

## BOOK REVIEWS

**Polygyny and Sexual Selection in Red-winged Blackbirds.**—William A. Searcy and Ken Yasukawa. 1995. Monographs in Behavior and Ecology. Princeton University Press. Princeton, New Jersey. xviii + 312 pp., 61 text figures. ISBN 0-691-03686-1 (cloth), 0-691-03687-X (paper). \$55.00 (cloth), \$29.95 (paper).

The Red-winged Blackbird (*Agelaius phoeniceus*) is probably the most thoroughly studied passerine bird on the North American continent. Because redwings are conspicuous, widely distributed, and occupy open breeding habitats relatively accessible to human researchers, they have attracted the attention of ornithologists and behavioral ecologists for decades. The species was first studied by Arthur Allen, who published a major paper on redwing breeding biology as early as 1914. Since then, at least 50 separate studies or major research programs on Red-winged Blackbirds have been initiated, spanning the continent from Connecticut to British Columbia, and Manitoba to Texas. No wonder that any aspiring redwing researcher faces a daunting literature just on his/her study species: this book lists over 180 publications on redwings alone, and three new books on this bird have appeared in the last year and a half. It thus is perhaps no surprise that the Red-winged Blackbird has figured prominently in the development or testing of numerous concepts in behavioral ecology, including the classic polygyny threshold model and the importance of plumage badges in territorial defense. It was with redwings that we first became aware, now over twenty years ago, that extrapair fertilizations could be surprisingly frequent in birds.

Searcy and Yasukawa have done a great service to both redwing enthusiasts and ornithologists in general by masterfully summarizing and synthesizing the existing mountain of information on the redwing's mating system and social behavior. Major topics included are patterns of parental care, territoriality, reproductive success, female choice, polygyny, and sexual selection. The book's principal theme is to explain why polygyny in redwings evolved and to explore how this mating system has affected other aspects of the bird's biology. This nice focus is maintained throughout, with the material presented usually highly relevant to understanding the evolution of polygyny. Searcy and Yasukawa use results of numerous studies besides their own, and for virtually every topic investigated they present data from at least three (and often more) studies done at separate locations across North America. They are fair in discussing strengths and limitations of past work and, where necessary, rely heavily on other people's findings; they do not toot their own horns or dwell excessively on their own results. Readers seeking new information on redwings will be disappointed, however. Although a few relatively minor previously unpublished results of the authors are presented and personal com-

munications from other redwing researchers are mentioned, this apparently was not intended to be a book with much new data. Searcy and Yasukawa write clearly and the book is easy to read, well edited, and attractively produced, but the publisher should upgrade the quality of paper used in its binding. The front cover on both of the paperback copies I have seen curled upward, rather severely, after only moderate use, diminishing the book's aesthetic appeal.

Hypotheses about the evolution of polygyny have often assumed that females incur a cost by choosing to settle with an already paired male; usually this cost is a forfeiture of male parental assistance. I was thus surprised by Searcy and Yasukawa's conclusion that polygyny in Red-winged Blackbirds has no cost. They argue that since male redwings provide very limited nonshareable parental assistance in general, females choosing to settle as part of a harem incur no cost in terms of lost aid. The best support for this conclusion comes from their finding across studies of either no difference in annual reproductive success among females from harems of different sizes or an increase in reproductive success with harem size. Neither pattern would be predicted if polygyny is costly. Unfortunately, the only known measure of reproductive success for female redwings is the annual number of fledglings produced, and little is known about how adult annual survival or juvenile recruitment may vary with harem size. It is possible that polygyny could have long-term costs for females. For example, Searcy and Yasukawa report that females spend a good deal of time chasing other females within a territory, and this activity (or other hidden costs of group living) might negatively affect a female's survival prospects to next year even though her seasonal reproductive output might not vary across harem sizes. The next challenge for redwing researchers should be to determine whether polygyny represents a cost in terms of lifetime reproductive success. The no-cost explanation seems not terribly general, as, in their comparisons with other polygynous species, Searcy and Yasukawa identify only two others for which their no-cost hypothesis may apply. Polygyny in redwings has been better studied than in any other species, yet one still comes away from this book unclear as to how this mating system evolved in redwings and other birds. In some respects we seem as far from answering this question now as we were thirty years ago when the polygyny threshold model came on the scene.

