

ANIMAL BEHAVIOR **AND** WILDLIFE CONSERVATION



EDITED BY
MARCO FESTA-BIANCHET & MARCO APOLLONIO

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Support for Island Press is provided by The Nathan Cummings Foundation, Geraldine R. Dodge Foundation, Doris Duke Charitable Foundation, Educational Foundation of America, The Charles Engelhard Foundation, The Ford Foundation, The George Gund Foundation, The Vira I. Heinz Endowment, The William and Flora Hewlett Foundation, Henry Luce Foundation, The John D. and Catherine T. MacArthur Foundation, The Andrew W. Mellon Foundation, The Moriah Fund, The Curtis and Edith Munson Foundation, National Fish and Wildlife Foundation, The New-Land Foundation, Oak Foundation, The Overbrook Foundation, The David and Lucile Packard Foundation, The Pew Charitable Trusts, The Rockefeller Foundation, The Winslow Foundation, and other generous donors.

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AND Wildlife Conservation

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ISLAND PRESS

Washington • Covelo • London

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Library of Congress Cataloging-in-Publication Data

Animal behavior and wildlife conservation / edited by Marco Festa-Bianchet and Marco Apollonio.

p. cm.

Includes bibliographical references and index.

ISBN 1-55963-958-X (hardcover : alk. paper) — ISBN 1-55963-959-8 (pbk. : alk. paper)

1. Animal behavior. 2. Wildlife conservation. I. Festa-Bianchet, Marco. II. Apollonio, Marco.

QL751.A6497 2003

636.9—dc21

2003005623

British Cataloguing-in-Publication Data available.

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Printed on recycled, acid-free paper 

Manufactured in the United States of America

09 08 07 06 05 04 03 10 9 8 7 6 5 4 3 2 1

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Preface

The Ettore Majorana Center for Scientific Culture in Erice, Sicily, is known worldwide as a place where important meetings happen, scientific collaborations begin, and new ideas are generated. The unique character of Erice, a walled town perched high upon a hill overlooking the sea, the efficiency and professionalism of the Center's staff, and the great facilities available (from conference rooms to restaurants) combine to provide a wonderfully stimulating atmosphere.

During a 1998 workshop in Erice on vertebrate mating systems, we two editors, Marco Festa-Bianchet and Marco Apollonio, saw the need for more reflection on how the study of animal behavior could facilitate conservation. When Professor Danilo Mainardi, director of the School of Ethology at the Center, asked us to organize another workshop, we said, in unison, "Behavior and conservation," even though we had not previously discussed the idea.

The invitations we extended were met with widespread enthusiasm—many researchers in animal behavior believe their work has useful applications in wildlife conservation. Most of our invited speakers began their scientific career by looking at fundamental questions in the evolution of animal behavior, and then moved to more "applied" research questions. Often, that switch in emphasis was motivated by the realization that animal populations were disappearing as their habitat was being altered by human activities and while many conservation programs continued to ignore the importance of animal behavior, particularly that of individual differences.

We asked all speakers to first review the theoretical foundations of their subject, then explore its implications for wildlife conservation. We also asked all authors to emphasize both the advantages and the limitations of applying knowledge in animal behavior to conservation.

The workshop on Animal Behavior and Conservation was held in Erice in November 2000. All participants provided a chapter for this book, which we rounded out with contributions from researchers who did not take part in the workshop. Financial support for the workshop in Erice was provided by the Erice Center, the Regional Government of Sicily, and the Italian Ministry of University and Scientific Research.

We are very grateful to our colleagues who provided very constructive reviews of earlier drafts of individual chapters: Erin Bayne, Merav Ben-David, David Coltman, Steeve Côté, Tim Coulson, André Desrochers, John Fryxell, Jean-Michel Gaillard, Brendan Godley, Rich Harris, Keith Hobson, Jeff Hutchings, Petr Komers, Wendy King, Gordon Luikart, Sandro Lovari, Dan Mazerolle, Bruce McLellan, Jan Murie, and Bill Sutherland.

Part I

Why Animal Behavior Is Important for Conservation

1.

General Introduction

Marco Festa-Bianchet and Marco Apollonio

Many of the species with whom we share our planet are going extinct because we overexploit them or destroy their habitat (Ehrlich and Wilson 1991, Caughley 1994). Species extinction and habitat destruction have an immediate impact upon many economic and social activities because various uses of wildlife provide income, enjoyment, or recreation for millions of people (Geist 1994). It is therefore not surprising that interest in the conservation of biodiversity is increasing among the general public as well as among behavioral ecologists who study wild animals and their environment.

