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EDITORIAL

Correct nomenclature and recommendations for preserving and cataloguing voucher material and genetic sequences

This Editorial provides some advice on (1) the use of scientific species names, including the formation of new species names, (2) the importance of depositing specimens, used for morphological or genetic analyses, in scientific collections that are accessible to other researchers and (3) the importance of ensuring that data associated with genetic sequences submitted to appropriate databases also include information about the specimen from which the sequence was obtained. A review of the practices currently employed in the literature and on the web indicates that there are different opinions on some of the points discussed below. Nevertheless, the main objectives of this Editorial are to encourage authors to be diligent in the way they use names and record data, to assist authors who might be unfamiliar with any of these practices and to direct authors to additional databases and guidelines (especially the *International Code of Zoological Nomenclature* that can give further explanation).

NOMENCLATURE

There are well-established rules and guidelines for the correct use of scientific species names (*i.e.* the Latin binomial names of species), and the correct usage of this nomenclature is important for conveying an essential part of the history behind the name. The nomenclatural rules and guidelines, however, are not widely known by researchers across all fields of biology, and this lack of familiarity can increase the chance of nomenclatural errors (Kottelat & Freyhof, 2007). It is important, therefore, to understand and follow the recommended standard practices.

1. Unlike scientific names, common names of fish species are not bound by formal rules of use (there are exceptions such as Nelson *et al*., 2004); therefore, in different parts of the world different common names are applied to the same species or the same common name may be applied to different species. In addition, many species do not have a common name that is widely recognized. Kottelat & Freyhof (2007) provide further discussion and some examples on these complications with common names. Therefore, it is the policy of the *Journal of Fish Biology* to avoid using common names, except at the first mention of the species name in the main text. The first time the species is mentioned, the common name should be given (if one is available) followed by the scientific species name [accompanied by the describing authority and date of authorship; see (3) below]. The common name should not be separated from the scientific name by a comma nor should the scientific species name be in parentheses [*e.g.* see (3) below].

2. In order to be consistent with the most frequent and well-known usage of common names, the common name should be taken from a widely distributed and well-accepted source of names. Some examples are Froese & Pauly (2010), *FAO Species Identification Guides for Fisheries Purposes* (http://www.fao.org/fishery/publications/en/). For British fishes use Wheeler (1992) and Wheeler *et al*. (2004); for European freshwater fishes use Kottelat & Freyhof (2007); for North American fishes use Nelson *et al*. (2004). Common names should be lower case unless the name refers to a person or place.

3. When first using scientific names in the main text of a manuscript, the full name (genus and species) should be given without abbreviation of the genus. This rule will ensure there is no possibility of confusion of the generic epithet or name. The scientific name should be followed by the names of the authors who first described the species (*i.e.* the describing authorities) and the date the species was described. This is in accordance with Article 51.1 of the *International Code of Zoological Nomenclature* (ICZN, 1999), stating that the use of species' author names is 'customary and often advisable' and follows the Code's recommendation 51A: 'Citation of author and date. The original author and date of a name should be cited at least once in each work dealing with the taxon denoted by that name'. The describing authority and date of authorship should not be separated by a comma, following the style used in Eschmeyer & Fricke's (2011) online *Catalog of Fishes* [also see (9) below].

   An example of how to present a species name on first use in the manuscript is as follows:

   the rainbow trout *Oncorhynchus mykiss* (Walbaum 1792);

   NOT, the rainbow trout *O. mykiss* (Walbaum 1792) (*i.e.* do not abbreviate the generic name);

   and NOT, the rainbow trout, [*Oncorhynchus mykiss* (Walbaum 1792)] [*i.e.* do not insert additional commas and parentheses; there are precise rules about the use of parentheses, as noted in (4) below].

   When three or more joint authors are responsible for a species name, then all authors of the species name should be included in the first citation (rather than '*et al*.'). This follows recommendation 51C of the *International Code of Zoological Nomenclature* (ICZN, 1999) that all authors of the name should be cited somewhere in the publication.

   By providing this complete information for species, the reader will know exactly which species is being discussed (as the full name and origin of the name are provided) and will have the necessary information to locate the original description of the species. This information may be important in a case where a species has undergone taxonomic revision in the past and may be cited under different scientific names. For example, the turbot S*cophthalmus maximus* has been referred to as *Psetta maxima* by many fish biologists or fisheries biologists (Bailly & Chanet, 2010), who might not be aware of the valid name. By explicitly referring to *Scophthalmus maximus* (Linnaeus 1758), it is quite clear what species is being discussed (*i.e.* the species that Linnaeus originally described in 1758).

