

## **The Taxon Filter, a novel mechanism designed to facilitate the relationship between taxonomy and nomenclature, vis-à-vis the utility of the *Code's* Article 81 (the Commission's plenary power)**

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The *International Code of Zoological Nomenclature* (ICZN, 1999; hereafter the *Code*) has one fundamental aim: 'to promote stability and universality in the scientific names of animals and to ensure that the name of each taxon is unique and distinct. All its provisions and recommendations are subservient to those ends and none restricts the freedom of taxonomic thought or actions.' (Preamble of the 4th edition of the *Code*; ICZN, 1999). To be clear: in its pursuit of this aim the *Code* is not an evidence-based scientific system, let alone a taxonomic method. It is, I would suggest, an accounting system akin to those used in finance, defined for this purpose as 'a system of collection, storage, and processing of [taxonomic] data that is used by decision makers' (Atabaki & Khanmohammad, 2013, p. 41). Such a system is by design based on general principles, receiving input from those engaged in taxonomic science. However, even if the science of taxonomy is distinct from the nonscientific realm of nomenclature, the two intersect every time information from the former is passed to the latter. In order to ensure that the system of nomenclature (e.g. Dubois, 2005) is perpetually meaningful to the scientific endeavour, logic dictates that its input from taxonomy must be evidence-based, and follow established scientific methodology (e.g. Popper, 1972; Simon et al., 2012) or 'best practice' (e.g. Dubois, 2005; Kaiser et al., 2013). Unfortunately, at its important intersection with science, the *Code* does not regulate the specifics for how taxonomic input should be generated, received, admitted, or incorporated into nomenclature.

The assumption that taxonomists produce knowledge based on a trail of evidence according to the scientific method (e.g. Popper, 1972), a hypothetico-deductive approach to the assembly of knowledge that includes repeatability and that has been refined and tested over more than two centuries, is so basic that it is hardly ever thought of when scientists make their findings available to a broader audience. This methodology is the key underpinning of how science finds knowledge, and it is what keeps science, and scientists, accountable. In my opinion, the requirement of evidence is also a critical aspect of what differentiates taxonomic science from other intellectual pursuits, such as literature, philosophy, or theology. Science and scientists are necessarily constrained by evidence in their work; there is no 'free speech' when it comes to generating, interpreting, and reporting the facts to which the evidence leads. The term 'free speech' is here used as in the *Universal Declaration of Human Rights* (United Nations General Assembly, 1948), according to which a person has an unfettered right to state their ideas and opinions, no matter whether these opinions are correct or false. While scientists are certainly able to select their form of literal expression, they are always limited by the scope of their findings.

It nevertheless happens on occasion that scientific misconduct is uncovered, such as when individuals knowingly (or unwittingly) usurp the position of scientists and by their actions and production compromise the integrity of scientific research (e.g. through mistakes, plagiarism, falsification or fabrication of data, intellectual theft, or violation of scientific principles; see Bouville, 2008; Fanelli, 2009). Such practices are usually identified quickly, dealt with harshly, and condemned universally. These are not, however, practices prohibited by the *Code*. A new taxon name or its accompanying description may be plagiarized, stolen, or contain false information (e.g. a description that an organism is red with black spots, when the type specimen is actually blue with white spots) without rendering the name unavailable even if it is later found to be based on scientific misconduct. This is not a matter of carelessness, resulting in poor taxonomy, incomplete evidence, deficient protocols or error-prone interpretations (all of which can happen to the best of taxonomists); it is the trouble with the promulgation of honest errors requiring correction, or the premeditated communication of a deceit in science. I here present my thoughts on what can happen when the *Code's* integrity is compromised by scientific misconduct or honest error, and I present a novel solution for how to deal with such a scenario.

### **Trouble in Herpetology**

In taxonomic herpetology there has recently been a troubling development with the emergence of what I qualify as pseudoscientific works, in which taxonomic decisions are reported whose methodology fails on the basic scientific principles described above, or based on modern concepts of publication in science (i.e. demonstrated scientific methodology including a list of specimens examined, scientific publication outlet, peer review with inclusion of editorial oversight; see Kaiser et al., 2013). In a textbook definition,

'Pseudoscience attempts to look like actual science so that its assertions might appear valid. However, unlike science, pseudoscience begins with a claim and looks only for things that support it. Controlled experiments are never done. In fact, direct tests of any kind even if possible, are generally avoided. Pseudoscience is indifferent to facts and tries to persuade with appeals to emotion, sentiment, or distrust of established knowledge. Unlike real science, pseudoscience does not progress; nothing is revised or learned.'