Searcy and Yasukawa also confront the problem that many of us have in distinguishing a species' social mating system from its genetic one. Like many birds, redwings engage in extrapair copulations, and some young are sired by males from outside the harem in which a female resides. Mixed paternity is viewed as a complicating factor in measuring reproductive success, female choice, and sexual selection. Surprisingly, given the extensive work on redwings,

relatively few studies have employed molecular techniques (e. g., DNA fingerprinting) to measure parentage. Those that have used these methods have been, so far, relatively short-term studies. The long-term redwing research programs—the ones with longitudinal information on adult survivorship and tenure of residence—have not yet achieved genetic measures of reproductive success. We need both the genetic and demographic data to estimate the costs and benefits of polygyny and the actual variance in reproductive success. This is one case where the separate, parallel studies of redwings have perhaps not been as collectively productive as they could have been had the various researchers joined forces to study a single well-known population.

My only substantive criticism of this excellent book is that Searcy and Yasukawa seem to have missed a golden opportunity to analyze geographic differences in redwing social behavior. The species has been so well studied that for virtually every topic there are multiple data sets from different locations in North America. In many cases different studies reach different conclusions. These usually are presented without interpretation or hypotheses for the geographic differences. In some cases, the differences are likely artifactual or reflect different methodologies, and these Searcy and Yasukawa point out. But certainly some differences are real, and I was constantly wondering why. One of the more striking patterns is that males provision young in western North America considerably less than in eastern locations. Searcy and Yasukawa suggest this may be because harem sizes in the west are larger and thus males there have less incentive to feed young. But why are harem sizes in western North America larger? Thorough exploration of the geographic differences in this case is important, because the no-cost hypothesis for the evolution of polygyny would seem more likely to hold for western than for eastern populations. Given the current funding climate and academic reward system, it seems unlikely that we will anytime soon have other species that have been studied in as many places as the Red-winged Blackbird: nowadays there is not much incentive to repeat studies on the same species in a different location. The existing information on redwings is a gold mine for anyone interested in geographic differences in social behavior. This book represents a start at mining that gold by at least summarizing the results of the disparate studies.

Searcy and Yasukawa are to be congratulated for producing a highly readable and useful review of Red-winged Blackbird social behavior. It will be of value to all ornithologists and to any behavioral ecologist interested in sexual selection and mating system evolution. Students will find many graduate research ideas in it, although with the army of people studying redwings over the years, one would guess that most of the easy, short-term things have already been done. But the many scientists interested in redwings should itself not deter new studies; Searcy and Yasukawa note that redwing research has attracted a set of “particularly cooperative, noncontentious” researchers. That a book such as this would be pro-

duced is certainly testament to that.—CHARLES R. BROWN, Department of Biological Sciences, University of Tulsa, Tulsa, OK 74104.

**The Flight of the Red Knot.**—Brian Harrington. 1996. W. W. Norton & Company, New York. 192 pp., 50 color plates, no text figures, 5 maps. ISBN 0-393-03861-0. \$29.95 (cloth).

As shorebirds gather by the thousands at a high tide roost in a nature reserve quite close to a major city, we may be impressed by their healthy conservation status and apparently safe survival prospects. For shorebirds, such as the Red Knot (*Calidris canutus rufa*), however, the scenario for trouble follows a different script than low numbers. According to Harrington: “The challenge is not to preserve a dwindling number of survivors but to protect those few pinpoints on the earth that are crucial to the continued existence of hundreds of thousands of birds . . .”. With this popular account of the annual cycle of Red Knots in the Americas and of the threats for their future well-being, written in association with media-man Charles Flowers, Brian Harrington hopes to win understanding and support of those who could use their power to reverse effects of habitat loss on shorebirds. *The Flight of the Red Knot* provides powerful advocacy and beautiful natural history. This volume should certainly catch the interest of all sensitive, but possibly not yet sensitized, human souls.

The life history of the Red Knot, and the importance of the few widely spread wetlands that allow this species to complete its seasonal journeys, is told in chronological order. The story begins in Tierra del Fuego and Patagonia where most Red Knots spend the northern winter. Through March and April, knots migrate along shores of Argentina and southern Brazil before embarking on what may be the longest uninterrupted flight in the animal world. After leaving Brazil in late April/early May, Red Knots are not seen anywhere, but arrive in large numbers in Delaware Bay a few days later, about 11,000 km closer to their arctic breeding grounds, suggesting an enormous intercontinental flight, during which birds would remain airborne for five full days. In Delaware Bay, Red Knots feast and fatten on “a reproductive blow-out by one of the earth’s most ancient living animals.” Horseshoe crabs (*Limulus polyphemus*) deposit trillions of tiny eggs on the beaches at the right time in the season for Red Knots to capitalize on. It is only two weeks later that female knots have completed a clutch of four eggs somewhere (where?) in Canada’s vast tundra region. Throughout the book the prose is rich and powerful: “It is no exaggeration to liken her accomplishment to a woman’s giving birth to a sixty pound baby within ten days of completing a six-thousand mile hike at altitudes higher than the Himalayas.”

