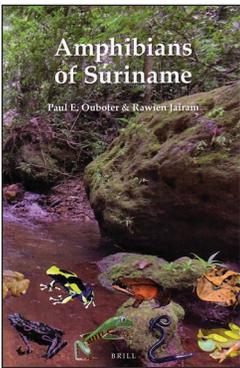


BOOK REVIEWS

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Amphibians of Suriname

Paul E. Ouboter and Rawien Jairam. 2012. Koninklijke Brill NV, Leiden, The Netherlands (www.brill.com). 376 pp. Hardcover. 110.00 Euros (approximately US \$151.00). ISBN 978-9-00420-799-8; Paperback. 34.80 Euros (approximately US \$48.00). ISBN 978-9-004 21-075-2.



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In addition to being useful to field biologists, field guides are valuable tools for disseminating information among non-scientists. They also often help decision-makers to identify areas of high biodiversity.

Although the Neotropical realm probably harbors the world's greatest biodiversity, the amphibian species richness of many South American countries is not well understood by the general public because synoptic overviews of their batrachofauna are lacking. Field guides to the herpetofauna of the Guiana Shield are scarce despite the fact that the region is characterized by high levels of diversity and endemism, with some of the most iconic herpetofaunal representatives of the Neotropics (e.g., *Dendrobates tinctorius* [Cuvier, 1797]). This situation is exacerbated by incomplete sampling in several parts of the region and by the recognized existence of numerous species waiting to be named. However, a few field guides from some areas within the Guiana Shield are available (e.g., Lescure and Marty 2001; Lima et al. 2006, 2012; Kok and Kalamandeen 2008; the three latter downloadable for free).

Although Suriname was one of the first South American countries to be scientifically explored (Hoogmoed 2013), no compendium of information about the country's batrachofauna was available until recently. Most information is scattered across the scientific literature, which is often difficult, if not impossible to obtain for the local population, amateur naturalists, and visiting tourists.

Amphibians of Suriname by Ouboter and Jairam (2012) is an attempt to remedy this issue, and the authors certainly have to be acknowledged for their efforts. This being said, neither author is known for his experience in amphibian taxonomy and/or biogeography, and most herpetologists working in the Neotropics will probably start reading their book with circumspection. My own reading of Ouboter and Jairam's volume highlights

a considerable number of mistakes, including some that I feel necessary to correct in this review.

Amphibians of Suriname is the first volume in the series *Fauna of Suriname*, produced by the well-known publishing group Koninklijke Brill NV with the support of NCB Naturalis (the former Rijksmuseum van Natuurlijke Historie, RMNH, Leiden, The Netherlands). The book is printed on acid-free paper and the binding of my hardback copy seems to be of high quality. The volume totals 376 pages including the preface and three indexes (subject, common names, and taxonomic), and is illustrated by 309 figures, 204 of which are color photographs, and 107 distribution maps (without indication of geographical coordinates). The book is divided into nine main sections. An Introduction (less than 2 pages); "Geography of Suriname" (eight pages); "Methods" (four pages); accounts of the 107 species said to occur in Suriname (316 pages), including the description of two new species and two new subspecies; a two page-section about the amphibian taxa that may occur in Suriname; "Zoogeography" (four pages); a section about conservation of the amphibians in Suriname (six pages); and finally a bibliography (nine pages), followed by a five-page appendix dealing with recent nomenclatural changes.

Although the authors complain in their introduction that no guide to the amphibians of the area (i.e., the Guiana Shield) is available in a language accessible to the Surinamese, the text they provide is written in rather poor English and was obviously not checked by a native English speaker before publication. In addition, the authors seemingly missed a field guide to the amphibians of Kaieteur National Park, located in the neighboring Guyana (Kok and Kalamandeen 2008), which is written in English and deals with many species present in Suriname. Unfortunately, this is not the only important reference missing. The lack of identification keys, even for families or genera, also comes as a surprise in a book intended as a field guide. Identifications can only be made by comparing photographs (many of problematic identification or poor quality, see below) and brief, often incomplete descriptions, which is inconvenient in the field. The lack of a glossary, which is always very useful to non-specialists, is also regrettable.

