REVIEWS

EDITED BY WALTER BOCK

Comparative study of Todies (Todidae): with emphasis on the Puerto Rican Tody, *Todus mexicanus*.—Angela K. Kepler. 1977. Cambridge, Nuttall Ornithological Club Publ. No. 16. xiii + 190 pp. $11.75.—With the publication of this monograph, knowledge of another little-known tropical group has advanced a major step forward. Following a brief introductory chapter detailing study areas, methods, and external morphology, 14 chapters outline the behavior, ecology, breeding biology, distribution, and evolution of the endemic Greater Antillean family. Most of the monograph is concerned with *T. mexicanus* in rainforest and scrub forest on Puerto Rico, but data on other species provide interesting comparative insights. Kepler provides much new information and overturns a number of misconceptions about todies.

Jamaica, Cuba, and Puerto Rico each have one endemic tody, while two occur in Hispaniola. As is common in island birds, all species occupy a wide range of habitats. The Jamaican species seems to be limited by an island-wide limestone formation which restricts sites for construction of nest burrows. The two Hispaniolan species are broadly sympatric now but apparently differentiated in isolation when the island was divided by a deep oceanic trough. They are sympatric over a 1265-m altitudinal range on one mountain. *Todus angustirostris* predominates at higher elevations while *subulatus* is more abundant in the lowlands.

Tody behavior is the central theme of several chapters. Vocalizations are described (including sonograms) and their functions are discussed. Todies lack complex vocal repertoires and thus depend on plumage displays and wing-rattling in both courtship and territorial aggression. Wing-rattling is produced as air passes rapidly over the outer primaries. Among the five species intensity of flank display is proportional to the amount of pink coloration in the flank feathers. At the extremes, *mexicanus* has no pink and no flank displays while *subulatus* has extensive pink flanks that are exaggerated by puffing up the feathers and lifting the wings.

A short chapter discusses maintenance behavior such as bathing, preening, scratching, and locomotion. Average flight distance increases (with one exception) with wing chord even in these relatively small short-winged birds. The unusually long wing of *T. angustirostris* may be attributable to character divergence as it flies more regularly and sits for shorter periods when sympatric with *subulatus*.

Todies tend to remain paired and occupy the same home range throughout the year. During the breeding season, territories are somewhat smaller than non-breeding season home ranges. Territory size and population density varies with habitat but territory volume varies less among habitats than does territory area.

Todies spend an unusual proportion of their time (up to 14 h/day) foraging. They are exclusively insectivorous and the most common foraging technique involves short flights to pick insects from the underside of leaves. Feeding rates and foraging efficiencies vary with habitat; both are highest in scrub. When sympatric, the Hispaniolan species exhibit character displacement relative to their foraging in allopatry on the same island. I suspect that todies are most similar ecologically to mainland tyrannids such as spadebills (*Platyrinchus*) or the somewhat larger flatbills (*Rhynchocyclus*).

As in most coraciforms, both sexes participate in the construction of nest burrows. On Puerto Rico problems of burrow construction and maintenance vary among habitats and climates, apparently limiting occupation of some areas. Although stream banks are used as nest sites in dry scrubland, they are rarely used in rainforest where flooding is more common.

Todies lay relatively large eggs (26% of body weight) and spend less than 25% of their time incubating. Attentive periods vary from 2 min early in incubation to 16 min late in incubation (average 13.1 min). Incubation lasts 21 to 22 days. Unlike most birds, feeding rates of nestlings increase continually up to fledging. Young are fed insects, which increase in size through the nestling period. Nestling mortality is high in unusually rainy periods because foraging by adults is restricted. The introduced mongoose is a major factor in nest losses, especially in rainforest.

Breeding is distinctly seasonal in all habitats and more extended in rainforest than in scrubland. Yearly variation in rainfall period causes displacement of breeding seasons; drought in 1970 accelerated breeding in rainforest and delayed it in scrubland.

One of the most interesting chapters deals with nest helpers. Many birds (jays, wrens) that have nest helpers have complex social systems, but this is not true for todies. Although the evidence is indirect, tody helpers seem unrelated to the nest owners. Generally helpers occur late in incubation or during the nestling period. Although the number of fledged young per adult is lower in helped nests than in nests without helpers, both clutch sizes and fledglings per nest are higher in helped nests. Helpers during incubation have less effect on fledgling success than helpers during the nestling period.

