

## REVIEWS

EDITED BY JOHN WILLIAM HARDY AND MARTIN L. MORTON

**Comparative myology of the hind limb of procellariiform birds.**—Robert D. Klemm. 1969. Carbondale, Southern Illinois Univ. Monographs, Sci. Ser., No. 2. Pp. xii + 269, 54 figs., 15 tables. \$6.75. **Evolution of diving adaptations in the stiff-tail ducks.**—Robert J. Raikow. 1970. Berkeley, Univ. California Publ. Zool., 94. Pp. vi + 52, 32 figs., 16 tables. \$2.50.

As these two monographs are similar in scope, approaches, goals, and problems, it is desirable to review them together. Both papers are important descriptive anatomies of the hind limb and tail of procellariiform birds and of stiff-tailed ducks (Oxyurini: Anatinae) respectively, both include extensive analyses of the functional and adaptational significances of these anatomical systems, and both base systematic conclusions on the results of these morphological and functional comparisons. Each monograph is an impressive study of which its author can be justly proud and for which he should be congratulated. Ornithologists interested in morphology and systematics should read both studies carefully for the wealth of valuable information, methods of analyses and results. Yet, my praise must be qualified, and I cannot advocate the use of either paper as a model for future studies. Although both Klemm and Raikow employ methods usually adopted by avian anatomists, my reservations arise because of serious problems in their functional analyses and especially in their considerations of the skeletal muscles. My worry is that I am not certain how extensively misapprehensions in the functional sections affect other parts of these studies. It is certainly incorrect to conclude that each portion of these studies is independent of other sections, and that shortcomings in the functional interpretations will not influence the descriptive morphology and the comparisons on which the systematic conclusions are based. Because of the importance I place on functional analysis in morphological-systematic investigations, I am sufficiently pessimistic to suspect that weaknesses in the functional interpretations pervade all other parts of these studies. But the extent and influence of this effect is very hard to ascertain without a careful and detailed evaluation. Obviously, many of the taxonomic conclusions offered by Klemm and by Raikow are valid and are as firmly based as most earlier taxonomic conclusions. Functional analyses of taxonomic characters will, I believe, become increasingly relevant in future morphological-systematic studies of birds; hence, while attempting only a general view of these monographs, I would like to give critical attention to a single central topic—that of muscle function—based upon the approaches used by Klemm and by Raikow.

The basic approach employed by Klemm and by Raikow for the analysis of muscle function is that commonly used in avian anatomy. Moreover, these studies are based extensively on the earlier papers of A. H. Miller (1937) on the Hawaiian Goose and of H. I. Fisher (1946) on New World Vultures. Thus my essay is a review of a basic approach in avian functional anatomy in addition to a review of Klemm's and Raikow's papers (see Gans and Bock, *Ergebn. Anat. Entwickl.*, 38: 116–142, 1965; Bock, *Amer. Mus. Novitates*, No. 2319, 1968).

Muscle-bone systems are mechanical systems and can be analyzed best with some method of mechanics. Care must be exercised in the use of the correct physical terms. Muscles contract and develop force, not power. Force, not power, is correlated

with total fiber number and angle of pinnation. Power is the rate of doing work ( $= \frac{\text{force} \times \text{distance}}{\text{time}}$ ) and while some muscles develop power as they contract and shorten, this physical parameter is of little value in functional anatomy of muscle-bone systems. Muscles contracting isometrically do not shorten and hence develop no power regardless of the force they generate and of the amount of metabolic energy used.

Moreover, it must be emphasized that the "strength" of a muscle (i.e. its force development) is proportional to its physiological cross-section (= total fiber cross-section) and angle of pinnateness, not to the cross-sectional area of the muscle (= morphological cross-section) as suggested by Raikow (p. 45) and Klemm (p. 117).

