

this end the authors' experience in survey work is distilled into a step-by-step handbook that is thorough, detailed and carefully compiled. This is not, and is not meant to be, for the general biologist, however interested in moose; it is meant for the survey specialist.

Field methods are described down to the inclusion of completed field sheets, advice on the scale of map to choose, and cautionary words on the importance of controlling field travel costs. One aspect treated less thoroughly than its importance warrants is the choice of aircraft and pilot. It is implied that pilots should have survey experience, and that aircraft should be slow and maneuverable, but requirements are not given in detail. The survey procedures combine robust and practical field methods with refined mathematical methods for survey design and data analysis, for which there are worked examples for every step. This is not for those shy of formulas; it's packed with them. Part of the reason for this is that there is a lot of repetition; for example, Satterthwaite's approximation for the degrees of freedom of combined variances is never given as a general expression, but occurs in various special forms nine times (and then is missing, where it would be an improvement, from Sec. 3.7.3 — Calculating the Expanded Population Estimate).

The aerial survey design advocated — or, rather, prescribed — is complex, requiring three survey stages, each subsequent one refining previous estimates. After the study area is divided into sample units, at a recommended size of 11–13 sq. mi. each, an initial survey of the entire study area is flown to estimate the density in each sample unit only well enough to assign it to a "high," "medium," or "low" density class. (Rules are given for deciding when sample units can safely be assigned to classes without being flown over.) A random sample of the units in each class is then flown in the "standard" survey to estimate a standard mean density for each class; and of those, some (or all) are chosen for a further sub-sampling of a 2-sq.-mi. plot for intensive search to estimate a sightability correction factor for the standard survey. (And then a fine factor may have to be obtained from a radio-collaring experiment to correct the intensive searches.)

The mathematical methods are generally sound, well constructed, and robust. The importance of efficient design and careful analysis is recognized, and the calculation and combination of sampling standard errors is given for each step. Included are: estimation of the visible population in each density class and combining them to the total; the calculation, and correction for small-sample bias, of the sightability correction factor; its use to expand the population estimate; optimal allocation of survey effort between strata and between standard and intensive searches; the detection and estimation of changes in population size; and, usefully, the design of surveys to do so, considering both Type I and Type II errors. A final section shows how to estimate sex and age ratios. The reader is warned against most of the likely temptations to depart from random sampling, but an exception is the suggestion (on p. 19) that, as long as sample units are searched in the random order in which they are selected, "the survey can be terminated whenever adequate precision of the population estimate is attained." Such a decision rule biases sampling in favour of small variances and produces too-narrow confidence intervals; if sample mean and variance are correlated, as in such studies they probably are, population estimates will also be biased. Statistically valid sequential sampling schemes do exist, but they're more complex than this.

In some aspects, the presentation is fussy: four levels of numbered heading are oppressive (though equations are not numbered), and the examples of worked calculations and completed field sheets are a continual hindrance to the flow of the material: if they were collected in an appendix, they would themselves cohere and flow as a counterpart to the text. Anyone using this as an instruction manual will want to keep it for reference and will then find the worked examples in the way. This tries to be a stand-alone self-contained volume, including, unnecessarily, an introduction to simple sampling theory, tables of random numbers and (twice) of "Student" 's t , and explanations of Type I and II errors, the power of tests, and the difference between linear and exponential growth of populations. The authors would have done better to assume adequate understanding of statistical and mathematical concepts — as it is they give little explanation of stratified sampling, of

ratio estimation, or of the term "bias." Programs, instructions, and example outputs for calculating results on an H-P 97 take up 11 pages of the book and 5 more of an appendix, although this model hasn't been in the H-P catalogue since 1984.

At the beginning of the introduction, the authors make it plain that their object is to set out, with no qualifications, no consideration of alternatives, the methods that they have found best. The result is a recital of "This is how we do moose surveys; follow these methods exactly, and you will have a good survey." True; but as such, it is narrowly aimed at people who are looking for such a set of instructions to follow. This is a small market; and most such readers would welcome more discussion of the options available, so that if forced to deviate, they could do so informedly. Many other readers — those with more general interests in wildlife surveys, who work with other species, in other habitats, with other survey designs and sampling schemes — will find this exposition interesting, but will regret that the authors do not reveal more of the experiences and decisions that went into developing their methods.

That this book is popular is shown by its already having been reprinted. It deserves to be popular not because of its detailed instruction on field techniques and cost management, nor because of the worked examples and HP-97 programs, but because it gives a complete set of design procedures and analytical routines for the mathematical aspects of stratified random aerial survey. Few survey biologists may need them all — but nearly every survey biologist will need some of them.

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THE ARCTIC WORLD. Edited by WILLIAM E. TAYLOR, JR.; principal writer, FRED BRUEMMER. Toronto: Key Porter Books Limited, 1985. 256 p., 130 colour photos, 100 black and white photos, 1 map.