The value of studies of single taxa is clearest in Chapters 14 and 15 on population regulation and evolution in todies. Kepler integrates her ecological and behavioral data to provide a more complete view of tody biology. Discussion of habitat requirements, weather, and insect densities provides insights into selection pressures on todies. Kepler concludes that the most important factors regulating *mexicanus* populations in rainforest seem to be predation and food supply as affected by climate. In scrubland, nesting sites and food supply (interspecific competition) are most important. Evidence for the importance of interspecific competition is indirect at best.

Kepler often interprets her results in the context of recent theoretical advances, but fails to conduct rigorous tests of hypotheses, including statistical analysis of results. Further, tabular material is inadequate to allow such tests. Citations to a more detailed dissertation and to manuscripts in preparation are distracting because they are not generally available. Technically there are few typographical errors but some maps are poorly drawn and/or reproduced. Printing of tables from original typescript presumably reduces publication costs without detracting from the monograph.

This study demonstrates the value of studies of single taxa, especially when they go beyond the more anecdotal efforts of past decades. The contributions of such studies to ornithological science will continue to be substantial, especially when they include integration of quantitative data on a variety of aspects of avian biology.—JAMES R. KARR.

Ecology and energetics of contrasting social systems in *Phainopepla nitens* (Aves: Ptilogonatidae).—Glenn E. Walsberg. 1977. Berkeley, Calif., University of California Press. 63 pp. $4.50.—This research effort compares the breeding social systems in the Phainopepla but is an excellent model for the approach of natural history studies by biologists. The Phainopepla is a relatively easy species to observe and study, but there are aspects of its biology that are perplexing and difficult. It has been an enigma to avian biologists in the Southwest. In many parts of Arizona and California the birds appear in the fall and establish territories over areas containing mistletoe clumps, they breed in early spring, rear their young, and then disappear until the next fall.

Walsberg, with some luck, hard work, and a broad background, has gathered and synthesized information on the ecology, ethology, and physiology of the Phainopepla where it breeds in one area in early spring and then followed what he felt was part of the same population to examine its breeding habits in the summer. The different types of territorial defense (A and B) used by each population in each situation are compared as well as the reasons for the evolutionary differences resolved by the quantitative description of the food resource, time of abundance, and availability. The selective advantage of each social system is examined by comparing the energy expenditures involved with defending these resources in each area.

Some might argue that the weakest part of Walsberg's thesis is that the California desert breeding population is part of, or is the same as, the population that breeds in the coastal areas of southern California. I feel he is correct, and our Phainopepla movement data in the Colorado River Valley support his contention. Many questions regarding this population remain unanswered (do the same individuals breed twice per year, etc.), but the evolution of this dual breeding system is logically supported by paleoecological knowledge of floral shifts during the Pleistocene. By combining this information, the specificity of the Phainopepla's food habits (berries), and the placement and timing of these resources, Walsberg was able to explain the movements and the selective forces that directed the evolution of these two different social systems.

This work will be an excellent and exciting set of lectures to present to students in ornithology or vertebrate natural history. Vertebrate ecologists will spend many interesting hours discussing and debating numerous points. Time, and now more directed effort, will help resolve many of the still unanswered questions.—ROBERT D. OHMART.

Ontogeny and phylogeny.—Stephen Jay Gould. 1977. Cambridge, Mass., Harvard University Press. xiv + 501 pp. $18.50.—As the title suggests, this book is a review and analysis of the relationship between the processes of ontogeny and phylogeny, a topic in evolutionary biology that is little discussed mainly because of the discredited slogan "Ontogeny recapitulates phylogeny." This issue has been of minor importance in avian biology although the large flightless ratites have been cited as an example of paedomorphosis. Possibly the functional demands of flight in birds place severe restrictions on patterns of ontogenetic development in this class. Yet it seems reasonable to suggest that more attention should be given to the phenomenon of heterochrony in the evolution of birds.

Gould's book is divided into two parts. The first is a historical review of the relationship between phylogeny and ontogeny that I found to be rambling and largely irrevelant. It is not clear whether this

section is a history of these ideas or a discussion of their philosophical meanings. Most readers can skip this part and turn directly to part two, which is the heart of Gould's book.

