

Book reviews

Extinctions: Living and Dying in the Margin of Error by Michael Hannah (2021) 325 pp., Cambridge University Press, Cambridge, UK. ISBN 978-1-108-84353-9 (hbk), GBP 20.00.

Each year I teach a class on extinction, more specifically on how we know when a species is extinct and the uncertainties associated with this. After this year's class a student came up to me and during our discussions on various aspects of extinction they pointed out that often in conservation we talk about extinction without appreciating what it really means, as though it is just a binary state or something nebulous hanging over us. Michael Hannah's book, *Extinctions: Living and Dying in the Margin of Error*, is therefore a welcome antidote to this situation by providing a deeper understanding of the five mass extinction events (often referred to as the Big Five) and how they relate to the Anthropocene.

Hannah's book is carefully written, providing the reader with an understanding of the geological time scale, how the different spheres (atmosphere, hydrosphere, geosphere and biosphere) interact and how diversity in the fossil record is measured, before diving into how mass extinction events are identified and the potential causal factors. As there are, or have been, uncertainties around various aspects of mass extinctions, Hannah is careful to discuss all competing hypotheses before explaining on which side of the fence he falls (although sometimes he appears to be sitting on the fence). It is this level of detail, the building-up of the reader's understanding and the precision of the writing, all supported with numerous references for further reading, that makes this a standout book on extinction. Hannah's writing style reminds me of one of those teachers who captures their students' attention and is always remembered for their engaging delivery. You know it is a good book when you have to put it down and text a friend to discuss a potential idea it has just sparked in you.

There are nevertheless a couple of points that I found frustrating. The first is rather minor: Hannah suggests there were more than five mass extinction events, in fact over a dozen, but he says little else about them. I was therefore left wondering: When did these events occur? Were they clustered in time or distributed throughout the history of life on Earth? What do we know or not know about them?

The second frustration is bigger. The book does well up until the last chapter or two, where Hannah applies the knowledge from the previous chapters to the current Anthropocene,

starting off with the megafauna extinctions during the Pleistocene. The take-home message seems to be that although vast numbers of species became extinct during the Big Five, life itself survived and that will most likely also be the case with the Anthropocene. Not to finish on too positive a note, Hannah suggests that if we do not act swiftly to counter anthropogenic extinctions, we will have caused a mass extinction unlike any of the previous Big Five. To me, this appeared as though he wanted to use the Big Five as a warning but fell somewhat short of this goal. I think this is because the previous chapters consider mass extinctions at the geological time scale, something Hannah frequently emphasizes, whereas we are living day by day (not millennium by millennium) in the Anthropocene. Despite these shortcomings, I would recommend the book to those interested in conservation who wish to get a big picture—a really big picture—on extinction and start thinking about not only how human activities are defining the Anthropocene, but how the effects of these activities are unprecedented and how they fit within the history of life on Earth.

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All Asian Primates by Sylvain Beauséjour, Anthony B. Rylands, Russell A. Mittermeier (2021) 536 pp., Lynx Edicions, Barcelona, Spain. ISBN 978-1-7372851-1-3 (pbk), EUR 55.00.

All Asian Primates is a remarkable source of up-to-date information about all 193 species of primates that occur across Asia. The book is organized in a systematic and user-friendly manner, with content divided into five sections, each dealing with one family of primate species. Each section introduces the family with a colour-coded map showing the distribution of its species, and a reference list is included at the end of each section.

Each species is presented on two pages: one with coloured photographs and the other with detailed information on taxonomy, threats and conservation status, supplemented with range maps. Taxonomic information also includes the phylogenetic relationships with other species, such as how and when a species deviated from its close relatives, probable hybrid populations and morphological variations.

The copious, brilliant photographs are a standout feature of this book. Whenever possible, the authors have included images of adult individuals, infants and juveniles, allow-

ing readers to identify even subtle variations in morphology and colouration. Some pages feature images of several individuals to illustrate variations, such as differences in the facial colouration shown for the moor macaque *Macaca maura*. This, together with the side-by-side layout of the description and photographs, and that closely related species are placed near each other, facilitates comparison of and differentiation between various species and subspecies. For example, without the photographs, differentiating between the black and brown form of the crested macaque *Macaca nigra* would be challenging. Species for which photographs are not available, such as the dark crowned long-tailed macaque *Macaca fascicularis atriceps* or Natuna Islands silver langur *Trachypitecus cristatus vigilans*, are illustrated with realistic paintings.

The conservation section provides information such as any legal protection status, CITES listing, relevant protected areas and the population trend for each species. For example, the dramatic drop of the Hainan crested gibbon *Nomascus hainanus* from 2,000 individuals in 1950 to only 13 in 2003, and the absence of protected areas for the Tapanuli orangutan *Pongo tapanuliensis*, of which only 800 persist in the wild, highlight the urgency of conservation action for these Critically Endangered species. Past, current, long-term and area-specific threats are described in detail, making these sections useful for developing conservation initiatives. For instance, habitat loss is a major threat for the Sumatran orangutan *Pongo abelii* across its range, whereas uncontrolled hunting and the pet trade are the major concerns for the Yunnan lar gibbon *Hylobates lar yunnanensis* in China and the Siamang *Symphalangus syndactylus* in Indonesia, respectively. The IUCN Red List status and the year of the last assessment are listed for each species, and the book indicates which species require immediate protection. The number of species assessed as Data Deficient (8%) or not assessed at all (12%) highlights the need for more research on many species.

