

REVIEWS

EDITED BY WILLIAM E. SOUTHERN

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

Proceedings of the symposium on birds of the sea and shore, 1979.—J. Cooper (Ed.). 1981. Cape Town, African Seabird Group (% FitzPatrick Institute, University of Cape Town, Rondebosch, 7700 South Africa). 473 pp. Paper covers, R27.00.—The symposium, held in 1979 at the University of Cape Town, commemorates the 50th anniversary of the Southern African Ornithological Society and the 150th anniversary of the University. Quite expectedly, participants were predominantly South African, with a few Europeans and Americans. Thirty-seven presentations, plus a summary, were given at the meeting, but only 26 papers were published; the rest had Abstracts only. The book is divided into five subject areas: Feeding Ecology (6 papers), Patterns of Distribution (5 papers), Distribution Studies (4 papers), Conservation of Species and Habitats (6 papers), and Physiology and Breeding Biology (5 papers).

The book begins without any introduction to the symposium; I would like to have seen some statement of purpose. Were the sections chosen for particular reasons or were they *post hoc*? Were there invited papers on certain subjects? A decision was obviously made to limit the species of concern to marine and shorebirds ("waders"), i.e. the Procellariiformes, Pelecaniformes, Sphenisciformes, and Charadriiformes, and not to include other "shore" birds such as Anseriformes, Gruiformes, and Ciconiiformes.

The Feeding Ecology section is diverse, running the gamut from seabird-fishery interactions to oystercatcher feeding techniques. R. W. Furness' paper on estimating seabird and Grey Seal food requirements and how these interact with commercial fisheries was enlightening. The indication that seabirds in several parts of the world may be consuming more than 20% of the fish production has obvious implications, not only to seabird and fish researchers but to commercial fishermen as well. An example Furness uses illustrating the close man-bird-fish interaction was the commercial overharvesting of the predatory herring and mackerel stocks on the North Sea, probably resulting in increased numbers of sprats and sandeels, in turn enhancing seabird productivity. It was not clear why the author included Grey Seals in this paper at all, as the data were weak and stood in contrast to those on seabirds.

The seabird-fishery theme is continued in a South African setting by Crawford and Shelton's excellent paper relating how changes in the pilchard and anchovy fishery have affected three seabird popula-

tions. An important finding was that Jackass Penguins and Cape Gannets responded very differently, penguins failing to respond to the abundant but erratic anchovy stock while gannets prospered. Such differences are noteworthy in a management age where community alterations and species substitutions need to be monitored closely. The authors wisely argue for an integration of seabird biology into the investigations of fishery managers. These first two papers illustrate how advanced the South African and northern European seabird-fishery research is compared to that in other parts of the world.

In discussing Procellariiformes as squid predators, Imber and Berruti propose the interesting notion that sampling stomachs of species in this group could be useful in learning more about squids, a group whose distribution is still largely unknown. A number of logistical problems remain, however, such as beak identification in stomach samples.

Imber's comparative study of the diets of southern ocean storm-petrels and prions provided some useful generalizations, e.g. increasing modification of the prions' bill correlating with increased specialization on smaller prey (copepods usually). However, I was unconvinced by his claims that competitive exclusion and character displacement are "evident" in explaining the species' dietary difference.

B. L. Furness summarized a 3-yr study of Arctic Skua parasitism at an Arctic Tern-puffin colony in Scotland, finding that the skuas' strategy differed in each of the 3 yr. The relative fish sizes carried by the two species and the tern breeding success (i.e. the number of parental feeding trips to the colony) apparently influenced the strategy employed. The paper is well written, but I would like to have seen some more statistics comparing time of search, chases, and sizes of host prey between species.

For oystercatcher enthusiasts, P. Hockey's chapter provides elaborate descriptions of how African Black Oystercatchers feed on mussels and limpets and how this species differs from its relatives in Europe and America.

In the next section, Patterns of Distribution, W. R. P. Bourne provides a necessary overview of major factors explaining marine bird distribution: prey density as influenced by coastal and oceanic currents and upwelling regions, meteorological effects such as wind direction, low pressure troughs, and fog. Other parts of the chapter are comparative, showing, for instance, how tropical waters with patchy, widely dispersed prey are dominated by the aerial marine

birds such as terns and Pelecaniformes, whereas the high latitude seas support primarily the more aquatic alcid, penguins, and diving petrels, which depend to a great extent on dense invertebrate populations. Bourne argues at the end that, in the area of human-seabird interaction, emphasis has shifted from disturbance at breeding sites to the growth and expansion in commercial fisheries, and that harvesting by a maximum sustainable yield policy will result in reductions of many seabird populations. While I don't dispute this latter point (at least in Europe, South Africa, and parts of North America), I wonder whether our concerns about disturbance effects should abate. Especially in underdeveloped regions of the world, harvesting of birds and eggs and general harassment continue at high levels.

R. Brook discusses South Africa's marine bird representation, showing that half of the 14 breeding species are endemics. Of the nonbreeding visitors, a slight majority are species found mostly in the southern cold regions ("notopontic"), while the fewest are tropical species ("thermopontic"). Brook argues that seabirds have been ignored in designating marine zoogeographic regions, but I wonder how his introduction of yet more terminology will be accepted.

The contributions by Liversidge and Le Gras and of Grindley were weak. Liversidge and Le Gras do not explain their methods of observing seabirds at sea and, as in other chapters, invoke competition as an explanation for species coexistence with no supporting evidence. Grindley's chapter is a conglomeration of five unrelated mini-studies, none of which could stand alone. I wondered what the point of the paper was, other than to provide a little more data on some relatively understudied species.

Some of the problems of censusing pelagic birds especially the attraction of some species to ships and the detectability of different species at varying distances from the observer, are discussed by A. Griffiths. I found myself wondering how the author kept track of individual birds for 10 min (his "following" criterion) if there were sometimes hundreds near the ship.

In the section on Distribution Studies, two papers treat Giant Petrels. J-F. Voisin and M. Bester show that the species at Gough Island are intermediate in some ways between Northern and Southern giant petrels, and in other characters resemble either. Analyses of variance should have been conducted for multiple comparisons among localities. P. Shaughnessy and J-F. Voisin made observations of Giant Petrels along the coast of SW Africa/Namibia, finding seasonal trends in abundance coinciding with Cape Fur Seal harvests. The birds scavenge seal blubber and carcasses and also dead penguins. Here also statistical tests were insufficient.

J. Mendelsohn gave some evidence that prion influxes near Marion Island coincided with the movement of severe cold fronts, the birds moving south

to avoid inclement weather and poor feeding conditions behind the front. His method of calculating relative abundances over time was highly qualitative, forcing the reader to accept the findings as an act of faith!

The strongest chapter in the section was that of M. Waltner and J. Sinclair on the distribution, molt, and biometrics of the Terek Sandpiper. This contribution, the longest in the book, is probably the only in-depth study of the species outside of the breeding season. The authors document the yearly changes in abundance at a number of locations in southern Africa. The majority of the paper is devoted to documenting the pattern of molt of wing, tail, and body feathers in both adults and juveniles. Molt sequence and rate seem to be similar to those of Curlew Sandpipers. Juveniles undergo only a partial molt of primaries and some other tracts. Females tend to be larger than males, but not enough to enable discrimination of sexes in the field.

The next section on Conservation of Species and Habitats was particularly apropos. As I had just completed the chapter by Morant, Cooper, and Randall on rehabilitation of oiled Jackass Penguins, the Spanish supertanker *Costillo de Bellver* broke in half, covering an area of 800 km² with oil just off Dassen Island, where half of the entire species population resides. Despite the fact that the authors claim a higher release percentage (78%) of oiled birds than anywhere else in the world, the treatment (described in the Appendix) indicates that released birds were held for 11 weeks and most required force feeding, obviously a costly operation. The authors, of course, close by saying that the emphasis needs to be placed on *prevention* of spills, but as the August 7 incident proves, we have much improvement to make.

The influence of a major habitat alteration (a pipeline laid across a colony) on nest site selection and population dynamics in a Common Tern colony was reported by M. Gochfeld for a large colony in the U.S.A. Color-marked birds in the alteration area were followed for 2 yr after the construction; about 16% were displaced to other sites. The author points out that, in areas such as the Atlantic Coast, terns may have few alternate colony sites to choose from if forced to move. More studies of this nature are needed, in which individuals are marked and followed for at least one season following an alteration or disturbance.

