REVIEWS

EDITED BY JOHN WILLIAM HARDY

The morphology of the syrinx in passerine birds.—Peter L. Ames. 1971. New Haven, Connecticut, Yale Univ., Peabody Mus. Nat. Hist., Bull. 37. Pp vi + 194, 21 plates. $6.50.—Although the syrinx is one of the oldest taxonomic features still used for the primary subdivision of the Passeriformes, no comprehensive review of its anatomy and its systematic relevance had been published since Müller's day. Peter Ames' monograph on the passerine syrinx is of prime interest to all ornithologists and should be read carefully for his important taxonomic conclusions on the arrangement of passerine suborders. Yet a real comprehension of the factual data and interpretations presented in this study is difficult, even for specialists in avian anatomy and systematics. Although a detailed "classical" review is essential as an aid for many ornithologists in their evaluation and use of this monograph, the heuristic value of such a review is limited. Instead, I prefer to stress some basic methodologies and approaches of comparative anatomical-systematic study of birds, which should provide a clearer insight into the problems of syringeal anatomy and passerine classification that confronted Peter Ames.

Theoretically a review of this monograph is impossible because we do not know the problems Ames wished to analyze, why these are significant, or how he intends to approach them. It is unclear whether this paper is a morphological study as the title states, or a purely systematic study as the abstract seems to suggest. I do not know whether earlier morphological descriptions of the syrinx are unsound and in need of redoing, or whether serious questions exist about the primary subdivisions of the Passeriformes into suborders and superfamilies. Or do doubts exist on the uniformity of syringeal morphology within the accepted passerine suborders?

The lack of an introduction, which provides the essential prelude to any scientific paper, is surprising. The monograph opens with an inclusive historical survey of past work on the passerine syrinx, which may have been intended as a general introduction but fails to do so. Most of the comments are brief, too vague, and do not evaluate the descriptions, interpretations, and conclusions offered in these earlier studies. A statement (p. 10) that Gadow and Selenka's (1893) oft-used description contains four labeling errors is of restricted value because the reader only discovers on page 94 what these errors are. Omission of an introduction, together with a neglect to formulate pertinent, critical questions is not uncommon in morphological-systematic studies and has contributed to the decline of this field; this lack weakens the present study seriously.

The tacit goal of this monograph is to determine the variation of syringeal anatomy in passerine birds by examination of as many genera as possible, and to ascertain the significance of this variation for the primary subdvision of the order. This approach is a purely comparative descriptive one with no attempt to inquire into the function of the syrinx as a whole or of its individual components. Emphasis was placed on obtaining a broad sample of most passerine families, with taxonomic decisions based on a total comparison of syringeal features. Certain individual structures, such as the Membrana trachealis and the Processi vocalis in the Furnarii, were given greater stress. Thus the basic approach and methods used in this paper are the classical ones employed in comparative anatomical-systematic studies for the past century. Many of the taxonomic conclusions are sound and represent a definite advance over previously held ideas. The division of the Conopophagidae reported earlier by Ames, Heimerdinger, and Warter is an out-

standing example; this conclusion should have been mentioned in the "Systematic conclusions" (pp. 153-164) instead of in the description (p. 29) where it is easily overlooked. But this study provides no new insights, either morphological or taxonomical, and leaves more problems than it solves.

The success of any morphological-systematic study depends upon the thoroughness and accuracy of the basic anatomical description of the taxonomic features. Systematic conclusions should be regarded with skepticism if a study is not based upon a solid morphological description of the taxonomic characters. Ames cites no earlier study that serves as an accepted descriptive basis of the skeletal, muscular, and membranal components of the syrinx. He includes no complete description of the syrinx and its musculature under a single heading, nor does he provide an adequate morphological description even if all the scattered anatomical accounts are gathered together. It is frequently unclear whether a name, such as the "Processus vocalis" (p. 20), has been used earlier or if this feature is being described for the first time. Other features, such as the "Membrana trachealis" (p. 20) which may be newly described, are not indicated on the illustrations, and are often inadequately described. In this case the relationship between the Membrana trachealis and the two Processi vocalis lying along its lateral borders appears significant, but is not mentioned in the text.

Many of the morphological descriptions are difficult to find. For example the M. obliquus dorsalis is illustrated in Figure 6 of plate 1 without further comment. A search of the text revealed a one-sentence description on page 33 without reference to Figure 6 or to the taxa in which the muscle is found. Further search revealed a two-sentence statement on page 51, with reference to Figure 6 but not to page 33, that this muscle is present in the genus *Ochthoeca*. Apparently, the M. obliquus dorsalis is not found in any other genus, but no definite statement is made. Nor does Ames offer any discussion of the possible functional, evolutionary or other significances of this muscle. These few brief comments are the total offered for a previously unknown muscle that was regarded sufficiently distinct to be named. The treatment of the M. obliquus dorsalis may be an extreme case, but it is not atypical.

A central problem with important theoretical and practical overtones is homologizing the tracheal and bronchial rings. Earlier workers did not delve into this matter, and numbered the rings from the tracheal-bronchial junction. Ames avoids this question, aside from stating that he found the classical tracheal-bronchial numbering unreliable and prefers to number the rings from a junction in the bronchus between an anterior "type A" ring and a posterior "type B" ring (p. 14). This terminology problem is serious because Ames describes the attachment of syringeal muscles in terms of "A" and "B" rings. He makes no attempt to ascertain whether the A-B junction is homologous in passerine birds and whether individual rings are homologous in these birds. Nor does he attempt to ascertain whether correlations exist between these rings and other syringeal features, such as the tympaniform membranes or the labium.

The problem of determining homologies in cartilaginous components of the syrinx stems from the general difficulty associated with any repeated structure, i.e., that of "serial homology." Tracheal and bronchial rings are repeated structures with a varying number of components in different species. Yet some individual homologies exist, such as the tracheal-bronchial junction. Others may exist, such as the position of the labium (p. 15) and the ring bearing it. An individual homologous ring may vary in its numbering, either from the tracheal-bronchial junction or the A-B junction. It is crucial to know whether a particular muscle

inserts on a ring that may be homologized individually in all species of a superfamily or suborder, or whether the muscular attachment varies. The ventral insertion of the M. tracheolateralis and of the several intrinsic muscles are especially important in this regard. Does the insertion of these muscles vary in terms of a particular homologous ring (from A-1 to B-3), or does the A-B junction vary? I would suspect that the insertion of the muscles is quite constant with respect to features of the syrinx not studied by Ames, such as the labium or the cartilage onto which the posterior end of the external tympaniform membrane attaches (see Chamberlain et al., Auk, 85: 247, 1968). Unfortunately, this information cannot be abstracted from Ames' paper.

