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Research and Management of the Brown-headed Cowbird in Western Landscapes

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Reviews

EDITED BY REBECCA HOLBERTON

The following critiques express the opinions of the individual evaluators regarding the strengths, weaknesses, and value of the books they review. As such, the appraisals are subjective assessments and do not necessarily reflect the opinions of the editors or any official policy of the American Ornithologists' Union.

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A Photographic Guide to North American Raptors.—Brian K. Wheeler and William S. Clark. 1999. Academic Press, San Diego, California. xviii + 198 pp., 377 color photographs. ISBN 0-12-745531-0. Paper, $19.95.—Field guides are to field ornithologists what hammers are to carpenters: essential tools of the trade. With the right field guide in hand, even a novice field worker in a new land stands a sporting chance of identifying birds. Without a good field guide, frustration can quickly set in. The role that field guides (together with their essential companion, binoculars) have played in ornithology is difficult to overstate. Consider for example, our understanding of the migratory behavior of Broad-winged Hawks (*Buteo platypterus*). At the beginning of the twentieth century, this obligate transequatorial migrant was thought by many to be a resident species throughout much of its North American breeding range. The broadwing was, after all, cryptic and difficult to see during the breeding season. The paucity of winter broadwing sightings, confounded by their frequent misidentification as young Red-shouldered Hawks (*B. lineatus*), led even seasoned field workers to consider the broadwing a year-round inhabitant in many areas.

All of that changed, however, as prismatic binoculars came into widespread use among field workers, leading to the development of the modern field guide. Roger Tory Peterson's *A Field Guide to the Birds* (1934) and its successors, as well as other regional bird guides revolutionized field identification of birds. But, over the years, that was refined to the point where the guides themselves demanded the creation of a new kind of bird guide devoted to specific birds within a particular region.

For raptors, these new specialty guides have run the gamut from ''gestalt'' text driven—black-and-white illustrated offerings like Harkness and Murdoch's *Birds of Prey in the Field* (Witherby Press, London, 1971) and Dunne, Sibley and Sutton's *Hawks in Flight: The Flight Identification of North American Migrant Raptors* (Houghton Mifflin, Boston, 1988)—through Clark and Wheeler's traditional full-color, art-driven *A Field Guide to Hawks in North America* (Houghton Mifflin, Boston, 1987) to, finally, the color-photograph-filled volume reviewed here.

Kimball L. Garrett's excellent review of the 1995 edition of Wheeler and Clark appeared in *The Auk* in 1997 (*Auk* 114:306–307). I won't go over previously trodden ground here as the current edition remains almost identical to the earlier hardcover edition except for a new cover, some minor corrections in typesetting, some photo reorientation, and several additions to the text that focus principally on age differences in eye color. I will, instead, reflect on my experiences using the earlier version and introducing it to others while working at a raptor migration observation site in eastern Pennsylvania in the United States.

Anyone who has spent time in the field helping others identify raptors knows that the new observers will need all the help they can get. Although raptors are relatively large birds, under many circumstances they can be difficult, often impossible, to identify to species level. Although part of the difficulty arises from the fleeting glimpses we often have of the birds, much of the problem can be traced to subtle intraspecific variation in their appearance. In many instances, plumage variation within a species can be greater than between species, making identification quite difficult at times. Wheeler and Clark deal with those circumstances by presenting 377 color photographs of North American raptors and vagrants, as compared to 33 and 193 images, respectively, in the first (1934) Peterson bird guide and the most recent *National Geographic Field Guide to the Birds of North America* (National Geographic Society, Washington, D.C., 1999). In most instances, the photos in Wheeler and Clark's guide are crisp, clear, and helpful. Nuances in species-specific coloration and individual variation within species, including those related to age and sex, are further detailed in the relatively sparse text and highlighted in the volume's copious photo legends. The book also provides an exhaustive

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(sometimes a bit exhausting) review of the general complexities of raptor identification.

Does the book succeed in its avowed mission? Most certainly, but only when used in conjunction with other guides. Although I would not recommend Wheeler and Clark's volume as a first and only guide for most hawk watchers, I would recommend it as a supplement to other specialty raptor guides. In conjunction with a more comprehensive bird guide, the book can turn an otherwise frustrating day at a raptor migration observation site into a rewarding experience for teacher and pupil alike. The work can also serve as a great teaching tool away from the field. In summary, I highly recommend this useful guide amazingly priced at $10.00 less than its 1995 edition!—KEITH L. BILDSTEIN, *Hawk Mountain Sanctuary, Kempton, Pennsylvania 19529, USA.*

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Research and Management of the Brown-headed Cowbird in Western Landscapes.—Michael L. Morrison, Linnea S. Hall, Scott K. Robinson, Stephen I. Rothstein, D. Caldwell Hahn, and Terrell D. Rich (Eds). 1999. *Studies in Avian Biology, Vol. 18.* 312 pages, 12 maps, 94 tables, 80 figures. ISBN 1-891276-06-9. Cloth, $18.00.—This collection of 33 papers and 3 summaries by 89 authors is a subset of 67 presentations given at a symposium held at California State University, Sacramento, California, 23–25 October 1997, and sponsored by the Partners in Flight Research Group, U.S. Bureau of Land Management, and U.S. Geological Survey Biological Resources Division. Much work on cowbird–host interactions has been accomplished in central and eastern North America. This symposium was organized to bring together the results of current work and the perspectives on potential affects of cowbirds on hosts in western landscapes. Although preceding it in publication of papers, it follows the lead of a symposium held in Austin, Texas in 1993 (Smith et al. 2000). In large part, this volume was quickly completed through determination and reciprocal reviews by the contributing authors and editors.

