Reviews

EDITED BY CARL D. MARTI

The following critiques express the opinions of the individual evaluators regarding the strengths, weaknesses, and value of the books they review. As such, the appraisals are subjective assessments and do not necessarily reflect the opinions of the editors or any official policy of the American Ornithologists' Union.

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The Origin and Evolution of Birds.—Alan Feduccia. 1996. Yale University Press, New Haven, Connecticut. x + 420 pp., numerous text figures and black-and-white photos, 11 tables. ISBN 0-300-06460-8. Cloth, $ 55.00.—In spite of the similarities in the chapter headings, Alan Feduccia's new *The Origin and Evolution of Birds* is not a revised edition of his excellent 1980 book *The Age of Birds.* Rather, it is a completely rewritten and enlarged new book dealing with the origin and evolutionary history of birds using all available recent evidence from fossil and recent birds. The new book is well over twice as large as the first one, reflecting the great increase in our knowledge of avian fossils since the end of the 1970s. The *Origin* contains much additional information, many more illustrations, and at least five times as many citations than the *Age* and is in every way a greatly improved analysis of the origin and evolutionary history of birds. If the *Age* was an excellent book, the *Origin* is an outstanding one. High opinion for *The Origin and Evolution of Birds* is definitely shown by its being given the prestigious and well-deserved 1996 Association of American Publishers Award for "Professional and Scholarly Publishing."

Without doubt *The Origin and Evolution of Birds* will be an important reference and source book for all ornithologists and others interested in the evolution of birds until Alan Feduccia publishes the next volume in this series. And, indeed, he should be planning the next volume at this time because of the ever increasing rate of discovery of new avian fossils and of new information on the origin and evolutionary history of birds.

When the *Age* was published in 1980, avian fossils from the Mesozoic were limited to *Archaeopteryx, Hesperornis, Ichthyornis,* and a small number of other poorly known genera, such as *Gobipteryx* and *Alexornis.* Since then the flood gates have opened with the recognition of a new subclass of birds, the Enantiornithes or "opposite birds," and a plethora of new Cretaceous forms as well as the Triassic *Protoavis.* Many of these new fossils are almost complete skeletons, and some are very common, as shown by the discovery of dozens if not hundreds of excellent specimens of the early Cretaceous *Confusiusornis*-like fossils from China. Few of these new Mesozoic avian fossils include feather impressions, but some have excellent impressions of flight, tail, and contour feathers. These new fossil finds have not provided much new information on the origin of birds beyond that known from *Archaeopteryx,* but they strongly suggest completely new pictures for the radiation of birds during the Mesozoic as well as for the initial radiation of modern birds at the beginning of the Cenozoic. Unfortunately, Feduccia was faced with a major difficulty in dealing with this wealth of new material because most of these new important finds have not been adequately prepared, studied, and described. What is available in the literature is information sufficient only to support naming of the fossil under the rules of zoological nomenclature and a general idea of its placement in the accepted highest-level avian taxa.

The *Origin* can be divided into two major parts, the first (pp. 1–166) deals with the origin of birds and their evolution through the Mesozoic, and the second (pp. 166–373) with the radiation of modern birds in the Cenozoic It ends with an extensive bibliography (33 pages) and an index. The split between these two parts comes in the middle of Chapter 4; it would have been better to divide this chapter into two. The first part is further subdivided into a section dealing with *Archaeopteryx* and the origin of flight (Chapters 1 and 3), the origin of birds from reptiles (Chapter 2), and the diversity of Mesozoic birds (half of Chapter 4). Organization of this volume would have been better served with a greater number of shorter chapters rather than the eight larger and heterogeneous chapters with identical headings, except for minor word changes, to those in the *Age.*

Feduccia's treatment of the earliest birds and the origin of flight is well presented and supported by the available evidence. He argues for avian flight evolving "from trees downward" rather than "from the ground up," and for the origin of feathers being associated with flight. I disagree with the latter and would argue that the origin of feathers was associated with thermoregulation and secondarily con-

nected with flight (Bock and Bühler, *Archaeopteryx* 13:5–13, 1995). However, there is little empirical evidence to permit a choice between these two historical explanations; the difference between these interpretations depends largely on consideration of the significance and role of homoiothermy in avian evolution. The Jurassic *Protoavis* deserves a more complete discussion regardless of whether one believes that it is avian or proto-avian. But here again, Feduccia was hampered in his treatment because the major descriptive paper on the postcranial skeleton of *Protoavis* has not yet been published, and most of the best evidence for avian relationships of this fossil comes from the postcranial skeleton. The title of this chapter is a misnomer because birds are no more "feathered reptiles" than mammals are "hairy reptiles" or reptiles are "scaly amphibians" or amphibians are "legged fishes."

Chapter 2 ("The Descent of Birds") is the source of all the controversy surrounding this volume, virtually all of it arising from cladists/dinosaurian paleontologists. Ever since the 1870s, no one has disagreed with T. H. Huxley's conclusion that birds evolved from the great archosaurian radiation. But it is an entirely different matter to narrow this conclusion down to one of the subgroups within the archosaurian reptiles. Following Heilmann and others, many workers accepted the conclusion that birds descended from the basal thecodont complex. Others, and more increasingly over the past quarter century following the analyses of John Ostrom, argued that birds descended from the theropod dinosaurs of the order Saurischia, and specifically from the dromaeosaurs that are advanced members of this group and represent a Cretaceous radiation that occurred some 30 million years after *Archaeopteryx*. Indeed, the most bird-like theropods come from the latest part of the Cretaceous. This phylogenetic conclusion is coupled in part with the conclusion that avian flight evolved from the ground up rather than from the trees down. Moreover, supporters of the theropod theory have used this presumed relationship between birds and dinosaurs to postulate the existence of many avian attributes in dinosaurs, including homoiothermy, nesting behavior, and recently the presence of feathers. Feduccia presents an impressive analysis of the features and arguments to support the theropod ancestry of birds and contends that the evidence and the methods of cladistic analyses used to support this conclusion are seriously lacking; hence, he has incurred the wrath of cladists and dinosaurian paleontologists in a number of reviews. I would support Feduccia's position completely and in a wager on the theropod ancestry of birds, I would bet against it. There are simply too many problems, including the good possibility that Chatterjee is correct in his conclusion that the late Triassic (225 million YBP) *Protoavis* is an ancestral bird. If confirmed as an ancestral bird, *Protoavis* would extend the known avian fossil history and the origin of birds to the very beginnings of the dinosaurs and into the age of the basal thecodonts of the archosaurian radiation. The age of *Protoavis* predates those theropods used to support the theropod ancestry of birds. One can only reject the ad hoc statement of some dinosaurian paleontologists that if *Protoavis* is a bird, then this simply means that the fossil record of the coelurosaurian and other "bird-like" theropods extends well back into the Triassic.

