

PUBLICATIONS

Counting Animals. 1975. M. Norton-Griffiths. Publication No. 1, Edited by J. J. R. Grimsdell and H. T. Russell. Serengeti Ecological Monitoring Program, African Wildlife Leadership Foundation, P.O. Box 48177, Nairobi, Kenya. 105 pages (typescript), 50 Kenya Shillings, U.S. \$6.00.

This is a very interesting and useful publication. Perhaps the title might have been "Counting African Animals from the Air," since nearly all of the text is devoted to aerial surveys. Ten pages are devoted to ground counts from vehicles, and a final two pages dispose of other methods used for animal censuses. A publication announcement indicates that this handbook is the first of a series on techniques in African wildlife ecology designed for Wildlife Department and National Parks personnel and for wildlife management students. It was produced by photo-offset from typed masters, but the reproduction, arrangement, and writing are all very good, making for easy reading. Both binding and proofreading need to be improved in future issues of the series.

In general, this handbook gives clear and largely nontechnical instructions for nearly all of the steps involved in designing and carrying out an aerial survey based on the strip-sampling procedure. Simple and explicit instructions are given for defining the survey area, drawing a random sample of units, executing the actual survey, and calculating confidence limits for the estimates. It should be very useful to anyone conducting aerial surveys of reasonably numerous large animals in fairly open country. Under other circumstances, some more technical guidance may be needed. For example, transect methods based on measurements of distances from observer to animal are not adequately explored in the handbook. Nonetheless, it should be valuable to anyone conducting aerial surveys because there are so many useful details on setting up the aircraft, training crews, recording, photography, and so on. Too many surveys are presently conducted in which such things as height (altitude) control, accurate delineation of strip width, and counting large groups of animals are neglected. Dr. Norton-Griffiths has quite obviously had a lot of

experience in dealing with these factors, so his recommendations are worth study in connection with any kind of aerial survey.

A few comments on specific points may be of interest. Although one of the three main objectives for counting animals (p. 1) has to do with distribution and movements, systematic sampling (evenly spaced transects) is not mentioned in the handbook. Although it brings in various problems, a systematic sample would seem to be worth considering when pattern and movements are of primary concern.

Some statistical concepts are not easy to present in simple terms. One that the author has trouble with is the idea of confidence limits. His claim that confidence limits can be interpreted as meaning "that there is a 95% certainty that the true number of animals lies in the stated range" (p. 11 and p. 14) may confuse a reader who stops to think about it. Once the survey has been finished, the calculated confidence limits either include the true number of animals or they do not—with 100% certainty! Our faith in

confidence limits has to rest either on a statement made before the survey is run or on a law of averages—if things are done correctly, 95 out of 100 such statements will include the true number of animals. The same kind of problem comes up in a definition of the statistician's use of "accuracy" (p. 41, "An accurate estimate is one that is near the true total"). Again it is the averaging process that is relevant—averaging a very large number of surveys based on an accurate (unbiased) method will give a value very close to the true number.

A statement that I like very much appears on page 27: "No one in his right mind would ever attempt to count anything in a strip wider than about 1/4 mile." However, a strip of 1.5 km is suggested for searching for large herds of buffalo (p. 30), so that it becomes apparent that experience and good judgement have to prevail. If only large herds are of concern, and the country is very open, one might indeed use a wider strip.

In discussing stratification (p. 36), the author recommends allocating sampling ef-



On some great plains many animal species live in vast herds and migrate seasonally. Aerial survey is the only reasonably accurate method of estimating their numbers. Photo: V. C. Gilbert

fort to strata in proportion to animal density, on the basis of a statement that "the variance within a stratum will be directly proportional to the density of the animals in the stratum." The rule for optimum allocation is to allocate in proportion to the product of the stratum standard deviation and the proportion of the total area falling in the stratum. Following the quotation above, one would thus allocate on the basis of the square root of density. In my experience, however, it is more likely that the standard deviation will be proportional to density, so I think the advice given is good even though the logic used may be questioned (in the low density stratum, I would allocate in proportion to square root of density, as the animals there tend to be roughly randomly distributed so that the variance is proportional to density).

A few instances where inadequate proof-reading may puzzle the reader may be worth mentioning. In Figure 18 (preceding p. 72), in the lower left-hand corner, " $t=2 \times 2$ " should be $t=2.2$. On page 81 (top), the denominator of the expression for "d" ought to be the square root of the expression given. Also, on page 82 there seems to be something missing in the first paragraph. Here, readers would be well-advised to look up the topic of one-way analysis of variance in a statistics text. A further problem is that counts of animals are usually not normally distributed, and some help from a statistician probably would be useful.

