BOOK REVIEWS

Copeia 104, No. 1, 2016, 300–305

Eye of Newt and Toe of Frog, Adder's Fork and Lizard's Leg. The Lore and Mythology of Amphibians and Reptiles. Marty Crump, in collaboration with Dante B. Fenolio. 2015. University of Chicago Press. ISBN 9780226116006. 304 p. (hardcover) $35.00; ISBN 9780226116143 (e-book) $21.00.—Marty Crump has given us one of those rare books that engages, enlivens, and entertains the reader, while providing an education that gives us new breadth as herpetologists, scientists, and social beings. How much do we think about how the lore and mythology of the animals we study have influenced, even subliminally, our own perceptions of the biology of those animals? Do we pay any regard to the degree to which the lore influences the public, including teachers, policy makers, and funding dispensers about their understanding of the nature of research, and especially what conservation of biodiversity really means? Dr. Crump has. She has thought about amphibian and reptilian lore, and its diverse impacts, ever since she was an undergraduate. Now she presents us with a compendium of that lore and mythology. It is a joy to read. Well known as an ecologist and conservation biologist, she gives strong impetus to understanding local perceptions as a part of conservation efforts.

The book is thoughtfully, even entrancingly organized, with chapters on (I paraphrase her chapter titles) (1) understanding the animals; (2) creation myths that feature amphibians and/or reptiles; (3) snakes, good or evil?; (4) song and sounds of frogs, snakes, and rain; (5) rebirth myths involving frogs and snakes; (6) love, morals, and death in folktales; (7) "how" and "why" stories; (8) perceptions of amphibians in folk beliefs; (9) perceptions of reptiles in folklore; (10) sexual power of reptiles; (11) folk medicines that feature venom, blood, skin, or bones; (12) witchcraft and magic; (13) ways reptiles and amphibians are used; and (14) the "singing tuatara." These chapters focus on the ways that perceptions about amphibians and reptiles influence understanding and conservation, and how we can use new understanding to promote conservation of biodiversity in local (and international) situations. The illustrations are superb: there are many photographs of animals representing major groups of amphibians and reptiles, and some particularly interesting and topical specimens, by Dante Fenolio, and other photos, drawings, graphs, etc., by friends, colleagues, and family. The photos of skeletons, tongues, paintings old and new, archaeological artifacts, jewelry, cooking and food, etc., all add vivacity to the accounts. The book is priced so that it is accessible to everyone—students, professionals, and the public.

Crump's writing style is graceful, harmonious, and elegantly crafted—it gently leads the reader to contemplate with thought and wonder, excitement and joie d' vivre, the tales of the attributes of amphibians and reptiles that have elicited respect and admiration, even the existence of god-like qualities, as well as fear and hatred. In her first chapter, she gives us a mandate to examine perceptions, including our own. They matter for many reasons, among them that a positive perception based on respect engenders protection, but a negative perception facilitates dislike and its consequences, even killing. Conservationists need to be aware of culture-specific beliefs to communicate, and they need to understand the bases of perceptions. Such concepts as relationships with animals, the common names used to refer to them, and descriptors such as beautiful and helpful vs. ugly and harmful can have emotional and religious implications. Crump provides a splendid discourse on folklore—arising to "explain" phenomena, learning via belief, accepted as truth. Her sampling, which she identifies as eclectic, reflects many versions of re-telling. She asks us to ask ourselves whether it is ethical to challenge peoples' perceptions, especially if it is to meet our own proclaimed goals? These are just some of the reasons she asks us to question our own perceptions of our work with both the animals and the peoples whose heritage they are—what are our goals? What are our methods?