(Bozzone & Green, in press).

These pseudoscientific works also run afoul of the *Code of Ethics* appended to the *Code*.

Recently, Australian snake enthusiast Raymond Hoser has presented over 500 new taxon names in 20 issues of his self-edited and probably non-peer reviewed *Australasian Journal of Herpetology (AJH)*; Hoser is invariably the only author. A significant portion of the herpetological community has supported the suggestions put forward by Kaiser et al. (2013) in response to Hoser's actions, but there is a broader question of how and whether the scientific community at large should respond to any invasion of pseudoscience into taxonomy. In particular, the question of what the implications of such incursions are for the *Code* and its existence as a safeguard of nomenclature has become of significance.

### Science, Nonscience, and the *Code*

In order to investigate this particular situation, I will once again clarify that it is currently not the purpose of the *Code*, nor is it in the purview of the International Commission on Zoological Nomenclature, to police taxonomy. Taxonomy is a scientific endeavour, whereas nomenclature is not. The *Code* should be used as the axiom, by which to determine whether taxon names are nomenclaturally available for use in subsequent publications. But this is precisely where a dilemma exists. The *Code* is by definition not scientific, but it generates a set of nomenclatural rules for taxonomy, and is only useful if there are scientists willing to use the rules. Thus, a name that slips through the (admittedly imperfect) scrutiny of peer review (e.g. Bohannon, 2013), or names generated en masse by poorly executed taxonomy automatically enter nomenclature. All it takes is the observance of a few very simple criteria for a taxon name to become available according to the *Code*. Under these circumstances, it is possible to produce large numbers of names that are *Code*-compliant but have no scientific basis; the *Code* expects these names to be considered in the same manner as science-based names.

In the case of what I qualify as nonscientifically produced taxon names in herpetology, Hoser uses the *Code* as a 'name-laundering scheme': his mass-produced names go in and 'clean' names come out. The more names that are put through the system, the greater is the likelihood that some will by coincidence stand if science eventually produces supporting facts. None of these names have a rigorous scientific foundation, which would at the very least require a certain amount of specimen work to validate holotypes along with careful first-hand examination of comparative material (either using museum specimens or molecular data). Hoser does neither; he resorts to bulk citations of all literature on a given taxonomic group, including particularly those papers that feature unnamed branches on relationship trees, and creates a new taxon name for any node that falls in line with his ideas. These passages generally include disclaimers, similar to the following from Hoser (2013, p. 5), which is followed by 151 citations: 'Where it is appropriate to rely on earlier published material, this is not necessarily rehashed herein. This is especially in terms of when the relevant material is widely available to readers on the worldwide web (internet)'. In Hoser's defence, careful science is not required by the *Code*. Hoser also violates multiple areas of ethics in his publications (as listed by Kaiser et al., 2013; Yanega, 2013a). Hoser's deportment is also not a problem for the *Code* since the *Code of Ethics* (which is violated by intemperate behaviour) is only an Appendix, and not mandatory.

### A Stability Problem

When large numbers of taxon names are produced and promoted, users who routinely rely on the output from science but who themselves are not expert taxonomists will tend to take up the most recent findings under the assumption that this output has a proper scientific footing. This is not indiscriminate use of information on the part of users; it is simply the use of misinformation that comes packaged in a pseudoscientific framework. Two examples may serve to illustrate that this is not merely an academic problem but one with broader implications.

The authorities in Timor-Leste, Southeast Asia's newest country, have been working on the development of wildlife policies and have been consulting the

literature available online. Their searches initially resulted in a mixture of science-based and Hoser's names. Use of two parallel taxonomies in this document could have created confusion in government policy and enforcement for years to come.

In Brazil, a country where a strong commitment to conservation has been emerging over the years, there are now two parallel taxonomies for snakes in use, one using science-based names and the other Hoser's names. For the purposes of species management, proper communication between government agencies, and the treatment of snakebite, dual taxonomies are impractical and must be avoided.

While neither of these examples has any bearing on the strict academic question of taxonomy and nomenclature, taxonomic research in herpetology nowadays leads in many cases to applications well beyond academia. As a consequence, the output from science becomes influential outside of science, and it is my opinion that as scientists we have a mandate to ensure the quality of our output.