A second important morphological problem that was excluded from description is the structure of internal syringeal features. Structures such as the labia and the internal and external tympaniform membranes are critical to functioning of the syrinx as a sound-production organ. If the syringeal muscles have a role in sound production, then the relationship between the cartilaginous rings onto which these muscles attach and the internal syringeal features must be known. Ames' decision to exclude the internal features from his comparative survey of the syrinx severely reduces the value of his observations for future studies of the function, adaptation, and possible evolutionary modifications of the passerine syrinx.

No attempt was made to homologize the intrinsic muscles found in the several major passerine taxa; statements in "The evolution of the syrinx" are indefinite. Ames implies (pp. 146–147) that the intrinsic muscles evolved independently in several suborders of the Passeriformes, but gives no details of the individual independent origins. He says little about the syringeal aponeurosis found in the Oscines and the Menurae (Plates 18, 19, and 21). Study of these plates suggests that the long intrinsic muscles are simply continuations of the M. tracheolateralis with the syringeal aponeurosis attaching to the superficial surface of the muscle; the text contains no clear description. Dissection of a crow syrinx showed that the aponeurosis attaches directly to the tracheal rings separating the M. tracheolateralis from the intrinsic muscles. The important questions are: Is a syringeal aponeurosis or an analogous feature present in suboscine groups, and if not how did the syringeal aponeurosis evolve? This feature appears responsible for much of the differences in the syrinx of the Oscines and Menurae from that of other passerines, but Ames scarcely mentions it.

Ames was faced with the problem of summarizing an immense amount of data into a reasonable and readable account. His "Morphological summary" (pp. 108–126) is most useful in this regard. The descriptions make little distinction between minor variants, such as fusion of rings and sizes of muscles, and major differences, such as attachments of muscles. The reader is left with a large mass of material with no indication of how to evaluate it. This becomes especially difficult when, as for the Pipridae (pp. 43–45), the muscles in each genus are described as "unlike" those of all other genera in the family. Yet, except for *Schiffornis*, the manakin genera constitute a homogeneous assemblage.

The monograph is badly under-illustrated; many genera described as markedly different from other members of the family are not pictured. The lack of figures is unfortunate because Ames' illustrations are excellent and clearly show the relationships of muscles to one another and to the cartilaginous elements. Additional figures would have added greatly to the paper's value.

Ames' treatment of variation in the oscine syrinx is most disturbing. He says

that it is much less variable than that in the Tyranni or Furnarii, and hence does not describe or illustrate it except for *Corvus*, which he chose as representative of the typical oscine syrinx. He states (p. 94) that the syringeal muscles show much variation in relative position, size, and attachment among the oscines, but does not give the range of this variation. It is important whether the variation in insertion of intrinsic muscles involves minor shifts on the same cartilage or whether it involves attachment to different bronchial rings. Description of a few extreme syringeal conditions would have been valuable in establishing the range of variation present in the Oscines. No suggestions are offered on why cartilaginous elements and muscles are so uniform in the oscines and yet so highly variable among the suboscine orders; this remains a most tantalizing evolutionary problem.

The absence of conclusive experimental studies on the sound-producing mechanisms of the syrinx places restrictions on consideration of possible functional properties and evolutionary changes in this structure (pp. 138–152). More insights could have been gained into these topics with a better comprehension of the correlations between functional properties of skeletomuscular systems and the observed morphology of the syrinx in different taxa. Evaluations of modifications in intrinsic muscles would be more meaningful if these changes were separated into two categories: (a) those muscular changes associated with increase in force development, and (b) those associated with increase in shortening abilities. I feel certain that, with a little reflection, many of the observed differences in the syringeal cartilages and muscles could be segregated into adaptive and paradaptive differences that would have permitted far sounder taxonomic interpretations.

The comparative evidence Ames presents strongly supports his major taxonomic conclusion that the Tyranni (most of Wetmore's Tyrannoidea), the Furnarii (most of Wetmore's Furnarioidea), and the Oscines plus the Menurae constitute major groups within the Passeriformes. His conclusion that the Tyranni are quite distinct from the Furnarii is argued soundly. Instead of recognizing five suborders as does Ames (pp. 153–164), I would prefer to recognize only three—the Furnarii, the Tyranni, and the Oscines (his Passeres and Menurae). I cannot find any strong reason to maintain the Menurae as a distinct suborder, as its syringeal morphology is basically that of the Oscines. The remaining passerine families—the Eurylaimidae, Pittidae, Acanthisittidae, Philepittidae, and Phytotomidae—are better left as "incertae sedis" instead of forcing them into one of the three well-based groups or separating some into another suborder (the Eurylaimi). Syringeal morphology appears to be of little value, at this time, for placing any of these families into suborders; they may be "primitive" members of any of the three major suborders, or may belong to one of more additional groups.

The major achievement of this monograph is, I believe, the demonstration that three major subgroups of passerine birds can be recognized on the basis of syringeal morphology. But this demonstration does not warrant the huge amount of comparative data presented. The major taxonomic conclusions could have been reached equally well with a considerably restricted comparative basis both in the diversity of genera examined and in the detail of description presented. Other aspects of this paper are weak. The morphological description is unsuitable as a dissection guide, or for comparative studies, functional investigations, and evolutionary considerations, or as the basis for taxonomic investigations on lower categorial levels. All too often, I felt that trivial aspects of syringeal morphology were described in detail or that topics of lesser importance were discussed at length while critical morphological points or profound comparative and evolutionary subjects were ignored, sometimes by choice. Consequently much effort was expended

for relatively few results with the saddist part being that most of the work must be redone if anyone wants to undertake comparative functional investigations, evolutionary studies, or further taxonomic analyses. The final outcome of any paper, and especially a broad comparative-systematic study, are greatly dependent upon decisions made early in the investigation on procedure and which features to include. It is at this point that a student is most dependent upon the judgment of his thesis advisor, who shares much of the responsibility for the success of any dissertation done under his tutelage. I feel that this study suffered greatly from a lack of critical judgment at this crucial point in the investigation.

