

Introduction

Volume Editors

Advances in ecological theory and in the techniques employed in studying ecosystems, habitat rehabilitation, population dynamics, species diversity, reproductive physiology, genetics, and behavior have begun to change the course of conservation. Until recently, conservation efforts concentrated either on a particular species without regard for its ecosystem, or on the protection of a defined geographical area with little or no consideration for the interactions between animals and plants. Similarly, the conservation literature was devoted either to specific endangered species or to general conservation issues. Volumes such as *The Giant Panda of Wolong* (Schaller et al., 1985) and *Endangered Parrots* (Low, 1984) focused primarily on individual taxonomic groups, while works like *Conservation Biology* (Soulé and Wilcox, 1980) and *Genetics and Conservation* (Schoenwald-Cox, 1983) emphasized a specific methodological or research orientation. On a more global scale, recent emphasis has been on monitoring ecosystems and biodiversity (Verner et al., 1986; Jones, 1987; Wilson, 1988; McNeely et al., 1990; Goldsmith, 1991), and on habitat rehabilitation and restoration (Cairns, 1988; Berger, 1990).

A review of the *ex situ* conservation literature reveals a parallel evolution of philosophy from single species propagation to attempts to simulate and reconstruct ecosystems for the purpose of preparing captive populations for reintroduction into the wild (e.g. Conway, 1980, 1989; Stanley-Price, 1989). Again, the focus of this literature has progressed from primarily one-dimensional (i.e., lacking an integrated approach that addresses conservation issues from a variety of perspectives) to multidimensional. In only the past few

years *ex situ* conservation efforts have begun to integrate methods from diverse disciplines while keeping in perspective each species' unique evolutionary history and function within its ecosystem. The present volume was designed to advance this trend in *ex situ* conservation, and argues for a more integrated scientific approach to conservation research.

This book's dual organization includes taxonomic groups and scientific disciplines. Seven taxonomic groups comprise the volume's main divisions and include: (1) invertebrates, (2) fishes, (3) reptiles and amphibians, (4) birds, (5) mammals (excluding marine mammals and primates), (6) marine mammals, and (7) primates. The scientific disciplines represented in each taxonomic division are (a) conservation, (b) reproductive physiology, (c) behavior, and (d) habitat design in captivity.

Each of the twenty-eight chapters in this volume is intended to represent a review of the literature in one of the scientific disciplines within a taxonomic group. Although the number of species in some taxonomic groups is greater than in others, space in the volume was allocated based on the amount of literature to be reviewed, resulting in a greater emphasis on those taxa for which more scientific information is known. This organization of the volume illustrates the taxonomic imbalance in the current literature, and may serve to encourage increased investigation in less well-studied groups.

The disciplines chosen for inclusion in the book represent those areas for which there are no major works covering multiple taxa. Scientific fields such as genetics (e.g. Hartl, 1980; Schoenwald-Cox et al., 1983; Ryman and Utter, 1987; Soulé, M.E., 1987; Val Giddings et al., 1989), nutrition (e.g. Crawford, 1968; Lint and Lint, 1981; Robbins, 1983), and veterinary medicine (e.g. Fox, 1923; Page, 1976; Kinne, 1980; Montali and Migaki, 1980; Edwards and McDonnell, 1982; Wallach and Boever, 1983; May, 1988; Smith and Hearn, 1988) are well represented in the literature and therefore were not topics of focus in the present volume. Many of the authors, however, have referred to these aforementioned scientific disciplines in order to achieve a more interdisciplinary discussion of their respective topics. In spite of the multidisciplinary nature of this volume, it is not intended to stand alone, but to become part of the growing literature in the new field of integrative conservation research (e.g., Wilson, 1988; Western and Pearl, 1991).

The conservation chapters review the status of the taxonomic group, and the need for and problems of conservation programs in captivity. Authors have focused on issues concerning the decline of species and provide current assessments of species status, threats to survival in the wild, and a personal view of the value of conservation efforts in captivity for that taxonomic group. A portion of each chapter is devoted to a discussion of endangered and threatened species currently bred in captivity and includes suggestions for research priorities designed to meet the conservation needs of the twenty-first century.

The purpose of the reproductive physiology chapters is to provide a review of the genetic, physiological, and environmental influences on captive propagation programs. Authors describe the normal reproductive processes of endangered animals or closely related nonendangered species by summarizing the literature on anatomy, endocrinology, and physiology. Discussion of current and developing technologies designed to diagnose and remedy reproductive failure include monitoring of endocrine cycles, hormonal manipulation of the ovary and the estrous cycle, artificial insemination, embryo transfer, and cryopreservation of germplasm. Authors were encouraged to make suggestions for future research in reproductive physiology and to evaluate the impact of advanced technology on this scientific discipline.

Authors of the behavior chapters review the status of field research and discuss the rationale for behavioral research on endangered and threatened species in captivity. For each taxonomic group there is a summary of methods employed and problems encountered in research on captive species. Abiotic, biotic, and social factors that influence the behavior of individuals or social groups in the targeted taxon are examined in the context of maintaining species in captivity while preparing them for reintroduction to the wild. Opinions are expressed concerning the desired direction of behavioral studies including which areas of investigation hold the greatest promise for integrating behavioral research into future conservation programs.

The final chapter in each taxonomic section is devoted to habitat design. These chapters review the practical and aesthetic issues concerning the design of captive exhibits for endangered and threatened species. Topics that are discussed include: economic limitations, security, health concerns, and particular species' biological and psychological needs. Requirements for space, light, climate

control, and social considerations such as group dynamics and predator/prey relationships are analyzed. Authors have drawn from their own experiences in habitat design as well as from the literature on captive environments.

Each taxonomic division in the book is preceded by a brief preview introducing the authors in that section. A glimpse of the author's background serves to acquaint the reader with the individual style and research orientation to be encountered in the chapter. Although authors were provided with an outline of topics to be covered, they were encouraged to bring their own ideas and opinions to their chapters. Generally speaking, authors associated with zoological parks and aquariums or with government wildlife agencies (e.g., curators and field biologists) approach their disciplines with a more applied orientation, while basic science predominates in those chapters written by university personnel and zoo laboratory scientists. This intentional mix of professionals provides a cross section of the philosophies and perspectives that will shape conservation research in captivity.