

## REVIEWS

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### **The Shelduck: A study in behavioural ecology.—**

I. J. Patterson. 1982. Cambridge, Cambridge University Press. x + 276 pp., 10 black-and-white drawings, 101 figures, 68 tables. \$49.50.—Traditionally, ethologists have emphasized studies of causation, ontogeny, evolution, and physiological bases of behavior, often without concern for ecological variables (e.g. food supply) or relationships to population density. Similarly, population ecologists have emphasized numerical values in relation to ecological variables without data on variability of individuals or social behavior. Recent attempts to integrate ethology, ecology, and population biology with the theory of natural selection have produced a new field that is now commonly termed Behavioral Ecology (e.g. J. R. Krebs and N. D. Davies (Eds.) 1978. Behavioral ecology. Oxford, Blackwell Scientific Publications). This integration provides a more full understanding of an animal's behavior based upon knowledge of costs and benefits in terms of fitness of alternative modes of action and organization in relation to population density and ecological variables. Testing of ideas in Behavioral Ecology will be assisted by detailed field studies using individually identifiable animals.

The goal of Patterson's book is to use data collected in a series of individual studies by himself and several colleagues, dating back to 1960, on the ecology and behavior of the Common Shelduck (*Tadorna tadorna*) to address several issues of behavioral ecology, especially the effects of social behavior on the limitation of population size. Shelducks were considered excellent subjects for study because of their relatively large size, conspicuous appearance, varied social behavior, and existence in small and accessible local populations in the estuaries of Great Britain.

Following a brief (Chapter 1: 4 pp.) introduction of the subject of behavioral ecology, the author proceeds in Chapter 2 with a treatment of the taxonomic position and description of Shelducks, which exhibit many goose-like characteristics (e.g. lack of conspicuous sexual dimorphism, prolonged parental care, persistent pair bonds) combined with morphological and molt features that are duck-like. The comparisons end there, however, as there is virtually no further reference to other waterfowl (or pertinent literature) thereafter. Included in the description is a characterization of body-weight changes from mid-winter through the breeding season. These data, however, are lumped averages of weights of birds captured in each month. Energy is the currency used

for explaining many of the variables in behavior and, indeed, is the main theme related to population limitation that recurs in discussions throughout the book. While this certainly seems a proper emphasis, the lack of precise data on body weight in terms of protein and lipids and the confounding variables related to whole body weights (e.g. trap bias, gut contents, and prolonged breeding season so that individuals are at different stages of the reproductive cycle) result in a large amount of logical speculation and conclusions without critical data. Strengths of the treatment are data on birds of known age and data on food supply and use. Chapter 2 concludes with a rather lengthy treatment of world distribution of Shelducks and the molt migration (pp. 17-39). Much of this struck me as distracting detail, given the main theme and strength of the book.

Thereafter, the book proceeds in chapter form through the annual cycle. Chapter 3 treats gregariousness in the winter flock. This section contains some excellent data on arrival of Shelducks on breeding estuaries in relation to age and sex (oldest and males first, 4+ yr olds preceding 3-yr olds, which precede 2-yr olds, which precede yearlings), the common re-pairing of previously mated birds, spatial organization, the preponderance of feeding activity in winter (February—63% of time), and the replacement of this activity with agonistic interactions and other behaviors as the breeding season approaches. Brief descriptions of displays are followed by much detail on dominance (most of which was previously published in journal format, but is needed here for the integrity of the book). Clear dominance hierarchies were evident that were related especially to pair-bonding, suggesting that females might stimulate aggression—or prefer the more dominant males. Interestingly, dominance did not relate consistently to advantage in obtaining territories, nor to success in rearing broods, nor to survival. Faced with these results, Patterson suggests that maintenance of pair-bonds may have been the main selection force for dominant, aggressive behavior, while leaving open the possibility that breeding population size might be regulated by dominance even though this was only weakly, if at all, supported by the evidence.

Chapter 4 deals with the territory. Much interesting information is presented here, especially because densities of food items were measured. Surviving pairs tended to occupy the same territory (80%), while males with new mates tended to follow females to

their old territories. Territory size did not decrease with an increase in food supply and ducks seemed to settle only where suitable food was present. Territories are of further interest in Shelducks because they do not contain the nest site nor are they the site of pair formation or brood rearing. They are, instead, an area in which the female can feed intensely without being disturbed by conspecifics (71% of her time during the pre-egg-laying phase and 80–90% during incubation recesses). While these data are convincing, it certainly would be nice to have more information on the role of stored reserves versus daily intake to meet the energy demands of reproduction. Even though Patterson concludes that territorial behavior has been selected for because it provides an undisturbed feeding area for the female, he admits that territories may function in limiting density in local populations, but notes that this aspect needs more quantitative study.

Chapter 5 details Shelduck behavior associated with searching for nest sites, which were usually burrows in sand dunes away from the estuarine mud-flat territories. Shelducks are again unusual in that they are semi-gregarious during this activity and are attracted to other birds on the ground in the nesting area just a relatively short distance from the territory, in which they are highly defensive (although agonism is evident when two or more pairs come together in the nesting area, they clearly are attracted to each other). Discussion of costs and benefits of this behavior tends to be teleologically phrased and indicates the need for more study (antipredator advantages related to vigilance and/or learning of the location of "good" nest sites). Because Shelduck nest sites were so difficult to find and the birds tended to desert easily, this aspect of the study was frustratingly difficult and, correspondingly, weak in comparison to other data.

Egg laying and incubation are treated in Chapter 6. Clutches were initiated over an extended period (mid-April to mid-June) and there was no evidence of renesting. Again, teleological phrasing is evident (e.g. p. 142, "... to make sure they were not observed at the nest by predators or other Shelducks"; p. 146, "... to indicate to the female that the coast is clear for her to emerge"). Parasitic egg-laying confounds the data on clutch size and nest success (common in hole-nesting ducks). Because of the difficulties described above relating to finding nests and human-caused desertion in addition to parasitic laying, this section is relatively weak (more frustrating to the author than to the reader, I feel sure).

Extended brood care by both parents is described in much detail in Chapter 7, which reads like a long journal paper and is somewhat distracting to the main theme of the book. Interestingly, and perhaps surprisingly, ducklings were not taken to the territory, but instead they congregated, and brood-mixing (creches) was common. Violent encounters among adult pairs (male fighting male and female fighting

female) probably promoted brood-mixing as well as the tendency for young to move away from adults and follow other pairs. There was no consistency among years on which adults accompanied creches other than that they were themselves birds which had hatched young. The significance of brood-mixing still needs study. Chapter 8 continues the discussion with respect to duckling survival. Approximately 35% of the young fledged, but this was highly variable (9–66%). Most losses occurred in the first week of life and were inversely related to density (although not consistently so). There was some evidence that a lower proportion of ducklings in mixed broods survived than ducklings in single broods and that lack of brooding during inclement weather was a contributing factor. A discussion of costs and benefits of single versus mixed broods in terms of risk to predation, interaction with weather, and freedom for adults to feed and migrate points out possibilities deserving of research but does not answer the questions in a satisfactory manner. Of interest here were data revealing that "donor" parents were dominant over "recipients" in 12 of 14 cases. There were no differences in survival of adults that hatched broods, fledged broods, or did not hatch broods. After ducklings fledged, adults departed on the molt migration, with males often leaving first.

The annual cycle is brought full circle with a discussion of recruitment and the nonterritorial flock in Chapter 9. This section highlights implications for the study of gene flow and the complexity of social organization that can only be observed in wild populations with marked individuals. Although there was unity in the sex ratio in the population, only 26% of returning yearlings were male. Acquisition of territories by age classes was as follows: none as yearlings,  $\frac{1}{2}$  at 2 yr of age,  $\frac{3}{4}$  at 3 yr of age, and all that were going to have territories did so by age 4; approximately 20% of older birds were not territorial in any given year. From there the discussion of emigration goes on in much detail; this treatment is indirect and relatively weak, although I am sympathetic with the author's desire to place his observations on this important and difficult-to-study aspect of life history on record.

Patterson's hypothesis is that recruitment was limited by food, which was assessed by Shelducks as they returned to original breeding areas or moved through other estuaries. This is supported by observations that represent one of the strengths of the study, as flock distribution could be manipulated by the provisioning of food by the investigator. Food supplies are a cornerstone of many theories of population regulation and spacing behavior but there are few quantitative tests of the ideas. Briefly, the results of the feeding experiment were as follows. Food (soaked wheat) was supplied on a portion of the mudflat in 2 yr in May after the flock had stabilized in numbers; the number of flock birds increased from

40 to 58% within a day or two of food being provided. The proportion of the flock in the section of the estuary where food was supplied rose from 8 to 74%. During the control years, flock size decreased from 1 to 16% during the comparable phenological time period.

The final chapter (10) attempts to integrate the available information by coming to a conclusion on factors limiting population size. Shelduck numbers in Great Britain have been increasing for 20 yr for reasons that are not entirely clear. Patterson suggests that nutrient enrichment of estuaries and more effective protection may have been influential. Data on survival rates were based on meager samples and analyzed by old-fashioned methods (Haldane's maximum-likelihood for incomplete data, following the procedure provided in Murton, R. K. 1966. *The Statistician* 16: 183). Mean annual survival was 69% and 62% for birds banded as adults and ducklings, respectively. Of more interest to me were data on survival (return) based on observations of the color-marked individuals. Using this method, the mean annual return rate was 78%, and territorial birds exhibited an 89% mean annual return rate. These data illustrate nicely the value of marked individuals and how survival (and immigration) was related to social status. Patterson suggests that banded Shelducks that were likely to be recovered after death had lower survival rates than average.

The major conclusion developed is that immigration and emigration, driven by food availability for territory establishment, were the major factors influencing year-to-year fluctuations in numbers. Breeding output and mortality seemed to have little effect on subsequent numbers.

Following are some additional general impressions. Colleagues have on occasion pointed out to me that ornithologists (perhaps particularly those studying waterfowl) in North America and in the Old World frequently have an antipathy for, or lack of knowledge of, each other's published works. Indeed, I have been criticized for this myself, so what follows is an attempt to illustrate this subject. Because Shelducks do not occur in North America, one would perhaps not expect frequent citation of North American literature. This book is not just a monograph on a species, however, but an attempt to integrate the subjects of behavioral ecology. Therefore, I was somewhat surprised at the almost total lack of citation of contributions from North America on most of the subjects treated in this book, especially a large literature on theoretical aspects of avian social behavior including many fine comparative studies of waterfowl. Similarly, important works on bioenergetics, analyses of banding data, and population control are neglected. For example, only 30 of 245 (12%) references are to North American authors. Of these, there are only 12 references to waterfowl, but 4 of these are to general treatments of taxonomy and de-

scription and the other 8 refer to techniques or to now somewhat dated studies (these references are 1954 to 1959, with two from 1965). Nine of the 30 citations from North America refer to classic descriptions of territory or home range, including works on mammals, published between 1939 and 1959. There are only six references to North American literature dealing with theoretical aspects of territory, energy, and dominance published since 1963. I am not sure to what degree this is a significant general problem, but to the degree that it is, this book illustrates the phenomenon.

Having said that, and having commented on other weak aspects above, I conclude that the strengths of the book far outweigh the problems. I enjoyed it and believe the author achieved his main objective with the data available on a difficult subject. I strongly support the author's goal of integrating the study of individually identifiable animals of known social status in a location where food was measured (and experimentally manipulated), and the results related to mortality, reproductive output, and emigration. This is a most difficult task, and Patterson deserves high compliments for his perseverance and insight. The work will be invaluable in any future comparative treatment of the family Anatidae and also should be useful in many more general reviews of animal social behavior and population regulation. It should be available in university libraries and in collections of investigators of these subjects.—DENNIS G. RAVELING.

**Resource competition and community structure.**—David Tilman. 1982. Princeton, New Jersey, Princeton University Press. xi + 296 pp., 98 text figures. \$27.50 (cloth), \$9.95 (paper).—Considerations of resources lie at the hub of all ecological and evolutionary investigations. Virtually all of our theory that relates to foraging behavior, population dynamics, species interactions, and the like is founded on the dynamics of resources and their exploitation. More often than not, however, resources are taken as a given in attempts to test such theory, and are not explicitly considered, much less measured. To paraphrase Mark Twain's comment on the weather, everyone talks about resources but nobody does anything about them.

David Tilman's book represents an attempt to do something about resources and how we consider them in ecological studies. Tilman's objective is to develop and use a simple, graphical theory of consumer-resource interactions to assess the effects of resource competition on the species composition and diversity of natural communities. While the theoretical approach is broadly based, the primary emphasis in its application is upon plant communities, an emphasis that reflects the early interest of plant ecologists in the role of resources and, especially, the relative ease with which plant nutrient resources can be measured

in comparison to many animal resources. Not coincidentally, it turns out that the theory works much better for plants than for animals.

Tilman defines a resource as "any substance or factor which can lead to increased growth rates as its availability in the environment is increased, and which is consumed by an organism" (p. 11). Recognizing that a species may potentially be limited by several factors, Tilman develops a classification of resource types that is based upon their interactions in determining the growth rate of a species. His development of this classification is thoughtful, and it comes into play repeatedly through the volume. In all cases, however, the key attributes of a resource, by Tilman's definition, are that it is *limiting* (in that it directly influences growth rates) and that it is *consumed*. Food or specific nutrients may thus be resources, as may space for many sessile organisms; temperature is not a resource, nor are some of the favorite niche dimensions that some ornithologists have used repeatedly, such as foraging height, foliage height diversity, or time of activity.

Tilman is clearly concerned with the effects of competition over resources on community structure, and this undoubtedly has contributed to his emphasis on limitation. As he notes (p. 96), "resource competition theory predicts that naturally coexisting species should have differing requirements for limiting resources, but places no constraints on the requirements of species for non-limiting resources. It is imperative that ecological studies of resource competition focus on those resources which actually limit species in their natural habitats, if the results of the experiments are to be used to interpret patterns in the natural world. Although studies of competition for resources which are never limiting in nature have some short-term heuristic value, in the long term such studies may confuse much more than they clarify." To his credit, Tilman is explicit about his restriction of resource limitation, but it does create a certain awkwardness at times. A factor that is a resource at one time, for example, may no longer be a resource at some later time when some other factor becomes more limiting to the species. Tilman does attempt to consider such problems in his treatment of resource interactions, but his resolution of this problem of when a factor is or isn't a resource is not entirely satisfying. Further, by confining consideration to factors that are limiting and the object of potential competition, Tilman's approach ignores a good deal of the dynamics of individuals and populations that may relate to nonlimiting factors.

Closely linked to the requirement of limitation in Tilman's treatment is the assumption of equilibrium: the theory predicts the equilibrium structure of communities based upon resource competition. Again, Tilman is explicit about this equilibrium approach, and justifies it as follows (p. 5): "it explores the long-

term effects of the consumer-resource process and . . . an assumption of equilibrium is inherently simpler than an assumption that a given observation can only be understood in terms of non-equilibrium processes. This is not to imply that non-equilibrium processes are unimportant, but rather that it is most appropriate to consider the simpler, equilibrium explanations first." This may indeed be so, but it turns out to be easier to deal with equilibrium assumptions in the theory than in the real world. Tilman develops at some length the responses of plant species to experimental fertilization treatments on plots at Rothamsted, England, that were initiated over a century ago, in the context of his theory's treatment of resource ratios; he notes in passing, however, that the plant community may not yet have reached a new equilibrium species composition, which somewhat compromises his use of this example.

Within these restrictions and with several other assumptions (all clearly stated), Tilman proceeds to develop his graphical theory and then to apply it to a variety of aspects of community structuring. In order to predict the equilibrium outcome of resource competition, however, one must have information on the reproductive or growth response of each species to the resources, the mortality rate experienced by each species, the supply rate of each resource, and the consumption rate of each resource by each species. This is an ambitious listing of desiderata, perhaps attainable for some nutrient-limited plant populations but unlikely for most animal species. Tilman's emphasis upon plant communities becomes more understandable.

The theory is nonetheless of considerable interest, and Tilman does a masterful job of presenting it clearly and thoroughly. A variety of interesting predictions emerge from this treatment, such as: (1) Individuals should not consume excess quantities of a nonlimiting resource, as this would place them at a competitive disadvantage to organisms that do not do so. (2) When several species compete for the same limiting resource, the one with the lowest equilibrium resource requirement will displace the others, as it can reduce the level of the resource below that required for the other species to maintain stable populations. (3) The species diversity of plant communities should be maximal in habitats with low nutrient levels, and should decrease with increasing productivity. (4) Unless random elements are incorporated into the model, it does not seem to predict previously hypothesized species-abundance distributions, such as lognormal or geometric. (5) If the species in a community differ in the relative proportions of nutrients or resources that they require, then in a spatially heterogeneous environment numerous species may coexist at equilibrium. (6) The species that is the superior competitor for a resource will become less dominant as that resource is added to

the system, but will become increasingly dominant as the resource for which it is the inferior competitor is added. These are intriguing predictions, and Tilman frequently suggests lines of research that could provide critical tests.

The concluding chapter is in many ways the most interesting, especially to animal ecologists. Here Tilman evaluates and extends his model, in an openly speculative manner. All sorts of interesting things emerge. He suggests that the process of plant succession may be understood as a consequence of the changing ratios of limiting resources through time—as the resource ratios change, species that are limited by particular ratios come and go, in an orderly fashion. He reiterates his earlier conclusion that the addition of spatial heterogeneity to a model of competition for two resources leads to the equilibrium coexistence of an unlimited number of species, but adding a trophic level to such a model also generates the prediction of unlimited species packing on a single limiting resource. Relaxation of the assumption of equilibrium has the effect of predicting that an unlimited number of species can persist on one or a few limiting resources, even in a homogeneous habitat. The general model thus seems rather sensitive to these realities of nature; as Tilman notes, much more experimental work will be required to determine the relative importance of these influences.

Finally, Tilman explores why there are so many plant species in relation to the number of limiting resources (he calculates a plant:resource ratio of 10,000:1), especially in comparison to animals (a species:resource ratio of 1:1). The key, Tilman believes, lies in how plants versus animals are limited by resources, and how this affects their sensitivity to spatial heterogeneity. For plants, most resources are essential: one nutrient may not substitute for another limiting nutrient. Most animals, on the other hand, use resources that may be nutritionally substitutable for one another; these may be used in a switching manner. A spatially heterogeneous habitat may permit seemingly unlimited diversity among organisms such as plants that are limited by essential resources, but for resource-switching organisms there can be no more species than there are resources, regardless of the amount of habitat heterogeneity.

I believe that Tilman's book is one of the most thoughtful considerations of resources and their effects upon ecological systems to have emerged in decades. I may not agree entirely with Tilman's view of what resources really are or with his emphasis on equilibrium, competition systems. These restrictions, however, enable him to develop an intriguing model, and Tilman takes pains to detail such limitations, explore their effects, and propose further directions for research. "Resource competition and community structure" is surely one of the best volumes in the Princeton Monographs series, and it is essential read-

ing for any ecologist or evolutionary biologist, regardless of the organisms studied.—JOHN A. WIENS.

**The emergence of ornithology as a scientific discipline: 1760-1850.**—Paul Lawrence Farber. 1982. Boston, D. Reidel Publishing Company. xxi + 191 pp. \$39.50 (cloth).—The title of this long-awaited monograph should include the word Europe, since the author discusses developments that occurred in certain European countries during the 1760-1850 period. In contrast to existing schools of thought that view the transformation of natural history either as a direct one into modern biology or as an "intellectual shift" from natural history to a history of nature, Farber in his introduction stresses the complexity of the story. Recommending both synthetic and comparative approaches, the author uses ornithology as a case study of the emergence of several disparate disciplines that have their roots in eighteenth-century natural history.

Farber starts with bird study as a "neglected literary activity" in the mid-eighteenth century, when birds were not yet the subject of thorough, scientific study. Serious works on ornithology began with the publication of Mathurin-Jaques Brisson's "Ornithologie" in 1760, a work that Farber considers a good example of the "collection-catalogue" approach to natural history. Georges-Louis Leclerc, Comte de Buffon, in his "Histoire Naturelle des Oiseaux" (1770-1783), the second part of the 36 volumes of his "Histoires Naturelles" (1749-1788), had a different approach. Buffon, like S. F. Baird in America nearly a century later, was at the center of a large network of government-funded collectors, which enabled him to increase the collections of the Cabinet du Roi. Despite this, Buffon's ideal was not a catalogue or taxonomic treatise but instead a series of natural-history articles on each species of birds. He stressed the importance of field studies, but as these were not prevalent at the time he had to survey the existing literature for all possible information on birds. "Planches enluminées" (colored plates) by the painter F. N. Martinet were an important addition to two of the more expensive editions of this natural history of birds. They provided important information much appreciated by later naturalists, because stuffed specimens at the time deteriorated quickly due to inadequate taxidermic techniques but the exquisite color plates did not change. An added attraction was the high literary quality of Buffon's prose.

