cathemeral activity. However, given the nature of the habitat, and the obviously restricted food resources, one could logically conclude that such activity was likely in order to ensure survival. A careful survey of the habitat revealed a number of small tree holes, cactus tangles, and other suitable retreats of sufficient size to accommodate an adult *Aotus* or a small family group. Those which we investigated did not contain any owl monkeys or other mammals, nor did they show any signs of recent use, such as food remnants, waste, hair, or rub marks.

This is the furthest north that we have observed *Aotus* in the Chaco, although Handen *et al.* (1994) documented the presence of owl monkeys in a location identified as Area II in the northernmost department, the Chaco. Multiple observations of a pair with and without offspring between 1989 and 1997 have been made in a farming area outside of the Mennonite colony of Neuland in the Chaco Central (D. Meritt Jr., unpublished observation: it is unclear if they were of the same pair, their offspring or unrelated animals). The habitat is considerably different in that location, as are the potential food resources. Neuland is part of the Mennonite colony located near Filadelphia in the Chaco Central. It is typical Chaco, without rocks and with dense thorny shrubs and an abundance of trees. The region is several hundred kilometers south and west of Defensores del Chaco and Cerro Leon, and considerably wetter.

Redford and Eisenberg (1992) report the presence of infant *Aotus* in the Paraguayan Chaco in August, September, and October. This corresponds with the present observation and those mentioned above in Neuland (D. Meritt Jr., unpublished). A number of authors have previously reported the presence of *Aotus* in large tree cacti, including Rathbun and Gache (1980), Stallings (1984, 1985), Stallings and Mittermeier (1983) and Stallings *et al.* (1989).

At the time of year when this observation was made, there were no fruits or seeds present in or on the vegetation and no flowers to be seen. There were a number of small lizards and infrequent small birds, but no large flying insects. A search for *Aotus* droppings to try to determine possible food sources was unsuccessful.

Acknowledgments: The authors are grateful for permission to carry out scientific studies in Paraguay through the courtesy and authority of the Ministro, Secretaria del Medio Ambiente. Partial support for this work was provided by the Chacoan Peccary Species Survival Plan (SSP) of the American Zoo & Aquarium Association (AZA) through funds provided by M. Scott for "Proyecto Tagua".

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The Use of Camera-Traps in a Survey of the Buff-Headed Capuchin Monkey, *Cebus xanthosternos*

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Camila Cassano

Introduction

The buff-headed or yellow-breasted capuchin monkey (*Cebus xanthosternos*) is endemic to a restricted region of the Atlantic Forest of eastern Brazil, one of the richest and most threatened ecosystems in the world (SOS Mata Atlântica *et al.*, 1998; Myers *et al.*, 2000). Due mostly to habitat destruction and hunting, this once-abundant species is rapidly declining in number, and is one of the 25 most endangered primates in the world (Mittermeier and Konstant, 2000; Konstant *et al.*, 2002; Mittermeier *et al.*, in prep.). In 2002 we began a survey of the remaining yellow-breasted capuchin monkey populations throughout its original distribution, in order to establish the conservation status of the species and to identify the threats to its survival.

Local people in all remaining forested areas in the original distribution of the species (as indicated by Oliver and Santos, 1991) were interviewed to determine if *C. xanthosternos* was still present in the area. Because these monkeys occur in low densities and are very difficult to see or hear, confirmation of their presence was difficult. We first tried to attract the capuchins with playback calls, using recordings of their vocalizations, but the groups did not answer. The large number of forests to be surveyed rendered the use of linear transect methods unfeasible. The presence of human observers may also frighten capuchins, since they are hunted. In order to confirm the presence of *C. xanthosternos* in the forests we decided to use camera-traps.

Camera-traps have been used successfully in numerous studies of large mammals. They provide information on species richness, activity patterns, abundance, and population density (Karanth and Nichols, 1998). The technique, however, is normally used in studies of terrestrial animals. Here we describe the use of camera-traps to collect information on arboreal primates.

Materials and Methods

We set up CamTrakker camera-traps (<http://www.camtrakker.com>) in forests where two or more interviews of local farmers or hunters had suggested the presence of capuchins. The cameras were fixed with elastic cords on trees directly in front of a platform on a second tree, mounted about 2 m above the ground and baited with bananas (Fig. 1). Each camera-trap has an infrared sensor aimed at the platform; when the sensor detects a moving heat source, it triggers the camera, and thus captures images of whatever species climbs the platform to eat the bananas. We used chains and padlocks to secure the cameras to the trees to deter theft.

