

protected area, would be a valuable addition to this monograph. For example the vast (34,400 km²), virtually uninhabited, and well-protected Kaa-Iya del Gran Chaco National Park likely provides a tremendous refuge for Red-footed and Chaco tortoises in Bolivia, although thorough population studies in many such protected areas represent enormous undertakings.

The bibliography is extensive and covers all three species. An even more comprehensive version is available on the publisher's website (<http://daten.chimaira.de/CHL3/BIBLIO.pdf>), both versions covering the period up to the publication date (2008). More recent publications, as well as some earlier ones, can be found on the Reptile Database (<http://reptile-database.reptarium.cz>). The book also provides a selection of websites (in several languages) as an overview of what is available on the Internet (as of 13 April 2008) with respect to biology and captive care of the three tortoises, and a short list of relevant institutions, associations, and publishing houses (principally in Europe). A curious addition is a selection of climatic charts (mean, maximum, and minimum temperatures, mean precipitation, days with precipitation) from 30 weather stations, which provide an overview of the climates experienced by the three species over their collective distributional range.

The writing style is engaging, effectively mixing facts and figures from the work of the authors and other researchers with anecdotes and personal observations from the authors' vast experience with all three species in the field and in captivity. Each section of the book is lavishly illustrated with excellent photographs (285 color photos in all), again covering a range of wild and captive scenarios. Considering the length of the book, the number of images, and the attractive presentation, the price is very reasonable. Its content is appropriate for a broad audience, from students and more specialized researchers, to conservationists, to pet owners, to zoo caretakers, to people interested in general natural history. The breadth and depth of the material also makes it suitable as a textbook and as a library reference volume. Certainly no other single volume integrates so much information on any of these three species, and the comparative presentation of the three species together is extremely valuable, enriched further by the authors' style and wealth of in-depth knowledge.

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Tadpoles of Africa: The Biology and Identification of All Known Tadpoles in Sub-Saharan Africa. A. Channing, M.-O. Rödel, and J. Channing. 2012. Frankfurt Contributions to Natural History, Vol. 55. Chimaira. ISBN 9783899734485. 404 p. €49.80 (approximately \$68.00) (hardcover).—The global inventory of living amphibians remains a work in progress, but one of great urgency given that a substantial portion of the world's species may go extinct in our lifetime (Wake and Vredenburg, 2008). Whereas the fauna is well known in certain geographic regions, such as Europe and North America, the same cannot be said for others, notably Africa, where inaccessible field sites, the small number of scientific specialists, and violent political conflict—sometimes even wars—have combined to impede even basic assessments of species diversity. In such places, there is a need for up-to-date, authoritative reference guides to facilitate identification of all life-history stages, to organize existing data, and to target critical areas that require further study. Hence, the present volume is both welcome and timely. Indeed, it represents a landmark contribution to our knowledge and understanding of a marvelous and unique amphibian fauna.

The authors are renowned specialists of African amphibians who have considerable field and laboratory experience studying larval anuran biology. Their task, however, is not an easy one; by necessity, their treatment is incomplete. First, the tadpole (indeed, anything about reproductive

biology) is unknown for more than half—58%—of the species they consider. The lack of information is particularly acute for two large genera, *Phrynobatrachus* (75 species) and *Hyperolius* (124 species), in which tadpoles are known for only 15% and 26% of their species, respectively. Second, although tadpoles “are recognized as the larval forms of frogs in most parts of Africa . . . they are rarely associated with the correct adults” (p. 10). Third, many newly discovered species remain undescribed, and many species whose current taxonomic placement is considered valid were once lumped with other species or previously recognized by a different name. Consequently, some tadpoles initially described under one species name may now belong to a different species, while others may not (yet) be accurately assigned to any named species. To the authors’ credit, they approach this situation with extreme candor and explicitly define the limits of the current knowledge base. For example, “Not all specimens [examined] were raised from known parents, or their identification confirmed using DNA. There may be some misidentifications, but we have been careful to omit specimens that we consider to be incorrectly identified” (p. 88).

The book begins with brief reviews of the geology, topography, ecological zones, and tadpole habitats of Africa. This section continues with an effective overview of anuran life histories and anatomy, which focuses on metamorphosing species, but also describes alternate life histories, especially direct development. The Introduction concludes with a discussion of tadpole biology, but especially ecology, behavior, and even sound production. The book ends with comments about tadpole identification, a binary identification key to genera, an extensive bibliography (with citations as recent as 2012), and the (mostly taxonomic) index. I did not test the key, and while the distinguishing characters seem appropriate and reasonable, surely some, such as the number and size of enlarged denticles on the anterior jaw sheath, will require use of a binocular microscope (although perhaps someone with steadier hands than mine could get away with a hand lens).

