser 2009a	*Antaresia*
Rayhammondus	subgen. nov.	Hoser 2012u	*Psammophis*
Rentontyphlops	gen. nov.	Hoser 2012as	*Typhlops*
Rentonus	gen. nov.	Hoser 2012ac	*Crotalus*
Rhiannodon	gen. nov.	Wells 2009b	*Glaphyromorphus*
Rhinocerophiina	subtrib. nov.	Hoser 2012d	Viperidae, Crotalinae
Richardwellsus	gen. nov.	Hoser 2012m	*Zamenis*
Robvalenticus	gen. nov.	Hoser 2012ai	*Rhadinaea*
Rolyburrellus	subgen. nov.	Hoser 2012as	*Typhlops*
Ronhoserini	trib. nov.	Hoser 2012as	Typhlopidae
Ronhoserus	gen. nov.	Hoser 2012as	*Typhlops*
Sammykukriae	subgen. nov.	Hoser 2012ag	*Oligodon*
Sayersus	subgen. nov.	Hoser 2009d	*Crotalus*[3,4]
Scanlonus	gen. nov.	Hoser 2012as	*Myriopholis*
Sharonhoserea	gen. nov.	Hoser 2012aa	*Coronella*
Shireenhoserus	gen. nov.	Hoser 2004	*Python*[2]
Simoselapini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Sinoelaphe	gen. nov.	Hoser 2012ae	*Euprepiohis*
Slatteryus	subgen. nov.	Hoser 2012u	*Psammophis*
Smythkukri	gen. nov.	Hoser 2012ag	*Oligodon*
Smythserpens	subgen. nov.	Hoser 2012aj	*Coniophanes*
Smythtyphlopini	trib. nov.	Hoser 2012as	Typhlopidae
Smythtyphlops	gen. nov.	Hoser 2012as	*Letheobia*
Smythus	subgen. nov.	Hoser 2009d	*Crotalus*[3,4]
Spectrascincus	gen. nov.	Wells 2012	*Lerista*
Spracklandus	gen. nov.	Hoser 2009e	*Naja* (*Afronaja*)[3]
Stegonotus adelynhoserae	sp. nov.	Hoser 2012s	*Stegonotus diehli*
Stegonotus lenhoseri	sp. nov.	Hoser 2012s	*Stegonotus modestus*
Stegonotus sammacdowelli	sp. nov.	Hoser 2012s	*Stegonotus parvus*
Strophurus intermedius burrelli	ssp. nov.	Hoser 2005	*Strophurus intermedius*
Sundanatrix	subgen. nov.	Hoser 2012ah	*Amphiesma*
Sutini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Swileserpens	gen. nov.	Hoser 2012t	*Buhoma*
Swileytyphlops	gen. nov.	Hoser 2012as	*Afrotyphlops*
Teesleptotyphlops	subgen. nov.	Hoser 2012as	*Leptotyphlops*
Toxicocalamina	subtrib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Trimeresurusini	trib. nov.	Hoser 2012d	Viperidae, Crotalinae
Trioanotyphlops	gen. nov.	Hoser 2012as	*Letheobia*
Troianous	subgen. nov.	Hoser 2012f	*Micrurus*