The collection of papers is divided into three sections. The first section deals with cowbird ecology and factors affecting cowbird abundance and distribution. The second addresses effects of brood parasitism on host reproductive performance and discusses the potential criteria for taking management action. The third section focuses on some aspects of cowbird control.

The authors of the summary chapters (Hall, Robinson, Rothstein, and Smith) present what is depicted as emerging perspectives and consensus, underscoring heterogeneity in cowbird distributions and their potential effects on host populations. The summary chapters also include the perspective that, although cowbirds may have significant influence on the success of parasitized nests, their effect on most host populations may be relatively minor. Under that perspective, concerns for cowbird control may be overrated and should be limited to some endangered species or local populations. In addition, alternatives to cowbird trapping and removal need more consideration, particularly at the landscape level. Rich, in the preface, also acknowledges the need for a better understanding of proximate relationships between cowbirds and cattle and spatial relationships between host parasitism patterns and landscape features of the West.

In many ways, the volume represents the current state of cowbird research and management. Some papers depict clear advances in our understanding of cowbird distributions and the relationships of cowbirds to their hosts. Collectively, the volume incorporates a great amount of data on cowbird biology, a testimony to the current level of activity. Its weighting to western landscapes also presents an emerging slant on cowbird–host biology that is unique to this volume. However, although the volume contains some of the best current research and some expansions of perspective, it also includes some significant analytic and conceptual limitations.

The initial section may be the volume's greatest strength. Those papers generally deal with issues affecting cowbird distribution at landscape levels and how habitat features may be related to high or low rates of parasitism. Robinson develops a respectable summary of that section, providing previous perspectives, then presenting hypotheses and predictions such that they can be evaluated with the results of the contained papers. Tewksbury et al. may provide one of the strongest analytical algorithms and its results at the local landscape level. Young and Hutto give an expansive evaluation of cowbird abundance at a broader landscape level, whereas Staab and Morrison identify specific habitat features that are related to higher parasitism levels. Several papers examining cowbird abundance and parasitism intensity show limited effects on hosts in shrubsteppe habitats (Van der Haegen and Walker, Farmer, and Ellison).

The second section, summarized by Smith, however, may be more problematic than enlightening. Smith attempts to isolate consequences of parasitism on host populations from consequences on host individuals or host nests. He acknowledges the lack of reliable estimates for ''key demographic parameters needed to model the impacts of parasitism reliably.'' Few studies deal with intrinsic growth rates. Under that handicap, he develops an argument that, even when the cost to

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some host individuals is high, the cost of parasitism to host populations or host communities is relatively small; only isolated populations of a few select species with limited distributions may be under significant threat from parasitism. From his interpretations, he develops some management guidelines for deciding when to implement local cowbird-control programs.

Two basic problems are evident in that section and in the cowbird literature at large. First, there are several prevalent analytical misconceptions; many statistics are accepted with little or no consideration as to whether the results were products of biological processes or artifacts of sampling design or analysis, or both. For example, almost all estimates of parasitism level are given as percents of observed samples, with the failure to recognize lessons of Mayfield (1961, 1975) indicating that samples of passerine nests are generally incomplete and nonrandom. The same principles that would cause one to apply the Mayfield approach for evaluating nest predation also apply to nests that are parasitized and abandoned. Because nest sample data will be most deficient in nests that fail early in their nesting cycles, a disproportionate number of nests that were parasitized and abandoned will be missed. The incomplete and nonrandom nest sample issue incorporates itself significantly in summary analyses that use studies with biased statistics (e.g. Lorenzana and Sealy, Whitfield and Sogge).

Several papers attempting to deal with seasonal fecundity overlooked renestings, or assumed, implicitly or explicitly, that females of their study species nested only once during their breeding seasons (e.g. Greene; Hahn et al.). Greene's general algorithm for assessing intrinsic growth rates was perhaps most respectable in the volume. However, his claim of limited renesting for an ''intensively monitored'' group of Lazuli Buntings (*Passerina amoena*) appeared to be generated from a small and perhaps opportunistic sample of nests (Table 3); that may have created the pessimistic conclusions regarding the threat of cowbirds to bunting populations. In contrast, the failure of Hahn et al. to consider renestings of hosts in deriving an upper bound of only 8.16 eggs laid per female cowbird in acceptor host nests may have created the authors' relatively benign conclusion for cowbird effects on hosts. The assumption of one to three renestings per host female would adjust estimates of Hahn et al. to 16–35 eggs per female cowbird. Their egg estimation generated speculation of much higher parental investment by cowbirds in their eggs, concepts empirically unsupported in their manuscript. Overall, the analytical misconceptions in this section do not help clarify the issue regarding effect of cowbirds on their hosts.

