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Avian Incubation: Behaviour, Environment, and Evolution

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BOOK REVIEWS

EDITED BY BARBARA E. KUS

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Avian Incubation: Behaviour, Environment, and Evolution.—D. C. Deeming [editor]. 2002. Oxford University Press, Oxford, UK. xiv + 421 pp., numerous text figures and tables, 2 plates. ISBN 0-19-850810-7. $85.00 (hard cover).

Avian incubation might conjure in the mind of the layperson an image of a robin sitting motionless on eggs and, in the mind of the poultry technician, an industrial force-draft oven maximizing broiler production for an obese consumer market. As editor D. Charles Deeming reveals in his opening sentence to *Avian Incubation*, the vast majority of the roughly 9000 bird species relies heavily on stereotyped aspects of bird-egg contact incubation to ensure development of offspring. However, the stereotypy of incubation belies not only its underlying complexity but also its myriad adaptive variations among and within species. Thus, to a behavioral or physiological ecologist concerned with the conflicting interests of a female barn owl and her embryo, avian incubation might conjure images of an egg-broodpatch feedback loop wherein broodpatch blood flow and heat transfer are precisely controlled by variations in egg-surface temperature and embryonic nitric oxide emissions, both avenues of communication enabling embryonic manipulation of parental behavior and physiology. Or, if it does not, it will after reading this book, a comprehensive and often engaging account of everything that is part of this intricate yet subtle process.

Pervading *Avian Incubation* is a theme of species diversity, particularly in incubation behavior but also in the characteristics of nest building and eggs. The basis for this diversity might stem from the fact that breeding environments and reproductive strategies are varied while embryonic requirements are not. That is, to meet the rigid requirements of the embryo, inter- and intraspecific variation in adult behavior and egg-laying physiology enable reproduction anywhere from the xeric dunes of the Sahara to the soggy tussocks of a northern bog and over an elevational range of 6500 m. Of course, such diversity can only be captured with the comparative approach, an approach readily adopted by several of the book's authors, many of whom distill data from a vast diversity of species into their proper ecological and evolutionary contexts.

Deeming has organized the book thematically, beginning with one of his own chapters on the evolution of avian reproduction and continuing with a group of chapters that schools the reader in some fundamentals of avian reproduction. This includes two more chapters by Deeming, both of which provide basic information on the functional anatomy and morphology of the egg, the process of embryonic development, and how each of these might relate to incubation behavior. Perhaps due to my own biases, I was disappointed that he mentioned neither the role nor even the existence of certain yolk components now garnering much attention. These include yolk androgens (Schwabl 1993), carotenoids (Royle et al. 2001), and immune factors (Saino et al. 2002), each potentially involved in dynamic interactions with incubation patterns that may modulate nestling growth and the sibling social hierarchy. This aside, these informative chapters prepare the reader for much of the remaining book.

The next theme centers on factors affecting the behavior of incubating birds and embryos. It is headed by Carol M. Vleck's update on the current state of the field in the neuroendocrine control of incubation. Vleck includes not only a thorough discussion of the endocrine-behavior basics but also a number of intriguing conceptual considerations, underlying the author's appreciation for evolution and diversity. Deeming follows this with his own account of the remarkable diversity of behavioral patterns falling under the incubation rubric, and the section closes with a captivating chapter by Robert B. Brua on interactions between embryo and incubating parent. Those who assumed such interactions were limited to embryonic tapping sounds and chirps during the final hours before hatching will be impressed with the communication modes available to an embryo not only in need of heat, but also, perhaps, signaling its identity (in crowded colonial situations) or its imminent hatching. For example, there is now evidence that the ubiquitous signaling molecule nitric oxide, released by the egg, interacts with brood-patch receptors to modulate broodpatch blood flow and hence heat output! Due to parent-offspring conflict and the fact that communication functions to manipulate receiver behavior or physiology, this exciting area of study raises a number of questions concerning the proximate and ultimate explanations for embryonic communication. For example, how is nitric oxide release controlled? How does certainty of maternity or paternity influence sensitivity to embryonic signaling and thus affect where along the conflict continuum the trade-off resolution for incubation pattern lies?