The chapters that follow delve into a wide and wonderful world of folklore and mythology about amphibians and reptiles. She reviews diverse creation myths involving herps that have origins in Egypt, Babylon, Namibia/Botswana, among the Aztecs, the Chinese, and Native Americans. She illustrates both similarities and differences, with deep understanding, joy, and wonderment. Her beautifully drafted comparisons and constructs enable us to explore why, for example, snakes may be viewed as life givers or life takers, why frogs are associated with life, especially fertility, but toads are often considered ugly, why crocodylians and turtles both are creatures in myths about carrying the world on their backs, why some salamanders have "magic" properties, and how amphibians and reptiles figure in foods, medicines, jewelry, music, and many other parts of human life. What makes an animal a positive force, to be loved, admired, revered, and/or protected, or a negative one, considered dangerous, venomous, to be killed on sight? Crump presents the lore and the myths and their backgrounds and consequences, asking cogent questions in a most thoughtful manner. Each chapter presents a new view of the focal animals or the focal topic—I didn't see any repetition of lore or myth despite different contexts, so the sheer number of the tales is huge, and their analysis is deep, profound, and enticing. Each chapter is filled with lively accounts and thoughtful reflection.

Fundamental to Crump's effort is her goal of an incorporation and understanding of lore and myth into efforts in conservation biology. To what degree are local perceptions, and their backgrounds, considered as we proclaim the necessity to conserve organisms and habitats? I will use Crump's accounts of the lore and myths about caecilians as an entry to examine how scientists might persuade local people to alter their perceptions. A few examples of the incorporation of understanding of local lore and myths into conservation biology immediately validate her thesis and her goals.

Sadly, some misleading published accounts state that there is no mythology or lore about caecilians—wrong! Crump

 DOI: 10.1643/OT-16-405 Published online: 8 April 2016

cites the legendary Minhocão of Central and South America, a 20 to 50-meter worm or serpent with a pair of tentacles on its head that burrows underground, is a vile and dangerous animal, and whose excavations cause houses and roads to collapse. The cryptozoologist Karl Shuker (1995) suggested that it might be an example of a giant caecilian, probably because of its limblessness and tentacles (others suggest a surviving glyptodont [Heuvelmans, 1959] or a descendent of *Titanoboa* [anon.]). Mayan cave carvings and paintings portrayed a very large "serpent" that was thought to eat humans. Crump astutely comments that it reminds her of the giant sandworms in Herbert's novel *Dune*. Rumors of sightings persist! As Crump pointed out, much of what is related is anecdotal. She cites the experiences of herpetologists who have worked in Guatemala and in Mexico and inquired about finding caecilians, only to learn that the animals are reputed to be extremely nasty (entering the anuses of people responding to calls of nature and in some cases, then eating the person alive internally). I, too, have tried to phrase my inquiries while in the field in Central America "delicately"—and been laughed at, or greeted with horror. I have been struck by the extreme similarity of the perceptions of caecilians wherever they occur—the invasion of body orifices is mentioned by indigenous peoples in Central and South America, Africa, and India and southeast Asia, as is the assumption that they are deadly poisonous. Common names relate to earthworms and/or snakes worldwide, and "double-headed snakes" is the name in both Costa Rica and India.

However, recent work on caecilians provides examples of the power of Crump's thesis that knowing the lore can allow scientists to persuade the local people from detesting and killing the animals to respecting and conserving them. A few local scientists have independently derived the perceptions and goals that Crump has articulated. They are aware of the impact of the lore, given that the local people kill caecilians on sight. Attempts to alter such perceptions are taking place in India and in Africa. Kotharambath and Von Oommen (2008) and Kotharambath et al. (2013) note that the many mythological beliefs about animals that have been passed through many generations in Kerala largely contribute to veneration of wildlife and natural habitats, but for caecilians, the lore has resulted in their being considered dangerous and despised. A significant program is under way in the northeastern states of India, where a number of caecilian species are endemic. Rachunliu Kamei studies the systematics and ecology of the caecilians of the region (Kamei et al., 2012). During her fieldwork she noticed that the local people feared caecilians and, believing that they are fatally poisonous, killed them. She has developed a program of mass education for diverse audiences, from the largely non-literate tribal villagers to the educated community. Kamei noted that government conservation initiatives are not respected because of mistrust. As a tribal native, she has developed close interactions with the people so that knowledge will inculcate sympathy for caecilians, negate the deeply rooted myths, and be passed on to posterity. Her program has included interactive field demonstrations for tribal communities in more than 15 localities. Handling the animals has been widely successful in dispelling the fear of caecilians (Kamei, 2015). She has addressed mostly students, but also forest department officials. Kamei reports that more than 95% of the 700+ people in her audiences learned about caecilians for the first time. In 2015, she gave a series of popular talks at educational institutions, and reached more than 6,000 members of the general public. Most got to see living animals. Kamei's audiences nearly immediately change perceptions and decide that caecilians are harmless and in need of conservation.