The second underlying weakness of this section, as well as in other parts of the volume, are misconceptions incorporated into design and interpretation of analysis that are actually removed from population models and population parameters. For example, Robinson et al. develop an analysis design combining potential host species that eject cowbird eggs laid in their nests with those that abandon a significant proportion of parasitized nests. They reason that both of those host groups cause a significant percent loss in cowbird eggs laid, resulting in a detrimental effect on cowbird populations. However, the parameter of interest in population models is young produced per female. Five successful eggs out of 10 produced per female (50% egg success) is as equally successful a strategy as producing 5 young from 20 eggs (25% egg success). Attention to population models would not have created that functionally misleading analysis design proposed by the authors. Their conclusion that habitats containing species that abandon parasitized nests can serve as sinks for cowbirds is numerically undemonstrated. They fail to consider the compensatory strategy cowbirds have of laying more eggs, and they also fail to explain how cowbirds became abundant enough in those habitats so that their numbers could subsequently decline.

In another example, DeGroot et al. failed to consider dispersal in their analysis design contrasting host communities between areas only 5–10 km apart that were either trapped or untrapped for cowbirds. Because untrapped sites are easily within expected dispersal distances of both hosts and cowbirds in trapped areas, treatments are not discrete and comparisons are not independent.

Although the second section struggles with problems mentioned above, it also assembles some useful approaches to the study of cowbird and host population dynamics. With relatively minor caveats, the fundamental model structure of Citta and Mills, and the basic algorithm of Greene, provide some highlights for taking a population perspective.

The third section contains a small collection of papers on efficacy of local cowbird-control programs. Eckrich et al. (recognizing a less than pure statistical design) provide an honest attempt to extract value from the large data set amassed at Fort Hood, Texas. Clotfelter et al. provide a credible site-scale perspective on the effects of burning on the use of Red-winged Blackbirds (*Agelaius phoeniceus*) as hosts by cowbirds.

The summary by Hall and Rothstein confronts the efficacy of local cowbird removal in increasing host populations. However, the authors operate under some of the same constraints listed above by interpreting statistically weak treatments tangential to the context of demographic and population models. For example, they assume that estimates of parasitism are accurate, and that parasitism was reduced to very low levels in several Willow Flycatcher (*Empidonax traillii*) studies (neither are necessarily true; see above). The low response in flycatcher numbers caused the authors to conclude that factors other than cowbird trapping were more important to flycatcher reproduction, rather than considering the

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possibility that the cowbird trapping was ineffectively implemented.

Hall and Rothstein digress somewhat from local cowbird-control removals to potential landscape alternatives. Sorely overlooked in that treatment was a critical appraisal of broad-scale control options. In fact, data and analyses of several studies elsewhere in this volume suggest potential cowbird effects on host communities and the value of broad-scale control options when using population perspectives (e.g. Citta and Mills, Greene, DeGroot et al., Peer and Sealy), but were not considered by Hall and Rothstein. In addition, the authors also include a treatment of a number of less science-based issues (e.g. rights of cowbirds, excessive money spent on trapping, profit motives of trappers) related to the development of scientifically sound management practices without recognizing that these can often complicate scientific evaluation.

Although this inexpensive volume contains some very good papers, there are hidden costs of treading a minefield of analytical and conceptual traps (thus wasting time and conservation dollars). This volume should be in all university libraries, and can be of use to researchers and decision makers for cowbird management, but with the caveat that little should be taken for granted. As researchers solidify analytical issues and take on more structured population-based perspectives, the understanding of cowbird–host processes and appropriate management considerations should improve substantially. This volume will still likely expand the general perspectives on this path.—JOSEPH A. GRZYBOWSKI, *College of Mathematics and Science, University of Central Oklahoma, Edmond, Oklahoma 73034, USA.*

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The Auk 118(1):274–277, 2001

Swifts: A Guide to the Swifts and Treeswifts of the World. 2nd edition.—Phil Chantler. 1998. Yale University Press, New Haven, Connecticut. 272 pp., 24 color plates, numerous maps & line drawings. ISBN 0-300-07936-2. Cloth, $40.00.—The first edition of this book appeared in 1995 among a host of similarly designed volumes on individual bird families published by Pica Press and others. Reviewers in the formal ornithological literature have often wondered for whom such texts were intended. The emphasis in these books is, as explicitly stated in this one, ''first and foremost an identification guide,'' yet one will surely not take a suitcase full of these volumes on any foreign field trip. The texts tended to be written by European (mostly British) field observers and are notably short on biological and ecological information. These are not the compendia of an acknowledged expert's life work, such as Short (1982) on woodpeckers or, more recently in the Oxford Press series, the wonderful syntheses by Kemp (1995) on hornbills, or Frith and Beehler (1998) on birds of paradise.

