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ORNITHOLOGICAL LITERATURE

AVIAN GENETICS: A POPULATION AND ECOLOGICAL APPROACH. By F. Cooke and P. A. Buckley (eds.). Academic Press, London, England, 1987: xvi + 488 pp., 58 text figs., 50 tables. $102 (hardcover), $39.95 (paperback).—The great expansion of research into the ecological and population genetics of birds that has occurred in the last 20 years has demanded the publication of a summary volume. Fred Cooke and Paul Buckley are to be congratulated in responding to this demand by producing a very well-edited and attractive book, for an intended audience of ecologists, population biologists, and ornithologists wanting to learn genetic techniques applicable to natural avian populations.

The book is organized into three parts. Part I describes techniques for assaying variation in Mendelian genes, quantitative polygenic systems, chromosomes, allozymes, and DNA sequences. Part II provides detailed summaries of the population genetic topics of philopatry and inbreeding, gene flow, genetic structure, natural selection, non-random mating, and geographic variation and speciation. Finally, in Part III, a selection of long-term studies is presented to illustrate how genetics is integral to understanding population-level phenomena in natural populations.

In Chapter 1, Buckley makes the point that most data on Mendelian inheritance of phenotypic characteristics in birds involve plumage patterns and plumage polymorphisms. For other than a handful of species, however, we do not have sufficient inheritance data to test hypotheses of genetic control of these phenotypes. He also draws the attention of field workers to the existence of threshold polygenes, primarily because segregation ratios can mimic those of simple Mendelian characteristics. For example, he noted that the essentially continuous range of plumage variation in the Variable Oystercatcher (*Haematopus unicolor*), which I had earlier ascribed to a major gene with epistatic modifiers (Baker, Notornis 20: 330–345, 1973), could equally well be accounted for by threshold polygenes.

Boag and van Noordwijk give a fine exposition of the theory and application of quantitative genetics in Chapter 2. They are to be lauded for their extremely balanced treatment of the advantages and problems associated with the analysis of polygenic characteristics. Quite rightfully, they stress that techniques such as heritability analysis artificially partition phenotypic variation into its causal components. Increasing attention is now being directed to "norms of reaction" to understand how a particular genotype can give rise to a range of phenotypes. I am uneasy over the genetic determinism implicit in current quantitative genetic models, wherein the genotype is assumed to be translated essentially one-to-one into the phenotype (with some environmental modulation). My unease stems from the assertion by epigeneticists such as Ho and Saunders (J. Theor. Biol. 78:573–591, 1979) that during development, the genotype specifies only a general algorithm that interacts dynamically with the environment to produce variable phenotypes. If the latter model is correct, then one cannot necessarily conclude that phenotypic resemblance between relatives has an additive genetic basis, but rather could be due to similar environmental induction.

In Chapter 3, Shields summarizes our scant knowledge of bird chromosomes, a deficiency that arises because their minute size (particularly of microchromosomes) makes it difficult to see them, let alone investigate their structure and homology. A conjunction of karyological and molecular studies may allow more progress in the future. New mapping strategies using X-rays and in situ hybridization with DNA probes tagged with a fluorescent dye make it possible to locate genes on chromosomes, and this approach could be fruitful for birds.

The detection and analysis of variation in allozymes is summarized in Chapter 4 by Evans. I found this chapter to be somewhat disappointing in that it was almost pedantic with respect

to details of laboratory technique, an overemphasis on problems of gel interpretation, and a bias towards fragmentary evidence for selection operating at allozyme loci. Evans repeats the old chestnut that it is not possible to test for neutrality, but that it is invoked only when evidence for selection has not been found (which he suggests may result from not looking at relevant parameters). The reverse is true; until the neutral theory of molecular evolution was formulated, it was not possible to generate specific quantitative predictions about the amount and organization of genetic variation in populations (Kimura 1983, Cambridge Univ. Press, Cambridge). Furthermore, Evans ignores the most comprehensive analysis of the nature of genetic variation in birds carried out by Barrowclough et al. (Current Ornithol. 2:135–154, 1984), wherein it is concluded that allozyme data fit predictions of mutation-drift neutral theory.

The first section concludes with an excellent chapter by Quinn and White on the analysis of DNA sequence variation. Because molecular approaches are providing incredible insights into the evolutionary past without reference to phenotypes, it has been suggested that population genetics is no longer a cohesive discipline (see Clark, Mol. Biol. Evol. 5:90–96, 1988). My own view is that researchers working at the phenotypic level will increasingly collaborate with molecular biologists or that they will acquire training in molecular techniques. The synthesis of phenotypic, allozymic, and DNA sequence variation within and among populations is required before we can truly appreciate the evolutionary forces acting on lineages. For example, subspecies of Canada Geese (*Branta canadensis*) are only weakly structured in their nuclear genes because of male-mediated dispersal between breeding ranges. However, mtDNA is structured into two clonal assemblages that presumably diverged in different glacial refugia. Breeding-site philopatry of females and maternal inheritance of mtDNA has preserved this subdivision in mitochondrial genes until the present day (Shields and Wilson 1987, Van Wagner and Baker, J. Mol. Evol. 31:373–382, 1990).

