Journal of Mammalogy, 96(2):460–462, 2015
DOI:10.1093/jmammal/gyu019

BOOK REVIEW

Yapa, A., and G. Ratnavira. 2013. The Mammals of Sri Lanka. Field Ornithology Group of Sri Lanka, Department of Zoology, University of Colombo, Colombo 3, Sri Lanka. 1,012 pp. ISBN: 978-955-8576-32-8, price (hard cover), Rs. 7500.

© 2015 American Society of Mammalogists, www.mammalogy.org

The last comprehensive book on the mammals of Sri Lanka was compiled 8 decades ago when the island nation off the coast of India was known as the British colony of Ceylon (Phillips 1935). A sumptuously illustrated opus that updates and exceeds this earlier monograph was published last year with text exquisitely written by Asoka Yapa and color plates artistically painted by Gamini Ratnavira.

I am sure that the original concept was probably a compact field guide but the meticulous attention to detail of the first author has created an encyclopedic volume on the current knowledge of mammals in Sri Lanka. But you will have to pour over this fact-packed book at home or in your office and not carry it into the field in your backpack because it is over 1,000 pages long and weighs almost 5 kg. The liberal use of photography to capture species in their natural habitat on the island acts as a showcase to bring this charismatic group of animals back to the forefront of Sri Lankan wildlife. Many are stunning full-page images taken by local amateur photographers with an interest in biological conservation.

The contents of the book start with a foreword by Rohan Pethiyagoda, founder of the Wildlife Heritage Trust and author of several papers on Sri Lankan biodiversity. He laments the decline of biological research since independence from British colonial rule in 1948. A resurgence in scientific research began with the start of a conservation movement to save the dwindling forest on the island in the 1980s, but there is still a need for "fresh exploration" because "the enlightenment is yet to come."

A section on "Enconiums" follows that sets out the authors' inspiration for writing this book. They wanted to produce an updated version of Phillips' "Mammals of Ceylon" that would do it justice as "everything that could ever be reasonably known about the country's mammals." Praise is given to the Department of Wildlife Conservation for maintaining a research presence during the postcolonial period of decline when local academic involvement was minimal. A shining-light example was the collaboration from 1967 to 1982 with John Eisenberg at the National Zoological Park of the Smithsonian Institution on elephant and primate studies (e.g., Eisenberg and Lockhart 1972).

The next chapter is an introduction to the mammals of Sri Lanka. There is a brief history of mammalian evolution and a discussion on the current anthropomorphic effects on the environment with an example of specific consequences to dugongs in the 50-km wide Palk Strait that is shared with India. We learn that there are about 126 species of Sri Lankan mammals, and no other island of comparable size in the world is as diverse. In addition, about 20% of this diversity is endemic to the country making it an interesting biogeographic laboratory.

It is refreshing to know that Yapa also does not shy away from controversy. He bemoans the bureaucracy associated with the Convention on Biological Diversity that was intended to give sovereignty over biodiversity but seems instead to unnecessarily impede research with red tape. Basic science, such as the support of natural history collections and the encouragement of local collaboration with foreign researchers, will go a long way in understanding and protecting the environment for future generations of Sri Lankans.

A discussion of primary literature sources of mammals from Sri Lanka is presented by Rajith Dissanayake, a squirrel taxonomist currently based at the University of London. Citations date back to the time of Linnaeus and the type localities of the Asian elephant and the endemic red slender loris (Wilson and Reeder 2005). The first natural history account of the mammalian fauna was by the British Army medical officer Edward Kelaart (1852). An influential mammal survey was conducted by the Bombay Natural History Society from 1911 to 1923 and scientific results published in their journal. This earlier work inspired the "Manual of the Mammals of Ceylon" by Phillips (1935). Although there have been published studies on mammal research since, no major updated synthesis has been forthcoming until Yapa's book in 2014.

Geology and biogeography are discussed in a chapter by Asoka Weerasinghe. Sri Lanka has Gondwanan origins related to India and Madagascar that started to break up about 120 million years ago (mya) as the Indian subcontinent began to drift north. It remained isolated until colliding with Asia approximately 35 mya. Since the Early Miocene, Sri Lanka has been disconnected several times from the mainland depending on the sea levels, including the current interglacial. The geological history has undoubtedly had a profound effect on the biogeography of Sri Lankan mammals, but there needs to be more detailed studies in this field of research.

