



EDITED BY CARL D. MARTI

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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The Handicap Principle, A Missing Piece of Darwin's Puzzle.—Amotz and Avishag Zahavi. 1997. Oxford University Press, New York. xvi + 286 pp., 148 text figures. ISBN0-19-510035-2. Cloth, \$25.00.—In publicity material released by the volume's publisher, it was suggested that the wide-ranging implications of the handicap principle should make it the most important new advance in animal behavior in decades. This claim might indeed be justifiable, for the Zahavis describe how their principle applies to an enormous range of behaviors. In many ways, this volume is a *tour de force*, both in revealing the authors' encyclopedic command of animal behavior, particularly that of birds, and by explaining how their theories might alter our view of many aspects of this discipline.

The handicap principle asserts that for an animal's signal to be effective, it must be reliable. And to be reliable, it has to impose a cost, i.e. the handicap, on the signaler. An example of this phenomenon, provided in the introduction, involves stotting in gazelles, the jumping response to sighting a predator. When a gazelle jumps high several times before fleeing, the Zahavis suggest that it is demonstrating its capacity to outrun its foe. By briefly handicapping itself with this display, the gazelle is reliably showing the predator that it could be useless to chase it. To convince the predator not to do so, the gazelle uses time and energy that it might need should the predator pursue it anyway. A signal therefore can become costly if it is to be effective. The Zahavis argue that such connections between an animal and its signal are ubiquitous, and provide several other examples.

The authors believe that when the handicap principle was first described (Zahavi, *Journal of Theoretical Biology* 53:205–214, 1975), it was almost unanimously rejected. They assert that it only became widely accepted in 1990, when certain mathematical models (Grafen, *Journal of Theoretical Biology* 144: 517–546, 1990; *Journal of Theoretical Biology* 144: 474–516, 1990) revealed its general applicability and capacity for ensuring reliable communication between competing individuals. It is difficult to gauge

whether this assessment of the principle's acceptance is accurate or simply the authors' interpretation. Shortly after its publication, I recall being taught this principle in a behavior class as an interesting explanation for the evolution of signals. At any rate, the Zahavis do not provide reasons for its suggested initial rejection, nor do they describe the models that supposedly led to its wider acceptance.

The book is divided into four main parts, each composed of several chapters, except for the last part, which has but one chapter. The chapters typically have many subsections dealing with specific aspects of the issue at hand. The first part is entitled "Partners in Communication." In its first chapter, "Prey–Predator Interactions," the Zahavis discuss the Arabian Babbler (*Turdoides squamiceps*), a small, group-living desert bird, which they have studied for some 25 years. They argue persuasively that the babbler does not give its alarm call primarily to warn group members about the presence of one of its predators (an unnamed raptor), but that it is actually directing its call at this predator. In essence, it is handicapping though benefitting itself in the same way as a stotting gazelle. Various other examples of how both predator and prey signal to one another are provided.

The second chapter in this part, "Communication Between Rivals," builds on this notion that a signal benefits its sender while handicapping it to be effective. When one individual sends a threatening signal to another of the same species, the risk to the threatener of being attacked should increase. An effective threat therefore must communicate one's confidence by demonstrating an ability and willingness to fight.

In the following chapter, "Mate Selection," the Zahavis describe how mating behaviors and associated traits, e.g. courtship feeding and vocalizations, all employ handicaps. Here, as well as throughout the volume, the handicap might only be suggested, rather than clearly explained, such as in the example of monarch butterfly (*Danaus plexippus*) mating. Usually, though, it is not difficult to imagine what the handicap is to the behavior being described.

In this chapter's last section, the Zahavis examine the

ways that other scientists have addressed the issue of "waste" in sexual displays. They begin by stating that Darwin did not consider how or why waste could attract mates and deter rivals, and that he did not see how an individual's investment in showing off could increase its reproductive success. They claim that Darwin simply treated these effects as a "given."

They then discuss how R. A. Fisher addressed the issue of wasteful signals. According to Fisher, the only advantage that showy males have is that females consider them attractive. Because these males pass on the "show off" trait, their male offspring will also be ostentatious and thus attractive to females. Although it would seem that mothers disadvantage themselves by having showy male offspring who waste resources, such males may become the only ones that are attractive to females. Hence, once some individuals consider a random feature to be attractive, a "runaway" process can develop in which this feature rapidly spreads throughout the population. Fisher thus assumed that female mate selection could be based on an exaggerated male feature that might not reflect his quality.

Yet, according to the Zahavis, the same wasteful traits that attract mates might also deter rivals of the same sex. They claim that the handicap principle does a better job of explaining the relationship between "showing off" and perceived courtship quality, particularly as it considers competition between rivals. Once again, the cost or "waste" is proposed to be the factor that makes showing off reliable. Accordingly, a female should view a male who can afford lavish, i.e. wasteful, displays to be the best father for her offspring.

In the beginning of the book's second part, "Methods of Communication," the Zahavis criticize the belief espoused by such notable biologists as Wallace, Lorenz, and Mayr, that markings evolved to enable animals to recognize members of their own species, or for discerning gender and age differences. Although experiments do show that animals use such features to identify one another, the Zahavis contend that this does not mean that they evolved for these purposes. Rather, they speculate that markings evolved through the competition that individuals engage in to determine each other's relative quality. Although the reasoning in this section is difficult to follow at times, it may lay the groundwork for exciting future research.

