## **PREVIEW – Animal Skulls : A Guide to North American Species**

This book, authored by the intrepid natural historian and master wildlife tracker, Mark Elbroch, is a celebration of the vertebrate skull. As emphasized in the *Introduction* to this attractive and well-crafted book, the human mind—encased in its own protective skull—is endlessly fascinated by the skulls of fellow vertebrates. Although we may not understand why, the allure of animal skulls is very real, and this book feeds the human desire to know more about them.

Animal Skulls is a unique reference and identification guide to skulls of 275 vertebrate species of North America. The book is extremely well illustrated with 1,434 black-and-white drawings and 123 color photographs. Some of the photographs are especially creative, including the cougar (Puma concolor) photo on page 42 superimposed with a semitransparent image of its skull. Topics in Animal Skulls are presented in a logical order. The *Introduction* includes a section entitled *Importance* of Collections, which is a powerful statement on the vital role of collections as repositories for biodiversity. The Bones of the Skull (Chapter 1) provides skull vocabulary, reference diagrams of skulls, and defines standard measurements used by scientists to describe the skull. The beautifully illustrated skulls and careful use of color to identify particular bones make this chapter especially useful to the lay naturalist. Chapter 2 focuses sequentially on teeth, jaws, the senses (as interpreted from cranial morphology), skull variation, and ways to determine age and sex of the skull's owner. Chapter 3 (Tracking Across the Surface of Animal Skulls) provides an unusual perspective on skulls that derives from Elbroch's experience as a wildlife tracker. In this chapter, Elbroch describes how scrapes, holes, gnaw marks, and other damage to skulls can be used as evidence ("tracks," if you will) of pre- and postmortem events in the life of an animal. For example, a table of intercanine widths for common predatory mammals may allow the "tracker" to determine what species of predator punctured the skull of a prey species.

The human fascination with skulls leads many lay naturalists to acquire small skull collections of their own. Accordingly, the "how to" guide for collecting and preparing skulls (Chapter 4) is a particularly useful addition to this book. Importantly, Elbroch reminds the lay naturalist to record essential data, including locality and date, for each skull—a practice that emphasizes the principal difference between a scientific collection and a mere collection of interesting skulls.

The heart of the book *Animal Skulls* begins in Chapter 5 with a visual guide to skulls. This section consists of more than 80 plates of full-size, half-size, or quarter-size illustrations of skulls of mammals (188 species—with a separate section illustrating mandibles of 140 species), birds (69 species), reptiles (10 species), and amphibians (3 species). Anyone finding a skull in the field, especially a mammal skull, would find it fairly easy to match the skull to one of these detailed black-and-white drawings, which would then lead them (in most cases) to a more detailed description of the skull in the "species accounts" section of the book. The illustrations of lower jaws of mammals will be particularly useful for identifying fragmentary remains such as those from owl pellets. The pages of this important section of the book are color tabbed

along their edges, and the skulls are arranged by increasing size, making it easy to locate and convenient to use as a quick reference guide.

The remainder of the book, more than half of its total pages, is devoted to "species accounts" of selected mammals, birds, reptiles, and amphibians. Each account is illustrated with multiple views (black-and-white drawings) of the cranium and mandible, highlighting features that distinguish this species from close relatives. These illustrations are well integrated with the text, which describes salient features of the skull using the formal scientific terminology introduced in Chapter 1. Color photographs of skulls in museum collections (carefully documented by museum and collection number) augment the line drawings in many of the species accounts. Following the species accounts are tables of selected skull measurements for each of the species covered in the accounts. Skull dimensions (including mean, range, and sample size by sex) were either taken from the literature (appropriate citations are included) or measured by the author himself. The inclusion of range and sex information for each dimension helps the reader grasp the concepts of individual and sexual variation in natural populations, 2 concepts that often are unappreciated by the lay naturalist. The book closes with a 10-page bibliography and a 10-page index, both of which seem to cover the text adequately. We did notice a few inconsistencies in the index; for example, the howler monkey (Alouatta) is listed under "Monkeys," whereas the night monkey (Aotus) is listed under "Night Monkey."

Despite its general high quality and completeness, Animal Skulls does have a few shortcomings. The subtitle, A Guide to North American Species, is misleading in that the book covers <10% of the approximately 1,000 species of currently recognized North American mammals. Because of this, users of this book will find that they can identify most skulls only to the level of genus, not species. However, identification to genus certainly is a crucial step in determining the identity of a skull. Geographic coverage in a book that includes "North America" in its title will depend, of course, on the author's definition of North America. In this case, Elbroch's decision to include selected Mexican species in Animal Skulls indicates that he uses the traditional definition of North America (Mexico northward). Given that, the author's selection of Mexican mammals seems haphazard-the hairy-legged vampire bat (Diphylla) is included, but not the more widespread and common genus Desmodus. The skull of a night monkey (Aotus) is shown on pages 120 and 240, despite the fact that night monkeys are exclusively Central and South American. Only 1 cetacean (Tursiops) is included in the species accounts. Although the author admits (page 108) that mammals are the focus of his book, his treatment of birds, reptiles, and amphibians is too superficial to make the book practical for field identification of nonmammalian skulls, even to the level of genus. Fish skulls are not illustrated or even mentioned in the book. A more fitting subtitle for this book would be A Guide to Selected North American Mammal Genera. The bird, reptile, and amphibian accounts should be retained as a surprise bonus for the reader, but they don't really deserve mention in the title.

Animal Skulls is endorsed by the American Society of Mammalogists because it is an excellent source of information on the mammalian skull. The book will appeal primarily to lay naturalists who want to identify (at least to genus level) mammal skulls they find in the field, and it may serve as a laboratory resource in mammalogy and vertebrate natural history courses that teach North American mammal taxonomy

to the genus level, as many do. It should be extremely useful to zooarchaeologists and others interested in identifying skeletal remains. Will this book replace existing mammalogy lab manuals, such as that of <u>Martin et al. (2001)</u>? Not likely, because most lab manuals cover mammals of the world (rather than just North America), and most go well beyond descriptions of skull structure and function. But it is this intense focus on the skull that makes *Animal Skulls* such an interesting contribution to the natural history literature. This book will appeal to anyone with a deep fascination with the structure, function, variety, and beauty of the vertebrate skull, which, as we mentioned at the outset, is just about everyone.