There is a chapter on author's notes and acknowledgments that outlines the origin of the book. Although completed over a 3-year period, the publication is firmly rooted in the zoological education that Yapa received during his university years in his adopted country of Canada after emigrating in 1970 from his native land of Sri Lanka. This experience was bookended with a childhood growing up with the future Sri Lankan leaders in wildlife art and conservation and a work career as an editor for the Canadian Forest Service.

The bulk of the book is devoted to the 126 species of mammals recognized from Sri Lanka, of which 29 are marine and 97 are terrestrial species. The marine mammals are composed of 1 dugong

and 28 cetaceans. Terrestrial mammals include 1 elephant, 5 primates, 23 rodents, 1 hare, 10 shrews, 30 bats, 17 carnivores, 1 pangolin, 1 boar, and 8 ruminants. The species accounts are presented in chapters consisting of traditional orders of mammals. This gets a bit tricky with the recent conclusion that hippos are more closely related to whales than they are to other artiodactyls. I give Yapa credit for not skirting this evolutionary revelation in a book aimed at the "interested layperson" and including a discussion on the superorder Cetartiodactyla, although the taxonomic ranks and names are still unsettled (Spaulding et al. 2009).

Within the orders or chapters of mammals, an introduction covering evolution, taxonomy, and morphology is given followed by a general discussion of representative families. Species accounts begin with the English common name, scientific name with taxonomic authority, subspecies if recognized, Sinhalese name and Tamil name. A description follows, including measurements, mass, external features, and comparisons to similar species. In addition, there is usually mention of the etymology of the name. The remaining text may include a range of information on habitat, behavior, reproduction, diet, physiology, life history, and conservation status. There is a descriptive distribution and a shaded range of occurrence overlaying a base map (except for cetaceans) with 3 levels of elevation and 4 areas of varying amounts of precipitation. A list of references ends each chapter.

There are 4 single species chapter accounts for the orders of mammals that include dugongs, elephants, pangolins, and hares. The first species account chapter is of the dugong, a marine mammal listed as vulnerable by the International Union for the Conservation of Nature. In historical times, they were found along the west coast of Sri Lanka and parts of the east with some herds numbering over 100 individuals. Now, dugongs occur only in the northwest and small groups of up to 5 are rarely seen.

Although traditional taxonomy recognizes the nominal subspecies of *Elephas maximus* as restricted to the island, recent mitochondrial DNA analysis paints a more complicated picture with a close relationship between a Sri Lankan and South Indian lineage with another one from the Sunda region that convergently diverged from a mainland population during the Pleistocene (Vidya et al. 2009). In addition to other basic biological information on the Asian elephant, Yapa intertwines the cultural, religious, and historical significance of the elephant in Sri Lanka with the biology of the beast.

Although I commend the first author for wading through the scientific literature for the most recent research, some judicious consultation would have been in order for the introductory section of the primate chapter. The conservative estimate by primarily paleontologists of the diversification of extant primates is 55.8 mya (O'Leary et al. 2013) and the liberal estimate by primarily molecular biologists is 80.8 mya (Meredith et al. 2011). Unfortunately, he uses the estimate of 185 mya based on the controversial method of panbiogeography advocated by Heads (2010), which unnecessarily pushes back the origin of widely distributed groups to the initial breakup of the supercontinent Pangea and a 130-million-year gap before the first appearance of a primate fossil.

Rodentia is the next chapter order, which includes *Srilankamys ohiensis*, a genus endemic to Sri Lanka and a basal lineage of the *Rattus* division. The origin of this monotypic genus coincides with the first isolation of Sri Lanka from the Indian mainland in the Early Miocene. There are several informational sidebars scattered throughout the text, including an excerpt story on squirrels from "a forthcoming memoir on rural life in Sri Lanka" by Kamala Gunasekera.

Endemism is high for Sri Lankan shrews with 6 of the 10 species found only on the island, a testament to the biogeographic influence on the evolution of this group of mammals. Another endemic monotypic genus occurs in Sri Lanka, *Solisorex pearsoni*. A sidebar discusses other possibilities of new discoveries, including a "mystery" shrew that was examined and photographed before being released.

Bats are the most diverse order of mammals in Sri Lanka and represent almost 1 in 3 of the terrestrial species. But Yapa documents the potential occurrence of 14 additional species if more thorough surveys were conducted throughout the island. Bats are one chapter that gets extra attention with an extended introduction on the unique adaptation of flight in mammals and a section on echolocation.

The order Carnivora is represented by 6 families and 17 species in Sri Lanka. Although visitors to the country may not readily see any of these species, they may notice other signs of the animals such as tracks or scat, which are illustrated for many of the cats and other carnivores. The leopard gets the longest account of any of the mammals with many superb photographs, paintings, and anecdotes of the top-level predator on the island.