The Introduction mainly aims at providing a brief history of herpetological research in Suriname, and the current state of knowledge of the number of amphibian species recorded from the country. The introduction does not mention expeditions to collect herpetofauna by Marinus S. Hoogmoed in 1974 and 1975 (throughout Suriname), and in 1979 (Tafelberg) (M. Hoogmoed, pers. comm.). The material collected during these expeditions has been deposited in the RMNH, Leiden. Neither is fieldwork (1975, 1980, 1986) by personnel of the American Museum of Natural History (AMNH, New York) in Suriname mentioned. In their figure 1 the authors present a graph showing the number of species known from Suriname over the years, however the legend

explains it as the rate of descriptions of *new species* of amphibians for Suriname which, of course, would be represented by a radically different graph.

The section "Geography of Suriname" briefly explains and illustrates the geology, geography, climate, hydrology, and different types of macrohabitats found in the country. The map of Suriname represents the country borders as claimed by the Surinamese government, but not as recognized by the international community (Anderson 2003), which poses problems with some species distributions (see below).

In "Methods" the authors mainly explain how to use the book, list localities explored between 1988 and 2010 by P. E. Ouboter, and briefly overview collecting methods. The authors state "In addition to direct observations and collecting, the amphibian collections at NCB Naturalis (Leiden Natural History Museum, Netherlands) and the National Zoological Collection of Suriname [NZCS] form a solid base on amphibians of Suriname." Later on the authors state "The distribution in Suriname is based on all distribution records available," which are said to include the collections of the NZCS and the RMNH, as well as the literature and their own observations. However, as is evident from several maps, many localities of RMNH specimens collected by M. Hoogmoed between 1968 and 1990 have not been incorporated. This is especially evident in the map of *Pristimantis marmoratus* (Boulenger, 1900) (fig. 288, p. 311), a species said to be known only from three localities and thus considered rare in Suriname. However, specimens identified as belonging to that species were collected in dozens of localities in Suriname in large numbers by M. Hoogmoed (pers. comm.), and *P. marmoratus* as currently understood (but see remarks in Kok and Kalamandeen 2008, Fouquet et al. 2013, and Kok 2013) could therefore be one of the most abundant species in the rainforests of Suriname. Indeed, the incomplete use of available data has resulted in several erroneous conclusions being drawn in the conservation portion of the field guide. Apart from the general statement of the authors about the material examined, there is no listing of the material used to compile the book. Similarly, no material used for making the maps is mentioned, except for some of the taxa described as new. This in itself is understandable, but it makes it difficult to check identifications, especially in the light of the mistakes the field guide contains. Given the many misidentifications made by the authors (see below) one might wonder which occurrence records may be fully trusted. Finally, no information is provided on the methods used to analyze the vocalizations of the new species described in the book.

The species accounts section unfortunately contains a large number of problems, of which I will here discuss only the most obvious and important ones. As a first remark, describing new taxa in a field guide is not advisable because field guides are often not properly peer-reviewed and their format usually prevents detailed descriptions. The descriptions of *Anomaloglossus leopardus* and *A. surinamensis* are very brief and far from the current standards of new species descriptions in herpetology. Sexes of holotypes and paratypes are not provided, and diagnoses are limited to comparison with two (*A. leopardus*) to three (*A. surinamensis*) congeneric species. Because nothing is stated about the methods used to analyze the advertisement calls, one might wonder how the authors measured the note length and note intervals in the calls illustrated on p. 41 (fig. 34). Spectrograms show significant background noise, which probably made it very difficult to decide where the note begins and ends. Temperatures at which calls were recorded are not mentioned. These data are

especially important since the authors use temporal characteristics to discriminate between the calls of *A. surinamensis* and *A. degranvillei* (Lescure, 1975).

Each taxon account begins with the scientific name of the species and the authorship. Species authors are systematically placed between parentheses, which is incorrect for many of them (authors should be placed between parentheses only when the genus name changed after the original description). The "Short descriptions" indeed are rather short and often do not serve to identify specimens correctly. The "Distribution" section in several cases contains mistakes, and the "Habitat" section is often very brief, the authors apparently having not surveyed the extensive literature that provides a wealth of data on this aspect for several of the species treated. There is usually no information about tadpole morphology and advertisement call of the species.