The real meat of the book—284 pages—comprises individual descriptions of the tadpoles of all 633 species of sub-Saharan frogs. Most species accounts are based on one or more published studies or constitute original descriptions prepared by the authors. Moreover, nearly all are linked to individual voucher specimens. Such precision is extremely important, insofar as it will (eventually) help fill remaining gaps in taxonomic coverage and resolve problems in assigning individual tadpoles to particular species. That being said, it’s unfortunate that not all vouchers appear to be deposited in institutional collections; the rest are either referenced to a collector’s field tag series or simply sourced to a general locality and/or a particular collector. Verbal descriptions of each tadpole are accompanied by numerous and helpful illustrations, which are provided in a consistent format. These include high-quality (halftone) drawings of tadpoles examined by the authors, line drawings of tadpoles reproduced from the literature, and close-up drawings of mouthparts, which are of great use in taxonomic identification. Many species are additionally illustrated with attractive color photos of living tadpoles and adult frogs. Each account is rounded out with brief notes regarding geographic range and habitat preference. Geographic distributions are based on data from the IUCN Red List website, v. 2011.2, occasionally supplemented by the authors’ own field observations. No explicit source is declared for the taxonomy adopted overall; presumably, the IUCN Red List was followed here as well,

although the accounts include at least one species described in 2012.

The volume is well produced in a compact format (21.8 × 15.2 × 3.3 cm). Both the cover and internal pages are prepared with a glossy surface, which should offer at least some resistance to rain and mud if the book is taken into the field. At slightly over 400 pages, however, the book weighs more than a few tadpoles—day hikers beware. I noted relatively few stylistic errors or other editing mistakes, and all were minor: e.g., “The tail and fins are botched [sic] with black” (p. 110). The writing style is crisp and lean, as is appropriate for a field guide, and the content is enlivened by some wonderful natural history observations, as in the account for *Acanthixalus sonjae*: “The tree hole where many clutches and adults were found, was shared by a large cobra *Naja melanoleuca* . . .” (p. 183).

The Global Amphibian Assessment, first completed in 2004, revealed the extreme plight of amphibian populations worldwide (Stuart et al., 2004). That paper reported several “important concentrations of threatened species” (p. 8 of supporting online material), which included the Upper Guinea forests of western Africa, the forests of western Cameroon and eastern Nigeria, the Albertine Rift of eastern central Africa, the Eastern Arc Mountains of Tanzania, and Madagascar. Tanzania, Cameroon, and Madagascar were among the 20 countries with the highest number of threatened species, although reliable estimates and comparisons were difficult to obtain because of the very incomplete understanding of the African amphibian fauna and its biology. Metamorphosing anurans pose a particularly difficult challenge because tadpoles and adults of the same species look so different from each other and are frequently misidentified. Going forward, new molecular approaches, such as DNA barcoding, that can rapidly link dissimilar life-history stages within a species (Che et al., 2012; Vences et al., 2012; Cruz et al., 2013) will be increasingly utilized to solve such puzzles. To be truly effective, however, such approaches require a comprehensive morphological and taxonomic foundation. *Tadpoles of Africa* provides such a foundation for future studies that seek to further document the rich diversity of African amphibians and reliably assess the threats to their survival. It is an essential guide for anyone who seeks to identify larval anurans on the African continent and explore their biology.

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Amphibians of Malawi. An Analysis of Their Richness and Community Diversity in a Changing Landscape. V. Mercurio. 2011. Edition Chimaira. ISBN 9783899734959. 393 p. €49.80 (approximately \$68) (hardcover).—Habitat change and loss are important drivers of worldwide faunal change and significant threats to amphibians in sub-Saharan Africa (Stuart et al., 2004). However, because longitudinal surveys are lacking, it is often difficult to evaluate temporal patterns of faunal diversity in Africa, and thus determine the effects of habitat change. While detailed long-term surveys will likely remain difficult in many areas of Africa, efforts to develop baseline surveys in different ecosystems in regions with well-known faunas are important for interpreting the broad-scale effects of habitat change. This recent volume focused on the amphibians of Malawi provides detailed accounts of its amphibian species and an excellent snapshot of amphibian diversity in many habitats across this small southeastern African country. Those interested specifically in African herpetology or more broadly in the relationship between habitat type and species richness will find this an interesting work.