Table 1. Continued

Taxon	Taxon Level	Citation	Recommendation
Tropidechis sadlieri	sp. nov.	Hoser 2003b	*Tropidechis carinatus*
Tropidolaemusini	trib. nov.	Hoser 2012d	Viperidae, Crotalinae
Tropidonophis (*Alanbrygelus*) *alanbrygeli*	sp. nov.	Hoser 2012ah	*Tropidonophis elongatus*
Tropidonophis (*Alanbrygelus*) *alanbrygeli sammywatsonae*	ssp. nov.	Hoser 2012ah	*Tropidonophis elongatus*
Tropidonophis (*Alanbrygelus*) *smythi*	sp. nov.	Hoser 2012ah	*Tropidonophis elongatus*
Tropidonophis (*Desburkeus*) *dikkoriae desburkei*	ssp. nov.	Hoser 2012ah	*Tropidonophis doriae*
Tropidonophis multiscutellatus cottoni	ssp. nov.	Hoser 2012ah	*Tropidonophis multiscutellatus*
Tropidonophis novaeguineae trioani	ssp. nov.	Hoser 2012ah	*Tropidonophis novaeguineae*
Tropidonophis picturatus pillotti	ssp. nov.	Hoser 2012ah	*Tropidonophis picturatus*
Tychismia	gen. nov.	Wells 2012	*Lerista*
Typhlophisini	trib. nov.	Hoser 2012as	*Typhlophis*
Typhlopini	trib. nov.	Hoser 2012as	*Typhlops*
Unechis boschmai crutchfieldi	ssp. nov.	Hoser 2012ad	*Unechis boschmai*
Unechis durhami	sp. nov.	Hoser 2012ad	*Unechis nigrostriatus*
Vermicellini	trib. nov.	Hoser 2012e	Elapidae, Hydrophiinae
Wallisserpens	gen. nov.	Hoser 2012ai	*Rhadinaea*
Wellingtonnatrix	gen. nov.	Hoser 2012ah	*Amphiesma*
Wellsnatrix	gen. nov.	Hoser 2012ah	*Amphiesma*
Wellsus	gen. nov.	Hoser 2009e	*Naja* (*Uraeus*)[3]
Whittonserpens	gen. nov.	Hoser 2012aj	*Conophis*
Whybrowtyphlops	gen. nov.	Hoser 2012as	*Letheobia*
Whybrowtyplops [sic]	subgen. nov.	Hoser 2012as	*Letheobia*
Whybrowus	subgen. nov.	Hoser 2012y	*Thamnophis*
Wilsontyphlops	gen. nov.	Hoser 2012as	*Namibiana*
Wollumbinia	gen. nov.	Wells 2007a	*Myuchelys*
Wollumbinia dorsii	sp. nov.	Wells 2009a	*Myuchelys latisternum*
Wondjinia	gen. nov.	Wells 2012	*Lerista*
Woolftyphlops	gen. nov.	Hoser 2012as	*Typhlops*
Woolfvipera	subgen. nov.	Hoser 2012v	*Atheris*
Xenotyphlopidini	trib. nov.	Hoser 2012as	*Xenotyphlops*
Yeomansus	gen. nov.	Hoser 2012al	*Hierophis*
Zeusius	gen. nov.	Wells 2007b	*Cyclodomorphus*
Zeusius melanops gillami	ssp. nov.	Wells 2007b	*Cyclodomorphus m. melanops*
Zeusius melanops swani	ssp. nov.	Wells 2007b	*Cyclodomorphus m. elongatus*
Zeusius sternfeldi	sp. nov.	Wells 2007b	*Cyclodomorphus casuarinae*

[1] replacement for *Adrasteia* Wells 2002f
[2] Schleip and O'Shea (2010)
[3] Wallach et al. (2009)
[4] Wüster and Bérnils (2011)
[5] Schleip (2008)
[6] unjustified emendation of Najini Boulenger 1884
[7] preoccupied by *Coniophanes* Hallowell 1861

standards that we think should be met for acceptable taxonomic studies (and their taxonomic conclusions).

