REVIEWS

EDITED BY M. ROSS LEIN

The following reviews express the opinions of the individual reviewers regarding the strengths, weaknesses, and value of the books they review. As such, they are subjective evaluations and do not necessarily reflect the opinions of the editors or any official policy of the A.O.U.—Eds.

Kadimakara: extinct vertebrates of Australia.—P. V. Rich and G. F. van Tets (Eds.), with illustrations by Frank Knight. 1985. Victoria, Australia, Pioneer Design Studio. 284 pp., 33 color plates, 212 text figures and maps. ISBN 0-909674-26-4. Cloth. Available from Australian Book Source, 1309 Redwood Lane, Davis, California 95616. $45.00.—"Kadimakara," or Dreamtime animals, are the strange monsters said in Australian Aboriginal myth to have lived amongst lush vegetation in what are now the deserts of central Australia. The legend explains how the kadimakara died and their enormous bones came to lie on the surface of salt pans in the Lake Eyre Basin. This book describes the discovery of these bones by British and European naturalists, and the subsequent course of Australian paleontology. After a straightforward historical chapter by Rich, there follows in more detail an engaging description by R. H. Tedford of the extensive Australian fieldwork by R. A. Stirton and his crews, who found in central Australia the record of a great Tertiary diversity, including several taxa of fossil flamingos and the Pleistocene giant emus.

The chapter summarizing the Australian environment throughout geological time will be useful to any ornithologist wishing to put the fossil avifauna in a broader context. Up-to-date conclusions from plate tectonic data are included in generalized and simplified form, as are climatic reconstructions for the continent. But the real heart of the book lies in the 33 chapters on individual species or small groups of related species of various extinct vertebrates, including 6 birds (from the Sphenisciformes, Dromornithidae, Galliformes, Phoenicopteriformes, Cuculiformes, and Caprimulgiformes). A description of each species was written by a paleontologist who has collected and studied that species. Anatomical information is provided in the context of some general information about closely related forms and with a beautifully illustrated reconstruction of the animal in a setting of sympatric taxa and appropriate vegetation. These detailed watercolors are in the very best traditions of both quality wildlife illustration and accurate reconstruction from fossil material. The biological information is accompanied by a description of the discovery and subsequent study (often with accompanying controversy) of the fossils representing that species. This part is often as interesting as the biology, bringing Australian paleontology to life in an added dimension.

Careful and thorough editing is evidenced by the paucity of typographical errors and by the uniform readability of the prose in spite of a diversity of authors. There are occasional lapses into terminology too technical for the ambitious layperson who would otherwise enjoy the book. A detailed index is provided, but a glossary is not. University and museum libraries should own "Kadimakara," and many community libraries will want to. Individuals may want to buy it for pleasure as well as edification, if they have interest in the Australian fauna, fossil vertebrates, or the history of paleontology. This book nicely demonstrates that being informative and a "good read" are not mutually exclusive.—NANCY A. NEFF.

Records of the Australian Museum (1985), volume 37, Nos. 3, 4.—J. K. Lowrie (Ed.). 1985. ISSN-0067-1975. "Morphology of the Noisy Scrub-bird, *Atrichornis clamosus* (Passeriformes: Atrichornithidae) . . ." and related papers. No price given.—This collection of 9 papers on the morphology and systematic relationships of the Australian scrub-birds (Menurae: Atrichornithidae) and lyre-birds (Menurae: Menuridae) had its impetus in the collection, in 1976, of a single specimen of the endangered Noisy Scrub-bird, which was previously represented by only one other anatomical specimen. The time was ripe for this action because these rare birds may never again be as available as they are now. Scientific inquiry into the long-enigmatic problem of the relationships of the Menurae is ample justification for the present studies, so overstatements about the value of this volume for the conservation of the species were unnecessary. Prudent use of this specimen was exemplified by the careful orchestration of research on its parts and the distribution of casts of the skeleton to several museums. It is both ironic and unfortunate that few other passerines have been studied in comparable detail, despite their relative abundance and availability.

M. H. Clench compared the body pterylosis of the Menurae with a representative series of other passerines by examining radiographs and the internal side of flat skins. M. L. Morlion clipped the feathers of *Atrichornis* and *Menura* to study the tracts of the wings and tails. G. T. Smith recorded the ontogeny of the natal downs of living scrub-birds. P. V. Rich, A. R. McEvey, and R. F. Baird made osteological comparisons within and between *Menura* and *Atrichornis*. R. J. Raikow and R. L. Zusi studied appendicular and

axial myology of the Menurae, respectively. W. J. Bock describes the cephalic myology and osteology of *Menura* and *Atrichornis* in comparison with a few selected passerines. Bock and Clench conclude the volume with a pointed summary paper, which answered concisely all of the questions I had about the other papers. Their summary, and the papers by Clench and Smith, also review the literature on the taxonomy of the Atrichornithidae, highlighting numerous errors in earlier papers.

The volume is generally straightforward and clear, though very dry. The illustrations, including radiographs, drawings, diagrams, and stereophotographs, are generally excellent throughout. Although Rich et al.'s photographs of skulls are too small to be useful, Bock rectifies this deficiency with good drawings in his description of cephalic anatomy. Papers are uniformly free of editorial and printing errors, but Clench and Smith's statement (p. 112) of the dearth of skeletal specimens of *Menura* and *Atrichornis* in 1966 could easily mislead readers to believe that the situation has not improved since then. Methods and sources of nomenclature are clearly cited in all but Morlion's paper. Raikow would have facilitated referral to his figures if he had listed anatomical abbreviations in the descriptive text, not only in "methods." Descriptions are inconsistent from one paper to another in that some are purely descriptive and others purely comparative. There are no obvious omissions of relevant literature in the references, but the citation of C. G. Sibley and J. E. Ahlquist's (1985, Proc. 18th Int. Ornithol. Congr.: 83) paper on passerine phylogeny needs to be updated throughout. The descriptive work stands on its own, and readers will not need to examine the supporting literature except to evaluate the systematic interpretations.

The chief faults in this volume derive from what was not included, such as description of the nonmyological soft anatomy, detailed functional analyses, and studies on the DNA by Sibley and Ahlquist, the syrinx by P. Ames, and the stapes by A. Feduccia, which use the same specimen of *Atrichornis*.

Although the volume is a great success as a descriptive treatise on the Menurae, it fails miserably in systematic interpretation because none of the authors, except Clench, made extensive comparisons with other passerines. The only systematic consensus reached is that the Menuridae and Atrichornithidae are sister taxa, but quite distinct from one another. Sibley and Ahlquist's (1985) hypothesis of a relationship between the Menurae and Ptilonorhynchidae receives varying degrees of skepticism. Clench, in particular, rejects their hypothesis of monophyly of the corvine assemblage, and instead advocates a sister-group hypothesis of the Ptilonorhynchidae and Paradisaeidae. No one gives credence to A. Feduccia and S. L. Olson's (1982, Smithsonian Contrib. Zool. 336: 1) hypothesis of a relationship between the Menurae and the Rhinocryptidae. Rich et al. argue vaguely that, as terrestrial passerines, the Menurae are convergent with, rather than related to, the suboscine rhinocryptids. Although this is plausible, Rich et al. do not support their opinion with detailed analyses, except for citing as an example the reduction of the pectoral appendage. Yet their conclusion is echoed as virtual fact by Bock and Clench. Many of the characters cited by Feduccia and Olson to unite the Rhinocryptidae and Menurae are obviously not related in any way to specialized locomotion. *Grallaria*, another terrestrial passerine that is definitely related to the Rhinocryptidae, does not exhibit many of these putative specializations (pers. obs.).

Laughably, Rich et al. suggest on the basis of a dried skeleton specimen that the last rib of *Atrichornis* passes through the sternal notch. Although stranger things occur in nature than in man's imagination, such an anatomical condition is unlikely because the sternal notch is covered by the membranous origin of the pectoral muscle in intact birds, including *Atrichornis*.

Bock and Clench present 9 hypotheses, representing the spectrum of opinions concerning the relationships of the Menurae, and critically examine each in light of the present studies. Their clear definitions of these hypotheses are useful, but several of these hypotheses do not differ significantly from each other. For example, the hypothesis of rhinocryptid/menurine relationship is stated 3 times (hypotheses 3, 5, and 9). Hypothesis 9, that the Rhinocryptidae and Menurae are both primitive and therefore closely related, is confused. Retention of shared primitive characters does not indicate relationship. Rejection of these hypotheses depends on what is considered to be a lack of "convincing" supportive morphological evidence, more than the presence of contradictive evidence. Bock and Clench argue that the Rhinocryptidae and Menurae are not relictual lineages but are instead convergent, because they interpret the Menurae as being specialized, rather than primitive. This fails to acknowledge that a given organism can exhibit a constellation of both primitive and specialized characters at the same time, a good example being the archaic egg-laying mammal *Ornithorhynchus*, which possesses poisonous spurs and other specializations.

This will be a classic morphological reference for centuries to come because of the rarity of museum specimens of both *Atrichornis* and *Menura*. It will be especially useful when and if the rest of the Passeriformes are studied in as much detail. Every major ornithological library should have a copy.—PETER HOUDE.

An analysis of physical, physiological, and optical aspects of avian coloration with emphasis on wood-warblers.—Edward H. Burtt Jr. 1986. Am. Ornithol. Union, Ornithol. Monogr. No. 38. x + 126 pp., 41 text figures. ISBN 0-943610-47-8. $15.00 ($12.50 to A.O.U. members).—The question "Why do birds have the

colors they have?" must surely be one of the more fundamental questions in ornithology. We know, or assume we know, the functions of colors: for camouflage, for optical signaling, and so forth. But very little work has been done to provide evidence that these functions are real. Burtt's monograph is an attempt to remedy this situation.

Burtt utilizes the 115 species of wood-warblers (Parulidae), which show a diversity of colors and patterns but similar size and proportions. He usually starts with a physical model and from this predicts which body regions should have which colors, if the hypothesis is correct. He then investigates whether the distribution of colors among wood-warbler species agrees with the prediction.

The main reasons the study of bird colors lags so much behind the study of, for instance, bird voices probably are the somewhat complicated method for objective measurement of color (reflection spectrophotometry) and the calculations necessary to transform the spectral values into "color values" that can be grasped intuitively. Burtt uses reflection spectrophotometry but supplements it with the Munsell color system to cope with the impressive number of color determinations to be done: 10 body regions of both sexes of 115 wood-warbler species, plus color determinations of legs and bills. Only 10 different plumage colors are considered necessary. This may be sufficient, but it is unsatisfactory that no data on variation are given. It is not mentioned to which color category, for example, rusty streaks on a yellow background are assigned.

Burtt studies in detail the suggestion that some colors are used because they make the feathers more resistant to natural wear. Experiments in which feathers are exposed to airborne particles show that dark (melanic) feathers are more resistant to abrasion than nonmelanic feathers. He predicts from the airflow pattern around a flying bird that remiges show the greatest tendency toward abrasion-resistant color, followed in sequence by the medial tail feathers, other tail feathers, and the dorsum. The data confirm this. I find this entirely convincing, but I suspect that the frequent occurrence of yellow-green backs is more related to concealment than to abrasion resistance. Burtt also fails to mention that in yellow-green feathers only the barbules are melanic. The rami are yellow and therefore have relatively little resistance to abrasion.

Melanic plumage is much more frequent in desert-dwelling species than in oceanic species, and Burtt relates this difference to a much higher density of large, airborne particles in deserts. He is probably right, but other factors that are undoubtedly also important are discussed too briefly. The strength of the study in dealing with the homogeneous group of wood-warblers is entirely lost in this comparison. It should not have been included in the monograph.

When dealing with the question of the influence of coloration on the energy balance between the bird and its environment, the unfeathered parts, in particular the legs, are emphasized. Burtt formulates a general equation for energy balance in the legs and concludes that dark-legged species are more tolerant than light-legged species of conditions that increase energy loss from the legs. He then beautifully demonstrates that light-legged species arrive north in spring, and depart south in autumn, at higher air temperatures than dark-legged species, and that light-legged species inhabit warmer habitats in winter than dark-legged species.