The simple fact is that at present, the evidence needed to narrow the ancestry of birds beyond the archosaurian radiation is lacking. Perhaps the major shortcoming is insufficient analyses of the thecodonts, which have remained rather poorly known. Until we have intensive studies of the morphology and possible relationships of the thecodonts and of the early members of the crocodiles and of the two orders of dinosaurs, any discussion of avian ancestry within the archosaurs simply is not possible.

Feduccia presents a thorough review of the known radiation of Cretaceous birds considering the lack of detailed descriptions of many of these fossils. Moreover, recent papers by Evgeny Kurochkin (e.g. *Archaeopteryx* 13:47–66, 1995) appeared too late to be included in Feduccia's analysis. Kurochkin was able to examine most of the Mesozoic avian fossils, more than any other worker I know of, and presented a tentative classification and phylogeny of the major taxa of birds. General consensus exists that *Archaeopteryx* and the Enantiornithes are grouped together into the Sauriurae with all other birds placed in the Ornithurae. At this time, available evidence suggests that *Protoavis*, whether placed in a separate subclass or not, is closer to the base of the Ornithurae than it is to the Sauriurae. Feduccia's discussion of the Enantiornithes is an excellent review of this little-known but important radiation of Cretaceous birds; yet, he can do no more than to present a tantalizing glimpse into this fascinating group of fossil birds that was unknown when the *Age* was published. The "opposite birds" comprise a diverse ecological/morphological radiation of birds found throughout the world and lasting until the end of the Cretaceous, and they include most of the known genera of fossil Cretaceous birds. Clearly, our understanding of avian evolutionary history will remain seriously incomplete until this group is better known, and this will not happen until these fossils are properly prepared and described fully.

Perhaps one of the most interesting ideas in this book is the bold hypothesis advanced slightly earlier by Feduccia (*Science* 267:637–638, 1995) that birds suffered extensive extinction at the end of the Cretaceous and that modern birds evolved as an explosive radiation in the early Cenozoic. This hypothesis was based on an analysis of the neognathous birds, which constitute a large majority of modern birds; the palaeognathous families are difficult to appraise

because their relationships to other neornithine birds are still unknown. Feduccia's model is based on only a single group of neognathous birds—the "transitional" shorebirds—that survived the extinction at the end of the Cretaceous and gave rise to the Cenozoic radiation. Kurochkin's analysis of avian relationships places the Palaeognathae and the Neognathae as parvclasses in the infraclass Neornithes, which had their origins early in the Cretaceous rather than splitting after the beginning of the Cenozoic. Kurochkin's classification and phylogeny of Mesozoic birds also must be considered as tentative and requiring much confirmation. Yet, even if confirmed, Kurochkin's conclusion of early avian evolution would modify Feduccia's hypothesis only to the extent that two lineages of Neornithes survived the Cretaceous extinction. But this difference does not modify the basic tenet of Feduccia's extinction model with modern birds radiating from a narrow base at the beginning of the Cenozoic. Feduccia's account of the history of modern birds is a novel and most bold conjecture, and it is supported by the currently known avian fossil record. Most significant is the lack of neornithine fossils, especially of the diverse neognathous aquatic birds before the beginning of the Cenozoic, in spite of the fact that the latter part of the Cretaceous has yielded numerous aquatic enantiornithid, hesperornithid, and ichthyornithid fossils. Feduccia's conclusion is simple—these groups of neornithine birds were not extant before the beginning of the Cenozoic. Feduccia's extinction hypothesis is most interesting and deserves careful attention, but a much more complete fossil record is needed before it can be considered to be well tested.

A significant part of Feduccia's argument supporting his extinction hypothesis is based on a most important, but inadequately discussed and appreciated recommendation first presented by Storrs Olson (*Smithsonian Contributions to Paleobiology* 35:1–33, 1977). Olson cautions most strongly against identifying avian fossils from the Paleogene and Cretaceous based on fragmentary limb elements, having shown that many of the limb elements of the Eocene frigatebird *Limmofregata* possess morphologies closely resembling those of a diversity of modern families or are sufficiently unique to be considered to represent an unknown group if found as isolated elements. Basically, almost all Paleocene/Eocene avian fossils are mosaics, combining the features of several or more orders of birds. Unfortunately, this critical idea of the mosaic nature of Paleogene fossils has not been further analyzed by Olson or any other avian paleontologist. And Feduccia does not give it the significance it deserved as his discussion is brief and buried within the section "Late Cretaceous Extinctions and 'Transitional shorebirds'" without a separate heading. Yet, Feduccia appreciates fully the importance of Olson's earlier recommendation and follows it throughout his discussion of avian history at the Cretaceous-Cenozoic boundary. Feduccia quite rightly questions the identification of neognathous birds from the Cretaceous based on single bony elements, and demonstrates that a number of these identifications have later been shown to be members of the hesperornithids or other strictly Cretaceous groups. Only the transitional shorebirds or graculavids bridge the boundary between the Cretaceous and the Cenozoic, and Feduccia argues that this group gave rise to the known diversity of neognathous orders in an explosive radiation.