Regrettably, a number of photographs are wrongly identified. Many show preserved specimens that do not provide a good idea of the species (e.g., fig. 299 of *Microcaecilia rabei* [Roze and Solano, 1963], several are from specimens from outside Suriname (which would not be a problem if the exact localities were mentioned), and the quality of some pictures is not good enough to allow easy identification in a field guide. One noticeable example of a problem related to a photograph is the illustration of "*Dendrobates tinctorius azureus*" on p. 107 (fig. 100). That subspecies is said by Ouboter and Jairam to be endemic to the Sipaliwini Savannah in Suriname. However, the photograph they use to illustrate that endemic subspecies is virtually the same as one provided by Naskrecki (2011: 234), showing a specimen that actually had been photographed in the Acarai Mountains of Guyana (locality confirmed by P. Naskrecki). Ouboter and Jairam wrongly report that the photograph was taken by Russell A. Mittermeier in the Sipaliwini Savannah. The authors thus illustrate an endemic subspecies stated to be only diagnosable based on coloration and a hunched back with a specimen presenting the same characteristics but coming from a neighboring country. In any case, it is surprising that the authors treat *D. azureus* Hoogmoed, 1969 as a subspecies of *D. tinctorius* without any argumentation. Wollenberg et al. (2006) synonymized *D. azureus* with *D. tinctorius*, and nobody has previously treated *azureus* as a subspecies.

The validity of the other two subspecies described as new in Ouboter and Jairam is also doubtful. There is no evidence indicating that *Atelopus hoogmoedi nassau* is anything other than a color morph of *Atelopus hoogmoedi* Lescure, 1974 (purple specimens are also known from northern Brazil), or possibly of *A. barbotini* Lescure, 1981. Frost (2014) treats *Atelopus hoogmoedi nassau* as a junior synonym of *Atelopus hoogmoedi*. I believe that the taxonomic status of *A. barbotini* and *A. hoogmoedi* needs to be clarified and that it is premature to assign the population from the Nassau Mountains to any of these taxa. In the same vein, there is no evidence for the validity of *Ameerega trivittata nassau*, a case already discussed by Hoogmoed (1971a, b). Hoogmoed found no morphological differences between the green and the orange striped morphs, and during fieldwork in 1974 and 1975 noted a rather narrow transitional zone between the green morph and the orange morph on top of the Lely Mountains, where specimens were more yellowish (M. Hoogmoed, pers. comm.). Dendrobatid frogs are well known to show great variation in color and pattern so using these characters alone for taxonomic purposes is problematic. The distribution map of *Ameerega trivittata* (Spix, 1824) (fig. 87, p. 93) does not indicate which localities refer to *A. t. trivittata* or to *A. t. "nassau*." Figure 91 (p. 97) does provide the distribution of *A. t. "nassau*," but

for readers not acquainted with the topography of Suriname it will be difficult to decide where this area is located in the country. Ouboter and Jairam do not mention any of the publications (Hoogmoed, 1971a, b) that have already discussed the orange morph of *A. trivittata* and showed that recognition of a subspecies was not warranted. Moreover, the authors only provide localities in the area of the Nassau Mountains, but the orange morph is also known from a lowland area at the western foot of the Nassau Mountains and from the central part of the Lely Mountains, which in their southern part have green *A. trivittata*. Schouten (2008) mentioned a locality on the Suriname bank of the Marowijne River (possibly Amapoema, cf. Hoogmoed 1971a, b), but its precise location was not specified.

Rhinella granulosa (Spix, 1824) is reported from Suriname (p. 56) although Narvaes and Rodrigues (2009) restricted this name to toads from northeastern Brazil. These authors mention *R. merianae* (Gallardo, 1965) and *R. humboldti* (Gallardo, 1965) from Suriname, but these two putative species are morphologically very similar—potentially synonyms—and their taxonomic status should be confirmed. I would advise the use of the name *R. merianae* for the Surinamese population in accordance with former use of the subspecies names of Gallardo (1965) until the taxonomic status of *R. humboldti* is confirmed, e.g., by molecular data.

Hyalinobatrachium crurifasciatum Myers and Donnelly, 1997 (p. 78) is a synonym of *H. capellei* (van Lidth de Jeude, 1904) (Castroviejo-Fisher et al. 2011).

Eleutherodactylus planirostris (Cope, 1862) is reported for the first time from Suriname (p. 108) and claimed to be part of the Surinamese batrachofauna. Except for the photograph, Ouboter and Jairam do not document any vouchers to support their assertion or to clarify if the species has become established in Suriname.