Raymond Hoser's Private Taxonomy.—Between January 2000 and September 2012, Raymond Hoser named two superfamilies, one family, three subfamilies, 89 tribes and subtribes, 113 genera, 64 subgenera, 25 species, and 53 subspecies of reptiles, including Old and New World snakes, geckos, skinks, and crocodiles (Table 1). These names constitute 76% of genera and subgenera and 16% of species and subspecies newly proposed for snakes over that time period (Uetz 2012). Hoser's invariably single-authored papers are characterized by a lack of scientific rigor and plagued by a variety of other problems, including: (1) naming of putatively allopatric populations without primary evidence, but listing the current distribution as the sole or primary distinguishing character (e.g., the diagnosis of *Oxyuranus scutellatus barringeri*—Hoser 2002a:47); (2) invention of evidence (e.g., body color of *Oxyuranus scutellatus adelynhoserae* Hoser 2009c, based on a holotype that is actually an isolated head: BMNH 1992.542); (3) repeated description of the same taxon as new (*Leiopython albertisi barkeri* Hoser 2000a = *L. a. barkerorum* Hoser 2009a = *L. a. barkerorum* Hoser 2012b; *Oxyuranus scutellatus barringeri* Hoser 2002a = *O. s. andrewwilsoni* Hoser 2009c); (4) descriptions of new species and subspecies based on morphological aberrations and vague differences in color pattern (e.g., *Acanthophis barnetti* Hoser 1998:24—diagnosed by the absence of raised supraoculars, which is merely an artifact of preservation [WW, pers. obs.], and "heavier dark pigmentation;" *Pseudonaja textilis cliveevatti* Hoser 2012i:38—diagnosed by stating that "each dorsal scale is darker brown tipped"); and (5) harvesting of clades from published phylogenetic studies for description as new genera or subgenera. For example, the division of *Natrix* into three monotypic genera (*Natrix*, *Jackyhosernatrix*, and *Guystebbinsus*) by Hoser (2012aa[1]) stems from the

[1] Due to the large number of works produced by Raymond Hoser in 2012 (N = 45), we continued the enumeration of citations by beginning the alphabet anew. Thus, in addition to Hoser (2012a–z), 19 additional references exist (Hoser 2012aa–as).

recognition of an unsupported branch in Pyron et al. (2011). Even though the use of patronyms in the naming of taxa is not a contravention of the *Code*, Hoser does not coin and assign names for the purpose of scientific need, taxonomic clarity, or improved characterization of biodiversity, but rather for personal reasons, as explained by the author in most of his etymology sections, as well as in several Internet blogs and social media environments. Hoser's genus and species names are all patronyms, and many include the author's surname (N = 43; Table 1) or the names of his relatives, employees, and even pets.

Without exception, Hoser's taxonomic decisions have been published in outlets with evaluation processes that, if they exist, are not designed to safeguard scientific rigor. Most recently, Hoser (2009a–e, 2012a–ac) has published in the *Australasian Journal of Herpetology* (*AJH*), a vehicle produced and mailed by Hoser himself, and primarily geared towards taxonomic articles of which he is the exclusive author and editor. Although the *AJH* masquerades as a scientific journal, it is perhaps better described as a printed "blog" because it lacks many of the hallmarks of formal scientific communication, and includes much irrelevant information (Ross et al. 2012). Examples of the latter include private email messages in their entirety, as well as polemics against taxonomic herpetologists (e.g., Hoser 2001:48–56; Hoser 2009a:3–21, 30; Hoser 2012a:1–34), taxonomic journals (*Zootaxa*; Hoser 2012a:15ff), wildlife officials (e.g., Hoser 2012f:12), and even judges in courts of law (e.g., Hoser 2012i:45). We maintain that *AJH* should not be considered a "public and permanent *scientific* record" and therefore fails a requirement of the *Code* (Art. 8.1.1; emphasis added) in both style and substance. The *AJH* is not a journal in the scientific sense. It is instead personally distributed by Hoser for unscientific purposes, and should therefore perhaps be best classified as advertising.