Gould presents in Chapter 7 an excellent review of the parallels between ontogeny and phylogeny, which he discusses under the heading of heterochrony. Unfortunately, he is not clear whether he regards heterochrony as a process or mechanism or a descriptive phenomenon. In most places he states that it is a mechanism (e.g. "produce evolutionary change by heterochrony" p. 238), but in many parts of his book he treats it as a descriptive phenomenon (note his glossary definition). Gould presents a good classification of the categories of heterochrony (see Table 3, p. 229) which he subdivides into two processes of acceleration and retardation. Most important is that he clearly separates the mechanisms from the morphological results of recapitulation and paedomorphosis. His clear separation of mechanisms and results is a major step in clarification of the highly confusing welter of terms and concepts that has dominated the study of the role of ontogeny in evolutionary change. He shows that the same morphological result can be achieved by different mechanisms contrary to the simple cause-effect relationship assumed by most earlier workers. Gould develops a clock model for heterochrony as a means for summarizing the relationships between the mechanisms and the results. The model is a good one and worth careful study. Chapter 7 is perhaps the best part of the book, which closes with an excellent conclusion (p. 262) that should be read carefully.

The second important contribution by Gould is his discussion of the evolutionary and ecological aspects of heterochrony, covered in Chapters 8 and 9. Gould points out clearly that the immediate adaptive advantage of a heterochromical change must be ascertained, that such changes cannot be discussed in terms of future advantages to the species. More interestingly, he stresses that these adaptive advantages need not be associated with the obvious morphological modifications resulting from heterochrony. The changes may be adaptations associated with breeding systems—changes under the control of r- or K-selection—with the morphological modifications being evolutionary by-products. Although I support the basic idea in these chapters that heterochrony must be related to selection, I find myself in strong disagreement with number of points. The relationship between acceleration and r-selection and between retardation and K-selection (p. 292–3) seems too simplistic. Moreover, the concept that r- and K-selection are opposing systems or at opposite ends of a continuum of selection does not seem reasonable. Nor is the implication valid that species under r-selection are freed from selection acting on the morphological-physiological properties of features as Gould implies (e.g. p. 338–9).

The final chapter deals with human evolution, in which ideas of retardation and neotony have important roles. Gould includes a very useful glossary of 10 pages.

My major objection to this book is that its core (Chapters 7–9) comprises only 142 of the 409 pages of main text. Gould would have done better to have written a thinner book which would have been read by more workers. I urge all ornithologists interested in the evolution of birds to read "Ontogeny and phylogeny." With the clarification of ideas provided by Gould it should be possible to find examples of heterochrony in birds, or if not, to ascertain the factors restricting this type of change in the evolution of birds.—WALTER J. BOCK.

Watching Birds/An Introduction to Ornithology.—Roger Pasquier. 1977. Boston, Houghton Mifflin Co. xviii + 301 pp., 112 black and white figures, illustrations by Margaret La Farge. $9.95.—This book was written for the bird watcher and the environmentalist as a guide through the main topics of ornithology. Ten main chapters discuss origin, evolution, and speciation; feathers and flight; food, feeding habits, and digestion; anatomy; voice; the breeding cycle; migration; winter habits; and distribution. Other chapters cover tips for the beginner on how to watch birds, why and how birds are studied, conservation, attracting and caring, and ornithological research today. An appendix lists 101 books—each usually with a terse, helpfully descriptive phrase or two—for further reading; and the addresses of six "ornithological" journals and three conservation organizations are cited. There is an 8-page index involving species mentioned in the text and 101 subjects. The 112 drawings by Margaret La Farge, buttressed by adequate legends, make this an attractive volume, the work being introduced with a foreword by R. T. Peterson.

RTP regards *A Guide to Bird Watching* as the lineal ancestor of this new book, a circumstance that I tend to doubt. *Watching Birds*, it seems to me, is the lineal descendant of G. M. Allen's *Birds and Their Attributes* and (to a lesser extent) J. A. Thompson's *The Biology of Birds*. The Allen and Pasquier books have much in common, including similar words in the titles of about seven main chapters. Both are directed toward the beginner; both eschew references to the literature. I liked Pasquier's list of recommended reading (which Allen did not attempt), but I thought he could have been somewhat more discriminating: I would have dropped some titles like *All the Birds of the Bible* and substituted Welty's

glaringly omitted *The Life of Birds* for Rand's *Ornithology: an Introduction*, which is dubiously included as "another good college level text."