Something might be said about the order in which randomly selected transects are flown. In many cases it may be sufficient to simply work across the area, taking the transects in the order of occurrence on the map. Inevitably, under random selection, a few transects will fall very close together, and one may then wonder if some animals may not be driven onto (or off) the next transect when one is searched. More importantly, when migratory herds are being counted (pp. 83-84) order may be critical. One useful scheme is to draw a new random set of transects for each unit of flying time (e.g., for each day). This will obviously increase dead-time (flying from transect to transect), but may nonetheless be a useful precaution. Schemes of this sort are useful for a variety of purposes, such as comparing observers, aircraft, and so on, and can be found in survey sampling texts under the heading of "replicate subsampling" or "interpenetrating sampling."

I would like to stress the "dubious legality" label attached to stratifying after the survey has been conducted (p. 85). It seems to me to be a way to get quite unsatisfactory results out of an otherwise well-run survey. There are more legitimate ways to approximate the same result. One is to lay out the

census area in a number of strips of the same size such that a few randomly located transects can be run in each strip. Another is to resort to systematic sampling. In either case, some help from a statistician is desirable, or one needs to spend some time with a text on survey sampling.

Two final comments:

1. I am doubtful about using "total counts" (pp. 87-92) for wild animals in anything other than quite restricted areas and unless the animals are largely indifferent to aircraft.

2. The user of strip transects had better be sure that he can see virtually all of the animals on the strip. This usually calls for a narrow strip and thus works well only if there are high densities of animals. —L. L. Eberhardt, *Battelle-Pacific Northwest Laboratories, USA*

This publication may be ordered by mail from the Nairobi Office of the African Wildlife Leadership Foundation. From outside Kenya requests should be accompanied by postal money orders in US dollars. From inside Kenya payment should be by cheque or postal money order originally drawn to the African Wildlife Leadership Foundation. Endorsed cheques or postal orders are not acceptable. —Ed.

Manual for Museums. 1976. Ralph H. Lewis, National Park Service, U.S. Department of the Interior, Washington, D.C. 53 illus., 412 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. \$4.70 (paper). Stock number 024-005-00643-5.

The Director of the U.S. National Park Service, Gary Everhardt, writes as follows in the foreword to this excellent book:

"Among the most important contributions the National Park Service has made since its founding in 1916 has been the development of extraordinary museum technology and administration—national in scope and international in influence. This manual, a distillation of what many persons have learned about the day-to-day operations of museums, is meant to provide curatorial standards and serve as a reference for museum workers everywhere.

"This book was written by Ralph H. Lewis, an outstanding museum administrator and curator with many years of experience in the National Park Service. It is an outgrowth of an earlier (1941) volume en-

titled *Field Manual for Museums* by Ned J. Burns, a work that went out of print during World War II and is, even to this day, in demand by curators and museum managers.

"In this present manual, Mr. Lewis carries on a tradition of excellence in museum practice that can be traced back to the mid-1930's when Carl P. Russell set the basic pattern for museum work in the national parks. In those early years most park museums could not afford or were too small to engage a full time professional museum staff. Dr. Russell set up centralized laboratories staffed by curators and preparators and provided the parks with exhibition and preservation expertise from this pool. The ordinary maintenance and operation of the museums were left to the superintendents who managed the parks, and to the archeologists, historians and naturalists who interpreted them."

Technically this manual covers the subject completely and in detail sufficient to give the novice curator—including the superintendent, interpreter, naturalist and historian involved in museum work—a strong feeling of security. Its four parts divide the rather overwhelming range of subject matter, with 17 chapters on various functions. Chapter 4, for example, is devoted to "Caring for a Collection." Here the details of preparing specimens for preservation, placing them in safe environments, periodic inspection and provision of preservation treatments are presented in 49 pages with 138 bibliographic references! Bibliographic wealth characterizes the book throughout. Chapter 5, "Using Museum Collections," contains seven pages of reference works with 137 citations.

It probably would be foolish to say that the book contains *everything* any curator would need to know to do his job, but I would guess that such a statement would be close enough to the truth to go unchallenged, at least by park people.

The book is full of good sense in addition to detailed technical guidance. When some technique, such as applying protective coatings on stone, for example, cannot be supported by deep and successful experience, the author clearly so states.

As a publication of the U.S. National Park Service, one would expect *Manual for Museums* to cover problems peculiar to the United States. This it does, but most of the work can apply to museums and historic structures anywhere.

Typography is excellent (10 point Times Roman), with useful appendixes and a good index. The paperback edition is trimmed to 152×234 mm. The publisher, incidentally, charges 25 percent additional as the postage charge, surface mail, on orders from outside the USA. —R. I. Standish