Lastly, this paper illustrates an important facet of current comparative morphological-systematic studies of birds, namely that the classical approach that was so successful in the past is no longer viable. One cannot simply undertake a comparative study of some morphological feature, no matter how detailed the descriptions or how many genera are examined, and expect to reach useful taxonomic conclusions. Systematic studies no longer depend solely upon the ability to observe and compare anatomical features. Extensive initial analyses of the morphological form and function must be undertaken to ascertain which features and which modifications may provide critical clues to the evolutionary history of the avian taxa under study. Carefully considered phylogenetic and systematic questions must be formulated before meaningful comparative surveys can be undertaken. The future of morphological-systematic study of birds is dependent upon the proper training of students in these newly developed and often still controversial approaches. Otherwise progress in this branch of avian biology will be painfully slow.—WALTER J. BOCK.

The functional morphology of the hind limb of the Domestic Pigeon, *Columba livia*.—Joel Cracraft. 1971. Bull. Amer. Mus. Nat. Hist., vol. 144, article 3: 171–268. 33 figs., 4 tables. $3.65.—Recent years have seen a number of anatomical studies of the avian locomotor system. Many of them have emphasized comparisons of related species to exemplify the structural changes that accompany the evolution of different adaptive types. The methods of functional analysis employed in such studies have not always been entirely satisfactory, largely because of a lack of precise information about the functional characteristics of the avian bone-muscle system and of methods for analyzing it rigorously. In the present study Joel Cracraft has attacked this problem by studying the hind limb of a single species in much greater detail than has previously been attempted. The gross and microscopic anatomy of the bones, muscles, and joints are described, and combined with motion analysis to give a total picture of the functional activity of the limb during standing, walking, running, and landing. It is the synthesis of these several approaches that gives the paper its great value as a model for future interspecific comparative studies.

This is probably the most complete study of the joint system of the avian hind limb ever presented. It considers the hind limb arthrology in detail, presenting descriptions and analyses of the hip, knee, intertarsal, tarsometatarsal-phalangeal, and interphalangeal joints, with emphasis on the joint capsules, ligaments, menisci, fat pads, and articular surfaces. This is followed by a functional analysis that describes the axes of movement within each joint and the structures that limit the range of movement in each direction.

The muscles are considered next. In addition to the usual descriptions of origins and insertions, the fiber arrangement is also discussed in detail. Each muscle was examined histologically to determine the relative number of twitch and tonus fibers

present. These characteristics allow the author to estimate the functional role of each muscle more accurately than could be done on the basis of topographical relations alone. On p. 213 it is stated that muscle fibers "do not necessarily extend the length of the fasciculus," and a few lines later that "it will be assumed that the fibers extend the length of the fasciculus." This simplifying assumption is unavoidable, given the information available, but it might have been useful to have some estimate of the error the assumption introduces.

Next comes a functional analysis of the hind limb muscles, based upon the descriptive data previously given. For the most part this is excellently done and goes far beyond what previous authors have attempted with their more limited data, but the author's conclusions about certain specific muscles may be questioned. As the ambiens tendon forms part of the origin of certain toe flexors, most workers have suggested that it aids in toe flexion. Cracraft suggests that it acts in extension of the tibiotarsus, which is probably true, but that it contributes little or nothing to toe flexion because of its insertion to an aponeurosis of origin rather than to one of insertion. The one function does not preclude the other, and it seems unlikely that this unusual arrangement is without functional significance. Perhaps the ambiens contracts simultaneously with the flexors, drawing their origin proximally and thus increasing their effective length of excursion. In any event, if it acted only on the tibiotarsus one would expect it simply to insert on that bone.

Functional anatomy of the locomotor system implies a correlation between structural specializations and their significance in locomotion. An inadequate analysis of limb movements during locomotion has been a chronic shortcoming of previous studies. Cracraft has tried to overcome this difficulty by correlating his dissectional study with a high-speed motion picture analysis of slow walking, moderate walking, and running in the pigeon. An analysis of the limb cycle in each of the three actions includes the changes that occur in the angular displacement and angular velocities of the hip, knee, and intertarsal joints. The general pattern of movement is similar in all three, but there are differences in the onset of the various phases. Furthermore, with increasing speed of movement the angular velocities at the joints increase to phenomenal levels. For instance in the final extension phase of the intertarsal joint during running, a velocity of 2,175 degrees per second is attained! This excellent motion analysis is somewhat simplified in that it does not take into account the movements of adduction, abduction, and rotation that must be involved in maintaining the pigeon's center of gravity directly over the left and right feet as they alternately support the weight of the body during walking or running. This omission probably does not greatly alter the validity of the general conclusions of this part of the study.

In his discussion of the factual data reviewed above, Cracraft departs somewhat from straightforward reportage and analysis, and goes out on a limb, so to speak, in using these findings to postulate the activity sequences of the individual muscles in a walking cycle and in the standing pigeon. This is the weakest part of the study, but in some ways the most interesting. The period of shortening or of holding activity in each muscle during ten stages of the walking cycle is postulated on the basis of the foregoing functional analysis. On the whole the estimations are convincing. The postulated activity periods are illustrated in Table 4, which gives a visual summary of the proposed pattern. Unfortunately this table is not adequately labelled. Some activity periods are indicated by solid lines and some by dashed lines, but the meaning of this difference is not explained. Some lines begin or end with a question mark. This presumably indicates uncertainty about the exact time the muscle starts or stops contracting, but it also is not explained.

This report has great value as a detailed description and analysis of the functional anatomy of a single species. In addition, the data should prove useful as a background for studies comparing the functional adaptations of different species relative to their phylogeny and taxonomy. Such studies are usually restricted to the use of preserved material in which some functional considerations, such as the range of joint movement, cannot be determined. Information from the present work could be useful in interpreting preserved material where a similar analysis is impossible, but caution is advisable when applying such findings to forms with very different structural adaptations. Cracraft's work would be an excellent preliminary to a comparative study of the Columbidae, but would have to be used very carefully in an analysis of other families.

The criticisms of specific points given above do not detract from my opinion that this is an excellent and important study of avian anatomy. Cracraft has set a new standard of thoroughness and precision in the analysis of the avian locomotor system. —ROBERT J. RAIKOW.

An approach to the study of ecological relationships among grassland birds.—John A. Wiens. 1969. Amer. Ornithol. Union, Ornithol. Monogr., No. 8. 93 pp. $2.50.—Within the last half dozen years or so two doctoral studies have concentrated on the structure and function of avian communities in grasslands. Martin L. Cody (Amer. Naturalist, 100: 371–376, 1966; Amer. Naturalist, 102: 107–147, 1968) chose to survey a wide array of communities in the grassland biome over a large geographic area. John A. Wiens in this monograph being reviewed concentrated on just one grassland community in one geographic location. Cody had to make some *a priori* assumptions to limit the kinds of measurements to be made in order to gain breadth of coverage and higher utility for generalization. Wiens's study paid a great deal of attention to detail and measured many more habitat characteristics, but had to sacrifice the applicability of his conclusions to other grassland types. Both approaches are valuable, and both studies have increased our understanding of grassland communities, even though they probably affect the future development of this understanding in different ways.