In the subsequent chapters of this part, the Zahavis argue that both the evolution and enacting of many communicative behaviors such as vocalizations and the use of body parts as signals, are better understood through the handicap principle. An interesting example involves the usual explanation for the feathers or bristling hairs that may surround an animal's head; i.e. that they increase its apparent size. The Zahavis point out that a body or head actually looks smaller within such a frame than it does without one.

Thus, they propose that animals display such hair or feathers not to fake size, but to demonstrate it reliably, because only a large individual can afford to make itself look smaller to rivals or collaborators. One might ask, though, how size is being reliably demonstrated if a face or body looks either smaller or larger than it really is?

Other examples and their explanations also require a stretch of the imagination, such as the one involving comparison of a young orangutan's (*Pongo pygmaeus*) vision with that of an adult male. A young orangutan has a wide field of vision, whereas an adult male's peripheral vision is impaired due to its sunken eyes and fleshy face. The Zahavis claim that only a large male can afford to advertise his social standing with a handicap that prevents him from seeing all around. The implication is that this handicap arose as an aspect of status-signal evolution. Surely, this handicap could simply be an incidental effect of the male's maturation. Throughout this section, many of the arguments about signal selection seem labored, and the discussions about differences between signal selection, sexual selection, and natural selection are not always clear.

Part III is entitled "The Handicap Principle in Social Systems." Early in its first chapter, "Testing the Bond," the authors suggest that all of the mechanisms used to test social bonds involve imposing on partners. Such imposition is considered to be yet another potential handicap, and is said to include such diverse behaviors as aggression during courtship in White Wagtails (*Motacilla alba*), and allopreening in babblers.

The next chapter, "Parents and Offspring," contains what appear to be some questionable assertions. First, in reviewing Trivers' theory of parent-offspring conflict (*American Zoologist* 14:249-264, 1974) and its explanation for how a baby's cries may coerce a mother to nurse it, the Zahavis argue that "Trivers did not take into account that behavioral mechanisms themselves evolve by natural selection" (p. 120). This assessment of Trivers' theory seems odd, because his writings show that he was well aware of the role of natural selection in the evolution of behavior (e.g. *Social Evolution*, 1985).

The authors also argue that the common explanation that young animals, such as babbler fledglings, cry to let their parents know where they are and/or that they are hungry, may be wrong. Rather, they suggest that their cries actually could be meant to be heard by predators; i.e. that fledglings cry to force their parents to feed them by endangering themselves. The seemingly simpler reason is that a fledgling cries when it is hungry or otherwise discomforted. Using an explanation that invokes self-endangerment by offspring makes it appear as if the authors are "reaching" in their attempts to employ the handicap principle.

Despite these misgivings, I found Chapter 13,

"Babblers, Competition for Prestige, and the Evolution of Altruism," to be one of the most fascinating and best-written portions of the book. By using babblers as their example again, the Zahavis convincingly show how their notion of "indirect reciprocity," which revolves around gains in prestige for altruistically behaving individuals, provides a stronger basis for the occurrence of altruistic behavior than does either reciprocal altruism or kin selection. They claim that "Once one views altruistic acts as signals that show the ability and intentions of the altruist, then altruism no longer poses any evolutionary enigma" (p. 149), and they assert that this explanation holds true for other birds, mammals, social insects, and even one-celled organisms. This chapter was breathtaking in its originality and in its capacity for turning well-accepted evolutionary arguments on their heads.

The last part of the book, "Humans," consists of but one chapter that attempts to apply the handicap principle to a wide range of human traits, such as hairlessness, menstruation, clothing, esthetics, and moral behavior. Even copulation is explained as a test of the social bond, an imposition that increases each party's knowledge of the other and thus of their relationship. Although this chapter was amusing, it suffers from attempting to use the handicap principle to explain too many aspects of our existence. It can be readily argued that many of the behaviors described in this section either have other evolutionary explanations, or are learned.

Overall, *The Handicap Principle* is a remarkable work. It is sweeping in its coverage, both in the organisms it considers and in its applications. The Zahavis' ability to derive explanations for behavior that counter or build upon those of the giants in this field is impressive. As indicated, at times it appears that the authors try too hard to make their principle broadly applicable. Yet, many of their hypotheses are testable, and this work should generate a considerable number of studies. The numerous black-and-white illustrations generally were enjoyable, although it was difficult to understand what several were about (e.g. on pp. 130 and 137). This book should be understandable to those with knowledge of the basic principles of animal behavior and evolution. Anyone interested in animal behavior should read it soon.—SAMUEL I. ZEVELOFF, *Department of Zoology, Weber State University, Ogden, Utah 84408, USA.*

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Host-Parasite Evolution: General Principles and Avian Models.—Dale H. Clayton and Janice Moore (Eds.). 1997. Oxford University Press, Oxford, Unit-

ed Kingdom. xii + 473 pp. ISBN 0-19-854893-1. Cloth, \$110.00; Paper, \$45.00.—Parasite-host interactions have been a hot topic for more than a decade, and for a variety of reasons many studies of parasitism have used birds as host systems. Despite this apparently fortuitous convergence for ornithologists, this is not a very "birdy" book. In other words, it is not really by or for ornithologists. That is not necessarily a bad thing, but it does mean that readers expecting to broaden their knowledge of avian biology per se by understanding avian parasites may be disappointed. Instead, the book uses birds as model systems and attempts, as the title states, to provide some general principles that will synthesize the field and suggest avenues for future research. The intended audience is an academic one, although the appendices contain enough practical information about collection and classification of bird parasites that managers might want to consult the book as well.