Although coverage of topics relevant for understanding the life of many shorebirds is comprehensive, the geographical scope of this book is surprisingly limited. Only one of the three subspecies of Red Knots living in the Americas (*C. c. rufa*) is discussed. The recently described subspecies *roselaari*, to which

birds wintering in Florida may belong, is only covered in passing. The wary reader may notice on p. 30 that still more geographical races occur elsewhere, i.e., the subspecies *islandica*, *canutus* and *rogersi* wintering in western Europe, West Africa and Australia/New Zealand, respectively. This American bias even affects the tale of how this bird got its name. In publications from Europe and Australia it is usually mentioned that knots, a very long time ago, may have been named after King Canute (who ruled Denmark and England just after the year 1000), either in view of his predilection for knot-flesh or his preoccupation with the tides. According to Harrington the churring "knut" contact calls led to their name. Is an American audience not inspired to the same extent by King Canute as are folks in the old world?

Much published and unpublished material on Red Knots worldwide is ably summarized in the main part of the book. "Important issues about shorebirds" are dealt with in appendices and notes, and a good index allows one to easily find particular types of information, but this is no original scientific publication. Perhaps to comfort the general readership, no source material nor references are provided to enable conclusions to be evaluated or particular points to be followed up. Most readers of *The Condor*, and students of shorebird-biology in particular, will miss this information. I especially miss the source material (there are no tables or figures to be found in the entire book) since most valuable and exciting results of Harrington's own work have yet to reach the primary literature.

These remarks do not detract from the accuracy and vividness of descriptions of various aspects of the life of knots. Red Knots are described as "amazingly efficient machines for converting marine invertebrates into forward motion through the air." Harrington is particularly strong when he discusses peculiar and complicated behavioral phenomena, such as remarkable synchronous flights entertained by flocks on wintering grounds, behavioral changes that take place before departure on long-distance flights, and exciting moments when a Peregrine (*Falco peregrinus*) attacks a feeding flock. I have worked on Red Knots in Europe and Africa, largely independently from Harrington's team at Manomet Bird Observatory, and it was exciting to see which of the knots' idiosyncrasies they've picked out and how they interpreted them. Overall, the story appears quite congruent! However, several pieces of information are puzzling. During northward migration, Red Knots appear to feed only by day, and fly to safe roosting sites at night. During a time when energy demands are high and with a species perfectly capable of finding prey by touch in darkness, this seems rather odd. Studies in West Africa and Europe indeed show them to routinely feed at night, and the same appears to happen at stopovers in New England during the southbound journey. Along beaches of southern Brazil and Florida, Red Knots rely almost completely on surfclams or coquinas (*Donax* sp.) for their food. In parts of the Gulf of Guinea in West Africa, Red Knots and *Donax* also co-occur, but surfclams have never been reported to be fed upon. What makes

this interaction between predator and prey so different at either side of the Atlantic?

A very attractive feature of the book is its wealth of photographs. Most were taken with great patience by David C. Twichell, who obviously belongs to the worldwide group of "knot-addicts." The photographs are not only beautiful, they also provide a fairly complete pictorial of the life-history of Red Knots and the current research methods used in the study of their migrations. As a comprehensive documentary it might be a bit short on habitat photographs. The captions are usually informative, although the photograph on pp. 98–99 shows a mixed flock of godwits and sandpipers, rather than the Red Knots of the caption "wheeling off into the distance."

I have no doubts that this book could possibly inspire a large audience to think positively about shorebirds, and thus help to generate the enthusiasm that is needed to ensure their survival in a world that will leave little room for species other than humans. A large part of the future of the American subspecies of Red Knots lies in the hands of the inhabitants of several South American countries. Red Knots spend most of their time in Argentina, Brazil, Chile, and Surinam, and translations of this book in Spanish and Portuguese could help to bring their plight to local attention. The interest generated by a book like this also might help several of the critically important research and protection programs that have recently been proposed in Argentina and Brazil, but which are so short of financial support!