The second part of the *Origin* provides an excellent treatment of the fossil history of modern birds. Contrary to the widely held belief that fossil birds are rare and scattered, Feduccia demonstrates the existence of a wealth of information. Diverse avifaunas are known from several Eocene localities, although the identification of some of this material is tentative because of their isolated remains and the mosaic nature of early neognathous birds. What appears to be lacking is a good avian fossil record from the Paleocene, the period of the presumed explosive radiation of these birds. Unfortunately, the available fossil record still provides almost no information on the evolution and relationships of avian orders and rather little about the affinities of the families within these orders. Because one of the characteristic attributes of birds is flight, biologists have been fascinated by flightlessness in birds, and Feduccia presents a long and detailed account of this phenomenon and of the diverse groups of flightless birds. I found this to be the most interesting chapter in the second half of the book. Even if one knows about the wide diversity of flightlessness in birds, it is always impressive to read a summary of flightless birds and to be reminded that the largest dromornithids of Australia equaled or exceeded the size of the elephantbirds (*Aepyornis*) of Madagascar. Unfortunately, the exciting new fossil birds from the Mesozoic discovered over the past two decades have overshadowed the Cenozoic fossils found for the past half century and the immense work done with them. Yet, it is clear from a careful reading of Feduccia's account of the fossil history of modern birds that a wealth of material exists and that much work remains to be done on these fossils with innumerable possibilities for new and better interpretations of the material. Feduccia's account of Allison Andors's redescription and re-interpretation of the well-known *Diatryma* as a browsing herbivore possibly related to the gallo-anseriform complex is an excellent example, as is Peter Houde's grouping of several Paleogene genera into the Lithornithidae as a taxon of North American-European primitive, flying palaeognathous birds. And Feduccia's discussion of the phorusrhacids shows that this is another fascinating group of avian fossils desperately in need of intensive revision.

The negative comment I have of this book is the responsibility of the publisher. My review copy has

the front cover half torn from the rest of the binding. But most serious are the illustrations. Although the tables are numbered, the illustrations lack a numbering system so that it is not possible for future workers to refer easily to a particular illustration. Most importantly, the reproduction of the illustrations is poor with many being too small, too dark, or too mushy (lacking in clarity), with the result that much of the important detail of these illustrations cannot be seen. The poor reproduction of many illustrations is regrettable because of the effort put into this project by Feduccia to support his text with an excellent and full series of illustrations. I hope that when this book is reprinted, the publishers will use a better process to reproduce the original art work.

The Origin and Evolution of Birds is the best analysis available by far of this subject. Not only should it be on the bookshelves of all ornithologists and biologists, both professional and amateur, who are interested in fossil birds and their evolution, it should be read carefully. Alan Feduccia should be congratulated not only for the immense work he put into analyzing the avian fossil record, but for dealing directly and fully with numerous controversies associated with the origin of birds, the evolution of avian flight, and the methods used in these inquiries. Moreover, the *Origin* is an interesting book because Feduccia points out again and again that there still is much engrossing work to be done on the known avian fossils, not to mention the many new ones we hope will be discovered over the next decade. Avian paleontology is a booming field within ornithology, and I hope that the *Origin* will stimulate avian biologists to undertake these needed studies. But most of all, I hope that Alan Feduccia is continuing to gather material for yet another synthesis of the avian fossil record, and I look forward to future volumes in the series of *The Age of Birds* and *The Origin and Evolution of Birds*.—WALTER J. BOCK, *Department of Biological Sciences, Columbia University, New York, New York 10027, USA.*

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Control of Bird Migration.—Peter Berthold. 1996. Chapman and Hall, London. ix + 355 pp., 99 text figures. ISBN 0-412-36380-1. Cloth, $59.95.—Much of the pioneering modern work on the genetic basis and physiological control of bird migration has been performed by Peter Berthold and Eberhard Gwinner and their academic issue. They began their studies in the laboratory of Jurgen Aschoff, where the groundbreaking research on circadian rhythms was done. The discovery by Gwinner, in the late 1960s, that events of the annual cycle, including migratory behavior, were under the control of endogenous circannual rhythms provided the foundation upon which the work described here by Berthold was built.

The book contains five chapters, but in essence the 210-page Chapter 2 on control mechanisms and ecophysiology is "the book." A 33-page introduction, a short chapter on orientation mechanisms, 10 pages on microevolutionary processes, and a brief synopsis complete the book and in some ways seem like afterthoughts. Chapter 2 covers all aspects of migratory physiology, beginning with the roles of circadian and circannual rhythms and continuing through endocrine regulation, metabolic adaptations, flight range, water balance, stopover, migration across ecological barriers, and the influences of exogenous factors such as weather, population density, social rank, and habitat preferences. Berthold has made important empirical contributions to many of these research areas, so it is not surprising that this is the most detailed and insightful section of the book. It is an excellent summary of current knowledge in the field, though it is not without its biases.

Anyone familiar with the field will not be surprised at the emphasis on the importance of heritable endogenous programs in the control of most aspects of migratory behavior. A typical passage is ". . .the endogenously programmed pattern of migratory activity (restlessness) could well function as a time-program for migration and that at least inexperienced first-time migrants with undisturbed fat reserves may essentially be guided by that program to their winter quarters" (p. 63). Gwinner's published reservations (1990, 1996) about whether the correlation between nocturnal restlessness in caged birds and migration distance should be extrapolated to the field where many other external factors must exert an effect are briefly mentioned, but the reader is left with the message that endogenous time-programs and vector navigation are sufficient to move a first-time migrant from natal site to the wintering area of its population. Repeatedly, we are told about aspects of migration that are "preprogrammed" ("pre" to what?), terminology that implies understanding but explains very little.

There is no doubt that many aspects of bird migration are driven by genetically based "programs," and I do not demean the importance of the discoveries that have revealed them. They provide a starting point for investigating the cascade of events from "gene" to behavior, however, not an end point of analysis. The future of the field surely lies in understanding how the action of specific (and as yet unidentified) genes interacts with external stimuli to produce the various components of migratory behavior. I need not belabor the sterility of the nature-nurture dichotomy, but Berthold often casts issues in an "either/or" framework. This is particularly apparent in the discussion of the control of partial mi-

gration (pp. 200–205). In cases such as the European Robin (*Erithacus rubecula*) and Dark-eyed Junco (*Junco hyemalis*), where some evidence exists for the roles of both social dominance and endogenous factors in the expression of migratory behavior, Berthold largely dismisses the former and advocates the latter as though they were mutually exclusive.