In Africa, there are ongoing efforts to increase awareness and protection for the critically endangered Sagalla Caecilian (*Boulengerula niedeni*) found in the Taita Hills of Kenya (Wojnowski and Malonza, 2009). Habitat modification has apparently reduced populations, as has their persecution because of their resemblance to snakes and earthworms. First, the herpetologists convened a workshop to educate the villagers about the uniqueness of the biology of caecilians. Then they introduced a contest in which local villagers could enter a common name for the animals in an attempt to induce the people to view caecilians more favorably; 336 villagers participated. Local elders judged and selected the name "kilima-mrota" (burrowing, thin) submitted by a 13-year-old girl. Two years later, interviews showed that the villagers could recognize caecilians, knew the species occurred nowhere else, and the new name helped in talking about conserving the animals and their habitats. A lasting impression, a positive perception, and strong desire to conserve both fauna and habitats had developed.

Crump's thesis is strongly supported. Education efforts changed the perceptions of the local people from negative to positive. Furthermore, that education was provided by native scientists who understand the local people; we "outsiders" must be careful about the way we attempt to transfer our attitudes and perceptions to the rightful stewards of the organisms and their habitats—relevant to Crump's questions about the ethics of attempting to change perceptions. Dr. Crump's book provides the basis for this conservation practice.

In summary, this book is a treasure! Every herpetologist, in fact any biologist interested in understanding perceptions about animals (and plants), their own and those of the public, should own this book. It should not stay on the shelf, but be read—often—browsed, both selectively and broadly, as well as consumed in depth. Marty Crump asks us why we are scientists, why we do our work the way we do, and urges us to think more broadly about perceptions of all sorts and to include an understanding of local perceptions in our research. This book is more than a compendium of lore and myths; it is a gift, an education, a remarkable treatise about ways of understanding biology. Its content alters and illuminates our perceptions of amphibians and reptiles and of conservation biology, and will enliven and enrich the reader's research, teaching, and citizenship in our world.

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Climate Change and Coastal Ecosystems: Long-Term Effects of Climate and Nutrient Loading on Trophic Organization. Robert J. Livingston. 2014. CRC Press. ISBN 9781466568426. 524 p. $129.95 (hardcover).—As climate change continues to shift and alter our environments at varying scales, it is often challenging to discern which changes have veered from natural cycles and what the baseline conditions were. Consistent, long-term ecosystem monitoring studies are exceptionally useful as they provide the context necessary to identify anthropogenic influences and are a starting point for cues and clues for human adaptation and mitigation to climate change. As an emeritus professor, Robert Livingston is a considerably experienced scientist and book author, and a pioneer in interdisciplinary ecosystem-based river, estuarine, and coastal research. Within eight parts, this book provides a comprehensive detailed description of Livingston's long-term research project on river-estuarine and coastal ecosystems in the Southeastern United States.

Part I is an overview divided into two chapters, covering the context and the methodologies of the river-estuarine and coastal ecosystem research described in the remainder of the book. This section highlights the importance of long-term environmental research and consistent protocols and methods. Livingston presents an extensive review of previous studies on coastal ecosystems, ecosystem research, and other long-term ecological studies. Interdisciplinary research is emphasized as a critical element to the success of his projects. We were impressed with the inclusion of social science methods in the discussion of how to best design an ecosystem-based ecological research program. However, while Livingston's interdisciplinary methods were an innovative integration of disciplines for a research question when the project started, modern interdisciplinarians would likely argue that such approaches are weak in their incorporation of the various sciences as his work is primarily from an ecological lens. While the methods section is quite detailed, readers with an extensive biological or ecological background would best be able to incorporate such approaches. An appropriate addition to Part I would be a synthesis chapter on why this work is particularly important in relation to anthropogenic climate change. Such a summary chapter in the beginning of the book would be useful, especially if it included a brief discussion on observed changes over time for fishes, oysters, and other organisms that are studied in detail in the following chapters. While the book provides a thorough analysis of long-term data sets, readers would benefit from a brief introduction on the main connections between changes in the biophysical environment and responses in flora and fauna population dynamics in the estuaries.