Are their conclusions about avian communities in grasslands, nevertheless, similar? As Weins queries in the beginning of his discussion, "How representative, then, are the Fitchburg area and its associated avian community of grasslands in general?" And Cody could just as well have asked how applicable are his generalizations to other specific grassland sites. Although Weins cites Cody for various comparisons between their studies, I would have liked a more extensive comparison.

There are differences in their results. Comparing species in common to the two studies and accepting the LeConte's Sparrow (*Passerherbulus caudacutus*) in Cody's Minnesota plot as an ecological replacement for its congener, the Henslow's Sparrow (*P. henslowii*) in Weins's Wisconsin study, their conclusions show some disagreement as to how the resident species partition the grassland habitat. Both show that the Henslow's Sparrows or LeConte's Sparrows occupy areas of taller vegetation where vertical and horizontal densities are greater. Weins's ordering of the Bobolink (*Dolichonyx oryzivorus*) and Savannah Sparrow (*Passerculus sandwichensis*) in Wisconsin, however, is the reverse of Cody's findings for these two species in Minnesota. Similarly Weins's placement of the Grasshopper Sparrow (*Ammodramus savannarum*) and the Eastern Meadowlark (*Sturnella magna*) is the reverse of Cody's in his Kansas plot, but in both studies the differences in these

two species' habitat segregation was slight. Are these differences due to methodology or are they real differences between communities in separated geographic areas.

Cody and Weins also both agree and disagree in regard to the foraging behavior of species common to both studies. Weins reports that the Bobolink and Eastern Meadowlark forage slowly and deliberately through the grass. Cody agrees for the Bobolink but shows the meadowlark moving more rapidly through the vegetation and stopping for briefer periods of time. Wiens found all the species of sparrows to forage more rapidly than these two icterids, while Cody classifies the LeConte's, Savannah, and Grasshopper Sparrows similar to the Bobolink in that they also progress slowly through the vegetation, stopping for over a minute between movements. As both authors used timed observations of individuals, these differences are perhaps not due to methodology, but I am not sure to what they can be attributed.

Wiens's approaching his physiognomic evaluation of the habitat with a broad view as to the importance of individual parameters to the birds' use of that habitat is philosophically more satisfying to me. Because of this approach, he discovered some correlations between species' distributions within the habitat and environmental factors (e.g. litter depth and coverage) that a less extensive analysis would certainly have missed. The intensity of his approach also appears to explain why he found a higher species diversity and greater spatial overlap between species than Cody reported. Concentration on one area gave Wiens a far greater chance to describe what was there than Cody could in his one-day-per-habitat censusing of the species and their distributions.

The description of the ecology of the grassland avian community may be the primary goal in this work, but Wiens provides considerable information on the ecology of the separate species—territory size and the shifts in territory size and arrangement during the breeding season, chronology of the sequence of breeding activities, nest-site descriptions, time budgets and the vegetative substrate used for various activities, food brought to nestlings, and the intensity of interspecific aggression. Thus this study provides good comparative data for anyone interested in the natural history of the species involved.

Wiens states that the develpoment of a physiognomically-based system of describing grasslands was a primary objective of his work. Although I wish he had argued the biological significance of some of his habitat correlations, the importance of this work to avian ecology lies in the attainment of this objective. It is a benchmark for all subsequent investigations on grassland bird populations. It segregates habitat parameters that are important from those that are not. The efficacy of such a foundation for further work is well-illustrated by Wiens's own successful involvement in the avian ecology of the comprehensive site network of the U. S. Grassland Biome IBP.—JOHN L. ZIMMERMAN.

Ecological isolation in birds.—David Lack. 1971. Cambridge, Massachusetts, Harvard Univ. Press. Pp. xii + 404, 58 figs. (including many line drawings by Robert Gillmor), 25 tables, 6 × 8¾ in. Cloth. $12.00.—My assignment to review David Lack's recent book, "Ecological isolation in birds," is simultaneously a simple and a difficult task. It is simple because the work can be read and fully appreciated in a couple of hours. This is both because it is lucidly written in the familiar Lack style, and because it contains no new or intellectually cumbersome ideas. The message is easily grasped: bird species differ in either range, habitat, altitude, size, or feeding station, or in two or more of these ways.

The book is difficult because of the beguiling simplicity of this doctrine. The reader continually wonders *why* a particular pattern of ecological isolation is observed in a certain genus or location, and *how* it came to evolve instead of some alternative pattern. These considerations are scarcely mentioned, perhaps because the qualitative and general form of the observations does not permit their treatment. Does the message really merit such an extensive elaboration? Yes, if it provides a timely and useful review or new input. In the latter the book appears deficient to this reviewer, and in the former achieves only limited success, for surely we have gotten further in bird ecology than enumerating the ways in which bird species may differ from each other. For several decades we have been hearing questions such as: Is the competitive exclusion principle being violated here? Or, How are the species in genus X ecologically different? I see little utility in the former question, which Lack rightly avoids, and the second question, to which his book is largely devoted, is of interest chiefly in its extensions: By how much do species differ? Does the overall amount of ecological segregation change from place to place, between different taxonomic or trophic groups, from season to season, between latitudes and faunas?

The organization of this volume parallels closely the author's 1968 work on breeding adaptation; chapters centered on taxonomic or geographic areas bring into perspective data provided in lengthy appendices. The unit within which patterns are now sought is the genus rather than the subfamily used previously. This seems unreasonably restrictive, and belies much evidence that competitive displacement patterns frequently occur between species in different genera. The discussion of hummingbirds in Chapter 13 illustrates this, as does Lack's quite reasonable explanation for reduced sympatry in North American over European parids in the presence of a greater diversity of other small insectivores.

Setting aside two quite forgettable surprises (introducing Chapter 8, "few studies have yet been carried out on ecological isolation in North American birds," and in 1944 only Usambara, Tanzania, was as ecologically well-known as Europe—what would Joseph Grinnell have thought?), the analysis of the distribution of white-eyes, Zesteropidae, is perhaps the highlight of the book. Particularly interesting is the observation that islands of intermediate size and isolation support many more species of white-eyes than both other islands and mainlands. The explanation supposes that island resource diversity decreases with island size and isolation less rapidly than does the number of potential colonists, to the advantage of these errant species.—MARTIN L. CODY.