The period 1780-1830 was a time of increased colonial expansion by France, Britain, Germany, and Holland. This resulted in an influx of natural-history specimens from South America, Africa, the East Indies, and Australia and the Pacific region. Scientific expeditions, some of which were funded by governments and public institutions and others by wealthy

individuals, provided additional specimens and information. The increase of ornithological material enabled a larger number of naturalists than ever before to study and attempt to classify birds. Pursuing his thesis on the transformation of natural history, Farber emphasizes that the sheer amount and variety of new natural-history specimens, a by-product of the colonial expansion, aided the splitting up of natural history into a series of taxon-oriented specializations and provided the main impetus for the differentiation of ornithology. Although he argues convincingly, many ornithologists and historians of science may find something lacking in this somewhat narrow view of the emergence of ornithology, because the author concentrates on the development of the classification of birds and minimizes advances made in other areas of ornithology. "Minor" traditions, such as life history, anatomy, morphology, monographs on individual species, or local and regional avifaunas, which were becoming more prevalent in Germany and England, are mentioned but considered secondary to the development of classification. Very little is written about the practitioners of these minor traditions, so their full contributions to science cannot be assessed from this book.

In the second half of the monograph the author repeatedly refers to a large group of internationally recognized experts who concentrated on fruitful questions of research and worked on common goals in ornithology. How these areas of study were selected and by whom is never elaborated on. The size of the ornithological community of Europe is not defined, except by quoting the names of 29 ornithologists from Hugh Strickland's 1844 "Report on the recent progress and present state of ornithology." Nor is this group of experts, not detailed as extensively as in Strickland, compared with or contrasted to the practitioners in other branches of natural history. Moreover, while Strickland considered ornithology in the 1840s "in a less advanced state than many other departments of zoology" (1845: 170), the impression is given by Farber's book that ornithology at that time was more advanced than other specializations of natural history. It "was among the first departments of natural history to emerge as an independent discipline and . . . was central in the theoretical debates, institutional developments, and popular appeal of natural history" (1982: 123).

If one considers Strickland's detailed descriptions concerning ornithological advances in areas other than taxonomy, it is hard to imagine that, in view of the greatly increased interest and scientific activity in ornithology in the 1830-1845 period, fruitful questions only stemmed from the attempted classification of the birds of the world. Farber maintains, however, that ornithological developments were indeed centered on the issue of classification and pursues this line of argument in some detail. "It was this concern with classification and the object of a com-

plete catalogue of birds that, in essence, defined ornithology; that is demarcated it from the study of all other living beings" (1982: 119). In saying this, many other advances in ornithology, particularly those in Germany, are ignored. With the emphasis on the pursuit of a complete catalogue of the birds of the world, one must conclude that any change in ornithology from the mid-eighteenth to the mid-nineteenth century was only quantitative and that there were no theoretical advances. After all, there were more specimens available and more scientists to study them than ever before. Brisson and Buffon, with their much smaller data base, were just more aware of the impossibility of such an attempt in the late eighteenth century.

To me, the argument concerning the emergence of ornithology as a *discipline* is not entirely convincing. One cannot refute that ornithology, as one of the taxon-oriented sciences, was in the process of differentiation from other branches of natural history. It is questionable, however, whether it could be categorized as a discipline toward the second half of the nineteenth century. The emerging field of ornithology, even in 1850, lacked some of the requirements of a scientific discipline, although other important factors were already present. There was a group of widely spaced specialists concerned with more or less common goals (i.e. the study and classification of birds). These specialists interacted at certain meetings of scientific associations. They published books on birds. They also published an increasing number of specialized articles in natural history journals and in the proceedings and transactions of various scientific societies. These articles were already written for other specialists rather than for the lay public. There were also institutions where ornithology was pursued, since by the 1840s the curiosity cabinets of wealthy dilettantes had been largely replaced by "working museums."

One important facet of disciplinization was missing during this period. There was no training and certification of a new generation of specialists. Without this important developmental factor a discipline cannot exist. Methods, standards, and goals can be found in an emerging scientific field. Scientific associations are usually established when there is a critical mass of scientists working on problems that separate their field from all others. The transmission of knowledge and techniques are unavoidable requirements of disciplinization. If there was any such training of future ornithologists during the period under discussion, it is not mentioned in this monograph. It is much more correct, therefore, to consider ornithology in 1850 as a specialization and not yet a discipline.

This is a thought-provoking book with many enjoyable passages and some interesting illustrations. It presents a historian's view of the development of one of the major aspects of ornithology in Europe. It

is not a seminal work on the subject, nor was it intended as such. Many ornithologists inculcated with modern methods and ideas of ornithology will find it fascinating to read about earlier times and concerns. Others will miss more detailed information on the history of their own area of research and how particular studies, such as life history or anatomy, related to the whole of ornithological developments. In a sadly neglected field within the history of science, Farber's book is a much-needed addition to histories of ornithology written exclusively by scientists. In a way, this book contains two monographs between its covers. The first one is on the development of aspects of ornithology in Europe, while the second one justifies this type of study. It should motivate other historians to continue where Farber left off, to develop certain periods, aspects, and the contributions of individuals in greater detail. In spite of its focus on classification, this monograph will interest both scientists and historians, will be useful for students, and will be a stimulating and essential addition to both private and university libraries.—*MARIANNE GOSZTONYI AINLEY.*

**Bird habitats in Britain.**—R. J. Fuller. 1982. Staffordshire, England. T. and A. D. Poyser, Ltd. 320 pp., 32 black-and-white plates, 79 figures, 55 tables. \$35.00.—In 1972, after the completion of the fieldwork for the Atlas Survey (Sharrock, J. T. R. 1976. "Atlas of breeding birds in Britain and Ireland," Poyser, Berkhamsted), the British Trust for Ornithology recognized that the field experience built up during the Survey could be redirected into a study of sites of ornithological interest. The Atlas was an excellent example of the great potential rewards of well-organized, broad-scale projects that are based on information contributed by amateur ornithologists, and a large cadre of local and regional participants for the new project was in place. The objective of the new project would not be to produce a guide for bird-watchers, but rather to gather information about sites that would be useful in conservation planning and reserve acquisition. A similar project (Smout, T. C. 1972. *Brit. Birds* 65: 263) had just been completed in Denmark. R. J. Fuller was appointed as national organizer at BTO headquarters. After 4 yr of fieldwork, the result was a compilation of information about the seasonal distribution of birds at approximately 4,000 sites in England, Scotland, and Wales. Because "The register of ornithological sites" included the descriptions of many places that are on private land and that support many species that are sensitive to human disturbance, it was not published. Instead, it is being used by the Nature Conservancy Council and the Royal Society for the Protection of Birds to set priorities in making decisions about management and land use.

In this volume Fuller has summarized data from

the Register in an analysis of avian biogeography in Britain. He follows the descriptive format of Ratcliffe's "A nature conservation review, the selection of biological sites of national importance to nature conservation in Britain" (1977. Cambridge, Cambridge Univ. Press, 2 vols.). In addition, he has done an excellent job of integrating information from the Register with BTO census data and the general literature on bird populations. For instance, in Chapter 1, on "Intertidal flats and marshes," he gives a detailed description of British salt-marsh habitats, how breeding and wintering birds use these resources, and the consequences of reclamation schemes, estuarine pollution, and habitat loss. In this and each of the succeeding 12 chapters (e.g. rocky coastlands, lowland heaths, lakes, woodland), the distribution of natural and seminatural habitats and the relative abundances of the characteristic species are discussed.

Details of the Register program and treatment of the data are described in Appendices 3-5. Observers used standardized forms to record site descriptions and the seasonal occurrences of bird species and to make rough estimates of abundances. Each habitat was classified to a subhabitat within a set of seven mutually-exclusive habitat divisions. Fuller acknowledges that communities are in fact open systems and he is aware of the limitations of the type of data in the Register for making comparisons. To overcome partially the problem that sampling effort differed among habitats, he often expresses data in terms of frequencies, the percentage of sites in a habitat on which a species was recorded. This is actually a measure of how widespread species are relative to one another. The frequencies plotted in decreasing order (Fig. 14.1) show that each habitat has a characteristic pattern. This figure is a very interesting demonstration of a biogeographic pattern that is actually above the level of community organization because it describes a pattern of the member species for many sites of the same habitat.

Only crude comparisons can be made for the relative species richness of the habitats (Table 53), because species/area effects are unknown and the sites differ greatly in size. But the Register information is supplemented with data from transect and mapping censuses. My only disappointments were the absence of any quantitative vegetation analysis and yet another example of bird species diversity/foilage height diversity expressed as the information theoretic measure  $H'$ . Personally, I think the rarefaction method (James, F. C., and S. Rathbun. 1981. *Auk* 98: 785) is the best method currently available for comparing the structure of communities and that numerous methods are available for expressing vegetation structure that are better than foliage-height diversity (James, F. C., and N. O. Wamer. 1982. *Ecology* 63: 159). Nevertheless, Fuller shows that even presence and absence data for many sites can be used

to show very interesting patterns of bird distribution. Also, although it seems reasonable always to conserve the largest tract possible (p. 68), there are situations in which more species would be protected by conserving two smaller sites that together had an equivalent area (Simberloff, D., and L. G. Abele. 1982. *Amer. Natur.* 120: 41).

In summary, this book does a lot more than identify priorities for nature conservation. It contains a multitude of interesting details about the habitat relations of British birds, and it brings together the immense data base of the Register with other available information from the literature. The product is a solid ecological analysis that is richly illustrated, not only with plates, but with Donald Watson's many figures, drawings, and watercolors. The tables summarize the data, and the bibliography is a good sample of British avian ecology. Clearly, the moors, bogs, and mountains of the northwestern section need more attention, but I know of no publication in the American literature that has attempted this very interesting analytic approach to the quantitative analysis of bird distribution in relation to the distribution of habitats.—FRANCES C. JAMES.

**Philopatry, inbreeding, and the evolution of sex.—**

William M. Shields. 1982. Albany, New York, State University of New York Press. 245 pp. \$16.95 (paper).—The main thesis of this book is that philopatry evolved because it promoted inbreeding. Most organisms, even highly mobile and migratory ones, show strong philopatry, moving on average less than 10 home-range diameters from the place of their birth to the site of their adult reproductive activities. It is argued that this extreme philopatry cannot be explained by current ecological theories that assume environmental heterogeneity, knowledge asymmetry, and a cost to movement to provide an advantage to remaining so close to home. An inevitable consequence of philopatry is inbreeding, and inbreeding sex eliminates the severe disadvantages of selfing (Muller's ratchet) while still providing the main benefits of sexual recombination. The major disadvantages of sex, the high cost of meiosis and the breaking up of good gene combinations (the argument is critically dependent on the importance of epistasis), are both greatly reduced by breeding with close relatives.

Shields argues that the disadvantages of inbreeding have been much overemphasized because most experiments have involved outbreeding populations suddenly subjected to extreme inbreeding (full sibling matings). These are precisely the conditions that would maximize the potential disadvantages of inbreeding because the period of outbreeding should result in the accumulation of higher levels of disadvantageous recessives than would have been the case had the populations been moderately inbred before

being subjected to more intense inbreeding. Field studies demonstrating inbreeding depression are very few, and depression is detectable only in the case of extreme inbreeding. In contrast, evidence suggesting the importance of outbreeding depression has been generally ignored. Therefore, Shields argues that the creative role of moderately intense inbreeding deserves much more attention in future studies, both theoretical and empirical, on the evolution of population structure.

This basic argument is articulated in the first chapter of the book. The remaining chapters review evidence that offers support for the basic thesis. Specifically, they deal with the relative nature of the concepts of inbreeding and outbreeding, the potential disadvantages of inbreeding, the advantages of inbreeding (coadaptation and the avoidance of outbreeding depression), inbreeding and sex, especially the cost of meiosis, the population structure and evolution of low-fecundity species, and predictions and tests from the basic hypothesis.

Mostly the book covers ground that has been treated extensively many times. Readers familiar with the literature on philopatry, sex, inbreeding, and epistasis will find little that is new, and will find several of the chapters rather tedious. For persons unfamiliar with the literature in these fields, however, the book provides a useful overview of the status of knowledge and current controversies. The arguments are basically qualitative, a substantial limitation because resolution of the key issues posed by Shields, such as the role of epistasis and the cost of meiosis, will require quantitative analysis, a task left entirely to future investigators.

Given that the book consists primarily of plausibility arguments, its real value, besides posing the basic hypothesis, must be judged in terms of the power of the predictions and tests brought to bear on the hypothesis. Unfortunately, the book is very disappointing on this score. Shields never spells out in any detail what unique predictions his theory would make or what tests would be most critical in distinguishing the inbreeding sex hypothesis as the cause of philopatry from, say, ecological and kin-selection theories. The way is not clearly paved for further testing.

Moreover, Shields presents only very weak tests of his hypothesis. His demonstration of correlations between reproductive rate and larval dispersal among marine invertebrates is unconvincing evidence. What relationship would be expected between reproductive rate and dispersal if philopatry had *not* evolved to promote inbreeding is not presented. It is clear that the "null" distribution is not one of no association between egg size and dispersal, because large eggs cannot be carried long distances in the plankton. There is no inevitable reason why masses of very small eggs could not be deposited close to a parent, but this is unlikely on ecological grounds because it



would subject large numbers of larvae to intense sibling competition. One does not need to invoke anything about either philopatry or inbreeding to explain the correlations Shields presents.

Evidence from plants is similarly weak. Tables that supposedly demonstrate support for the theory contain no information either about pollen vagility or seed vagility, the two traits Shields expects to be inversely related to one another. Moreover, his arguments rest on the dubious assumption that wind-pollinated plants have higher pollen vagility than do animal-pollinated species. Many students of the problem believe that animals on average move pollen longer distances than the wind, which inevitably produces high concentrations of pollen close to the parent plant and cannot selectively target conspecific stigmas. Comparisons that might be of some interest, such as between desert annuals, where variability is primarily in time rather than in space, with forest annuals, where environmental variability is in both space and time, are not explored.

Ornithologists will be particularly interested in the use of avian examples to support the theory. Unfortunately, the treatment of avian evidence is no more convincing than that given for other groups. Shields assumes a demic structure of waterfowl populations that does not accord with existing evidence. He argues that the fact that so few avian species mate on their wintering grounds is evidence for the importance of inbreeding. A more plausible argument is that the vast majority of long-distance migrants are nocturnal, making it virtually impossible for pairs to remain together during migration even if they formed on the wintering grounds. Nor does he discuss breeding systems of species like gulls, in which pairing takes place in "clubs" and the birds move to the colonies already paired.

The fact that the predictions and tests are generally weak does not, of course, mean that the basic hypothesis is false. Its validity will ultimately depend on further experiments and more critical predictions and tests. The weakness of the tests, however, does seriously reduce the value of the book. Indeed, it can be argued that the force of the hypothesis is seriously diluted by burying it in masses of arguments that at best merely indicate the plausibility of the thesis. My judgement is that Shields would have served his own cause better by offering a concise version of his basic thesis in a single paper, saving the book for such time as really critical tests can be devised and performed.

Nonetheless, the basic hypothesis deserves to be taken very seriously. There is no question that current thinking is dominated by the perception that inbreeding is to be avoided at all costs, while outbreeding is an unmitigated benefit. Shields makes some compelling arguments for reconsidering that position and for recognizing the potential benefits of sex combined with moderate levels of inbreeding.

His hypothesis does offer a way out of the dilemma posed by the maintenance of sex in low-fecundity species, organisms that forced G. C. Williams to conclude that they had inherited sex from high-fecundity ancestors and had been unable to lose it. It also offers the possibility that the cost of meiosis has been overestimated because most calculations have assumed extreme outbreeding. Quantitative calculations will be needed to determine how much the cost of meiosis is really reduced by actual inbreeding patterns of philopatric species, and how important epistasis is relative to single gene effects, but Shields has presented a challenge that needs to be pursued. I hope that the expansion of an excellent paper into a mediocre book does not blunt the influence the basic thesis deserves to have.—GORDON H. ORLIANS.

**A.B.A. Checklist** (Second ed.).—G. Stuart Keith (Chief Editor). 1982. Privately published, available from the American Birding Association, P.O. Box 4335, Austin, Texas. 90 pp., 1 map. Paper. \$9.00 (\$8.25 to A.B.A. members) plus \$2.25 handling.—This checklist includes all birds believed to have occurred naturally in North America north of Mexico and exotics established in the same region. It begins with a preface professing fealty to the AOU checklist committee, and an introduction reviewing the area covered and the changes since the first edition. These changes include 7 additions by splitting, 10 deletions by lumping, 5 deletions by reevaluation of records, and 47 additions of recently recorded species. The introduction also includes a list of changes in English names, with a general discussion of the reasons for the changes, and a statement of the criteria used for inclusion of accidental and introduced species.

The species list is organized by order and family in the sequence of the AOU Checklist (fifth ed.), except that families of Charadriiformes are rearranged. Within families the order of species usually follows the 1957 AOU Checklist, but accidental species added recently are inserted haphazardly. Each species entry includes brackets at the left for ticking, the English name, the Latin binomial, a single letter designating status (Accidental, Extinct, Introduced, Native, Visitor) and a line to the right margin, evidently for notes. Extinct species lack the brackets for ticking.

The species list is followed by a summary of records for all species considered accidental and for about 40 other rare species, and by 10 blank pages for insertion of future supplements. The A.B.A. Code of Ethics graces the inside back cover.

I compared the species list to that in the 34<sup>th</sup> Supplement to the AOU Checklist (July 1982). The lists are very similar in content, with the major exception that the AOU included Hawaiian birds. The A.B.A. list is more conservative about including species represented by questionably wild individuals (it omits, for example, *Anser erythropus*, *Larus belcheri*, *Fringilla*

*coelebs*) or by questionably established introduced populations (omits *Psittacula krameri*, *Myiopsitta monachus*). On the other hand, the A.B.A. is less fastidious about including birds represented only by sight records, such as *Diomedea melanophris*, *Pterodroma longirostris*, *Chlorostilbon ricardii*, and *Vireo crassirostris*.

The A.B.A. Checklist is not a good source of current taxonomic, nor nomenclatural, information. According to the preface, scientific names were changed to conform to the 34<sup>th</sup> Supplement only where they involved changes in species status (and some of those were missed—e.g. *Melanitta deglandi* should be *M. fusca*, *Myiarchus stolidus* should be *M. sagrae*). Many genera submerged by the AOU are retained in this list (e.g. *Halocyptena*, *Hydranassa*, *Hesperiphona*) and the few newly recognized by the AOU (*Tachybaptus*) are not included. The reassignment of the Five-striped Sparrow to *Amphispiza* was not followed; it remains in *Aimophila*. Curiously, the A.B.A. places the Smew in *Mergus*, a recent trend in European works not followed by the AOU.

On a more positive note, the checklist is attractively produced and features large easily readable print. It also seems carefully proofread; I found no typos in a careful search of the species list.

This checklist adequately fulfills its major task—to serve as a repository for the lifelists of A.B.A. members—but in my opinion it will not be very useful to others.—WAYNE HOFFMAN.

**Multivariate analysis in community ecology.**—Hugh G. Gauch, Jr. 1982. Cambridge, Cambridge University Press. x + 298 pp. Paper, \$14.95; Hbk, \$37.50.—During the last decade the use of multivariate statistical methods in ecological research has increased dramatically. This has been primarily due to the desire of ecologists to examine simultaneously the abundance and distribution of more than a few species in space or time and, in many cases, relate this variation to environmental gradients. My impression is that multivariate statistical procedures remain rather arcane to many ecologists, so that a critical review of the use of multivariate analyses in community ecology would be useful. This book is an attempt at such a review, by an author who has published many papers on the use of multivariate statistics over the last 10 yr and who has been intimately involved with developing the Cornell Ecology Programs Series, a multivariate statistical computer package. The book emphasizes “the preferred techniques,” stressing applications rather than methods. Special attention is given to terrestrial plant community studies, reflecting the author’s background. Unfortunately, there are few critical discussions of many statistical techniques, and many of the techniques discussed (e.g. reciprocal averaging, detrended correspondence analysis) are from the Cornell Ecology Programs Series. There is hardly an equation

in the book. Animal ecological studies receive relatively little attention and many of the animal community studies discussed are inappropriate or poor examples of multivariate analyses.

