

ORNITHOLOGICAL LITERATURE

EVOLUTION AND THE DIVERSITY OF LIFE: SELECTED ESSAYS. By Ernst Mayr. Belknap Press of Harvard University Press, Cambridge, Mass., 1976: ix + 721 pp. \$20.00.—In this book Ernst Mayr presents 47 essays on various topics in evolutionary biology originally published in many books and journals between 1940 and 1974, though most are from the past 2 decades. Some of the essays have been shortened, have had the references updated, or have been adapted by the addition of new comments clearly distinguished from the original version. Two have been translated into English. The essays are divided into 9 sections, their titles and the number of essays in each being: (I) Evolution (9 essays); (II) Speciation (7); (III) History of Biology (6); (IV) Philosophy of Biology (4); (V) Theory of Systematics (4); (VI) The Species (5); (VII) Man (1); (VIII) Biogeography (9); and (IX) Behavior (2). For each section Mayr has written a brief introduction placing the topic in historical context and assessing his own contribution to it. Many of the essays deal directly with birds and will be of special interest to ornithologists; these include "Bird speciation in the tropics," "History of the North American bird fauna," "Inferences concerning the Tertiary North American bird faunas," "The origin and history of the Polynesian bird fauna," "Fragments of a Papuan Ornithogeography," "The ornithogeography of the Hawaiian Islands," and "The nature of the colonization of Birds." Most of the essays do not deal directly or principally with birds, but with general aspects of evolution and systematics that are applicable to ornithology as well as other branches of evolutionary biology. This is a valuable collection of essays, many of which are otherwise available only in specialized libraries. For anyone interested in the evolutionary aspects of avian biology, this book is indispensable.—**ROBERT J. RAIKOW.**

ECOLOGY AND EVOLUTION OF AN ANDEAN HUMMINGBIRD (*Oreotrochilus estella*), by F. Lynn Carpenter. University of California Press, Berkeley, California, 1976: 106 pp., 8 black-and-white plates, 14 text figs., 11 tables. \$2.50.—Probably more than any other avian group, hummingbirds are presently serving as vehicles for testing ecological-evolutionary theory. The attention is well deserved. The ease with which they can be observed and captured, their territorial tendencies and dependency of spatially and temporally restricted nectar sources, and the great degree of species' sympatry, are all attributes that make them a convenient group to study. Surprisingly, however, there are only 2 monographs on individual species; one by F. Gary Stiles on the behavioral ecology of *Calypte anna*, and the recent one considered here. Carpenter continues the trend set by Stiles—dependence on long-term systematic study, thorough documentation, and insistence that the way to understand the evolution of a species is through its extant ecology.

Carpenter follows the activity of *Oreotrochilus estella* through 2 wet seasons and 1 dry season in southern Peru and northern Chile. *O. estella* is one of only a handful of resident hummingbird species living above 4000 m, though species literally swarm on the slopes and in the lowlands below. Carpenter set out to identify the morphological, behavioral, and ecological adaptations that are integrated into the life history strategy of *O. estella* and which allow it to exploit this climatically rigorous and vegetatively sparse habitat. Hummingbirds seem to be more specialized and less variant in morphology, physiology, and behavior than most other avian groups, thus Carpenter has selected this particular species as the one most likely to be "aberrant" and show striking differences in these categories from "typical" tropical or temperate species.

The monograph is organized into 5 major sections: (1) morphological adaptations, (2) behavioral adaptations (foraging and roosting), (3) reproductive adaptations, (4) territorial adaptations, and (5) energetics. In the first section adaptive value of large size, dull coloration of both sexes, and large foot size, characteristics unusual in hummingbirds, are discussed. Coloration is seen as an antipredator device peculiar to a grassland habitat totally devoid of trees, and the large size of both sexes ($\bar{x} = 8$ g) is believed related to increasing energy use efficiency. Large foot size is explained as an adaptation to vertical roosting on canyon and cave walls.

