



## The Linz Zoocode project. Fifth report of activities (2022). Nomenclatural availability. 4. Electronic publication

Alain DUBOIS<sup>1</sup>, Panakkool Thamban ANEESH<sup>2</sup>, Aaron M. BAUER<sup>3</sup>, Luis M. P. CERÍACO<sup>4</sup>, Gimo M. DANIEL<sup>5</sup>, Jurate DE PRINS<sup>6</sup>, Thierry FRÉTEY<sup>7</sup>, Ivan LÖBL<sup>8</sup>, Olivier LORVELEC<sup>9</sup>, Milen MARINOV<sup>10</sup>, Annemarie OHLER<sup>11</sup>, Michael SCHMITT<sup>12</sup>, Andrew WHITTINGTON<sup>13</sup>, Mark T. YOUNG<sup>14</sup> & Erna AESCHT<sup>15</sup>

on behalf of the Linz Zoocode Committee (LZC)\*

<sup>1</sup>Institut de Systématique, Évolution, Biodiversité (ISYEB), Muséum national d'Histoire naturelle, CNRS, Sorbonne Université, EPHE, Université des Antilles, Paris, France.

✉ [adubois@mnhn.fr](mailto:adubois@mnhn.fr), <https://orcid.org/0000-0002-6463-3435>

<sup>2</sup>Takehara Station, Setouchi Field Science Center, Graduate School of Integrated Sciences for Life, Hiroshima University, 5–8–1 Minato-machi, Takehara, Hiroshima, 725–0024, Japan.

✉ [aneesh@hiroshima-u.ac.jp](mailto:aneesh@hiroshima-u.ac.jp), [anee3716@gmail.com](mailto:anee3716@gmail.com), <https://orcid.org/0000-0002-8506-5107>

<sup>3</sup>Department of Biology and Center for Biodiversity and Ecosystem Stewardship, Villanova University, Villanova, Pennsylvania 19085, USA.

✉ [aaron.bauer@villanova.edu](mailto:aaron.bauer@villanova.edu), <https://orcid.org/0000-0001-6839-8025>

<sup>4</sup>Museu de História Natural e da Ciência, Universidade do Porto, Praça de Gomes Teixeira, 4099-002 Porto, Portugal.

✉ [luisceriaco@gmail.com](mailto:luisceriaco@gmail.com), <https://orcid.org/0000-0002-0591-9978>

<sup>5</sup>Department of Terrestrial Invertebrates, The National Museum, Bloemfontein, South Africa; Department of Biological & Environmental Sciences, Walter Sisulu University, Mthatha, South Africa.

✉ [gimo.daniel@nasmus.co.za](mailto:gimo.daniel@nasmus.co.za), <https://orcid.org/0000-0003-3602-5034>

<sup>6</sup>Royal Belgian Institute of Natural Sciences, Brussels, Belgium. <https://orcid.org/0000-0001-7637-5755>

<sup>7</sup>Association RACINE, 5 allée des Cygnes, 35750 Saint Maugan, France.

✉ [fretey.thierry@wanadoo.fr](mailto:fretey.thierry@wanadoo.fr), <https://orcid.org/0000-0001-5421-4563>

<sup>8</sup>Muséum d'Histoire Naturelle, Route de Malagnou 1, 1208 Genève, Switzerland.

✉ [ivan.lobl@bluewin.ch](mailto:ivan.lobl@bluewin.ch), <https://orcid.org/0000-0002-8747-3702>

<sup>9</sup>DECOD (Ecosystem Dynamics and Sustainability), INRAE, Institut Agro, IFREMER, 35042 Rennes, France.

✉ [olivier.lorvelec@inrae.fr](mailto:olivier.lorvelec@inrae.fr), <https://orcid.org/0000-0002-3711-2992>

<sup>10</sup>Biosecurity Surveillance & Incursion Investigation Plant Health Team, Ministry for Primary Industries, Christchurch, New Zealand.

✉ [milen.marinov@mpi.govt.nz](mailto:milen.marinov@mpi.govt.nz), <https://orcid.org/0000-0003-3284-2555>

<sup>11</sup>Institut de Systématique, Évolution, Biodiversité (ISYEB), Muséum national d'Histoire naturelle, CNRS, Sorbonne Université, EPHE, Université des Antilles, Paris, France.

✉ [annemarie.ohler@mnhn.fr](mailto:annemarie.ohler@mnhn.fr), <https://orcid.org/0000-0001-6531-464X>

<sup>12</sup>Universität Greifswald, Allgemeine & Systematische Zoologie, Greifswald, Germany.

✉ [michael.schmitt@uni-greifswald.de](mailto:michael.schmitt@uni-greifswald.de), <https://orcid.org/0000-0001-7377-3643>

<sup>13</sup>FlyEvidence, Pentrefoelas, LL24 0TA, Wales, United Kingdom.

✉ [awhittington@flyevidence.co.uk](mailto:awhittington@flyevidence.co.uk), <https://orcid.org/0000-0002-0465-1172>

<sup>14</sup>School of GeoSciences, University of Edinburgh, Edinburgh, Scotland, United Kingdom.

✉ [markyoung1984@gmail.com](mailto:markyoung1984@gmail.com), <https://orcid.org/0000-0002-7263-6505>

<sup>15</sup>Member of the International Commission on Zoological Nomenclature; retired head of the invertebrate collection (except insects), Biology Centre of the Upper Austrian Museum, J.-W.-Klein-Str. 73, 4040 Linz, Austria.

✉ [ernaescht@gmail.com](mailto:ernaescht@gmail.com), <https://orcid.org/0000-0001-7660-9355>

\* [sapo421@gmail.com](mailto:sapo421@gmail.com)

## Contents

|  |     |
|--|-----|
| Abstract . . . . .   | 73  |
| Key words . . . . .  | 73  |
| <b>1. Introduction.</b> . . . . .  | 73  |
| <b>2. Long-term status of electronic publications and archives as a whole</b> . . . . .  | 73  |
| 2.1. <i>The problems</i> . . . . .   | 73  |
| 2.2. <i>The possible solutions</i> . . . . .   | 74  |
| <b>3. Changes in the Code introduced by the 2012 Amendment concerning e-publications</b> . . . . .   | 75  |
| 3.1. <i>Introduction</i> . . . . .   | 75  |
| 3.2. <i>The publication date threshold (Article 8.5.1)</i> . . . . .   | 77  |
| 3.3. <i>Statement of the publication date (Article 8.5.2)</i> . . . . .  | 77  |
| 3.4. <i>Registration on Zoobank (Article 8.5.3)</i> . . . . .  | 77  |
| 3.5. <i>Multiple registrations (Article 8.5.3)</i> . . . . .   | 79  |
| 3.6. <i>Onomatergies (nomenclatural acts): catastasies and airesies (Article 8.5.3)</i> . . . . .  | 79  |
| 3.7. <i>Information preregistered on Zoobank (Article 8.5.3)</i> . . . . .   | 79  |
| 3.8. <i>Evidence provided of preregistration on Zoobank (Article 8.5.3)</i> . . . . .  | 80  |
| 3.9. <i>Error in stating the evidence of preregistration on Zoobank (Article 8.5.3.3)</i> . . . . .  | 81  |
| 3.10. <i>Redundant and ambiguous LSIDs (Article 8.5.3)</i> . . . . .   | 83  |
| 3.10.1. <i>LSIDs of works.</i> . . . . .   | 84  |
| 3.10.2. <i>LSIDs of nomina</i> . . . . .   | 84  |
| 3.10.3. <i>LSIDs of airesies</i> . . . . .   | 86  |
| 3.10.4. <i>Conclusion.</i> . . . . .   | 86  |
| 3.11. <i>Intent to archive a work (Article 8.5.3.1)</i> . . . . .  | 86  |
| 3.12. <i>International Standard Numbers: ISBN and ISSN (Article 8.5.3.2)</i> . . . . .   | 87  |
| 3.13. <i>Accuracy and reliability of the information on preregistration on Zoobank (Article 8.5.3)</i> . . . . .                             | 87  |
| 3.14. <i>Different versions of e-publications (Articles 8.1.3.2, 9.9 and 21.8.3)</i> . . . . .   | 88  |
| 3.14.1. <i>Papers published only online</i> . . . . .  | 88  |
| 3.14.2. <i>Papers published both online and on paper</i> . . . . .   | 92  |
| 3.14.3. <i>Promulgation, unpromulgation, mispromulgation, depromulgation.</i> . . . . .  | 93  |
| 3.15. <i>The actual promulgation date.</i> . . . . .   | 93  |
| 3.16. <i>Facsimiles</i> . . . . .  | 95  |
| 3.17. <i>Online supplementary material.</i> . . . . .  | 97  |
| 3.18. <i>Negation of intention, retraction of papers, invalidation of works by the Commission.</i> . . . . .                                 | 97  |
| 3.19. <i>Deliberate ignorance vs. refutation</i> . . . . .   | 98  |
| 3.20. <i>Nomenclatural and taxonomic databases, websites, blogs, etc.</i> . . . . .  | 98  |
| <b>4. Discussion: summary of the main problems.</b> . . . . .  | 99  |
| <b>5. New proposals</b> . . . . .  | 103 |
| 5.1. <i>Introduction</i> . . . . .   | 103 |
| 5.2. <i>Summary of the problems</i> . . . . .  | 106 |
| 5.2.1. <i>Distinction between publication and promulgation</i> . . . . .   | 106 |
| 5.2.2. <i>Unambiguous identifiers of e-publications and nomina</i> . . . . .   | 106 |
| 5.2.3. <i>Mandatory archiving.</i> . . . . .   | 106 |
| 5.2.4. <i>Different versions of e-publications.</i> . . . . .  | 106 |
| 5.2.5. <i>Accurate promulgation dates of e-publications.</i> . . . . .   | 107 |
| 5.2.6. <i>Online supplementary material</i> . . . . .  | 107 |
| 5.2.7. <i>Subsequent online corrections.</i> . . . . .   | 107 |
| 5.2.8. <i>Databases, websites, blogs, etc.</i> . . . . .   | 108 |
| 5.2.9. <i>Facsimiles of unavailable works and the meaning of the terms ‘obtainable’ and ‘obtained’ in Articles 8.1.2 and 9.12.</i> . . . . . | 108 |
| 5.2.10. <i>Invalidation and retraction of works</i> . . . . .  | 108 |
| 5.3. <i>New wordings proposed for some Articles concerned by the 2012 Amendment.</i> . . . . .   | 109 |
| 5.4. <i>New definitions proposed for the Glossary of the Zoocode.</i> . . . . .  | 114 |
| 5.4.1. <i>Versions of electronic works</i> . . . . .   | 114 |
| 5.4.2. <i>Promulgation, unpromulgation, mispromulgation, depromulgation.</i> . . . . .   | 114 |
| 5.4.3. <i>Obtainable, obtained.</i> . . . . .  | 115 |
| <b>6. Decisions of LZC Session 44 (Electronic publication).</b> . . . . .  | 115 |
| <b>7. References</b> . . . . .   | 116 |

## Abstract

This fifth report of activities of the Linz *Zoocode* Committee is devoted to a detailed survey of the problems raised by the current Rules of the *Code*, published in 2012, regarding the nomenclatural availability of works published online and registered on the database *Zoobank*. It points to various deficiencies in these Rules and in the conception and functioning of *Zoobank*, which result in uncertainties regarding the availability of these works and of their various versions. It proposes new wordings for these Rules, as well as for the terminology used regarding electronic publications.

## Key words

Nomenclatural availability, electronic publication, promulgation, different versions of publications, version of record, online supplementary material, onomatergies, catastasies, airesies, *Zoobank*.

## 1. Introduction

Until 31 December 2011, the *Code* (Anonymous 1999) denied nomenclatural availability to online publications, but the 2012 Amendment (first published in *Zootaxa*: Anonymous 2012) changed this situation in making the electronic publication (e-publication) of *onomatergies* (nomenclatural acts; Dubois 2013) possible for the *catstasy* (Code-compliant *promulgation*; Dubois 2020a) of new nomina (scientific names; Dubois 2000) and new *airesies* ('first reviser actions', such as lectotype designations or fixation of relative precedence between synchronic synonyms or homonyms; Dubois 2013). After a brief period of 'enthusiasm' by many taxonomists, editors and publishers, it soon appeared that the nomenclatural problems posed by this Amendment were countless. Some relate to the long-term status of e-publications and archives as a whole, some to the basic Rules of the modified *Code* and some to the difficulties encountered by many authors, referees, editors and publishers of scientific periodicals and publishing companies to understand, respect and follow these Rules. These problems have already been addressed in many details in a number of papers, and it would be very time and space consuming to repeat them again. To fully monitor the discussion below, readers are therefore advised to consult and study the works of Dubois (2010a, 2017e, 2020a–c), Dubois & Aescht (2016a–b, 2017, 2019) and Dubois *et al.* (2013, 2014, 2015a–b, 2021a,c, 2022a–c) listed in the References below.

## 2. Long-term status of electronic publications and archives as a whole

### 2.1. The problems

This question was discussed at length in Dubois *et al.* (2013) and briefly tackled in other publications such as Dubois *et al.* (2021c). The basic problem of electronic publication and archiving is its technology dependence (Dubois 2010a). Both the original accessibility and downloading, and the long-term conservation and permanent access, of electronic documents such as PDFs, depend on the availability and good functioning, not only of computers, smartphones or other equipment allowing their reception, but also of software and programs allowing to download, open and read

them, of power supplies, of international networks such as internet, and of storage (archiving) and distribution centres for such documents. A host of factors may affect this functioning, from financial difficulties or impossibility of individuals or institutions to afford the equipment or the access to internet, local and rather short outages due to simple technical incidents or accidents, action of hackers or terrorists, permanent or temporary censorship by States, local conflicts or international wars, and which might go as far as a worldwide electromagnetic collapse in case of world or large regional war. Even without going this far, the sustainability of the ‘electronic world’ is extremely costly in terms of electric supply of rare earths and elements, of semiconductors, etc., and its perpetuation will always depend on their availability, which may be challenged in case of major environmental, economic and/or military crisis.

Compared to electronic publication, paper publication has many advantages, not being technology or big funding dependent: the ability of printed documents to span the centuries, even without special protection and curation (needing mostly a dry and calm environment, preferably in obscurity), has largely been demonstrated. Their main weaknesses are that they are space-consuming and vulnerable to (accidental or intentional) fire, flooding and humidity. They may raise problems of accessibility, if the storage system is defective and does not allow to locate them, they may be vulnerable to administrative decisions, such as reorganisation or relocation of libraries, which are prone to disrupt their classification and indexing and to lose or destroy some of them. However, beside the fact that reading them only requires eyes and light, but no screens, computers, servers, etc., in the long run they are much less consumptive in energy and other resources: the wood, water, ink and electricity needed for their production and distribution are necessary only once, whereas every download and consultation of an electronic work requires energy. In our times when awareness about energy waste has become paramount, the worldwide development of this highly intensive energy technology may appear as an incongruity.

Despite all these problems, it is quite clear that it is now ‘too late’ to decide (at least for the time being) not to use electronic publication in science (just like in many other domains), given the gigantic practical advantages, possibilities and comfort it provides to users, but also, perhaps mostly, given the importance of the economic interests behind their use. What is much more questionable, particularly but not only in the domain of taxonomy, where ‘old publications’ are still daily used all around the world, is whether electronic publications should *replace* paper publications altogether, or be used *in conjunction* with the latter.

## 2.2. *The possible solutions*

There is no absolute and general solution to these various problems. Local and short-term solutions can exist for some of them, from the increase of funding for research institutions in order to shelter them from outages due to mere financial difficulties, to the protection of electromagnetic equipment and standard storage centres through placing them in well-protected buildings and Faraday cages in anticipation of potential e-bombing or other big natural or human-caused electromagnetic disruptions. Advanced technical solutions for long-term safe storage of all kinds of documents have been or are being implemented in domains like astrophysics, geosciences, molecular biology (particularly related to the Human Genome Project) or humanities by organisations like the National Science Foundation (NSF; Bement 2007) or the European Organization for Nuclear Research (CERN; <<http://home.cern/science/computing/storage>>; <<http://home.cern/news/news/computing/cern-data-storage-gets-ready-run-3>>). Unfortunately, such technical solutions, which may also be effective for wealthy States, big companies or banks, are usually not accessible to universities and museums where the bulk of taxonomic research is carried out.

For domains like taxonomy, partial and temporary solutions may consist in multiplying the copies of electronic documents (e.g. on magnetic tapes) and storing them in different places, in having several mirror sites and archives in multiple data centres, and caring for their being updated simultaneously whenever changes are brought to them, but such approaches are heavy and costly, and cannot be considered to be long-term solutions.

In the absence of access to highly technical protected systems of electronic data storage, it seems inescapable to consider that the safest way to allow a long-term preservation of documents is not through electronic websites or ‘standard archives’ but as material, paper-printed documents (Dubois 2010a). For reasons mentioned above, it is unlikely that scientific publishers will soon abandon online publication, so that for the time being the only realistic possibility would seem to have an international initiative for the printing and storing of paper copies of all electronic publications and the deposition of these copies in several (at least ten?) gigantic, highly ‘professional’, libraries distributed in the major geographical regions of the world (see Dubois *et al.* 2022c). The decision to implement such a project seems impossible today, but might be accelerated if or whenever one or a few major collapse(s) lead(s) to the complete loss of billions of electronic documents. This is not only conceivable, but very likely. It already occurred concerning the files of some bank customers, social security information or commercial documents in various countries, and it is highly plausible that such nasty events will proliferate in the coming years or decades, especially given the currently very labile international diplomatic and political situation, and if wars or other catastrophes become common, in relation with the environmental, climatic, social and economic crises that are currently increasing worldwide.

Today, electronic publications do not appear to most people, including taxonomists, to be threatened, and the statements above are hardly audible to them, and will remain so until they are confronted with one of the problems mentioned. It is nevertheless useful to remind them, in order to try and raise more awareness in our community and perhaps more caution in some of our decisions. This also provides the general context of some of the proposals made in this paper.

Below we discuss the nomenclatural consequences of electronic publications having become predominant, if not universal, in current taxonomy.

### 3. Changes in the *Code* introduced by the 2012 Amendment concerning e-publications

#### 3.1. Introduction

The crucial importance of having clear, unambiguous Rules for nomenclatural availability, and the accurate date of the latter, is misunderstood by some taxonomists. Without such clear Rules, nomenclatural stability could not exist. If the nomina of Aristotle and Pliny, or vernacular names that had never been made available in the realm of zoological nomenclature, were suddenly introduced in this realm to replace long established and used nomina, as suggested by some (e.g., Gilman & Wright 2020 and Palma & Heath 2021, Smith & Figueiredo 2021 and Mosyakin 2022) for so-called ‘ethical’ or other reasons, the results would be devastating for zoological nomenclature and by way of consequence for biology as a whole.

A detailed presentation of the changes brought to the *Code* regarding the nomenclatural availability of electronic papers by the 2012 Amendment of the *Code* (Anonymous 2012; designated below as ‘A-2012’ for more brevity) was provided in Dubois *et al.* (2013), which should be consulted in this respect. In fact this paper provided a very thorough analysis of the problems posed by these changes and should have prompted a reflexion of the Commission and of publishers of electronic papers to provide solutions to these problems, but the blunt denial of their existence by both groups and their

refusal to discuss the points raised in this paper (Anonymous 2014, Moylan *et al.* 2014) resulted in a persistence, and even in some respect an increase, of these problems, as we will see below.

These changes, which concern Articles 8, 9, 10, 21 and 78 of the 1999 *Code* (Anonymous 1999), raise a variety of questions, complexities and problems, which we will try to review below as exhaustively as possible, although new ones regularly appear in the taxonomic literature and cannot be foreseen. The analyses presented below are based both on a detailed critical examination of the new Rules of A-2012 and on a study of the concrete results of these Rules in several works published online in some periodicals, including several published by BioMed Central (BMC) (Dubois *et al.* 2013: 59–82), as well as *Biota Neotropica* (Dubois *et al.* 2013: 87–88), the *Bulletin of Zoological Nomenclature* (Dubois *et al.* 2015a), the *European Journal of Taxonomy* (Dubois *et al.* 2013: 86–87), *PLoS* (Dubois *et al.* 2013: 82–86), *Palaeontologia Electronica* (Dubois *et al.* 2013: 87), *Parasite* (Dubois *et al.* 2015b: 262), *Snudebiller* (Dubois *et al.* 2013: 87), *Systematic Entomology* (Dubois *et al.* 2015b: 262), and the *Zoological Journal of the Linnean Society* (Dubois *et al.* 2014).

Before going further, it is useful to stress again that the words ‘publication’ and ‘published’ are used in the *Code* with two distinct meanings. The first one is the general meaning, which points to the **production and distribution** of a document, either on paper or in electronic form. The second one is a specialised, technical term of zoological nomenclature, which means ‘published, after 1757, in a *Code*-compliant manner’, i.e., respecting the criteria and Rules allowing to provide nomenclatural availability to the work and the nomenclatural novelties it contains. For the first, general meaning, below the noun **work** and the verbs **issue** and **release** will be preferably used, whereas for the second one, the noun **promulgation** and the verb **promulgate** (Pavlinov 2014, Dubois 2020a: 51) will be employed, as already decided by the LZC in its Session 39 (Dubois *et al.* 2022a). The terms **distribution** and **distribute** apply to both situations (Dubois *et al.* 2022b).

