evolution. But he has still produced a very valuable book for professionals and students wishing an introduction to the evidence, ideas, and literature on the early history of animal life or seeking inspiration for new areas of research at the bottom of the metazoan fossil record.

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A Cetacean Species

The Gray Whale. *Eschrichtius robustus.* MARY LOU JONES, STEVEN L. SWARTZ, and STEPHEN LEATHERWOOD, Eds. Illustrations by Pieter Arend Folkens. Academic Press, Orlando, Fla., 1984. xxiv, 600 pp. $75.

The phenomenal upsurge in marine mammal research during the past decade is well exemplified by this volume that treats one of the most intensively studied species of great whale. Conveniently brought together are the results of 25 independent studies by 38 investigators (one Japanese, five Soviet, seven Canadian, and 25 American). The chapters are arranged under four general headings.

In the first section (Evolution, Fossils, and Subfossil Remains), L. G. Barnes and S. A. McLeod attempt for the first time to apply phylogenetic systematics to the baleen whales (suborder Mysticeti). They reaffirm the mysticete affinities of the problematic toothed *Aetiocetus* of the Oligocene (the allegedly related *Mirocetus* and *Ferecetotherium* are not mentioned). They also demonstrate that the traditional family Cetotheriidae is a non-monophyletic assemblage of early (Oligocene to Pliocene) baleen whales. The living mysticetes fall into four well-marked families: Balaenidae (right whales), Neobalaenidae (the pygmy right whale), Eschrichtiidae (the gray whale), and Balaenopteridae (rorquals). The polarity of the character-states that distinguish these taxa is discussed in detail. The distribution of apomorphic states reveals no unequivocal phylogenetic pattern. The authors criticize earlier ideas about the relationships among the mysticetes but do not try to resolve the phylogeny of either the living or the fossil taxa.

Although now living only in the North Pacific, the gray whale has long been known from subfossil remains in Europe. J. G. Mead and E. D. Mitchell now report 10 finds of gray whale bones from western North Atlantic beaches between Long Island and Florida. Carbon-14 dating reveals that the most recent specimen died in the late 16th or early 17th century. These discoveries lend some plausibility to the contention that the enigmatic "scrag whale" of New England colonial times was the gray whale.

The second section (Historical Relationships and Exploitation) covers the aboriginal, old-style, and modern fisheries for gray whales. The six chapters here bring together much previously untapped archival material that will interest historians and anthropologists as well as cetologists. I. I. Krupnick's account of aboriginal whaling in Siberia and H. Omura's account of early Japanese whaling summarize information from published and unpublished sources that are otherwise practically inaccessible to Western researchers.

Part 3 (Demography, Distribution, and Migration) includes nine chapters, all of which deal with the eastern North Pacific ("California") population (the western or "Korean" population appears to be close to extinction). Because of their narrow coastal migration corridor and their circumscribed inshore winter range, gray whales are one of the easiest wildlife species to count. They have been systematically censused many times from vessels, aircraft, and shore, and the data have been subjected to elaborate mathematical analyses. Having been responsible for much of this research, I have been disillusioned to find that population estimates based on surveys of the winter grounds and those based on migration counts differ by a factor of two. There is an even greater discrepancy between estimates of calf production. Many possible biases in these estimates are discussed by S. B. Reilly. Jones and Swartz's five-year study at Laguna San Ignacio and J. D. Darling's 10-year study at Vancouver Island, based on observations and photographs of individually recognizable animals, indicate one of the most promising directions for research on cetacean population ecology.

In the last section (Biology and Behavior), A. V. Yablokov, L. S. Bogoslovskaya, and S. A. Blokhin report studies on age, growth, reproduction, stomach contents, and parasites of gray whales killed in the Siberian subsistence fishery; their data corroborate and extend previous research conducted in California. Other authors have investigated feeding, sound production, diving patterns, and movements. The variety of new techniques they have used suggests some of the potential for future field studies of live whales. Side-scan sonar allowed M. Nerini to observe the impact of feeding whales on the benthic communities of the Bering Sea. Hydrophones revealed to M. E. Dahlheim, H. D. Fisher, and J. D. Schempp the diversified acoustic behavior of a species that less than 20 years ago was called "the quiet gray whale." Radio-tagging enabled J. T. Harvey and B. R. Mate to track a migrating whale for 6680 kilometers from Baja California to Unimak Pass, Alaska.

The editors have made it easy for readers to find their way among the wealth of new information. The table of contents and the running heads include both the titles and the primary headings of each chapter. At the head of each chapter is a complete outline of the contents. There is an adequate subject index, but names of organisms and authors are slighted.

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Meteoric Processes

Physics of Meteoric Phenomena. V. A. BRONSHTEN. Reidel, Boston, 1983 (distributor, Kluwer Boston, Hingham, Mass.). xviii, 357 pp., illus. $74. Geophysics and Astrophysics Monographs. Translated from the Russian edition (Moscow, 1981).

It has been over 25 years since the appearance of the classic theoretical monographs by B. Yu. Levin and the late E. J. Öpik on the phenomena that accompany the entry of meteoric bodies into the atmosphere of a planet. In *Physics of Meteoric Phenomena*, V. A. Bronshten has succeeded admirably in synthesizing and summarizing work done in this field since then. The topics covered will be of interest to workers in plasma physics, aerodynamics, radiation gas dynamics, meteoritics, meteor astronomy, and space science as well as to those concerned with middle and upper atmospheric physics, chemistry, and spectroscopy.

The author uses the model of simple ablation theory in a hydrostatic isothermal atmosphere as the context in which to view meteoric phenomena. What little is known regarding fragmentation and its eventual inclusion in a realistic way in the modeling process is considered in the last chapter of the book with an update in the last appendix of the English edition.

The book begins with a treatment of