The first two chapters give an overview of multivariate analyses, their use, and sampling methods. Discussed in these chapters are such topics as minimum matrix size (usually  $10 \times 10$  or  $15 \times 15$ ), noisy data, redundancy, outliers, roles and purposes of multivariate analyses, and how to conduct a field-oriented research project. The author also introduces the three major approaches that he believes multivariate analyses can be used for in community studies: direct gradient analysis, ordination, and classification. Each of these is discussed in one of the next three chapters.

The chapter on direct gradient analysis is the weakest. To Gauch, “direct gradient analysis is used to display the distribution of organisms along gradients of important environmental factors,” and the emphasis of the chapter is on data displays. It is a curious collection of examples, however, since Gauch has defined any study that simultaneously examines more than one variable for more than a few individuals as multivariate. Most of the illustrations used are from well-known studies but are shown out of context with little explanation. Most will be confusing to those unfamiliar with the original papers. The one vertebrate study depicted shows the vertical distribution of first sightings of foraging tree squirrels in Africa. Although nine species of tree squirrels were studied, this example is clearly not multivariate, even by Gauch’s own definition. No multivariate analysis techniques for direct gradient analysis are explicitly discussed, although in the following chapters 44 and 22 pages are devoted to ordination and classification techniques, respectively. For example, no mention is made of ways in which multivariate statistical techniques can be used with environmental data to derive important gradients. The distribution of associated organisms can then be examined along these gradients from the environmental data. This type of direct gradient analysis approach is now used frequently in animal ecological studies.

The two chapters on ordination and classification deal only with species abundances, and since little animal research is conducted in this manner, all illustrations in these two chapters are from botanical studies. The exclusion of environmental data from ordination and classification studies will seem strange to animal ecologists since these two terms have a much broader meaning in animal studies.

The final two chapters are concerned with applications and conclusions. The applications chapter is largely devoted to listing uncritically ways in which multivariate analyses have been performed (e.g. one page lists all the crop plant studies that have used multivariate analyses). Due to the broadness of Gauch’s definition of multivariate analyses, reworked

data from the classic study of old-field successional avifaunas by Johnston and Odum (1956, Ecology) are presented as an example of multivariate analysis. Surely the author could have presented a more convincing illustration to back up his statement that multivariate analysis is a powerful tool in avian habitat management. Only one paragraph discusses species-by-attribute matrices, the most common approach in animal ecology. Gauch states that this kind of analysis is very important in understanding community organization, and great debates concerning "niche space" or "resource space" in animal communities and multivariate statistical methods are going on now in the ecological literature. Why is this topic only given one paragraph of treatment?

The most impressive part of the book is the bibliography, which I estimate contains over 850 citations, of which about a fourth have been published in the 1980s. This large collection of citations is due primarily to the compilation of long lists of references that are presented in the text, mostly without criticism or synthesis, so that the book is mainly a collection of the uses of multivariate analyses rather than a primer on techniques.

I am not sure what audience will find this book most useful. I doubt that undergraduates will find it of much use. Graduate students and neophyte researchers will find it a useful introduction into the literature, but it certainly should not take the place of more rigorous treatments of multivariate statistics. Animal ecologists will be disappointed in the handling of the animal literature, and possibly it would have been better to title the book "Multivariate analysis in plant community ecology" and forego the attempt to incorporate animal ecology. In this respect, animal ecologists may get more mileage out of a copy of the recent symposium on multivariate statistics in wildlife habitat studies (USDA Forest Service General Technical Report RM-87, Rocky Mountain Forest and Range Experimental Station, Fort Collins, Colorado). For a discussion of community ecology, I would have much preferred an ecologist explaining the statistics rather than have a statistician attempt to explain the ecology.—KIMBERLY G. SMITH.

**Invertebrate populations of the deciduous forest: Fluctuations and relations to weather.**—S. Charles Kendeigh. 1979. Illinois Biological Monographs 50. Urbana, Illinois, University of Illinois Press. 107 pp., Paper. \$12.50. **Bird populations in east central Illinois: Fluctuations, variations, and development over a half century.**—S. Charles Kendeigh. 1982. Illinois Biological Monographs 52. Urbana, Illinois, University of Illinois Press. 136 pp., Paper. \$14.50.—In 1933 Victor Shelford initiated a long-term research project on invertebrate populations in William Trelease Woods, a relatively undisturbed 24-ha woodland acquired by the University of Illinois in 1917–1918.

Shelford was particularly bothered by the reliance on data collected in conjunction with the fur trade, crop production, and insect outbreaks in animal population ecology and was determined to collect data on populations that were relatively free from human interference. The sampling regime consisted of bi-weekly samples of ground invertebrates (extracted in Berlese funnels) and 48 sweep samples of both forest herb and shrub layers. Shelford continued this project to near his retirement in 1946, when he turned the project over to another faculty member at the University of Illinois, S. Charles Kendeigh, who continued the project until near his retirement in 1971. Shelford summarized his involvement in this project in two papers in Ecological Monographs in 1951, where he championed his paired environmental variable concept, emphasizing ultraviolet light (= radiation) and moisture, and debunked the effect of sunspots on population fluctuations. In the first of the present monographs under review, Kendeigh summarizes his involvement in the project, analyzing 38 yr of data from Trelease Woods, plus data from nearby Brownfield Woods (23 yr) and Funk Forest (17 yr).

Like Shelford, Kendeigh emphasizes density-independent regulation of invertebrate populations and analysis focuses on the role of environmental factors in population fluctuations. Unlike Shelford's approach, however, Kendeigh's analysis is largely statistical, using multiple regression with both step-down (variable elimination) and step-up (variable addition) models, which sometimes give quite different results. A total of 31 environmental variables (13 temperature, 11 precipitation, 3 interactions, 2 snow, and 2 ultraviolet radiation) and population level the previous year are the independent variables, plus a yearly index, derived from summing average monthly estimates for each taxon, and maximum monthly population each year for each taxon are the dependent variables. Thirteen major taxa are discussed, as well as the 48 most common species from 6 invertebrate orders represented in the woods, and all significant regression equations are presented in an appendix. This analysis is not without its problems, particularly in light of the large amount of data analyzed. For example, in comparing the three woodlots, the more years included in the analysis, the greater the number of significant variables that enter into the regression equations for a given taxon. Also comparing the three woodlots, in only 17% of the equations did the same variable appear in the equations for a given taxon, suggesting that populations in different woodlots are controlled by different factors. In comparing the two regression equations for each taxon at each woodlot, only 43% of the significant variables in the regression equations were found to be related to both monthly and yearly population estimates. Three of the 48 species (*Drosophila*, a beetle, a snail) had no significant regression models.

Nonetheless, Kendeigh is able to make a few generalizations concerning invertebrate populations.

The most important variable, entering into almost all equations, is population level the previous year, suggesting that population levels do not fluctuate widely between years. The next most important variable is mean minimum temperature the previous December to February, which relates to overwinter survival. Ultraviolet radiation also has high scores, and Kendeigh suggests, as did Shelford over 30 yr ago, that more attention should be given to this environmental factor in animal research. Kendeigh also concludes that precipitation is generally more important than temperature because the former enters into more equations, a conclusion that supports Shelford's previous emphasis on moisture.

In 1934 another long-term research project was started in Trelease Woods when A. C. Twomey began censusing breeding and wintering birds. In 1940 Kendeigh also took control of this project and data collection continued through 1977 at Trelease Woods. Over the years, six other nearby woodlands also were incorporated into the study. Generally, 11 censuses were done between April and August and 4–6 counts were made between December and February each year. A Christmas Bird Count also was conducted in Trelease Woods since 1941. Some data were available from the period 1924–1929, so that the bird project spans about 50 yr. Kendeigh summarized the data each year for consistency, although data were collected by many students associated with Kendeigh at University of Illinois (all listed in the Acknowledgments), many of whom are themselves prominent ornithologists today.

The bird data are discussed in light of the yearly cycle, fluctuations from year to year (both for major groups of birds and each common species) intra-regional variation, changes in relation to vegetation succession, community structure variation, and dispersal of new species into the study area. Much attention is given to year-to-year fluctuations and Kendeigh is able to demonstrate that, over the 50 yr of study, one stochastic environmental event had more influence on the avian populations of Trelease Woods than any other factor. Who would have guessed at the beginning of the study that one of the most prominent tree species in the forest, the American elm, would be virtually eliminated in one short decade? Population levels of nearly every species were affected by this dramatic opening of the canopy in the early 1950s and the reclosing of the canopy in the mid- to late 1960s. For example, the House Sparrow was unreported in the woods until 1955, when it became very common, nesting and roosting in dead elms, until 1965, when it virtually disappeared from the woods again.

Given that these two long-term projects were directed by Kendeigh for many years, one might logically expect a discussion tying the results of the stud-

ies together. Kendeigh only attempts this in a very general qualitative manner, with little or no mathematical treatment. For example, in the avian monograph, he suggests that some birds show a population response 4–5 yr after an increase in the invertebrate prey, but cautions that the response depends on the rate of invertebrate increase and the bird species involved. This could be investigated statistically in a more rigorous manner. Other interesting comparisons come to mind. The elimination of the American elm had profound effects on the bird populations, yet it is hardly mentioned in the invertebrate monograph. Didn't the elimination of a major tree species affect invertebrate populations? Happily, all data associated with both the invertebrate and bird projects have been placed in the archives of the University of Illinois Main Library and are available to researchers who wish to examine the data more closely.

The avian monograph is clearly written and should be of interest to all avian ecologists, as it will probably become one of the classics in avian population studies. The invertebrate monograph will have a much smaller audience, but it may be of particular interest to those working on bird communities in the eastern deciduous forest. The scope of the invertebrate monograph is much narrower and there has been almost no attempt to incorporate recent literature into the discussions in this monograph.

These two monographs represent nearly 50 yr of research effort, by many individuals, on two research projects directed by two of the most prominent animal ecologists this century in North America. In these hard financial times, when most field projects run only a few years, these two projects stand as a great tribute to the University of Illinois for the support of the research of Shelford and Kendeigh for nearly 40 yr. It would appear that the baton apparently did not get passed on to some young Turk to continue the work, but the data base assembled should be a gold mine for future investigators.—KIMBERLY G. SMITH.

**CRC Handbook of census methods for terrestrial vertebrates.**—David E. Davis, Ed. 1982. Boca Raton, Florida, CRC Press. 397 pp. \$125.00 in U.S., \$140.00 outside U.S.—Obtaining an accurate estimation of the number of individuals within a population of one or of several species occupying a specified area is absolutely critical to any sort of rigorous ecological investigation, be it basic or applied. Any attempt to focus attention on censusing methodology is thus important and timely. Davis clearly sets forth the objectives of this handbook in his preface: the handbook "is the first attempt to record various procedures for determining the number of vertebrates in an area . . . it aspires to reach the level of proficiency of methods for older areas of biology, such as microbiology." The emphasis is explicitly on the *collection* of census data, not on the statistics of their analysis

(although a concluding chapter by Davis provides a useful, if elementary, review of abundance calculation procedures). In his comments in the Foreword, Mosby presents a slightly different focus for the volume: "This publication seeks to summarize under one cover the most satisfactory procedures developed by knowledgeable wildlifers working with a large variety of vertebrates. The judicious application of the information here assembled should aid materially in the wise use of our vertebrate wildlife resources." Grand claims, indeed, and if they were fulfilled, this volume would be a boon to all practicing field ornithologists.

Unfortunately, the handbook falls far short of that goal. There are two obvious reasons for this. First, the treatment is generally simplistic and presented in an elementary manner, as is perhaps apparent in Davis' introductory comments (e.g. "... you need to know how to collect data. This handbook will help you achieve your purpose"). I had the feeling I was reading a high school primer. Second, the coverage is extraordinarily spotty and uneven. This is a consequence of the design of the handbook: various authors (there are 160 contributors) were asked to prepare a brief article based upon their use of a particular method in a study on which they had recently published. The contributions thus are "certified," in a sense, in that the methods they present have mustered at least enough respectability to be part of published papers, but they are also thus quite specific in their focus.

The main body of the handbook contains short (1-3 page) accounts of methods that can be used to census particular species (5 amphibians and reptiles, 44 birds, and 60 mammals; some species are treated in more than one article) or assemblages of more than one species in particular habitat types (32 articles). There seems to be little rationale underlying the inclusion of various species. The species accounts of birds consider a diverse array, including flamingos, Everglade Kites, Herring Gulls, robins, House Sparrows, Song Sparrows, Australian miners, and queleas. The habitat articles deal with birds in, for example, shoreline, urban, hemlock forest, riparian, transmission-line, dune, shrubsteppe, and Galapagos Island environments. With relatively few species or habitats considered and the variety so great, it is difficult to see how one might in fact use the handbook unless one was working with the same or similar species or habitats. For some of these, at least, the articles do provide a reasonable overview of the major censusing or capture/markings procedures, although the descriptions are generally so brief that suitable detail is lacking.

Although none of the contributions individually is particularly weak, collectively the assemblage gives an impression of superficiality that I find disturbing. My concerns are reinforced when I read in the introduction that statistical aspects are not given much

emphasis because elaborate statistical methods are rarely used. "The reasons are simple, but often forgotten. Studies of terrestrial vertebrates usually deal with small numbers. Also the investigator may capture or record a high proportion of the population and hence use actual numbers rather than estimates. Also most studies use a census method to get data for some purpose (diversity index, Environmental Impact Statement (EIS), birth rate, etc.), and the investigator does not want to spend much time on the census. Lastly, verification of assumptions may require so much effort that the investigator uses some simple method (e.g. mice per trap night) that cancels most assumptions when used comparatively." To me, these sound like rationalizations for conducting quantitatively crude and unreliable censuses.

This "handbook" thus misses its mark rather badly, I'm afraid. The serious student or researcher planning research on vertebrate populations or communities would be better advised to study the contributions contained in Ralph and Scott's "Estimating numbers of terrestrial birds" (1981. *Studies Avian Biol.* 6) or to consult treatments such as that of Caughley (*Analysis of vertebrate populations*. 1977. New York, John Wiley), Tanner (*Guide to the study of animal populations*. 1978. Knoxville, Univ. Tennessee Press), Miller and Gunn (*Symposium on census and inventory methods for populations and habitats*. 1981. Moscow, Univ. Idaho Forest, Wildl. Range Expt. Station Contrib. 217), or even Southwood (*Ecological methods*. 1978. New York, John Wiley). One could assemble a nice basic reference library on censusing for less than the cost of this absurdly overpriced "handbook."—JOHN A. WIENS.

**Collins British birds.**—John Gooders (Ed.). 1982. London, William Collins Sons, Ltd. 384 pp. £12.95.—When the dust-jacket of a book makes the sort of outrageous claim that this book does: "This book will tell you, and *show* you, *all there is to know* [my italics] about the birds of Britain and Ireland," it invites criticism from reviewers. My tendency to discount the dust-jacket as being publicity material was, however, quickly offset by the chauvinism of the preface, whose central theme is that, because British and Irish ornithologists have become more European and worldwide in their studies, there has been a dearth of books on the birds of the British Isles, a situation that Gooders is supposed to rectify. I would hardly characterize the period 1950-1980 as being short of bird books relating to Britain and Ireland: the fine series of monographs from T. & A. D. Poyser, such volumes as Perrins' "British Tits," and Newton's "Finches" in Collins' own *New Naturalist* series, Hutchinson's "Ireland's wetlands and their birds," and a host of similar books deserve better than the cavalier dismissal of Gooders' preface. Perhaps the arrogance of the claims for Gooders' book left me to approach his

text with no small prejudice, but one could hardly miss the shortcomings I found.

The first 70 pages of the book consist of an introduction and a series of essays by different authors on a variety of topics: Identification (Peter Grant), songs and calls (Eric Simms), habitats (Ian Presst), nests and nesting (Jim Flegg), food and feeding (Philip Burton), range and distribution (Colin Harrison), and migration and movements (Robert Spencer). Then follow some 266 pages providing individual species accounts, each species account comprising a color portrait, a general descriptive paragraph, and short sections dealing with voice, habitat, reproduction, food, range and distribution, and movements; the left-hand third of each page is reserved for about a column inch of summary text about the bird or its populations, a map of its distribution in the British Isles or, in some cases, in the Palearctic or worldwide, and (typically) small diagrams illustrating flight patterns or sexual differences. The remaining 40 or so pages of the book comprise chapters dealing with rare, introduced, and ornamental birds, where to watch birds, the legal situation relating to birds, the addresses of various societies, and a short bibliography and index.

Popularizers are rarely up to date, and Gooders' introduction suffers badly from this effect. The vague generalities prevailing through the introduction in relation to island biogeography and climatic change contrast sadly with the authoritative text provided by Harrison's essay on range and distribution. Gooders is at his best when dealing with the human aspects of ornithology, particularly in relation to rarities. Such ideas as "Britain and Ireland are uniquely situated for the enjoyment of the skill of identification and the activity of seeking the unusual" highlight a significant aspect of birdwatching in Britain. But such insights deal with the sociology of *birdwatching* rather than of *ornithology*. The same shortcoming appears, for example, on page 11, in discussing range changes in British Birds: Gooders describes the retreat of southern species and the increase in northern-latitude species in Britain in response to a decline in average summer temperatures, but then finds it perfectly satisfactory to point out a number of southern species that extend their range northwards, without any comment as to why these range expansions occur. This is, to my mind, the distinction between British birdwatching and British ornithology: the one is quite satisfied to focus on the "whats" of birds, the other addresses itself to the "whys" of the group. Gooders' text also suffers from inferior grammatical editing, notably in the recurrence of plural nouns governing singular verbs and vice versa.

The essays at the start of the book are considerably better and generally (though not uniformly) more authoritative than is Gooders' text. The first of these essays addresses the topic of identification. Peter Grant is Chairman of the *British Birds* Rarities Committee

and knows his subject thoroughly, but some of the advice he offers suffers from a lack of a clear image of the market for which he is writing. Much of the advice he offers on pages 18–19 constitutes good advice for the embryo "twitcher" developing an interest in rarity hunting but, as much of the rest of the book is more suited to the newly interested birdwatcher who is still coming to terms with common birds, let alone rarities, I am less than happy that this advice is appropriate. Similarly, his advice on page 19 about the submission of ornithological notes for publication in local club reports is suspect. He highlights here the importance of rarities and the unusual, and offers as the reason for submitting these records the resulting development of self-censorship about one's identification of rarities. This may be good psychology but hardly serves the function of such local reports as documentation of population changes—if one records only rarities, does the absence of records at a later date mean a species was absent or that it was too common to meet Grant's criterion of rarity value?

Eric Simms' article on song and call exudes authority and is thoroughly up-to-date, but it is nevertheless well-aimed at the interested amateur. The only slip-up in this respect that I detected was on page 29, where illustrations of sound spectrographs are presented without an explanation as to how to interpret such diagrams. Presst's article on bird habitats is well written and reasonably comprehensive for British and Irish habitats, as one might expect of the Director of the RSPB. For certain habitats (notably freshwater), however, I felt that regional variation in these birds and their communities was understated. One was left by his text very much with the impression that a lake or river, etc., would hold the bird species described wherever in the British Isles that lake or river was located. The analyses by Marchant & Hyde (1980. *Bird Study* 27: 183) provide strong evidence to the contrary for British waterways, whilst Fuller's "British Bird Habitats" (Poyser, 1982) demonstrates the same point for other habitats.

Flegg's essay on nests and nesting suffers some curious textual jumps, presumably due to editing by the publisher, as similar jumps appear elsewhere in the book. (Thus, on page 40, a paragraph on territory suddenly reverts to a discussion of eggs started two pages earlier. Similarly, in Burton's essay a paragraph on page 49 on beneficial species suddenly reverts back to a discussion of adaptations for feeding, and on page 71 Spencer's essay comes to an abrupt halt.) Flegg's essay suffers from excessive caution in advancing explanations, a caution that must be confusing for the novice. Instead of the logic of "there are x explanations of this phenomenon, each appropriate to different species," Flegg tends to follow an explanation with a sentence of the type "this cannot be the explanation because . . ." In presenting novice birdwatchers with explanations of the value of ter-

ritory or of the function of egg color or whatever one surely needs to be bold, presenting the fundamental idea for the reader to grasp firmly, later modifying the explanation for particular species. The practice of setting up possible explanations only to demolish them as a general explanation must make for confused understanding on the part of the tyro.