In the second section behaviors associated with these unique roosting and foraging habits are discussed in the context of the climatic and biotic factors that have determined the evolution of morphological adaptations. Carpenter suggests that cave and rock roosting is an adaptation for avoiding nocturnal predation and for protection against ambient winter night temperatures which sometimes approach 0° C. Foraging technique at flowers is shown to involve significantly less hovering than in other hummingbirds, but much more perch feeding, an adaptation Carpenter sees as an energy-saving response to high altitudes where thin air produces a large energy demand for hovering. Pollen feeding by *O. estella* on the only winter blooming hummingbird-flowered plant, *Chuquiraza spinosa*, is discussed as a probable coevolutionary pollination relationship in which the plant is more reliably pollinated by *O. estella* at this time of year than by more externally temperature-influenced insects.

Section 3 deals with the selection of nest sites, construction of nests, the phenology of nesting, and nesting success. Most nests are constructed under rock overhangs, are well insulated, and occur near the richest nectar sources. Carpenter argues that these features protect the nestlings from severe weather and nest predators, and account for the high nesting success compared to other hummingbirds. Because such sites are limited, competition for nest sites was intense and was believed to account for the evolution of an aggressive female territoriality associated with the nest site in which both male and female conspecifics are usually vigorously repulsed (Section 4). The aterritorial males appeared to be subdominant to females, and males visit females on territories and display and attempt to mate with them, the reverse of what occurs in all other hummingbird systems described to date. Carpenter believes this atypical arrangement is forced by the need for females to occupy gorges and construct nests there. Because, incidentally, the richest nectar sources are also found in these areas, males are forced out onto open hillsides where food is dispersed and scarce and therefore not dependable. The larger size of males is also seen as related to food supply: larger body size is believed to result in more efficient linear flight between distant food sources.

In section 5 an energetics model of feeding territoriality is generated for *O. estella* by measuring resting and torpid metabolism, estimating cost of linear and hovering flight, then computing time and energy budgets for both sexes in summer and winter. Winter is seen as the critical time of year when most mortality occurs despite a very physiologically efficient torpidity system finely tuned to the daily winter ambient temperature regime.

An integrative concluding discussion section recounts the morphological, physiological, and behavioral adaptations that allow *O. estella* to exploit the high Andes, discusses the possibility of a taxon cycle in *O. estella* and other high Andean species, and concludes with a discussion of evolution and colonization at high altitudes. Topics covered include numbers of trochilid species in high altitude vs. low altitude environments, the relation between competition and speciation in high altitude hummingbird species, and the magnitude and speed of evolutionary change to life at high altitude.

The monograph is well written in a crisp, easily read style. Jargon is kept to a minimum, so the interested layman will be able to glean much from each section. Figures and tables are kept simple and are effective in helping to grasp textural explanation. Statistical analysis is straightforward.

Most major contentions are well argued. There is effective integration of field observations and laboratory experimentation, particularly regarding torpidity. The choice of this "aberrant" species for investigation was a good one and Carpenter generally makes a strong case for the major hypotheses that the peculiar adaptations of *O. estella* have been forced by the climatic and physical factors characteristic of the altiplano and, secondly, that hummingbirds, usually regarded as a highly specialized and adaptively limited group, can evolve adaptations which allow them to exploit unusual and climatically rigorous environments.

The work is not without weaknesses. In my opinion there is excessive speculation throughout, particularly in the first section (morphological adaptations). Arguments regarding body size differences between *O. estella* and other hummingbirds and explanations for sexual dimorphism in *O. estella* are protracted and overextended. Occasionally, major arguments are based on very small sample sizes.

Conceptual confusion also sometimes occurs. Early on, with little evidence, winter mortality is identified as the most important population limiting factor and implicitly regarded as ultimately limiting. Later, the introduced winter blooming *Eucalyptus* is believed to have decreased winter mortality, but this is not regarded as important because at this point Carpenter tells us that ultimate limitation occurs through nest site scarcity. In another section, he says that "the nesting stage is still probably the most vulnerable of the whole life cycle," but no data are offered in support. Still later in the energetics section the species' winter energetics strategy is pictured as extremely efficient and finely tuned. If so, one wonders why winter mortality occurs to the extent that it supposedly does. The reader is left guessing what Carpenter really does believe ultimately limits the population.