The Unscientific Taxonomic Contributions of Richard Wells.—The second case of taxonomic malpractice involves Richard Wells, who has a long history of producing scientifically controversial names, beginning with a near-wholesale alteration of the taxonomy of Australian amphibians and reptiles (Wells and Wellington 1983, 1985). Since 1 January 2000, Wells has described one family, 25 genera, seven species, and three subspecies of reptiles in a publication called *Australian Biodiversity Record*, which he alone edits and produces. Whereas some of the observations in these accounts relating to the natural history of particular taxa may qualify as scientific, the taxonomic decisions proposed by Wells (e.g., Wells 2000a–d) are without scientific merit. Like those published by Raymond Hoser, works by Wells follow the basic requirements of the *Code*, yet lack standard taxonomic data: new taxon names are supported by a diagnosis, but no justification is given for the necessity or authenticity of these names beyond the personal opinion of the author, which is often irreconcilable with published evidence (e.g., Wells 2007d). A failure to specify the material examined and a lack of comparisons with related specimens mean that the taxonomic decisions published by Wells are generally unsupported by well-established sources of evidence. This has resulted in the erection of genera based on characters with unsuitably high degrees of variation, as well as the naming of clinal variants as distinct species. In addition, type designations are often vague, precluding identification of the specimens upon which the names are based (e.g., "an adult specimen in the Australian Museum" in the case of both *Elseya jukesi* and *E. dorriani*; Wells 2002a:8). Furthermore, Wells is very active on blogs, where he has repeatedly threatened "taxonomic terrorism" should his proposals not be accepted by practicing taxonomists. In summary, while Hoser and Wells are undoubtedly knowledgeable about reptiles and could potentially make meaningful scientific contributions, both are instead producing unscientific herpetological taxonomy for apparently private purposes, based on vague descriptions, insufficient evidence, misrepresentations, and other forms of malpractice, which are defended aggressively by personal accusations and invective.

A Matter of Process.—Whereas taxonomy is considered to be a scientific endeavor, nomenclature is essentially a tool for taxonomists to stabilize the use of names corresponding to particular taxonomic findings and entities (*sensu* Mayr 1969; Simpson 1961). Nomenclature could be viewed as the language that scientists use to communicate about biological diversity, and effective communication requires the linguistic terms (in this case, taxon names) to be explicit, universal, and as stable as possible (de Queiroz and Gauthier 1994). The *Code* and the rulings of the ICZN safeguard and uphold the rules of nomenclature, but unfortunately these safeguards do not extend to the taxonomic processes by which names are established in the first place. There is currently no system in place by which the ICZN can prevent the establishment of nomenclature, and concomitant classification schemes, based on taxonomy produced by unscientific practices, including instances of "taxonomic vandalism" (Jäch 2007a,b). As ICZN commissioner Douglas Yanega expressed (Yanega 2009:423), "I think the present system by which we name species is not policed effectively and has loopholes and ambiguities. For example, scientific names can be published in journals without peer review. Although that freedom is fine, the reality effectively permits taxonomic vandals to plagiarize others or publish without scientific merit." This is an apt summary of the problems in taxonomic herpetology (and other disciplines) that are the primary focus of this article: instances where the *Code* protects names produced unscientifically, including those without sufficient evidence, justification, or privately published to bypass the peer-review process.

Best Scientific Practices for Publishing Taxonomic Decisions in Herpetology

The following guidelines, loosely modeled after those presented by the Turtle Taxonomy Working Group (2007), are a set of recommendations against which authors of taxonomic decisions in herpetology, editors of journals publishing such decisions, and anyone consulting such publications upon their release, may judge the merits of these taxonomic decisions and the methods by which they were reached. They are not intended to serve as the single binding set of rules for how taxonomic decisions should be reached, presented, and published in herpetology. However, from our point of view, taxonomic decisions that do not adhere to these best practices should be considered inadmissible to the body of scientific knowledge (and its applications).

Governance.—For any taxonomic decision that proposes a new taxon name or a change to an established one, the ultimate authority regarding nomenclature lies with the ICZN and its *Code*. To be acceptable, nomenclatural changes should be proposed not only in accordance with the requirements presented in the articles of the *Code*; they should also adhere to its spirit (as detailed in the *Introduction* to the *Code*) and its ethics (as detailed in the *Code of Ethics* of the *Code*). However, unless the ICZN formally votes on the conservation or suppression of taxon names, academic freedom governs their use and it is a judgment call of authors, editors, and readers whether a proposed name should be applied. Thus, we uphold the long-standing tradition by which taxonomy will stabilize over time by use and acceptance or invalidation and rejection in the scientific literature.