Although biologists are well aware of the viability consequences of close inbreeding, the consequences of philopatry are open to debate. In Chapter 6, Greenwood summarizes current thinking on inbreeding, dispersal, and optimal outbreeding. I know of no convincing electrophoretic evidence in support of high levels of inbreeding in birds, although Greenwood thinks this could be misleading because of wide confidence limits to estimates or that they may be confounded by selection or low levels of dispersal. The last two objections can be ruled out, however, because gene flow among contiguous demes is high, and evidence for selection at allozyme loci is almost totally lacking in birds.

Those interested in direct and indirect methods for estimating gene flow and the genetic structure of populations will be delighted with the insightful review by Rockwell and Barrowclough in Chapter 7. They conclude that *equilibrium* populations of birds thus far studied are only very weakly structured, consistent with high estimates of gene flow. It cannot be overemphasized that many continental populations of birds, especially those in regions that were formerly glaciated during the last ice age, are unlikely as yet to have reached an equilibrium between gene flow and mutational input. Indirect methods (Slatkin, Science 236:787–792, 1987) using private alleles or by inverting Wright's formula $F_{ST} = 1/(1 + 4Nm)$ to obtain the gene flow estimator (Nm) are invalid under non-equilibrium conditions.

Part II concludes with a chapter by Price and Boag on the detection and measurement of natural selection on phenotypic characters in natural populations of birds. They use the Lande and Arnold (Evolution 37:1210–1226, 1983) approach to measure selection on correlated characters, which requires knowledge of heritabilities and genetic correlations between characters. While they are strong advocates of this approach, Price and Boag also point out problems associated with the stability and estimation of genetic correlations and selection of characters, as well as the need for very large sample sizes. They give an example of selection operating on Medium Ground-Finches (*Geospiza fortis*) during the 1977 drought

on Isla Daphine Major in the Galapagos, which yields the counterintuitive result that beak width has been selected to decrease, whereas body size and beak depth have been selected to increase. Yet in the original population of 640 birds prior to the selection event, these three characters were all positively correlated (Table 3). This presumably must mean that the 97 survivors were large-bodied and possessed deep but relatively narrow bills, and this further implies that in large birds there is a non-linearity in the covariance of bill depth and width. A scatter plot (Fig. 5) of residuals from the regression of beak width on six independent variables is used to argue against non-linearity, but the beak depth observations cannot be identified within the cloud of data points. This is a crucial point, because the calculation of selection differentials is based on linear regression of the phenotypic characters. Measurement error is a potentially confounding factor here, especially since beak width is difficult to measure with good precision (although Grant and his colleagues report high repeatabilities for *G. fortis* measured in different years—see Grant et al., Biol. J. Linn. Soc. 23:1–39, 1985).

Non-random mating and its effects on the structure of populations is the subject of Chapter 9. Findlay explains that population patterns of non-random mating cannot be interpreted as evidence of true mating preferences, because the latter is exercised by individuals who may vary in their choice, especially given different availability of mates and ecological constraints. In Chapter 10, Corbin investigates the relationship between geographic variation and speciation. He concludes that there is evidence of a major reorganization of genomes either during or following speciation for the genera he has analyzed. This conclusion is suspect, however, because it is based on differences in slope of plots of F_{ST} against Nei's *D* within and among species. This relationship is inescapably curvilinear if the within and among species comparisons are treated as one array, as previously noted by Barrowclough (J. Field Ornith. 55:509, 1984). In the Epilogue, Buckley defends Corbin's conclusion of bilinearity, but it seems likely that the reduced slope for the within-species regression is induced by gene flow among populations rather than indicating that genetic revolutions accompany speciation. Evidence is accumulating from electrophoretic studies that, although founder effects can accelerate population divergence in birds, both intraspecific and interspecific diversity can be explained by gradual divergence in isolated populations of small to moderate size (Baker et al., Evolution 44:564–582, 1990).

The case histories presented in Part III are all impressive examples of the role of genetic analyses in understanding the population biology of birds. Van Noordwijk's assessment of the quantitative ecological genetics of Great Tits (*Parus major*) is a stimulating insight into not only what is known about this much-studied species, but also what needs to be done to clarify the interactions of genetics with environmental conditions. The observation that heritability of nestling body size is high in years when food is abundant but is zero in seasons when food is scarce clearly indicates that environmental influences can swamp genetic "control" of body size. Such environmental modulation of phenotypes *within* populations should warn researchers of the potential dangers of rigid selectionist interpretations of phenotypic variation, as did James' (Science 221:184–186, 1983) discovery of an unexpectedly large environmental component of phenotypic variation *within* populations.