However, when I read this chapter I had a vague feeling that something in the reasoning was unclear. Burtt states (p. 119) that "metabolic heat entering the legs from the body is negligible." But he recognizes (p. 45) that when the temperature of the legs approaches 0°C, heat must be transferred from the body to the legs. At higher temperatures, apparently, only heating of the legs resulting from the absorption of solar and long-wave energy is taken into account, as if the energy-balance equation is applied to legs that are nonliving structures separated from the rest of the bird. I feel that the way the equation is used is an oversimplification, but believe the results.

Other chapters deal with coloration that interferes with vision, with color patterns that increase visibility, and with the colors of optical signals.

It is no small task Burtt has put before himself. Not only has it involved a lot of practical work, but also knowledge of such diverse fields as color science, anatomy, energetics, mechanical physics, and behavior. With this in mind, it is almost unavoidable that some errors are made, and my critique is to be seen in that light. On the whole I feel Burtt has succeeded. He convincingly demonstrates the deductive power of the "evolutiono-engineering approach."

But this method is not perfect, as also pointed out by Burtt, because it can only suggest which hypotheses merit further consideration. No measurements of selective pressures are carried out. A risk in this method is that the model is adapted to fit the correlations that the researcher intuitively feels are correct. This should not lead to rejection of the method, but instead it should result in attempts to make the models more realistic and exact. Burtt has taken significant steps to establish such models.

His study is important on three levels: (1) the demonstrations of particular colors occurring frequently on certain body regions in accordance with predictions based on a physical model, (2) the discussion of how color patterns result from the integration of colors under selection from different causes, and (3) the systematization of the field "avian coloration" as seen from a functional, evolutionary point of view. Perhaps the last of these is most important, and probably Burtt's study will inspire similar studies. The monograph is an important pioneer work of fine quality in a field of ornithology that deserves more attention.

The text is clear and concise. Errors are few, but present. Equations 4.4 and IV.17 should be identical, which they are not. The illustrations are mostly good, but the symbols are not sufficiently different in Fig. 40, and there is tremendous variation in the degree to which the diagrams have been reduced from their original size. I find it unforgivable, however, that this monograph on coloration is published entirely in black and white. Not a single illustration is in color. Only the dull bluish gray cover attempts, in vain, to remedy the situation. Is it forbidden for serious, scientific papers to be beautiful? It is a pity the editor missed the chance given by the subject of this monograph.

The study is essential to college, university, and museum libraries. I further recommend it to anyone interested in bird colors, and who will take the trouble to become acquainted with the somewhat complicated, but not overwhelming, theory of color definition and measurement.—JAN DYCK.

Harrier: hawk of the marshes (The hawk that is ruled by a mouse).—Frances Hamerstrom. 1986. Washington, D.C., Smithsonian Institution Press. 171 pp., 27 black-and-white photos, 18 figures, 11 tables, numerous sketches. ISBN 0-87474-538-1, cloth, $24.95. ISBN 0-87474-537-3, paper, $10.95.—Several years ago Smithsonian Institution Press inaugurated a series of nature books with the publication of Robert Nero's "The Great Gray Owl" (1979). Books in the series are aimed at a wide audience, including bird-watchers, amateur and professional ornithologists, undergraduates studying ornithology, and nature lovers. To date, the offerings—which should not be confused with the continual spate of coffee-table books in which a weak text is surrounded by elegant photography—are reminiscent of the book-length narratives of F. F. Darling, Niko Tinbergen, and Konrad Lorenz. Although some of the books include color photos, the bulk of illustrations in this series consists of numerous black-and-white photos, sketches, and figures. Fran Hamerstrom's "Harrier: Hawk of the Marshes," a personalized account of the author's monumental 25-yr study of the breeding ecology of Northern Harriers (*Circus cyaneus*) in central Wisconsin, is the most recent avian offering in the series. Although the book contains 12 appendixes (mainly tables) of original data and 22 episodic chapters detailing the author's experiences, Hamerstrom's effort is not so much a detailed treatise in avian ecology as an autobiography.

And what a career she has had. Fran Hamerstrom is a remarkable ornithologist in a number of ways: She was the only female graduate student of the venerable Aldo Leopold, and she was almost single-handedly responsible for organizing and implementing a successful cross-Atlantic "foreign aid" program that enabled many war-ravaged German ornithologists to get back on their feet in post-World War II Europe, long before the Marshall Plan took effect. But perhaps her most remarkable accomplishment has been her 25-yr study of Northern Harriers on land managed for Prairie Chickens (*Tympanuchus cupido*), on the Buena Vista Marsh in Portage Co., central Wisconsin. The study, initiated in 1957 and continued in earnest from 1959 through 1983, is not only one of the longest studies of breeding raptors in North America, it also has the dubious distinction of being one of the least funded long-term studies ever attempted. (Although she received a total of $1,300 from the J. Van Tyne and F. M. Chapman funds—or about $50/yr over the length of the study—Hamerstrom bore almost the entire cost of her "harrier project." As she notes in her chapter on fund raising, "nobody paid me to work on harriers.") The book is not a primer on grantsmanship, but it provides plenty from Fran about what to do and what not to do in the field.

Hamerstrom's study is also noteworthy because it provided a training ground for dozens of budding ornithologists. Aside from her husband and constant companion, Fred, the harrier project attracted numerous young and not-so-young students, some 48 of whom are listed in in the book's Dedication. Although not all of these former students—Hamerstrom prefers the (I hope) endearing term "gabboon"—have gone on to careers in ornithology, a number have, including the current Book Review Editor of *The Auk* and me. Fran Hamerstrom is to be congratulated on her accomplishment as unofficial advisor to so many undergraduate and graduate students. She continues this effort in the book by providing those interested in Northern Harriers with a rudimentary introduction to the breeding ecology and behavior of the species. In addition, much of the book is a manual in field techniques associated with the study of harriers. Although Fran is not your typical "how to" author, the book manages both to inform and entertain during these passages. The heart of the book, however, is a personal account of the results of Hamerstrom's long-term study in which 326 harrier nests were found, 647 nestlings were banded, and numerous adults were marked individually with color jesses and imped feathers. (Imping is the falconry technique of replacing the damaged portion of a bird's remige or rectrix by splicing the feather with an undamaged section from a spare that Hamerstrom adapted for color marking.)

Hamerstrom's initial attraction to harriers was her desire to learn whether they mated for life. (They do not.) In addition to describing how she went about answering this question, her book documents a decline in the breeding population of the Buena Vista harriers during the "DDT years" and the subequent increase in their numbers after widespread application of the pesticide ceased in the area in the early 1970's. The book also provides a surprisingly candid account of the effects of telemetering a pair of breeding harriers (both individuals deserted the nest), as well as intriguing descriptions of the "personalities" of several hand-reared harriers. (If the latter accounts

fail to convince readers of the necessity of getting close to one's study animal, I suspect nothing ever will.) Hamerstrom also touches on the positive correlation between the number of breeding harriers and the abundance of meadow voles (*Microtus pennsylvanicus*) in central Wisconsin.

The book provides fine coverage of Hamerstrom's studies of the breeding biology of harriers on the Buena Vista Marsh, but it is not a monograph on harrier behavior and ecology. Hamerstrom does not, for example, offer much on migration or winter ecology, nor does she undertake a thorough comparison of her results with those of other raptor biologists. Readers who want to know more about harriers elsewhere in their range will need to check the primary literature, which is considerable, as well as Donald Watson's fine monograph "The Hen Harrier" (1977). Although the latter concentrates on Watson's observation of harriers in Scotland, it offers a more complete view of harrier ecology than does Hamerstrom's book. (Interestingly, the front covers of these two books are strikingly similar: both depict the aerial transfer of a vole from an adult male harrier to its mate.)

"Harrier: Hawk of the Marshes" is certainly not a full-scale monograph on Northern Harrier ecology and behavior, but it is good reading and should be of interest to raptor aficionados as well as to those wanting to know more about the personalities of avian ecologists. The book is well laid out, with numerous photos, maps, and graphs; none of these are numbered, however, and most have only brief legends. As a result, the rationale for their inclusion is not always apparent.—KEITH L. BILDSTEIN.

Holocene vertebrate fossils from Isla Floreana, Galápagos.—David W. Steadman. 1986. Smithsonian Contrib. Zool. No. 413. iii + 103 pp., 4 black-and-white plates, 25 text figures, 12 tables. No price given.—In this report, David Steadman makes several significant scientific contributions. First, and in my mind foremost, is the publication of his collection of fossils from Isla Floreana, one of the Galápagos Islands. This work provides a new and valuable set of information that we may use to improve our understanding of avian evolution on these islands. Second, Steadman compares the fossil and modern faunas of Isla Floreana. There is an extended discussion of the factors that led to the extinction of 7 vertebrate taxa on Floreana. Finally, Steadman discusses his findings as they relate to island biogeography.

To set the stage for his analysis of the fossil fauna, excellent summaries of the geology, climate (modern and prehistoric), vegetation, and human history of Floreana, and of the Galápagos Islands in general, are included. These go far beyond the usual background material provided in such publications and should prove valuable to other investigators working in this historically important archipelago.

The Galápagos Islands have played an essential role in furthering our understanding of evolution, and now, with Steadman's collection of fossils, we have information concerning the ancestral forms on these islands. More than 20,000 specimens were collected during this study, and 28 species were identified in the prehistoric fauna through comparisons with modern skeletal material. The description of the fossils include their probable age, the relative frequency of each taxon within the collection, and the probable means by which they were deposited in the lava tubes.

Beyond reporting on this intrinsically interesting set of fossils, the significance of this contribution lies in its application to island biogeography. The major underlying question throughout the report is "How much impact have humans had on the existing fauna?"

As a result of his faunal analysis, both present and past, Steadman concludes that 7 vertebrate taxa have become extinct since man's arrival on the island. The importance of this finding is that the fauna of Isla Floreana cannot be considered to be in an equilibrium state. Steadman states that ". . . most biogeographers prefer to analyze today's floras and faunas, not those of the past. But such studies are meaningless if the fauna of a relatively undisturbed island is compared to that of another island that has been greatly altered by man." Consequently, Steadman feels that historical information is essential to any study of island biogeography: "I believe that any biogeographical analyses, whether on continents or islands, are unreliable if they are not backed by historical information."

Having stated the importance of historical information to the successful study of island biogeography, Steadman discusses several other criticisms of this research program. The points raised are very interesting but add little that could not be found in the more extensive literature that directly addresses these questions.

An understanding of the causes of recent extinction is essential before discussing how those extinctions affect research in island biogeography. Therefore, it is important that the reader carefully consider Steadman's conclusions concerning the number of forms that have disappeared from Floreana in recent times. Of the 7 taxa identified by Steadman, there remains serious doubt whether 2 were even extant on Floreana at the time of human settlement. *Buteo galapagoensis* has never been reported from Floreana, either as a fossil or as an extant taxon. Yet Steadman includes it as a taxon that has gone extinct in historic times on the strength of a statement by Gould that Darwin had knowledge of them (p. 68). The connection to Floreana is extremely tenuous, made more so by the fact that Darwin, the person responsible for the original "observation," makes no mention of it in his writings.

The second species, *Tyto punctatissima,* is known from Floreana only as a fossil form. Steadman includes this species as a taxon that has gone extinct on Floreana in historic times because of the occurrence of *Mus* and *Rattus* bones in the lava tubes. The assumption is that these two introduced mammals could only have appeared in the lava tubes as a result of predation by *Tyto.* "I believe that barn owls died out in historic times, as with all other extinct vertebrates from Floreana. Otherwise, the remains of black rats (*Rattus rattus*) and house mice (*Mus musculus*) in the caves would be difficult to explain" (p. 68). Barn Owl predation would certainly account for the appearance of these mammalian fossils in the lava tubes (assuming that *Tyto* was extant on the island when humans colonized), but it is not clear that this was the only possible means of deposition. For example, Steadman does not discuss why these rodents could not have entered the lava tubes under their own power, a reasonable possibility for small terrestrial forms. Unless alternative explanations can be eliminated, the occurrence of these fossils provides very weak support for the idea that *Tyto punctatissima* was resident on Floreana when humans arrived.

