

BOOK REVIEWS

Copeia, 2000(2), pp. 623–638
© 2000 by the American Society of
Ichthyologists and Herpetologists

THE AMPHIBIANS OF THE FORMER SOVIET UNION. S. L. Kuzmin. 1999. Pensoft Publishers, Akad. G. Bonchev Str. Bl. 16, 1113, Sofia, Bulgaria (E-mail: pensoft@main.infol.bg). ISBN 954-642-045-x. 544 p. \$98.00 (hardcover).—Herpetologists involved in the study of the amphibians of what once was the Soviet Union now have an up-to-date overview, in English, of current knowledge of the amphibians inhabiting this vast region. Russian biologists have a long tradition of studies on the taxonomy, distribution, ecology, and biology of their herpetofauna. Because these studies are published in Russian, or even in the other languages of the former Soviet Republics, most of their results are unavailable to many researchers. Until now, only the English translation of Nikolsky's monograph (1918) and of the 1949 book by Terentiev and Chernov were available as a general introduction to the amphibians of the former Soviet Union.

Kuzmin's monographic work is a more extended and updated version of his previous book (1995) published in German. The book contains nearly 900 references. All titles have been translated into English, and the original language is clearly stated for each of them. The book begins with a general introduction that is certainly valuable and timesaving for all herpetologists having an interest in the herpetofauna of the former USSR. The first chapter deals with the history of herpetological research in the USSR; and the second is concerned with zoogeography, the third with ecological issues, and the fourth with conservation. Apart from providing the brief portraits of the most active Russian herpetologists, the first chapter gives a useful list of Russian herpetological milestone books, a list of the Russian journals representing the main bibliographical sources of herpetological information, and a list of the richest museum collections in the former USSR. Accounts of the distribution, ecology, and conservation problems of each species are based on the author's large database, some of it previously unpublished. The status of the different species in the former USSR is discussed, and details on the species' status in each state and in all the ex-Soviet Nature Reserves are provided.

Chapter 5 contains keys for species-level identification of eggs, larvae, and adults. Keys are illustrated with effective drawings. The detailed descriptions of larvae do not include the morphology of oral cavities and are not complemented by illustrations of mouth morphology. The description of adults does not include information on vocalizations. Chapter 6 contains data on the currently recognized 41 species of amphibians, according to Kuzmin (1995) and Ananyeva et al. (1998). Guides previously available in English described 35 (Nikolsky, 1918) and 33 (Terentiev and Chernov, 1949) species, respectively. For each species, the author gives a detailed and up-to-date discussion, at both the species and subspecies level, of taxonomy (including synonyms), morphology (including details on karyology, larvae, and metamorphs), and distribution. The morphological variability of each species is shown in low-quality black-and-white photographs of alcohol-preserved specimens. Pictures of better quality are found in the 42 color plates placed at the end of the book. Maps depicting current political borders, vegetation types, species richness, and single species distributions also are placed at the end of the book. These maps are detailed (50-km grid resolution) and of good graphical quality. Differences in scale and scarcity of reference points, however, may be perplexing for anybody who is not familiar with the geography of the region and make the evaluation and direct comparison of ranges difficult.

The ecology of each species is described in detail, but there is little reference to data on the same species for other parts of their ranges. Data on species abundance, also relevant for the evaluation of grant applications or for conservation projects, are given. The effect of climatic factors, such as temperature, annual activity, breeding cycles, and embryological and larval development, is described in detail. Reproductive behavior is described very briefly. Information on longevity and population structure is based on available skeletochronological data. Detailed information on feeding ecology of larvae, the last premetamorphic stage, recently metamorphosed juveniles, and adults of most species is provided in summary tables. These data are partly unpublished and partly published only in Russian. Another outstanding contribution consists in the review of available data on parasites and diseases. Species accounts conclude with a general discussion of the con-

ervation status of each species and the influence of human activities. References are listed after each species account, but citations are not included in the text. Species accounts do not necessarily begin on a new page, and we found this inconvenient.

Apart from being the only updated guide to the amphibians of the former USSR in English, this book is a very important source of general information relevant to everybody interested in the fauna of Europe and Central Asia. The author gives a deep review of morphological, ecological, and life-history data obtained from studies carried on populations at the margins of their European or Asiatic ranges. The book also includes the most complete dataset on feeding of European amphibians currently available in English.

In conclusion, we can say that no book is perfect in itself. The ignorance that we in Western countries have, regarding the Russian and ex-Soviet literature, may have a parallel similar ignorance of our literature in the East. In this framework, one can easily understand how some minor errors have crept into the book. For example, G. A. Boulenger was Belgian, not English, despite the many years he spent at the British Museum (NH). Some other incorrect statements, such as that *Bufo calamita* can be found in Italy, unfortunately are common errors even in some recent guides to the amphibians of Europe. What matters, however, is that this book definitely fills a major gap in Western knowledge of the amphibian fauna of the former Soviet Union.

LITERATURE CITED

- ANANYEVA, N. B., L. Y. BORKIN, I. S. DAREVSKY, AND N. L. ORLOV. 1998. Entsiklopediya Prirody Rossii: Zemnovodniye i Presmykayushchiesya [Encyclopedia of the Russian nature: amphibians and reptiles]. ABS, Moskva.
- KUZMIN, S. L. 1995. Die Amphibien Russlands und angrenzender Gebiete. Westarp-Spektrum, Heidelberg, Germany.
- NIKOLSKY, A. M. 1918. Faune de la Russie et des Pays limitrophes. Amphibiens. Académie Russe des Sciences, Petrograd, USSR. English translation, 1936; Fauna of Russia and adjacent countries. Amphibiens. Israel Program for Scientific Translations, Jerusalem.
- TERENTIEV, P. V., AND S. A. CHERNOV. 1949. Kratkii Opredelitel Zemnovodnykh i Presmykayushchikh SSSR. [A short guide to the amphibians and reptiles of the USSR]. Uchpedgiz, Moscow, USSR. English translation, 1965; Key to the amphibians and reptiles of the USSR. Israel Program for Scientific Translations, Jerusalem.
- EMILIO BALLETO AND CRISTINA GIACOMA, *Dipartimento di Biologia Animale, Università di Torino, Via Accademia Albertina 17, 10123 Torino, Italy. E-mail: (CG) giacoma@dba.unito.it.*
-
- TREEFROGS OF AFRICA. Arne Schiøtz. 1999. Edition Chimaira, Friedberger Anlage 14, 60315 Frankfurt am Main, Germany. ISBN 3-930612-24-0. 350 p. 750 figs. DM 98 (about \$52). (hard-bound).—The amphibian fauna of Africa is poorly known, largely because of the scarcity of researchers working on the fauna since the end of the colonial era. In 1967, Arne Schiøtz published *The Treefrogs (Rhacophoridae) of West Africa*, which he based largely on collections he made in localities from Sierra Leone west to Cameroon and on examination of museum material, and an exhaustive literature survey was included. The publication is basically a collection of descriptive accounts and sonograms of all known species of treefrogs of that region; it includes a number of new species descriptions, and all species are illustrated with black-and-white photographs. Several years later, Schiøtz published *The Treefrogs of East Africa* (1975), based on material from Uganda, Tanzania, Kenya, Zambia, and Malawi. Until now, these two publications have been the only portable guide for identification of treefrogs in the field. Schiøtz's most recent effort, *Treefrogs of Africa*, is an important addition to the sparse literature on a conspicuous, yet underanalyzed, element of the African biota.
- The book represents the first attempt at a continentwide synopsis of the Hyperoliidae and Rhacophoridae of Africa and builds on his earlier works, filling the geographic gaps in them by including accounts from Largen on Ethiopia; Lanza on the Somali Horn; Perret and Amiet in Cameroon; earlier works by Noble and Laurent on the Congo Basin fauna; Laurent on Angola; and Stewart, Poynton, Broadley, Lambiris, Passmore, and Carruthers and Channing on Central and South Africa. "Lost" species of uncertain status whose descriptions were based on limited material collected from insecure areas still poorly sampled (e.g., Angola, the Congo Basin) are included with at least original drawings and brief descriptive synopses. As might be expected, the majority of these species are members of the largest genus, *Hyperolius*.
- Recent advances in desktop publishing technology have enabled Schiøtz to publish all of the photographs in the book in color, a fact of

enormous importance to the fieldworker, because many amphibian chromatophore pigments are alcohol soluble, and patterns quickly become indistinct in preservative. Hyperoliids are a colorful group, and color patterns are important in the descriptions of most taxa. Although many of the figures will be familiar to readers as color renditions of photos published earlier in black and white, Schiøtz has also included many additional images from researchers worldwide. The figures are generally of good quality and well presented, and key features in the various species are usually well illustrated. Especially welcome are color figures of rarities such as *Kassina maculifer*, *Kassinula wittei*, *Afraxalus orophilus*, *Leptopelis palmatus*, and the newly erected genera *Alexteroon*, *Arlequinus*, and *Chlorolius*. Color figures are particularly valuable in taxa wherein there is much pattern variation, such as the bewildering *Hyperolius viridiflavus* complex (see below), and Schiøtz included images of nearly all nominate subspecies, especially from central and southern Africa.