Arguments in the concluding discussion also are flawed. The relationship of trochilid species diversity at high vs. low altitudes is simplistic and arguments marshalled to explain the reason for low diversity at high altitude are confused, e.g., "rigorous" environment is poorly defined and seemingly confused with "stressful," and it is not clear whether it is the "rigor" of the environment or the lack of evolutionary time that is the main explanation for the low diversity. Further, though the effect of speciation rate on diversity is considered important, the importance of extinction rates of species in high elevation environments is not even mentioned, an unexpected oversight for one who argues earlier for the presence of a taxon cycle in *O. estella* and related high-altitude congeners.

In general, however, this study is a valuable addition to our increasing knowledge of hummingbird systems and is one of the few to date that provides an overview of the ecology and evolution of a single species. Serious students of hummingbird ecology will find it very useful.—DAVID L. LYON.

CROWS OF THE WORLD. By Derek Goodwin, illus. by Robert Gillmor. Cornell University Press, Ithaca, New York, 1976: vi + 354 pp., 3 color plates, many line drawings and distribution maps. \$28.50.—This is a reference guide to the family Corvidae. Most of the book (286 pages) is devoted to individual accounts of each of the 116 species of corvids. In each account there is a detailed description of the species, followed by

discussions of field characters, distribution, feeding and general habits, nesting, voice, and display and social behavior. For each species there is also a range map. Those familiar with the range descriptions given in most check-lists (e.g. Khorasan, the Dasht i Lut desert and Persian Baluchistan) will appreciate this visual aid. For most species a line drawing is also provided. Although some of these illustrations are rather poorly reproduced, they add a new dimension to a work of this kind. Readers are usually forced to choose between books that provide many color photos and plates but do not give much information on the birds depicted, or those that provide detailed information with little visual reinforcement. This book provides an excellent compromise between these formats.

The species-by-species analysis of the Corvidae is one of the most comprehensive studies of the vast amount of information that has been recorded concerning this family. In his introduction, Goodwin states that, "one of the book's purposes is to indicate what is not known" about various members of this family. By reading the description and synopsis of the behavior and biology of each species, and then reviewing the references that are listed immediately following the discussion of each bird, the reader becomes aware of the gaps in the information concerning that form. It is probable that these analyses may stimulate readers who are in a position to record observations on some forms to do so, and not disregard the birds with a paraphrase of Aesop's "It's only a crow and that signifies nothing!"

The first chapter discusses taxonomic nomenclature and mechanisms of speciation. For those familiar with these concepts there is little new information, but the chapter should prove helpful to readers not well-versed in these areas. Fig. D.1. is a dendrogram showing the "presumed relationships of the corvine genera." The author does not give data or references that could enable the reader to quickly interpret the meaning of this "phylogeny" or determine the basis by which it was constructed.

The next 2 chapters deal with the adaptive radiation and adaptive characters, and the plumage and coloration of the Corvidae. They provide information that will help the reader to better understand the descriptions given in the species accounts. Chapter 4, on behavior, is longer and more detailed than the preceding chapters. This is understandable considering the vast amount of information that has been recorded on the complex behavioral patterns of the Corvidae. Goodwin has ably summarized much of this information and presents it in a well-organized, easy to read form.

The author states, "In the species section forms believed to be most closely related to each other are placed together in so far as this is possible within the confines of linear arrangement." Although most readers will find the author's arrangement for the most part acceptable, I feel that he should have included a list of the references or observations that were used in constructing this sequence. The book concludes with indexes of common and scientific names.

Crows of the World is a well-written and informative book that provides a well-organized mass of information on all 116 species of Corvidae. It would be a useful addition to any ornithological library.—STEPHEN R. BORECKY.