Parkin summarizes his studies of the evolutionary genetics of House Sparrows (*Passer domesticus*) in Chapter 12. This work is impressive for its scope and thoroughness. Using Ohta and Kimura's (Genet. Res. 22:201–204, 1973) formula for neutral alleles, he calculates that present day populations in Britain should have heterozygosities of 61–74%. Since predicted levels are much higher than he actually observed with protein electrophoresis, he concludes that bottlenecks may have reduced levels of heterozygosity. However, this discrepancy can be accounted for in other ways. First, the long-term effective population size is almost certainly much smaller than current census population sizes. Second, the majority of electrophoretically detectable alleles may be slightly deleterious, in which case hetero-

zygosity will increase only slowly with population size (Kimura 1983). Although Nei's *D* can in theory be used to estimate divergence times of different populations, these estimates are only rough approximations, given the vagaries of sampling errors (particularly across loci). Parkin's assumption that present day populations are in equilibrium is also questionable, given the short time frame since the last glacial period.

The final case histories by Cooke on the Snow Geese (*Chen caerulescens*) and O'Donald on the Great Skua (*Catharacta skua*) are highlights of the book. They demonstrate how major long-term studies of bird populations can accumulate the sample sizes and detail necessary to test sophisticated genetic hypotheses. As such, they should be required reading for all aspiring and practicing population biologists.

I very much enjoyed reading the Epilogue, where Buckley draws together an excellent synthesis of past and future research. With such a wide ranging review, it is almost inevitable that some errors should creep in. For example, it is manifestly *not* true that birds have lower levels of heterozygosity than other vertebrates; birds and mammals have very similar degrees of within-population genetic variation (Avise and Aquadro, Evol. Biol. 15:151–185, 1982). The overall impression gained from this volume is that we currently have relatively little evidence in support of natural selection maintaining polymorphism in bird populations. Researchers should, therefore, heed Buckley's plea "that as a working null hypothesis, henceforth all avian plumage polymorphisms should be considered selectively neutral, and that tests be designed solely to falsify that null hypothesis. If such falsification were demonstrated, then and only then, on a case-by-case basis, would it be reasonable to attempt falsification of carefully crafted alternative hypotheses." Furthermore, this kind of rigor is now possible at the level of morphological evolution among populations. Although natural selection is doubtless involved in the adaptive moulding of phenotypes, its role has usually been assumed *a priori*. Simple null models of phenotypic evolution (e.g., Hill and Lynch, Evolution 40:915–935, 1986; Lynch, Evolution 42:455–466, 1988; Turelli et al., Evolution 42:1085–1089, 1988) allow testing of alternative mechanisms such as genetic drift and mutation. Rejection of neutral models should be a prerequisite for investigating the action of selection on quantitative characters.

I strongly recommend this fine volume to all ornithologists despite its hefty price.—ALLAN J. BAKER.

BIRDS OF THE LOWER COLORADO RIVER VALLEY. By Kenneth V. Rosenberg, Robert D. Ohmart, William C. Hunter, and Bertin W. Anderson. Univ. of Arizona Press, Tucson, Arizona, 1991: 416 + xv pp., 34 figs., 6 tables. $40.00.—Few regions on earth have been altered by man as profoundly and swiftly as has the lower Colorado River Valley. The damming of the river and the replacement of most native vegetation by the introduced saltcedar (*Tamarix chinensis*) constitute an ecological upheaval affecting all of the American Southwest. This book describes how this upheaval is reflected among birds. Its primary basis is the original research conducted from 1972 to 1986 by a group of biologists under Ohmart and funded largely by the U.S. Bureau of Reclamation. For the historical perspective the authors relied on previously published literature, especially Joseph Grinnell's account of his 1910 expedition.

The genius of this book, and of the research behind it, is its integration of fundamental description, experiment, and theory. Four hundred species accounts constitute the core of the book; these discuss abundance, migration schedules, changes in status, subspecies, habitat, and breeding and feeding habits in a flexible format. Thus basic natural history data provide a firm foundation for further analysis. Among the six chapters preceding the species accounts, one discusses the authors' experiments in reforestation, and another treats more

theoretical ecological problems, as tested by the authors' observations. Although the results of these experiments have been published elsewhere, their being summarized here gives the book a dimension seldom found in regional avifaunas. The recommendations for habitat restoration are grounded in experiment. Reasons for past failures of restoration attempts that wasted government money are explained, and the recurrent irresponsibility of government agencies is illustrated with stories of specific incidents (page 68). I hope that every official with jurisdiction over the Colorado valley reads this book before making another decision.