In general the text of *Watching Birds* reads easily. I noted about 15 statements that I regarded as poorly worded or in error, and the inclusion of American Birding Association in the list of "ornithological organizations" struck me as absurd. The title of the book may be something of a misnomer. It does encourage *watching*, but it has almost nothing on field techniques. It is really devoted to *understanding* birds. The book covers a lot of ground, and it succeeds in living up to its subtitle as "an introduction to ornithology." Attractively printed and illustrated, it should be helpful in orientating new purchasers of the Peterson field guides or Robbins et al. After this one, the next step upward is Welty. That may be a quantum jump; but the Mayfields and the Nices of American ornithology had to start from scratch . . . and this, after RTP, may be the place.—JOSEPH J. HICKEY.

Aus dem Leben der Vögel.—O. Heinroth. 1977. Third, improved edition, checked and supplemented by Katharina Heinroth. Berlin, Heidelberg, New York, Verständliche Wissenschaft, Springer-Verlag. 159 pp. $5.30.—Oskar Heinroth (1871–1945) belonged to the generation of ornithologists who still had a fair chance of getting a spear in the leg when fleeing from aborigines on some remote South Sea island with an inadequately known bird fauna. In fact, this was exactly what happened to him, but he returned without delay and was able to rescue the valuable collection of bird skins amassed before his encounter with the unfriendly crowd. In later days, his contact with exotic birds was less dramatic. He became a director of the Berlin Zoo, known as one of the finest in the world, and was for many years the *doyen* of the Central European ornithologists, having published (together with his first wife) the monumental four-volume work "Die Vögel Mitteleuropas." As the president of the venerable Deutsche Ornithologen-Gesellschaft, he sometimes shocked the members with his philosophy and intentionally crude remarks, as when he told the touching story about a Hazel Hen, raised with infinite pains by him and his wife, only to lose its life when caught in a door. Heinroth concluded with the remark: "*und er schmeckte so gut.*"

Heinroth had plenty of opportunities to study the behavior of the half-tame Mallards breeding in and around the zoo; he also studied the behavior of different species of pigeons. The papers published on these subjects make him one of the precursors of ethology. Konrad Lorenz considers that Heinroth was the founder of this branch of science, although most people would award this position to Lorenz himself. It seems that Heinroth had little interest in elaborating theories to explain his observations. Once, when a member of the audience asked him what conclusions he drew from the wealth of facts presented by him in a lecture, he answered drily: "Well, gentlemen, you may find the rhyme for this yourselves."

The present small book, the shortest introduction to ornithology known to me, was first published in 1938. The third and most recent edition has been brought up to date to some extent by his second wife. In fact, up-to-dateness is of little importance in this connection; the notes of Leonardo da Vinci on bird flight are still well worth reading without being updated. Heinroth's introduction to ornithology, though short, is also highly original. The author definitely preferred to see things with his own eyes, and what eyes he possessed! Generally, people go more or less blindly through the world. Heinroth knew this, deploring that even bird painters failed to observe that flamingos sleeping on one leg have the head turned backwards on the side of this leg, whereas geese sleep with the head turned to the opposite side of the standing leg.

There is hardly one of the 22 short chapters that does not include important original observations, or at least a very personally selected and brilliantly combined set of facts. Thousands of ornithologists listen hundreds of times every year to the impressive wing music of the Mute Swan, but how many realize that this music compensates for the muteness of the species? Or did you know that the adult Mute Swan is the only member of the family Anatidae that cannot dive? And that the male in territorial encounters swims with the legs moving together, instead of with alternate strokes? Such observations abound in Heinroth's book.

The original approach of the author is visible everywhere. In other introductions to ornithology, the chapter on bird sight starts inevitably with some anatomy, some retinal physiology, etc. Not that there is any harm in this. But Heinroth does not spend much time on these well-known things; instead, he tells us about how the eyes of birds work independently of each other, and about the mode of action of the lids, which is highly birdish and quite unlike that in mammals.

All this is written in a most brilliant and tangible way. It is, of course, no surprise to us that the remiges of a crane or a goose may grow as much as 10 mm a day, but we see this fact in a new light when we are reminded that our finger nails grow only 0.1 mm a day. Mammals, most definitely, do not possess all the world records in the animal kingdom.

