REVIEWS

EDITED BY WILLIAM E. SOUTHERN

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

Acoustical communication in birds: Volume 1, Production, perception, and design features of sounds; Volume 2, Song learning and its consequences.—Donald E. Kroodsma and Edward H. Miller (editors), and Henri Ouellet (taxonomic editor). 1982. New York, Academic Press. xxxi + 371 pp., ISBN 0-12-426802-3 (vol. 1), and xxxi + 389 pp., ISBN 0-12-426802-1 (vol. 2), numerous figures and tables (both volumes). $70.00.—This reviewer will admit to possible favorable bias in finding the first citation of the Introduction to one of his works, but will attempt to convince the reader that even with an opposite initial bias anyone will be won over by this ambitious work. Not since the 1960's yielded Thorpe's "Bird Song" (1961), Greenewalt's "Bird Song" (1968), and Hinde's "Bird Vocalizations" (1969) has there been such an authoritative and comprehensive review, which a cynic might have maintained would never again be possible. Reality has a way of defeating cynicism.

The volumes are dedicated to Peter Marler, with a laudatory Foreword by Robert Hinde, which is surely a piece of modesty considering his own role in guiding this field through several decades. A Preface by editors Kroodsma and Miller explains the contents, and Ouellet provides a taxonomic note. Then we are off and running through the world of nonpareil sounds that belong to the birds.

Ethologists will be joyed by the tone-setting Introduction, where the editors emphasize the importance of clear thinking about the four classes of behavioral causes and origins: phylogeny, causation, ontogeny, and adaptation (to use their terms). Theory and experiments notwithstanding, the editors conclude rightly that basic recording and description is our most pressing challenge in a world where species, especially tropical birds, are vanishing forever at an alarming rate. David C. Wickstrom then sensibly reviews principles of recording equipment rather than providing a tiresome string of model-specific recommendations that would soon be outdated. John H. Brackenbury convinces me yet again that how birds produce their sounds really is not understood; more and clearer diagrams would have helped dolts such as me understand how those membranes are supposed to vibrate. Arthur P. Arnold reviews his interesting work on brain hormones and that of Nottebohm on brain anatomy. Robert J. Dooling's chapter on acoustical psychophysics struck me as sensible: it is clearly useful to know what and how birds hear in interpreting their song. Basic perception is similar to ours, but sound localization may be quite different because the two ears of birds are connected by acoustical conduit. R. Haven Wiley and Douglas G. Richards have produced a truly outstanding chapter on the transmission, detection, and recognition of sounds, much of which has appeared elsewhere but is usefully assembled and integrated here. One can mention that attenuation rises with frequency but there is no good reason to expect habitat-related differences, that degradation through reverberation is serious in forests and through amplitude fluctuations in open habitats, and many other major conclusions. There are so many good minor points, however, that this chapter should be read by everyone studying avian vocalization. Eugene S. Morton asks interesting questions about the motivational rules behind sound structure, but I am not (yet) convinced by his proposed answers. Peter H. Becker, whose previous work (all published in German) deserves to be better known, has penned a fine chapter on species specificity of song. One point, among many good ones, that caught my attention is the lack of convincing evidence for character displacement in song. Ironically, the next chapter by editor Edward H. Miller tries to convince one almost of the reverse, quite unsuccessfully, however. Clive K. Catchpole reviews the evidence that song both repels rival males and attracts females.

The second volume unnecessarily repeats the Foreword, Preface, Note on Taxonomy, and Introduction of the first volume, thereby wasting about 30 pages that the buyer has to pay for. Editor Donald E. Kroodsma begins by reviewing vocal learning, showing that the songs of virtually all oscines require learning for development, whereas vocal learning is established for only two orders besides the Passeriformes (namely the Psittaciformes and Apodiformes). Peter Marler and Susan Peters recount their painstaking studies of early subsong and later plastic song in the Swamp Sparrow, noting especially the "selective attrition of syllable types" that characterizes song development (not unlike human language development?). My departmental colleague Jeffrey R. Baylis will probably accuse me of crass favoritism in nominating his review of mimicry as the exemplary chapter of these volumes, but in defense of objective judgment I ask: what other author so carefully traces the intellectual history of his or her subject (e.g. to Witchell 1896 and to Darwin)? Who else lays down

his or her definitions so carefully, points out the logical errors of previous literature so clearly, provides the plan of attack so explicitly, considers alternative hypotheses so comprehensively, and draws the conclusions so rationally? Susan M. Farabaugh's fine review of duetting shows it to be correlated with yearround territoriality and prolonged monogamous pair bonds, serving the usual functions of song plus possibly others. Editor Kroodsma returns with a chapter on repertoires—appropriate in that his Brown Thrashers, with "up to several thousand different song types," must surely hold the record. Paul C. Mundinger reviews local dialects and larger geographic patterns of vocal variation in remarkably clear terms, due in part, perhaps, to his frequent use of short, declarative sentences. Myron Charles Baker contributes what seems to be a very specialized chapter on the genus *Zonotrichia*, but through his pioneering efforts we know more about the relation between population genetics and song dialects in this genus than in any other. J. Bruce Falls reviews acoustical recognition of individuals, including mates, parents, offspring, and neighboring territorial holders. Colin G. Beer provides an articulate and philosophical consideration of communication; one suspects that even if he had nothing of substance to say, he would say it eloquently. But he does have many things of substance to say, and his is the chapter most enjoyable to read in the two-volume set. Several authors provide in their chapters useful comparative surveys, but the pièce de résistance is the Appendix by Kroodsma and Baylis: a 14-page table of "A World Survey of Evidence for Vocal Learning in Birds."

If my praise appears unchecked, I should add that only space limits my documenting quarrels here and there in nearly every chapter. To pick upon Editor Kroodsma's second chapter as an example, I note that he implicitly assumes every bird has a finite repertoire and never stops to consider the havoc caused by mathematical estimates from sampling if an individual can continue to generate new song-types throughout his lifetime. Nor when considering diversity (variety) in song are approaches such as Shannon's entropy concept—so widely used in ecology—even considered. Yet to parade such picking of nits throughout would just divert attention from the overwhelming success of the volumes.

What can be said of this two-volume work in summary? It is obvious from the foregoing that there is barely space to suggest the contents of each chapter, much less scrutinize all the new suggestions and generalizations emerging from such extensive review. One overall point, however, is easily made: that which is missing from the volumes. The principal gap is perhaps small, but I think revealing for a study with such a broad title: the material is overwhelmingly restricted to song of songbirds. Is no one analyzing songbird calls? What of vocalizations of the roughly half of the avian class that are not oscines? And how about nonvocal acoustical communication, such as the different"drumming" of woodpeckers and grouse, flight noises of various species, and so on? A few authors mention these, to be sure, but the volumes point out, if unintentionally, the paths not taken—and choosing them for future research could make all the difference.

The set is unique in my experience in having a taxonomic editor. I certainly applaud this feature but it is a downright shame that he had no apparent access to the new A.O.U. Check-list. By the time the volumes reached me I already had in hand the sixth edition of the "Check-list," which rendered obsolete many of the names used in the volumes.

So, in sum, almost everything you ever wanted to know about avian song but were afraid to ask is here somewhere, if only along an interesting tangent that you can locate through using the fine index. The vast majority of authors have been graduate students or postdoctoral associates of Peter Marler, which is entirely appropriate; but one does wonder what differences might have occurred without the "Rockefeller emphasis." This is a terrific work that every ornithologist, as the aphorism goes, will want in his or her library.

Appendix

No, I never heard of a review having an appendix either, but this two-volume set containing 18 numbered chapters by different authors (only Kroodsma wrote two) provides an opportunity to compile a list of seminal papers on acoustic communication in birds. Here—summarized by authors' surnames, year of publication (all this century) and journal or book name—are the references that appeared in the greatest number of separate bibliographies. Fewer than 50 of the nearly 1,500 different references cited were listed four or more times, making this list the upper 3% of influential books and papers. Appearing in *eight* bibliographies was Thorpe (61 Bird Song); in *seven* Greenewalt (68 Bird Song) and Lein (78 Can. J. Zool.); in *six* Armstrong (63 A Study of Bird Song), Bertram (70 Anim. Behav.), Brooks-Falls (75 Can. J. Zool.), Howard (74 Evolution), Immelmann (69 *In*: Bird Vocalizations), Kroodsma (76 Science), Marler (59 *In*: Darwin's Biological Work), Nottebohm (72 Am. Nat.), Payne (73 Ornith. Monogr.), and Smith (77 The Behavior of Communicating); in *five* Goldman (73 Auk), Krebs (77 Anim. Behav.), Kroodsma (74 Z. Tierpsychol. and 77 Am. Nat.), Marler-Mundinger (72 *In*: Ontogeny of Vertebrate Behavior), Marler-Peters (77 Science), and Milligan-Verner (71 Condor); and in *four* Borror-Gunn (65 Auk), Catchpole (80 Behaviour), Dawkins (76 The Selfish Gene), Emlen (72 Behaviour), Falls (63 Proc. Int. Ornith. Congr. and 69 *In*: Bird Vocalizations), Ficken-Ficken-Hailman (74 Science), Hartshorne (56 Auk and 73 Born to Sing), Konishi (65 Z. Tierpsychol.), Konishi-Nottebohm (69

In: Bird Vocalizations), Kroodsma (79 Auk), Kroodsma-Verner (78 Auk), Lanyon (75 Publ. Nuttall Ornith. Club), Lemon (75 Condor), Marler (60 *In*: Animal Sounds and Communication, 61 J. Theor. Biol. and 70 J. Comp. Physiol. Psychol. Monogr.), Marler-Hamilton (66 Mechanisms of Animal Behavior), Martin (77 Condor and 79 Condor), Morse (70 Nature), Schiovitz (75 Behaviour), Thorpe (58 Ibis), Wildenthal (65 Auk), Wiley (76 Anim. Behav.), and Wiley-Richards (78 Behav. Ecol. Sociobiol.).

The number of references cited three times exceeds the entire foregoing list, so there is not space to provide them. Only 280 references were cited twice or more, which is less than 19% of the total number of references. Of the top 3% listed above 7 are books, 3 monographs, 6 chapters in books, and the remaining 31 are journal papers. Of those papers 6 were from *The Auk*, more than from any other journal—a proud note on which to close the review.—JACK P. HAILMAN.

The hummingbirds of North America.—Paul A. Johnsgard. 1983. Washington, D.C., Smithsonian Institution Press. 304 pp., 16 color plates, 16 numbered figs., 9 tables, 6 appendices. $35.00.—Hummingbirds have dazzled man for centuries. No other group of birds has evoked such fascination and flowery prose. Into this small book, Johnsgard has attempted to incorporate much of what we know about the Trochilidae. Although emphasizing "North American" species, the six brief introductory chapters on the comparative biology of hummingbirds form an excellent entrée into the family as a whole. Classification, distribution, and general attributes; evolution and speciation; anatomy and physiology; ecology; behavior and reproductive biology are all covered. In his smooth and easy style, Johnsgard has become a master at paraphrasing the significant portions of an enormous and far-flung literature into tight, readable text. With 16 books to his credit, one might justifiably wonder if quality has been sacrificed for quantity along the road to this prodigious production. If such is the case, it is not clearly evident in this book.

The chief features of the volume are (1) a concise review of hummingbird biology; (2) species accounts that summarize all that is known about the 23 species that have been reliably recorded north of the Mexican border; (3) dichotomous keys based on plumage color and size both for North American species and for all forms of Trochilidae; (4) a list of hummingbird-adapted plants in North America; and (5) 16 full-page color illustrations by James McClelland of species of hummingbirds and the plants with which they commonly associate. The accounts of hummingbird foraging behavior and floral ecology are especially welcome. Importantly, for many species he calls attention to gaps in our knowledge [e.g. territory size of the Ruby-throated Hummingbird (*Archilochus colubris*)].