L. Underhill used a cluster analysis to classify wader census sites in southern Africa, using relative species abundance as the clustering criterion rather than the more variable absolute abundances. There was no correlation between geographic locations of census sites and dendrogram groups, but it would be informative to construct dendrograms for several consecutive censuses to see how consistent any "structure" really is.

Patterns of both migrant and resident waders at

Langebaan Lagoon, South Africa were reported by H. G. Robertson. Even though the study would have been strengthened if replicate counts were made at each season, the lagoon is clearly shown to be a "wetland of international importance" and should be registered with the Ramsar Convention. An interesting suggestion in the paper is that large numbers of Curlew Sandpipers overwintering in Africa in a given year reflect a high juvenile/adult ratio, which might be an index of breeding success in the previous season (90% of the overwintering population is juvenile).

The final two papers of the section are on European waders. P. Ferns' study of seasonal/annual changes of shorebird numbers along the Severn Estuary in England reveals another area worthy of listing as a major international wetland. The paper is particularly useful in revealing the shortcomings of census programs in which observers change over the years and in which estimation ability also changes. For these reasons, the author cautions about interpreting any population trends reported for the estuary. The Isle of Vlieland in the Wadden Sea, Netherlands is another extremely valuable wetland for waders during all seasons. G. Th. de Roos nicely documents the importance of polders, especially as high tide roosts. The author further documents the negative effects that human recreation has had on the density of European Oystercatcher nests.

The final section on Physiology and Breeding Biology is a smorgasbord of topics. A. J. Prater provides an excellent review of molt patterns in Palearctic Charadrii, examining sequences, age-sex differences, timing of molt relative to latitude, duration, and suspended molt. Appropriately, he places molt events in an ecological context, arguing that longer durations in tropical and southern latitudes are related to the "more stable environmental conditions." More research is obviously needed to separate climatic and food influences among regions.

A refreshing chapter to read because of its cosmopolitan nature was J. Burger's on the transition period (dependence to independence of young) in seabirds. Four developmental stages are described for the world's major seabird families, showing how the temporal patterns differ from group to group. She suggests that seasonal and food constraints explain most of the differences among groups. For instance, frigatebirds and the tropical boobies have very long parental care periods, are under little seasonal constraint, but face a sparse, widely scattered food regime. The paper is basically an abridgement of the chapter in her co-edited book "Behavior of Marine Animals. Vol. 4: Marine Birds" (Plenum Press).

Returning to South African birds, Randall and Randall's nice chapter on the Jackass Penguin documents in detail the annual pattern of nesting and molt at St. Croix Island. Some birds can raise 2 broods in a season and still molt at the normal time, all in 1

yr! Also of interest was the report that the timing of nesting was suboptimal for adults (high heat load), but when the earliest chicks hatch the pilchard (the primary food for penguin growth) have begun arriving in large numbers. The paper would have been strengthened if the authors' disturbance effects (running transects in the colony) had been monitored and if some statistical testing had been performed on chick weights and survival as functions of the period in which they were banded.

The importance of krill to Gentoos chick development is documented by A. J. Williams. Breeding in mid-winter at Marion Island seems to be a tactic that ensures that chicks maintain a krill diet during the early growth period. The author invokes competition to explain why Gentoos avoid breeding at the same time as the other three penguin species. Although it is plausible that diffuse competition is important among the hundreds of thousands of pairs on one island, demonstrations and possibilities are distinctly different.

Lastly, S. Mahoney's neat study on the thermal physiology of Anhingas and Double-crested Cormorants demonstrates major species differences in behavioral responses to temperature and thermal tolerances. These differences relate to the tropical distribution of Anhingas versus the temperate-tropical distribution of cormorants.

In summary, I found most of the chapters in the book worth reading, although admittedly many would be of interest mainly to South Africans. Although a few papers presented some new ideas or variations on old themes, most were not particularly innovative, being either reviews or basic descriptions of relatively unknown species. I was bothered by the frequent reference in many papers to the significance of competition/resource partitioning accompanied by very little, if any, evidence. Sufficient statistical analyses were also lacking in many papers, requiring one to examine tables to look at differences reported to be real. The editor has done a commendable job. I found very few typos and, for the most part, the figures and tables were clear.

Despite some shortcomings, all serious marine and shorebird researchers and students should reserve a place on their bookshelves for this volume.—R. MICHAEL ERWIN.

Once a river.—Amadeo M. Rea; illustrated (in part) by Takashi Ijichi. 1983. Tucson, Arizona, University of Arizona Press. xiv + 285 pp., 32 photographs, 25 drawings, 18 maps, and 14 tables. \$24.50.—Stream valleys of the southwestern United States are notable for the species diversities and individual densities of their avifaunas, and that of the Gila River of Arizona and New Mexico is no exception. The waters from such valleys, however, also are needed to help sustain human life in that arid region, and man's appro-

priation of this resource has proceeded largely without regard to faunas or similar considerations. As a consequence, the Gila no longer flows as it once did, resulting in significant losses of its biotic elements and, ultimately, in the quality of man's own existence in the area. In Amadeo Rea's study area—the Gila River Indian Reservation near Phoenix, Arizona—the river no longer flows at all, and this book tells what this means in terms of the changes in the habitats and birdlife.

The prehistoric inhabitants of Rea's study area included Hohokam farmers, whose ruins have yielded the remains of about 30 kinds of birds. The successors to that culture included the current Pima people, and ethnographic studies reveal their continuing awareness of perhaps 70 kinds of birds. Early Europeans add few species to our appreciation of the area's birds, although accounts dating back as far as 1694 speak of habitats that must have supported a rich avifauna. The first really extensive documentation of the avifauna of the reservation had to wait until the early twentieth century, most notably in the work of M. French Gilman from 1907 to 1915. The next significant work was that of Rea, in the period of 1963 to 1981.

The result of these various sources is an enumeration of some 244 species (*sensu* Rea) of birds having occurred on the Gila River Bird Reservation, these being covered both in a general way in the text and in detail in an annotated list. The latter treats status, distribution, and taxonomy, and the data in these accounts provide the grist for broader textual accounts on such avian subjects as comparative breeding and wintering avifaunas, extirpations, population declines, colonizations, range extensions, migration and other dispersal, and habitat associations. From almost any angle that one views the data, it is clear that recent decades have not been good for most of the reservation's birds or their natural habitats. The documentation is here to show how and why this is the case.

One of the few faults that I find with "Once a river" is the extent of taxonomic digression of a sort that adds little and may actually detract from the message. In particular, treatises on species and higher-level taxa are inappropriate in this type of work, and even some of the treatments of subspecies—which are useful in studying movements of birds—are of questionable value. Tighter editing also would have been helpful, and I find the frequent repetition of scientific names through the text to be quite unnecessary. There is also some inconsistency in nomenclature, including the use of multiple common names for given species (e.g. Mexican/Common Black Hawk, Marsh Hawk/Northern Harrier, Wied's Crested/Brown-crested Flycatcher, Desert/Black-throated Sparrow, Red-backed/Dark-eyed Junco). In addition, I noted the use of both *Archilochus* and *Calypte* for Costa's Hummingbird, missing italics (e.g. Allenrol-

fea occidentalis, *Pyrocephalus rubinus*, *Thryomanes*), unnecessary italics (e.g. *Cicada*, *Sora*), and typographical errors (e.g. *Mimus polyglottos*, *Campylorhynchus bruneicapillus*, Russel).

"Once a river" does not tell a pleasant story, and it is made all the more unpleasant by the knowledge that it is merely one among many. Biotas worldwide have been and continue to be damaged and destroyed at an alarming rate by the actions of unthinking or uncaring mankind. In the Southwest in particular, the story is an old one, and it gets no better with the retelling—whether one frames it in the twentieth century on a river such as the Gila or centuries ago at Chaco Canyon. And yet there is hope, as some of us have learned that we either conserve the environment or we risk oblivion. Thus, instead of merely serving as an epitaph for a stretch of river, Amadeo Rea's book should galvanize us into more concerted action to conserve our environment and its biotas.—JOHN P. HUBBARD.

Evolution and development.—J. T. Bonner (Ed.). 1982. Report of the Dahlem Workshop on evolution and development. Berlin, Springer-Verlag. vi + 357 pp. \$22.00.—The current questioning of the tenets of the "new synthesis" stems from two concerns. First, there is some disillusionment with a view of speciation that emphasizes isolating mechanisms at the expense of the recognition of lineages having unique evolutionary histories. Second, many paleontologists and neontologists question whether macroevolutionary patterns (the origin of species and higher taxa) can be understood solely in terms of microevolutionary processes. The latter point has led to the rise of the "punctuated equilibrium" model and to increasing research into the details of proximate mechanisms of macroevolutionary change—development and epigenetics. For many evolutionary biologists, this rebirth of interest in developmental patterns and processes started with the publication of Gould's "Ontogeny and phylogeny" (1977, Cambridge, Massachusetts, Harvard Univ. Press). Interest has continued to grow in this area, and enough researchers are currently involved that reviews, symposia, and books have started to appear.

