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The dangers of inadequate literature search to nomenclatural stability: the case of the *nomina* *Hyla quoyi* Bory de Saint-Vincent, 1828 and *Hyla prasina* Burmeister, 1856 (Amphibia: Anura)

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Boana prasina (Burmeister, 1856) specimen. Photograph: Diego Santana.

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The dangers of inadequate literature search to nomenclatural stability: the case of the *nomina Hyla quoyi* Bory de Saint-Vincent, 1828 and *Hyla prasina* Burmeister, 1856 (Amphibia: Anura)

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ABSTRACT
Ohler & Dubois (2018) argued that Article 23.9 of the *Code* cannot be used to reject the name *Hyla quoyi* Bory de Saint-Vincent, 1828 in favor of its junior synonym *Hyla prasina* Burmeister, 1856. However, their statement was based on an insufficient literature search erroneously suggesting that *H. prasina* had been rarely used. We discuss this issue and give recommendations on searches in electronic bibliographical databases.

KEY WORDS
Amphibia,
Anura,
nomenclatural act,
Principle of Priority,
synonymy.

RÉSUMÉ
Les dangers d'une recherche bibliographique insuffisante pour la stabilité nomenclaturale : le cas des noms Hyla quoyi *Bory de Saint-Vincent, 1828 et* Hyla prasina *Burmeister, 1856 (Amphibia: Anura).*
Ohler & Dubois (2018) ont affirmé que l'article 23.9 du *Code* ne peut pas être utilisé pour rejeter le nom *Hyla quoyi* Bory de Saint-Vincent, 1828 en faveur de son synonyme plus récent *Hyla prasina* Burmeister, 1856. Cependant, leur déclaration était basée sur une recherche insuffisante dans la littérature suggérant à tort que *H. prasina* n'avait été que rarement utilisé. Nous discutons ce problème et donnons des recommandations sur les recherches dans les bases de données bibliographiques électroniques.

MOTS CLÉS
Amphibia,
Anura,
acte nomenclatural,
principe de priorité,
synonymie.

INTRODUCTION

Caramaschi & Niemeyer (2010) stated that the name *Hyla quoyi* Bory de Saint Vincent, 1828 should be considered a *nomen oblitum* under Article 23.9 of the International Code of Zoological Nomenclature (ICZN 1999) (hereafter "the *Code*"), and its "well established" junior synonym *Hyla prasina* Burmeister, 1856 should be a *nomen protectum*. In a paper recently published in this journal, Ohler & Dubois (2018) argued that the nomenclatural act of reversal of precedence proposed by Caramaschi & Niemeyer (2010) was invalid because they had failed to meet the criteria of the *Code*.

For the nomenclatural act proposing the reversal of precedence between *Hyla quoyi* and *H. prasina* to be properly implemented, it would be necessary to explicitly cite at least 25 published works by at least 10 authors in the last 50 years within a span of not less than 10 years (Article 23.9.1.2). In their search, Ohler & Dubois (2018) found only 11 references, suggesting that *Hyla prasina* was not a widely used name. For this reason, they concluded that *H. prasina* cannot be considered a *nomen protectum*, and that the name *Hyla quoyi* should be used. In this work we provide arguments contrary to Ohler & Dubois (2018) and highlight how incomplete literature reviews that call for the Principle of Priority or its reversal can have negative impacts on nomenclatural stability.

MATERIAL AND METHODS

We made a search in online databases on 6 April 2018 for references between 1968 and 2018 (the last 50 years) with the terms "*Hyla prasina*" OR "*Hypsiboas prasinus*" OR "*Boana prasina*", and a search for references after 1899 with the terms "*Hyla quoyi*" OR "*Hypsiboas quoyi*" OR "*Boana quoyi*". Searches were made in two steps: one with the selected terms restricted to the title of the work; another with the terms in any part of the text. Databases used were Google Scholar (https://scholar.google.com.br), BioOne (http://www.bioone.org/), JSTOR (http://www.jstor.org), Science Direct (https://www.sciencedirect.com), Scopus (https://www.scopus.com), Web of Science (http://webofknowledge.com), and Wiley Online Library (https://onlinelibrary.wiley.com). Additionally, we searched on all issues of the traditional journal Herpetological Review which is not completely indexed by those databases but is available online (https://ssarherps.org/herpetological-review-pdfs/). We considered as valid references only those that constitute a published work under Article 8 of the *Code*.

RESULTS

For terms related to the name *Hyla quoyi*, the only published work found that considers it a valid name is Ohler & Dubois (2018). Search in Google Scholar for the terms "*Hyla prasina*", "*Hypsiboas prasinus*" or "*Boana prasina*" in the title of the article resulted in seven references, of which five can be considered a published work by the *Code* (Kwet & Miranda 2001; Kiss *et al.* 2009; Madelaire *et al.* 2012, 2013; Delgado & Haddad 2015). Nevertheless, 244 references were recovered when the terms were searched in any part of the text. Some results were duplicates; many are unpublished works (dissertations and theses); a few present the selected term only in the title of a cited reference; but not less than 70 in fact are published works that considered *Hyla prasina/Hypsiboas prasinus/Boana prasina* as a valid name (see Discussion).

