

cussion. The other informative chapters are the chapters on salt marshes (by W. G. Beeftink), lagoons (by G. Colombo), and sand dunes (by L. A. Boorman). Another strength of the book is the breadth of coverage of environments. The chapters on reclaimed land and the sub-maritime fringe cover important areas usually omitted from this type of discussion.

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## Descriptive Statistics

**Exploratory Data Analysis.** JOHN W. TUKEY. Addison-Wesley, Reading, Mass., 1977. xvi, 688 pp., illus. \$17.95.

Descriptive statistics involves the use of graphical techniques and measures of location and scale to explore data, find anomalies, display patterns of association, and show what one has found. It is thus an essential tool for every statistician and every empirically minded scientist. New approaches to descriptive statistics, although rare, are potentially extremely important.

John Tukey, a statistician of the first rank, has set himself the task of seeing what insights into descriptive statistics might be gained from modern statistical thinking. He has created a body of new methods, many of which are potentially useful. *Exploratory Data Analysis* is a first extensive report on these new methods. Tukey distinguishes between exploratory and confirmatory data analysis. His concern in the exploratory phase is to examine the data from many points of view, as a detective might, to see what overall patterns they suggest. In the second, confirmatory phase, the apparent patterns are examined more closely to see if they withstand rigorous statistical scrutiny.

Because many of the ideas in descriptive statistics are seemingly simple, a writer is tempted to present them in an overly elementary form. Unfortunately Tukey has yielded to this temptation. He is therefore unable in this volume to tell his more sophisticated readers what he is really thinking about. We are told a great deal about what the methods are but all too little about their properties and when to use which. Thus this volume has severe limitations as a research monograph.

As an elementary textbook, the book also suffers. Despite the use of many dif-

ferent sizes of type, major points are often lost under a mass of detail. For example, in the review of chapter 11 circling of negative numbers is given equal weight with examination of residuals. In chapter 1 we learn how to place our finger to count numbers the Tukey way. This level of detail is boring and unnecessary and makes the book baffling as a textbook. Several professors who have used it as a textbook say they would not do so again.

There is also the matter of its vocabulary. Tukey delights in making up new words, whether necessary or not. Thus the lower quartile becomes the "lower hinge," the upper quartile the "upper hinge," and the interquartile range the "hinge spread." This new vocabulary is a burden to professors and, more particularly, to students, who will be expected to be able to read and perhaps write papers involving statistics after leaving a statistics course. From this book they will know little of the common vocabulary and much that is idiosyncratic to Tukey.

A third group of potential readers, empirical workers in scientific fields, may find the book somewhat more useful. They are, however, likely to be put off by the unfamiliar vocabulary and mystified by the question when and why to use which techniques. Among the techniques they might find most useful are the analysis of the family of power transformations (particularly exhibit 21 of chapter 6, p. 198) and the analysis of two-way plots (especially exhibit 7 of chapter 10, p. 349). They should be ready to do a lot of work to understand those techniques, however.

What we have, then, is a statistical cookbook, with dishes new to both teacher and student. There are almost no published technical papers in which this new statistical cuisine can be tasted. The consequence is that the flavoring done by amateur chefs is bound to be off, and much statistical mischief can ensue. I would prefer that Tukey and his group had opened a few restaurants, publishing papers that would have been subject to review by epicures, before going into the mass cookbook market. A few such papers, particularly three by Tukey (1), and a few other recent books (2) dealing with exploratory data analysis have appeared, and a useful review of the subject can be found in a forthcoming paper by Leinhardt and Wasserman (3).

Despite all its weaknesses, both as a research monograph and as a textbook, there is very important and novel business going on in the book under review. Tukey suggests a freedom of approach to

data that is bound to be liberating. "Try things," he continually suggests, "plot your data differently. Maybe transform. Keep looking." This spirit is already influential in statistics and is likely to become more so. It's a pity that this book does not do a better job of explaining such an important point of view.

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## Avian Pests

**Granivorous Birds in Ecosystems.** Their Evolution, Populations, Energetics, Adaptations, Impact and Control. JAN PINOWSKI and S. CHARLES KENDEIGH, Eds. Cambridge University Press, New York, 1978. xxii, 432 pp., illus. \$41. International Biological Programme 12.

Each year birds damage millions of dollars worth of crops, particularly grains. Among the culprits, the house sparrow (*Passer domesticus*), widely distributed in Europe and Asia and introduced to most of the western world, poses the biggest threat. Others include the red-winged blackbird of North America and the red-billed dioch of southern Africa. For more than a decade, these species and some of their relatives have been subjects of intensive studies of evolution, population dynamics, and production, coordinated by the Working Group on Granivorous Birds of the Section on Terrestrial Productivity of the International Biological Program. The present volume, edited by J. Pinowski of Poland and S. C. Kendeigh of the United States, summarizes and synthesizes these studies.

*Granivorous Birds in Ecosystems* is a model of coordinated and integrated research by independently funded investigators. Although granivorous birds, principally the house sparrow, are the main source of data and the subjects of the

original investigations reported upon, each chapter delves much more deeply into avian biology and provides a useful and often pace-setting synthesis of the field. The contributions to *Granivorous Birds* may be characterized as quantitative, multivariate, synthetic, and oriented toward systems and toward production (energetics).