The main consequences of A-2012 concerning the availability of e-publications, and the problems associated with them, have been summarised under three points (Dubois *et al.* 2013: 19–20). These may be reformulated, using the unambiguous terminology presented above, as follows:

[A1] Any work issued only electronically before 2012 is permanently unavailable in zoological nomenclature (Article 8.5.1 of A-2012). Any work issued electronically after 2011 **may** be available for the promulgation of nomenclatural novelties, if it complies with **all** the requirements of Articles 8.1, 8.5.2 and 8.5.3 of A-2012. It must therefore: [A1a] have been issued for the purpose of providing a **public** and **permanent** scientific record; [A1b] be **obtainable**, when first issued, free of charge or by purchase; [A1c] have been produced in an edition containing simultaneously obtainable copies by a method that assures widely accessible electronic copies with **fixed content and format** (e.g. PDF/A, ISO Standard 19005-1:2005); [A1d] include the **date** of issuing in the meaning of the *Code* in its final format (not that of a provisional document); [A1e] have been **registered** in *Zoobank* **before** issuing; [A1f] provide **evidence** in the work itself that this preregistration has been done; [A1g] have been **archived**, or intended to be so, by an appropriate organisation unambiguously identified in the *Zoobank* entry; [A1h] have an **ISBN or ISSN**; [A1i] provide the latter in its *Zoobank* entry. Although this is not clearly stated in A-2012, its **promulgation date** is that of its actual first release under its **final version** on the website of its electronic publisher, not that of any preliminary version.

[A2] Paper-printed **facsimiles** or reproductions of unavailable electronic works (i.e., those issued before 2012 or after 2011 but not complying with the requirements of Articles 8.1, 8.5.2 and 8.5.3 of A-2012), do not qualify as available works for the purpose of zoological nomenclature (Article 9.12 of A-2012), and the nomenclatural novelties they contain are nomenclaturally unavailable. They differ from genuine available paper works through [A2a] not being clearly **obtainable**, when first issued, free of charge or by purchase, even if deposited in five major libraries or other archives; or/and [A2b] having been directly printed on demand from the PDF as provided on a publisher’s website, bearing the same ISSN/ISBN as the latter or no such identifiers, but lacking their own ISSN/ISBN.

Let us consider successively the main points of this Amendment that raise problems, for authors, editors, referees and users of taxonomic papers, or that generated debates regarding their interpretation.

These complex matters were discussed in a series of works cited above (Dubois *et al.* 2013, 2014, 2015a, 2022a–c; Dubois & Aesch 2017, 2019), where these discussions cover dozens of pages, and it would be a waste of time, energy, electronic storage and transfer, and ultimately paper, to repeat them again. Below, we will just summarise these works and remind the decisions, declarations and definitions already taken in this respect by the LZC through its internal votes.

### 3.2. *The publication date threshold (Article 8.5.1)*

*All* works issued *only* in electronic form before 2012 are *unavailable* (except if subsequently validated by the Commission under its Plenary Power).

The works so issued after 2011 *may* be available *if* they comply with other requirements (see below), including the express mention of their publication date.

A special problem is raised regarding the status of works issued online before 2012 but for which paper printed copies were then deposited in or sent to 5 or more libraries. This point is discussed at more length below (§ 3.16 and 5.2.9).

### 3.3. *Statement of the publication date (Article 8.5.2)*

To be available, a work issued online after 2011 must specify its distribution date *in the work itself*. The date does not need to be complete (day, month, year). It may be limited to month and year, or to year, but complete absence of mention of the date makes the work unavailable in zoological nomenclature. The unavoidable consequence of this statement is that its mere presence in the contents or colophon of the journal or on the website of its publisher or periodical does not make it available.

This Rule would seem to be simple and straightforward, but it is not so, because of the absence in Article 8.5.2 of a single word: the word *accurate*. As a matter of fact, Article 9.9 states that “preliminary versions of works accessible electronically in advance of publication” are not published, and Article 21.8.3 states that “advance electronic access does not advance the date of publication of a work, as preliminary versions are not published”. However, in most (if not all!) real cases of works first released as preliminary versions, the final version distributed by the publisher bears the same date as the preliminary version(s), although its actual distribution date may be months later than that of the latter, and quite often even not in the same year. The publication date stated in the available version is then clearly *inaccurate*, which may have important nomenclatural consequences in case of conflict of synonymy or homonymy involving another publication. The *Code* in its current version does not clearly state that in such cases the ‘final version’ itself is not available, although it would seem to be an inescapable consequence of Article 8.5.2. We will come back to this problem below (§ 3.14).

### 3.4. *Registration on Zoobank (Article 8.5.3)*

Strangely, the current text of Article 8.5.3 only requires that the work be ‘registered’ in *Zoobank* and only later in the Article that this registration ‘has occurred’ for the work to be available. It would have been much clearer to require both ‘preregistration’ and ‘postregistration’ of the work, which would by itself mean that ‘postregistration’ alone does not provide availability, which is only implied, but

not clearly stated in the current version of this Article, and is mentioned only in the second paragraph of the Examples of Article 8.5.3.3. Similarly, the use of two distinct denominations (*Official Register of Zoological Nomenclature* and *Zoobank*) for a single database is redundant and confusing, and the second appellation, which is much shorter and simpler, and is the only one mentioned by most authors, is sufficient. As for the use of a capital letter inside this name (CamelCase writing), it is not justified grammatically (Dubois *et al.* 2013: 6, footnote 6) and is not adopted here.

Note that what is preregistered in *Zoobank* is the title of the work and its authorship, and the intention to publish this work, but not its whereabouts (such as periodical issue and date of publication, or page numbers), as these pieces of information will be known only once the work has indeed been published. Therefore, the registration process of a work on *Zoobank* is a two-step process:

[B1] first, preregistration of the intention to publish the work, with provisional mention of the book or periodical where the author(s) intend(s) to publish it, of its planned authorship and, if relevant, of the new onomatergies it may contain, allowing to obtain a *Zoobank* registration number or “Life Science Identifier” (LSID) for the work that will be cited in the published version of the work; this preregistration is accessible (visible on the screen) only to the person who entered it in the database, not to other customers;

[B2] second, postregistration, after actual promulgation of the final version of the book or periodical where the work was finally published, of its complete reference, accurate publication date, actual authorship and, if relevant, of the new nomina it contains; this postregistration is accessible to all customers.

An important point, rarely mentioned, is that the latter pieces of information may be different from those preregistered, but that this does not invalidate the nomenclatural availability of the work. Possible examples of such situations include the following: [C1] a new nomen first intended to appear in this work may finally be missing in it, following requests by the referees or editor, or a change of opinion of the author(s); [C2] for similar reasons, a new nomen not initially preregistered for this paper may be added between the preregistration and the distribution; [C3] for similar reasons, or because of involuntary misprints, a last minute change in the spelling or rank of a new nomen, or even in the nomen itself proposed for a new taxon (possibly with the same holotype or syntypes) may have been made between preregistration of the work and its distribution.

The following case discussed in Dubois & Aescht (2019) shows that situation [C1] is not only theoretical. In the *Zoobank* entry of a manuscript planned for promulgation, a new nomen was preregistered under two distinct paronyms: *Amazona gomezgarzai* and *Amazona albifrons gomezgarzai*. However, in the final paper as it was issued (Silva *et al.* 2017), the second paronym is missing. Thus, this paronym remains currently unpublished, although it still appears on *Zoobank* as a result of the original registration. In this case, this has however no bearing on its availability, as anyway it is not a distinct nomen but just a distinct paronym of the same nomen and availability of the latter was provided by the binomen appearing in the final version. But the consequences will be different if such withdrawal concerned a new distinct nomen.

Fortunately, it seems that *Zoobank* does not allow users or even moderators to ‘correct’ the original preregistrations, as otherwise this would open the door to many confusions and manipulations. For this reason, works planned for publication, preregistered in *Zoobank* but later never issued, are still present in this database, but inaccessible to customers, and should remain so, in particular because there is no fixed delay between the preregistration of a work and its issuing, which may occur years after the preregistration. In fact, preregistration is just a statement of ‘intention to publish’, which is indispensable for the nomenclatural availability of an e-publication, but becomes effective only after the actual distribution.



### 3.5. Multiple registrations (Article 8.5.3)

A-2012 does not state who is supposed to (pre)register a new work on *Zoobank*. Therefore, it may be the author, or one of the authors, the editor or the publisher, or even other actors (e.g., a secretary or the director of the laboratory where the work had been carried out). Some journals care for implementing the registration, while others leave this task to the author(s). When the situation is not made clear to the authors (e.g., on the website of the journal), this may result in misunderstandings, and the same work may be registered twice, with two different LSIDs, which would be prone to create confusion. We have no evidence that this occurred actually, but the website of *Zoobank* does not state whether it has a system of detection of such possibilities and of avoidance of this problem.

### 3.6. Onomatergies (nomenclatural acts): *catastasy* and *airesis* (Article 8.5.3)

Before going further, an important terminological clarification must be made, concerning what the *Code* and A-2012 call ‘nomenclatural acts’. As defined by the Glossary of the *Code* (p. 99), a ‘nomenclatural act’ is “A published act which affects the nomenclatural status [...] of a scientific name or the typification of a nominal taxon”. The first published act [D1] that can affect a nomen is its **promulgation** (Dubois 2020a), i.e., its introduction respecting the *Code*’s requirements that make it nomenclaturally available in the taxonomic literature. Then, subsequent acts [D2] can **modify** the status of a nomen or nominal taxon. This includes: [E1] subsequent **designations** [E1a] for nominal species or subspecies of [E1a<sub>1</sub>] lectotypes or [E1a<sub>2</sub>] neotypes, or [E1b] for nominal genera or subgenera of [E1b<sub>1</sub>] type species or [E1b<sub>2</sub>] subsequently included species (**postnucleospecies**; Dubois 2022); [E2] fixation of **relative precedence** between synchronous nomina or nomenclatural acts (so-called ‘first reviser actions’ in the *Code*); [E3] choice of the correct original spelling (**lectoprotograph**; Dubois 2010b) among several multiple original spellings (**symprotographs**; Dubois 2010b) of a nomen (another case of ‘first reviser action’).

As we will see, the *Code* in its 1999 text and in A-2012, as well as the application *Zoobank*, use the formula ‘nomenclatural act’ in an ambiguous or variable sense. For more clarity in the discussions, below the term **onomatergy** (Dubois 2013) is used to designate ‘nomenclatural acts’ in general, and the terms **catastasy** and **airesis** (Dubois 2013) respectively for onomatergies resulting in the promulgation of a new nomen with its original status, and for onomatergies resulting in the modification of the status of a nomen or nominal taxon. Among the latter, distinction is made between [E1] subsequent fixation of onomatophore for a nomen, or **airetophory** (Dubois 2013), [E2] subsequent fixation of precedence between two synchronic airetophories, or **airetoproedry**; and [E3] subsequent choice of a lectoprotograph among symprotographs, or **airetophography**. The latter two terms are new. They are derived from the Greek terms *αἵρεσις* (*airesis*), ‘choice, election’ and, respectively, *προεδρία* (*proedria*), ‘precedence, first place’ and *γράφω* (*grapho*), ‘I write’.

### 3.7. Information preregistered on *Zoobank* (Article 8.5.3)

For a work to be considered ‘published’ in the sense of the *Code*, i.e., promulgated, the only information that is required by Article 8.5.3 is preregistration of the (reference of) the work itself. Following this preregistration, *Zoobank* provides an LSID, which, when mentioned in the work when it is issued, provides objective evidence that this registration has occurred.

According to the Example given in Article 8.5.3 of A-2012 (see [3.10] below), it would be possible to register in *Zoobank* [F1] works (publications), [F2] nomina and [F3] ‘nomenclatural acts’. Clearly,

this use of the formula ‘nomenclatural act’ is restrictive, as it seems to be limited to airesies and to exclude catastasies. This is not equivalent to the use, which is wider, including both catastasies and airesies, of this formula as defined in the *Code*’s Glossary (see [3.6] above), and it is still different from a third meaning, implemented in *Zoobank*, where it designates only catastasies.

In *Zoobank*, every entry for a publication includes two items, entitled ‘Nomenclatural Acts’ and ‘Other Taxon Names’. In all such entries, the only ‘Nomenclatural Acts’ recorded are in fact *some* new catastasies introduced in the publication (only those that have been duly registered as such) and no airesies. Under ‘Other Taxon Names’, which is supposed to accommodate the nomina already available before the work and mentioned in it, the only nomina that are mentioned are also those that have been duly registered in *Zoobank* as such. There is no entry for ‘nomenclatural acts’ other than promulgation of new nomina, i.e., for airesies (e.g., lectotype or neotype designations or ‘first’ reviser actions). Therefore, the page dedicated to any publication in *Zoobank* contains only some of the information it would seem to provide according to A-2012.

Although *Zoobank* was launched in September 2012, ten years later (in April 2022) this application still only allows to register works and nomina but not airesies. Therefore, if a work contains new airesies but no new nomen, and if the author (or editor) fails to register the work itself, the work is not available and thereby the airesy is not available either. This was the case of the lectotype designation for the turtle species *Plesiochelys langii* Rüttimeyer, 1873 by Anquetin *et al.* (2014), published in a work that was not registered in *Zoobank*—which required the publication of a second, corrective paper (Anquetin 2015; Dubois & Aesch 2017). Such (still undetected) cases are probably numerous in post-2011 online taxonomic publications.

In A-2012, the Commission furnished the following justification for its decision not to permit the registration of airesies in *Zoobank*:

“*Registration of works.* The shift to registration of works instead of registration of names addressed a problem caused by requiring registration of names but not of acts (as originally proposed): a work could have names that were not available because they were not registered, but nomenclatural acts in the same work would be available, which would be confusing. The alternative approach, to also require registration of acts in electronic works, was problematic, as it would be easy for authors to forget to register acts such as first reviser’s choices in situations where the Code does not currently require a statement that an act has occurred. The shift to registering works lets registration of names and acts proceed on a voluntary basis, which gives more time to fully develop those functions in ZooBank, and allows more informed decision-making if such registrations are proposed to be mandatory in the future.”

Ten years later, the Commission has still not ‘fully developed’ its thought about the registration of airesies, and has not implemented in *Zoobank* a solution to the problem mentioned above. It is thus more than likely that a number of airesies published online since 2011 are not nomenclaturally available, whenever the works where they appeared were not considered by their authors to require *Zoobank* registration because they did not include new nomina. When these cases are later discovered by taxonomists, this may raise problems regarding nomenclatural accuracy and stability. It is therefore urgent to care for this problem. An easy way to do so would be to *require* the preregistration of the work itself for its nomenclatural availability, which is not the case currently, i.e., to suppress the tolerance afforded in this respect by the Example of Article 8.5.3, as we will now see.

### 3.8. Evidence provided of preregistration on Zoobank (Article 8.5.3)

The requirement that preregistration be mentioned in the work itself is distinct from preregistration proper and would merit an Article of its own, but in the current *Code* it is part of the same Article 8.5.3, which states that evidence that such registration has occurred must be provided in the work itself.

However, immediately after this statement, Article 8.5.3 adds a strong caveat to this Rule, mentioning the following strange ‘examples’:

**“Examples.** Evidence of registration is given by stating information that would be known only if the registration has occurred, such as the exact date of registration or the registration number assigned to the work or to a new name or nomenclatural act introduced in the work. A work issued as a PDF may contain the registration number as an embedded hyperlink. Even if the registration number is not visible in the normal viewing mode of the file or when the work is printed from the file, it is deemed to be cited in the work itself because the text of the hyperlink can easily be revealed using standard software for viewing PDFs.”

Regarding the “information that would be known only if the registration has occurred”, these different examples do not have the same relevance and reliability.

As for the exact date of registration, it is indeed present in the registration entry of the work in *Zoobank* once this work has been published, but in a ‘hidden’ way, as for a mysterious reason it only appears briefly in a small rectangle when passing gently the computer’s mouse on the orange rectangle bearing the mention ‘LSID’. It would be much clearer if this information was permanently visible on the screen without requiring this action, the possibility of which may be unknown to some (many?) users of *Zoobank*.

As for the mention of the “registration number assigned to the work or to a new name or nomenclatural act introduced in the work”, it means that the mention of the LSID of the work is not mandatory but can be replaced by mention of the LSID of a new nomen or airesy appearing in it. This is possible for new nomina, which can be registered on the application *Zoobank* only *after* the work itself has been so. But the last part of this sentence is misleading: it seems to indicate that a work distributed online could be made available through the mere mention of the LSID of a ‘nomenclatural act’, other than the establishment of a new nomen, introduced in the work—which is impossible since, as shown above, airesies *cannot* be registered as such on *Zoobank*, and therefore cannot have LSIDs! This ‘tolerance’, which appears to be justified only by the spirit of concession to online publishers mentioned above, is just a potential source of nomenclatural problems, and it should therefore be cancelled.

The last mention of this paragraph, about “standard software for viewing PDFs” is quite astonishing in a document like the *Code*, which is supposed to last for years or decades. Who knows what will be the “standard software” for this purpose in the future? This tolerance also appears as a concession made to publishers of online journals in order not to disturb their practices, instead of asking them to adapt the latter to the *Code*’s requirements.

This Article should therefore be considerably simplified. It should require in all cases the mention of the registration number of the work (LSID) in the work itself latter for its nomenclatural availability, not any other information (date of registration or registration numbers of new nomina, not to mention registration numbers of airesies), which are not given by *Zoobank*. We provide below (§ 5.3) a simplified version of this Article, now consisting of two distinct Articles 8.5.3 and 8.5.4.

### 3.9. Error in stating the evidence of preregistration on Zoobank (Article 8.5.3.3)

Article 8.5.3.3 of A-2012 then reads as follows:

“An error in stating the evidence of registration does not make a work unavailable, provided that the work can be unambiguously associated with a record created in the *Official Register of Zoological Nomenclature* before the work was published.

**Examples.** The following are examples of admissible errors: In preparing a manuscript an author accidentally deletes the final digit of the registration number. An author states the wrong date of registration forgetting that ZooBank uses Coordinated Universal Time rather than local time. An author registers two works that are in review for publication and accidentally uses the same ZooBank number in both published versions.

The following are examples of inadmissible errors: An author, in preparing a manuscript for publication, states that day's date for the registration date, intending to register it later that day but forgetting to do so. The author discovers the omission after the work is published and immediately registers it; because registration occurred after publication, the work is not available. A publisher discovers errors in a work and reissues it to correct those errors, but instead of registering the new edition, uses the original ZooBank number; the revised edition is not available because it was not separately registered."

More briefly, this states first that, although Article 8.5.3 requires authors to state the registration number or the date of registration of a paper, in some cases this number or this date may be wrong without nomenclatural consequences. It should simply be corrected, but this does not qualify as an airesy. Why then ask for it? The distinction between 'admissible' and 'inadmissible' is quite subjective indeed, and many cases not considered in these examples would be difficult to place in either category. An error is an error and when this happens this is a deviation from the Rules. Why would we establish Rules if taxonomists are warned that they may not follow them but that it has no consequences? The examples provided may appear to follow common sense, but there may be many examples, not considered, which may be sitting in between admissible and inadmissible, making it difficult and subjective for taxonomists to decide in which category the error falls.

Furthermore, and much more importantly, these examples carefully avoid to mention a *very frequent* situation: that where the date appearing on the final version is clearly *wrong*, being the date of publication of a preliminary version, a problem discussed in more details below (§ 3.15). In fact, this Article tolerates errors in the process required for making an onomatergy available, which is quite at variance with the usual Rules of the *Code* in other cases.

Let us just consider one such situation supporting the latter statement, that of 'incorrect original spellings'. The conditions given by Article 32.5 for considering that an original spelling is wrong and should be corrected are very restrictive, as they exclude incorrect transliteration or Latinisation and they require the presence, in the original work, of evidence that the spelling used was not that intended by the author, a condition which is often impossible to comply with, not only in old publications but also in recent ones (see e.g. Dubois & Seret 2019<sup>1</sup>). The example of the frog nomen *Hysaplesia*, published by Boie (*in* Schlegel 1826a), is particularly enlightening in this respect. The spelling of this nomen, proposed for four species previously referred to the genus *Hyla* Laurenti, 1768, was etymologically unjustified and incomprehensible, contrary to the spelling *Hylaplesia* used for the same genus by the same author (Boie *in* Schlegel 1826b) in a paper published a few weeks after the first one, as well as by all the other authors of this epoch. In this case, simple 'common sense' clearly commanded to consider *Hysaplesia* as an incorrect original spelling and *Hylaplesia* as its subsequent correct spelling, but this is not what the Commission decided to do, despite a long public discussion (from 1983 to 2009), and despite the fact that to deal with this case it had made use of its Plenary Power, which would have allowed implementation of a much better solution of this case (for details see Dubois 2017b). Many other similar cases in which the Commission closely adhered to the letter of the *Code*, without giving due consideration to the peculiarities of the real situation, could be cited (e.g., Bour & Dubois 1984, Dubois *et al.* 2021b). Such cases show that, when nomenclatural problems are raised concerning ancient paper publications, the Commission is usually very strict, not to say rigid and blind, and applies the Rules of the *Code* literally, even when this results in absurd decisions. Why, then, did it adopt a completely opposite attitude in the case of electronic publications? We will come back to this question below (§ 3.15).

Therefore, for Article 8.5.3.3, after a detailed discussion the following re-wording was adopted by the LZC in its Session 16 (Dubois & Aescht 2019: 16):

"8.5.3.3. An error in stating the evidence of registration does not make a work unavailable, provided [1] that the work can be unambiguously associated with a single record created in *Zoobank* before the work was published, and [2] that this record can be unambiguously associated with a single version of the work, bearing a given publication date, DOI and LSID.