Both authors use a measure of muscle mass (either volume or dry weight) as an index to the relative development of the functional properties of muscles. The size of each muscle is presented as a percentage of the total mass of the hind limb or the tail musculature with the implication that a larger muscle is better functionally. The authors imply that muscle function is "contraction" or "force development" with no elaboration of the varied parameters of muscle function; these include force development, excursion, speed, rate of fatigue, metabolic rate, and efficiency (energy required). These parameters can vary independently of each other and at least several can be estimated on the basis of gross morphological data. The use of muscle volume as an index to muscle function is incorrect. Muscle mass does not correlate with force development or excursion, which are two important functional properties that can be estimated by gross morphologists and which are essential for considerations of the adaptive significance and evolution of muscle-bone systems. Force development is correlated with total fiber number (and angle of pinnation) and distance of excursion with fiber (not muscle) length (and angle of pinnation). Fiber number and fiber length can vary independently, but these morphological parameters are inversely correlated with each other in muscles of equal mass. Muscles containing few long fibers are quite different from those with many short fibers, but this difference does not appear in tables listing the weight or volume of muscles.

The data on muscle size presented by Klemm and by Raikow and all conclusions based upon this information have limited, if any, value. Most affected are their discussions of the functional significance, adaptation, and evolution of the hind limb and tail. Their taxonomic conclusions are probably little affected, although I believe that these conclusions would be substantially strengthened with an improved functional analysis. Even morphological description is influenced by the degree of functional acumen. Neither author included fiber length, fiber number, and angle of pinnation in their muscle descriptions. These morphological parameters are important and can be estimated with a reasonable degree of accuracy; they should not be omitted from future descriptions of avian skeletal muscles.

Both authors present values for the lengths of the "power arm" and "weight arm" for each muscle-bone complex, but I am unable to ascertain exactly how these have been measured. Presumably these lever arms are the measured distance from the fulcrum to the muscle insertion and to the point of application of the resisting force. If so, it is also essential to know the angle at which each force is applied to the bone; neither author measured these angles. This invalidates their functional conclusions based on considerations of the mechanical advantage of individual muscles.

Rather than using simple lever analysis, I would recommend using "free-body diagrams" which provide more information and contain fewer pitfalls. One of these

pitfalls which could be avoided is the old trap of correlating the site of muscle insertion relative to the articulation (fulcrum) with the speed of rotation of the bone or the force that the bone can apply. Both Klemm (pp. 117-118) and Raikow (p. 39) assume that muscles inserting far from the articulation have a large mechanical advantage and hence are adapted for strength over speed. Conversely muscles inserting close to the fulcrum move the bone more rapidly, but sacrifice force. This relationship is incorrect. Greater torque development by a muscle (force times moment arm) is required for increase in speed of rotation of the bone and for increase in the force applied by the bone ("effective strength"). Muscles insert close to articulations (close to the fulcrum) for reasons other than mechanical advantage or greater torque development.

Judgement of the functional analyses of Klemm's and Raikow's monographs is not my purpose; nothing would be gained if ornithologists simply accepted my comments as an unfavorable review. Rather I hope that workers will reread and study these papers carefully in the framework of the information presented in this review. Comparative evolutionary morphological studies of avian skeletomuscular systems are at the threshold of an era of really fundamental and exciting advances that will eclipse all previous contributions of avian anatomists. Recent studies have provided strong hints of future directions of investigations but much study is required before we even know what questions must be asked and how to proceed to answer them. The hind limb is an ideal object for evolutionary morphological studies as its structure is sufficiently complex, it is highly variable among birds, and its functions and biological roles are easier to comprehend than those of the avian wing. I hope that insights gained from careful study of Klemm's and of Raikow's monographs will stimulate and encourage avian anatomists to undertake the new and admittedly difficult investigations required in the developing field of avian evolutionary morphology.—  
WALTER J. BOCK.

