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Front Cover:
A female golden-faced saki, *Pithecia pithecia chrysocephala,* from the Central Amazon. Photo by Russell A. Mittermeier.

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Short Articles

Plantas Útiles en la Alimentación de Primates en la Cuenca del Río Samiria, Amazonia Peruana

Rolando Aquino
Richard E. Bodmer

Introducción

La Reserva Nacional Pacaya Samiria, con una extensión de 2,150,770 ha (Rodríguez *et al*., 1995) y enclavada entre los ríos Marañón y Ucayali, está dominada por bosques inundables de agua blanca, lo que dio origen a un ecosistema complejo con diversos tipos de hábitat, entre los que se encuentran los aguajales (asociación de *Mauritia flexuosa*), restingas y llanuras. En estos tipos de bosques habitan diversas especies de mamíferos entre arbóreos, semi-arbóreos o excelentes nadadores (Peres, 1997). Entre los mamíferos arbóreos se encuentran 12 especies de primates que para sobrevivir se alimentan de las plantas adaptadas a los cambios estacionales de inundación y estiaje. Los bosques inundables o de várzea, sujetos a grandes inundaciones, tienen menos diversidad de plantas que los bosques de altura o de tierra firme, pero no por ello son menos importantes. Al respecto, se conoce muy poco sobre la diversidad de plantas de cuyos frutos y otros órganos se alimentan los primates que habitan en la citada reserva. Hasta ahora, el único estudio sobre dieta alimentaria de primates fue llevado a cabo por Soini (1986, 1995) en bosques de llanura de la Estación Biológica de Cahuana, ubicada en el curso medio del río Pacaya de la Reserva Nacional Pacaya Samiria (RNPS). La escasa información disponible nos motivó a la conducción del presente estudio, el cual se llevó a cabo en paralelo a los censos por transecto de mamíferos en la cuenca del río Samiria y bosques afines de la RNPS, próximos al límite con el río Marañón. Aquí presentamos un avance sobre los resultados obtenidos de junio de 1997 a enero del 2001.

Áreas de Estudio

Los registros de plantas alimenticias fueron llevados a cabo en restingas (alta y baja), llanuras y aguajales del bosque de várzea y en terraza baja del bosque de altura de los principales tributarios del río Samiria, desde muy cerca de la confluencia con el río Marañón, aguas arriba hasta la quebrada Cauchillo (Fig. 1). Como parte del estudio también se incluyeron los bosques circundantes al curso medio de la quebrada Yanayacu de Pucate, cuyas aguas son vertidas directamente al río Marañón, aguas abajo de la boca del río Samiria y los bosques circundantes de la quebrada de Parinari, cuyas aguas son igualmente vertidas directamente al Marañón, aguas arriba de la boca del río Samiria (Fig. 1). En términos generales, los bosques de las áreas de estudio presentaron alteraciones que variaron desde ligeras a moderadas por la existencia de trochas y senderos para la caza, pesca y/o la extracción de los frutos de *Mauritia flexuosa* y el palmito de *Euterpe oleracea.*

Métodos

Los censos de monos se realizaron durante 15 días de cada mes. Desde el inicio de los censos en junio de 1997, cada vez que un grupo de primates fue avistado en plena actividad alimenticia procedimos de manera simultánea al registro de los frutos y de otros órganos de las plantas. Cuando se trataba de frutos, los restos caídos en el piso del bosque fueron colectados en bolsas de polietileno con anotación del tipo de planta, estado de madurez y la parte comida. Las bolsas con el contenido fueron numeradas y etiquetadas indicando el lugar y la fecha de colecta, luego se añadió alcohol absoluto como preservante. La identificación de las muestras se hizo por comparación con el material de referencia del Centro de Reproducción y Conservación de Primates no Humanos de la Estación Experimental del Instituto Veterinario de Investigaciones Tropicales y de Altura con sede en Iquitos, Loreto. También hicimos uso de las descripciones de Roosmalen (1985) y de las claves y descripciones de Spichiger y colaboradores (1989, 1990).

Resultados y Discusión

Plantas alimentarias
Durante los censos, 10 de las 12 especies de primates que habitan en la Reserva Nacional Pacaya Samiria fueron observadas en 275 oportunidades comiendo frutos y otros órganos de 52 especies de plantas pertenecientes a 22 familias. De ellas, las familias Arecaceae, Moraceae, Leguminosae y Lecythidaceae, destacaron por agrupar la mayor diversidad de especies (Tabla 1). Entre las plantas alimentarias, *Mauritia flexuosa* probablemente es el recurso alimenticio más importante para los primates en la RNPS. Los registros nos indican que los frutos de esta especie en comparación a las demás fueron proporcionalmente los más consumidos por seite de las 12 especies de primates que habitan en la cuenca del río Samiria. Nuestros registros también indican a esta especie como una de las pocas plantas con prolongada disponibilidad y abundancia de frutos en este tipo de bosques (Tabla 2). Le siguen en importancia *Scheelea cephalotes* y *Clarisia biflora*; los frutos de la primera constituyeron recurso alimenticio casi exclusivo para *Cebus apella* y *Cebus albifrons,* mientras que la segunda para *Lagothrix lagotricha* y *Alouatta seniculus* (Tablas 1 y 2). Los resultados obtenidos fueron similares a los reportados por Terborgh (1983) para la Estación Biológica de Cocha Cashu en el Parque Nacional del Manú y por Soini (1986, 1995) para la cuenca del río Pacaya, con excepción de las palmeras, las cuales estaban ausentes en esa localidad. Nuestros resultados conjuntamente con los de Soini (1986, 1995), demuestran que en el bosque inundable el mayor número de especies de plantas que aportan en la alimentación de los primates pertenece a las familias Arecaceae, Moraceae y Leguminosae. Estos hallazgos también fueron muy similares a los obtenidos en bosques de altura para los primates de tamaño pequeño (Norconk, 1986; Castro, 1991; Smith, 1997), pero difieren de los