As a start to answering such questions, an understanding of how the incubation environment is maintained would help, and that is precisely what the next group of chapters provides. Bob W. Lea and Hillar Klandorf begin with their comparative chapter on nature's little hot-water bottle, the brood patch. This edematous, defeathered portion of the breast and abdominal area, under precise control of pituitary hormones and gonadal steroids, enables the efficient trans-

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fer of heat from parent to egg and also possesses additional, somewhat surprising characteristics. Afferent input via the brood patch may control clutch size through feedback inhibition of egg production, and the changing sensitivity of the brood patch over the course of incubation may influence nesting behavior as well as parental collection of nest materials. Additionally, this chapter is a helpful segue into J. Scott Turner's quantitative models on the biophysical maintenance of egg temperature, through which he arrives at some unexpected predictions for incubation patterns and how they should change as the embryo develops. Despite the dependence of his models on relatively simple systems, Turner never loses sight of the natural world and reminds the reader throughout of its vagaries, each of which will impact behavior and embryonic development in innumerable ways.

In Chapter 11, Deeming constructs an attractive hypothesis for the evolution of the altricial developmental mode. High rates of egg-turning in albumen-rich eggs hastened embryonic development and the potentially costly incubation period, opening a window for a new developmental mode among birds. Here, Deeming takes the comparative approach, an approach in keeping with the theme of this book but which also demands from its practitioners a certain level of responsibility. Because individual species (or any taxonomic unit, for that matter) are not statistically independent units, making comparisons among them requires correcting the data for phylogenetic relationships (Garland et al. 1999). Deeming does not do this, weakening the support for his hypothesis. Indeed, I found it disappointing that a book so dependent on species diversity and the comparative approach almost completely fails to acknowledge the existence of this technique (but see Underwood and Sealy's chapter on egg coloration).

Glenn K. Baggott and Kate Gaeme-Cooke then lead the reader into the nest's microbial world, an area proving to be a fertile field of study, in part the result of a burgeoning interest in immunocompetence and sexual selection in birds. Still, some of the information in this chapter is sure to surprise even the specialist. For example, who would have guessed that a bacterium dependent on the nutritional resources of the eggshell cuticle participates in a symbiotic relationship with the bird through slow alteration of the cuticle structure and the steady enhancement of shell vapor conductance?

The next group of chapters highlights the diversity of incubation strategies found among birds. It begins with David T. Booth and Darryl N. Jones's chapter on incubation in megapodes, a group that uses natural heat sources such as composting litter heaps or geothermal activity for egg incubation, and continues with a look by the late Bill A. Calder, III, at another end of the incubation spectrum where hummingbird behavior resides. But some of the most compelling examples of the diversity of incubation come from birds that breed in extreme environments. As Cynthia Carey reveals, the thermal and gaseous requirements of eggs do not differ among breeding environments; thus, certain components of incubation, eggs, or the nesting microenvironment must vary between benign and extreme environments to compensate for their radically different ambient conditions. Carey describes a range of behavioral and physiological specializations, including the more than five-month fast of the incubating King Penguin (*Aptenodytes patagonicus*) and the grebe's eggshell vapor conductance, which is 2.7 times that of comparable species laying in surroundings less mesic than the grebe's floating island of soggy vegetation.

No compendium on avian incubation would be complete without a chapter on brood parasitism. Like their nonparasitic hosts, obligate brood parasites face a diversity of nesting environments and ambient temperatures and therefore draw from an extraordinary behavioral and physiological repertoire to ensure the successful development of their offspring. Still, as authors Spencer G. Sealy, D. Glen McMaster, and Brian D. Peer point out, we are in need of more research on just how it is that a parasite's egg can thrive in such a diversity of incubation environments.