The volume attempts to be both general and specific. The first 12 chapters provide an overview of host-parasite evolution (interestingly, the term "coevolution" is studiously avoided). The specific part of the book appears in the last five chapters under the heading "Avian Models" and in the six appendices on techniques, resources, and Latin names. The premise, we assume, was that the general section would be applicable to a wide range of systems, while the more specific section provides a list of host-parasite systems in birds in which the general principles can be studied. This division is not entirely successful. Most chapters in the first section almost exclusively use avian examples, which is not in itself a bad idea; many studies of host-parasite phylogenies, for example, or of parasite effects on host sexual selection, have been carried out in birds, so little is lost by the focus. On the other hand, readers interested in a truly general treatment of, for example, parasite community ecology, may be disappointed.

The general chapters address topics ranging from genetic control of immunity (Wakelin and Apanius) to parasitism and life-history evolution (Møller) and the role of parasitism in co-speciation (one chapter by Hoberg, Brooks and Siegel-Causey, and one by Paterson and Gray). The chapters on topics with which we were familiar were thorough and competent, though yielding few surprises. Møller provides a carefully researched and well-organized contribution, with the body of the chapter consisting of paired sections on the effects of parasites on life-history traits and, conversely, the effects of these life-history traits on parasites. He is careful throughout the chapter to differentiate experimental from observational studies. A chapter on "Comparative Studies of Host-Parasite Communities" by Gregory also is well prepared. Payne has a chapter on "Brood Parasitism," which while excellent in itself, is out of place in a book otherwise dealing with parasites that live in or on their hosts, as indicated in the intro-

duction to the volume. If parasitism was to be taken in its broadest sense, the book should have included topics such as producer-scrounger systems or mate-choice copying behavior, as examples of information parasitism, and extrapair parentage as a case of parasitism of parental care. Readers interested in brood parasites are not likely to pick up this book as a reference.

The issue of the intended audience appears at another level. Some chapters assume that the reader has a general understanding of a topic, and we found that chapters on subjects relatively unfamiliar to us were sometimes daunting. Readers should be warned that if they lack a background in, for example, systematics, they will find the chapters on host-parasite speciation hard going. Other chapters are virtual repeats of reviews that have appeared elsewhere, and one is almost completely anecdotal. Nearly all the chapters contain thorough, up-to-date references, and having all the material on such a diversity of aspects of host-parasite interactions in one place is a plus.

The appendices, which deal mostly with field and laboratory methods in avian parasitology, perhaps are an unexpected highlight of the book. These appendices are a thoughtful inclusion for the merely curious (who among us has not occasionally wondered, on reading a paper, "How exactly did they do that?") and will be extremely useful for researchers planning to embark on similar lines of research. Three of them contain information about collection and identification of the different taxa of avian parasites, a fourth gives resources for identifying specific bird parasites, if one happens to have some in hand, and a fifth summarizes Latin names of birds in the text. The final appendix, on events leading to an acquired immune response, seems out of place and would have been better as an addendum to the chapter by Wakelin and Apanius on the genetic control of immunity.

The book will probably find its way to the shelf of anyone working in bird-parasite interactions, because it provides a comprehensive summary of the field and a convenient gateway to the vast primary literature.—MARLENE ZUK AND GEORGE LOZANO, *Department of Biology, University of California, Riverside, California 92521, USA.*

uila chrysaetos) has inspired and intrigued people from around the world for centuries, but until now, no one has attempted to assemble existing scientific information on the species in one volume. Jeff Watson has done an admirable job of pulling together diverse sources of data to produce a comprehensive and scholarly treatise on one of the world's best known birds of prey. This was not a simple undertaking, given the species' distribution throughout most of the Holarctic.

The book covers all aspects of Golden Eagle biology as well as significant information on the biology of other members of the genus *Aquila*. It begins with an overview of eagle distribution and includes chapters on diet, molt, movements, mortality, threats, and conservation. Much of the volume (seven chapters) is devoted to breeding biology, from courtship through postfledging. The book includes up-to-date population estimates as well as important sections on eagle/livestock relationships and the phenomenon of "Cainism." One chapter highlights the unique historical and spiritual relationship between eagles and humans on three continents. The 73 tables and 76 figures present extensive data that support many of the ecological principles outlined by Newton (*Population Ecology of Raptors*, 1979), e.g. the relationship between female size and egg mass. Watson also notes data gaps, raises questions, and identifies opportunities for future research. He does not hesitate to incorporate data from related species when information on the principal species is weak or lacking (e.g. survival rates).

I was particularly impressed with the section on factors that influence breeding performance. Watson not only covered the well-known topic of how food influences nesting success, but he included six pages on the more overlooked issue of how weather affects breeding eagles. Although Watson did not have access to Steenhof et al.'s recent paper on interactive effects of weather and prey on Golden Eagles in Idaho (*Journal of Animal Ecology* 66:350-362, 1997), his synthesis of published data from throughout the world came up with conclusions remarkably similar to ours.

