

Conclusions

Guajá cultural survival as well as the survival of endemic primate species in the region is extremely threatened. The situation has escalated since 1985 with construction of the Carajás railway through the middle of their territory to mine iron. Guajá reserves are highly contested from agribusiness, loggers, and *posseiros* (illegal Brazilian squatters) systematically encroaching into their habitat, creating subsequent deforestation and development.

Conservation of the indigenous reserves is of particular importance for the endangered *Chiropotes satanas satanas* and the recently identified *Cebus olivaceus kaapori*, whose habitat is restricted to the traditional territory of the Guajá people. The hunting of monkeys for food in itself, particularly using indigenous methods, is often not the real threat to monkey populations. Hunting pressure more often arises in the wake of deforestation when monkey populations are reduced and restricted to circumscribed patches which may then allow a species to be hunted out entirely. The fates of the Guajá people and the local monkeys are intertwined. Preservation of the indigenous reserves of the Guajá for traditional hunting also provides primates a refuge from habitat destruction.

Acknowledgments

I am most grateful to the Guajá people, the National Indian Foundation (FUNAI), the Brazil Science Council (CNPq), the Museu Goeldi Herbarium, the Tulane University Herbarium, and João Farias Guerreiro of the Universidade Federal do Pará. Financial support was obtained through grants from the Fulbright Institute for International Education, the American Society of Primatologists, and the Tinker Foundation.

Loretta Ann Cormier, Department of Anthropology, 338 Ullman Building, 1212 University Boulevard, University of Alabama at Birmingham, Birmingham, Alabama 35294-3350, USA.

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HABITAT FRAGMENTATION AND PARASITISM IN HOWLER MONKEYS (*ALOUATTA CARAYA*)

Antonia Concepción Mirope Santa Cruz
 Juan Toribio Borda, Exequiel María Patiño
 Laura Gómez, Gabriel Eduardo Zunino

Introduction

Comparative studies of ecto- and endoparasitism affecting howler monkeys (*Alouatta caraya*) in relation to the fragmentation of their habitat are unknown for Argentina. Translocation of fauna is potentially dangerous for both the translocated and resident populations, which may lack resistance when confronted with new species of parasites. In order to better manage the translocation of species and to help solve conservation issues, it is important to understand the effects of parasitism. Here we report observations on the fragmentation of habitat and parasitism in populations of *Alouatta caraya*.

Methods

Habitats

Three study sites were chosen in northeastern Argentina. The first was a severely fragmented and degraded semideciduous forest (SF) in the basin of the Río Riachuelo, San Cayetano (Corrientes province) (27°30'S, 58°41'W).

The second was a flooded forest (FY) recently fragmented by the lake formed by the Yaciretá dam in Ituzaingó (Corrientes) (27°28'S, 56°44'W). The third was a flooded forest (FF) on the island of Brasilera (Chaco province) (27°20'S, 58°40' W). This last forest was considered a control because there is almost no human activity and it is not severely fragmented. These sites are within the Chaqueña and Paranaense Biogeographic Provinces (Cabrera and Willink, 1973).

Parasitological analysis

A total of 44 animals were sampled, 21 (48%) from SF, 9 (20%) that were rescued from FY before the dam completion, and 14 (32%) from FF. The howlers were captured using anesthetic darts. Each was inspected systematically, fur and all natural orifices, for all visible arthropods and tissue samples were taken from cutaneous lesions and other areas suspected of acari infestation. The samples were preserved in Railliet and Henry's solution for systematic classification and the acari were cleaned in Amman's lactophenol (Amato *et al.*, 1991) for identification. The faecal analyses were carried out using flotation (modified Ritchie's method), and by simple sedimentation (Weitz *et al.*, 1992). Trematode, cestode and nematode eggs were identified using a light microscope. Vegetative forms of protozoa were determined by using the method of Thienpont *et al.* (1979).

Results

The highest occurrence of parasitism was observed in San Cayetano (SF): 57% of the howlers sampled. Eight species

of parasites were recorded, four of which were not found in the other groups (Table 1). The monkeys captured in Yaciretá (FY) showed 44.4% infestation, with four species of parasites, and only a single species was present in the Brasilera (FF) group. In this control area, only 7.14% of the specimens sampled had parasites, with a single species (Table 2).

Discussion

The most frequent endoparasitosis and the only one identified in all three sites was bertellosis (De Negri, 1985). Psoroptidosis (Fain, 1963; O'Connors, 1988) and oxyurosis and strongiloidosis were detected only in the fragmented habitats. The howlers also showed louse infections, protozoosis, trematodosis and nematodosis in the severely fragmented habitats SF and FY.