Hypsiboas dentei (Bokermann, 1967) is also reported from Suriname for the first time (p. 144). No vouchers are reported and the two photographs illustrating the account are obviously not from Suriname (see also Hoogmoed 2013). Instead, Ouboter and Jairam apparently base this new record solely on the map in Lescure and Marty (2001), arguing that the southwesternmost locality of that species lies in Suriname, which is incorrect (Anderson 2003). It would have been better to mention this taxon in the section dealing with the species that may be present in Suriname (as did Hoogmoed 2013).

Scinax jolyi Lescure and Marty, 2001 is “provisionally” reported (pp. 176–178) from localities in the northeast of Suriname. However, Marinus Hoogmoed (pers. comm.) examined the specimen illustrated in figs. 167–168 (in the RMNH collections), directly compared it with three paratypes of *S. jolyi* and identified it as a female *S. nebulosus* (Spix, 1824). Fig. 165 also shows *S. nebulosus* and I come to the conclusion that the report of *S. jolyi* for Suriname is based on incorrect identifications (confirmed by A. Fouquet, pers. comm.).

Leptodactylus bolivianus Boulenger, 1898 is reported from Suriname (p. 224) although the correct name of the taxon in Suriname now is *L. guianensis* Heyer and de Sá, 2011 (Heyer and de Sá 2011).

Leptodactylus ocellatus (Linnaeus, 1758) is reported from Suriname (p. 250) although the correct name of the taxon in Suriname is currently *L. macrosternum* Miranda-Ribeiro, 1926 (Frost 2014). However, figures 236 and 238 do not illustrate *L. macrosternum* but rather likely represent *L. longirostris* and *L. fuscus*, respectively.

Chiasmocleis hudsoni Parker, 1940 is reported from Suriname (p. 272) apparently only on the basis of the holotype (and thus from Guyana, see comments in Peloso et al. 2014) since no additional locality is provided on the map. The type locality actually is further east in the headwaters of Kutari Creek (Hoogmoed 1973), on the border of Guyana and Suriname. Hoogmoed (2013) provides a photograph of a specimen collected on the airstrip at Sipaliwini, and there is more material in RMNH from the Rechter Kabalebo river collected in 1975 (M. Hoogmoed, pers. comm.).

Pipa arrabali Izecksohn, 1976 is synonymized with *P. aspera* Müller, 1924 on the basis of insufficient material and subjective arguments that are not convincing (p. 290). Thus, this synonymization should be rejected and the species *P. arrabali* remains on the list of Suriname species. Both species are well defined by Trueb and Cannatella (1986).

Two species definitely known from Suriname are not dealt with in the species accounts section of the book: *Microcaecilia grandis* Wilkinson, Nussbaum & Hoogmoed, 2010 (Wilkinson et al. 2010), and *Pseudopaludicola boliviana* Parker, 1927 (Hoogmoed 1979, as *P. pusilla*).

Additional problems with wrongly identified photographs are:

On p. 61, the “*Rhinella lescurei* (Fouquet, Gaucher, Blanc and Velez-Rodriguez, 2007)” in fig. 57 is a *Rhinella martyi* (Fouquet, Gaucher, Blanc and Velez-Rodriguez, 2007); the same is true of fig. 59 on p. 63.

On p. 75, the “*Cochranella geijskesi* (Goin, 1966)” in fig. 70 is a *Vitreorana oyampiensis* (Lescure, 1975).

On p. 77, the “*Vitreorana oyampiensis* (Lescure, 1975)” in fig. 72 is a juvenile *Hypsiboas*.

On p. 89, the “*Ameerega hahneli* (Boulenger, 1884)” in fig. 84 is an *Allobates femoralis* (Boulenger, 1884).

On p. 149, the “*Hypsiboas fuentei* (Goin and Goin, 1968)” in fig. 139 is *Hypsiboas crepitans* (Wied-Neuwied, 1824). The authors, however, mention that the former may be a junior synonym of the latter, but still provide a full species account with occurrence records.

On p. 161, the “*Osteocephalus buckleyi* (Boulenger, 1882)” illustrated in fig. 150 is most likely *O. taurinus* Steindachner, 1862.

On p. 209, the “*Phyllomedusa hypochondrialis* (Daudin, 1800)” in fig. 194 is actually *P. tomopterna* (Cope, 1868).

On p. 221, the “*Leptodactylus andreae* (Müller, 1923)” in fig. 206 likely is *Adenomera heyeri* Boistel, de Massary and Angulo, 2006.