Philip Burton writes on food and feeding, providing altogether a delightful essay that should stimulate any bird student, novice or professional. Were Burton writing as a university teacher he would have no difficulty in persuading students to come into his research area. His treatment of morphological adaptations in feeding apparatus brings the subject alive to a degree that few writers in this area achieve.

The remaining two introductory essays are both authoritative accounts of their respective subjects, on range and distribution (Harrison) and on migration and movements (Spencer). The latter essay contains some unfortunate phrases in the marginal notes (presumably supplied by the editor): thus, the note "Ringed Swifts are invariably found dead" on page 66 set me wondering how long would it be before the ringing of Swifts was stopped in the interests of conservation. The essay also suffers from the type of bad editing already commented upon, particularly in relation to the placement of subheadings. Thus, on page 66 the title *Nomads* is placed a paragraph too low and again, on page 71, the title *Four million birds* is placed a paragraph too low. The text itself, however, provides a straightforward and up-to-date account of our understanding of bird movements, catching something of the excitement of the study of migration that gives the subject its appeal to amateurs and professionals alike.

The species accounts form the core of the book. About one-third of each page is occupied by a Terence Lambert portrait of the species concerned. These are excellent as portraits but again highlight the recurring defect of the book, a fluctuating concept of its market. The accompanying text is so simplified that the book can serve only as an introductory volume for people beginning birdwatching. For such people the portraits are less than helpful. The Peterson field guide technique of pointers highlighting the relevant features for field identification is far more helpful, even if the bird concerned is drawn schematically. The detailed portraits here do not always convey the jizz of the species and some of the drawings, particularly those of terns, have the bird portrayed in a posture in which it looks positively ill at ease.

Each main species account is accompanied by a map showing the British and Irish distribution of the commoner resident species. The maps show both winter and breeding distributions for the commoner species but the choice of colors (yellow for summer distribution, blue for winter distribution, green for the distribution of resident species) is far from ideal,

frequently being difficult to discriminate. Thus, on page 123 the yellow dot used for the discrete Goldeneye colony is virtually invisible; other examples of this defect are the maps for Gannet on page 88 and for Marsh Warbler on page 278. The use of green or yellow also gets overridden by the wintering blue in the case of coastal seabirds (e.g. the Cormorant on page 91). I could find no acknowledgement of the source of the breeding distribution maps but formed the impression that they were derived from those in Sharrock's (1976) "Atlas of breeding birds in Britain and Ireland."

A detailed critique of the text in the individual species accounts would be too consuming of time and space to be warranted here. Whilst the text is broadly correct it is riddled with minor errors, inconsistencies, and anomalies. These occur at several levels. Some are as minor as the description of the food of the Swift as "insects of various species" instead of the more strictly correct "invertebrates of various species." For Stock Dove the predominant food is stated to be grain, without mention of the importance of weed seeds. The Stonechat is stated to produce a third brood occasionally whilst the available specialist studies of this species indicate the third brood is fairly regular. For the Stock Dove again the text states "A recent decline in numbers has been attributed to agricultural pesticides" but there is no reference to the well-documented recovery that has taken place since 1961-1962. Again, the population crash experienced by Whitethroats in 1968 goes unmentioned under that species. Similarly, much of the information on population numbers has been taken unthinkingly from the "Atlas of breeding birds." Thus, for the Stock Doves just mentioned, the Atlas figure of over 100,000 pairs is quoted, even though the British Trust for Ornithology's Common Birds Census Scheme indicates that numbers are probably four or five times this level now. Similarly, the wintering population estimates provided by Gooders do not always agree with the best available recent information. Where Gooders says that several hundred Great Northern Divers may winter, Prater's (1979) "Estuary birds in Britain and Ireland" puts that number at 2,000-2,500, and Gooders' similar estimate for Red-necked Grebe should be replaced by Prater's estimate of 80 or so (with occasional cold weather influxes). For the Turnstone, Gooders estimates 10,000-12,000 where Prater estimates 25,000. Other errors are scattered throughout Gooders' accounts of wild-fowl and wader numbers, with Gooders in general being out of date. Note, incidentally, the misprint discrepancy for Shoveler breeding numbers, with Gooders citing 10,000 pairs where Sharrock quotes 1,000 pairs.

The illustrations in the section on rare birds are by far the poorest drawings in the book, occasionally touching something of the reality but with most looking disproportionately plump, large-billed, or

wrong-legged. Each illustration is accompanied by one or two column inches of text highlighting the main features of the species.

Several pages at the end of the book are devoted to where to watch birds, a topic now invariably associated with Gooders. These accounts are broken down under various subheadings, including National Nature Reserves of bird interest, Royal Society for the Protection of Birds Reserves, Bird Observatories, major haunts of rarities, major seabird colonies, major estuaries, and reservoirs. This arrangement is somewhat messy, since each section must be consulted before an adequate idea of the best places in any particular region of the country can be identified. The notes provided are generally cryptic, although those on the Observatories are notably more informative.

The rest of the book is devoted to a small number of appendices. The first deals with birds and the law and is largely confined to the situation for England and Wales, with a few notes on exceptions for Scotland. Although the rest of the book deals with Britain and Ireland, no information is provided as to the legal situations in Northern Ireland and in the Republic, both of which differ from that of Britain. The last two pages of the book cover society addresses and a bibliography. The latter contains some curious omissions, there being no mention, for example, of Ian Newton's "Population ecology of raptors," of Derek Ratcliffe's "The Peregrine" or of Roger Durman's "Bird observatories in Britain and Ireland," nor of Sharrock's "Rare birds in Britain and Ireland." A short index is also provided.

I see little in this book to recommend it to the serious birdwatcher, let alone to the ornithologist. Despite the extravagant claims made on its dust-jacket, it is restricted in scope and out of date in some information. I believe it has a market, in that band of British and Irish birdwatchers who have progressed beyond the "Birds of my garden" stage and who are interested in acquiring basic information about their local birds, without getting involved in the complications of a fully scientific treatment. For such readers the introductory essays are particularly valuable in providing ornithological backgrounds to the more condensed species accounts. For this same group of readers, too, the Lambert paintings must surely be attractive, providing the novice with a glimpse of the details he will not see in the field until his experience mounts. It is also an attractively produced book, with its wealth of color and layout making one want to read it through. It is not, however, a field guide, and it is not a compendium of ornithological knowledge. In short, despite the pretensions of its claims, it is a book only for the developing birdwatcher going through his basic training, to be set aside after two or three years of practical experience. Established ornithologists (and more so Amer-

ican ornithologists) will find little need for it.—RAYMOND J. O'CONNOR.

**South American landbirds, A photographic aid to identification.**—John S. Dunning. 1982. 364 pp., 1,200+ color photographs. Newtown Square, Pennsylvania, Harrowood Books. \$37.50; Soft cover \$32.50.—For nearly 20 yr John Dunning has travelled widely in Central and South America, driven by a passion for bird photography. From the rain-drenched Chocó region of northwest Colombia to the remote interior of Mato Grosso and beyond, Dunning persisted in his attempts to mist-net and photograph his subjects in a specially designed enclosure. In doing so he and his wife Harriet withstood innumerable discomforts and logistical problems. The first hint of Dunning's dedication and ability was revealed by "Portraits of tropical birds" (1970), a collection of 72 stunning, full-color photographs of Neotropical birds. "South American landbirds" far exceeds the scope of that work, but quality is still a trademark of Dunning's craft.

This amazing book contains color photographs of more than 1,100 species of South American landbirds, as well as brief descriptions and range maps for these and nearly 1,400 additional species. The titillating array of photos includes a tremendous number of little-known species, many not previously illustrated in a book of any kind. I was amazed to see such rare and/or difficult-to-capture species as Gould's Jewelfront (*Polyplancta aurescens*), Straight-billed Reedhaunter (*Limnortyx rectirostris*), Barred Antthrush (*Chamaeza mollissima*), Rufous-crowned Antpitta (*Pittasoma rufopileatum*), Rufous-rumped Antwren (*Terenura callinota*), Helmeted Manakin (*Antilophia galeata*), Pin-tailed Manakin (*Ilicura militaris*), Sharpbill (*Oxyruncus cristatus*), Rufous-brown Solitaire (*Myadestes leucogenys*), and Yellow-crowned Chlorophonia (*Chlorophonia flavirostris*), to name a few. Thirty-nine photographs were contributed by Robert Ridgely, who is given as a collaborator on the title page; these were mainly of raptors and parrots, all taken in the wild with telephoto lenses. Notable among this selection are Red-billed Curassow (*Crax blumenbachii*), Spot-winged Falconet (*Spizopteryx circumcinctus*), and Red-fronted Macaw (*Ara rubrogenys*).

The vast majority of the photographs reflect Dunning's skill as a photographer: they range in quality from good to excellent. Particularly good are those of hummingbirds, male manakins, antpittas, and most tanagers. I assume that some of the poorer photos in this guide (e.g. the Andean Solitaire [*Myadestes ralloides*] that is as blue as a Mountain Bluebird [*Sialia currucoides*]) resulted from the reproduction process. A reflection of this problem is that subtleties in color differences among female manakins (pp. 100–104) and *Elaenias* (pp. 110–111) are not well shown. I person-



ally do not like the vivid blue backgrounds in many of the photos, especially those of undergrowth-dwelling antbirds, flycatchers, and thrushes, etc., and prefer the natural backdrops of foliage and branches. The photographs are a bit small, averaging about 4 × 4 cm, but their size contributed greatly to the overall compactness of the book, which can easily be carried in the field. The only serious technical problem in this book results from the abrupt cutting of the right-hand margins on some of the pages; this caused the lopping off of portions of bills or tails.

The text seems to be quite free of typographical errors. The species descriptions are succinct and an effort was made to provide key plumage characters where possible. The descriptions of species not illustrated often refer to others that are; this enhances the usefulness of this book as a field guide. I found several apparent misidentifications in the photographs. The female Black-bellied Antwren (*Formicivora melanogaster*), 86-1, looks like a female White-fringed Antwren (*F. grisea*) of the nominate race; the female Ornate Antwren (*Myrmotherula ornata*), 90-12, also appears to be a female White-fringed Antwren. The Dusky-tailed Flatbill (*Ramphotricon fuscicauda*), 112-4, is obviously a female Barred Becard (*Pachyramphus versicolor*). The female Purple-throated Euphonia (*Euphonia chlorotica*), 174-10, is misidentified, but I am not certain of its correct identity (possibly a female Finsch's Euphonia [*Euphonia finschi*]), but it has the rufous forecrown of an Orange-bellied Euphonia [*E. xanthogaster*], not known from Surinam where the photo was taken). Photos 5 and 6 on page 110 were possibly reversed; in my copy the bird in 6 appears to have some rufous on the rear-crown, a characteristic of the Rufous-crowned Elaenia (*Elaenia ruficeps*). The bird in photo 3 on p. 130 looks more like a Rufous Spinetail (*Synallaxis unirufa*) than a Rufous Wren (*Cinnyertheria unirufa*).

My only other substantive complaint with this book stems from the varying detail and accuracy portrayed by the range maps. The majority are well done, especially those in the latter half of the book (pp. 193-324). Most problems arise in the western one-third of the continent, where the Andes seem to be misplaced longitudinally in many of the maps. Though very accurate detail can be given on these small maps (e.g. Barred Fruiteater [*Pipreola arcuata*], p. 92) in many cases it is not. No fewer than 27 Andean species (e.g. Puna Hawk [*Buteo poecilochrous*], Andean Pygmy-Owl [*Glaucidium jardinii*], Sword-billed Hummingbird [*Ensifera ensifera*]) are shown to occur in the Amazonian lowlands of western Brazil! The maps for at least 11 species not known from Bolivia (e.g. Blue-headed Macaw [*Ara couloni*], Yellow-billed Jacamar [*Galbula albirostris*], Castelnau's Antshrike [*Thamnophilus cryptoleucus*]) erroneously include a portion of that country. Numerous species restricted to the lowlands east of the Andes are shown to range west to the Pacific

coast (e.g. White-throated Tinamou [*Tinamus guttatus*], Gray-fronted Dove [*Leptotila rufaxilla*]). Gross errors, like those of the misdrawn maps of Crested Bobwhite (*Colinus cristatus*), Tawny-faced Quail (*Rhynchortyx cinctus*), Yellow-fronted Woodpecker (*Melanerpes flavifrons*), and Hazel-fronted Pygmy-Tyrant (*Pseudotriccus simplex*), are quite rare. Avian zoogeographers might find it tempting to use these potentially valuable maps in their surveys; those who do should be aware of their shortcomings.

"South American landbirds" will prove very useful to ornithologists and advanced amateurs visiting any part of the continent. The author states (p. xi) that "this book is not for the scientist. It is designed to help the beginning bird-watcher identify the land birds of South America." As one who has been with many groups of inexperienced neotropical bird-watchers, I question whether this or any photographic guide could ever serve as a primary field guide for beginners in South America. In a review of the Audubon Society's photographic guides to North American birds, Tudor (1978. Auk 95: 201) lucidly discussed the problems associated with such books. Due to the vagaries of light exposure and the variable behavior of the bird subjects themselves, it is virtually impossible to show the characteristic field marks—colors, patterns, postures, etc.—of a dozen or more similar species on a page of photographs. This is, however, routinely done by artists in the Peterson-style field guides. The purposes of a field guide are best met through the grouping of species according to similarities in morphology and/or geographic distribution, although I realize this is difficult in a book that covers all of South America. (Note that on p. 58 of Dunning's guide only 5 of 12 woodcreepers occur together in the same locality and habitat, and they differ radically in size, shape and color pattern.) Furthermore, although this book illustrates males and/or females of an amazing 1,100+ species, this total represents only about 45% of the landbird fauna of the continent. Anyone attempting to use this guide in species-rich Amazonia will find that photos of a great many species are lacking. In some localities in eastern Ecuador and Peru, for example, as many as 10 species of sexually dimorphic *Myrmotherula* antwrens occur together in rainforest undergrowth and middlestory. "South American landbirds" illustrates only one of these, the White-flanked Antwren (*Myrmotherula axillaris*). A relatively high number of the difficult-to-identify furnariids, antbirds, and flycatchers are also lacking. This deficiency, together with a general lack of specific information on behavioral characteristics (especially voice), habitat preference, and elevational distribution (for montane species) would render it difficult to use this book as a primary field guide, particularly in the regions covered by more comprehensive references such as "A guide to the birds of Venezuela" by Meyer de

Schauensee and Phelps. The Dunning guide, however, will prove very useful as a supplemental reference in such regions, and even more useful in those areas lacking even mediocre field guide coverage (e.g. central and eastern Brazil and Paraguay).

In conclusion, I feel that everyone with an interest in Neotropical birds should own this surprisingly inexpensive, well-done book. It will prove useful, in some way, to amateurs and professionals alike. I look forward to seeing more of Dunning's superb photography in the near future. The author has admirably requested that 10% of the publisher's sales receipts be donated to the World Wildlife Fund—U.S. "to be used for the purchase and protection of bird habitat in South America." I sincerely hope that this important contribution to Neotropical ornithology will find its way into the hands of conscientious citizens throughout Latin America. The future of the richest bird fauna on earth lies with them.—THEODORE A. PARKER, III.

**Marine birds and mammals of Puget Sound.**—T. Angell and K. C. Balcomb III. 1982. Seattle and London, University of Washington Press. xiii + 145 pp., numerous black-and-white drawings. \$14.50.—Tony Angell and Ken Balcomb have produced a volume that introduces the beginning naturalist, or perhaps the nonbiologist regional planner, to the birds and mammals of the Puget Sound and Strait of Juan de Fuca regions. The book is not a reference work containing primary source material. The authors do an admirable job of introducing their readership to the concept that habitat preferences determine where we might encounter a species, and of stressing the all-important lesson that only through preservation of habitat will we continue to enjoy the company of our wild brethren. The interesting personal, anecdotal experiences of the authors, which they use to introduce the bird and mammal families, should make the book of much greater educational value than many "nature books" that treat the natural world in an abstract, distant manner. This is a handsome volume, in part because it has been enriched by Angell's numerous black-and-white drawings; the design of the volume is also rather attractive.

The book, bound in hard paper, begins with introductory sections that discuss and classify the marine, estuarine, and wetland habitats of the Puget Sound region. Next is a discussion of various natural and unnatural factors that modify these habitats and the use of them by birds and mammals. These discussions are written quite specifically for Puget Sound and environs. The main body of the book is composed of short accounts of the basic natural history of 124 avian and 14 mammalian species. Included are raptors, corvids, and other species, such as Kingfishers, that frequent coastal areas. Each account is comprised of accurate information on a species' body size,

its population status and distribution, and its food and critical habitat. The information is much more detailed in the mammal accounts, written by Balcomb, than in the bird accounts, written by Angell. The source of the information is easier to trace in the mammal section. Each account is accompanied by a range map, but it is not clear when the dots used in the maps indicate the sites where the species has actually been sighted in the Puget Sound region or when they indicate sites of suitable habitat where the species should be found. I think that at times one alternative is possibly true and at other times the second alternative is possibly true. Except for some marine mammal species, the range maps cover only waters lying on the United States side of the U.S./Canadian border.

The appendix is composed of six tables and six maps that synthesize information on the habitat distribution and species' use of habitats in the region. This material and the way it is presented goes beyond the overall introductory thrust of the book. Persons seriously interested in maintaining wildlife habitat in the Puget Sound area through regional planning would find the appendix, and the bibliography that follows, of great interest.—DAVID G. AINLEY.

**Avian incubation: Egg temperature, nest humidity, and behavioral thermoregulation in a hot environment.**—Gilbert S. Grant. 1982. Ornithological Monographs No. 30, American Ornithologists' Union, 75 pp. \$9.00.—Low-latitude deserts are among the most difficult terrestrial environments for birds to reproduce in. Since they typically are diurnal and nonfossorial, birds must directly meet the challenges of this extreme environment during periods in which physical stresses are greatest. This is particularly true during reproduction because the adult's behavioral responses to thermal stress are limited in association with the restriction of individuals to the nest site for extended periods and because the embryo is thought to be particularly vulnerable to heat stress. In spite of these difficulties, an impressive variety of birds breed during the summer in subtropical deserts. Gilbert Grant recognized the critical nature of this problem and examined the mechanisms that allow a variety of shorebirds to nest during the summer near the Salton Sea in the Sonoran Desert of California. This is an extremely harsh environment—solar radiation is intense, shading vegetation is essentially absent, and normally during the summer day air temperatures 1–2 m above ground reach 40–45°C, while soil surface temperatures exceed 50°C. In his examination of birds nesting in this area, Grant sought particularly to quantify the nature and degree of thermal stress experienced by both the egg and the adult bird, and then examined the nature and derivation of mechanisms used to cope with such thermal stresses. He also examined problems of egg water

loss in this xeric habitat and evaluated possible regulation of nest humidity by the parent bird. Most of Grant's observations deal with the physiological ecology of incubation in Black-necked Stilts, though he also presents data on American Avocets, Killdeer, Snowy Plover, Forster's Terns, Gull-billed Tern, Black Skimmer, and Lesser Nighthawks.

Grant found that, despite high environmental heat loads, average egg temperature is not remarkably high in these species, ranging from 34.8 to 39.8°C in the various species. During the hot afternoons, however, maximum egg temperatures commonly reach 42°C. These values remain below maximum shade air temperature, a feat that is accomplished primarily by evaporative cooling, which is produced by these shorebirds applying mass quantities of water to the clutch. This "belly-soaking" by the shorebirds studied (not the nighthawk) probably is derived from a distraction display and typically consists of a stereotyped drenching of the abdominal feathers by parent birds as they wade in the Salton Sea. Although an incubating parent may leave the nest briefly, drench its feathers, and then return to the nest, belly-soaking usually occurs at nest-relief so that the returning parent has wet plumage. This happens frequently during hot portions of the day, when attentive bouts tend to be shortened. For example, at shade air temperatures of 40–44°C, a parent still spends an average of only 12 min (males) to 14 min (females) on the nest before it is relieved by its mate. The returning mate typically has very wet abdominal feathers. Grant concludes that this wetting functions primarily to cool the adult, eggs, and chicks. His extensive observations at the nests of stilts and Killdeers, however, demonstrated that the chicks do not drink from the wet feathers, as do young sandgrouse.