Of particular interest is the next set of chapters on ecological and evolutionary aspects of avian incubation. This begins with Percy N. Hébert's chapter on factors affecting the onset of incubation behavior. Early incubation onset (relative to clutch completion) may induce hatching asynchrony and thus influence the energetic costs of rearing the brood and the probability of brood reduction. Interestingly, timing of incubation onset may vary with environmental factors, suggesting that a conditional strategy for hatching asynchrony may enable the modulation of energy outlay to maximize prospects of current as well as future reproduction. The trade-off between the relative prospects of current and future reproduction is a cornerstone of life-history theory, which for birds has rested on the assumption that the major cost of reproduction is incurred during the egg-laying and nestling phases. But the extent to which the incubation phase levies a cost has been a contentious issue since S. Charles Kendeigh's seminal work in the 1960s. In Chapter 20 of *Avian Incubation*, Joost M. Tinbergen and Joe B. Williams review the evidence and conclude that incubation, indeed, can be energetically costly, particularly when it is cold and when clutches are large. Jane M. Reid, Pat Monaghan, and Rudi G. Nager then discuss the extent to which incubation costs (energetic and otherwise) may impinge on reproductive success and therefore to what extent incubation plays a role in the life-history trade-off between current and future reproduction. Of particular interest here is the notion that incubation costs may vary among individuals. For example, if incubation limits extra-pair mating opportunities, low quality individuals unlikely to obtain extra-pair matings would pay less for incubation in terms of its costs to fitness. It is refreshing to see in this penultimate chapter (and elsewhere in *Avian Incubation*) such an emphasis placed on individual variation. The multiple levels at which variation in both the causes and consequences of incubation can occur are an underlying theme throughout *Avian Incubation* and illustrate the extraordinary range of a behavior so ubiquitous among bird species.

In his closing chapter, Deeming summarizes areas of avian incubation needing additional study. In particular, he calls for more research on the control mech-

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anisms underlying incubation onset, on the gaseous communication between embryo and parent, and on the proximate basis of hatching asynchrony. He also suggests that efforts at protecting endangered species and habitats may improve with knowledge of incubation behavior. It is interesting that he ends on this note, because one obvious omission from this book is a chapter focused on conservation.

In his preface, Deeming expresses hope that this book will be useful not only to those interested in avian reproduction, but to those interested in artificial incubation and to both professional and amateur ornithologists alike. In fact, individual chapters should be of interest to any number of behavioral and physiological ecologists, biophysicists, and evolutionary biologists, regardless of whether or not they study birds. Rooted in solid science, *Avian Incubation* is geared for a scientifically minded audience but is likely to be of some use to people from a variety of disciplines.

On the book's cover is an illustration by Simone End of an egg-tending owl. The notion that owls incubate eggs should not surprise anyone, but what first comes to mind when thinking about them might be either their exquisitely sophisticated neural coordination of auditory and visual sensory input underlying their keen predatory skills, or perhaps their spooky hoot. This picture serves to remind the reader that the single phenomenon of incubation is as diverse as it is fundamental. In *Avian Incubation*, Deeming succeeds in making this known.—KEITH W. SOCKMAN, Department of Psychological and Brain Sciences, Johns Hopkins University, Baltimore, MD 21218. E-mail: sockman@jhu.edu

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Extinct Birds, Second Edition.—Errol Fuller. 2001. First edition 1987. Cornell University Press, Ithaca, New York. 400 pp., 200 color illustrations, 104 black-and-white illustrations. ISBN 0-8014-3954-X. $49.95 (cloth).

This handsomely illustrated volume is a revision of a 1987 edition that provides historical and biological information about recent, extinct birds. Since 1987, more birds have come to be considered extinct, and, unexpectedly, a few species have been found and can be taken out of the extinct category (at least for now). Fuller's book provides a tremendous amount of detail about each of 85 bird species worldwide that have (apparently) gone extinct since 1600. Each account provides information about the history of discovery of a species; its distribution, description, measurements, and biology; and usually the grim facts of its demise. Fuller has done an excellent job of summarizing the earlier literature on each species, some via direct research on original sources, and some clearly obtained from excellent early authoritative works such as Rothschild (1907) or Hachisuka (1953). He has not been comprehensive at surveying or interpreting the more recent literature, especially the modern technological and paleontological advances in our understanding of the distributions, biology, and ecological consequences of the extinction of these birds.