The behaviour of animals.—Jiro Kikkawa and Malcolm J. Thorne. 1971. Milton, Q. Australia, Jacaranda Press Pty. Ltd. 223 pp. 16 photos (9 in color), numerous drawings and diagrams. About $5.00.—A check of the shelves in my library revealed eight paperbacks devoted to a survey of animal behavior, all published in the past 7 years. This book compares favorably with the best two on my shelf. It is well-written, almost too profusely illustrated, and covers the immense breadth of animal behavior better than most others. It will not sit unused upon my bookshelf. I noted no typographical errors, but the color plates are not of good quality.

I know of no really excellent text in animal behavior for students with little background in the discipline, and this book is no exception. The book is woefully inadequate in its treatment of motivation and the ontogeny of behavior. The few statements concerning motivation indicate that the authors accept, uncritically, the motivational models of Lorenz and Tinbergen, constructs that are no longer acceptable to the ma-

jority of ethologists, including Tinbergen. The ontogeny of behavior is mentioned only in passing, yet this is one of the most active areas of research in animal behavior and the best text in behavior devotes more than a third of its pages to the subject. In the brief discussion on behavior genetics, the exciting hybridization experiments of Dilger, Johnsgard, and others are ignored.

The authors present 11 pages on kineses and taxes and then a very scant four pages on the fascinating problem of orientation and navigation. I find the mere 24 pages on social behavior inadequate, but I congratulate the authors on attempting a chapter on social behavior; authors of only one other paperback and only two of the major textbooks have been similarly courageous.

The book contains a considerable amount of information of little relevance to behavior, a situation particularly undesirable in so short a book. There is a two-page table, plus four pages of text, on the locations and physiological functions of the endocrine glands and less than a page on behavior-endocrine relationships. These pages could have been used much more wisely in presenting some of the recent, exciting work in endocrines and behavior. Two pages are devoted to the cranial nerves and almost three pages to the autonomic nervous system, and all of these are essentially devoid of mention of behavior. There are eight pages on the structure of vertebrate brains and practically the only behavioral information given is that the mammalian cortex is involved in learning and the avian striatum is associated with innate behavior. It has been shown that avian "intelligence" is inversely correlated with the amount of cortex present, and that the development of the hyperstriatum in, e.g. crows and parrots, appears to be correlated with learning and intelligence. The authors must be aware of this, for they list a key reference in their bibliography, yet their book persists in holding to the old story that the striatum is correlated with instinctive behavior. The discussion of exogenous vs. endogenous rhythms is too brief and very inadequate.

Literature references are not cited within the text, but at the end of the book is a list of references, by chapter. I find this system inadequate and frustrating. I was intrigued by a mention of muskrats culturally acquiring a habit of storing corn, and then losing the habit when the local population was decimated by drought. After some thumbing through the list of references, I found this observation was attributed to Errington (Muskrat populations, Ames, Iowa State Press, 1963). I looked in Errington's index and checked out all references to food storing except one: pp. 105–390 *passim*. I am thus faced with reading 285 pages of Errington to find the original statement of this interesting case of subhuman culture. I would prefer a more adequate system of literature citation by the authors.

The book is probably a bit thin for use as an only text in a course in animal behavior. It might be used as one of several books in a year course in biology. It has probably the best brief survey of behavior by phylum, from the protozoa to the vertebrates, of any paperback, and this might fit well into many biology courses, but potential users of a short text might look at Manning (An introduction to animal behavior, Reading, Massachusetts, Addison-Wesley, 1962) and Johnsgard (Animal behavior, Dubuque, Iowa, W. C. Brown, 1967), as well as this book. Although Kikkawa is an ornithologist, birds are not prominent in the book. A birdwatcher with no understanding of behavior might prefer Sparks (Bird behaviour, London, Hamlyn, 1969) as an introduction to this fascinating subject.—HELMUT C. MUELLER.

Handbook of the birds of Cyprus and migrants of the Middle East.—David Armitage Bannerman and W. Mary Bannerman. 1971. Edinburgh, pp. xvi + 237, 27 pls., 1 map, 45 text figs. Cloth. £3.00.—Cyprus, third largest and the easternmost major island in the Mediterranean, is for the second time (first in 1958)

the subject of a bird book by the Bannermans. Treated here are 356 species, 271 in detail and 85 mainly in a brief appendix. Some 153 species are illustrated in color by David M. Reid-Henry and by Miss Chlöe Talbot-Kelly. Another 40 species are shown in line drawings by various artists, and there is a very basic, foldout map of the country. The book weighs 24 ounces, measures 6 × 9 inches, and seems sturdy in construction.

Not unexpectedly, taxonomy and nomenclature do not always follow the "vogue," but the mostly conservative departures should not really complicate use of the book even for neophytes. Higher classification follows Wetmore's 1960 treatment, except as follows: Gruiformes included in Galliformes, Lariformes split from Charadriiformes, and separate families recognized for vultures (Aegypiidae) and buntings (Emberizidae). *Arenaria* is retained in the Scolopacidae and *Agrobates* (= *Erythropygia*) in the Sylviidae, while *Tichodroma* is transferred to the Sittidae. Split are some often-lumped species (e.g. *Oenanthe cypriaca, Anthus petrosus*) and genera (e.g. *Stigmatopelia, Budytes*) and retained are some outdated names (e.g. *Apus murinus, Oenanthe leucomelas*) and the now barred umlaut (e.g. *Gypaëtus, Sylvia rüppelli*). Less conservative are various generic lumpings (e.g. *Morus* = *Sula*), but even there a certain conservativeness surfaces, e.g. *Actitis* (but not *Totanus*) = *Tringa* and *Erolia* (but not *Crocethia*) = *Calidris*. Common species names, all in English, are in general conformity with those used in other bird guides, but some subspecies names are also encountered, including some that might cause confusion if used alone, e.g. Levantine [= Manx] Shearwater, Cyprus [= Short-toed] Tree-creeper, and Guillemard's [= Red] Crossbill.