None of several weaknesses detracts seriously from the value of the book. The criterion for inclusion of species in the detailed accounts of natural history (that of having been "reliably reported from anywhere north of the Mexican border") is based on dubious logic. A host of other interesting species, whose main distributions in Mexico and Central America are equivalent to those included, also could have been covered. Furthermore, as Calder notes (1983. Science 221: 1044), some important recent literature has been skipped. In this regard, I was disappointed to see no mention of Williamson's early work on the molt and testis cycle of the Anna's Hummingbird (*Calypte anna*), despite the fact that some of his findings were later expanded upon by Stiles. Also, the distribution maps are too broadbrush and include significant errors. For example, although the Calliope Hummingbird (*Stellula calliope*) nests in the higher mountains of southern California, the map cuts off the breeding range well to the north of there, somewhere in the southern Sierra Nevada.

More seriously, Johnsgard does not critically analyze the primary literature. Thus, he cites (p. 166) Grant and Grant [1970 (given as 1968 in the Bibliography), Hummingbirds and Their Flowers, New York, Columbia University Press] for the assertion that the northern Mojave Desert lacks both ornithophilous flowers and breeding hummingbirds. In fact, Costa's Hummingbird (*Calypte costae*) breeds to the northern limits of the Mojave Desert in California, Nevada, and Utah, as Johnsgard's own map partially illustrates. On page 53, we read of the "amazing example" of a Rufous Hummingbird (*Selasphorus rufus*), included to illustrate the excellent memory of hummingbirds and their capabilities for detailed human recognition. Supposedly, this hummingbird befriended a person recuperating from tuberculosis in a California sanitarium. The bird took over a feeder placed outside the patient's window. The hummer is claimed to have "greeted" the convalescent when he went outside in his wheelchair and even appeared almost a year later at the person's home some 13 km away. Such post-pharmaceutical hallucinations have no place in serious biological literature. Johnsgard also cites (p. 131) Brandt's claimed estimate that a Blue-throated Hummingbird's (*Lampornis clemenciae*) 10-year old nest "consisted of some 24,000 kilometers [14,909 miles] of spider and insect thread." To what degree Johnsgard has included lesser exaggerations from the literature remains undetermined.

In design, the book is attractive but wasteful. Sixteen of the 22 full-page maps are at least twice as large as necessary. Why illustrate all of North America for species that occur only, or mainly, in Mexico? Only the map of the Rufous Hummingbird deserves a full page. Two maps are entirely redundant. Because they include the distributions of two species,

the editor used each map twice (pages 70 and 86; pages 148 and 154). Eleven pages are blank; 12 others contain so little text that they easily could have been eliminated by slight condensation. In the heart of the book, the accounts of the 23 "North American" species (pp. 67–231), each page has a margin *one-third* the width of the page in addition to a margin of normal width. Speaking conservatively, this book could have been at least 75 pages (25%) shorter without any loss of information or attractiveness.

Although, in the author's words, this is a "semi-technical book," both tyros and pros will find much of value here. Beginners will cite it endlessly as a fact book for term papers; advanced students will use it mainly as a secondary reference to direct them to specific titles in the primary research literature. With such a potentially broad audience, it is unfortunate that the Smithsonian Institution Press did not choose a more economical format that could have substantially reduced the price and brought the book within reach of more readers.

Johnsgard is to be congratulated for once again condensing a vast literature into a very useful single volume, the best now available on hummingbirds.—NED K. JOHNSON.

The Arctic Skua. A study of the ecology and evolution of a seabird.—Peter O'Donald. 1983. Cambridge, Cambridge University Press. xvi + 324 pp., 27 figures, 91 tables. ISBN 0-521-23581-2. $49.50.—The Arctic Skua (*Stercorarius parasiticus*), which I will refer to by its North American name, the Parasitic Jaeger, is a medium-sized seabird in the very specialized subfamily Stercorariinae. Females weigh about 510 g and males 82 percent as much, or about 420 g. Like the other two members of *Stercorarius*, it has elongated central rectrices, in this species into a short pointed spike. The species is polymorphic in plumage. Plumage types in all populations range from pale individuals with dark brown upper parts and white underparts to uniformly dark brown individuals, with a proportion of the population intermediate in color. Northern populations of the species have 90–100% pale individuals; this percentage declines to 20% in southern populations. The species breeds on arctic tundra where it occupies large territories and is a predator on birds (shorebirds as well as passerines), birds' eggs, microtine rodents, berries, and insects. In the North Atlantic it has a large maritime population in which breeding adults are kleptoparasitic on other seabirds.

The subject of this book is a population of Parasitic Jaegers along the southern edge of its breeding range in the Shetlands, on the islands of Foula and Fair Isle. The Fair Isle colony has been studied over 30 yr, beginning with the arrival of Kenneth Williamson in 1948 to direct the Fair Isle Bird Observatory. Peter O'Donald studied the colony from 1958 to 1961 and from 1973 to 1979. During the 30 yr that the colony has been under observation it has grown from 15 pairs to its present size of 120–140 pairs.

The author's fieldwork emphasized breeding behavior, ecology, and evolutionary genetics, the results of which are in Chapters 4, 5, 6, 7, and 8 of the book. Chapter 3 (Feeding behaviour), Chapter 2 (Numbers and distribution), and the section on mating behavior (Chapter 7, Section 7.1) are from other sources. Chapter 9 (Genetic models of sexual selection in birds) and Chapter 10 (Mating preferences of Arctic skuas) are based on two published papers by the author (Heredity 44: 391–415; Heredity 45: 201–217). Models in these papers are herein reanalyzed with new data and in some instances the original conclusions have been modified.

The author was interested in such questions as (in his words): What are the genetics of the polymorphism of the jaeger? Is the polymorphism stable or is it still evolving? How are the gene frequencies distributed? and, What selective forces are acting on the phenotypes? Briefly, his conclusions are as follows. The polymorphism in the Parasitic Jaeger population on Fair Isle is the result of assortative mating as a result of sexual selection of dark phenotype males by female choice, opposed by natural selection for earlier sexual maturity favoring the pale phenotype. The polymorphism has been stable on the Shetlands from 1934 to 1979, five skua generations. Calculation of coefficients of selection predict a slight increase in the dark form and eventual fixation of the dark alleles. At least 10 generations will be required to verify the stability of the polymorphism at the calculated selection rates. The author concludes that the polymorphism in this species is a diffusion cline and that its stability is maintained in the Shetland populations by the opposing selection factors plus immigration.

O'Donald's case can be summarized as follows. Inheritance records suggest that pale adult Parasitic Jaegers are homozygous for pale alleles, dark adults are mostly homozygous for dark alleles, and intermediate adults are mostly heterozygous. Mating is positively assortative. Dates on which adults breed for the first time have a high degree of heritability. Pairs that have bred together breed early and their date of egg laying becomes remarkably consistent. Newly formed pairs of both experienced and inexperienced adults breed later than they do in subsequent years. Early breeders are the most successful and there is a sharp decline in breeding success in the latter part of the season. The Parasitic Jaeger usually lays two eggs that are incubated from the first egg. Incubation is usually for 25 or 26 days (median = 26) and is the same for first and second eggs and for all jaeger phenotypes. It takes approximately 31 days for chicks to fledge, with no evidence of any difference between first and second chicks or chick phenotype or between offspring of experienced and

inexperienced or of early and late breeding adults. There is no difference in survival rate among the phenotypes of the 34.6% of the chicks that survive to breed. There is a difference among phenotypes in the age at maturity, however. A larger proportion of surviving pale birds breed for the first time at 3 yr of age than of the other two phenotypes. The mean age at breeding of pale birds is 4.0 yr, compared with 4.6 yr for dark birds and 4.5 yr for intermediates. When a pair divorces the females usually move and when they remate the males generally remain on or near the original territory, suggesting that males have tenure on the territory. Because established pairs breed very early in the season and are very consistent between years in their date of egg laying, evidence for sexual selection must be sought in the newly formed pairs each year. Fortunately, approximately 39% of the pairs of both first-time and experienced birds are new each season. All new pairs nest later than established pairs and have the reduced success related to late breeding that affects all pairs in the colony equally. The date of breeding of 328 new pairs shows that pale males take 11.4 days to find a mate, dark males 6.3 days, and heterozygous males 8.4 days. The differences are significant and are significantly different from breeding dates of second-year pairs. The data on egg dates and phenotypes of new pairs fit a model based on sexual selection by female choice.

The book is clearly written. The argument is developed stepwise and at each step alternative hypotheses are discussed and analyzed against the jaeger population data. The result is a book that is informative, provocative, and pursuasive. I particularly commend to ornithologists the author's arguments on sexual selection and the evolution of territoriality in a monogamous species. Territories may evolve for any of several reasons, but once evolved they presumably limit the number of males that can breed, and thereafter become a mechanism of sexual selection. Sexual selection by itself then favors males with larger than average territories, quite apart from the question of defending a food supply. To the degree that this is correct, efforts to measure a food supply as a basis for territory size must fail. The difficulty of finding pursuasive evidence of competition among associated species that currently vexes many ecologists may be partly explained if it can be demonstrated that territory size is at least in part related to sexual selection. Sexual selection has been getting considerable attention in the past few years; perhaps as an alternative to the food defendability hypothesis of territory it is an idea whose time has come.

I do have some minor criticisms. The subtitle of the book, "A study of the ecology and evolution of a seabird," is somewhat of a misnomer. The author concerns himself almost exclusively with the Parasitic Jaegers of the Shetlands with some reference to studies in Iceland and northern Europe. There is no reference to any studies on jaegers from the North American arctic by Pitelka (Pitelka, F. A., P. Q. Tomick, and G. W. Treichel. 1955. Ecological Monographs, 25: 85), Maher (Maher, W. J. 1970. Arctic 23: 112; 1974. Pacific Coast Avifauna No. 37), or others. The discussion of territoriality in the species would have been broadened by consideration of the fact that over most of its geographic range it occupies and defends large territories and functions as a true predator in arctic ecosystems. No reference is made, either, to the recent division of *Catharacta* in the southern hemisphere into three species (Devillers, P. 1977. Auk 94: 417), although this is a minor point in the context of the book.

Finally, I would disagree with the author's evolutionary tree of the Stercorariidae (Figure 1.7, p. 30). I consider the Pomarine (*Stercorarius pomarinus*) and Long-tailed (*S. longicaudus*) jaegers as more closely related to each other than either is to *S. parasiticus*. In reaching this conclusion I emphasize the paucity of melanism in the former two species (compared with *S. parasiticus* and *Catharacta*), their geographic and ecological exclusiveness on the breeding ground, and their territorial systems, which reflect their strong adaptations as predators on microtine rodents in arctic ecosystems. The Pomarine and Long-tailed jaegers have never been reported nesting in the closely spaced colonies of either *S. parasiticus* or *Catharacta*, and their highest reported nesting densities have been on exclusive feeding territories in association with lemming population highs in the low arctic of northern Alaska and the high arctic of Ellesmere Island and northeast Greenland, respectively.

In summary, this book is clearly written, stimulating, and provocative. Readers without a strong background in population genetics and statistics may find it slow going but I strongly recommend reading it. It should be in college and university libraries that have graduate programs in ornithology and ecology as well as in the libraries of graduate students in avian population ecology and their supervisors.—WILLIAM J. MAHER.