The authors identify and interpret patterns and trends while also expressing fully the individuality of each species. For example, they describe the direct relationship between structural complexity of a habitat (greatest in cottonwood-willow woodland) and the number of bird species the habitat supports. Yet they also point out that while the distribution of some species may be governed by the structure of the habitat, others are governed by food supply, availability of nesting sites, or temperature tolerance. An important trend the authors note is the decline and loss of migratory, summer-resident insectivores. Yet the apparently irreversible decline of the Willow Flycatcher (*Empidonax traillii*), Bell's Vireo (*Vireo bellii*), and Yellow Warbler (*Dendroica petechia*) contrasts with the recovery of Lucy's Warbler (*Vermivora luciae*), the extension into new habitats of the Yellow-breasted Chat (*Icteria virens*), and the flourishing of the Blue Grosbeak (*Guiraca caerulea*).

A chapter on finding birds in the lower Colorado River valley is helpful but because many roads are not marked or named on the maps in this chapter the visitor will want to equip himself with a detailed road map as well. Other features are a calendar of bird activity (arrivals, departures, peak numbers, singing, nesting, etc.), bar graphs of seasonal status, histograms of numbers of many migrants, and a tabulation of Christmas Bird Count results, the last probably more reliable than those of most such counts elsewhere.

Unfortunately, the authors do not cite the sources for specific records, perhaps because of the "general space limitations" mentioned on page 117. If the Univ. of Arizona Press really imposed such limitations, it has done us a serious disservice. Citations of original sources are fundamental to the verifiability of data that is central to science. The lack of such citations, the only serious defect in an otherwise outstanding book, can only cast suspicion on the data.

The authors did miss a couple of worthwhile opportunities, however. In their history of the ornithological exploration of the Colorado River, they skip from Grinnell's expedition of 1910 to Monson's arrival in 1943. Yet Laurence M. Huey visited the Bard region regularly in the 1920s and 1930s. His collection and field notes are readily available in the San Diego Natural History Museum but are not referred to once in this book. In "Birds of Arizona," Phillips, Marshall, and Monson referred to Huey's collection frequently, so Rosenberg et al. can hardly have been ignorant of it. These data should further illuminate conditions during the last years before the dams changed the Colorado valley forever.

The original data on food habits are based in part on "almost 5,600 bird specimens . . . collected for dietary analysis." These data represent a significant contribution to the book and to the literature on bird diets in general. Yet these 5600 specimens could have been used for other purposes as well but apparently were not. The authors do not mention their disposition. For example, the account of the Brown-headed Cowbird (*Molothrus ater*) implies that 110 individuals were collected over all seasons of the year. These specimens could have provided extensive information on this cowbird's breeding cycle, molt schedule, and dispersal that apparently was not taken or not used. Concerning the cowbird's subspecies, Rosenberg et al. say only "breeding Brown-headed Cowbirds are all presumably *M. a. obscurus*. . . . However, *M. a. artemisiae* Grinnell may occur in winter." By not identifying their 110 cowbirds to subspecies, Rosenberg et al. missed generating information with a

very practical application: if cowbird removal is ever undertaken in the Colorado valley, as it has been in coastal southern California, the trapping should take place at a time and place where the largest numbers of the locally breeding subspecies can be caught. The authors appreciate the applications of taxonomy (for example, see the account of Wilson's Warbler [*Wilsonia pusilla*]), but I'm sorry they missed the opportunity to extend the results beyond those already published by Grinnell, Phillips, and Rea.

The importance and usefulness of this book extend far beyond the visiting birdwatcher or ecologist interested in the adaptations of desert birds. Wildlife managers and park planners anywhere in the Southwest should read the examples showing how native plants can be integrated into a domesticated environment. Residents and tourists need educating on the river's environment and history, lest they think that the deafening hordes of speed-boaters and jet-skiers are the river's indigenous wildlife. Society should know the price it has paid for its thirst for the Colorado.—PHILIP UNITT.

BIRDS OF MALHEUR NATIONAL WILDLIFE REFUGE, OREGON. By Carroll D. Littlefield, illustrations by Susan Lindstedt. Oregon State Univ. Press, Corvallis, Oregon, 1990: 304 pp. $25.95 (hardcover), $15.95 (paperback).—This book is an authoritative reference which should prove to be a valuable addition to the shelf or backpack of any serious birder or traveller who wishes to visit a truly outstanding area for bird observation. If you are a birder, you should not visit Malheur National Wildlife Refuge without first using the book as a guide to help you determine when to go and which portions of this large (73,000+ ha) area to visit. The book is divided into two parts. The introductory portion provides background information of the area. Descriptions of the area are arranged both by geographic areas of the refuge and by the different plant communities within the refuge. Additionally, this section has a chronological guide to the refuge which covers the winter season, the summer season, and both the spring and autumnal migration periods.