Watson's book is unquestionably thorough, but land-use effects and the eagle's general behavioral repertoire might have received more attention. The discussion of land-use effects was limited to Scotland and did not address some of the significant work that has been done in North America on the effects of energy development on nesting eagles. Watson's discussion of behavior focused on the nesting season, and he included very little on behavior not associated with nesting. His descriptions of vocalizations and interactions with other species could have been expanded. Otherwise, the topics that Watson treats briefly or not at all are those that have received little attention in the literature. For example, no studies have been done on the phylogenetic re-

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The Golden Eagle.—Jeff Watson. 1997. T. & A.D. Poyser, London. xx + 374 pp., numerous black-and-white illustrations, 76 text figures, 73 tables. ISBN 0-85661-099-2. Cloth, \$49.95.—The Golden Eagle (*Aq-*

relationships of *Aquila* based on DNA or chromosomal evidence. In his chapter on future research needs, Watson emphasizes DNA fingerprinting, radio telemetry, and GIS analyses of land-use patterns as promising approaches for investigation.

Throughout the book, Watson emphasizes the Scottish populations that he knows best. His keen insights, based on 15 years of experience, bring a personal perspective to the work. Most chapters begin with a personal introductory anecdote. The result is a pleasing blend of personal observations and scientific data. Watson presents a limited amount of his own unpublished information in the book. His new data on diets and nest spacing of Scottish Golden Eagles are valuable contributions, but it is Watson's commanding familiarity with the literature that makes the book outstanding. Watson's most important contribution is that he cites and summarizes many non-English references (French, Spanish, German, and Japanese) that too often are neglected by most western authors. His impressive bibliography also includes several references from the gray literature, and Watson presents many interesting facts that he has assembled during contacts with eagle biologists from throughout the world. It is noteworthy that most information on Golden Eagles has been gathered in the past 40 years.

Although the writing could be crisper in places, Watson's semiformal style strikes the often elusive balance between accurate scholarly writing and entertaining prose. The book is extensively illustrated by Keith Brockie's striking black-and-white drawings, and the frontispiece of a Scottish landscape was painted by the author's father, Donald Watson. The lack of photographs is not a problem because Brockie has skillfully illustrated most of the relevant points. As in most other Poyser volumes, figures are interspersed in the text, and tables follow the six appendices and the bibliography. The chapters follow a logical organization, and summaries at the end of each chapter are especially convenient. An extensive 10-page index helps the reader to find information on a specific topic easily and quickly.

I found more typographical errors than I would like to see in a publication of this quality. For example, Wahlberg's Eagle (*Aquila wahlbergi*) was misspelled several times in Chapter 2. I also found some errors in the bibliographic references as well as inconsistent citation formats. Some of the tables were confusing. Much of the Scottish information is broken down by "region." Unfortunately, Watson used two different regional classification schemes, both of which have nine regions. One is described at length in Chapter 4 and is depicted on a map (figure 6); the other is based on longitudinal bands and is described in a cited reference. The nine regions depicted in table 7, therefore, do not correspond to the nine regions depicted in tables 15, 17, and 64, and it is unclear which regions are depicted in table 23. The only

truly significant error I found was that trichomoniasis was incorrectly described as a bacterial disease on page 225; it was listed correctly on page 187 as being caused by a parasitic protozoan. The only instance I found of incomplete or inadequate citations was Watson's failure to cite a 1983 paper by his colleague, R. H. Dennis, on replacement clutches.

This new book is an excellent addition to Poyser's reference books on birds. It complements the existing volumes on the Hen Harrier (*Circus cyaneus*), the Kestrel (*Falco tinnunculus*), the Barn Owl (*Tyto alba*), the Sparrowhawk (*Accipiter nisus*), and the Peregrine Falcon (*Falco peregrinus*). Watson's book on Golden Eagles will be useful to the naive reader interested in learning the basics of eagle biology, but it will be even more important as a reference for serious students. It is an essential reference for anyone working on Golden Eagles or any other species of the genus *Aquila*. Ecologists who are formulating or testing new theories will find the book especially useful because all available data on the genus are assembled in one place. No university library should be without this book.—KAREN STEENHOF, *Snake River Field Station, Forest and Rangeland Ecosystems Science Center, Biological Resources Division, U. S. Geological Survey, 970 Lusk Street, Boise, Idaho 83706, USA.*

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The Birds of British Columbia. Volume 3. Passerines: Flycatchers through Vireos.—R. Wayne Campbell, Neil K. Dawe, Ian McTaggart-Cowan, John M. Cooper, Gary W. Kaiser, Michael C. E. McNall, and G. E. John Smith. 1997. University of British Columbia Press, Vancouver. 693 pp., numerous maps and color photographs, 6 appendices. ISBN 0-7748-0572-2. Cloth, \$75.00 (\$95.00 Canadian).—British Columbia is perhaps the most ecologically diverse political unit in Canada. Ocean, temperate rain forests, Canada's only true desert, and alpine tundra are only a sample of the environments that are found within British Columbia's borders. Given the diversity of habitats, it is not surprising that roughly 75% of the species of birds observed in Canada, and 50% of the birds observed north of the Mexican border, have been found within the province. British Columbia also contains a substantial portion of the world's breeding population of roughly 20 species of birds. Given the rich avifauna of British Columbia, any account of the province's birds will be substantial. As a four-volume set (the fourth volume has not yet been released), "substantial" is an understatement for *The Birds of British Columbia*. The series is a distillation and blending of all available sources of information on distribution, abundance,

and movement of birds in Canada's westernmost province. Volume 3 is a handsomely produced, colorful continuation of the series, which started publication in 1990.