In his editorial foreword, W.E. Taylor, Jr., points out that southerners commonly regard the Arctic as remote, hostile and barren, whereas, he contends, though all these things, it is also profoundly beautiful, abounding in fascinating wildlife, and from a cultural point of view a place of long history and humanity. All the pictures and illustrations bear witness to this theme.

This is a large-sized volume with some 256 pages of high quality paper, about two-thirds of which are devoted to pictures, mainly colour photographs. Also reproduced are a number of archival photographs and prints. A text is pitched to present a serious but easy-to-read adjunct to the illustrative matter. One can readily imagine that a picture-only browser will finish up having taken in most of the text as well, gleaning in the process a fascinating insight into the circumpolar region.

A broad description of the geography and general environment, particularly wildlife, is provided. Also it embraces a history of man's penetration of these regions right up to the present day, beginning with Stone Age man's move northward into the Russo-Siberian Arctic and eventually crossing over the Bering Straits into what is now the Canadian Archipelago.

Augmenting the general survey is an examination in greater detail of certain of its aspects. Thor Larsen describes the fauna and Frans Wielgolaski the flora, both offering explanations of the various biological mechanisms that have allowed the different species to adapt successfully in the frigid climate. Turning to the human population, Robert McGhee traces the anthropological history of the races and tribes that have made their homes around the Arctic Circle. A.F. Treshnikov tells of the polar exploration that has taken place since the 11th century and particularly the scientific missions of the past 200 years. Finally, Ernest

S. Burch, Jr., completes the story by providing an account of the technology that has moved into the North since World War II and how its effects, together with a noticeable increase in the population rate of the native people, are imposing cultural shock to their traditional ways of life.

The format of first providing a generalized picture and then selecting certain subjects for further exposition leads inevitably to some repetition in the text. On balance, however, the interest generated in having a second look, but from a different angle, outweighs the disadvantages. Of particular interest is the way in which the author has, as it were, placed himself on the polar ice cap and, sweeping around 360°, described the scene from that vantage point. Of the European incursions beginning with the Norse, it becomes apparent that whatever their national origins and whatever their motives — were it the search for a northern passage to and from the Orient, the quest for furs and whale oil, the prospecting for minerals such as oil and gas, or the attempt to educate the native population and impose another culture upon them — the same problems were encountered in the eastern as well as the western side of the Arctic and the same solutions, both good and bad, sought and with roughly the same results.

The illustrations, which form the major part of this book, serve to emphasize the unspoiled beauty of these regions, where areas of vast wilderness remain inhabited only by those creatures that have adapted themselves successfully. The pictures include a number of superb black and white photos, most notably one of a group of Inuit in an ice house taken early in the century. Illustrations of the 17th- and 18th-century explorations are mainly taken from contemporary engravings. Seven chapters comprise photos only, bearing such titles as "Surprising Arctic," "Arctic Waters," "Polar Animals & Birds" and "Brief Flowering." Overall, some two-thirds of the pictures are the work of the principal author, Fred Breummer, with the remainder coming from public archives or private collections. The subjects embrace the native population, flora and fauna, transportation, religion and art. Although there are quite a number of hunting pictures, curiously only three show fishing. It would be easy also to imagine that the sun hardly ever stops shining, as there is only one page depicting stormy scenes. Possibly, however, storms don't make good pictures. Similarly, the stresses that modern socio-economic influences are placing on family life, mentioned in the text, are nowhere reflected. These, however, are minor quibbles. The one real criticism I have with the book is that the solitary map is entirely inadequate. The little half-page version, though attractively produced, left me searching in vain for most of the places I came across in the text.

Nevertheless, for a popular illustrated survey and history of the circumpolar Arctic, *The Arctic World* is a joy to behold and a worthwhile addition to any library.

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BOOKS RECEIVED

- ANTARCTIC MINERAL EXPLOITATION: THE EMERGING LEGAL FRAMEWORK. By FRANCISCO ORREGO VICUNA. Cambridge: Cambridge University Press, 1988. ISBN 0-521-32383-5. xv + 615 p., bib., appendix. Hardcover. US\$89.50.
- DAWSON CITY. By MICHAEL DOOGAN. Edited by PENNY RENNICK. Anchorage, Alaska: Alaska Northwest Publishing Company, 1988. Alaska Geographic, Vol. 15, No. 2. ISBN 0-88240-185-8. 93 p., illus., maps, bib., index. Softbound. Cdn\$18.95.
- GLOSSARY OF PERMAFROST AND RELATED GROUND-ICE TERMS. Prepared by S.A. HARRIS, H.M. FRENCH, J.A. HEGINBOTTOM, and G.H. JOHNSON.