See the Article 51 of the *International Code of Zoological Nomenclature* (ICZN, 1999) for further recommendations for citation of species authorities.

First use of species names in the title and Abstract of a manuscript submitted to the *Journal of Fish Biology* should include common and scientific names as above, but do not require the describing authority and date of authorship. The *Journal of Fish Biology* does not require species authorities or dates to be included with lists of species names compiled in Tables.

4. When first using scientific species names in a manuscript, the describing authority name appears in parentheses only if the binomial combination of the name has changed since the original description [as defined in Article 51.3 of the of the *International Code of Zoological Nomenclature* (ICZN, 1999)]. For example, Richardson described the salmonid species *Salmo clarkii* in 1836. Subsequently, several authors have recognized this species as being part of the genus *Oncorhynchus*, so the accepted name is *Oncorhynchus clarkii* (Richardson 1836). The parentheses are used to make it clear that the scientific binomial name is different from the one that was first used for this species by Richardson.

   Similarly, in the examples given in (3) above, Walbaum described *Salmo mykiss* in 1792 and it was subsequently recognized as a part of the genus *Oncorhynchus*, so the accepted name is *Oncorhynchus mykiss* (Walbaum 1792).

   By comparison, Cuvier described the species *Salmo marmoratus* in 1829, and this binomial is still accepted as valid for this species (*i.e.* the species has not been moved into any other genus or synonymized with any other species). Therefore, the full name is *Salmo marmoratus* Cuvier 1829 and no parentheses are used for the describing authority.

   An exception to this use of parentheses is when the species name was originally combined with an incorrect spelling or an emendation of the generic name [see Article 51.3.1. of the *International Code of Zoological Nomenclature* (ICZN, 1999)].

5. It is strongly recommended that the original publication that provides the species name should be consulted in order to verify the author and date of the species name (or any of the original descriptive information about that species, if that is also discussed in a manuscript). This can sometimes be very difficult, however, and in such cases Eschmeyer & Fricke's (2011) online *Catalog of Fishes* should be used as the standard authority for the scientific species name, author and date of description. A typical example of an entry is given below, for *Salmo henshawi* Gill & Jordan 1878:

   > *henshawi*, *Salmo* Gill [T. N.] & Jordan [D. S.] in Jordan 1878:358 [Manual of the vertebrates of the northern United States, ... 2nd edition.; ref. 2376] Lake Tahoe and streams of California, U.S.A. Syntypes: USNM 17086 (1), 21083 (1), 23467 (1), 107328 (2). Author is T. N. Gill. Synonym of *Salmo clarkii* (Richardson 1836), but a valid subspecies – (La Rivers 1994:281 [ref. 23389]). Synonym of *Oncorhynchus clarkii* (Richardson 1836), but a valid subspecies – (Behnke 1992:73, 111 [ref. 23385], Thurow *et al*. 1997:1094 [ref.

> 25523], Sigler & Sigler 1996:169 [ref. 25943] as *clarki*, Fuller *et al*. 1999:244 [ref. 25838] as *clarki*, Moyle 2002:288 [ref. 26449] as *clarki*, Wydoski & Whitney 2003:57 [ref. 27816] as *clarki*, Scharpf 2006:26 [ref. 30386], Trotter & Behnke 2008:63 [ref. 30146]). Current status: synonym of *Oncorhynchus clarkii* (Richardson 1836). Salmonidae: Salmoninae. Habitat: freshwater, brackish, marine.

The entry lists the original name as given by the describing authors (in this case Gill & Jordan), the date the species was first described (1878) and then lists references to other uses of this name or other names. The accepted, valid name is given last as the 'Current status'. In this case, *Salmo henshawi* is currently recognized as a synonym of *Oncorhynchus clarkii* as described by Richardson in 1836. Therefore, specimens identified as *Salmo henshawi* take the name *Oncorhynchus clarkii* (Richardson 1836). Note that, in this instance, however, the sub-species status is recognized by some authors, who treat it as *Oncorhynchus clarkii henshawi* (Gill & Jordan 1878) [see also point (8), below].