Two additional taxa (*Alsophis biserialis* [Colubridae] and *Geospiza nebulosa*) appear to have been more common in the prehistoric fauna but were rare at the time humans arrived. In these cases extinction clearly took place after human settlement, but it is not known what role humans played. Human activity may have perturbed an equilibrium situation and caused the extinctions, as suggested by Steadman, or may simply have accelerated the extinction of forms that were already dying out. The distinction between these alternatives is important because Steadman is suggesting that these recent extinctions are complications that are unaccounted for by island biogeographic theory. Extinction is an integral part of this theory, however, and if taxa were already headed for extinction, then it may be inappropriate to use their disappearance as evidence that the assumptions of the theory have been violated.

Though independent of the major points raised by the author, there is one methodological problem that I must mention. In general Steadman does a superb job of describing the collecting sites and methodology and of detailing the progression of thoughts that led to his conclusions. While discussing the 28 vertebrate taxa that appeared in his fossil collection, however, he recommends, but does not substantiate, three nomenclatural changes (elevating *Tyto punctatissima, Pyrocephalus nanus,* and *P. dubius* to full species). The use of proper nomenclature is critical when reporting the results of scientific studies. To change nomenclature in such a casual manner (a total of three modern specimens were examined for these two genera) is inappropriate.

This report is a valuable contribution to our knowledge of faunas of the Galápagos Islands, with implications for biogeography. Steadman has demonstrated that through a careful study of the literature and early collections (where these sources of information exist), it is possible to document faunal shifts that have occurred since the initiation of human activity in an area. This information can be invaluable to biogeographers. Additional information can be obtained through an investigation of fossil remains. Such paleontological studies can provide information about prehistoric faunas and estimates of prehistoric extinctions. I recommend this book to museum and university libraries, and to paleontologists and ornithologists interested in island faunas.—SCOTT M. LANYON.

Grand Canyon birds.—Bryan T. Brown, Steven W. Carothers, and R. Roy Johnson. 1987. Tucson, Arizona, University of Arizona Press. xv + 302 pp., 50 text figures, 2 maps. ISBN 0-8165-0930-1. Cloth. $19.95.—The distribution of birds in the Grand Canyon region has been summarized over the years in a series of annotated checklists, most recently in 1984. Brown et al. attempt to do more. This volume is both a summary of the status and distribution of 303 species found in and near the Grand Canyon and a history of ornithological research in the area. The authors seek to describe to the layperson why ornithologists and park managers study Grand Canyon birds. The result is a very enjoyable account emphasizing the value of modern research and pointing out how much is still unknown.

The first half of the book is devoted to a description of the Canyon, its habitats, and how early and contemporary naturalists have investigated its birds. The work of Mearns, Merriam, Nelson, and the Baileys, among others, is described in a highly readable narrative (Chapter 1). This account makes heavy use of the published field notes of many early ornithologists, and should remind us of the importance even today of taking complete field notes and making them available for future researchers. Although most journals no longer publish such records, field notes can be deposited in appropriate museums so that comparisons between present and future avian distributions will be possible. Such sources must be used with caution, though. According to Brown et al., the only record of Gray Catbird (*Dumetella carolinensis*) for the Canyon was a bird seen by Edward Nelson in 1909. One must wonder if Nelson was familiar with the Great Basin race of Rufous-sided Towhee (*Pipilo erythrophthalmus curtatus*). Female *curtatus* are very gray, and the mewing of a western towhee can be easily mistaken for that of a catbird.

The authors use Merriam's life zones to describe the Canyon's habitats (Chapter 2). This is entirely appropriate as Merriam developed the life-zone concept during his studies at the Canyon and the nearby

San Francisco Peaks. Chapter 3 details changes in bird distribution, including the paleontological and historic evidence concerning the presence of California Condor (*Gymnogyps californianus*) in the Canyon. More recent changes due to the damming of the Colorado River are extensively discussed.

The remainder of the book is devoted to individual species accounts. These accounts give each species' general status and distribution, along with brief notes on natural history. Taxonomy and the order of species follow the 1983 A.O.U. Check-list, with minor lapses (i.e. "common flicker," pp. 57 and 58). Nomenclature is not conventional in that the common names of birds are not capitalized, and the 35th Supplement to the A.O.U. Check-list (1985) was apparently overlooked. The species accounts of two forms that were raised to species status in the 35th Supplement should be corrected: the account for the Yellow-bellied Sapsucker (*Sphyrapicus varius*) actually applies to the Red-naped Sapsucker (*S. nuchalis*), and the account for the Western Grebe (*Aechmophorus occidentalis*) omits any mention of Clark's Grebe (*A. clarkii*). The latter is especially unfortunate, as the range and status of Clark's Grebe in this area is not well known.

The species accounts highlight recent changes in bird distribution caused by the creation of Glen Canyon Dam. Many of these changes are surprising. For example, several riparian birds, notably Bell's Vireo (*Vireo bellii*), have expanded their range along the river as areas of salt cedar (*Tamarix chinensis*) have become established. Western managers usually believe that native birds do not use this exotic plant. On the other hand, Black Phoebes (*Sayornis nigricans*) and Cliff Swallows (*Hirundo pyrrhonota*) have declined since the dam was built, probably because the sediment-free water issuing from the base of the dam no longer provides the mud necessary for these species to build nests.

Three appendices provide a description of four good birding locations, a gazetteer, and a list of common and scientific names of plants mentioned in the text. The last is incomplete. A Select Bibliography provides listing of relevant regional works. The text is warmly illustrated with drawings by Marion Sharp and photographs of habitats and early Canyon ornithologists.

"Grand Canyon Birds" is a desirable addition to community and personal libraries. In combination with a more technical annotated checklist of the area, it provides birders with a thorough summary of the status of the region's birds. In addition, this book will give any visitor to the Grand Canyon region a heightened appreciation of the work involved in gathering that knowledge.—JOHN B. DUNNING JR.

Patterns and evolutionary significance of geographic variation in the *schistacea* group of the Fox Sparrow (*Passerella iliaca*).—Robert M. Zink. 1986. Amer. Ornithol. Union, Ornithol. Monogr. No. 40. vii + 119 pp. ISBN 0-943610-50-8. $15.00 ($12.50 to A.O.U. members).—Evolutionary biologists study geographic variation to gain insights into the minimum adaptive potential of species. Conventionally, differences among populations have been taken to reflect adaptations to environmental gradients, and as such to indicate the sorts of changes that might take place in a lineage through time. It has been argued that microevolutionary events of the sort reflected by geographic variation are comparable to those that occur in transpecific evolution. Whether this is true or not, however, is an area of debate in biology. As well, the recent work of James (1983, Science 211: 184) raises the serious issue of the extent to which interpopulational trends in phenotype might simply be a reflection of the influence of environment on early development of individuals. Therefore, it is no longer possible to assume that geographic variation reflects adaptation, or that well-marked local populations are incipient species. Much can be learned from studies of geographic variation, however, in part because these issues are unresolved, and Robert M. Zink's study of geographic variation in the *schistacea* group of Fox Sparrows is an important addition.

The Fox Sparrow is a widespread, polytypic North American emberizid that is conventionally divided into three distinctive subspecies complexes. The *schistacea* group of subspecies, found in the mountains of the western United States, is the focus of this study. Although of limited distribution, there is a great deal of geographic variation in the *schistacea* group, and it is found in several different habitats. The purpose of Zink's study was ". . .to determine what evolutionary forces influence the historical origin and current maintenance of geographic variation in the Fox Sparrow" (p. 3). To this end, he examined genetic as well as phenotypic variation within and among 31 populations of Fox Sparrows from the western United States. There are many studies of geographic variation in size and coloration of birds, but few surveys of intraspecific variation in allozymes in a bird species, and none on the scale of this work. Zink assessed variability at 38 presumptive loci in 687 Fox Sparrows. Although the average heterozygosity in individual *schistacea* Fox Sparrows was equivalent to that of other vertebrates, there was little genetic differentiation among populations. Mantel tests indicated there is no simple geographic structure to the interpopulational genetic variation that does exist, and multiple regression revealed only a few significant relationships between allelic frequencies, heterozygosity, and the independent variables latitude, longitude, and elevation. Recognizing that some statistically significant relationships would be expected by chance alone, Zink wisely is cautious about inferring causal relationships. He argues cogently that the observed genetic uniformity among populations likely either reflects recency of ancestry or high rates of gene flow. The

data on allozyme variation in Fox Sparrows presented in this paper are of great value.

In addition to obtaining allozyme information, Zink measured 8 features on the skin and 15 on the skeleton of each specimen. He analyzed the sexes separately. (Unfortunately, sexual dimorphism is not mentioned, but presumably it was of sufficient magnitude to require separate analyses.) Of the 625 adult specimens, 449 were males and only 176 females. Only 3 of the 31 samples of females have $n > 10$, and 14 have $n < 5$; in 1 sample, $n = 1$. I realize it is often not practical or even possible to obtain samples that would wholly satisfy statisticians, but means, let alone variances, cannot be accurately estimated with fewer than 10 individuals (at a minimum). In spite of this, Zink analyzed geographic variation using ANOVA and a posteriori tests (Tables 9 and 11; several figures) and MANOVA. Zink is sensitive to the sample-size problem and discusses the results cautiously, but they should not have been included in the publication. Twenty-four of the samples of males contain 10 or more individuals; in 2, $n < 5$. The analyses of patterns of variation in the males would have been improved if only the "large" samples had been included in ANOVA and MANOVA analyses.

Zink presents the results of univariate analyses as a series of figures with pie diagrams showing geographic patterns. Statistically homogeneous sets of samples are delineated on the figures, but unfortunately mean values are not given. There is, in fact, not a single mean value given in the entire paper, making it impossible to gain insight into the magnitude (as opposed to the statistical significance) of the interpopulational variation. We are told that Fox Sparrows "exhibit extreme inter-locality variation . . . ," but not what constitutes "extreme." From the figures a general pattern of interpopulational variation is evident: Fox Sparrows have small bills and small bodies in southern Oregon and in the Great Basin, large bills and bodies in southern California and the North Coast Range, and are intermediate in size in east-central California. Zink describes characters that have this pattern of variation as showing "north–south clines." Although the pie diagrams provide an easily interpreted display of the general trends of variation, they do not show whether or not there are clines—or at least ramp-clines—and by casual inspection the trends do not appear to be north–south (although latitude is an important predictor of both body and bill size; Table 18). Bivariate plots of various measures of morphology and geography would have shown whether or not the variation was clinal.

Zink extracted the first three principal components from log-transformed data with multivariate techniques. For the male skin data, only PC I had an eigenvalue of greater than one, and all of the measures of bill correlated highly with it. The PCA was neither jackknifed nor bootstrapped, so it is difficult to assess the character stability of the correlations, but we doubtless can interpret PC I as a measure of bill size, which Zink shows to increase with body mass. The other components were small and of similar magnitude, and probably cannot be interpreted (Gibson et al. 1984, Syst. Zool. 33: 408). For the skeletal data, again only PC I had an eigenvalue of greater than one, and all of the measures correlated positively with it. As with the skin data, the other two components were small (for males eigenvalues of 0.85 and 0.76) and not interpretable. The patterns of geographic variation shown by PC I skin and PC I skeleton are nearly identical, and like that described above.

To assess the relationship between environmental variation and morphological variation, Zink used canonical correlation analysis. In all analyses, one canonical variable was sufficient to express the dependency between the morphological variables and the environmental variables (latitude, longitude, elevation, and 11 direct measures of the climatic environment). For the skin measures, Zink found that birds were larger (primarily larger bills?) at low latitudes and where it was coldest. For the skeletal measures, larger birds (body size?) were found at lower latitudes and where the June temperatures and annual precipitation were highest. Although Zink writes that "No simple association emerges from the environmental-skeletal comparison" (p. 70), the variable loadings on the climatic variables (though not on latitude) were as high as those that he interprets for the skin features. No redundancy analyses were done, however, so we cannot assess the explanatory powers of these canonical correlations (Wartenberg 1985, Syst. Zool. 34: 259).