I find, unhappily, that the title misrepresents the contents of the book, for the work is not detailed enough to be a genuine handbook and its treatment is too superficial to provide meaningful coverage of Middle Eastern migrants. Considerably more detail could have been included on plumage and measurements, particularly with reference to age, sexual, seasonal, and geographic variation within species, and technical details for identification. Of the 85 appended species 50 are not described at all, while even in some common birds such things as immature plumage have been ignored. In view of the active banding program in Cyprus and the opportunity to examine birds caught by limers, more information for birds in the hand would have been a useful contribution. The illustrations could also have been expanded, particularly with the aim of supplementing those provided in popular European guides to birds. Henry's 14 vignettes of Cyprus birds (reprinted from the 1958 book) may be more charming and artistic, but for information content most of those of Miss Kelly are more useful, even with their flaws. Captions for many of the plates leave much to be desired in regard to identification of individual plumages to age, sex, and season. Most of the line drawings are of limited value for identification, and the map is inferior to that of the 1958 book (e.g. not shown is the oft-cited village of Paralimni, south of Famagusta).

Particular criticism can be made of the questionable practice of quoting subspecific identifications of birds that were banded and released (e.g. clinal races of *Erithacus rubecula,* p. 165) and the failure to cite names of various contributors of data (e.g. the authority for identification of *Streptopelia turtur arenicola* in Cyprus, p. 218). In fact, at times there is an almost coy evasion of naming names, e.g. in the accounts of the Common Bee-eater (p. 121) and Scops Owl (p. 128), and in references to a paper (by John Ashton-Johson) in the 1961 Oologists' Record. A more personal slight is the failure to acknowledge me and the Smithsonian Institution for the use of an unpublished report on bird-liming in Cyprus, although data from this are frequently cited.

Errors of typographical nature seem relatively few, although I noted misspellings of Threskiornithidae (p. xiii), surviving (p. 96), and *inornatus* (p. 221), *Cyanecula* used for *Cyanosylvia* (p. 164), and a meaningless *"par"* in *Sterna bengalensis* (p. 217.) In discussing African races of *Pycnonotus barbatus* (p. 148), vent color should be white instead of red, at least in reference to North Africa forms.

While disappointing in its incompleteness, this work is a definite improvement over the 1958 work (which I do not recommend) and provides a general, updated checklist and serviceable field guide to the birds of Cyprus. For those interested in greater depth, a recent Cyprus checklist is apparently in the offing, and to aid all birders in identification I recommend (additionally) the European field guides, which will cover most of the species of Cyprus.—JOHN HUBBARD.

The lung air sac system of birds. A contribution to the functional anatomy of the respiratory apparatus.—Hans-Rainer Duncker. 1971. Berlin, Springer Verlag. Ergebnisse d. Anatomie u. Entwicklungs geschichte, 45 (6). 171 pp., 41 text figs.—This monograph on the functional morphology of the avian respiratory system can be described with one word—magnificent. It is an outstanding example of a modern morphological study combining excellent anatomical description, broad comparisons, and a functional analysis of the lung air sac system. These are supported by a thorough understanding of the mechanism of breathing in birds and comprehension of the adaptive significances of the avian respiratory apparatus. Most important is that Professor Duncker demonstrates the consequence of the structure and function of the avian lung for several basic facets of the biology and evolution of birds.

A brief historical review and clear statement of problems to be investigated introduces the study. Morphological description is limited to features directly associated with breathing; hence, structures as the syrinx and nonrespiratory air sacs are excluded. No attempt was made to sort out all errors in earlier papers and to correlate results and terminology of this study with those of earlier ones; this decision is a wise one although it will cause some difficulties. The species described and compared include members of most orders and a spectrum of birds of different sizes and modes of life. Duncker developed a superb method of injecting the lungs and air sacs, and making skeleton-lung-air sac preparations. The resulting descriptions and figures provide the best three-dimensional representation of this complex system of sacs and tubes that I have seen. One can easily understand all aspects of the air sacs and the varied sets of bronchi, including their relationships with the skeleton and the internal organs. One of the important morphological concepts presented is the distinction between the "paleopulmo" (ancient lung) present in all birds and the "neopulmo," along with its network of parabronchi between the primary bronchus and the posterior air sacs, present in all small birds and in some large species belonging to advanced groups.

Special mention must be made of the illustrations accompanying the morphological descriptions. The photographs and all drawings represent the highest standard of excellence for anatomical illustration. This monograph should be examined just for the illustrations, with care not to miss figures 37 and 38 showing the two major types of parabronchi. The complex figure captions must be read with care.

Two morphological puzzles remain. One results from this study, namely the pattern of pulmonary circulation in birds possessing a neopulmo. The second is the vexing problem of the size and the functional role of bronchial musculature. Duncker describes the bronchial musculature carefully, but discounts (as do other

recent workers) any role of these muscles in regulating the pattern of air flow. Although I cannot find any objections to this interpretation, I still have lingering, vague doubts and hope that study will continue on the functional significance of bronchial muscles.

The pattern of air flow and ventilation of the lung is discussed in detail based upon earlier suggestions of Hazelhoff. Here, mention must be made of the physiological studies of avian respiration by K. Schmidt-Nielsen and his students (see Sci. Amer., December 1971). Duncker and Schmidt-Nielsen agree that air flow through the parabronchi is in a single direction from the posterior air sacs during exhalation. But Duncker shows that this flow exists only in the paleopulmo, not in all parts of the lung in all birds as implied by Schmidt-Nielsen. Air flow in the neopulmo reverses during inhalation and exhalation according to Duncker. These differences in air flow in the paleopulmo and the neopulmo may account for different conclusions about lung ventilation in earlier papers.

Duncker discusses several adaptive aspects of the avian lung, but the most interesting is his conclusion on the ontogeny of the lung, which he describes as a system of rigid tubes. He argues that the small lumen of the air capillaries (3–10μ) combined with the surface tension of their moist surfaces would prevent the lung from being expanded by muscular forces if it had collapsed. Thus, in contrast to the mammalian lung, the avian lung cannot be unfolded at birth, but must develop as an expanded lung with rigid tubes while the chick is breathing air. The lung develops during the last several days prior to hatching after a connection forms between the amniotic cavity and the air bubble and while gas exchange is still maintained by the chorioallantois. The developmental requirements of this highly efficient avian lung precluded the evolution of viviparity in birds. Duncker must be applauded for this original and ingenious conclusion, which is the most realistic suggestion known to me for the absence of viviparity in birds.

All ornithologists should read Duncker's monograph as it is fundamental to all future work on the avian respiratory apparatus. It should provide the needed "morphological break-through" for a real understanding of avian respiration for which Professor Duncker deserves the gratitude of all ornithologists.—WALTER J. BOCK.