Once alert to the endogenous bias, the material on control and physiology of migration provides a thorough, up-to-date synthesis of the field. The coverage of literature is extensive, and many areas ripe for research are noted. The chapter on orientation mechanisms draws heavily on recent reviews, and the reader would do well to consult other sources for treatments of that complicated subject. The text is well written and reads smoothly, the progression of topics coherent and logical. I found only a few instances of incorrect or confusing wording ("dispersion movements" [p. 197]; the movements of crossbills referred to as "aperiodic," "regular," and "unpredictable" in the same sentence [p. 6]), but in general they do not hamper comprehension. The misspelling of Deutsche Forschungsgemeinshaft in the acknowledgments is embarrassing inasmuch as it funded most of the work. More problematical, as they impinge on automated literature searches, are a number of misspellings of scientific names: *Chloephaga* and *Stercorarius* in both text and index; *Muscicapa* and [*Protonotaria*] *citrea* in the index.—KENNETH P. ABLE, *Department of Biology, State University of New York, Albany, New York 12222 USA.*

LITERATURE CITED

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GWINNER, E. 1996. Circadian and circannual programmes in avian migration. Journal of Experimental Biology 199:39–48.

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The Kentucky Breeding Bird Atlas.—Brainard Palmer-Ball, Jr. 1996. University Press of Kentucky, Lexington. xii + 372 pp., numerous black-and-white photos and maps, 6 text figures. ISBN 0-8131-1965-0. Cloth, $29.95.—Kentucky has a lengthy ornithological history dating back to Audubon, with most of the available information on the state's avifauna summarized in Robert Mengel's comprehensive book *The Birds of Kentucky* (1965). This work remains a primary reference on all aspects of ornithology in the state, but its descriptions of status and distribution for species reflect the habitat conditions of the late 1950s and early 1960s. Although Kentucky remains a largely rural state, it has not been able to escape "progress," and some of its current habitats bear little resemblance to those encountered by Mengel.

Following precedents originally established in Europe and transported to many portions of the United States and Canada, the amateur and professional birders of Kentucky organized their efforts to systematically survey the breeding birds of their state. Utilizing established breeding bird atlas methodology, data were collected during 1986 through 1991. For a fairly large state with a relatively small human population centered in a few urban areas, the logistics of surveying the entire state posed a number of significant challenges. Statewide coverage eventually was achieved, but at the cost of relatively superficial coverage within a number of priority blocks.

This atlas represents the culmination of the efforts of all concerned, from the 160+ observers who collected data in the field to the handful of people coordinating the project to its completion. Its content is fairly similar to previously published breeding bird atlases. A relatively brief introduction describes the methodology followed by the project, summarizes the results, and discusses the limitations of the data. Most of the text is devoted to the species accounts, in what has become a familiar two-page format. One page is devoted to maps showing breeding distribution and abundance, and tables summarizing breeding status within the priority blocks. Distribution maps depict breeding status using the standard possible, probable, and confirmed categories. The other page provides the written account summarizing current and historic patterns of distribution, habitat preferences, and the available information on their breeding biology and phenology in Kentucky as well as a good quality black-and-white photograph of each species. Following these species accounts, a section briefly discusses the extinct and extirpated species. The appendices include one that provides descriptions and photographs of the physiographic provinces found in the state.

In general, the factual information is well presented and easily understood. The species accounts are well written and informative, although out of necessity, they frequently rely on breeding information provided by Mengel. The author cites other sources when they are available, so the reliance on Mengel's work reflects a paucity of research conducted in Kentucky during recent years rather than an inadequate search of literature sources. Although one might have minor disagreements with occasional statements in the text, no glaring errors were obvious.

Several innovations were attempted in this atlas, but with mixed results. In addition to the distributional information routinely collected by breeding

bird atlases, an attempt was made to depict statewide patterns of abundance on maps included in each species account. Six qualitative categories of abundance were defined, from "not observed" and "only one individual or pair observed in block" to "one of the commonest species in the block." These categories were recorded by atlasers in the field, based on subjective observations rather than any systematic censuses. Given the superficial coverage in many blocks, this information may not be particularly meaningful. An additional problem arises from the presentation of this information, because various shades of gray are used to represent the categories. The most abundant and least abundant categories are apparent on the maps, but some of the intermediate categories are difficult or impossible to distinguish, especially for the rarer species where little information and only a few categories are presented.

Many species accounts also contain a table summarizing occupancy and abundance within priority blocks based on their average forest cover. Forest cover was assigned to one of five qualitative categories as interpreted from USGS topographic maps, whereas abundance was derived from the qualitative categories presented in the abundance maps. This information is based on a number of generalizations and cannot be subjected to quantitative analyses. At best, these tables exhibit bird-habitat relationships that are very obvious, such as woodland species being somewhat more abundant in blocks with the greatest amount of forest cover, but they do not provide any new insights into these relationships. Although these innovations may not have been completely successful for this project, they represent novel approaches for the use of atlas data and could be improved by future breeding bird atlases.

Despite these limitations, this atlas still provides an abundance of information concerning the current status of breeding birds in Kentucky. It successfully documents many of the changes that have occurred in the state's avifauna during the past 30 years. However, given the superficial coverage within many priority blocks, the absence of data from a particular county or region should be viewed with caution. Although the statewide patterns of distribution are accurate for most species (except for a few nocturnal or otherwise secretive species that were regularly overlooked), the absence of records from a particular block or county could be the result of incomplete coverage rather than a species' absence from the area. When combined with atlases from adjacent states that have already been published, such as Ohio and West Virginia, a regional perspective on current bird distribution patterns can be obtained.

