

and notational bibliography. Second ed. Bishop Museum Press, Honolulu, Hawaii, 375 pp.

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Altringham, J. D. 1996. **BATS: BIOLOGY AND BEHAVIOUR.** Oxford University Press, Inc., New York, 262 pp. ISBN 0-19-854075-2, price (hardcover), \$65.00.

Bats: biology and behaviour primarily is aimed at undergraduate and graduate students wishing to learn about bats, but it also is a useful reference for everyone from professional biologists to persons simply interested in learning more about the biology of bats. The two stated goals of the book are to give an account of the biology of the world's bats, emphasizing those aspects that are unique or highly adapted; notably flight and echolocation. The second objective is to illustrate processes and concepts of broad biological relevance, many of which are major themes in current research.

The book is organized into an introduction, eight chapters, an extensive list of references, and a comprehensive index. About 75 detailed drawings of bats, and >100 other illustrations (mostly graphs) provide a wealth of visual information. There are four tables; differences between megabats and microbats, characteristics shared by microbats and megabats, aspects of the biology of five species of emballonurids in Central America, and a summary of bat-diversity indices in the Old and New Worlds. Four "boxes" contain explanations of cladistics, molecular taxonomy, power for flight, and sound. The text contains a myriad of facts and figures to support statements about the biology of bats (with appropriate citations of the scientific literature).

The introduction is subtitled *Biology Lessons From the Bats*, presumably in reference to the second goal of the book: "to illustrate processes and concepts of broad biological relevance." Presented there is a brief summary of what appears in the rest of the volume. Chapter 1, *The Evolution and Diversity of Bats*, contains the evolutionary history of bats, including fossils, origins of megabats and microbats, the current debate concerning the phylogenetic relationship between Primates, Megachiroptera, and Microchiroptera, and a summary of the classification, distribution, and diversity of the 18 families of

bats in the world. Chapter 1 also provides an introduction to the evolution of flight and echolocation, which are presented in more detail in chapters 2 and 3, respectively.

Chapter 2, *Flight*, reviews basic principles of the aerodynamics of flight, including aerofoils, vortices, and flapping flight. The advantages and evolution of flight, and the physiological, biomechanical, and ecological aspects of flight are discussed. Altringham does an excellent job of relating basic physics to flight in bats, and then of describing the ecological significance of attributes such as aspect ratio, wing loading, and shape of wings.

Chapter 3, *Echolocation*, begins with an overview of echolocation in bats and other vertebrates, and continues with descriptions and illustrations of how sounds are generated and perceived by Microchiroptera. Examples of topics covered include frequency-modulated calls, constant-frequency calls, how bats avoid being confused by other bats, the neural basis of echolocation, the selection of prey, the association between wing beat, respiration, and emission of pulses, and interactions between flight, food, and foraging habits.

Chapter 4, *Torpor and Hibernation*, emphasizes the importance of torpor and hibernation in maintaining the balance of energy. Ectothermy, endothermy, heterothermy, the importance of body size, the ecology and physiology of torpor and hibernation, hibernacula, biological clocks, and the ecological ramifications among these topics are explored.

Chapter 5, *Reproduction and Development*, delves into mating patterns and behavior, timing of reproductive cycles, birth, development, infant-mother communication and maternal care, foraging patterns of mothers, life expectancy, and sexual dimorphism. Selection of maternity sites is examined briefly, but most information on roosts is presented in Chapter 6.

Chapter 6, *Behavioural Ecology*, primarily emphasizes roosting and foraging ecology. However, there also are glimpses into related topics including reciprocal altruism, optimal foraging, information transfer, social structure, and migration.

Among topics addressed in Chapter 7, *Community Ecology and the Interactions Between Bats and Other Organisms*, are global distribution, species richness, communities and guilds, co-evolution of bats and prey, bat-plant inter-

actions, and pollination and dispersal. This chapter provides considerable synthesis of topics described or eluded to in other chapters. For example, data on the ecological implications of wing loading, aspect ratio, and echolocation are used in examining the structure of communities and guilds. Throughout this chapter and Chapters 1-6, Altringham provides an excellent and logical summary of information from the >400 cited references.

Chapter 8, *Conservation*, was somewhat disappointing; not because of its content, but because of its brevity (only three pages). I realize that "brevity is wit," but I believe this would have been an excellent opportunity to point out some of the significant problems facing conservation of bats in our rapidly changing world. Perhaps, it would have been a good place to summarize what has caused some of the problems we now face (present some case histories), what needs to be done, and what is being done. The usefulness of bat houses and the need to educate the general public about bats would have been possible additions to this chapter.

Overall, I greatly enjoyed reading this book; it is an excellent contribution to the literature on the biology of bats. There are some trivial imperfections that may be noticed by some readers, but these oversights do not diminish the value of the book. For example, "thought" is misspelled on p. 34, Bracken Cave, Texas, usually is considered to be in the southwestern United States, not the southeastern United States, Crustacea, Amphibia, Neotropics, and others should be capitalized, pepper should not be capitalized, the volume of the article by Johnson-Murray (1977) is 58, not 59, the common name of *Tadarida brasiliensis* is Brazilian free-tailed bat, not Mexican free-tailed bat (*T. brasiliensis mexicana*), and referring to the family Muridae as "rats and mice" would have been more accurate than referring to them as "Old World rats and mice." I believe the author should not have used "very" as often in the text (e.g., very similar, very agile, very earliest, very variable, very different, very common, very abundant, very widespread, very wide, very long, very tough, very readable, very useful, very important, very low, very high), that "because" should have been used to indicate reasons why things occur and "since" should have been used to refer to passage of time, and that most of the time the author used "which when he should have used

"that." Again, these minutia do not affect the factual content and usefulness of the volume. If I were to undertake writing such a book, I would hope to do as well as Altringham.

The primary goals of the book clearly were achieved. In addition to providing a useful account of the biology of the world's bats, the author has used bats to demonstrate how basic biological processes also shape the rest of our natural world. For example, bats illustrate adaptive radiation, optimal foraging, co-evolution, reciprocal altruism, the consequences of continental drift, and predator-prey adaptations. I believe this book is a valuable reference for bat enthusiasts (amateur or professional), and I highly recommend it to anyone interested in the biology of mammals.—TROY L. BEST, *Department of Zoology and Wildlife Science, and Alabama Agricultural Experiment Station, 331 Funchess Hall, Auburn University, AL 36849-5414.*

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Silva, M., and J. A. Downey. 1995. *HANDBOOK OF MAMMALIAN BODY MASSES*. CRC Press, Boca Raton, Florida, 359 pp. ISBN 0-8493-2790-3, price (cloth), \$99.95.

All those with an interest in mammals will welcome this ambitious compilation of data on body mass. Mammalogists are aware that, aside from knowing what kind of creature one is dealing with, the single most important datum for any mammal is its body mass. Identification puts the subject in a phylogenetic context and together with its mass allows one to predict numerous features of the organism's physiology, morphology, life history, and sometimes even its ecological role. Much is known about body mass among mammals, but a handbook that assembles these data in a readily accessible form clearly can benefit diverse researchers.

One can glean from this volume, for example, that body weight in extant mammals varies over eight orders of magnitude, ranging from a blue whale (*Balaenoptera musculus*) weighing in at 172,000 kg to the Etruscan shrew (*Suncus etruscus*) with a minimum adult weight reported at 1.2 g. Second place at 2 g is shared by three bats, six other shrews, and one rodent. Probably no other vertebrate group can claim such a range in body size. Among the 4,629 or more species