Though Heinroth disliked constructing theories to "rhyme" with his facts, he gives an important one-sentence key to his work when he states that the knowledgeable ornithologist is impressed by the many different, more or less rigid and inborn ways in which these feathered vertebrates have solved the same problems, depending upon their anatomy and the habitats they occupy. This point of departure is a basic one in Heinroth's *oeuvre* and makes him one of the great ornithologists of all time.

The sooner this book is translated into English, the better. It ought to be read by everyone who can afford $5.30 and who has a serious interest in birds.—LARS VON HAARTMAN.

Grzmimek's Encyclopedia of Ethology.—B. Grzimek (Editor in Chief). 1977. New York, Van Nostrand Reinhold. xx + 70 pp., over 250 plates. $39.50; **Grzimek's Encyclopedia of Ecology**. 1976. 705 pp., 275 color plates. $39.50; **Grzimek's Encyclopedia of Evolution**. 1976. 559 pp., 500 color plates. $39.50.—These volumes, which are in the same style and companion volumes to Grzimek's "Animal Life Encyclopedia" (see Parkes 1975, Auk 92: 178–181, for a review of the avian volumes), are translations from the German edition. The translations are well done and the volumes are attractively published with many color plates and text drawings. The editors (e.g. K. Immelmann for ethology) and most of the authors of individual articles are well known workers in their field. The style of writing is clear and pleasant, a tribute to the translators and editors. The level of these volumes appears to be aimed at the undergraduate or well-read layperson. Supplementary readings are given, but the chapters are without direct citations. The ethology volume has a useful dictionary, while the evolution volume has a classification of the animals only.

The evolution volume is somewhat misnamed. It is actually a history of life with two short chapters on evolution, one on the history of evolutionary theory and one on evolutionary theory. Moreoever, it has only one very short chapter of 20 pages on the evolution of plants. The ecology volume has a major section on "The environment of man" that deals with many current conservation and environmental problems. The ethology volume covers a wide spectrum of topics from sensory physiology and biological clocks to neurophysiology and ethology. My overall impression is that the ethology volume is the best, but the other volumes are not far behind.

These books are not designed for the specialist although I could read many of the chapters with profit. They are best suited for the general public library, the nature center library, and the high-school and undergraduate college library. The two disadvantages are (a) the large number of supplementary readings in German (except for the ethology volume in which almost all references are in English), which reduces the opportunities for a person to delve deeper into a subject, and (b) the cost of each volume. The price of $40.00 per volume (5.4, 5.7, and 7.2 cents per page) may make them less attractive than other volumes. But this cost must be balanced against the high quality of the writing, both style and content, large number of color plates of excellent quality and overall attractiveness of the volumes.—WALTER J. BOCK.

The birds of the Malay Peninsula (Vol. V).—Lord Medway and David R. Wells. 1976. London, H. F. & G. Witherby, and Kuala Lumpur, Malaysia, Penerbit Universiti Malaya. xxxi + 448 pp., 24 color plates, color frontispiece, 7 maps, 11 tables, 7 figures. £ sterling 25.00.—This important work brings up to date the knowledge of all the species of birds known from the Malay Peninsula in a large, meticulously researched volume. The Malay Peninsula is defined as that part of the peninsula south of Latitude 10°N, thus including the provinces of southern peninsular Thailand as well as peninsular (or west) Malaysia (formerly called Malaya), and Singapore, plus the nearby islands. A good series of maps is included, showing the area covered.

The book is the fifth volume of a series by H. C. Robinson and F. N. Chasen published from 1927–1939, which is long out of print and expensive. For the time, those four volumes were one of the finest bird publications for any tropical area in the world and are still important reference works. All that was then known about Malayan birds was put in species accounts under the headings: Malay name, Description, Soft Parts, Dimensions, Range in Malay Peninsula, Extralimital Range, Nidification, and Habits. There is also some introductory material including: Geography, Zoogeography, History of Local Ornithology, Nomenclature, and Migration. The four volumes are divided into: Vol. I, The Commoner Birds; Vol. II, The Birds of the Hill Stations; Vol. III, Sporting Birds, Birds of the Shores and Estuaries; and Vol. IV, Birds of the Low-country Jungle and Scrub.

