

## **The Lost World of the Moa: Prehistoric Life of New Zealand**

Author: James, Helen F.

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*Archaeopteryx* is a part-time shorebird, an occasional climbing bird, and an archosaurian "cat" ... (p. 167).

However, Paul's main theme is "Were some dinosaurs also neoflightless birds?" (chapter 11), and he argues that dromaeosaurs, troodonts, oviraptorosaurs, therizinosaurs, and ornithomimids all have characters expected in neoflightless birds. His arguments, however, are narrative and he rejects cladistics as a methodology. "Cladistics will be a useful but limited tool for further investigating the neoflightless dinosaur hypothesis" (p. 254), and "The limits of cladistic methodology mean that no matter what the results of contemporary cladistic analyses or investigations of flight heritage are, in the end, only an improved set of transitional fossils will reveal the actual situation" (p. 255). Paul summarizes, "Protarchaeopteryx, dromaeosaurs, troodonts, caudipterygians, oviraptorosaurs, and therizinosaurs provide telling evidence of having descended from fliers more advanced than *Archaeopteryx*" (p. 257).

Much of the remainder of the book is dedicated to phylogenies, the Mesozoic, extinctions, and the Cenozoic. That discussion is followed by a series of appendices with character lists and other associated information on anatomy, locomotion, etc. The discussion is full of convoluted statements that are difficult to grasp, such as "the global archosaur fauna was not healthy," and "A nonlinear, chaotic response to these environmental perturbations may have exaggerated what should have been survivable events..." (p. 301). In the discussion on the Cenozoic, Paul states that "The skull of *Diatryma* appears similar to that of the terror bird *Phorusrhacos*... but is even more similar to the shoebill stork... and that of the possibly herbivorous dromornithid *Bullockornis*..." (p. 308). First, the skulls of those birds are totally and dramatically dissimilar, and second, does this mean that the shoebill (*Balaeniceps*) is extinct? Such statements do not lend much confidence to Paul's anatomical comparisons of archosaurs and theories of origins based on paleontological morphology.

Despite its faults and the perception of a Disney-like fantasia produced by his freelance creative artwork, Paul's thesis, that certain birdlike terrestrial dinosaurs may be secondarily flightless birds deserves attention, and recent analyses provide evidence that *Caudipteryx* and oviraptorosaurids may well be birds (Jones et al. 2000, Maryanska et al. 2002). Too, S. Czerkas (2002) has theorized that all the Dromaeosauridae may be a lineage of secondarily flightless birds, but derived from a predinosaur, a basal archosaur, not part of the theropod assemblage. In addition, the recently described four-winged dinosaur from China (Xu et al. 2003) appears to be much more birdlike than dromaeosaurlike, and its supposedly diagnostic dromaeosaur tail (also like that of a ramphorhynchoid

pterosaur) and claws bear little close resemblance to those of the typical dromaeosaurs such as *Deinonychus* and *Velociraptor*. Are these early Cretaceous Chinese fossils actually remnants of the early avian radiation, which also produced secondarily flightless forms such as *Caudipteryx*? We must keep an open mind to bizarre possibilities, and certainly Paul's book will encourage all interested in this topic to begin thinking out of the box.—ALAN FEDUCCIA, *Department of Biology, University of North Carolina, Chapel Hill, North Carolina 27599-3280, USA. E-mail: feduccia@bio.unc.edu*

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**The Lost World of the Moa: Prehistoric Life of New Zealand.**—T. H. Worthy and R. N. Holdaway. 2002. Indiana University Press, Bloomington and Indianapolis, Indiana. xxxiii + 718 pp, 145 figures, 97 black and white photographs, 61 tables, 4 appendices, bibliography, index. ISBN 0-253-34034-9. Cloth, \$89.95.—The study of New Zealand's ancient birdlife got an early start when Sir Richard Owen announced in 1840 that the islands were once inhabited by giant wingless birds—the moa. Bones of elephant birds from Madagascar were not reported in the literature for another 11 years, and in Hawaii the first fossil bird was described 103 years later, for comparison. Owen requested more bones to examine from New Zealand, and New Zealanders quickly obliged, eventually

bringing a multitude of remains from archaeological and paleontological sites into museum collections and publishing a large literature on them. The upshot, it is fair to say, is that the study of Quaternary island birds is now far more advanced in New Zealand than it is for any other major island group. In this book, the two most prolific current practitioners in the field offer a thorough review and update on what has been learned.