As I am writing this review, I sit in a large hide overlooking a big sandspit in the western part of the Dutch Wadden Sea, the major roost of Red Knots in our country. A few hundred birds feed a few 100 m away, only a day after they have returned from their Siberian breeding grounds, after 5,000 km and a few days of flight. Many of the exciting questions about shorebird migration in general, and Red Knots in particular, occupy the minds of our team members too. For us *The Flight of the Red Knot* serves as a source of inspiration and comparison as we continue to unravel aspects of the world of this wonderful, rare and truly global bird species.—THEUNIS PIERSMA, Netherlands Institute for Sea Research (NIOZ) and Centre for Ecological and Evolutionary Studies at the University of Groningen, P.O. Box 59, 1790 AB Den Burg, Texel, The Netherlands.

#### **The Penguins: Ecology and Management.**—

Peter Dann, Ian Norman and Pauline Reilly [Eds.]. 1995. Surrey Beatty & Sons, Chipping Norton, New South Wales, Australia. xvii + 475 pp., 9 color plates, 112 text figures, 70 text tables. ISBN 0-949324-58-2. AU\$85.00 (cloth).

Third in a line of summary volumes presenting the forefront of research on penguins, this volume resulted from the Second International Symposium on Penguin Biology, which was held at Phillip Island, Australia, in August 1992. Each of the three volumes are composed of chapters written by various researchers and, like those to the preceding two volumes, the contributions to the present volume—to-

taling 21—likely will be well-cited for years to come owing to the high quality of research and writing exhibited therein. The format of the present volume is similar to the earlier volumes—division of chapters into broader subject areas: breeding biology, foraging ecology and energetics, sexual and geographic variation, and management of penguins and their environment. Most subject areas among the three volumes have been surprisingly consistent, although some differences have occurred depending upon content of contributions and categorization of chapters on the part of the editors. This is the first penguin volume to have a subject area on management. As in former volumes, an introduction has been prepared by a well-known and pioneering penguin researcher, this time by Pauline Reilly, who recounts her involvement in penguin research in Australia.

A chapter on hydrodynamics and another on sexual dimorphism are applicable to the entire penguin order; remaining chapters are more narrow in their taxonomic attention. Among those chapters, representation of species is diverse, although, not surprisingly, an Australian bent is evident: six chapters on King Penguins *Aptenodytes patagonica*, five on Little Penguins *Eudyptula minor*, four on eudyptid species, eight on pygoscelids, and four on spheniscids. The diversification evident in the present volume is healthy, as it allows comparison of species having a wide diversity of ecologies.

The first subject area, breeding biology, is composed of 8 chapters, two of which would be more appropriately placed under a heading, "Behavior." These two chapters, one by L. S. Davis and the other by J. R. Waas, share the results of clever research that delved into, respectively, those environmental factors that control diurnal behavior cycles of penguins, and ways in which penguins control each others' behavior. Both chapters have much to contribute to a much broader audience than penguinologists and hopefully the volume will be well enough indexed among various bibliographic schemes that behavioral ecologists and researchers of other seabird species will become aware of them. Four chapters (three on King Penguins) interpret annual variation in size of breeding populations through use of mathematical and conceptual models. Deducing how many King Penguins actually exist in a given breeding colony has been especially problematic to date, because of the biannual cycle and large number of nonbreeders evident in a given breeding season. Assessing the presence of nonbreeders, in fact, is (or should be) problematic in population assessments of other avian species. Among penguins, however, the presence of nonbreeders is far too obvious to ignore. These chapters offer hope that these difficulties, at least for King Penguins, will eventually be overcome (or at least agreed upon among various researchers). The chapter by J. P. Croxall and P. Rothery offers a mathematical model that perhaps could be applied both to other species and to attempts to relate variation in actual population counts to annual variation in actual demographic variables. Such an analysis is uncommon because of the rare availability of population and demographic data collected consistently

over decades. The seventh chapter by P. D. Boersma and D. L. Stokes reports investigations on hatching asynchrony, an important component of the breeding strategy of many penguin (and seabird) species. The detail of this study should now be applied to other penguin species so that the importance of hatching asynchrony can be deduced through comparative study. The eighth chapter by P. Dann et al. on the cost of reproduction in Little Penguins, covers another subject that most penguin ecologists and many avian ecologists in general contemplate even with much less complete data. This is another demographic study that has been built upon decades of work.