The fifth volume, as planned by F. N. Chasen, was to be a summary volume with modernized nomenclature, incorporating those species not already covered. Mr. Chasen died near Singapore in the early stages of World War II and his manuscript (if any) was lost. Mr. Grönvold's plates, however, survived. E. Banks prepared a manuscript (probably in the 1950's) for the final volume that was helpful in the preparation of the final manuscript.

Useful though the first four volumes are, the artificial and unfortunate division of the Class Aves makes them most exasperating to use, as information on any particular species is often split into accounts in three separate volumes. The authors of Vol. V circumvented this potential quagmire adroitly by repeating the information that will likely be most utilized. Thus, the World Range, Status and Distribution, Migration, Breeding (except nest descriptions), Moult, Longevity, and Voice sections are complete in the summary volume. Since the book is not likely to be used for identification, only those parts of plumage and soft part descriptions that were not given in the first four volumes are mentioned. The sections on molt and longevity are all new and result mostly from the extensive netting that was part of the Migratory Animals Pathological Survey banding program from 1963–1970. The voice section in many species accounts is the most complete descriptive material on Malayan bird calls in existence, some described here for the first time. The descriptions were made from a large collection of tape recordings obtained by a diverse group of amateurs and professionals in the last 15 years. An enormous amount of new distributional material is packed into the species accounts. The cutoff date for inclusion of records was 31 December 1973 and already several species have been added to the Malay Peninsula list.

Scientific nomenclature is up to date and reasonable. *Ciconia stormi* is maintained as a species separate from *Ciconia episcopus*. *Pitta megarhyncha* is split from *Pitta moluccensis* because they both breed on Langkawi Island off northwest peninsular Malaysia. The systematic section has an extensive bibliography and an excellent gazetteer giving geographical coordinates of all localities mentioned.

Three introductory chapters summarize what has been learned (and what needs more study) in some important areas of tropical avian biology as they apply to Malaysian birds. In the first chapter, titled "Resident Birds," David Wells discusses species diversity, zoogeography, and annual cycles. While he doesn't propose any new thories, the discussion of general principles and ideas as they relate to work done in Malaysia is useful. The Malay Peninsula has several broad habitat divisions: lowland forest, montane forest, mangrove, open country, the sea and its islands, and the various water bird habitats. The lowland forest is the most diverse with as many as 166 resident bird species recorded within 3 square miles, among the highest in the world. Species diversity in other Malaysian habitats is much less. While the temperature in the Malay Peninsula lowland forests varies only a few degrees during the year and is one of the world's most stable environments, breeding and molt do not occur randomly throughout the year but generally in clearly defined periods for the insectivorous species. The ultimate timing factor is believed to be the availability of food, which is influenced by the relative periodicity of rainfall. A lean season of lesser insect abundance in autumn is followed by heavy rains that stimulate new plant growth, which brings on greater insect abundance. Then widespread bird breeding in spring is followed by a protracted molt which ends prior to the lean season. Reproductive potential appears to be low in many bird groups while longevity is correspondingly high.

Chapter 2 is a discussion of the "Migratory Birds" of the Malay Peninsula by Lord Medway. All but several of Malaya's wintering species are Palearctic in origin and most of these come from far eastern Asia. One of Malaya's more interesting migratory phenomena, the trapping of migrants at lights on misty nights on high mountains, is briefly summarized. The diurnal migrants are identified, migration dates mentioned, and a detailed table of daily shorebird counts (over the whole year) is presented. Some aspects of wintering bird biology, such as habitat preference, weight changes, molt, and interactions with resident birds are discussed. The third chapter, by Ian C. T. Nisbet, is "The Eastern Palearctic Migration System in Operation." He discusses migratory pathways, east-west segregation of conspecifics, wintering site selection, inter- and intra-specific competition between wintering birds, return of migrants to previously used wintering sites, migration timing and cues, energy requirements, and stopovers during migration. A good bibliography is provided with the introductory chapters.

My only criticism is that the plates, while decorative, have no function in this type of book and add a great deal to its cost. Further they look hastily done and are not uniform in quality, but range from good to scruffy, the broad brush strokes obscuring detail. A few, such as *Muscicapa parva* on Plate 10, are difficult to recognize.