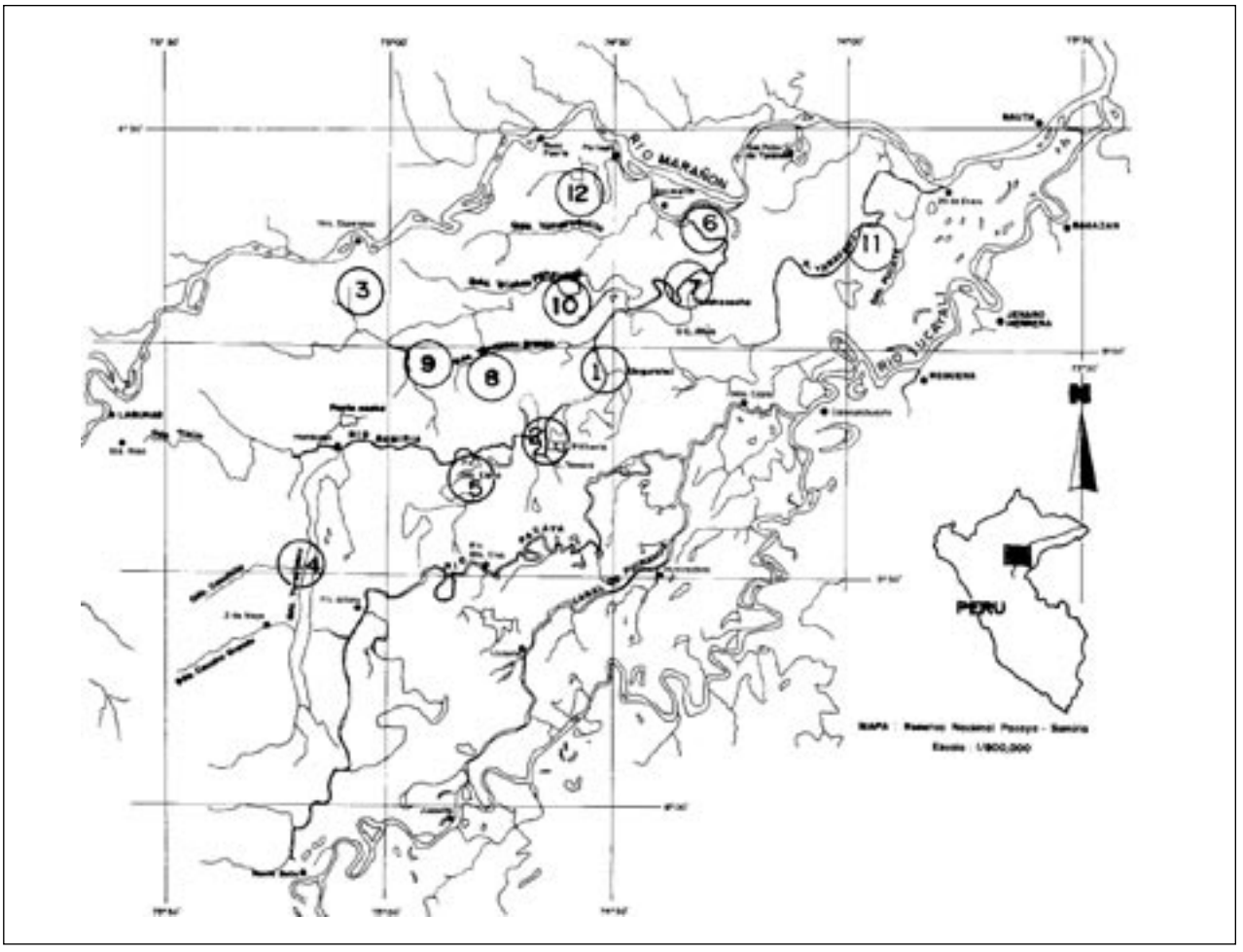

Fig. 1. Mapa de la Reserva Nacional Pacaya Samiria mostrando las áreas de estudio en la cuenca del río Samiria y tributarios: 1) Ungurahui, 2) Pithecia, 3) Quebrada Pinche, 4) Quebrada Cauchillo, 5) Santa Elena, 6) Bolívar, 7) Tacsha Cocha, 8) Quebrada Guanaico, 9) Quebrada Armana, 10) Quebrada Wishto Yanayacu, 11) Quebrada Yanayacu de Pucate y 12) Quebrada Parinari.

Tabla 1. Lista preliminar de plantas consumidas por primates en la cuenca del río Samiria, Reserva Nacional Pacaya Samiria. M: mesocarpio, S: semilla, A: arilo, H: hoja, F: flor, Ab: *Ateles belzebuth*, Ach: *Ateles chamek*, Ll: *Lagothrix lagotricha*, As: *Alouatta seniculus*, Ca: *Cebus apella*, Cal: *Cebus albifrons*, Pm: *Pithecia monachus*, Sb: *Saimiri boliviensis*, Sf: *Saguinus fuscicollis* y An: *Aotus nancymae*.

Especies	Parte comida					Frecuencia	Primates consumidores
	M	S	A	H	F		
Anacardiaceae							
Spondias mombin	X					11	Ll, Sb, Ca
Annonaceae							
Annona duckei	X	X				5	Sf, Sb, An
Xylopia sp.	X	X				2	Sb, Pm
Arecaceae							
Astrocaryum chambira		X		X		3	Ca, Cal
Astrocaryum murumuru	X			X		2	Ca
Bactris sp.						3	Cal
Geonoma sp.	X					1	An
Euterpe oleracea	X					2	Pm
Iriartea exorrhiza	X					3	Ll, Ca, An
Mauritia flexuosa	X					35	Ab, Ach, Ll, As, Ca, Cal, Pm
Mauritiella peruviana	X					3	Ll, Cal
Scheelea cephalotes	X					26	Ll, Ca, Cal
Scheelea sp.	X					1	Ca
Bombacaceae							
Ceiba pentandra				X		2	As

continua

Tabla 1, *continuado*

Especies	Parte comida					Frecuencia	Primates consumidores
	M	S	A	H	F		
Cecropiaceae							
Cecropia sp.				X		1	As
Pourouma sp.	X					2	Ll, Sb
Chrysobalanaceae							
Couepia subcordata	X					3	Ca, Pm
Euphorbiaceae							
Alchornea latifolia (?)		X				1	Pm
Fabaceae							
Copaifera sp.		X				4	Ca
Flacourtiaceae							
Laetia corymbulosa					X	2	Pm, An
Lauraceae							
Ocotea sp.	X					2	Ll, Ca
Leguminosae							
Erythrina glauca			X			3	An
Inga punctata			X			9	Ll, Ca, Cal, Sf, Sb
Inga sp. 1			X			7	Ll, Ca, Cal, Pm, Sb
Inga sp. 2			X			7	Ll, Ca, Cal, Sf
Macrolobium sp.			X			3	Sf
Parkia sp.						2	Sf
Lecythidaceae							
Couroupita subsessilis	X			X		6	Ll, Ca, Cal
Eschweilera sp.		X				16	Ll, Ca, Pm
Grias peruviana	X					2	Ca
Gustavia sp.		X				2	Ca
Gnetaceae							
Gnetum sp. 1	X					2	Pm, Sf
Gnetum sp. 2	X					2	Ca, Sb
Guttiferae							
Rheedia acuminata	X					4	Ca, Pm, Sb
Tovomita sp.	X					3	Ca, Sb, Sf
Menispermaceae							
Abuta sp.	X					2	Ll, Ca
Moraceae							
Brosimum rubescens	X					3	Ll, Sf
Clarisia biflora	X					21	Ll, As
Coussapoa sp.	X	X				5	Ll, Ca, Sb, Sf
Ficus insipida	X	X				7	As, Ca
Ficus sp. 1	X	X				11	Ll, As, Ca, Sb
Ficus sp. 2	X	X				6	As, Ca, Sb, Sf
Ficus sp. 3	X	X				4	Ll, As, Sb, Sf
Myristicaceae							
Iryanthera sp.		X				1	Pm
Virola surinamensis	X	X				5	Ab, Ll, Pm, Sf
Virola pavonis (?)	X	X				2	Pm, Sf
Myrtaceae							
Calycorectes sp.	X					5	Ll, Ca, Pm
Olacaceae							
Minquartia guyanensis	X	X				11	Pm
Passifloraceae							
Passiflora sp.	X	X				5	Ca, Sf
Sapindaceae							
Paullinia sp.		X				5	Ll, Pm
Sapotaceae							
Achras zapota	X					6	Ab, Ca, Ll
Pouteria sp.	X					4	Ll, Ca, Pm

reportados para primates de tamaño mediano y grande, cuyos principales componentes alimenticios correspondieron más bien a los representantes de las familias Sapotaceae y Apocynaceae (Aquino, 1999; Aquino, obs. pers.), las mismas que estuvieron escasamente representadas en el bosque de várzea ó inundable de la cuenca del río Samiria.

Tabla 2. Período de consumo de frutos y semillas por los primates en la cuenca del río Samiria, Reserva Nacional Pacaya Samiria.