Inasmuch as the genetic data indicate that there is probably a great deal of gene flow among populations, Zink is reluctant to interpret the substantial geographic variation in morphology that we are told exists as being adaptive. Even though the variation in bill size in *schistacea* Fox Sparrows is perhaps greater than that in any other emberizid, Zink wonders, "If conditions in southern California and the southern North Coast Range permit either a faster development or longer growth period, larger bills could result. . . . [S]ubstantial differences in morphology can be mediated by changes in the timing of onset and offset, and the rate at which particular body regions grow" (p. 94). I applaud Zink for being cautious about interpreting morphological variation as necessarily reflecting genetic adaptations that have evolved in local populations, but I am puzzled about the lack of enthusiasm—perhaps even indifference—with which he presents, analyzes, and discusses his morphological data. He writes, "I could conclude . . . that the initial stages of speciation involve differentiation in size, bill shape, plumage coloration, but not at enzyme loci. Frankly, such interpretations about adaptation and speciation 'make sense' and might in fact be adequate, if not accurate, assessments. However, . . . explanations about non-adaptation and a lack of speciation potential are also consistent with my data. . . . It is difficult to determine which patterns of

variation represent adaptation. . . ." (p. 95). Nonadaptationist as well as adaptationist explanations are consistent with any data set (as are creationist ones). Should we abandon comparative biology altogether simply because it is difficult to separate the adaptive and nonadaptive components of variation? Zink might answer in the affirmative, but I would have welcomed a discussion of Fox Sparrow food and how it might vary from place to place, of the diversity of emberizid communities, and of other factors that might logically select for (or directly influence) the diversity of bill sizes. In any event, changes in the tempo of ontogeny or the degree of phenotypic canalization may have a genetic basis and be subject to natural selection. No "genetic revolutions" are needed, but let us not completely abandon the notion of adaptation in the euphoria of neutralism. Let us not forget that natural selection apparently does operate on features such as body size and bill size (Endler 1986, Natural Selection in the Wild, Princeton Univ. Press).

By concentrating on the *schistacea* group, Zink was able to study in detail differentiation among geographically close populations living in different habitats or climatic environments. In some instances these were collected from continuously distributed populations, in others from spatially isolated ones. There are advantages as well as disadvantages to this approach. On the one hand, we are able to appreciate local adaptation (or the lack thereof); on the other we do not gain perspective about the range of variation in the Fox Sparrow, or perhaps Fox Sparrows. Given that one study cannot be carried out at all levels, I am nonetheless disappointed with this coverage of the *schistacea* group. Of the 31 samples assembled, only 6 are from outside the state of California and only 1 is from more than 150 miles from the boundaries of that state (13 birds from the Ruby Mountains in Nevada). *Schistacea* sparrows apparently are found north into southern Canada, and east to Utah and Colorado. I question whether the range of variation (genetic or phenotypic) even within the *schistacea* group has been adequately assessed. It would have been particularly satisfying to have a sample or two from British Columbia, where intergradation into *P. i. altivagans* may occur. Certainly, anyone reading only the conclusions of this work should be warned that Zink's suggestion that the three subspecies groups of Fox Sparrows be recognized as distinct "phylogenetic species" (i.e. evolutionary units) is not founded on information contained in his paper.

I picked up this monograph with excitement because I expected to find not only a stimulating discussion of geographic variation but also "state of the art" analyses. The analyses, alas, though generally adequate, do not "show the way." On the other hand, the discussions are clear, far-reaching, thoughtful, and touch many current ideas in evolutionary biology. If Zink refuses to be an "adaptationist," he has at least spared us tedious ad hoc hypotheses to explain geographic trends.—J. D. Rising.

The birds of Africa. Vol. 2, Gamebirds to pigeons.—Emil K. Urban, C. Hilary Fry, and Stuart Keith (Eds.). 1986. London, Academic Press. xvi + 552 pp., full-page plates (28 in color, 4 half-tones) by Martin Woodcock, numerous line drawings by Ian Willis, and distribution maps. ISBN 0-12-137302-9. $99.00.—With Vol. 2, "The Birds of Africa" has come of age, overcoming some of the growing pains obvious in its predecessor (see Auk 100: 1005, 1983, for review). Production has been improved, resulting in a sturdy book; within, the color plates are considerably better, and each layout of legends for a given plate now occupies a full facing page, greatly facilitating reference to the figures. A significant departure from Vol. 1 is the adoption of the superspecies concept.

A 6-page introduction precedes the nearly 500 pages of taxonomic accounts. The latter embrace Galliformes, Gruiformes, Charadriiformes, Columbiformes, and the sandgrouse, here treated as a separate order, Pterocliformes. The 39-page bibliography is separated into (1) general and regional references, (2) those pertaining to each of the 22 families treated, and (3) acoustic references, prepared by Claude Chappuis, that provide a unique listing of published discs and cassettes, individual recordists, and institutions with sound libraries containing African material. Following the bibliography is a page of errata for Vol. 1 and indexes of scientific, English, and French names.

Taxonomy in general follows that of Snow (1978, An Atlas of Speciation in African Non-passerine Birds, London) for species, and White (1965, A Revised Check List of African Non-passerine Birds, Lusaka) on the subspecific level. The 21 authors of this volume (which include the 3 editors) "have been required to assess critically the generic application of a species, superspecies affiliation, specific boundaries, and the validity of described races." This inevitably "has led to a few systematic innovations" such as the ordinal status for sandgrouse, elevating the terns to family level, and some changes in genera. The introduction sets forth the editors' rationale for decisions relating to treating various forms as full species or subspecies. Notable among the occasional deviations from recent treatment is the splitting of the Little Tern into *Sterna saundersi* and *S. albifrons*. The eastern Cream-colored Coursers are left with that species (*Cursorius cursor*), not merged with the southern *C. rufus* as done by Hayman et al. (1986, Shorebirds, London).

Readers can expect some unfamiliar English bird names. The editors have given each species "a name that clearly distinguishes it from every other bird in the world." European, rather than American, names are used for Palearctic species where these differ, but those widely used in Africa are favored over differing European ones. The editors' approach to change has been conservative; they favor traditional names even where these are "not completely accurate or appropriate." This philosophy, alas, is not extended to the Senegal Plover, here Lesser Black-winged Lapwing.

Martin Woodcock's pleasing and well-reproduced

color plates seem better planned, the figures far more lifelike than those in Vol. 1. Some of the shorebirds, in particular, are very well done. In a few cases the illustrations neither reflect identification comments in the text nor permit recognition of confusing species. The females of Hartlaub's and Black-bellied bustards (*Eupodotis hartlaubii* and *E. melanogaster*) on Plate 11 provide an example. The text states that Hartlaub's has the "lower back to tail grey (brown in ♀ Black-bellied Bustard)" but the figure of Hartlaub's is brown-tailed, and the tail of the female Black-bellied is entirely concealed. The flying figure of the latter species should show a broad band of black across the ends of the secondaries, and the amount of black on the primary tips is much less extensive than represented here. The black bill tip of *Sterna albifrons* is omitted on Plate 26, and the white forehead patch, although properly shaped, does not appear to extend behind the eye—a distinction between this form and *saundersi*. The flight pictures of the latter on Plate 28 are misleading, with too little black on the primaries. The next incorrectly refers to the eye ring of *Vanellus lugubris* as dark reddish purple; Mr. Woodcock's painting properly shows it as yellow. He has painted the legs of *V. melanopterus* much too bright, however; they should be dark, dull reddish. The bill of *V. crassirostris* should be pink, not red. The flight figure of this species should show white primary coverts, obvious in the flying bird.

The text figures of birds are more uniform than those in Vol. 1, but the treatment is still oddly variable. Thus, the eyes are darkened in some, blank in others. Dark plumage patches, such as plovers' breast bands, may be shaded (*Vanellus melanopterus*) or left white (*Charadrius tricollaris*). Many drawings are mere outlines, utilitarian, perhaps, but aesthetically deficient, especially as they are reproduced quite large (as one would expect a finished drawing to be). The flying White-rumped Sandpiper (*Calidris fuscicollis*) (p. 294) is poor, but most of the birds are well drawn.

Perhaps the most serious flaw in the book is the lack of distinction between records reflecting specimens or preserved photographs and those based on observations alone. Few birds now are collected anywhere to substantiate records, and Africa is no exception. To ignore sight records would be unrealistic, but freely including them in a major faunal work poses a dilemma for the ornithologist. When perusing a species account in this work, the reader usually has no hint as to the kind(s) of supporting data involved. A few examples illustrate this problem. The Little Crake (*Porzana parva*) is attributed to Kenya on the basis of a single sight record evidently not accepted by the local experts who compiled the 1986 edition of that country's checklist, which excludes the species. The same observer is responsible for the only Zambian record of this crake. Some will find these reports questionable, particularly as the Little Crakes collected in western Uganda in 1901 still represent the only *certain* record of this species in the southern half of Africa. Some critical Kenyan workers feel that their country's sole record of a *Catharacta* is not specifically identifiable, though it is included here under *C. skua* as in earlier publications. There appears to be no evidence to support this identification. And perhaps the Asiatic Dowitcher (*Limnodromus semipalmatus*), for which the sole African report is based on yet another Kenyan sight record, might better have been placed in brackets, as are the other two dowitcher species.

The problem extends even to subspecific levels. The supposition that East Africa's Herring Gulls (*Larus argentatus*) are largely the dark-backed *L. a. heuglini* likely is correct, but again there is no evidence. And nothing new has come to light regarding the obviously paler examples that visit the east coast. Britton et al. (1980, Birds of East Africa, Nairobi) considered these "possibly referable to *taimyrensis*." "The Birds of Africa" now says they are "apparently" *taimyrensis*, but we are not informed if any Herring Gull ever has been collected south of the Gulf of Aden.

A lesser problem is the somewhat uneven treatment of rarities for which references to original published reports, and sometimes dates, may be wanting. Cases in point are the accounts of White-rumped Sandpiper and Rufous-necked Stint. Specific dates accompany each record of the former, but no record of *C. ruficollis* is dated. Within some species accounts, too, there are inconsistencies.

Most of the distribution maps appear to be carefully done, but I question the "dense breeding" designation for the Blue Quail (*Coturnix chinensis*) across much of northern Tanzania and Kenya where the bird seems always to have been scarce and very local, and where it has altogether eluded several active fieldworkers during recent decades.

Typographical errors are rare, but there are inconsistencies in spelling. My name is correct on one page but with an extra terminal "n" on another; grassland appears either as one word or two, etc. Although originally this series was to have been finished in four volumes, plans now more realisitically call for six. This is an important work and all but essential to anyone concerned with African birds, and I look forward to the appearance of subsequent volumes. At the same time, I hope that critical evaluation of unusual records and such details as cross-checking text material with the illustrations will not be sacrificed to the expediency of early publication. It is a shame to have readily detectable errors and discrepancies—even though many are minor—mar an otherwise splendid book.—DALE A. ZIMMERMAN.

John Xántus: the Fort Tejon letters.—Ann Zwinger. 1986. Tucson, Arizona, University of Arizona Press. 255 pp. ISBN 0-8165-0941-7. Cloth. $23.50.—This book was not written for ornithologists or by an ornithologist, but it contains much material of ornithological interest. It consists mostly of the text of 48

letters written by John Xántus, a colorful Hungarian natural-history collector, to Spencer Fullerton Baird, the visionary of the Smithsonian Institution, during the former's stay at Fort Tejon, California, between May 1857 and January 1859. The book contains a number of serviceable line drawings of birds from Xántus' letters. The author's contributions are an introductory chapter and the detailed footnotes following each letter. Although somewhat weak biologically, this material contains much of general interest and indicates a genuine scholarly effort.

Xántus' letters reveal a man of tremendous energy and curiosity. Although he often comes off as being a bit testy and self-important, this can be partly forgiven, considering his ongoing logistical distractions and the imperfect communication systems of the time. For example, he evidently did not acquire an adequate collecting gun or his personal trunks of collecting supplies until near the end of his tenure at Fort Tejon, yet he still managed to collect, prepare, and ship 1,794 bird skins and 145 mammal skins, as well as large quantities of plants, nests, eggs, fishes, reptiles, and minerals, to the Smithsonian during his 20-month assignment. The implication that this was done at the expense of Xántus' actual military duties (serving as a surgeon's assistant) is not surprising.