1 This was not understood by White *et al.* (2019) and the referees and editor of their paper.

**Examples.** The following are examples of admissible errors: [a1] In preparing a manuscript an author accidentally deletes the final digit of the registration number. [a2] An author states the wrong date of registration forgetting that *Zoobank* uses Coordinated Universal Time rather than local time.

The following are examples of inadmissible errors: [i1] An author, in preparing a manuscript for publication, states that day's date for the registration date, intending to register it later that day but forgetting to do so. The author discovers the omission after the work is published and immediately registers it; because registration occurred after publication, the work is not available. [i2] An author or publisher registers two works that are in review for publication and accidentally uses the same *Zoobank* number in both published versions; both works are unavailable because the LSID number is not unambiguously associated with a single work. [i3] A publisher discovers errors in a work and reissues it to correct those errors, but instead of registering the new edition separately, uses the original *Zoobank* number, DOI and/or publication date; both editions are unavailable because the work identified by these pieces of information fails to have fixed content and layout."

### 3.10. Redundant and ambiguous LSIDs (Article 8.5.3)

Under the heading 'What is ZooBank?', this application writes:

**“What Gets Registered in ZooBank?**

Currently, ZooBank accommodates the registration of four different kinds of data objects:

**Nomenclatural Acts:** Published usages of scientific names for animals, which represent nomenclatural acts as governed by the ICZN Code of Nomenclature. Most of these acts are 'original descriptions' of new scientific names for animals, but other acts may include emendations, lectotypifications, and other acts as governed by the ICZN Code.

**Publications:** Publications that contain **Nomenclatural Acts**, as defined above.

**Authors:** Anyone who is an author of one or more **Publications** (as defined above), or who is a contributor to ZooBank content.

**Type Specimens:** Type specimens for scientific names of animals. The registration of Type Specimens is considered provisional and is not yet fully implemented in ZooBank.”

These statements contain several inaccuracies. There exist no “‘original descriptions’ of new scientific names for animals”: descriptions apply to specimens or (quite inappropriately in fact; see Dubois 2017*d*) to taxa, but not to nomina<sup>2</sup>. Descriptions (or more exactly diagnoses) allow the availability of nomina for the taxa being so characterised, but nomina are not ‘described’. Besides, contrary to what is stated here, for the time being (?), “emendations, lectotypifications, and other acts as governed by the ICZN Code” cannot be registered on *Zoobank*. Finally, entertaining a confusion which is frequent in the literature, type specimens are types (onomatophores) of nominal taxa (taxomina), not of scientific names.

Concerning nomenclature proper (i.e., beside persons and specimens), *Zoobank* claims to use “Life Science Identifiers” (LSIDs) for three distinct purposes: identification of works (publications), of nomina and of ‘nomenclatural acts’ (in fact airesies). The stated purpose of these identifiers is to provide *unambiguous* association between a record on *Zoobank* and a work or elements (nomina, airesies) first published in this work. As stated previously (Dubois & Aesch 2019: 9–10), this purpose makes sense only if the system is *bijective*, i.e., if the unambiguity works in both directions, from the LSID to the element it refers to, and in the reverse way. Let us consider the three kinds of nomenclatural LSIDs supposed to be used in *Zoobank* from this point of view.

<sup>2</sup> This terminological mistake could appear as due to oversight and devoid of meaning, but in fact it seems to reflect a more widespread confusion, as it appears regularly in the taxonomic literature, e.g. in Moylan *et al.* (2014: 6), who wrote [our stress]: “The production of paper copies did not confer ‘availability’ to an electronic work or any new *species names described therein*. Yet in cases where multiple paper copies for *articles describing new names* were indeed issued (and did conform to Article 8 of the *Code*) these copies form a separate work on their own.”

### 3.10.1. *LSIDs of works*

Concerning works, this requirement of unambiguity may be complied with only if a given LSID points to a single document, and if a given document has only one LSID. (The same applies in fact to Digital Object Identifiers or DOIs, also used to identify publications, and which are redundant with the LSIDs for this purpose). If the first condition is not respected, the situation [G1] will be that of redundant LSIDs, and if the second condition is not, the situation [G2] will be that of an ambiguous LSID. Both situations will be potential sources of nomenclatural inaccuracy and instability.

[G1] Two or more LSIDs will be redundant if the same work can be preregistered, e.g. by different co-authors of a work, under two different LSIDs. This situation was considered above (§ 3.4).

[G2] An ambiguous LSID is one that can be attached to two distinct documents. This is not only a theoretical possibility, but a very frequent situation nowadays indeed: it applies whenever a document is distributed online expressly as a ‘preliminary version’, with a given LSID (and DOI), followed later by a ‘final version’ distributed online with the same LSID (and DOI). As, according to Article 9.9 of A-2012, the first document is unavailable and the second one available, they cannot be stated to be ‘the same’ document, and the fact that they bear the same LSID (and also the same DOI) is bound to be a source of nomenclatural ambiguity, confusion and dysfunction. This also occurs, and then it is ‘worse’, when a ‘final version’, once published online, is ‘corrected’, i.e. *modified*, instead of publishing separately an independent ‘erratum’ or ‘corrigendum’ as suggested in Recommendation 8D of A-2012. Comments on some such cases were provided elsewhere (Dubois *et al.* 2013: Appendix 1; Dubois & Aesch 2017). Ironically, the paper of Dubois *et al.* (2013) was re-issued by the publisher as a different version, following the modification of some figures, and this information does not appear on the version currently available on the *Zootaxa* website, but those who downloaded the original version or who received the original printed version can check the difference. This has no nomenclatural consequence in this case, as the paper did not include any nomenclatural act, but this shows that even ‘serious’ journals can be ‘tempted’ to surreptitiously modify the online versions of some of their papers rather than re-issue them transparently as a new version. This was one of the reasons why some authors, e.g. Dubois (2010a) and Dubois *et al.* (2013), were very reluctant to allow the possibility of nomenclatural availability to be provided by electronic publication, and there is little doubt that there are other (numerous?) such cases in the recent online taxonomic literature. We will come back to this question below (§ 5.2.4).

### 3.10.2. *LSIDs of nomina*

At first sight, it would seem that *Zoobank* provides LSIDs for nomina. This seemingly simple statement is questionable, for two distinct reasons which are both related to the use in *Zoobank* of an imprecise terminology.

[H1] As mentioned above (§ 3.10), on *Zoobank*, the entries concerning publications include an item entitled ‘Nomenclatural Acts’, not ‘New Taxon Names’, so that it would seem that this entry concerns onomatopergies. However, in fact the only onomatopergies that are mentioned under this heading are catastasies. As the second item on these entries is entitled ‘Other Taxon Names’, this supports the interpretation that what are recorded under ‘Nomenclatural Acts’ are indeed new nomina, i.e. the *results* of some nomenclatural acts, not these acts themselves—or both! Even if this does not prevent understanding, the use of a term describing an action for the result of this action testifies to a poor mastering of language and terminology, that is at least disturbing when coming from an organisation supposed to deal with nomina, i.e., with language.

[H2] What *Zoobank* calls ‘names’ is a heterogeneous category, which covers both nomina and paronyms. A *nomen* is a scientific name proposed by (an) author(s) for a ‘nominal taxon’, i.e., the

permanent link between this name and a specimen (or specimens), either directly (for species-series nomina) or indirectly (for genus- and family-series nomina). A nominal taxon has an *authorship* and *date*, and a (virtual or real) *onomatophore*. Its nomen is established (as *protonym*) under a given *spelling*, *rank* and *onymorph* (association of terms such as *combinations*, that involve specific epithets and generic substantives, or other associations, such as between generic and subgeneric substantives or between specific and subspecific epithets). These three parameters (or dimensions) are liable to change, e.g., when changes of the rank of a taxon (e.g., genus to subgenus or the reverse) are implemented. These different forms of the nomen, which keep the same authorship, date and onomatophores, are not different nomina but different avatars or *paronyms* of the same nomen (the protonym and subsequent *aponyms* if relevant). Nomina and paronyms differ in several respects. Nomina may be available or unavailable, and valid or invalid. As such, they may be involved in synonymy, homonymy and priority. None of these concepts apply to paronyms, for which the concepts of availability or unavailability are irrelevant, but which, when their nomina are considered valid for taxonomical reasons, may be correct or incorrect.

A full acknowledgement of this relation between nomina and paronyms would require to distinguish the way they are referred to by LSIDs: the simplest system would be to use LSIDs only for nomina and to refer to paronym by adding to these LSIDs tempering numbers or letters making it quite clear that all the different paronyms of a nomen do not have independent nomenclatural status but are entirely subordinate to the former. This system is fully workable and it was implemented in the Appendices A6 and A7 of Dubois *et al.* (2021a). But this is not the solution that was retained in *Zoobank*. This application treats two different paronyms of the same nomen as “homotypic synonyms”, as if they were different available nomina, considered for objective reasons to designate the same taxon. But paronyms do not have types, are not concerned as such by availability or unavailability, and cannot be synonyms, three qualifications that apply only to nomina. Thus, to come back to the example given above (§ 3.4), *Amazona gomezgarzai* and *Amazona albifrons gomezgarzai* are not synonyms but paronyms, and should not be ascribed different LSIDs. If the logic of *Zoobank* was to be followed, the 38 paronyms of the family-series nomen *RANINA* Batsch, 1796 (see Dubois *et al.* 2021a: 604) should be ascribed different LSIDs, as would the 29 paronyms of the nomen *SALAMANDRAE* Goldfuss, 1820 (see Dubois *et al.* 2021a: 606). Following the *Zoobank* model, different LSIDs should be given to different paronyms having the same spelling but different ranks, such as *RANINA* used by Batsch (1796: 179) for a family, by Gray (1825: 214) for a family-series taxon of unstated rank, by Bonaparte (1838: [195]) for a subfamily, by Gravenhorst (1843: 393) for a legio, by Günther (1858: 344) for a section and by Dubois *et al.* (2021a: 245) for a subtribe. All these LSIDs would be redundant as they would just refer to different avatars of the same nomen, not to different nomina. These different paronyms are the same nomen but refer to different taxa, and even the same paronym may refer to different taxa: e.g., almost all the generic nomina in Linnaeus which are still in use designate now genera which are much less inclusive taxa than in the original work. The confusion between nomina and paronyms stems from a confusion between nomina and taxa, i.e. between nomenclature and taxonomy.

Just like for the registration of works mentioned above, the possibility exists that the same nomen be registered independently by different authors at different dates, sometimes much later than the registration of the work that contained them. Just through looking at this website, it is not clear whether *Zoobank* has a system preventing the presence in this database of such redundant, and therefore confusing, LSIDs. This is not easy to check for an outsider of the administration of *Zoobank*, as downloading long lists of nomina takes a long time every time the screen has to be refreshed. However, starting the alphabetical exploration of the list of so-called ‘nomenclatural acts’ (in fact catastasies) concerning genera, one comes soon to the nomen *Astyanax* Baird & Girard, 1854, which has two LSIDs (CF26289E-9C43-479F-BBA5-767BC3A6EFE and 4DB39814-5BBA-4D7B-

8C5D-F830AB26824D). Spending more time on analysing this database would most likely disclose other examples.

We are therefore very far from having an unambiguous and bijective system where a given nomen corresponds to a single LSID and a given LSID to a single nomen. As we have seen, the redundancy and confusion can derive from two possible sources: the non-discrimination between nomina and paronyms, and different registrations of the same nomen. In view of this situation, the usefulness of LSIDs of nomina in taxonomy and nomenclature appears highly questionable. These identifiers would be plainly useful only if they were bijectively unambiguous, which is not the case currently.

### 3.10.3. *LSIDs of airesies*

Although Article 8.5.3 mentions the possibility to register ‘nomenclatural acts’ in *Zoobank*, it does not permit registration of airesies. This difference of treatment between catastasies and airesies has no theoretical or practical justification, and, as shown above (§ 3.6), can be a cause of nomenclatural problems.

### 3.10.4. *Conclusion*

In view of the elements above, it appears that: [I1] given the system of promulgation of works chosen by the Commission for electronic publications, the mention in the work itself of its LSID should be made mandatory in the *Code*, and no tolerance in this respect be allowed; [I2] a system should be implemented in *Zoobank* to impede the duplicate registration of LSIDs for the same work; [I3] the system currently in force in *Zoobank* allows for the possibility to implement both redundant and ambiguous LSIDs for nomina, and does not permit to implement LSIDs for airesies; [I4] however, if no tolerance is allowed, as suggested above (§ I1), for the mention of the work’s LSID in the work for its nomenclatural availability, the need of LSIDs for nomina and airesies disappears, and these could be abandoned—or a considerable improvement of the current system should be brought to it to avoid both redundant and ambiguous LSIDs.

## 3.11. *Intent to archive a work (Article 8.5.3.1)*

Article 8.5.3.1 requires that, for the availability of an e-publication, the entry in *Zoobank* provides “the name and Internet address of an organization other than the publisher that is intended to permanently archive the work in a manner that preserves the content and layout, and is capable of doing so. This information is not required to appear in the work itself.” The following justification of the mention of an ‘intent to archive’ was provided in the paper where A-2012 was presented (Anonymous 2012: 6):

“*Intent to archive*. The original proposal asked for archiving within one year, which created a ‘limbo period’ during which it would not be known if the archiving requirement had been fulfilled. The change to requiring ‘intent to archive’, analogous to intent to deposit a holotype (Article 16.4.2), eliminates this uncertainty. ZooBank provides a list of accepted archives and stores archive information for journals where such is known. If a user leaves the archive field blank, ZooBank warns that a statement of the intended archive is required for electronic publication. Users can suggest archives to be added to the accepted list in ZooBank.”



This explanation is far from being satisfactory, as it does not mention what is the status of a work that was ‘intended to be archived’ if this archiving has never occurred subsequently. The only possible reason for such a strange wording seems to be that this ‘flexibility’ is again a kind of ‘gift’ to publishers, allowing them more freedom and comfort in their work. But as no *a posteriori* control that this ‘intention’ has indeed been followed by action is required or foreseen, even after a fixed period (e.g., one year), this amounts in fact to making this requirement null and void. Even if after several years it can be shown that this archiving has not been implemented, the publisher may pretend still having the intention to do it. Such a strange ‘Rule’ is in fact not a Rule and should have no place in a juridical text like a *Code*. Actually, it is not the only one of its kind in the current *Code*. As stated in A-2012, Article 16.4.2 also allows a ‘statement of intent’ of deposition of a holotype or syntypes in a collection, but this does not justify it: rather, it points to the need that this other Article, which did not exist and the previous editions of the *Code* and was unfortunately added in the 1999 edition, be also modified (see Ceriaco *et al.* 2016, Dubois 2017c), but this question is outside the topic addressed here and will be discussed in forthcoming Sessions of the LZC.

Therefore, concerning Article 8.5.3.1, the requirement of ‘intent to archive’ the new work should be replaced by that of its ‘effective archiving’, as already proposed by the LZC (Dubois & Aesch 2019: 14). This archiving must be immediate at the time of publication, and no ‘limbo’ period be allowed. The name and address of the archive, as well as a registration reference in this archive, must be postregistered in *Zoobank* at the same time as the final reference of the work (including its issue number and pagination). As long as this information is missing in the *Zoobank* entry, the work would still be unpromulgated and unavailable. On the other hand, its absence in the work itself would have no nomenclatural consequence. This is because, whereas the obtention of an LSID for the work is immediate when the title of the latter is preregistered, that of a registration reference in an archive may take more time and anyway can be made only after its archiving, i.e., after its production. Delaying the distribution of the work until the archiving is done would delay the availability of the work. The publication date would be that of the distribution of the work, but the absence of postregistration of the archiving would nullify it subsequently.

This proposed change in A-2012 is presented below (§ 5.3).

### **3.12. International Standard Numbers: ISBN and ISSN (Article 8.5.3.2)**

Article 8.5.3.2 requires that the *Zoobank* entry provides the ISBN of the work or the ISSN of the periodical where the work is published. Just like for the preceding Article, it states: “The number is not required to appear in the work itself”, but in this case this is not justified, as this number can be known before publication. This ‘tolerance’ should therefore be suppressed (see § 5.3 below).

Note that this Article puts a limitation on the books and periodicals usable for e-publication of onomatopoeies. Not all publishers take the step to register their publications in the ISSN and ISBN systems, especially concerning monographs and in some countries, and those who don’t are *de facto* barred from publishing online new nomina or airesies in a *Code*-compliant manner. Fortunately, for the time being they can still do it on paper, as for the availability of paper publication no such mention is required.

### **3.13. Accuracy and reliability of the information on preregistration on Zoobank (Article 8.5.3)**

As discussed above, Article 8.5.3 of A-2012 mentions several conditions that are supposed to be indispensable for a work published online to be nomenclaturally available, but several of these

conditions are not really critical for this availability, not only because the Example of Article 8.5.3.3 allows for ‘admissible errors’ and because the evidence of archiving the work is not required, but also because the concepts of ‘accuracy’ and ‘reliability’ are completely missing in this Article. Thus, an ISBN or ISSN must be provided, but what happens if it is inaccurate or even ‘invented’ and non-existent? Admittedly, it is unlikely that an author would ‘invent’ a non-existent book or periodical to provide availability to self-published works and onomatergies, but, considering how easy it has become nowadays to create PDFs that ‘look like’ having been really published in genuine books or periodicals, this cannot be ruled out as totally impossible. However, much more worrying is the question of the date of publication. This date and its accuracy are of paramount importance in nomenclature, as in case of homonymy or synonymy between competing nomina or airesies this date will be the criterion allowing to establish the precedence among them. But, as mentioned above and discussed in more detail below, in many cases nowadays the date that appears in the PDF of the final version is not the actual date of distribution of the work but that of its (or one of its) preliminary version(s), and is therefore not accurate. This is a major problem that has to be addressed, which is done below (§ 3.15).

### **3.14. Different versions of e-publications (Articles 8.1.3.2, 9.9 and 21.8.3)**

#### **3.14.1. Papers published only online**

Articles 9.9 and 21.8.3, as published in A-2012, were quite straightforward. The beginning of Article 9 reads as follows: “**What does not constitute published work.** Notwithstanding the provisions of Article 8, none of the following constitutes published work within the meaning of the Code: (...)”. This was followed by a list of situations, including that of Article 9.9: “preliminary versions of works accessible electronically in advance of publication (see Article 21.8.3)”. Then Article 21.8.3 just repeated the same statement in a more detailed manner: “Some works are accessible online in preliminary versions before the publication date of the final version. Such advance electronic access does not advance the date of publication of a work, as preliminary versions are not published (Article 9.9).”

However, A-2012, which presented several new definitions for addition to the Glossary of the *Code*, did not do this for the terms ‘preliminary version’ and ‘final version’. In the absence of any operational definition, these terms can only be interpreted as meaning that, as soon as a publisher distributes successively several versions of an electronic work, differing by *any* feature (such as the format and layout, the colours, the page numbers, or the spelling of even a single word or letter), the first version(s) qualifies/qualify as preliminary, and the last one as the only final version. However, in some cases, no such final version can be stated to exist, as the journal where the work was published allows for unlimited modifications of the works on its website, thus following a general trend of our society which has been designated as a ‘culture of updates’ (Dubois *et al.* 2013: 39). This applies to online-only periodicals which practice the subsequent inclusion of corrections, comments and other additions as inserts within the ‘final versions’ of papers after their original release, instead of publishing notices of errata or corrigenda as separate publications, as stated in Recommendation 8D of A-2012. These inserts modify the ‘content and layout’ of the paper, which cannot therefore be claimed to be ‘immutable’ as, in journals having this editorial policy, new inserts can always be added at any time. Since, after their publication, such modified versions become the only ones that can be found on the website of the journal, according to Article 8.1.3.2 they make the work nomenclaturally unavailable. The status of ‘final version’ of a work can be maintained only if it is the only one that remains accessible on the website of the publisher after its ‘official’ publication (i.e., not bearing

a mention like ‘prepublication’, ‘early view’, ‘provisional PDF’, etc.). If the work presents new onomatologies, they will be available only there, not previously in preliminary versions (let us leave aside at this stage the question of its date). If this ‘final version’ is again later replaced by a still newer version, the only possible interpretation respecting A-2012 is that it loses this status: then the work cannot be stated to have a final version and is deprived definitively of nomenclatural availability.

It is therefore necessary to distinguish several distinct categories of versions for works published online: [J1] *preliminary versions*, distributed online before the final version, and among which it is possible to distinguish, whenever relevant, [J1a] the *original preliminary version* and [J1b] *(a) subsequent version/s*, that differ/s from the original version in some respect but is/are liable to be still indefinitely modified by the publisher, e.g. by changes in the pagination (which may occur when the paper is incorporated into an issue or volume and subsequently modified in this respect and possibly in others, such as the mention of a volume or issue number) or by the incorporation of corrections or additions within the preliminary version; [J2] if available, *a final version*, with a fixed content and layout, that will remain absolutely unchanged on the website of the publisher as long as the latter is active; this version can usually be distinguished from preliminary versions, which often are not referred to a periodical volume and number, and have no pagination or a pagination starting on page 1, by the fact that they bear volume and issue numbers, and pagination within the latter; [J3] in some cases, *(a) postfinal version/s*, resulting from the incorporation of corrections, additions or comments to the version initially presented as the final version. Not all works exist under these different versions. Some are published once and for all as a final version [J2], which is not preceded or followed by any other version. Some works exist only as [J1a] and [J1b], but never as [J2], and therefore never reach the status of nomenclatural availability. Those for which there exists at least one [J3] are definitively devoid of nomenclatural availability, just like many other categories of works (e.g., published on paper before 1758, published online before 2012 or published online without valid preregistration after 2011). The distinction between [J1a] and [J1b] is relevant, because, as we will see below, the former is usually the version to which the ‘publication date’ is (erroneously) attached.