Collins (1997) concluded his review of the first edition of *Swifts* by suggesting that the ''limited audience'' for this effort was only those of ''the globetrotting birding community.'' By that I suppose he means someone like me. I like to have on my shelves a summary of the global state of knowledge about a group of birds, and particularly such a difficult group as the swifts (the small swifts of New Guinea and the Philippines certainly confused me in the field). I often photocopy relevant portions to take on trips; indeed, color photocopying is advanced and inexpensive enough to make copying selected color plates worthwhile. Thus I have been a sucker for those books, but, with the exception of the Oxford Press series, have been mostly disappointed. If the books are not intended to summarize all that is known about a set of birds, but, instead, emphasize identification and distribution, authors should at least (1) provide current, state-of-the art identification material, (2) adequately consult the literature and had a wide spectrum of field experts review drafts, (3) provide decent plates, (4) have distribution maps that are up-to-date and reasonably precise where a range is known, and avoid the suggestion of accuracy of a range that is not well known, and (5) be consistent and well-informed in the presentation of their perspective on contentious issues related to taxonomy, phylogeny, and English names. The efforts by Chantler on those points have fallen short in some, if not all, of those areas.

I bought the first edition of *Swifts* and took photocopied pages with me to Gabon and South Africa. My initial impression was this one might be better than most. The bibliography was lengthy and the acknowledgments listed several important experts on certain swifts in Africa and Southeast Asia. The Old World material seemed reasonably good (indeed, this book evolved from a paper on the identification of Western Palearctic swifts that appeared in the journal *Dutch Birding*) and the maps, consulted while I was in Africa, seemed adequate. However, the New World ma-

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terial seemed a lot weaker (see comments below). I was also not impressed with the plates and, although they acknowledge that capturing the shape of flying swifts is not easy, the paintings of the swifts in California that I am most familiar with were not very good. The reviews of the first edition generally supported those impressions. Old World field observers heaped praise (e.g. Turner 1996, Anon 1996), but a Neotropical field expert gave it a witheringly negative review (Howell 1996). Reviewers in the more formal ornithological literature were not much impressed (e.g. Perrins 1996, Collins 1997) but did make many specific suggestions for improvement. Because of this apparent feedback, I had high hopes for the second edition. Any second edition in this genre is uncommon. That one appeared five years after the first edition, giving enough time for Chantler to have considered comments and corrections from readers and reviewers and to have followed up with any experts who were not initially consulted. This would have greatly improved the product accordingly, particularly strengthening the New World material.

This second edition differs from the first in several significant ways. The artist Gerald Driessens is no longer listed as the junior author. The jacket says ''several plates have been revised by the artist'' but I found only one change: a new Plate 10 for African spinetails. The art is better but it was not the plate in most need of revision. The text has been renumbered and lengthened by 26 pages, and there are about 75% more bibliographic references. Yet those changes have not significantly improved the book. It's more up-to-date on some distribution details but, as stated above, the serious weaknesses noted by reviewers in the first edition have yet to be corrected. None of the many specific errors pointed out by Collins (1997) were fixed, except for a statement about the eggs of Alexander Swift (*Apus alexandri*; more on that below). Seemingly innumerable mistakes weakened the impressive-looking bibliography. Collins noted the misuse of ''Anon.'' in the bibliography when the author is actually known; those errors have been quadrupled in the new edition (none cited in the volume are anonymous, unlike the unsigned short review below cited as Anon 1995). The additional references in the second edition do not actually reflect a more thorough in-depth revision. Surely the only published account of a swift in the *Birds of North America* series would have been consulted, but Bull and Collins (1993) was overlooked for the account of Vaux's Swift (*Chaetura vauxi*).

Chantler does cite several other papers published by Evelyn Bull, but those are all erroneously listed in the bibliography under ''John Bull'' (of New York state fame). In addition, Howell (1996) questioned whether the artist had ever ''seen a live, free-flying Neotropical swift.'' I now wonder how many of the bibliographic references were actually read by the author. And, although the dust jacket claims the first edition was ''highly acclaimed,'' it seems as if the author or publisher ignored the negative reviews.

In a book whose first line claims it ''is first and foremost an identification guide,'' the identification sections are the subject of special scrutiny. The biggest identification challenge in North America is Vaux's versus Chimney (*C. pelagica*) swifts. Chantler says that Vaux's Swift is ''best distinguished from Chimney Swift by its more highly contrasting rump and uppertail-coverts, generally paler grey-brown plumage, and best of all by the underpart pattern.'' Whereas those plumage differences provide useful secondary points, I consider size, shape, and vocalizations significantly more important. When the two species occur together (as they occasionally do in California and elsewhere), size and shape differences are apparent. Even when the species are not present together, size comparisons with frequently adjacent swallows can be helpful (e.g. Vaux's Swift is nearly as small as Violet-green Swallow [*Tachycineta thalassina*], and the Chimney Swift is a tad larger than the Barn Swallow [*Hirundo rustica*]).