The publishers are offering this book at a price affordable to virtually anyone, from scientist in the field or lab, to frog hobbyist in the home; a copy for the lab and additional one for the field is not inconceivable.

The organization of the *Treefrogs of Africa* is reasonable; Schiøtz's taxonomic philosophies and advice on collection and preservation techniques remain basically unchanged from his earlier works. A word of caution: scientific investigators interested in internal morphology should be aware that Schiøtz's methods, which involve fixation and preservation in alcohol only, will usually render cartilaginous structures difficult, if not impossible, to stain with Alcian blue. Schiøtz's section on keeping frogs in captivity, although brief, is perhaps unnecessary because the literature on maintenance of terraria is large, especially in Europe; regardless, *Treefrogs of Africa* will have broad appeal to culturists if only for its lavish illustrations. Schiøtz has chosen to present species accounts alphabetically by genus which makes the book relatively easy to use and at the same time, avoids the rather controversial status of relationships within these genera. There are relatively few editorial glitches; I found a few spelling errors in geographic names, for example, Arabuko/ Sokoko for Arabuko-Sokoke Forest (fig. 12), and figure 672, a distribution map appearing on page 294, is duplicated on page 299 (fig. 682).

Treefrogs of Africa is without doubt a major contribution as a guide to identification of hyperoliid species in the field and laboratory and

a welcome progression from his pioneer works on East and West Africa published decades ago. This book is unique, the only reference of its kind in existence. However, I must address some scientific issues in the book that are particularly disappointing to me as the first phylogenetic systematic revisor of the family Hyperoliidae and that raise some concern as to the validity of some of Schiøtz's statements. For instance, if one includes the discrete pectoral patches found in male *Leptopelis*, the presence of topical glands (see Drewes, 1984) could be accurately used as a synapomorphy to differentiate the Hyperoliidae from all other African ranoid frogs, the femoral glands of certain ranid species notwithstanding. Moreover, inasmuch as the glandular nature of these structures was established histologically in all recognized genera (Drewes 1984:20), it is at best perplexing, if not downright misleading, at least in the mind of this reviewer, to find that Schiøtz continues to use the term "gular flap" (p. 23).

Another case in point: the presentation of the genus *Nesionixalus*, endemic to the islands of Sao Tomé and Príncipe clouds the history of its somewhat controversial status; more important, several morphological characteristics that supposedly supported the validity of this genus and have been shown to be erroneous, are nevertheless listed by Schiøtz (p. 309). Perret (1976) originally erected *Nesionixalus* based in part on the absence of a vocal sac and vocal sac openings. I discovered that both structures were, in fact, present and consequently returned the species to its original status, *Hyperolius thomensis* Bocage (Drewes, 1984:52). In 1988, Perret conceded the presence of both characters but maintained *Nesionixalus* as valid on the strength of other characters listed in the original description (size, toe tips, etc.). The issue is not whether *Nesionixalus* is a valid genus; the issue lies in the fact that *Treefrogs of Africa* presents information on this genus that has been shown to be incorrect on two occasions in the literature. The description of *Nesionixalus mollerii* on the next page (p. 311) compounds the confusion; Schiøtz indicates this species is based on the presence of a large gular sac, a statement in direct conflict with the generic diagnosis presented on the previous page.

In his treatment of the genus *Leptopelis* (p. 248), Schiøtz states that their "taxonomy is therefore reasonably settled," with the exception of a number of savannah species in southern Africa. I suggest this is not really the case and cite, for example, our own difficulty in identifying several series of *Leptopelis* collected

by us a little more than a year ago in Equatorial Guinea, and we are using *Treefrogs of Africa*.

In his discussion of the newly described *Hyperolius orkarkarri* (p. 177), Schiøtz cites Channing (pers. comm.) as mentioning DNA studies that suggest *H. orkarkarri* is close to the sympatric *H. v. goetzi*; this is highly unlikely if *H. orkarkarri* is a valid species. Had the author queried the taxon's describer for details or for anything other than slides and bibliography, he might have been informed that the DNA sequences had been inadvertently based on *H. v. goetzi* tissue, rather than on that of *H. orkarkarri*. That student has completed her doctoral dissertation, is presently at Cornell University together with the appropriate tissue sample, and results are expected soon. Schiøtz's failure to confer on issues like these casts doubts on the merits of his interpretations of others whose work is presented in the book. It is akin to the recent tendency on the part of a number of authors to cite Frost (1986) as an authority in and of itself, rather than the works of the various herpetologists listed in *Amphibians of the World*.

The bibliography, portions of which were evidently provided by Mark-Oliver Rödel, is only partially referenced in the text which, in my opinion, diminishes its value to some degree. As an example, there is a wealth of published information on the truly remarkable physiological adaptations of rhacophorid foam-nest frogs, *Chiromantis*; these attributes are alluded to in the text in a general way, but the actual publications that contain much more detail are not cited, even though they appear in the bibliography.

Overall, *Treefrogs of Africa* is a valuable book for the identification of these species. The reasonable price makes it accessible to a broad range of readers from professional herpetologist to hobbyist, and I have no doubt the book will do well in the marketplace. However, readers are cautioned against accepting this book as the "last word" on systematic relationships among hyperoliid frogs. The author has been removed from the herpetology for many years, and the accuracy of his presentation of published views of some systematists active in the field of anuran systematics is suspect.

LITERATURE CITED

- DREWES, R. C. 1984. A phylogenetic analysis of the Hyperoliidae (Anura): treefrogs of Africa, Madagascar, and the Seychelles Islands. Occ. Pap. Calif. Acad. Sci. 139:1-70.
- FROST, D. R. (ED.). 1985. Amphibian species of the world, a taxonomic and geographical reference. Assoc. Syst. Coll., Lawrence, KS.
- PERRET, J.-L. 1976. Revision des amphibiens Africains et principalement des types, conservés au Musée Bocage de Lisbonne. Arq. Mus. Bocage 5:15-34.
- . 1988. Sur quelques genres d'Hyperoliidae (Anura) restés en question. Bull. Soc. Neuchâtel. Sci. Nat. 111:35-48.
- SCHIÖTZ, A. 1967. The treefrogs (Rhacophoridae) of West Africa. Spolia Zool. Muse. Haun. 25:1-346.
- . 1975. The treefrogs of eastern Africa. Steenstrupia, Copenhagen, Denmark.
- ROBERT C. DREWES, *Department of Herpetology, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118. E-mail: kassina@calacademy.org.*
-
- PARASITES OF NORTH AMERICAN FRESHWATER FISHES. 2d ed. Glenn L. Hoffman. 1999. Cornell University Press, Ithaca, New York. ISBN 0-8014-3409-2. xx + 539 p. \$90.00 (cloth: alkaline paper).—Physical wear sometimes signals the usefulness of books, and when I snoop through the bookshelves of colleagues, seldom do I find a volume that appears more useful than the first edition of *Parasites of North American Freshwater Fishes* (Hoffman, 1967). Long ago the cover of my own copy lost most of its light blue threads, and although I often considered having it rebound, I never felt I could spare it long enough to do so. However, since publication of the first edition, the field of biology has developed from blossom to bloom. It has prospered from swollen interest and new techniques, and this in turn has produced a veritable explosion of scientific literature. Because all biological subdisciplines have application to the study of parasites, parasitology has rapidly advanced during this new age of biology. And because fishes make such wonderful hosts and are so numerous, accessible, and valuable, much of this progress has resulted from studies of the parasites of fishes. Therefore, it was with great anticipation that we awaited the second edition of Hoffman's incredibly useful book.
- The second edition of *Parasites of North American Freshwater Fishes* is large, consisting of 22 unnumbered chapters printed mostly in two-column style. The book is principally an identification guide to the parasites of North American freshwater fishes. Its contents are supported by a professional consideration of the literature from Linnaeus through 1988 and "major"

works through 1992. A useful content index crowns most chapters, and identification keys (often to genera and sometimes to species) supported by figures are provided for almost all groups of parasites considered, including Algae, Fungi, Protozoa, Cnidaria, Monogenea, Digenea (adults and larvae), Cestoidea, Nematoda, Acanthocephala, Hirudinea, Branchiura, Copepoda, Isopoda and Turbellaria, and other miscellaneous parasites (including pentastomes, mites, unionid larvae, and lampreys). Most of the 485 figures are reproductions from previously published sources, and the reproductions are good, albeit of uneven overall quality. Below genera headings, lists of species are presented along with information on host affiliations, geographic range, and biology. Citations to the primary literature to support these sections are amply provided. For instances when much is known regarding a parasite's biology, Hoffman provides expanded presentations that include, for example, more detailed and thorough discussions on development, lifecycles, host-parasite interactions, and parasite control. In addition to its primary consideration of the parasites of native and naturalized fish species, the second edition also provides information on some exotic species as well as on some brackish water and marine fishes.