Two related disciplines, wildlife conservation and wildlife management, use ethological knowledge to limit the impact of humans on ecosystems. Wildlife conservation is concerned with the preservation of species and their habitat in the face of threats from human development. Wildlife management, including fisheries management, seeks sustainable strategies to exploit wild species while ensuring their persistence and availability for future use. Ideally, these strategies should also not damage components of the ecosystem other than the exploited species. Although the distinction between the two disciplines is often blurred, wildlife management is often oriented toward specific objectives for one or a few species of economic interest. The goals of conservation are broader and include the preservation of genetic diversity so

that species will maintain their ability to evolve in response to environmental change. Recently, however, wildlife conservation and management are coalescing into a single discipline. Management is often a component of conservation strategies (for example, limited sport harvest of some high-profile species can be used to generate funds for habitat preservation [Lewis and Alpert 1997]), and the conservation of genetic diversity or interpopulation connectivity is often a goal of wildlife management. For simplicity, we will use the term *management* in this introduction to refer both to situations where wild animals are the subject of some form of exploitative management, and to situations where they are of concern because they are at risk of extinction.

Regardless of how one defines *wildlife management* or *wildlife conservation*, however, practical application of these terms inevitably involves the consideration of both animal and human behavior. This book explores how knowledge of animal behavior can help prevent species extinction and sustainably exploit wildlife populations. It is clear to us, however, that human behavior plays a far greater role than animal behavior in both conservation and management.

The Role of Animal Behavior in Wildlife Management

It is important to define the role that animal behavior can play in wildlife conservation and management. Problems in wildlife management are a subset of the global environmental problems that are of interest to conservation biology. Major ecological problems include the wholesale loss of species through habitat destruction; the pollution of air, soil, and water; the introduction of exotic species (including domestic animals, parasites, and pathogens); and the alteration of global biogeochemical cycles. Knowledge of animal behavior is not the sole key to solving global conservation problems; but then, paradoxically, neither is any branch of ecology or any other science. Indeed, biologists do not make the important decisions that affect species extinction and people's continued ability to benefit from functional ecosystems. Such decisions are the purview of politicians and business leaders, who are primarily interested in political and economic goals and are therefore much more influenced by political and economic processes than by science (Morowitz 1991).

Changes in socioeconomic circumstances are also important. For example, immediately following World War II, agriculture was the main occupation in several southern European countries. People were widely distributed over the countryside. Almost all natural resources were exploited, including lands with low productivity. Following industrialization in the mid-1960s, much of

the land that was either hilly or mountainous was abandoned as people sought a more comfortable lifestyle in cities. Space and resources in the abandoned countryside became available for wildlife. Urbanization may thus explain the recent recovery of wildlife in Europe more than any other economic or biological process. In North America, increased affluence, good rural road networks, and ability to work from home are instead leading to suburbanization of wildlife habitat, with negative consequences for biodiversity, especially of large predators.

Everyone can make “minor” decisions with environmental consequences, from not eating seafood caught with methods causing extensive bycatch of nontarget species, to not building a home on critical habitat, to family planning, to voting patterns in democratic societies. Zoologists, including animal behaviorists, clearly play a major role in the conservation of biodiversity by informing decision makers and the general public about the ecological consequences of human activities. Solving the global conservation problems that threaten our quality of life, and in some cases our very lives, will require scientific knowledge, but first and foremost it will require a better system of economic valuation of goods and services. Economic externalities such as pollution, habitat destruction, and the loss of ecological functions (including those that provide clean air, safe drinking water, and a stable climate) must be incorporated in the evaluation of different activities (Chichilnisky and Heal 1998). Perhaps the greatest contribution that ecologists can make to environmental conservation is to convince decision makers at all levels, from heads of state to individual consumers, to think about the long-term consequences of their decisions.

Behavioral ecologists typically study the long-term evolutionary consequences of different animal behaviors. As a result, when examining the consequences of human actions, they usually consider a longer timescale than the few years to the next election, or this year’s balance sheet, or the time it takes to win one particular court case. It is essential that they transmit such long-term thinking to other sectors of society.

Students of animal behavior can provide an extremely important approach to wildlife conservation because of their tendency to examine individual differences, to emphasize the role of variability, and to think in terms of trade-offs between different behavioral strategies. Such emphasis on the behavior of individuals and the strategies they adopt to maximize fitness plays an important role when a species’ natural behavior can lead to conservation problems in habitats altered by humans. In extreme and rare cases, the best management strategy may be to interfere with a species’ natural behavior.