Breeding bird atlases represent an important contribution from amateur birders to the ornithological literature. This atlas is no exception. Even with the limitations resulting from incomplete coverage of a number of blocks, this book will become the new standard for the status and distribution of breeding birds in Kentucky. Anyone with an interest in the state's avifauna will want to obtain a copy of this book, and it also belongs on the shelves of the libraries of colleges, universities, and other institutions.—BRUCE G. PETERJOHN, *Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, Maryland 20708, USA.*

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The Flight of the Red Knot: A Natural History Account of a Small Bird's Annual Migration From the Arctic Circle to the Tip of South America and Back.—Brian Harrington and Charles Flowers. 1996. W. W. Norton and Company, New York. 192 pp., 50 pp. of color photographs, 8 pp. of maps. ISBN 0-393-03861-0. Cloth, $29.95.—Shorebirds—sandpipers, plovers, and their relatives of the suborder Charadrii—are the most consistently long-distance migrants in the bird world. In North America, the great majority of arctic and subarctic breeding species that cross the equator to winter in the Southern Hemisphere are shorebirds, and several world-class long-distance migrants are among them. Species such as Pectoral Sandpiper (*Calidris melanotos*), Sanderling (*C. alba*), White-rumped Sandpiper (*C. fuscicollis*), Baird's Sandpiper (*C. bairdii*), and Red Knot (*C. canutus*) annually migrate from north of the Arctic Circle to southern South America and back again.

Glimpsing these mysterious, almost magical travelers during their relatively fleeting visits in autumn to windswept beaches of the Atlantic coast, during spring pauses in flooded fields of the Midwest, or on rocky intertidal shores of the Pacific Northwest has started many young naturalists on a lifetime of birdwatching, and in some cases, on a career in ornithology. *The Flight of the Red Knot* presents a detailed and rich natural history account of the life cycle and remarkable migration of one of these species as illuminated by the studies of Brian Harrington and his colleagues. It is a book that aims for and reaches several targets. It is an information-rich account of the natural history of this species, full of facts and conjecture based on continuing research. It is also an easily read story that celebrates the wonder and magic of the migratory feat of these small birds, and an essay on the importance of conservation of shorebird migratory stopover sites.

A bit more than half of the book is organized as a seasonal journey, weaving geographic location together with season to describe the annual cycle of the Red Knot. Along the way, the authors introduce a wealth of information about this species, and often

about other shorebirds as well. Foraging ecology, energetics, breeding behavior, physiology, predator evasion, molt, and conservation are all treated, along with detailed discussions of local sites and Red Knot behavior along the migratory route. Harrington and coworkers have followed the species throughout the year and the hemisphere, and have ample information to convey. The treatment is more than a recital of data, however. For example, describing the abundance of horseshoe crab eggs that makes Delaware Bay during spring a magnet for the Red Knot and other migratory shorebirds helps the reader appreciate Red Knot biology. The authors note that if all the crab eggs were allowed to hatch and mature, "the crabs could cover 90% of the surface of New Jersey." To convey the remarkable physiological feat of a Red Knot laying four eggs shortly after arriving on the breeding grounds, they compare this to "a woman's giving birth to a 60-pound baby within 10 days of completing a 6,000 mile hike at altitudes higher than the Himalayas."

A sixth, concluding chapter presents the shorebird conservation dilemma, drawing on the case already made for the Red Knot, and broadening it to include many other shorebird species and many migratory stopover sites. The energy demands and seasonal schedules of long-distance migratory shorebirds leave them dependent upon a network of refueling sites between their wintering and breeding quarters. The continued existence and health of these sites have implications far beyond the local level; loss of migration sites where shorebirds can replenish fat reserves may prohibit successful breeding on sites thousands of kilometers away. This chapter is not a gloom-and-doom presentation, however; examples of successfully protected sites, and a discussion of the Western Hemisphere Shorebird Reserve Network's efforts at research, education, and protection provide a positive message.

The remainder of the book is a series of appendices that addresses several additional topics about shorebirds: banding, diet, market hunting, threats to Delaware Bay, mud (I love that chapter title), navigation, and migrants in the Midwest. The final nine pages of notes on ecology, history, migration, and shorebird viewing explain the nine footnotes in the earlier text. Throughout the book are artistic and instructive color photographs of every aspect of Red Knot natural history, by David Twichell and other photographers.

The book is not without an occasional error, some merely typos (my favorite was "camily family"), but a few were more substantive. A discussion of polygyny and polyandry in sandpipers is very confusing, and might best be skipped by the reader. A fascinating story of winter site fidelity among Sooty Terns (*Sterna fuscata*) and golden-plovers on Laysan in the Central Pacific mixes the winter range of the Pacific Golden-Plover (*Pluvialis fulva*) with the breeding range of the American Golden-Plover (*P. dominica*). But these are mere quibbles. The book is a pleasure to look at and will be a delight to read for anyone who treasures shorebirds, or wants to know them better. It is full of fascinating information, while remaining easily readable. It will offer information to the knowledgeable ornithologist, but will be especially welcome to the amateur birder and natural historian.—PETER G. CONNORS, *Bodega Marine Laboratory, University of California, Bodega Bay, California 94923, USA.*

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Tertiary Avian Localities of Europe.—Jiri Mlikovsky (Ed.). 1996. Acta Universitatis Carolinae Geologica 39:519–846. Paper, $20.00.—Although technically part of a serial publication, this book is available for purchase at an extremely reasonable price, including postage, through its editor (J. Mlikovsky, Vrsovick 11, CZ-101 00 Praha 10, Czech Republic). Anyone with an interest in paleornithology, or vertebrate paleontology in general for that matter, should have a copy of this epochal undertaking.

The book reviews, in English, all of the localities of Europe (i.e. west of the Urals and the Ural River) that have yielded birds of Tertiary age (Paleocene through Pliocene, 65 to 1.8 mya). The introduction briefly states the purpose and scope of the catalogue, gives a succinct overview of European biostratigraphy, including references, and even provides a useful table of transliterations of the alphabet in six eastern European languages (Russian, Ukrainian, Byelorussian, Serbocroatian, Bulgarian, and Macedonian).