A second important mechanism involved in egg thermoregulation is constant (in the nighthawk) or nearly constant (up to 90% in stilts) attentiveness by the parents during daylight hours. This produces extreme heat loads on the parents, which respond by extensive panting, gular flutter (in the nighthawk), and dorsal pteryloerection. Dehydration in female Lesser Nighthawks must be extreme, because they incubate continuously throughout daylight hours without relief and without drinking.

Grant's data also hint that he may have missed a third method of egg-temperature regulation possibly employed by some of these species. This is facultative hypothermia by the adult, which would allow it to use its body as a heat-sink to cool the eggs below environmental temperature. A colleague and I recently demonstrated that desert-nesting Mourning Doves exposed to air temperatures of 44–46°C maintain core body temperature near 38°C, or about 5–6°C lower than expected for doves exposed to such environmental temperatures. Contact with the adult's relatively cool body maintains egg temperature at or below 40°C. This is an important mechanism for this

species, which does not have immediate access to surface water and which nests during periods so hot that even shaded eggs may exceed 45°C. Grant's data suggest that some of the species he studied also may employ this technique. For example, data for the Lesser Nighthawk indicate that egg temperature may be held below air temperature without "belly-soaking" by the adult. How is this accomplished? More striking, a temperature transmitter was implanted into one stilt and recorded a body temperature of 36.6°C during the hot afternoon; this is substantially lower than expected, even for a stilt not exposed to heat stress. Grant attributes this low temperature to the transmitter being located in an abdominal air sac, which he suggests was cooled below general core temperature by respiratory evaporation. Sufficient data are not available to evaluate this possibility, and Grant made no other measurements of body temperature to allow examination of this possible use of adult hypothermia to cool the eggs.

Grant also presents an extensive data set describing hydric relations of eggs incubated in this extreme environment, including descriptions of shell conductance to water vapor, egg dehydration, nest humidity, "nest ventilation," and effects upon egg desiccation and respiration of salt and mud on the eggs. Interestingly, eggs incubated in nests at the Salton Sea do not dehydrate remarkably more than do those of species in more mesic environments (i.e. during the course of incubation, eggs of these species lose an average of 9–18% of their initial mass in water), nor do nest humidities appear to differ remarkably from those of birds in other habitats.

Parental wetting of eggs with water from the Salton Sea often coats the eggs with salt and mud. This did not appear to reduce embryonic oxygen consumption, but the presence of mud can depress water-vapor conductance of eggs an average of 10% in Black-necked Stilts and 16% in American Avocets. A layer of salt had no significant effect.

Using data for the Killdeer and the Snowy Plover, Grant also examines the hypothesis, put forth by Hermann Rahn and his coworkers, that parent birds regulate nest humidity. This might seem particularly likely to occur in species that regularly bring water to the nest. By analysis of parental behavior, nest humidity, and ambient humidity, however, Grant concludes that variation in parental attentiveness and belly-soaking do not function to regulate nest humidity.

In addition to belly-soaking and foot-wetting, Grant describes a suite of thermoregulatory mechanisms used by the attending parent. These include postural orientation with regard to sun and wind, almost continuous panting during daylight hours, and the conspicuous erection of dorsal plumage that often is observed in heat-stressed birds.

Grant's approach to these problems generally is up-to-date, and he clearly appreciates recent develop-

ments in physiological ecology. Much of his work is devoted to topics of substantial current interest, such as regulation of egg dehydration during natural incubation. In addition, the monograph is well-written and edited; the text, figures, and tables generally are clear, concise, and contain few typographic errors. I do have two criticisms, however. First, the techniques used are only adequate in most places and are questionable in some. For example, most of the temperature data were collected using a YSI thermistor thermometer. Grant's model goes offscale above 50°C, so some data simply were lost. Grant does not state the size of thermistor probe inserted into eggs, but probes of the diameter (about 4 mm) commonly supplied with the YSI instrument are sufficiently large that axial conduction of heat can significantly alter egg temperatures. Without additional technical details, Grant's egg temperatures thus are suspect.

A second example of problems in methodology arises from Grant's measurements of nest humidity using egg hygrometers. These devices consisted of stilt or avocet egg shells filled with silica gel. The hygrometer is placed in a nest and its uptake of water vapor determined by weighing the eggs after 24 h. With such small eggs, mass change must be measured to  $\pm 1$  mg. Rather than weighing them in the field, Grant sealed his hygrometers in plastic bags and transported them to UCLA for measurement. Unfortunately, typical plastic bags are partially permeable to water vapor and at least some water vapor must have been enclosed in the bags with the hygrometers. Grant apparently was aware of this problem and states that the mean mass of egg hygrometers treated in this manner differed by only 2% from that of controls. My experience with eggs the size of a stilt's (21 g fresh weight) indicates that the egg hygrometer will weigh at least 10 g. A 2% mass change is thus 200 mg. Using Grant's values for nest humidity and shell conductance to water vapor, the daily mass gain of the hygrometers may be crudely estimated to be about 115 mg, or only about 1% of the egg hygrometer's mass. This suggests that Grant's method may have produced substantial errors in his values for nest humidity. These two examples of technical problems suffice for illustration, but the critical specialist undoubtedly will find additional difficulties.

A second problem arises from the tactical error that Grant probably committed by spreading his research efforts among too many species and too many sub-projects. He studied eight species and quantified an impressive variety of variables (climatic data, egg temperature, egg reflectance, embryonic oxygen consumption, egg water loss, nest humidity, shell water-vapor conductance, and parental behavior, to name but a fraction). An unfortunate result is that many values are based upon very small sample sizes (e.g. body temperature measured in only one stilt; relations between air temperature and egg temperature in Killdeer and nighthawk based upon data from only

two nests of each species). Had research effort been concentrated upon one or two species, such as the Black-necked Stilt, Grant might have had time to collect a uniformly solid data set and include some critical data, such as hatching success in nature, that are missing.

These flaws, however, are not overwhelming. Indeed, Grant is to be congratulated for focusing attention on an important set of problems in the biology of desert birds. In spite of having to work in one of the most inhospitable environments in the world, Grant has collected an important set of observations that will be valuable to those interested either in avian incubation or the physiological ecology of desert birds.—GLENN E. WALSBURG.

**Evolution without Evidence. Charles Darwin and *The Origin of Species*.**—Barry G. Gale. 1982. Albuquerque, University of New Mexico Press, x + 238 pp. \$21.95.—Annually the volume of *Darwiniana* increases, and it has now reached truly monumental proportions. It is not inappropriate, however, that another bibliographic and analytical text should be published in the centennial year of Darwin's death. Each of Darwin's researchers appears to have read (almost?) everything that was written by Darwin and about Darwin. Many (Irving Stone, for example) have had as their goal the understanding and appreciation of the man Charles Robert Darwin. This last certainly appears to be impossible, as each author colors Darwin in his (or her) own special hues. What Gale proposes to add to the composite picture of Darwin is summed up on pp. 151–152, where he notes that Darwin's managerial capabilities were "crucial" to the development of his work. Actually, of course, this small book (160 pages of text) has many interesting comments on Darwin and in reality is about many other aspects of the Darwin, Darwinism, problem.

Starting at the beginning, the title of this book is misleading and tends to produce an adversarial mindset in the reader. Gale is justified in giving much attention to the method(s) of Darwin and indirectly to the question "Was the *Origin* actually science?" It is clear that in the minds of Lyell, Hooker, and Huxley what Darwin was doing was science—at least in the terms of the time. And Darwin often in the *Origin* comments that if this or that were so then his whole argument would be in vain; in short, falsified in the Popperian sense. Of course, one can point to the comments of many antidarwinists, St. George Mivart or Louis Trenchard More as examples, who would deny the legitimacy of Darwinism.

The title goes a bit further than just method. It states a lack of supporting facts, yet on p. 137 the author notes that "Darwin is able to put together a coherent, cohesive, and forceful argument on a subject of vast magnitude and difficulty supported by a relatively narrow base of solid, incontrovertible evi-

dence." What Darwin intended to do was produce a theory that had the greatest explanatory power, and he did that.

If one forgives the weakness of the title and the clumsiness of the argument that Darwin's theory [of natural selection] was the *least objectionable* (p. 140) available theory, one can enjoy other parts of this intellectual buffet. Another sore point with me was the assumption that Darwin was not adequately educated or capable of functioning as a "naturalist" on the "Beagle." As one who has collected, I can say that Darwin was as well prepared as any other 22-yr-old for a 5-yr voyage around the world. This is particularly true in terms of the education then available that would prepare him for such a voyage. Amateurism was in, and Darwin was not much different from others in the sciences. The fact remains that he did an excellent job over a wide range of subject matter. Darwin had Henslow's instructions and Lyell's first volume to guide him. The latter was particularly valuable because it directed his attention to important geological questions, questions with import in terms of transmutation of species. Receipt of the second volume of Lyell's work raised new questions and gave new direction to Darwin. Gale does a good job with Lyell's influence on Darwin but, if anything, undervalues it. To lament what might have been seems out of place in view of what was.

Gale expands the question of competency by pointing out that Darwin needed the 20 yr between the voyage of the "Beagle" and the *Origin* to train himself and collect information. I believe that most biologists would agree with Gale's assessment, but it does not refute Nora Barlow's belief that Darwin returned from the voyage as "a scientist who could command the attention of the great men of the day." Even with the better training of today's scientists, years would be needed to explore and understand such a question as the (secondary) cause of evolution. [A recent book by Ospovat (1981, the Development of Darwin's theory, Cambridge Univ. Press) has as its theme the development of Darwin's ideas on natural selection.] To suggest that Darwin was somehow not the best man for the job neglects the fact that there was no other.

Gale has some other strawmen that he assaults with dispatch, but again these distractions are part of the price any reader must pay for almost any, if not all, books. There are several very interesting areas. Darwin's correspondence with Joseph Hooker and Asa Gray is part of the argument of Darwin's managerial skill but also reveals much of the "real" Darwin. Darwin wrote Hooker on January 20, 1859: "I always comfort myself with thinking of the future, and in the full belief that the problems which we are just entering on, will some day be solved; and if we just break the ground we shall have done some service, even if we reap no harvest." This quotation is particularly interesting in terms of the present-day re-

surgence of creationism and the unsettled debates of the evolutionists.

The quotation also remarks on "reaping a harvest." Gale points out the practical nature of Darwin and his ambition and need for recognition by his peers. In this Darwin was no different from scientists then or now. Darwin's managerial skills appear again in terms of Darwin's daily program of activity and his schedule of publications. (Gale does not make much of the volume and scope of Darwin's publications, of his skill as an experimenter, of his clarity of vision as to what needs to be done to investigate a point, and of his wisdom as a naturalist. All these are impressive to me, and all were done by a man who is always described as sick much of the time.) Gale does go into a more subjective side of Darwin (pp. 154-163), the argument as to whether Darwin was a don or a dunce. Gale leans on John C. Green's "Reflections on the progress of Darwin studies" (not in the literature cited) for much of his commentary. I would certainly agree with Jacques Barzun about Darwin's begging a question "because the begging generally covers pages of circumlocutory matter," but disagree with his comment that "Darwin was not a thinker . . ." or that "Darwin . . . does not belong with the great thinkers of mankind." Actually we are back again to an earlier mentioned problem—finding the "real" Darwin, the man not the myth. We will never know Darwin's thoughts and ideas beyond those he chose to place on paper for all to see (although we do get glimpses of him from his son Francis and from others who knew him). Darwin as a thief of ideas seems an excessive view, certainly not as probable as Darwin a man of great and demanding ambition.

The book has a short appendix summarizing the major elements of Darwin's theory, its difficulties, and its support. Gale does not separate the "theory" into its component parts: the fact of evolution and a theory of its cause—by natural selection. What he does in this section is to summarize the arguments of the *Origin*—a useful, if misleading, activity. Also, there are copious notes on the sources of ideas in the chapters (pp. 171-211), with many references and ideas not seen in the text. The "works cited" are divided into primary and secondary sources, a reflection, perhaps, of the author's training in the history of science at the University of Chicago. The author includes reference to only one other publication (1972) under his name and is currently employed by the government in the Department of Energy.

I like the book very much and consider it of the same genre as that of Gillespie, Ghiselin, or Ruse. It is easy to read, interestingly written, and informative—well worth the price.—MALCOLM JOLLIE.

**The cotingas.**—D. W. Snow. 1982. Ithaca, New York/London, England, Cornell University Press/

British Museum (Natural History), Oxford Univ. Press. 203 pp., 21 color plates, 30 maps, 3 appendices. \$35.00/£30.—Having spent over 20 yr studying Neotropical birds, I was elated to hear that David Snow was at work on a book on the cotingas, one of the most interesting and diverse families of birds. I was not to be disappointed—at least by Snow's part of the book. He first addresses some of the obvious general topics that need to be discussed, such as the origin, classification, and distribution of the group; evolutionary radiation and sociobiology; color, ornamentation, and display structures; and breeding and the annual cycle. He then begins a section on systematics of the family that takes up most of the rest of the book, each chapter presented by genus. He avoids giving detailed descriptions of typical plumages as they are available in a number of other publications; however, full attention is given to plumages not well known or those previously undescribed, and plumage sequences and molt are also well documented when appropriate. If, as in *Pipreola*, there are several species groups within a genus, he discusses related birds at the same time. After discussing the systematics of the members of a genus, he then covers habitat, food, behavior, breeding, plumages and molt, physical characters such as structure (both external and internal, including soft-part colors), and, lastly, gives brief comments on geographic variation and presents measurement and weight data, where available, for a selected group of forms. Several genera and species with which Snow had little or no experience are presented as chapters written by others, notably *Ampelion* by Theodore A. Parker, III, *Conioptilon* by John W. Fitzpatrick, and *Rupicola peruviana* by Cesar E. Benalcázar and Fabiola Silva de Benalcázar. Following the generic discussions are appendices covering geographic variation among members of the family, the derivations of the scientific names of members of the family, and one that adds to the distribution maps that accompany each genus or set of genera.

The book is one of the first of many dealing with an entire family of birds to use a good comparative presentation. Although Snow rarely mentions the superspecies concept, his presentation, both in the text and on the maps, often makes it obvious that certain members of a genus probably do represent members of a superspecies (i.e. map 18, p. 99, showing the distribution of the three forms of *Carpodectes*). The maps are among the best that have been in any bird book. Often taking up nearly three-quarters of a page, they may seem wastefully large to some people, but their size allows for accurate placement of symbols and, when necessary, allows for most of South America and part of Central America to be on a single map. The Andes are shown in a gray-shaded tone and in great detail, and most major rivers are indicated, making obvious breaks in distribution clearly evident. The only complaint that I

have about the base map is that I have been unable to locate the explanation of what contour line was used to denote the Andes—I am guessing that it is either 1,500 m or 2,000 m.

As a reviewer it seems necessary to point out some of the mistakes and problems in the book. Basically there are very few, but they have managed to creep in. On Map 8 there is a symbol for *Ampelion rufaxilla* buried under two symbols for *A. stresemanni* at the northern end of the Cordillera Blanca in central Peru west of the Marañón River—the former, a humid forest, east-slope bird, surely does not occur in the high *Polylepis* forests occupied by the latter. Although seven localities are mentioned for *A. stresemanni*, only six are plotted on the map; the missing locality seems to be the one in the eastern Andes listed by Parker on p. 62. On Map 21 a locality for *Lipaugus cryptolophus* that is west of the Marañón River surely must be wrong—another case of a humid forest, east-slope species that would not be expected in the high, arid brushland. There may be other such problems, but probably not many.

Other spot checks revealed few other problems or omissions, but I did note that the origin of the name *tallmanorum*, which I applied to *Pipreola riefferii tallmanorum* (named for Dan and Erika Tallman, who worked in the region of the type locality), was omitted from Appendix 2; McIlhenny, as applied to *Conioptilon mcilhennyi*, was, happily, included!

Any negative comments I may have about the text of this excellent book are truly "nit-picking." Snow has done a fabulous job. What is not known about cotingas is, however, enough to illustrate yet again that field studies of Neotropical birds are still sorely needed. Some of the finest, most detailed research on cotingas has been done by Snow and his wife Barbara and was previously published elsewhere, but summarized for this book. Their studies of the bizarre Calfbird, *Perissocephalus tricolor*, and of several of the bellbirds, *Procnias*, are excellent models for other students of cotinga natural history to follow.

The cotingas are one of the most bizarre, beautiful, and varied group of birds as can be found anywhere. I had hoped to find them well illustrated in this book, but I was disappointed by the 21 plates by Martin Woodcock. These plates show the adults of all species and, when appropriate, show some geographic, sexual, or age variation. The illustrations are adequate, but not much better. After seeing the nice paintings that Woodcock did for Derek Goodwin's recent new book *Estrildid finches of the World* (1982. Ithaca, New York, Cornell Univ. Press), I am convinced that Woodcock has not seen a living cotinga. In general his cotinga illustrations are quite lifeless. Many of the birds have greatly oversized eyes, such as those on the *Pipreola* plates; some large birds, such as those on the plate of *Cephalopterus*, look small, almost manakinlike; some, such as the *Phoenicircus*, are too thin and long-tailed; the adult male *Querula purpu-*

*rata* has only a single long tertial instead of three as it should. I am also reminded of a comment that George Sutton once made to me about backgrounds and plants: "they are just as important as the bird and deserve just as much attention." I wish Woodcock had spent more time on the plants and backgrounds than he apparently did. Again, I am being "picky," but I did wait with great anticipation to see this marvelous family of birds well depicted and I was disappointed. I suppose that Woodcock was able to see many of the Estrildid finches alive because these birds are commonly kept in captivity, and thus he avoided many of the problems he had with the cotingas. The plates do perform their function—they are pretty and they are well reproduced. Really, I must say that they are adequate, but they are just not up to my expectations. I guess once someone sees Guy Tudor's cotingas in the *Guide to the birds of Venezuela* (1978. Princeton, New Jersey, Princeton Univ. Press), it is difficult to be satisfied with portrayals that are not as good!

I did find one legend mix-up—the labels for two of the *Xipholena* species are switched so that White-winged is called White-tailed and vice-versa, but since only one species of the three has a white tail, the problem is easy to solve.

Although I have picked out problems in the text and maps, and I have been "ruthless" with the quality of the illustrations, I must say that *The cotingas* is one of the finest books on a single family of birds to appear in a long time. Instead of simply reporting the facts, and information is presented in such a manner as to suggest many areas within the family that are in need of further study. Anyone interested in tropical birds or just an exceedingly interesting group of birds will want to own this book. As a 1982 publication with 21 color plates the price is not bad.—JOHN P. O'NEILL.

**Estrildid finches of the world.**—Derek Goodwin. 1982. London, British Museum (Natural History); Ithaca, New York, Comstock Publishing Associates. 328 pp., 8 color plates. \$45.00.—The Old-World family Estrildidae comprises some 139 species. In this, the third monographic treatment of an avian family by a prolific scholar, Goodwin brings together the vast literature on classification and biology of this fascinating group. Several of the more detailed studies reviewed are his own.

In the introductory chapter (p. 7) the author discusses the relationship of the viduines to the estrildids. He favors the view that the viduines are properly placed in the Ploceidae, and that the morphological and behavioral similarities with the estrildids do not reflect relationship but are the result of special adaptations of the avian parasites to their hosts. Based on studies of pterylosis and appendicular myology, however, Morlion (1980. Proc. IV Pan-

Afr. Ornithol. Congr.) and Bentz (1979. Bull. Carnegie Mus. Nat. Hist. 15) arrived independently at the conclusion that the viduines are closely related to the estrildids. Bentz proposed making the viduines a subfamily (Viduinæ) of the Estrildidae and that the currently recognized estrildid tribes be raised to subfamilies: Poephilinae, Lonchurinae, Estrildinae. If Bentz is correct, then the colorful palate markings and head-twist behavior of nestlings must have been present in the "ancestral" viduine, "preadapting" it to its parasitic mode of life. Perhaps more modern techniques in systematics (e.g. DNA-hybridization) will provide us with answers to this taxonomic controversy.

Following the introduction are two short chapters on distribution and adaptive radiation and plumage and coloration. This is followed by a longer chapter (pp. 20–50) on behavior and biology. Goodwin discusses (p. 21) the experiments demonstrating the Zebra Finch's (*Poephila guttata*) ability to survive long periods without water. He suspects similar abilities in other desert forms: these have been demonstrated in Cutthroat Finches (*Amadina fasciata*) (Edmonds, 1968. Auk 85: 326) and Silverbills (*Lonchura cantans* and *L. malabarica*) (Willoughby, 1969. Comp. Biochem. Physiol. 28: 655).