The book begins with a short introduction, and is followed by the species accounts organized in taxonomic groupings (with ratites, doves, parrots, and songbirds having the lion's share of extinct species). Each section begins with a brief introduction that describes extinct subspecies, and rare and endangered forms within the group. Fuller quotes extensively from published and unpublished writings of ornithologists and other historical figures that observed, studied or described the taxa. Ratites are dealt with first, including the extinct elephant birds of Madagascar and moas of New Zealand. Fuller tells some wonderful stories about putative encounters between Westerners and moas long after they were presumed extinct. He speculates about the plumage of moas: perhaps they had colored wattles and fleshy combs like cassowaries, or perhaps were feathered more like emus? However, there is no mention in the section about the published DNA analyses of moa remains, or about the ecological consequences of moa extinctions detailed by paleoecologists. The series of DNA studies by Alan Cooper and Alan Baker (e.g., Cooper et al. 1992, Haddrath and Baker 2001) are either unknown to Fuller or ignored. Yet, these studies more clearly place the moas in a phylogenetic context than the works that Fuller cites, and they provide evidence about the evolutionary relationships and divergence among moa species.

This aspect of the book is a bit troubling—that much of the more recent, relevant literature is not included in the synopses. By my rough assessment, with regard to genetic studies alone, Fuller did not refer to recent (and not so recent) papers that contain DNA data and analyses for moas (Dinornithiformes), an elephant bird (*Aepyornis*), the Dodo (*Raphus cucullatus*), Solitaire (*Pezophaps solitaria*) and Passenger Pigeon (*Ectopistes migratorius*), the Great Auk (*Alca impennis*), Hawaiian and Laysan Rails (*Porzana sandwichensis* and *P. palmeri*), the Stephen's Island Wren (*Xenicus lyalli*), the PioPio (*Turnagra capensis*), and the Huia (*Heteralocha acutirostris*). These omissions are bothersome, but by no means do they detract from the overall worthiness and usefulness of the book.

Perhaps what makes this book so interesting and different is the ancillary historical information provided about each bird. In particular, I enjoyed reading the biographical accounts and detail about personal char-

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acteristics of the ornithologists who discovered or described these birds. Fuller appears to have his champions in the stories (e.g., he idolizes Sir Richard Owen for having identified moas as large ratite birds on the basis of a fragment of bone), and also his evildoers (e.g., the trio of missionaries in New Zealand that tried to wrest credit for the discovery of moas from Owen and a perhaps even more prescient Jewish merchant, Joel S. Polack). The historical detail is quite remarkable, with relevant quotes that bring alive the passionate and often quarrelsome natures of the personalities involved in the discovery and study of these extinct birds.

Because I am most familiar with the extinct Hawaiian birds, I paid especially close attention to the sections detailing the Hawaiian taxa. In general, the historical information is largely complete and accurate, but there are some serious errors of omission and fact. Perhaps the greatest error is that Fuller ignores or is unaware of the extensive fossil studies by Storrs Olson and Helen James (e.g., Olson and James 1991, James and Olson 1991), and their implications for our understanding of extinction and taxonomy of the Hawaiian avifauna. He somehow attributes recent fossil finds to H. Douglas Pratt rather than to the original sources. His listing and taxonomy of Hawaiian honeycreepers is out of date, based largely on a 1979 reference. I could add at least 10 species to his list of only seven historically extinct species. It would also have been valuable to mention that there are many additional species of extinct Hawaiian birds known only from fossils, and that for many of these there is evidence that they survived beyond 1600, even if they were not collected by Western naturalists after Cook's initial visit to the islands in 1778.