The book is a valuable up-to-date and authoritative work on the amphibian diversity of Malawi, which has at least 82 frog and two caecilian species according to the author. It builds upon the important summaries of the fauna provided for Malawi by Arthur Loveridge (1953), Margaret Stewart (1967), John Poynton and Donald Broadley (e.g., 1985), and Alan Channing (2001), and provides the first detailed summaries of the natural history of several species in Malawi. More so than previous works, the author focuses explicitly on the relationship between specific habitats and amphibian species diversity. Malawi contains a mélange of habitats typical of south-central Africa, and the author focuses his attention on both Zambezi and transition woodlands, deciduous forests and thickets, evergreen forests in the mountains and lowlands, and the grasslands, which can contain extensive areas inundated with water. The author presents the result of research conducted during the course of his Ph.D., which included approximately six months of field survey days in Malawi from 2006–2008. This fieldwork included opportunistic and visual encounter surveys at 25 localities in seven principal study areas spread across the length of this narrow country. These surveys comprise the most recent comprehensive study of Malawi's amphibian fauna and will provide critical baseline data for assessing patterns of faunal change in the coming decades.

The book begins with a helpful introduction to Malawi, its geological history, habitats, and protected areas, and a concise history of research on the country's amphibian and reptile fauna. Following a compelling case for the need to understand the effects of habitat change on African amphibians, the author lays out his field methods, sites surveyed during the work, and the ways in which patterns of species diversity were subsequently analyzed. Next are the systematic accounts, which comprise approximately 60% of

the text, and an interesting summary of the diversity of reproductive modes exhibited by Malawian amphibians complete with photographs of habitats, eggs, and tadpoles. The keys to both genera and species generally rely on characters that are easy to observe in the field and should prove useful even to non-specialists. The author then presents results for the diversity of species at each site, complete with species accumulation curves and calculations of different diversity indices. The book concludes with a discussion of the effects of habitat types on amphibian species richness that touches on a range of topics including how both reproductive modes and water bodies may serve to structure patterns of diversity. The bibliography will certainly be of interest to those studying the amphibian fauna of Malawi and neighboring countries. The book is relatively free of typographical errors, and the few I found are unlikely to cause much consternation to the reader.

For each species, the systematic account provides details on its external morphology and coloration, distribution (in both Malawi and other countries), habitat types and elevational ranges within which it is found, as well as assorted remarks (often related to taxonomy or intraspecific variation) and sometimes advertisement calls. These accounts are supplemented with excellent color photographs of most species in life, maps showing the distribution of localities in Malawi, and sometimes figures depicting sonograms, oscillograms, or even bivariate plots from ordination analyses. For a number of taxa, such as that recognized here as *Hyperolius viridiflavus nyassae*, multiple photographs nicely reveal intraspecific variation in coloration and pattern. Species encountered by the author during his field surveys had the most detail and provide excellent short summaries that will be of use to those working in Malawi and neighboring countries.

The systematic accounts generally synthesize information in the literature well. In some cases, the evaluation of previously published work remains unclear. For example, *Amietia cf. fuscigula* is listed as occurring in the Misuku Mountains of northern Malawi based, in part, on specimens referenced also by Loveridge (1953). However, Loveridge (1953) also reports this species from Nchisi and Chowe in central and southern Malawi, respectively, but these localities are not reported for this species. The account for *Phrynobatrachus perpalmaris* notes ambiguity in the three localities mapped and that the source of these localities (mapped in Channing, 2001) was not traceable. Yet two of these localities are cited by Loveridge (1953) in his account for this species and the third is surely based on specimens (MCZ A-27877–80) collected by Archie Carr in 1952, and likely determined by Loveridge. While the systematic and faunal inventory literature can provide excellent sources for distributions, published databases from scientific collections also provide an important resource that could have been utilized more extensively. For example, the account for *Scolecophorus kirkii* (p. 306) notes that "Malawian records are old and no other specimen has been collected recently," which presumably is based on the most recent records (from 1946 and 1949) cited by Loveridge (1953). Yet a specimen of *S. kirkii* was collected in Zomba in 1975 by Lynn Robbins (CM 61021). By including information on the last date of collection of many species, the author might have provided important additional information relevant to the effect of changing habitats, including potential population declines.

There is rather limited information in the accounts on Malawi's threatened amphibian species, their conservation status, and current threats. Currently, four Endangered frog species occur in Malawi (IUCN, 2013): *Arthroleptis franciei*,