Stability.—Whereas new species will be named and taxonomic changes will periodically be necessary to reflect improved information on inferred relationships between taxa, it is ideal if taxonomists maintain concordance with existing nomenclature, and thereby retain existing classifications, to the extent possible to preserve the stability of the established system. Preservation of nomenclatural stability is one of the primary objectives of the *Code*, and even though the *Code*'s articles currently do not set stringent constraints on the naming of taxa, the lack of such constraints must not be misconstrued as license to produce taxonomies according to the letter of the *Code* yet in violation of its spirit, as demonstrated by the examples of Hoser and Wells. Taxonomists should favor nomenclatural continuity unless new, strongly supported analyses make changes unavoidable.

Species.—The biological basis for classification lies with elucidating relationships of evolutionary lineages. Thus, underpinning the presentation of taxonomic decisions are data sets that credibly and reliably assert that the group to be named is on an independent evolutionary trajectory. Names of species should not be coined merely to recognize unusual patterns of distribution or even morphology, but to identify biologically cohesive populations with recent common ancestry, no matter their distribution. The burden of evidence is high in such cases.

Higher Taxa.—Taxonomic decisions regarding taxa above the species level require particular care and demand an even higher burden of evidence, because changes in the names of higher taxa can be especially confusing and destabilizing for users of taxon names and classifications. Names of higher taxa should ordinarily only be coined when data sets reliably identify a monophyletic group containing multiple terminal taxa, although not all such clades necessarily require formal recognition. In this regard, the naming of monotypic higher taxa should be avoided as far as possible, because minimal phylogenetic knowledge is conveyed by such arrangements. However, under some circumstances the establishment of monotypic higher taxa may be justified. For example, this may be the case when an existing generic definition cannot be applied to a sister species with highly divergent morphology, which would otherwise be included in the existing genus. In general, naming of monotypic higher taxa should be avoided and names must be based on the currently available evidence irrespective of hypotheses that the taxon could be expanded in the future.

Evidence.—Information gathering in science is a careful and deliberate process, and it requires the best effort possible to produce a transparent chain of evidence based on reproducible methods. Three lines of evidence are generally accepted for the proposal and testing of taxonomic hypotheses. First, novel evidence is obtained through field and laboratory work, involving samples (e.g., whole specimens, animal parts, tissue samples) from known phenotypes collected in nature, with precisely known provenance, and associated with the obligatory documentation. These samples are deposited in institutions where their long-term curation makes them accessible to other researchers for subsequent hypothesis testing (see Cotterill 1997 on the value of biological collections).

Second, evidence should be sourced from existing samples in museum collections or from published information (e.g., GenBank), both of which are ultimately obtained as described above. In the case of museum specimens (or specimens linked to published information) whose provenance is not precisely known, or whose phenotypic characteristics were not detailed well in life, scientists know to exercise due caution to judge the merits of the material they choose to incorporate into a study.

One or (typically) both of these lines of evidence should be required for taxonomic investigations. They act as a base for further research, so that later work does not have to begin the evidence-collection process *de novo*. For example, storage of sequence data in GenBank makes these data readily available online. If no records from publicly accessible genetic databases, backed by suitable voucher specimens, are listed in support of a taxonomic decision alleged to have been derived from DNA sequence data, then the decision should be rejected. In the case of morphological studies, a standard requirement is a list of specimens of a proposed taxon and a list of the comparative material examined, with their unique identifiers (i.e., source collections and catalog numbers); therefore, if these are not cited (Cifelli and Kielan-Jaworowska 2005:651) the proposed taxonomic arrangement should be rejected. In each case, the mandated citation of the evidence ensures reproducibility, which is one of the hallmarks of science (e.g., Popper 1972).