Other errors include stating (p. number) that the Hawai'i 'O'o feeds ''from the flowers of ochias [sic], lehuas, lobelias and other such plants.'' ''Lehua'' is the Hawaiian name for the flower of the 'ōhi'a tree, *Metrosideros polymorpha* (often listed as 'ōhi'a lehua). However, more seriously, Fuller misleads by stating that Hawaiian birds are ''horribly vulnerable to mosquitoes'' and ''the bite of these insects often proves fatal to delicate Hawaiian birds'' (p. 331). As far as I know, there is no evidence that bites of mosquitoes directly cause mortality in Hawaiian birds, but there is a great deal of evidence that the diseases these mosquitoes carry (avian malaria [*Plasmodium relictum*] and pox [*Poxvirus*]) can cause mortality. Fuller never really makes it clear that these are the lethal factors rather than the mosquito's bite. Later (p. 350) he states that collectors in the 1890s noted that the feet and heads of 'akialoas (*Hemignathus* spp.) were ''covered with sores, tumours and swellings.'' Again, he does not make the connection that these are diagnosed symptoms of infection by avian *Poxvirus*, and that native birds with these infections today have these same symptoms.

In spite of these errors of biology, Fuller does do very well in detailing the human historical aspects of Hawaiian ornithology. He correctly notes the important roles of Lord Walter Rothschild and Cambridge Professor Alfred Newton in facilitating the study of Hawaiian birds, pointing out that we would have very little information at all about these taxa had not Rothschild and Newton sent their collectors (Palmer, Wilson, and Perkins) to the islands. He also summarizes very nicely the records of collection of these species, and in which museum collections the specimens currently reside.

The book is wonderfully illustrated, with a mix of historical and contemporary paintings by an incredible array of artists. These range from a variety of Old Dutch masters and Audubon to late Victorian painters such as Keulemans and Frohawk, to paintings by living artists such as Julian Hume, Douglas Pratt and Elizabeth Butterworth. Fuller himself is a talented and highly artistic bird painter—his paintings of Great Auks, birds of paradise, and parakeets are particularly nice. In addition, the book is illustrated with often-whimsical photographs of the historical personalities and even of some of the extinct species themselves.

Extinct Birds is a well-written and nicely illustrated book that will be of great interest to ornithologists and conservation biologists, and would appropriately serve the interested amateur. It will colorfully and comprehensively serve as a reminder of the evanescence of nature and species, and of the factors that continue to threaten birds today. It is my likely unrealistic hope that future editions will not be significantly larger than this second edition.—ROBERT C. FLEISCHER, Department of Systematic Biology, National Museum of Natural History, Smithsonian Institution, 3001 Connecticut Ave., NW, Washington, DC 20008-0551. E-mail: fleischer.robert@nmnh.si.edu.

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BRIEFLY NOTED

Asian Buffet—All You Can Read

A Field Guide to the Birds of Korea.—Woo-Shin Lee, Tae-Hoe Koo, and Jin-Young Park. Illustrations by Takashi Taniguchi. Translated by Desmond Allen. 2000. L.G. Evergreen Foundation, Seoul, Korea. 328

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pp., 120 color plates, 450 color range maps. ISBN 0-8014-8631-9. 30 000 won (about $24; paper).

All 450 species of birds found on the entire Korean Peninsula are covered for the first time in this comprehensive field guide. The introduction provides such field guide standards as how to use the book, glossary of terms, and a diagram of avian topography. Unfortunately, there is no information on habitat or geography of Korea, which is too bad given how little Westerners know about North Korea. Species descriptions include such standard information as description, similar species, voice, status, and habitat within Korea. The book is illustrated by Takashi Taniguchi, who has illustrated a half dozen other field guides from the region. The color drawings, which often depict adults of both sexes and juvenile and immature forms, are spread throughout the book on plates that accompany the brief species descriptions and range maps. For each species, the plates often also include birds in summer and winter plumage, and perched and in flight. Useful diagnostic characteristics are indicated with arrows. The range maps are a rather small scale, emphasizing each species' range within eastern Asia rather than details of their distribution on the Korean Peninsula. Measuring 18 × 11.5 × 1.8 cm, the book is small enough to carry in a back pocket. The binding is inferior in quality: on my copy the cover is separating from the endpapers, to which it is poorly glued. The book will be useful for people birding Korea, but there is very little information about each species, so those interested in learning about Korean species should consult a more authoritative text. All proceeds from sale of the book will be donated to avian conservation efforts in Korea. For a more in-depth review see Lee (2001, Ibis 143:511).