During May 1981, 47 researchers met in Berlin to discuss the current state of knowledge of the interrelationship between developmental mechanisms and morphological evolution. The overall goal of the workshops was "to bring together a common understanding of evolution and development at levels of analysis from molecules to cells to organisms as life histories to their change through geological time." The resulting volume includes an overview by John Tyler Bonner followed by summaries and background papers from four workshops on the genome, cells, life histories, and macroevolution.

The reports of the group reviewing the organiza-

tion and function of the genome describe recent advances in knowledge of the structure of eukaryotic DNA sequences. These include the discoveries of introns, insertion elements, dispersed repetitive sequences, and evidence for concerted evolution of these repeated sequences. Also discussed are Kauffman's work on general properties of complex genetical regulatory systems, and a model by Davidson for the appearance of novel pathways of gene expression. Unfortunately, the reviews of all these advances are quite brief and really not adequate introductions without additional background material. An equally important problem is that the relevance of these new discoveries to actual developmental mechanisms is presently unknown. Hence, while much has been learned about genome organization, details of the mapping between genomic structures and developmental patterns remains unknown.

I found the reports on the cellular basis for morphogenesis to be provocative. They include reviews of the developmental processes that lead to differences in size and shape, and of the growing body of evidence suggesting that genes encode algorithms for organismal development, not specific blueprints. This latter, subtle distinction needs to be incorporated into the thinking of evolutionary biologists; there are multiple lines of evidence leading to the conclusion that explicit genetic programming for specific characters does not exist. Also of interest here is a list of evolutionary innovations requisite at the cellular level before complex structures can evolve in multi-cellular organisms.

The reports of the group reviewing development and aspects of life histories, selection, and adaptation are critical of naive adaptationism (e.g. Gould and Lewontin. 1979, *Proc. Royal Soc. Lond. B* 205: 581). It is argued that some changes in development are inevitable consequences of "physical constraints, developmental architecture, or ancestral legacies." Examples of confusion between adaptation and developmental constraints are given, as are examples of evolutionary diversification following the release of constraints. The discussion of the role that selection for new life history patterns might have in driving changes in developmental timing, begun by Gould in "Ontogeny and phylogeny," is continued here in papers by Stearns and by Bonner and Horn. Overall, however, I found this section disappointingly diffuse. This probably reflects the lack of well-documented case histories of differences in development and adaptation within clades of organisms.

The summary and two background papers prepared by the group studying development and macroevolution are definitely worth reading. For the last few years the "punctuated equilibrium"—"phyletic gradualism" debate has focused on the reasons for the long episodes of morphological stasis in the fossil record. Alberch shows that the observed properties of morphological evolution—canalization, threshold

phenomena, and constraints on directionality—are analogous to the general properties of complex dynamical systems—domains of attraction, the existence of bifurcations, and directionality. This suggests that the stability properties of an epigenetic system are more important than the details of its genetics. For example, a phenotype might be canalized for some range of genotypes and environments, but alter substantially to a new morphology when pushed beyond those limits. Thus, stasis and abrupt change, on a geological time scale, may be inevitable results of the nature of epigenetic developmental systems. Furthermore, physical and developmental constraints may set limits on potential morphologies and make some transitions, hence some evolutionary directions, more probable than others.

A useful part of this section are the examples. In his "Ontogeny and phylogeny," Gould presented a "clock model" that was an attempt to relate the various forms of heterochrony (neoteny, progenesis, etc.) to mechanisms of developmental timing. Alberch et al. (1979, *Paleobiology* 5: 296) followed Gould's initiative and produced a formalism relating all differences in developmental timing to evolutionary change in three variables: relative time of onset of developmental growth of a character, rate of growth, and time of termination of the growth. Gould's report in this section includes examples in which changes in each of these three variables have effected morphological change in organisms. These examples may be useful for persons who found the Alberch et al. paper overly terse and abstract.

Following the 1980 macroevolution meetings at the Field Museum and the subsequent plethora of position papers and rebuttals, it has become clear that a satisfying understanding of macroevolution is going to require a detailed explication of developmental processes. This seems especially true of the origin of morphological novelties. Consequently, it is hard for me to imagine an evolutionary biologist today, interested in macroevolution, not keeping abreast of at least the general status of research in development. In this regard, "Evolution and development" is not ideal, as it seems slightly too compressed and advanced to be an introduction. However, it should prove worthwhile for researchers especially interested and willing to jump modestly into the esoterica of the field. Most ornithologists not working in evolutionary biology or morphology will not be interested in reading this book, nor will many individuals need personal copies. Nevertheless, I cannot imagine a major research institution without it.—GEORGE F. BARROWCLOUGH.

Hierarchy. Perspectives for ecological complexity.—T. F. H. Allen and Thomas B. Starr. 1982. Chicago, Univ. Chicago Press. xvi + 310 pp. ISBN 0-226-01431-2. \$27.50.—How do we deal with the be-

wildering complexity of nature in our pursuit of scientific knowledge? Some investigators have undertaken broad comparisons based on superficial surveys that only scratch the surface of nature. Others have become entrapped in a whirlpool of increasing reductionism, learning more and more about less and less. Still others have simply ignored complexity, resorting to loose logic, unfounded inference, or story telling to achieve their understanding of nature. As Allen and Starr note, however, complexity is something that needs more than an ad hoc treatment. In this book, they advocate and develop an approach to complexity based on hierarchies, on partitioning complexity into inclusive sets or levels, so that one may examine patterns and processes both within and between levels.

A hierarchy, as they view it, is more than simply a series of increasingly inclusive categorizations of nature. It has a functional reality, produced through the "behavioral interconnections wherein the higher levels constrain and control the lower levels to various degrees." Complexity in natural systems is a consequence of nonlinearities and asymmetries in the relationships between entities in such hierarchies and their environments, and it is Allen and Starr's thesis that, by viewing systems in the framework of hierarchies, we can begin to discern the causes of complexity.

As an example, avian social systems may be viewed in a hierarchical fashion, ranging from individuals being distributed independently of one another through territorialism and dominance-structured groups to cooperative groups. Allen and Starr relate this sociality spectrum to food resources, and especially to the transfer rates between food and consumers in relation to the rate of transfer of information between consumers regarding the status of the food supply. Where such transfer rates are slow, individuals may exploit the resource independently of one another, they argue, because the system is buffered against "overconnection." An overconnected system has so many linkages between its components that it is unstable, and thus unlikely to persist. As food supplies become more limited, however, the transfer rate to consumers increases. This leads to overconnectedness of the system; territoriality, however, acts to divide the food supply into compartments. This reduces the transfer rates and, consequently, the degree of connectedness in the system as a whole—it becomes more stable. The same arguments are extended to other forms of sociality. The scenario is supported with references to work on honeycreepers, sunbirds, vultures, wolves, and lizards. The approach offers some intriguing ideas, but it is not clear that it resolves any issues in the evolution of sociality or points to new, more productive forms of investigation of such matters.

The approach followed by Allen and Starr throughout their book is explicitly holistic and anti-

reductionist. They argue, for example, against the development of "more detailed specificity of more local circumstances so that more exotic mathematics can be applied," suggesting that this will lead us away from rather than toward an understanding of complexity. They note that yielding to the temptation to simplify in order to achieve specific objectives leads inevitably "to hollow conclusions regarding the behavior of sterile model systems which yield little of the richness of observed phenomena." And they argue strongly against a rigidly mechanistic approach to theory and modelling, as such endeavors necessarily assert that the world itself is mechanistic. "Perhaps the main body of predictive biology is readily couched in mechanistic terms," they observe, "precisely because mechanisms are all that are sought. If there are phenomena that are not susceptible to mechanistic explanation, then the prevalent investigative strategy will not find them." Whether or not they are ultimately correct, Allen and Starr's arguments should give pause to those who champion an exclusively reductionist, mechanistic approach to nature.