In monographic detail, the book covers the terrestrial birds in the Quaternary of New Zealand, treating moa, kiwi, waterbirds, raptors, rails, shorebirds, and the remaining land birds in turn. Seabirds in the terrestrial environment get a short chapter, as do bats, lizards, and frogs combined. The geographic coverage includes the Chatham Islands, Lord Howe, Norfolk, and the sub-Antarctic islands of the region. Following the systematic section, two concluding chapters offer a broader view of the region's Quaternary faunas and their decline. The fundamental questions that Worthy and Holdaway pose in the book are: What species composed the regional vertebrate faunas of the Quaternary in New Zealand? How were vertebrate species affected by Quaternary climatic shifts? What life-history attributes, ecological roles, and habitat preferences did the extinct species have? What caused them to become extinct?

The authors naturally devote more space to the fossil taxa that they have studied most intensively: Moa for Worthy and Haast's Eagle (*Harpagornis moorei*) for Holdaway. The enormous Haast's Eagle was more massive than any living eagle and had an elongate, vulture-like skull. Nevertheless, the authors argue at length and convincingly that it was not primarily adapted for scavenging; rather, it was morphologically suited to be a powerful predator capable of taking the largest moa. A photograph of a pelvis of *Dinornis giganteus* (the largest moa) that was clearly pierced by enormous talons certainly supports their functional anatomical interpretation. The authors devote three chapters and two appendices to the 11 species of moa, covering everything from moa postures, to diagnoses and descriptions of bones, to age and sex ratios within species. With the large samples of moa bones now available to them, they are even able to document a pattern of size diminution within species lineages from the last glacial maximum to the Holocene epoch.

Attention to the historical development of knowledge is a hallmark of the book. The opening chapter gives the history of discovery of the islands' Quaternary fossil record, including brief biographies of those who contributed to the record's early elucidation and a chronology of fieldwork at the major fossil sites. In the systematic section, Worthy and Holdaway meticulously document the history of discovery and classification of each extinct species. By blending the history of discovery with comparative anatomy and

ecological interpretation, the authors have created a narrative that I found very readable and that both lay readers and professionals should enjoy. Adding to the allure of the book are the many black-and-white figures showing bones, fossil sites, mounted skeletons of extinct birds, artists' depictions of the extinct birds in life, historic photographs of excavations and museum displays, and many exquisite old anatomical illustrations from Owen's publications and other sources.

The data presented in the book emphasize knowledge gained from the study of bones. Tables of bone measurements are provided for most species. There are also histograms of bone measurements showing evidence of sexual size dimorphism, comparative morphometric analyses, estimates of body mass, phylogenetic analyses, maps showing species distributions in 301 South Island fossil sites, dietary analyses based on damage by predators to the bones of prey species, and faunal analyses based largely on pellet accumulations from ancient owl roosts. The extent of knowledge about New Zealand's extinct fossil birds will surely surprise most readers. To me, and no doubt to others working in island paleontology, the progress that this book summarizes is simply inspirational.

When discussing sources of information about the past, other than old bones, the authors generally do not include supporting data. To give two examples, the discussion of the former distributions of vegetation zones is not accompanied by paleobotanical data, and the book quotes very few radiocarbon dates even though the discussion often hinges on chronology. It was clearly the authors' intent to treat those topics in a style suitable for a lay audience. Because of that, professional readers will be grateful that Worthy and Holdaway included an extensive bibliography of Quaternary paleobiology in New Zealand, a valuable entrée to a literature that can be difficult of access for outsiders. The archaeological perspective on moa hunting is likewise not presented in depth here; the best single source on human interactions with moa is still A. Anderson's (1989) excellent book, *Prodigious Birds*.

In all, a phenomenal 66 species of Quaternary birds from the New Zealand region are now globally extinct. It is increasingly clear that most of these birds were lost after humans began visiting and eventually settled New Zealand, between 2,000 and 700 years ago. As the authors explain, debate about causes of extinction now centers on ecological changes associated with initial human settlement of the islands, as opposed such "natural" phenomena as climate change and species senescence.