The third line of evidence is the existing scientific literature—the body of knowledge produced prior to a new research effort. Investigation of the literature on the taxonomic group of interest can provide direction and perhaps impose constraints on proposed taxonomic changes.

Taxonomic decisions proposed in the absence of compelling supporting evidence should be inadmissible in science and in applications of scientific knowledge. Likewise, equivocal or weakly supported nodes in phylogenetic trees should not be named. Furthermore, taxonomic decisions are ideally based on consilience of multiple data sets (e.g., morphological, morphometric, bioacoustic, behavioral, molecular). In the case of cryptic species that cannot be discriminated morphologically or behaviorally, support from molecular data (e.g., mtDNA, nucDNA, cytogenetics) is usually required. The burden of evidence rests on the author(s) of taxonomic decisions, and in each paper that contains such a decision the rationale must be explicit.

This discussion of evidence would be incomplete if we omitted the next logical next step scientists should ideally take once compelling evidence about taxonomic relationships becomes available. Unresolved taxonomic inconsistencies can cause confusion and uncertainty in the literature, which is undesirable for scientists in other disciplines who rely on taxonomists for clear guidance on issues of nomenclature and taxon definition. We therefore strongly recommend that authors who present data sets with clear taxonomic implications (e.g., well-resolved and well-supported molecular phylogenies, evidence for undescribed species) follow their evidence to its taxonomic conclusion and add suitable, formal taxonomic proposals to their discussion. Additionally, an 'orphaned' data set may invite such mischief as discussed above.

Publication.—We think that proposals of taxonomic decisions invariably require a quality control assessment (i.e., peer review) by a group of qualified taxonomic herpetologists (i.e., the editors and reviewers of a particular manuscript). Proposals should take the form of carefully prepared manuscripts that outline the evidence leading to a justified conclusion. Their assessment would typically constitute the editorial process of peer-reviewed journals, during which competent scientists prepare reviews of the work. Authors and print or Internet outlets avoiding this process can readily be identified as working outside the acceptable rules of science and taxonomy.

It is our recommendation that taxonomic decisions and their concomitant nomenclatural changes are only acceptable when published in peer-reviewed scientific journals and after meeting the following criteria: (1) The investigation must follow an appropriate scientific methodology, which has to be presented in a section devoted to methods. (2) The investigation must provide a list of publically accessible specimens examined, including collection catalog numbers. (3) Publication occurs in a regularly published outlet for scientific research (i.e., not a popular science or trade magazine), available via subscription or accessible online. (4) The outlet must be supported by an editorial team (e.g., editor, associate editors) and supervised by an expert scientific panel (i.e., an editorial board), whose identities and professional affiliations are printed in each issue. (5) Ideally, the manuscript is reviewed by at least two individuals and an editor who, by their research and publication record, can objectively be considered experts in the field. (6) The publication is indexed in the *Zoological Record*, the *Science Citation Index*, or future equivalent databases. (7) If published electronically after 2011, the work must follow the parameters defined by the ICZN (2012). We further propose that the herpetological community, perhaps through the well-curated and easily accessible *Reptile Database* or *Amphibian Species of the World* and with oversight from the ICZN, electronically publish an annual list of outlets known to meet the standards above, through which acceptable taxonomic decisions can be published. New journals, or those not included in the initial listing, may follow the proposed criteria to establish a record of publishing scientifically rigorous taxonomic decisions and will be added to the list as warranted.

The Tricky Business of Working with the *Code*

Taxonomy is a unique area of science because it not only requires research (identification, description, and classification) but also bookkeeping (nomenclature). While the investigative activities are governed by the Scientific Method, bookkeeping is governed, to some extent, by the *Code*. This creates the potential for disharmony in an otherwise logical process; this disharmony is what taxonomic vandals exploit.