**An atlas of speciation in African passerine birds.**—B. P. Hall and R. E. Moreau. 1970. London, Trustees Brit. Mus. (Nat. Hist.). Pp. xv + 423, 439 maps, foreword by Ernst Mayr. £15.—This atlas of 439 maps plotting the published, and a considerable number of unpublished, specimen locality records for all the 962 species of African breeding passerine birds is the first attempt to do anything of the sort for so vast a continent with so rich an avifauna. Early in the work on this atlas Mrs. Hall realized that a large number of the nonpasserine birds required worldwide, rather than purely African, treatment, and that this also applied to Palaearctic passerine migrants that winter in Africa, but do not breed there. She therefore decided to limit the survey to only the passerine birds that breed on the sub-Saharan African continent, but not including Mediterranean Africa, whose birds are really Palaearctic. This left a vast avifauna of 962 species. When one considers that in innumerable cases the authors had literally hundreds of records to incorporate and many obscure localities to trace and to map accurately, the enormity of their total effort becomes apparent. The work, well and critically organized and carried through, now makes readily available a truly vast amount of both old and new information. With each map is a succinct statement of the ecology and the characters of the birds therein plotted, and at the close of each family the authors give a carefully reasoned and informative summary, and they even correlate the purely African data with that of extra-African regions in those groups where the family has a greater than uni-continental distribution. These short paragraphs are digests of much knowledge and critical appraisal that are disarmingly simple in their presentation.

As Mrs. Hall states at the beginning of her introduction, this great series of maps constitutes the first attempt to show in graphic form, for the ready comprehension of the student, the results, "and the continuing process, of evolution in a large continental avifauna by means of plotting on one map the distribution of species believed to be immediately descended from a common ancestor." By placing closely related species on the same map it becomes evident where they overlap and where they are allopatric, and these facts give the field student indications of where to look and what to study in an attempt to assess and to interpret the past history of each of these current distributional patterns. It must be kept in mind, when using this atlas, that every existing specific distributional picture is not merely a discrete fact of local interest, but is always, and inevitably, the result of the past history of the species and of the region. This is the real, inherent interest in each of them, and each could become a valid point of departure for further study of the evolutionary vicissitudes of the particular species.

In the volume under review, the concept of the superspecies, a group of obviously related species, is stressed, as it is more apt to be suggestive than would be each of its components separately. In her introductory chapter, Mrs. Hall has summarized these "first" findings and has indicated that a more detailed analysis of the speciation patterns will be presented in a future publication. It should be stressed that she is the major author of the book, and was aided, while his health permitted, by the late R. E. Moreau. The book is a most important contribution to African ornithology and to the "source materials" for evolutionary studies, particularly of speciation and distribution.

On the whole, the enormous task of assembling and collating tens of thousands of records from the vast and heterogeneous literature of African ornithology appears to have been carried out with remarkable care, efficiency, and, especially, judgment. Because the published reports span more than a century of literature, the task of placing correctly together records originally appearing under many different scientific names required much experience and knowledge on the part of the compilers. At the same time, it would be too much to expect that the authors, working separately, and consulting each other chiefly by mail, were able to include every published record, or that they never suffered even a momentary lapse from accuracy. It can only have been such a lapse that caused them to record a mountain forest bird like *Pseudocalyptomena graueri* from such an improbable locality as the Budongo Forest, as the record they based this on is a correctly published specimen of *Pitta reichenowi* (p. 409). However, this is clearly an exceptional case, and only serves to reassure us that even the experts are human and have their off moments. It also points out the risk involved in abbreviating generic names to their initial letters, as this may tend to render transmutable data on taxa that would otherwise never suggest this treatment to their compilers.

Aside from the major evolutionary import of the data it presents, the volume indirectly points out which regions of Africa are still inadequately known. A glance at the map showing all the specimen record localities plotted in the atlas (p. xi) shows how little studied are the avifaunas of large areas of northern Mozambique, of most of the Ivory Coast, of Guinea, of the eastern part of Senegal, southwestern Angola, eastern Ubangi-Shari, the Bahr-el-Ghazal area of southwestern Sudan, and many parts of the immediate sub-Saharan belt.

The 439 maps constitute the real "meat" of this volume, but they are followed by a very useful tabular digest of the number of superspecies, species-groups, and independent species, arranged both by families and by habitats. Among other interest-

ing things, this reveals that 176 out of the 962 species included in the book are "independent," that they have no close affiliations with other species, that they reveal no "obvious" common unity of immediately antecedent phylogenetic connection with other species. These constitute 18.3 per cent of the total, and they raise questions of evolutionary interest that should stimulate field workers in Africa to look for ethological comparisons that might help to fill the gap left by the lack of morphological, systematic evidence. This table is followed by one giving English names for all the species, and by an appendix listing the museum collections and manuscript lists from which localities of specimen records have been taken, by a list of "general" references consulted, and by a list of specific references and of addenda received too late for plotting on the maps.