Localities are arranged by country, with each country being treated as a separate chapter (France is divided into 3 chapters by age). Mlikovsky has written the majority of the 29 accounts, with 10 other experts having contributed all or part of 12 of them. Each begins with a short historical introduction, a list of museums and acronyms where fossils are located, and a map showing localities by number. This is followed by a correspondingly numbered list of localities, each of which in turn consists of a precise geographic and stratigraphic description and a list of the avifauna, all densely cross-referenced. Each chapter is free-standing with a separate bibliography.

A concluding chapter by Mlikovsky entitled "Tertiary Avian Faunas of Europe" is an excellent overview summarizing the avifaunas of 14 different time periods complete with maps of localities, avifaunal dynamics in Europe in the Tertiary, and an analysis of the fossil record by major taxonomic group (mainly by family). This incredibly information-packed

volume is made even more useful by the inclusion of six indexes: new species (i.e. those originally described as new from the localities listed), genera, families, collections (i.e. institutions housing fossils), authors, and localities.

There has long been a desperate need for a volume such as this. Europe has a rich record of Tertiary birds, but many of these were described in very obscure journals that are difficult to access and often written in languages not comprehended by western scientists. Since Lambrecht's great *Handbuch der Palaeornithologie* (1933), the borders and names of many European countries have changed, and much more has been learned about geology, chronology, and stratigraphy, although this literature, often of a very local nature, is likewise bibliocryptic and widely scattered. For this reason, authors have continued to cite incorrect information from Lambrecht, or from Brodkorb's *Catalogue of Fossil Birds*, which often is derived from Lambrecht as well. Compounding the difficulty of studying the fossil record is the fact that specimens of fossil birds were often transferred from one institution to another, or were lost or destroyed, with no record of this having been published.

With the present publication one may determine the whereabouts, when known, of a given fossil in a museum collection, cite a geographically correct location for its occurrence, and place it in a much more precise chronological framework based on modern stratigraphy. Plus, one has access to the entire literature on the subject through 1995, all copiously cross-indexed.

The volume might have appeared earlier except that the editor experienced a dreadful setback when his computer was stolen. A full year was needed for him to bring the manuscript back to pre-theft form. The ornithological world can be grateful, however, that Mlikovsky had the heart to return to the project and carry it to completion. The result is a compendium that will be absolutely indispensable for anyone needing information on the most interesting 63 million years in the history of birds.—STORRS L. OLSON, *Department of Vertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, USA.*

The Auk 114(3):538, 1997

The Hornbills: Bucerotiformes.—Alan Kemp. 1995. Oxford University Press, Oxford, United Kingdom. x + 302 pp., 13 color plates, black-and-white distribution maps, numerous line drawings. ISBN 0-19-857729-X. Cloth, $60.00.—This is the first in Oxford University Press's ambitious *Bird Families of the World* series. This series will consist of handbooks that detail the natural history of each species in each avian family, as well as summarize in introductory chapters the important features of the group, including general patterns in anatomy, ecology, behavior, evolution, and conservation. For the series to begin with hornbills by Alan Kemp is sensible, because he is the world's leading hornbill biologist having extensive experience in all areas of hornbill natural history, and was certain to produce a good overview. As an African, Kemp has worked mostly on African species, but he also has experience in Southeast Asia. From the extensive and up-to-date bibliography, it is clear that he has formed useful contacts with hornbill biologists throughout the African, Asian, and Papuan regions in compiling this work.

The Hornbills is extremely thorough and a great information source. The introductory chapters provide many details (often using tables to summarize data) on such subjects as body design and dimensions, metabolic rate, displays (with line drawings), food, breeding biology, development of chicks, systematics, and conservation. A chapter on captive breeding and constructing artificial nests is even included. I was particularly interested in the systematics section, which is comprehensive. The phylogeny of the family is fairly well known and, combined with extensive ecological data, provides the opportunity for the author to speculate about evolutionary pathways and biogeographic history. The species accounts are authoritative and complete. Kemp keeps them even and succinct by summarizing potentially repetitive facts in introductory sections to each subfamily, genus, and in some cases subgenera. Maps accompany each genus and species, and accurate color plates by Martin Woodcock illustrate several plumages of each species (resting and in flight).

The book is intended as an information source, not a coffee-table adornment. Signs of cost cutting are evident—the plates are gathered in the center of the book with some photographs of habitats and nest sites, and each plate has many birds crowded together. The layout of chapters and black-and-white drawings is simple, almost like a manuscript. However, what it lacks in flash, it makes up in content. If you want to know about an individual hornbill species, or the group as a whole, this book will be the place to go for a long time to come.—FREDERICK H. SHELDON, *Museum of Natural Science, Louisiana State University, Baton Rouge, Louisiana 70803, USA.*

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The Wood Duck and the Mandarin.—Lawton L. Shurtleff and Christopher Savage. 1996. University of California Press, Berkeley. 232 pp., 256 color pho-

tographs, 32 color plates, 2 appendices. ISBN 0-520-20812-9. Cloth, $35.00.—This is a very well-produced book detailing the natural history, conservation, and cultural aspects of the Wood Duck (*Aix sponsa*) and the Mandarin Duck (*A. galericulata*). High-quality color photographs abound in this handsome publication and certainly give fitting recognition to these most colorful perching ducks in the genus *Aix*. Interest in creating a book on these two species resulted from their unique presence together on the senior author's ranch in northern California. The Wood Duck is distributed in North America while the Mandarin Duck normally is found in eastern Asia. Mandarin Ducks that became established on the ranch apparently originated from individuals that escaped from bird collections in Sonoma County. Addition of nest boxes to supplement natural cavities has helped to produce a feral, self-sustaining population of several hundred Mandarins that generally occupy the same habitats as the native Wood Duck. Although I do not condone the introduction of exotic species, especially, as in this case, when their requirements overlap so much with those of native species, this is an unusual situation resulting in some unique observations.