After the publication of A-2012, this situation, although quite complex, was clear, and did not seem to open the possibility of a discussion, but this ‘obvious’ conclusion was challenged by a few authors, including members of the Commission and of its Secretariat, who introduced the new concepts of ‘version of record’ and of ‘metadata’ (descriptors of published documents, such as volume, issue and pagination), borrowed from the world of online publishers (e.g., Carvalho Moura *et al.* 1998, Anonymous 2008), a world that completely ignores the peculiarities and needs of zoological nomenclature (Dubois *et al.* 2015b, 2022b). These concepts are absent in A-2012 and are therefore not *Code*-compliant. The fact that some publishers adopted them and now qualify some preliminary versions of ‘versions of record’ does not change anything to this situation. In many cases, the so-called ‘version of record’ differs from the final version by only a few details, such as the absence of the final pagination and of volume and issue numbers, but, as noted previously (Dubois *et al.* 2015b, 2022b), this mere fact is enough to ascertain that a change has been brought to the document, so that the possibility that other changes may have been made into it, including in some onomatologies, in the original onymorphs or spellings of some nomina, in collection numbers of nomen-bearing or other specimens, etc., cannot be ruled out, especially when the documents at stake are long, which makes the word by word comparison of two versions difficult or impossible. The following comments published in Dubois *et al.* (2015b: 257–258) are worth remembering:

“Contrary to many publications in other fields of research, taxonomic publications are cited for many decades, and this demands to treat them differently from standard scientific publications which are often obsolete after 20 years or less. The confusion that might be introduced in the taxonomic literature by the existence and citation of two different documents differing by their metadata is not worth the small ‘advantage’ that a hurried publication online might have in a few rare cases. Taxonomy does not need quick publications,

it needs serious and solid ones. A major motivation for shortening the publication delay of a taxonomic work is not scientific, it is the importance given by many taxonomists for being credited with the ‘authorship’ of new names, a motivation which is a terrible nuisance for the science of taxonomy (Dubois, 2008, 2015). The delay between the preliminary work with provisional metadata and the final one with the definitive ones will in general be of a few weeks or months, at most of a few years. This is a drop of water in the ocean of time which is the working time of taxonomy. If Krell’s (2015) advice was followed, this might ‘please’ some publishers and authors, but taxonomists would have to carry for ever the confusing situation of citing two documents which are supposedly the same but are in fact different. In 50 years from now, if taxonomy still exists, we would still have to find in synonymies of revisions and monographs some references to a final document with definitive page and issue numbers, and in parallel some other references to the ‘same’ work but in a provisional version with different page numbers and no issue number—although this version would have been available online only for a few weeks or months and then have disappeared from all websites and have become unavailable to the whole scientific community, except the individuals or institutions that would have downloaded it during the small period of its availability as a ‘preview’ document. This is not serious!”

Therefore, any evidence that a change has been brought to any aspect of the ‘format and content’ of an online document, including its metadata, this must be interpreted as an evidence that the first issued version was a ‘preliminary version’ and is not nomenclaturally available, and the second one is the ‘final version’ and is available.

In this respect, the situation is clear only when the statement exists that a version is either [K1] a preliminary one (‘early view’, ‘preproofs’, etc.), either original or subsequent but still potentially modifiable (despite being possibly labelled as ‘version of record’) or [K2] a genuine non modifiable final version. Thus, a statement as follows is of clear interpretation: “This is a PDF file of an article that has undergone enhancements after acceptance, such as the addition of a cover page and metadata, and formatting for readability, but it is not yet the definitive version of record. This version will undergo additional copyediting, typesetting and review before it is published in its final form, but we are providing this version to give early visibility of the article. Please note that, during the production process, errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.” (Dufresnes *et al.* 2019a: [1]). In the latter case, the preliminary version was distributed (‘made available online’) on 11 September 2019, but the final version (Dufresnes *et al.* 2019b) was issued at an unknown precise date in the December 2019 issue of the journal, and must therefore be credited, for nomenclatural purposes, with the publication date of 31 December 2019. Note that in the *Zoobank* entry of this work, the latter is credited with the publication date of September 2019, like in many other cases of works first published as preliminary versions.

A clear clue that a version is not the final one is when it can easily be detected to include parts of text that can be shown to have been modified in a subsequent version. For example, the Acknowledgements in page 14508 of Hofmann *et al.* (2019b) are different from those that appear in the corresponding page 11 of Hofmann *et al.* (2019a). In this case, the fact that the version first published online was a preliminary one could also be detected by the presentation of the references being different in pages 11–14 of the latter and in pages 14508–14511 of the former, but in such cases the fact that the pagination is different is enough to ascertain that the latter only qualifies as the final version. In many cases, the pagination is therefore a reliable indicator that a work is a preliminary, not final, version, and this allows to save time and work to establish this fact. For this reason, ***pagination should always be given foremost importance to establish if a version is preliminary or final.*** This approach is exactly opposite to the ‘version of record’ approach and disqualifies it.

This is the reason why, in its Session 16, the LZC proposed that, in Article 8.1.3.2, the phrase “widely accessible electronic copies with fixed content and layout” be replaced by “widely accessible, definitively edited and paginated, electronic copies with fixed content and layout” (Dubois & Aesch 2019: 15). However, even then, an uncertainty may subsist regarding the adjective ‘definitive’ since, as discussed above, some journals may continue to introduce modifications, such as additions or corrections, in this final version.

A solid solution to this very irritating problem will not be possible without introducing several changes in A-2012. We are aware of four possible approaches to this challenge.

The first one (Dubois *et al.* 2015a: 15) consists in publishing the work both as an online document and as a paper-printed one, and to distribute them exactly on the same date, and caring for the original online document not ever being modified subsequently. This was, for example, the practice of the journal *Zootaxa* until the end of 2012 and this is still the practice of its sister journal *Bionomina*, so that there exists in fact no ‘preview’ of the latter. This practice eliminates any possible subsequent discussion about the availability and publication date of a paper dealing with nomenclatural matters, as, irrespective of the *Zoobank* registration, the nomenclatural availability is provided by the paper version as it has been for 250 years. This solution is not possible for journals that do not have paper editions, which are more and more numerous nowadays.

The second solution applies to journals that have adopted the practice of publishing ‘preliminary versions’ of online works. It consists in using the exactly same document for the first online publication of the isolated paper and for its final publication as part of a volume and issue, either simply online or both online and on paper. This course has been followed by some taxonomic journals such as *Zootaxa* since the beginning of 2013. For this to be possible, the order of the papers in each issue and the numbering of their pages must therefore be strictly chronological, following the order of acceptance, edition and distribution of the papers. It was suggested (Dubois *et al.* 2015a: 15) that online journals which adopt such an editorial policy could agree to share a common ‘label’. This proposal was detailed as follows (Dubois *et al.* 2015b: 263):

“[...] we proposed that the journals who wish so might adhere voluntarily to a ‘charter’ and be given a ‘label’. The latter would just state that the adhering publishers and journals agree to respect the following specifications: [1] these journals publish only one ‘final’ version, bearing a unique DOI [and LSID], of each of their papers having taxonomic and nomenclatural implications; [2] the label appears on the first or last page of each paper; [3] the record corresponding to this paper in *Zoobank*, registered before its publication, is not liable to be surreptitiously changed [...]. This label could be registered, for example by the Commission if it is interested, and its mention would appear in databases dealing with periodicals (such as *Zoobank*). [...].

The label of a periodical or publisher could be withdrawn as soon as a violation of the charter was reported to the body in charge of the label. This would not require being ‘voted’ upon by any committee or commission. The simple fact, if demonstrated (through the comparison of two PDFs), would be enough. A fixed period (e.g. of 3 years) would then be required before a possible readmission on the list of periodicals bearing the label.”

This proposal did not elicit any comment or any reaction from the Commission or other organisations or colleagues. The LZC does not have the financial possibility to implement this solution, so that, unless and until it finds support, it cannot be implemented (Dubois & Aesch 2017: 44).

The third practice (Dubois *et al.* 2015a: 15) would involve including in preliminary online versions of publications *disclaimers* following Article 8.2 and Recommendation 8G of A-2012, stating that these previews are not published in the meaning of the *Code*. Such disclaimers would be removed from the final version, which would then appear clearly as the only one providing nomenclatural availability to the work and its onomatopoeies.

We here propose a fourth, simpler, solution to this problem, which of course will require some changes in the practices of taxonomists and publishers, but which we think would allow to remove ambiguity and doubt in this difficult domain. We propose the following changes to the Rules of A-2012 concerning the availability of e-publications (see § 5.3 below):

[L1] adding the *requirement* to mention explicitly the exact formula ‘final version’ in the version that will not suffer any subsequent change;

[L2] adding the *requirement* that this final version be the only one remaining accessible on the website of the journal;

[L3] considering all other previous versions differing, even by small details, from the final version,

whether called ‘preliminary’, ‘early view’, ‘ahead of print’, etc., or even ‘version of record’, or simply without any qualification of version, as ***definitively unavailable***;

[L4] if a version previously distributed with the label ‘final version’ is subsequently replaced on the website of the journal or book by a different version, ruling that this ***withdraws the nomenclatural availability*** to all versions of the paper including this last one, just like in case of invalidation of a work by the Commission.

Two more qualifications [L5] and [L6] should be added, concerning the publication date stated in the final electronic version itself: they will be considered below.

To complete this discussion, let us remember that, in its Session 13 (Dubois & Aesch 2017), the LZC already adopted a definition of ‘preliminary version’, a concept not defined in A-2012 and for which a shorter definition had already been proposed by Dubois *et al.* (2015a–b). Following the discussion above, a more precise definition is provided below (§ 5.4.1). Additionally, we also provide in § 5.4.1 definitions of ‘final version’ and ‘postfinal version’, concepts not defined in A-2012 either.

### 3.14.2. *Papers published both online and on paper*

Some periodicals and books have a ‘mixed’ editorial policy: they publish their works both online and on paper. Three models exist in this respect: [M1] both versions are distributed exactly on the same day; [M2] the online version is distributed first; [M3] the paper version is distributed first.

The policy [M1] was used by some journals, such as *Zootaxa* and *Zookeys*, before publication of A-2012, in order to be able to publish their papers in a *Code-compliant* way (on paper) but also to distribute them mostly online through electronic versions. However, once A-2012 was published, they shifted to the policy [M2]. Nevertheless, some publishers of periodicals having nomenclatural implications, such as *Bionomina*, still stick to the [M1] model.

The approach [M2] is probably the most used model nowadays. However, this does not mean that the online version is always that which provides availability to the work. It is so only when the online version published before the paper version is also the final version, which is the case for *Zootaxa* and *Zookeys*. If only preliminary and subsequent electronic versions are distributed first, then the paper version, and then only the final electronic version, the nomenclatural availability is provided by the paper version. Its actual distribution date is then the publication date of the work.

Finally, the model [M3] is used by a few periodicals, which removes any possible doubt and ambiguity regarding the version that provides nomenclatural availability. In such cases, the date difference may be of only one day, in order to make it quite clear which version is the valid one for this purpose, for example by a mention like: “Published in *Weevil News* Print (ISSN 2747-5514): 01. December 2021. Internet (open access, PDF): 02. December 2021” (Stüben 2021: 1).

Let us note finally that more and more scientific periodicals, even among the oldest and best known, tend to abandon their paper versions, but that this is not clearly indicated on their websites. The latter often make a distinction between their most recent papers, stated to be still in their preliminary stage of ‘early view’, often with provisional pagination, and those in the final version, belonging in a volume and/or issue and bearing their definitive pagination (but often and erroneously the same date of publication, as we have seen). It is not always easy to understand from their websites if these final versions exist only online or both online and on paper, although this is an important information for nomenclature: if the online paper is mispromulgated, the paper version, if it exists, may provide availability to the work, but if it does not exist the work will remain unavailable.

All these different possibilities have consequences regarding the actual promulgation date of onomatologies, as discussed below.

### 3.14.3. *Promulgation, unpromulgation, mispromulgation, depromulgation*

As we have seen, the term ‘publication’, if used within the realm of zoological nomenclature, is ambiguous, as it may mean either the fact of distributing/publishing a work or the work/publication itself after this distribution (‘trivial’ sense of the term), or the fact of publishing the work in a *Code*-compliant manner, making it nomenclaturally available (technical meaning of the term in nomenclature). For this latter meaning, we have proposed to use the noun ***promulgation*** and the verb ***promulgate***. Promulgation of a work must be distinguished from three other situations: ***unpromulgation***, ***mispromulgation*** and ***depromulgation***. An online work may be published (in the trivial sense of the term) but ***unpromulgated*** if it is explicitly presented as not complying with the criteria of the *Code* for promulgation (e.g., by bearing a mention like ‘preliminary version’, ‘early view’, etc.). It may be ***mispromulgated*** if it is published and considered by its author, editor and/or publisher as promulgated (e.g., by bearing a mention like ‘version of record’) but is not so because it does not comply with the criteria of the *Code* for promulgation (e.g., by differing from the ‘final version’ of the work in some respects, such as its metadata). Finally, it may be ***depromulgated*** if, after having been validly promulgated, it corresponds to one of the three following situations (see § 5.2.4 and 5.3 below): [N1] absence of postregistration of the reference to its archiving; [N2] publication of a postfinal version after the final version; [N3] removal of nomenclatural availability of the work by the Commission under the Plenary Power.

### 3.15. *The actual promulgation date*

As mentioned above, the concept of ‘actual publication date’ of e-publications is fully missing in A-2012. This date is that of the distribution of the final version, not of its submission to the journal or of acceptance by the latter, nor of any preliminary or subsequent one, including the so-called ‘version of record’, before publication of the final version. Thus, a genuine problem arises whenever the date of publication stated in the final version is that of a preliminary version, not of the final one, as it is the case for many recent works, including some mentioned above, such as Dufresnes *et al.* (2019b) and Hofmann *et al.* (2019b), and others mentioned in Dubois *et al.* (2013, 2014, 2015a–b, 2021a) and Dubois & Aeschl (2017, 2019). This problem is further enhanced by the fact that in such cases the *Zoobank* entry indicates as ‘publication date’ of the work the date of distribution of the preliminary version. In fact, while in other scientific domains, including molecular phylogeny, evolution or ecology, such prepublications or ‘preprints’ may indeed in some cases be used as evidence that a researcher or a team was the ‘first one’ to have made a discovery or proposed a hypothesis, in nomenclature this is not only useless but it may act in the reverse direction, if it results in the unavailability of the work or the onomatopoeies it contains. The insistence of some taxonomists to publish new nomina or new airesies in periodicals that practice prepublication is an indication that they do not understand the nomenclatural Rules or that they do not care for them.

This is a crucial point and a major lack, which is striking for any experienced taxonomist, as this date is the only one that will have to be taken into account in cases of nomenclatural conflict between synonymous or homonymous nomina or of competing airesies in different publications.

As a matter of fact, problems related to the actual publication dates of works printed on paper have played an important role throughout the whole history of zoological taxonomy and literature. It is well known that the dates that appear in the books and periodicals themselves are often wrong, in most cases because the work was published later than this date, and in much rarer cases because it was in fact published earlier than this foreseen date. Taxonomists have devised a number of solutions to deal with this problem, which all rely on ***external*** evidence, not on evidence appearing in the work itself. In some rather rare cases, this evidence points to an ***exact*** date of publication: e.g., shipping date

stamped on the envelope in which the periodical was mailed, or presence in the next issue of the same periodical of an explicit statement of the date where the work at stake was *actually distributed*, not ‘intended to be so’. But, in most cases, the evidence points only to a *default* date: e.g., rubber stamp affixed to a work upon reception by a library, or mention of the work among the ‘works received’ in the minutes of a meeting of a learned society. For papers published in periodicals, some doubts may remain then about whether the work so received was [O1] the final version appearing in an issue of the periodical or [O2] a separate or preprint, which both, before 2000, were liable to advance the date of publication. However, in most cases this can be established without ambiguity.

The situation is different regarding electronic versions of works, as these are not stamped upon reception in libraries, and there remain nowadays only a few learned societies that publish reports of their meetings, where mention could be made to reception of works. Furthermore, when such information is available, few addressees will state whether the electronic version received was a preliminary, subsequent, final or postfinal one. Since, as we have seen above (§ 3.14.1), the websites of most electronic journals are not reliable in this respect (as they indicate as publication date of the work the date of online distribution of its original preliminary version), the only reliable evidence can be external. It may be for example the date of downloading of the PDF of the final version of the work on the personal computer of a researcher or of a library, date which appears on the link to this document on this computer, but this is not a public and permanent information. A public information about this could be the date of uploading of this final version in an archive where the work is supposed to be permanently kept, as required by Article 8.5.3.1 of A-2012. However, this date may be much later than the actual online distribution of this version, because, as stressed above, this Article only requires the mention of the ‘intent’ to archive the work, not its actual archiving (which could indeed play the role of a solid evidence for the publication date). We are therefore left, in many cases, with an uncertainty regarding the actual publication of the final version. Some periodicals indicate on their websites the date of distribution of the final electronic version, or of the paper version, of the whole issue containing the paper, and this date can be accepted as accurate unless evidence is provided to the contrary. In many cases, this date appearing on the website consists only in a month, so that the publication date usable for the purposes of zoological nomenclature will have to be the last day of the month. When no such information is present on the website, we are left with uncertainty regarding the actual publication date of the work, and recourse to indirect (such as citation in a work clearly stating that the version cited is the final one) or private (such as date of downloading on a personal computer) information is available. In some cases of competing onomatologies, this may be quite insufficient and unsatisfactory.

Anyway, the important point here is that, as soon as evidence exists that a work has been distributed as two or more versions differing by any detail, they must be considered as consisting in one or several preliminary and subsequent version(s) and a single final version (if it does indeed exist). The two following changes in A-2012 should therefore be added to those of § 3.14.1 above:

[L5] if a final version bears the date of any preliminary version, it is thereby made automatically and definitively unavailable;

[L6] if a final version bears a date which is at variance with that indicated in the website of a journal or book, this makes thereby the work definitively unavailable.

Then, to add a complication, if a work has been distributed both online and on paper, its accurate publication date may be either that of the paper version or of the final electronic version, and in this respect attention must be paid to the various situations described above (§ 3.14.2).

It is clear from the discussion above that, anyway, the current problems raised by the mere existence of preliminary electronic versions of papers having nomenclatural implications will not be easily solved, even through an improvement of the Rules regarding these versions. The only real solution



would be through a drastic change in A-2012, stating that preliminary versions are not allowed in papers including nomenclatural novelties, and that providing evidence that a paper has been distributed, with the same DOI and LSID, under at least two different versions, makes it definitively unavailable. However, implementing such a solution would appear to be unrealistic nowadays.

### 3.16. Facsimiles

For a smooth and uncontroversial management of zoological nomenclature, A-2012 must be taken very seriously, not under ‘tolerant’ criteria (Dubois *et al.* 2013: 24–25). This applies in particular to a strict respect of the transition 2011/2012 for the availability of periodicals or books existing only in an electronic version, without simultaneous publication of an independent paper edition (bearing a distinct ISSN/ISBN), or to a *strict* respect of *all* the criteria given by A-2012 for the nomenclatural availability of periodicals or books existing only in an electronic version, without any paper edition. As pointed out in Dubois *et al.* (2013), this is contradictory with some of the ‘advices’ published by some Commission members.

Article 8.6 of the 1999 *Code* accepted the availability of “works produced after 1999 by a method that does not employ printing on paper” if these contained “a statement that copies (in the form in which it is published) have been deposited in at least 5 major publicly accessible libraries which are identified by name in the work itself”. This Rule became retroactively obsolete with the publication of A-2012, and anyway it could not be used to provide availability to e-publications deposited as paper copies in libraries, as these copies were not ‘in the form in which [these works were] published’.

Article 8.6 of the 1999 *Code* was suppressed in A-2012. The question of paper versions of papers published online before 2012 deposited in five (or more) libraries but not “obtainable, when first issued, free of charge or by purchase”, as stated in Article 8.1.2 of A-2012, was discussed at length in Dubois *et al.* (2013: 4, 14–25, 45): such versions qualify as facsimiles of unavailable works and are therefore themselves unavailable according to Article 9.12. The conclusions of this discussion (Dubois *et al.* 2013: 20–21) can be slightly reworded as follows:

“Paper-printed facsimiles or reproductions of unavailable electronic publications differ from genuine available paper publications through: [1] not being clearly obtainable, when first issued, free of charge or by purchase, even if deposited in five major libraries or other archives; [2] having been directly printed from the PDF as provided on a publisher’s website, bearing the same ISSN/ISBN as the latter or no such identifier, not their own ISSN/ISBN.

Facsimiles or reproductions as paper-printed copies of unavailable electronic publications (i.e., those published before 2012 or after 2011 but not complying with the requirements of Articles 8.1, 8.5.2 and 8.5.3 of A-2012 of the *Code*), do not qualify as available publications for the purpose of zoological nomenclature (Article 9.12 of A-2012 of the *Code*), and the nomenclatural novelties they contain are nomenclaturally unavailable.”