Especies	Meses											
	E	F	M	A	M	J	J	A	S	O	N	D
Abuta sp.	X	X						X				
Achras zapota		X	X			X						
Alchornea latifolia (?)												
Annona duckei						X						
Astrocaryum chambira		X				X	X					
Bactris sp.			X									
Brosimum rubescens				X		X	X					
Calycorectes sp.											X	X
Clarisia biflora						X	X			X	X	X
Couepia subcordata												X
Copaifera sp.						X						
Couroupita amazonica				X					X			
Coussapoa sp.					X	X						
Eschweilera sp.	X	X							X	X	X	X
Euterpe oleracea												X
Ficus insipida		X	X		X	X	X					
Ficus sp. 1	X		X	X				X		X	X	
Ficus sp. 2			X	X	X				X	X		
Ficus sp. 3	X					X				X	X	
Gnetum spp.		X					X					
Grias peruviana						X	X					
Gustavia sp.												X
Inga punctata (?)	X	X	X									
Inga spp.	X	X	X	X								
Iriartea exorrhiza				X			X			X		
Iryanthera sp.						X						
Laetia corymbulosa				X	X							
Macrolobium sp.									X	X		
Mauritia flexuosa	X	X	X	X	X		X	X	X	X	X	
Mauritiella peruviana				X								
Minquartia guyanensis								X	X			
Parkia sp.									X			
Passiflora sp.		X	X									
Paullinia sp.	X	X										
Pourouma sp.												X
Pouteria sp.	X				X	X						
Rheedia acuminata	X											X
Scheelea cephalotes	X	X					X	X			X	
Scheelea sp.	X											
Spondias mombin	X	X		X							X	X
Ocotea sp.			X	X								
Tovomita sp.					X							
Virola surinamensis		X	X			X						
Xylopia sp.	X											X

Partes consumidas

Las partes más utilizadas por los primates fueron el mesocarpio y las semillas de frutos maduros e inmaduros. En referencia a las hojas, solamente observamos haciendo uso de este recurso a *Alouatta seniculus* y *Cebus apella*; la primera comiendo hojas tiernas de *Ceiba pentandra*, *Cecropia* sp. y *Couroupita subsessilis*, y la segunda de *Astrocaryum murumuru*, cuyo ápice previamente era forzado con ambas manos hasta lograr desprenderlo. En comparación con nuestras observaciones, en la cuenca del río Pacaya Soini (1995) observó a *A. seniculus* alimentándose de hojas de al menos 13 especies de plantas, a *Pithecia monachus* de tres especies y a *Lagothrix lagotricha* de siete especies. Finalmente, en tres oportunidades se observó el consumo de flores de *Laetia corymbulosa* y *Erythrina glauca*, plantas arbóreas que tienen como principal hábitat las orillas de ríos y caños de los bosques inundables de agua blanca. *Pithecia monachus* y *Aotus nancymae* fueron las únicas especies a quienes sorprendimos haciendo uso de estos recursos. *Alouatta seniculus* y *Ateles belzebuth* fueron encontrados en repetidas oportunidades comiendo el corcho de la corteza en descomposición. Esta conducta poco usual en otras especies de primates podría tener relación con las sales minerales, suplemento que en los bosques de altura lo consiguen ingiriendo tierra en las denominadas "colpas", lugares que acostumbran visitar con cierta frecuencia. Una conducta muy similar ha sido observada en *Saguinus tripartitus* en la cuenca del río Napo (R. Aquino, obs. pers.).

Variación estacional en el consumo

De acuerdo con nuestros registros, la producción de frutos en la cuenca del río Samiria y sus tributarios ocurrió durante todo el año. Sin embargo, la mayor diversidad de especies fue consumida entre enero y abril y entre junio y julio; es decir, desde el inicio hasta el final de la estación lluviosa y comienzo de la estación seca, exceptuando mayo (Tabla 2). *Mauritia flexuosa* fue prácticamente la única especie con producción de frutos durante casi todo el año, al menos así lo indican los respectivos registros de consumo. Otras especies con periodicidad más o menos prolongada de fructificación fueron *Ficus* spp., *Clarisia biflora*, *Eschweilera* sp., *Scheelea cephalotes, Inga* spp. y *Spondias mombin*. Estas especies fueron consumidas durante cinco a seis meses (Tabla 2). Finalmente, observaciones *in situ* también nos indican que en la cuenca del río Samiria la mayor disponibilidad de frutos ocurrió entre enero y julio y una marcada escasez entre agosto y septiembre.

Otros componentes en la dieta alimentaria

Durante el período de estiaje coincidente con la escasez de frutos, *Cebus apella* y *C. albifrons* fueron observados comiendo moluscos acuáticos de los géneros *Pomacea* y *Marisa*; ambos eran buscados activamente en el lecho de pequeños arroyos. Asimismo, *C. apella* fue observado comiendo huevos de aves y de tortuga terrestre (*Geochelone denticulata*), así como pequeños saurios (lagartijas, camaleones y otros) capturados entre las brácteas de palmeras durante las actividades de forrajeo en los aguajales.

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Rolando Aquino, Instituto de Ciencias Biológicas Antonio Raimondi (ICBAR), Universidad Nacional Mayor de San Marcos, Lima, Perú, y **Richard E. Bodmer**, Durrell Institute of Conservation and Ecology, University of Kent, Canterbury, England. *Toda correspondencia remitir a*: Rolando Aquino, P.O. Box 575, Iquitos, Perú, correo electrónico: <ivitaiq@terra.com.pe>.

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Habitat Use by the White-Footed Tamarin, *Saguinus leucopus*: A Comparison Between a Forest-Dwelling Group and an Urban Group in Mariquita, Colombia

Katja Poveda
Pedro Sánchez-Palomino

Introduction

The white-footed tamarin (*Saguinus leucopus*) is endemic to Colombia. Its geographic distribution, between the eastern banks of the lower Río Cauca and the western part of the middle Río Magdalena in the north of the country, has been dramatically reduced in recent years, largely due to deforestation (BIO, 1998; Pachón and Bohorquez, 1991; Defler, 2004). Habitat loss has resulted in *S. leucopus* being classified as Vulnerable on the IUCN Red List (Hilton-Taylor, 2003) and it is also listed on Appendix I of CITES. Information available on this species is limited to some considerations on captive breeding (Alveario *et al.*, 1985), behavior and vocalization in captivity (Blumer and Epple, undated) and the results of some censuses in different regions of Colombia (Calle, 1992; Bernstein *et al.*, 1976; Green, 1978; Vargas, 1994; Vargas and Solano, 1996). No ecological studies have been conducted to date.

We found a group of white-footed tamarins living in the backyards of some houses in the small town of Mariquita in central Colombia. According to the residents, the group had lived there since at least 1997 and had not been introduced. A second group of *S. leucopus* was found in a remnant forest patch close to the town. We studied the home range, daily path length and diet of the two groups in order to compare their use of these two distinct habitats. To our knowledge this is the first study presenting data on the ecology of the white-footed tamarin.

Methods

Study site and subjects

Mariquita is in the north of the Department of Tolima, Colombia (5°12'N, 74°55'W) at an altitude of 690 m (Fig. 1). Mean annual temperature is 26°C and mean annual rainfall is 2237 mm (records of IDEAM – Instituto de Estudios Ambientales, Colombia). A secondary forest patch of 120 ha abuts the western side of Mariquita. We identified seven groups (of two to 12 tamarins each) within the forest remnant, on farms near the forest and in the backyards of the residential area of Mariquita (Table 1). We selected one forest and one backyard group based on the accessibility of their ranges. We studied them from July to December 1999. The forest group was composed of 11 individuals and was observed for 101.0 hours. Five individuals made up the urban group, which was observed for 229.8 hours. One female in each of the two groups produced twins in September, 1999.

The urban gardens and backyards in Mariquita have many fruiting trees such as mango (*Mangifera indica*), banana

Figure 1. Location of Mariquita, Colombia (upper left), and the home ranges of a forest-dwelling group (white arrow) and an urbanized group (black arrow) of *Saguinus leucopus* (aerial photo taken by IGAC, 1996).

(*Musa sapientum*), papaya (*Carica papaya*) and guava (*Psidium guajaba*). The urban group ranged through the backyards of 10 houses, separated by fences and surrounded on all sides by other houses. The area of all the backyards together was approximately 1.5 ha. The tamarins moved around through the crowns of the trees, while occasionally descending to the roofs of the houses or fences. Although we never witnessed the study group crossing streets on the ground, other groups were seen doing so, indicating that they are not a serious obstacle. Vegetation in the forest remnant is represented by the families Lauraceae, Rubiaceae, Guttiferaceae, Anacardiaceae, Caesalpiniaceae, Mimosaceae, Musaceae, Polypodiaceae and Araceae. Abundant species include *Cassia moschata*, *Myrcia* sp., *Byrsonima spicata*, *Cupania latifolia*, *Nectandra* sp. and *Vochysia ferruginea* (Cortolima, 1997; Pachón and Bohorquez, 1991).