Part II, "Long-Term Habitat Conditions" encompasses four chapters providing a background on the region, reporting on long-term changes in precipitation and river flows, a discussion of local nutrient loading, and research on dredged passes to the Gulf of Mexico. Ecosystem-based research is emphasized, and Livingston clearly stresses the importance of relationships and interactions.

The majority of the book, Part III, chapter 7, discusses the trophic response to long-term climate changes. While indeed comprehensive in reporting results, the book often confounds climatology for climate change. Linking climatology and the functioning of Gulf estuaries is a separate book than one comparing climate change impacts on estuarine ecosystems. Chapter 7 concludes with the statement, "The effects of climatological changes thus depended on factors that were related to differences in natural habitat conditions and the relative impacts of anthropogenic nutrient loading and dredging in the individual estuaries" (p. 191). Climatology refers to typical or average conditions over a certain time window, e.g., 30-year period. Climate change, however, refers to the processes at hand which include, but are not limited to, changing air and water surface temperatures, long-terms changes in rainfall, long-term changes in the sea level, long-term changes in any ecological processes due to various components of the ecosystem, biotic or abiotic, changing due to environmental shifts associated with a changing climate (Karl et al., 2003; Hansen et al., 2012). While Livingston later relates rainfall patterns to the long-term health of these ecosystems, chapter 7 is more of a summary of the conditions and characteristics of the study areas. In this chapter, Livingston discusses water quality fluctuations, the physical structure of estuaries, river flow patterns, salinity stratification and dissolved oxygen trends, the role of nutrient loading, plankton bloom activity, and species richness.

Part IV, chapter 8, details the impact of anthropogenic nutrient loading on the Choctawhatchee and Pensacola estuaries. This section provides data on nutrient influences on the physical conditions as well as on biological shifts at various trophic levels. The maps would be more useful if context maps were included, showing exactly where the smaller scale area fits into an area more easily recognized by the reader. While the book title implies that the text is focused on climate change, many of the shifts described (e.g., loss of submergent aquatic vegetation, DO changes) are due not to climate change, but to other anthropogenic influences such as coastal development and sewage releases. The distinction between climate change and other human induced factors should be more readily clarified. The discussion in chapter 8 includes a disclaimer that any climate change cause-and-effect relationships cannot be made due to the short time frame of the study, but a discussion of likely

influences would have been helpful and welcomed by the reader.

Part V, chapter 9, is a comparative analysis of gulf ecosystems, focusing on Gulf Coast estuaries. Data on sediment types, salinity stratification, and FII (fish, infauna, and invertebrate) indices are a number of the data described and graphed in this section. The chapter closes with an in-depth look into the Apalachicola River-Estuary, known to be one of the most productive river-estuary ecosystems. Livingston discusses the research conducted in the 1970s aimed at learning more about the system for informed environmental protection policies but how land development in the region has largely ignored scientific studies.

Part VI, the last chapter, considers information dissemination on environmental research in the area and how the media misrepresents scientific results. This is perhaps the most interesting chapter and puts the extensively detailed results from the previous chapters into context and encourages future research in this area. Livingston does not restrain from communicating his political views as he provides a historical perspective on environmental research and policy. While the rest of the book only slightly touches any answer to the question, "so what?," here Livingston fully expresses his frustrations with the misuse of scientific information and why the lack of scientific evidence in policy-making and news reporting is so detrimental. The use of news clippings in the text adds a colorful flavor to the chapter, and the tone is noticeably shifted from the straightforward reporting manner in the rest of the book to a more candid and advisory inflection. Misconstrued and sensationalized science is often an issue in media sources, and the case study of the Perdido Bay pulp mill is particularly interesting from the perspective of a scientist arguing with environmentalists, government agencies, and industry representatives. The last paragraph of this chapter ties everything together, and explains that if climate change-induced droughts and public ignorance continue, these once highly productive water systems will continue to be increasingly negatively affected.