The second subject area, foraging ecology and energetics, is composed of 6 chapters. It brings us the next generation of the saga on how well penguins have lent themselves to the most high-tech elements of modern electronic ornithology. Penguins' size, strength, philopatry and naïveté to humans have allowed investigation of their natural history that is unthinkable for many wild birds. Not just radiotelemetry, but also satellite tracking, satellite imagery of environmental factors, diving and activity recorders (i.e., foraging tactics), and chemical analysis of metabolism. Of course, included is the old standby, to which penguins lend themselves well compared to other avian or even mammalian species: stomach lavage in statistically useful quantity to reveal diet without harming the research subjects. Possibly, the chapter by Handrich et al. in the first subject area above might have been more appropriate here because it shows how another new technology, implanted PIT tags and computerized weighing scales, can be used to investigate comings and goings and food-load sizes of penguins over extensive temporal periods. In the present section, the chapters by R. Bannasch and B. Culik each offers results from innovative research on the hydrodynamics and energy expenditure of penguins using, respectively, models in wind tunnels and water baths, and real penguins swimming in tanks. These works certainly will (or should) inspire much future research. The chapters by K. R. Kerry et al. and R. P. and M.-P. T. Wilson are among the first to bring high-tech electronic ornithology beyond the "gee-wiz" stage and to apply the information gathered, in ample quantity, to real-time problems of penguin ecology. The remaining two chapters by M. A. Hendell et al. and E. C. Woehler represent the ultimate use of the information gathered by the preceding chapters in this section: summaries of prey consumption and energetics, and placement of penguins within the energetic context of other species in their trophic level.

The remainder of the book is composed of the sections entitled Sexual and Geographic Variations, and Management of Penguins and Their Environment and, compared to the first two sections, presents information of much more value to penguin affectionados than to avian ecologists in general. The section on sexual and geographic variations is composed of two chapters that deal mostly with bill morphology. The final section, composed of five chapters, presents case histories of how particular management prob-

lems have been planned or addressed. The chapter by M. Fortescue could well have been placed in the first subject area (breeding biology), because it looks at breeding ecology as a function of habitat quality. It qualifies for placement in the present subject area because of the way that humans have influenced habitat quality. The remaining chapters in this subject area also deal with human influence of penguin well-being, including habitat contamination by chemicals (pollution) and visitation by too many people. Ironically, the venue for this second international symposium on penguins was the "Penguin Parade," which perhaps better than almost any other similar venture, at least of which I am aware, has channeled what would have been disturbance to wildlife (visitation by too many people) into a money-making scheme. The scheme is so successful that in my opinion it is funding the most complete all-around field and laboratory investigation of seabird ecology anywhere in the world. Tourist dollars are funding well-planned, intensive, long-term research, buying and restoring habitat for several species, and at the same time realizing unequalled wildlife educational accomplishments. The nature of penguins has led them to, and is responsible for, this situation, as well.

Obviously, I am enthusiastic about this book. It should find a place in any biological library, be it private, public or academic, that includes ecological subjects. Actually, the investigation of penguin biology, because the species has lent itself so well to field research exemplified by this and the other two summary volumes, provides an understanding of a family (order) of birds beyond that which has been accomplished for many others. The penguin story also includes even physiology, investigated in much detail, but which has not been well represented in this, or other penguin volumes.—DAVID G. AINLEY, H. T. Harvey & Associates, P. O. Box 1180, Alviso, CA 95002.

**Birds & Climate Change.**—John F. Burton. 1995. Christopher Helm Publishers Ltd., London. 376 pp., 11 black & white photos, 25 line drawings, 32 text figures, 4 text tables, 3 appendices. ISBN 0-7136-4045-6. \$39.00 (cloth).

Explaining the distribution and abundance of organisms is the ultimate quest of ecologists. This challenge deserves highest priority during the present climatic change and collapse of biodiversity, even if ongoing climatic change is not anthropogenic. Elucidating the web of interacting causes that determine species distributions and their dynamics, in particular, will require the most sophisticated quantitative tools now being developed. Therefore, John F. Burton focuses on a topic critical to conservation and to basic understanding in ecology. Furthermore, he sets the right goal for the book—to stimulate interest in this topic by naturalists and nonscientists as well as additional research by avian ecologists and climatologists. I will focus on the usefulness of the book as a review and stimulus for scientists because that

is my perspective and that of most readers of *The Condor*.