Seabirds, an identification guide.—Peter Harrison. 1983. Boston, Houghton Mifflin Co. 448 pp., 88 plates, 31 text figures, 312 maps. $29.95.—This, at long last, is a truly comprehensive guide to seabird identification. For the first time, people travelling in any ocean can be reasonably prepared to identify the birds they see. The book is too big to fit in a pocket, but necessarily so: space is not wasted. A space-saving two-column format is used, margins are quite narrow, and the text is written telegraphically. A foreword by Roger Tory Peterson precedes a brief "how to use this guide" section, a glossary, and the author's introduction. The main body of the work consists of 88 plates by the author, illustrating all of the birds considered, followed by 206 pages of species accounts, and a section of distribution maps. Coverage

generally is by whole families, so that if a family contains marine species the whole family is included. Thus, all grebes, pelicans, and cormorants are included even though some species are more or less restricted to fresh water. The exceptions are Scolopacidae, appropriately represented only by the three phalaropes, and Anatidae. Only 20 of the more marine waterfowl are included, and they are treated superficially, with line drawings and no species accounts or maps.

Species accounts average two-thirds of a page long, and each contains descriptions of plumages, a section labeled FHJ (for Flight, Habits, Jizz), a description of distribution, and a comparison to similar species.

The plates are quite adequate for identification and will be the most useful part of the book. They include several poses of most species, often both sitting and flying. Some of the birds appear rather stiff and awkward, but this does not detract from their suitability for identification. Some of the albatrosses in flight seem to be holding their necks more outstretched than is typical, and some of the shearwater bodies are too slender. The thickness of the Caspian Tern's bill is exaggerated, and *Gygis alba* is drawn with an inordinantly long neck.

The information in the species accounts seems generally up to date and accurate, although several taxonomic changes have occurred too recently to be included. Two new species have been described (a grebe, *Podiceps gallaroidea*, and an albatross, *Diomedea amsterdamensis*), *Sterna antillarum* has been split from *S. albifrons*, and *Pterodroma feae* and *P. madeira* have been split from *P. mollis*. The author has provided important new information on the identification of several notoriously difficult genera, including the prions (*Pachyptila*), the gadfly petrels (*Pterodroma*), the diving petrels (*Pelecanoides*), and the crested penguins (*Eudyptes*). The illustrations and discussions of frigatebird plumages are outstanding.

I do have a few complaints and criticisms, but I should first emphasize that the inadequacies I mention detract only slightly from this generally wonderful book. The labeling for several of the text figures is inadequate. It is not immediately obvious in Fig. 5 which drawings are of Wandering Albatrosses, and the placing of names on Fig. 30 is also ambiguous. The worst, however, is Fig. 10 (drawings of bills of *Pelecanoides*). I suspect that most readers will conclude incorrectly which drawings belong to which species. The descriptions of "Jizz" (in North America the German term "gestalt" often is used for this seminal concept) are often too general to be useful. Thus, *Sula leucogaster* has "lighter jizz" than gannets, and *Phalacrocorax pelagicus* has "more delicate" jizz than *P. auritus* or *P. penicillatus*. The bibliography would have been handier had titles been included.

I have only four major criticisms of the descriptions and characters for identification. First, I take exception to Harrison's description of the geographical variation in *Procelsterna cerulea* as "two morphs." His statement that "dark morphs generally occur S. of 25°S" is quite inaccurate, for the southwestern *subspecies* (*albivitta* group) are the palest. Second, the small alcids of the North Pacific differ substantially from each other in body shape and attitude in flight. These differences are often more useful for identification than the plumage characters described. Third, the illustrations of *Phaetusa simplex* are carefully arranged to hide the diagnostic wing pattern. Fourth, at least in Alaska, some *Gavia adamsii* have quite yellow bills, instead of white or ivory-white as perceived in Europe.

The distribution maps seem pretty good, but I noted a number of small errors. The range in western Ecuador of *Phaetusa* is omitted, and the breeding ranges of several species extend farther south in North America than indicated (e.g. *Gavia immer, G. stellata, Aechmophorus occidentalis, Larus argentatus, L. marinus,* and *L. glaucescens*). The range of *Pterodroma cooki* in the North Pacific is probably overestimated, and that of *Rissa brevirostris* may be underestimated. In general, the book is quite free of typos and similar lapses, but I did note that Map 304 is labeled "Cassin's Murrelet."

All in all, this is a fine work, very useful for anyone planning to identify seabirds, and is a must for anyone planning to identify seabirds outside of North America or Europe.—WAYNE HOFFMAN.

Coevolution.—Edited by Douglas J. Futuyma and Montgomery Slatkin. 1983. Sunderland, Massachusetts, Sinauer Associates. xii + 555 pp. Paper $24.95. **Coevolution.**—Edited by Matthew H. Nitecki. 1983. Chicago, University of Chicago Press. x + 392 pp. Paper $17.00, cloth $30.00.—We have here two quite different approaches to what is proposed to be a single topic. The first is a series of review articles of considerable depths, the second a series of lectures given at a systematics symposium at the Field Museum in 1982. It is at once manifestly clear that the unity assumed in the titles is not realized. Rather, these books discuss in 28 "chapters" a variety of biological problems in the ecological realm. Thirty-one authors are involved; only Montgomery Slatkin contributed to both. Both books start with a definition of coevolution but quickly retreat to the specialty areas of the many authors. The resultant heterogeneity is probably an improvement on what would have been produced had there been adherence to the avowed subject. These chapters once again focus on the increasing specialization and reductionism (of a sort) going on in biology. With this specialization the language becomes increasingly harder to follow even though the ideas may be elementary (if not trivial). Although several of the authors give the appearance of addressing their problems in a seemingly candid fashion, much is either masked in verbosity or sim-

ply omitted. Reading these papers is not easy for the nonprofessional.

"Coevolution occurs when the direct or indirect interaction of two or more evolving units produces an evolutionary response in each. Even so restricted, coevolution may comprise most of evolution" (van Valen, in Nitecki: 1). The last part of this statement raises questions. Olson (Nitecki: 313) sees coevolution as one end of a spectrum of interactions with coadaptation at the other end. "The word *coevolution* was coined by Ehrlich and Raven (1964, Evolution, 18: 586) in their discussion of the evolutionary influences that plants and the insects that feed on plants have had on each other" (Futuyma and Slatkin: 1). This idea of coevolution, which does not do justice to the word itself, was later transformed into the concept of "diffuse coevolution" in which one species does not have a specific inherited response to a heritable trait in another, or, in the original usage, where a number of species respond "diffusely" to a heritable trait of a food source or predator (better identified in a couple of instances as coadaptation?). The definition of coevolution as involving reciprocal inherited character change between pairs of species (or possibly small groups—but no examples of this are given), does justice to the term and clearly separates it from "diffuse coevolution."

Having a definition ["Definitions do *not* play any very important part in science (Popper, K. R. 1962, "The open society and its enemies. Vol. 2. Hegel and Marx," 4th ed, Routledge & Kegan Paul, London, p. 14)] does not lead to acceptance. Under this banner one finds papers dealing with pollination adaptations, adjustments to competition, convergence of faunas, community dynamics and composition (including chronofaunas), mimicry, animal dispersal of seeds, symbiosis (parasitism, mutualism) and predator-prey interactions. What van Valen hinted at—"Most of evolution"—is achieved (but not within the limits of the definition).

Definitions aside, there is a rich feast of particulars here that will delight the biologist or ornithologist. Birds do not play a large role in the various presentations, but the biological problems addressed are applicable to birds. Diana F. Tomback (Nitecki: 179) is the only one to directly discuss birds. She talks about nutcrackers and pines and asks whether their relationship is coevolution or coadaptation. She suggests that since *Cembrae* pines apparently moved into North America across the Bering Strait that this spread of a large-seeded pine ("adapted to being fed upon by nutcrackers"), was accompanied by the invasion of North America by the nutcracker. With time these invaders evolved into the present species, *Nucifraga columbiana*. Unfortunately for her argument, she gives enough information to stir doubt of her thesis. Doubt springs from the fact that there are other large-seeded pines with nutcrackers to feed on them. Some nutcrackers in fact live on hazelnuts! There is also the question as to whether the cones of *Cembrae* pines are in fact adapted for dispersal of seeds by nutcrackers.

One of the current definitions of coevolution is attributed by several writers to Daniel Janzen. His contribution, in Futuyma and Slatkin, concerns seed dispersal by way of the feces of animals. This is an excellent "review" paper, with page after page of citations to the literature on fruits or seeds eaten by birds or other animals. One wonders, however, what this extensive mass of information has to do with coevolution. He does come up with questions such as, "Why don't all fruit types converge? Why don't all frugivorous vertebrates become purely that (and seed dispersers)?" He closes (p. 262) with the comment: "The interaction of seed dispersers and plants is so rich in relevant detail and so idiosyncratic from one system to the next that it may appear so chaotic as to be uninteresting to study."

Charles Mitter and Daniel R. Brooks, in Futuyma and Slatkin, wrote on "Phylogenetic aspects of coevolution" and, as they discussed parasites and their hosts, the argument for coevolution is strong. The argument is strengthened by the "parallel" evolution of both host and parasite as determined by systematics. Their figure 1 (p. 67) shows cladograms for both the primate hosts and their species of parasitic pinworm (*Enterobius*—Nematoda). I do not know what set of host-parasite relationship shows the closest correlation but certainly, this is a good one. The argument for evolution of change of species with change of environment is supported by evidence such as this. Robert M. Timm (Nitecki: 225) speaks of Fahrenholtz's Rule, coined by Eichler (1948. Annals and Magazine of Natural History, Ser. 12, Vol. 1, p. 588), as "In groups of permanent parasites the classification of the parasite usually corresponds directly [to] the natural relationships of the host . . . ." He describes the species relationships between host gophers and their lice. It is a nicely told and convincing story. Other aspects of host-parasite relation are described by John C. Holmes, who notes (p. 161) that "Price . . . has concluded that extensive reciprocal coevolution with the host is the rule for parasites." His is a rather clumsy statement but understandable. Holmes supports Price's conclusion with a discussion of helminths as parasites and their interrelationships with hosts. Barrett (chap. 7 in Futuyma and Slatkin) discusses the biology of "Plant-fungus symbiosis." His discussion of lichens is especially interesting (and appropriate!).

The Chicago symposium, as one would expect, extends consideration of coevolution (or is it coadaptation?) into a time frame. S. David Webb describes the Clarendonian chronofauna (late Miocene), rich in ungulates, that developed in central North America and persisted for about 10 million years. During this time the environment shifted from forest land, to savanna, to steppe. These changes in environment

were accompanied by species changes and diversity changes. Webb then compares this fauna with the living African ungulate fauna (in terms of body size and molar volume). Webb (p. 269) states that "The purpose of this chapter is to suggest that the large herbivores of the Clarendonian chronofauna represented a coevolving set of primary consumer species which also had regular coevolving relationships with the producer species of the savanna flora." This last idea may be the one that leads to the idea of convergence (similar numbers of species with similar body sizes and molar volumes), but these ideas of convergent community structure are not really properly viewed as coevolution. Everett C. Olson, who coined the term "chronofauna," described late Carboniferous and early Permian fossils from Oklahoma and Texas. Unlike Webb, he is aware that what he is describing is better viewed as coadaptation. He suggests (p. 309) that the terms coevolution and coadaptation are "ends of a spectrum of intereactions . . . ." The accounts of Webb and Olson are both highly speculative, but are not particularly outstanding in this respect as compared with the other accounts.