On p. 233, the “*Leptodactylus hylaedactylus* (Cope, 1868)” in fig. 216 is likely *Adenomera andreae* (Müller, 1923). In the text (p. 222) the authors state that they could not distinguish between *A. andreae* and *A. hylaedactyla* (but they still provide a description and pictures for both taxa) and that they think *A. andreae* is a junior synonym of *A. hylaedactyla*, although they do not take formal taxonomic action.

On p. 317, the “*Pristimantis zeuctotylus* (Lynch and Hoogmoed, 1977)” in fig. 294 is a juvenile *Scinax boesemani* (Goin, 1966).

Some taxonomic changes occurred when the book was probably in press (e.g., *Amazophrynella minuta* [Melin, 1941] [Fouquet et al. 2012b, c]), or soon after its publication (e.g., in the genera *Osteocephalus* [Jungfer et al. 2013] and *Adenomera* and *Lithodytes* [both removed from *Leptodactylus*, see Frost 2014]); *Scinax trilineatus* (Hoogmoed and Gorzula, 1979) was synonymized with *S. fuscomarginatus* (Lutz, 1925) (Brusquetti et al. 2014), and these are not further discussed here.

The next section (p. 334) deals with seven amphibians that may be present in Suriname, but are not yet recorded or are “known from one specimen collected in the far past only.” *Caecilia albiventris* Daudin, 1803 is probably a synonym of *C. tentaculata* Linnaeus, 1758 (Maciel and Hoogmoed 2011). *Anomaloglossus degranvillei* is likely endemic to French Guiana (see Fouquet et al. 2012a). The list could have been extended with some more recently described species from neighboring countries.

The section “Zoogeography” divides the taxa known to occur in Suriname into six groups (contents not listed, but figured in fig. 307) and species with a restricted distribution in Suriname are divided into five groups (Table 9), of which the group “restricted to bauxite capped mountains” can immediately be discarded, as all species in that group are known from other (lowland) localities as well, both in Suriname and elsewhere. Species reaching their limits in Suriname are also dubious, e.g., *Physalaemus ephippifer* (Steindachner, 1864) is said to reach its eastern limit in Suriname, but the species was described from Pará and occurs in northern Pará and in the surroundings of Belém as well. The authors apparently were aware of this distribution, because they mention “mouth of the Amazon” as part of its distribution, and that area is well east of Suriname.

The section “Conservation of Amphibians in Suriname” cannot be trusted because of the methodology used (simply counting specimens collected and localities recorded), because of the fact that the authors did not evaluate all material available in the collections they consulted for distribution data (see above), and because the authors have obviously misidentified several specimens.

The bibliography is not up to date, with many references missing (both old and recent ones).

The Appendix is a simplified (not critical) explanation of the nomenclatural changes proposed by Faivovich et al. (2005) and Frost et al. (2006).

In conclusion, Ouboter and Jairam’s book unfortunately has inaccuracies that may mislead the reader and, because of the issues mentioned above, the volume is of limited interest to both professional and non-professional herpetologists.

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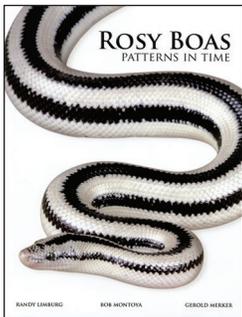
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Rosy Boas—Patterns in Time

Gerold Merker, Bob Montoya, and Randy Limburg. 2011. *ECO Herpetological Publishing & Distribution, Rodeo, New Mexico* (www.rosyboa.info). 184 pp. US \$29.95. Softcover. ISBN 978-0-9832789-0-0; Hardcover US \$69.95 (ISBN 978-0-9832789-1-7).



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The title of my college geology text, *Rocks: Patterns in Time*, came to mind as I studied the cover of the present work. Rocks and Rosy Boas are two entities that seem inextricably associated over much of the

American Southwest. The title led me to imagine panoramic vistas of rocky landscapes, eroding over eons as animals crept over them. Among those creatures were the “slow-moving and peaceful” Rosy Boas of the genus *Lichanura*—a genus dating from at least the late Miocene. The title suggests a dissertation on the evolution of boa color patterns, a potentially fascinating topic, with some populations evolving along habitat gradients and others in isolation. However, the authors state that their work “discusses proven technologies for the successful maintenance and captive breeding of Rosy Boas.” My thoughts now disturbingly afflicted with memories of pine shavings saturated in rodent urine, I prepared for literary doldrums.