Dubois & Aescht (2017) showed that the so-called ‘reply’ of the Commission (Anonymous 2014) and of editors and publishers (Moylan *et al.* 2014) to Dubois *et al.* (2013) did not in fact reply to the arguments presented in the latter work but simply ignored them. The core of the problem lies in the interpretation of the word *obtainable* in the phrase “obtainable, when first issued, free of charge or by purchase”. In Article 8.1.2, this word can only mean “acquirable, that can be acquired” by anybody actively asking for it, not only acquired passively through reception or deposition in a few libraries chosen by the publisher. Therefore, all the electronic works for which papers were deposited in libraries but were not obtainable upon request by any other interested persons are unavailable in zoological nomenclature, and this applies to all the onomatopoeies (new catastasies and airesies) they may contain. Evidence that some paper-printed copies of PDFs deposited in libraries before 2012

were not obtainable, whereas others were available, were provided in Dubois *et al.* (2013: 14–17, 59–60, 67–71, 86–88), with detailed analyses of precise examples concerning several journals published by BMC, as well as *PLoS One*, the *European Journal of Taxonomy*, *Snudebiller*, *Palaeontologica Electronica* and *Biota Neotropica*. A simplistic approach treating all such paper-copies identically would be inappropriate. In fact, because of several ‘levels of misunderstanding’ of the *Code*, there is a gradation or range from clearly unavailable works to clearly available ones, through works that can be considered as ‘possibly available’ (depending on some information that is currently not known). To illustrate this, let us come back to a few examples analysed in Dubois *et al.* (2013).

At one extremity of this range, the case of the periodicals published online by BMC until 2012 is clear. Although paper copies of some (and anyway not all) of these PDFs were deposited in a few libraries, when contacted to order some of them, the publisher of these journals denied that they were genuine printed copies (Dubois *et al.* 2013: 59):

“I can confirm that we do not publish copies of any of our journals”. (6 November 2012).

“BioMed Central does not print any of journals/articles unless we receive an actual order. When this occurs our Reprints Department assesses the order and then provides the customer with a price. However, it would always be much more cheaper [*sic*] and more efficient for any institution/customer to simply access the journal in question and print the articles that they require.” (7 November 2012).

Therefore, the printed copies of these papers were not seen by their publisher itself as actually ‘published’ and cannot qualify as available publications but as “facsimiles or reproductions obtained on demand of [...] unpublished works [...], even if previously deposited in a library or other archive” (Article 9.12).

At the other extremity of this range, the journal *PLoS One*, which initially (in 2006) published its papers only online, announced in May 2009 that it changed its publication model and would then print ‘numerous copies’ of its e-publications and that these copies would be obtainable against payment by “Anyone who requests a copy” (Dubois *et al.* 2013: 82). Such paper printed works then qualify clearly as promulgated works for the purposes of zoological nomenclature.

These complex questions cannot therefore be solved only by ‘simple’ replies but need detailed analyses, which are not “outside the scope” of the paper at stake (Anonymous 2014: 3). This prompted the following comments in Dubois *et al.* (2013: 88): “the details of every case must be scrutinised in order to know whether a work published electronically qualifies as a publication as defined in the 2012 amendment. It is quite doubtful that all authors and users of taxonomic publications will indeed do such a work. It is therefore quite predictable that nomenclatural problems will appear in electronic-only published periodicals, at least in the first years after September 2012.” This prediction is still valid today, ten years after the promulgation of A-2012.

A few authors tried to ‘save’ some of these unavailable works and their nomenclatural novelties. This is the case of the nomen *Bufo siculus*, published online by Stöck *et al.* (2008) in a work one paper copy of which was found to have been deposited in the Paris Museum library (Dubois *et al.* 2013: 62), but for which there exists no published evidence of the existence of other printed copies, as this was not mentioned in the publication itself<sup>3</sup>.

3 It is interesting to note that, instead of simply admitting that this nomen is unavailable and suggesting the original authors to publish an available nomen for this taxon, or doing it themselves, several authors tried to ‘save’ this anopronym, first using misleading arguments (Krell 2009: 273) later rebutted (Dubois *et al.* 2013: 65–66), but again recently ignoring this reply and writing: “whether ‘numerous identical and durable copies’ (Article 8.1) were registered [*sic*] by the authors in parallel is yet to be addressed (P.A. Crochet pers. comm.)” (Dufresnes *et al.* 2019b: 22). This statement is outdated, as it refers to Article 8.6 of the 1999 *Code*, not to A-2012. In 2008, this Article 8.6 was still in force but [1] a paper print of a PDF does not comply with the requirement “in the form in which it is published”, and [2] the question is not whether such paper copies of this work were deposited (not ‘registered’) in libraries, but whether the work includes a statement about this deposition. This statement is clearly missing in the Stöck *et al.* (2008) paper, which closes this discussion.

### 3.17. *Online supplementary material*

The question of online supplementary material was also discussed in detail in Dubois *et al.* (2013) and this discussion does not need to be repeated here. Its main conclusion is that such electronic supplements, which are not mentioned in the references of the papers that are entered on *Zoobank*, and that are not automatically downloaded when the PDFs of the papers registered on *Zoobank* are downloaded, are not nomenclaturally available. Therefore, if they contain some information that is mandatory for the availability of a new nomen (e.g., designation of a holotype, description or diagnosis) or of an airesy (e.g., designation of a lectotype or neotype, prioritisation of a work), and if this information is missing in the body of the paper itself, these onomatergies are not available. We will come back to this point below (§ 5.5).

### 3.18. *Negation of intention, retraction of papers, invalidation of works by the Commission*

Since the 1985 version of the *Code* (Anonymous 1985), this text has contained a statement concerning the ‘negation of intention’, i.e., the possibility for an author to provide *explicitly*, in the paper itself, a statement according to which this work is not intended to provide nomenclatural availability to the onomatergies (new nomina and airesies) it contains. This Rule is still present in Article 8.2 of the current version of the *Code* and it must be respected. It is important however to note that this applies only when this negation of intention appears explicitly in the original paper itself, not in any subsequent work by the same or other author(s), including in any erratum or corrigendum published (distributed) subsequently from this paper.

The same applies to the concept of ‘retraction’ of papers, a practice recently developed in some scientific publications, which poses many ethical and historical problems as it amounts in fact to historical revisionism or denialism, as pointed out in (Dubois *et al.* 2013: 32, footnote 29) and discussed in detail in Dubois (2020*b–c*). Concerning zoological nomenclature, any work, once validly promulgated, cannot be suppressed or retracted by any voluntary individual action, including by the author(s) of the work, and the onomatergies it contains, if originally published in a *Code*-compliant manner, remain available. ‘Retraction’ does not mean ‘destruction’ or ‘disappearance’. Once ‘retracted’, a paper remains accessible to readers, so that it can still be used by taxonomists as a source for onomatergies and nomina. This is true not only for paper publications (as no serious librarian would allow the material destruction of printed works under his/her care) but also for electronic publications, as ‘retracted’ works remain accessible on the web, although sometimes with the mention that they have been ‘retracted’).

Once published without a negation of intention, and respecting the criteria of Articles 3.2, 7–9 and 11.4, a work and all its onomatergies are available, and this availability can be removed only through the publication of a decision of the Commission taken under the Plenary Power, or in two very particular cases of unintentional depromulgation discussed above (§ 3.11, 3.14.1 and 3.14.3) and below (§ 5.2 and 5.3). Note however that, after 1913 (date of introduction in the *Code* of the concept of Plenary Power; see Stiles 1913*a–b*), any statement by the Commission that a work is unavailable although the *Code*’s conditions for availability were originally present, which is not relying explicitly on the use of the Plenary Power, is null and void.

Invalidation (so-called ‘suppression’; see Dubois 2000) of a work by the Commission under the Plenary Power is a strong decision, with important consequences. It implies the invalidation of all the onomatergies validly promulgated in this work, except if the Commission, either in the publication announcing this invalidation or in a subsequent work, decides to protect some of these onomatergies from invalidation or to restore their availability after having removed it. This used to be the case in

the first years of activity of the Commission: close attention was often given then to ‘save’ some well-known nomina from invalidation when they were clearly in general use in the literature. In the recent years however, the Commission has tended to ignore this possibility and to invalidate some works that had been considered available for decades or centuries, including some well-known nomina established in these works, thus acting exactly in the direction opposite to its often stated intention to protect by all means ‘nomenclatural stability’ (see e.g. Dubois 2017*b* and Dubois *et al.* 2021*b*).

### 3.19. *Deliberate ignorance vs. refutation*

The purpose of the *Code* is to provide universal Rules for the management of zoological nomenclature in the three main stages of the Nomenclatural Process (availability, allocation and validity), not to regulate taxonomic thought and action. Taxonomy is a scientific discipline, and science never establishes ‘truths’: it proposes hypotheses, which stand as long as they are not refuted, and then must be abandoned and replaced by others. Nomenclature is not concerned with ‘truth’ or with scientific accuracy, it just allows to ‘translate’ taxonomic hypotheses, as long as they are accepted as valid by some authors at least, as a set of universal statements regarding the availability, allocation and validity of nomina. These statements require to take into account the whole corpus of publications that deal with these three domains, whether one ‘likes’ them or not, or whether one agrees or not with the scientific interpretations of data and hypotheses on which these nomenclatural actions are based.

Deliberate ignorance of some works duly published in a *Code*-compliant manner and having nomenclatural implications and which have not been invalidated by the Commission under its Plenary Power, as promoted by some authors (e.g., Orr & Fliedner 2011, Kaiser *et al.* 2013, Gilman & Wright 2020, Poyarkov *et al.* 2021, Smith & Figueiredo 2021), is unacceptable and should be bluntly rejected by the international taxonomic community. Not doing so would open a reign or arbitrary and self-decisions by individuals or groups in parallel with respect for the *Code* and the Commission’s decisions by other colleagues, a kind of ‘nomenclatural Wild West’ without Rule of Law, which would soon result in a nomenclatural chaos that would be highly deleterious to all biological sciences and to society as a whole.

Whenever the careful and faithful application of the nomenclatural Rules to publications have implications that pose genuine scientific, technical or ethical problems, such cases should be submitted to the Commission, either for their resolution as specific ‘cases’ under the Plenary Power or more widely through introducing modifications into the *Code*. Whenever the Commission decides not to adopt a proposal submitted to it, e.g. to invalidate some works, the community should respect and follow this decision instead of ignoring it or trying to circumvent it through ‘tricks’ (e.g., Cranston *et al.* 2015, Krell 2015). Like all human groups, and although it sometimes clearly forgets it, the Commission can make mistakes: the proper way to address these problems is to submit new applications to it, until the problem is solved, but certainly not to ignore its (sometimes wrong and unjustified) decisions, as in the long run the repetition of such an attitude is prone to considerably weaken the necessary respect due by the community for the *Code* and the ‘Opinions’ (in fact decisions) of the Commission, and to promote nomenclatural mayhem.

### 3.20. *Nomenclatural and taxonomic databases, websites, blogs, etc.*

The last twenty years have witnessed the flowering of taxonomic and nomenclatural databases, websites, blogs, and other online tools providing classifications of organisms, lists of taxa and nomina, and sometimes comments on the taxonomy, nomenclature, biogeography, conservation status and

biology of the taxa concerned. Most of these databases just contain compilations of data and few of them include original data.

Many of them go beyond the mere presentation of the ‘state of the art’ in any given domain but present new interpretations, taxonomic or nomenclatural acts.

An important particularity of most of these databases is that they are the result of the work of a single or a few persons, and are not submitted to any kind of ‘peer review’ or even to demand for the opinion of colleagues.

Many of them are unreliable, as they contain mistakes, especially in the field of zoological nomenclature (Dubois 2017*a–b*, Dubois & Ohler 2018), and should be used mostly as a way to obtain preliminary information and data that should later be critically evaluated through always going back to the genuine original publications. Many of them, specialised on taxonomic groups, just refer to, or are uncritical copies of, other more inclusive databases. Few of these databases provide genuine bibliographic references, e.g. to original descriptions of taxa, but just refer to entries in ‘comprehensive’ databases such as those of the GBIF. Therefore, the errors that may have appeared originally in one database are often subsequently spread automatically to other databases and, being consistently repeated in several documents, may appear to some as accurate and reliable.

A serious work on the taxonomy and nomenclature of a zoological group should never rely only on such databases. Furthermore, such databases do not stand as available works in zoological nomenclature: they have no ISSN or ISBN, are not registered on *Zoobank*, and, being often ‘updated’, they have no stability and should not be cited as bibliographic source for information, as their content may have changed in the meanwhile (Dubois 2022). The authors that refer to databases as a source of original (i.e., not borrowed from duly published works) taxonomic or nomenclatural information (e.g. Mound & Hastenpflug-Vesmanis 2021, Poyarkov *et al.* 2021, Böhme & Jablonski 2022), instead of providing this information in full, run the risk to see their reference leading to an empty source, for which the term ‘phantom information’ would be appropriate. Several examples of such situations were given in Dubois *et al.* (2013: 33), which also provide counter-examples of the appropriate course to follow in such cases. As a matter of fact, since they are not available publications according to the *Code*, they should never be cited as sources of new onomatergies (new nomina or airesies), as the latter are null and void. This applies among others to designations of lectotypes or neotypes, of type species for nominal genera, to prioritisation of a publication over another synchronic one or to emendations of spellings. If an onomatergy is necessary, it should be promulgated and presented as ‘new’ in a duly published paper (e.g., Martín *et al.* 2012), not credited to the author of the unavailable nomenclatural action.

#### 4. Discussion: summary of the main problems

As shown by the discussion above, A-2012 leaves several important questions regarding the e-publication of nomenclatural acts unanswered, or with incomplete or flawed answers. Beside other minor ones, the two main such questions are: [P1] the crucial need for absolute stability of the content and format of publications having nomenclatural implications, and more largely for the permanency of such publications even if the electronic network of internet faced difficulties or problems; [P2] the crucial need for each of these publications to have a unique, clear and precise publication date. None of these needs was adequately taken into account by this Amendment, and their solutions will require its modification.

Both these problems derive from the fact that electronic publication is by essence considerably different from paper publication. Paper publication results in the production, distribution and physical

storage of material documents that, once printed and distributed, cannot be modified. Such documents are the basis for *nomenclatural foundation*, one of the basic principles of zoological nomenclature (Dubois 2005a, 2011; Dubois *et al.* 2019) which states that the status of a nomen or onomatery is fixed once and for all in the document where it is first published, and cannot be modified later on, except in very specific and limited situations, and concerning only a few situations, such as subsequent fixation of onomatophores, or justified emendations and mandatory changes in spellings of nomina. In all other cases, any new publication of a modified version of a text, or of corrections to it, has to be considered a distinct work, with its own date, and any change in the spelling, rank or onomatophore (and therefore taxonomic allocation) of a nomen that it may contain has its own nomenclatural status and is junior to the original status of the nomen.

In contrast, electronic publications are by nature considerably labile, as their content and format can be modified immediately at any time, and the modified version, which may differ from the original one by only a few details (but some of which, concerning for example the spelling of a new nomen or the onomatophore of a new nominal taxon, may have important nomenclatural consequences), may be difficult to distinguish from the latter. The concept of *longevity* of documents, which is of paramount importance in nomenclature, is quite incompatible with and, in fact, contradictory to, the very nature of electronic documents. Given its importance, this point should have been granted the greatest attention when devising the new Rules of A-2012, but the problems emphasised above show that the results are below expectation.

The solution retained by the Commission to make an electronic work nomenclaturally available is based on the strict requirement of online preregistration of the work before its publication, and then its postregistration after distribution. This would be a good solution if the preregistration concerned the final proofs of the work itself just before its distribution strictly unmodified, or its published version on the very day of its distribution. However, what A-2012 requires is just to preregister a title of work, with its author(s), but with an unknown content. Even the postregistration, that follows the distribution of the document, does not concern the work itself but just its title and reference (journal, issue, pagination). It does not even require that the work be duly deposited in an archive, but only the 'intent' to do so (and, as shown above, even if this intent is never implemented, this does not cancel the availability of the work).

Besides, if the work has indeed been archived, some of the archives which may be used for this purpose are not in open access and do not allow to check *which* document has indeed been archived, i.e., using the terminology above, if it is the preliminary version, a subsequent version, the final version or a postfinal version of the work. In other words, even if an electronic work has been pre- and post-registered before and after publication, it is often impossible to know which version has been so and should be considered the 'final' one of the work, as well as its actual publication (distribution) date. The only system that would allow this would be if the archiving of the work was compulsory for its availability and if this archived version was accessible for free downloading by any interested user. This would be possible for example if *Zoobank* itself was such an archive, or if a specific archive, or several, was/were created for this purpose. However, this 'ideal' solution appears impossible to implement, for two distinct reasons: [Q1] the archive in question should have a gigantic storage capacity and a high level of protection, which would require a considerable funding that seems for the time being out of reach for the community of taxonomists; [Q2] the free accessibility of these archives would be incompatible with the economic model of copyright which is the basis of many online journals published by profit-making companies; it is more than unlikely that they would accept such a system, except perhaps if it could include a procedure allowing them to receive from the community of taxonomists some funding for these downloads. For sure, this problem would not exist with periodicals and books published by non-profit companies, that already provide open access to their papers, but they represent a small minority of the publications dealing with taxonomy and nomenclature.

And here we are bound to consider an aspect of A-2012 that has been largely overlooked so far. This aspect was made quite clear by a member of the Commission, who wrote about a nomen unavailable for having been established only online before 2012 in *BMC Evolutionary Biology*: “*Bufo siculus* entered the printed taxonomic literature in the year of its description (Razetti [*sic*] 2008). Actually, I have received Razetti’s [*sic*] paper as a PDF, hence have no indication that a paper version exists. I just assume, as everybody else does, that journals that are not generally known as electronic-only do exist on paper. [...] Papers in BMC journals are recognised and cited, and the names published are entering the scientific record despite being unavailable according to the zoological Code.” (Krell 2009: 273). This prompted detailed comments in Dubois *et al.* (2013: 65–66), which are worth referring to. Krell (2009) clearly favoured a *de facto* instead of *de jure* nomenclatural system (for details, see Dubois 2005b, 2011). To make this brief, he suggested that nomenclatural availability could be bestowed to a nomen invalidly published online through it having been cited as valid in the printed literature, i.e., through ‘usage’. If this advice was to be followed, thousands of *nomina nuda* that have been erroneously used as valid over the 250 years of zoological nomenclature would suddenly see their availability confirmed, which would have cataclysmic consequences on nomenclatural stability and accuracy.

This ‘detail’ throws an interesting light on some of the dispositions of A-2012, as well as of some of its subsequent interpretation by some Commission members, that can clearly be qualified as ‘lax’. This concerns for example the concepts of ‘admissible errors’, ‘intent to archive’ or ‘version of record’, which as we have seen are at the root of several of the problems here discussed. The support given by some Commission members at least to these concepts are summarised by the word *liberality* (Krell 2015). This advocated permissiveness contrasts with other dispositions of the *Code* and their rigid interpretation often adopted by the Commission in other situations, when they concerned old paper publications, as discussed above (§ 3.9). This flexibility is likely to be appreciated by commercial, profit-making publishing companies, some of which are listed on the stock exchange, and which have expressed their high concern about the criticisms raised by some taxonomists regarding A-2012 (Moylan *et al.* 2014) without providing genuine replies to these criticisms. However, this laxity has deleterious consequences on the smooth functioning of zoological nomenclature, as shown above. The *Code* is a text the function of which is to facilitate the work of taxonomists, not to please the shareholders of private commercial companies. In this respect, in any other domain of activity, the presence in a body having juridical attributions, like the Commission, of members or employees of private companies having financial interests that are likely to be affected by some of its decisions, would be considered to constitute a situation of conflict of interest and would not be tolerated, or at least these persons would not be allowed to take part in the discussions and votes concerning the topics related with their private interests.

Minelli (2013), facing the problems posed by the publication of a paper both on paper and online (but ignoring those, much more important in fact, caused by preliminary electronic versions) proposed a ‘milder’ system supposed to solve these problems. He did not go as far as suggesting that the papers themselves be downloaded on *Zoobank*, but that the information providing the nomenclatural availability of the onomatopergies promulgated in the paper be so. This would displace the act of nomenclatural promulgation from publication to registration. He wrote (Minelli 2013: 6):

“Imagine a website providing access to all scientific names of animals proposed thus far and also offering an interactive interface through which you can enter all data (differential diagnosis or description, fixation of type etc.) required by the *Code* in order to make a new name available for the purposes of zoological nomenclature: all items, except for publication in the traditional sense of the word. Entering your data through that website would represent *registration as well as a publication*. The system should be carefully instructed to check your input data for compliance with the *Code* and would offer you definitive assistance in avoiding the risk of proposing a junior homonym of an existing name. At the end of the registration/publication session, your new name would be not only available in the sense of the *Code*, but also immediately visible to everybody,

thus strongly reducing the risk that other specialists working on the same animal group may long overlook the newly described species.

To be sure, implementing (and maintaining!) a similar website will not be that easy. Establishing such a system will require consummate skills in informatics to translate the articles of the *Code* into functions of the interactive website. It will also require a lot of time and money to fill the archive component of the system with a complete list of the scientific names of animals published to date. It will require steady financial support to ensure that it will function with the necessary continuity and safety.

In terms of resources involved, this would certainly be a ‘big science’ enterprise. In terms of its usefulness, not only for taxonomists, the producers of scientific names of organisms, but also for the users of names, this is a challenge to be seriously considered, technical and financial difficulties notwithstanding.”

