JAGUAR PREDATION ON MURIQUI *BRACHYTELES ARACHNOIDES*

So far, no natural enemy, apart from man, has been recorded for the muriqui, *Brachyteles arachnoides*. However, the species' defensive behavior suggests it is not free from predation, the lack of records being due to a lack of studies in areas where both muriquis and predators, such as big cats and raptors, co-exist (Galetti, in press). One such area is the Fazenda Intervales (for a site description see Olmos, 1991), where there is both a sizeable muriqui population (Martuscelli and Petroni, 1994) and some of the last living jaguars (*Panthera onca*) in the Atlantic forest domain.

On 1 November 1989, while conducting a bird survey near the Saibadela research base in an area of primary forest at an altitude of 65 m, I found a dried jaguar scat (recognizable by general appearance and size) composed almost entirely of the soft, pale golden hairs of a muriqui, along with a few bone fragments. This is the first record of a jaguar feeding on a muriqui.

Although the monkey could have been scavenged, I believe that predation is more likely. Wardens at Intervales report that jaguars feed on muriquis, and the marked mobbing behavior displayed by the monkeys in the presence of a jaguar suggest that they recognize it as a threat, and predation may even occur during such encounters (Galetti, in press, pers. comm.), or when the monkeys descend to the ground for drinking.

Popular tradition has it that the jaguar is fond of monkey flesh (Santos, 1984) but the only accounts qualifying this are given by Schaller (1983), who reported predation on *Aotus* and *Alouatta caraya* in the Brazilian Pantanal, and Emmons (1987) who found one *Ateles paniscus* among 40 prey items in the diet of jaguars in the Peruvian Amazon. The paucity of data on neotropical big cats does not permit speculation on their impact on primate populations.

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MURIQUI CONSERVATION: THE URGENT NEED OF AN INTEGRATED MANAGEMENT PLAN

The Need of a Plan: In previous numbers of this newsletter, Sérgio Mendes and Adriano Chiarello (vol. 1, no. 2) and Karen Strier (vol. 1, no.3) revived an important issue: the necessity of human interference for the long term conservation of the muriqui (*Brachyteles arachnoides*). Two conflicting considerations can be drawn from the two articles. The first is the urgent need of action. The species is known to occur today in a few fragments of the once widespread Brazilian Atlantic Forest. Many of these fragments are located within privately owned areas, or in official reserves that are in need of better protection. Mendes & Chiarello suggested that, at least in the case of the state of Espírito Santo, muriquis from small private forests should be translocated to larger protected reserves with low population densities.

The second consideration is the need of scientific data to diminish costs and risks of conservation measures. For Mendes and Chiarello, translocations should be preceded by the confirmation of the size and composition of remaining groups, and accompanied by the acquisition of genetic and morphological data. Strier suggested that systematic studies on the ecology and demography of the involved populations should also be conducted for three years before and after translocations.

The suggested accompanying studies illustrate how measures cannot to be taken in isolation, and in both articles it is implicit that translocations would help us develop a long term management plan for *Brachyteles*. I agree on the urgent necessity of both translocations and a management plan, but in my opinion the latter should be our most immediate goal at the moment. There are many management

options to be considered, each one representing different interrelated problems, and requiring different sets of data (Strier, 1992). An efficient plan should integrate how much we already know about muriquis and the different management options, and also what relevant data are still unavailable. Option priorities could then be established, and isolated measures could be put in a more comprehensive and pragmatic perspective.

The idea of an integrated plan for muriqui management is not new. Célio Valle, pioneer muriqui researcher and conservationist, has been informally proposing it for a few years now. In part, Célio's ideas never took off because muriqui ecology and behavior has only been the subject of intensive field research within the past decade. Decisions depending on the knowledge of the natural habits of the species were hindered by lack of data. On the other hand, *Brachyteles* has quickly become one of the most studied Brazilian primates (Bernardes *et al.*, 1988).

Integrating Available Information: Decisions concerning translocations of muriquis to new areas illustrate the need of an integrated plan. The success of such measures will depend on the impact they have on both source and target populations, and on the chances translocated individuals will have to survive and reproduce. Accompanying studies (Mendes & Chiarello, 1994; Strier, 1994) can help in our attempts to predict and measure this success, but only if their results are evaluated in a comparative perspective.

Previous research on muriqui feeding behavior and socioecology (i.e., Milton, 1984; Fonseca, 1985; Strier, 1991; Rimoli, 1994), and on demography (i.e., Milton & de Lucca, 1984; Lemos de Sá, 1991; Paccagnella, 1991; Strier *et al.*, 1993) are therefore of great importance. This research can indicate relevant parameters to be quantified during accompanying studies, and serve as sources of comparative data. In this way, we can better evaluate the proximate causes of different population densities at different sites, and their suitability as source and target areas for translocation.

Muriquis subjected to management action will not only face new ecological constraints, but new social environments as well. Data on muriqui social relationships (i.e., Mendes, 1990; Strier, 1992b; Rimoli, 1993) should also be considered whenever we are to form or break social groups. Males, for instance, remain in their natal group throughout their life, and establish hierarchical relationships based on strong affiliative bonds, rather than dominance hierarchies based on agonistic interactions (Mendes, 1990). They are otherwise intolerant of males from other groups. Intergroup male interactions are generally restricted to disputes associated with the monopolization of estrous females and large food sources (Strier *et al.*, 1993). Males left with little or no allies of the same sex may reach very low rates of reproductive success, depending on the level of intrasexual competition they will face. Likewise, the establishment of captive groups containing unfamiliar males may be hindered by their lack of predisposition to form affiliative bonds.