A naturalist in Costa Rica.—Alexander Skutch. 1971. Gainesville, Univ. Florida Press. 378 pp., numerous plates and chapter headings (black and white), 6 text figs. $12.50. Those familiar with the life histories of tropical American birds written by this thoughtful naturalist will find in this volume the account of the author's life and its environment during his years in tropical America. As a student, trained in his university studies primarily in botany, he lived for 6 months in the Almirante Bay region in western Panama, and in the following year for a period in northern Honduras. In these travels, in addition to his studies of plants, he became interested in the appearance and mannerisms of the abundant birds that he encountered daily in his work afield. On return north, in searching the literature, he found so little information other than descriptions and technical names for these feathered creatures that he decided finally to devote his life and further activities to their study.

The economic depression of that period made support for such investigations difficult. From slender personal resources he made two visits to Guatemala, the second time for a year devoted to the birds of the highlands. He found then that while there were no funds available for work in ornithology, there was a market for the botanical specimens that he continued to gather while occupied mainly with

his avian interests. For 7 years, during his studies of birds, he made extensive collections of plants that were sold to large herbaria. His studies, began in 1935, centered in the valley of El General in southern Costa Rica, with visits to other areas, including such distant localities as Barro Colorado Island, administered by the Smithsonian Institution in the Panama Canal Zone, and 6 months in northwestern South America. In 1941, through the modest funds accumulated from these sources, he purchased the small farm that he called Los Cusingos that since has been his permanent home.

The first section of the present book, under the heading "A naturalist's wanderings," is devoted in large part to ornithology. The second part, "A naturalist's homestead," begins with settlement on his farm, and continues with details of life and contacts there with his neighbors. While studies of the birdlife were a main interest, there is much on plants and insects, and on the physical and other aspects of the area. After twenty years in southwestern Costa Rica, he extended his studies to localities on the Caribbean slope for species of birds not present on the Pacific side of the republic.

Following these general accounts is a summary of ecological changes that came in later years through increase in human population and the extensive clearing of the original forests. These brought reduction or elimination to the larger mammals, as well as to many of the birds.

At the end he lists the 307 species of birds recorded in the valley of El General, of which he found the nests of 157 kinds. A second appendix gives his published bibliography of 243 entries, including six that are listed as books on birds. From a survey of this list we may judge the success of the author in his plan to add to knowledge of the manner of life of the birds of the American tropics. Through long hours of observation he has recorded in detail the activities of many species known otherwise mainly from specimens and the occasional brief notes on the circumstances of their collecting. His studies have centered especially on food, mating, nest building, eggs and their incubation, and the care of the young. In total result he has placed on record a vast amount of information not previously known. His contribution, in number of species studied in the broad geographic area concerned, appears to exceed that of any other individual.

The present book outlines in detail the background in which this information has been produced. His active work continues, and a further volume of life histories was issued by the Nuttall Club as the present review was written. His contributions are treasured items in my personal library.—ALEXANDER WETMORE.

Birds of Florida.—George S. Fichter. 1971. Miami, Seemann Publ. Co. 114 pp., 230 drawings by Constance S. McSweeney, 57 photos. $6.95.—This dreary little book appears to have been written by a man who knows nothing about birds aside from what he has found in the published works of others, and illustrated by a woman with the same qualifications.

The book treats 308 of the "common" species of Florida. Each bird is listed under its vernacular name only, with a brief description of its appearance and (usually) of where and when it may be found in the state; the species accounts vary but average about 50 to 60 words each. In some cases the accounts are adequate, but most are completely insufficient for identification. When sizes are given, they are in general comparative terms and can occasionally be misleading: the Clapper Rail is described as "The size of a Blue Jay or slightly larger."

The book is filled with errors, both of omission and commission. To cite just

a few, the American Flamingo is passed off as scarcely needing description, but in the 58-word account that follows the only color mentioned is black (for the tips of the wings and bill). The Limpkin is noted to resemble a *female* night heron. In the female American Redstart "The upper tail feathers are white." The male Rusty Blackbird "has a distinct white eye ring." Both the female Orchard Oriole and Scarlet Tanager have "black" wings, the male Scarlet Tanager is "all red, with only the edges of the wing feathers black," and the Blue-gray Tanager has "wings and tail violet." Only the male Rufous-sided Towhee is described, and its eye is given as "orange to reddish" although the iris is white in the resident Florida race.

As the author is clearly not an ornithologist, the reader could hope that he at least might be a writer. Yet one finds under Fox Sparrow: "A northwestern Florida winter visitor, this large sparrow is prominently streaked with reddish brown; they form a distinct spot in the center of the breast." Many other grammatical errors and awkward phrases occur, seasoned with such obvious typos as "yee" for "eye."

The illustrations are black-and-white sketches set in the margin beside their respective species accounts. Some are adequate, most are poor, and a few are ghastly. In comparing these drawings to Arthur Singer's in "Birds of North America" (C. S. Robbins et al., New York, Golden Press, 1966) it seems that the illustrator owes a *remarkable* debt to Mr. Singer, but has none of his talent. Parts of the text, including the placement of the Ciconiiformes between the Galliformes and Gruiformes, also show a strong similarity to Robbins, and many of the errors mentioned earlier can be attributed to misinterpretations of material in that book. For example, Robbins gives the length of a Blue Jay as ten inches and that of the Clapper Rail as fourteen, yet no one who knew the two species would consider them as about the same size. Singer's illustration of the female redstart has the body and tail angled so that the white under tail coverts might look, on quick glance, like a white rump. And in my copy of Robbins the oriole and tanager plates are so colored that they might lead to the erroneous descriptions cited above. It is to be hoped that Messrs. Robbins and Singer have either a good sense of humor or a good lawyer.

Of the "57 photographs in color and black-and-white" cited on the title page, only four are actually in color. The remaining 53 are more a fuzzy gray than black-and-white, and contain some bad misidentifications: both the photographs of flocks of "Gull-billed Terns" and "Common Terns" are of Sooty Terns; the "Pine Warbler" appears to be a *male* American Redstart; the "Bald Eagle" is almost certainly a Turkey Vulture; and the flock of "Herring Gulls" is at least predominantly of Ring-billed Gulls. Many of the photographs are so poor that positive identifications are impossible.

This is *in toto*, an "un" book—unoriginal, uninspired, unintelligible, and unnecessary. It sells for $6.95; Robbins' may be bought for $3.95.—MARY HEIMERDINGER CLENCH.