Although *FishBase* (Froese & Pauly, 2010) uses the *Catalog of Fishes* (Eschmeyer & Fricke, 2011) as the nomenclatural authority, the nomenclature in the *Catalog of Fishes* is updated more frequently than *FishBase*. For this reason, the *Catalog of Fishes* should be used as the preferred source of nomenclatural information. It is also important to remember that despite the fact that the *Catalog of Fishes* is widely recognized as the most important resource for valid names in fishes, errors are made in this database, and authors are therefore encouraged to check the validity of names and sources independently when possible. If errors are found in the *Catalog of Fishes*, then they should be reported to the webmaster for the *Catalog*.

6. When the describing authority is Linnaeus, it is common to abbreviate this to 'L.' (because he made the first description of many species and his name is so ubiquitous within taxonomy and nomenclature). For example, *Cyprinus carpio* L. 1758. The *Journal of Fish Biology* follows this policy.

7. After initial use of the species' common and scientific names, subsequent reference to the species name in the *Journal of Fish Biology* should use the scientific name only (without the describing author or date) and should not use the common name. The generic name should be abbreviated to a single letter (*e.g. Cyprinus carpio* abbreviated to *C. carpio*), except at the start of a sentence or where confusion may arise from multiple genera with the same first letter; see the *International Code of Zoological Nomenclature* (ICZN, 1999), Appendix B, General Recommendations, no. 11.

8. It is strongly recommended that sub-species taxonomy and nomenclature are not used, because definitions of sub-species as discrete entities are often unclear or subjective; if there is a clear distinction, then the taxon should probably be recognized as a full species (see Kottelat, 1997, for further discussion). If a decision is made to recognize a sub-species, however, the describing authority must refer to the person who described the taxon name that is applied to the sub-species. Thus, in the example in (5) above, for the sub-species *Oncorhynchus clarkii henshawi*, the describing authority is Gill & Jordan who first described

Salmo henshawi, not Richardson who described the species *Salmo clarkii* (later named *Oncorhynchus clarkii*) which now includes the sub-species *henshawi*.

9. Many journals do not expect the citation for the original description of a species to be included in References. This is especially true now that all relevant bibliographic information can easily be obtained from the *Catalog of Fishes* (Eschmeyer & Fricke, 2011) based on the species name, describing authority and date of description. Therefore, there is no need to include the same information in the list of references given in a manuscript. The *Journal of Fish Biology* follows this policy. Thus, if the species *Oncorhynchus clarkii* (Richardson 1836) is cited in the text, there is no requirement to include Richardson (1936) in the list of references. [The absence of a comma between the describing authority name (*e.g*. Richardson) and date (1836) makes it clear that this is different from a standard bibliographic reference]. Exceptions to this are when additional specific details about the species (*e.g*.general morphology and ecology; *i.e.* more than just the species name) are supplied in the original description and discussed in the manuscript.

10. When listing synonyms for a species (a now uncommon practice in descriptions and re-descriptions of species), it is important to follow a consistent and commonly used style. The following style is required by the *Journal of Fish Biology*, based in part on Mincarone & Fernholm (2010) and with explanatory notes given in square brackets:

    Eptatretus cirrhatus (Forster 1801) [the valid species name]

    Homea banksii Fleming 1822:375 (original description; type locality: South Seas; holotype: unknown)

    Bdellostoma heptatrema Müller 1836:79 (original description; type locality: South Seas; holotype: unknown)

    Bdellostoma forsteri Müller 1836:80 (original description; type locality: Queen Charlotte Sound, New Zealand; holotype: unknown). Conel, 1931:76

    Bdellostoma forsteri var. *heptatrema* Müller, 1838:174 (new combination)

    Bdellostoma cirrhatum. Günther, 1870:511 (in part). Hutton, 1872:87 (in part). Putnam, 1874:160 (in part). Günther, 1880:27

    [Note that species names that are modifications of an existing binomial, rather than an original description, are separated from the author name by a full stop, *Bdellostoma cirrhatum*. Günther, 1870:511 (in part).]

11. When publishing a species name that is new to science, authors must explicitly indicate that the name is intentionally new, as required by Article 16.1 of the *International Code of Zoological Nomenclature* (ICZN, 1999). Recommendation 16 A of the Code gives several examples of text that can be used in headings, or at first use of new names, such as: ‘fam. nov.’, ‘g. nov.’, ‘sp. nov.’, ‘ssp. nov.’ (Note that although these are Latin abbreviations they do not appear in italics, even when incorporated in the scientific name being described).