Some 240 pages of species accounts comprise the second and major portion of the book. As with most publications of this type, the species accounts and treatments are not perfectly balanced with each other either in depth or detail. Some of the accounts may reveal some of the biases of the author. The unevenness of the accounts occurs primarily with the level of detail offered for particular species, but the uneven treatment detracts from neither the clarity nor usefulness of the book. Each of the species accounts is authoritative, well documented, and provides the types of information needed to further a deep appreciation of the area's importance as either a breeding location or stopover resting spot for the 300+ species that use the refuge.

Carroll Littlefield is certainly well qualified to author this book. He is an accomplished ornithologist and he has spent many years at Malheur National Wildlife Refuge. His knowledge of the habits and populations of the local avifauna is unsurpassed. The literature citation section of the book is acceptable, but not overly exhaustive considering the large number of graduate studies that have been conducted on Malheur National Wildlife Refuge. Refuge files sometimes offer a wealth of chronological and biological data, but are also somewhat inaccessible and certainly ponderous. This is a combination of traits which usually discourages their use. It is obvious that Littlefield spent a great deal of time filtering through the volumes of files at Malheur National Wildlife Refuge and was therefore able to provide the detailed species accounts that this guidebook offers. Now that Littlefield has compiled these records into a more accessible volume, he has increased their value to the ornithological community manyfold.

Carroll D. Littlefield should be commended not only for this contribution to the ornithological community, but for this book as a model for future "Birds of the such-and-so"

volumes. Carroll Littlefield's training as an ornithologist and his thorough knowledge of the Harney Basin are obvious throughout the entire book. It is a valuable contribution to the ornithological literature of the region and provides a thorough guide for a serious birder who is a potential refuge visitor or for the "armchair" birder who wishes to visit vicariously a great birding spot.—RICHARD B. STIEHL.

AN ANNOTATED CHECKLIST OF THE BIRDS OF TENNESSEE. By John C. Robinson. Univ. of Tennessee Press, Knoxville, Tennessee, 1990: xi + 276 pp., 33 range maps, 3 numbered text figs., 6 tables. $29.95.—A compilation and synthesis of previously published information must be well organized, arranged in a dependable way, and utilize explicit definitions for categories. John Robinson has done just these things and more in this work. Starting primarily from the rich but cryptically presented notes on the birds of the state that have appeared in *The Migrant,* he has painstakingly reorganized the data into a coherent summary of the distribution and status of 373 species in Tennessee. The work includes thorough coverage through May 1988, as well as noteworthy records from later in 1988. Species accounts include consistent treatment of Status, Abundance, Spring and Fall Arrivals and Departures, Summer and Winter Occurrence, Remarks, and Substantiation. I like the book, which is Tennessee's first book devoted primarily to accounts of species. Robinson suggests the work will be useful to field workers before, during, or after fieldwork. I think its primary use will be as a reference work, for which it is admirably suited. I have had several occasions to use it as a reference, and found it reliable. But the style that makes it useful as a reference makes it dry for general reading. I have few quibbles with the book; one concerns the several range maps arranged as an appendix. The material presented in the maps is interesting, but I am perplexed by the choice of species; many others besides the 33 chosen would be as interesting. The quibbles are minor, however. Robinson's work is a solid foundation from which other work can be launched. The data it contains will be a baseline from which future changes in Tennessee's avifauna can be assessed.—PAUL B. HAMEL.

AUKS AT SEA. Spencer G. Sealy (ed.). Cover illus. by John Schmitt. Proceedings of an International Symposium of the Pacific Seabird Group, Pacific Grove, California, 17 December 1987. Studies in Avian Biology No. 14. Cooper Ornithological Society, Los Angeles, California. 1990: 180 + vi pp.—It wasn't so long ago that the pelagic ecology of auks was a mystery wrapped in an enigma. We waved good-by as the irritating birds flew out to sea, and fired off our best guesses a couple of hours later when they came home. We hardly knew where they'd been, let alone what they'd been doing there. The Dovekie (*Alle alle*), perhaps the commonest seabird in the Northern Hemisphere, is still best known as a storm-blown stray. "Auk ecology" was mainly about birds nesting on cliffs or islands—certainly not as members of marine communities. But this bafflement is evaporating with remarkable speed. The pelagic review in Nettleship and Birkhead's "The Atlantic Alcidae" (Academic Press, 1985) has already been overtaken by the papers in this symposium—presented only two years later. I don't doubt that the successor to "Auks at Sea" is already in the pipeline.