In the section on "Voice" (p. 48) Goodwin cites Nicolai, who stated that sound spectrograms only imperfectly reproduced the variety and nuances of estrildid calls, and that calls easily distinguished by the unaided ear may look almost identical on a sonogram. This may be true if one relies only on the traditional pitch versus time displays. The recent amplitude-display modules developed by Kay Elemetrics would probably enable investigators to amplify and quantify small tonal (pitch-amplitude) differences between morphologically similar signals (see e.g. techniques in Bowman, 1979. J. Ornithol. 120: 354). Goodwin does not believe that a rigid distinction between "courtship" and "undirected" song could be drawn (p. 49). Recent studies of Zebra Finch songs by Sossinka and Böhner (1980. Z. Tierpsychol. 53: 123), however, revealed a number of quantifiable differences between the two song types.

Threat displays are usually poorly developed in Estrildids (p. 38). There are a few exceptions, however, which Goodwin should have called attention to in this section, notably the highly ritualized displays of the African Mannikins (*Spermestes/Odontospiza* group) and *L. (Padda) oryzivora*. These are described later in the species accounts of the Bronze Mannikin (*L. cucullata*) and Java Finch, but overlooked in *L. (Odontospiza) griseicapilla*.

Chapter 5 (pp. 51–64) deals with keeping estrildids in captivity and contains much useful information for the hobbyist or scientist who wishes to maintain captive stocks for study.

Species accounts follow in Chapter 6. Goodwin treats the estrildids as 21 species groups. The distri-

bution of each species is illustrated by a map. A little over a third of the species are illustrated in color. A general description of each species group, their habits, and Goodwin's interpretations of their taxonomic affinities precedes the details on each species. A plumage description of each species is followed by brief subspecies descriptions, then (when available) sections on field characters, distribution and habitat, feeding and general habits, nesting, voice, display and behavior, and list of references.

Mayr (1968. *Breviora*, Mus. Comp. Zool. 287: 1) noted (p. 5) that: "The Estrildidae appear to be unique among bird families in that color pattern is a relatively poor clue to relationship." Taxonomists have often relied on behavioral characters in assigning estrildids to genus, subgenus or tribe (the subfamily of Bentz, op. cit.). Goodwin points out that the "straw display" (p. 40) is the most widespread among estrildids and is probably phylogenetically the oldest form of courtship display. In its complete form (illustrations on pp. 39–41) a bird holds a straw by one tip, then bounces up and down a perch by alternate stretching and bending of the legs. The straw display is widespread among waxbills (Estrildae) but is thus far unknown for members of the genus *Lonchura sensu stricto*.

The displays of *Lonchura leucogastra* are hitherto undescribed. A hybrid *L. striata* × *L. leucogastra* (produced in my laboratory) was backcrossed to its mother (*L. leucogastra*). The backcross consistently gave a full straw display. *L. striata* × *L. leucogastra* hybrids backcrossed to *L. striata* females produced two male offspring with displays almost identical to *L. striata* (bowing, lateral pivoting, mandibulating). It is thus likely that the straw display is typical of *L. leucogastra*. The presence of the straw display is thus not a good clue to phylogenetic relationships, as Goodwin proposes (see beyond). Some mannikins may hold a straw during the introductory portions of their display (*L. punctulata*, *L. striata*, *L. spectabilis*).

Güttinger has argued convincingly that the Madagascan Bibfinch (*L. nana*) is not related to the African *Spermestes* group. Goodwin agrees with Güttinger in resurrecting the monotypic genus *Lepidopygia*. Goodwin noted (p. 261) a generalized resemblance between the Bibfinch and the two silverbills (*Eudice*), but added that the similarities might be due to convergence. He suggested that the straw display of the Bibfinch may indicate relationship with the African Waxbills (Estrildae). Data suggest to me that the Bibfinch may indeed be closely related to the silverbills and Asiatic Mannikins. The Bibfinch shares the straw display with the silverbills (and probably *L. leucogastra*). Calls of the Bibfinch are morphologically similar to those of the silverbills, notably *L. malabarica*. Both Bibfinch and silverbills have naked young (contra Güttinger, not all *Lonchura* have naked young). The palate of the nestling Bibfinch

bears a single horseshoe typical of *Lonchura* species. The Bibfinch and both silverbills sometimes use nests of weavers (Ploceidae) in which to breed. I would favor merging the Bibfinch in the genus *Lonchura*. This would be consistent with Goodwin's treatment of *Lonchura* (*Padda*) *oryzivora* and *Estrilda* (*Coccygia*) *melanotis*, which, like the Bibfinch, have peculiar plumage characteristics but have been merged in the larger genera. In addition to the dove (*Alectroenas*) mentioned by author (p. 261) are several Madagascan species with close relatives in Asia rather than Africa. These include an owl (*Ninox*), a Bulbul (*Hypsipetes*), a Magpie Robin (*Copsychus*), a Cuckoo (*Cuculus*) (Moreau, *The bird faunas of Africa and its islands*. New York, Academic Press, 1966). It should not be surprising, then, that an Asiatic Mannikin also managed to colonize the island.

In addition to the morphological characters (p. 262) shared by the African mannikins (subgenus *Spermestes*) and *L. griseicapilla* are a suite of unique behavior patterns that they share. These include double begging calls, a wing-up fighting posture, and absence of "peering." Goodwin notes that most *L. griseicapilla* display with a straw. Some individuals, however, court with bill wide open and tongue wagging (p. 269), a display shared with *Spermestes*. I would thus favor merging *Odontospiza* in *Spermestes*, as the chief differences between the two taxa are in plumage coloration/pattern.

None of my remarks are meant as serious criticism. I consider Goodwin's book a splendid synthesis of what is known on Estrildids. Bringing together all the literature, especially all the German literature, was an enormous undertaking. The author writes for the biologist and aviculturist. Estrildids are often colorful and usually easily maintained and bred in captivity. Much of our knowledge of this group has been contributed by aviculturists: there are 109 references from *Gefiederte Welt* and 77 from *Avicultural Magazine* in the species accounts. The author's synthesis reveals that displays are still unknown for at least 43 species, and that detailed field studies (e.g. those on *Lagonosticta senegala* by Morel and Payne) have been regrettably few. He also calls attention to quite a number of hitherto unsolved taxonomic problems on species, generic, and subfamilial levels. I recommend this book to all who are interested in keeping and/or studying estrildid finches or birds in general. Those looking for biological problems to solve who share the author's sentiments that (p. 10) "small is beautiful," will find a wealth of useful information in this opus.—LUIS F. BAPTISTA.

**The California Islands: Proceedings of a multidisciplinary symposium.**—Dennis M. Power (Ed.). 1980. Santa Barbara, California, Santa Barbara Museum of Natural History and Haagen Printing. vii + 797 pp., cover photo by F. G. Hochberg, 247 figs. (including



2 foldout maps in color), 126 tables. \$20.00.—This book results from a conference held on 27 February through 1 March 1978 in Santa Barbara, California, where over 400 persons gathered to hear and discuss 69 papers dealing with the geology, biology, and anthropology of the California or Channel Islands.

After an introduction by Power, the 43 included papers are divided under six major headings: "Geologic History and Paleontology"; "Prehispanic Man"; "Vegetation Changes and the Impact of Feral Animals"; "Evolution and Ecology of Land Plants"; "Biogeography, Evolution, and Ecology of Marine Organisms"; and "Biogeography, Evolution, and Ecology of Land Animals." Although only eight titles deal explicitly with birds, an impressive number of other papers provide data of fundamental relevance to any interpretation of the history of the avifaunas of these islands. For example, on the basis of geologic evidence, Junger and D. L. Johnson, and Vedder and Howell cast serious doubts on the existence of a possible Quaternary land bridge or bridges between either the Santa Monica Mountains on the mainland and the chain of northern islands or between any of the other islands. Nonetheless, the likelihood of a shallower (estimated maximum water depth of 100 m) and narrower (6 km) Quaternary channel between the mainland and the northern group of islands makes the past barrier seem much less formidable than previously has been envisioned. Wenner and D. L. Johnson also argue against a land bridge, based on distributional information from terrestrial vertebrates exclusive of birds. They invoke sweepstakes dispersal as the primary mechanism by which the islands were populated by land organisms. These authors also propose that prehistoric man could have either inadvertently or intentionally transported to the islands various small reptiles and mammals as pets or food. This method of colonization was proposed earlier (N. K. Johnson 1972, *Condor* 74: 311) as a possible source for the distinctive form of the California Quail (*Lophortyx californica catalinensis*) on Santa Catalina Island. Berger's report of a probable mammoth kill site on Santa Rosa Island, complete with a fire area and stone tools and dated by the radiocarbon method as being at least 40,000 yr old, suggests that Indians have been on the California Islands for a much longer tenure than previously supposed. Consequently, aboriginal influences on the insular flora and fauna are likely to have been prolonged and widespread. Indeed, D. L. Johnson, in a separate paper, describes the profound stripping of vegetation and erosion on San Miguel Island presumably resulting from the substantial population of both late Pleistocene elephants and prehistoric man.

Modern man and his domestic animals, especially goats and sheep, have also exacted their toll on the native flora, as several authors (Minnich, Brumbaugh, Hobbs, and Coblenz) lament. Coastal sage scrub has been especially reduced on several islands,

through destructive browsing and grazing. The latter activities, coupled with a major fire, have also caused serious deterioration of the groves of *Pinus muricata* on Santa Cruz Island. Hobbs describes the present conifer stands there as senescent, with poor or no regeneration. The effects on the resident avifauna of such pervasive habitat modification, described for virtually all of the major islands, cannot have been minor.

The ornithological papers deal specifically with seabirds (Hunt et al.; Wingfield et al.; Hand), land birds (Diamond and Jones, Power), historical changes in the populations of resident raptors (Kiff), nesting biology of the endemic form of Scrub Jay (*Aphelocoma coerulescens insularis*) (Atwood), and avifaunal remains from Indian middens on San Miguel Island (Guthrie). As Hunt et al. state, 11 species (approx. 24,000 pairs) of primarily marine birds nest on the islands off southern California, some reaching substantial population sizes [e.g. Cassin's Auklet (*Ptychoramphus aleuticus*) at ca. 11,150 pairs]. Some remarkable population changes have occurred during historical times, many of which are directly or indirectly attributable to man. San Miguel Island, with 14,000 to 15,000 pairs, supports the largest seabird colonies. In general, most seabirds nest on the small islands and offshore rocks that lack foxes. Two papers concern the Western Gull (*Larus occidentalis wymani*). In the first (Wingfield et al.), the origin of the homosexual pairing that occurs in a significant proportion of the breeding adults of this species on Santa Barbara Island is examined. The hypothesis currently favored to explain such female-female pairing is that the sex ratio is skewed toward this sex. However, we still lack an explanation of why females occur in excess of males in these breeding colonies. Hand documents a stable or growing population of nesting Western Gulls on Bird Rock, Santa Catalina Island, between 1965–1966 and 1974, although the number of fledglings produced in 1974 was significantly lower than found in the earlier censuses.

In a paper that is surprisingly similar in content to their earlier offering (Jones and Diamond 1976, *Condor* 78: 526), Diamond and Jones discuss avifaunal turnover on the California Islands. Once again they seriously underestimate both the probable amount of turnover due to sampling error (pseudo-turnover) and that caused by man and his fires, DDT, goats, sheep, and rabbits on these much-abused islands. More importantly, they continue to give unwarranted importance to the low level of real turnover that probably does occur, when, in fact, no one has yet presented any convincing evidence that the tiny number of species and of individuals on which avifaunal turnover calculations usually are based is anything more than a trivial fringe component of insular ecodynamics. As Simberloff puts it (1976, *Ecology* 57: 630), experiments are necessary "to examine whether faunal turnover is significant in sizeable

communities or whether it is a quaint, mathematically tractable, but usually minor effect observable only in systems smaller than those of interest to most ecologists."

Focusing on the morphologically distinct bird populations on Guadalupe Island of species that also occur on other California Islands, Power presents a thorough analysis of size variation in the Rock Wren (*Salpinctes obsoletus*) and House Finch (*Carpodacus mexicanus*), based on his own measurements. For other Guadalupe Island differentiates, measurements published by others were used. Although much chaotic or patternless variation is revealed, the most extreme island phenotypes for both the Rock Wren and House Finch occur on Guadalupe Island; intermediate phenotypes are found on the San Benito Islands. Much of the variation in the size characters studied for the nine species as a group seemed to relate mainly to variation in the single parameter of body size. The increase in bill size commonly found in island birds is reported for several of the taxa examined, but Power did not uncover any general insular trends in this feature.

Kiff's paper thoroughly documents the extermination of the formerly substantial populations of the Bald Eagle (*Haliaeetus leucocephalus*), Osprey (*Pandion haliaetus*), and Peregrine Falcon (*Falco peregrinus*) from the Channel Islands. The data he marshals overwhelmingly support the view that man was responsible for the demise of the Bald Eagle and Peregrine Falcon; information for the Osprey, however, is equivocal on this point. Because these species have figured prominently in the calculation of avifaunal turnover rates for the California Islands, Kiff correctly concludes that "It is difficult to see the relevance to natural turnover rates of calculations based, in large part, upon man-induced extinctions."

Atwood offers important new information on the breeding biology of the island form of Scrub Jay. Basically the nesting of *A. c. insularis* is similar to that reported for mainland populations of the species in the western United States. Mean clutch size of the island subspecies, however, is significantly lower than in two races from the adjacent mainland, a finding in keeping with the hypothesis that temperate insular forms are more subject to K-selection than are their mainland counterparts. Although nest predation may be high in *A. c. insularis*, the island jays have very low (19%) mortality beyond the nest and early fledgling stage, and in this respect closely resemble the Florida Scrub Jay (*A. c. coerulescens*).

Finally, Guthrie's paper provides new information on the past avifauna of San Miguel Island, based on analysis of remains from four rich midden sites with varying durations of occupancy between 4770 and 400 B.P. Three species of birds not currently known to nest on the island, the extinct genus *Chendytes*, Manx Shearwater (*Puffinus puffinus*), and Leach's Storm Petrel (*Oceanodroma leucorhoa*), bred on San

Miguel within the last 2,000 yr. Because remains of the House Finch are lacking from the relatively abundant passerine material from one site, Guthrie suggests that this species did not occur on the island prior to 500 B.P. Snow Geese (*Chen hyperborea*) and probably other granivorous anatids were eaten by the prehistoric humans. Most marine birds, however, seem to have been killed for their feathers rather than for food. These are just a few of the points illuminated by this very informative analysis.

In sum, this book is a first-rate, scholarly production. The general level of papers is high, with many contributions containing sophisticated data, thorough analyses, and results of lasting value. And, with an abundance of good illustrations and a pleasing format, the book is also attractive. Organization is logical and editing has been painstaking; I noted no errors beyond the trivial flaw that when my copy rests on its back the title on the spine is upside down.

Power's summary is a well-reasoned review of the major points of each contribution considered in the light of past investigations and new research techniques, models, and theories. Although no real synthesis emerges, such would perhaps be premature and especially difficult to develop at this point because the contents of the volume are too disparate to permit the telling of a unified story. Nonetheless, these proceedings form a fine sequel to the first attempt at a cohesive treatment of the California Islands (R. N. Philbrick (Ed.), *Proceedings of the Symposium on the Biology of the California Islands*, Santa Barbara Botanic Garden), published in 1967 and still a valuable reference. Hopefully, the favorable trend established by Philbrick and Power will continue and our dedicated colleagues in Santa Barbara will publish, sometime around 1993, a third volume of approximately 1,700 pages devoted to these fascinating islands.—NED K. JOHNSON.

**An introduction to behavioural ecology.**—J. R. Krebs and N. B. Davies. 1981. Sunderland, Massachusetts, Sinauer Associates, Inc. 292 pp. \$16.50 paper, \$39.60 cloth.—This is a book "about the survival value of behaviour . . . about competition between individuals for the chance to reproduce and pass on their genes to future generations" (p. 1). It is based largely on two main premises: (1) that genes are selfish and (2) that animals will tend to optimize. These premises are based in turn on the fundamental assumption "that animals are well adapted to their environments" (p. 27). Thus, the entire book focuses on the question of how "a particular behavior contribute(s) to the animal's inclusive fitness" (p. 28). Predictably occurring (and reoccurring in most cases) buzz words and concepts include "cheaters and sneakers; evolutionary arms races and chases; (homosexual) rape, chastity belts, and transvestites; cuckoldry, sperm competition, and paternity certain-

ty; altruism, inclusive fitness, and kin selection; incest and inbreeding; honesty, reliable signals, and manipulation; allocations, investments, and costs and benefits; and selfish genes, optimality models, game theory, and evolutionarily stable strategies." These terms provide both a capsule summary of book content and an index of writing style.

Krebs and Davies have produced a highly readable account of "behavioural ecology." Chapters and chapter sections typically begin with a relatively brief general introduction to the topic, followed by detailed accounts of example studies. In Chapter 9 ("Cooperation and helping in birds, mammals and fish"), discussions of the Florida Scrub Jay (*Aphelocoma coerulescens*), Pied Kingfisher (*Ceryle rudis*), Ostrich (*Struthio camelus*), and Groove-billed Ani (*Crotophaga sulcirostris*) comprise about 10½ of the 18 pages. In this chapter accounts of bird, mammal, and fish examples cover roughly 11, 3, and ½ pages, respectively, leaving about 3 pages for more general topics plus 1 page for the Conclusion, Summary, and Further Reading sections. In another 18-page chapter (2: "Ecology and Adaptation: Comparison between Species"), detailed accounts of weaver birds, African ungulates, and primates comprise about 2, 1, and 9 pages, respectively. Other chapters contain more general commentary than these two, and still others contain detailed accounts of other taxonomic groups (e.g. Chapter 8: "Alternative Strategies," where frogs, crickets, wasps, and fish are featured). Overall, 38 of the 93 photographs and excellent figures, and 13 of the 28 tables, deal directly with birds.

The book is highly readable, not only because of the lavish attention to "stories" of animal (and some plant) adaptation, but also because of the "convenient and informal shorthand rather than traditional formal scientific style" (p. 3). The style is straightforward, often given in the form of question-and-answer summaries: e.g. "Why then . . . ? The answer is . . ." (p. 154), "Why is it good . . . ? The answer is . . ." (p. 232). Or, behavioral rules are summarized, as "if big, fight; if small, sneak . . . if large, call; if small, be a satellite" (p. 156), or "if large, steal; if small, hunt" (p. 164). Using such a style, the dangers of oversimplification are large; Krebs and Davies do remind the reader of the dangers of "handwaving, by thinking up explanations . . . without rigorous quantification" (p. 35), and admit that the stories told throughout the book are "inevitably too simple" (p. 247). The advanced student and researcher soon realize this. For example, characterizing the environment of marine fish as a "giant homogeneous womb," where zygotes are "likely to remain in the same thermal and chemical regime throughout development" (p. 139), does injustice to the considerable temporal and spatial heterogeneity in marine environments. While warning of handwaving, though, the authors offer no shortage of "plausible ideas" for adaptation and counter-

adaptation. To be fair, however, the authors do sometimes stress that these ideas are merely hypotheses.

While many behavioral ecologists and sociobiologists have abandoned the use of loaded terms such as rape, transvestite, etc. (and others listed earlier), Krebs and Davies argue that anthropomorphic motivations should not be confused with functional consequences, and that "all the 'ifs' and 'buts' of an impeccably cautious and impregnable account would have made the book twice as long and half as easy to understand" (p. 247). In this style, then, we learn of "gangs" of small fishes "chasing females and stimulating them to spawn with the group ('gang bangs')" (p. 166), and that "from the plant's point of view the bee is a flying penis" (p. 230), and that it is no "evolutionary surprise . . . that our nose cells do not produce sperms or eggs" (p. 199). Science should be fun, and scientists must have a sense of humor; yet casual use of words and analogies, while appropriate in private, may in public do a developing discipline more harm than good.

This informality is further reinforced by use of the first names, or even nicknames, of some scientists, but the rules of use are not always clear. Certain associates, such as Brian, Jane, Nick, Paul, and Richard, are understandable. Curiously, though, Pat reverts to Patrick (pp. 230, 259), while Robert slips to Bob (pp. 116, 201); Wilson and Hamilton remain E.O. and W.D., and Hinde simply Hinde; embarrassing-ly, Nancy is really Mary Sue (p. 216).