In response to Hoser's new names, many scientific authorities in herpetology that would have to deal with them, such as researchers, scientific societies, journal editors, and compilers (e.g. *The Reptile Database*), have opted not to use them (see Kaiser et al., 2013). This situation has become destabilizing for nomenclature; even if Hoser's publications follow the letter of the *Code*, some authorities in the field are treating these names as if they were nomenclaturally unavailable, largely because they cannot be reliably used in the absence of satisfactory scientific argumentation justifying their appropriate attribution. As a result, there is consensus but not unanimity, meaning that multiple names will be in use simultaneously for a large number of organisms. Compilers of taxonomically broader databases, who justifiably do not regard themselves as qualified nor see it as their responsibility to choose between competing names, may be forced to resort to a wholesale listing of all sets of names (e.g. the *Encyclopedia of Life*; J. Hanken, pers. comm.), which adds to the trail of confusion among potential users. If the purpose of the *Code* is 'to promote stability and universality in the scientific names of animals,' this goal cannot be achieved so long as Hoser's names are treated as available by the *Code* and unavailable by many in the herpetological community.

Other than usage, a key problem for stability with Hoser's approach is his practice of giving names to even the most poorly supported groups, and then selecting type material he assumes to be suitable from lists presented in the literature, without ever evaluating this material himself. This creates an intrinsic instability for each taxon name since it is uncertain that the purported type specimen even has the characteristics listed in the taxon's description. This instability notwithstanding, the resulting names may reflect natural groups for which scientific research may find solid evidence; if such evidence emerges, then Hoser's 'senior synonyms-in-waiting' would be the available names despite their shortcomings (i.e. they are not based on properly evaluated or even properly listed type material or on valid scientific concepts). Tedious evidence-based research will then be required to reconcile inadequate type specimens with the new data, creating a potential further source of nomenclatural instability.

Hoser's naming of poorly supported branches from published phylogenies is contrasted by scientists' tendency to 'err on the side of caution' before making taxonomic judgments that produce new names. The more cautious, scientific approach takes time and patience, which creates a perpetually fertile ground for those

interested in naming new taxa quickly. If it became apparent that Hoser's activities did indeed result in nomenclaturally available names with some frequency, scientists could become tempted to defend their turf pre-emptively and 'err on the side of naming,' by making taxon names available for all branches of phylogenies they discover, even though the evidence may not be conclusive.

This dispute goes well beyond the level of petty squabbling between a small set of individuals operating in a limited niche of science; it pits a strong majority of scientists against a single individual who seeks to validate his actions by using the *Code*. Given that the organisms under consideration are continually in the public eye, whether through conservation efforts, media outlets, herpetoculture, or public health concerns, nomenclatural instability can have a significant negative socio-political impact. The continuing presence of these names as available names in herpetology will sustain the acrimony between Hoser and his critics, will be distracting to herpetological taxonomy, and will engender confusion on the part of non-taxonomist users of taxon names in herpetology who suddenly find themselves asked to choose between two sides in a never-ending controversy.

### **Is Scientific Credibility in Jeopardy?**

In our fast-paced, social media-driven world, science is no longer restricted to the knowledgeable few. Discoveries, methodologies, and disputes are instantly made visible in a 24-hour global news cycle. While this is welcome because it hastens the dissemination of knowledge, it is also problematic because of the potential spread of disinformation and the inability of the public to distinguish real science from pseudoscience. I believe this matter to be a serious problem for the credibility of the scientific endeavour, one that has not been addressed in the past. Perhaps there really was no need for nomenclatural problems to be considered a significant impediment to science; such issues could have been seen as a nuisance only for the few taxonomists who subsequently had to deal with the new taxon names. At a time when the accounting of biodiversity is of great importance and where accuracy in diversity estimates is needed for species management and conservation, however, the appearance of several hundred taxon names based on poorly executed science is a significant detriment.

While it is easy and probably correct to say that taxonomic research will eventually ferret out the false names and place them into the synonymy of scientifically acceptable names—after all, it has always been thus—this is not good enough any more, especially when a single, self-supported individual with the ability to publish at will can easily produce new names faster than scientists can synonymise them; the former has no constraints imposed by peer reviewers, publishers, tenure review boards, funding agencies, or even access to specimens. Poorly executed taxonomy not only contaminates the products of science, but will also divert the efforts of other scientists away from following their own research goals; it compels them instead to devote their efforts to refuting pseudoscience. What, then, can be done to ensure that the *Code*, when faced with situations that require immediate remedy, lives up to the standard that 'all its provisions and recommendations are subservient' to stability, universality, and uniqueness of taxon names?