The scope is broad but concise. Spencer Sealy's Introduction sets the scene, reminding us of Robert MacArthur's basic zoogeographical principles and the Ashmoles' fundamental contributions to the pelagic ecology of seabirds. The opening section has papers on "Patch Use" and the tactics of foraging: Hunt et al., and Schneider, Harrison et al. in the Bering Sea; Schneider, Pierrotti et al., and Piatt off Newfoundland; Cairns and Schneider, and Gaston and McLaren in the eastern Canadian Arctic. I liked the linking of Least Auklets (*Aethia pusilla*) in the Pribilofs to various indices of zooplankton abundance. I was also

intrigued by the importance of "fronts" there, in concentrating *injured* euphausiids at the surface, to the benefit of Black-legged Kittiwakes (*Rissa tridactyla*) and Red Phalaropes (*Phalaropus fulicarius*) as well as murres (*Uria* spp.). "Allocation of Time and Energy" takes a wider, more strategic view, with the budgets of a piscivore and a planktivore: Common Murres (*U. aalge*) off Newfoundland and Marbled Murrelets (*Brachyramphus marmoratus*) off British Columbia (Burger and Piatt, Cairns et al., Carter and Spencer). Scott, and Duncan and Gaston, describe the swimming migration of young Common Murres and Ancient Murrelets (*Synthliboramphus antiquus*) off the West Coast. There are specialized accounts of diets in relation to available resources: for the Common Murre in Monterey Bay (Croll), Thick-billed Murres (*U. lomvia*) wintering off Newfoundland (Elliot et al.), and various auklets breeding in the Bering Sea (Harrison). The Newfoundland samples were birds taken in the peculiar, legal but unregulated "turr hunt" there. Other auks in peril include the declining Common Murres in central Californian colonies (Takekawa et al.) and the birds killed in the same area by the *Apex Houston* oil spill in 1986 (Page et al.). Finally, Vader et al. summarize the effects on both murres of the decline of capelin (*Mallotus villosus*), an important food in the Barents Sea.

This is a very nice mix of papers presented by leading workers on the pelagic ecology of auks. I particularly liked the comparisons and contrasts at different levels: piscivores vs planktivores, East vs West coasts, Boreal Zone vs Low Arctic. It's a pity we can't yet compare Atlantic Dovekies with the West Coast planktivores or Alaskan auks with Siberian ones. I was disappointed to find only one European contribution; from the pelagic seabird's perspective, the Atlantic is one big Ocean, and should be treated as such. It might be interesting to expand the papers on patch use, and other "energetic" topics by comparisons with baleen whale models. For efficient foraging on euphausiids, a finback (*Balaenoptera physalus*) apparently needs a "patch" at least ten times denser than the overall mean (Brodie et al. 1978. Limnol. Oceanogr. 23:1264–1267). This gives us some kind of bracket for optimum prey densities for auks. However, these niggles are mostly wishful thinking. "Auks at Sea" is an excellent symposium volume, and I recommend it to everyone interested in the pelagic ecology of seabirds.—RICHARD G. B. BROWN.

THE KESTREL. By Andrew Village, illus. by Keith Brockie. T. & A. D. Poyser, Ltd., London, England, 1990: 352 pp., 32 black-and-white photographs, 85 numbered text figures, 77 tables, 2 appendices. £18.00.—Ian Newton's significant contributions to our understanding of raptor ecology come from his detailed and precise studies. Andrew Village has clearly learned well from his mentor, and this book compiles a vast amount of data on the Eurasian Kestrel (*Falco tinnunculus*), most of which is derived from Village's own careful studies. The emphasis of this book is on the ecology and regulation of Eurasian Kestrel populations; however, the author leads off with an extremely interesting chapter on kestrels around the world. The term "kestrel" is applied to certain small members of the genus *Falco,* a large genus which also includes the Peregrine (*F. peregrinus*), Gyrfalcon (*F. rusticolus*), Northern Hobby (*F. subbuteo*), and Merlin (*F. columbarius*), to name but a few. Village takes a typological approach towards defining the characteristics that separate "kestrel" species from other members of the genus. He concludes that there is no "clear-cut way of defining" the kestrel group and points out that modern techniques such as DNA-DNA hybridization may help unravel the position of kestrels among the falcons. In lieu of these data, an opinion would have been welcomed. As another student of kestrels, the "group" seems real, though perhaps diffuse, to me.

Several chapters discuss topics that seem to deviate from the theme of population regulation, but are necessary for complete coverage of kestrel natural history. Still, Village

successfully demonstrates the importance that variables such as timing of molt, differential weight gain between males and females prior to egg laying, and seasonal changes in energy budgets have on population dynamics. Two final chapters provide a synthesis of possible mechanisms that regulate kestrel population density. Village concludes that food supply seems to be the primary regulating factor and attempts to characterize the adaptations that kestrels, as well as other raptors, employ to successfully exploit cyclic food resources, such as the voles seemingly so important to kestrels.