This proposal poses several problems that seriously challenge its appropriateness:

[R1] It is very unlikely that the Commission, or another international body dealing with zoological nomenclature, would be able to raise sufficient permanent funding to allow not only the launching but also the long-term functioning of such an expanded version of *Zoobank*, which would require the creation of several permanent jobs, not only volunteers. After more than ten years of functioning, this system has already proved unable to register airesies, and it shows several other weaknesses discussed above (§ 3.4–3.10). It has so far postregistered only a tiny proportion of all the available nomina of zoological nomenclature and did not even include all the nomina appearing in major catalogues like those of Agassiz, Sherborn and Neave, or all the generic nomina listed on the online version of the *Nomenclator Zoologicus*.

[R2] The introduction of a nomen for a new, or already recognised but still unnamed, taxon, is a scientific, not purely technical act. It consists in the statement that a formal taxonomic unit of biodiversity should be scientifically accepted and a nomen assigned to it. In some cases, this requires long developments and discussions, which could not be entered in the boxes of a website, that must be limited in content. This system proposes to dissociate the scientific work of presentation and discussion of the arguments in favour of recognition of the taxon from the technical work of promulgation of its nomen in a *Code*-compliant manner. These are indeed different matters, but so far they have in most cases been associated in the same work which has provided both the scientific and the technical information. Dissociating them could be a strong incitation for some taxonomists to provide only the technical information that is strictly necessary for the availability of the onomatergy and to ignore or pay little attention to the scientific dimension of the work. Of course, this is already the case in a part of the taxonomic works where new nomina are proposed, since, in taxonomy like in other fields, not all works are of the same scientific quality, but the fact that, to be published, a taxonomic work often has to go through a review by peers, certainly limits the errors. The *Code*’s criteria of availability of nomenclatural novelties do not include the need to go through peer review, which is fully justified because the number of referees really mastering the nomenclatural rules is dramatically low, much lower than that of referees competent in phylogeny, anatomy and taxonomy. However, when a paper is submitted to such referees, this may avoid mistakes or omissions not only in its nomenclatural but also in its taxonomic content. If adopted, the system proposed would be likely to result in bringing down the quality of taxonomic works erecting new taxa and naming them. Lazy taxonomists would limit their work to the registration of a limited list of pieces of information and would never publish genuine detailed taxonomic works justifying their nomenclatural acts, as anyway these works would not be necessary anymore to allow to attach one’s name as ‘author’ of the new nomina, the root for ‘mihilism’ (Bruun 1950; Dubois 2008, 2015)<sup>4</sup>.

[R3] The system proposed is presented as providing ‘registration as well as publication’, but this is misleading. A page in a website does not qualify as a publication, as it cannot be downloaded as a document with fixed content and layout, e.g. as a PDF/A. If *Zoobank* is to remain an interactive

---

4 Dubois (2015: 23, footnote 18) explained why the term ‘mihilism’ should be preferred to other terms or expressions sometimes used to designate this phenomenon.



website, its pages will be permanently modified (as they are today), and the criterion of longevity of the document will not be fulfilled. If it were so, it would be equivalent to a PDF downloaded from a publisher's website, and *Zoobank* would become a publisher itself, but the unreviewed 'papers' it would publish would only be 'skeletons' of papers. As discussed above (§ 2.1), the possibility of a temporary or permanent 'crash' of internet and of electronic storage media, particularly in case of major conflict, cannot be ruled out. If this were unfortunately to happen, while some, many or all databases and websites harbouring PDFs of scientific papers could be erased, some copies of these PDFs might remain stored in some institutions or on the personal computers of some researchers, but the same could not apply to webpages that could not be downloaded as PDFs. A real, very informative example of this situation is the website *Lisanfos*, created in 2010, once harboured by the Madrid Museum (<<http://www.lisanfos.mncn.csic.es/>>), and which provided very useful information on fossil lissamphibians, but which was closed in 2016: all the information which had been patiently and carefully entered by its authors on this database is now inaccessible to customers. The same fate could be expected to the content of *Zoobank* if this application had to close for financial or other reasons or was removed accessibility by electromagnetic aggressions.

[R4] This proposal does not mention paper publications, as if the latter had disappeared, but this is not true. Some taxonomists even tend now to come back to them because of the problems posed by electronic publications discussed above. Paper publication is devoid of many of the problems regarding availability and actual publication date, and is therefore a much simpler and straightforward model for the publication of nomenclatural novelties. P-publications should not be imposed new constraints in order to align them with e-publications.

This 'solution' therefore appears not to be a good one. In order to solve the problems raised above, we are therefore proposing below some changes to be brought to A-2012.

## 5. New proposals

### 5.1. Introduction

Many examples have been provided above, and in various publications including Dubois (2010*a*, 2017*e*, 2020*a–c*), Dubois & Aescht (2016*a–b*, 2017, 2019) and Dubois *et al.* (2013, 2014, 2015*a–b*, 2021*a,c*), showing that many authors, referees, editors and publishers have had difficulties understanding and applying correctly the criteria of availability of works implemented in A-2012, as it could be foreseen (Dubois 2010*a*). With the publication of A-2012, zoological nomenclature has entered a kind of 'grey zone' (Krell 2015) from which it does not seem close to escape (Dubois *et al.* 2015*b*: 261). It has been argued "that the promulgation of the 2012 Amendment was too early and that the strong advice of some authors not to allow electronic publication for new names and nomenclatural acts (Dubois *et al.* 2013: 6) was justified. The existence of online publications was too recent, not enough experience of the situations and problems had been accumulated, and many of the problems to come had not yet been anticipated. By hurrying to publish this Amendment to comply with the request of some publishers (but not of the community of taxonomists, most of whom were probably happy to publish in traditional journals having also an online version but still published on paper like *Zootaxa*), the Commission has opened a Pandora's box which will be difficult to close. It is noteworthy that this Amendment was adopted by a majority of the Commission's members but not unanimously, although, given the importance of this Amendment for the future of zoological nomenclature, unanimity would have appeared to be a reasonable condition for its adoption." (Dubois *et al.* 2015*b*: 261).

This being said, this Amendment is now part of the *Code*, and zootaxonomists who think that the existence of an international code of nomenclature, even imperfect, is much better than an absence of rules, should now follow it, which does not impede them to propose improvements to the *Code* in force (Dubois 2011). Therefore, in order to try and reduce the problems detailed above, it is here proposed to modify the 2012 Amendment in a variety of domains. The proposals below aim at trying and solve the problems raised above concerning the Rules of A-2012 for the nomenclatural availability of electronic publications.

Several basic ‘principles’, already formulated previously (Dubois *et al.* 2013, 2015*b*; Dubois & Aescht 2016*a*), have governed our formulation of the proposals presented below:

[S1] In order to work efficiently, a juridical text like the *Code* provides Rules, which rely on facts, not suggestions or advices. These Rules must be strictly followed, not interpreted in the light of a supposed ‘spirit’ of this text or of supposed ‘intentions’ of those who wrote it. The notion of ‘liberality’ and ‘permissiveness’ have no place in a complex system like that of zoological nomenclature, where they would only be a source of ambiguity and confusion, and they delay the understanding and respect of the Rules by the members of the international community of taxonomists. If some Rules are not clear enough or deficient, they should be improved, not ignored or circumvented through ‘tricks’, but, as long as they have not been changed, they should be complied with by all.

[S2] In a revised version of A-2012, it is important to ensure that any publication (whether online or on paper) and, if relevant, its archived version, as well as the *Zoobank* entry corresponding to it, be definitive and not liable to be modified subsequently in any respect, even bearing on ‘small details’. If errors and problems are discovered in this work and if ‘corrections’ have to be made to it, this should be through a new, distinct document, archive or entry.

[S3] In all versions of the *Code* until the A-2012, all criteria used to ascertain the nomenclatural status of a publication regarding its availability, except one, relied on information intrinsic to the work itself, i.e., present in the work itself. The only exception concerned the publication date, for which information obtained from external sources could in some cases be used to consider that the publication date printed in the work itself was inaccurate, and to correct it. However, as shown above, several new Rules of A-2012 rely on criteria extrinsic to the publication itself, which have to be sought from external sources. This important novelty was stressed in Dubois *et al.* (2013: 40) as follows:

“Until the 1999 *Code*, most of the criteria in use were intrinsic to the publication. The compliance to such criteria (existence of a paper-printed publication, explicit intention to establish a new nomen, diagnosis or description, designation of onomatophore, etc.) could be assessed directly through studying the publication itself. A single important piece of information had sometimes to be sought from extrinsic sources: the publication date. The new Rules concerning electronic publication are quite different, because they require finding, or in some cases checking, several pieces of information from extrinsic sources, such as registration in ZooBank, presence of ISSN/ISBN or identification of the ‘final’ version of a work published online and of its actual distribution date. This cannot in the least be considered as a progress, as it makes the work of taxonomists longer, more cumbersome [...], and sometimes the results remain nevertheless uncertain [...]. If one of our aims is really nomenclatural robustness, the number and importance of extrinsic factors should in contrary be reduced, but this seems difficult in e-publications, because of the many problems outlined above (existence of several successive versions of works with different dates of online accessibility, additional information provided in ‘supplementary’ or ‘subsequent’ documents, etc.). If one adds to these problems the low nomenclatural culture of many, amateur but also professional, taxonomists, it is difficult to be very optimistic regarding the number of errors, misinterpretations or contentious cases which are likely to spread in taxonomic works, at least in the first years after the 2012 amendment. Particular attention will have to put in examining the compliance of works with the new Rules.”

One possible way to reduce these problems would be to have some information provided by *Zoobank* (or another system of information archiving) that would be sent to the authors before the distribution of the work and for inclusion in the latter, such as a registration number for an onomatery (like an LSID in the current system—except that currently the same LSID can point to different subsequent

versions of a document!), but [T1] that would be delivered only once all conditions of availability are complied with, and [T2] that would provide guarantees for permanency and impossibility of subsequent ‘corrections’. As already predicted (Dubois & Aescht 2016a: 45), this is not easy to conceive and implement, but we make proposals in this respect below.

[S4] As shown by various examples discussed in (Dubois *et al.* 2013, 2015a–b) and above, since A-2012 was promulgated, many taxonomic papers were published online that did not comply with its criteria of nomenclatural availability for such works, so that the new nomina and airesies they contain are themselves not available. What should be done regarding these nomina and airesies? Krell (2015) suggested to act with ‘liberality’ and ‘permissiveness’ towards them, i.e., to accept them as valid even if they were not so. We fully disagree with such an approach, which we think holds major potential problems (Dubois *et al.* 2013: 41). Where should such ‘permissiveness’ start and end? Who will decide when this ‘tolerance’ should be exerted? Should we accept such decision when taken by a ‘famous’ or ‘important’ taxonomist or biologist, or to reject it when coming from an ‘obscure’ colleague or amateur? This would in fact consist in resurrecting the medieval ‘principle of authority’ to replace *a priori* stringent Rules that should be respected equally by all. Or should we rely on the Commission to use its Plenary Power to ‘validate’ such invalid onomatopergies—in line with the tendency of the Commission in the recent decades to ‘save’ invalid nomina or airesies when the latter have had a so-called ‘prevailing usage’, even in just a handful of publications by ‘well-known’ people (see examples in Dubois 2011)?

We think such approaches would just result in weakening the respect due by taxonomists to the *Code* and in encouraging nomenclatural sloppiness and laziness, thus contributing to ambiguity and confusion in the use of nomina in zootaxonomy. If the Commission decided to erase all these mistakes as if by magic, this would send the wrong message to the community. Furthermore, such a solution would apply only to a few well-known cases and problems, i.e., presumably those published in a few ‘major’ journals, or by influential authors, or dealing with ‘emblematic’ animals, but many others would remain unnoticed for various periods, and never-ending problems are likely to appear as long as rigorous application of the *Code* is not clearly acknowledged to be the only Rule for all. We think the Rules of the *Code*, including those of A-2012, should be strictly followed by all taxonomists and that, in all cases of errors, their regularisation should be done through new publications by the authors of these errors themselves, and preferably at the expense of the periodicals that published them. We think this would have a pedagogical and dissuasive function, and could avoid or minimise the repetition of such errors. The LZC took some initiatives in this respect (Dubois & Aescht 2016b), which resulted in the publication of a few corrective papers (Dubois 2017e and following papers in the same issue), but it is impossible for a small group of volunteers to cover the whole field of zoological nomenclature without appropriate funding. It will be the collective responsibility of the community of zootaxonomists to care for correcting these mistakes, and in this respect the sooner will be the better, in order to avoid the multiplication of unsolved problems that will, when discovered, lead to nomenclatural confusion and instability. Be it as it may, in what follows we are just discussing the Rules of the *Code* relative to e-publication, considering that these Rules should never been circumvented but followed by all, and errors when they occur being corrected when discovered by the community.

We come back below to the problems posed by A-2012 discussed above. We summarise these problems (§ 5.2) and propose for the Linz *Zoocode* alternative wordings to some parts of the Articles that composed this Amendment (§ 5.3), as well as new definitions for some terms of its Glossary (§ 5.4).

## 5.2. Summary of the problems

### 5.2.1. Distinction between publication and promulgation

The distinction between the two meanings ('trivial' and '*Code*-compliant') of the words 'publication' and 'published' stressed above (§ 3.1), previously adopted by the LZC in its Session 39 (Dubois *et al.* 2022a), is clarified below (§ 5.3) by the replacement in the Articles 8 and 9 of the term 'published' by the term 'promulgated'.

### 5.2.2. Unambiguous identifiers of e-publications and nomina

It was shown previously (Dubois & Aesch 2019: 16) and stressed again above (§ 3.3–3.4, 3.8–3.9, 3.11) that the current wording of the Articles of A-2012 dealing with the identifiers of e-publications and nomina registered in *Zoobank* are not satisfying, as they do not allow bijective unambiguous association between a given LSID and a given work or nomen. Concerning airesies, as long as *Zoobank* does not allow to register them it is irrelevant to mention them in the *Code*. Rewordings are therefore proposed below (§ 5.3) for the Articles 8.5 and 8.5.3 (the latter being divided differently and its parts being partly renumbered) and for the Recommendation 10B.

### 5.2.3. Mandatory archiving

It was shown previously (Dubois & Aesch 2019: 14) and stressed again above (§ 3.1) that the current requirement of the Article 8.5.3.1 of A-2012 of 'intent to archive' the new work should be replaced by that of its 'effective archiving'. A rewording is therefore proposed below (§ 5.3) for this Article and the associated Recommendation 8H.

### 5.2.4. Different versions of e-publications

In its current version, A-2012 distinguishes two kinds of 'versions' of works issued electronically: 'preliminary' and 'final' versions, the latter having a 'fixed content and layout', i.e., being unmodifiable. According to this Amendment, online prepublications, however called ('advanced publications', 'early views', 'preliminary versions', etc.), of works later released online as a 'final version' differing from them by any aspect of its content and layout, are unavailable, and the publication date of the work is that of the latter version. However, it was shown previously (Dubois *et al.* 2013: 26–29) and above (§ 3.14) that the situation may be more complex in some cases, as a given work may be released electronically under several versions, that we called preliminary (original or subsequent), final, and postfinal. Of these versions, for each work only the version which proves to be unmodifiable, and permanently accessible on the website of the publisher as long as the latter is active, complies with the requirements of A-2012 and is nomenclaturally available. If no such version exists, because the publisher's practices include the possibility to modify indefinitely the versions of the works on its website (to include corrections, additions or comments), then no 'final version' of the work exists and the work is permanently unavailable in the frame of zoological nomenclature. This (so far undetected) complexity has led us above (§ 3.14.1) to propose four statements [L1] to [L4], which, for full clarity and understanding, we propose to incorporate in the *Zoocode* into revised formulations of the Articles 8.1.3.2 and 9.9 of A-2012 presented above and in § 5.3 below.

Besides, we propose to add several definitions related to these questions (§ 5.4.1–2) to the Glossary of the *Zoocode*.

### 5.2.5. *Accurate promulgation dates of e-publications*

As already stressed in several papers (Dubois *et al.* 2013: 4, 71–75) and above (§ 3.3), most (if not all) works that have so far first been distributed online as an unavailable preliminary version and later as a final version bear in the latter the date of distribution of the preliminary version. This is not acceptable, as if this information is taken by readers at face value this will cause problems in case of homonymy or synonymy that may be discovered only later and result in nomenclatural instability. Articles 8.5.2 and 21.7.2 should therefore be modified in order to require that the date figuring in the final version be the actual date of distribution of this version, not just ‘a date of publication’ being in fact that of the unavailable preliminary version, and failing to do so should result in the nomenclatural unavailability of the work. Too many works have already been published following the deficient wording of these Articles in A-2012 to allow to make this change retroactive, but this change should become effective after a threshold date to be fixed later on. The corrected versions of these Articles that we propose are provided below (§ 5.3).

### 5.2.6. *Online supplementary material*

Online ‘supplementary information’, ‘supporting information’, ‘additional file’, etc., are documents distinct from those which they are supposed to ‘complete’, whether published on paper or online. Such supplementary material of paper publications that have not been preregistered on *Zoobank* as such (i.e., with the explicit mention that they consist in electronic document(s) distinct from the paper version of the work) and that do not contain evidence that such preregistration has occurred, are clearly nomenclaturally unavailable, as stressed in Dubois *et al.* (2013: 29–30) and in § 3.17 above. As in the case of supplementary online material of electronic publications, their availability depends on the way the work has been preregistered on *Zoobank* (i.e., on the presence/absence of mention of this supplementary material in the reference of the work appearing on *Zoobank*) and on the way it can be downloaded from the website of the journal or publisher. The supplementary material is nomenclaturally unavailable whenever [U1] the reference mentions only the pages of the ‘main’ work itself, not those of its supplement(s), or [U2] only the ‘main’ work is downloaded when clicking on its link, or [U3] downloading the supplements can be done only from the PDF of the ‘main’ work. This may have important nomenclatural consequences if some information required by the *Code* for the availability of a new nomen or airesy is missing in the ‘main’ work and has been relegated to the supplement(s). In order to make these points clear, it is proposed below (§ 5.3) to add a sentence in the Examples of A-2012 following Article 8.5.3 (now 8.5.5).

### 5.2.7. *Subsequent online corrections*

A-2012 contains a Recommendation 8D about the immutability of works. Although first provided in this Amendment, which deals primarily with e-publications, this Recommendation applies both to paper and electronic publications. It would be clearer for all users of the *Code* if it provided more details on the differences between both kinds of works in this respect (Dubois *et al.* 2013: 4, 30–32). Regarding paper publications, it is impossible to modify a work already published, and errata, corrigenda and addenda can only be published as ‘separate publications’, either on paper or online. If distributed on paper, this correcting work usually complies with the traditional criteria of availability of p-publications, but if published as an electronic document it does so only if it complies with those of A-2012. Regarding the corrections and additions that can be brought to an e-publication, they can be either published as a ‘separate publication’ (which may be available or not, depending on its

respect of the criteria of Article 8.5 of A-2012) or as a modification of the final electronic version of this work, thus qualifying as a postfinal version being not only unavailable but also removing the nomenclatural availability of this final version (see § 5.2.4 above). These comments lead us to propose below (§ 5.3) a new wording for Recommendation 8D.

#### 5.2.8. *Databases, websites, blogs, etc.*

As pointed out long ago already (Dubois 2003; Dubois *et al.* 2013: 4, 32–34), and again stressed above (§ 3.20), websites, online forums, blogs, databases, etc., are ephemeral and labile documents, often self-published online without having been submitted to peer-review. They are distributed electronically, do not have paper versions, they lack a fixed content and format (being regularly updated), are not registered on *Zoobank*, and are devoid of ISSN or ISBN numbers. Therefore, they do not qualify as published works in the sense of the *Code* (Article 9.11). As such, they should not be viewed as genuine scientific publications and should preferably not be mentioned in reference lists, at least if the same information is available in papers published in scientific periodicals or books. If this is impossible, they should be clearly cited as ‘unpublished data’ or ‘personal communications’, not as references to published works that could remain accessible in the long run for consultation. Since they are not available publications according to the *Code*, they should never be cited as sources of new onomatergies (new nomina or airesies), as the latter are null and void: doing so could be the source of nomenclatural errors and instability. This is important enough to deserve being mentioned in a new Recommendation of Article 8 of A-2012, presented below in § 5.3.

#### 5.2.9. *Facsimiles of unavailable works and the meaning of the terms ‘obtainable’ and ‘obtained’ in Articles 8.1.2 and 9.12*

The question of the nomenclatural availability of works published online before 2012 but 5 paper prints of which had been deposited in libraries was discussed at length previously (Dubois *et al.* 2013; Dubois & Aesch 2017) and is again above (§ 3.1, 3.16). The so-called ‘reply’ of the Commission to the arguments of Dubois *et al.* (2013) was misleading, being based on a trick (Dubois & Aesch 2017: 37–41). It was obscure on the meaning given by the Commission to the formula “*may* form a separate edition”. It is impossible from this sentence to know in which cases it does so and in which cases it does not. As explained in detail in Dubois & Aesch (2017), the crucial point in this matter lies in the meaning of the words ‘obtainable’ and ‘obtained’ in Articles 8.1.2 and 9.12. The wordings proposed below for these Articles (§ 5.3) and for these two terms (§ 5.4.3) clarify this point.