Results of previous muriqui research can provide scientific support for decisions on how to conduct specific measures for conservation. Other decisions will require further data, since there are many aspects of muriqui ecology and behavior that are still poorly understood. Assessing how much we know, and what we should learn through field research is an immediate necessity.

Priorities: As Mendes and Chiarello and Strier point out, capturing and moving individuals will represent costs as well as risks. Acquired funds should therefore be carefully allocated so that areas and populations in greater need of action are not given low priorities. The necessity, risks, and costs of translocations should also be weighted in relation to those of other measures, such as the creation and development of captive breeding programs, and the protection of legal and private reserves.

Setting priorities immediately is hindered by the lack of at least two relevant sets of data: the exact number and location of muriquis remaining in the wild; and the extent of deleterious effects of inbreeding in present populations. New muriqui groups are still being discovered, as illustrated by Mendes and Chiarello's survey of *Brachyteles* in the state of Espírito Santo, and the report by Martuscelli and Petroni (1994) for São Paulo, Rio de Janeiro, and Paraná. Estimates of the total population and the degree of inbreeding at known sites remain largely speculative. At the Caratinga Biological Station, for example, earlier suggestions of inbreeding depression were offset by the observed high rate of population growth and low rates of infant mortality in the past 11 years (Strier *et al.*, 1993).

A better picture of the current distribution of *Brachyteles*, and the degree of inbreeding depression at different sites, will certainly help us

to decide on priorities, and to evaluate the role different types of reserves could play. Protecting large official reserves is of obvious importance. Besides their overall greater biodiversity, they may hold large viable muriqui populations that may need little or no human interference in the short term.

Small private reserves may have, on the other hand, a complementary role in the preservation of *Brachyteles*. There are very few large areas of Atlantic Forest that are both demarcated as official reserves and efficiently protected, and each has a limited carrying capacity. Despite the recent progress at the Rio de Janeiro Primate Center, captive individuals have yet to reach the two digits mark. Each privately owned forest currently containing muriquis thus represents a valuable summation of genetic material, which can be stocked now for future action. Besides, measures may be used to enhance genetic diversity at relatively small sites as well as larger ones (Strier, 1992), augmenting the total number of viable populations and individuals.

Most of what we know of muriqui natural habits comes from one private reserve, the Caratinga Biological Station. This site, along with larger areas now being studied (e.g., Carlos Botelho State Park and Fazenda Intervales, both in São Paulo) are also important for the continuation of research and the acquisition of comparative data. In Carlos Botelho, for instance, two years of trail cutting and habituation were necessary before systematic data began to be collected (Oswaldo Carvalho Jr., pers. comm.). Establishing further field sites for muriqui research is important but also time consuming, and the already productive field sites should be respected for their potential as guaranteed sources of rapid data acquisition.

Perspectives: Other plans for preserving wild primate populations demonstrate the complexity of management action. The reintroduction program of the golden lion tamarin, for instance, was accompanied by prior and follow-up studies of the behavior and ecology of captive and wild groups, a carefully designed environmental awareness campaign, and the reinforcement of the protection of the Poço das Antas Biological Reserve (Dietz *et al.*, 1986). Even then, unpredicted factors, such as the need to train groups to locomote on flexible supports and to search for food through micromanipulation, prior to release into the wild, delayed the success of the project. For *Leontopithecus*, the effect of this delay was counterbalanced by an extensive and successful captive breeding program.

Muriquis have slow rates of infant development, take approximately six years to mature, and mothers give birth to a single infant every two years at best (Strier, 1992). Success in captive breeding is beginning to be achieved for the first time at the Rio de Janeiro Primate Center (Coimbra-Filho *et al.*, 1993, 1994), but the establishment of a viable captive genetic bank could be a matter of many years. There is little room for trial and error, or the misplacement of priorities. Saving *Brachyteles* requires a thoughtful and scientifically sound plan.

Karen Strier is currently organizing a symposium on field studies of muriqui ecology and behavior, to be held at the VIth Congress of the Brazilian Primatological Society in July, 1994. Each researcher will summarize his/her objectives and results, and their significance to the conservation and management of *Brachyteles*. Likewise, the IUCN/SSC Captive Breeding Specialist Group is planning a Population and Habitat Viability Analysis (PHVA) workshop for early 1995. The symposium and workshop will tell us how much we know and what we should learn in the immediate future, and help us establish our priorities. It will represent the first opportunity for Célio Valle's old idea of a truly comprehensive plan to take off.

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News

Project Keystone Plants for Large Frugivores in the Atlantic Forest of Brazil

The importance of fruits for the community of large frugivores (including birds and mammals) has been studied since 1986 by Mauro Galetti in a semideciduous forest near Campinas, in the state of São Paulo. In this study the diets of tufted capuchins (*Cebus apella*) (see Galetti and Pedroni, 1994) and brown howling monkeys (*Alouatta fusca*) (see Galetti *et al.*, 1994) were compared with the whole community. The study was presented as a master's thesis at the State University of Campinas (Unicamp) under the supervision of Dr. Patrícia Morellato (Galetti, 1992; Galetti, 1993). In contrast to studies in the Amazon region, keystone plant species were not evident. Primates shift their diets during the periods of fleshy fruit scarcity (dry season), whereas birds usually migrate or eat fruits of low nutritional value. During the dry season capuchins became seed and flower predators while howlers increased the amount of leaves in the diet (Galetti and Peres, 1993).

To determine if this pattern is a general trend in the Atlantic forest, Mauro Galetti is continuing his studies as a Ph.D. candidate at the University of Cambridge, England, under the supervision of Dr. David J. Chivers. His field work started in October 1993 at Fazenda Intervales, Sete Barras, São Paulo, where he is studying the population density and