Part VII, the "Closing," includes a summary conclusion and well as an extensive five part appendix. While journal articles provide the necessary components of methods used, such publications are often too short to fully describe the details and reasoning behind applying various methodologies to a new researcher in the field. This book uses the generosity of the textbook format to comprehensively describe the necessary details a novice researcher may need to replicate or adapt Livingston's methodologies. This book is an excellent compilation of long-term datasets on biotic and abiotic factors in estuariane systems of Florida over a multi-decadal period, and as such can serve as a reference for future research. Such features are particularly useful for interdisciplinary studies. However, this book is not a suitable source for anyone who wants to learn more about climate change and would not be worth the high price tag to such a reader. Inferences can be made from the results, and future researchers can take his work on describing ecosystem baselines to then do further climate related studies.

Livingston's discussion of ecosystem-based interdisciplinary research will stimulate further discussions on this area. The majority of the text is set to a tone to describe and report, not to offer suggestions, with the exception of the final chapter. The text is sometimes repetitive in terms of providing context, but this can be helpful for readers who are selecting only one chapter or one part to read.

Our main critique is that the title is misleading because the book is focused on Livingston's specific research in a specific location, not climate change and coastal ecosystems in general. A suggested book name that would more accurately portray the essence of the book would be *Estuarine Ecology in the Southeastern US*. While the context and methodologies are thorough, less emphasis is on the role of climate change in these systems and more so on reporting the results of years of observing multiple metrics in these systems. The goal of the research is to determine how human activities affect processes in relation to continuous natural cycles. The answer to this goal was minimally addressed and could have been further examined in the text. The text could have also benefitted from a synthesis section on what has been learned about the impact of climate change on these heavily studied ecosystems. Further emphasis could also have been placed on discussing the importance of river-bay linkages. An additional drawback of the book is that the colored graphics are found in the middle of the book; thus, the reader needs to flip back and forth to understand any color-dependent results.

Within the text are a few statements regarding scientific uncertainty that were unnecessary. For example, "No one can accurately predict the future with respect to the incidence of droughts and changes in water temperature and sea level" (p. 135) and, "It is true that no one can predict the future of the Apalachicola River flows" (p. 284). Thousands of climate scientists have developed climate models to predict climate change (summarized in the Intergovernmental Panel on Climate Change Fifth Assessment Report, IPCC, 2014; http://ar5-syr.ipcc.ch/ipcc/ipcc/resources/pdf/IPCC_SynthesisReport.pdf). While we are not qualified to evaluate the validity of studies that have modeled flows in the Apalachicola River (Huang et al., 2004), hydrological modeling of river flow is a large body of research that continues to grow, including in Florida and other parts of the Southeastern US (Bolster and Saiers, 2002; Kokkonen et al., 2003).

While the results and details in the book are very specific to Livingston's study area in the Southeastern US, the emphasis on valuing long-term studies, particularly in a time where funders are eager for results in a short time frame, is helpful for any such comprehensive study. This book is an obligatory read for any river-estuarine-coastal scientist working in the Southeastern US and is worth the price tag to any such researcher, and is also helpful to those writing a coastal ecology related literature review. Livingston not only describes much of his own work, but also references many related studies and the results of those projects. The book is also a good source for related but previously unpublished data.

This book is a major contribution to the river-estuarine and coastal ecosystems of the southeast of the United States, but also to other long-term ecosystem-based studies interested in standardized protocols and comprehensive reporting of results. The text appropriately acknowledges the need to value such long-term studies and the difficulties in maintaining such consistent research spanning decades. Researchers who are interested in their own long-term studies can use this book to develop ideas on how to report and display such complex projects.

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Sharks & Rays of the Arabian/Persian Gulf. Dareen K. Almojil, Alec B. Moore, and William T. White. 2015. MBG (INT) Ltd. ISBN: 978-0-9930427-2-0. V + 178 p. $36.00 (paperback).—*Sharks & Rays of the Arabian/Persian Gulf*, referred to henceforth as the Gulf, is an informative book on an otherwise poorly known elasmobranch fauna from this region. Regional shark books and guides such as this are often popular since they frequently cater to a wide variety of audiences, ranging from government agencies tasked with identifying species for fisheries purposes, to conservation groups, and the general public, which may include anglers, divers, or those with an interest in the natural history of this fascinating group of fishes. Furthermore, following the recent trend of most shark books of this nature, their cartilaginous relatives, the rays or batoids, are also included in the present book.