The first chapter portrays the occurrence of the two species on the author's ranch and describes various interspecific similarities and differences. Narratives in this chapter and elsewhere are very general in nature and are appropriate for a general audience. Subtle differences exist between the species in habitat use. Mandarins also tend to be nonmigratory, whereas most Wood Ducks disperse in autumn, and Wood Ducks begin nesting 3–4 weeks earlier than the Mandarin Duck. It is interesting that both species engage in intraspecific nest parasitism, but observations of mixed broods are rare. This is attributed to the keen sense of smell of both species that enables them to identify nests being used by the other species and going elsewhere to nest. I am very skeptical of this explanation. It is much more likely that the low degree of interspecific nest parasitism is due largely to the different nesting chronologies exhibited by the two species.

The next two chapters focus on the Wood Duck. The first of these reviews the historical status in North America, and the next describes aspects of the natural history from fall through summer. Nothing is new here, but the authors do a good job of summarizing information from previous publications. More detailed accounts, especially of life history, can be found in the proceedings of the Wood Duck symposium (Fredrickson et al., *Proceedings of the 1988 North American Wood Duck Symposium*, 1990) and in the recent book by Bellrose and Holm (*Ecology and Management of the Wood Duck*, 1994).

Chapters four and five present information about the Mandarin Duck. In the Far East, it is admired for its beauty and has been an integral part of the culture in those countries for centuries. Compared with the Wood Duck, however, little is known about the Mandarin's life history, distribution, and abundance in the wild. The authors take the reader to countries of east Asia, Ussuriland in Russia, China, and Japan, and to Great Britain where Mandarin's have been introduced and naturalized. Here we learn about the Mandarin from Savage's experiences and from descriptions by local biologists in those countries. Again, information is of a general nature but some interesting facts emerge. Mandarin's eat more animal foods (fish and amphibians) than Wood Ducks, the eggs and ducklings of Mandarin are about 16% larger than those of Wood Ducks (even though adults are approximately the same size), and male Mandarins accompany the female and brood for 1–2 weeks after hatching. Disappearance and degradation of wetland habitats are major problems throughout the Mandarin's range.

The final chapter is devoted to conservation. It reviews the various conservation efforts that were successful in reestablishing Wood Duck populations in North America, and advocates similar measures for the Mandarin, whose populations have reached low levels in many areas. Conservation of wetland habitats is a top priority. The first of two appendices provides information needed to begin a nest box program for either species. The second gives advice on trapping and banding methods for Mandarins.

The price is extremely reasonable for a publication with such a wealth of color photographs. The book is very well written, but the general nature of the narrative makes it more suitable for the lay person than for the professional biologist. The book is suitable for both community and university libraries, and it would be a welcome addition to the coffee tables of all waterfowl enthusiasts.—GARY R. HEPP, *Department of Zoology and Wildlife Science, Auburn University, Auburn, Alabama 36849, USA.*

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Lives of North American Birds.—Kenn Kaufman. 1996. Houghton Mifflin Company, Boston, Massachusetts. Sponsored by the Roger Tory Peterson Institute. xxv + 675 pp., more than 600 color prints and range maps. ISBN 0-395-77017-3. Cloth, $35.00.—This book is billed as a one-volume encyclopedia on the life histories of 680 species of North American birds north of Mexico, with distributional information on more than 900 birds. It is not written for scientists, but rather for the general public. Although it surpasses field guides as a reference book, it contains no literature citations. This omission does make for

easier reading, but it reduces the book's usefulness to ornithologists. An excuse might be that the book was put together after the CD-ROM *Peterson Multimedia Guide: North American Birds* was produced, but it still puts limits on the book.

Most species accounts have a general section on distribution and natural history, with following sections on habitat, feeding (including comments on diet and behavior), nesting (with subsections on nests, eggs, and young), migration, and conservation status. This information is well written and up to date. A good color photograph accompanies most of the regular species (usually of a male in alternate plumage) as does a small but accurate range map (apparently condensed from the new editions of the Peterson field guides). A 15-page introduction is worthwhile reading and explains how to interpret the information in the species accounts.

Each family of birds is introduced by up to a page of interesting general information, and almost all genera also have an introductory paragraph. For some reason, the avian orders are not similarly introduced; perhaps the publishers did not want the book dated by all the changes expected with the new edition of the *AOU Check-list*. Ample opportunities are present to discuss the evolutionary connections between genera or families or the biogeographical implications of isolation or sibling species. However, these fascinating interpretations strangely are missing. I believe that a great chance was passed up to inform a growing lay audience about these important facets in the appreciation of birds.

It is recognized that limits exist as to what can be covered, but some important missing concepts include the fact that grebes have lobed rather than webbed feet, and why the American White Pelican (*Pelecanus erythrorhyncos*) has a lump on its bill during the breeding season. Although the 600 maps seem fairly accurate, there is a strange truncation in the northern portions of many of them. We are shown an empty map of Mexico clear down to the Yucatan, yet the distributions of at least 149 species (25% of the maps) are cut off by the margins at the northern edge of their range and in Alaska. The maps in the Peterson field guides are fine, so it seems as if the images simply were scanned in so that the northern and western edges were cut off.

Even though specific references are not given, an appendix provides some of the sources consulted. Kaufman relied heavily on the available species accounts in the *Birds of North America* series, as well as on handbooks, life-history books, journals, and Frank Gill's *Ornithology* text (1995). He makes some questionable claims, though, and without references it is not possible to evaluate them. For instance, Kaufman states that the females of four species of loons incubate more than the males. It is very difficult to sex loons in the field, and I wonder about the validity of these statements. At least in the Common Loon (*Gavia immer*), the contributions of the sexes to incubation are nearly identical (J. Paruk pers. comm.).