An index of scientific names, and a short appendix of "final addenda," particularly, but not solely, of Forbes-Watson's important findings on Mt. Nimba, Liberia, complete this most important volume. All workers on African birds will find this book an invaluable reference work and will be increasingly indebted to its authors, who deserve their thanks and their commendation.—HERBERT FRIEDMANN.

**Owls/their natural and unnatural history.**—John Sparks and Tony Soper. 1970. New York, Taplinger Publ. Co. 206 pp. Illustrated by Robert Gillmor, many pencil drawings, 17 black-and-white photos. The one colored photograph, the frontispiece, is credited to Patrick Morris. \$5.95.—In a world where no ornithologist has seen fit to write a monograph on the owls or even on any one species of owl, this work would seem from its title to fill a great need. It does not. In many ways it is not as good as Herbert Zim's "Owls," a book for children published by William Morrow & Co. in 1950. Dr. Zim's objective was to cover the owls of the continental United States and he did. Sparks' and Soper's objective was to cover the owls of the world and they fall far short of the mark. This book discusses less than a fourth of the known species of the world's living owls as tabulated in the authors' systematic list of owl genera and species, which shows a number of unexplained departures from Peters and other currently recognized standards.

This book gives the general impression that the authors bit off more than they could chew. The natural history of owls, which ends on page 156, while failing to cover the owls thoroughly, digresses to ramble on about other nocturnal birds such as caprimulgids and the Oil Bird. The unnatural history of owls, pages 159–171, skips lightly from the Bible, the Romans, the Greeks, Shakespeare, British poets, and folklore to the "Red Indian," proverbs, and slang. It is all incomplete and as careless as the term "Red Indian," which is fortunately almost obsolete and in bad taste. Among adages the common "blind as an owl" is omitted. Owl slang lists obsolete 18th and 19th century usages, but omits the currently common "night owl."

The authors researched the owls of North America very inefficiently or they would know, as Ralph Palmer points out in "The mammal guide," that "the prairie dog, rattlesnake, burrowing owl living together in harmony is a myth, since rattler and owl eat young 'dogs' and 'dogs' eat owl eggs and young." Another misstatement is that "owls have not been able to develop their own specialized bat interceptor." With my own eyes I have watched a Great-horned Owl take to its perch outside Carlsbad Caverns nightly to feast on the emerging bats, which it snatched in flight quite expertly.

The three-page-plus bibliography is a clue to the book's many faults. Sparks and Soper do not list the fine work on Barn Owls by G. Guerin, "L'Effraye commune en Vendée," Paris, 1928; A. A. Allen's paper on the Screech Owl, nor Haverschmidt on

the Little Owl. Many American books on the folklore of birds and legends of American Indian tribes were ignored. Sparks and Soper would like to sell their book to Americans, but did not consult American source material on American owls or they would not have used an illustration showing a pair of Burrowing Owls fraternizing with a prairie dog next to a hole in the ground.—ELIZABETH S. AUSTIN.

**Bird embryology.**—V. V. Rol'nik. 1968. Leningrad, Izdatel'stvo "Nauka." Translated from Russian, Israel Program for Scientific Translations, Jerusalem 1970. Available from U. S. Dept. Commerce, Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151. Pp. vi + 379. Paper. \$6.00.—This is a publication of the Sechenov Institute of Evolutionary Physiology and Biochemistry of the U. S. S. R. Academy of Sciences. Although all the main aspects of avian embryology are dealt with to some extent, the author sets as her main task a description of physiological development. The morphological side of development has been studied intensively for more than two centuries, but, except for an obsolete book by Preyer in 1885, this is the first comprehensive treatise of embryo-physiology based on evolutionary principles. Some 1,100 citations are given, approximately equally divided between Russian and other languages. The coverage of the literature appears very complete up at least to 1960, as far as I am able to judge, but the number of papers cited for the 1960s is relatively small, especially of non-Russian languages, and there are no citations later than 1966.