The study of animal behavior is most usefully applied to the conservation

and management of populations because it both identifies and provides ways to deal with a key characteristic of animals: they are not all alike. Individual differences in age, sex, size, aggressiveness, learning ability, past experience, heterozygosity, and a myriad of other variables can all affect how an animal reacts to a given situation and may determine the success or failure of a management strategy or a conservation initiative. Conservation of animal populations thus often depends on meeting the challenge of how to incorporate individual differences in wildlife management. The importance of individual differences in wildlife conservation is a central theme of this book.

There is a hierarchy of levels of individual heterogeneity, and all are important to wildlife management and conservation. One may start by considering behavioral differences between similar species. For example, two North American canids, the wolf (*Canis lupus*) and the coyote (*C. latrans*) react in opposite ways to urbanization and intensive agriculture: wolves disappear, coyotes prosper (Tremblay, Crête, and Huot 1998; Mladenoff, Sickley, and Wydeven 1999). One may argue that the coyote's greater behavioral adaptability is the key to its success because it allows coexistence with humans, whereas the wolf's behavior leads to its demise: wolves range over a wide area, hunt in packs, and are intolerant of humans. Within the same species, however, there are often behavioral differences between broad geographical areas: wolves in southern Europe coexist with human population densities that are much greater than densities that wolves tolerate in North America (Promberger and Schroeder 1992). The animals belong to the same species, but their behaviors are very different. Southern European wolves resemble North American coyotes in their ability to survive alongside dense human populations. At a smaller geographical scale, variables such as prey type and level of human exploitation can affect pack size, turnover rates, and social structure, which in turn can determine the level of genetic diversity by varying the opportunities for dispersers to recruit into packs. Indeed, it has been suggested that high levels of shooting and trapping in eastern Canada may artificially increase the rate of hybridization of wolves with coyotes (Wilson et al. 2000). Finally, the sex/age composition of each pack, individual preferences, and previous experience may affect variables such as prey selection or space-use patterns, which may in turn affect vulnerability to human harvest or the probability of conflict with humans because of livestock depredation.

Specialist predators that appear to form a "search image" for a particular type of prey are a very good example of how animal behavior can affect wildlife management on a local scale. Marco Festa-Bianchet has studied the ecology and behavior of bighorn sheep (*Ovis canadensis*) in the Sheep River population since 1981 (Festa-Bianchet et al. 1995). From 1982 to 1995, cougars (*Puma concolor*) were studied in the same area. Most cougars in the

Sheep River drainage had radio collars. From 1982 to 1993, they killed only zero to two sheep a year. From 1993 to 1995, one adult female cougar suddenly switched from hunting deer (*Odocoileus* spp.) and wapiti (*Cervus elaphus canadensis*) to preying upon bighorn sheep, and was almost single-handedly responsible for a 20% decline in the bighorn population (Ross, Jalkotzy, and Festa-Bianchet 1997). A similar phenomenon occurred in another study area, Ram Mountain, from 1997 to 1999: again, following a sudden increase in cougar predation, mortality of adult females doubled, mortality of adult males tripled, and the bighorn population declined by almost 50%, although factors other than cougar predation were likely also involved. Almost no cougar predation was recorded at Ram Mountain from 1972 to 1997, but cougar signs were seen in almost every year. In both cases, the increase in predation was apparently due to an individual cougar's specialist behavior. Predation was not associated with increased availability of bighorn sheep as prey or, apparently, a decline in alternate prey.

Because the behavior of bighorn sheep is very different from that of cervids, a cougar must change hunting technique to prey on sheep. Hunting bighorn sheep requires specialized, learned skills that not all cougars have. Indeed, one male cougar attempted to kill a lamb and was itself killed when he and his victim fell off a cliff. From a management viewpoint, the experience both at Sheep River and at Ram Mountain suggests that a generalized predator-control program would have had little effect without removal of the sheep-killing individual (Ernest et al. 2002). Finally, in both cases cougar predation led to an increase in bighorn mortality despite low population density: because the increased predation was due to individual behavior, it was independent of population density.