A Guide to the Birds of the Philippines.—Robert S. Kennedy, Pedro C. Gonzales, Edward C. Dickinson, Hector C. Miranda, Jr., and Timothy H. Fisher. 2000. Oxford University Press, Oxford, UK. 369 pp., 6 pen-and-ink drawings, 72 color plates, 500 color range maps, 1 table. ISBN 0-19-854669-6. $39.95 (paper). ISBN 0-19-854668-8. $95.00 (cloth).

With over 7100 islands, the Philippines is a daunting and complex country for which to catalog the avifauna. Kennedy et al. have done an admirable job with this first-ever complete guide to all 572 species occurring on its islands. In addition to providing an overview of the book, the Introduction discusses how the author considered accepting records of new localities for species. An overview of Philippine avifauna and biogeography would have been helpful. The publishers have compiled a team of 12 superb artists to illustrate the plates. Each species is beautifully illustrated, usually within the ecologically and behaviorally appropriate context. Male and female, adult, immature, and juvenile, breeding and nonbreeding plumages are often shown as well as flight and perching postures. Confusing races are also shown, usually in ways to emphasize distinguishing characteristics (e.g., four subspecies of the Colasisi [*Loriculus philippensis*], Plate 30). Species maps indicate endemic, resident, migrant/accidental, and resident ranges, and focus on the region occupied rather than always the entire country. Accompanying each plate are brief descriptions of the species status, appearance, and habitat. Following the plates are more in-depth accounts for each bird, including description, similar species, habits, voice, and range, including a list of islands the bird has been found on historically. Sometimes brief notes on the bird's taxonomic and conservation status are included. The authors have compiled a useful table to aid identification of the nine confusingly similar species and subspecies of swiftlets, including major islands of occurrence and diagnostic characteristics. Although too large to fit in most back pockets (23.3 × 15.5 × 2.8 cm), this book would be indispensable for anyone birdwatching in the Philippines. This book, which is well documented and wonderfully illustrated, will make a useful companion in the field as well as a worthwhile addition to any collection of regional bird guides and natural history books. For a more in-depth review see Crosby (2002, Ibis 144:166–167).

A Guide to the Birds of Southeast Asia.—Craig Robson. 2000. Princeton University Press, Princeton, New Jersey. 504 pp., 104 color plates. ISBN 0-691-05012-0. $59.50 (cloth).

Another in Princeton's superlative ''Guide to the Birds of . . . '' field guide series, this one covers all 1251 species of birds found in the seven countries that make up Southeast Asia: Cambodia, Laos, peninsular Malaysia, Myanmar (formerly Burma), Singapore, Thailand, and Vietnam. A team of 14 artists beautifully and accurately illustrated each species. The reproductions are a bit on the small size—necessitated by the difficulty of covering so many species in a single volume small enough to travel with—but still in high enough quality to see many fine diagnostic details. The majority of birds are depicted perching, but some (e.g., hawks, gulls, and herons) are shown both in flight and perched. Separate illustrations show major plumage variants including sex, age, and distinctive subspecies. Illustrations are grouped in 104 color plates accompanied by very brief diagnostic characteristics. Following the plates are more-detailed, yet still brief species accounts including identification, vocalizations, habitat, behavior, range, status, breeding status, nest, and egg descriptions. The information provided is useful in the field, but perhaps too brief to be of much use as a reference book. Only English and scientific names are given, no Asian or local names. No range maps are provided. This attractive and useful book is a bit large (24.5 × 18.5 × 5 cm, 1.1 kg) for carrying in a back or jacket pocket, but would be invaluable for a serious birder or ornithologist visiting the area. For a more in-depth review see McGowan (2001. Quarterly Review of Biology 76:94–95) and Styring (2001, Auk 118:570–571).

Birds of Thailand.—Craig Robson. 2002. Princeton University Press, Princeton, New Jersey. 272 pp., 128 color plates, 950 color range maps. ISBN 0-691-00700-2. $24.95 (paper). ISBN 0-691-00700-4. $49.50 (cloth).