### **Democracy in Taxonomy—the Taxon Filter**

The solution to the issue will require a strong stand by scientists in each discipline befallen by those whose taxonomy is suspected to be faulty. In herpetology, Kaiser et al. (2013) produced a set of best practices and a list of recommendations for how to treat Hoser's taxon names. However, such best practices must be employed in the future, and the *Code* could protect any taxon names despite the community's refusal to use them. In the grander scheme of things, the best way to address the issue could be to institute an idea I saw first formulated by ICZN Commissioner Douglas Yanega in a *Taxacom* post, and which I refer to as the Taxon Filter. Considering how rogue names might formally be handled one by one, Yanega (2013b) wrote that 'the only way this [...] would be practical is if there were an online interface which allowed for real-time debate and used verifiable IDs to allow for a democratized voting process; a taxonomic social medium.' The idea that the scientific community determines which names stand and which do not, is not something new. Lists of Available Names are an option provided for in the *Code* (Article 79) and peer-reviewed publications validating or synonymising taxon names are created routinely with community (i.e. reviewer and editorial) support. Unfortunately, from start to finish some of these processes can take years, and cannot be used to react rapidly and reliably to the hundreds of new names being published every month across the entirety of taxonomy, any one of which can 'go viral' and enter the mainstream media within a matter of hours after publication (see examples below), even if they are not *Code*-compliant.

The Taxon Filter would be a binding, rapid, public, and democratic community validation process. During an initial registration process, researchers would have the opportunity to become registered in the Taxon Filter's area of their discipline. Initial registration for the Taxon Filter would require some form of verification, such as an institutional or personal email address and a taxonomic credential (e.g. a peer-reviewed taxonomic paper), so that one individual could not register several fictional identities. Once a critical number of individuals was reached (a number determined within each discipline, but likely a percentage of those who publish in a given area) taxonomic cases could be introduced. For example, a required minimum of five applicants from a zoological discipline would create an online petition concerning a particular taxon name, and provide the reason for the petition. Members registered in that discipline would be notified that a petition in their area of interest had been posted, and they would be invited to comment and vote. Open voting would begin immediately after the petition had been filed, continue for a set minimum time and allow real-time discussion (similar to the comment threads used on Facebook). I believe that in most instances, a consensus would emerge quite rapidly (e.g. by a very one-sided vote) so that a decision was generated expeditiously. Petitions without a clear consensus or with considerable argumentation for and against would fail and require traditional resolution outside the Taxon Filter, via peer-reviewed publication. A decision to disqualify a taxon name post-publication via the Taxon Filter would result in its removal from all lists of available names; the name would become permanently relegated to the status of unavailable for the purposes of nomenclature. All taxon names beginning in 2000 could thus be reviewed (2000 being the year the latest edition of the *Code* came into effect), but only if a petition were filed with the requisite support. This arrangement amounts to a scientific safeguard, positioned so

that taxonomic decisions can be broadly reviewed before they pass into the realm of nomenclature and require adjudication via the *Code*; the Taxon Filter's mesh is designed to eliminate names based on poorly executed taxonomy. The Taxon Filter could even be extended to pre-publication filtering, perhaps voluntarily and at the initiative of the prospective authors of taxonomic decisions once a manuscript has been accepted for publication, so that potential taxonomic or nomenclatural problems could be revealed before the taxon names appear in print.

The recent descriptions of the fossil primate *Darwinius masillae* by Franzen et al. (2009) and the fossil sperm whale *Leviathan melvillei* by Lambert et al. (2010a) serve as examples to show that the Taxon Filter has utility beyond the scope of mass-produced scientifically inadmissible names, and that it can be applied as a rapid response to more general issues of *Code*-noncompliance. *Darwinius* was published in an online-only journal, which at the time rendered the taxon name unavailable according to the *Code*. It required the production of printed copies to make the name nomenclaturally valid. Given that this fossil was of significant public interest, its name spread rapidly on the Internet and achieved global recognition within hours, and the issue of improper nomenclature became a very public embarrassment. A petition filed with the Taxon Filter might have resolved this issue within days of publication, irrespective of the letter of the *Code* (which now permits electronic publication; ICZN, 2012). In the case of Lambert et al. (2010a) peer review by the venerable journal *Nature* failed to reveal that the genus name *Leviathan* was preoccupied by a mammoth. It became necessary to publish a corrigendum two months later (Lambert et al., 2010b) to change the genus to *Livyatan*. The Taxon Filter could have accelerated the correction and, if used prior to publication, might have headed off the problem entirely.