Allen and Starr are similarly irreverent in commenting on the role of human perceptions in guiding scientific investigations. Ecologists have generally misunderstood the process of community succession, they suggest, because ecologists have generally been preoccupied with changes at the species level, and have missed the complex interactions at smaller or more inclusive hierarchical levels. This is perhaps because species are perceived as "real" biological entities, while other levels are not. The same considerations apply to the definition of boundaries between entities or levels. We tend to discern such discontinuities within the limitations of the human perceptual system, and it is thus hardly surprising that the entities or levels in fact appear to be very concrete. This, however, does not mean that those boundaries are in fact real or, more important, the only discontinuities of biological interest.

Such problems arise in part because of a neglect of the hierarchical structure of natural systems, but also because different components of a system or different levels in a hierarchy (e.g. a predator and its prey) operate at different scales of space and of time. This mismatching of scales is exacerbated when, as human observers, we view the system or gather data from it on yet different scales, those that we consider important (e.g. minutes or a calendar year). Transforming data, as is often done as a preface to statistical analysis, may distort relationships further, if the transformed variables operate at intrinsically different scales. Allen and Starr do an excellent job in developing these difficulties of scale and the consequences of ignoring them, and they have the courage to offer some possible solutions.

"Hierarchy" is not an easy book to read. It tends to ramble, digresses into irrelevant areas and exam-

ples (e.g. Humphrey Bogart movies, the London underground), and is riddled with a mixture of jargon from several jargon-rich disciplines (although the good glossary helps some). One is inclined to abandon it in the early pages, wondering what the point of it all really is. The book does contain some interesting insights and stimulating arguments, however, and it is worth the effort required to plough through it. I'm not at all certain that it offers any real solutions to the problems of scale, biases of human perceptions, hierarchical structure, reductionism, and the like that plague biological investigations. It does, however, call attention to the difficulties, and it is unlikely that we will make much progress in solving these problems until we first recognize them as such.—JOHN A. WIENS.

Les oiseaux de Chine, de Mongolie et de Corée; passereaux.—R. D. Étchécopar and F. Hüe. 1983. Paris, Societe Nouvelle des Éditions Boubée. In French. 704 pp., 22 color plates, 2 black-and-white plates, 93 line drawings, 1 political map, 1 physical map, 334 distribution maps. Priced at \$125.00 by one American bookseller; 549 French francs (about \$70.00 U.S., includes handling charges) if ordered from the publisher (11, Place Saint-Michel, 75006 Paris, France).—This book is the second of a two-volume series on the birds of China (including Tibet and Taiwan), Mongolia, and Korea. About 620 passerine species are described. A total of 442 species and 8 subspecies is featured in the color and black-and-white plates, and an additional 93 or so species are illustrated by line drawings. The breeding ranges of 475 species (plus subspecific forms) are shown in the distribution maps. All information available to the authors has been organized in the species accounts under four headings: identification, behavior, nesting, and distribution and subspecies. Major references for the region are included in an abridged bibliography. The French, English, and Latin names of birds are listed in separate indices. A very brief table of contents at the end of the book lists the first page of each major section in the book as well as the caption pages opposite the color and black-and-white plates.

One of the most attractive features of this book is the set of excellent color and black-and-white plates done by Patrick Suiro. Except for a general tendency to elongate the shape of birds, most of the errors noted are inaccuracies in color reproduction rather than misrepresentations of morphological dimensions. For instance, *Sitta formosa* in Plate 27 should be buffy rather than rufous on the side of the head, chin and throat; its underparts are also too rufous. In the same plate, *Certhia himalayana* should not be quite so rufous in the flank and vent. *Stachyris chrysaea* (and probably *S. ruficeps praecognita*) and *Macronus gularis* in Plate 29 are green where they should be yellow.

The wing patch in the male plumage of *Pteruthius flaviscapris ricketti* in Plate 32 should be darker brown and the female plumage should have less green in the wing. All the *Phylloscopus* species shown in Plate 35 are too brown above and have eye lines that are too dark. *Dicaeum ignipectus* in Plate 38 should have buffy rather than light orange underparts. The nature of these color aberrations (too brown, too rufous, too green, etc.) suggests that they probably resulted from the printing process rather than from any inattentiveness to detail on the part of M. Suiro.

The three color plates done by Gilbert Armani are less skillfully executed. Birds overlap one another in Plate 24 (transposed with Plate 42) to result in a crowded and confusing composition. The rendition of *Malanochlora sultanea* in Plate 24 will help little in its identification because of the misleading shape of the crest, the overly long and thick bill, the hunched posture of the bird, and the orange cast to the usually yellow parts. The *Lonchura* species shown in Plate 42 have bodies and bills that are too massive, and *L. striata* should have a sharply pointed tail.

In contrast to the volume on nonpasserines (see review by B. King. 1980, Auk 97: 427), the plumages shown in the plates of this volume are labeled according to sex. It is often unclear at first glance, however, which birds are members of a species-pair, as females are not always placed nearest to conspecific males. Caption numbers and sex symbols are also somewhat confusing when they are placed equidistant between two forms. Most unsexed plumages represent monomorphic species but such is not invariably the case—the unlabeled plumages shown for *Turdus chrysolaus* and *T. kessleri* in Plate 28 represent only the males of these two dimorphic species.

The plates could have been better organized for use in the field. Although there is some attempt to represent the size relations of birds within a plate, there is no scale provided to indicate the actual size of birds. The inclusion of arrows to emphasize distinguishing field marks would have been a helpful device for sorting through the array of 16–21 birds in each plate. It was surprising that subspecific forms were not always juxtaposed to permit easy intraspecific comparisons. The plates are evenly dispersed through the 657 pages of text, thus making it difficult to locate any particular plate quickly. It would have been a great convenience if all the plates were placed in one section of this 3-inch-thick book. Besides the transposition of plates 24 and 42, there are other, less noticeable, errors. "*Liocichla*" is misspelled in two different ways on caption page 289; *Turdus* "*feae*" is misspelled on caption page 193; the common name *Rhipidure à gorge blanche* is assigned to both *Rhipidura albicollis* (correctly) and *R. aureola* on caption page 129.

Many of the line drawings are taken from the authors' "*Les Oiseaux du Proche et du Moyen Orient*" (1970, Paris, Éditions N. Boubée & Cie) and are nice-

ly done. The remaining drawings, a few of which illustrate birds at the nest, are by M. Suiro, and maintain the high standards established in his color and black-and-white plates.

A distribution map can potentially be more effective in describing a species' range than a list of localities. However, I found the distribution maps in this book to be unsatisfactory. The absence of latitude and longitude lines detracts from the information contained in the maps, especially so for those unfamiliar with Chinese geography. Rather than draw an outline around actual collecting localities to approximate a species' breeding range, the authors have chosen to represent this with a uniformly stippled area. Consequently, it is not possible to see how much they have extrapolated in constructing the breeding ranges shown. This manner of representing breeding ranges poses yet another problem. The distributions of subspecific forms are distinguished by areas of different size dots and are each identified by a number from a list in the species account. Often, species comprised of several subspecies appear to have discontinuous ranges. However, for many such species, the discontinuities probably represent gaps in field data rather than real gaps in distribution. Maps are only labeled if the breeding ranges of two or more species are shown together. Confusion reigns whenever the unlabeled map of one species appears on the same page as the heading for the next species account; this happens frequently. Migratory movements are indicated by arrows for some species, but no wintering ranges are shown.

Many genera already well represented by color plates (e.g. *Erithacus*, *Paradoxornis*, *Parus*, and *Sitta*) are additionally provided with species identification keys based on plumage characteristics. The effort and space devoted to these keys might have better served other purposes. On the other hand, the "technical" keys provided for genera that are not illustrated (*Cettia*) or that are difficult (*Phylloscopus*) should prove to be extremely useful.

The species accounts are well written and concise but the depth of coverage varies greatly from species to species. Very few species are fully described. Only one measurement (to the nearest 0.5 cm) is given for body length in the "Identification" section, even when a species is sexually dimorphic in size. However, male and female plumage characteristics are treated separately and this is particularly helpful for identifying the female of a dimorphic species when only the male plumage is illustrated. Immature plumages are not discussed. A sub-section on field identification highlights the diagnostic features of the plumage, flight, calls, and/or points out the salient differences between species similar in appearance. The "Behavior" section is actually a compilation of life-history observations and may comment on song, sociality, habitat, and foraging preferences. The length of the breeding season, nest construction and

nest site, clutch size, and egg measurements are treated in the "Nesting" section of the species account.