The twelfth installment in the ''Princeton Field Guides'' series, not to be confused with the superior Princeton ''Guide to the Birds of . . . '' series. *Birds of Thailand* is a scaled-down version of Robson's *Guide to the Birds of Southeast Asia* (above). It contains condensed information from that guide for the 950 bird

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species found in Thailand. Descriptions are reduced and sometimes changed to telegraphic style. Information on identification (i.e., size, age, and sex-specific description, voice, habitat, and behavior) is retained, but more ancillary information (i.e., status, breeding, nest, and eggs) is removed. However, of particular note is the addition of color range maps for all species, in some ways making this guide more useful than the parent volume for birders working in or visiting the country. Names are not given in Thai. There is a very brief introduction on how to use the book, a glossary, and a diminutive bibliography. The book measures 14.8 × 22 × 1.9 cm. This book would make a valuable companion for birders in Thailand, but Robson's *Guide to the Birds of Southeast Asia* is a better library resource. For a more in-depth review see Redman (1999, Ibis 141:691).

A Field Guide to the Birds of China.—John MacKinnon and Karen Phillips. 2000. Oxford University Press, Oxford, UK. 586 pp., 128 color plates, ~1300 color range maps, 6 appendices. ISBN 0-19-854940-7. $45.00 (paper).

Covering 1329 species, this very thick field guide (3.7 cm) is a useful one for birders visiting this highly diverse country. This book encompasses the lowest point on earth (−155 m) and the highest (8848 m), and spans tropical forests and mangrove swamps to alpine and permafrost-covered grasslands. Over 100 species of birds are endemic to China or nearly so. China is the center of diversity for pheasants and laughing thrushes, and this book is particularly interesting as a source of information, albeit brief, on these groups. The color plates, by Karen Phillips and David Showler, are well executed and show multiple morphs (male, female, adult, immature, breeding, winter, dark phase, light phase, etc.) of each species as appropriate. Many are shown both perching and in flight. Color range maps accompany each plate along with English, scientific, and Chinese names using Chinese characters. Species accounts briefly describe appearance, voice, range, distribution and status within China, behavior, and habitat. In this section, Chinese names are given in pinyin romanized form. There are informative discussions of the physical, climatic, and floristic environment as well as Chinese culture, ornithological history, and avian conservation and biogeography. The book is also to be published in Chinese, making it accessible to many Asian ornithologists and birders, which will help facilitate the collection of more data on the fascinating but understudied Chinese avifauna.

A Field Guide to the Birds of West Malaysia and Singapore.—Allen Jeyarajasingam and Alan Pearson. 1999. Oxford University Press, Oxford, UK. 460 pp., 72 color plates, 42 black-and-white drawings, 16 black-and-white maps, 6 appendices. ISBN 0-19-854962-8. $55.00 (paper). ISBN 0-19-854963-6 $95.00 (cloth).

The Malay Peninsula contains 665 native species of birds, in spite of the loss of 60% of its original equatorial rainforest. The illustrations by Alan Pearson are decent, with vivid colors, although they are a little lacking in depth. Distinct sexual forms are usually illustrated separately and age differences sometimes are. The plates are accompanied by very brief diagnostic descriptions and sizes. Species accounts, provided in a separate section, include information on description, voice, species range, regional distribution and status, habitat, and habits. Vernacular names are given in English and Bahasa Melayu, the local language. The book also provides succinct introductions to ornithological history, physiography, climate, habitats (natural and anthropogenic), birding areas, and avian biogeography, migration, and breeding in the region. Two of the appendices, one on nightbird calls and the other on barbet calls, are useful for field identification of these often confusing birds. Latitudes, longitudes, and elevations of many of the places named in the book are also included in appendices. Although too large to fit in the back pocket, this guide is still small enough (21 × 14.5 × 3.8 cm) to easily bring in the field. For a more in-depth review see Jepson (2000, Ibis 142: 690) and McGowan (2001, Quarterly Review of Biology 76:94–95).—WILLIAM I. BOARMAN, Western Ecological Research Center, U.S. Geological Survey, San Diego, CA 92123. E-mail: william_boarman@usgs.gov

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