Following a brief introduction to the project by Kendeigh and Pinowski, R. F. Johnston and W. J. Klitz summarize the evolution, genetics, and morphological variation of the house sparrow. Over its introduced range, the house sparrow exhibits considerable developmental and evolutionary plasticity. In chapter 3, M. I. Dyer, Pinowski, and B. Pinowska provide a detailed, well-structured analysis of geographic variation in the demography of the house and tree sparrows and several North American Icteridae (blackbirds and grackles). Here one begins to realize the extent of comparative data on these birds. Chapter 4, by Pinowski and A. Myrcha, summarizes data on the production of biomass, primarily egg production and growth of the young. Chapter 5, by Kendeigh, V. R. Dol'nik, and V. M. Gavrilov, thoroughly synthesizes much of avian energetics. The chapter is particularly useful because its viewpoint, that of production, complements other recent, lengthy reviews of the subject. In chapter 6, J. A. Wiens and Dyer combine the principles and findings of avian energetics with data on population dynamics and productivity. The result is a systems model of the seasonal energy demands, hence food consumption, of *Passer* in various localities. Chapter 7, by Dyer and P. Ward, addresses the problem of pest management. The authors properly place management in economic and environmental contexts and push for continued research of the sort reported in *Granivorous Birds*. Finally, in chapter 8, Wiens and Johnston search for a common thread of adaptation in the fabric of granivory and, failing to find one, conclude that "different species or species complexes have attained [pest status] in different ways, through different adaptive correlates of granivory." The book concludes with a brief epilogue by Kendeigh, Wiens, and Pinowski, several appendices of tabulated data on populations, breeding, and metabolism, 46 pages of references, and a good index.

Close examination of *Granivorous Birds* will reveal to every reader the shortcomings, omissions, and uncritically accepted and improperly or inadequately analyzed data that inevitably creep into such an ambitious, far-reach-

ing book. Nonetheless, *Granivorous Birds* offers information and ideas that will greatly reward anyone interested in population dynamics, energetics, production, and pest management.

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## Unicellular Eukaryotes

**The Biology of Diatoms.** DIETRICH WERNER, Ed. University of California Press, Berkeley, 1977. x, 498 pp., illus. \$32.50. Botanical Monographs, vol. 13.

*The Biology of Diatoms* follows the *Biology of Blue-Green Algae* (which was volume 9) in the series Botanical Monographs. The book deals with one of the most important groups of unicellular eukaryotic algae. It will inform researchers and advanced students of diatoms about work complementary to their own and may stimulate collaboration between workers in different fields. Several excellent contributions provide an exhaustive and critical review of current knowledge, often identifying unresolved problems. Most of the 12 contributions, particularly those with an ecological orientation, emphasize the importance of research at the species level and the great functional diversity diatoms exhibit. In contrast, the structural diversity of diatoms is inadequately represented. The book is also poorly and insufficiently illustrated. Numerous references (over 1600 in all) are listed with the corresponding chapters.

Werner introduces the book briefly and presents three alternative systematic outlines with no evaluation. The fine structure of diatom tests is illustrated by only a few photographs and hardly any text. The account of cellular fine structure by E. L. Duke and B. E. F. Reimann, though it lacks sufficient illustration, is comprehensive and well introduced and contains original and stimulating ideas. It should have been placed at the beginning of the book. R. W. Eppley compares various culturing methods, and Werner discusses various aspects of the metabolism and biochemistry of silica. Photosynthesis is treated briefly by E. G. Jørgensen, with discussion of pigments and temperature effects. J. A. Hellebust and J. Lewin deal comprehensively with diatom heterotrophy and discuss its ecological implications. The biochemical composition of diatoms is reviewed by W. M. Darley, their motility by M. A. Harper, and their

sexuality by G. Drebes. R. Patrick in the treatment of the ecology of freshwater diatoms emphasizes their diversity and their value as indicators in studies of water pollution. C. D. McIntire and W. W. Moore tabulate the literature on regional distribution of benthic marine diatoms and discuss the use of computer and multivariate analysis for diatom assemblages. The last contribution in the book, by R. R. L. Guillard and P. Kilham, is also the longest and most interesting. It raises and discusses many fundamental questions, relates plankton diatoms to the sediment record, and provides a comprehensive review of the distribution of planktonic diatoms in the world's oceans (citing over 400 references). Indexes of subjects and species are appended to the book.

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**Advances in Human Genetics.** Vol. 8. Harry Harris and Kurt Hirschhorn, Eds. Plenum, New York, 1977. xiv, 446 pp., illus. \$35.

**Alcohol and the Liver.** Proceedings of a symposium, Toronto, May 1976. M. M. Fisher and J. G. Rankin, Eds. Plenum, New York, 1977. x, 406 pp., illus. \$39.50. Hepatology, vol. 3.

**Algebraic Number Theory.** Robert L. Long. Dekker, New York, 1977. xii, 192 pp. \$18.50. Pure and Applied Mathematics, 41.

**Amorphous Magnetism II.** Proceedings of a symposium, Troy, N.Y., Aug. 1976. R. A. Levy and R. Hasegawa, Eds. Plenum, New York, 1977. xii, 680 pp., illus. \$59.50.

**Analytical and Quantitative Methods in Microscopy.** Papers from a symposium. G. A. Meek and H. Y. Elder, Eds. Cambridge University Press, New York, 1977. viii, 276 pp., illus. Cloth, \$24.95; paper, \$8.50. Society for Experimental Biology Seminar Series, 3.

**Annual Review of Anthropology.** Vol. 6. Bernard J. Siegel, Alan R. Beals, and Stephen A. Tyler, Eds. Annual Reviews, Palo Alto, Calif., 1977. viii, 604 pp. \$17.

**Anxiety, Learning, and Instruction.** Joan E. Sieber, Harold F. O'Neil, Jr., and Sigmund Tobias. Erlbaum, Hillsdale, N.J., 1977 (distributor, Halsted [Wiley], New York). x, 262 pp. \$16.50.

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