#### 5.2.10. *Invalidation and retraction of works*

As discussed above (§ 3.18), once a work has been promulgated in a *Code*-compliant manner, the only way to invalidate it is through a decision of the Commission acting under its Plenary Power, or in two very particular cases of automatic unintentional depromulgation of electronic publications discussed above under § 3.11 (absence of postregistration of the reference to the archiving of the work after its publication) and § 3.14.1 (replacement on the website of the publisher of the ‘final version’ of a work by a ‘postfinal version’), as well as under § 3.14.3 and 5.3.

Individual zoologists or groups, associations, societies or committees of zoologists are not entitled to depromulgate a work once promulgated. This applies to all works that have been ‘retracted’ by

their authors, editors or publishers, or by outsiders who could decide to consider a work unavailable although it does not fall in one of the three categories above: in such cases, the community of taxonomists, including referees, editors and publishers, should not accept to publish such unwarranted statements.

In A-2012, Article 8.7 of the 1999 edition of the *Code* was left unchanged. Below we propose modifications of this Article that allow to take these comments into account.

### 5.3. New wordings proposed for some Articles concerned by the 2012 Amendment

| 2012 Amendment  | Our proposal  |
|---|---|
| <b>Article 8. What constitutes published work.</b> A work is to be regarded as published for the purposes of zoological nomenclature if it complies with the requirements of this Article and is not excluded by the provisions of Article 9. | <b>Article 8. What constitutes promulgated work.</b> A work is to be regarded as promulgated for the purposes of zoological nomenclature if it complies with all the requirements of this Article and is not excluded by the provisions of Article 9. |
| <b>8.1. Criteria to be met.</b> A work must satisfy the following criteria:   | [UNCHANGED].  |
| 8.1.1. it must be issued for the purpose of providing a public and permanent scientific record,   | [UNCHANGED].  |
| 8.1.2. it must be obtainable, when first issued, free of charge or by purchase, and   | 8.1.2. it must be obtainable upon request, when first issued, free of charge or by purchase, and  |
| 8.1.3. it must have been produced in an edition containing simultaneously obtainable copies by a method that assures  | [UNCHANGED].  |
| 8.1.3.1. numerous identical and durable copies (see Article 8.4), or  | [UNCHANGED].  |
| 8.1.3.2. widely accessible electronic copies with fixed content and layout.   | 8.1.3.2. widely accessible, definitively edited and paginated, electronic copies with fixed content and layout, and, after [date to be fixed later], expressly labelled as ‘final version’.   |
| <b>Example:</b> PDF/A (Portable Document Format Archive), described by ISO Standard 19005-1:2005, is a file format that allows content and layout to be preserved unchanged.  | [UNCHANGED].  |
| <b>8.5. Works issued and distributed electronically.</b> To be considered published, a work issued and distributed electronically must  | <b>8.5. Works issued and distributed electronically.</b> To be considered promulgated, a work issued and distributed electronically must  |
| 8.5.1. have been issued after 2011,   | [UNCHANGED].  |
| 8.5.2. state the date of publication in the work itself, and  | 8.5.2. state the actual date of promulgation of the final version in the work itself,   |
| 8.5.3. be registered in the <i>Official Register of Zoological Nomenclature</i> (ZooBank) (see Article 78.2.4) [and contain evidence in the work itself that such registration has occurred].   | 8.5.3. be registered in <i>Zoobank</i> (see Article 78.2.4),  |
| [8.5.3. be registered in the <i>Official Register of Zoological Nomenclature</i> (ZooBank) (see Article 78.2.4)] and contain evidence in the work itself that such registration has occurred].  | 8.5.4. contain evidence in the work itself that such registration has occurred by stating its <i>Zoobank</i> Life Science Identifier (LSID);  |

...Continued on the next page

TABLE. (Continued)

| 2012 Amendment  | Our proposal  |
|---|---|
| <p>8.5.3.2. The entry in the <i>Official Register of Zoological Nomenclature</i> must give an ISBN for the work or an ISSN for the journal containing the work. The number is not required to appear in the work itself.</p>  | <p>8.5.5. be provided with an International Standard Number (ISBN or ISSN), this number being mentioned in the work itself.</p>   |
| <p><b>Examples.</b> Evidence of registration is given by stating information that would be known only if the registration has occurred, such as the exact date of registration or the registration number assigned to the work or to a new name or nomenclatural act introduced in the work. A work issued as a PDF may contain the registration number as an embedded hyperlink. Even if the registration number is not visible in the normal viewing mode of the file or when the work is printed from the file, it is deemed to be cited in the work itself because the text of the hyperlink can easily be revealed using standard software for viewing PDFs.</p> | <p><b>Examples.</b> [1] Evidence of registration is given by stating information that would be known only if the registration has occurred, such as the exact date of registration or the LSID assigned to the work or to a new nomen introduced in the work. [2] To be nomenclaturally available, any supplementary online material to a work published on paper or online (and then distinct from it) must be expressly preregistered on <i>Zoobank</i> as such, must contain evidence that this preregistration has occurred, and must bear an International Standard Number (ISBN or ISSN).</p> |
| <p>8.5.3.1. The entry in the <i>Official Register of Zoological Nomenclature</i> must give the name and Internet address of an organization other than the publisher that is intended to permanently archive the work in a manner that preserves the content and layout, and is capable of doing so. This information is not required to appear in the work itself.</p>   | <p>8.5.4.1. The entry in <i>Zoobank</i> must give the name and Internet address of an organisation other than the publisher that has archived the work in a manner that preserves the content and layout, and is capable of doing so permanently, as well as a reference to registration in this archive. As long as this information is missing in the <i>Zoobank</i> entry, the work is still not nomenclaturally available. This information should appear in the work itself.</p>   |
| <p>8.5.3.3. An error in stating the evidence of registration does not make a work unavailable, provided that the work can be unambiguously associated with a record created in the <i>Official Register of Zoological Nomenclature</i> before the work was published.</p>   | <p>8.5.4.2. An error in stating the evidence of registration does not make a work unavailable, provided [1] that the work can be unambiguously associated with a single record created in <i>Zoobank</i> before the work was published, and [2] that this record can be unambiguously associated with the final version of the work, bearing a given publication date and a given <i>Zoobank</i> LSID.</p>  |

...Continued on the next page



TABLE. (Continued)

| 2012 Amendment   | Our proposal  |
|--|---|
| <p><b>Examples.</b> The following are examples of admissible errors: In preparing a manuscript an author accidentally deletes the final digit of the registration number. An author states the wrong date of registration forgetting that ZooBank uses Coordinated Universal Time rather than local time. An author registers two works that are in review for publication and accidentally uses the same ZooBank number in both published versions.</p> <p>The following are examples of inadmissible errors: An author, in preparing a manuscript for publication, states that day's date for the registration date, intending to register it later that day but forgetting to do so. The author discovers the omission after the work is published and immediately registers it; because registration occurred after publication, the work is not available. A publisher discovers errors in a work and reissues it to correct those errors, but instead of registering the new edition, uses the original ZooBank number; the revised edition is not available because it was not separately registered.</p> | <p><b>Examples.</b> The following are examples of admissible errors: [a1] In preparing a manuscript, an author accidentally deletes the final digit of the LSID. [a2] An author states the wrong date of registration forgetting that <i>Zoobank</i> uses Coordinated Universal Time rather than local time.</p> <p>The following are examples of inadmissible errors: [i1] An author, in preparing a manuscript for publication, states that day's date for the registration date, intending to register it later that day but forgetting to do so. The author discovers the omission after the work is published and immediately registers it. Because registration occurred after publication, the work is not available. [i2] An author or publisher registers two works that are in review for publication and accidentally uses the same <i>Zoobank</i> number in both published versions. Both works are unavailable because the LSID number is not unambiguously associated with a single work. [i3] A publisher discovers errors in a work and reissues it to correct those errors, but instead of registering the new edition separately, uses the original <i>Zoobank</i> LSID and/or publication date. Both editions are unavailable because the work identified by these pieces of information fails to have fixed content and layout.</p> |
| <p><b>8.7. Status of suppressed works.</b> A work that has been suppressed for nomenclatural purposes by the Commission by use of the plenary power [Art. 81] and that satisfies the provisions of this Article remains published within the meaning of the Code, unless the Commission has ruled that it is to be treated as not having been published;</p>   | <p><b>8.7. Status of suppressed works.</b> Once promulgated, a work can be depromulgated, in three situations: [1] by a decision of the Commission under the Plenary Power [Article 81]; [2] by absence of postregistration of the reference to the archiving of the work after its distribution; [3] by replacement on the website of the publisher of the 'final version' of a work by a 'postfinal version'.</p>   |
| <p>8.7.1. such a work remains available as a source of published descriptions and illustrations, but not as a work in which a name or nomenclatural act (such as the fixation of a name-bearing type, or the determination of precedence under Article 24.2) can be made available.</p>  | <p>8.7.1. Such a work remains available as a source of published descriptions and illustrations, but not as a work in which a nomen or an airesy can be made available.</p>   |
| <p>[MISSING]</p>   | <p>8.7.2. Invalidation of a promulgated work by individual zoologists or groups of zoologists, or its retraction by its author, editor, publisher or anyone else, is not permitted and, if published, such actions should be ignored by taxonomists.</p>  |

...Continued on the next page

TABLE. (Continued)

| 2012 Amendment   | Our proposal  |
|--|---|
| <p><b>Recommendation 8D. Content immutable.</b> The content of a work is immutable once it is published. Corrections should be made through notices of errata or other separate publications. Second or other additional printings of a work should be clearly labelled as such, with date of publication stated in the work, even if no changes have been introduced.</p> | <p><b>Recommendation 8D. Content immutable.</b> The content of a work is immutable once it is published. Corrections should be made through separate works, published either on paper or electronically. In the latter case, to be nomenclaturally available, these corrective works should comply with the criteria of Article 8.5. If incorporated in a modified version of the ‘final version’ of a work published electronically, corrections or additions result in this modified version being a ‘postfinal version’ (Article 9.9) and make the work unavailable in zoological nomenclature. Second or other additional editions of a work published on paper should be clearly labelled as such, with date of publication stated in the work, even if no changes have been introduced. If published electronically, the mention of the accurate date of distribution of the work is compulsory for its nomenclatural availability.</p> |
| <p><b>Recommendation 8H. Archiving encouraged.</b> Authors are encouraged to ensure that their electronic works are archived with more than one archiving organization. Archiving organizations utilized for registered works should have permanent or irrevocable license to make a work accessible should the publisher no longer do so.</p>                             | <p><b>Recommendation 8H. Multiple archiving encouraged.</b> Authors are encouraged to ensure that their electronic works are archived with more than one archiving organisation. Archiving organisations utilised for registered works should have permanent or irrevocable license to make a work accessible should the publisher no longer do so.</p>   |
| <p>[MISSING]</p>   | <p><b>Recommendation 8I.</b> Websites, databases, blogs, and other documents distributed electronically, lacking fixed content and format, unregistered on <i>Zoobank</i> and missing ISBN or ISSN, do not qualify as available publications in the frame of the <i>Code</i>. They should therefore never be cited as sources of new nomina or airesies, as this would be a source of nomenclatural errors and instability.</p>   |
| <p><b>Article 9. What does not constitute published work.</b> Notwithstanding the provisions of Article 8, none of the following constitutes published work within the meaning of the <i>Code</i>:</p>   | <p><b>Article 9. What does not constitute promulgated work.</b> Notwithstanding the provisions of Article 8, none of the following constitutes promulgated work within the meaning of the <i>Code</i>:</p>  |
| <p>9.9. preliminary versions of works accessible electronically in advance of publication (see Article 21.8.3);</p>  | <p>9.9. preliminary versions of works accessible electronically in advance of promulgation (see Article 21.8.3), or postfinal online versions incorporating corrections, additions or comments to the version initially issued as the final version;</p>  |
| <p>9.12. facsimiles or reproductions obtained on demand of an unpublished work [Art. 8], even if previously deposited in a library or other archive.</p>   | <p>9.12. facsimiles or reproductions obtained on demand of an unpromulgated or mispromulgated work [Art. 8], even if previously deposited in or sent to libraries or other archives.</p>  |

...Continued on the next page

TABLE. (Continued)

| 2012 Amendment  | Our proposal  |
|---|---|
| <p><b>Example:</b> A Ph.D. thesis that was distributed only to members of the student's thesis committee is listed for sale in the catalogue of a print-on-demand publisher. The print-on-demand work is a reproduction of the thesis. Because the thesis was an unpublished work in its original form, it remains unpublished. If an editorial process was evident in converting the work to print-on-demand form (e.g., change to single spacing, repagination, addition of running headers), it might be considered published.</p> | <p><b>Examples:</b> [1] A Ph.D. thesis that was distributed only to members of the student's thesis committee is listed for sale in the catalogue of a print-on-demand publisher. The print-on-demand work is a reproduction of the thesis. Because the thesis was an unpromulgated work in its original form, it remains unpromulgated. If an editorial process was evident in converting the work to print-on-demand form (e.g., change to single spacing, repagination, addition of running headers), it might be considered published. [2] All works published only online after 1999 and before September 2012 are nomenclaturally unavailable. Printed copies of the PDFs of such works which [2a] do not mention their own ISSN or ISBN, different from that of the electronic document, or/and [2b] which are not clearly and publicly (e.g., as announced in the work itself or at least on a website) obtainable upon request by some interested customers at least, when first issued (and not as copies printed subsequently on demand), free of charge or by purchase, do not qualify as publications. They must be seen as facsimiles of unavailable works and do not provide nomenclatural availability to any nomenclatural novelties they may contain.</p> |
| <p>21.7.2. Works issued as electronic copies are required to state a date of publication (Article 8.5.2), even if incompletely specified (Article 21.3).</p>  | <p>21.7.2. Works issued as electronic copies are required to state the actual date of promulgation of their final version (Article 8.5.2), even if incompletely specified (Article 21.3).</p>   |
| <p><b>21.8. Advance distribution of separates and preprints.</b> Advance distribution of separates or preprints affects date of publication as specified by the following criteria:</p>   | <p><b>21.8. Advance distribution of separates and preprints.</b> Advance distribution of separates or preprints affects date of promulgation as specified by the following criteria:</p>  |
| <p>21.8.3. Some works are accessible online in preliminary versions before the publication date of the final version. Such advance electronic access does not advance the date of publication of a work, as preliminary versions are not published (Article 9.9).</p>   | <p>21.8.3. Some works are accessible online in preliminary versions before the promulgation date of the final version. Such advance electronic access does not advance the date of promulgation of a work, as preliminary versions are not promulgated (Article 9.9).</p>   |
| <p><b>Recommendation 10B. Registration of names encouraged.</b> Authors are encouraged to include registration numbers from the <i>Official Register of Zoological Nomenclature</i> for new names and nomenclatural acts introduced in their publications, and to register names and acts that have been previously published.</p>  | <p><b>Recommendation 10B. Registration of nomina encouraged.</b> Authors are encouraged to include registration numbers from <i>Zoobank</i> LSIDs for new nomina introduced in their publications, and to register nomina that have been previously promulgated.</p>  |

## 5.4. New definitions proposed for the Glossary of the Zoocode

### 5.4.1. Versions of electronic works

**Preliminary version of work accessible electronically in advance of publication.** Any version of a work distributed online and which differs, even slightly, in layout and/or content (e.g., by even a single letter or a single modified element of layout, by the pagination or by the mention of an issue number), from the ‘final version’ of the same work subsequently published online, qualifies as a ‘preliminary version’ (original or subsequent). It is accessible online only during a limited period, before being definitively replaced on the website where it was first distributed by the ‘final version’, which then remains unchanged. A ‘preliminary version’ is nomenclaturally unavailable. After [date to be fixed later], any version of a work published electronically online that does not bear the express mention ‘final version’ is deemed to be a ‘preliminary version’.

**Final version of work published electronically.** After [date to be fixed later], the ‘final version’ of a work distributed online is the version that bears explicitly the mention ‘final version’ and which remains unchanged, in format and content, on the website where it was first distributed. To be nomenclaturally available, this version should be published as a PDF/A (Portable Document Format Archive) or any other format that allows keeping the document with a strictly fixed content and layout. If this version is replaced on this website by a modified version, it loses its status of ‘final version’ and the work becomes a ‘postfinal version’ which is definitively unavailable.

**Postfinal version of work published electronically.** After [date to be fixed later], any version of a work distributed online that incorporates corrections, additions or comments to the ‘final version’, and that replaces it on the website where the latter had initially been issued, qualifies as a ‘postfinal version’ and removes definitely nomenclatural availability to the work.

**Version of record of work published electronically.** Any version of a work distributed online, bearing or not the mention ‘version of record’, that differs from its ‘final version’ by its ‘metadata’ only, qualifying therefore as a ‘preliminary version’ which is nomenclaturally unavailable.

**Metadata.** Any data included in a work distributed online, including some of its descriptors (concerning the volume and issue in which it is finally incorporated, or its pagination), that differ from those that appear in the ‘final version’ of this work. Such a difference in metadata makes the version that include them before modification a ‘preliminary version’ which is nomenclaturally unavailable.

### 5.4.2. Promulgation, unpromulgation, mispromulgation, depromulgation

**Promulgation.** The distribution of a work conforming to Articles 8 and 9, making it nomenclaturally available.

**Unpromulgation.** The distribution of a work not conforming to Articles 8 and 9, making it nomenclaturally unavailable, and recognised as unavailable by its author.

**Mispromulgation.** The distribution of a work not conforming to Articles 8 and 9, making it nomenclaturally unavailable, but not recognised as unavailable by its author.

**Depromulgation.** The removal of the nomenclatural availability of a work originally distributed conforming to Articles 8 and 9, because of either [1] absence of postregistration of the reference of its archiving, or [2] publication of a postfinal version after the final version, or [3] removal of nomenclatural availability of the work by the Commission under the Plenary Power.

### 5.4.3. Obtainable, obtained

**Obtainable.** [1] *In Articles 8.1.3 and 8.4.2.1:* producible, that can be produced. [2] *In Article 8.1.2:* acquirable, that can be acquired.

**Obtained.** *In Article 9.12:* produced and acquired.

## 6. Decisions of LZC Session 44 (Electronic publication)

**Submitted by:** Alain Dubois.

### **Relevant information**

*Date of original submission:* 7 March 2022.

*Fifteen-day deadline for comments:* 22 March 2022, extended to 6 April 2022.

*Closure of comments:* 7 April 2022.

*Opening of vote:* 7 April 2022.

*Fifteen-day deadline for vote:* 22 April 2022.

*Number of voters:* 15.

*Two-third majority:* 10.

### **Question submitted to the vote of the LZC**

Vote by *Yes* or *No* for the text above.

### **Result of vote**

14 *Yes* (Aesch, Aneesh, Bauer, Ceriaco, De Prins, Dubois, Frétey, Löbl, Lorvelec, Marinov, Ohler, Schmitt, Whittington, Young).

1 *Absence of vote* (Daniel).

### **Conclusion**

The proposal LZC 44, concerning the availability of electronic publications in the *Zoocode*, is adopted by the Linz *Zoocode* Committee.