The fact that this book uses a dated scheme of classification will bother some and probably infuriate others. And even though this is more of an annoyance than a problem, many of the contemporary concepts that the second edition does not endorse are now relatively well established and will be tested only through further use.

In the book's forward, E. H. Williams Jr. politely raises the issue of classification and supplies information regarding some more contemporary views. The volume's reliance on an older classification scheme appears further magnified in several places because of the way some information is organized. For example, rather than being placed with other platyhelminths, turbellarians are considered in a chapter that also deals with mites, clams and mussels, parasitic fishes, seeds, pollen, and diatoms (all of which are not even parasites). The chapter titled "Fish parasites found in or on other animals" only considers nonpiscine vertebrates, and in treating mammals, humans are not mentioned. These examples make it apparent that in some spots Hoffman wed information for functional rather than phylogenetic reasons. For example, miscellaneous parasites of fishes are gathered into a separate chapter rather than being presented in phylogenetic order through-

out the text. Even the two highly useful fish-parasite checklists are arranged in alphabetic rather than phylogenetic order. Of course, phylogenetic relatedness often bestows members of natural groups (be they hosts or parasites) with shared life-history traits that can sometimes be used to great advantage to predict infections and affect parasite control. And thus it is lamentable that the second edition does not promote this tool.

Several chapters in the second edition are very short, and given their contents, they might have been best formatted as appendices or even omitted. For example, as presented, the one-page chapter titled "Predators" has nothing to do with parasites, and it appears out of place with regard to the principal chapters. The chapters titled "Public health aspects of fish parasites" and "Fish parasites found in or on other animals," two pages and one page long, respectively, are separated by 333 pages of text. It would have been more appropriate to combine the information in these chapters into an appendix or to place it in the book's introduction. Likewise, information in the chapter titled "Some North American fish parasites, listed by location in the fish" could have been incorporated into the introductory chapter. Information contained in the chapters titled "Methods" and "Chemotherapy and prophylaxis of parasitic diseases of fishes" is cursory and somewhat dated. It would have been best for the methods chapter to be expanded into a more useful one that included illustrations. The chapter concerning chemotherapy and prophylaxis seems outside the scope of this book and probably should have been omitted.

As my relationship with the second edition unfolds, I have noticed a few omissions regarding parasite species within taxa with which I am most familiar. Similarly, I have found a handful of misspellings and other errors throughout the text. Of course, these types of lapses are to be expected in such a massive and broad-ranging work, and in the second edition they appear relatively few in number and should not mislead cautious professionals who use the book according to its intended purpose.

In all, I consider my aforementioned criticisms to be nit-picky. Fact is, the second edition of *Parasites of North American Freshwater Fishes* is an exceptionally useful volume that will be easily harnessed by parasitologists, ecologists, ichthyologists, fisheries managers, aquaculture and aquarium professionals, and serious fish hobbyists. The book is pleasing to the touch and appears durable. An added bonus is that its cloth binding allows it to lie flat when opened

to any page—a feature that will be appreciated when working in the laboratory. In producing such a fine second edition, Hoffman has, however, created a potential dilemma regarding whether to station a single copy in one's laboratory or office. I solved this conundrum by obtaining two copies, and I am already happier for it.

LITERATURE CITED

HOFFMAN, G. L. 1967. *Parasites of North American freshwater fishes*. Univ. of California Press, Berkeley.

GEORGE W. BENZ, *Tennessee Aquarium and Southeast Aquatic Research Institute, One Broad Street, Chattanooga, Tennessee 37401-2048. E-mail: GWB@ennis.org.*

THE AMPHIBIANS OF BARRO COLORADO NATURE MONUMENT, SOBERANIA NATIONAL PARK AND ADJACENT AREAS. Roberto Ibáñez D., A. Stanley Rand, and César A. Jaramillo A. Accompanying compact disc of VOCALIZATIONS OF FROGS AND TOADS FROM BARRO COLORADO NATURE MONUMENT, SOBERANIA NATIONAL PARK AND ADJACENT AREAS. Roberto Ibáñez D., A. Stanley Rand, Michael J. Ryan, and César A. Jaramillo A. 1999. Fundación Natura, Circulo Herpetologico de Panamá, and Smithsonian Tropical Research Institute. ISBN 9962-811-17-1. 187 p. \$20.00 (hardbound book), \$15.00 (CD) + \$5.00 shipping and handling to United States (available from Smithsonian Tropical Research Institute Bookstore, Apdo. 2072, Balboa, Republic of Panama. E-mail: bookstore@tivoli.si.edu).—The tremendous diversity of Neotropical amphibians is still a frontier for many herpetologists; identifying them, even to genus, is a difficult task. With this volume, Ibáñez, Rand, and Jaramillo have produced the most useful resource to date, addressing the needs of those visiting one of the most-studied areas of tropical America. In addition to the 62 species covered in the book, a separate CD, including Ryan as a contributing author, is available. This CD presents the recorded calls of 52 species of frogs and toads found in central Panama. No one is better qualified than these authors to produce these guides. Ibáñez and Jaramillo are native to Panama and have studied the local amphibian diversity throughout their careers. Rand, an em-

inent tropical herpetologist, has lived and worked in Panama as a staff scientist with the Smithsonian Tropical Research Institute, and Ryan has been studying calling behavior in frogs, often in collaboration with Rand, for over 20 years. As I read about and listened to these frogs that I have spent many evenings watching, it made me yearn for another trip to Panama. This guidebook and CD will certainly be useful to herpetologists who work, or want to work, in these areas of tropical rain forest.

The book is presented in both Spanish and English, with the foreword, introduction, map and gazetteer, species accounts, glossary, ecological summary of species, and statement on declining amphibians written in Spanish in the first half and in English in the second half. The color photographs, which include all 62 species, are centrally located. The species names and brief descriptions, also in both Spanish and English, accompany each plate on facing pages. Sonograms of calls from 52 frog species are listed and illustrated; most are advertisement calls, and some species have other call types illustrated. Finally, about 450 references and a taxonomic index conclude this highly informative guide.

The species accounts, color photographs, and recordings of the frog calls provide an excellent introduction to amphibian diversity of Panama. The sonograms are especially useful for anyone interested in calling behavior in frogs. An exceptional feature of each species account is a list of key references of research done on the species. These brief citations are fully referenced in the literature cited section and have associated key words, which eases the task of finding papers on various topics for each species. References are up to date, as recent as 1998, and papers using past nomenclatural treatments for a particular species are indicated. By simply scanning the references, one can easily determine which species have been well studied and which have not. Although a key reference on distribution is cited for most species, and local distribution information is given, it would have been useful to know the entire range for each species. This would allow interested readers to see which species are more narrowly or widely distributed.