At JSTOR, there are 15 published works that cite one of the names as valid (Heyer *et al.* 1988; Bertoluci 1998; Eterovick *et al.* 2002, 2005; Garcia *et al.* 2003, 2007; Jim 2004; Gomes *et al.* 2004; Haddad & Prado 2005; Wiens *et al.* 2005; D'Heursel & Haddad 2007; Antunes *et al.* 2008; Lehr *et al.* 2010; Madelaire *et al.* 2012, 2013) – the last two cite *Hypsiboas prasinus* in the title. Another record cites *H. prasinus* only in the title of a cited reference; and three do not constitute published works.

Searching in BioOne recovered three articles with the selected terms in the title (Madelaire *et al.* 2012, 2013; Delgado & Haddad 2015) and 13 with the terms in the text: 11 that cite *Hyla prasina/Hypsiboas prasinus* as valid (Eterovick *et al.* 2002; Garcia *et al.* 2003, 2007; Haddad & Prado 2005; Faivovich *et al.* 2005; D'Heursel & Haddad 2007; Antunes *et al.* 2008; Madelaire *et al.* 2012, 2013; McAllister *et al.* 2013; Delgado & Haddad 2015), one journal table of contents (not a published work), and Ohler & Dubois (2018).

In Science Direct the search recovered four references with the terms in the text: one table of contents (not a published work), and three articles (Faivovich *et al.* 2004; Kiss *et al.* 2009; Moretti *et al.* 2017) – the second one with *H. prasinus* in the title. In Scopus and the Web of Science we found four published works (Kiss *et al.* 2009; Madelaire *et al.* 2012, 2013; Delgado & Haddad 2015) and one meeting abstract citing *H. prasinus* in the title. If selected terms can be in any part of the text, the search at Scopus recovered 26 published works: 14 citing one of the species names as valid (Kiss *et al.* 2009; Caramaschi & Niemeyer 2010; Madelaire *et al.* 2012, 2013; McAllister *et al.* 2013; Toledo *et al.* 2013; Campião *et al.* 2014; Delgado & Haddad 2015; An & Waldman 2016; Greenspan *et al.* 2016; Pinheiro *et al.* 2016; Kindermann *et al.* 2017; Köhler *et al.* 2017; Moretti *et al.* 2017) and 12 citing *H. prasinus* only in the title of a cited reference. The Web of Science recovered 13 references: 11 articles (Bertoluci 1998; Giaretta *et al.* 1999; Faivovich *et al.* 2005; Zina *et al.* 2007; Kiss *et al.* 2009; Caramaschi & Niemeyer 2010; Madelaire *et al.* 2012, 2013; Delgado & Haddad 2015; Batista *et al.* 2015; Moretti *et al.* 2017), one meeting abstract, and an article (Valente *et al.* 1993), we were unable to access; if restricted to the Core Collection, the search recovered six articles and one meeting abstract.

Search in Wiley Online Library recovered no articles with the selected terms in the title, and only two with the terms in the text (Eterovick *et al.* 2005; Greenspan *et al.* 2016). The search in all issues of *Herpetological Review* recovered

only one reference (Kwet & Miranda 2001). Finally, eight references we have in our archives but are not included in databases but cite one of the names as valid (Beçak 1968; Lutz 1973; Lynch 1979; Reynolds & Foster 1992; Duellman *et al.* 1997; Stuart *et al.* 2008; Pyron & Wiens 2011; Haddad *et al.* 2013).

Based on the results from our search, the longest period without published works citing *Hyla prasina*, *Hypsiboas prasinus*, or *Boana prasina* as valid names was between 1979 and 1987. After 1997 at least one work per year considers those names as valid.