Table 1. Number of individuals of *Saguinus leucopus* in groups observed in a forest fragment, in urban backyards and on a farm. Asterisks (*) indicate the groups studied for habitat use.

Group Nr.	Location	No. of Individuals
1 *	Forest	11
2	Forest	7
3	Forest	10-12
4	Forest	2
5 *	Backyards	5
6	Backyards	4
7	Farm	6

Table 2. Plant species consumed by *Saguinus leucopus* in **a**) a forest group and **b**) an urban group, and percentage of total foraging time, from July to December 1999. FR = fruit; FL = flower; B = bark; Not ID = not identified.

a) Forest group

Family	Species	Part eaten	% Time eating
Cecropiaceae	*Cecropia peltata*	FR	35
Sapindaceae	*Talisia* sp.	FR	24.2
Burseraceae	*Protium* sp.	FR	15.8
Moraceae	*Sorocea sprucei*	FR	12.5
Annonaceae	*Rollinia edulis*	FR	5
Tiliaceae	*Trichospermum mexicanum*	FL	1.7
Euphorbiaceae	*Tetrorchidium* aff. *echeverianum*	FR	1.7
Euphorbiaceae	*Pera arborea*	FR	0.8
Araliaceae	*Didymopanax morototoni*	B	0.8
Malpighiaceae	*Byrsonima spicata*	FR	0.8
Melastomatacae	*Tococa* sp.	Not ID	0.8
Rutaceae	*Zanthoxylum* sp.	B	0.8

b) Urban group

Family	Species	Part eaten	% Time eating
Anacardiaceae	*Mangifera indica*	FR	49.35
Bombacaceae	*Matisia cordata*	FR	16.17
Caricaceae	*Carica papaya*	FR	8.22
Myrtaceae	*Psidium guajaba*	FR	5.01
Moraceae	*Ficus* sp.	FR	4.86
Annonaceae	*Annona muricata*	FR	4.55
Lauraceae	*Persea gratissima*	FL, B	2.41
Musaceae	*Musa sapientum*	FR	2.26
Myrtaceae	*Eugenia jambos*	FL, FR	2.10
Rutaceae	*Citrus aurantium*	B	1.49
Oxalidaceae	*Averrhoa carambola*	FL, FR	1.19
Arecaceae	*Cocos nucifera*	FL	1.19
Malvaceae	*Hibiscus* sp.	FL	1.19

Data Collection

From July to December, 1999, we estimated fruit abundance (dry mass of fruit/ha) at one-month intervals in the areas of the forest and urban groups. We counted the fruits from all of the fruiting trees in five backyards, and afterwards 20 fruits per tree species were collected, oven-dried and weighed. We estimated the total fruit weight by species in a given area by multiplying the mean fruit weight by the number of fruits counted. In the forest, fruit counts were made within eight randomly established 8 x 100 m plots, and vouchers of each fruit species were collected for species identification. As in the town, 20 fruits of each species were sampled, dried and weighed to estimate forest fruit weight. Once the diet composition of each group was known, only the species they consumed were used for calculating fruit abundance in each habitat.

Each study group was observed for five days per month (July to December, 1999). The position of the group was determined every 30 minutes using a Global Positioning System (GPS) and maps. The urban group's home range was estimated using the minimum convex polygon method (White and Garrott, 1990) and the Home Range program of Ackerman *et al.* (1989). Due to the irregular form of the forest margin, using the same method in the forest would have included pasture never used by the tamarins in the home range calculation. To estimate the home range of the forest group, we divided it into 50 x 50 m quadrates and summed all those which were entered. The daily path length of each group was calculated by summing the distances between all the 30-minute location points during the day (Ackerman *et al.*, 1989). Because the forest group usually could not be followed for complete days, we used the distance traveled on the single complete day of observation each month. Even so, the daily path length is undoubtedly underestimated because of periods when we lost contact.

We quantified diet composition by calculating the percentage of time spent eating different food items (fruits, invertebrates, flowers, bark, etc.). Trees from which tamarins gathered food were marked, and leaf and fruit samples were then collected for subsequent identification at the Herbarium of the Instituto de Ciencias Naturales, Universidad Nacional de Colombia (COL).

Results

We recorded 82 fruiting plant species in the forest, but only eight of them were exploited by *Saguinus leucopus* as a fruit source. Average monthly dry mass of the fruits included in the forest group's diet was 8.2 ± 5.9 kg/ha (mean ± SD, n = 6). In the urban area, 12 species of plants produced fruits, nine of which were eaten by tamarins. Average monthly dry mass of the fruits of plant species consumed by *S. leucopus* in the backyards was 444.4 ± 355 kg/ha (mean ± SD, n = 6).

In addition to fruits, the tamarins ate flowers, bark, leaves and a number of items we were unable to identify. Thirteen plant species provided food in the backyards and 12 in the forest (Table 2). Both groups invested 82-84% of their feeding time to consuming fruits, between 8 to 15% eating invertebrates and less than 8% eating bark, flowers and other foods which we could not identify (Table 3).

The tamarins' home range in the forest was 17.7 ha, whereas the urban group used about 0.73 ha (Fig. 1). Daily path lengths varied in the forest from 783 to 2387 m, with the only two dawn-to-dusk measures being 1848 and 1851 m. The mean daily path of the urban group was 496 m with a range of 224 to 612 m.

Discussion

Urban tamarins had a shorter daily path length and a substantially smaller home range than the group living in the forest fragment, apparently because they were able to sustain themselves on the densely planted fruiting trees in backyards. The differences could also have been due to the different group sizes (Schoener, 1968; Davies and Houston, 1984; Dunbar, 1988; Barton *et al.*, 1992). The urban group of five individuals used 0.73 ha, or 0.14 ha per individual. The forest group, on the other hand, was composed of 11 individuals living in an area of 17.7 ha, or 1.6 ha per individual, indicating that the number of individuals in a group cannot be the only cause for the difference in home range size. The area used per individual in the forest was over 11 times that used by the urban individuals.

The quality of the habitat is another factor that affects home range size and path length (Rylands, 1996). The small home range size and path length of the urban group is likely a reflection of high fruit density. Davies and Houston (1984) and Altmann (1974) proposed that the lower limit of the home-range size is determined by the distribution of important resources that fulfill life requirements. The impact of the closely packed fruit trees, providing food throughout the study period in the backyards of the town of Mariquita, was marked both in terms of diet (Table 2b) and the fruit biomass available.

Table 3. Percentages of food items in the diet of an urban and a forest-dwelling group of *Saguinus leucopus*.

	Forest	Backyards
Invertebrates	15	8
Fruit (pulp+seeds)	82	84
Bark	1	1
Flowers	1	2
Not Identified	1	5
Exudate	0	0

Fruit was the most common food item eaten by both study groups, followed by invertebrates, flowers and bark. This is in line with findings for other callitrichids (Snowdon and Soini, 1988; Egler, 1992; Peres, 1993; Valladares-Pádua, 1993; Dietz *et al.*, 1997; Knogge, 1998). The plant species exploited by the two groups were completely different, which is likely due to the presence of different resources in the two environments (Table 2).

Our findings suggest that *Saguinus leucopus* is flexible in its diet and behavior. This offers some hope for its future conservation status, as it appears able to adapt to a variety of environments, even an urban setting. Surveys and effective protection in parks and reserves, however, are still vital measures for the conservation of this little-known species, which is confined to a range dominated by intensive colonization and forest destruction (Defler *et al.*, 2003).

