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Book Review: Statistics in Omithology

Douglas H. Johnson

Northern Prairie Wildlife Research Center

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Book Reviews

Statistics in Ornithology.

B. J. T. Morgan and P. M. North (eds.). Berlin: Springer-Verlag, 1985. xxv + 418 pp. \$29.60 (paperback).

This book, the 29th in Springer-Verlag's *Lecture Notes in Statistics* series, arose from a one-day meeting held in London in 1982. All but two of the papers presented at that meeting are included, as are additional papers not given in London. Refereeing was done by the two editors.

The meeting brought together individuals of different disciplines bound by a common interest in the study of birds. Authors include statisticians, ornithologists, ecologists, and population biologists. Their experiences range from developing new statistical techniques applicable to ornithology to using existing methods in innovative ways to conducting the fieldwork to provide the data on which the methods ultimately rely. The editors recognize the uneven level of statistical proficiency, but they hope that the volume will increase the awareness of diverse individuals and stimulate cross-fertilization of ideas. Yet it is difficult to identify the target audience of the proceedings.

Beyond an introductory chapter by the editors, the 26 chapters are loosely divided into three sections. The first is a general one dealing with color, feeding, movement, and migration. Among these six papers is one by J. R. Dale, illustrating the use of Mantel's score statistic to compare the rates of change of two biological features, here eye-ring color and bill color of British blackbirds. P. W. Greig-Smith uses experimental results to determine an optimal model of foraging for seed-eating birds, for which the nutritional advantage of larger seeds is offset by the greater time required to handle them. The birds do not have perfect knowledge of the values of the seeds, an assumption made in many models of optimal foraging, but must "estimate" values from characteristics of the seeds. They may respond to both the mean and variance of alternative feeding opportunities.

The second section comprises seven papers dealing with data from censuses, surveys, and indexes of various sorts. S. T. Buckland and A. J. B. Anderson exemplify the use of principal component analysis and cluster analysis on an incidence matrix of bird species (rows) seen at various locations (columns). P. C. Lack proposes a test, based on the von Mises distribution, to determine whether a species shows seasonal peaks in abundance. The test is intended to discern the presence of migratory members of a species that occurs throughout the year. How the method handles seasonal increases caused by the addition of young birds is not made clear. M. D. Mountford addresses the difficult problem of determining changes in bird populations from sample plots, not all of which are inventoried each year. He applies a method that he published earlier (Mountford 1982), which combines information from plots visited in successive years and from those with missing visits. I would like to have seen a rigorous evaluation of the method, perhaps with simulated data. B. D. Ripley describes the use of spatial statistics in the analysis of bird nests that have been mapped in a prescribed area; much of the material is based on Ripley (1981).

The third and largest section of the book treats survival. R. M. Cormack illustrates with several examples a method that he has developed for capture-recapture situations. It is based on a multinomial model and uses the GLIM computer program for estimation. The method offers an intriguing alternative to that of Jolly (1965) and Seber (1965). Other applications of Cormack's procedure are given in a chapter by J. Clobert, J. D. Lebreton, M. Clobert-Gillet, and H. Coquillart. In an interesting but superficial introduction to Bayesian statistics, R. F. Janz discusses the use of subjective knowledge in ornithology. The choices of prior in his examples are unmotivated, and much more could be done in this area. K. H. Lakhani shows how an easily made assumption may prove calamitous. The assumption, necessary to provide tractable estimates in several models of age-specific survival, is that survival probabilities of older birds are equal. This can yield misleading estimates. The models are not robust, but they give very different answers depending on which probabilities are set equal. Most of these important results were published by Lakhani and Newton (1983).

The book provides an uneven view of the statistical contributions to various aspects of ornithology. Taxonomy, which prompted R. A. Fisher to develop discriminant analysis, is not mentioned. Growth and development, a subject to which growth curves and other multivariate methods pertain, is discussed by a single author (Dale). Studies of avian behavior offer rich opportunities for such statistical methods as Markov chain and other stochastic models of behavior and the spatial distribution of nests.

Five papers deal with this subject, but they are mostly concerned with movements of birds. The distribution and biogeography of birds, for which several proposed models can be tested statistically, is treated in two chapters, both on the species-area curve. The identification of relations between bird numbers and habitat features has received much statistical attention; a workshop was devoted to the topic a few years ago (Capen 1981). Only the Buckland and Anderson paper fits within that category, although discriminant analysis and other multivariate procedures play a major role. The estimation of population size, or an index to it, is an important topic in applied ornithology, and it was the sole subject of a recent conference (Ralph and Scott 1981). Only two papers, and part of Cormack's, treat this subject.

The topic receiving the greatest attention, with 10 papers, is the estimation of survival rates. (G. L. Hensler's contribution on nest survival probabilities is more appropriately considered as the lone effort on reproductive rates.) This disparity in part reflects current activity on the interface between ornithology and statistics, but that is not a complete justification, because research is going on in several of the subject areas that are neglected in this volume. The editors could have made an effort to round out the proceedings by soliciting work in those fields or identifying subjects worthy of statistical attention.

The editors' stated purpose is to preserve the flavor of the meeting. I assume that this was done, and the message I carried away was that the meeting was interesting. Beyond that, why the book? Who is the audience? Statisticians interested in the problems addressed and methods used in ornithology might profitably skim the book, but there is precious little meat to be found. Ornithologists looking to see how to solve their problems might be rewarded, but they could equally likely be misled, especially into thinking that their problems have not been considered by statisticians or, worse, that they are inappropriate for statistical treatment.

Because of its breadth, the book provides no comprehensive view of any single subject. In contrast, proceedings such as Capen (1981) and Ralph and Scott (1981) covered meetings that were more narrowly focused and thus are worthwhile overviews of their topics.

In short, the meeting was probably a good one, but the organizers should have let it go at that.

DOUGLAS H. JOHNSON
Northern Prairie Wildlife Research Center

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