Though the stated primary focus of the book is Rosy Boas in captivity, the chapter on Captive Care occupies only 12 pages. The guidance for the care and propagation of Rosy Boas seems generic for most live-bearing snakes native to temperate climates, though the average hobbyist may not be aware of the miserly cycling of drinking water every three weeks. Topics discussed include proper housing, temperature control, propagation,

feeding, diseases and parasites, and handling, each of which is illustrated by one or more color photographs. I was not aware that there was a technique to waking your boa, or that Rosy Boas will indeed bite under certain circumstances. I do not know what portions of text were composed by which author, but each seems to have a preferred cage temperature: 27–29°C is given on page 10, 25–31°C on page 13, and 25–29°C on page 14. At the end of the book there is a 22-page collection of photographs of unusually or uniquely colored boa “morphs.” This pictorial spread is occasionally interrupted with boxes of text that ask such questions as “What is a Snowy Rosy Boa?” The authors add some history to the derivation of the morph lineages, which I gather are cultivated in captivity from off-colored, wild-caught boas.

The refreshing heart of the book, 130 pages, consists of what the authors term a “photographic journey to show how this beautiful reptile has adapted to so many locations.” The journey has many stops—40 in California, 16 in Arizona, and 22 in Mexico. Nearly every stop is illustrated by a habitat shot and two or three boas. If you have a favorite spot for finding boas, it is probably mentioned in this book. I am familiar with a number of the localities, and have a perspective on the subtle changes in the habitat and boas one might encounter on a drive from Morongo Valley to Pioneertown, and across to Twentynine Palms. But, I fear that readers unfamiliar with the arid Southwest will not recognize the significance of many of the habitat and pattern morph associations, a situation which could have been improved by a locality map. The arrangement of locales used by the authors, however, does illustrate the gradual, often subtle shift in color pattern over often small geographic increments, illustrating the many ways that a simple theme of a pale snake with three stripes can vary from one place to another.

The book is not a taxonomic treatment and Rosy Boa subspecies are not mentioned (in fact, the words *Lichanura trivirgata* are absent). A map on page 23 shows the ranges of four classic subspecies, which are referred to as “forms,” but are not further discussed. An unstated, and perhaps unintentional, theme of the book is the impossibility of assigning many populations of Rosy Boas to one of the traditional subspecies. The long photographic essay is itself a visual argument against the subspecies concept.

The book is nicely produced, 21 × 28 cm, on glossy paper stitched between stiff paper covers. It seems durable, and conveniently remains open when laid flat on its spine. Aside from dozens of scenic habitat photographs, there are 362 photographs of boas, 50 of boa heads and body sections, and 38 of other amphibian and reptile species that might be encountered while searching for Rosy Boas. Most of the boa shots appear to have been taken with use of a soft flash, which perfectly highlights the color and pattern of each snake. For me, the most interesting photographs are those of the “Colonet” Boa, the type “morph” of *Lichanura roseofusca*. Though described nearly 150 years ago, that odd coastal morph from which the name Rosy Boa derives has, to my knowledge, only now been adequately illustrated.

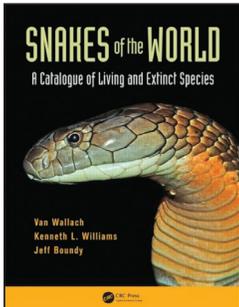
The back cover contains a promotional blurb about the book, emphasizing that it details the maintenance and propagation of boas resulting from over 100 years of combined experience by the authors. The condensed account of their indoor achievements is thorough and nicely illustrated. For some hobbyists, the boa ensconced in its cage of aromatic pine shavings is sufficiently satisfying. Fortunately for the field-oriented, the authors have also assimilated many years afield into a pictorial display of boas in their natural environment. Their visual achievement not only provides a spatial concept of Rosy Boa pattern variation, but

for many, like me, it recalls finger pads rubbed raw from turning granite rocks, and cholla spines embedded in awful places. The journey on which readers are taken is well worth the investment.

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Snakes of the World: A Catalogue of Living and Extinct Species

Van Wallach, Kenneth L. Williams, and Jeff Boundy. 2014. CRC Press/Taylor and Francis, Boca Raton, Florida (<http://www.taylorandfrancis.com>). xxvii + 1209 pp. Hardbound. US \$142.00. ISBN: 978-1-4822-0847-4; eBook (VitalSource format) \$104.97. ISBN 9781482208481.