There has been a great deal of ornithological activity, both amateur and professional, in the Malay Peninsula in the last 25 years, and the authors have done a superb job of synthesizing these new data and pointing out some useful directions for research. This volume, the concluding one of an excellent series, treats the entire avifauna of the Malay Peninsula. It stands as an independent volume in its own right and one that can be strongly recommended to all ornithologists interested in the birds of Southeast Asia and in the biology of tropical birds.—BEN KING.

Mechanics of feeding in the Mallard (*Anas platyrhynchos* L.; Aves, Anseriformes).—G. A. Zweers, A. F. C. Gerritsen, and P. J. van Kranenburg-Voogd. 1977. Contributions to Vertebrate Evolution, vol. 3. vii + 109 pp., 20 figures. Paper $19.75.—For many years, primarily since the 1920's and 1930's, avian morphology has progressively become less descriptive and more functional in its approach. Emphasis has shifted from asking what structure is present and the form it may take to discovering how that structure works. An attempt to construct a general historical overview of this change might recognize three main phases. First, there was an extension of the older descriptive work in which function was inferred from gross structure. In bone-muscle systems this procedure focused on the origins and insertions of muscles and the general configuration of joints. Statements were expressed in terms of the probable role that individual muscles played in moving bones from one position to another. This "phase" has continued up to the present and many published papers, Ph.D. theses, and the like have adopted this approach, although this type of analysis has lost its significance in the eyes of most functional morphologists.

The second "phase," although present in some early papers, is basically a child of the 1960's. Investigators began to incorporate evidence from physiological studies in their analyses. The latter were not themselves physiological in approach; instead, muscles were analysed in more detail, their fiber architecture was noted, as was relative muscle weight and in some cases their fiber types, and then these data were interpreted using known (or surmised) physiological information to yield more precise functional statements about the movements of bone-muscle systems. This second phase allowed for a sense of increased understanding of these systems since one could now make inferences about relative muscle force, speed of contraction, length of shortening or stretching, and perhaps some statement about fatiguability. Yet the specimens being observed were quite dead, sometimes for years, and thus functional inferences remained conjectural.

Finally, a third phase has begun to develop in the 1970's. It has now become fashionable within vertebrate functional morphology to perform physiological experiments on living organisms in order to discover what "really" is happening: inference, some workers would have us believe, has been virtually eliminated. Clearly, the third phase represents an advance in our knowledge and does not merely serve only as a showcase for elegant experimentation. Within avian functional morphology—excluding much fine work by physiologists themselves—this approach is uncommon, especially as it is applied to bone-muscle systems. Unquestionably, the finest work of its kind—perhaps in all the vertebrate literature—has been performed recently by G. A. Zweers and his colleagues in Leiden.

Two studies have been published, both on the Mallard. The first (1974. Structure, movement, and myography of the feeding apparatus of the Mallard (*Anas platyrhynchos* L.). Netherlands J. Zool. 24: 323–467) was concerned primarily with a functional analysis of the jaw and tongue apparatus. The second, under review here, was a follow-up study and details the role of the beak and tongue during feeding. In order to convey fully the importance of these studies it is necessary to consider both of them in this review.

The first study included detailed descriptions of the osteology, the important joints of the kinetic mechanism, ligaments, jaw musculature, and the tongue apparatus (osteology, extrinsic and intrinsic musculature). These descriptive sections were followed by a discussion of the jaw movements using cinematography (64 frames per second). Finally, the most important portion of the study treated the functional analysis of the muscles during drinking and straining fine-grained food in water using electromyographic analysis. The latter was accomplished with the placement of fine wire electrodes surgically implanted in the muscles and the resultant signals synchronized with the concurrent cinematography.

The subsequent analysis of the experimental results is extremely complex and probably will be of interest only to the specialist—indeed, it could only be understood by a specialist, maybe. This is, perhaps, the major shortcoming of the study. It would have been extremely helpful if the analysis had been simplified or at least summarized in an understandable manner. As it is, a reader must wade through pages of complicated data and graphs—one simply drowns in detail. But, in fairness, the feeding mechanism is so intricate, it may have been impossible for Zweers to accomplish this simplification, particularly given the detail level his view was focused at. And here also lies one of the important aspects of the study: the feeding mechanism is demonstrated to be much more complex than previous analyses would seem to suggest.