The book has an introduction that provides the reader with basic information on the Gulf's geography, physical environment, uniqueness of the fauna, and key habitats. This is followed by a "How to use this book" section with a brief explanation of the information for each species profile. A glossary and keys to the families and genera concludes this section. The key to the family and genera has an asterisk (*) to denote those families and genera that have not been confirmed from the Gulf.

The remainder of the book is mostly composed of individual species accounts with basic information including common and scientific names, size, key features to identify each species, distribution, Gulf occurrence, a short section on habitat and biology, conservation status, remarks, and references. Each species account has a photograph or illustration of the species in lateral view, or dorsal view for the rays, a ventral view of the snout, tooth drawing, and other diagnostic characters where appropriate. Many of the accounts have a photograph of the species either in its natural environment or at a fish market in the region. The key features part of each species account is done in bullet point format to highlight the key external morphological characteristics to identify each species.

The book features 30 shark and 24 ray species known to occur in the Gulf, but includes an additional 16 shark and 11 ray species accounts for species that may occur here or may have occurred in the recent past. The higher classification of species includes a total of three orders, nine families, and 15 genera of sharks, and four orders, ten families, and 16 genera of rays confirmed from the Gulf, with possibly an additional four families and 15 genera of sharks (two families, nine genera) and rays (two families, six genera) occurring here. Each family name within an order is highlighted in a different color.

The authors are certainly knowledgeable about the fauna and have gone to great lengths to research and separate out those species confirmed to occur in the Gulf. Those unconfirmed species are in a separate section at the end of the known species account so as not to confuse matters. I found this latter section on possible species occurrences in the Gulf useful in answering questions on species that have been reported previously from this region. This section tries to clear up some of the confusion in the literature.

Overall, I found this book to make a nice contribution to the identification of sharks and rays from the Gulf region. I would expect anyone with an interest in identifying the Gulf fauna to have this book in their library.

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Marine Faunal Diversity in India: Taxonomy, Ecology and Conservation. Krishnamoorthy Venkataraman and Chandrakasan Sivaperuman (Eds.). 2015. Academic Press. ISBN: 9780128019481. 519 p. $120.00 (paperback).—India is fortunate in having thousands of kilometers of marine coast and an equally diverse marine fauna. This publication regarding the marine and coastal ecosystems of India comprises a set of chapters written and edited mainly by local researchers. It brings together an outstanding amount of data and information on the diversity and distribution of marine faunal communities as well as details about their ecosystems and conservation status. The contents fall into two major sections: 19 chapters devoted to marine faunal diversity, and ten chapters for ecology and conservation.

The first major section includes four chapters on fishes, three on crustaceans, and one chapter each on sponges, corals, mollusks, bryozoans, sea urchins, sea grasses, ascidi-

ans, reptiles, birds, and mammals. There are also chapters on communities of marine organisms that inhabit the coastal areas and another on macrofaunal communities that are associated with coral reefs. Some of these chapters are comprehensive, dealing with all of the species known from the region; others highlight just particular species or just particular areas. There are some poorly thought out sections; for instance, several of the tables listing taxa appear to have no clear taxonomic order.

As fish taxonomist, I found most interesting the sections pertaining to the marine ichthyofauna. In Table 12.1, the authors provide a useful comparison of the number of species and genera found in each family from India versus the numbers found in the rest of the world. In Table 12.2, the authors list all of the threatened and vulnerable fishes species known from the region. Other chapters focusing on other taxonomic groups are similarly organized; however, I was disappointed to find a fair amount of redundancy between some chapters—something the editors should have certainly handled.

The second section of the book, pertaining more to ecology and conservation had several chapters that failed to fully cover the subject matter or dealt with taxonomic issues that could have been placed in the earlier sections of the book. Some chapters covered obscure topics, such as the one titled "Lucrative Business Opportunities with Shrimp Brood Stocks," that seemed out of place in this book.

The presentation of the material overall suffers from redundancy, poor organization, and some sloppiness that reflects poor editing. However, the book is practical for those interested in a good overview of the marine fauna of India.

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