The guide is quite effective for identifying species in the field. A scale, in centimeters, is even printed on the back cover for measuring specimens. Most tropical frogs do not have established common names, as, for example, exist for some bird species, but some descriptive categories are given here. For example, “dish-faced treefrogs” and “little yellow *Hylas*” are

designated among the large treefrog family (Hylidae), which helps narrow difficult identifications. Each family is introduced with key characters and brief notes on comparing other similar-looking species. For each species, detailed descriptions are given that include body size, eye color and form, skin color and texture, foot structure, call (for frogs), and general natural history. Many of the terms used would be foreign to the casual tourist, even with many defined in the glossary, but are very useful for biologists. The color photographs are all of live amphibians, and the postures ensure that many diagnostic features are visible. Although most photographs appear to be of males, body size measurements and, where relevant, features distinguishing males from females are given, which should allow readers to identify individuals of both sexes. Even so, male frogs often are much more conspicuous, especially if they are reproductively active and calling. The recordings on the CD are quite clear and accurately represent sounds heard in the field.

This book and CD contribute greatly to what we know about Neotropical amphibians, and, as with other combinations of sound recordings and species descriptions (e.g., Heyer et al., 1990), it will certainly facilitate future studies on amphibians in the region. Checklists and more general ecological information have been available in other publications (e.g., Auth 1994; Rand and Myers, 1990), and the introduction cites other sources for more detailed information. This is one of the few true field guides to the herpetofauna of the American tropics and is useful for comparing information about amphibians from other regions in Central America. Finally, these resources will certainly help researchers who are new to the area, or thinking about working in the area, to avoid feeling overwhelmed when faced with a noisy chorus of over 15 species of frogs calling simultaneously, as happens often in the rainy season.

I highly recommend this very readable and informative guide and accompanying CD. Only a few minor grammatical errors occur, at least in the English text. Publishing the guide in both Spanish and English may provide an incentive for local students, researchers, and visitors to learn about these amphibians.

LITERATURE CITED

- AUTH, D. L. 1994. Checklist and bibliography of the amphibians and reptiles of Panama. *Smiths. Herpetol. Info. Ser.* 98:1–59.
- HEYER, W. R., A. S. RAND, C. A. G. DA CRUZ, O. L. PEIXOTO, AND C. E. NELSON. 1990. Frogs of Boracéia. *Arq. Zool. São Paulo* 31:231–410.
- RAND, A. S., AND C. W. MYERS. 1990. The herpetofauna of Barro Colorado Island, Panama: an ecological summary, p. 386–409. *In: Four Neotropical forests*. A. H. Gentry (ed.). Yale Univ. Press, New Haven, CT.
- CATHERINE R. BEVIER, *Department of Biology, Colby College, Waterville, Maine 04901. E-mail: crbevier@colby.edu.*
-
- RATTLESNAKE: PORTRAIT OF A PREDATOR. Manny Rubio. 1998. Smithsonian Institution Press, Washington, DC. ISBN 1-56098-808-8. xxxii + 240 p. \$39.95 (hardcover).—Conservation biologists speak of large mammalian predators such as tigers as elements of the “charismatic megafauna” that grab disproportionate attention in public discussions of declining biodiversity. The herpetofauna, too, has its charismatic elements, and surely most biologists would include the rattlesnakes among them. This book is intended largely as a celebration of rattlesnakes, and as such it succeeds. Its pages are filled with bold images of these magnificent animals, and the lay audience to whom the book is directed cannot fail to be impressed by the aesthetic qualities of these snakes. Likewise, professional herpetologists will enjoy leafing through the pages simply to enjoy the imagery. Unfortunately, the text, which also is aimed at a general audience, is flawed and would have benefited from a rigorous professional review. It is not that there are many egregious errors of fact but, rather, a host of minor assumptions and conjectures presented as truth.
- In the Preface, the author describes his background and rationale for the book, which he intends as a “photographic and written tribute” to his subjects. A professional photographer, Rubio credits his interest in rattlesnakes to childhood visits to the Staten Island Zoo, then the premier collection of captive rattlesnakes. He also provides a section on his photographic techniques and, refreshingly, describes the conditions and limitations of photographing captive specimens on naturalistic backgrounds, including the need to maintain sanitary conditions while working in zoos. This discussion avoids the implication, too common in coffee table books on natural history, that the portraits represent wild animals encountered in the field. Although there are a few photographs of wild rattlesnakes, the majority are of captives, in ro-

bust good health, free of mud and dust, and composed with the eye of a professional photographer.

The first several chapters cover the characteristics of rattlesnakes, their natural history, morphology, feeding, hibernation, reproductive biology, locomotion, and venom delivery. Later chapters deal with the interactions between rattlesnakes and humans, including rattlesnake roundups, commercial exploitation, religion, artistic imagery, and conservation. These are followed by three appendices. The first two are checklists of species and subspecies, arranged by scientific and common names, respectively. The third lists the national herpetological societies and some regional societies. A glossary and bibliography conclude the sections. The index includes both subjects and taxa, but the latter are listed only by common name, requiring reference to the appendices to locate species by their scientific names.

Although the photographs that accompany these chapters are compelling, the backgrounds, which are intended to be naturalistic, sometimes are inappropriate. For example, polished aquarium gravel peppers the substrate of numerous photographs showing species as diverse as *Crotalus cerastes* (p. 36–37), *C. lepidus* (p. 33), *C. molossus* (p. 17), and *C. viridis* (p. 80). Occasionally it is implied that animals posed under artificial circumstances are engaging in natural behaviors. For example, the same *C. molossus* is later (p. 127) seen draped across the same artificial background, as it “climbs amid a pile of rocks,” whereas a *C. viridis* (p. 87) is shown “drinking from a temporary rain pool” filled with pea gravel. Likewise, domestic mice are shown in feeding sequences, no doubt another compromise to the circumstances of captivity, although one photo from the field (p. 74) shows *C. atrox* feeding on a dove. An interesting series of photographs (p. 72–73, 76) shows *C. lepidus* swallowing a scolopendromorph centipede (on the telltale gravel substrate). In general, the photos are relevant to the adjacent text, but in some cases, they seem to have been selected simply to add to the visual appeal of the page composition.

In contrast to the excellence of the photographs, the text is infused with inaccuracies and, more frequently, with undocumented statements presented as fact. Examples of the former include the statement (p. 18) that both *Sistrurus catenatus* and *S. miliaris* “have tiny rattles” (whereas that of *S. catenatus* is similar in dimensions to other rattlesnakes; Cook et al., 1994). Individuals of several taxa, such as *Crotalus horridus* and *C. viridis cerberus*, that become black as

adults are said to be “not truly melanistic” because “they are not born black” (p. 39–40). Despite the unequivocal statement that “frogs have no true ribs” (p. 123), several basal anurans retain such elements. The statement that “[u]nlike a true penis, there is no enclosed internal seminal duct in the hemipenis to carry the sperm” correctly characterizes the hemipenes but not the true penis of other reptiles, in which an open sulcus contrasts with the enclosed penile urethra of mammals. The sweeping statement that “[t]he digestive process is like that of all higher vertebrates” (p. 82) not only conflicts with recent studies (e.g., Secor, et al., 1994) but also misses an opportunity to introduce the reader to a fascinating area of physiological study, to which rattlesnakes have contributed. An apparent editorial oversight retained the statement that “[t]he effective range of movement between each pair of vertebrae is approximately 25 inches vertically and 25 inches from side to side.” Presumably the statement should read “degrees,” rather than “inches.” Finally, a specimen (p. vii–ix) identified as *C. viridis abyssus* is in fact *C. mitchelli pyrrhus*. Although the Grand Canyon populations of those two taxa are often confused (M. E. Douglas, pers. comm.), the error is especially unfortunate because it occurs on the title pages of the book.

More frustrating are the countless examples of conjecture, sometimes identified as opinion but other times simply presented as fact. Thus, for example, it is said unequivocally that keels “add strength and elasticity to the scales” (p. 48), and apical pits “may produce gender-recognition substances during courtship and mating” (p. 69). It is said that the brille (“spectacle”) “protects the sensitive underlying cornea from abrasion, [but] hampers the snakes [*sic*] vision . . . as it becomes worn from daily activities.” Although “no explanation or correlation has been given for the differences in tongue coloration, . . . it may serve a cryptic function” (p. 39). Although “[t]here is no documentation, . . . it is conceivable that Apache warriors chose their vivid facial markings from [*Crotalus willardi*]” (p. 47).