COLLECTED PAPERS IN AVIAN PALEONTOLOGY HONORING THE 90TH BIRTHDAY OF ALEXANDER WETMORE. Edited by Storrs L. Olson. Smithsonian Contributions to Paleobiology, No. 27, Smithsonian Institution Press, Washington D.C., 1976: xxvi + 211 pp.—Alexander Wetmore has done more to revitalize avian paleontology during the past half century than any other person, and this volume is a remarkable testament to the vigor and excitement of the field today. Festschrift volumes have not been popular recently, at

least in this country, which may not be a bad thing because they are often collections of major papers by minor authors, or minor papers by major authors; assemblages of journal rejects rescued from the bottom drawers of file cabinets. Such is decidedly not the case with this volume. An outstanding group of workers has presented a collection of always interesting and often exciting reports on a variety of topics. Though the book opens with brief "appreciations" of Wetmore's work and influence on the field by S. Dillon Ripley and Jean Delacour, and a scientific biography of Wetmore's work by Storrs L. Olson, it is the papers themselves that offer the finest testament to the role that Wetmore has played in stimulating many workers to enter and explore the field. This is further demonstrated in the acknowledgements of Wetmore's influence by various authors, and by the number of new taxa that they have named in his honor.

More than just a collection of fine research reports, this volume is also a summary statement of the present state of avian paleontology. For this reason, rather than try to review all of the papers separately, I will take this opportunity to assess the strengths and weaknesses of the field, and its current role in avian biology, at least as I perceive it from the viewpoint of an interested nonparticipant in the field.

Paleontology in recent years has shifted from an emphasis on the description of new forms, as important as that continues to be, to an analysis of the significance of its findings in terms of evolutionary theory. Thus it has become more closely associated with biology and less with geology than was formerly the case, a trend that is recognized in the increasing use of the term paleobiology. In this context its greatest potential contributions to ornithology would seem to lie in three general areas: (1) the origin of birds and of their peculiar adaptations, especially for flight, (2) analysis of the phylogeny of the higher categories of birds, and (3) clarification of the role of birds in the evolution of ecosystems through time. I will consider the field as exemplified by the present collection of papers in relation to these three areas.

The problem of the origin of birds has been reexamined by several workers in recent years, following several decades during which Heilmann's thecodont theory went unchallenged. Of the several ideas recently suggested for avian origins, John Ostrom's theory of an origin from the coelurosaurian dinosaurs has been the most convincing. In this volume Ostrom uses his intimate knowledge of the anatomy of *Archeopteryx* to speculate on some of the anatomical changes that must have occurred between *Archeopteryx* and modern birds so as to make powered flight possible. The main interest centers on the coracoid and its changes in form that were apparently associated with a conversion of the action of the supracoracoideus muscle, converting it from a depressor of the wing to an elevator, thus making possible the recovery stroke of powered flight.

The toothed birds of the Cretaceous are reexamined in two papers. Philip D. Gingerich assesses the significance of these birds to avian phylogeny. He argues that *Hesperornis* did indeed have teeth, and also a paleognathous palate. This leads him into a consideration of the ratite problem, and he argues against Cracraft's theory that the ratites are monophyletic because (among other reasons) the paleognathous palate is considered to be a primitive condition among birds rather than a derived state. Larry D. Martin and James Tate Jr. provide a detailed description and analysis of *Baptornis*, a diving bird closely related to the better-known *Hesperornis*.

In order to understand both the phylogeny of birds and the evolution of faunas, it is obviously important to know at what periods in time the various groups occurred, and especially when they first appeared. Fossils are the source of this information, and many useful data have been provided by avian paleontologists, including several important contributions in this volume. Nevertheless, the overall picture is subject to

frequent reevaluation and must be regarded with a certain caution owing to the frequency with which specific fossil forms are reallocated to different higher taxa. In the present volume, for example, Alan Feduccia reassigns the genus *Neanis*, previously considered to be the oldest known passeriform, to the order Piciformes. Feduccia and Larry D. Martin discuss *Uintornis*, which was originally placed in the Picidae, then the Bucconidae, then shifted to the Cuculiformes. They return it to the Piciformes, but in a new family Primobucconidae. Storrs L. Olson shifts *Protornis* from the Alcedinidae to the Momotidae, thus giving this presently New World family an Old World history. Charles T. Collins moves the extinct family Aegialornithidae from the Apodiformes to the Caprimulgiformes. Reallocations of this sort are not uncommon in the avian paleontological literature. It is unclear whether this is because the often fragmentary remains are ambiguous, or because earlier workers were less rigorous in their studies than more recent investigators. However, in some cases, including those in this volume, it seems that new interpretations follow upon the analysis of larger and better samples than those available to earlier workers. This is an important problem because the whole picture of avian phylogeny, to the extent that paleontology contributes to it, depends on the accurate recording of the occurrence of different groups in time and space, and unexpected discoveries may have a profound effect on our ideas of the history of particular groups. This is clearly illustrated by Storrs L. Olson, who presents us with Motmots in Europe and Todies in Wyoming.

