

pictures of the early hominids and the artefacts they produced. Although it is expensive, think of it this way: if you are interested in your past, and how your past has provided you with the symbolic tools to be a scientist, then this is the handbook for you.

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Strengthening conservation with ethology

Behavioral Approaches to Conservation in the Wild

edited by Janine R. Clemmons and Richard Buchholz

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Biological conservation draws on a myriad of disciplines, including biology, sociology and economics. Few would disagree that the most successful conservation programmes are those that are multifaceted and multilayered, because of the complex terrain of conservation. It is in this spirit of diversity of approach that this volume urges conservation biologists to more actively include behavioural biology in their efforts to conserve and manage wildlife. Without a doubt, ethology is central to effective conservation biology. For instance, some of the most basic biological data used in conservation work come from the censusing of populations or species, and proper census methods require accurate knowledge of the behaviour of the target organism. Also, in the context of limited funding for conservation, it has been noted that some failures of past initiatives could have been avoided had ethologists been involved in the projects from the onset¹. It is this theme of enhancing conservation with behavioural biology that permeates this collection.

Although each chapter in this volume is laced with examples from published literature on how behaviour can help conservation, in general the contributions fall into two categories: those that argue from a theoretical level that ethology has much to offer conservation, and those that provide concrete case studies of how specific conservation programmes have benefited from involving behavioural biology. The former are quite varied and reflect the richness of ethology itself. One simple example from Chapter 1

is the observation that ethology tends to focus on the level of individuals or populations, whereas conservation biology traditionally has been concerned with the preservation of species, assemblages, or systems. And yet, more and more it appears that some conservation initiatives are better served by the use of populations as the units of management (for example, see Ref. 2). Indeed, behavioural differences among individuals within a species often delineate populations. The ethologist's ability to recognize and investigate these differences and thus describe different populations fits nicely with conservation geneticists, who also are concerned with distinguishing among populations.

Another example is related to conservation biology's goal to preserve diversity. Rather than concentrate primarily on preserving genetic diversity, as conservation biology has emphasized in the past, it is suggested that behavioural diversity should be protected as well (for instance, Chapter 4 points out that differences in migration of the monarch butterfly populations on the eastern and western coasts of North America should be protected, not just monarchs as a species). Furthermore, it is noted that variation in behaviour can be used in phylogenetic analyses, in conjunction with other traditional characters such as differences in genetics or morphology, and so enhance the taxonomic classification of organisms. Taxonomic classification is considered essential in constructing management units in the preservation of biodiversity³. Again, the spirit of ethology as a powerful complement to the other disciplines in conservation is emphasized.

A number of the contributions in this book describe concrete examples of conservation programmes with ethology in action. The editors managed to pull together a wide variety of case studies, ranging from hatching asynchrony in parrots (Chapter 7) to sea-finding of marine turtle hatchlings (Chapter 13). Throughout these examples, it becomes clear that behavioural information is necessary to enhance the design and success of conservation initiatives. One powerful example is the potential use of food supplementation to sustain or boost numbers of a small population (Chapter 11). In the case of Seychelles magpie robins, supplementary feeding increased the number of young that survived, but because breeding territories were limited, young magpie robins often became 'floaters' and disrupted the reproductive success of established breeding robins. In the case of red foxes, abundant food sources foster the expression of polygyny, which can reduce the effective population size because of an increased number of non-breeding males in the population.

One of the greatest strengths of this book is the way all the contributors stress the need to integrate a variety of perspectives in

conservation biology. Rather than attempting to elevate behavioural biology above other disciplines, this volume presents ethology simply as one more tool in the conservation's toolbox, acknowledging the contributions of other approaches. This becomes particularly clear in Chapter 10, which describes how genetic research has been employed to uncover the mating behaviour of endangered species. Knowledge of mating systems within populations is a prerequisite for effective population modeling and for accurately predicting changes of the population in response to altered environments.

Conservation biologists who read this volume will find it very inspiring. It should stimulate them to ponder how they can enhance their own conservation projects and research initiatives by incorporating a behavioural perspective. For ethologists, this volume should spur them to consider how they might contribute more to the conservation and management of wildlife.

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- 3 Wilson, E.O. (1992) *The Diversity of Life*, Harvard University Press

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