The only contributor to both of these volumes is Montgomery Slatkin. In the Nitecki volume, he displays his skills as a mathematical modeler, using ecological character displacement as an example of coevolution. He concludes that "competition between sympatric species does not inevitably lead to character displacement," and suggests the presence of a selective (?) force or forces leading to convergence! He notes that the assumptions one puts into a model determine its utility. A similar statement can be made about some of his nonmathematical ideas. He asks interesting but misleading questions such as (p. 345): "If they [species] can evolve in response to each other in some areas [areas of sympatry] and coexist as a result, why have they not done so everywhere [?]." This question is in part rhetorical but also has a large number of smaller ecological questions contained in it. The situation he describes that leads to this question is not one, in my view, that can be identified as character displacement, the basic subject of his chapter.

As in most modern ecological discussions, mathematical models are described (or play a central explanatory role) not only in Slatkin's chapter but also in chapters by Simon A. Levin (Nitecki), Jonathan Roughgarden (Futuyma and Slatkin), May and Anderson (Futuyma and Slatkin) and Daniel Simberloff (Futuyma and Slatkin). Simberloff pursues his use of the null hypothesis in terms of "sizes of coexisting species." As a last comment, van Valen (Nitecki) mentions the Gaia hypothesis in which the effects of organisms on their environment are also controlled by adaptation. One aspect of this view is that the amount of oxygen (or carbon dioxide) in the environment is balanced through use or production by various organisms. This appears to be the old "balance of nature" idea in a new garb. The changing environment of the world, due to human activities, should be evidence that "nature" is no longer in control.

These two books are quite different, although dedicated to the same subject, which as yet lacks clear definition, limits, and purpose (in terms of contributing to an understanding of ecology or evolution). The purpose of scientific writing is threefold: 1) to entertain, 2) to enlighten, and 3) to stimulate discovery. These volumes do well in the first two categories but there is doubt about the third. Overall, I would view these volumes as worth the price. The Futuyma and Slatkin volume is particularly useful in terms of its single "literature cited."—MALCOLM JOLLIE.

The theory of sex allocation.—Eric L. Charnov. 1982. Princeton, New Jersey, Princeton University Press. x + 355 pp. $52.00 hardback, $17.00 paperback.—This book is about sex, a subject dear to the heart of any evolutionary biologist. More specifically, it weds the theory of natural selection to the phenomenon of sex allocation, which is ". . . the allocation of resources to male versus female reproductive function." Charnov makes it clear that he is not so much interested in the proximate (physiological = how?) questions of sex allocation that seek to find mechanistic explanations, but rather the ultimate (evolutionary = why?) questions, the answers to which, according to the author, are the bases of "selection thinking," the process that investigates the structure of nature.

In a series of 17 chapters the subject matter includes an analysis of the evolution of sex ratio in dioecious organisms, sequential hermaphroditism (sex reversal) in Pandalid shrimps and Labroid (coral reef) fishes, and simultaneous hermaphroditism in barnacles, marine fish, and higher plants. The author provides the theoretical framework of his thesis, which rests primarily on the Evolutionarily Stable Strategy. He employs numerous graphics and basic calculus to show that environmental, social, or life-history parameters result in natural selection favoring one or the other form of sexuality (dioecy or hermaphroditism). The contents of these chapters offer a fascinating, instructive, and extremely throught-provoking exercise for any biologist.

What does the book have to offer ornithologists? The discussion of avian sex ratios is given only 3½ pages (111-114) wherein the author considers whether such animals, which have well-developed sex chromosomes, can control by sex allocation the numbers of sons and daughters produced. We are told at the onset that the heterogametic female might have the ability to control segregation of the sex chromosomes autosomally but that such behavior affecting the primary (fertilization) sex ratio is not forthcoming from any available data. The only other alternative, then, is to effect a change in the number

of post-hatch males and females directly via direct parental manipulation of the sex ratio. This is more readily visualized as feasible in altricial species, in which one or both parents can selectively eliminate members of one sex or the other based on the complete dependence on the parents by the young for resources. Precocial species, on the other hand, have fewer options in effecting sex-ratio changes because the young are relatively independent of parental care soon after hatching. At any rate, most data from both domestic and wild birds indicate that no consistent trend away from the classical 50:50 occurs. Even though one sex may be more expensive to produce than the other, there is no evidence that suggests a resultant overproduction [nonrandom?] of the cheaper sex, and short-term adaptive alteration of the sex ratio of birds is likewise not yet evident. I find such statements extremely interesting in view of recent data, published since this book, by Ankney (1982. Auk 99: 662) and myself (1983. Auk 100; 726) that suggest nonrandom and possibly even adaptive sex determination in wild birds is at least possible.

The other vertebrates (fish, reptiles and mammals) are dealt with briefly (pp. 104–120) but they are given a fine review complete with an adequate historical set of literature citations.

This book is full of ideas and should be read and digested by all biologists so that the overriding principles set forth eventually can be tested in a number of animal and plant groups. It is indeed a valuable review of a topic that we shall no doubt hear much of at upcoming conferences and in future journal issues.

Despite the author's contention (p. 3) regarding the relative merits of seeking answers to proximate versus ultimate questions, I am more concerned with the formulation of a mechanistic explanation for sex allocation (the "how" question). I am willing to await analysis and interpretation of data from a variety of long-term field studies before attempting to answer the ultimate "why." Although this may not be in line with Charnov's "selection thinking," such "practical thinking" may prove to be equally valuable in the eventual understanding of the biological significance of sex allocation.

I recommend this book to all who have read and pondered the writings of Charles Robert Darwin.—JOHN P. RYDER.

Mate choice.—Patrick Bateson, Ed. 1983. Cambridge, Cambridge University Press. xv + 462 pp. ISBN 0-521-25112-5 $19.95 (paper), $59.50 (cloth).—Questions of who mates with whom, when, where, and for what reasons generate an enormous amount of scientific and personal curiosity (witness the best-selling status of nonfiction lists of the sexual encounters of the rich and famous). Given the social and evolutionary significance of reproduction, perhaps the interest is understandable. It is, in any case, an interest that spans many levels in a hierarchy of description and explanation. In order to understand mate choice fully, one must describe its causes and consequences in terms of both proximal (mechanism) and ultimate (evolutionary) factors. The scope of that task is obviously beyond the capabilities of a single individual or even discipline. Bateson, himself a competent generalist in the mate-choice arena, has edited a volume of contributions by specialists in a variety of fields with the expressed hope of addressing the "coherent topic of mate choice" coherently. As a whole, the book succeeds despite occasional individual lapses and the odd unintegrated chapter.

Most of the 21 chapters of "Mate choice" are based on presentations from a 1981 conference held in England. While Bateson contends that the book "is emphatically not a set of conference proceedings," it still reads like one. There is less cross-referencing and continuity and more variability in chapter style and quality to contend with than one might wish. Balanced against this is the opportunity to sample the insight and expertise and the agreements and disagreements of a broad spectrum of experts in close quarters. This allows the reader a clearer, and often more entertaining, view of the experts' preferences, as they compete, court, mate, and even divorce intellectually over their often conflicting ideas about mate choice.

The book is divided into sections, some of them more coherent than others. The introduction contains a useful overview by Halliday that illustrates many of the topics and central themes found throughout the volume. In the first major theme, we are warned of the importance and difficulty of distinguishing between intrasexual competition and intersexual choice as determinants of the mating system and as the prime movers or potential targets of sexual selection. Halliday provides conceptual and methodological recommendations for dealing with such questions that recur and are elaborated upon elsewhere (Sections II, III, and VII). He also raises the second major issue of who might be expected to compete over or choose mates (male, female, or both) and on the basis of what criteria (e.g. whether choice is arbitrary or adaptive, and if the latter, whether its value stems from gaining better somatic or genetic resources, or from achieving behavioral or genetic compatibility between mates). This theme is also developed extensively throughout the book (Sections II, III, IV, V, VII). Only a few chapters (Wickler and Seibt, on the meaning and use of monogamy, and Duck and Miell, on human friendship) and one section (VI, on hormones, with Hutchinson and Hutchinson on birds and Keverne on monkeys) fail to address these issues. This is not to say that they are poorly done or uninteresting. In fact, Wickler and Seibt offer a thought provoking challenge and useful warning about the semantic morass that can trap the

unwary when everyday language is borrowed for technical discussion, but their contribution and the others are more or less tangential to the core of the book.

That core begins in section II, where O'Donald provides population genetic models of female choice that imply that Fisher's runaway process will rarely run, and that populations are likely to be polymorphic for choosy and indiscriminate females. That polymorphism and the frequency dependence it generates underlie his explanation of the otherwise puzzling "rare male" phenomenon. In his understandable explication of Lande's quantitative genetic models of arbitrary choice, Arnold seconds the notion of polymorphism but also concludes that Fisher's runaway can and probably has run. He also describes and prescribes variance partitioning as the method of choice for measuring the absolute and relative strengths of the different components of natural and sexual selection. The latter could provide elegant results but, as Bradbury and Gibson note in their comprehensive review of the potential causes and consequences of lekking, "unfortunately elegance requires careful analysis and large sample sizes."

Parker's theoretical treatment (Section III), reminds us that choice entails potential costs as well as benefits, and so permits optimality and game theory (ESS) analyses that generate counterintuitive results. While the bulk of his contribution is straightforward and powerful, he also is the strongest proponent of distinguishing between active and passive mate choice (similar notions can be found in Arak, Cooke and Davies). To me this notion confuses the distinction between proximate and ultimate. Parker states of passive choice, "The female need exert no active preference between males, she simply moves towards the most intense source of the conspecific cue. For active mate choice we would require that the female rejects certain conspecific males in favour of others." A female that phonotacticly moves toward the loudest singing bird in a lek simply has a physiologically different choice mechanism than a female that discriminates between song types and avoids one. It is still expected that the behavior of the females will favor louder singing or one of the song types, and both male character states will increase in frequency owing to sexual selection. I am not sure that distinguishing between these functionally identical processes serves any useful purpose. The remainder of section III contains a useful look at the same problems in role-reversed species (Petrie) and empirical reviews of mate choice in anurans (Arak) and rabbits (Bell).

Section IV deals with theory (Partridge, Bateson, Cooke and Davies) and data (Cooke and Davies on the Snow Goose, Williams on the Mallard, and D'Udine and Alleva on the House Mouse) on the occurrence, development, and potential value of different types of nonrandom mating. Cooke and Davies present a useful step-by-step method for exploring such questions. They use their long-term data on positive assortment in the Snow Goose as an exemplar of what their method can do. Their most interesting and surprising result is an absence of any fitness consequence of the mating bias they amply document. With some empirical reference, primarily to *Drosophila*, Partridge concentrates more on the theoretical costs and benefits of inbreeding and outbreeding and other forms of nonrandom mating. Bateson also explores the potential costs and benefits of inbreeding and outbreeding. Their shared conclusion (echoed by others, such as Halliday, Parker, Cooke and Davies) is that there could be an optimal level of relatedness between mates that insures well-adapted progeny. Mates could be chosen on the basis of possessing compatible rather than intrinsicly "good" genes.

Bateson also does an excellent job of explaining his proximate "optimal discrepancy" model of mate choice. His Japanese Quail (and D'Udine and Alleva's mice, among other species) appear to choose mates that are neither too similar nor too different from the models they imprint on early in life (usually parents or siblings). The net result is that they choose mates of intermediate levels of relatedness (e.g. first cousins in the quail). Such behavior is thought to minimize the genetic disruption associated with over-wide outbreeding and the fitness depression of over-close inbreeding. Their conclusions are not surprising to me (e.g. Shields, 1982. Philopatry, inbreeding, and the evolution of sex, Albany, New York, SUNY Press), but they remain under-appreciated possibilities. If Partridge and Bateson's efforts carry the possibilities to a wider audience, they will have performed an important service.