Two aspects of Village's research lend themselves to the comprehensive nature of the book. First, Eurasian kestrels were studied year-round, yielding valuable data on winter food supplies and kestrel movements and mortality. This information is essential to discerning and interpreting breeding population dynamics. Second, Village conducted his research in two very different areas of England. In 1976–1979 data were collected in the grasslands of the Southern Uplands of Scotland, while from 1980–1988 most of the data were collected in southeast England in areas of arable farmland. These two areas are extremely different, and by comparing parameters such as food availability, climate, and nest site dispersion between the two sites, Village is able to distinguish different factors that regulate the individual populations. However, since the duration of study in each area is relatively short, some questions, such as population turnover, are, Village admits, difficult to address.

As in any definitive natural history study, this book raises as many questions as it answers. Village does an excellent job of posing questions that his data have failed to address and often usefully speculates on areas where future research would be profitable. As I read the book, I continually jotted ideas down in a notebook for future reference. Village frequently compares his findings with published literature, most frequently that on the European Sparrowhawk (*Accipiter nisus*). There were several places where I felt congeneric comparisons would have been more appropriate, especially considering the voluminous body of literature on the American Kestrel (*Falco sparverius*). Two appendices review the various methods used to estimate kestrel diets and the measurement of home ranges. Though not as comprehensive as the original methodological literature, the appendices are useful for those unfamiliar with the techniques. As a reference for graduate students searching for ideas for a thesis, this book should be required reading.

The format of the book follows closely the style of other Poyser books. Figures are interspersed throughout the text, but tables are arranged at the end. Although flipping back and forth to consult the tables may be distracting, excellent summaries at the end of each chapter facilitate easy understanding. Keith Brockie's illustrations rate as some of the best kestrel drawings I have ever seen and provide a little personality for these birds that Village understands so well.

Although the book skirts more theoretical treatments of population ecology, it provides a broad empirical framework for those treatments to be made by others. The book might bore theoreticians, but for most students of population ecology, birds, and more specifically, raptors, the book is exciting, useful, and inspiring.—REED BOWMAN.

RECENT ADVANCES IN THE STUDY OF NEOCENE FOSSIL BIRDS. I. THE BIRDS OF THE LATE MIOCENE-EARLY PLIOCENE BIG SANDY FORMATION, MOHAVE COUNTY, ARIZONA, by K. Jeffrey Bickart (pp. 1–72). II. FOSSIL BIRDS OF THE SAN DIEGO FORMATION, LATE PLIOCENE, BLANCAN, SAN DIEGO, CALIFORNIA, by Robert M. Chandler (pp. 73–161). Ornithological Monographs No. 44. $19.75 ($17.75 to AOU members).—Imagine studying mixed flocks of flamingos, stilts, avocets, plovers, sandpipers, cranes, and huge storks along the edge of a shallow lake in western Arizona, with six species of geese scattered from the grassy shore out to deeper water. Or how about a short pelagic trip off San Diego that features five grebes, three

albatrosses, three shearwaters, two boobies, two gannets, four cormorants, and nine alcids among 35 species of seabirds? These seemingly fanciful situations once were genuine, although well before you or your binoculars existed.

Through the study of fossils, K. Jeffrey Bickart and Robert M. Chandler have illuminated important chapters in the history of North American birds. Bickart describes the avifauna (based on 1000 identifiable bones from 38 species in 13 families) from the lacustrine Big Sandy Formation, near Wickieup, Mohave County, Arizona. This formation is late Miocene to early Pliocene in age, 6.1 to 4.6 million years old. Most species from this interval of time can be referred to modern genera (not necessarily living in North America today), although not to extant species. As expected from lacustrine sediments, the birds are dominated by freshwater species (80% of the bones are from anatids), although hawks, eagles, accipitrine vultures, a dove, and a crow are represented as well. Bickart does an excellent job of describing and interpreting the osteology of anatids, particularly the geese (Anserinae), a most difficult group to classify on the generic or species level. Bickart usually deals effectively with the perplexing situation of trying to decide if his fossils, which include nearly complete associated skeletons, can be reconciled with named species that are based only on a fragment or two. Even though his material is of much greater quantity and quality than that of previous researchers, Bickart is conservative in naming new species. Sometimes, as in the case of the stork *Ciconia* sp. (90 bones from 14 skeletal elements), a more rigorous effort at species-level classification would seem to be warranted.

Bickart reviews the systematic literature for each taxon from the Big Sandy Formation, often exposing unresolved matters. I found this to be helpful, although the account of the supposed shelduck *Anabernicula* was perplexing. After pointing out numerous osteological and systematic problems with this strictly fossil genus, Bickart tentatively referred a nearly complete associated skeleton to *Anabernicula,* prefaced by (p. 35), "... it [*Anabernicula*] might include some species that properly belong with the Anserinae, and others with the Tadornini of the Anatinae.