The book is about climatic change and bird distributions, but it also contains a scattering of comments about distributions of butterflies and reptiles. As a review for scientists, the text is too loosely referenced. Numerous accounts of changes in species distributions are unreferenced, as are the summary appendices. A scientific reader's response might be to skip the book and begin with the bibliography, but this would be a mistake. The book contains a tremendous amount of natural history and information on avian distributions that will be of interest to anyone fascinated with the topic of climatic change and birds.

The author's vision of producing a book that is a tool for scientists and a delight for nonscientists was fully realized by the publisher. The book is excellently bound and the text is complemented by artful line drawings by John Davis. The photographs, however, are often overly dark, and I found several of the scientific figures inscrutable, in part, because the captions provided inadequate explanations.

The historical review of climatic change is a brief and interesting summary. However, because it was based on papers published prior to 1975, I was left wondering what had been learned during the past 20 years. This might be a minor consideration if global patterns of climatic change were adequate to explain shifts in species distributions, but populations respond to local climates that may deviate greatly, as the author points out, from global patterns such as cooling associated with the "Little Ice Age." Similar questions about the validity of projected future climate change must be raised primarily because the author relies heavily on the secondary literature. John Gribbin's 1990 book, *Hothouse Earth: the Greenhouse Effect and Gaia*, is the primary source for climate change scenarios. Gribbin's presentation of climatic change was considered biased in 1990, and it is out of date today because of rapid scientific developments in this area. Furthermore, predicting regional climatic change is still beyond the limits of scientific knowledge.

The case for climate causing change in bird distributions is loosely argued and rests primarily on non-quantitative associations between regional climatic change and shifts in species distributions. But some species' distributions change in association with climate while others do not; some shifts are large and rapid while others seem slight and slow. The reader is left with the weak and often repeated conclusion that climate was somehow involved. To be fair, the author acknowledges the operation of many factors in addition to climate that potentially influence avian distributions: habitat alteration (including changes in food supply, nest-site availability, vegetation structure, etc.), human persecution (including hunting and pollution), interspecific interactions (e.g., competition, predation, parasitism), chance dispersal events, etc. These factors potentially interact with each other and each probably interacts with climate. Thus, concluding that climate is involved in the spatial expansion or contraction of populations neither increases basic scientific understanding nor provides conserva-

tionists with useful points of attack in addressing declines of rare species or expansion of pest species.

From a scientist's point of view, the book would have benefited greatly from being condensed to include only examples for which adequate evidence is available to make a convincing case for or against climate as a critical factor. Emphasis on such examples might have allowed convincing quantitative arguments. Although these examples probably would have come only from the 20th century, strong climatic changes have occurred during that time, as identified by the author. Certainly, it would be fascinating to know how bird populations responded to the Little Ice Age, 1250–1850, but the author only succeeded in convincing me that the data are simply not available to make a scientific assessment.

What data are needed to evaluate the influence of climate on bird distributions? I would include planned field or natural experiments. Species reintroductions exemplify field experiments, but only when these reintroductions are accompanied by careful monitoring of the factors influencing the reproduction and survival of colonists. Natural experiments are planned comparisons such as those conducted over altitudinal or latitudinal gradients which include multiple (i.e., replicated) populations of the same species. Natural experiments also require monitoring of the primary factors influencing recruitment to provide the data essential to assess the role of climate relative to other factors influencing distributions. Although more historical data are available for birds than for any other widespread taxon, bird observations or censuses combined with climatic data are simply inadequate to link climate causally with changes in bird distributions.

General readers interested in avian distributions will find this book packed with interesting information. Scientists, however, should obtain the book via interlibrary loan. The book is useful because it focuses on a critical and timely topic while covering an astounding breadth of species. But depth was sacrificed to breath to such an extent that only foggy explanations of how climate might influence bird distributions could be offered.—NICHOLAS L. RODENHOUSE, Department of Biological Sciences, Wellesley College, Wellesley, MA 02181, e-mail: nrodenhouse@wellesley.edu

**Stokes Field Guide to Birds (Eastern Region).**—Donald and Lillian Stokes. 1996. Little, Brown and Company, Boston, MA. xxiv + 472 pp, color plates and maps for all species. ISBN 0-316-81809-7. \$16.95 (paper). **Stokes Field Guide to Birds (Western Region).**—Donald and Lillian Stokes. 1996. Little, Brown and Company, Boston, MA. xxiv + 520 pp, color plates and maps for all species. ISBN 0-316-81810-0. \$16.95 (paper).