Not only does this guide to swifts fail to mention size and shape differences, but the two are painted nearly the same size and shape in the plates. In addition, the line sketch of purported differences in Vaux's Swift when the tail is spread or not does not match my field experience with the Vaux's Swift over the past few weeks. Further, vocal differences are another key but Chantler's comment that Vaux's Swift is ''rather softer than Chimney'' is of little help. Reference to Bull and Collins (1993) would have helped. They describe the Vaux's Swift ''high-pitched, rapid chipping and buzzy insect like twitter given in flight'' as compared to ''Chimney Swift vocalization lower-pitched with sharper chips predominating.'' Kimball Garrett's pithy characterization, that a Vaux's Swift ''sounds like a Chimney Swift on steroids,'' captures the difference between the two species well. But Chantler did not read Bull and Collins or contact Garrett (whose name is misspelled ''Garnst'' in this book, an error pointed out in review four years ago and left uncorrected).

The distribution maps for California swifts in the first edition could have been improved in the second. For example, although the scale was sufficient to map the Vaux's Swift breeding range in Santa Cruz and Monterey counties south of San Francisco, it is not shown for this area despite a series of relevant publications, including Roberson and Tenney (1993) and Sterling and Paton (1996), that included maps.

Taxonomic and name decisions by Chantler were also unsettling. Having some field experience with *Hydrochous gigas* (Giant or Waterfall Swiftlet) in Java, I was surprised that the first edition had merged that genus with *Collocalia* swiftlets. Since the first edition, more recent research has supported *Hydrochous* as a monotypic genus (Lee et al. 1996, Holmgren 1998). Despite discussing some evidence in the second edi-

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tion, Chantler has not revised his generic assignment. That seems particularly ill advised because a hefty portion of the introduction delves into differentiating the genera of swifts. Likewise the English name ''Papuan Swift'' is a particularly poor choice for the enigmatic *Collocalia papuensis,* one of the rarest and least-known New Guinea species, and called by all Papuan authorities (e.g. Somadikarta 1967, Coates 1985, Beehler et al. 1986) the distinctive and useful name ''Three-toed Swiftlet.'' Although Chantler's work could be influential, he showed poor judgment in choosing Sibley and Monroe's (1990) misleading and ambiguous name over the long-established moniker.

All this brings into question the quality of the author's research and judgment in the development of this book. To further illustrate, consider the question of the color of the eggs of *Apus alexandri,* a species endemic to the Cape Verde Islands. Although seemingly an obscure issue, egg color has been considered of taxonomic importance (e.g. Brooke 1971). Citing Bannerman and Bannerman (1966 [sic = 1968]), the first edition of *Swifts* said ''This species is unique in the Apodidae in having finely red-brown freckled (most densely clustered at broadest end), not pure white eggs.'' What Bannerman and Bannerman actually said, referring to a set collected by Alexander (1898), was ''These [eggs] were white, minutely freckled with reddish-brown, forming a faint zone round the larger end.'' (I read that as tiny freckles around the large end only, not throughout, but I digress.) In the second edition of *Swifts,* this text is replaced by the following, ''eggs plain white (not 'red-brown' freckled)'' citing Hazevoet (1995). What Hazevoet actually said was (internal citations omitted):

> ''Brooke found that *alexandri* has no close relatives and, for that reason, gave it specific rank. His judgment appears to be at least partly based on the supposition that *alexandri* is the only swift that does not lay plain white eggs, those described by Alexander being freckled with reddish brown. The eggs collected by Naurois, however, were pure white and those collected by Alexander were presumably misidentified.''

This is detailed stuff but perhaps not unimportant. Hazevoet (1995) is an unabashed proponent of the phylogenetic species concept and, under that concept, egg color is not relevant when discussing species-level taxonomy. Yet, discounting Alexander's eggs as ''presumably misidentified'' is surely just speculative at this point. Nothing in Alexander's (1898) or Bannerman and Bannerman's (1968) detailed discussion suggests that the nest found by Alexander with its two eggs were other than the swift's. If these eggs were misidentified, what were they? Are they extant? If so, wouldn't it be worthwhile to check them out, especially if one was writing a major new monograph on swifts? (The implication in Hazevoet is that Alexander deposited the material in the British Museum and, therefore, could be examined.) Whatever the answers, the issue is not as simple as changing the egg description details from ''red-brown freckled'' (first edition) to ''plain white, not 'red-brown' freckled'' (second edition). In ornithology, as in politics, the devil is in the details, and I am not convinced the details were appropriately researched for this volume.