I tentatively refer the Wickieup goose to this genus, although if the genus did not exist, I would unquestionably refer the material to *Branta* in the Anserinae, even though it is so much smaller than any extant goose."

Perhaps the strongest point of Bickart's study is his taphonomic analysis of the Wickieup birds (pp. 54–61). Bickart postulates that massive die-offs, perhaps from botulism, may be responsible for the accumulations of bird bones at Wickieup. He suggests why there are biases in the relative abundances of species and skeletal elements. It is a pity that Bickart overlooked very pertinent research by Jehl (1988, Auk 105:97–101) on death assemblages of modern birds at Mono Lake, California.

Chandler describes the avifauna (2000 identifiable bones, representing about 39 species in 13 families) from the San Diego Formation (late Pliocene marine sediments, 3.0 to 1.8 million years old) of southwestern San Diego County, California. After reviewing previous research, Chandler compiles the entire avifauna for the first time, describing new species and revising classifications as needed. Most of this research seems to be careful and straightforward. One glaring error concerns extinct grebes, where the same specimen (LACM 2113/1071, tibiotarsus) is referred to *Podiceps subparvus* Miller and Bowman on pp. 93–94, and then to *Aechmophorus elasson* Murray on p. 95. An annoyance is the repeated misuse of the obsolete term "Recent" rather than "Holocene" when referring to the geochronological unit that represents the last 10,000 years. This is complicated further by Chandler's frequent misuse of "Recent" as an adjective that really means "modern" or "living." In some cases, the context does not determine which of the incorrect meanings is intended.

Being bound together in a single volume, one cannot avoid comparing the two papers. Neither has an "Abstract," although each has a short "Summary" at the end which reads

just like an abstract. Bickart's paper has fewer errors, an exception being the incomplete sentence about doves on p. 52. Bickart's photographs are better than Chandler's (sharper focus, cut out more carefully, have scale within the plate). Unlike Bickart, Chandler goes to great length to determine character polarities. Bickart presents a more thorough overall picture of his paleofauna, providing good perspective on how the birds from Wickieup compare to others of similar age. Bickart also describes the sedimentary environment and the associated fossil fauna, dominated at Wickieup by large mammals. Neither Bickart nor Chandler mentions the presence or absence of juvenile bones, an indicator of local nesting. In fact, neither author suggests seasonality of their paleofaunas, which is particularly surprising for Bickart, given his interest in taphonomy. Chandler never states whether he regards the marine birds of the San Diego Formation as a nesting colony, a nearshore wintering or migratory avifauna, or a pelagic accumulation of unknown seasonality. In fact, the only community-level interpretation of the San Diego Formation avifauna is in an upbeat, invigorating Foreword to the entire volume by Storrs L. Olson, who points out that the history of North American marine and freshwater avifaunas would be pure conjecture without fossils.

This volume will be of interest to those studying the evolution or ecology of North American waterfowl or seabirds. Like the recent *Ornithological Monograph* No. 45 by Storrs Olson and Helen James on late Quaternary birds from Hawaii, the papers by Bickart and Chandler represent a renewed exposure of paleontology in mainstream ornithological publications. While admirable, the research by Bickart and Chandler would have benefited greatly had they been among the primary collectors of the fossils they studied. The time is ripe for new field work at both the Big Sandy and San Diego formations, using modern techniques of measured stratigraphic collecting, as well as fine-mesh screens to sample the smallest species.—DAVID W. STEADMAN.

ANNOUNCEMENTS

SOUTHERN AFRICAN ORNITHOLOGICAL SOCIETY THEMATIC SYMPOSIUM

A symposium on the topic "Migration, Dispersal and Nomadism" will be held at Langebaan, South Africa, 12–16 September 1993. The symposium will take place on the shores of Langebaan Lagoon, one of southern Africa's prime wader (shorebird) sites, in the new West Coast National Park. At the time of the conference, the migrant waders will be arriving from their northern breeding grounds, and the spring flowers in the park will, weather permitting, be close to their best. All persons interested in attending this symposium should inform Mr. T. B. Oatley, Avian Demography Unit, Dept. of Statistical Sciences, Univ. of Cape Town, Rondebosch, 7700 South Africa, in order to be put on the mailing list to receive a copy of the First Announcement which will contain further details of the programme. The First Announcement will be posted in late 1992. Anyone wishing to present a paper or a poster should also inform Mr. Oatley. Papers on all aspects of migration will be welcomed, but special attention will be devoted to the Palearctic-African, intra-African, and Southern Ocean migration systems and to the conservation of migrant birds. The concepts dispersal and nomadism will be interpreted liberally, and will include, for example, topics such as the foraging movements of seabirds. Papers presented at the symposium will be considered for publication in a special number of *Ostrich,* the journal of the Southern African Ornithological Society.