Species sufficiently widespread to have been included in the authors' Near and Middle East book tend to have better coverage for the "Behavior" and "Nesting" sections. As the outflow of field data from China increases, however, more and more of the details borrowed from the earlier work will undoubtedly prove to be inappropriate or inaccurate. For example, *Parus ater* is reported to produce a less substantial clutch (4-5 eggs) than *P. caeruleus* (which is neither present in China nor is it included in this volume), whereas the recently published "Fauna Sinica, Volume 13: Passeriformes (Paridae-Zosteropidae); (1982, Peking, Science Press) states that *P. ater* produces two clutches of 9-10 eggs per year. On the basis of observations made in the Near and Middle East, the habitats of *Sitta europaea* in China are reckoned to include oak forests at 1,850 m, firs, spruces and cedars up to at least 2,600 m, as well as hazelnut and poplar trees in valleys. The "Fauna Sinica" volume provides a more detailed list of habitats for this species: deciduous and mixed deciduous forest between 300 and 1,900 m in Northeast China; evergreen subtropical forest, deciduous and mixed deciduous forest between 800 and 3,200 m in Southwest China; woods adjacent to villages and mixed forests from low to mid-elevation in Central and South China.

The "Distribution and subspecies" section of the species account enumerates the subspecific forms recognized by the authors and recounts their diagnostic features, breeding ranges, and migrational movements. Although disagreements with Cheng's "Distributional checklist of Chinese birds" (1976, Peking, Science Press) are noted, few other references are cited to justify the subspecific determinations chosen. The names of provinces and regions, rather than the actual collecting sites, are listed to indicate the extent of the breeding ranges. Degrees latitude and longitude are sometimes given to help define the limits of a subspecific form but these data have doubtful utility in the context of this book, because distribution maps lack latitude and longitude lines. A description of the species' world-wide distribution concludes the species account.

The transliterations of Chinese place names used in this book are ones established in the French literature. It is unfortunate that the authors did not take this opportunity to standardize Chinese place names for Western workers by instituting non-partisan transliterations based on Pinyin, the official transliteration system of the People's Republic of China since 1958. The plethora of synonyms generated by workers of diverse linguistic persuasions continues to be a problem for anyone consulting Western publications on Chinese birds. The glossary of place names in the nonpasserine volume indicates the authors' recognition of this problem but will accomplish little

to improve the situation, as not all synonyms were included.

An exhaustive list of references was thought to be beyond the scope of this project because the authors had only intended to produce a "handbook" for the birds of the region. Hence, the abridged bibliography contains only the major references that, when considered together, probably cite all the relevant publications. The table of contents is too abbreviated to be useful. Plates are listed by number rather than by the groups they contain. Of the 657 pages devoted to the species accounts, only the first page is listed. The omission of a paginated systematic list in the table of contents is particularly inconvenient for a book this size. Although the indices are well prepared and will guide the reader to the taxa of interest, they cannot present a systematic overview of the groups treated.

This book certainly provides some very competent illustrations and descriptions for identifying Chinese passerines in the field. However, the inclusion of distribution maps, life-history information, and discussions of subspecific forms expands both the coverage and the bulk of the book beyond that of a field guide. This volume and the volume on nonpasserines are too cumbersome for field use—together, they occupy as much space as a toaster (10" × 7" × 6") and weigh about 6.2 pounds. (Perhaps M. Étchécopar and the publisher can be persuaded to prepare a more portable edition that contains all the plates but only brief commentary on bird identification and distribution.) Unfortunately, the additional material does not contribute enough substance to make the book a satisfactory reference for Chinese passerines. The distribution maps need to be more carefully prepared, life-history accounts need to be updated with information from the Chinese literature, and taxonomic discussions should cite supporting references. Moreover, standard technical data such as measurements of the wing, tail, tarsus, and culmen, body weight, immature plumage characteristics, wintering range, and collecting localities are available for most species in the Chinese literature and should be incorporated.

Even given the inflated prices of books at present, the publisher's price of \$70.00 seems high for this volume; needless to say, the bookseller's price of \$125.00 is outrageous. Although I consider this book to be inadequate as a serious reference work, I would encourage university and museum libraries to purchase this volume and the volume on nonpasserines to make them available to impecunious ornithologists. As one librarian stated, "there is nothing else comparable in a Western language," and indeed, these two volumes are important as the starting point for all future works on Chinese birds by Western biologists.—MARINA WONG.

Proceedings of the first technical meeting on western palearctic migratory bird management:

Branta bernicla bernicla.—M. Smart (Ed.). 1979. International Waterfowl Research Bureau, Slimbridge (Glos.), England. vi + 228 pp., 21 tables, 40 figures. Paper, £6.00.—In December 1977 the publishers of this book and the International Council for Game and Wildlife Conservation assembled many of the world's experts on Brant geese in Paris for a 2-day conference to exchange the latest information on the ecology and management of the species. More than 50 "delegates" from 12 countries, including Canada and the United States, and several conservation organizations attended. A total of 27 reports form the main body of the proceedings; all are in English except one in French. The preface, titles, summaries of each paper, final recommendations, and an "Annex" are in both English and French; transcripts of discussions following each paper and opening and closing speeches are in either English or French. The back cover and first page contain black-and-white line drawings of Brant by Sir Peter Scott.

The meeting dealt mainly with the palearctic *Branta b. bernicla*, which, after more than 25 yr of protection by an increasing number of countries throughout its range, had recovered from a low of about 16,000 individuals to a population in excess of 100,000 by the mid-1970s. Because of agricultural depredations, some hunting groups were asking that Brant be reinstated as a game species in some wintering areas. Further, the coastal habitat upon which Brant (and many other species) depends during winter and on migration was (and still is) being destroyed or altered at a rapid rate.

The first 12 papers deal with the historical and present status, movements, and distribution of Brant in the respective countries of eastern and western Europe. There are 2 papers on winter feeding ecology, 1 on monitoring breeding habitat with satellite imagery in North America, 5 on agricultural depredations, 1 on hunting, and 2 on drafting international strategies and agreements. Hugh Boyd (Canadian Wildlife Service) and John Rogers (U.S. Fish and Wildlife Service) each provided excellent papers on the current state of knowledge and management of North American Brant populations. Three papers were submitted in absentia from workers in the Soviet Union; the last ornithological survey made in the Siberian region where most of the European Brant nest was in 1949.

It was reported by A. K. M. St. Joseph that color-marked Brant caught in southeast England and the Netherlands return consistently to the same sequence of wintering sites each season. Individuals return not merely to the same estuary but to the same preferred feeding areas within it. Some evidence was presented in papers by K. Charman and B. Ebbinge that Brant may be exceeding the carrying capacity of winter habitat in some estuarine feeding sites in southeast England and in Holland. As a result, alternate food sources are exploited, including nearby agricul-

tural lands. In England, Brant follow a consistent sequential pattern of food utilization from eelgrass (*Zostera*), to green algae (*Enteromorpha*), to saltmarsh vegetation, and then agricultural crops. Since the disappearance of *Zostera* in the Dutch Wadden Sea, Brant occur there in large numbers only in spring, when they feed in tidal marshes on *Plantago maritima* or in cultivated grassland. Ebbing postulated a positive correlation between spring weight achieved in the Wadden Sea staging areas and subsequent breeding success.

Agricultural depredations by Brant in Europe have been dealt with in various ways. Since 1973, the West German government has compensated farmers for damage caused by Brant to pastureland and now must deal with the problem of escalated claims. In England, farmers are allowed by special court permit to shoot offending geese. In the Netherlands, farms have been purchased and are being managed as reserves for geese. A simple scaring technique described by Pfeiffer has been used to protect crops in the Netherlands. Nylon strings are attached to wooden poles 12-16 m apart and are stretched at right angles to prevailing wind directions. Geese refuse to fly into fields protected by string.

Swift and Harrison reviewed the history of hunting of *Branta bernicla* and recent conservation measures. They favor hunting as a method of mitigating damage by Brant to pastures and crops. On the whole, there is little demand to reopen seasons for the shooting of Brant in most European countries.

An important observation, made by H. Boyd, was that present subspecific designations are not useful and that there are at least six stocks of Brant "... which differ widely in present abundance, in reproductive potential, and in vulnerability of the places they live in, while overlapping in distribution and in appearance in confusing ways." As a result, each stock presents different problems for protection and management.

Participants in the conference agreed on 12 recommendations including more communication, more research (particularly in the U.S.S.R. on the nesting and molting grounds), no hunting of European stocks until populations become more stable and better methods are worked out for controlling the kills, and the use of scaring techniques and alternative feeding refuges rather than killing to alleviate damage to crops.