Another important problem is how to interpret fossil forms that are intermediate in characteristics between living taxa. "Intermediate" in this context means that the fossil forms are mosaics of characters, some shared with one taxon and some with another. Pierce Brodkorb describes a new form, *Alexornis*, that shares some characteristics with the Bucconidae (Piciformes) and some with the Momotidae (Coraciiformes). Pat Vickers Rich and David J. Bohaska describe the oldest known owl, *Ogygoptynx*, as intermediate between the Tytonidae and Strigidae. What can such forms represent phylogenetically? The usual solution is to suggest that the intermediate is some sort of "link" between the later taxa, perhaps ancestral to both of them. The problem of interpretation arises in part at least, from a failure to analyze the meaning of the individual characters, rather than just listing and totalling them. Rather, they should be interpreted in terms of the directions of evolution of evolving characters within the larger taxa; some "similarities" may then be found to be primitive character states, and some derived. If phylogenetic affinities are hypothesized only on the basis of the latter, much of the confusion from conflicting evidence could be eliminated. Of course there is the problem that many of the characters used in avian paleontology are minor variations in bony knobs, projections, grooves, etc., easily subject to convergence and difficult to analyze cladistically with much confidence. Still, it might be worthwhile to try.

Several papers provide descriptions or reinterpretations of fossil birds and early avifaunas, and contribute to an increased understanding of the ecological roles of birds at various times and places in the past. Among the most significant are studies by Alan Feduccia and Larry D. Martin on Eocene Piciformes, and by Storrs L. Olson on Oligocene Coraciiformes. It is suggested that these groups were the dominant small land birds in these epochs, and that the ascendancy of the Passeriformes to their current dominance may not have occurred until Miocene time. Among the analyses of more restricted areas, Oscar Arredondo's review of the Pleistocene predatory birds of Cuba presents a remarkable picture of giant eagles, owls, and vultures analyzed in terms of their ecological relationships with the contemporary mammals. Joel Cracraft analyzes

the Moas of New Zealand and demonstrates how an adequate fossil record can be subjected to detailed mathematical analysis. He presents a story of adaptive radiation in these giant flightless birds, and also provides a new classification in which many fewer species are recognized than were admitted by earlier workers.

Other noteworthy studies in this volume include reviews of the Lower Miocene swifts by Charles T. Collins, of the Pleistocene pied-billed grebes by Robert W. Storer, of a Pleistocene avifauna of Ecuador by Kenneth E. Campbell, Jr., and of the Paleogene birds of Asia by E. N. Kurochkin. Descriptions of a new Miocene osprey by Stewart L. Warter and of a new Miocene flightless auk by Hildegard Howard are also included. The final paper, by G. Victor Morejohn, brings us to Recent times with the discovery in California Indian middens of bones from the flightless duck *Chendytes lawi*, previously known from Pleistocene remains.

Altogether, this volume demonstrates that avian paleontology is alive and well, and making important contributions to several areas of systematic ornithology, though it is also troubled by some of the philosophical and methodological problems faced by systematics generally. Students of avian biology owe a debt of gratitude to Storrs L. Olson for his work in organizing this outstanding collection of reports in avian paleontology.—ROBERT J. RAIKOW.

A GUIDE TO EASTERN HAWK WATCHING. By Donald S. Heintzelman. Pennsylvania State University Press, University Park & London, 1976: 99 pp., maps, charts, and black-and-white photos. Cloth \$8.95, paper \$5.95.—Following brief written descriptions of each species, there are sections on field equipment, migration seasons, mechanics of hawk flights, and hawk lookouts. For each state or province there is information on hawk-watching localities, giving the quality of spring and fall observations, a description of the area, and directions for reaching it. Areas covered include the Great Lakes region and Eastern Canada, New England, the Middle Atlantic States, and the Southern Appalachian States. The book ends with appendices listing raptor conservation organizations, sample field data forms, as well as a short bibliography and index. The heart of the book consists of some 70 plates of raptors in flight; most of these are photographs but a few are line drawings. These will aid the observer in identifying flying birds. There are no illustrations in which different species are shown together for rapid comparison, but such are available in other books such as Peterson's field guides, to which the present volume should prove a handy supplement.—ROBERT J. RAIKOW.

