evolution of different feeding modes in the adult animal. The volume ends with a metaphysical essay by Katz entitled "Is evolution random?" There is a good chance that at least one of these papers will change the way you think about the relationship between development and evolution.

GARY FREEMAN
Department of Zoology, University of Texas, Austin, TX 78712

Social Mammals

Behavioral Biology of Killer Whales. BARBARA C. KIRKEVOLD and JOAN S. LOCKARD, Eds. Liss, New York, 1986. xvi, 457 pp., illus. $79.50. Zoo Biology Monographs, vol. 1.

This is the first volume of the series Zoo Biology Monographs, which is intended to provide "a forum for indepth studies and reviews of diverse taxa and issues within the professional scope of practicing zoo biologists." The series is dedicated to the worldwide movement to preserve biological diversity, a movement in which zoological parks are playing an essential and increasing role. Judging by the first volume, these books, which aim to provide a thorough understanding of animals in their natural habitats as well as in captivity, should become an important resource not only for zoo biologists but also for conservationists and academics concerned with ecology and behavior.

The killer whale, *Orcinus orca*, is an immensely striking animal whether seen in the wild or in captivity. This long-lived, highly social species has provided unique opportunities for long-term research on behavior, ecology, and demography.

The book is divided into three main sections, considering evolution and natural history, behavior and social groupings, and vocalizations and communication. Most of the studies presented were conducted on three wild pods of killer whales found in the region of southern Vancouver Island, British Columbia, and Puget Sound in Washington State.

One of the major questions about killer whales concerns the nature of their mating system. In the first section, Duffield reviews the taxonomy of *Orcinus orca* and discusses chromosomal studies and their implications with respect to the mating system. Chromosomal evolution has been rapid in *Orcinus*, and the species karyotype has diverged radically from the strikingly conservative pattern of other cetaceans. Duffield suggests that this divergence might be caused by a social structure involving some degree of inbreeding.

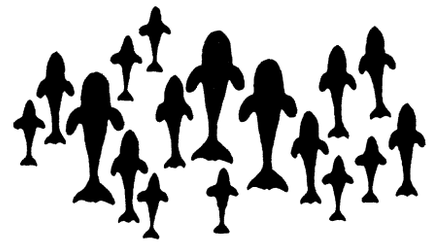
Matkin and Leatherwood review the literature on killer whale distribution, abundance, and social behavior. Their chapter and one on demography by Balcomb and Bigg show that killer whale pods are extremely stable social units with practically no dispersal of individuals between them. The integrity of pods is also indicated by the existence of pod-specific dialects, discussed later in this volume by Hoelzel and Osborne and elsewhere by J. K. Ford and H. D. Fisher (*Rep. Int. Whaling Commission* **32**, 671 [1982]). Sara Heimlich-Boran suggests that the males, traditionally assumed to be the breeding bulls in a pod, may be siblings or offspring of the pod's breeding females, residing permanently in their natal pod.

These studies suggest an unusual mammalian social system in which dispersal by either sex is rare or nonexistent and males breed either with close relatives in their own family pod or with females in other pods during social interactions between pods. More data are needed on this intriguing question.

The second section begins with a descriptive chapter by Jacobsen with interesting information on natural history, daily patterns, and foraging behavior of northern Vancouver Island pods. A chapter by Ray *et al.* presents data on social and respiratory synchrony of captive killer whales that will be of use in assessing the health of captive animals. A chapter by Osborne quantifies the time budgets of Puget Sound killer whales and gives particularly interesting descriptions of complex greeting ceremonies when pods meet and discussion of behavioral differences between these and the northern Vancouver Island pods.

The most intriguing chapter is by Sara Heimlich-Boran, who quantifies the frequencies of association between individual members of J-pod, one of the best-studied killer whale groups. Young calves prefer to associate with their own mothers, but after a few years, particularly when a younger sibling is born, they shift allegiance to a nonbreeding female, who is usually a close associate of their mother. This "aunting" behavior is particularly interesting, but, disappointingly, few data on the age and status of the "barren" females who act as "aunts" are presented here. Heimlich-Boran concludes that J-pod is composed of four subunits centered around breeding females and their offspring. This chapter is well complemented by a chapter by Haenel in which a clear qualitative description of calf behavior is given.

Two chapters on vocalization and communication by Morton *et al.* and Bain offer complementary approaches to studying the context of killer whale vocalizations in captivity and relating findings to the excellent earlier studies by Ford and Fisher in the wild.



Aerial diagram of killer whale tight resting formation. Pod size and age-sex composition are modeled after J-pod. [From R. Osborne's chapter in *Behavioral Biology of Killer Whales*]

In the final chapter Lockard summarizes the information presented in the book with reference to primate behavior. This one comparative chapter is disappointing because killer whale social behavior is as likely to converge with that of other carnivores, which are barely mentioned in the book, as it is with that of primates. The comparative analysis that is done is too brief and in a section entitled "are killer whales cannibalistic?" confusing. The book lacks an exhaustive comparative discussion of killer whale mating systems, which could have helped in formulation of hypotheses for future research.

Although few conclusions are drawn by the contributors, a wide variety of basic data are presented that will provide grist for the mills of marine mammalogists and those interested in mammalian social systems. In keeping with the goals of the series to which the book belongs, the information will also be of use to zoo professionals concerned with sound captive management of killer whales.

PETER O. THOMAS
Animal Behavior Graduate Group, Division of Environmental Studies, University of California, Davis, CA 95616

Books Received

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Asymptotic Theory of Statistical Inference. B. L. S. Prakasa Rao. Wiley, New York, 1987. xvi, 438 pp. $49.95. Wiley Series in Probability and Mathematical Statistics.

Atlas of Selected Oil and Gas Reservoir Rocks from North America. A Color Guidebook to the Petrology of Selected Oil and Gas Reservoir Rocks from the United States and Canada. Edwin W. Biederman, Jr. Wiley-Interscience, New York, 1986. xx, 399 pp., illus. $125.