Other idiosyncrasies of the text include a preoccupation with subspecies and color variants, not uncommon in such popular works, and a peculiar unevenness of literature citations. The former reaches its apogee in a formal reference (p. 209) to a long-discredited nomen nudum for a Mexican population of *Crotalus durissus* (McCranie, 1993), which the author believes merits recognition. Typographic and grammatical errors occur regularly but do not present an unreasonable distraction. One unfortunate

error (p.29) resulted in reversing the labeling for photos of *C. atrox* and *C. ruber*. Literature citations generally are not presented in the text, and the selective bibliography displays reasonable coverage, arranged by general subject. This is an understandable decision given the style and primary audience of the book. However, citations are occasionally provided in the text, often for relatively minor points, and they frequently do not reflect original sources. Thus, for example, the author cites Brown and Greenberg (1992) in the text in reference to ambush behavior, while relegating the original citation (Reinert et al., 1984) to the bibliography. A personal communication is cited to document the thoracic location of many rattlesnake strikes, rather than a published study (Kardong, 1986). It would have been preferable to have omitted all in-text citations.

On the positive side, two of the later chapters include images and information that may interest professional herpetologists. The chapter on rattlesnake roundups provides photographs and personal descriptions of the Sweetwater, Oklahoma, roundup of *Crotalus atrox* and the Claxton, Georgia, roundup of *C. adamanteus*. These images, together with the still more gruesome coverage of the Texas roundups in the 27 July 1998 issue of *Sports Illustrated*, are a sobering reminder that, although such predators as wolves and raptors have been rehabilitated recently in the eyes of the general public, it remains open season on rattlesnakes in several states. Readers interested in a scholarly treatment of this important topic are directed to a recent analysis by Fitzgerald and Painter (2000), who estimate that more than 125,000 rattlesnakes of all species enter the commercial trade annually, of which about 15% derive from roundups. The other end of the spectrum of human uses of rattlesnakes is seen in the chapter on their religious significance, where the author presents a series of compelling images, photographic and verbal, of a snake-handling service in West Virginia. The reader is impressed not only with the fervor of the worshippers but also with the patience of the snakes.

On balance, this book presents a visually pleasing introduction to this engaging group of snakes. Despite its textual lapses, it will fill a useful role in public education and provide professional herpetologists with lasting images of these remarkable animals.

LITERATURE CITED

BROWN, W. S., AND D. B. GREENBERG. 1992. Vertical-tree ambush posture in *Crotalus horridus*. *Herpetol. Rev.* 23:67.

- COOK, P. M., M. P. ROWE, AND R. W. VAN DEVENDER. 1994. Allometric scaling and interspecific differences in the rattling sounds of rattlesnakes. *Herpetologica* 50:358–368.
- FITZGERALD, L. A., AND C. W. PAINTER. 2000. Rattlesnake commercialization: long-term trends, issues, and implications for conservation. *Wildlife Soc. Bull.* In press.
- KARDONG, K. V. 1986. Predatory strike behavior of the rattlesnake, *Crotalus viridis oregonus*. *J. Comp. Psychol.* 100:304–314.
- MCCRANIE, J. R. 1993. *Crotalus durissus*. *Cat. Am. Amphib. Rept.* 577:1–11.
- REINERT, H. K., D. CUNDALL, AND L. M. BUSHAR. 1984. Foraging behavior of the timber rattlesnake, *Crotalus horridus*. *Copeia* 1984:976–981.
- SECOR, S. M., E. D. STEIN, AND J. M. DIAMOND. 1994. Rapid upregulation of snake intestine in response to feeding: a new model of intestinal adaptation. *Am. J. Physiol.* 266:G695–G705.

ALAN H. SAVITZKY, *Department of Biological Sciences, Old Dominion University, Norfolk, Virginia 23529-0266. E-mail: asavitzk@odu.edu.*

THE ORIGIN AND EVOLUTION OF LARVAL FORMS. Brian K. Hall and Marvilee H. Wake, eds. 1999. Academic Press, San Diego, California. ISBN 0-12-730935-7 425 p. \$79.95 (hardbound).—This well-conceived and well-edited book offers much of interest to both herpetologists and ichthyologists, although it deals with larval biology of insects and marine invertebrates as well as vertebrates. I will focus on the chapters dealing with vertebrates. Several of these chapters represent integrative biology at its best, with discussions that cut across the fields of developmental biology, genetics, evolution, functional morphology, and ecology. It is an excellent reference for graduate students and investigators in these fields and for herpetologists and vertebrate biologists in general. I found much information that was useful in preparing lectures for both a graduate level herpetology course and an undergraduate vertebrate biology course. There is some overlap in content with the recently published book on tadpoles (McDiarmid and Altig, 1999), but Hall and Wake's book provides a much broader taxonomic and evolutionary perspective on larval biology, with considerably less detail on tadpoles.

Multiauthor volumes often suffer from a lack of synthesis, but this book is provided with an excellent introductory chapter by the editors, who give a historical overview of research on

the larval biology of invertebrates and vertebrates, including development, evolution, and ecology. This chapter does a nice job of providing a conceptual framework for the rest of the book. The editors also provide a brief epilog at the end of the book that ties together the themes of the separate chapters and suggests productive avenues for future research. My only criticism is that the links between larval biology of invertebrates and vertebrates are not always clear, and I cannot help but think, from the perspective of a vertebrate biologist, that the book would have been even more successful if it had a more limited taxonomic focus.

Several chapters will be of great interest to herpetologists. James Hanken's chapter on "Larvae in Amphibian Development and Evolution" is a high point of the book. It provides a masterful synthesis of amphibian larval development and evolution, beginning with the fossil record of larval amphibians and progressing through a discussion of complex life histories in amphibians, heterochrony, development and morphological diversification, and the loss of larvae in many lineages of amphibians. Hanken's approach is strongly phylogenetic, with numerous cladograms used to illustrate evolutionary changes in patterns of development and life history. It should be required reading for any graduate students contemplating work on larval development or amphibian life histories.

Christopher Rose provides an excellent review of hormonal control of larval development in amphibians. His treatment goes beyond standard textbook discussions of the subject, often based on voluminous studies of *Xenopus*, *Rana*, and *Ambystoma*, to include discussions of hormonal control in a wide variety of amphibians, including those with direct development. He also briefly discusses hormonal mediation of viviparity. Another standout chapter is one by Laurie Sanderson and Sarah Kupferberg, which discusses the development, functional morphology, and ecology of larval feeding in both amphibians and fishes. Much of this material has been reviewed in other publications, but this is the best synthesis I have seen and the only one that integrates discussions of filter feeding and suction feeding in both amphibians and fishes. It also is the most ecological of the chapters and clearly illustrates how underlying patterns of development and morphological variation are tied to differences in feeding ecology. This would be an excellent introduction for graduate students interested in larval feeding ecology who know little or nothing about the functional biology of larvae.

A couple of other chapters touch on topics of interest to herpetologists. Eric Greene's chapter on phenotypic variation has a brief discussion of trophic polymorphism and cannibalistic morphs in amphibian larvae, a topic also briefly discussed by Sanderson and Kupferberg. A very short chapter by Michael Hart and Gregory Wray on heterochrony touches briefly on amphibians but is devoted mostly to tunicates. Hanken's chapter has more to offer vertebrate biologists on this topic. The biology of fish larvae is not covered extensively in this book, despite the great interest among ichthyologists in the early life histories of fishes. Nevertheless, the single chapter devoted entirely to larval fishes, by Jacqueline Webb, is an excellent one and is particularly useful for someone who knows next to nothing about the subject. She reviews general patterns of larval fish development, the problems posed by a planktonic lifestyle, and morphological specializations. Her discussion of the morphology and development of the sensory systems is especially detailed. I found this chapter to be a very useful source of information for a vertebrate biology course, because the textbook for that course (Pough et al., 1999) has little to say about larval fishes. I was especially intrigued by her illustrations of the bizarre forms of many larval fishes.

Overall, this book will be a useful reference on the shelves of herpetologists, ichthyologists, and integrative vertebrate biologists. It also will be most useful to researchers in the currently hot field of evolution and development whose interests cut across taxonomic lines between vertebrates and invertebrates.