THE BIRDS OF THE LIGONIER VALLEY. By Robert C. Leberman. Special Publication No. 3, Carnegie Museum of Natural History, Pittsburgh, PA, 1976: 67 pp., many line drawings, 6 color plates, numerous photographs. \$5.00.—This is an unusually handsome regional list. The Ligonier Valley lies in Southwestern Pennsylvania between the western-most ridges of the Allegheny Mountains; the area covered is about 100 square miles. Following brief introductions to the area and its ornithological history, the bulk of the book is devoted to species accounts giving the abundance and seasonal occurrences of all birds reported from the area. The line drawings by Carol H. Rudy are attractive and lifelike, illustrating many of the species discussed. H. Jon Janosik has contributed 6 outstanding paintings of locally observed forms, including a seldom-pictured immature Kirtland's Warbler. Unfortunately some of the brilliance of the original plates has been

subdued by the printer. The Ligonier Valley is an exceptional birding area, and anyone interested in exploring it will find this book an attractive and useful aid.—ROBERT J. RAIKOW.

BIRD FLIGHT PHOTOGRAPHY. By Roger F. Cram. Creative Arts Photography, P.O. Box 642, Hiram OH 44234: 35 pp., line drawings. \$3.95.—Uncomplicated instructions for amateur bird photography using only simple and inexpensive equipment. Order directly by mail.—R.J.R.

ANALYSIS OF VERTEBRATE POPULATIONS. By Graeme Coughley. John Wiley & Sons, New York, 1977: ix + 234 pp.—This is a detailed guide to a study of the mechanics of population biology. Chapters are devoted to The Population; Age, Abundance; Rate of Increase; Dispersal; Fecundity; Mortality; Relationship between Parameters (calculation of r , birth rates, death rates, etc.); Mark-Recapture; and Population Analysis in Management. The first 3 chapters are so cursory as to be of little value, but from Chapter 4 (Abundance) onward this text becomes an interesting "how to" book for a study of basic population parameters. Many statistics, formulae and indices are given, and the level of the math is algebra or less. Great pains were taken to avoid even a hint of calculus (e.g. the fundamental growth equation, $dN/dt = rN$ is only given in its algebraic form, and the differential is not even mentioned). Nevertheless, the mathematics are presented logically and lucidly. This work is valuable in that it pulls together methodological techniques and criticisms for most population parameters. By avoiding complicated mathematics the volume has value to beginning students, specialists and field workers in conservation and game areas. This useful book should form a part of the library of most population biologists, particularly those interested in the analysis of field data and in various techniques of obtaining the data.—MICHAEL A. MARES.

MY RECIPES ARE FOR THE BIRDS. By Irene Cosgrove & Ed Cosgrove, Doubleday & Co., Inc., New York, 1976: 31 pages, paper cover. \$2.95.—A handy collection of recipes for bird feeders designed to attract various species, with helpful advice on the design and placement of feeders.—R.J.R.

ANNOTATED CHECKLIST OF THE BIRDS OF ONTARIO. By R. D. James, P. L. McLaren, and J. C. Barlow. Life Sci. Misc. Pub., Royal Ontario Museum, 100 Queen's Park, Toronto, Canada, 1976: 75 pp., paper covers, 2 maps. \$2.50.—Status, breeding status, distribution, frequency, dates of occurrence, and egg dates for 427 species.—R.J.R.

A GUIDE TO BIRD-WATCHING IN MALLORCA. By Eddie Watkinson. AB Grafisk Formgivning, Stockholm; Available from M. Philbrick, PO box 83, Vashon, WA 98070; no date given: 56 pp., paper covers, many maps. \$3.90.—Not a guide to the birds, but to finding them. Detailed maps and instructions on many local areas, with information on how to get there and what birds to expect at any season, along with helpful advice on local customs, laws, transport, and so forth.—R.J.R.