
*Primate Responses
to Environmental Change*

Primate Responses to Environmental Change

Edited by

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Introduction

This book concerns the various ways that primates respond to environmental change. By studying these patterns of responsiveness we not only gain useful knowledge about the structural, physiological and behavioural propensities of different species, but also acquire important information relating to issues of contemporary concern, such as conservation and the management of animals in the wild as well as in various forms of captivity.

For example, there is growing concern among biologists and conservationists about the influence of habitat destruction, such as logging, on the fitness and survival of wild primates. There is also increased awareness of the need to improve the care of primates in zoos and laboratories, including the enrichment of captive environments. Further, because an increasing number of primate species are becoming endangered, knowledge of their responsiveness to new environments is an essential requirement for effective breeding programmes in captivity, and for the translocation and rehabilitation of species in the wild.

In theory, studies of many closely related species are required in order to consider relevant evolutionary processes, as well as to develop functional hypotheses about the adaptive significance of various biological propensities and their interrelationships in the short and longer terms.

In the case of primates, we have a sound body of information about the physiological responsiveness, social organization, cognitive capacities and life strategies of different species. However, we need a much wider comparative data base and, so far, there have been few long-term comparative studies. Moreover, it is only relatively recently that researchers have turned to studying the interrelationships of primate characteristics and how these influence the ways in which different species, and individuals of different age and gender within species, respond to changes in their environment.

The idea for this volume developed from that of my last single-

author book entitled *Primate Behaviour and Social Ecology*, which was also much concerned with aspects of responsiveness to environmental change. Since that publication in 1984 there have been notable developments in this research area and I believe that the time is now right for a volume devoted solely to the topic. The aim has been to provide information in novel contexts on a wide variety of theoretical and practical issues, and to stimulate further interest in an area with enormous research potential. The result is an unusual contribution in biology, and, at the time of writing, there is no similar text. Students in a variety of disciplines, including zoology, psychology, anthropology, conservation biology and wildlife management, should find it valuable.

I have organized the book into three parts, for each of which I give an introductory overview of the contents. The first part presents a series of discussion papers. Briefly, these generally involve characteristics of primates that underpin their responsiveness to change. These include morphological and sensory characteristics, behavioural flexibility in the short and long term, cognitive abilities, interrelationships between physiological and behavioural indices of responsiveness, reproductive status and social change, and, last but not least, the delineation and potential functions of individual variation in responsiveness.

The second part is devoted to environmental change in nature. Many topics could have been chosen. I made the selection from studies that address critical and frequently occurring examples of environmental change, and the contributors provide new perspectives and, most often, new information. The topics included are deforestation, provisioning by supplemental food, the problem of primates as pests, rehabilitation of apes into a free-ranging environment, the responsiveness of different species of ape to attempts by observers to habituate them to their presence, and, finally, problems of primate conservation.

Similar perspectives determined the choice of topics in the third part. An overriding aim in this case was to present principles and techniques that will, hopefully, stimulate different kinds of research in captivity. For example, the means whereby natural patterns of behaviour may be encouraged are discussed in various contexts. Several empirical studies also demonstrate the comparative interface between reproductive status and social behaviour in species of marmosets and tamarins. 'Stress' responses are considered with reference to the nature of the physiological mechanisms involved and the environmental stressors that influence them. Long-term and interdisciplinary comparative studies of two species of New World

monkeys present an exemplary case of the interrelationships between behavioural organization and physiological responsiveness. The final concluding remarks on my part are an attempt to highlight some advances in studies of environmental change generally, as well as to indicate future developments.

With two relevant exceptions (Chapters 1 and 5), all the material in the book refers to simian primates (monkeys and apes) exclusively. This bias reflects my own interests, but there is also a good case at this relatively early stage for not confusing attempts to draw out many of the comparative perspectives by including studies on prosimian species. Primate responsiveness within the whole order has to recognize that prosimians 'share distinct patterns of anatomy, physiology and behaviour which make them quite unlike simians . . . that prosimians are specialised along very different lines from simians' (S.K. Bearder, personal communication). There is also much interest in simian species in the wild as important indicators of the state of whole ecosystems. Moreover, in captivity, they elicit special concern for their environmental needs, given their natural social, cognitive and manipulative skills. It is also the case, of course, that higher primates are appropriate models for many biomedical interests, as well as for investigations of comparative principles of responsiveness to environmental change.