LITERATURE CITED

- MCDIARMID, R. W., AND R. ALTIG (EDS.). 1999. Tadpoles. The biology of Anuran larvae. Univ. of Chicago Press, Chicago.
- POUGH, F. H., C. M. JANIS, AND J. B. HEISER. 1999. Vertebrate life. 5th edition. Prentice Hall, Upper Saddle River, NJ.
- KENTWOOD D. WELLS, *Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, Connecticut 06269-3043. E-mail: kentus@uconnvm.uconn.edu.*

PROCEEDINGS OF THE 5TH INDO-PACIFIC FISH CONFERENCE. B. Séret and J.-Y. Sire (eds.). 1999. Société Française d'Ichthyologie & Institut de Recherche pour le Développement,

Paris. ISBN 2-9507330-5-0. 888 p. \$68.00 plus \$19.00 postage to North America. (Available from: B. Séret, Société Française d'Ichthyologie, 43 rue Cuvier, 75231 Paris cedex 05, France.)—This substantial volume contains papers presented in Nouméa, New Caledonia, from 3–8 November 1997. The basic theme is to provide the latest results of studies on the biodiversity of marine and freshwater fishes of the Indo-Pacific area. There are 79 peer-reviewed papers in a variety of areas: fresh and brackish water fishes; coastal fishes of reefs, lagoons, and mangroves; pelagic fishes; deep-sea fishes; chondrichthyan fishes; endangered species, consequences of species introduction; phylogeography, genetic and chromosomal differentiation; resource assessment; fish farming, aquarium fish issues; reproduction, growth, physiology; population and community ecology; fish larvae; parasitology and ichthyology; databases on Indo-Pacific fishes; future of ichthyological research in the tropical Indo-Pacific; fish collection management; fish poisoning; fish behavior; elasmobranch as contemporary biological models; relations between man and fish in South Pacific cultures. Each paper is in English with a second abstract in French, and each has its own bibliography. Color illustrations are sprinkled throughout the volume.

M.-L. Bauchot sets the stage with a 21-page sketch of the history of discovery of the Indo-Pacific region by European explorers. Her paper is attractively illustrated with maps and drawings of naturalists and fishes. In a paper on zoogeography of coral reef fishes, Randall reminds us that the Indo-Malayan region (southeast Asia, East Indies, northern Australia) has the richest fauna estimated at 2900 species of reef and shore fishes. He attributes this fact to the stability of sea temperatures in this region during the ice age and to the presence of east-west barriers to dispersal due to glacial lowering of sea level in Torres, Malacca, and Sunda Straits.

New Caledonia is of continental origin unlike most Pacific islands which are volcanic. It broke away from Australia in the late Cretaceous. Much of the flora is related to plants of Australia and New Zealand. The fish fauna is typically Indo-Pacific, but there is an endemic galaxiid in freshwater. Marquet and Mary discuss the freshwater fishes of New Caledonia and map the distribution of 13 species including *Galaxias neocaledonicus*. Families of economic interest in freshwater include Anguillidae, Kuhliidae, Mugilidae, and Gobiidae.

Systematic papers of many levels are scattered throughout the volume including new species

descriptions such as a new cobitid from Thailand by Sontirat and generic relationships of internally fertilized southeast Asian halfbeaks by Meisner and Collette. Meunier and Zylberberg present SEM and TEM ultrastructural evidence to support the contention that the scales of the coelacanth, *Latimeria chalumnae*, an extant sarcopterygian fish, are similar to those of the elasmoid scales of the Teleostei which belong to the Actinopterygian lineage. Collette compares mackerels, molecules, and morphology and concludes that finding a stable phylogenetic hypothesis is a process of "reciprocal enlightenment."

Natural history information abounds in this volume. McDowall and Stewart describe newly found specimens of *Agrostichthys parkeri* (Regalecidae) from New Zealand. This bizarre, extremely slender, compressed, and elongate ribbonfish can reach 530 mm TL and has a dorsal filament 80% of its body length. This species may be able to generate a weak electric discharge.

The largest collection of papers is in the chondrichthyan fishes section. Among the 12 papers is a discussion of the biogeography of Australasian chondrichthyan faunas by Last and Séret. Yano et al. report on the 10th known specimen of megamouth shark, *Megachasma pelagios*. This mature female from Japan, with oocytes in the right ovary, was 5.44 m and had mating scars on the trunk, head, and first dorsal fin. Albert et al. review brain sizes in fishes including the 19 g brain of the 1040 kg megamouth No. 10. They conclude that chondrichthyans possess the largest brains among fish groups, both absolutely and in proportion to their body sizes.

Faliex provides an interesting review of parasites as natural fish tags that can be useful for taxonomic, biogeographic, and evolutionary studies. There are seven papers on fish poisoning. Molgó et al. review the bioactive agents involved in various types of fish poisoning including ciguatera, scombroid, puffer, and shark poisoning. Bataille-Benguigui, an anthropologist, provides a thoughtful paper on human-fish relationships within Polynesian culture and calls for a multidisciplinary approach to fish studies.

The above are just a sample of the variety of topics in this volume. There is something for everyone interested in Indo-Pacific fishes in this very useful compilation. The breadth and depth of coverage make me want to review past conference proceedings to see what I missed and to attend the next conference.

TIM M. BERRA, *Department of Evolution, Ecology, and Organismal Biology, Ohio State University, Mansfield, Ohio 44906. E-mail: berra.1@osu.edu.*

FISHES OF BERMUDA: HISTORY, ZOOGEOGRAPHY, ANNOTATED CHECKLIST, AND IDENTIFICATION KEYS. William F. Smith-Vaniz, Bruce B. Collette, and Brian E. Lockhurst. 1999. American Society of Ichthyologists and Herpetologists, Special Publication No. 4. Allen Press, Lawrence, Kansas. ISBN 1-891276-09-3. 424 p. \$48.00 (hardcover).—This handsome volume is the result of 25 years of effort to obtain a better understanding of Bermuda fishes. The task included not only fieldwork and the examination of museum specimens but the raising of funds necessary for publication. To the authors' credit, they were able to communicate their enthusiasm for the project to organizations and individuals who provided adequate support.

In terms of the need to provide an up-to-date catalog of the fishes of Bermuda, the authors could have been justified in producing a simple checklist with keys for identification. Instead, they did a great deal more so that their book will set a new standard for reporting the ichthyology of oceanic islands. Especially notable are the sections devoted to geology, habitats, history of previous work, fishery resources, and zoogeography.

Ichthyological work in Bermuda began with Henry Maurice Drummond-Hay (1814–1896). Between 1846 and 1851, he produced a series of 100 watercolors of fishes that had exceptional scientific accuracy; 41 of them are reproduced in this volume. Drummond-Hay's illustrations are followed by 24 colored photographs of variable quality that suffer in comparison. The remaining figures, black-and-white photographs and line drawings, are uniformly good. The outline drawing of each fish family is a helpful aid to identification. The book cover is attractive with four of Drummond-Hay's illustrations placed around an outline map of Bermuda.

The section devoted to the biographies of the early Bermuda naturalists provides useful historical information. Details are given about the lives and accomplishments of nine people who made major contributions to our knowledge of Bermuda fishes. The account begins with John Tavernier Bartram (1811–1899) and ends with John Tee-Van (1897–1967). The most colorful member of the group was Charles William Bee-

be (1877–1962). Beebe was best known for his bathysphere adventures, but he was also the author of 21 books and more than 800 articles, many of them dealing with Bermuda. He led more than 50 scientific expeditions and described 87 new species of fishes, a prodigious lifetime accomplishment.

Oceanic islands have reduced biotas in comparison to the closest mainland. Biologists interested in such places pose typical questions such as (1) what species are present? (2) how did they get there? (3) how long have they been there? and (4) are there indications of endemism? In regard to the first question, the authors took care to document the occurrence of all the species on their checklist and to provide pertinent comments about each one. Much additional information is provided in the form of convenient tables, that is, fishes introduced to Bermuda; data on range, habitat, and diet; fishes reported as the result of misidentifications; comparison of family diversity to that of nearby localities; a biogeographic analysis; and a list of fishes historically present but presumed to now be extinct.

Questions number two through four are of primary interest to biogeographers. On page 80, the authors agreed with McDowell (1968) that "... ocean currents combined with the dispersal capability and continued influx of pelagic larvae via the Gulf Stream have reduced the effectiveness of geographical isolation as a zoogeographic barrier and accounts for the relatively low number of Bermuda endemics." To this statement, they added information indicating that, during the last glacial maximum, the position of the Gulf Stream was shifted farther south. Consequently, they said, "Bermuda species at or near their thermal tolerance were probably eliminated." The authors also noted that there was a significant loss of habitat caused by the drop in sea level during the ice age.