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New Records of Martins' Bare-Face Tamarin, *Saguinus martinsi* (Primates: Callitrichidae)

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Introduction

Martins' bare-face tamarin, *Saguinus martinsi*, was described by Thomas (1912) as *Leontocebus martinsi*, based on material collected in the locality of Faro, left bank of the Rio Nhamundá, Pará, Brazil. The new species was named in honor of the collector of the holotype, Oscar Martins. Hershkovitz (1966) considered Martins' bare-face tamarin to be a subspecies of *S. bicolor*, reaffirming this taxonomic status in subsequent studies (Hershkovitz, 1970, 1977). Hershkovitz (1977) considered all bare-face tamarins as conspecifics and recognized three subspecies in this group: *S. b. bicolor* (Spix, 1823), *S. b. martinsi* and *S. b. ochraceus* Hershkovitz, 1966. Groves (2001, p.146) found this tamarin to be "extremely distinct" from *S. bicolor* and listed it as a full species and, although not having examined any specimens, provisionally placed *ochraceus* as a subspecies. Martins' bare-face tamarin is one of the least-studied taxa among the Neotropical primates, with just six localities of occurrence recorded and few specimens in museums (Thomas, 1912; Cruz Lima, 1945; Hershkovitz, 1977).

Most studies on the biology of bare-face tamarins refer to the pied tamarin, *S. bicolor* (Egler, 1986; Snowdon and Soini, 1988), while information on the biology of *S. martinsi* is restricted to its geographical occurrence. Bare-face tamarins are endemic to the Amazon rainforest, and all three taxa have very restricted distributions (Hershkovitz, 1977). As far as is known, *S. martinsi* is confined to the north of the Rio Amazonas, between the Rio Erepecurú and the Rio Nhamundá (Hershkovitz, 1977). Its northern limits are unknown. According to Hershkovitz (1977), the

northernmost record for *S. martinsi* is Cachoeira Porteira, based on a specimen from the Museu Paraense Emílio Goeldi (MPEG 420). Rylands (1985) indicated that the Rio Trombetas Biological Reserve, situated on the left bank of the Rio Trombetas, would be the only protected area where *S. martinsi* may occur.

The diet of *Saguinus bicolor* is largely composed of insects and fruits (Hershkovitz, 1977; Snowdon and Soini, 1988). Although there are few records of group sizes, it would seem that *S. bicolor*, as is typical of the genus, lives in groups of generally seven to nine individuals (Snowdon and Soini, 1988). It can be found in a great diversity of habitats, usually using lowland areas and evergreen humid forests (Mittermeier *et al.*, 1977). *S. bicolor* was the first callitrichid from the Brazilian Amazon to be listed as Critically Endangered, largely due to its minute range, which is centered on Manaus and is rapidly being deforested for both urban and rural development. In addition, *S. bicolor* is being replaced by the golden-handed tamarin, *Saguinus midas*, which has been expanding into the periphery of the pied tamarin's remaining habitat (Ayres *et al.*, 1980, 1982; Egler, 1983; Subirá, 1998a, 1998b; Rylands *et al.*, 2003). Although not facing equivalent threats from deforestation, very little is known of the status of *S. martinsi*, which would also seem to have a very restricted range and is quite possibly suffering a similar diminution in its range with its replacement by *S. midas*.

Here we provide an update on the geographic distribution of *S. martinsi*, describing 10 new records in the region of the Rio Trombetas. In addition, we present data on the sizes of a number of groups observed in the Saracá-Taquera National Forest, west of the lower Rio Trombetas.

Methodology

Study area

Fieldwork was carried out in the Saracá-Taquera National Forest (429,600 ha), an area rich in bauxite, located in the district of Porto Trombetas (01°40'S, 56°00'W), municipality of Oriximiná, western Pará, Brazil. The study site is 100 km to the west of the confluence of the Rios Trombetas and Amazonas. The bauxite deposits are associated with a series of Tertiary boundaries, and are found under plateaux at altitudes varying from 150 to 200 m.

The extraction of bauxite requires the removal of the vegetation and of the first layer of soil. Bauxite is usually found at depths of 4 to 15 m, requiring heavy machinery to mine it. Noisy trucks and tractors work full time in three shifts a day. After extraction, the holes are filled with a mixture of soil and vegetational remains, and the area is reforested.

Our study concentrated on two of these plateaux: Almeidas and Bela Cruz. The vegetation there is classified as dense tropical forest in the sub-region of the lower plateaux of the Amazonian rainforest. The canopy is generally dense, reaching 30 to 40 m, with a sparse understorey, except in some areas where it is dense in shrubs and small trees reaching heights of 15 to 20 m. Common emergent tree species include *Dinisia excelsa*, *Bertholletia excelsa* and *Cedrelinga*

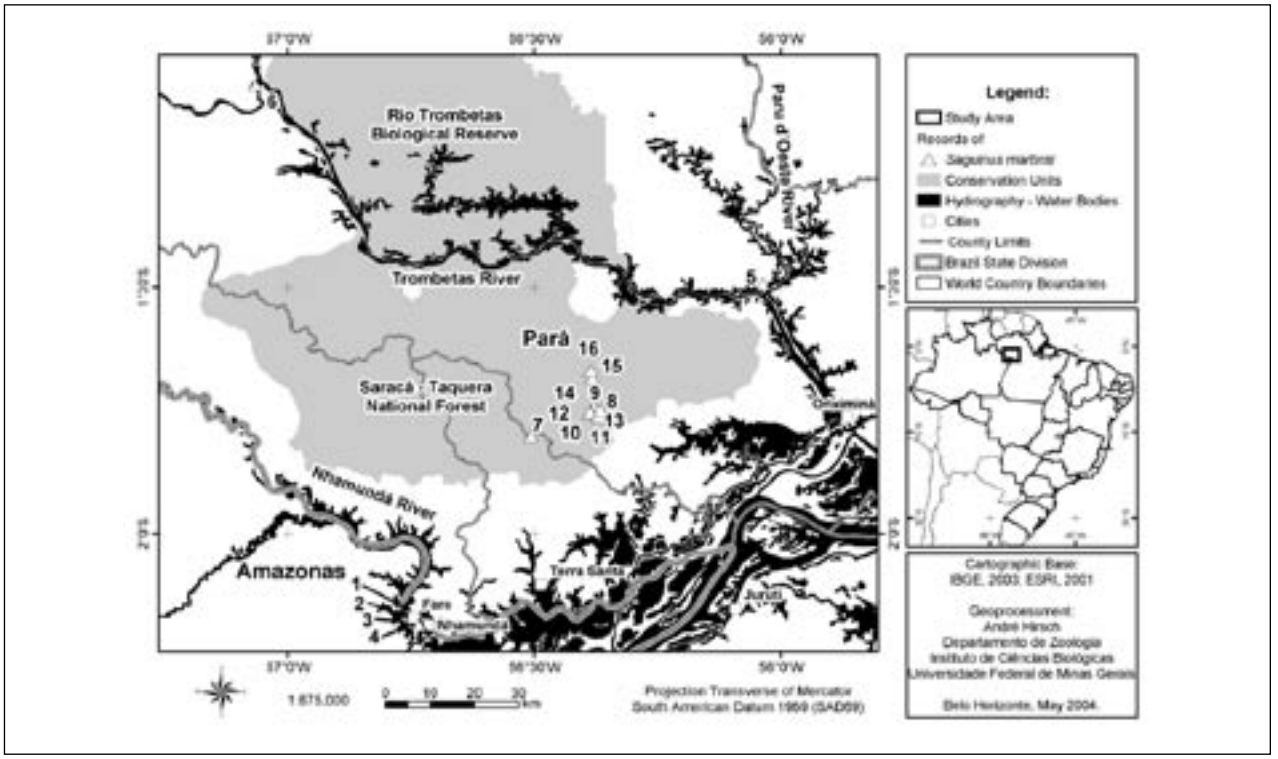

Figure 1. The Rio Trombetas Biological Reserve (385,000 ha) and the Saracá-Taquera National Forest (429,600 ha), indicating the plateaux where *Saguinus martinsi* groups were observed. Localities for *Saguinus martinsi* are included from the literature and from the present study (see Table 2).

catanaeformis (Brazil, MME-DNPM, Projeto RADAM, 1976). The Almeidas and Bela Cruz plateaux are 867 and 1500 ha, respectively. The deforestation of the Almeidas plateau started in August 2002, and will be completed by 2006. The deforestation of Bela Cruz plateau will start in 2008.