There are a few aspects of the book that could be improved. Firstly, some of the range maps would be better if they zoomed in on specific locations. For example, the ranges of the Natuna Islands silvered langur *Trachypitecus cristatus vigilans* and the western cross-marked langur *Presbytis chrysomelas* are very small, represented on the maps by small dots that are easily missed. Secondly, some of the colour coding would benefit from an explanation; e.g. the range of the rhesus macaque *Macaca mulatta* is shown with

red and blue sections, but the colour coding is not explained. Thirdly, the structure of the descriptive text is not always consistent: for most species, information on threats and conservation are presented in separate paragraphs, but these are missing for some species, creating the impression that these are not threatened or do not require conservation action. Finally, some citations do not have corresponding references.

Overall, *All Asian Primates* is an excellent reference book that I would recommend to researchers and students working in primate conservation.

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Climate Ghosts: Migratory Species in the Anthropocene by Nancy Langston (2021) 208 pp., Brandeis University Press, Waltham, USA. ISBN 978-1-68458-065-1 (pbk), USD 29.95.

I have always been fascinated by migratory species, especially birds, so this book captured my attention. What happens to migratory birds when they leave an area is a question that has long intrigued people. The ancient Greek philosopher and scientist Aristotle thought that some birds hibernated or transformed into different species as winter approached. People believed this for centuries until scientists started to unravel the mystery of bird migration in 1899, when birds were first ringed for scientific purposes. Today, migratory species face numerous threats such as habitat loss and degradation, illegal hunting and climate change.

In *Climate Ghosts*, environmental historian Nancy Langston focuses on three migratory species in the Great Lakes watershed in North America: the woodland caribou *Rangifer tarandus caribou*, common loon *Gavia immer* and lake sturgeon *Acipenser fulvescens*. The term ghost species is used to describe species that are not completely extinct, but extirpated from an area where they once occurred, and to which they could—if the right actions are

taken—potentially be restored. The book is organized into five chapters: Chapter 1 introduces the three species in the context of their natural environment and the challenges they face in the Anthropocene. Chapter 2 talks about the history of the woodland caribou in the upper Great Lakes and Chapter 3 deals with the effects of a warming world on this species. In Chapter 4 we learn about the Indigenous communities and efforts to restore the lake sturgeon, and Chapter 5 is about the common loon.

The caribou, loon and sturgeon are all of particular importance to the Native communities in the region, who have long considered them to be their non-human relatives, not merely resources to be exploited. The European colonization of North America, however, led to a dramatic drop in their populations, through uncontrolled hunting, development, commercial fishing, habitat loss, pollution and climate change. For example, rising temperatures lead to an increase in wildfires in boreal forests, resulting in the destruction of ground lichens that the caribou feed on during winter. There have been efforts to restore these species, some of which have been more successful than others.

The book provides historical references on the three species, their habitats and migrations, the effect of predators, and their significance for and relationships with the region's Indigenous people. It also highlights the human activities that have negatively affected both wildlife and local communities. For example, sturgeons are seen as a spiritual gift by the Indigenous community in the Upper Great lakes, and their vanishing led to a profound sense of spiritual loss. Similarly, many of the northern cultures associated loons with vision, possibly because of the birds' bright red eyes in the breeding season, and saw in them a reminder for people to treasure the natural world they see.

Historical information, dating back several centuries, is skilfully combined with details on present and planned restoration actions, providing insights into the past, present and possible future of these threatened species. The core challenge for the caribou is described as

trying to survive in a world in which populations of their predators, such as wolves and bears, have been partially restored, but the habitat connections and corridors that historically allowed caribou herds to migrate over vast distances and escape those predators have not been repaired. In an effort to save the rapidly dwindling population, caribou were translocated to potentially suitable areas, but an ecosystem approach was not employed. As a result, a restoration effort known as the Big Bog Project was deemed unsuccessful: the caribou were unable to move freely because their habitat remained fragmented, and Indigenous rights and relationships with nature were not considered.

The case of the lake sturgeon is described as more hopeful. Historically plentiful and an important food source for the Menominee tribe in the spring, lake sturgeons could no longer move upstream after two dams were constructed on the Wolf River, in the 1880s and 1920s. In a collaborative effort between the Menominee tribe and Wisconsin Department of Natural Resources to reintroduce the species to its historic spawning grounds at Keshena Falls, more than 100 adult sturgeons were transferred upstream, beyond the dams, in the hope that the fish would continue their migration. In the spring of 2012, sturgeons were observed spawning at Keshena Falls for the first time in over 100 years.

Nancy Langston's main argument in this book is that restoration of these species and of the Indigenous culture requires a collaborative and holistic approach. The book helped me understand that integrating Indigenous knowledge with western scientific research, often referred to as 'two-eyed seeing', is essential to protect species and habitats effectively, and to ensure a sustainable future. Throughout the book, the prose flows well and without complex jargon, making this an enjoyable and accessible read. I would highly recommend *Climate Ghosts* to anyone interested in migratory species and climate change.

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