As the authors have shown in their figure 2, the contemporary position of the Gulf Stream is far to the west and north of Bermuda. Because the archipelago does not lie within the direct influence of the Gulf Stream, it is difficult to see how a continued influx of pelagic larvae via the Gulf Stream could be taking place. Certainly, larvae can be picked up by the Gulf Stream and initially transported, but to reach Bermuda, they would have to disperse over a huge oceanic expanse. In a following paragraph, the authors suggest transport by cold-core rings that are budded off the Gulf Stream. But such rings elevate and carry cold slope water into the Sargasso Sea. They are not likely to provide suitable conditions for tropical larvae.

During the Wisconsin glaciation, the Gulf Stream was displaced to the south, and Bermuda was more directly affected. However, at that time, the sea surface temperature was much too cold for tropical organisms.

Considering that Bermuda is an old, well-isolated, oceanic archipelago lying more than 600 miles from the continental shore, how can one account for the extremely low endemism of 2.9%? Granted that its external relationships are with the Bahamas and the southern U.S. coast, the apparently low level of gene flow should not preclude the evolution of many endemic species. Other oceanic islands of similar age and isolation demonstrate relatively high levels of endemism. For example, endemism in Hawaiian fishes is 23.1% (Randall, 1998), and for Galapagos fishes it is 14–16% (McCosker, 1998).

Some years ago (Briggs, 1966), I published a paper on oceanic islands, endemism, and marine paleotemperatures. I noted that tropical species were confined within the 20 C isocryme (a line depicting average sea surface temperatures for the coldest month). Bermuda was seen to be situated very close to the isocryme that formed the northern border of the tropics. On the other side of the Atlantic, the Cape Verde islands were similarly situated. Both island groups had shore fish faunas with very low rates of endemism. I concluded that, during the Wisconsin ice age, the tropical species were eliminated and that, following the renewal of tropical temperatures, those archipelagoes had been repopulated.

The more recent literature on North Atlantic climatic history lends support to the theory of an ice age elimination of the Bermuda tropical fauna. In the Western Atlantic, the temperature decline had a devastating effect all the way south to the Caribbean where the drop was about 4 C (Stanley, 1989). Therefore, it seems unnecessary to explain the low endemism at Bermuda by invoking such causes as a constant influx of larvae via the Gulf Stream or the ice age drop in sea level. The southward displacement of the Gulf Stream could not have brought in cooler water because it did not shift as far south as Bermuda (Keffer, 1988; Stanley, 1989). It seems evident that the extinction of the tropical species in Bermuda was the direct result of a severe temperature decline that affected the whole of the North Atlantic Ocean. The repopulation, probably by waif dispersal, took place so recently that, in most cases, new species have not had time to evolve.

Another valuable section of the book is that devoted to the history and management of the

fishery resources. Bermuda was colonized by 1612. Only 20 years later, there were signs that the shore lines were becoming overfished. By the year 1700, more than 300 two-masted fishing boats were being used. Since that time, an increasing number of regulations have been passed to sustain the fish stocks in the face of a large demand. Bermuda now has a population of more than 58,000 people and an annual tourist influx of over 500,000. It appears that Bermuda is having considerable success in its conservation efforts. Its present fishery management plan is worth study by other countries who value their reef resources.

The book has two appendices. The first is a list of species of selected families that also occur on the U.S. coast, the Florida Keys, or the Bahamas. Appendix 2 consists of a map and station data for the extensive collection of Bermuda fishes housed at the Academy of Natural Sciences in Philadelphia. Also, the Literature Cited section is comprehensive and there is an index to the scientific and common names. Despite my comments about the zoogeography section, this is an exemplary book in which the authors and the ASIH can take justified pride.

LITERATURE CITED

- BRIGGS, J. C. 1966. Oceanic islands, endemism, and marine paleotemperatures. *Syst. Zool.* 15:153–163.
- KEFFER, T., D. J. MARTINSON, AND B. H. CORLISS. 1988. The position of the Gulf Stream during Quaternary glaciations. *Science* 241:440–442.
- MCCOSKER, J. E. 1998. Review of "The fishes of the Galapagos Islands" by J. S. Grove and R. J. Lavender. *Copeia* 1998:809–812.
- MCDOWELL, R. M. 1968. Oceanic islands and endemism. *Syst. Zool.* 17:346–350.
- RANDALL, J. E. 1998. Zoogeography of the shore fishes of the Indo-Pacific region. *Zool. Stud. Acad. Sinica, Taiwan* 37:227–268.
- STANLEY, S. M. 1989. *Earth and life through time*. 2d ed. W. H. Freeman and Co., New York.
- JOHN C. BRIGGS, *Zoological Collections, Georgia Museum of Natural History, University of Georgia, Athens, Georgia 30602. E-mail: jbriggs@urches.uga.edu.*

SHARKS, SKATES, AND RAYS: THE BIOLOGY OF ELASMOBRANCH FISHES. William C. Hamlett, ed. 1999. Johns Hopkins University Press, 2715 North Charles Street, Baltimore, Maryland 21218-4363. ISBN 0-8018-6048-2. 515 p. \$115.00 (hardcover).—The last decade of the

millennium has witnessed a remarkable shift in the public perception of sharks and their batoid relatives. Because of an increased awareness that sharks may, in fact, be beneficial to the ocean ecosystem, the Hollywood image that sharks are lying in wait for unsuspecting beachgoers has undergone a dramatic metamorphosis. In addition to numerous television documentaries, much of the credit for the renewed awareness must be given to the dozen or so books published during the past 15 years providing vivid glimpses of the natural history of this incredible group of animals. With the exception of several nicely organized symposium proceedings focusing on specific aspects of elasmobranch biology, it has been some time since a technical offering encompassing virtually all of the functional anatomy found in sharks has been attempted. The volume reviewed here is such an undertaking.

In his Preface, William Hamlett implies that his book might serve as a successor to the 1922 Frank Daniel classic, *The Elasmobranch Fishes*, which reappeared as a second edition in 1928 and as a third, revised edition in 1934. In fact, on first glance, the Tables of Contents in the Hamlett volume and the Daniel editions are virtually identical, from the topics selected to the relative order of their presentation. In building on the Daniel legacy, Hamlett, by his own admission, has decided to focus on a systems approach, restricted to anatomy and physiology. For the most part, the contributors assembled have succeeded in restating and updating the knowledge of elasmobranch functional anatomy originally offered by Daniel. A refreshing variation on the theme is the concerted effort by the contributors to address the batoid literature whenever possible. Although attention to the batoid relatives is certainly welcomed, its inclusion undoubtedly led to the unfortunate choice of *Sharks, Skates, and Rays* as the book's title. This title may be a source of confusion to unknowing buyers who are familiar with the popular Gilbert, Mathewson, and Rall volume of the same name, also published, coincidentally, by the Johns Hopkins University Press.

The volume at hand is organized into 16 chapters plus an appendix containing a checklist of living elasmobranchs. The chapters do not conform to any one particular format, allowing each contributing author to cover the topic in a fashion of his or her choosing. The chapters are enhanced with a variety of drawings, graphs, or plots, and many contain black-and-white photographs to illustrate the anatomy, histology, or ultrastructure.

The first chapter, "Systematics and Body

Form," is tremendously expanded over Daniel's version. In tackling this complicated topic, Leonard Compagno admits "... that there are at least as many classifications ... of cartilaginous fishes as authors who have published them." Nevertheless, Compagno is an excellent choice to provide his version and does so in a clearly defined framework of recognized problem areas in neoselachian classification and phylogeny and appropriately includes references that provide alternative interpretations. The bulk of the chapter is a review of the extant neoselachian orders and families and includes the batoids. The illustrations are not intended as reproductions from his FAO Species Catalogue but are rather simplified, not-to-scale silhouettes that serve his purpose of stressing the variations in body form described in great detail in the accompanying text.

Chapter 2, "Integumentary System and Teeth," is a nicely organized, well-documented, informative chapter, describing evolutionary, structural, and functional aspects of the skin, placoid scales, stomodaeal denticles and gillrakers, dermal fin rays, fin spines, and teeth. Authored by Norman Kemp, this chapter is highlighted with detailed line drawings and photographs, including histological sections, micro-radiographs, and electron micrographs, to illustrate his message. The section devoted to the teeth of elasmobranchs is especially noteworthy.

The third chapter, the second contributed by Leonard Compagno, provides a comprehensive account of the elasmobranch endoskeleton. In a descriptive style that is more detailed than is typically found in a comparative anatomy text, Compagno methodically depicts the numerous components of the axial skeleton, vertebral column, and appendicular skeleton for living sharks as well as living rays. As in his earlier chapter, Compagno's illustrations enhance the take-home message of the text. Through the use of idealized skeletal drawings, instead of the typical depiction of the spiny dogfish as a representative elasmobranch, concepts of endoskeletal variation among neoselachian sharks and rays are more easily conveyed.

