



EDITED BY REBECCA L. HOLBERTON

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

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The Evolution of Avian Breeding Systems.—J. David Ligon. 1999. Oxford University Press, New York. xxi + 504 pp., 1 black-and-white plate, 62 figures, 9 tables, 1 appendix. ISBN 0-19-854913-X. Cloth, \$98.00.—The mating behaviors of animals have always fascinated scientists and the public alike. In the last decade a suite of new genetic, physiological, theoretical, and phylogenetic methods has advanced our understanding of mate choice, sexual selection, and parental behavior. For example, just a decade ago most researchers got on well with simple laboratory and field devices, whereas now students of mating behavior routinely use techniques of molecular genetics and immunology, develop advanced mathematical models, and use sophisticated statistical tools. Avian research was, and is, at the cutting edge of these studies.

Ligon has taken up the challenge of reviewing most of the key topics in avian mating behavior. The literature is vast, as reflected by the nearly 1,000 references included in this volume. Ligon summarizes much research about mate choice, including the topical issues of good genes, parasites, and fluctuating asymmetry, and he also deals with sexual selection and speciation and investigates how various mating systems might have come about. In contrast to most current books on sexual selection and mating systems, Ligon's treatise stands out by having a broad, primarily historical (phylogenetic) perspective and by focusing on a popular group of animals, the birds. The ideas are expressed beautifully, although at times at great length.

The book can be divided into five parts: introduction (Chapter 1); sexual selection and mate choice (Chapters 2 to 6); issues related to mate choice that include speciation, female-female competition, and the evolution of parental care (Chapters 7 to 10); mating systems (Chapters 11 to 16); and conclusions (Chapter 17). Each chapter ends with a substantial summary. The Introduction defines the key tenets of the book. First, Ligon investigates how mate choice, mating systems, and parental care might influence

each other. These relationships are familiar to most avian biologists, although specific examples would have provided a better grasp of the feedback among the three subjects. Incidentally, I found no definition of "breeding system" and wonder whether Ligon's definition is different from that of Reynolds (1996). Second, whereas most current work emphasizes the role of ecology in influencing mating systems, Ligon emphasizes the significance of phylogenetic constraints. The phylogenetic approach clearly is timely because reconstructions of phylogenies (largely based upon molecular data) and analyses using comparative methods have advanced considerably in recent years.

Chapters 2 to 6 deal with mate choice. Ligon proposes that traditional ethological concepts (e.g. sign stimuli, innate releasing mechanisms, fixed action patterns) are useful in understanding mate choice. I must admit that I am skeptical about reviving these concepts for this purpose because I don't see what would be gained from using them over standard proximate (e.g. neurobiology and neuroendocrinology) and ultimate (e.g. behavioral ecology and sociobiology) analyses of mating behaviors. Ligon also presents a wealth of information on the diversity of ornaments such as plumage, wattles, and spurs and argues that some of them actually are not used in mate choice. This leaves the reader wondering whether the lack of such relationships is genuine or perhaps the consequence of low statistical power and/or unrealistic experimental manipulations. I particularly enjoyed the chapter that deals with case studies of major hypotheses; Ligon presents balanced arguments and does not hesitate to add his views on several controversial topics.

Chapters 7 to 10 are a bit of a potpourri. One of these chapters is devoted to sexual selection and speciation, and I am sure that this treatment will inspire much research in coming years. I particularly welcomed the chapter on mate choice by males and female-female competition, because these topics are somewhat the reverse of what many researchers

might expect and thus rarely come into the forefront of interest. I was slightly puzzled by the chapter on avian parental care. First, Ligon repeatedly states that his book does not deal with parental behavior. Yet, as this chapter makes clear, it is virtually impossible to understand sexual selection and mating behavior without it. Second, the ancestral state of avian parental care, as well as phylogenetic transitions, are contentious issues, and Ligon makes clear his favorite views. Nevertheless, I found it unsatisfactory that the only rigorous study that was based on a large data set (McKittrick 1992) was mentioned only briefly, whereas other somewhat more hypothetical scenarios were discussed and praised at length.

Chapters 11 to 16 provide excellent syntheses of social monogamy, extrapair copulations, polygyny, cooperative breeding, and classical polyandry and include many detailed case studies of some of the best-known avian systems. However, I have the feeling that some of Ligon's conclusions are premature. For example, Ligon concurs with David Lack that monogamy (associated with biparental care of young) must be the most productive mating system for most birds (p. 265). To demonstrate that socially monogamous birds achieve higher reproductive success than deserting ones, one needs to show that (1) the payoff from staying with the mate and caring for the young exceeds (2) the payoff from desertion (i.e. reproducing with a new mate and/or improving survival until future breeding seasons) for males and females. Although simple male-removal experiments (summarized in his table 11.1) potentially could estimate (1) for the male, they neither investigate (2) nor say anything about the payoffs for the female. Because behavior (e.g. caring/deserting decisions) and qualities (e.g. body condition, attractiveness) may be phenotypically correlated, both (1) and (2) must be estimated experimentally. As far as I know, this has not been done fully with any socially monogamous bird.

The "Conclusions" propose several interesting lines of research for further investigation. I fully concur with the author that new phylogenetic studies are required to understand the evolutionary history of mating behaviors. However, I was somewhat surprised that Ligon does not express concern that much of our current information on the costs and benefits of certain mating systems (e.g. classical polyandry) is based on observational studies and thus is open to alternative explanations. Few research projects have estimated fully the major components of mating decisions from a life-history perspective, especially for both sexes. In my view, additional experiments, preferably in the natural habitats of various bird species, remain necessary to have a better understanding of why a particular mating behavior occurs in one species but not in another.

Overall, I liked this book because it condenses a

wealth of information. The book is timely, because studies of mating behavior are rapidly proliferating. Also, the basic questions and some of the research methodologies have been defined, but luckily controversial issues exist that still attract students and keep researchers busy. However, I was disappointed to find little mention of recent advances in theoretical models of sexual selection. Some of these models focus on a single sex and use standard optimization procedures (e.g. static optimization), whereas others explore the interactions between individuals using a game-theoretic approach. The latter are particularly important for analyzing the conflicting interests of males and females that lie at the heart of sexual selection. From a broader perspective, theories often have a major influence on the way empiricists think about their favorite animal. In turn, influential empirical studies frequently motivate modelers to focus on some specific questions in a rigorous way. Thus, my point is that the feedback between contemporary theoretical and empirical research is one of the cornerstones of research in animal behavior, and much remains to be learned by integrating such approaches in studies of mating behavior.

These concerns should not reduce the value of this ambitious book, which is the best review available on avian mating systems. Overall, I found the book to be strong in factual information and packed with good natural history, although it is less useful if you want to update your knowledge about the theoretical foundation of mating behavior and match these theories with current empirical studies. I highly recommend this book to professional and amateur ornithologists. Unfortunately, it is quite expensive at \$98, so many students and amateur bird fans probably will not be able to buy it. In any case, it is well worth recommending it to your institution's library.—TAMÁS SZÉKELY, *Centre for Behavioural Biology, University of Bristol, Bristol BS8 1UG, United Kingdom.*

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