We visited the platforms every week to replace the bananas and change the film in each camera. The cameras were set to shoot only during the day, with a delay time of 90 seconds to prevent multiple photographs of the same individuals. The main aim of our survey was to register the capuchin monkeys; the number of cameras and the time they were left in the field varied according to the ease of access to the forest and its size.

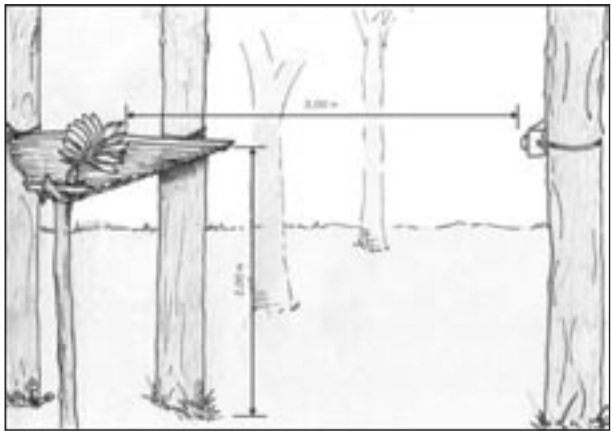

Figure 1. Camera-trapping arrangement: platform baited with bananas, and the CamTrakker camera mounted three meters away.

Results

We installed camera-traps in 13 different forests and used three to eight cameras in each, depending on the size of the fragment (approximately 1:400 camera/ha). *C. xanthosternos* was successfully phototrapped in all of the 13 areas. The time necessary to achieve photos of the monkeys varied from one week to three months.

The technique also proved efficient in recording the presence of four other primate species in the region (Table 1), besides other mammals normally difficult to detect such as *Eira barbara*, *Nasua nasua*, and *Sciurus aestuans*. When the cameras were set to operate both day and night, they also caught *Procyon cancrivorus*, *Rhipidomys mastacalis*, *Micoureus demerarae*, *Marmosops incanus* and *Didelphis aurita* eating the bananas on the platform.

Discussion

Camera-traps have been used to record a large number of mammal species, especially those which are furtive and inconspicuous. They can also be used in ecological studies to estimate relative abundance and population density (Karanth and Nichols, 1998; Trolle and Kéry, 2003). In these cases, the location and the sampling duration need to be standardized. This was not, however, the objective of our study, which was merely to confirm the presence and identity of the animals.

In some areas, and for certain primate species, it is possible to play a tape of their calls (playback) along trails to attract the groups and/or to stimulate a reply (Diego *et al.*, 1993; Kierulff, 1993; Mendes, 1993; Pinto, 1994). However, the buff-headed capuchins failed to respond to recordings of their calls even in areas where they were known to occur.

The use of bait can alter group home ranges and also bias sampling due to the attraction of determined species. By using bananas for bait, we expected to attract frugivorous

Table 1. Primates registered with camera-traps, Bahia, Brazil.

Cebidae	
Cebus xanthosternos	Buff-headed capuchin; macaco-prego-do-peito-amarelo
Callitrichidae	
Leontopithecus chrysomelas	Golden-headed lion tamarin; mico-leão-da-cara-dourada
Callithrix kuhlii	Wied's black-tufted-ear marmoset; mico-estrela
Callithrix penicillata	Black-tufted-ear marmoset; mico-estrela
Callithrix geoffroyi	Geoffroy's tufted-ear marmoset; sagüi-de-cara-branca

Figure 2. Buff-headed capuchin monkeys, *Cebus xanthosternos*, caught by a camera-trap on a platform baited with bananas.

and omnivorous species, a prediction confirmed by our records of *C. xanthosternos*, the golden-headed lion tamarin (*Leontopithecus chrysomelas*), and the marmosets (*Callithrix*). More folivorous species such as howler monkeys (*Alouatta*) and titi monkeys (*Callicebus*) were not caught by the camera-traps. Although these latter two were present in some of the areas we surveyed, they were apparently not attracted to the platforms and the bananas. Both *Alouatta* and *Callicebus* use the upper canopy more consistently than the primates listed in Table 1, and since the platforms were only 2 m above the ground, the howlers and titi monkeys may not have had the opportunity to find the fruit and be photographed.