Finally, as an editor, I have inevitably found that editing a book really *is* all the things that one is told it is going to be! In some cases there have indeed been many hours of apparently thankless work. Nevertheless, there has also been a sustained interest and enthusiasm for the whole project on my part, as well as on that of the contributors. It is my pleasure to thank each and every one of them with warmth and respect. Undertaking any such project presupposes not only a willingness to work at it, but the availability of appropriate secretarial assistance. 'Appropriate' in this context ideally implies a very high level of speed and typographical accuracy, together with a sufficient interest in the whole enterprise to make it a pleasure to work with (rather than despite) the person, and on whose help in numerous ways one may completely rely. My thanks as ever go to Joan M. Morris, whose work on all these counts has been superb.

It is also a pleasure to acknowledge the skill, tact, and friendly advice of Sarah Bunney, who copy-edited the manuscript. I thank her most warmly on behalf of all of us.

Hilary O. Box

— Part One —
General Perspectives



A white-handed gibbon (*Hylobates lar*) feeding on the terminal branches of a tree in Malaysia. (Photo: David Chivers/Anthrophoto.)

In this first part of the book is a series of discussion papers on the characteristics of primates that influence their responsiveness to environmental change. David Chivers (Chapter 1) lays a sound foundation by considering the importance of feeding strategies, as the means whereby species can adjust to short-term and long-term changes that occur naturally, as well as those brought about by human destruction of habitats. To this end, he describes primate characteristics in terms of their special senses, locomotion and posture, masticatory apparatus, digestive systems, and the ways in which adaptations to different types of diet influence potential responsiveness to environmental perturbations.

Phyllis Lee (Chapter 2) considers sources of environmental change in nature and the various ways in which these may be studied. In particular, she provides some examples to establish principles of adaptive behavioural responsiveness. As an example of a short-term change, she considers changes in behaviour among the chimpanzees of Gombe Stream National Park, Tanzania, with reference to the supply of provisioned food. Innovation and traditions of behaviour are also described. Ecological changes in the longer term are discussed with reference to life history variables and, most unusually, she further considers attributes of behavioural flexibility that have contributed to the survival and extinction of different primate genera.

The editor (Chapter 3) considers aspects of cognitive processes among the primates that are implied, but not empirically well understood, in the context of responsiveness, with special reference to the complexities of social change. She then considers how responsiveness is expressed differently among species, according to their different lifestyles and physiological propensities.

In line with an increasing interest in the complex parameters that influence primate reproduction, David Abbott (Chapter 4) provides a comparative review to emphasize the social control of fertility. Recent research, such as his own, into the influences of the social status of females, gives clear insights into the ways in which fertility in different species may be influenced to varying degrees by social environment.

Finally, it is an unfortunate omission in our knowledge and thinking about responsiveness to change that so little attention is given to issues which concern the nature of, and especially the functions of, individual variation. Anne Clark (Chapter 5) redresses this balance admirably, by drawing together information from various disciplines. She proposes that the differences among behavioural characteristics between one individual and its

conspecifics are adaptive rather than the exact value of the characteristics in a continuum of variation.

Species differences in tolerance to environmental change

DAVID J. CHIVERS

1.1 INTRODUCTION

The central issue in considering tolerance to environmental change – the secret of survival for both individuals and species – lies in the ability to locate, consume and process adequate food; only then can individuals breed successfully to perpetuate the species. Food location involves the use of special senses and postcranial musculoskeletal system in locomotor aspects of positional behaviour. Food consumption or intake involves postural behaviour and manual activity and/or oral movements. Food processing involves mechanical breakdown of food in the mouth and chemical breakdown in the gastrointestinal tract, as well as transport through the whole digestive system. These three crucial facets of behaviour will be examined in turn for primates living in different environments, with special emphasis on their capabilities to cope with changes, whether natural or induced by humans.

Primates are unusual among mammals in their lack of anatomical specialization and in their behavioural flexibility. Their success lies in avoiding specializations for faunivory (eating animal matter) or folivory (eating leaves or grasses), and in escaping the reproductive constraints of the oestrous cycle. Although the behavioural, especially social, advantages of the menstrual cycle of haplorhine primates (tarsiers, monkeys, apes and humans) are of prime importance, the focus in this chapter is on diet and feeding behaviour in the widest sense – on the ecological aspects of behaviour.

Most orders of mammals are specialized for eating either animal matter (vertebrate and/or invertebrate) or foliage. Faunivores include the Insectivora (insectivores), Carnivora (carnivores) and Cetacea