Birds of Madagascar. Oiseaux et fauves d'Afrique, vol. 1.—Jean C. Roché. 1971. L'oiseau Musicien, 04 Aubenas-les-Alpes, Haute Provence, France. Each 12-inch, 33⅓ rpm phono-disc in jacket, illustrated and annotated in French and English (transl. A. Heimann). 30 ff. each.—These recordings have no scientific objectives, nor are they intended as identification aids; their intention is simply to demonstrate the variety of bird sounds. Within this rather limited framework they achieve a modicum of success in presenting a wide selection of African vocal

types, from the braying of hornbills and the bark of turacos to the ringing duets of Boubou Shrikes and the virtuoso performances of Robin Chats. The birds sing together in a series of "bird concerts," and on the African disc these concerts are enhanced by being stereophonic. The Madagascar disc (monaural) is less successful as it presents fewer birds with consequent loss of variety.

Production is good and the recordings are of a generally high quality, although there is distortion in a few species. The jackets are very attractive but curiously irrelevant—not one of the birds that appear on them is heard on the discs inside.

The format is the same on both discs. On one side three different regions of tht country are visited, in each of which one hears a concert of birds supposedly typical of that area, without narration. On the other side the birds are singled out and identified. This is done both in French and English, understandably in a bilingual production, but it does result in half a side being wasted through duplication. As it is, only 33 species are heard on the African record and 23 on the Madagascar.

These discs have two principal faults. First many birds are misidentified while others are not identified at all; and second the concerts are artificially contrived, being in many cases a composite mix of birds that would never be heard singing together in the wild. Roché is an able tape recordist with a long line of records to his credit, but he has put these discs together hastily from a limited selection of material. The result is two rather superficial productions of limited value, and unless you enjoy simply listening to the music of bird voices without being too fussy about what you are listening to or where it lives, these are two records that every ornithologist can afford to be without.—STUART KEITH.

High Arctic—An expedition to the unspoiled north.—George M. Sutton. 1971. New York, Paul S. Eriksson, Inc. Pp. viii + 116, 11 col. pls. $12.95.—For 42 years George M. Sutton has retained his remarkable enthusiasm for the far north. Both the text and illustrations of his most recent book convey the sense of excitement that accompanies the arctic spring. The text is as much a human as a biological chronicle—the impressions and reactions of eight scientists to the events of four weeks of June on Bathurst Island, N.W.T. The highlight of the book is the collection of eleven watercolors by the author, which portray some of the unusual birds and mammals of that area against the stark and simple beauty of the arctic landscape.

One wonders if the publishers have done Dr. Sutton a disservice. At $12.95, the price seems a bit inflated. Even with a number of blank pages and a remarkably small typefield, the book extends but 116 pages. Could it not have achieved the wider circulation that it deserves at a more moderate price? Of the eleven watercolors, eight are displayed over two pages each, placing the binding crease down the center of the painting. The paintings were clearly not composed with such treatment in mind, and the serious collector might consider foregoing the book in favor of the folio of prints, sold separately by the same publisher.—STEPHEN F. MACLEAN, JR.

Annual review of ecology and systematics. Vol. 2.—Richard F. Johnston, (Ed.). 1971. Annual Reviews, Inc., 4139 El Camino Way, Palo Alto, California. Pp. x + 510, numerous figs., tables. Cloth, 6¼ × 9 in. $10.00.—Only one paper of 19 in this volume is specifically concerned with birds: "The insectivorous bird as an adaptive strategy," by Douglass H. Morse. He concludes that strategies have

evolved in response to the patterns of food stores in space and time and that both constancy and predictability are crucial to determination of spacing of birds and their foraging techniques. Other papers that may be of interest to avian systematists or ecologists are: "The hypothesis of nonspecificity and taxonomic congruence," by James S. Farris; "Principles of clustering," by W. T. Williams; "The karyotype in systematics," by R. C. Jackson; "Theory of feeding strategies," by Thomas W. Schoener; and "Seed predation by animals," by Daniel H. Janzen.—JOHN WILLIAM HARDY.

ALSO RECEIVED

Field work of a museum naturalist/1919-1922/Alaska: southeast/Alaska: far north.—Alfred M. Bailey. 1971. Denver Mus. Nat. Hist., Mus. Pictorial No. 22. 192 pp. $2.50.—This interesting account of travel to, from, and in Alaska is a sort of light postscript to the many papers, scientific and popular, A. M. Bailey has extracted over the years from his well-kept field notes of 1919-22. The only serious ornithology are lists of birds collected, reprinted from the author's earlier papers. The book would be easier and pleasanter reading if the author did not jump back and forth from the active to the passive voice and if he had added an index.—ELIZABETH S. AUSTIN.

Six came flying.—Marquis MacSwiney of Mashanaglass. 1972. New York, Alfred A. Knopf. 270 pp., map of castle grounds by J. Maestro, 22 photos by various people. $6.95.—This is a very interesting story entertainingly told and good leisure reading. A student of swans may possibly find nuggets of Trumpeter Swan behavior heretofore unrecorded as well as a short, but sound, bibliography. —ELIZABETH S. AUSTIN.

Birds of Lebanon and the Jordan Area.—S. Vere Benson. 1970. London, The International Council for Bird Preservation. xxxii + 218 pp., 8 col. pls. (94 species), many black-and-white drawings, and a map—all by the author except as mentioned in the text. A checklist of 315 species including 6 so-called unproved records and 52 scarce or occasional records. £3.00.—This competent guide to the birds of Lebanon and the Jordan Area seems to be the work of a hopeless optimist. This is a region where the populace regularly shoots all birds at all seasons and especially when the birds are most vulnerable at breeding time. In the introduction after giving the usual reasons for writing a guide book, the author says "The third, and most urgent, purpose of this book is to encourage conservation," and her hopes to do so rest on an Arabic edition to be used by students. I hope Miss Benson will be successful and that the detailed drawings and excellent text of her book do not become a guide to Lebanese pothunters instead of the few bird watchers, foreign and domestic.—ELIZABETH S. AUSTIN.

Wildlife of Mexico. The game birds and mammals.—A. Starker Leopold. 1972. Berkeley, Los Angeles, London, Univ. California Press. Pp. xvi + 568, 194 figs., unnumbered text figs., 7 × 10½ in. Cloth. $18.50.—This is a second printing of a work originally published in 1959. For several years it has been out of print. Lowery's review (Auk, 78: 446, 1961) proclaimed its importance in furthering conservation of wildlife in Mexico, and criticized its arbitrary (if understandably arbitrary) stance on what is and what is not a game animal by Mexican criteria as compared to those of a foreigner from the United States of America.—J.W.H.