Field techniques

Fieldwork was carried out from July to November 2003 by two teams, each composed of one researcher and one field assistant. The censuses, restricted to locating primate groups, began at 06:00 and ended at 11:00 hrs. Sightings of monkeys were recorded *ad libitum* (Altmann, 1974). Geographic coordinates were taken using a Garmin eTrex GPS unit. On encountering a group, each survey team recorded the group size, time of the record, geographic coordinates and the stratum height occupied by the animals.

Table 1. Geographic coordinates and group size of *Saguinus martinsi* in the Saracá-Taquera National Forest, Pará, Brazil.

Date	Plateaus	Coordinates	Group size
29 July 2003	Plateau Almeidas	01°44'29"S, 56°22'40"W	6
2 August 2003	Plateau Almeidas	01°44'31"S, 56°22'44"W	4
29 August 2003	Plateau Bela Cruz	01°48'06"S, 56°30'24"W	3
21 November 2003	Plateau Almeidas	01°45'18"S, 56°23'06"W	4
22 November 2003	Plateau Almeidas	01°45'54"S, 56°22'12"W	5
23 November 2003	Plateau Almeidas	01°45'36"S, 56°22'19"W	8
24 November 2003	Plateau Almeidas	01°45'15"S, 56°23'16"W	1

Secondary data

Supporting data on occurrences of bare-face tamarins were acquired from the literature (Cruz Lima, 1945; Hershkovitz, 1966, 1977; Thomas, 1912) and an examination of the mammal collections of the Museu de Zoologia da Universidade de São Paulo (MZUSP), the Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ) and the Museu Paraense Emílio Goeldi (MPEG). An interview with Manoel Santa Brígida, a technician at MPEG, also provided useful information on three new records of this taxon.

Results

A group of *Saguinus martinsi* was observed for the first time on 29 July 2003. Another six records were later made by direct observations, five on the Almeidas plateau and one on the Bela Cruz plateau (Table 1, Figure 1). Group sizes varied from four to eight individuals (Table 1) and at least four different groups were found in the study area. All records occurred between 06:30 and 10:10 hrs. In all observations, the animals were using the middle strata of the forest, up to 20 m high.

M. S. Brígida also observed a number of *S. martinsi* groups in three areas in the Rio Trombetas region between 1997 and 2003 (Table 2). Figure 2 indicates the results of the review of the literature and of the scientific collections, in addition to the records produced in the present study. These data allow an update of the geographic distribution of *S. martinsi*.

Discussion and Conclusions

Although this study has doubled the number of recorded localities for *S. martinsi*, much more data is needed to better understand its geographical distribution. Although known to occur in the region of the Rio Trombetas (Hershkov-

Table 2. Geographic records of the occurrence of *Saguinus martinsi*.

Localities	References
1. Faro, left bank of the Rio Nhamundá (type locality), 02°11'S, 56°44'W	Cruz Lima (1945), Hershkovitz (1966, 1977), Thomas (1912), MNRJ 2844, MPEG 185
2. Fazenda Paraíso em Palha, municipality of Faro, near 02°11'S, 56°44'W	Hershkovitz (1977), MPEG 184
3. São José, Rio Nhamundá, near 02°11'S, 56°44'W	Hershkovitz (1977)
4. Iacarana, Rio Nhamundá, near 02°11'S, 56°44'W	Hershkovitz (1977)
5. Rio Erepecurú (=Rio Cuminá), right tributary of the Rio Paru d'Oeste, 01°30'S, 56°00'W	Cruz Lima (1945), Hershkovitz (1977)
6. Cachoeira Porteira, Rio Mapuera, municipality of Oriximiná, 01°05'S, 57°04'W	Hershkovitz (1977), MPEG 420
7. Plateau Bela Cruz, 01°48'S, 56°30'W	Present study
8. Plateau Almeidas, 01°44'S, 56°22'W	Present study
9. Plateau Almeidas, 01°44'S, 56°22'W	Present study
10. Plateau Almeidas, 01°45'S, 56°23'W	Present study
11. Plateau Almeidas, 01°45'S, 56°22'W	Present study
12. Plateau Almeidas, 01°45'S, 56°22'W	Present study
13. Plateau Almeidas, 01°45'S, 56°23'W	Present study
14. Bacaba Plateau, 01°45'S, 56°22'W	M. S. Brígida, pers. comm.
15. Reforestation area, 01° 41'S, 56°23'W	M. S. Brígida, pers. comm.
16. Lowland forest, 01°19'S, 56°22'W	M. S. Brígida, pers. comm.

itz, 1977), there are few field records from there. Its distribution includes only one strictly protected area, the Rio Trombetas Biological Reserve of 385,000 ha; we presume it occurs east of this river to the Rio Paru do Oeste (Erepecurú), but this remains to be confirmed (Rylands, 1985; Rylands and Bernardes, 1989). The correct delimitation of its range is of fundamental importance for its conservation. Although this is an area protected by the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA), the two plateaux censused (and others) will be deforested in the coming years. Cachoeira Porteira remains the northernmost record of *S. martinsi*, albeit from a museum specimen, but it may occur further north. There are no doubts that its range is restricted, however, and potential threats include urbanization and the expansion of bauxite mining activities, besides the establishment of soybean plantations. Further studies are urgently needed to assess the status of *S. martinsi*, besides long-term research on its ecology and behavior.

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Behavioural Changes in Response to an Injured Group Member in a Group of Wild Moustached Tamarins (*Saguinus mystax*)

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Eckhard W. Heymann

Introduction

Injury and disease can be major sources of death in wild primates (Dunbar, 1988). However, healed injuries indicate the potential for recovery (Schultz, 1939; Zihlman *et al.*, 1990; Lovell, 1991), but whether or not an individual recovers and survives may depend not only on the severity of the injury or disease, but also on whether it can remain in contact with its group. This may be important in terms of reduced predation risk, access to food resources, thermoregulation, and compensatory care (Chapman and Chapman, 1987; Dittus and Ratnayeke, 1989; Gould, 1997). If locomotion is impaired, an individual's capability to keep up with a travelling group will depend on the behaviour of the rest of the group. Kin structure and/or the level of within-group co-operation probably influence how far single animals or a whole group will modify their behaviour in favour of a disabled individual. In this paper, we examine behavioural modifications in a group of a co-operatively breeding primate, *Saguinus mystax*, after one individual was hurt during a raptor attack and remained temporarily handicapped. Specifically, we look at changes in patterns of resource use and retirement to sleeping sites as measures of potential behavioural and ecological costs. The event reported here was unforeseen, and no *a priori* predictions could be made; thus our analyses are *post hoc* examinations of factors that we perceived as having been modified.

Methods

The observation was made during a field study of moustached tamarins, *S. mystax*, and sympatric saddle-back tamarins, *Saguinus fuscicollis*, at the Estación Biológica Quebrada Blanco (EBQB) in north-eastern Peruvian Amazonia (04°21'S, 73°09'W; for details of the study site see Heymann, 1995). A well-habituated group of eight *S. mystax* living in association with five *S. fuscicollis* has been followed by the first author (ERTH) for 4-7 days per month since March 1997. Periods of observation ("observation blocks") of each species are alternated. At the time of the event described here, the *S. mystax* group consisted of an adult male, two subadult males, one adult female, two subadult females, a juvenile male and a juvenile female (hereafter called F-j). Routine data collection included instantaneous scan-sampling at 10-minute intervals, recording the activity and height of each visible group member of the focal species, the time of leaving and retiring to sleeping sites, and the time of entering and leaving feeding trees.