"Coded" Challenges.—The *Code* assists taxonomic scientists once their research is completed by providing rules for the proper administration of a name. It is here that the *Code*, grown from a scientific need, fails to adhere to the science it supports. For example, according to Article 13.1.1 of the *Code*, to become available a name must be "accompanied by a description or definition that states in words characters that are *purported to* differentiate the taxon" (ICZN 1999; emphasis added), regardless of the diagnostic utility of these characters or even their existence. Therefore, the inclusion of taxonomic characters in support of a taxonomic decision may, in practice, be viewed as only *pro forma*. Even as taxonomists endeavor to follow the evidence carefully (e.g., by listing the minutiae of species characteristics in descriptions; Mąkol and Gabryś 2005), such evidence is not required by the *Code*! Even though the gatekeepers of taxonomic science (i.e., the editors, reviewers, and users of taxonomy) may require evidence, the omission in the *Code* provides loopholes for the entrenchment of taxonomic vandals. Furthermore, the *Code*'s *Principle of Priority* (Article 23; ICZN 1999) is the dictum that governs the validity of taxon names, whether derived by proper scientific procedures or not. Consequently, taxonomy becomes prone to abuse by authors like Hoser and Wells.

The ICZN is well aware of the problem of taxonomic vandalism and the resulting destabilization of nomenclature, as exemplified above. Commissioners raise the topic regularly, and the Commission is considering how it can help promote nomenclatural stability in the face of such issues in a way that works within the limits of the *Code* and does not curtail academic freedom (E. Michel, ICZN Executive Secretary, in litt.). It is important to recognize that the purpose of the *Code* is to provide for both continuity and stability of scientific names. The *Code* "has one fundamental aim, which is to provide the maximum universality and continuity in the scientific names of animals compatible with the freedom of scientists to classify animals according to taxonomic judgments" (ICZN 1999: Introduction, line 2). Acceptance of unscientific publications, such as those discussed above, extends the freedom to name animals to people not acting as scientists, which violates the spirit of this "one fundamental aim." Although the ICZN has staunchly advocated and defended the *Principle of Priority* regarding taxonomy, exceptions exist for extraordinary circumstances: "The *Code* recognizes that the rigid application of the *Principle of Priority* may, in certain cases, upset a long-accepted name in its accustomed meaning through the validation of a little-known, or even long-forgotten, name. Therefore the rules must enable the *Principle of Priority* to be set aside on occasions when its application would be destructive of stability or universality, or would cause confusion." (Introduction, Principle 4; ICZN 1999). In the case of unscientific taxonomy, the *Principle of Priority* may be set aside due to lack of usage of a taxon name *in scientific publications*. Thus, boycotting the use of unscientific names proposed since 1 January 2000 and adhering to the recommendations we present (Table 1) will eventually permit the ICZN to rule against them, the *Principle of Priority* notwithstanding.

Items for Action

The Line in the Sand.—To defend herpetological taxonomy against unscientific incursions, we propose that the herpetological community, including authors, reviewers, editors, users of taxon names in applications, and other interested parties, set aside and *strictly avoid the use of the taxon names listed in Table 1*. These taxon names (proposed since 1 January 2000) can be objectively categorized as unscientific by the criteria we have presented. Users may follow the recommendations we present in Table 1 until the ICZN concludes its deliberations about countering the effects of taxonomic vandalism.

In practice, we suggest a two-tiered implementation of this proposal. Firstly, texts in which unscientific taxon names originate should only be cited in the scientific literature when a new taxon is being proposed to overwrite the unscientific name. Secondly, in circumstances where it is necessary to cite a text in which an unscientific name originated, authors should not use the unscientific name itself but should include a suitable explanatory statement, such as: "We follow the recommendations of Kaiser et al. (2013) and consider the name proposed by [author, year] for the taxon under investigation unscientific and unavailable."