The real value of this book comes from Kaufman himself. He has a tremendous knowledge of North American birds, and writes in an exciting and compelling manner. He captures your imagination with such phrases as "Trogans are gorgeous birds of the forest. . .," or magpies call attention to themselves with ". . .their white wing patches flashing like beacons. . .," or waders ". . . are long-legged fishermen of the shallows." All of these comments make the text a fun read. Many people will probably benefit from this book because it is so informative, up to date, and well written. It may not belong in a university or museum library, but certainly it should be in community and public school libraries. In addition, it would make a great gift for your mother if she is into birds.—C. H. TROST, *Department of Biological Sciences, Box 8007, Idaho State University, Pocatello, Idaho 83209, USA.*

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John Gould the Bird Man: Associates and Subscribers.—Gordon C. Sauer. 1995. Martino, Mansfield Center, Connecticut. 190 pp., 1 photograph. Limited edition of 300 numbered and signed copies (available from Maurizio Martino Fine Books, P. O. Box 373, Mansfield Center, Connecticut 06250). Cloth, $48.00.—Through a distinguished career as a professor of medicine, Gordon C. Sauer has maintained a passionate avocation of accumulating materials for a comprehensive understanding of the life and times of John Gould, the 19th century impresario of sumptuous illustrated bird books. Sauer's learned papers, books, and even newsletters on this subject span nearly half a century, the best known being his 1982 book *John Gould, The Bird Man: A Chronology and Bibliography* (reviewed by Marianne Ainley, *Auk* 100: 1016–1017).

The present volume is a modest offshoot of that earlier work and consists of an alphabetical listing of Gould's "associates" and the subscribers to his many lavish volumes. Associate is used in a very broad sense to include correspondents and other persons and institutions, even journals in which Gould published, who can somehow be associated with Gould or his publications. The book contains some 2,777 entries we are told. Each is briefly identified, some with the single word "subscriber," others with more or less extensive references to literature or archives. The whole can be viewed on one hand as an expanded, annotated cross-index to Sauer's larger work, but on the other as an eclectic compendium of resources for

biographers and historians of Victorian zoology in general. The work concludes with a seven-page bibliography.

Because this is an outgrowth of the 1982 book, Ainley's perception that that work emphasized Gould as artist-entrepreneur over Gould the systematist holds true for the newer volume as well. For example, Gould published many original descriptions of new species in such journals as *Annals and Magazine of Natural History* and *Proceedings of the Zoological Society of London*, but frequently would send advance notices of these to *The Athenaeum*, a London "Journal of Literature, Science and the Fine Arts." In too many cases, the *Athenaeum* notice was published first, with sufficient description of the new species that for purposes of priority it must take precedence over the description in the scientific journal. Our diligent scholar disappoints here, however, as Sauer does not mention *The Athenaeum*, either in the present work nor in that of 1982, which is all the more unfortunate because Richard Bowdler Sharpe, in the bibliography published with his *Analytical Index to the Works of the Late John Gould* (1893), also omits the *Athenaeum* notices. This is of very minor importance in developing a biography of Gould the book producer, although it will be significant to the systematist or scientific bibliographer.

Sauer's enthusiasm and productivity have spawned popular attempts at biographies of Gould in which Sauer was either a participant or is given much credit in the acknowledgments. The first of these, by Maureen Lambourne (*John Gould—Bird Man*, 1987), though accurate and attractively illustrated, is very brief and has more the appearance of a book for younger readers. A much more studious biography was essayed by Isabella Tree (*The Ruling Passion of John Gould*, 1991), who, however, was utterly clueless as to the aims and conduct of systematic ornithology, which, with her superimposition of late 20th century "correctness" on a Victorian corpse, makes portions of her book so inexpressibly bad as to render futile the search for sufficiently poignant adjectives. Gould has more than once been portrayed as a social-climbing entrepreneur who took advantage of the talents of others to advance his business in an attempt to rise above his own class. Tree has milked this flabby udder dry, which, we may hope, will free others to pursue more fruitful lines of inquiry. In a day in which curatorships and professorships for ornithologists were essentially nonexistent, Gould made an extremely successful livelihood out of the study of birds. This accomplishment ought to count very heavily towards his greater glory.

Recall that it was Gould who straightened out Darwin's muddled notions concerning the finches of the Galapagos, masterfully recognizing them all as close relatives and naming them in the single genus *Geospiza*, this immediately before setting off to Australia where he was instrumental in elucidating the practically unknown birds and mammals of an entire continent. It seems almost ironic that not long after he returned from remote Australia, Gould was the first ornithologist to describe a new species of bird (*Pipra vitellina*) from the long-traversed isthmus of Panama, later to be such a mine of new species for others to name. The single sentence that would adequately summarize Gould's contribution to our knowledge of hummingbirds will never be written.

Although Gould is thought of as having contributed little to African ornithology, he was the original describer, in 1852, of that quintessence of the Ethiopian avifaunal realm, the Shoebill (*Balaeniceps rex*). What can that have been like? Imagine being the first with knowing eyes to see a specimen of such an incredible bird. In the manner of his day, Gould named *Balaeniceps* in a two-page note and reckoned it to be a grallatorial manifestation of the Pelecanidae. Sciolists soon removed it to the vicinity of storks. More than a century after Gould, Patricia Cottam remarked upon the pelecaniform characters of the skeleton of *Balaeniceps*, but she was ignored in favor of Sibley's evanescent meringues and Cracrafts's cladistic harangues. Now, with systematics in the mortal coils of DNA, we have come full circle, with Sibley placing *Balaeniceps* back in the Pelecanidae. This is progress?

For much of his career, John Gould probably knew the birds of the world and their literature better than any other person on earth. The number of new taxa that he recognized and described rank him among the great taxonomists of all time in ornithology. Gould not only flourished in, but was one of the principal foci of, an era of ornithological discovery the intensity of which makes the remarkable times of a Walter Rothschild seem almost pedestrian by comparison. Here must lie a wonderful story waiting to be told. Gordon Sauer has provided an extremely rich supply of resources for the Gould historian and is now at work assembling Gould's correspondence for publication. When this is done, Sauer will have provided us with almost all of the inscribed vestiges of John Gould, *Homo sapiens*, fully invested in the sediment of his times. Let us hope that some knowledgeable historical biologist will then extract from this a detailed assessment of the breadth and depth of Gould's lasting contributions to ornithology. Only then will we understand fully just how extraordinary Gould's accomplishments really were.—STORRS L. OLSON, *Department of Vertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, USA.*