Although far from being an exhaustive monograph, the Proceedings brings together in one place much useful information on the status and ecology of Brant. It is also an excellent case study of the many difficulties encountered in wildlife conservation at the international level. It is a desirable book for college and university libraries and should be of particular interest to waterfowl biologists and wildlife managers.

In light of recent controversy concerning revisions

in the AOU checklist, it is ironic that "Brent Goose" is used as the English name throughout.—ERWIN E. KLAAS.

The wildfowl of Britain and Europe.—Malcolm Ogilvie. 1982. Oxford, Oxford Univ. Press. 84 pp. 30 color plates. \$16.50.—Of about 140 extant species of waterfowl in the world, 54 occur in the western Palearctic. In this, his most recent book, Ogilvie introduces the reader to the waterfowl of Europe including occasional visitors and introduced species. Although written primarily for laymen, ornithologists will find the book informative but should not expect a major treatise on European waterfowl. The text is drawn primarily from Volume I of "The handbook of the birds of Europe, North Africa, and the Middle East: the birds of the Western Palearctic," of which the author was an editor.

An introductory chapter outlines the characteristics of European waterfowl. It contains sections on waterfowl classification, evolution and hybridization, habitat, distribution, numbers and mortality, movements, food, social patterns and behavior, breeding biology, and plumages and molts. The sections are informative, well-written, and provide a succinct overview of several major aspects of waterfowl biology. Subjects discussed include a detailed description of the family Anatidae and traits that distinguish the various tribes of waterfowl occurring in the western Palearctic. Factors contributing to the evolution of new forms, habitat use, and causes of mortality are also discussed. Waterfowl movements and distribution during the year are compared and feeding traits of the various species are described. Other subjects discussed include types of pair bonds, flocking patterns, displays, nest-site characteristics, clutch and egg traits, incubation, brood development, and plumages and molt patterns of European waterfowl.

Species accounts compose the rest of the text and are grouped by related forms. They contain a brief description of distribution, population status, morphology, and calls. A color plate for each species (reprinted from the handbook) is on the opposing page. For species endemic to the western Palearctic, a plate usually includes male and female in breeding plumage, male in eclipse plumage, juvenile(s), and downy young. Separate plates depict the geese and shelducks, surface-feeding ducks, and diving ducks in flight. The paintings of swans and geese are by Sir Peter Scott and the ducks by N. W. Cusa. The jacket attractively depicts Brent and Red-breasted Geese against a gray background.

My primary criticisms of the book are the brevity of the text and lack of line drawings or other illustrations (except for the color plates). The author's excellent treatment of European waterfowl biology in the introductory chapter would have been more ef-

fective if black-and-white drawings had been used to highlight some of his key points on such matters as taxonomy, speciation, habitat associations, and food habits. Similarly, range maps would have helped the reader gain a better understanding of the distribution of various European waterfowl. Maps of the geography of the western Palearctic region on the front and back flyleaves are helpful, but do not replace the need for waterfowl range maps. Readers seeking more information are encouraged in the foreword of the book to go to Volume I of the handbook, but many laymen probably will not have ready access to it. In the absence of literature citations, a list of additional readings would also have been helpful in directing readers to other important sources of information on European waterfowl.

Waterfowl in Europe, as in North America, face numerous threats, as alluded to by Dr. Peter Cramp in the foreword. The fact that most species of European waterfowl have stable or increasing populations, despite man's long presence on the continent, is an encouraging sign. Throughout the world, however, waterfowl are becoming increasingly dependent on man's direct intervention to protect vital wintering and breeding grounds, regulate harvest, etc. As the need for governmental action increases, public awareness and support of waterfowl and wetland conservation will be crucial to ensure that proper steps are taken to protect this resource. In Europe, waterfowl conservation has been hampered by the lack of international agreements and by the widely divergent views and interests among the numerous nations sharing responsibility for the resource. However, the Ramsar Convention on wetlands and other initiatives indicate a growing recognition of the need for cooperation among nations to protect wetland habitat. A section on conservation in this book would have been helpful to direct those interested in protecting waterfowl and their habitats to organizations involved in such matters. Perhaps waterfowl and wetland conservation efforts in Europe will be the subject of a future publication.

This attractive new book should stimulate additional interest in and concern for European waterfowl. The text is concise and is packed with interesting facts, the illustrations range from excellent to good, the binding, cover, and paper are of high quality, and the print is sufficiently bold and of uniform color to assure easy reading. Ornithologists and others interested in waterfowl from the United States, Canada, and elsewhere will find this book useful as a primer for improving their awareness of waterfowl populations breeding in the western Palearctic. To those taking special delight in viewing waterfowl, the plates alone are worth the cost of the book.—GARY L. KRAPU.

Physiology and behaviour of the Pigeon.—Michael Abs (Ed.). 1983. New York, Academic Press.

xii + 360 pp. ISBN 0-12-042950-0. £34.00 (\$63.00).—The Pigeon (*Columba livia*) is one of the most thoroughly studied species of birds. Studies of the Pigeons and other doves, especially *Streptopelia*, have contributed significantly to both zoology and psychology. This book results from Michael Abs' perception of a need for an overview of the physiology and behavior of the Pigeon, especially an overview that would assemble and condense the widely dispersed literature and indicate areas in which additional work would be profitable. Fourteen contributors have assembled 17 chapters, each dealing with a different topic, although two chapters treat different aspects of the visual system. Each chapter, then, constitutes a mini-review of about 20 pages. The selected areas are comprehensive, but seem to have been chosen as much to reflect the expertise of the contributors as for breadth of topics. I will introduce them not sequentially, but as they represent strengths and weaknesses of the work as a whole.

As would be expected in a series of review articles, the book contains little new information. Most of the contributors have done an excellent job of summarizing the voluminous literature and providing extensive references. A major exception is D. Goodwin's chapter, "Behaviour," which cites only nine references, including four books and one film.

Goodwin's chapter also suffers from his use of emotionally loaded terms; e.g., "... some very few individual males (Domestic) show a fatherly attitude towards all fledglings and recently bereaved pairs may adopt strange fledglings." Goodwin clearly credits birds with the ability to experience "very intense emotion," a judgment that I am not prepared to challenge here, but the use of such colored terms as "bereaved," "sexual jealousy," and "enemy" may lead to distorted interpretations.

In contrast, another chapter dealing primarily with behavior, Juan D. Delius' "Learning," is a gem. Delius begins by noting that, although several thousand publications deal with the conditioning of Pigeons, little is really known about learning as such because "most investigation has been done by behaviourist psychologists striving to identify general, universal principles of learning, largely ignoring species and situation differences." He then proceeds to discuss exactly what pigeons can learn and how we have learned what they learn. This chapter should be mandatory reading for any student embarking on a project involving learning or behavioral manipulation.

The book is highly successful in indicating areas needing additional work. Virtually every author indicates deficiencies in our knowledge. In some cases the deficiencies are extensive. In F. M. Anne McNabb's "Excretion," F. L. Powell's "Respiration" and "Circulation," Bernice M. Wentzel's "Chemical Senses," and, to a lesser extent, R. Necker's "Somatosensory System," the contributors have composed sum-

maries of data for birds in general and fitted in specific values for Pigeons where those were available. So little is known about the chemical senses in most birds that Wentzel finds many of her comparisons among mammals and reptiles and at one point contrasts the Pigeon with the rest of the Metazoa! Figure 7 in Necker's chapter shows a mammalian pathway within the descending trigeminal tract, although "it has not been shown to exist in birds." A. Aulie's "The Fore-Limb Muscular System and Flight" is a good introduction to the physiology of the flight muscles in general.

Of course, other chapters deal with topics in which Pigeons have been the prime experimental animal. A. Chadwick's "The Endocrinology of Reproduction" and W. Rautenberg's "Thermal Regulation" deal almost exclusively with data from Pigeons. A chapter by Abs and L. F. Baptista on "Vocalizations" is the only chapter that presents completely new material, a summary of the different sounds produced by strains bred for vocal performance and a discussion of the evolution of those calls.

R. Necker's "Hearing," like several other chapters, begins with a general section, but quickly moves to data dealing solely with electro-physiological investigations and tests of auditory capabilities in Pigeons. Jacky Emmerton divides her discussion of the visual system into two chapters, "Functional Morphology of the Visual System" and "Vision." The former deals with neural connections, central nervous control, and the organization of the retina; the latter with performance from detection to perception. P. Griminger's "Digestive System and Nutrition" contains an extensive table of the nutrients known to be required by various birds, as well as discussions of the food preferences of *Columba livia* under both laboratory and wild conditions and of spontaneous and experimental atherosclerosis in Pigeons. Abs summarizes "Ontogeny and Juvenile Development."