The 22 chapters are divided between three sections. The first section deals with the egg and embryo development prior to incubation, the second with the morphology and physiology of embryo development, and the third with the necessary environmental conditions for the development of bird embryos. The last section will be of special interest to ornithologists. Major attention is paid throughout to embryonic development in the domestic fowl and other domestic species both under natural and artificial incubation, although data on song and other birds are brought in as much as possible. The volume of information on other species is, however, quite small. Although not a handbook by any means, frequent references are made for improving the practice of artificial propagation of birds.

Attracting my special attention was the discussion of the influence of environmental factors on egg productivity, incubation temperatures, loss of egg weight during incubation, turning of eggs, etc. I do not know where else one can find such coverage of contributions by Soviet investigators to these topics. I could quarrel about the accuracy of some details here and there, but on the whole I judge the treatment thorough and reliable. I recommend the book most heartedly.—S. CHARLES KENDEIGH.

**International zoo yearbook, vol. 10.**—Joseph Lucas (Ed.). 19???. Zool. Soc. London. Pp. vi + 372, 49 black and white photos, numerous figs. and tables.—In describing the contents of this volume, I can do no better than draw upon parts of p. vi entitled "Editorial." Volume 10 is divided into three parts. Section 1 consists of 20 papers on hawks and owls in captivity. Section 2, new developments in the zoo world, contains 62 papers and notes and is divided into subsections dealing with Architecture and Construction, Breeding, Conservation, Husbandry and Research, and Veterinary work and Zoos. Section 3, a reference section, contains detailed lists of public live animal collections of the world; zoo associations and federations; mammals, birds, reptiles, amphibians and fishes bred in captivity in 1968; and a census of rare animals living in zoos and other institutions in 1969. The volume concludes with a cumulative subject index for volumes 1 to 10.

Scanning the subject matter of the first section, of most interest to ornithologists, one finds such interesting papers as "Problems of reproduction in birds of prey in captivity;" "Further notes on the California condor" (by Todd and Gale of the Los Angeles Zoo), which gives information on molt; "Egg laying and incubation by American Golden Eagles;" and "The white little owls at Jerez Zoo" by F. Carabantes, who describes a family of totally albino *Athene noctua* discovered in the wild. Two of the young were captured and raised in the zoo (Figure 10).

Section 2 contains an article on a captive colony of Red-footed Boobies at Oahu Sea Life Park by K. Pryor and I. Kang, and others on breeding of guinea fowl, cranes, macaws, hornbills, and birds of paradise.

Without doubt this volume contains more of value to ornithologists than any of the previous volumes. At \$21.00 it will probably be purchased mainly by institutions. Any vertebrate researcher keeping animals in captivity should find this series of publications valuable.—JOHN WILLIAM HARDY.

**American hawking.**—Hans H. Peeters and E. W. Jameson, Jr. 1970. Davis, California, Lawton and Alfred Kennedy. Foreword, preface + 145 pp., 7 pls., 4 figs., 35 unnumbered text figs.,  $7\frac{1}{4} \times 10\frac{1}{2}$  in. Cloth. \$25.00.—Considered strictly as an instructive text, "American hawking" is by far the best recent work on the methodology of keeping, training, and flying a captive bird of prey. The authors briefly and clearly define the equipment needed by the aspiring falconer before obtaining a hawk, the initial steps in training, daily care, symptoms of common diseases and their cures, and finally, "entering" the trained raptor on prey.

In the preface the authors state, "In the interest of conservation, we have emphasized the well being and welfare of the trained hawk." Herein lies the main concern of "American hawking" to the readers of *The Auk*. Keeping a well-trained healthy animal in one's back yard certainly puts a self-centered interpretation to the term "conservation." So doing always removes a potential breeder from the population, which is particularly hard to justify when the captive may be from a depressed population like *Falco peregrinus anatum*.

As it contains no original information of the life histories of the birds of prey, the book is of limited scope to most ornithologists. It is recommended only to those interested in the mechanics and philosophy of this ancient sport.

The attractive format of the text is enhanced by the uncut pages of heavy, high-gloss paper; the fine reproduction of the colored plates and drawings by Hans J. Peeters; and the annotated bibliography of hawking literature.—MICHAEL J. FOGARTY.