The rationale for strict adherence to this recommendation is found in the *Code* itself. According to the *Code* (Article 23.9.1–3; ICZN 1999) it is desirable to avoid the use of names that threaten stability even when this reverses the *Principle of Priority*. This is one area of the existing *Code* where ICZN actions can favor the establishment of names generated within a genuine scientific framework. The *Code* adopts a strict stand against names (including those that could be classed as unscientific) that have not been used in "at least 25 [scientific] works, published by at least 10 authors in the immediately preceding 50 years and encompassing a span of not less than 10 years" (Article 23.9.1.2; ICZN 1999); thus, authors following best practices could legitimately create names that, under strict application of the *Code*, would amount to junior synonyms of taxa named in an unscientific manner. Unscientific names should be boycotted and scientifically sound names should be used in their place; applications requesting the suppression of unscientific names could then be filed with the ICZN after 10 years have elapsed, and the Commission would then be able to enforce the *Code*. Whilst the date of 1 January 2000 as a "line in the sand" is arbitrary, we consider it a suitably clear juncture at which to begin the rigorous defense of taxonomic integrity in herpetology.

Best Practices.—We further propose that the best practices presented above be used as a basis for framing a practical standard for the taxonomic process in herpetology that can be amended and adopted by herpetological societies and the editorial boards of scientific journals.

ICZN Action Against Taxonomic Vandalism.—We applaud the discussions held by the ICZN on how best to curb taxonomic vandalism, and we encourage the Commission to proceed with all due speed in their deliberations. Time is of the essence, especially given the recent emergence of instances (described above) where individuals have flagrantly violated the spirit of the *Code* and have used taxonomic publications as a vehicle to defame and inflict professional harm on those working within ICZN guidelines.

Censure of Taxonomic Vandals.—We further espouse the idea that emerged at the Seventh World Congress of Herpetology, that herpetological societies pass motions of censure against Raymond T. Hoser and Richard W. Wells (and any other agents of similar grievous taxonomic malpractice that may emerge) for their unwarranted and deliberate destabilization of herpetological nomenclature in the absence of evidence and peer review. We apply the term censure in the sense of *Demeter's Manual of Parliamentary Procedure* (Demeter 1969), meaning that these societies express strong disapproval while allowing the opportunity for those censured to subsequently reform. As of this writing, the British Herpetological Society (BHS) and the Deutsche Gesellschaft für Herpetologie und Terrarienkunde (DGHT) have adopted resolutions to censure Hoser and Wells.

The ideas we present have received broad support from herpetological taxonomists and others with an interest in herpetology (see *Acknowledgments*), and the authors have received formal support from the American Society of Ichthyologists and Herpetologists (per email vote taken by the society's Executive Committee), the Australian Society of Herpetologists (per unanimous Annual General Meeting vote), the BHS (per unanimous Council Meeting vote), the Chinese Herpetological Society (per decision by the society's Standing Council), the DGHT (per Peter Buchert, President; Axel Kwet, Vice President; Jörn Köhler, Chief Editor of *Salamandra*), The Herpetologists' League (per Board of Trustees vote), the Societas Europaea Herpetologica (per decision by the society's Council: Claudia Corti, President; Uwe Fritz, Vice President; Anna Rita Di Cerbo, General Secretary; Wolfgang Böhme, Ordinary Member), the Society for Research on Amphibians and Reptiles in New Zealand (per unanimous Annual General Meeting vote), and the World Congress of Herpetology (per Executive Committee vote) to endorse the Point of View presented here. In addition, the Committee of the Herpetological Association of Africa has expressed its opposition to taxonomic vandalism and has endorsed ethically conducted, scientifically sound taxonomic practices similar to those presented in our Best Practices section. The Crocodile Specialist Group also supports our Point of View, specifically the call to avoid the use of taxon names produced by the type of "vanity publishing" perpetrated by Hoser and Wells (Ross et al. 2012).

Last, it is our hope that the model we present here to safeguard herpetological taxonomy (combining best taxonomic practices, ICZN support, self-policing by authors, reviewers, and editors, and society action) may emerge as a workable solution for other zoological disciplines facing similar challenges.

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