Given the premises of the book, it is understandable that Dawkins and Maynard Smith are featured throughout (their names occur on 25 pages apiece, according to the Author Index). Others occurring on 10 or more pages include Bertram, Brockman, Clutton-Brock, Hamilton, Harvey, Krebs, and Parker. The information and 401 references are very current, and a third are 1979 or later, while over half (57%) are 1977 or later. The occasional reference to material "in prep" (as well as the citation of one 1983 paper) gives the impression of an exciting and very fast-moving field, a feature making the book very stimulating.

Who will be interested in buying this book? According to the back cover of my paper edition, this text is "aimed at second and third year undergraduates." It is a simplified version of the co-edited volume, "Behavioural Ecology: an Evolutionary Approach," which was intended more for upperclassmen and beginning graduate students. Given its intended audience, and apart from the writing style and the occasional over-simplifications, I think that the book presents an exciting and intimate view of behavioral ecology for the undergraduate with a good prior introductory biology course. The text is well-written, alternative ideas are evaluated and hypothesis-testing stressed, transitions from chapter to chapter are logical, figures are professionally done, and detailed comments that are unnecessary for the flow of the

text are confined to 11 "boxes" set aside from the text. Most of the major topics of behavioral ecology are addressed, including the comparative method, optimality theory, group living, defending resources, fighting and assessment, sexual selection, mating systems (2 chapters), co-operation and altruism (2 chapters), signal design, and coevolution. Selected portions of these chapters would be excellent reading for beginning ornithology classes.—DONALD E. KROODSMA.

**Physiological ecology: An evolutionary approach to resource use.**—Colin R. Townsend and Peter Calow (Eds.). 1981. Sunderland, Massachusetts, Sinauer Associates, Inc. xi + 393 pp., figures, tables. \$38.00 (cloth), \$23.60 (paper).—The editors of this interesting volume explain that their mission is to present organisms (plants, animals, and microorganisms) as transformers that have to apportion finite input resources among metabolic compartments (e.g. cellular respiration, defense, repair, storage, growth, and reproduction), where optimally favorable partitioning strategies serve to maximize fitness. A total of 13 authors (10 from the United Kingdom, as are the editors, and three from the United States) have contributed to this worthwhile endeavor in the form of 13 chapters (of 15 to 35 pages each) cast into four sections, with introductory comments provided for the last three sections.

Part 1 is an introduction, beginning with Calow and Townsend's chapter on "Energetics, Ecology and Evolution." They describe fitness and natural selection and explain that ultimate judgment of physiological adaptations should be determined in terms of their effect on gene transmission to succeeding generations. It is pointed out that students of adaptations traditionally ask, in an *a posteriori* fashion, what it is about phenotypic characters correlated with particular ecological circumstances that makes them better able to be transmitted genetically. In a more recent approach, one attempts to predict, *a priori* (and using conceptual or mathematical models or computer simulations), what phenotypic characters ought to effect fitness and thus be selected for under given ecological conditions. This latter approach assumes that evolution maximizes neo-Darwinian fitness, that we can use phenotypic measures of fitness, that we have appropriate techniques with which to find the trait that maximizes this fitness measure, and that the resultant prediction can be compared with observations in nature or in controlled experiments. Reservations concerning the *a priori* approach are also discussed. This chapter concludes with a brief reflection on *r*- and *K*-selection, some historical notes, and a further statement of the objectives of the book.

Chapter 2 is J. Phillipson's "Bioenergetic Options and Phylogeny," in which are discussed evolutionary advantages of organismic characteristics that

minimize energy expenditure per unit of body mass and advantages of large body size. Starting with the anaerobic condition of primitive earth, the author considers the hypothesized evolution of the synthesis of ATP (adenosine triphosphate, the high-energy storage and transport compound so pervasively important in nature in cellular metabolism). This is followed by a discussion of the evolution of photosynthesis and of the appearance of the important cellular process of oxidative phosphorylation as the biosphere accumulated oxygen as a consequence of photosynthesis. Phillipson reviews maintenance energy expenditure with respect to body size and phylogenetic status, with three major groups of organisms recognized and discussed: unicellular organisms, multicellular ectotherms, and multicellular endotherms. The exposition then proceeds to a discussion of regression relationships of energy expenditure versus body mass, offering explanations relative to such factors as cell membrane surface area, multicellular anatomy, and avenues of body heat loss. Energy budgets are discussed in ectotherms and endothermic homeotherms, all from an evolutionary viewpoint, and stressing production efficiency and maintenance costs.

Part 2 is entitled "Acquiring the Resource Input" and pursues the concept of fitness by examining ways in which organisms maximize energy acquisition input, i.e. the rate at which the energy resource is obtained. In Chapter 3, H. W. Woolhouse presents "Aspects of the Carbon and Energy Requirements of Photosynthesis Considered in Relation to Environmental Constraints." Woolhouse gives us the basics of the photosynthetic machinery in plants, of the energetics of photorespiration, and of carbon dioxide balance and stomatal water loss; and some adaptive features of these phenomena are shown. Particular emphasis is then given to the adaptive nature of crassulacean acid metabolism and  $C_4$  photosynthesis. The chapter concludes with the tantalizing remark that topics not discussed—such as photosynthetic adaptation to shade, and temperature adaptation of the photosynthetic apparatus—also are of importance for more complete understanding of the fitness of particular species of plants.

Townsend teams with Roger N. Hughes in presenting Chapter 4, "Maximizing Net Energy Returns from Foraging," which considers foraging theory as an analysis of costs vs. benefits of foraging. Optimal foraging results in maximal rate of energy intake and may have several components, such as maximization of encounters with food items and optimal choice of diet to maximize energy intake per encounter. Discussion then follows of what has been called the "marginal value theorem," which speaks of maximizing the net energy gain per unit length of foraging period. The chapter covers macrophages (carnivores and some herbivores), microphages (aquatic filter feeders and deposit feeders), but not parasites

on animals or plants and not herbivores for which mineral nutrients (rather than energy) are limiting. Some elementary mathematical models are presented, but the discussion can be followed fairly well without digestion of them. The authors conclude that there is validity in the basic assumption that "the rate of energy gain from food has been a significant limiting factor and has contributed an important selection pressure in the evolution of foraging behavior."

Chapter 5 is "Strategies of Digestion and Defecation," by R. M. Sibly. In discussing strategies of digestion, the phenotypic measure of fitness used is the rate at which energy is obtained by digestion (although it is suggested that in flying animals the strategy should also include consideration of the weight to be carried). Food processing in digestive systems begins with attacking the defenses of the food item (e.g. by mechanical or chemical means, which actually expend energy) and proceeds to alimentary absorption (by which energy is made available to the consumer organism). Birds and large mammals are given special attention through several examples. Models are discussed for digestion that involves continuous flow through one compartment, discontinuous flow through one compartment, and continuous flow through two compartments.

Part 3 considers "Partitioning the Resource Input," that is, the ways in which assimilated energy becomes partitioned among cellular metabolism, structural and functional repair, defense, reproduction, and storage; and it presents physiological, ecological, and evolutionary implications of various partitioning strategies. First, Daniel H. Janzen offers observations on "Evolutionary Physiology of Personal Defence" (Chapter 6). Defense (whether physical or chemical) is discussed in a restricted sense, i.e. with respect to predators and parasites, not with respect to competitors or to physical environmental factors. In this chapter, Janzen considers natural selection of the defensive characteristics of seeds, the serving of some defensive characteristics in additional useful functions, and untapped potential for defense. Much emphasis is on evolutionary considerations, including anachronisms, coevolution (with a warning that most organisms studied today evolved their displayed traits in habitats other than those in which they are observed), and defense costs to the defended.

"Repair and Its Evolution: Survival versus Reproduction" is the subject of Chapter 7, by T. B. L. Kirkwood. It is pointed out that there are relationships between repair and fitness, and between repair and defense, and fitness costs and benefits are discussed. Special attention is given to intracellular repair, repair by cell division in plants and animals, and the relationship between repair and life history. In the latter discussion, distinction is made between maintenance repair and emergency repair. The author

elaborates on the intrinsic rate of population increase as a measure of fitness with respect to repair in life histories with reproduction that is asexual, semelparous (sexually reproducing once), and iteroparous (sexually reproducing more than once).

Caroline M. Pond discusses "Storage" as Chapter 8. The primary focus is the storage of energy, considering metabolic costs of storage, kinds of materials stored, and temporal strategies in deposition and retrieval of the materials. From an examination of the characteristics of storage molecules (e.g. capacities for transport and interconversion), discussion proceeds to types of anatomical sites of energy storage tissues (and their relative advantages). Factors determining the quantity of energy stored include metabolic rate and starvation time, effect on the organism's mechanical performance, nutrient accumulation time, stage in the life cycle, and stage in seasonal cycles. The chapter closes with a discussion of fatty tissue functions other than energy storage.

Calow and Townsend address "Resource Utilization in Growth" as Chapter 9, speaking of rates of growth and development as correlates of fitness. They examine conversion efficiency with respect to efficiency of cell metabolic pathways, and include reference to energy of activity and to the bioenergetic demands of endothermy. Growth rate as a fitness index is considered in plants, invertebrates, and poikilothermic and homeothermic vertebrates. The strategy of a high *vis-à-vis* a low maximum growth rate is discussed with respect to selective value in several ecological situations: exposure to high rate of predation, short breeding season, high level of competition in plants, and low resource availability (and concomitant high stress). The chapter section entitled "Is growth rate maximized or optimized?" considers that there may be costs as well as benefits in rapid growth. This is followed by a discussion of passively and actively controlled growth (the likely outcomes of a maximization or optimization growth strategy, respectively), and simple models are presented for each. This chapter closes with some considerations of body form, discussing primarily allometry with respect to resource allocation and body function.

In Chapter 10, Calow discusses "Resource Utilization and Reproduction," showing how the relationship between energy intake and body weight and between energy output and body weight jointly determine the maximum metabolic limit to body size. He then considers that body size must in fact be less than the maximum so that there is energy available for reproduction, and a model is presented to show the effect of resource availability to this amount of energy. Life-cycle strategies (iteroparous versus semelparous) are discussed relative to energetic costs of reproduction and somatic metabolism. Mathematical models are used to examine the question of optimizing gamete number with respect to gamete

size, employing gamete survivorship as the distinction between microgametes and macrogametes. Energetic costs of postnatal parental care in animals are considered, and the chapter concludes with discussion of fitness implications of nonsexual reproduction and hermaphroditism.

Part 4 addresses "Integrated Studies of Bioenergetic Strategies." In Chapter 11, on "Energy, Information and Plant Evolution," Otto T. Solbrig begins with some introductory concepts (e.g. that of genetic fitness) and he offers comments on genetic and phenotypic evolution by natural selection. Optimality models are discussed with respect to their realism, predictability, and overall value and limitations to the theoretical biologist. Specifically, models are presented for optimal capture of solar energy by plants (with emphasis on leaf size and shape) and for life-history strategies (addressing the basic energetic conflict between growth and reproduction). Extant theories are discussed, together with their assumptions and possible testing of the models.

In Chapter 12, Eric R. Pianka discusses "Resource Acquisition and Allocation among Animals," essentially a presentation on animal energy budgets. His approach is to offer brief case histories of various budgeting strategies, indicating that many questions remain relative to their adaptive significance. Using arthropod examples, Pianka looks at ontogenic energy budget changes, fitness versus fecundity, and growth versus reproduction. Then he examines energy needs with respect to morphology in weasels, trophic level in mammals, and foraging strategy and coadaptation in lizards. Overall, many interesting observations and conclusions are presented, while alluding to many more questions still unanswered.

L. M. Gosling and M. Petrie define a social system as "the sum of the individually determined behaviors" in Chapter 13, "The Economics of Social Organizations." In this way they feel that features of animal groups can be viewed as consequences of such a summation and not as features upon which natural selection operates directly. Behaviors are considered in two groups: those oriented toward survival and maintenance of the individual, and those directed toward reproduction; and they are viewed with regard to effects of energetic constraints forced upon them. The authors discuss how bioenergetics of the individual influences antipredation behaviors, feeding behaviors, mating behaviors, and behaviors involved with producing and rearing offspring. Limitation of the above considerations are admitted and caution is expressed to those attempting to employ optimization modelling to integrate behaviors into an optimum lifetime strategy.

The book is physically readable, i.e. attractively printed with clarity generally inclusive of figures, tables, and mathematical notation. The readability with regard to the subject matter will be found to vary among the chapters, largely owing to the different

sorts of reader backgrounds needed (and assumed) rather than to the competence of the authors. Several chapters (e.g. 4, 6, 7, 8, 9, 10, 12 and 13) will hold special interest to those of ecological orientation. Some chapters are more speculative in content than others, essentially because their topics have as yet found less in the way of scientific resolution. More than 600 references are cited in a single bibliography, with coverage international and fairly recent (in 1981).

The major attraction of this book is that it does a good job of satisfying its primary goals: to show that organisms are systems adapted for the capture, transformation, and transmission of energy and that evolutionary success depends upon the efficiency with which energy is thus processed. The major drawback is that its limited scope is not what its title purports the book to be; it is neither a coverage of physiological ecology nor a treatment of the use of resources by organisms. The only resource addressed consistently is energy. What is included is covered in an illuminating and provocative fashion, however, although to encounter in a single volume material relating to animals, plants, and micro-organisms will startle (and, alas) disinterest many who consult it. I can envision the book serving as a focal point for a graduate student seminar course, although the clientele will have to prove themselves comfortable with some biochemistry and mathematics in addition to possessing a background in evolutionary thought.—JERROLD H. ZAR.

**Wörterbuch der Verhaltensforschung** (Dictionary of ethology).—Klaus Immelmann. 1982. Berlin and Hamburg, Paul Parey. 317 pp., 123 figures. DM 38 (about \$16.00 paper).—This is an attractively made book with unusually large type and illustrations for a dictionary. It looks and almost reads like a textbook and I suspect it will be used primarily by German undergraduates. Each German entry is followed by the English equivalent and there is an English "index" that lists the German equivalents for English terms. The book could thus be used as a German-English or English-German dictionary. As such, it invites comparison with Armin Heymer's *Ethological Dictionary* (1977. New York, Garland, \$22.50). Heymer's book is a truly trilingual dictionary: each German entry, including the full definition, is replicated in English and French, and there are indices in the latter two languages. For a translator, a full English definition is useful in providing an understanding of the exact meaning of the word.

I estimate that Heymer has about 34% more German terms listed (1,190) than Immelmann (830). For my detailed comparison of the two books, I chose to sample the entries from *AAM* through *Altruismus* (for convenience, I will present German words in italics). Remarkably, I found only 14 terms that occurred in both books in this sample. Of the 21 terms found

only in Immelmann, I think that a person with only marginal command of German would find the book useful in translating 6; the remaining 15 could be relatively easily understood by reference to an ordinary German-English dictionary. A similar proportion (11/34) of the entries unique to Heymer are useful.

From my sample, I find deficiencies in both books. Immelmann translates *Abschütteln* as "throwing away" and directs the reader to *Totschütteln*, which is given only in the German definition of *Tötungsverhalten* and even there it is only mentioned, not defined, and not translated. Heymer equates *Abschütteln* with *Totschütteln* and provides an adequate definition of the latter. However, *Abschütteln* could have a quite different meaning than *Totschütteln* in other contexts and this could easily confuse a translator. Immelmann translates *Aktualgenese* as "micro genesis," a term I find totally useless for the ontology of a behavior in an individual.

Heymer translates *Aktionssystem* as "system of actions" which is completely meaningless. He also refers the reader to *Ethogramm*, where there is no hint as to the meaning of *Aktionssystem*. Immelmann wisely lists no English word for *Aktionssystem*; his brief German definition indicates that this is an obsolete term for which the modern equivalent is behavioral repertoire. He neglects to mention, charitably, that *Aktionssystem* is obsolete because it contains theoretical constructs that few modern ethologists find acceptable. However, Immelmann's treatment is better than that of Heymer, which leaves one with the impression that *Aktionssystem* is equivalent to *ethogram*, which it is not. Heymer translates *Akinesis* into English as "akinesia," a word I cannot find in either of my unabridged English dictionaries. I did find it in my medical dictionary where it is defined as a loss of motor function. Heymer's definition is: "Immobilization determined by reflexes, torpidity resulting from continued contraction of the locomotory muscles; e.g., freezing of some animals esp. insects, in danger." I assume, therefore, that *Akinesis* is "freezing" behavior or tonic immobilization and not hibernation or some disorder of the motor nervous system. If the semi-colloquial "freezing" were deleted from his definition I would not have the vaguest idea of the meaning of his verbiage. As in the above, Heymer frequently presents what I believe is useless anatomical and physiological information at the expense of an adequate behavioral explanation.

Too many of Heymer's definitions are inadequate, e.g. the definition of a neural transmitter could not be understood by someone who did not know what they are and how they operate, and if one knows, one does not need a definition. Some of Heymer's inadequate definitions are misleading, e.g. Altruism: "The protection and assistance of endangered companions occurring in both animals and man." There is no hint that altruism might occur in situ-

ations other than those involving danger. This might mislead an inexperienced translator to believe that *Altruismus* applies only to behaviors performed in the presence of danger. Immelmann's definition is excellent, including a variety of behaviors and explaining reciprocal altruism, which appears to be a concept unknown to Heymer. Immelmann's definition refers the reader to seven other entries, each of which contains information pertinent to altruistic behavior and four of which specifically mention altruism. I found only three of these seven terms in Heymer, and the definitions of each were cursory and incomplete. Many of the definitions in both dictionaries refer the reader to other terms; in both this is clearly indicated by an arrow preceding the word. An English reader thus could find related terms in Immelmann by simply looking for arrows and then finding these German terms in the dictionary. I did this for some of the seven terms listed in the definition of altruism, thus collecting a chain of terms that I then tried to find in Heymer. This revealed that Heymer is woefully inadequate in the terminology of modern behavioral ecology and sociobiology, and the fact that Heymer was published 5 yr before Immelmann is a totally insufficient excuse for this deficiency. Indeed, Heymer is generally deficient in all evolutionary and ecological aspects of behavior. Heymer is better than Immelmann for the reader interested in "classical" ethology and, particularly, human ethology. Heymer also contains more obscure and rarely used terms.

Both dictionaries should be in the library of any university where research in animal behavior is performed. I would recommend Immelmann to someone with more than a beginner's knowledge of German and who wishes to buy only one German-English ethological dictionary. I would also recommend Immelmann to any aspiring ethologist who is seriously trying to learn German: read it to help you learn both German and ethology.—HELMUT C. MUELLER.

**W. H. Hudson—A biography.**—Ruth Tomalin. 1982. London, Faber and Faber Ltd. 314 pp. \$24.95 (cloth).—William Henry Hudson was a naturalist, writer, and conservationist. Born of American parents on the pampas of La Plata, Argentina in 1841, William grew up surrounded by birds, flowers, snakes, and insects. His love of nature manifested itself at an early age and provided his happiest moments throughout a long life. In this thinly settled region of Argentina the young Hudson was isolated by his love of nature. The discovery of Gilbert White's "The natural history and antiquities of Selborne" had a profound effect on the 15-yr-old Hudson, recovering from typhus and unsure of his future. A bout of rheumatic fever affected his heart while still a teenager, and his future looked very gloomy indeed. Whilst grappling with the subject of religious doc-

trine during this period, a gift of Darwin's "The origin of species" gave him fuel for new thought. After an initial rejection he reread the book as a naturalist, and eventually became an evolutionist. His serious illnesses and periods of convalescence permitted Hudson to defer decisions about his future and to travel to places whose natural history was poorly chronicled.

During the 1860s and early 1870s, Hudson spent time observing nature and becoming an authority on Argentinian and other South American birds. A major event during this period was his discovery, in the early 1860s, of the demand for bird skins and other natural-history specimens and the possibility of earning a living as a collector. The young Hudson sent his specimens to Dr. G. Burmeister, Director of the Buenos Aires Natural History Museum, and on his advice approached Spencer F. Baird in late 1865 and offered his collection to the Smithsonian Institution. Baird was immediately interested and this was the beginning of a new career for Hudson. Incidentally, his first letter to Baird is also the earliest piece of W. H. Hudson writing to survive.