The book appears to have been produced with some constraints on size that have led to certain unfortunate features. Most of the authors begin their contributions with generalized statements intended to lead the naive reader into their topic. Because they have compiled a wealth of material, however, almost all authors have rapidly adopted a condensed style that, although avoiding jargon, does require some expertise for a full understanding of the offering. For instance, it occurred to me while reading Schmidt-Koenig's "Orientation," that, had I not recently prepared a lecture on this topic, I would have been less aware of the logic of the clock-shift experiments and might not have fully appreciated the conclusions. The condensation occasionally leads to a soporific listing of facts and references. This problem is best avoided by those contributors who explore specific arguments and controversies. Outstanding in this regard are Chadwick's discussion of the disputes concerning the role of prolactin, Wentzel's analysis of the experi-

mental evidence for olfactory abilities in birds, and the entire chapter by Delius.

The citations listed at the end of each chapter list only the author and journal. Titles are given only for books. Undoubtedly this tactic saves space, but I found it annoying, especially when I was not sure if a statement referred only to Pigeons or to birds in general. A glance at the citations could provide no clues.

The book also has a number of technical errors. I found several rather obvious typos including a repeated line and a tendency to substitute a comma or semicolon for a closing parenthesis. My copy contained many poorly printed letters.

English is not the primary language of either the editor or several of the contributors. However, that fact is not evident from the text. I found only one "Germanic" sentence. Purists, however, may be disturbed by the total disregard of the distinction between "which" and "that" and the sometimes capricious use of commas.

In summary, I judge the flaws in this book to be relatively minor, especially when compared to its contributions. "Physiology and behaviour of the Pigeon" provides an excellent introduction to the recent literature in several areas of avian physiology. Hence, I consider this book an essential addition to academic libraries of general biology, psychology, zoology, or veterinary medicine, and I recommend it for the private libraries of those interested not only in Pigeons but in any aspect of avian physiology or behavior.

This book is dedicated to the late Professor William T. Keeton, for whom the Pigeon was a special animal. I think he would have been pleased.—ABBOT S. GAUNT.

Fauna Sinica, series vertebrata. Aves 2: Anseriformes.—Tso-Hsin Cheng et al. 1979. Peking, China, Science Press, Academia Sinica. Text in Chinese. vi + 143 pp., 8 color plates, 2 black-and-white plates, 32 line drawings, 32 distributional maps. No price given.—This volume on Chinese anseriforms was prepared by ornithologists from the Peking Institute of Zoology (Academia Sinica), the Peking Zoo, the Shanghai Natural History Museum, the Shanghai Normal University, the Zhangbai Shan Nature Reserve, and the Tianjin Wool and Feather Processing Factory. Undoubtedly, all Chinese ornithologists will have contributed in some manner to this 14-volume series by the time of its completion.

The organization of this volume is identical to that of volume 4 (Galliformes), which was the first volume to appear (reviewed in *Auk* 99: 396). A general account (pp. 1–20) first characterizes the order in terms of external (topography) and internal morphology (palate and sternum structure) and life history traits. A systematics discussion then traces the classification of Chinese anseriforms from the "Book of Songs"

(1100 B.C.) to Sibley's more recent work based on egg-white proteins. The fossil record and the world distribution of the order are treated briefly. Many members of this order are important as game species and as sources of down and feathers, and medicine (the ashes of swan feathers are believed to heal knife wounds; the ashes of *Mergus* bones are said to cure edema and food poisoning; the dried and pulverized bile of *Tadorna* is supposedly effective in treating burns). When assembled in large feeding flocks on the wintering grounds, however, some of these same species cause extensive crop damage or losses. Consequently, both the prerequisites for successfully rearing anseriforms and for capturing them are covered in considerable detail. A brief discussion of conservation measures advocates the judicious use of trapping techniques and suggests ways of increasing the reproductive success of wild populations. The 46 species treated in this volume are listed and the phylogenetic relationships of the 8 tribes recognized by the authors are shown in a dendrogram. Figures and descriptions are provided at the end of this chapter to explain how the measurements in the species accounts were taken.

The species accounts (pp. 22–128) are preceded by a dichotomous key (pp. 21–22) that sorts the Chinese anseriforms into genera. Species identification keys are also provided for the larger genera. A complete species account includes information under the following headings: Chinese synonyms, distribution, diagnostic characteristics, plumage characteristics (male, female and juvenile), a table of measurements (from left to right: sex [number of specimens], weight, total length, culmen, wing, tail, and tarsus; weights are in grams and lengths are in millimeters; columns are deleted when data are lacking), taxonomic discussion, ecology, economic significance, and, finally, a reference to the original description.

There are no surprises in the morphological descriptions of the species accounts. The "Ecology" sections, however, encompass an impressive body of recently collected life-history information on Chinese anseriforms. Especially noteworthy are the accounts of Baer's Pochard (*Aythya baeri*) and the Chinese Merganser (*Mergus squamatus*), two species that are poorly known in the Western literature. A nest found in Qingdianwa, Ji County, Hebei Province, extends the breeding range of *A. baeri* southward; details of its diet, nesting habitat, nest and egg characteristics, and its behavior on the wintering grounds are also described. Based on observations made in Zhangbai Shan, Jilin Province, an even more extensive account is provided for *M. squamatus*, detailing its habitat, feeding behavior, breeding biology, and nest and egg characteristics. Recent field data on other species reveal behavioral differences between Chinese populations and populations observed elsewhere. British individuals of the Common Shelduck (*Tadorna tadorna*) are reported to abandon their downy young at

the time of migration (Coombes, 1949. *Nature* 164: 1122), whereas breeding pairs observed in China stay with their young until the following spring, and only then does the male leave the family group in advance of the female. Outside China, the movements of other southern populations of the Lesser Whistling Duck (*Dendrocygna javanica*) appear to be governed by rains (Delacour, 1954. *Waterfowl of the world*, volume 1, London, Country Life Limited). The movements of populations in Guangxi Province, however, may be more predictable, as individuals arrive at the end of April and leave by the end of October. Individuals of *D. javanica* studied in the Chuan Shan region of Guangxi have never been observed to either roost or nest in trees and seem to prefer grassy areas that have few trees as nest sites. A recent record from Tibet raised the altitudinal limit of nesting Ruddy Shelducks (*Tadorna ferruginea*) to 5,700 m, whereas the previous upper limit was reported to be 4,000 m in the Himalayas (Étchécopar and Hüe, 1978. *Les Oiseaux de Chine, de Mongolie et de Corée; non-passereaux*. Tahiti, Les Editions du Pacifique).

The "Economic Significance" discussions of the Swan Goose (*Anser cygnoides*) and the Mallard (*Anas platyrhynchos*) cite ancient Chinese texts and archeological evidence to demonstrate that these two species were domesticated in China at the same time as, or even before, their domestication in other ancient cultures.

Two appendices follow the species accounts. Appendix 1 (pp. 129–134) provides information on the commercial uses of feathers and includes detailed descriptions and names of feathers from 10 common anseriforms. Methods of processing feathers for commercial use are also briefly described. The English equivalents of Chinese and Latin species names are listed in Appendix 2 (pp. 135–137). The Bibliography (pp. 138–140) cites all the Chinese and Western references consulted by the authors. The index of Chinese names (pp. 141–142) precedes the index of Latin names (pp. 142–143).

Although esthetically pleasing, the 8 color plates, which illustrate 21 species, are perhaps the weakest feature of this volume. Plumages are not labeled and are often inaccurate in pattern as well as in color reproduction (e.g. the head markings of the Northern Pintail [*Anas a. acuta*] and the Baikal Teal [*Anas formosa*] in Plate 2). The few female plumages shown are mostly hidden behind conspecific males and the visible portions are not sufficiently detailed to be of use in species identification. Plate 9 contains black-and-white reproductions of two exquisite and biologically accurate Chinese brush paintings of the Ruddy Shelduck from the Song Dynasty (980–1127) and of the White-fronted Goose (*Anser albifrons*) from the Qing Dynasty (1792). Plate 10 shows a Qing Dynasty (1736–1795) brocade patterned with Mandarin Ducks (*Aix galericulata*).

The line drawings are adequate but tend to be too

dark and are poorly printed. Those showing the mating behavior sequences of the Bar-headed Goose (*Anser indicus*) and the Mandarin Duck are modeled after drawings in Johnsgard's "Handbook of waterfowl behavior" (1965. Ithaca, Cornell University Press).