The LZC President (Alain Dubois)

7 April 2022

## 7. References

- Anonymous [International Commission on Zoological Nomenclature] (1985) *International code of zoological nomenclature*. 'Third edition'. London (International Trust for zoological Nomenclature): i–xx + 1–338.
- Anonymous [International Commission on Zoological Nomenclature] (1999) *International code of zoological nomenclature*. 'Fourth edition'. London (International Trust for zoological Nomenclature): i–xxix + 1–306.
- Anonymous [NISO] (2008) *Journal Article Versions (JAV): recommendations of the NISO/ALPSP JAV Technical Working Group*. Baltimore (NISO): [i–ii] + i–viii + 1–27.
- Anonymous [International Commission on Zoological Nomenclature] (2012) Amendment of Articles 8, 9, 10, 21 and 78 of the International Code of Zoological nomenclature to expand and refine methods of publication. *Zootaxa*, **3450**: 1–7.
- Anonymous [International Commission on Zoological Nomenclature] (2014) Zoological nomenclature and electronic publication—a reply to Dubois *et al.* (2013). *Zootaxa*, **3779** (1): 3–5.
- Anquetin, J. (2015) Establishment of a lectotype for the species *Plesiochelys langii* Rüttimeyer, 1873. *PeerJ*, **1108**: 1–3. <<https://doi.org/10.7717/peerj.1108>>.
- Anquetin, J., Püntener, C. & Billon-Bruyat, J.-P. (2014) A taxonomic review of the late Jurassic eucryptodiran turtles from the Jura mountains (Switzerland and France). *PeerJ*, **369**: 1–45. <<https://doi.org/10.7717/peerj.369>>.
- Baird, S. F. & Girard, C. F. (1854) Descriptions of new species of fishes collected in Texas, New Mexico and Sonora, by Mr. John H. Clark, on the U.S. and Mexican Boundary Survey, and in Texas by Capt. Stewart Van Vliet, U.S.A. *Proceedings of the Academy of natural Sciences of Philadelphia*, **7**: 24–29.
- Batsch, A. J. G. C. (1796) *Umriß der gesammten Naturgeschichte: ein Auszug aus den frühern Handbüchern des Verfassers für seine Vorfesungen*. Jena & Leipzig (Christian Ernst Gabler): i–xvi + 1–287 + 3–160 + [1–32] + [i–vi] + 1–80.
- Bement, A. L., Jr. (ed.) (2007) *Cyberinfrastructure vision for 21<sup>st</sup> century*. Arlington, USA (National Science Foundation): 1–57.
- Böhme, W. & Jablonski, D. (2022) Making forgotten information available: an early study on the Afghanistan Mountain Salamander *Paradactylodon (Afghanodon) mustersi* (Smith, 1940) (Caudata: Hynobiidae). *Bonn zoological Bulletin*, **71** (1): 1–7.
- Bonaparte, C. L. (1838) *Iconografia della fauna italica per le quattro classi degli animali vertebrati*. Vol. **2**. Fascicolo 22. Roma (Salviucci): *Hyla viridis*, *Raganella arborea*: [193–198].
- Bour, R. & Dubois, A. (1984) Nomenclatural availability of *Testudo coriacea* Vandelli, 1761: a case against a rigid application of the Rules to old, well-known zoological words. *Journal of Herpetology*, '1983', **17**: 356–361.
- Bruun, A. F. (1950) The Systema Naturae of the twentieth century. *Science*, **112**: 342–343. <<https://doi.org/10.1126/science.112.2908.342.b>>.
- Carvalho Moura, A. M. de, Machado Campos, M. L. & Barreto, C. M. (1998) A survey of metadata for describing and retrieving Internet resources. *World Wide Web*, **1** (4): 221–240. <<https://doi.org/10.1023/A:1019228117935>>.
- Ceríaco, L. M. P., Gutiérrez, E. E., Dubois, A. *et al.* [490 additional signatories] (2016) Photography-based taxonomy is inadequate, unnecessary, and potentially harmful for biological sciences. *Zootaxa*, **4196** (3): 435–445. <<https://doi.org/10.11646/zootaxa.4196.3.9>>.
- Cranston, P. S., Krell, F.-T., Walker, K. & Hewes, D. (2015) Wiley's EarlyView constitutes valid publication for date-sensitive nomenclature. *Systematic Entomology*, **40**: 2–4. <<https://doi.org/10.1111/syen.12119>>.
- Dubois, A. (2000) Synonymies and related lists in zoology: general proposals, with examples in herpetology. *Dumerilia*, **4** (2): 33–98.
- Dubois, A. (2003) Editorial. Should internet sites be mentioned in the bibliographies of scientific publications? *Alytes*, **21** (1–2): 1–2.
- Dubois, A. (2005a) Proposals for the incorporation of nomina of higher-ranked taxa into the Code. *Bulletin of zoological Nomenclature*, **62** (4): 200–209.
- Dubois, A. (2005b) Proposed Rules for the incorporation of nomina of higher-ranked zoological taxa in the *International Code of Zoological Nomenclature*. 1. Some general questions, concepts and terms of biological nomenclature. *Zoosystema*, **27** (2): 365–426.
- Dubois, A. (2008) A partial but radical solution to the problem of nomenclatural taxonomic inflation and synonymy load. *Biological Journal of the Linnean Society*, **93**: 857–863. <<https://doi.org/10.1111/j.1095-8312.2007.00900.x>>.
- Dubois, A. (2010a) Contributions to the discussion on electronic publication IV. (6) Registration as a fourth floor of the nomenclatural process. *Bulletin of zoological Nomenclature*, **67** (1): 11–23.
- Dubois, A. (2010b) Retroactive changes should be introduced in the Code only with great care: problems related to the spellings of nomina. *Zootaxa*, **2426** (1): 1–42. <<https://doi.org/10.11646/zootaxa.2426.1.1>>.
- Dubois, A. (2011) The *International Code of Zoological Nomenclature* must be drastically improved before it is too late. *Bionomina*, **2**: 1–104. <<https://doi.org/10.11646/bionomina.2.1.1>>.
- Dubois, A. (2013) Zygoity, a new nomenclatural concept. *Bionomina*, **6**: 1–25. <<https://doi.org/10.11646/bionomina.6.1.1>>.
- Dubois, A. (2015) Zoological nomina in the century of extinctions: new proposals. *Bionomina*, **8**: 11–53. <<https://doi.org/10.11646/bionomina.8.1.1>>.

- org/10.11646/bionomina.8.1.2>.
- Dubois, A. (2017a) A few problems in the generic nomenclature of insects and amphibians, with recommendations for the publication of new generic nomina in zootaxonomy and comments on taxonomic and nomenclatural databases and websites. *Zootaxa*, **4237** (1): 1–16. <<http://dx.doi.org/10.11646/zootaxa.4237.1i.1>>.
- Dubois, A. (2017b) The nomenclatural status of *Hysaplesia*, *Hylaplesia*, *Dendrobates* and related nomina (Amphibia, Anura), with general comments on zoological nomenclature and its governance, as well as on taxonomic databases and websites. *Bionomina*, **11**: 1–48. <<http://dx.doi.org/10.11646/bionomina.11.1.1>>.
- Dubois, A. (2017c) The need for reference specimens in zoological taxonomy and nomenclature. *Bionomina*, **12**: 4–38.
- Dubois, A. (2017d) Diagnoses in zoological taxonomy and nomenclature. *Bionomina*, **12**: 64–88.
- Dubois, A. (2017e) Report 2017-1 of the Observatory on Availability in Zoological Nomenclature. *Dumerilia*, **7**: 50–61.
- Dubois, A. (2020a) The status regarding publication date and availability of taxonomic works published online without proper *Zoobank* registration. *Bionomina*, **18**: 44–55.
- Dubois, A. (2020b) Nomenclatural consequences of the *Oculudentavis khaungraae* case, with comments on the practice of ‘retraction’ of scientific publications. *Zoosystema*, **42** (23): 475–482. <<https://doi.org/10.5252/zoosystema2020v42a23>>.
- Dubois, A. (2020c) ‘Retraction’ of taxonomic papers: the meaning of the word ‘issued’ and related ones in zoological nomenclature. *Zoosystema*, **42** (26): 519–523. <<https://doi.org/10.5252/zoosystema2020v42a26>>.
- Dubois, A. (2021) It is high time that taxonomists follow the *Code*. 4. Amphibia of Indochina. *Bionomina*, **24**: 38–50. <<https://doi.org/10.11646/bionomina.24.1.4>>.
- Dubois, A. (2022) Type species of genera in zoological nomenclature. *Bionomina*, **26**: 1–33. <<https://doi.org/10.11646/bionomina.26.1.1>>.
- Dubois, A. & Aescht, E. (ed.) (2016a) LZC Session 2. Discussion INF-01. Nomenclatural problems with electronic publications. *Dumerilia*, **6**: 45–46.
- Dubois, A. & Aescht, E. (ed.) (2016b) LZC Session 6. Proposal AVA-01. Observatory on Availability in Zoological Nomenclature. *Dumerilia*, **6**: 62–70.
- Dubois, A. & Aescht, E. (ed.) (2017) LZC Session 13. Proposal AVA-04. Problems with the 2012 Amendment of the *Code*. *Dumerilia*, **7**: 35–47.
- Dubois, A. & Aescht, E. (ed.) (2019) LZC Session 16. What is the meaning of ‘fixed content and layout’ in Article 8.1.3.2 of the 2012 Amendment of the *Code*? Consequences regarding this Amendment. *Dumerilia*, **8**: 6–34.
- Dubois, A., Aneesh, P. T., Bauer, A. M., Ceríaco, L. M. P., Daniel, G. M., Dellapé, P., Engel, M. S., Frétey, T., Löbl, I., Lorvelec, O., Marinov, M., Ohler, A., Schmitt, M., Whittington, A., Young, M. & Aescht, E. (2021c) Optical discs in zoological nomenclature: problems and proposed solution. *Bionomina*, **24**: 1–8.
- Dubois, A., Aneesh, P. T., Bauer, A. M., Ceríaco, L. M. P., Daniel, G. M., De Prins, J., Frétey, T., Löbl, I., Lorvelec, O., Marinov, M., Ohler, A., Schmitt, M., Whittington, A. & Aescht, E. (2022c) The Linz *Zoocode* project. Fourth report of activity (2021). Nomenclatural availability 3. Paper publication. *Bionomina*, **28**: 50–70. <<https://doi.org/10.11646/bionomina.28.1.3>>.
- Dubois, A., Aneesh, P. T., Bauer, A. M., Ceríaco, L. M. P., Daniel, G. M., Frétey, T., Löbl, I., Lorvelec, O., Marinov, M., Ohler, A., Schmitt, M., Whittington, A. & Aescht, E. (2022a) The Linz *Zoocode* project. Second report of activity (2020). Nomenclatural availability. 1. What is nomenclatural availability? *Bionomina*, **28**: 1–17. <<https://doi.org/10.11646/bionomina.28.1.1>>.
- Dubois, A., Aneesh, P. T., Bauer, A. M., Ceríaco, L. M. P., Daniel, G. M., Frétey, T., Löbl, I., Lorvelec, O., Marinov, M., Ohler, A., Schmitt, M., Whittington, A. & Aescht, E. (2022b) The Linz *Zoocode* project. Third report of activity (2020). Nomenclatural availability. 2. Work availability. *Bionomina*, **28**: 18–49. <<https://doi.org/10.11646/bionomina.28.1.2>>.
- Dubois, A., Bauer, A. M., Ceríaco, L. M. P., Dusoulier, F., Frétey, T., Löbl, I., Lorvelec, O., Ohler, A., Stopiglia, R. & Aescht, E. (2019) The Linz *Zoocode* project: a set of new proposals regarding the terminology, the Principles and Rules of zoological nomenclature. First report of activities (2014–2019). *Bionomina*, **17**: 1–111. <<https://doi.org/10.11646/bionomina.17.1.1>>.
- Dubois, A., Bour, R. & Ohler, A. (2015a) What is an online ‘preliminary version’ of a publication in the meaning of Article 9.9 of the *Code*?—One more step on the trail of the Asian elephant. *Bulletin of zoological Nomenclature*, **72** (1): 6–18.
- Dubois, A., Bour, R. & Ohler, A. (2015b) Nomenclatural availability of preliminary electronic versions of taxonomic papers: in need of a clear definition. *Bulletin of zoological Nomenclature*, **72** (3): 252–265.
- Dubois, A., Crochet, P.-A., Dickinson, E. C., Nemésio, A., Aescht, E., Bauer, A. M., Blagoderov, V., Bour, R., Carvalho, M. R. de, Desutter-Grandcolas, L., Frétey, T., Jager, P., Koyamba, V., Lavilla, E. O., Löbl, I., Louchart, A., Malécot, V., Schatz, H. & Ohler, A. (2013) Nomenclatural and taxonomic problems related to the electronic publication of new nomina and nomenclatural acts in zoology, with brief comments on optical discs and on the situation in botany. *Zootaxa*, **3735** (1): 1–94.
- Dubois, A., Frétey, T., Lorvelec, O. & Ohler, A. (2021b) The nomenclatural status of the amphibian and reptile nomina introduced by La Cépède in his *Histoire Naturelle des Quadrupèdes Ovipares et des Serpens*, with comments on

- various questions of zoological nomenclature. *Bionomina*, **23**: 1–180.
- Dubois, A., Nemésio, A. & Bour, R. (2014) Primary, secondary and tertiary syntypes and virtual lectotype designation in zoological nomenclature, with comments on the recent designation of a lectotype for *Elephas maximus* Linnaeus, 1758. *Bionomina*, **7**: 45–64.
- Dubois, A. & Ohler, A. (2018) The *Hyla quoyi*–*Hyla prasina* case (Amphibia, Anura), with comments on bibliographic and taxonomic databases and on Article 23.9 of the *Code*. *Zoosystema*, **40** (23): 501–506.
- Dubois, A., Ohler, A. & Pylon, R. A. (2021a) New concepts and methods for phylogenetic taxonomy and nomenclature in zoology, exemplified by a new ranked cladonomy of recent amphibians (Lissamphibia). *Megataxa*, **5**: 1–738.
- Dubois, A. & Seret, B. (2019) A justified emendation for a specific nomen of shark (Chondrichthyes), with comments on some Articles of the *Code*. *Bionomina*, **15**: 59–62. <<https://doi.org/10.11646/bionomina.15.1.5>>.
- Dufresnes, C., Mazepa, G., Jablonski, D., Caliani Oliveira R., Wenseleers, T., Shabanov, D. A., Auer, M., Ernst, R., Koch, C., Ramírez-Chaves, H. E., Mulder, K. P., Simonov, E., Tiutenko, A., Kryvokhyzha, D., Wennekes, P. L., Zinenko, O. I., Korshunov, O. V., Al-Johany, A. M., Peregontsev, E. A., Masroor, R., Betto-Colliard, C., Denoël, M., Borkin, L. J., Skorinov, D. V., Pasyukova, R. A., Mazanaeva, L. F., Rosanov, J. M., Dubey, S. & Litvinchuk, S. (2019a) Fifteen shades of green: the evolution of *Bufotes* toads revisited. *Molecular Phylogenetics and Evolution*, Journal pre-proofs: [1–25]. <<https://doi.org/10.1016/j.ympev.2019.106615>>.
- Dufresnes, C., Mazepa, G., Jablonski, D., Caliani Oliveira R., Wenseleers, T., Shabanov, D. A., Auer, M., Ernst, R., Koch, C., Ramírez-Chaves, H. E., Mulder, K. P., Simonov, E., Tiutenko, A., Kryvokhyzha, D., Wennekes, P. L., Zinenko, O. I., Korshunov, O. V., Al-Johany, A. M., Peregontsev, E. A., Masroor, R., Betto-Colliard, C., Denoël, M., Borkin, L. J., Skorinov, D. V., Pasyukova, R. A., Mazanaeva, L. F., Rosanov, J. M., Dubey, S. & Litvinchuk, S. (2019b) Fifteen shades of green: the evolution of *Bufotes* toads revisited. *Molecular Phylogenetics and Evolution*, **141**: 1–25. <<https://doi.org/10.1016/j.ympev.2019.106615>>.
- Gilman, L. N. & Wright, S. D. (2020) Restoring indigenous names in taxonomy. *Communications Biology*, **3** (609): 1–3. <<https://doi.org/10.1038/s42003-020-01344-y>>.
- Goldfuss, G. A. (1820) *Handbuch der Zoologie*. Theil **3**, Abtheilung 2. Nürnberg (Johann Leonhard Schrag): i–xxiv + 1–512, pl. 3–4.
- Gravenhorst, J. L. C. (1843) *Vergleichende Zoologie*. Breslau (Graß, Barth & Co.): i–xx + 1–687, pl. 1–12. <<https://doi.org/10.5962/bhl.title.58729>>.
- Gray, J. E. (1825) A synopsis of the genera of Reptiles and Amphibia, with a description of some new species. *Annals of Philosophy*, (2), **10**: 193–217.
- Günther, A. (1858) On the systematic arrangement of the Tailless Batrachians and the structure of *Rhinophrynus dorsalis*. *Proceedings of the zoological Society of London*, **1858**: 339–352. <<https://doi.org/10.1111/j.1469-7998.1858.tb06387.x>>.
- Hofmann, S., Baniya, C. B., Litvinchuk, S. N., Miede, G., Li, J.-T. & Schmidt, J. (2019a) Phylogeny of spiny frogs *Nanorana* (Anura: Dicroglossidae) supports a Tibetan origin of a Himalayan species group. *Ecology and Evolution*, **2019**: 1–14.
- Hofmann, S., Baniya, C. B., Litvinchuk, S. N., Miede, G., Li, J.-T. & Schmidt, J. (2019b) Phylogeny of spiny frogs *Nanorana* (Anura: Dicroglossidae) supports a Tibetan origin of a Himalayan species group. *Ecology and Evolution*, **2019**: 14998–14511.
- Kaiser, H., Crother, B. I., Kelly, C. M. R., Luiselli, L., O’Shea, M., Ota, H., Passos, P., Schleip, W. D. & Wüster, W. (2013) 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. *Herpetological Review*, **44** (1): 8–23.
- Krell, F.-T. (2009) ZooBank and the next edition of the Code—challenges and new developments in the 250th year of zoological nomenclature. *Aquatic Insects*, **31** (suppl. 1): 269–282. <<http://dx.doi.org/10.1080/01650420903083393>>.
- Krell, F.-T. (2015) A mixed bag: when are early online publications available for nomenclatural purposes? *Bulletin of zoological Nomenclature*, **72** (1): 19–32.
- Laurenti, J. N. (1768) *Specimen medicum, exhibens synopsis Reptilium emendatam cum experimentis circa venena et antidota Reptilium austriacorum*. Viennae (Joan. Thom. Nob. de Trattner): i–ii + 1–215, pl. 1–5. <<https://doi.org/10.5962/bhl.title.5108>>.
- Martín, C., Alonso-Zarazaga, M. A. & Sanchiz, B. (2012) Nomenclatural notes on living and fossil amphibians. *Graellsia*, **68** (1): 159–180. <<https://doi.org/10.3989/graellsia.2012.v68.056>>.
- Minelli, A. (2013) Zoological nomenclature in the digital era. *Frontiers in Zoology*, **10** (4): 1–7. <<https://doi.org/10.1186/1742-9994-10-4>>.
- Mosyakin, S. L. (2022) If ‘*Rhodes*’ must fall, who shall fall next? *Taxon*. <<https://doi.org/10.1002/tax.12659>>.
- Mound, L. A. & Hastenpflug-Vesmanis, A. (2021) All genera of the world: order Thysanoptera (Animalia: Arthropoda: Insecta). *Megataxa*, **6** (1): 2–69. <<https://doi.org/10.11646/megataxa.6.1.2>>.
- Moylan, E., Harold, S., Harris, P., Foote, C., Arme, C., Minelli, A., Kowalczyk, M. & Black, C. (2014) Online-only publishers are here to stay, and will continue to work closely with the ICZN. *Zootaxa*, **3779** (1): 6–8.
- Orr, A. & Fliedner, H. (2011) Notes on the correct spelling of species-group names of Australian butterflies (Lepidoptera). *Australian Entomologist*, **38** (3): 101–108.



- Palma, R. L. & Heath, A. C. (2021) Science versus vernacular: should some taxa of animals and plants be renamed according to 'indigenous' practices. *Bionomina*, **22**: 32–38. <<https://doi.org/10.11646/bionomina.22.1.1>>.
- Pavlinov, I. Y., [Павлинов, И. Я.] (2014) Taxonomic nomenclature. Book 2. From Linnaeus to first Codes. [Таксономическая номенклатура. Книга 2. От Линнея до первых кодексов]. *Zoologitsheskie Issledovaniya Zoological Research [Зоологические исследования]*, **15**: 1–223.
- Poyarkov, N. A., Nguyen, T. V., Popov, E. S., Geissler, P., Pawangkhanant, P., Neang, T., Suwannapoom, C. & Orlov, N. L. (2021) Recent progress in taxonomic studies, biogeographic analysis, and revised checklist of Amphibians in Indochina. *Russian Journal of Herpetology*, **28** (3A): 1–110. <<https://doi.org/10.30906/1026-2296-2021-28-3A-1-110>>.
- Razzetti, E. (2008) Taxonomic remarks on *Bufo lineatus* and *Bufo siculus*. In: C. Corti (ed.), *Herpetologia Sardiniae*, Latina (Edizioni Belvedere, Societas Herpetologica Italica): 420–424.
- Rütimeyer, L. (1873) Die fossilen Schildkröten von Solothurn und der übrigen Juraformation. *Neue Denkschrift der allgemeinen schweizerischen naturforschenden Gesellschaft*, **25**: 1–185.
- Schlegel, [H.] (1826a) Notice sur l'erpétologie de l'île de Java; par M. Boie. (Ouvrage manuscrit). *Bulletin des Sciences naturelles et de Geologie*, **9** (2): 233–240.
- Schlegel, [H.] (1826b) Erpetologische Nachrichten. *Isis von Oken*, **20** (3): 281–294.
- Silva, T., Guzmán, A., Urantówka, A. D. & Mackiewicz, P. (2017) A new parrot taxon from the Yucatán Peninsula, Mexico—its position within genus *Amazona* based on morphology and molecular phylogeny. *PeerJ*, **3475**: 1–40. <<https://doi.org/10.7717/peerj.3475/correction-1>>.
- Smith, G. F. & Figueiredo, E. (2021) 'Rhodes-' must fall: some of the consequences of colonialism for botany and plant nomenclature. *Taxon*. <<https://doi.org/10.1002/tax.12598>>
- Stiles, C. W. (1913a) Report of the International Commission on Zoological Nomenclature. *IX<sup>e</sup> Congrès international de Zoologie tenu à Monaco du 25 au 30 mars 1913*: 852–894.
- Stiles, C. W. (1913b) Report of the International Commission on Zoological Nomenclature. *Science*, (n.s.), **38** (966): 6–19.
- Stöck, M., Sicilia, A., Belfiore, N. M., Buckley, D., Lo Brutto, S., Lo Valvo, M. & Arculeo, M. (2008) Post-Messinian evolutionary relationships across the Sicilian channel: mitochondrial and nuclear markers link a new green toad from Sicily to African relatives. *BMC evolutionary Biology*, **8**(56): 1–19 + 5 additional files. <<http://dx.doi.org/10.1186/1471-2148-8-56>>.
- Stüben, P. E. (2021) Zwei neue Cryptorhynchinae (Coleoptera: Curculionidae) aus der Mediterraneis. *Weevil News*, **95**: 1–14.
- White, W. T., Kyne, P. M. & Harris, M. (2019) The correct spelling of the nomen of the lost shark *Carcharhinus obsolerus* White, Kyne & Harris, 2019 (Chondrichthyes, Carcharhinidae). *Zootaxa*, **4657** (3): 599–600.

Submitted: 23 May 2022. Accepted: 22 July 2022. Published: 25 August 2022.

Corresponding editor: Alessandro Minelli.