Given that *The Birds of British Columbia* will be a four-volume series, purchasers should strongly consider obtaining Volume 1 in addition to any other volumes. The series is organized as unit, and the first volume provides a great deal of interesting background information, including: (1) the only detailed descriptions of the physiographic regions into which British Columbia has been divided, (2) maps of observer coverage of the province, (3) a history of ornithology and ornithologists in the province, and (4) a general description of the format of the species accounts. Although I am reviewing only the third volume of the set, many of my comments will concern the series as a whole, because I found it impossible to consider any single volume in isolation from the rest of the series. I will keep to general comments and impressions because of the large size of the book and my inadequate qualifications to comment on the veracity of the contents of each of the species accounts. When I cite specifics, it is with the intent of illustrating more general comments.

The large size of this book is partially due to the format used to present information: graphics are used extensively to present information on range, seasonal occurrence and abundance, and trends in population size through time. Each species account contains a full-page map of British Columbia on which data on sight records and breeding records have been placed in a grid (I believe that each grid square is $\frac{1}{4}^\circ$ latitude by $\frac{1}{2}^\circ$ longitude, although this is not explicitly stated). Additionally, almost all species accounts feature a map showing the ecological region in the province in which each species is most prevalent in both the breeding and nonbreeding season. All of this information allows readers to rapidly assimilate basic facts about a species' occurrence in British Columbia, and I think that the authors made a wise decision in using extensive graphics to supplement the text. Likewise, I found the extensive use of color and black-and-white photographs useful in providing a general impression of the types of habitats occupied by species.

The text of each account provides a brief description of the species' world distribution, followed by comments on the species' current abundance, and, where relevant, its change in range and abundance within B.C. Following this basic distributional information is a more detailed description of the species' breeding and nonbreeding habitat, as well as descriptions of nest sites and metrics of reproductive success. Each regularly occurring species is given between 4 and 10 pages, with most accounts being between 6 and 8 pages in length. My initial reaction to the species accounts was that they resembled a pared-down version of the accounts in *The Birds of*

North America (BNA) series currently being produced by the American Ornithologists' Union and the Academy of Natural Sciences of Philadelphia. However, the goal of *The Birds of British Columbia* is to summarize information on distribution and habitat associations, whereas the BNA accounts present a far greater variety of information for each species. Another difference is that the BNA series is produced by an extremely large pool of authors, allowing greater depth of research to go into each account. Species accounts in *The Birds of British Columbia* have been reviewed externally by persons familiar with the species in order to counter the problems faced by a few authors dealing with many species. However, for readers interested in obtaining a detailed summary of a species' life history across its range, the BNA accounts likely are a better reference. Likewise, *The Birder's Handbook* (Ehrlich, Dobkins, and Wheye 1988) is a more convenient source of basic information on species, and a source often referenced in the volume under review. *The Birds of British Columbia* appears to have staked out its territory in the realm between the BNA accounts and *The Birder's Handbook*, but with a much restricted geographical coverage.

One aspect of this book that surprised and pleased me was the thorough documentation of the data compiled for production of this volume. A significant legacy of this book is the documented data—roughly 500,000 sight records and 50,000 nest records of passerines, all in computer databases. Such a collection of data could be the starting point, if not the sole source of data, for many future investigations into the distribution and life history of birds. The introduction notes the sources of data used and documents the contents and organization of the computer databases used to produce the species accounts. Appendices summarize migration arrival and departure dates, breeding bird censuses, Christmas Bird Counts, and even list all people contributing data to the volume (all 6,498 of them!). In contrast to the appendices, the index is extremely rudimentary, serving only to direct readers to the start of each species account (a task that the table of contents does not perform).

The book presents an enormous quantity of data, but I am not certain of the identity of the target audience. Much of the presentation appears aimed at a very general readership. Photographs of birds and their habitats abound, giving a general reader a feeling for the birds' environment. The graphical presentation of data is equally suited to convey general patterns to an audience not seeking detailed information. However, the authors also have quantified sample sizes used in graphics, presented data on reproductive parameters in an almost raw form, and provided statistical analyses of data from the Breeding Bird Survey, information that appears to be for the benefit of a more technical audience. It is the research-oriented audience that I think is less well served by the book. Range maps do not indicate that

some areas of B.C. simply have never been visited by bird watchers (as judged by maps presented in Volume 1), and no attempt was made to quantify the effects of variation in observer effort across the province. The maps in Volume 1 that show observer coverage have not been updated and presented in Volume 3. As a result, it is difficult or impossible for readers to judge how much of a species' apparent distribution is the result of varying levels of activity of bird watchers. Failure to acknowledge varying observer effort also is evident in other ways. For example, the statement that "... 94% of nesting records we have examined are from localities south of latitude 51°N ... " (p. 294) is used to support the authors' assessment that Brown Creepers (*Certhia americana*) breed more commonly in the southern than the northern part of B.C. The data might equally well indicate that the vast majority of bird watchers are found in the southern part of the province, which would not be surprising given the geographic distribution of humans within the province. Other material that I found curious was a series of "Noteworthy Records," sometimes more than one page in length, which mostly listed dates and locations of sightings or nestings of each species. It is unclear why these records should be noteworthy and singled out for publication. I found no explanation of the criteria for choosing noteworthy records, either in Volumes 1 or 3. The value of some tabular material, such as a two-page listing of a haphazard group of Cliff Swallow (*Petrochelidon pyrrhonota*) colonies (pp. 173–174), also is questionable.