At about the same time, some cougars in southwestern Alberta started preying on domestic dogs, possibly as a response to increased residential development on cougar range, which is currently a problem in many areas in western North America. Included among the victims were the hounds used to capture cougars at Sheep River from 1985 to 1994. The normal reaction of a cougar pursued by hounds is to climb a tree. It is likely that tree-climbing by cougars has been selected as an adaptive response to pursuit by packs of wolves. Wolves compete with cougars for the same prey and can kill a cougar if they can catch it. Cougars may react to dogs as they would react to wolves. Once a cougar learns that domestic dogs are easily killed, however, it may change its behavior and fight rather than run. Clearly, dog kills lead to rural residents' intolerance of cougars in general. Faced with a difficult social situation, it would be very valuable for managers to know whether the dog-killing behavior is generalized or limited to a few specialist cougars. It would also be very useful to know how to prevent the development of dog-killing

behavior in wild cougars. These examples show how behavior, even the behavior of single individuals, can affect many aspects of wildlife management.

Goals of This Book

Our principal objective in assembling this volume was a simple one: to provide a broad overview of how knowledge of animal behavior can improve our ability to manage wildlife. Most chapters explore how conservation strategies either are or should be affected by animal behavior and how particular aspects of behavior affect the viability and growth of populations. Others explore the limits of animal behavior's contribution to conservation biology. In particular, the book addresses practical aspects of conservation and explores the role of animal behavior in the conservation of various ecosystems. Contributors examine both the importance of general principles and the key role played by specific characteristics of different species. Conservation is not a biological problem, it is a human problem. We do not subscribe to the view that wildlife management must improve natural systems, but rather believe that management actions are required either to remedy environmental damages caused by humans or to lessen the impact of human exploitation on natural systems. Because behavior can affect the reactions of wildlife to different conservation strategies, behavior must be taken into account for both remedial and preventive management. The chapters herein will outline the circumstances in which animal behavior affects conservation biology, and identify which behaviors are particularly important to ensure either the continued survival or the sustainable exploitation of wildlife.

Because conservation biology arises from a need to prevent, or at least lessen, human impact on ecosystems, an exploration of the role of animal behavior in conservation must take into account the diversity of situations that are faced in different areas of the world. Human attitudes, societal orientations, economic diversity, and traditions are all very important aspects of wildlife conservation. Social attitudes also determine what people want to protect or exploit, which wild species have economic or cultural value, and the acceptance of different management strategies. These social and economic factors interplay with animal behavior to affect the consequences of human actions on biodiversity. To partially account for diversity in both biology and culture, we attempted to select contributors interested in different aspects of animal behavior, based in different countries, and with expertise in animal behavior in a variety of geographical and political settings. We were only partially successful, mostly because researchers interested in and able to pursue studies in animal behavior are most often based in Western countries. The contributors bring to bear their own scientific expertise as well

as their personal experience. Just as differences in behavior can affect the success of alternative conservation strategies, differences in societal attitudes are often the main reason why a conservation strategy can work in one human setting and fail in another.

Structure of the Book

The book is organized into five parts. In part I, chapter 1 provides a general introduction. In chapter 2, Morris Gosling explores the main reason why animal behavior is important to conservation: because individuals differ, models attempting to predict population dynamics, genetic variability, and the risk of population extinction can be improved by a consideration of individual behavior.

Part II (chapters 3–7) considers how resource-use strategies affect wildlife conservation. Rosie Woodroffe examines how dispersal behavior, particularly of carnivores, can have both positive and negative implications for conservation. Dispersing individuals can in some situations ensure gene flow and sustain a metapopulation structure, but in other cases dispersal movements bring carnivores into conflict with humans. When most habitat has been destroyed, the chances of successful dispersal are so low that emigration becomes essentially a source of mortality.

Paolo Luschi details the example of marine turtles, which migrate over huge distances over very long periods of time, requiring international coordination of protective measures. For exploited populations there is uncertainty over national “ownership” of different stocks, because individuals traverse the territorial waters of several countries.

André Desrochers considers how different bird species behave near edges of different types of habitat to show how this behavior affects the ability of different species to cope with habitat fragmentation brought about by forest harvesting. This is a very important topic in many boreal forests where forestry activities are expanding, often with unknown consequences for biodiversity.

Isabelle Côté examines fisheries management with and without taking into account details of fish mating systems. Norman Owen-Smith underlines the importance of foraging behavior for the reintroduction of extirpated large herbivores to remaining habitat. Both chapters argue that a knowledge of animal behavior is essential for the success of management programs: availability of suitable habitat is not necessarily all that is needed to guarantee the persistence of some animal populations.

Part III (chapters 8–12) examines practical applications of animal behavior in wildlife management. Jean-Michel Gaillard and coauthors provide an