Two chapters are devoted to the muscular system, chapter 4 concentrating on the gross anatomy and chapter 5 focusing on the microscopic anatomy and physiology. The first part of chapter 4, coauthored by Karel Liem and Adam Summers, assumes a rather classic approach to descriptive anatomy and includes crisp renderings of the usual somatic muscular perspectives. A refreshing addition is the inclusion of batoid somatic musculature illustrations. The highlight

of this chapter is a thoroughly referenced section on functional morphology, documenting recent experimental efforts to relate muscular systems to their ultimate functions, including the mechanics of feeding, respiration, and locomotion.

In the second muscle chapter, Quentin Bone relates very nicely the information available on elasmobranch muscle fibers. The section on sharks is divided into well-documented and clearly illustrated discussions of microscopic anatomy, electrophysiology, and biochemistry, with obvious emphasis on the relationship of structure to function. A considerable portion of the chapter is devoted to batoid musculature, a topic that historically has received very little attention. In fact, the current knowledge is so sparse that much of this batoid section is unpublished material of the author, including informative comparisons between shark and batoid muscle fiber anatomy, innervation, and functional roles.

Chapter 6 is an extensively referenced account of the elasmobranch digestive system. Using photographs and detailed illustrations of gross anatomy, in combination with light and fluorescent micrographs, coauthors Susanne Holmgren and Stefan Nilsson have clearly summarized the organ arrangement, innervation, and endocrine control of the elasmobranch digestive process. The section devoted to the physiology of gut motility and blood flow is effectively presented, with x-ray photography and representative experimental data to illustrate various aspects of digestive tract physiology.

The seventh chapter, authored by Patrick Butler, describes the respiratory system as it relates to the morphology and blood circulation of the gills. With the exception of a 1992 reference to digital radiographic imaging of circulating blood, however, the information in this chapter appears to differ very little from that put forth in a 1988 review by the same author on the same topic, including essentially the same collection of drawings and photographs.

The next two chapters address the elasmobranch circulatory system. In chapter 8, Ramon Munoz-Chapuli provides a comparative discussion of the peripheral circulation across six elasmobranch taxa: three selachian and three batoid. The anatomical comparisons are elegantly presented through corrosion casts, many of which are included as photographs and provide a dramatic way to illustrate the differences. In chapter 9, Geoffrey Satchell addresses some of the "distinctive attributes" of elasmobranch circulation. Although discussions of the pseudobranch, cutaneous vessels, lateral abdominal

veins, venous sinuses, hepatic vein sphincters, and various retial systems contributing to blood warming are appropriate for this chapter, the summary of the elasmobranch immune system is grossly outdated and, in many instances, inaccurate.

Among this book's finest chapters is chapter 10, simply titled, "Heart." Not only has he contributed a thorough and clearly illustrated chapter, Bruno Tota has also compiled a comprehensive mix of the classic and contemporary (40 citations from the 1990s) literature pertaining to the elasmobranch heart and its function.

The 11th chapter, authored by Michael Hofmann, is a nicely presented, thoroughly documented anatomical description of the elasmobranch nervous system, with references to electrophysiology and function (behavior) whenever possible. The use of subdivided brain cross-sections, with a histologically stained half and an illustrated half showing locations of major nuclei, are particularly effective.

Chapter 12, coauthored by Horst Bleckman and Michael Hofmann, is a well-organized review of the anatomy, peripheral physiology, behavior, and neural connections for the handful of special senses, including chemical, visual, acoustic, hydrodynamic, tactile, electric, and magnetic reception, that have contributed greatly to the evolutionary success of the elasmobranch fishes. The extensive list of references is a nice blend of the classic and contemporary literature on the variety of these sensory topics.

A chapter on the rectal gland, contributed by Kenneth Olson, and a chapter on the urinary system, coauthored by Eric Lacy and Enrico Reale, focus on the strategies developed by elasmobranchs to maintain osmotic and ionic homeostasis. Both chapters are dominated by ultrastructure as the means to describe the physiological significance of the respective organs. Lacy and Reale, recognized experts on the functional morphology of the elasmobranch kidney, do a particularly nice job of sorting through the literature describing renal structure and function obtained from a variety of sharks, skates, and rays, from both marine and freshwater environments.

The final two chapters in the book address the female and male reproductive systems, respectively, and are contributed by volume editor William Hamlett, with Thomas Koob as coauthor on the female system. Both chapters are excellent summaries of the numerous reviews of elasmobranch reproduction that have appeared during the past few decades, with updated information from the current literature. Refer-

ences cited in both chapters are appropriately extensive.

In keeping with his stated intent to offer a resource of general introductory information with current technical citations, Hamlett has succeeded in compiling an extremely useful elasmobranch reference text for novices and experts alike. As a result, this volume can be rec-

ommended as a valuable addition to personal libraries, libraries at marine laboratories, and departmental libraries at teaching facilities offering courses in elasmobranch biology.

CARL A. LUER, *Senior Scientist, Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, Florida 34236-1096. E-mail: caluer@mote.org.*

BOOKS RECEIVED

Copeia, 2000(2), pp. 638
© 2000 by the American Society of
Ichthyologists and Herpetologists

MONTEVERDE. ECOLOGY AND CONSERVATION OF A TROPICAL CLOUD FOREST. Nalini M. Nadkarni and Nathaniel T. Wheelwright, eds. 1999. Oxford University Press, New York. ISBN 0-19-513310-2. 608 p. \$75.00 (paper).—This large multiauthor volume provides a comprehensive review of biological research conducted at Monteverde, Costa Rica, one of the premier biological preserves in the world. The first three chapters describe the history of the reserve, its physical setting and climate, and its vegetation. Four taxonomic chapters review the terrestrial animals of the forest (insects and spiders, amphibians and reptiles, birds, and mammals). The book concludes with synthetic chapters on plant-animal interactions, ecosystem ecology and forest dynamics, agriculture, and conservation (with two chapters on the last topic). The chapter on amphibians and reptiles by Alan Pounds will be of most interest to readers of this journal. He provides a concise summary of the distribution and diversity of amphibians and reptiles of the area, followed by detailed discussions of research conducted at Monteverde on population ecology, reproductive ecology, habitat use, and conservation issues. A four-page appendix at the end of the book provides a comprehensive list of all amphibian and reptile species at Monteverde, with a summary of their distribution and microhabitat use. Like all of the taxon-oriented chapters in the book, this chapter concludes with a series of short essays on aspects of amphibian and reptile biology. Jay Savage discusses his discovery of the golden toad (*Bufo periglenes*), and Alan Pounds discusses the impact of population declines or extinction of the golden toad and other amphibians at Monteverde in initiating the current concern about declining amphibian populations around the world. Martha Crump contributes an essay

on how female meadow treefrogs (*Hyla pseudopuma*) choose their oviposition sites. All of these essays provide personal stories of research at Monteverde by the various authors. Every graduate student and senior researcher who has done, or plans to do, research at Monteverde or elsewhere in Costa Rica will want to have a copy of this book, as will almost anyone interested in tropical biology.—K.D.W.

AMPHIBIANS AND REPTILES IN THE MIDDLE EAST. Ragnar Kinzelbach and Max Kasperek, eds. 1999. Zoology in the Middle East 19. ISSN 0939-7140. 130 p. Available from Max Kasperek Verlag, Mönchhofstrasse 16, 69120 Heidelberg, Germany. E-mail: Kasperek@t-online.de. DM 37 + postage (paper).—This publication is a special issue of the journal *Zoology in the Middle East* focused entirely on amphibians and reptiles. There are 13 papers contributed by authors from Europe and several Middle Eastern countries. Most of the contributions deal with systematics, including a description of a new species of gecko, several short notes dealing with the status of previously described species or new distributional records, and a couple of studies of geographic variation in lizards. There also are two papers on nesting and embryological development of sea turtles, a general paper on the biology of a tortoise species, a description of calls of a ranid frog from Israel, and a brief note on distress vocalizations produced by a salamander (*Mertensiella*). The volume ends with a list of papers on amphibians and reptiles published in previous issues of this journal. Most of these papers are likely to be of interest only to specialists working on particular groups, and it seems unlikely that most herpetologists will want to purchase this issue of the journal separately.—K.D.W.