Perhaps I am biased by my learning birds with an early black and white edition of Peterson with its barbless arrows, but I have always found it frustrating to work with beginning birders using one of the photograph-based field guides because the pictures never seemed to highlight the critically diagnostic

field characters. This, however, is not the case with the eastern and western Stokes guides. The authors have carefully selected photographs that do illustrate what the learner needs to see in the field and also have made sure that the color reproductions are as close to reality as possible. I suppose every user could quibble about the diagnostic value or colors of some of the photographs, but on the whole they are satisfactory. The accompanying text provides succinct, boldface phrases of the key characters, allowing quick reinforcement. If the observer can determine whether the unknown bird is a flycatcher or a vireo or a warbler, a color tab index permits immediate reference to the species.

Each species is covered on a single page, except in cases where two species are similar and closely related (e.g., Botteri's and Cassin's Sparrows, Clark's and Western Grebes). Where appropriate, different plumages based on sex, season, and age are illustrated and described. The text also includes brief descriptions of feeding behavior and natural history, habitat, and song (thankfully, no sonograms). Nest and nest site are given; the description for the Dickcissel is not the typical placement, but for all the other species with which I am familiar, the text is accurate. A valuable inclusion is a brief description of the species' population status using Breeding Bird Survey and Christmas Bird Count data trends.

Another innovation is the learning page which introduces difficult groups like hawks, shorebirds, gulls, warblers, and sparrows. But the content often falls short of its potential. Rather than simply picturing the commonly seen species, as was done for the warblers, the space could be better used to emphasize characters that separate subsets of species within these groups as was done with the sparrows, e.g. those with eye-rings, those with white outer tailfeathers.

The authors state that "all regularly occurring species within the range of the guide are included." The western guide, however, omits, for example, Buff-collared Nightjar, Colima Warbler, Ferruginous Pygmy Owl, and Neotropical Cormorant, although the latter is covered in the eastern guide. The eastern guide does not include White-crowned Pigeon, Red-billed Pigeon or Brown Jay. All these are certainly peripheral even though regular, but so are, for example, Audubon's Oriole, Great Kiskadee, and many of the southern Arizona specialties which are included. Some exotics are included (e.g., Spotted Dove and Sky Lark), whereas others are not (e.g., Crested Myna). I hope subsequent editions will include all omitted species.

The range maps are small, and if the breeding range, indicated by yellow shading, is not large (e.g., Roseate Tern, Whooping Crane), it is difficult to see. The map for the White Ibis is incorrect. Whereas the map for the Great-tailed Grackle reflects recent range expansion, that for the House Finch does not. Nor does the map for the Bald Eagle indicate the results of considerable effort and concern to re-establish the former breeding range. Furthermore, more care could be exercised in drawing the maps. According to these guides, there are no Wood Ducks,

Lesser Prairie-chickens, Snowy Plovers, Common Poorwills, Sedge Wrens, or Black-headed Grosbeaks nesting in Kansas.

But these shortcomings are relatively minor. The books are informative and useful field guides, providing quality at an economical price. They should be in the collection of both college and community libraries and will be favored by many bird watchers. I will include the eastern guide among the set of recommended field guides for my own classes.—JOHN L. ZIMMERMAN, Division of Biology-Ackert Hall, Kansas State University, Manhattan, KS 66506-4901.

**The Coevolutionary Process.**—John N. Thompson. 1994. University of Chicago Press, Chicago. xi + 376 pp. ISBN 0-226-79759-7 \$49.00 (cloth), 0-226-79760-0 \$19.95 (paper).

Reading John Thompson's *The Coevolutionary Process* reminded me of plugging through Ernst Mayr's *Animal Species and Evolution* in preparation for my Ph.D. oral exams. Both are well written, but neither was light reading. They are full of such a diversity of examples and taxa that I could always look forward to going on to the next chapter to learn something new about the structure of nature which has always driven my curiosity. There are other parallels in the two books: both rest more on evolution than ecology, both attempt to tie population genetics into their arguments, and both view geographical effects within species lineages as driving forces in the shaping of nature. Thompson's goal, however, is different. Whereas Mayr's concern was with speciation, Thompson's is with specialization within species and how coevolution (reciprocal selective pressures between species) influences specialization. Although not explicitly stated, specialization in a species is equated with the number of other species with which it has ecological interactions that will have evolutionary consequences.