In part, my criticism is that the authors have obscured our ignorance of the birds discussed in this volume. This is a personal preference on my part, but I would have liked to see *The Birds of British Columbia* pointedly suggest where more field work is needed. Where should bird watchers go if they want to explore new regions and expand our knowledge of bird distributions? Which species deserve closer monitoring because of suggestions of systematic declines in population size? Do the data suggest that nest parasitism by Brown-headed Cowbirds (*Molothrus ater*) is increasing through time? A brief summary and interpretation of patterns of distribution and abundance would be a welcome introduction to the book. The authors hinted on occasion at the need for more research. Their treatment of the "Western" flycatcher complex (pp. 72–79) suggests that this group's taxonomy may be murkier in British Columbia than in California. Species for which little of the basic breeding biology is known are also noted (e.g. Townsend's Solitaire [*Myadestes townsendi*], p. 383; Bohemian Waxwing [*Bombycilla garrulus*], p. 467). Although I would have liked to see the authors process and interpret their data more than they did, the size of the task relative to the number of authors makes the lack of interpretation understandable.

The large quantity of information presented in *The*

Birds of British Columbia should make this work a part of any well-endowed reference library. However, the size (i.e. cost) and regional specificity of the book probably make it unlikely that these volumes will find a place in many personal collections outside of British Columbia and the northwestern United States. Because the volumes constitute an integrated series of books, at least Volume 1 also is required in order to get the most out of the information presented in any of the other volumes. In addition to being a source of data on the birds themselves, *The Birds of British Columbia* should be used as a source for anyone wishing to produce a reference on a regional avifauna in the future. This work serves as an excellent example of what can be accomplished when sufficient resources are directed at integrating all of the sources of distributional information available for a geographic region. I also think that future authors should consider a greater role for finding and interpreting patterns in their data, and be more rigorous in dealing with problems of geographical variation in observer effort than is the case in the reviewed volume. I hope that the greatest legacy of this book is as a springboard for future research, both amateur and professional; the documented and computerized databases produced in order to compile Volume 3 of *The Birds of British Columbia* seem an ideal starting point.—WESLEY M. HOCHACHKA, *Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, Montana 59812, USA.*

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Discovering Birds: The Emergence of Ornithology as a Scientific Discipline, 1760–1850.—Paul Lawrence Farber. 1997. Johns Hopkins University Press, Baltimore, Maryland. 191 pp., 10 black-and-white illustrations. ISBN 0-8018-5537-3. Paper, \$14.95.—Natural history changed dramatically during the second half of the 18th century and the first half of the 19th century. Attempts to explain this phenomenon have stressed a rejection of classification and description for emerging disciplines that either acknowledged evolution or concentrated on subjects such as physiology. Farber, however, argues that some natural historians acknowledged evolution before the 19th century and that the field did not die, but was slowly fragmented into distinct scientific disciplines. Furthermore, he maintains that the transformation of natural history was exceedingly complex and cannot be explained by a single factor as others have claimed. To present his arguments, Farber describes the ontogeny of ornithology, one of the first disciplines to emerge from natural history.

The author begins his discussion of ornithology's formative period with Brisson's *Ornithologie* (1760) and Buffon's *Histoire Naturelle des Oiseaux* (1770), two revolutionary attempts to compile the current knowledge of birds. Although these works alone cannot be construed as the impetus for ornithology's emergence, they served as important sources of information and models of publication for those who increasingly narrowed their focus to the class Aves. Chapters 3 to 7 are devoted to the large number of other events and attitudes that ultimately contributed to the increase in knowledge of avian biology and the formation of the new field of research. For example, Farber discusses the increase in the number and extent of voyages to European colonies during the late 1700s. Such voyages provided excellent opportunities for naturalists to obtain specimens and behavioral observations from areas outside of Europe. Some of the quotes that are sprinkled liberally throughout these chapters are too lengthy, but most of them effectively support the author's interpretation of events, communicate the flavor of the writing of the time, and hint at the origin of Farber's extensive vocabulary.

Readers may be temporarily confused by the continuation of the narrative beyond 1830, the date by which ornithology had arguably achieved independence from natural history. However, it quickly becomes apparent that the author extends the time frame 20 years in order to include Bonaparte's *Conspectus Generum Avium*, a work that recorded most of the advances made in avian systematics since Buffon and Brisson. It seems appropriate to end with a landmark ornithological publication after beginning with works of similar stature and aim. With the bulk of his work finished, the author closes by discussing the utility of his research in a stepwise fashion. First, he wisely identifies his book as a case study in the fragmentation of natural history and admits that it may not be representative of contemporary transformations in other disciplines. Second, he discusses a few ramifications of ornithology's independence from natural history. Most notable among these effects is Darwin's dependence on avian systematists (ornithologists) to determine whether passerines on islands in the Galapagos Archipelago were, indeed, different species. Third, Farber acknowledges that topics that may have been bothering the reader all along, such as regional variation in the financial commitment to collection activities, clearly need some explanation and yet remain outside the scope of the current work.