Since our impression was that the group modified its pattern of feeding site use after F-j was injured, we calculated the number of feeding trees visited per day and the percentage of feeding tree visits represented by repeated visits to the same feeding tree per day. We compared the means of these parameters between the period before the attack, during the three days immediately after, and in the period following. We also calculated the time lag between the first and the last animal entering a sleeping site, and compared this between the different periods. Percentages were Arcsine-transformed before analyses. Comparisons were made with a one-way ANOVA, followed by the Tukey HSD test for unequal sample size using Statistica® 5.0.

Results

Raptor attack

When observations of the *S. mystax* group began on 1 July, 1997, all group members were apparently healthy and none showed any problems with locomotion. On 5 July the *S. fuscicollis* group became the focal species. The *S. mystax* were associated with the *S. fuscicollis* from the early morning on, and stayed with them for the whole day. In the afternoon of 5 July, the *S. mystax* were spread out and resting on open branches exposed to sunlight about 15 m above the ground, in a tree approximately 18 m in height.

At 1514 h, two alarm calls were given almost simultaneously, and all the tamarins dropped from their resting places. At this moment, a medium-sized raptor flew rapidly through the canopy, coming from above and diving into the subcanopy. A loud scream was heard from a *S. mystax*, and the raptor was seen turning around and flying towards the place where the tamarins had dropped to the forest floor. Another scream was heard and several tamarins were seen running on the floor. The raptor turned around again and perched on a branch, looking towards the tamarins. The raptor was dark-brown on the upper parts and light-brown with white spots on the belly, and had a total length of about 40 cm – perhaps a *Micrastur semitorquatus* or related species. When the observer approached to take a closer look the raptor flew away. His three flights had taken a total of 25 seconds; the entire event, from the first alarm call to the raptor flying away, lasted approximately one minute 20 seconds.

None of the tamarins were missing after the attack, but F-j was injured, with her left leg hanging down as she sat. She tried without success to lift it onto the branch with her left hand and screamed when starting to walk. No external wound was apparent, but she limped heavily when walking. When the group moved off from the place where they were attacked, F-j had problems keeping up, particularly since the others were moving low down in the vegetation, where she was unable to leap between vertical supports. From the site of the attack the group moved towards a sleeping tree about 250 m away. F-j followed behind, but eventually lost contact with the group. At 1627 h the group entered a new sleeping tree. F-j gave contact calls several times but did not receive a reply. She passed by the sleeping tree, still giving contact calls. At this time, her calls were answered, and F-j returned and entered the sleeping tree at 1645 h.

Behavioural changes after the attack

Modification of the group's activity was most notable on the first day after the attack. During progression, F-j lagged behind and frequently gave contact calls. Whenever the distance between F-j and the group exceeded about 25 m, the group stopped and waited for F-j to catch up. F-j stayed for over four hours in a feeding tree, to which the rest of the group returned a total of seven times that day. During the next two days, F-j also remained in feeding trees for prolonged periods, while the group foraged and made repeated visits to other feeding trees in the surroundings. On one occasion when the distance between F-j and the group exceeded 70 m, contact between F-j and the group was maintained through long calling.

On the days after the attack, the group visited fewer feeding trees per day compared to previous and later observation blocks, but the differences were not significant (Fig. 1a). However, the percentage of visits to feeding trees represented by repeated visits to the same tree(s) varied significantly between periods and was higher in the days following the attack (Fig. 1b).

On the three days following the attack, F-j was always the last animal to leave and to enter sleeping sites. The mean time lag between the first and last animal to enter a sleeping site was significantly higher on the day of and the three days following the attack in comparison to periods before and after this event ($F_{2,39} = 21.704$, $p < 0.0001$; Table 1). F-j recovered and survived into adulthood, but slight limping always remained notable.

Discussion

Given the highly co-operative nature of tamarin societies (Caine, 1993; Goldizen, 1987; Shahuano Tello *et al.*, 2002), one would predict some response to the injury by other group members or the group as a whole. In the present case, patterns of resource use were modified on the days following the attack (compared to previous and later observation periods). This allowed F-j to remain in contact with the group despite being strongly impaired. It is unlikely that the modification resulted from seasonal variation in resource availability, as the period covered by the analyses includes the middle-late rainy season (March-May), a transitional month (June), and the early-middle "dry" season (July-August). Given a decline of fruit availability from the rainy towards the "dry" season at our study site (Tirado Herrera and Heymann, unpubl.

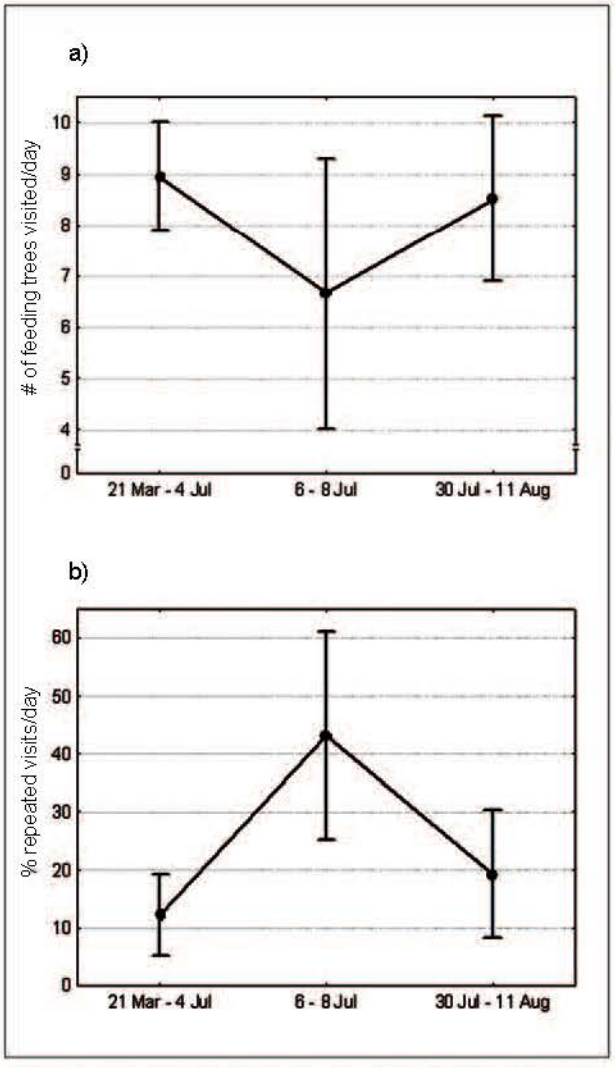

Figure 1. Comparison of parameter values between the period before, immediately after, and following the attack. (a) Number of feeding trees visited per day ($F_{2,27} = 1.3727$, $p = 0.27$). (b) Percentage of visits to the feeding trees per day accounted for by repeated visits to the same tree ($F_{2,27} = 5.994$, $p < 0.01$). Dots represent means, and vertical bars 95% confidence intervals.

Table 1. Time lag (min) between first and last animal entering sleeping tree and comparison with other groups.

Study group	Group size	Mean	SD	Maximum	n days
This study	8				
a) 21 Mar – 4 Jul 1997		1:24	0:41	3:00	29
b) 5 Jul 1997 (day of attack)*		18:00	-	-	1
c) 6 – 8 Jul 1997*		5:40	4:36	11:00	3
d) 30 Jul – 11 Aug 1997#		1:47	0:40	3:00	9
EBQB 1985/86†	3	0:24	0:17	1:00	5
EBQB 1990†	4-5	1:01	0:45	2:45	15
EBQB 1995§	7	<2:00	<1:24	5:57	13

* last animal always F-j
\# F-j last animal on 2 days
Tukey HSD test: a vs. d: n.s.; a vs (b+c): $p < 0.0005$; d vs. (b+c): $p < 0.0005$
† Heymann (1995)
§ Heymann, unpublished data

data), a seasonal effect should have resulted in a constant increase or decrease, respectively, of the parameters examined here, rather than in the observed fluctuation.