In introducing the subject of specialization Thompson debunks the view held in the early twentieth century that specialization usually leads to extinction. Examples that show the broadening of food choice by phytophagous insects with narrow food preference are related to geographic variation of food preference for a species. The importance of geographic variation in interactions between species becomes a theme that is repeated throughout the book. To propose a situation that can generate geographic variation in adaptation, Thompson uses Sewall Wright's model of adaptive peaks and semiisolated demes which can profit from genetic drift to move between adaptive peaks.

Thompson organizes the book in three major divisions: general evolution of specialization, geographic structure of specialization, and effect of coevolution on specialization. In looking at the evolution of specialization, he separates phylogenetic evidence, genetic mechanisms, and patterns of ontogeny in separate chapters. His general definition of specialization seems to be stretched when he deals with ontogeny because he finds insects with complete metamorphosis and parasites with distinct life history stages in

different hosts as more specialized than groups with one life-history stage, given that each life-history stage is monophagous. The idea makes sense in relation to his interest in the genetics of specialization in that the adaptation of the holometabolous insects or multihost parasites must involve different sets of genes for adaptations to counter the defenses of each host.

The second major section of the book on the geographic structure of specialization seems less tightly organized. It is built around the idea that a meaningful way to deal with different levels of specialization is to divide animals into groups based on their relations with their food. Parasites spend their whole life or life-history stage on one individual host without killing it. Parasitoids use one individual host but end up killing it. Grazers feed from several individuals without killing them and predators kill several prey as food. I liked the development of this idea in Thompson's 1982 book, *Interaction and Coevolution*, and Peter Price's books and articles on the parasitic life style. Thompson develops it further in relation to specialization to explain why parasites tend to be more specialized than other groups and what unique conditions occasionally will allow extreme specialization in the other groups. He then goes back to his theme of geographic variation in feeding patterns and ends with analysis of specialization in mutualists. Particular attention is paid to what types of mutualism allow extreme specialization.

The third major section of the book couples specialization with coevolution. It starts with the genetics of coevolution and examines a variety of patterns of genetic change that can be involved in coevolution. These genetic patterns are then incorporated into a "geographic mosaic theory of coevolution." This chapter repeats Thompson's view of the major importance of geographical variation in understanding the pattern of evolution of specialization. A logical sequel to that idea is a chapter on how coevolution can be involved in speciation. The book ends with two chapters that look at patterns of coevolution that are very broad and do not involve obvious mechanisms that lead to specialization.

Thompson warns the reader in the beginning of the book about his greater reliance on some fields of research in which he is directly involved. His work on mutualisms ranges from the very specialized yucca-moth interaction to the very general interaction between migrating frugivorous birds and plants that produce fleshy fruits. Thus, it is not surprising that the book is very strong in its treatment of mutualisms. Mimicry which involves mutualism (Mullerian) and antagonism (Batesian) gets very short coverage in the book, especially considering the large literature on selective mechanisms and geographical patterns in mimicry.

Thompson attempts in this book to counter the criticism that coevolution with the narrow definition of reciprocal selective pressures between species has a limited bearing on the evolution of natural communities. He cites recent discovery of sibling species with narrow diet choice in place of one previously recognized polyphagous species. He provides other

examples of greater attention to geographic variation leading to a view of nature that includes more co-evolved specialization at a local level. In general the narrower the specialization the more likely that specific coevolution is possible. A problem I have with the field of coevolution is that it is usually difficult to determine an independent variable in the patterns described. Thompson refers, in very general terms, to limits set by the physical environment, but he never develops what those limits may be. To be fair, the topic is coevolution and plants do not coevolve with their physical environment. However, a view of nature that puts coevolution in a proper perspective should start with the limits that the physical environment puts on the pattern of plant growth and defense. Contrasts between selective pressures on plants in

terrestrial versus aquatic, fresh water versus marine, and benthic versus pelagic systems should help to understand the limits set on coevolution in those broad habitats.

I profited from reading *The Coevolutionary Process* and would recommend it to advanced students in evolutionary biology, especially those who wish to build a world view that includes the origin of patterns of species specialization in natural communities. For ornithologists, the very thorough index shows that birds are referred to on 68 of the 295 pages, dealing especially with brood parasites and birds that feed on conifer seeds and fleshy fruits.—CHRISTOPHER C. SMITH, Division of Biology, Kansas State University, Manhattan, KS 66506.