Thus, despite my initial high hopes, I cannot recommend this new edition. If one already owns the first edition, the revisions in this new work do not justify paying the price again. Those areas in most need of reworking have not been changed and some new material appears hastily compiled and ill-advised. If you don't own the book, I recommend Chantler's (1999) text in Volume 5 of the *Handbook of the Birds of the World* series. You'll get much of the same material plus better plates (by Ian Lewington) and spectacular color photos (not to mention the summaries on owls, nightjars, and hummingbirds). If a small volume summarizing information about Old World swifts is of use to you, Chantler's *Swift* book will fill that niche. However, you should probably look elsewhere for information about New World swifts.—Don Roberson, *282 Grove Acre, Pacific Grove, California 93950, USA.*

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The Auk 118(1):277–278, 2001

Atlas of Breeding Birds of Tennessee.—Charles P. Nicholson. 1997. University of Tennessee Press, Knoxville, Tennessee. xiii + 426 pp., 176 black-and-white drawings, 23 tables and figures, 281 distribution and abundance maps, 19 other maps. ISBN 0-87049-987-4. Cloth, $45.00.—*The Atlas of Breeding Birds of Tennessee* provides the first detailed account of the abundance and distribution of the 170 confirmed breeding bird species in the state. It is the product of research conducted by the Tennessee Ornithological Society between 1986 and 1991. The first chapter, ''The Atlas Project,'' describes how creation of the breeding bird atlas was conducted. That chapter includes a description of the survey blocks, atlas breeding codes, and a sample of a field card used to collect the data. The author describes the need for ''miniroutes'' (abbreviated Breeding Bird Survey routes) to measure abundance. He also describes how the data analysis and mapping were carried out. The first chapter also has maps of Tennessee that provide details of the counties, major cities, as well as state and federal land holdings.

The second chapter, ''Landscape and Ornithology of Tennessee,'' comprises five sections. The first section, ''The History of Tennessee Ornithology,'' provides an outline of people who have studied or observed Tennessee birds, from Louis Joliet's notes about seeing and collecting Carolina Parakeets (*Conuropsis carolinensis*) along the Mississippi River, to the present day. The list of many people that have contributed to Tennessee ornithology includes Alexander Wilson, John James Audubon, Edward Drinker Cope, and William Brewster.

The second chapter section, ''The Environment of Tennessee,'' describes and delineates the 10 physiographic regions of Tennessee, ranging from the Blue Ridge Province in the eastern part of the state, to the Mississippi Alluvial Plain in the west. That section also describes the state's past and present climate as well as possible climate changes that may occur in the future. The section finishes with a description of vegetation characteristic of each physiographic region and includes vegetation maps. The next section, ''The Landscape of Tennessee,'' describes the changes that have taken place in the state's landscape over the years. Humans arrived in Tennessee about 10,000 years ago when the state was predominantly covered by spruce-fir forest. Mixed hardwood forests appeared after the glacial retreat and are the predominant native habitat in Tennessee today. Graphs illustrate the degree of forest clearing that has taken place as well as the amount of land now devoted to agriculture. In many areas, mining and the loss of wetlands have also influenced the landscape of Tennessee. The author also provides a nice overview of the state's past and present physiognomy.

''Historic Changes in the Tennessee Avifauna'' follows the landscape section in Chapter 2. As this title suggests, this section provides an account of the changes in abundance and distribution of Tennessee birds. Using historical accounts and surveys dating back to the late 1880s and comparing them to mod-

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ern surveys, we learn that 26 species have expanded their range, whereas 10 species have either experienced a decrease in their breeding range or have becaome extinct in Tennessee. Using Breeding Bird Survey data, the atlas shows that 16 species have an increasing population trend, whereas 39 species are showing population declines. That section finishes with a description of conservation efforts in the state that include Wild Turkey (*Meleagris gallopavo*), Osprey (*Pandion haliaetus*), and Bald Eagle (*Haleaeetus leucocephalus*) restoration, and Partners in Flight efforts on behalf of songbirds.

The last section of this chapter, ''An Overview and Analysis of Atlas Results,'' contains the maps of atlas block and miniroute locations. It also includes the numbers and proportions of ''possible,'' ''probable,'' and ''confirmed'' breeding species, a list of the 20 most frequently reported species, and the proportion of Neotropical migrant species that have been detected in the state. Cluster analysis and detrended correspondence analysis are also provided to examine bird community groupings.

The third chapter, ''Species Accounts,'' makes up most of the book. Species are listed in taxonomic order. Each account consists of a text summary of that species abundance, distribution, and breeding biology. The descriptions are concise but informative. Accounts include maps showing where the species has been found and where the species has been granted as possible, probable, or confirmed status. Abundance of species found during miniroute surveys are displayed using contour maps. All of the maps are well done and are easy to understand, giving the reader a good idea of where and in what concentrations the species may be found. Most species accounts are accompanied by attractive line drawings contributed by Elizabeth Chastain, Chris Meyers, or David Vogt, who all contributed their talents to the book.

Following the main species accounts, the final chapter, ''Miscellaneous Species,'' covers the 19 species that are unconfirmed, extirpated or extinct, introduced, or hybrid breeders in the state. Each account consists of a brief description of where a particular species bred according to historical records. The only two such species that were detected during the period covered by the atlas are Hermit Thrush (*Catharus guttatus*) and Magnolia Warbler (*Dendroica magnolia*), and distribution maps like those provided in the ''Species Accounts'' chapter indicate where they were found. As with the previous chapter, the miscellaneous species accounts are brief but informative.