From an ornithological standpoint, the lack of any real effort to place the significance of Xántus' Tejon work into modern perspective in this book represents a missed opportunity. For example, only passing mention is made of Xántus' discovery of two new bird species, *Strix occidentalis* and *Empidonax hammondii*, at Tejon, as well as several new races and major range extensions. Among the more interesting portions of Xántus' correspondence are his comments on the California Condor (which he found "quite numerous"). This species is consistently confused with the Turkey Vulture and even the Golden Eagle (pp. 126–127) throughout the book. Surprisingly, the author seems to be unaware that the present-day Tejon Ranch was the virtual nucleus of the condor's range right up until the recent capture of the last free-flying individual. Various misspellings and other misidentifications of birds occur in the book, but not to a distracting extent.

More important (and, in a sense, the ultimate damaging criticism of any collector) is the near impugning of Xántus' fidelity to recording correct specimen localities in the book's introduction. This is based partly on confusion (not that of Xántus) over the type locality of "his" desert night lizard, *Xantusia vigilis*, despite the fact that the matter is satisfactorily resolved in Xántus' favor in a later footnote (pp. 149–150). Given the standards of the day, one cannot help but be impressed by the amount and accuracy of Xántus' record-keeping.

The Xántus letters represent a classic example of the perennial relationship between museum administrators, who are preoccupied with results as measured by the numbers and quality of specimens, and their field collectors, who are necessarily consumed by the logistical details often essential for mere survival, let alone the successful acquisition and shipment of specimens. For my taste, the author is a bit too hard on Xántus, whom she describes as being "possessed of the hubris that comes from a glorified self-image unsupported by reality and intensified by the tenuousness of his personal circumstances." Despite his personal flaws and contradictions, Xántus was a stupendous collector, and, as the author points out, "What matters, as it always does in the perspective of time, is the work and the achievement."—LLOYD F. KIFF.

A review of the problem of lead poisoning in waterfowl.—Glen C. Sanderson and Frank C. Bellrose. 1986. Illinois Nat. Hist. Surv. Spec. Publ. No. 4. 34 pp., 13 tables, 8 text figures. ISSN 08888-9546. No price given.—Lead poisoning of waterfowl has recently become a highly controversial subject because of efforts to substitute nontoxic steel shot for lead shot. The history of lead poisoning, its magnitude, diagnosis, variation in susceptibility within and among species, and management practices to reduce lead toxicosis are the subjects of this book. I had the feeling that the authors carried the conviction, or at least the hope, that this piece might put the controversies to rest. Such a result is probably beyond reach, given the perils of extrapolation from our present data base to a continental scale.

Lead poisoning of waterfowl is widespread. Sanderson and Bellrose estimate that about 40% of waterfowl ingest lead during a winter, based on the incidence of lead pellets found in gizzards of shot birds at any one time in relation to the increased vulnerability of lead-poisoned birds to being shot, the time required to pass pellets through the digestive system, and the length of stay of waterfowl on winter grounds. This is a sobering calculation given that we know so little about the sublethal effects of exposure of waterfowl to lead, even if the great majority of those exposed survive.

Variability among and within species in susceptibility to lead toxicosis at different locations and time periods seems related to foraging mode and diet in relation to availability of lead pellets. Diets high in protein, calcium, and phosphorus offer some protection to individuals, probably by reducing lead absorption in the blood stream, compared with low-protein seed diets.

Many persons are perplexed at the magnitude of estimates of the numbers of waterfowl that die from lead poisoning. Sanderson and Bellrose provide a well-reasoned case that day-to-day losses are much higher than expected because of the secretive behavior of sick birds and the efficiency of predators and scavengers in removing them before being discovered by

humans, including investigators searching for carcasses. Large-scale, noticeable die-offs occur only under unusual conditions and, in total, probably contribute less than chronic, unnoticed losses. Finally, most losses occur after the close of hunting when the birds can more easily feed in areas previously subjected to hunting.

Major opposition to requiring steel shot has come from California, based in part on the relative lack of data confirming lead poisoning as a major cause of mortality in this state's large wintering waterfowl populations. Sanderson and Bellrose seem to reach an awkward impasse when treating data from California. For example, Bellrose demonstrated that banded Mallards (*Anas platyrhynchos*) dosed experimentally with lead pellets experienced greater mortality than undosed controls. A large-scale study of Pintails (*Anas acuta*) in California failed to demonstrate a significant difference in band recovery rates. Sanderson and Bellrose (p. 22) attribute differences between these studies to a high-protein diet of Pintails late in winter when the dosing occurred vs. a high-corn diet of Mallards. Then they state, "Had the California experiments been conducted during the fall when the pintails feed more extensively on rice, barley and weed seeds, results might have been different." Elsewhere (pp. 19, 28, 29), however, the authors emphasize that most mortalities occur after the close of hunting (when the California study took place). A major study cited to confirm that Pintails are exposed to lead (p. 22) was the study that revealed that lead poisoning was a minor cause of death of carcasses examined in California (p. 19). Critics are likely to continue to contend that results from elsewhere do not reflect the situation in California.

A major part of the book presents the case for substituting steel for lead shot by addressing concerns about ballistic properties or steel, crippling potential, damage to shotgun barrels, and cost of shells. Probably the authors' most persuasive point is that total losses from both crippling and lead poisoning should be considered in judgments on the value of using steel vs. lead shot. In the main these seem to be balanced treatments, except for the analysis of crippling, which I believe is the weakest part because the method of analysis used results in a best-case scenario for steel while intentionally ignoring other methods of analysis (p. 24). Sanderson and Bellrose conclude that, nationwide, there would be little or no difference between crippling losses with steel or lead loads based on the differences in cripples per 100 shots fired (an unweighted average of 2.4% more cripples with steel from the 3 duck studies; $[4.2 - 4.1] \div 4.1 = 2.4\%$ increase in birds lost/100 shots; my calculation). Hunters hit fewer birds per 100 shells fired with steel than they do with lead, however, probably because of inexperience with steel loads and different ballistic characteristics. Data (unweighted) presented for these same studies reveal that steel loads resulted in 15.3% fewer birds hit per 100 shots (19 vs. 16.1) and an increase in crippling losses of 16.3% if data are expressed as cripples per total birds hit (up from 17.8% to 20.7%) or an increase in crippling of 21% if data are expressed as birds lost per bird bagged (up from 21.6% to 26.1%) (my calculations). Readers can make these calculations for the individual studies reviewed. The significance of these differences in terms of total birds lost depends on the opportunities hunters have to shoot more times with steel loads to compensate for their lower efficiency with these shells. Many hunters are likely to continue to object to being required to use shells that result in fewer birds hit per shell fired and a higher proportion of hit birds being lost than when they use lead loads. Finally, if direct killing with lead is not considered a limiting factor for most waterfowl populations, it should not be surprising that many persons resist the imposition of further regulations on their activities based on the desire to eliminate an indirect and proportionately much smaller mortality caused by hunting with lead-shot shells.

I recommend this monograph for personal, professional, and institutional libraries for those who deal with avian mortality studies. It is a useful document summarizing most of the data and contentious issues on lead poisoning. The views and types of analyses used by persons opposed to nationwide implementation of steel-shot use are not treated fully, however, compared with the views of those who recommend that steel shot should be required.—DENNIS G. RAVELING.

Bachman's Warbler, a species in peril.—Paul B. Hamel. 1986. Washington, D.C., Smithsonian Institution Press. 109 pp., 3 photos, 1 drawing (by Keith Russell). ISBN 0-87474-545-4. Paper. $11.95.—In this book, Paul Hamel assembles and synthesizes the extensive literature on the endangered, and possibly extinct, Bachman's Warbler, one of the least known and most mysterious of North American birds. In addition to an almost certainly complete, alphabetical-by-author listing of publications that mention Bachman's Warbler, Hamel has organized, in a separate section, all the literature by topics, such as "territory," "migration," "clutch size," "searches" (for extant populations), etc. A synthesis of the literature is presented in 38 pages of prose organized into the same basic sections as the literature compilation.

Hamel's literature survey is remarkably thorough and scholarly. Among the 501 titles are many unpublished documents, popular articles, and tantalizingly obscure references (you haven't heard of the *Lesser Squawk*??) that only a tenacious bibliophile would ever be able to disinter. For a species as poorly known as Bachman's Warbler, examination of even

the most superficial and anecdotal observations may provide useful information. Future researchers on this species will be forever grateful for this indispensable compilation, the likes of which are available for few North American species. The organization of this material into topic sections and the author's distillation of the literature for each topic further augments the book's usefulness to future researchers. Hamel has been fair and generous in presenting speculative hypotheses of other workers concerning the various mysteries associated with the decline of this species, even when these conflict with his own.

Based on such an exhaustive literature review, readers will naturally expect the latest updates on the two questions of greatest concern, namely (1) Does Bachman's Warbler still survive? and (2) Why did it decline? For the most part Hamel skirts the first question, probably to avoid casting doubts on any of the sight records from the last two decades. He endorses observations from 1962 or 1963 as representing the last individuals "found on territory." I personally remain cautiously optimistic concerning whether the species still survives, mainly because of extrapolation from the current situation with Kirtland's Warbler. If we did not know the location of the tiny breeding population of this species, we would consider Kirtland's Warbler to be virtually extinct, because only a handful of individuals has ever been detected in migration or winter (in spite of intensive searches during the latter season). Therefore, if a comparable population of less than 1,000 Bachman's Warblers still exists scattered in the deep swamps of the southeast United States, which are largely unvisited by ornithologists, we should not be surprised if the species went unrecorded for years during migration or winter. A similar situation exists with Golden-cheeked and Colima warblers, the breeding grounds of which are, fortunately, well known.

As for the reasons for the disappearance of the species, Hamel endorses a cautious hypothesis that embraces a combination of factors, principally postglacial shrinkage of the natural winter range and habitat destruction by humans on both the breeding and winter ranges. Vulnerability to hurricanes is also endorsed as a potential catalyst for a catastrophic decline. One of the most extensive discussions in the book focuses on breeding- and winter-habitat requirements of this species, which remain a critical, but at this point mostly speculative, parameter in the search for reasons for the decline. Let's hope the anecdotal information on this and other aspects of the biology of Bachman's Warbler will not be the last information available.

This book, with its typewriter print, is a "no frills" production, but the consequent bargain price means that anyone with an interest in endangered species, warbler biology, or natural-history mysteries can afford to add this to their library. As a basic, scholarly reference work on the species, Hamel's book is a worthwhile acquisition for institutional libraries.—J. V. Remsen Jr.

A world of watchers.—Joseph Kastner. 1986. New York, Alfred A. Knopf. x + 241 pp., 8-page glossy insert with 9 color figures by L. A. Fuertes. ISBN 0-394-52869-7. Boards. $25.00.—This well-made book is described on its dust jacket as "an informal history of the American passion for birds—from its scientific beginnings to the great birding boom of today." Included are prologue, postlogue, notes, and 18 chapters with esoteric titles like "Men of standing" and "A pastime for chums." They cover Indians to John Cassin; S. F. Baird and the U.S. Army; William Brewster and the Nuttall Ornithological Club; and the early A.O.U. Elliott Coues is "The Prodigious Trouble-maker." Then come the Linnaean Society; Audubon societies; Witmer Stone and the Delaware Valley Ornithological Club (DVOC); bird collecting; oology; William H. Forbush; the Wilson Ornithological Club; Margaret Nice; school teachers; John Burroughs; the Bronx of J. J. Hickey, Allan Cruickshank, and R. T. Peterson; field guides; and "millions of bird watchers."

Well written are interesting stories known to few readers now, e.g. Arthur Bloomfield, Franklin D. Roosevelt's neighbor's butler, a self-taught ornithologist who indirectly contributed to Griscom's "The birds of Dutchess County, New York"; the baffling disappearance in 1913 of Charles Pennock of the DVOC and his reappearance as ornithologist John Williams of Wakulla Co., Florida; Henry Ford's impulsive gift of a new car in thanks for John Burroughs' poetry; the brief ornithological prominence of the widely known murderer Nathan Leopold; and others.

Unfortunately, despite conspicuous pretensions of scholarship, the book is badly flawed by error and misstatement, of which space permits only a sampling. That it is not "directly concerned with ornithological science" (p. 4) is no excuse.