12. Names of non-fish species used in manuscripts submitted to the *Journal of Fish Biology* should include the scientific name wherever possible, but the name of the describing authority and the date of description need not be included.

Further discussion and guidelines for standard practices of zoological nomenclature may be found in Winston (1999) and the *International Code of Zoological Nomenclature* (ICZN, 1999).

VOUCHER MATERIAL

13. Specimens used for taxonomic analyses should, whenever possible, be deposited in appropriate scientific collections where there is evidence that there are adequate resources to maintain the material in good condition. Examples of qualifying collections include museum and university collections, or private collections with sufficient resources to maintain and curate collections in perpetuity.

14. Specimens should have identifying catalogue numbers (which should be reported in the manuscript), so that they are easily accessible to the scientific community for subsequent examination and taxonomic revision.

15. Name-bearing type specimens [holotype, syntypes, lectotype and neotype; see Article 72.1.2 of the *International Code of Zoological Nomenclature* (ICZN, 1999)] of taxa that are described in the *Journal of Fish Biology* as new to science must be deposited in institutions that can meet Recommendations 72F.1-5 of the *International Code of Zoological Nomenclature* (ICZN, 1999) for institutional responsibility. The chosen institute for deposition of name-bearing type specimens should be able to meet these responsibilities into the foreseeable future. A paratype series may be distributed among more than one institution at the discretion of the authors. For example, where a paratype series includes numerous specimens, the series can be divided into two or more representative samples, each comprising several specimens that are deposited at different institutions. It is also recommended that type material is deposited at institutions that already have a large number of types of related species, in order to make it easier subsequently for researchers to view comparative material together (either when visiting the institution or by requesting a single loan package from that institution).

Institutional abbreviations used in manuscripts should follow standard code designations as given by Fricke & Eschmeyer (2010).

GENETIC SEQUENCE DATA

16. Novel nucleotide sequences must be submitted to an International Nucleotide Sequence Databases (INSD) and have an accession number from the European Biology Laboratory (EMBL), GenBank Data Libraries (GenBank) or DNA Data Bank of Japan (DDBJ). This information is essential for other researchers to access the genetic data and make comparative analyses with their data. The

genetic database accession numbers must be included before the manuscript is published in the *Journal of Fish Biology*.

The *Journal of Fish Biology* strongly recommends that the specimens from which genetic material has been sequenced are preserved with voucher numbers in appropriate collections [see (13)–(15) above], and when authors deposit data in genetic data banks they include:

1. The collection catalogue numbers for the specimen from which the genetic sequence data were derived.
2. Collection locality data for the specimen.

GenBank's data accession format includes several modifiers, *e.g.* 'collection-date', 'country', lat-lon', 'specimen-voucher', to assist with recording this information (see http://www.ncbi.nlm.nih.gov/Sequin/modifiers.html/).

17. For taxonomic papers that refer to gene sequences derived from specimens preserved in collections, authors should include a table that clearly links each gene sequence accession number with the specimen from which it was derived. Sequences from type specimens should also be clearly identified in this Table [*e.g.* given in bold text or otherwise marked up as in the Table shown below)]. An example is given below.

Species	Catalogue number	Locality	GENBANK sequence number from specimen		Genetype status
			COI	ND1	
Milyeringa veritas	LSUMZ 13636	Milyering Well*	HM590594	HM590606	Topogenetype
Milyeringa veritas	LSUMZ 13638	New Moubowra Cave	HM590596	HM590608	Not applicable
Milyeringa brooksi	LSUMZ 13637	Pilgonoman Well*	HM590595	HM590607	Paragenetype and topo-genetype
Milyeringa brooksi	ABTC22891, SAM	Javis Well	AY722169	AY722306	Not applicable

Example of data taken from Chakrabarty (2010*b*).
*Type.

A nomenclature for genetic sequences for type specimens has been proposed by Chakrabarty (2010*a*) and may be used in the Table (but is not obligatory for *the Journal of Fish Biology*): sequences from holotypes are identified as *hologenetypes*, those from topotypes are topogenetypes and the genetic markers used can also be incorporated into the nomenclature (*e.g.* paragenetype ND2).

I. J. Harrison, Associate Editor
P. Chakrabarty, Assistant Editor
J. Freyhof, Assistant Editor
J. F. Craig, Editor-in-Chief

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