Three appendices follow the last chapter. The first is a list of the common and scientific names of all plant and animal species mentioned throughout the book. The second appendix is a summary of breeding chronologies for each species. The table lists the ranges of dates on which eggs, nestlings, and fledglings have been found; this should be very useful for anyone studying reproductive biology of Tennessee birds. The last appendix is a list of known Brown-headed Cowbird (*Molothrus ater*) hosts that occur in the state. Again, this table provides a quick reference for someone interested in brood parasitism in Tennessee birds.

The book concludes with an extensive (25 pages) Literature Cited section. The bibliography appears to be exhaustive and is a valuable resource for finding references on a particular species or some aspect of Tennessee natural history. In summary, this thorough, informative and well-illustrated atlas is invaluable for anyone interested in studying, finding, or learning about breeding birds in Tennessee. Although designed primarily for the professional ornithologist, the atlas would be easily comprehended by the layperson. It definitely belongs in personal as well as university and public libraries.—DAVID A. ABORN, *Department of Biological and Environmental Sciences, University of Tennessee at Chattanooga, Chattanooga, Tennessee 37403-2598, USA.*

The Auk 118(1):278–279, 2001

Alien Species in North America and Hawaii: Impacts on Natural Ecosystems.—George W. Cox. 1999. Island Press, Washington, D.C. xii + 387 pp. ISBN 1-55963-679-3. Cloth, $60.00, ISBN 1-55963-680-7. Paper, $30.00.—This book focuses on one of the greatest threats to biodiversity in North America, the spread of alien (or exotic) species into ecosystems across the continent. The United States is the most ''invaded'' country in the world for a variety of reasons discussed herein (despite the title, this book focuses on the United States with minimal treatment of Canada and Mexico). Cox makes the point that, for the general public, this huge threat to North American (=United States) biodiversity is generally unknown. Based on my own experience, I certainly agree. Particularly obnoxious exotic species clearly do become known to the public in the geographic area invaded (in my part of the country one thinks of zebra mussels, *Dreissena polymorpha,* or the Asian honeysuckles, *Lonicera* spp.), but Cox's exhaustive treatment makes it quite clear that the problem goes far beyond the better-known villains. The general public (including most of our undergraduate students) has little or no idea how severe the invasion is or its ecological implications.

The book is laid out in five parts. The first part (Introduction) comprises three chapters that indicate the extent and historical perspective of the problem.

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Half of the book is included in the second part (Regional Perspectives) wherein 10 regions of the continent (=United States) are treated. In terms of descriptive data, this is the meat of the book, and I found myself continually surprised by the great number of exotic species that have invaded each region. The third part of Cox's book (Biotic Perspectives) includes three chapters that discuss exotic species and the role that humans played in their introduction. That includes the deliberate introduction of game species and the spread of North American native species into new parts of the country, as well as the planned and unplanned release of human associates (e.g. cats, rats, mice, pigs, and goats).

The three chapters in the fourth part (Theoretical Perspectives) investigate ecological and evolutionary patterns, including such questions as: ''What makes an invading species successful?'' ''What makes a community vulnerable to invasion?'' ''Might invaded communities reach alternative stable states?'' and ''What might be the evolutionary changes in both exotic and native species in invaded communities?'' My guess is that, for many readers, that section is potentially the most interesting—it proved to be so for me. However, at the same time, I was somewhat frustrated to learn how little we know about those patterns and the fact that, at least at present, there simply are no clear answers to many of the questions raised.

The last part (Policy Perspectives) includes two chapters that ask the question, ''What is to be done?'' Even the most conservative estimates conclude that dealing with the impact of exotic species costs the United States several billion dollars a year (perhaps over $100 billion per year!). Although the arsenal of proposed ''weapons'' is broad, appropriate use of these will require ecological wisdom not always shown in the past.

Are the interests of The Auk readers affected by exotic species? Those of us who are field ecologists are working with bird study species whose ecology is very likely influenced in some way by invading plants, animals, and microbes, including pathogens. The impact of exotic species on the systems we study may be subtle or dramatic but, in any case, it would be unwise simply to assume that we don't need to take into consideration the presence of alien species in our field research. For example, if one finds reduced nesting success, is it due to competition with an exotic species for a nest site? Or, is it due to parasitism by Brown-headed Cowbirds (*Molothrus ater*)? Similarly, are high nest-predation rates the result of an introduced predator? Is reproductive success low because the feeding rate to nestlings is low, perhaps as a result of competition for food with an exotic species? Maybe an introduced pathogen is reducing food availability or directly affecting nestling health. And on and on.