I wince at the indiscriminant use of the terms "birder," "watcher," and "birding." There were no birders in the present sense in the 19th century. Ornithologists then usually also studied mammals or other groups, and all were called naturalists. Their activities and goals bore little resemblance to those of birders today. To describe Mark Catesby, Meriwether Lewis, Audubon, and Coues as "birders" is absurd. Nor are *The Auk* and *The Condor* birding journals.

Errors include some wide misses. Presumably Elsa Guerdrum (not "Guerdon"; p. 9) Allen's bad guess that the Lewis and Clark expedition "added hundreds of new birds to our list," led to Kastner's variation (p. 11) that Meriwether Lewis "described scores of birds new to American natural history."

Whatever that is taken to mean, among identifiable Lewis-Clark species only 5 were formally named

(Lewis' Woodpecker, Clark's Nutcracker, and Western Tanager by Wilson; Whistling Swan and "Columbian" Sharp-tailed Grouse by Ord). A few others sufficiently characterized and then new (e.g. Ring-necked Duck, Mountain Quail, Poorwill) had long been named by the time of their first learned notice (1893) in Coues' well-known edition of Lewis and Clark's travels. The whole Lewis-Clark list, in fact, consists of ca. 90 species, many then already known from North America or unidentifiable as described.

I find no source or support for the statement (p. 98) that Audubon brought back 6,000 (!) birdskins from his 5-month Missouri River expedition of 1843. Careful reading of Audubon's journal (Dover ed., 1960) suggests that 600 would be remarkable for a trip intended "solely for . . . work on the Quadrupeds."

There are not "dozens of editions" (p. 12) of Nuttall's historically important little manual, but about five.

Kastner states that John Cassin, ca. 1855, "challenged" Thomas Bewick on a point of esthetics (p. 14). Presumably Bewick, dead since 1828, failed to respond. Also, Major Bendire (p. 25), decorated for bravery at Canyon Creek, Montana (13 September 1877), is said "after that battle" to have talked "the fierce chief Cochise" into a truce. Cochise, a Chiricahuan Apache, was never in Montana and died on 8 June 1874. The "New England doctor" mentioned on page 3 was D. G. Elliot, neither a doctor nor a New Englander.

Oology (p. 113) does not include the study of nests (nidology) or anything but eggshells. The oologist who "wanders off into a territory of odd facts that other birders miss" (p. 116)—such as northern birds laying larger clutches than southern conspecifics—is not practicing oology but ornithology. Facts, in science at least, are never "odd." Nor did responsible oologists (contra p. 115) identify birds from nests and eggs; if in doubt, they collected the parents.

Quotation and citation fare badly. Of 15 comparatively extensive quotations that I chose at random, 1 is correct, 3 are nearly so, and 11 (pp. 24, 25, 26, 37, 52 [2], insert p. [2], 85, 87, 137, and 138) range from pretty bad to bizarre.

Some of many errors in citation could delay research; William Bartram wrote no book entitled "Catalogue of Birds of North America" (p. 10). The reference is to the heading of a chapter ("Catalogue of the birds of eastern United States") in his classic "Travels" of 1791. Baird, Cassin, and Lawrence published no "Catalogue of North American Birds." Meant was "The Birds of North America" (1860), essentially a reprint of vol. 9 (1858) of the "Reports of Explorations and Surveys . . . from the Mississippi River to the Pacific Ocean" subtitled simply "Birds."

Conspicuous simple errors include Pergerine for Peregrine (p. x), *Verivorma* for *Vermivora* (p. 23), James G. Cooper for William A. Cooper (p. 37), A. A. Allen for J. A. Allen (p. 63), Elliott for Elliot (p. 65, correct on p. 64), Wakula for Wakulla (p. 92), Widman for Widmann (p. 143), American Ornithologists' Association for A.O.U. (p. 225), Normal for Norman (p. 226), and the novel "preemptorily" (p. [2], line 8 of insert).

The Fuertes paintings are well reproduced, and the chapters begin with his pencil drawings. One (p. 60) shows Cooper's Hawk (the words "A. cooperi" in longhand on the drawing give a clue), but is called a goshawk. The goshawk appears on page 132, where Cooper's Hawk is supposed to be.

The author has explored much literature as an observer of people drawn to birds, and offers an opinion of most of them. I would not suggest that bird-addicted people are less prone to foolishness, vanity, jealousy, and other faults than comparable samples of humanity. But I doubt that we are more so, either. Kastner approves of Brewster, Stone, and Forbush, but Cassin is brusque, self-centered, crusty; C. E. Bendire is captious, bumptious, miserly, suspicious; T. M. Brewer is thin-skinned; Coues loose-tongued; and C. C. Abbott touchy. "All birders are thin-skinned about criticism" (p. 63); members of an "often testy" community (p. 19), they "depart from the subject as naturalists tend to do" (p. 62). They rarely say—they declare, rejoin, say penitently, deliver little sermons, sneer. Sometimes they exult, but more often they complain, accuse, insist haughtily, whimper, react indignantly, splutter, and preach. The chapter on Coues seems less balanced than his treatment in Cutright and Brodhead's fine biography.

The chapter on scientific collecting reflects the chaos that attends emotionally charged issues, but ends with a mistaken assumption (p. 112). Kastner writes: "in 1933, as if signing off an era, Frank M. Chapman, who had himself once been an active collector" said that field glass students owed much to knowledge won by the gun. But Chapman was not "signing off" an era. For more than 50 years a powerful force for bird protection, he also directed the growth of the largest bird collection in the world. He was still collecting vigorously in 1933. And many major bird collections have grown immensely since then as required by various new kinds of research.

The rapid development of ornithology from 18th-century natural history into a scientific discipline was aided by mountains of information gathered by many people. Their observations, organized and analyzed (as by Darwin), sometimes earned leadership in natural history. Later the identification skills of dedicated "birders" fitted them for the greatest of all amateur contributions to science, i.e. bird-banding on a huge scale, and several forms of censusing and mapping that can provide invaluable environmental indicators. None of this is even mentioned by Kastner.

This book is neither ornithology nor history (however "informal"). No thesis is developed, no major conclusion reached in a long series of musings. It is probably best described and judged as journalism (Kastner is a retired editor of *Life*). In any case, its

pronouncements call for a greater than average suspension of confidence.—ROBERT M. MENGEL.

Proceedings of hawk migration conference IV.—M. Harwood (Ed.). 1985. Hawk Migration Association of North America. xi + 393 pp., numerous figures. ISBN 0-938239-01-5. Paper. $29.95.—Proceedings of conferences are, at best, a mixed blessing. Participants can speak on whatever they want. The publication is rarely refereed, and even a dedicated editor cannot exert nearly as much control as can the editor of a journal. Publication is usually delayed for several years, and the preliminary reports characteristic of conference presentations are often severely dated at the time of publication. The only positive aspect is that conference proceedings allow publication of the occasional, worthwhile but incomplete, suggestive or speculative paper that would not appear in a refereed journal. Most of the strengths and the weaknesses of this conference (held in Rochester, New York, in March 1983) proceedings can be seen in the 4 papers by Neal G. Smith. These could have been combined into one paper, adding clarity and saving at least several pages. With the exception of some interesting, and aberrant, data gathered in 1982, Smith's first 3 papers contain little of substance that cannot be found in another conference proceedings (I. Newton and R. D. Chancellor [Eds.] 1985, Conservation studies on raptors, Int. Counc. Bird Preservation Tech. Publ. No. 5). The fourth paper, "Path between North America and limbo: the 'wintering grounds' syndrome and future research on migratory raptors," contains little not found in the previous papers or another conference proceedings (A. Keast and E. S. Morton [Eds.] 1980, Migrant birds in the Neotropics, Smithsonian Inst. Press).

Smith has spent more than a decade studying the spectacular migrations of raptors through the Isthmus of Panama. His data, new observational methods, analyses, insights, and even speculations on intercontinental migration constitute a unique and invaluable contribution that should be read by every student of hawk migration. For example, his thesis that Broad-winged (*Buteo platypterus*) and Swainson's (*B. swainsoni*) hawks migrate most of the way from their breeding areas in North America to their wintering areas in South America without feeding enroute, relying on updrafts to provide most of the energy for the passage, is convincing. The value of his work does not justify multiple publication, however.

Clark's paper on the migrations of Sharp-shinned Hawks (*Accipiter striatus*) reopens the ancient argument between Murray (diversion lines) and Mueller and Berger (wind drift and leading lines) and shows little understanding of either hypothesis. Clark notes that few Sharp-shins captured at Cape May, New Jersey, were recovered to the northwest during the breeding season and presents this as proof against wind drift. This ignores the fact that Sharp-shins tend to follow the ridges of the Appalachians (about 150 km northwest of Cape May) in fall migration. (In this volume, Klem et al. show that only 1.7% of Sharp-shins left the Kittatinny ridge at the Lehigh River Gap and flew southward.) He further assumes that the standard direction ("preferred direction") of migration is south and not, for example, southwest. I implore the reader (and Clark) to read the papers by Murray and Mueller and Berger. Clark does present data of some relevance to the hypotheses. First, 96% of the Sharp-shins captured at Cape May are juveniles, a much higher percentage than found at inland stations in the United States. Clark attributes this to adults "selecting a different migratory route." I suggest that young birds are more likely to become "lost" and to drift with the wind. Second, Clark fails to note that 26% of the juvenile male Sharp-shins, and 23% of the juvenile females, banded during fall migration at Cape May were recovered the following winter *north* of the latitude of Cape May! This suggests that about one-fourth of the Sharp-shins observed at Cape May are "lost" in their southward migration, an observation that should be considered in any explanation of the concentrations observed at Cape May. The observations of 48 Sharp-shins tagged with radio transmitters (Holthuijzen and Oosterhuis in this proceedings) suggest that most fall migrants depart Cape May to the north. There are no winter recoveries of fall-banded birds north of inland banding stations.

Brinker and Erdman's summary of the migration of Red-tailed Hawks (*Buteo jamaicensis*) in Wisconsin is a significant contribution. Their suggestion that the migration has a bimodal seasonal distribution is interesting, but I wonder if the bimodality would withstand the scrutiny of statistics. Their contention that juveniles winter farther south than adults is not supported by my statistics (Mann-Whitney $U = 293$, $n_1 = 24$, $n_2 = 32$, two-tailed, $P > 0.12$).

Hoffman's reports on Cooper's Hawks in the Goshute Mountains in Nevada and the Wellsville Mountains in Utah and (with Potts) on Golden Eagles in Utah are interesting and significant. However, I cannot understand some of his data. In the Cooper's Hawk paper, Fig. 2 presents the fluctuations of Cooper's Hawks through the season, apparently by 5-day averages. Data from the Wellsville Mountains are presented as birds observed per hour, from the Goshute Mountains as birds trapped per hour, and from Hawk Mountain, Pennsylvania, as percentage of total seen. The sample sizes given in Fig. 2 do not agree with Table 1. Hoffman states that these indices are comparable, but I question this assertion. Similar, questionable comparison of indices occurs in the Golden Eagle papers. Hoffman claims that the hourly distribution of migrating accipiters through the day in the Goshutes and Bake Oven Knob, Pennsylvania, is "almost identical" to that of Cedar Grove, Wisconsin. In

fact, the peak at Cedar Grove is at least an hour earlier than the other two localities. Hoffman notes that the peak at the Wellsville Mountains is two hours later than in the Goshutes and suggests that the Snake River plains halt migration early in the afternoon, resulting in few birds the next morning in the Wellsvilles. I suggest a simpler explanation: Cooper's Hawks avoid the relatively barren ridges of the Wellsvilles until midday but fly over the forested Goshutes early in the day. Figure 1 of both the Cooper's Hawk and the Golden Eagle papers are identical, an unnecessary duplication.

Gauthreaux contends that behavioral dominance is an important factor in the differential migration of the age and sex groups within a species of raptor. The two virtues of this paper are its brevity and the presentation of data from an unpublished Master's thesis on the Rough-legged Hawk (*Buteo lagopus*). Among museum specimens collected in winter, males were more abundant than females south of 41°N and vice versa for farther north (by my calculations, $G = 17.6$, $P < 0.0001$). I know of only one other study of raptors that shows statistically significant differences between the sexes in migration (Mueller et al. 1977, Auk 94: 256). Gauthreaux summarizes which sex winters nearest the breeding area for an additional 7 species. Overall, Gauthreaux's hypothesis may have some merit for some species that disperse or migrate irregularly, but not for species of diurnal raptors.