- Edited by B. LADANYI, D.C. SEGO, and R.O. VAN EVERDINGEN. Ottawa: National Research Council of Canada, 1988. Technical Memorandum No. 142. ISBN 0-660-12540-4. 156 p., black and white photos, figs. Softbound. Cdn\$15.00.
- JOURNAL OF AN ALEUTIAN YEAR. By ETHEL ROSS OLIVER. Seattle: University of Washington Press, 1988. ISBN 0-295-96567-3. xxxviii + 248 p., black and white photos, illus. Softbound. US\$12.95.
- KINSHIP AND THE DRUM DANCE IN A NORTHERN DENE COMMUNITY. By MICHAEL ASCH. Edmonton, Alberta: The Boreal Institute for Northern Studies, Academic Printing and Publishing, 1988. The Circumpolar Research Series. ISBN 0-919-058-74-4. xi + 113 p. Softbound. Cdn\$12.95.
- LAND OF THE MIDNIGHT SUN, A HISTORY OF THE YUKON. By KEN S. COATES and WILLIAM R. MORRISON. Edmonton, Alberta: Hurtig Publishers Ltd., 1988. ISBN 0-88830-331-9. vii + 336 p., 106 black and white illus., 7 maps. Hardcover. Cdn\$25.95.
- POLAR SCIENCE, TECHNOLOGY AND INFORMATION. Edited by PETER ADAMS and FRANK DUERDEN. Ottawa: Association of Canadian Universities for Northern Studies, 1988. Tenth Anniversary Conference of ACUNS, Ryerson Polytechnical Institute, May 1-2, 1987. ISBN 0-921421-03-6. vii + 230 p., appendix. Softbound. No price indicated.
- QULIAQTUAT INUPIAT NUNANINNIN: THE REPORT OF THE CHIPPIKPIKUK RIVER AND UPPER MEADE RIVER ORAL HISTORY PROJECT. By WENDY H. ARUNDALE and WILLIAM S. SCHNEIDER. Fairbanks: University of Alaska, 1987. A Report for the North Slope Borough Commission on History, Language, and Culture. xii + 100 p., maps, tables, illus. Softbound. No price indicated.
- THE ALASKA ALMANAC: FACTS ABOUT ALASKA, 1988 EDITION. Anchorage: Alaska Northwest Publishing Company, 1988. ISBN 0-88240-244-7. 254 p., maps. Softbound. US\$6.95, Cdn\$8.85, + \$1.50 postage per book.
- THE ARCTIC GRAIL — THE QUEST FOR THE NORTH WEST PASSAGE AND THE NORTH POLE 1818-1909. By PIERRE BERTON. Toronto: McClelland and Stewart, 1988. ISBN 0-7710-1266-7. 672 p., illus., maps, bib., index. Hardcover. Cdn\$29.95.
- THE BERING LAND BRIDGE NATIONAL PRESERVE: AN ARCHEOLOGICAL SURVEY. By JEANNE SCHAAF. Anchorage, Alaska: National Park Service, 1988. Research/Resources Management Report AR-14. Vol. 1: xx + 483 p.; Vol. 2: xxii + 606 p., maps, illus. Softbound. No price indicated.
- THE LIVING TUNDRA. By YU. I. CHERNOV. New York: Cambridge University Press, 1985. ISBN 0-521-35754-3. 213 p., black and white illus., index. Softbound. US\$17.95.
- THE UPPER YUKON BASIN. By MONTY ALFORD. Anchorage, Alaska: Alaska Northwest Publishing Co., 1987. Alaska Geographic, Vol. 14, No. 4. ISBN 0-88240-183-1. 120 p., illus. Softbound. US\$18.95.
- VEGETATION OF THE SOVIET POLAR DESERTS. By V.D. ALEKSANDROVA. New York: Cambridge University Press, 1988. ISBN 0-521-32998-1. 228 p., black and white illus., index, bib. Hardcover. US\$49.50.

PAPERS TO APPEAR IN ARCTIC

- JANES, R.R. An Ethnoarchaeological Model for the Identification of Prehistoric Tipi Remains in the Boreal Forest.
- HANKS, C., and POKOTYLO, D. The Mackenzie Basin: An Alternative Approach to Dene and Metis Archaeology.
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- YESNER, D.R. Moose Hunters of the Boreal Forest? A Reexamination of Subsistence Patterns in the Western Subarctic.
- BURN, C.R., and FRIELE, P.A. Geomorphology, Vegetation Succession, Soil Characteristics and Permafrost in Retrogressive Thaw Slumps near Mayo, Yukon Territory.
- ARUNDALE, W.H., and JONES, E. Historic Land Use Processes in Alaska's Koyukuk River Area.
- ARUNDALE, W.H., CLARK, D.W., and QUICK, P.McW. Current Perspectives on Western Boreal Forest Life: Ethnographic and Ethnohistoric Research in Late Prehistoric and Historic Archaeology, A Preface.