Even-toed ungulates in Sri Lanka are well-known animals such as wild boar, buffalo, and deer, including healthy herds of the handsome spotted deer commonly seen in national parks in the dry zone. But the small spotted chevrotains or mouse-deers are a poorly studied group endemic to the Subcontinent. They were previously considered a monotypic genus; however, recent research has split them into 1 species in India and 2 additional species in Sri Lanka. And there is potential for a 4th undescribed species, also from tiny Sri Lanka!

The 28 species of cetaceans command the largest proportion of the book. An introduction gets in depth into the unique adaptations found in these marine mammals. There are many great photos and illustrations of the surfacing and diving sequences for rorquals. Detailed insights are also given from Sri Lankan whale researchers based on studies from the oceans surrounding the island. The sperm whale gets one of the longest species accounts with 20 pages summarizing interesting aspects of their behavior, echolocation, and anatomy.

The species accounts end with a short chapter on introduced mammals. Although there are references listed at the end of each chapter, a combined bibliography of over 500 literature sources has also been compiled. Five appendices include a glossary, suggestions for the growing whale watching industry in Sri Lanka, comparative surfacing and diving sequences for the 7 larger species of whales, summary of tracks of scats of select species, and a dental formula chart for most genera of Sri Lankan mammals. Appendicies follow with recent

information on a couple of mystery animals and the addition of newly acquired bat echolocation recordings, one area of research that needs more attention with important implications to the conservation of this speciose group. There are indices of common and scientific names, and ending with a checklist of the 126 species of mammals recognized from Sri Lanka.

The authors should be congratulated on amassing the most comprehensive volume on Sri Lankan mammals. There is a wealth of information presented in an engaging and thought-provoking style. The intended audience is the "interested layperson," so some professional biologists will certainly have alternative suggestions for information relating to their mammals of study. For example, "to make a long story short" oversimplifies the evolution of the Paenungulata by giving the impression of a linear transformation from Hyracoidea to Sirenia to Proboscidea, instead of a branching pattern united by common ancestors. Notwithstanding some line spacing issues, editorial rigor and quality of publication is first rate. A few minor quibbles include no obvious description of the elevation and precipitation on the base maps for the species distributions, no subheadings within the species accounts for comparative purposes and easier reading, and the unavoidable typos.

One of the more interesting and useful aspects of this book that I found was the highlighting of gaps in our scientific knowledge of mammals from Sri Lanka. Although written for amateur naturalists with an interest in wildlife, I think professional mammalogists will find this book a necessary addition to their library. It may well take another 8 decades before another significant edition is forthcoming on this unusual fauna that is begging to be studied.

—Burton K. Lim, *Department of Natural History, Royal Ontario Museum, 100 Queen's Park, Toronto, ON M5S 2C6, Canada; e-mail: burtonl@rom.on.ca.*

Literature Cited

Eisenberg, J. F., and M. Lockhart. 1972. An ecological reconnaissance of Wilpattu National Park, Ceylon. Smithsonian Contributions to Zoology 101:1–118.

Heads, M. 2010. Evolution and biogeography of primates: a new model based on molecular phylogenetics, vicariance and plate tectonics. Zoologica Scripta 39:107–127.

Kelaart, E. F. 1852. Prodromus faunae Zeylanicae being contributions to the zoology of Ceylon. Observer Press, Colombo, Ceylon.

Meredith, R. W., et al. 2011. Impacts of the Cretaceous terrestrial revolution and KPg extinction on mammal diversification. Science 334:521–524.

O'Leary, M. A., et al. 2013. The placental mammal ancestor and the post–K-Pg radiation of placentals. Science 339: 662–667.

Phillips, W. W. A. 1935. Manual of the mammals of Ceylon. Ceylon Journal of Science, Colombo National Museum. Colombo, Sri Lanka.

Spaulding M., M. A. O'Leary, J. Gatesy. 2009. Relationships of Cetacea (Artiodactyla) among mammals: increased taxon sampling alters interpretations of key fossils and character evolution. PLoS One 4(9):e7062. doi:10.1371/journal.pone.0007062.

Vidya, T. N. C., R. Sukumar, and D. J. Melnick. 2009. Range-wide mtDNA phylogeography yields insights into the origins of Asian elephants. Proceedings of the Royal Society of London, B. Biological Sciences 276:893–902.

Wilson, D. E., and D. M. Reeder (eds.). 2005. Mammal species of the world: a taxonomic and geographic reference. 3rd ed. Johns Hopkins University Press, Baltimore, Maryland.