In the second study with Gerritsen and van Kranenburg-Voogd, attention is directed toward the beak and tongue. Included are histological descriptions, a summary of the relevant bones, ligaments, and muscles, and their functional analysis during straining of food using cinematography, cineradiography, and electromyography. The analyses are accomplished by the development of causal models for lingual movements and the transportation of food and water. The models themselves encompass the suction-

pressure pump mechanism of food and water uptake, expulsion of water, filtering of food, and the transport and swallowing of food. As with the previously described paper, this study will probably be of limited value to the nonspecialist. Both, however, should be required reading for anyone interested in vertebrate feeding mechanisms.

To my knowledge these two studies, taken as a whole, represent the finest and most complete analysis of the feeding mechanism of any vertebrate. This includes the most extensively studied species, you and me. It will, of course, be unrealistic to expect many future studies to come close to the level of detail presented in these papers; after all, it took years to produce these results. If such studies are repeated for other species, and they should be, workers will have to address more fundamental problems. What are the purposes of such studies, other than trying to understand how the feeding mechanism of a particular species works? What are the broader questions being investigated? How do these individual, detailed studies relate to answering these broader questions? The investigations of Zweers focus on the narrow and by design do not attempt to deal with broader questions: this was not their purpose. These papers, in a real sense, stand as a monument to experimental functional morphology, and they represent its strengths, but also its weaknesses. This is not to negate the importance of this work. Indeed, congratulations are insufficient: Zweers and his colleagues deserve our respect and admiration for one of the finest studies in all of avian biology.—JOEL CRACRAFT.

OBITUARIES

ELIZABETH SCHLING AUSTIN (23 January 1907–23 May 1977) began her ornithological career both early and late. "Sliver" (an alliterative nickname from her childhood) would give you an argument if you tried to call her an ornithologist; she insisted that she was an ornithologist's *wife*. So in one way, she began her career at the age of 7, when she first met young Oliver L. Austin, Jr. at dancing school. She and Oliver were married some years later—in 1930—while he was a graduate student at Harvard University. For many years after that she devoted her life to her family: making ends meet during the Depression; moving from place to place with Oliver as he began his professional career; bearing two sons, Anthony and Timothy; becoming a wartime Navy wife. After the Japanese surrender, she and the boys joined Oliver in Tokyo where he was serving on General MacArthur's personal staff as a wildlife consultant.

It was not until her children were raised, and particularly after she and Oliver settled in Florida in 1957, that Elizabeth became seriously interested in birds. She had shown early promise as a writer while a student at Saint Elizabeth Academy, Convent Station, New Jersey. Although she had no formal education in ornithology, informal training in the subject came from the many years with her husband. Her writings on birds were always thoroughly discussed with, and read by, Oliver before they were sent for publication, but Sliver did her own work. She was a tireless reader and a skilled library researcher—persistent until she was satisfied that she had ferreted out the last bit of information on a particular subject.

In 1960 she was appointed a Research Associate of the Florida State Museum, a post she held until 1973 when she and Oliver both retired. From 1960 to 1965 she wrote a weekly newspaper column, "Wild Adventure," for the Florida Times Union in Jacksonville. Her main contribution to scholarly ornithology, "Frank M. Chapman in Florida: His Letters and Journals," appeared in 1967. This was followed by several children's books, for which she had a special talent: "Penguins, the Birds with Flippers" (1968), "Birds that Stopped Flying" (1969), and "The Random House Book of Birds" (1970). The latter included Oliver as co-author, but Elizabeth did virtually all the writing. She also contributed the bird articles for "The Golden Book Encyclopedia of Natural Science" (1962).

Born in New York City, Elizabeth was a member of a socially prominent family and raised in an intellectually stimulating environment. Her father was the renowned horticulturist and florist Max Schling, a good friend of botanist Liberty Hyde Bailey. She also spent much time in Europe as a child and was fluent in German. Elizabeth was strongly instilled with an appreciation for excellence and a sense of what was right. She insisted on these in herself, and expected them in others—hence the penetrating and often rapier-like quality of her many reviews in Bird-Banding and The Auk, for which she was well known among ornithologists. Less known were her anonymous and pungent contributions to The Auklet.

Of the several awards and honors received in her lifetime, Sliver perhaps was proudest of her election to the class of Elective Member of the AOU in 1972. This was followed in 1973 by the joint award, with