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Behavior, Ecology, and Conservation of Colobine Monkeys: An Introduction

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The Colobinae of Africa and Asia are perhaps best known for their specialized stomachs, which allow them to subsist on leafier and more chemically defended diets than most other primates (Kay and Davies, 1994; Oates *et al.*, 1994). Many colobines are also renowned for their shy and indolent dispositions (Fashing, 2006), traits that make them particularly challenging study subjects. Nevertheless, research on colobines has led to some of the most exciting and contentious discoveries in the history of primate behavior and ecology.

Over the past 3 decades, colobines have been at the center of an ongoing debate about the adaptive function of infant killing by males. After repeatedly witnessing male Hanuman langurs (*Semnopithecus entellus*) attempting to kill unrelated infants on Mount Abu, India in the early 1970s, Hrdy (1974, 1977) proposed the groundbreaking hypothesis that infanticide was part of a sexually selected alternative male reproductive strategy. In addition to inspiring a legion of impassioned detractors (Bartlett *et al.*, 1993; Curtin and Dolhinow, 1979), Hrdy's hypothesis stimulated a large body of research not only on primates, but also on other animals, from burying beetles to barn swallows to lions (van Schaik and Janson, 2000). Though the issue of infanticide's adaptive function for male primates remains far from resolved today, at present the strongest evidence consistent with the

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sexual selection hypothesis has come from studies on the very same colobine species that first inspired Hrdy to develop her hypothesis, Hanuman langurs (Borries *et al.*, 1999, a,b).

In addition to their influential contributions to our understanding of male reproductive strategies, colobines have played an important role in efforts to answer one of the fundamental questions in ecology: what are the ecological determinants of animal abundance? Influenced by earlier theoretical work by Janzen (1974) on the factors affecting vegetation quality in tropical forests, McKey (1978, 1979) examined the extent to which the chemical composition of plant items influenced food choice by black colobus (*Colobus satanas*) at Doula-Edéa, Cameroon. The results of this study led McKey (1978) to suggest that colobine abundance is limited by the quality of the mature foliage available at a site. Although McKey (1978, 1979) overestimated the importance of plant chemical defenses on the palatability of leaves to colobines, the results of many subsequent studies have supported his important general notion that leaf quality influences colobine abundance (Chapman *et al.*, 2002; Oates *et al.*, 1990; Waterman *et al.*, 1988). In fact, colobine research over the past few decades has established such a tight predictive relationship between mature leaf quality and colobine biomass across forests (Davies, 1994; Fashing *et al.*, 2007) that it represents one of the strongest examples yet known in the animal kingdom of a single ecological variable influencing animal biomass.

While the contributions of colobine biologists to the fields of primate behavior and ecology have been considerable, colobine researchers have perhaps been even more vital to the development of the relatively new field of primate conservation. Some of the earliest articles on primate conservation were written by the colobine specialists Struhsaker (1972, 1981) and Oates (1977, 1979, 1981), who, in addition to being influential primate ecologists, are leading conservationists today (Oates, 1996a, 1999; Struhsaker, 1997; Struhsaker *et al.*, 2005). Working extensively in rain forests across Africa, Struhsaker, Oates, and colleagues documented the adverse effects of logging, hunting, and other destructive human activities on colobines and other sympatric primates (Oates, 1996b, 1999; Struhsaker, 1997). They also recently had the unfortunate task of having to report the near extinction of Miss Waldron's red colobus (*Piliocolobus badius waldronae*), the first primate taxon to essentially disappear in *ca.* 500 yr (Oates *et al.*, 2000; McGraw, 2005). Oates (1996b) contends that among the primates, colobines such as *Piliocolobus badius waldronae* are unusually vulnerable to extirpation and extinction via hunting because of their inopportune combination of large body size, sluggishness, and often low levels of visual

alertness. Indeed, though they account for only 15% of living primate species (Cowlishaw and Dunbar, 2000), 9 (36%) colobines are on the 2004–06 list of the world's 25 most endangered primates (Mittermeier *et al.*, 2005).

Considering the conservation threats facing colobines, the increased research attention given the subfamily in recent years is encouraging. In fact, there are more colobine studies ongoing today than ever before, with data on issues relating to colobine behavior, ecology, and conservation accumulating at an unprecedented pace (Fashing, 2006; Kirkpatrick, 2006). Seeking to convene as many colobine biologists as possible to present their latest research findings and exchange ideas for future research and conservation priorities, I organized an all-day symposium entitled *Behavior, Ecology, and Conservation of Colobine Monkeys* that was held at the XXth Congress of the International Primatological Society meetings in Torino, Italy on August 27, 2004. After the Congress, 8 participants submitted manuscripts based on their talks to the *International Journal of Primatology*; they appear here in revised form as the first 8 articles in this issue. The Editor-in-Chief of the *International Journal of Primatology* later added 3 additional independently contributed papers consistent with the theme of the issue.

This collection represents a series of primarily natural history-based field studies, several of them employing tools that are relatively new to colobine biology such as GIS (geographic information systems) and computer modeling. It is also clear from this issue that researchers have not applied recent technological innovations in noninvasive hormone monitoring (Lasley and Savage, 2006) and molecular genetics (Di Fiore and Gagneux, 2006) as widely to the colobines as they have to many other primates. While these techniques promise to help answer longstanding questions and open up new avenues for research in colobine biology, the value of observational, question-driven natural history studies such as the ones featured in this issue should not be forgotten. Even with the recent upsurge in research on colobines, it is alarming that many of the world's endangered colobines have never been the subject of even 1 basic ecological study. Many managers are thus faced with the difficult task of planning for the conservation of colobine species whose basic needs they know very little about. It is a sad irony that at a time when the distributions of primate taxa are shrinking worldwide, and population surveys and natural history data are needed more than ever to facilitate informed conservation planning and management, there is increasingly little funding available for this type of basic research.

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