On a more personal note, Bateson takes me to task for calling the mating pattern that results "optimal inbreeding" instead of "optimal outbreeding," as he prefers. The relatedness of potential mates is a continuous variable, so mating patterns must fall on an inbreeding/outbreeding continuum bounded by selfing and species-wide panmixia. Bateson implies that what we call the intermediate optimum is, therefore, a semantic problem. If the optimum were usually near the middle of the continuum, I would agree. The classic analogy for a purely semantic choice is the half glass of water used to distinguish between the pessimist, who perceives it as half empty, and the optimist, who perceives it as half full. A first-cousin preference confirms my *a priori* prediction that in most vertebrates the optimum will usually be nearer the inbred end of the continuum. Calling the result "optimal outbreeding" is a bit like calling a glass that is 90% full optimally empty. It is too pessimistic and politic for me, although I do agree with Bateson that the crucial issue is to emphasize the importance of considering genetic balance.

The final sections of the book (V and VII), dealing with the central themes, provide comprehensive reviews of the roles of behavioral compatibility and past experience with a specific individual in mate choice in long-lived species (Rowley, for monogamous birds in general; Coulson and Thomas, for the Kittiwake), analyses of and detailed prescriptions for generating fitness component analyses of mating tactics (Dunbar), or multivariate models of mating decisions (Wittenberger).

The book succeeds admirably in providing a comprehensive review of our current knowledge of mate choice, at least in the vertebrates. My only major disappointment is the short shrift given Zahavi's (1975. J. Theor. Biol. 53: 205) handicap principle, especially in view of his idea's phoenix-like rise from its ashes. Since over half the chapters deal extensively or exclusively with birds, the book should be as useful to ornithologists as to the generalist interested in mating behavior. With its significant internal disagreements, the book provides stimulating and entertaining fodder for discussion, making it a good choice for graduate seminars as well as for one's personal library. Because it also offers many novel and unique hypotheses and methods for testing them as well as more traditional views, it should also serve the active researcher usefully. In short, I enjoyed it and recommend it, especially for late-night reading.—WILLIAM M. SHIELDS.

Öko-ornithologisches Glossarium. Eco-ornithological glossary.—Rudolf Berndt and Wolfgang Winkel; translation by Rosemary Jellis. 1983. Berlin, Duncker & Humblot. 79 pp. 30 DM.—This slender volume, originally published in part in Die Vogelwelt in 1977, is offered as a means of making technical ecological terminology, especially as it relates to ornithology, more widely accessible to both amateur and professional students of birds. Because it gives both German and English definitions it is a potentially useful tool for translators as well.

As a glossary the book is inadequate from an American point of view, as it contains many terms not in use outside of Europe (if they really are English terms at all, such as "gradology," "hemerophily," and "ruderal organism") and many that I simply do not recognize. Among my favorites in this category is carposis, which is not a plague afflicting cyprinid fishes but rather "the interrelation of individuals of different species in which only one species benefits, though the other is not disadvantaged [*sic*]." I was somewhat startled to encounter the term "sexility," which is claimed to be a synonym for sex ratio but which may be simply a direct translation of the German "Sexilität." It is amusing to see aerial insects described as "air plancton." I found the translations to be somewhat stiff and overly literal, leading to a proliferation of compound nouns that either require no definition for most people or have no intrinsic meaning, such as "change of breeding-place," "differential species," "acquisition of the means of subsistence," "individual world," "attachment to place," and "vagabondizing birds." Fructivorie is translated as fructivory rather than frugivory, and Ortstreue as fidelity to place instead of the more common site-fidelity.

There is a preponderance of terms of a type that I can only describe as "ecospeak," including "biocoenotic nexus," "dismigration," "synecological optimum," "ecome," "ornitope," and "monoplex," as well as a lack of numerous English terms that would seem appropriate for this glossary. For example, the definition of parasitism mentions neither piracy nor kleptoparasitism, and the definition of predator, while making the peculiar claim that in ornithology this refers specifically to hawks and owls, makes no mention of "raptors." Absent are such terms as altruism, kin selection, group breeder, iteroparity, and character displacement, to name a very few.

To make matters worse, the definitions are frequently inadequate or downright bad, as in that of selection as "a naturally occurring, positive sorting out . . . of those characteristics, individuals, and populations which are relatively the best adapted to a given environment. According to 'selection theory' this leads, in the course of 'phylogeny', to the further development and formation of species." No attempt is made to distinguish between anagenesis and cladogenesis, and for the definition of phylogeny one is referred to the definition of selection!

Typographic and linguistic gaffes abound in this book, contributing to the overall impression that this attempt to bring German- and English-speaking ornithologists closer together is not entirely successful. The book in its present form may be most useful for translators but only if they are already thoroughly familiar with the definitions in their native language.—MARY C. MCKITRICK.

Reproductive physiology of vertebrates (Second edition).—Ari van Tienhoven. 1983. Ithaca, New York, Cornell University Press. 491 pp.—It comes as no surprize to most ornithologists that the variety of plumages, wattles, combs, etc. is as diverse among avian species as are secondary sex characteristics among any other vertebrate class. What may surprize many ornithologists who read this book, however, is that the primary sex organs of birds are the least diverse of any other group of vertebrates. The testes and associated ducts and the ovary and oviduct show remarkable uniformity throughout the group. Furthermore, with the possible exception of those most primitive of vertebrates, the cyclostomes (lampreys and hagfishes), the class Aves is the only vertebrate group that has no known form of viviparity or ovoviviparity. Most likely this is an adaptation for flight,

as embryos take time to develop and could impose an increasing burden on the female, possibly impairing flight. Although eggs can represent a significant percentage of the female's body mass, they are usually only held for a few hours before oviposition, thus reducing impairment of flight to a minimum.

What birds lack in terms of a placenta or diverse gonadal structure they certainly make up for in the wide array of parental strategies. Some show analogies with mammals. For example, Columbiformes produce crop milk for feeding young that is very similar to mammalian milk. Even more fascinating is the fact that production of crop milk is under the control of the pituitary hormone prolactin, which also regulates milk synthesis and lactation in mammals. We are all familiar with the wide variety of nest structures built by avian species, which can range from a bare scrape on the ground or a rock to the enormous colonial nests built by some weaver finches. Then there are the mysterious incubation mounds of the Megapodes and, finally, what may possibly be a unique avian trait, brood parasitism.

As the title of this book suggests, the major thrust is physiological, and there is little discussion of behavioral ecology or natural history of reproduction. Not that this detracts from the book; rather, it is a fine compendium that will be a standard reference for years to come. The nontechnical reader will find this volume rather dry and lacking in synthesis. The author does point out, however, that he assumes the reader to have a basic knowledge of physiology and endocrinology, and that the book is intended as a reference and guide to the basics of reproductive physiology. The volume serves this purpose admirably and will be of particular use to teachers and to all serious investigators of avian reproduction, even though the approach is broadly comparative. It is important, I think, for ornithologists to put their favorite experimental subject in phylogenetic perspective from time to time.

The first three chapters introduce the reader to sex and its determination, sexual reproduction compared with parthenogenesis, sexual development, and the intersexes represented by hermaphrodites, freemartins, and sex reversals. Once again the class Aves is very conservative in this regard, with true cases of hermaphroditism, parthenogenesis, and sex reversals being extreme exceptions rather than the norm as in many teleost fish, some amphibians, and reptiles. The endocrinology of sexual development, including sexual differentiation of the brain, is discussed well here. In mammals it is generally accepted that neonatal androgen secretion masculinizes the brain, possibly via aromatization to estrogen in the target cells. The brain of females, the neutral sex, develops normally in the absence of sex steroids. In birds, males are the neutral sex, and differentiation of the male brain, at least in Japanese Quail (*Coturnix coturnix*), is actually inhibited by administration of sex steroid hormones, thus feminizing the male. This process is a curious "mirror-image" of the system in mammals. Birds appear to have rather diverse mechanisms of sexual development, however, for in the Zebra Finch (*Poephila guttata*) treatment of females with estradiol neonatally can masculinize the brain. This fascinating dichotomy clearly suggests that more research on birds in this area is likely to make a major contribution to our knowledge of sexual differentiation in general.

Next follow chapters on puberty and on the structure and functions of the testes, ovary, and associated organs. These chapters are broadly comparative and take a classical approach. The author then moves on to consider reproductive cycles, insemination and fertilization, care of the embryo and fetus, and, finally, the processes of spawning, oviposition, spermiation, and parturition. Although these chapters are also comparative, there is a heavy emphasis on higher vertebrates, particularly mammals. The section on puberty in birds is limited entirely to highly domesticated species which mature only once and, like many species of mammal, remain reproductively active as long as the days remain long and sufficient food is provided. Very few, if any, natural avian populations are likely to display this type of maturation. The vast majority, if not all, avian species are seasonal, and in species that reproduce annually, puberty occurs each year. This is unlike many seasonally breeding mammals, in which gonadal recrudescence and regression are nowhere near as dramatic as in birds. In some species, such as sheep and bears, the testes show no obvious annual cycle in size, although spermatogenic activity does decline during the nonbreeding season. The final chapters of the book cover immunology of reproduction, behavioral endocrinology, and environmental control of reproductive rhythms. Again, there is an emphasis on mammals, but there is also much of interest for the ornithologist.

In general the book is well produced and typographical errors are few. Some chapters are a little out of date. For example, the sections on temporal patterns of production of sex steroid hormones are restricted to 2 or 3 species, whereas now there is information for about 15–20 species, including several quite different types of mating system. Also, the chapter on environmental control of reproductive cycles places a heavy emphasis on the role of photoperiod acting either as a "driver" or as a *Zeitgeber* for endogenous rhythms of gonadal development and quiescence, and relatively little discussion of other cues such as nutrition, temperature, and social interactions. To be fair it should also be said that this area of research continues to develop at such a rapid pace that it is difficult to see how any book could remain up to date for more than a few months. Apart from these rather unavoidable shortcomings, I do recommend the book highly. Again, the nontechnical reader and amateur ornithologist will find the book heavy going, but nevertheless this volume will be of value

to all students of the breeding biology of birds.—JOHN C. WINGFIELD.

World inventory of avian skeletal specimens, 1982.—D. Scott Wood, Richard L. Zusi, and Marion Anne Jenkinson. 1982. Norman, Oklahoma, American Ornithologists' Union and Oklahoma Biological Survey. 224 pp. $25.00. **World inventory of avian spirit specimens, 1982.**—D. Scott Wood, Richard L. Zusi, and Marion Anne Jenkinson. 1982. Norman, Oklahoma, American Ornithologists' Union and Oklahoma Biological Survey. 181 pp. $25.00.—The format and organization of these two volumes are similar. Both are oversize, computer-produced, paper-bound volumes. In each a brief introduction and acknowledgments are followed by a list of the museums inventoried, arranged by number of specimens, the addresses and names of the curators, and indexes to orders, families, and subfamilies and to genera and their common synonyms. The bulk of each tome is a taxonomic list of all bird species of the world followed by the number of specimens, *if any*, held by each institution. For the volume on alcohol-preserved specimens all 41 museums inventoried are included in the one table. The table for skeletal specimens lists the 45 largest collections separately. Column 46 summarizes the number of specimens held in 44 smaller collections. The appendix gives the names and addresses for these smaller collections and the species and number of specimens held by each.