Discovering Birds is a well-written monograph that describes the emergence of a prolific, modern scientific discipline. Moreover, the second edition is much more reasonably priced than its predecessor. The esoteric topic, however, probably will reduce the appeal of this book for all but ornithologists, science historians, and libraries of museums and larger universities. A few chapters may be useful for an advanced ornithology course, if the instructor wishes to assign reading on early attempts at classification or the formation of major research collections.—ROARKE E. DONNELLY, *Division of*

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Birds and Farming in Europe: The Common Agricultural Policy and its Implications for Bird Conservation.—Deborah J. Pain and Michael W. Pienkowski (Eds.). 1997. Academic Press, San Diego, California. xvi + 436 pp. ISBN 0-12-544280-7. Cloth, \$65.00.—This book provides a valuable synthesis of existing and new information for biologists, policy planners, and land managers concerned with effects of agriculture on wildlife (particularly birds), especially within the European Union (EU). The book is particularly strong in documenting and discussing the role of agricultural intensification (i.e. striving for greater productivity, in part from increased use of agrichemicals) since World War II in the dramatic declines in the diversity of farmland habitats available to wildlife, in the quality of the remaining habitat, and in the species richness and abundance of farmland birds in particular. A compelling case is made for extensification (i.e. producing less from a given area of land) using environmentally sensitive management systems as an alternative to conserve and restore wildlife in farmlands. The authors argue that extensification is a good solution to the conservation crisis in that extensive systems can be sustainable (and indeed were for many centuries in parts of the world). However, they point out that to achieve this will require farming within natural environmental constraints rather than finding artificial means of supporting systems operating outside these constraints. The challenge is to integrate conservation with food production on the wide scale that is needed to make a significant influence. Achieving this through extensification will require many farmers to reduce production, and, as a consequence, suffer financially. Thus, for conservation to succeed, individual farmers will need policies and financial incentives that assist them in adopting different farming practices. More broadly, policies need to fully internalize the environmental costs and benefits of agriculture into practices, markets, and policies. That is, when farmers, agribusiness, or policy makers make decisions, positive rewards for environmental benefits and penalties for environmental damage must be built in so that the environment is part of the decision-making process.

The book develops the above themes in three distinct sections. As outlined in the preface, Chapters 1 to 4 provide important background information on:

(1) the types of farmed landscapes and ways that these have developed within the EU; (2) the influence of the Common Agricultural Policy (CAP) on this process; (3) the importance of farmed land for biodiversity conservation, especially of birds; and (4) the influence of agricultural intensification on birds over the last 40 years. Chapters 5 to 12 are case studies detailing the ecological relationships between selected bird species and farmed habitats or farming systems, and the effects of agricultural intensification on birds and farmland biodiversity more generally. The case studies span the EU and incorporate low- and high-input farming systems that produce a wide range of agricultural commodities. They also illustrate the feasibility of designing and implementing policy instruments to bring about a new philosophy of land use. Chapters 13 and 14 draw conclusions from the preceding chapters and outline the directions that agricultural policy reforms need to take in the future if farmland birds and biodiversity more generally are to be conserved. Some of the key points (many iterated among chapters) are highlighted in the following paragraphs.

Farm structure in Europe is very old and largely is a result of history rather than of rational allocation of agricultural land. Although the spread of agriculture in Europe reduced the extent of natural habitats and their species, it probably led initially to an increase in biodiversity through the creation of new seminatural habitats (e.g. grasslands, heathlands, shrublands, and pastoral woodlands) and entirely artificial habitats such as annually cultivated and perennial crops. Because change was slow, many species were able to adapt and expand into these new habitats where they mimicked natural conditions. With continued loss of natural habitats, many species have become dependent on low-intensity agricultural habitats and the farming practices that maintain them. Low intensity, traditional farming landscapes have a high biological diversity, especially where a variety of crops occur in small fields within a matrix of other habitats such as hedgerows, woodlots, ponds, marshes, and fallowland. These landscapes also are highly valued for their scenic qualities and cultural significance. The most productive agricultural land in Europe is where farms are largest. This contrasts with more recently settled countries (e.g. the United States, Canada, and Australia), where the poor land is in very large holdings so that low production per hectare is compensated for by many hectares (e.g. ranches in the United States, cereal farms in western Canada).

Birds are useful indicators of farmland condition because they are the best monitored and researched taxa. Because birds often are less sensitive than certain other groups (e.g. plants and invertebrates), their declines signal a considerable loss of biodiversity. Agricultural intensification (excluding pesticide effects) adversely affects 42% of the species of agricultural

birds, indirect effects of pesticides (e.g. reduced food such as insects and weed seeds) 24%, agricultural abandonment 22%, agricultural expansion 13%, overgrazing 13%, and direct effects of pesticides (e.g. poisoning) 7%. Overall, a general impoverishment of biodiversity is occurring in agricultural habitats.

The Convention on Biological Diversity requires contracting parties (essentially governments) to develop plans for the conservation of biological diversity and to ensure that it is incorporated in all other policies for other activities. The conservation of biological diversity is not just about protecting rare species but also about using the countryside in a way that prevents currently common species from becoming rare. Potential exists for using wildlife species as a measurable indicator of sustainable use. Nature conservation is not just another land use but an approach to the wise use of all land. To do this, agricultural traditions need to be maintained rather than separating conservation and farming in different areas. If policies are to be successful, it is essential that local and national biodiversity priorities be set, both in terms of individual species and groups of species or ecosystems. Once set, conservation measures based upon these priorities must be coordinated at local, regional, national, and international scales.