Clark's paper in this volume is cited by Gauthreaux as evidence for females wintering farther north than males in the Sharp-shinned Hawk. Clark notes that the "mean wintering area for immature males is almost 100 km farther south than that of the immature females" and that recoveries of adults were too few to permit a legitimate comparison. His data, however, do not show that juvenile females winter farther north than males (Mann-Whitney $U = 644$, $Z = 0.68$, $n_1 = 24$, $n_2 = 63$, two-tailed, $P > 0.50$). There is a tendency for adult males to winter farther south than adult females ($U = 5$, $n_1 = 3$, $n_2 = 13$, $0.10 < P < 0.15$). (My sample sizes differ slightly from those of Clark's Table 3 because a few data points are hidden, or missing, in his Fig. 3.) Evans and Rosenfield (*in* Newton and Chancellor 1985) found that in Sharp-shins banded at Duluth, Minnesota, females tended to winter farther south than males. Clark notes that adults tend to winter farther south than juveniles, but this was not statistically significant (females: $P > 0.50$; males: $P > 0.30$; two-tailed Mann-Whitney U).

Kerlinger argues that the daily rhythm of hawk migration may be an artifact of hawks flying at increased altitudes as the day progresses and thus becoming increasingly difficult to detect. Direct support for his thesis is provided by radar observations at localities away from leading lines and one morning of observation at Cape May. This is an extremely unlikely explanation for the rhythms observed at Cedar Grove, where birds ascend to great heights in the afternoon only rarely on days when hawks are seen in at least reasonable numbers in the morning. Hawks migrating along a coastline do not behave as hawks migrating inland or as those at points such as Cape May.

I wish Cochran's remarkable account of following radio-tagged Peregrines (*Falco peregrinus*) from Assateague Island were written more precisely. I believe his results but fear that his casual style will lead many to ignore his work. The problems begin with Cochran's title, "Ocean migration of Peregrine Falcons: is the adult male pelagic?" He presents no data on adult males, and "pelagic" is hardly the word for any land bird that migrates over the ocean. More details on the methods of interpretation would have enhanced the presentation. The results show that Peregrines often migrate over the ocean, often far from land, and sometimes at night. Soaring is the typical mode of flight at night, perhaps because thermals are generated in the relatively cold air after a cold front passes over the warm waters of the Gulf Stream. Cochran's unfortunate use of an "innate flight direction," which differs within and between individuals, alone may be sufficient to preclude acceptance of his ideas.

The review of over-water migration by raptors by MacRae is overly ambitious and incomplete. Many localities are not mentioned, most notably those in the Red Sea region in the Middle East and Whitefish Point on the Great Lakes. Too much of what has been published is accepted uncritically, and the literature has not been consulted adequately. As an example of the former MacRae cites Hofslund (1966, Wilson Bull. 78: 79), who believes that some Broad-winged Hawks arrive at Duluth by island hopping from Isle Royale. This belief is based on the observation of some Broad-wings arriving at Duluth from Lake Superior. We have occasionally seen Broad-wings arriving at Cedar Grove from the east, flying into the wind from a considerable distance out over Lake Michigan. We have also seen flocks soaring high and drifting well out over the lake, and returning westward in the same manner as those described above. I believe Hofslund's observations were most likely birds that had drifted offshore in a thermal a short distance north of Duluth and returned when the thermal disintegrated. MacRae gives examples of species with long over-water migrations: (1) *Falco vespertinus amurensis*, which she states may travel 3,000 km over water from India to southern Africa. Brown and Amadon (1968, Eagles, Hawks and Falcons of the World, New York, McGraw-Hill) are uncertain about the migration route of the subspecies and over-water distances may be much less. (2) *Accipiter soloensis*, which MacRae claims migrates from "Japan to the East Indies a distance of approximately 3200 Km." The species does not breed in Japan (Brown and Amadon 1968). (3) *Accipiter gularis*, which supposedly has the same breeding and wintering ranges as *A. soloensis*. *Accipiter gularis* does breed in Japan (as well as Korea and eastern China) and

winters in the Philippines, Western Indonesia, The Malay Peninsula, and west to Burma and eastern India. Examination of an atlas indicates that the greatest distance between islands in a migration from Japan to the Philippines would be about 230 km; over-water distances to points south would be shorter. I believe MacRae's review is biased, emphasizing over-water migrations in many species that generally are quite water-shy and cross water regularly in only a few localities.

The editor obviously labored for many hours in the production of these proceedings. I noted only 3 minor typographical errors. The editor would have benefited greatly, however, if the contribution had been subjected to peer review and if he had obtained editorial advice from a professional scientist.

There are more papers in this volume that I can criticize, and a few that I cannot. Overall, there is much of significance and interest to students of hawk migration in these proceedings. I would buy the volume, but I cannot recommend it to others unequivocally, particularly in view of the high price.—HELMUT C. MUELLER.

Wildlife 2000: modeling habitat relationships of terrestrial vertebrates.—Jared Verner, Michael L. Morrison, and C. John Ralph (Eds.). 1986. Madison, Wisconsin, University of Wisconsin Press. xxv + 470 pp. ISBN 0-299-10520-2. No price given.—With the passage of the Forest and Rangeland Renewable Resources Planning Act in 1974 and the National Forest Management Act in 1976, a major conservation concept became law in the United States. Federal agencies are now required to protect the resource base when timber is cut and to assure that the full diversity of the biota is protected on all public lands. Wildlife biologists are directed to develop plans describing how their activities will meet this objective. "Wildlife 2000" is a set of timely examples of one way they are responding to this directive, by using computer technology to formulate models of the habitat relationships of terrestrial vertebrates. The goal is to provide managers with predictions of population changes that will occur when habitats change. The title, "Wildlife 2000," suggests that such models and their applications are expected to be a major part of wildlife science in the future.

The papers were presented at a conference sponsored by the San Francisco Bay Area Section of the Wildlife Society, the U.S.D.A. Forest Service, and the Department of Forestry and Resource Management of the University of California, Berkeley, held in October 1984 at Stanford University's Sierra Camp. Participants included U.S. government personnel, plus scientists from the United States, Canada, England, Finland, and Poland.

The 85 papers are well organized and edited. After excellent introductory material, there are five technical sections, each with its own introduction and two summaries, one from a researcher and one from a manager. Most of the technical papers are about birds. The sections cover the development and testing of models, biometric approaches to modeling, cases in which information on habitats fails to predict animal populations, and studies of the effects of habitat fragmentation, of succession, and of the application of simulation models to the problem of wildlife-habitat relationships.

One large class of models is the Habitat Suitability Index Models (HSI) developed by the U.S. Fish and Wildlife Service. The objective is to predict the carrying capacity of a habitat or a region (e.g. the Ruffed Grouse in Michigan) from information on the food available, the structure of the vegetation, floristics, and landforms. Usually the information is taken from the literature and from the opinions of experts. The results are used in Habitat Evaluation Procedures (HEP). Several authors complain that few of the many HSI models have been tested in the field and that their predictive power seems to be low. The large effort invested in the production of these models should be reviewed critically. If they are not useful to managers, alternatives should be considered.

Many authors have used advanced and complex methods of statistical data analysis. Two common procedures are logistic regression and discriminant function analysis. Effron (1975, J. Am. Stat. Assoc. 73: 699) compared the merits and proper application of these two procedures. I contend that discriminant analysis is appropriate only when sampling is from well-defined groups. It is not appropriate to distinguish used from unused habitats of a species because the unused category is too subjective and ill defined. A particularly interesting paper by R. G. Johnson and S. H. Temple compares the bird populations on tall-grass prairie fragments in Minnesota. They used a factorial design and logistic regression to show for several species that the plots with the highest densities of birds were not in habitats where nest productivity was highest. Thus, one must be careful to define just which criteria should be used to define the "best" habitat. In the section on habitat patchiness and fragmentation, Y. Haila expresses a sensible mix of theoretical and empirical aspects in his conclusions. Without invoking island biogeographic theory, he says that the bird distribution in northwestern Europe can be accounted for parsimoniously if one assumes that "different species colonize islands (of habitat) independently of each other, and in numbers that are compatible with their regional abundance and habitat requirements."

Some authors express concern that enthusiasm for modeling has been carrying this effort beyond the practical objectives of the legislation. Van Horne and Noon plead for more "intensive" effort in the form of manipulative experiments and fewer large-scale surveys. Thomas reminds us that what was measured should not be assumed to be what the bird actually

responded to. Marcot complains that clear guidelines for managers are not emerging from wildlife-habitat models.

I would like to add three more ideas not sufficiently emphasized by even the most negative authors. First, principles of experimental design can be incorporated into the design of observational studies. Doing so permits some separation of confounding variables in nonexperimental work. The paper by Johnson and Temple is a good example. Second, developing a model and testing it in a new situation is a less rigorous procedure than defining the entire population of interest to begin with and sampling it. The first principle of statistics—"define the population of interest and sample it randomly"—should be mounted on the wall over each personal computer. Third, the mandate is to enable management to preserve biotic diversity. Ideally, this ability should be based on an understanding of the causal factors that underlie the habitat relationships of animals. The current effort to construct correlational models of wildlife-habitat relationships is not the most efficient way to achieve the objective. Managers must bring specific problems to researchers, and researchers must use principles of experimental design to solve them. If researchers employed principles of experimental design, progress could be made even in cases in which manipulation of the variables is not feasible. The comments of D. H. Johnson (1981, pp. 11-19 *in* D. E. Capen [Ed.], Rocky Mountain For. Range Exp. Stn. Rep. RM87, Ft. Collins, Colorado) and of H. C. Romesburg (1981, J. Wildl. Manage. 45: 293) should not be overlooked.—FRANCES C. JAMES.

OTHER ITEMS OF INTEREST

[Key to the identification of our birds in nature.]—František Balát. 1986. Prague, Czechoslovakia, Academia. 320 pp., 72 color plates of 6-16 birds each. Price 62.00 crowns.—This is a cardboard-covered, large pocket-sized field guide written in Czech. A brief introduction is followed by various keys illustrated by a few simple line drawings showing, for example, the flock silhouette of Bohemian Waxwings (*Bombycilla garrulus*) in the air, or Gray Partridges (*Perdix perdix*) burying themselves in the snow to roost. One of these, showing a colony of European Bee-eaters (*Merops apiaster*), is printed upside down. The species descriptions are to the point, and short: habitat, description of appearance and of voice and calls, manner of flight, average dates of migrations, and, finally, economic role based on food habits and predator pressure.

The color plates adequately depict the members of this Central European avifauna. Though the individual birds are small on some of the crowded plates, the stances and silhouettes, and in most cases the colors, are good. The criticisms of these plates are minor. Many specimens are depicted with too large a head (a fault of many pictorial guides except those illustrated by accomplished and very experienced bird artists). The publishers are to blame for a general tone of pinkish discoloration that prevails in several plates in my copy. Where male, female, and juvenile (even downies) or winter/summer birds bear different plumages, these all are generously included—a good point. A bad one: The birds on each plate are drawn roughly to the same size. As size is not specified in the descriptive text, this poses some difficulties to the beginner.

This is a potentially useful book for the Czech, Moravian, Slovak, and even Polish language areas of Central Europe, where up-to-date guides were available only in English or German and aimed at different, neighboring avifaunas.—M. D. F. UDVARDY.