In recent papers, Holdaway, Worthy, and their coauthors have invigorated this debate by advocating that predation alone caused the extinctions, a perspective they strongly promote in the book. They attribute the extinction of moa to blitzkrieg-like over-

harvesting by prehistoric human hunters. To account for prehistoric extinctions of smaller species that are unlikely quarry for humans, they make the intriguing argument that the invasive kiore or Pacific rat (*Rattus exulans*) played a predatory role in New Zealand similar to the role that the brown tree snake (*Boiga irregularis*) has famously played on Guam. Radiocarbon dates suggest that the rat was transported to New Zealand on Polynesian sailing canoes as many as 2,000 years ago, and may have caused an early wave of extinctions before humans had begun to earnestly settle there.

It is important to realize that the extinct and extirpated vertebrates studied by Worthy and Holdaway are properly part of the modern fauna of New Zealand. Their former ecological roles must be taken into account if we are to understand natural ecological structure and function in New Zealand's remaining native habitats. From a global perspective, the book contributes to understanding of the causes of avian extinctions and the roots of the current biodiversity crisis. It consequently has great value for modern ecologists and conservationists, as well as for those who are curious about the past.—HELEN F. JAMES, *Division of Birds, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20013-7012, USA. E-mail: james.helen@nsmnh.si.edu*

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**Handbook of the Birds of the World, Volume 7.**—Josep del Hoyo, Andrew Elliott, and Jordi Sargatal (Eds.). 2002. Lynx Edicions, Barcelona, Spain. 613 pp., 70 color plates, 317 photographs, 408 distribution maps. ISBN 84-87334-37-7. \$185.00.—Inaugurated 11 years ago, publication of this elegant series is now approaching the halfway mark with the appearance of volume 7, which includes two families of the Galbuliformes (Galbulidae, Jacamars; Bucconidae, Puffbirds) and four families of the Piciformes (Capitonidae, Barbets; Ramphastidae, Toucans; Indicatoridae, Honeyguides; Picidae, Woodpeckers). Thus, all nonpasserine groups have now been covered. Useful pictorial and alphabetical indices, mounted in

plastic on a single sheet, are included with the book as a loose insert. Those indices cover all taxa that comprise the first seven volumes. The remaining 9 volumes on passerines will extend the projected total to 16, allowing more extensive treatment in view of the burgeoning literature and the increasing availability of high-quality illustrative material. (The original intention of holding the series to 12 volumes was abandoned after a massive response to a questionnaire included with volume 6 [almost 3,000 replies from over 40 countries!] indicated an overwhelming preference for expanded coverage.)

Following a theme instituted in earlier volumes in which special topics are reviewed in major essays, volume 7 starts with an elaborate 57-page foreword by E. Fuller on recently extinct birds (starting with the year 1600), introduced with a life-size color photo of an egg of the Great Elephantbird (*Aepyornis maximus*). Most species that are certainly extinct or probably extinct are illustrated in color. A worthy discussion of "Hypothetical Species and Mystery Birds" illuminates the serious problems attending taxonomic allocation of recently extinct birds, not the least of which has been the suspect original "naming" of more than a few entities on the basis of skimpy specimens, sketches, or paintings by early traveler-naturalists with no real ornithological qualifications. Further, some "extinct" and other mystery birds have turned out, upon inspection, to be hybrids. Fuller's scholarly essay is an exceptionally fine read.

As an international enterprise, 10 authors wrote this volume, including D. Christie, N. Collar, E. Fuller, J. Horne, T. de Melo-Júnior, P. Rasmussen, L. Short, J. Tobias, H. Winkler, and T. Züchner. Sixteen illustrators prepared the color plates. W. J. Bock and N. J. Collar served as consultants for systematics and nomenclature and status and conservation, respectively.

The heart of the book follows the successful format established early in the series, in which each family is introduced by a substantial essay dealing with systematics, morphology, habitat, general habits, voice, food and feeding, breeding, movements, relationships with humans, and status and conservation. Many species, including rare and little-known forms, are highlighted by vivid color photographs whose long captions describe special features of appearance, natural history, and behavior. The plates are uniformly magnificent. These are typically positioned on the left to face the first cluster of species accounts placed on the right and on pages to follow, enabling rapid comparison of appearance and text.

The species accounts follow the now-familiar format of organization under the English vernacular name and scientific binomial followed by French, German, and Spanish translations, other English common names, if any, and principal categories for taxonomy, subspecies and distribution, habitat, food