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Just 15 years ago most textbooks in biology, zoology, or even herpetology claimed that there are ~6000 reptile species (e.g., Becher 1998; Margulis and Schwartz 1998). Some may still use this number today. We do not

know where this number came from originally, but we suppose someone must have guessed it in the 1960s when it was about right. In fact, it was only in the 80s and 90s that some of the first “complete” species lists were published, such as Frank and Ramus (1995) who listed ~6700 species of reptiles. This was clearly a step forward but most of these books suffered from a number of shortcomings. Most importantly, they did not provide any references to the scientific literature where the names or the taxonomy came from. Hence one of us [PU] started to compile his own list, partly based on Frank and Ramus (1995), which subsequently became the EMBL Reptile Database (Uetz and Etzold 1996).

Since then numerous checklists, atlases, and catalogues have been published, usually either based on geographic areas (such as *Reptiles and Amphibians of Australia* by Cogger 2014), or on taxonomic group (such as the TTWG turtle checklists, TTWG 2014). These works all represent important updates to the local or global faunas.

However, no book has ever tried to compile a comprehensive and annotated checklist of all snakes until Wallach et al. did so in their monumental new *Snakes of the World*. It is a species checklist listing all extant and extinct snake species, including their basic synonymy, type information (primary type and type locality), distribution (by country and subdivisions such as states), and references (sample pages are available on Google Books and other sites). The book lists 3509 extant and 274 extinct species on 794 pages. On top of that it includes a bibliography of 306 pages (with an estimated 11,000 references!), resulting in a total of 1209 pages. The authors also included 26 pages on *species inquirenda*, that is, species of unclear status, and also organized references to the literature geographically on 13 pages. Overall, the book provides a wealth of information essential to any snake taxonomist or layman who is seriously interested in snake taxonomy.

Should you buy this book if you are a “mere” snake enthusiast? It depends. If you like to have six pounds of paper sitting on your bookshelf or your desk you should. Wallach et al. provide a permanent record of snake taxonomy as of December 2012.

Unfortunately, this is also the time when the problems began, including for the very first species listed in the book: *Acalyptophis peronii* Duméril 1853. Within days of the deadline that Wallach et al. had set for themselves Sanders et al. (2012) published a phylogenetic analysis of the sea snakes in which they suggested the synonymization of *Acalyptophis* with *Hydrophis*, thus renaming the species *Hydrophis peronii* and rendering the Wallach book obsolete, even before typesetting had begun. You will not find the name *Hydrophis peronii* in the book, nor the index, which does list all synonyms. Luckily, the index distinguishes current names from synonyms by bold and regular typeface, respectively. Unfortunately, in many cases this was not properly copyedited, so that many valid species are listed in regular typeface. Similarly, while extinct species are listed in alphabetical order together with extant species, they are distinguished in the text with a dagger (†) but not in the index. In other words, if you would like to look up more than a few species, e.g., a list of all extinct species, you will have to do a lot of manual searching.

In fact, searching is what makes the book truly difficult to use. If you want to look up a single species or genus you are fine. But as soon as you try to do a more complex search, such as for the rattlesnakes of Mexico, it will become pretty difficult if not impossible. Luckily, there is an eBook version, but it is in a proprietary format of CRC Press, called VitalSource. We have not used the eBook but assume that searching and highlighting is possible as in most eBooks. However, we do not know if this gives you any added benefit, such as linked references from within the text. In the printed book even looking up a few references quickly becomes a drag. Many species entries have several dozen references in the format “Bocage, 1895” which you have to look up one by one in the bibliography, requiring a lot of thumbing back and forth.

Even if the book is up to date until 2012 or early 2013, many of the taxonomic decisions are difficult to track down. For instance, Wallach et al. recognize the genus *Taphrometopon*. They cite Zaher et al. (2012) as source but that paper does not even mention the genus (although Zaher et al. do show three species of *Psammophis* in a tree that correspond to what Wallach apparently considers as the *Taphrometopon* clade).