The results indicate that infestation indexes are directly related to the area and degree of fragmentation of forest available to the howlers. The group size and density were considerably smaller in the severely fragmented forest at San Cayetano but similar at Yaciretá and Isla Brasilera. Although sample sizes were small, especially for Yaciretá, the high degree of parasite infestation at San Cayetano may reflect, or be associated with, the behavioral and ecological disruption caused by fragmentation (Ojeda and Mares, 1984). Fewer trees in smaller forest fragments indicate less food, and the monkeys in these areas tend to spend a longer time in each tree (Kowalewski and Zunino, 1999), increasing their exposure to infection and reinfection from parasites (Freeland 1976, 1980; Gilbert, 1994). Small forest fragments with insufficient food also forces the monkeys

Table 1. Parasites found in the three study sites.

San Cayetano (SF)	Yaciretá (FY)	Isla Brasilera (FF)
Ectoparasites		
<i>Pedicinus (Pediculus) mjobergi</i>		
<i>Cebalges gaudi</i>	<i>Cebalges gaudi</i>	
Endoparasites		
Protozoa (unidentified ameba)		
Trematoda (eggs) Unidentified		
<i>Bertiella mucronata</i> (eggs)	<i>Bertiella mucronata</i> (eggs)	<i>Bertiella mucronata</i> (eggs)
Nematoda (eggs) Unidentified		
Oxyuridae (eggs)	Oxyuridae (eggs)	
<i>Strongyloides</i> sp. (eggs)	<i>Strongyloides</i> sp. (eggs)	

Table 2. Study sites, number of samples and degrees of parasitism.

	San Cayetano (SF)	Yaciretá (FY)	Isla Brasilera (FF)
N	21	9	14
% infested	57	44.4	7.14
Number of parasite species	8	4	1
Density (monkeys/ha) ¹	0.9	2-3	2-3
Group size ¹	5	10	12
Home range (ha) ¹	-8	-4	-4
Habitat fragmented ¹	YES	YES (recent)	NO

¹ Brown and Zunino (1994); Zunino *et al.* (1995).

to go to the ground to travel between forest patches, also increasing the probability of infestation. The effects of fragmentation on parasite loads and rate of infection should be considered in the management (especially reintroduction and translocation) of species such as *Alouatta caraya* in Argentina.

Acknowledgments

This investigation was carried out with the support of the Secretaría General de Ciencia y Técnica, Universidad Nacional del Nordeste (SGCyT/UNNE-PI 489). We thank M. Kowalewski for his comments on earlier drafts of the manuscript.

Antonia Concepción Miropé Santa Cruz, Juan Toribio Borda, Exequiel María Patiño, Laura Gómez, Facultad de Ciencias Veterinarias, Universidad Nacional del Nordeste, Sargento Cabral 2139, 3400, Corrientes, Argentina, and **Gabriel Eduardo Zunino**, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" CONICET. División Mastozoología. Avda. Angel Gallardo 470, 1405, Buenos Aires, Argentina.

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A STUDY OF SPIDER MONKEYS (*ATELES GEOFFROYI VELLEROSUS*) IN THE FOREST OF THE CRATER OF SANTA MARTA, VERACRUZ, MÉXICO

Gilberto Silva-López
Joaquín Jiménez-Huerta

Although studies at Sierra de Santa Marta, Veracruz, Mexico, have documented the situation of primates inhabiting the forest fragments of the slopes of the mountainous massif (e.g., Benítez-Rodríguez, 1989; Silva-López, 1987; Silva-López and García-Orduña, 1984; Silva-López *et al.*, 1986, 1988, 1993), little is known of the primate groups inhabiting the crater of Santa Marta. Santa Marta is an extinct volcano located to the south of the Los Tuxtlas region, and harboring one of Veracruz's larger continuous tracts of tropical rainforest. Los Tuxtlas, including Sierra de Santa Marta, was recently decreed a Biosphere Reserve by the Federal Executive (23 November, 1998) (Enrique Portilla Ochoa, pers. comm.), which was endorsed and supported by the several studies conducted throughout the years on its rich fauna and flora (Andrle, 1964; Rappole and Warner, 1980; González Ch. *et al.*, 1987; González Soriano *et al.*, 1997). Based on this study and on recent visits made by Domingo Canales Espinosa (pers. comm.), it can be safely assumed that no major changes have occurred to the vegetation of the crater in the 4–5 years since the original survey.

The walls and bottom of the crater are covered by high evergreen rainforest, and encompass an area of approximately 5,000 ha. According to Mario Vázquez Torres (unpubl. data; see also Benítez-Rodríguez *et al.*, 1992), vegetation in both the forest and the forest fragments of the Sierra's eastern slopes is very similar in structure and species composition, with *Pseudolmedia oxyphyllaria*, *Guarea glabra*, *Cymbopetalum penduliflorum*, *Inga* spp., *Sapium lateriflorum*, *Brosimum alicastrum*, *Dendropanax arboreus*, *Ficus* sp., *Rheedia edulis*, *Terminalia amazonia*, and *Nectandra ambigens* among the dominant species. Due to the steep slopes of the crater walls