In a preliminary report on these inventories (Zusi, Wood, and Jenkinson 1982. Auk 99: 740), the authors presented some revealing analyses. A brief inspection of the final product shows these remarks still hold. One out of every three species of birds of the world is *not* represented by a skeletal specimen in any collection. The situation is equally dismal for spirit specimens. Furthermore, the lists the authors summarize err on the side of inclusiveness, as many museums did not distinguish partial from complete skeletal specimens, and usually gave no consideration to the quality of fluid-preserved specimens, some of which are too desiccated to be of much use. From personal experience I also know that many of the specimens listed come from zoological gardens. Although valuable, zoo birds have limitations. If taken in the wild rarely do they have accurate locality data, and if captive-reared they may have abnormalities that are not found in wild birds.

Most of the species available in anatomical collections are represented by 10 or fewer specimens. This situation makes impossible the study of species variation by sex, geography, or any other way. Most spirit specimens are prepared for later dissection, and rightly so. But dissection usually reduces the value of the specimen for future work. Obviously, even under the ideal situation of adequate series, replacement specimens are needed. Skeletons usually are prepared either as articulated or as disarticulated specimens—they cannot be both. Different preparations have different uses. Paleontological studies, for example, require disarticulated and totally clean bones. The study of bird anatomy and paleontology has increased dramatically during the last few decades. I predict these fields of study will continue to grow. Concurrent investigations require more total specimens.

Over half of all the collections listed, and two-thirds of the major collections, are located in North America. The species for which numerous skeletons are available, over 100 for example, are also strongly biased in favor of the Nearctic. Such regionalization greatly limits research. Shipping specimens is time consuming, expensive, and with some danger as regards probability of safe arrival and return. Furthermore, ideas rarely develop in a vacuum. At least a small variety of specimens is needed where a potential investigator is located in order for that person to develop ideas worth testing. In order to reduce these deficiencies, extensive collections should exist many places in the world.

The limitations I describe are with the anatomical collections and not the inventories, and I suggest that these two volumes will have a greater impact on ornithology than any other book of the 1980s. Certainly they are a boon to investigators, who now can decide on the practicality of proposed anatomical research as well as plan an efficient approach to obtaining the necessary specimens. Prior to the publication of these volumes, information on the availability and location of anatomical specimens was either unavailable or assembled by an individual and a few colleagues.

I expect, and hope, that a great indirect benefit to ornithology will result from the existence of these two books. Persons with the collector's bent will take up the challenge to "fill in the gaps," that is, to improve the holdings of the museums with which they are affiliated. I hope these books will also spark an interest in others to join the collectors' ranks. The preservation of birds found dead need not compromise the environmental principles of anyone. Therefore, I urge bird watchers as well as ornithologists who have yet to add a specimen to any collection to develop the view that a dead bird (especially of a species locally uncommon) that is found and discarded has been wasted. Save dead birds killed by oil spills or other maritime disasters. Save birds killed during migration. In no way does saving these potentially valuable specimens condone human destruction of our environment. The steps necessary to prepare a bird in the field for eventual preparation as a skeleton are easy to learn and simple to perform. Of course, a fresh bird is necessary for preparing a spirit specimen. I ask curators to join in what I hope will be an awakening by developing simple exchange procedures with their colleagues elsewhere

in the world. The birds abundant at your locality often represent families absent from the collection cared for by a colleague.

I close by thanking the authors and their associates. Much hard work went into preparing these lists. Plans have been made for updating the lists when appropriate. I hope that soon it will be necessary to update the 1982 volumes—GLEN E. WOOLFENDEN.

Einführung in die Verhaltensforschung (third edition).—Klaus Immelmann. 1983. Hamburg and Berlin, Paul Parey Verlag. 238 pp. Paper, 28 DM.—It is a general rule that reviewers of books limit their remarks to what the author of the target volume has actually written. *Ad hominum* remarks are declassé, and it is equally unacceptable to criticize views that the author might have (but in fact did not) advanced. Since the author of "Einführung in die Verhaltensforschung" is widely known, liked, admired, and respected by his peers, personal comments could in this case only bring blushes to the subject's cheeks. Immelmann is widely read, literate, thoughtful, forceful but not dogmatic: altogether a charming man and effective teacher. Nor is his text easily faulted for either what it includes or omits. It is tautly organized; it is pithy; it provides a fairly complete overview of the concepts and approaches that characterize modern ethology and indicates their historical harbingers; it even (in this third edition) provides a well-integrated synopsis of what has become known as sociobiology and behavioral ecology.

The book differs strikingly from its German competitors in its absence of dogmatic or devotional adherence to the Lorenzian cult. It is, in short, an excellent introductory text, and would surely find users here had it been written in English [given the availability of several similar texts in English—most akin is J. Gould's "Ethology" (Norton)—it is unlikely that a translator's efforts would be richly repaid].

Yet, having stated my high opinion of the author and of his text, I cannot suppress the wish that another chapter or two had been added. What I find lacking in this and other currently available texts is a sense of perspective. Is ethology but a search for answers to many discrete and only partially interesting queries? Or can our questions themselves be ordered? Are there superordinate questions? What are these, and why do we grant them exalted status?

I find many otherwise capable students unable to respond adequately to the question, Why should I want to know the effects of, for instance, mild food deprivation on sibling-bonding? The answers are too often pragmatically oriented or paraochial; too infrequently do they show evidence of the existence of a larger conceptual scheme to which individual observations are related. Of course, the danger of theoretical treatments is that they seem inevitably to favor a particular view that may so dominate the field as to block all others. The attraction of Konrad Lorenz's early work lay in the structure it provided for disparate facts. The antagonism that Lorenz's approach later provoked was due to slavish adherence to early dicta that precluded open-minded testing of alternative hypotheses.

Immelmann is in many ways unique among German ethologists. Although reared in the Lorenzian tradition, he is able to evaluate alternative views equally well. Thus, his introduction is not simply an apologia for a particular world-view, but truly an introduction to the many varied approaches that characterize modern ethology. But in developing his even-handedness, Immelmann has perhaps gone too far in abandoning the search for an integrative model. Despite my admonition about criticizing what was not said, my wish to hear this author articulate his views on ethology's objectives are too strong to be suppressed. Let this critique, then, be a plea for a fourth edition, with an additional chapter on where we go from here.—PETER KLOPFER.

Comparative ecology of Peruvian grebes—A study of the mechanisms of evolution of ecological isolation.—Jon Fjeldså. 1981. Vidensk. Mddr. dansk naturh. Foren. 143:125-249.—Fjeldå describes this monograph as a "detailed account of the biology of the grebes inhabiting the lakes of the Andean Mountains," and I concur with this assessment. Comparative analyses are presented on the White-tufted Grebe (*Rollandia volland*), Titicaca Flightless Grebe (*R. microptera*), Pied-billed Grebe (*Podilymbus podiceps*), Least Grebe (*Tachybaptus dominicus*), Great Grebe (*Podiceps major*), Silver Grebe (*P. occipitalis*), and Taczanowski's Grebe (*P. taczanowskii*). Chapter 1 is a presentation of species, including phylogenetic relationships, morphology, phenotypic characteristics, behavior, habitat, and natural history. Some of these presentations are somewhat superficial and limited due to the lack of published data on the species. Chapter 2 is a description of the study area in the Junin and Titicaca basins of the high Andes. Chapter 3 includes subsections on "The structure of Andean water-bird communities" (omitting 27 rare species) and "Ecological relations of grebes to other birds." Most of the first subsection is based on a chi-square test of the spatial relationships among 35 species and review of previously published work by Fjeldså. The second subsection is theoretical, regarding possible interspecific competition among grebes, Andean Gulls (*Larus* spp.), and cormorants (*Phalacrocorox olivaceus*).

Chapter 4 is a long (56 pages) and detailed comparative analysis of niche utilization. This chapter has subsections on "Seasonal movements," "Dispersal patterns," "Habitat selection," "Daily activity rhythm," "Feeding tactics," "Food selection," and "Niche overlap." Information on seasonal movements was limited. The subsection on Dispersal Pat-

terns was restricted to spatial relationships, primarily nearest-neighbor analysis of nest spacing, intraspecific spatial patterns, and interspecific spatial relationships. The subsection *does not* include data on movement out of or among geographic areas. Thus, "dispersion" seems to be a better term, and the author used "dispersion" in Figs. 9 and 10. The presentations of several species (e.g. Least Grebe, Great Grebe, Titicata Flightless Grebe) in this subsection were brief. The subsection on Habitat Selection includes a statistical and descriptive analysis of many environmental factors associated with grebe observations. The Habitat Selection subsection is relatively detailed and represents a major strength of the monograph. The Food Selection subsection includes a species-specific description of stomach contents and food availability. These data are compared to reflect "selection" by the birds. Diet diversity and food overlap among species are also discussed. The last subsection is a surprisingly succinct presentation of overall niche overlap. I suspect this is due to the existing gaps in ecological knowledge of the species.

Chapter 5 is a 20-page presentation of "The anatomical basis for segregation by food." The chapter is divided into 2 subsections: the first deals with "Food selection and functional anatomy of the feeding apparatus." Fjeldså draws the reader's attention to the "theory of character displacement" in the Introduction of the monograph. Because of this, I was disappointed by the character-displacement discussion. I found this information speculative, and much more data are needed to address the topic properly. The subsection presents an interesting, thorough analysis and comparison of bill morphology and prey selection. The second subsection is a detailed, thorough, and standard comparison of "Functional anatomy of the feeding apparatus."

Chapter 6, entitled "Discussion of evolution of ecological isolation," is the chapter most germane to the manuscript title. This chapter is primarily a theoretical and conjectural discussion of evolution of ecological segregation, character displacement, and sexual dimorphism. I feel the chapter would have been improved by several graphic presentations of hypothesized explanations. The last chapter is a comparison of ecotopes and pathways for resource partitioning.

The monograph is well-written and quite readable. There are a handful of typographical and grammatical errors, but they are not distracting. The manuscript is certainly a major contribution to the literature on grebes, and is recommended to university and museum libraries and anyone interested in a detailed analysis of the phylogenetic and ecological relationships of closely related avian species.—JOHN T. RATTI.

Evolution and genetics of life histories.—Hugh Dingle and Joseph P. Hegmann (Eds.). 1982. New York, Springer-Verlag. xii + 250 pp. ISBN 90702-5. $33.80.—Following the publication of several thoughtful review papers a few years ago, studies of life history and demography proliferated. During this proliferation, quantitative genetics, in theory and practice, became an integral part of the discipline. The contribution that quantitative genetics has made to the understanding of life-history variation is evident in this book, the proceedings of a symposium held in October of 1980. The 12 essays included here, plus the transcription of the lively discussion section, also focus attention of what genetical studies have not contributed to our understanding.

The goals of the symposium, as stated by the editors, appear to have been met or surpassed by the work of the contributors. Most of the papers explore the genetic architecture of demographic variables such as age at first reproduction, fecundity schedules, survival probabilities, and reproductive allotment (among others). "Genetic architecture" is the pattern of additive genetic variance (and, ultimately, heritability in the narrow sense) for individual traits, and the extent to which the phenotypic correlations among several traits are based on genetic correlations. Several papers investigate how that architecture can vary with environmental conditions, and one paper investigates how one genotype can express a host of widely disparate phenotypic patterns of survival and fecundity as the result of exposure to different environmental conditions. Two papers investigate how variation in life-history traits is associated with discrete genetic polymorphisms (parthenogenetic reproduction in one case and gender in the other).

Although any such collection of papers varies in quality of writing and content, this collection displays less variation than most. Different readers may disagree with the nuances of interpretation or the extrapolatory leaps of individual authors, but on the whole the papers are informative, provocative, and easily digested. A few highlights deserve special mention. Templeton explodes a number of myths surrounding the evolution of parthenogenesis, using a review of theoretical work and presenting empirical results from his work on *Drosophila*. Both Templeton and Schultz demonstrate that some parthenogenetic animal species do not appear to lack genetic variability. The papers by Dingle et al. and Istock attempt to connect microevolutionary processes to macroevolutionary patterns, and the essay by Meagher and Antonovics includes a lucid discussion of two-sex population projection matrices. The editors' Introduction, on why life-history traits are worth studying, is a concise yet elegant statement of where evolutionary biology and ecology merge.