Similarly, Wallach et al. cite Zaher et al. (2012) as source for the synonymy of many other genera, such as *Rhadinophis* and *Rhynchophis*. Again, Zaher et al. did not formally synonymize the two genera although they do show that *Rhynchophis bouleengeri* nests within *Rhadinophis*. Another example is *Rhynchophis prasinus* (now again *Gonyosoma prasinus*). Wallach again cites Zaher et al. (2012), but they show *prasina* in their tree as *Rhadinophis*. In fact, Zaher’s analysis is overused; according to Wallach et al. *Stenophis* is a “synonym of *Lycodryas fide* Zaher et al., 2012.” However, it was Nagy et al. (2010) who synonymized *Stenophis* with *Lycodryas*.

We could quote many other examples in which the origin of taxonomic decisions is not obvious. We will mention just one: *Xenochrophis vittatus* is placed in the genus *Ceratophallus* (p. 152). Wallach et al. cite Dubey et al. (2012), Guo et al. (2012) (misspelled as Gou), and Zaher et al. (2012) as sources but none of them even mentioned that name (although all of them showed *X. vittatus* in their trees). Hence it is usually unclear who used a combination for the first time. In other words, Wallach et al. often draw conclusions from papers which were not drawn by the authors of those papers.

It is hard to do an overall evaluation of the completeness of the species list without a machine-readable version. One

immediately obvious omission is the absence of subspecies. Wallach et al. simply elevated all subspecies to full species or put them into the synonymy of valid species. We would argue that this unnecessarily conceals the diversity of snakes. For instance, the Reptile Database currently (December 2014) contains 433 snake species that have a total of 917 subspecies (which is the main reason why the number of species in the database—3522—only slightly larger than those in the book, at 3509).

We wondered how many discrepancies exist between Wallach et al. and the Reptile Database. Besides the differences between species and subspecies counts, we compared the 518 snake genera in the database to the 539 listed in the book. Quite surprisingly, more than 130 genera showed differences in species numbers! Only at second glance was this less dramatic than the numbers suggest. As noted, the differences can mostly be explained by subspecies elevated to species level, and more importantly, by relatively few large-scale taxonomic rearrangements. For example, at least 30 genera have been either erected since 2012 or received new species. The genus *Acalyptophis*, as mentioned earlier, was synonymized together with another eight other genera with *Hydrophis* in one fell swoop (Sanders et al. 2012), and all of these genera are kept in the book. Carrasco et al. (2012) synonymized several genera (including *Rhinocerocephis*, *Bothropoides*, and *Bothriopsis* and others) back into *Bothrops*. Similarly, Hedges et al. (2014) split up blind snakes and erected another eight new genera (obviously too late for the book), a nomenclatural act that was partly reversed by Wallach himself recently (Pyron and Wallach 2014). As a last example, *Vipera*, *Trimeresurus*, and *Naja* were split up by various authors (including Wallach et al.) into many genera whereas the Reptile Database still uses subgenera for these. The bottom line is that pretty much all the species (described up to 2012) are both in the book and the Reptile Database although there may be different generic assignments or different levels (species vs. subspecies). The discrepancies may be confusing to many users, given that many field guides rightfully use subspecies to distinguish morphologically different forms (even though in many cases morphology does not match their phylogeny, but that's another story). We found only a few species missing from the book, such as *Toxicocalamus mintoni* Kraus, 2009 and *Toxicocalamus pachysomus* Kraus, 2009.

To get a better comparison of species names, we compared the “A” section from the index to the Reptile Database. Surprisingly, we could not find about 20% of the species combinations in the database. Again, at second look, this often turned out to be a matter of spelling variants or combinations thereof. For instance, the index lists five spelling variants of *Walterinnesia aegyptia*, of which only one is the Reptile Database (which has yet another one that is not in Wallach's book). However, since the index also includes fossil species without being labeled as such we may have missed many of them when searching. Annoyingly, a number of names are misspelled in the index but not in the actual text, e.g., *Coniophous* [= *Coniophanes*] *fissidens andresensis*, *Elphe* [= *Elaphe*] *anomala*, *Pseudoxenodar augusticeps* [= *Pseudoxenodon angusticeps*], etc.—and these are just some examples from the “A” section of the index, listed under their species epithets. The first example is especially annoying as *andresensis* is listed with *andresiana* and *andreoides* between *almaweibi* and *Alopecion*—clearly out of alphabetical order.

Despite its numerous issues, the book is the only comprehensive resource on extinct snakes that we know of and the best available catalog of both extinct and extant snake names in print.

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