Understanding the relationship between agriculture and the environment is central to future rural policy. The power of agricultural markets, technology, and policies to cause change means that they need to be treated as central concerns by those seeking rural policies that support biodiversity. However, their influences are erratic and unpredictable. A wider, integrated strategy is needed to ensure sustainable use of farmed landscapes. Conservation will continue to need a legislative system of species and site protection to complement new agriculture policies. Nature conservation policies have, in the past, given insufficient weight to the protection, management, and promotion of biodiversity across the whole of the countryside. The reasons for this are explained in Chapter 1 to 3, and the consequences are illustrated in Chapters 4 to 12. A major objective in the future must be to construct policies so that they fully internalize the environmental costs and benefits of agriculture into practices, markets, and policies. To do that, a vision of a future countryside is developed in order to develop objectives for reform and translate them into specific negotiating targets for policy makers.

The adverse effects of modern agriculture are so well documented in the EU that it has become one of the fixed elements of debate about agricultural policy reform. A scheme to foster some arable extensification should be the urgent objective of farming policy makers in the EU including the prerequisites that: (1) intensification is recognized as relating to crops and that it can only be solved by extensification of crops, not by creating or managing other habitats; (2) the

argument be rebutted that, notwithstanding set-asides, intensification generally is good for conservation because it confines the adverse effect of intensive farming in ever more intensified crops, thus releasing a greater area for wildlife; and (3) further reform of the CAP to switch enough money from market support mechanisms to specific arable extensification and other conservation measures. Although the public subsidy for food production is increasingly dubious, it is appropriate for public money to be spent on environmental benefits because these have no market. If the process of extensification were to embrace environmental objectives and the broad-leaved "weeds" preferred by declining bird species were redefined as "bird-seed plants," then the farming system might be able not only to tolerate certain non-crop plants, but even encourage them on some fields. The previous set-aside scheme has been beneficial to some seed-eating birds. It needs to be renamed and relaunched as "conservation farmland" to be a scheme that would be more palatable to the paying public and the farmers who would perceive both a purpose and a product. Although information aimed at already sympathetically minded farmers seeking technical information is valuable, of longer-term importance in influencing thinking is "training the advisers."

Given that the most environmentally useful farms tend to be small enterprises, it would be appropriate to support the development of marketing mechanisms for unique regional products. Maintaining farmed landscapes and managing farmland in an environmentally sensitive fashion not only will contribute to the conservation of birds and other biological diversity, but also to other social and environmental objectives, including a less-polluted environment and a sustainable future for local communities.

The only weakness of the book is the extent to which it is relevant outside of the EU. Agricultural intensification has been occurring in the United States and Canada for the last 40 years, suggesting that there are many parallels between the continents. Although much less studied, evidence suggests that farmland wildlife in temperate North America is being adversely affected by agricultural intensification (Freemark, *Landscape and Urban Planning* 31:99-115, 1995; McLaughlin and Mineau, *Agriculture Ecosystems and Environment* 55:201-212, 1995). Grassland birds, for example, have exhibited steeper and more consistent declines than any other group of birds monitored by the Breeding Bird Survey (Samson and Knopf, *BioScience* 44:418-421, 1994). Of the bird species listed by the Committee on Endangered Wildlife in Canada, 38% are endangered, threatened, or vulnerable as a result of agriculture. For the most part, however, the role of farmers as managers and stewards of the countryside, rather than just as producers for the market, is not yet a significant part of the cultural and policy mind-set of temperate North Amer-

ica. Until that changes, agricultural reform to protect and enhance biodiversity envisioned for the EU in this book will be unlikely. Without this, the ideals and international agreements forged in the Convention of Biological Diversity will be undermined in Canada and the United States. This book belongs in university, government, and policy and research institute libraries. It is well produced and worth the price.—KATHRYN E. FREEMARK, *National Wildlife Research Centre, Environment Canada, Hull, Quebec K1A 0H3, Canada.*

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Effects of Military Training and Fire in the Snake River Birds of Prey National Conservation Area.—U. S. Department of the Interior. 1996. U. S. Geological Survey, Biological Resources Division, Snake River Field Station, Boise, Idaho. xix + 130 pp., Paper, Available free of charge from USGS/BRD/Fresc, Snake River Field Station, 907 Lusk Street, Boise, Idaho 83706, USA.—This volume is a summary of numerous reports and published papers by investigators who conducted a four-year study in the Snake River Birds of Prey National Conservation Area (NCA) in southwestern Idaho. The NCA is a unique area that supports an exceptionally high density and diversity of raptors, and the study was initiated in response to concerns about negative effects of wildfires, military training exercises, and livestock grazing on wildlife there. The effects of these forces on the vegetation, prey-species populations, and raptors were examined by teams of investigators. The information presented in this volume on the implications of these effects will be useful to others dealing with similar issues elsewhere.—CARL D. MARTI, *Department of Zoology, Weber State University, Ogden, Utah 84408, USA.*

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Flight-feather Molt Patterns and Age in North American Owls.—Peter Pyle. 1997. American Birding Association, Colorado Springs, Colorado. 32 pp. ISBN 1-878788-36-1. Paper, \$9.95.—This monograph presents patterns of flight-feather replacement for all 19 North American owls. Based on examination of molt in more than 2,400 museum specimens, summaries for determining age up to four years are given.—CARL D. MARTI, *Department of Zoology, Weber State University, Ogden, Utah 84408-2505, USA.*