The intriguing result of reading Cox's book is that one begins to think about such questions. Cox provides so many interesting case histories about such a variety of habitats that it is inevitable that the reader interested in avian ecology will ponder such questions. Having said that, there is relatively little in the book that directly addresses birds, an exception being the treatment of avian introductions into Hawaii (with respect to bird introductions, the most invaded island archipelago in the world). The few bird examples given by Cox include the possible negative influence of introduced predatory crabs on native invertebrates and, thus, on Pacific coast shorebird populations (p. 55), the long-term impact of Dutch elm disease on Eastern U.S. forest-birds communities (p. 100), the disturbance of avian breeding habitats in southern Florida by the spread of the shrub known as Brazilian pepper (*Schinus terebinthifolius*) (p. 115), the consequences for native bird species as a result of exotic plants in grassland and riparian habitats (pp. 136, 148, 155), and the sad history of introduced game bird species throughout the U.S. (p. 200).

Should an avian ecologist buy this book? Let me answer by saying that an avian ecologist should read this book and request that your university library purchase a copy. Cox's treatments of species invasions in the habitats of North America are so informative that I think any field biologist working in one of these habitats would likely benefit from reading that habitat's treatment. Even if birds are discussed peripherally in some of those cases, the habitat summaries lead one to question in what ways one's study species might be influenced by exotic invaders. Certainly, for anyone who teaches a conservation biology course as I do, this book is essential reading. Even if one simply prepares a lecture or two on introduced species for another course, Cox's book clearly presents a wide variety of case histories to enliven a lecture. Without doubt, as I update my lectures on alien species, I will do so with Cox's book at my side.—RANDALL BREITWISCH, *Department of Biology, University of Dayton, Dayton, Ohio 45469-2320, USA.*

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Physiological Diversity and Its Ecological Implications.—John I. Spicer and Kevin J. Gaston. 1999. Blackwell Science Limited, Oxford, United Kingdom. x + 241 pp. 99 text figures. ISBN 0-632-05452-2. Paper, $59.95.—Ecological physiology occupies the interface of two major disciplines within biology and, therefore, can offer integrative views of organisms that combine the insights and context of ecology

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with the analytical rigor of the best traditions of mechanistic physiology. Within the last decade, however, the status and preferred directions for research within ecophysiology have been the subject of substantial debate. Some, for example, argue that this discipline has essentially answered all of its initial, large-scale questions of how animals function in their natural environments and how they are adapted to them evolutionarily (e.g. Bennett 1987). Others have questioned this disciplinary hubris and have been impressed that we may well know much less than is commonly perceived. A single example, with apologies to my ornithological colleagues, is the physiological ecology of small mammals occupying hot deserts. Here, it is clear that many of the most familiar generalizations accepted in textbooks and taught to generations of students are misleading (Walsberg 2000).

Although many have called for new perspectives on ecological physiology, few have provided them in the exemplary fashion of Spicer and Gaston's *Physiological Diversity and its Ecological Implications.* This book provides a broad overview of variation in a host of ecologically relevant aspects of physiology (e.g. energy relations, temperature tolerance and regulation, water relations, ionic relations). Spicer and Gaston's essential thesis is that such variation has been largely ignored for too long and that understanding the nature, origins, and consequences of diversity in physiological systems is critical to understanding ecological physiology. Our lack of attention to physiological diversity has had major consequences. A salient example is the difficulty that such ignorance imposes upon understanding the evolution of physiological traits. Between two populations occupying contrasting habitats, for example, differences in physiological performance may be derived from genetic differences, or from acclimation, or from ontogenetic effects induced by growth and development in differing environments. If acclimation and ontogenetic effects are of major importance, then differences in physiological performance may well be buffered from effects of natural selection. Understanding the relative contributions of these alternative sources of variation is clearly vital to understanding the role of natural selection as well as the innate physiological lability of individuals.

Spicer and Gaston explore physiological diversity from several points of view. The book is organized following hierarchical levels of biological organization. That is, they first consider variation with time in an individual (including acclimation and ontogeny), then progressively explore variation between individuals, between populations, and between species. Within each hierarchy, they examine the patterns and structure of physiological diversity, its mechanistic bases, and notable weaknesses in our understanding.

I was particularly struck by three overall features of this book. First, it is broad in its taxonomic coverage. The examples discussed, which are myriad, cover a wide set of invertebrate and vertebrate animals. Second, the authors have provided useful and nondogmatic discussions of a variety of sometimes contentious issues such as the ''beneficial acclimation hypothesis'' and the importance of accounting for phylogenetic relatedness in physiological studies (''phylogenetically correct physiology''). Finally, throughout this book, Spicer and Gaston have taken care to explicitly identify important and inadequately understood questions in some detail. The book ends with a two-page list of critical questions that need to be addressed related to ecophysiological diversity.

The mechanics of the book also meet high professional standards. It is very well written, well illustrated, and replete with references and examples from both the older as well as recent (up to 1998) literature.

In summary, *Physiological Diversity and its Ecological Implications* effectively develops a valuable new perspective within ecological physiology. This book deserves to be read by all in the discipline, including graduate students as well as established researchers.—GLENN E. WALSBERG, *Department of Biology, Arizona State University, Tempe, Arizona 85827-1501, USA.*

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