As they were photographed feeding in small groups, the images allowed us to identify minimum numbers of individuals (Fig. 2). Photographing dependent infants and juveniles helps to determine demography and reproductive seasonality. Camera-traps also provided additional information, such as the interactions between *C. kuhlii* and *L. chrysomelas* caught feeding at the same time. Associations between these species have been reported by Rylands (1989) and Raboy (2002) in the region of Una in Bahia.

When the goal is only to verify the occurrence of a species in a given area, the use of camera-traps is efficient and relatively inexpensive when compared to playback and linear transect techniques, which are more time-consuming and require more trained researchers to walk the trails. Although the cameras themselves are quite expensive, it takes little time to prepare the platforms and few people to monitor the cameras, bait the platforms and change the film. They proved to be vital for the success of our survey of *C. xanthosternos* and other primates that are otherwise so elusive.

Acknowledgments: For their financial support of this project, we acknowledge PROBIO/MMA, FNMA/MMA, the Disney Wildlife Conservation Fund, the Margot Marsh Biodiversity Foundation, the European zoos involved in the breeding programme (EEP) of *C. xanthosternos* (Apenheul, The Netherlands; Chester and Colchester, UK; Mulhouse, the Friends of Mulhouse Zoo, and La Vallée des Singes, France; and Zürich, Switzerland), Conservation des Espèces et des Populations Animales (CEPA), France, and the Zoologische Gesellschaft für Arten- und Populationsschutz (ZGAP), Germany. For their assistance and additional support, we also thank IBAMA, IESB, UESC, Conservation International – Brazil and the members of the International Committee for Management and Conservation of *C. xanthosternos* and *C. robustus*. I also acknowledge most especially the inspiration of Dr. James Sanderson, who introduced us to the "art of camera-trapping" and gave us our first cameras to test. We are grateful to Gabriel Pacheco for the drawing of the platform; to Waldney Pereira Martins, Edsel Amorim Moraes Jr., Fábio Falcão, Priscila Suscke Gouveia, and Cassiano Gatto for their support during the fieldwork; and Renato S. Bérnils and James Sanderson for their comments on the final text.

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Preservation and Extraction of DNA from Feces in Howler Monkeys (*Alouatta caraya*)

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Introduction

Techniques of molecular genetics are increasingly used to study various aspects of the social systems of human and wild non-human primates (Altmann *et al.,* 1996; Gagneux *et al.*, 1999; Nievergelt *et al.*, 2000; Paabo, 2003; Di Fiore, 2003). In the past, studies of primate molecular genetics were limited by the availability of blood or tissue samples for DNA extraction. Today, samples such as hair and feces, obtainable through non-invasive methods, are preferred for genetic analysis. This strategy avoids the capture of the animals, minimizing any undesirable impact on their behaviour as well as preventing injuries and infectious diseases either to the animal or the sample collector (Constable *et al.*, 2001; Sibal and Samson, 2001). As a result, it is becoming safer and easier to obtain information on kinship, sex ratio, effective population size and gene flow in undisturbed populations of arboreal and threatened species.

Although a number of recent studies have used non-invasive sampling to examine aspects of the social structure of several Old World primates (Gagneux *et al.*, 1999; Gerloff *et al.,* 1999; Goossens *et al.*, 2000; Constable *et al.*, 1995, 2001; Vigilant, 2002), only a handful of studies have used feces from New World monkeys as a source of DNA for molecular studies (Surridge *et al.*, 2002; Escobar-Paramo, 2000; Böhle and Zischler, 2002). The main goal of this study was to test alternative methods for preserving and subsequently extracting DNA from fecal samples of a New World primate, in order to identify a low-cost solution that might be broadly applied in molecular ecological research on platyrrhines.

Materials and Methods

Sampling

We collected fecal samples from two groups of black-and-gold howler monkeys in two habitats: flooded forest on Brasilera Island, near the confluence of the Río Paraná and Río Paraguai in the Chaco region of northern Argentina (27°20'S, 58°40'W), and the semi-deciduous forest of the basin of the Río Riachuelo, a tributary of the Río Paraná, further to the southwest (27°30'S, 58°41'W) near the southern margin of the geographic range of *A. caraya*. Samples were collected from a total of five different individuals immediately after defecation. Individuals 1 and 2 were from the flooded forests, and individuals 3, 4 and 5 were from the riparian forests. In all cases one sample (10 g) was taken from each individual and subdivided into four sub-samples of approximately 2 g each, which were then preserved according to the following protocols:

1. In paper envelopes kept in shadow at approximately 20°C (68°F);