Birds of the Rocky Mountains.—Paul A. Johnsgard. 1986. Boulder, Colorado, Colorado Associated University Press. xi + 504 pp., 42 color plates, 15 text figures. ISBN 0-87081-150-9, cloth, $39.50; ISBN 0-87081-152-5, paper, $16.95.—Another of Johnsgard's recent books, this volume stresses identification, status, habitats, and ecology. Arrival and departure dates as well as nesting dates are given where available. Understandably (knowing the author's interests in behavior), social courtship is also covered, and usually three or more references are given for each of the 354 species discussed. Appropriately, Johnsgard describes distribution by the "latilong" method first used in Montana by Skaar and adopted later for Wyoming and Colorado. Good introductory material is presented on the dominant vegetation from Rocky Mountain National Park in Colorado north to the Canadian Rocky Mountain Parks. Seasonal status by 1-degree blocks of latitude and longitude is given for each species plus a map, where appropriate, of breeding distribution within the central and northern Rocky Mountains. The detail is quite thorough. Numerous references are presented, including unpublished theses. Unfortunately, three authors' surnames are misspelled, and one reference is listed twice but under different authors' names. The colored plates, many by Johnsgard, add much to the beauty of the book, as do the author's numerous line drawings. The captions under the Yellow-bellied Sapsucker and Black-backed Woodpecker were misplaced, but an erratum slip was inserted by the publishers. Most libraries will do well to add the book to their collections. Visitors to the numerous National Parks in the region will find the book most readable and worthwhile.—RONALD A. RYDER.

Beyond the Roaring Forties: New Zealand's subantarctic islands.—Conon Fraser. 1987. Seattle, Washington, University of Washington Press. x + 224

pp., maps, 174 color and 16 black-and-white photographs. ISBN 0-295-96508-8. $45.00.—This is an interesting and unusual combination of the natural, social, and political history of an extremely isolated group of islands. The Antipodes, Bounty, Snares, Campbell, and Auckland islands belong to New Zealand and, in addition to their geography, are isolated by the gale-force winds of the Southern Ocean. The discussion of birds is limited, and emphasis is placed on the vast numbers of breeding seabirds (penguins, Sooty Shearwaters), rarities (*Leucocarbo ranfurlyi, Megadyptes antipodes, Anas aucklandica*), and endemic land birds. The biology is superficial, but Fraser establishes a clear sense of understanding of the significance of large colonies and the relationship of birds, other animals, and plants to their environment. The maps are excellent.

A large part of the text contains fascinating accounts of early explorers, the first settlers, and several scientific expeditions. Despite the severity and vagaries of the climate, humans have demonstrated a curiosity of place, and seen potential profit in these islands. The accounts of early settlements, shipwrecks, and exploitation of both natural and human resources are pithy. The contemporary accounts and illustrations add valuable insights for the reader.

Fraser is a film maker and writer; the book was produced by the New Zealand Government printing office. All the islands are relatively unspoiled, some without the commonly introduced rats and cats, and are currently managed as nature reserves.—A.H.B.

The birds of Israel.—Uzi Paz. 1987. Lexington, Massachusetts, Stephen Green Press (distributed by Penguin Books, New York). vii + 264 pp., 60 color plates (photos by Yossi Eshbol), numerous small drawings. ISBN 0-8289-0637-8. $26.95.—Israel has a rich avifauna. There are 470 recorded species with 163 breeding species. This in an area (20,000 km^2) an order of magnitude less than Arkansas, with 306 species (James and Neal 1986, The Birds of Arkansas, Univ. Arkansas Press), and three orders of magnitude less than Canada, with 578 species and 426 breeders (Godfrey 1986, The Birds of Canada, Ottawa, Natl. Mus. Canada).

This volume, originally in Hebrew (copyright by the Ministry of Defense, Tel Aviv), is a series of species accounts supplemented by selected color plates, intended for an encyclopedic treatment of the Israel fauna and flora. It is a satisfying summary of the natural history of the birds. Although its format is slightly larger than a field guide, it would be useful to the traveler as it includes distribution information and good descriptive material, and is peppered with interesting facts. Additional emphasis is given regarding migrant birds (there are 121 regular migrant species), which is appropriate because of Israel's location. Some analysis of biogeography is included, and various aspects of the relationships of humans and birds are introduced. Again, an appropriate subject in an area that has undergone extensive ecological changes in the past 3,000 years. The estimated numbers of birds, especially migrant raptors and shorebirds, are impressive.

The book is well made, the translation flows easily, and there is a useful index of common and scientific names. A list of birding sites is appended. Royalities are to be divided between the RSPB and Waterfowl Trust—a nice touch because all conservation efforts will benefit.—A.H.B.

The Editorial Office continually receives material for review. A portion of this material is inappropriate for detailed comment for a variety of reasons. However, because it may be of general biological, but not specific ornithological, interest or potentially of only limited readership, it is not reviewed. As a service to our readers, occasionally these items will be listed briefly.—A.H.B.

On the track of Ice Age mammals.—A. J. Sutcliffe. 1985. Cambridge, Massachusetts, Harvard Univ. Press. 224 pp. ISBN 0-674-63777-1. $25.00.

New Zealand bird prints.—G. Moon. 1986. New Zealand, Heineman. 15 color photos. Order from ISBS, Inc., 5602 NE Hassalo, Portland, Oregon 97213. $49.95.

Conservation of Cameroon montane forests.—S. N. Stuart (Ed.). 1986. International Council for Bird Preservation, 219c Huntington Road, Cambridge CB3 0DL, U.K. ISBN 0-946888-07-8.

East Asia/Pacific shorebird study programme.—D. Parish and D. Wells (Eds.). 1985. Interwader, P.O. Box 10769, Kuala Lumpur 50724, Malaysia. ISBN 967-999-74-0-1.

Eye on nature.—G. Laycock. 1986. New York, Prentice Hall. 162 pp. ISBN 0-668-06542-7. $9.95.

Audubon reader: the best writings of John James Audubon.—S. R. Sanders (Ed.). 1986. Bloomington, Indiana Univ. Press. ISBN 0-253-20384-8. Paper. $9.95.

Birds worth watching.—G. M. Sutton. 1986. Norman, Univ. Oklahoma Press. 207 pp. ISBN 0-8061-1975-6. $19.95.

Evolution: selected papers of Sewall Wright. An annotated collection of 42 of Wright's papers.—W. B. Provine. 1986. Chicago, Univ. Chicago Press. 649 pp. ISBN 0-226-91053-9. Paper. $25.00.

Checklist of the birds of Belize.—D. S. Wood, R. C. Leberman, and D. Weyer. 1986. Carnegie Mus. Nat. Hist. Special Publ. No. 12. 24 pp. $2.00.

Electromyography for experimentalists.—G. E. Loeb and C. Gans. 1986. Chicago, Univ. Chicago Press. 400 pp. ISBN 0-226-49015-7. Paper. $22.00.

Predator-prey relationships: perspectives and approaches from the study of lower vertebrates.—M. E. Feder and G. V. Lauder. 1986. Chicago, Univ. Chicago Press. 198 pp. ISBN 0-226-23946-2. Paper. $11.95.

Ecology of the wet-dry tropics (symposia of ESA, Darwin, May 1983).—M. G. Ridpath and L. K. Corbett (Eds.). 1985. Proc. Ecol. Soc. Australia Vol. 13; Darwin Inst. Technol. 333 pp.

The return of the Brown Pelican.—J. E. Brown; photos by D. Guravich. 1983. Baton Rouge, Louisiana State Univ. Press. 118 pp. ISBN 0-807-11114-7. $24.95.

The 1984 field ornithology index (keyword system to access 49 journals).—J. Kennington (Ed.). 1986. Tulsa, Oklahoma, Puffin Publ. $20.00.

Physiological ecology of animals.—R. M. Sibly and P. Calow. 1986. Palo Alto, California, Blackwell Scientific Publ. 179 pp. ISBN 0-632-01495-4.

The pleasures of watching birds.—L. Oberman. 1986. New York, Prentice Hall. 256 pp. ISBN 0-13-681305-4. $17.95.

Songbirds in your garden.—John K. Terres. 1987. New York, Harper and Row. 306 pp. ISBN 0-06-091-337-0. $9.95.—First published in 1953, this is a revised, paperback version of the third edition.

Collins field notebook of British birds.—Roger Lovegrove and P. Snow. 1987. New York, Penguin Books. 128 pp. ISBN 0-00-219729-4. $21.95.

Game management.—Aldo Leopold. 1987. Madison, Univ. Wisconsin Press. xxiv + 481 pp. ISBN 0-229-10774-4. $14.00—Reprint of 1933 issue.

Biological museum methods. Vol. 1, Vertebrates.—George Hangay and Michael Dingley. 1985. Orlando, Florida, Academic Press. 379 pp. ISBN 0-123-23301-1. $75.00.

The age of birds.—Alan Feduccia. 1987. Cambridge, Massachusetts, Harvard Univ. Press. ISBN 0-674-00976-2. Paper. $12.95.—Reprint of 1980 volume.

Songbird carving with Ernest Muehlmatt.—R. Schroeder and E. Muehlmatt. 1987. Harrisburg, Pennsylvania, Stackpole Books. 284 pp. ISBN 0-8117-1817-4. $39.95.

The appropriation of nature: essays on human ecology and social relations.—Tim Ingold. 1987. Iowa City, Univ. Iowa Press. 287 pp. ISBN 0-87445-167-2. $35.00.

All about bluebirds.—E. P. Floyd. 1987. Jonesboro, Arkansas, Enrichment Enterprises. ISBN 0-941699-00-5. $5.95.

Sternes continentales. Vol. 2, Annales biologiques du centre.—J. L. Senotier. 1987. St. Jean de Braye, France, Fédération Régionale des Assoc. Protection l'Environment. ISBN 2-906231-01-0.

Spirit of enterprise: the 1987 Rolex awards.—David Reed (Ed.). 1987. Birshire, England, Van Nostrand Reinhold. ISBN 0-7476-0003-1.

The habitat guide to birding.—Thomas P. McElroy Jr. 1987. New York, Nick Lyons Books. 288 pp. ISBN 0-941130-36-3. Paper. $13.95.—Reprint of 1974 edition.

Penguins.—John Sparks and Tony Soper. 1987. New York, Facts on File. 246 pp. ISBN 0-8160-1753-0. $19.95.—Revised (1967) edition.

The bird watchers diary.—E. M. Reilly and G. Carruth. 1987. New York, Harper and Row. 218 pp. ISBN 0-06-096092-2. Paper. $12.95.

Die Vogelwelt ussuriens.—A. J. V. Knystautas and J. B. Sibner. 1987. Wittenburg Lutherstadt, East Germany, A. Ziemsen Verlag. 188 pp. ISBN 3-7403-0013-2. DM 64.00.

Anvario ornitologico 86. Aves acuaticas.—Federacion de Amigos de la Tierra (FAT). 1986. Madrid, FAT. 253 pp. ISBN 84-85639-71-5.

The travelers reading guide.—M. Simony (Ed.). 1987. Revised edition. New York, Facts on File. 831 pp. ISBN 0-8160-1244-X. $29.95.

Birds of Britain and Europe.—C. Perrins. 1987. Austin, Univ. Texas Press. 320 pp. ISBN 0-292-75532-5. $14.95.

Abundance and distribution of the birds of Ohio.—E. G. Peterjohn, R. L. Hannikman, J. M. Hoffman, and E. J. Tramer. 1987. Ohio State Univ. Biol. Notes No. 19. 52 pp. ISBN 0-86727-103-5.

Birding around the world.—A. R. Lotz. 1987. New York, Dodd, Mead & Co. 266 pp. ISBN 0396-08990-9. $18.95.

Songs of the North: a Sigurd Olson reader.—H. F. Mosher (Ed.). 1987. New York, Viking Penguin. 267 pp. ISBN 014-017007-3. $7.95.

Wild animals I have known.—E. T. Seton. 1987. New York, Viking Penguin. 358 pp. ISBN 014-017005-7. $7.95.

The mammals of Britain and Europe.—A. Bjärvall and S. Ullström. 1986. London, Croom and Helm. 240 pp. ISBN 0-709-93268-5. $39.95.

The urban naturalist.—S. D. Garber. 1987. New York, John Wiley & Sons. 242 pp. ISBN 0471-85793-9. $12.95.

The lost notebooks of Loren Eiseley.—K. Heuer (Ed.). 1987. Boston, Little, Brown and Co. 260 pp. ISBN 0316-35921-1. $24.95.

Fireside waterfowler.—D. E. Wesley and W. G. Leitch. 1987. Harrisburg, Pennsylvania, Stackpole Books. 352 pp. ISBN 0-8117-0617-6. $29.95.