One goal of the symposium seemed unmet: to consider the ecological background for genetic variability. Only one paper (Bradley) concentrated explicitly and empirically on the ecological milieu. For some

authors, a "selective force" remains either an abstract construct or an intuitively reasonable potential force of mortality. In fairness to the authors, this aspect of the study of life histories remains the most formidable and appears likely to be the limiting factor in the further development of the field.

None of the papers in this volume is concerned with birds. Indeed, only one paper is concerned with vertebrates. Nevertheless, this volume belongs on the shelf of every college, university, or museum library, because its subject matter is really the fundamental phenotype on which natural selection acts: the selective value of any genetically based trait depends upon how that trait influences the schedule of births and deaths of the phenotypes that carry the trait. For those investigators who work directly with demographic problems, the book is an essential addition to their library. For the ornithologist with only a passing interest in life-history variation, this book is not a justifiable purchase. But for all ornithologists, as well as all ichthyologists, herpetologists, etc., the book should be "required perusing," with some papers such as Templeton's as "required reading," if they are to keep abreast of both the advances and limitations of a rapidly growing and important field of inquiry.—JOSEPH TRAVIS.

Les sociétés animales.—Rémy Chauvin. 1982. Paris, Presses Universitaires de France. Collection "Le Biologiste." 290 pp., 38 figures.—Rémy Chauvin is well-known for his previous books, which include "Le monde des fourmis" (Plon, Paris, 1969) and "L'éthologie" (Presses Universitaires de France, Paris, 1975), and for his research on social insects. In this volume, part of a series of textbooks on biological subjects intended mostly for students but also for research workers who want to keep up with disciplines outside their specialty, Chauvin describes some of the fascinating aspects of the social behavior of animals.

The author considers that progress in the understanding of animal societies has been made recently, chiefly as a result of the study of pheromones in insects and of primate group behavior. This explains his division of the book into two parts: the social life of insects (mostly the honey bees and several species of ants), and the social behavior of mammals (mostly primates but also rodents). The last two chapters of the book deal with sociobiology and with behavioral problems in humans, respectively.

Chauvin's book is of limited use for ornithologists because he mentions only a few of the numerous studies on the social behavior of birds. Yet, as an ornithologist I found the lack of ornithological examples to be of interest because I was made to think about the social behavior of organisms that are for the most part so different from feathered ones. I thus was forced to broaden my vision.

I suspect, however, that Chauvin is not very familiar either with birds or with the ornithological literature, because the few examples he cites are not necessarily well presented, or else because the bird names are incorrect. Thus, *Lagopus lagopus scoticus* (the Red Grouse) is called Lagopède d'Ecosse in French ornithological books, but "coq de bruyère écossais" by Chauvin (p. 122). In French, "Coq de bruyère" is the name given either to the Black Grouse [*Tetrao tetrix* (Petit Coq . . .)] or the Capercaillie [*Tetrao urogallus* (Grand Coq . . .)]. This point about vernacular names is not as trivial as it may seem. Throughout the book, I found Chauvin to be somewhat careless in his treatment of the names of the animals he deals with (far too often he uses vernacular names instead of Latin names, and at times the reader cannot know what species he is writing about).

Other negative aspects of the book are the cavalier treatment of bibliographic references (even though the text ends with a respectable bibliography, many authors cited in the text are not mentioned in the list of references), the absence of any index, and the numerous typos. Worse than these criticisms of detail, however, is Chauvin's attack on what he calls "sociobiologie." Without bothering to describe E. O. Wilson's book to the reader, Chauvin launches into a diatribe against neodarwinism and sociobiology (Chapter XIII). As a critique of either neodarwinism or sociobiology, this chapter is quite biased. A reader who is unfamiliar with E. O. Wilson's writings on sociobiology would totally misunderstand sociobiology (*sensu* Wilson) after reading Chauvin, and furthermore might be inclined not to try to read Wilson's book.

The positive aspects of "Les sociétés animales" are that it is easy to read even though it is tightly packed with information and covers a lot of ground, and that Chauvin has made a serious effort to cover the international literature on the topics he selected for discussion.—FRANÇOIS VUILLEUMIER.

Auf Darwin's Spuren.—Claus Koenig. 1983. Hamburg, Paul Parey. 224 pp. ISBN 3-490-18518-8. Price not given.—I was raised in a tradition that dictates the bringing of a small gift to one's host. Merely bringing any gift would not do, however; the gift had to be appropriate. Flowers for a sufferer from hay fever are no greater a pleasure than is a cabernet to a guzzler of Pabst. The rule applies to books as well. A paperback thriller that will be a delight to a host who will soon be airborne can be a positive embarrassment to he who must display it on a shelf.

No one, of course, will be embarrassed to display C. Koenig's beautiful book, whose illustrations, typeface, format, and paper make the volume a joy to behold. But, the issue of appropriateness still persists. Why would an English-speaking audience want this German-language travelogue? Aside from valu-

able practice in reading German, what does it offer that is not to be found in any number of English-language volumes on the same theme? Retracing Darwin's footsteps, literally or figuratively, is not exactly a novel sport for American or English zoologists—as witnessed by volumes such as that by Alan Morehead. Nor can it be honestly claimed that Koenig's work is in any way significantly different from others, except by being in German.

To German readers, on the other hand, especially those who find other languages a strain, this volume will be a welcome gift. Aside from its elegance, and the competent treatment of biological themes, the volume also fills a distinct gap in German biological literature. It is a curious fact that the furor unloosed by the publication of Darwin's opus in England, France, and the United States, and the diatribes of Wilberforce, Cuvier, and Agassiz, found little resonance in Germany. Certainly evolutionary concepts were as common in nineteenth-century Germany as elsewhere. Goethe and Haeckel, for instance, were widely read. But the evidence of widespread interest in Darwinism is lacking. "Social Darwinism," the application—some would say misapplication—of competition theory to humankind, on the other hand, was an instant success. The National Socialists (Nazis) of twentieth-century Germany are a belated fruit of that mutant seed sowed by Spencer and his followers. At all events, "Social Darwinism" aside, biology curricula and libraries in Germany have been relatively (and strikingly) deficient in Darwiniana.

Lay readers of natural history tomes who desire something more than pretty pictures of the Pampas will relish this volume. It is hardly suited to the more rigorous needs of professional biologists, but this is not a criticism. The professional can still enjoy the travelogue.—PETER H. KLOPFER.

Behavioral energetics: the cost of survival in vertebrates.—Wayne P. Aspey and Sheldon I. Lustick (Eds.). 1983. Columbus, Ohio, Ohio State University Press. 300 pp., figures, tables. $27.50 (cloth).—The nine papers (chapters) in this volume were presented in a Biosciences Colloquium at Ohio State University in 1980. "Orientational strategies in birds: A tribute to W. T. Keeton" by Melvin L. Kreithen briefly describes migratory flight directed toward the rotational axis of star movement under a clear night sky and along paths of the prevailing winds. The paper then reviews known and possible navigational cues used by homing pigeons. In the laboratory, pigeons are sensitive to ultraviolet light wavelengths, polarized light, small changes in atmospheric pressure, and infrasounds; these environmental variables may be useful for spatial orientation. The paper concludes that efficient and redundant strategies of navigation among birds permit them to migrate and find home with a minimum of energy consumption; this is the only reference in the paper to the energetics theme of the book.

"Life energetics of sockeye salmon, *Oncorhynchus nerka*" by John R. Brett describes migration, feeding behavior, growth, and energy budgets of Babine Lake (British Columbia) sockeye salmon for different life stages, fry to adult. A detailed chronological energetics (33 time periods during 3.3 yr) of growth and metabolism clearly shows that in the last 4 months of ocean life the fish consumes as much food as the sum of all previous months, and that it takes 16,000 kcal of food to produce a 4,000-kcal salmon. This paper is an excellent synthesis of years of field and laboratory studies on the sockeye salmon.

"Costs of reproduction in baboons (*Papio cynocyphalus*)" by Jeanne Altmann describes an energy-based model for computing the percent of time that a female must spend feeding to maintain her body weight during pregnancy and during lactation. The values computed are compared with field observations of time spent feeding. The modeling shows that a mother baboon could not provide all caloric requirements for herself and her infant beyond 6–8 months of infant age. The energy model is very simplistic and "inevitably somewhat unrealistic." The author says that the limited available input data did not warrant further refinement of the model. Ways in which a primate infant might reduce its mother's future reproductive success are presented.

"Reproductive behavior of subadult elephant seals: The cost of breeding" by Cathleen R. Cox clearly describes the factors causing the generally low reproductive success of subadult males and the breeding strategies of the few successful ones. Generally, as males increase in age their reproductive efforts increase and the timing of their reproductive efforts improves. Rate of male mortality is used as a measure of the high cost of breeding, rather than rate of energy expenditure.

In the paper "Costs of aggression in trout and pupfish," C. Robert Feldmeth has computed the energy cost of aggressive activities associated with territorial defense from a time-budget analysis of both species in their natural habitat and the metabolic rates of swimming and aggressive movements measured in the laboratory. Dominant trout defend a preferred stream position and dominant male pupfish defend a breeding territory. The benefits of territorial defense for both species are discussed. The cost:benefit ratio is much more favorable for the dominant individuals of both species because they apparently do not expend as much energy as do their nonterritorial counterparts in the social and reproductive hierarchy.

In "Amphibians and reptiles as low-energy systems," F. Harvey Pough describes modifications of life style and life history in ectothermic tetrapods that are specializations for especially low energy flow,

and he delineates fundamental differences between ectothermic and endothermic tetrapods. In contrast to endotherms, ectotherms rely upon anaerobic metabolism for more than half of the energy required for high levels of activity. Their resting metabolic rate is an order of magnitude lower and they can suspend activity for days or longer. They also can exploit an abundant food resource for a brief period and then await its renewal in an alert but energetically inexpensive condition. Pough shows that correlations between dietary habits and energy requirements are not as clear in ectotherms as in endotherms; he suggests several problems of scaling that confuse the analysis.

The paper describes ontogenetic changes in physiological performance of amphibians and reptiles that are consonant with changes in their environment and behavior. After examining general patterns of foraging activities among amphibians and reptiles, two generalizations are presented, based on studies of lizards. Pough analyzes the relationship between energy requirements and body form and size in ectotherms and endotherms. He points out that the roles of small ectotherms and endotherms in the ecosystem are quantitatively different. This paper is a good synthesis of literature (109 references) that addresses several interesting questions about the ecological energetics of ectothermic tetrapods.

"Cost-benefit analysis of temperature and food resource use: A synthesis with examples from the fishes" by Larry B. Crowder and John J. Magnuson discusses elements of optimal foraging theory and behavioral thermoregulation. Fishes are expected to allocate time for food and temperature resource use in heterothermal environments in ways that maximize growth (and reproduction). Net rate of energy gain convertible to growth is used as a cost-benefit function for fish. A bioenergetics model of fish is used to examine optimum food ration and temperature conditions; fish body size, activity level, and food quality are held constant in the simulations. Four field studies of fish distribution are examined to assess whether or not natural selection may have shaped the behavior of these fishes to select habitats in which they can maximize net energy gain. The authors conclude that fish distribution with respect to temperature and food often makes sense bioenergetically (a few exceptions are cited) and that fishes do not strictly follow the predictions of behavioral thermoregulation or optimal foraging alone. They suggest other variables that could be included in future bioenergetic models.