During the next 3 yr Hudson made numerous trips around Buenos Aires and sent his collection to Baird. In late 1869, however, Baird had to inform the young collector that funds were no longer available. British ornithologists Philip Lutley Sclater and Osbert Salvin also examined Hudson's collection sent to the Smithsonian, and in 1868 gave the "first account of their studies" at a meeting of the Zoological Society of London. Even after Hudson's connection with Baird ceased, his relationship with Sclater and Salvin continued. He began writing about the "habits of birds," a practice Sclater encouraged. Further excursions to Patagonia resulted in more essays and new specimens during the early 1870s.

In 1874 Hudson decided to leave Argentina. He sailed for England where he met Sclater, who continued to remain helpful, although the two never became friends. In 1875 Hudson married and settled in London, where for a number of years the Hudsons led a rather hand-to-mouth existence. While familiarizing himself with the avifauna of London and surrounding regions, Hudson also began writing poetry, essays, and short stories, mostly based on his experiences in South America.

His first book, "The purple land that England lost," was a picaresque story incorporating his love and knowledge of the South American land and its plant and animal life. It was published in 1885, but unfortunately only one reviewer was enthusiastic. The much longed for financial success was not yet forthcoming and Hudson returned to the writing of essays on natural history, which he later incorporated in such works as "The naturalist in La Plata" (1892), and "Idle days in Patagonia" (1893). While increasingly hoping to conquer the literary market, Hudson also

collaborated with Sclater on "Argentine Ornithology" (1888, 1889).

In spite of his early collecting practices, Hudson had been concerned with the disappearance of wild-life and wildlife habitats. In 1891 he allied himself with the newly formed Society for the Protection of Birds (later the Royal Society for the Protection of Birds—RSPB). Hudson helped the society by writing pamphlets and publishing letters, and he remained closely associated with the organization for the remainder of his life. In his will he left "nearly all he had" to the RSPB.

In addition to this direct help, Hudson contributed considerably to an increased nature awareness of the British public. His descriptions of nature, starting with "The naturalist in La Plata" (1892), "Birds in a village" (1893), "British birds" (1895), and "Birds in London" (1898) brought him critical acclaim, some measure of financial success, and the friendship of many naturalists, writers, and artists. He could take long vacations and study trips to the English countryside, and use his experiences in further works.

During the last 20 yr of his life Hudson travelled almost continuously around England, studying not only nature but also the people. In his writing, however, he used both British and South American experiences. "El Ombu" (1902), "Green mansions" (1904), and "Far away and long ago" (1918) delighted the public, as did "Hampshire days" (1903), "A foot in England" (1909), and "Birds in town and village" (1919). He died while finishing "A hind in Richmond Park" in August 1922.

Ruth Tomalin has written a picaresque biography of the restless traveller, naturalist, and author. She follows his life and work as closely and in as much detail as possible, quite an accomplishment because Hudson was notoriously vague and reticent about certain dates and events. She is at her best describing Hudson as a literary figure and conservationist.

In her preface to "Notes and References," the author states, "bird names are those used by Hudson. Modern names, where they are not given below, or in the text, may be found in, for example, *A Guide to the Birds of South America*, Rudolphe Meyer de Schauensee." The author's treatment of bird names provides the most frustrating aspect of the book. Current bird names are very rarely incorporated in the text. References are *not* numbered in the text, but are given at the end of the book, by chapter, page, and line. It is annoying and impractical to count 30+ lines on any page and then look at the back of the book on the offchance that the current vernacular or scientific name of a bird may be found. Tomalin's documentation of British birds is somewhat better, but uneven. In places she discusses the different local names of a given species. She repeatedly refers to Hudson's encounters with "white owls" and "brown owls," however, apparently unaware that three



species of "brown owl" are present in southern England all year around (*Athene noctua*, *Asio otus*, and *Strix aluco*), and *Asio flammeus* winters there.

The documentation of biographical and literary sources is more thorough, but again the lack of numbering in the text makes it awkward for the reader to get the right reference easily. The book contains a number of interesting black-and-white photographs, including one the young Hudson sent to Professor Baird in 1868, which was rediscovered in the 1940s. The appendices include Hudson's 1870 attack on Darwin, concerning South American woodpeckers, together with Darwin's reply.

The book will be of interest to anyone who has enjoyed the books of W. H. Hudson and to ornithologists willing to do a bit of detective work on the South American birds mentioned in the text. It will be a useful addition to the Biography section of any library.—MARIANNE GOSZTONYI AINLEY.

**Une journée chez les oiseaux** (A day with the birds).—Pierre Morency. 1981. La Société zoologique de Québec. (33 rpm disc available from Diskade, 2322, rue Sherbrooke est, Montréal, Québec H2K 1E5 Canada. \$9.98 (Canadian).—Pierre Morency shares his experiences of a typical June day at the Isle of Orleans, in the St. Lawrence just downstream from Québec. He begins before dawn, with the singing of the Eastern Wood Pewee (*Contopus virens*) and Tree Swallow ("*Irodoprocne bicolor*"), and concludes after dusk with the sounds of the Barred Owl (*Strix varia*) and Common Nighthawk (*Chordeiles minor*). Highlighted on the disc are recordings of 24 oscines, 2 flycatchers, 12 non-passerines (including 2 ducks, 2 hawks, a rail, a snipe, 2 gulls, a dove, an owl, a nighthawk, and a woodpecker), 2 amphibians, and the eastern chipmunk. The non-technical commentary by the author is extensive, covering topics such as the habits, plumage, singing style, and personal impressions of each species, and comprises about 37% of the total 51 min. Coverage for most species is adequate, with as few as 3 songs for the Common Yellowthroat (*Geothlypis trichas*) and White-throated Sparrow (*Zonotrichia albicollis*), to as many as 19 for the Eastern Bluebird (*Sialia sialis*). The mixed quality of the recordings together with some background sounds impart to the listener a more realistic field experience than would the use of consistently high-quality recordings, found typically in more "instructional" records. One probable misidentification involves the "percussionist of the orchestra." He is identified as a Downy Woodpecker (*Picoides pubescens*), but according to four other records we consulted (two produced by D. J. Borror and two by Cornell's Laboratory of Ornithology), the drumming is 50% too fast, at the rate of 27 strokes/second, and is more typical of the Hairy Woodpecker (*Picoides villosus*). All but two species [the American

Kestrel (*Falco sparverius*) and Northern Mockingbird (*Mimus polyglottos*)] were recorded in the province of Québec; bioacousticians interested in more data would have to write the author or perhaps one of the seven who contributed the recordings. The record jacket is handsomely designed, with a singing Magnolia Warbler (*Dendroica magnolia*) and Northern Harrier (*Circus cyaneus*) gracing the front and back covers, respectively, and with photographs (some quite bluish) of an additional 12 species inside. Overall, Morency, with the assistance of Raymond Cayouette, has produced for the ornithological audiophile a pleasant "field trip," especially for those fluent in French.—DONALD E. KROODSMA AND DAVID A. SPECTOR.

**A field guide to the Grand Canyon.**—Stephen Whitney. 1982. New York, Quill. 320 pp., 87 plates, 17 figures, index. Paper, \$12.50.—Given the vast array of interpretive and explanatory literature on the Grand Canyon already in print, one may question the wisdom or motivation for adding yet another title. Stephen Whitney, author of the latest contribution, had a different perspective in mind, however. Whitney's stated intent in undertaking this ambitious project was to produce "first and foremost a field guide, a handy, compact reference for the person who wants to identify and learn something about the rocks, landforms, plants and animals of the Grand Canyon" (p. 10). The finished product is not, however, a field guide in the conventional sense. The format, length, and weight of the book, even in paperback, work against the ideals of convenience and compactness. What Whitney has produced, instead, is a concise encyclopedia of Grand Canyon natural history, incorporating a remarkable range of subject matter—something for everyone, literally.

The text is arranged in four major sections. Part I, "The Grandest Canyon," comprises 10 chapters of background information on regional orientation, plant and animal distribution, human history, hiking, and other contemporary visitor activities and services. Part II deals with geology (2 chapters), Part III is devoted to plants (5 chapters), and Part IV discusses animals (5 chapters).

In attempting to cover a great range of factual material within a necessarily finite space, the obvious problem is maintaining even-handedness in treatment of the various subjects. What works effectively for one area (e.g. a brief, episodic chronology of events in the chapter on "The Historical Record") has no utility of application elsewhere. The result is that some chapters are short on explanatory text and long on lists or identification criteria, while others become more didactic, as in the chapters on geology. Of greater concern to me were some examples of unevenness resulting from basic conceptual notions. For instance, in Chapter 10 ("Precautions for Hikers"),

there is a 5-page discussion of venomous animals, which may well tend to over-emphasize this particular threat; but nowhere in the text do we find any reference to the feral burro problem, a management dilemma that has direct impact on hikers as well as many other visitors to the canyon. To cite another example, there is a chapter and several plates devoted to the identification of ferns—which is certainly worthwhile in and of itself—but other than a plate depicting five species of venomous arthropods, the only insects described or illustrated are butterflies.

As I thumbed through the book, I couldn't help but admire the author's *chutzpah* in attempting to provide illustrations and/or sketches for the entire gamut of natural history subjects, from fossils to mammals. Not surprisingly, this effort has met with mixed success. His best work, in my opinion, is the color plates of plants and butterflies; those dealing with vertebrates are generally less satisfactory, and in some cases rather poorly rendered.

The flowering plants are conveniently grouped by primary flower colors, with marginal color-coding to facilitate ready access to each group. The various species are attractively arranged and, for the most part, accurately depicted. I was especially impressed by the section on cacti; very few other works intended for a general readership have an adequate treatment of this important group of plants. The plates dealing with trees and shrubs are adequate, with useful details regarding cones, leaf morphology, and fruits; the silhouettes of general plant form employed here, however, didn't seem all that helpful.

Turning to the illustrations of vertebrates, my impression was that the reptiles were the most accurately rendered as a group, although there appeared to be a bias toward selecting the most vividly colored races of the lizards. Only four species of amphibians are depicted, and for two of these the distinctive "field guide" features are not shown (i.e. the "spade" for the spadefoot toad and the characteristic round parotids for the red-spotted toad). On page 304, the author refers to the relative scarcity of amphibians, their nocturnality, and the difficulty of identifying them in the dark. He should have reminded the reader that vocalizations are an important aid in distinguishing various species of frogs and toads.

The plates of the higher vertebrates, both birds and mammals, were the most disappointing to me, at least in the artistic sense. Connoisseurs of field-guide art will probably find many of the birds rendered in a somewhat stilted and disproportionate manner. I felt this to be particularly true of the raptor plate (admittedly, I might have scanned it with a hypercritical eye). One may also question the choice of the avian species depicted. According to the author (p. 298) "The species shown here are those that an average park visitor is most likely to see," but I se-

riously doubt the likelihood of the "average" visitor seeing peregrines, the accipiters, or most of the owls. Further to the point, only three of the woodpecker species shown are listed as "common"; the other six are "uncommon" or "rare." Another problem: a great many of the species shown could not be seen without taking a float trip on the river or an extended trek into the inner canyon.

The mammal drawings are the least satisfactory of the lot. Pen-and-ink sketching is evidently not the author-artist's best technique, and some of these border on the amateurish or are actually misleading (e.g. the rock squirrel on Plate 63). Many are poorly proportioned and posed in a stiff, "taxidermic" style—this is especially true of the ungulates. Again, I question the criteria used for selecting species to be illustrated. Despite his stated rationale for not including any of the bats (too nocturnal and too erratic in flight—p. 293), the casual visitor is much more apt to see some of these than most of the mammals that are shown; I feel that at least two or three of the more common bats should have been included.

Turning to other major sections of the book, the chapters on geology, in particular, are well written and coherent. Whitney has successfully distilled a large body of knowledge down to manageable proportions, and the accompanying illustrations, including those of fossils, are well drawn and informative. I also liked Chapter 6 on "Prehistoric Peoples," which presents a brief but adequate review of the former inhabitants of the canyon along with some of what is known regarding their cultures.

There are obviously limits as to what can be included in an interpretive guidebook, but somewhere I would like to have seen a discussion on present-day (but ongoing) management and administrative problems, such as the controversy on limiting the number of river tours, the problems of water-level regulation (*via* Glen Canyon Dam), burro management, and the proliferation of visitor-use facilities on the rims.

Finally, I encountered a number of format or publication problems, not all of which are the author's responsibility by any means. The captions to the figures on Plates 1 and 2 (dealing with plant community types) are obviously reversed. Another odd reversal of standard procedure is found in the printing of the captions to all of the plates, wherein scientific names are printed in conventional type, while common names and descriptions are done in italics! Confusion is somewhat moderated by a return to the proper method in the text chapters dealing with the biological taxa. I also felt that the arrangement of the plates *vis a vis* the accompanying explanatory texts was unwieldy; the plates are all grouped together in the center of the book, so that the chapters dealing with the pictured forms must be sought elsewhere—mainly at the back of the book. The two pages of photos

chosen to illustrate the chapter on history of the park area seemed an unimpressive lot, but that may be no more than my own personal bias.

On the plus side, the author and his publishers have come up with an attractive addition to the popular literature on the Grand Canyon. The overall information content is good, and excellent lists of ref-

erences for further reading are included. I fear that the price (\$12.50 in paperback, even) may keep it from a large part of the on-site visitor clientele for whom it is mainly intended, but it should certainly find its way into the library of every Grand Canyon enthusiast.—JOSEPH R. MURPHY.

#### ALSO RECEIVED

**Capture-recapture and removal methods for sampling closed populations.**—Gary C. White, David R. Anderson, Kenneth P. Burnham, and David L. Otis. 1982. Los Alamos National Laboratory, LA-8787-NERP, UC-11. 235 pp., many tables and figures. Available from N.T.I.S., U.S. Dept. Commerce, 5287 Port Royal Road, Springfield, Virginia 22161. No price given.—This soft-covered manual outlines the basic concepts and methods of sampling animal populations and is the primer for "Statistical inference from band recovery data—a handbook" (1978. C. Brownie, D. R. Anderson, K. P. Burnham, and D. S. Robson, Resource Publ. No. 131, U.S. Fish and Wildlife Service), which only my computer-wizard associates can understand. As such this manual seems extremely useful and clear to me, with chapters on underlying assumptions, statistical concepts, capture-recapture and removal methods, density estimations, examples, study design, open models, the future, a fortran users' manual for program capture, and numerous references. An interesting sidelight is photographs and biographies of leaders in this field. This work is invaluable in pointing out the many pitfalls in banding studies, the statistical methodology needed, and the models in need of testing to make banding efforts worthwhile. I fear that most past and present bird-banding efforts were a waste of time, other than as recreation, and especially for estimating populations. Several simplistic cartoons do not really add to the presentation although they do provide some relief from the numbers, but other figures are extremely useful in explaining the statistics involved. The text is well organized and unusually well written for this genre. Many examples illustrate the methodologies. Anyone interested in sampling animal populations in any way *must* read carefully this text and heed its warnings prior to actually capturing an animal in the field. This volume has been valuable to me, and I suspect it will assist others, especially in designing studies and in communication with number crunchers. The spine of my volume is already ruined after only several hours of use.—RALPH W. SCHREIBER.

**Falkland Islands birds.**—Robin W. Woods. 1982. England, Anthony Nelson. 79 pp., 61 photographs (56 color, 5 black-and-white), endpapers map.

\$15.00.—This attractive little book is Robin W. Woods' sequel to his larger, highly authoritative "The Birds of the Falkland Islands" (Anthony Nelson, 1975), now out of print. Until April 1982, when war broke out between Great Britain and Argentina over the Falkland Islands, few people had ever heard of the Falklands, much less their birds. As it happened, the war was fought in the austral fall when penguins and other seabirds were off their breeding grounds. But even if the conflict had occurred while the birds were breeding, little harm to them would have resulted, as practically all hostilities were in East Falkland, far from most of the colonies, which are mainly on West Falkland and its outlying smaller islands.

Now that the Falklands are almost a household word, Woods' new book, prepared just before the war, could hardly be more timely. Primarily a condensation of his earlier book, it covers the 69 species of birds "most likely to be seen during the Falkland Islands summer." Nearly all of the species are illustrated with superb photographs by Cindy Buxton, Annie Price, and the author. An introduction deals briefly with the islands' physiographical features (enhanced by an endpapers map), ecology, and the more significant aspects of Falklands bird life. Then, after a useful habitat table and a checklist, come the accounts of species, each separately and adequately treated with comments on identification, relative abundance, and local distribution.

The book is just the right size ( $5\frac{1}{4} \times 8$  inches) to be tucked into one's luggage. A quick perusal of the photographs will show why the Falkland Islands are unique among the archipelagos in the higher latitudes of the world's southern oceans for their remarkably wide variety of both sea- and land-birds.—OLIN SEWALL PETTINGILL, JR.

**Orphans from the sea.**—Jack Denton Scott, photographs by Ozzie Sweet. 1982. New York, G. P. Putnam's Sons. 61 pp., numerous black-and-white photographs. \$10.95.—An ever-increasing number of bird rehabilitation centers appears to be cropping up across the nation. The fact that most such facilities are depositories for large numbers of injured, sick, and oil-covered birds annually serves as further evidence of the impact our society is having on wildlife. The brief

and simply written text of this book will introduce the inexperienced person to the types of endeavors undertaken by the more professionally run rehab centers. It is not, however, a "how to" book that will provide information for those operating such facilities or desiring to do so. It is primarily a pictorial essay about the Suncoast Seabird Sanctuary that could stimulate support from the general populace.

Although I recognize the potentially important role this type of facility can serve by saving crippled representatives of endangered or rare species (for example), I am concerned that ever-increasing numbers of people are devoting their efforts (both time and money) to this level of "conservation." Would the \$50,000 in donations spent annually at this one facility to feed pelicans and gulls as well as captive species provide more and longer-lasting benefit if it were spent on habitat acquisition or habitat improvement?—W.E.S.

**Limicoles. Gangas et Pigeons d'Europe.**—Paul G eroudet. 1982. Paris, Delachaux et Niestl . 240 pp., 31 text figures, 16 black-and-white photographic plates, 16 color plates. Price not given.—In this volume, Paul G eroudet continues his series on European birds, covering the shorebird contingent of the Charadriiformes. Following an introduction that details some basic features of shorebird biology and life history, species' accounts provide information on synonymy and nomenclature, plumages, identification, voice, behavior, food habits, habitat, reproduction, migration, relationships to man, distribution, and literature citations for each of 44 species. The text illustrations, by Denis Clavreul, generally show behavioral postures; the color plates, by the late Paul Barruel, are done with skill and sensitivity.—J.A.W.

**Range and wildlife management in the Tropics.**—H. F. Heady and E. B. Heady. 1982. New York, Longmans. 140 pp. \$6.95.—In three major sections, rangelands are defined and rangeland assessment and management alternatives are described, generally at

a superficial level despite the complexity of the subject. Because of limited discussion of wildlife resources (mostly large mammals), inclusion of wildlife in the title seems inappropriate. Overall, the lack of a rigorous treatment of the subject (no quantitative theory or empirical data) suggests limited usefulness even for its intended audience of intermediate-level students.—JAMES R. KARR.

**Handbuch der V gel Mitteleuropas. Volume 8, Parts I and II. Charadriiformes (Part 3).**—Urs N. Glutz von Boltzheim and Kurt M. Bauer. 1982. Wiesbaden, Akademische Verlagsgesellschaft. 1,270 pp., numerous text figures and maps, one color plate. DM 306.—These two volumes continue the ambitious and thorough treatment of middle European birds that characterized earlier volumes of the "handbuch." Part I of this volume includes accounts of 25 species of skuas, jaegers, and gulls, while part II completes the treatment of the Charadriiformes with accounts for 13 tern species and 7 alcids. The species accounts vary in length, from less than a page for the extinct Great Auk to 87 pages for the Black-headed Gull. The accounts are thorough and comprehensive. [For an overview of this series, see Mayr's review (1978 Auk 95: 615).]—J.A.W.

**Index to illustrations of living things outside North America.**—Lucile Thompson Munz and Nedra G. Slauson. 1981. Hamden, Connecticut, Archon Books, The Shoe String Press. 441 pp. \$49.50 (cloth).—Ever wondered where to find an illustration of some obscure plant or animal? Apparently enough folks do to justify publication of this volume, which is an index guide to illustrations of over 9,000 species of plants and animals from various parts of the world, extracted from 206 books. It is a companion volume to Thompson's "Index to illustrations of the natural world" (1977), which dealt with species found only in North America. Basic entries are provided under common names, but another index is organized by scientific names.—J.A.W.