Critics of a mechanism like the Taxon Filter may point out that it may be a difficult task to decide which petitions should succeed and which should fail, and that this entire process could be seen as a form of censorship. If these critics have themselves published in peer-reviewed scientific journals, then they are already aware that as scientists, we routinely and voluntarily submit ourselves to a form of censorship during the publication process; peer review and editorial decisions are pre-publication judgments of our work. Review and concomitant revision are accepted scientific processes and, even though they are imperfect, they are what we have come to see as the best available option. If we submit ourselves to such scrutiny routinely anyway, then the Taxon Filter is nothing extraordinary but merely an extension of, or an aid to, the existing process.

Others may be concerned that the Taxon Filter could be unduly influenced by special interest groups, which would skew the voting one way or another for any given petition. I doubt that this could ever become a significant problem given that taxonomists tend to work in relatively narrow niches most of the time, and those working on that 'special interest' are probably the most qualified to comment. It also implies a readiness on the part of a significant number of scientists to simultaneously engage in inappropriate behaviour, which I find implausible.

This solution to the dilemma we face in taxonomy is modelled on how we make many decisions in science, by presenting proposals and allowing qualified community members (as during the business of scientific societies) or reviewers (as during the publication process or the grant review process) to decide how we shall collectively

proceed. Moreover, in addition to allowing the taxonomic community to uphold its standards, the Taxon Filter will be a completely transparent process. It will make it easy to follow the arguments for and against a name, it will grant universal access to all interested and qualified parties, and it showcases the manner in which decisions affecting the interaction of taxonomy and nomenclature are made.

### **An Effective Alternative**

While I believe the concept of a Taxon Filter to be of interest in the broader discussion about how to improve the interaction between scientific input and the rules of nomenclature outlined in the *Code*, the original aim of this article was not to promote the Taxon Filter at any cost, but to find a solution to the instability, confusion, and discord caused by individuals who follow the letter of the *Code* but violate its (unenforceable) spirit and ethics. In herpetology, we have reached the point when the scientific community has formally and nearly unanimously rejected the use of names coined by Raymond Hoser since the year 2000. Given that these names have appeared in a single outlet and their production has followed the same pattern that makes them unacceptable to herpetologists, such names could be rendered void for the purposes of nomenclature if the Commission used its plenary power (Article 81) to declare all names proposed in Hoser's *AJH* unavailable. The Commission has the authority to take such an action even if it is not compliant with, or justified by, the *Code*. It is the 'last resort' that the Commission can employ to fix things when the need arises, or pre-emptively when the need is expected to arise.

At issue therefore is not merely whether there are specific Articles in the *Code* that are violated by the production of names in the *AJH*. Given the argumentation I present above, I firmly believe that there are such violations, but all Articles are to some degree subject to interpretation, and disagreement over the issue is likely. Setting aside the focus on which specific Articles would assist with a 'legalistic' solution, perhaps a more suitable approach is to consider what should be done for the good of the community. At this time, the controversy in herpetology has played out in the pages of scientific journals (e.g. *Herpetological Review*, *Zootaxa*), in the *AJH*, and, endlessly and acrimoniously, in public online forums and social media. Personally, I do not engage in the latter but I find the effect on the scientific community, just by exposure to the vitriol in the discussion, disturbing; it potentially damages the perception of science and, specifically, the relationships among taxonomists. I believe that Hoser is not in accord with the spirit and the ethics of the *Code* with his publications and his comportment. The Commission can fix this very effectively by using its plenary power.

There is precedent for this step, albeit for entirely different reasons, and the Commission recently took it in the case of a work by Lacepède (Savage, 2003; Opinion 2104, *BZN* 62: 55; March 2005). That decision, however, came at the expense of considerable time and effort by many respondents to the case, and it was years in the making. To reduce the impact not only of names coined in the *AJH* but also of the discussion itself as it plays out in the scientific community, the Commission could act in this specific case for the benefit of the herpetological community, without setting a general precedent. Many of my colleagues and I believe that in this case, the spirit of the *Code* is truly more important than the letter of the *Code*. The question before us, as scientists wishing to rely on the *Code*, is whether we



will now act to support the *Code* in its aim ‘to promote stability and universality’ when the rapid information flow of 21st Century science threatens once more to impact nomenclature (as it did in the days before the *Code* permitted electronic publication). Considering that the *Code*’s ‘provisions and recommendations are subservient’ to its aim, I expect that we will.

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