The paper "Economics of foraging strategies in sunbirds and hummingbirds" by Larry L. Wolf and F. Reed Hainsworth examines the mechanisms that might be important in organizing feeding behavior in birds that specialize on nectar as their principal energy source. They focus on the identification of possible decision points that should occur during feeding behavior and the types of decisions that probably are made. Laboratory choice studies show that hummingbirds are influenced more by sugar volume intake rate than by total sugar volume or flower corolla length. Hummingbirds rewarded by a sufficient sugar volume rate are more likely to continue feeding at another flower of the same color. The rate of learning the task does not appear to vary with training color. In a Colorado field study, Broad-winged Hummingbirds (*Selasphorus platycercus*) apparently foraged randomly within their total territory. The authors discuss the possible inputs that control amount consumed on a foraging bout and the frequency of bouts. Under short-term conditions hummingbirds may not always adjust meal size or frequency to maximize rate of net energy gain, but over longer times important negative feedback components work to regulate closely total energy stores within and among days. The authors discuss four models of control observed among physiological systems and conclude that daily energy regulation shows a proportional control feature.

"Cost-benefit of thermoregulation in birds" by Sheldon I. Lustick focuses on the physiological, physical, and behavioral responses of Herring Gulls (*Larus argentatus*), Starlings (*Sturnus vulgaris*), blackbirds (*Molothrus alter, Agelaius phoeniceus, Quiscalus quiscula*), and Carolina Chickadees (*Parus carolinensis*) to thermally stressful environments. In Herring Gulls plumage color (and absorptivity to solar radiation) varies from brown (75% absorptivity) of juveniles to gray (50% absorptivity) and white (10% absorptivity) of bicolored adults. On warm sunny afternoons adult bicolored gulls adjust their posture and orientation to minimize their exposed surface area and absorbed solar radiation. Why are white birds found in the Arctic and black birds in the desert in spite of the limitations of these plumage colors for thermoregulation? Lustick believes that behavioral adjustments remove the selective pressure to evolve the appropriate plumage for thermoregulation. The paper describes the microclimate in summer and winter of avian roost sites in deciduous and coniferous woods. Heat loss from blackbirds and starlings under a range of forest canopy covers, wind velocities, and for clear and overcast skies is computed. Seasonal changes of the roost-site location are directed toward reducing heat loss. Finally, Lustick presents convincing evidence that metabolic data collected in the laboratory can help us understand the foraging strategies of the Carolina Chickadee in winter.

This volume has several good chapters that will be of interest to vertebrate ecologists. The content of some chapters is better described by the subtitle of the book, "the cost of survival in vertebrates," than by the main title. Discussions (questions and answers) that followed the presentation of 7 of the 9 papers at the colloquium are included in the book. I recommend the acquisition of this book for college libraries and for individuals with comprehensive holdings in vertebrate biology.—JAMES A. GESSAMAN.

ALSO RECEIVED

Birds new to Britain and Ireland.—J. T. R. Sharrock and P. J. Grant (Eds.). 1982. Calton, T. & A. D. Poyser. 263 pp., 81 photographs. ISBN 0-85661-033-X. No price given.—This volume is a compilation of 93 accounts of first sightings originally published in *British Birds* between 1947 and 1982. In addition, the editors have provided comments on subsequent occurrences, current status, and identification of the 83 species reported on in the book. A small (3.3 × 5.6 cm) world map is provided showing the generalized distribution of each species.

Details associated with each of the sightings range in length from about one page to over six pages. Much of each entry is devoted to the trials and tribulations associated with locating and identifying the species in question. Information also is provided on morphology and, in some cases, behavior useful in identification. Editorial comments at the end of some entries are intended to assist observers in recognizing these species during future encounters. An editors' summary places all of the sightings in perspective by year, month of the year, and geographical location in Britain and Ireland.

The frequently expounded criticisms associated with use of sight records could be used to question the value of this compilation. Such reservations are reinforced somewhat by the descriptions associated with two reported sightings of Ring-billed Gulls (*Larus delawarensis*). If not for the ring placed on the bill of the bird sketched in Figure 13, I would not consider it distinguishable from some other gulls and, even with the ring, I would never consider it representative of a bird in "first summer" plumage (i.e. 1-yr-old). Most ring-bills in this age class show most of the characters emphasized in the comparative sketch of *L. canus* (Fig. 13)—faded primaries, nearly white and worn secondaries, and varying amounts of dark flecking on white body feathers. In most 1-yr-old ring-bills, the black extends very close to the bill tip, thereby lessening the impression of the ring prevalent in older individuals. The bird shown in Figure 13 more closely resembles (except for crown and tail markings) a 2-yr-old ring-bill. As some ring-bills in this age class retain crown and nape streaking, I could accept this as being within the range of second-year plumage characteristics. Such is not the case, however, with the tail markings shown, which are clearly indicative of the younger age class. Typically the band on 2-yr-old ring-bills is narrower and subterminal. Description of the adult-plumaged ring-bill at Blackpill seems more clearcut, but two problems exist if the descriptive information provided is to assist others in identifying this species. First, I question the statement that the gray of the mantle of ring-bills is paler than that of Herring Gulls (*L. argentatus*). This certainly is not the case when plumages of sympatric ring-bills and Herring Gulls are compared, although this difference may hold in Britain. Second, there is far more variability in the primary spotting than indicated by the authors.

Aside from this criticism, I found the volume interesting and its greatest contribution may be placement of these records in one place for future reference about vagrants. In addition, it was rewarding to be reminded of the enthusiasm and dedication of birdwatchers in this part of the world.—W.E.S.

The birdwatcher's activity book.—Donald S. Heintzelman. 1983. Harrisburg, Pennsylvania, Stackpole Books. 250 pp., 64 black-and-white photographs, 8 illustrations. Paper, $11.95.—The purpose of this book is to "advance the cause of bird watching, study, conservation, and related activities" (p. 7). It discusses the basics of bird watching and a sample of activities, including studying bird behavior, collecting detailed information on the bird life of local areas, conducting projects that promote conservation of various groups of species, experimenting with bird feeding, collecting bird-related items such as stamps and decoys, and stimulating public interest and appreciation in birds. The book presents a rapid succession of examples and is easy to read and comprehend.

The topics included are discussed in varying degrees of thoughtfulness and completeness. Compensation for less detail is made by referencing additional reading materials at the end of each chapter. Greatest detail is reserved for activities involving diurnal raptors. Subjects discussed in this chapter range from state and national legislation to an outline for a raptor education course. General lack of detail is evident from the beginning of the book. The first chapter, which is intended to be a review of "all the bird-watching basics" (p. 9), supplies little information that cannot be gained from most popular field guides. A lack of detailed thought in developing the book is evident, for example, in the various chapters that describe field activities. The birdwatcher is warned late in the book (Chapter 6) of the consequences of close observations of eagles. Similar concern, however, should have been initiated in the second chapter, where enjoying bird behavior is advanced, including collecting data on nesting birds.

Few of the photographs supplement information in the text; most relate only generally to the topic of the chapter. The best photographs are those that provide shock value, including one showing rows of dead hawks that had been shot during migration. The text also contains unneccesary bulk, such as long lists of names with little discussion of their relevance.

This book should be considered of interest only to new birdwatchers who do not have access to other similar books. The purpose of this book is laudable, and a wide range of interesting material is provided. However, its content contains subjects that are, generally, superficially discussed and add little information to that which is available in numerous books and through various conservation and environmental organizations.—MICHAEL J. SWEET.

The breeding birds of Europe. A photographic handbook.—Manfred Pforr and Alfred Limbrunner. **Volume 1. Divers to auks.** 1981. ISBN 0-88072-026-3. **Volume 2. Sandgrouse to crows.** 1982. ISBN 0-88072-027-1. London, Croom Helm (distributed in North America by Tanager Books, Inc.). 327 pp.; 394 pp., many color photographs, black-and-white drawings. $48.00.—This two-volume set is a collection of color photographs of most of the breeding birds of Europe. Each of the species receives a two-page treatment, with a large photograph occupying one page while the second contains two or three smaller photographs (generally of chicks and of eggs) and text information. The text is brief, describing the general distribution and current status of the species, breeding biology, and seasonal movements. A table provides condensed information on body and wing size, voice (a phonetic description), breeding period, clutch size, egg characteristics, incubation period, and fledging period. A small map shows the breeding distribution in Europe. In all, some 330 species are covered in the two volumes.

The value of these volumes is in the photographs, which are generally quite good and often excellent. It is especially valuable to have available photographs of chicks (although for the passerines there is a certain repetitiveness to photograph after photograph of a nest full of gaping mouths). A quick check of the maps shows them generally to be quite accurate, although the small size constrains detail. The books are not designed to be identification guides but, as the title suggests, a compilation of photographs accompanied by a limited amount of supplementary information. They're really quite nice books.—J.A.W.

Finding birds in the national capital area.—Claudia Wilds. 1983. Washington, D.C. xii + 215 pp. ISBN 0-87474-959-X. Paper, $10.95.—This handy guide is an outgrowth of a series of articles that appeared in *Audubon Naturalist News* and of the author's interaction with birders in the vicinity of Washington, D.C. After a brief introduction to the birds of the region and the region itself, about 32 pages are devoted to a species list for the area (some 340 species have been recorded) and a sentence or two indicating when and where to look for each species. The next 150 pages are devoted to the main purpose of the book—directing the reader to 160 productive birding locations. The organization is logical and easy to follow, being arranged into sections emphasizing the physiographic provinces of the region and metropolitan and suburban Washington. In turn, the sections are divided into two to ten chapters, with each chapter devoted to a specific part of the region.

The area covered is sizeable (about 385 × 425 km), extending from the Allegheny Plateau, across the ridges and valleys of western Maryland and Virginia, along the Piedmont to the coastal plain, Chesapeake Bay, Delmarva Peninsula, and the Atlantic coast. The location of each area covered by a chapter is shown on two two-page maps at the end of the book, one of the National Capital area and the other an enlargement of the District of Columbia and Arlington County. Persons unfamiliar with the D.C. area will find these maps particularly useful during trip planning. Larger scale local maps clearly show the routes and areas discussed in each chapter. The maps are without confusing detail, yet seem to include the information necessary for reaching each goal.

The remainder of the book includes two chapters (Pelagic Trips and Finding Your Own Owls) and three short appendices (Natural History and Ornithological Societies, Useful Publications, and Cooperative Birding Activities) and an index. Content of the appendices is rather provincial. By adding only a few more lines, national organizations and journals (such as The American Ornithologists' Union and *The Auk*) could have been included.

Overall, the book is clearly written, seemingly free of errors, and securely bound. Persons visiting this part of the United States will find this little book very handy.—W.E.S.

Birds of the world.—Oliver L. Austin, Jr., with illustrations by Arthur Singer. 1983. Racine, Wisconsin, Western Publishing Co. 317 pp., 300 color illustrations, colored end papers showing eggs and young, many colored range maps. ISBN 0-307-46645-0. $24.95.—This is a reprinting of the edition of this handsome work that first appeared in 1961, and which has been unavailable for some time. It is good to have it available once again, for it provides a visually stunning introduction to the diversity of the world's birds, and Austin's accompanying text contains a great deal of information. Unfortunately, the text has not been updated at all, and thus it contains no reference to the many advances in our knowledge of the behavior, ecology, distribution, or systematics of the world's birds that have been made over the past two decades. Further, some of the errors that were contained in the first edition (see Rand, A. L. 1962. Auk 79: 288) linger on. As a consequence, this reissue of this book must be viewed with considerable caution. For an outdated but beautiful bird book, it's a bargain.—J.A.W.