DISCUSSION

Our search for works published between 1968 and April 2018 considering *Hyla prasina*, *Hypsiboas prasinus*, or *Boana prasina* as a valid name recovered 93 references that met the criteria of Article 23.9.1.2 of the *Code* (Beçak 1968; Lutz 1973; Lynch 1979; Haddad & Pombal 1987; Heyer *et al.* 1988, 1990; Martins & Haddad 1988; Reynolds & Foster 1992; Baldissera *et al.* 1993; Duellman *et al.* 1997; Pombal 1997, 2010; Bertoluci 1998; Giaretta *et al.* 1999; Machado *et al.* 1999; Amaral *et al.* 2000; Bernarde & Machado 2001; Kwet & Miranda 2001; Bertoluci & Rodrigues 2002; Eterovick *et al.* 2002, 2005; Machado & Bernarde 2002; Garcia *et al.* 2003, 2007, 2008; Faivovich *et al.* 2004, 2005; Gomes *et al.* 2004; Jim 2004; Rocha *et al.* 2004; Haddad & Prado 2005; Pombal & Haddad 2005; Ribeiro *et al.* 2005; Wiens *et al.* 2005; Conte & Rossa-Feres 2006, 2007; d'Heursel & Haddad 2007; Machado & Maltchik 2007; Melo *et al.* 2007; Moraes *et al.* 2007; Zina *et al.* 2007; Antunes *et al.* 2008; Kolenc *et al.* 2008; Kwet 2008; Miranda *et al.* 2008; Stuart *et al.* 2008; Araújo *et al.* 2009; Condez *et al.* 2009; Kiss *et al.* 2009; Santos *et al.* 2009; Shibatta *et al.* 2009; Toledo & Haddad 2009a, b; Araújo *et al.* 2010, 2013; Caramaschi & Niemeyer 2010; Forlani *et al.* 2010; Lehr *et al.* 2010; Iop *et al.* 2011; Pyron & Wiens 2011; Rossa-Feres *et al.* 2011; Gründler *et al.* 2012; Toledo & Batista 2012; Madelaire *et al.* 2012, 2013; Valdujo *et al.* 2012; Araújo & Almeida-Santos 2013; Haddad *et al.* 2013; McAllister *et al.* 2013; Toledo *et al.* 2013; Batista & Bastos 2014; Maffei & Ubaid 2014; Campião *et al.* 2014; Mattos *et al.* 2014; Silva *et al.* 2014; Zina *et al.* 2014; Delgado & Haddad 2015; Nazaretti & Conte 2015; Batista *et al.* 2015; Gonçalves *et al.* 2015; Nascimento *et al.* 2015; An & Waldman 2016; Garey & Provete 2016; Santos & Conte 2016; Greenspan *et al.* 2016; Pinheiro *et al.* 2016; Guerra-Fuentes *et al.* 2017; Kindermann *et al.* 2017; Köhler *et al.* 2017; Moretti *et al.* 2017; Silva *et al.* 2017; Taboada *et al.* 2017; Dorigo *et al.* 2018). This long list clearly shows that *Hyla prasina* Burmeister, 1856 is a widely used name (mostly under the combination *Hypsiboas prasinus*, now *Boana prasina*), contrary to the statement by Ohler & Dubois (2018).

Despite the amount of evidence of the wide use of *Hyla prasina* in the literature, for the reversal of precedence to apply, conditions of both Articles 23.9.1.1 and 23.9.1.2 need to be met. But since Ohler & Dubois (2018) used *Hyla quoyi* as a valid name, the condition of Article 23.9.1.1 no longer applies ("the senior synonym or homonym has not been used as a valid name after 1899"). However, the use of the obscure name *H. quoyi* instead of the widely recognized *H. prasina* will cause confusion and threatens stability. To solve this, Article 23.9.3 is to be followed, i.e., the case needs to be referred to the International Commission of Zoological Nomenclature (hereafter "the *Commission*") to be ruled using their plenary power. The use of the younger name (*H. prasina*) is to be kept until a decision is made.

While our manuscript was under review, Kolenc & Baldo (2018) also published a note showing the wide usage of *Hyla prasina* in literature. Furthermore, they argue that assumptions by Ohler & Dubois (2018) were based on a false premise with wrong conclusions and should be invalidated. According to Kolenc & Baldo (2018), the invalidation of the proposals of Ohler & Dubois (2018) finds support in Article 23.2 of the Principle of Priority, where it reads "the Principle of Priority is to be used to promote stability and it is not intended to be used to upset a long-accepted name in its accustomed meaning by the introduction of a name that is its senior synonym or homonym". Although we agree with Kolenc & Baldo (2018) regarding the mistakes committed by Ohler & Dubois (2018), we refrain to affirm that Article 23.2 can be called to invalidate the proposals of these latter authors without referring the issue to the *Commission*.

Electronic bibliographic databases are a very useful tool, making the search for references much faster and maybe more complete than ever before. Many different databases are available, and, as our work shows, each brings its particular results for a same search. Google Scholar by far recovers more results, although with some duplicates and many unpublished works – mainly dissertations and theses, which can be useful depending on the needs of the research. Despite the variety of bibliographical databases available, Ohler & Dubois (2018) restricted their search to the core collection of the Web of Science and the Web of Science Zoological Record. They did not indicate which terms they used for their search but said that it recovered only 11 references. Such very restricted bibliographic search led Ohler & Dubois (2018) to incorrectly suggest that the old and forgotten name *Hyla quoyi* should be used instead of its junior widely used synonym *Hyla prasina*. We strongly recommend authors aiming to propose reversal of precedence for names based on Article 23.9 of the *Code* to expand searches to a wide range of electronic databases, especially Google Scholar. But we call attention that some traditional journals containing important taxonomic publications may not be completely available online (like *Boletim do Museu Nacional*, *Papéis Avulsos de Zoologia*, and *Revista Brasileira de Biologia*, in Brazil). Thus, this fact can hinder or bias proper bibliographic searches if a library is not visited. Also, we suggest that searches at electronic bibliographical databases should be replicable, and when their use is cited in the study, the selected terms and other search criteria should be informed.

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