The distributional maps shown are from Cheng's "Distributional checklist of Chinese birds" (1976. Peking, Science Press, Academia Sinica) but have been updated with new breeding localities for the Mute Swan (*Cygnus olor*), the Spotbill Duck (*Anas poecilorhyncha*), Baer's Pochard, and the Chinese Merganser. The breeding range of a species is delineated by either a solid line (when certain) or a dashed line (when uncertain) around the collection localities. Arrows show the direction and route(s) of migration and hatched areas represent the wintering grounds.

Other than the consistent misspelling of "*Potamogeton malaianus*" in the species accounts, this book was relatively free of typographical errors. The English name of *Bucephala clangula* should be "Goldeneye" and not "Golden-eyes"; *Anas strepera* should be called "Gadwall" rather than "Gadwell"; misspelled captions include: *Anas* "*poecilorhyncha*" *zonorhyncha* in Plate 4 and "*Histrionicus*" *histrionicus* "*pacificus*" in Plate 8.

This volume is an admirable addition to the series projected to cover the entire Chinese avifauna.—MARINA WONG.

Numerical ecology.—Louis Legendre and Pierre Legendre. 1983. New York, Elsevier Scientific Publishing Co. (P.O. Box 1663, Grand Central Station, New York, New York 10163). xvi + 419 pp. ISBN 0-444-42157-2. \$83.00.—Ecology is a numerical science. Increasingly, the questions ecologists pose are couched in statistical or mathematical terms, and as the questions are (by the nature of Nature) complex, so too are the numerical methods that ecologists employ. Ecologists have responded to the increasing sophistication and complexity of numerical analysis in their discipline in several ways. Some have simply ignored it, and continued to use simple and superficial procedures or to draw qualitative inferences from data in the absence of any sort of numerical analysis. Others have embraced the new approaches, applying them indiscriminately to all sorts of data, sometimes with little regard for the appropriateness of the methods or for their underlying assumptions. Some ecologists, on the other hand, have recognized the power of complex numerical analyses but have used them judiciously, carefully considering their limitations and assumptions. "Numerical ecology" is a book that has something to offer all three groups.

The book, an expanded translation of the French edition published in 1979, is intended as a practical handbook, emphasizing the biological interpretation of various numerical procedures rather than their

mathematical or statistical derivations per se. Nonetheless, the treatment of the procedures contains a substantial amount of mathematical and statistical detail, although this detail is presented in the context of developing an understanding of the limitations and assumptions of the analyses. The book concentrates on matrix algebra (1 chapter), dimensional analysis (1 chapter), information theory (1 chapter), multivariate statistics (5 chapters), and series analysis (2 chapters). The major portion of the book thus is devoted to the multivariate approaches that are so popular in contemporary ecology. These chapters review such topics as the basic form of multivariate statistics, the family of similarity or distance measures, cluster analysis, various forms of ordination (e.g. principal components analysis, factor analysis), discriminant analysis, and canonical correlation analysis. The two chapters on series analysis include discussions of spectral analysis, correlograms, Markov processes, and Leslie matrix analyses. Throughout, the procedures are illustrated with specific "case studies" of ecological applications taken from the literature. These are especially useful in providing not only a feeling for how a method might be applied to a real-world data set, but also in indicating some of the limitations of the techniques.

Generally, the development and presentation of topics is quite clear, although the writing style is a bit stilted in places and the various forms of mathematical, statistical, and ecological jargon sometimes interact in complex ways. Still, most ecologists (and a good many others) could benefit from studying this book, and they might even find that by considering some of the topics *before* they gather data, the design of their studies and interpretability of their results could be improved. Unfortunately, the book is overpriced, and this will prevent many from giving it the attention it deserves. Have your library buy a copy; then check it out and read it carefully.—JOHN A. WIENS.

The economy of nature: A textbook in basic ecology, second edition.—Robert E. Ricklefs; drawings by John Woolsey. 1983. New York, Chiron Press, Incorporated. ix + 510 pp., 163 figures, 45 tables, 151 photos. \$24.95.—The title of this text is derived, as Ricklefs indicates in the introductory chapter, from Ernst Haeckel's 1870 definition of ecology, and it is particularly appropriate because the book also represents economy in verbiage, bulk, and price by comparison with Ricklefs' tome, "Ecology."

A comparison of "Economy" with "Ecology" suggests that the shorter book is basically an abbreviated version of the longer one: many chapter titles and major headings within chapters are similar if not identical, topic sentences (or whole paragraphs) are frequently duplicated, and the same photos, tables, and figures appear in both. This is, however, what

we might reasonably expect. Fortunately, "Economy" has emerged from the contraction with Ricklefs' lively narrative style very much intact.

The chapter order suggests five major sections. The first eight chapters (123 pages) emphasize conditions and variations in the abiotic environment and the diversity of biotic communities that results. Three chapters (67 pages) that follow deal with ecosystem structure and function—primary production, energy flow, and nutrient cycling. Energy "flow" has always seemed a misnomer to me, considering its inherent inefficiency and the "reluctant" involvement of many organisms; and "nutrient cycling" should probably read "materials cycling" because cycles of substances not generally considered to be nutrients (*viz.*, water and carbon) are included. A third section of three chapters (51 pages) pertains to autecology. The fourth part, comprising five chapters (134 pages), is devoted to population ecology, and the final four chapters (84 pages) to community ecology.

Ricklefs has organized the 43 chapters of "Ecology" within ten sections, and I believe "Economy's" 23 chapters would benefit from a similar treatment. As it stands, students frequently do not perceive the relationship of individual chapters to each other and to the entire book. Furthermore, I would consider it advisable to rearrange the chapters and sections to reflect a sequence from autecology through population and community ecology to a consideration of ecosystems. All students comprehend the progression of successively more inclusive levels of organization in nature, and this would aid students coming to ecology from a molecular and cellular biology orientation in placing the "province of ecology" within a familiar conceptual context.

The narrative text is followed by a two-page explanation of the international system of units, two pages of conversion factors, and a 10-page glossary. A 13-page section of "Selected Readings" is partitioned by chapter so that it is easy to relate examples used in the narrative to the appropriate reference, even though there are no formal literature citations.

I noted two particularly commendable virtues in this text: the use of a large number and variety of illustrative examples, and considerable success in conveying a sense of the tentative and partial truths that scientific endeavors typically yield. However, student comments to me included persistent complaints that examples in the book are not prefaced by clear explanations of the ecological principles or phenomena they are supposed to illustrate. Consequently, I suspect that faculty who use this book with the most success will be those who relate their lec-

tures directly to the text and include explicit statements of appropriate principles and processes.

Several concepts I expected to encounter in a basic ecology text are conspicuously absent: biochemical oxygen demand (BOD), biological magnification, estuary, and guild have all been omitted. Species diversity is briefly considered, but none of the diversity indices is explained or even mentioned. "Niche" is relegated to a brief entry in the glossary, and the term "biome" is never used, even though there is a 26-page photographic essay entitled "A Survey of Biological Communities."

The book is relatively free of typographical errors, although the figure on page 93 is missing both a number (8-4) and a caption. However, I found the index to be rather superficial, and therefore frustrating. For example, the index listing for *Azotobacter* refers to page 178 but not to page 393 where this organism is also mentioned. More significantly, there are index listings for Dansereau and Raunkiaer but not for life forms, plant life forms, or vegetation classification. This prompted a comparison of index entries per page of text, as one measure of index comprehensiveness, with three other books that might be considered competitors. There are approximately 828 index entries, or about 1.79 per page of text, in "Economy" compared with 1.75 in R. L. Smith's "Elements of ecology and field biology," 2.28 in E. P. Odum's "Basic ecology," and 3.83 in R. Brewer's "Principles of ecology." Some of these differences are undoubtedly due to writing style—whether concise or expansive—but I suspect a higher value indicates a more complete index.

My experience, having used "Economy" in a junior/senior-level ecology course required of all biological science majors, suggests that this book is probably unsuitable for use as an introductory text by biology majors and non-majors alike: it is not comprehensive enough, even within the constraints of moderate length, so that a number of important concepts are omitted; it frequently avoids the common language of ecology (e.g. niche, biome, principle of limiting factors), so that students may not associate some concepts with terms in conventional use; and it lacks clear statements and concise explanations of the ecological principles, processes, and phenomena that are included. For the same reasons, this book would be virtually useless as a reference source in a personal collection or university library. In view of Ricklefs' considerable abilities and accomplishments, "The economy of nature" represents less than ecologists should expect and students require of this basic textbook.—GARY G. GRAY.