**Mexican macaws, comparative osteology and survey of remains from the Southwest.**—Lyndon L. Hargrave. 1970. *Anthropol. Pap. Univ. Arizona*, No. 20. Pp. ix + 67. \$5.00.—"Mexican macaws" is designed for use by archaeologists working in southwestern United States and northern Mexico. The first of the two major sections of the paper describes osteological age characteristics of macaws, genus *Ara*, and features distinguishing the two species likely to occur in the region, namely the Military Macaw, *A. militaris*, and the Scarlet Macaw, *A. macao*. Age characteristics were determined from 12 specimens of four *Ara* species. As one might guess, the species characteristics are few and subtle, and based on the short series available to me, do not always hold true. Numerous line drawings illustrate the bones and their diagnostic features, and several tables give measurements of modern and archeological specimens. The second section describes the cultural areas

providing macaw remains and the condition of the identified material. Appendices discuss proper use of common names and the need for preserving material, and describe proper field and laboratory care of specimens. This paper is of limited interest to ornithologists.—GLEN E. WOOLFENDEN.

**Bristow and the Hastings Rarities affair.**—James M. Harrison, D.S.C. 1968. Sussex, England, A. H. Butler Ltd. Pp. xv + 160, 18 photographs of holograph letters, bills, and accounts, one colored plate painted by the author. 30 shillings.—For the information of those who are unfamiliar with the subject matter referred to in the title of this book, George Bristow was an English taxidermist in the town St. Leonards-on-Sea, Hastings, who mounted and often sold a number of uncommon birds supposedly shot in the vicinity between 1892 and 1930. In a special issue of *British Birds* in August 1962 a statistician and two ornithologists report on an investigation of these rarities and delete between 80 and 90 species of the uncommon birds. In his present book Dr. Harrison defends Mr. Bristow and his records. The defense is strongly and ably presented. It does not rest on Dr. Harrison's personal knowledge of Mr. Bristow alone, but on facts, figures, and later records of the disputed species.—ELIZABETH S. AUSTIN.

**Photographer in the rain-forests.**—Paul Griswold Howes. 1969. Noroton, Connecticut, Sylvanus Books. Pp. xx + 218, 112 black and white photographs and snapshots taken by Frank M. Chapman, George K. Cherrie, and the author over 50 years ago. \$6.95.—As Sylvanus Books is a nonprofit publishing house owned by Paul G. Howes and Associates, one might say this book is privately published, but it has none of the shortcomings common to such books and all the earmarks of the work of the practiced writer that Mr. Howes is. The book is delightful reading and will let young people experience the hardships of expeditions into unexplored, tropical wilds in the early years of this century. The book will give older readers nostalgic memories of Teddy Roosevelt, Beebe, Chapman, Fuertes, Cherrie, and others. Mr. Howes must have kept detailed diaries, for no one's memory could possibly have total recall of every bird and beast he met after 50 years or more.—ELIZABETH S. AUSTIN.

**The Storm Petrel and the owl of Athena.**—Louis J. Halle. 1970. Princeton, New Jersey, Princeton Univ. Press. Pp. xiv + 268, 2 maps, and a number of inept black and white drawings by the author scattered through the text. \$7.50.—I opened this book anticipating unusually pleasant reading, words of wisdom thoughtfully put together by a onetime winner of the John Burroughs Medal. From the preface where Mr. Halle apologizes for his illustrations to the list of species and index at the end, the book proclaims itself a potboiler. In the introduction the author complains of the differences in the common names used by the British and Americans and then compounds these difficulties by giving *Larus canus* an obsolete American name that does not appear in the Check-list of North American birds (fifth Ed., Baltimore, Amer. Ornithol. Union, 1957) but did appear in the fourth edition (1931). Throughout his book—the first part presumably written very recently and the second part reprinted from earlier writings—obsolete scientific names and common names that do not appear in any authoritative publication abound. To add insult to injury he even misspells the obsolete "*Machetornis ruficollis*." The book is so full of errors and inconsistent statements that I found it unprofitable and unpleasant reading.—ELIZABETH S. AUSTIN.