Modification of resource use (increased number of repeated visits to the same feeding site) may incur costs in terms of increased risk of cueing-in a predator and reduced dietary variability. Since the genetic relationships of the group members are not known (although F-j most likely is the daughter of the adult pair and the sister of the subadult and juvenile group members), it is not clear whether benefits obtained through kin selection or other benefits balanced these costs. An additional cost factor may have been represented by F-j lagging behind the group when entering a sleeping site. Rapid retirement to a sleeping site within 1-2 min is highly consistent between different groups (Table 1), and probably represents an anti-predator strategy (Caine, 1987; Heymann, 1995). Lagging behind could potentially increase the risk of being detected by, or cueing-in, a predator.

Whether or not F-j would have survived without the modification in the group's behaviour cannot be answered. Our observations provide evidence that wild tamarins modify their behaviour in response to an injured member.

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Diurnal Birth of a Wild Red Titi Monkey, *Callicebus cupreus*, at the Estación Biológica Quebrada Blanco

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In most diurnal primates, births take place during the night (Jolly, 1972, 1973), which may relate to ecological, behavioural or physiological factors (Timmermans *et al.*, 1998). The circumstances surrounding a birth are therefore usually not observed. Such observations might be particularly interesting in species where offspring are carried mostly by individuals other then the mother – such as in titi monkeys, night monkeys, the marmosets and tamarins – to see how soon the newborn may be transferred to a helper. Here we report unusual circumstances surrounding the birth of a red titi monkey, *Callicebus cupreus*, observed at the Estación Biológica Quebrada Blanco (EBQB) in north-eastern Peruvian Amazonia (04°21'S, 73°09'W; for details of EBQB see Heymann, 1995).

The titi monkey group was composed of the adult pair, a subadult male and an as-yet unsexed juvenile. This well-habituated group had been under regular monthly observation between October 2002 and September 2003 as part of a thesis project (Perez Yamacita, in prep.). The group was monitored by two of us (CFA and EWH) on 10-13 October 2003, and quantitative data were collected by the first two authors with the help of CFA on 16-18 October 2003 as part of a field course. Instantaneous scan sampling at 10-minute intervals was employed for data collection (Martin and Bateson, 1993). While monitoring the group, we noted the swollen abdomen of the female titi monkey, suggesting that she might be pregnant. She copulated with her mate on 11 October 2002.

On 18 October the group left its sleeping tree at 0530 h and moved into a neighbouring tree, where the titis rested until 0600 h. They then moved, fed, and rested intermittently until 0940 h. During this period, all were in the lower forest levels and clearly visible for much of the time. No infant was present. At 0950 h the group moved into a vine tangle at a height of about 22 m. The two adults remained there for the next two hours, while the subadult and the juvenile foraged and fed nearby, occasionally approaching the adults.

At 1300 h, we saw the neonate for the first time. It was carried by the juvenile, who had climbed down and was moving at a height of about 7 m. The neonate had dark grey skin and was very sparsely haired. Head-body length was estimated to be about 12-13 cm. The juvenile was not moving particularly slowly or carefully, and at one point the juvenile rubbed his back, and the neonate, against a trunk. When the neonate screamed, the other group members looked towards the juvenile and the neonate, but did not interfere.

The juvenile continued to carry the neonate until between 1440 h and 1450 h. We did not notice the transfer, but from 1450 h it was carried by the adult male, who stayed mostly in the upper canopy, while the others used different levels of the forest during foraging, moving and resting. At 1530 h, the adult male climbed down and approached the female. They rested together at a height of 4 m. We heard the neonate vocalizing, and at 1600 h it moved from the male's back to his ventrum. At 1610 h the female climbed up into the canopy, followed by the male with the neonate. They remained out of sight until 1640 h, when the male, still with the neonate, entered a sleeping site, immediately followed by the female. The subadult and the juvenile entered at 1650 h and 1659 h, respectively.

The quantitative data collected during a 3-day observation period do not allow for a statistical comparison of activity budgets. However, it may be no coincidence that the time spent resting by the female on the day of the birth was 41%, compared to 24% on the two days preceding the birth. Furthermore, she was much more vigilant (12% of time) compared to 6% and 3%, respectively, the two days before.

While we could not determine the exact time of birth, it is clear that it took place after 0950 h, most likely during the prolonged resting period of the male and the female. In captivity, birth in titi monkeys occurs during the night (Meritt, 1980), but no information is available from the field. In wild New World monkeys, diurnal births have been reported from *Saguinus labiatus* and *S. imperator* (Nacimento Bezerra and Porter, 1999; Windfelder, 2000). It is difficult to estimate how common diurnal births may be as opposed to nocturnal, due to the rarity of any reports on births in the wild.

In titi monkeys, the father is the principal infant carrier from the first week of life (Jantschke *et al.*, 1995; Wright, 1984), and it would seem to be quite unusual that this newborn was carried by the juvenile for some time after its birth. The juvenile was born in November 2002 and had, therefore, never seen a younger sibling before. It was inexperienced in this sense, and showed inappropriate behaviours, such as trying to rub off the neonate. The parents did not interfere, and the newborn was apparently unharmed. When the group was followed again on 21 and 23 October, the male was carrying the infant. By September 2004, it had become a juvenile.

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Occurrence and Diet of the Black Bearded Saki (*Chiropotes satanas satanas*) in the Fragmented Landscape of Western Maranhão, Brazil

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Introduction

The bearded sakis, *Chiropotes*, are medium-sized platyrrhine frugivores, morphologically specialised for seed predation (Kinzey and Norconk, 1993; Peetz, 2001). Like most Amazonian primates, relatively few detailed field data are available, especially considering the dimensions of the genus' geographic distribution, which extends from the southeastern extreme of the Hylaea as far north and west as the right bank of the Orinoco (Silva Jr. and Figueiredo, 2002). As is also so often the case, the taxa most threatened with extinction are the least well-known.

The black bearded saki, *Chiropotes satanas satanas*, is the only Amazonian pitheciid found east of the Rio Tocantins (Ferrari and Lopes, 1996) – one of the biome's most densely populated areas – and has been classified as Endangered for some time (IUCN, 1994; Rylands *et. al.*, 1997; MMA, 2003). Johns and Ayres (1987) proposed that the subspecies could be extinct by the end of the twentieth century, although fortunately this prediction proved unfounded. Several recent studies (Carvalho Jr. *et al.*, 1999; Lopes and Ferrari, 2000; Pereira, 2002) have identified a growing number of remnant populations, often in relatively small forest fragments.

While these studies have shown that the black bearded saki is more tolerant of habitat fragmentation than was previously thought, the ecology of the subspecies is still poorly known, and more detailed field data are necessary for the development of effective conservation strategies. With this in mind, five remnants of the original forest cover – including two of less than 100 ha – were surveyed in western Maranhão in order to identify surviving populations of bearded sakis and collect preliminary data on their feeding behaviour. Sakis were found in all fragments, where they were observed feeding mainly on immature seeds. This apparent ability of *C. s. satanas* to survive extremes of habitat fragmentation will be an important asset for its conservation over the long term.

Methods

This study took place on the Celmar plantation complex in the western extreme of the Brazilian state of Maranhão, northwest of the city of Imperatriz. This part of the state is known locally as the Tocantina region, and represents the easternmost extreme of the Amazon forest, or Hylaea. Present-day forest cover consists of a series of fragments that vary in size and degree of habitat disturbance, totalling 40,000 ha, separated by pastures and *Eucalyptus* plantations covering 31,000 ha (Almeida, 2001). Approximately 11,600 ha of primary *terra firma* forest remain, distributed in 12 fragments of different sizes. Bearded sakis were found in all, and data were collected in five fragments, ranging in size from eight to over 2,000 ha (Table 1).

The fragments were visited regularly throughout 2001 (see Carvalho, 2002). In the four larger fragments, in addition to informal observations, standard line-transect surveys were carried out, with a total of between 100 km and 133 km walked per site (Port-Carvalho and Ferrari, 2002; Port-Carvalho and Ferrari, in prep.). Estimates of population density for the three largest fragments were calculated using a Fourier series expansion (Ayres *et al.*, 2000). Whenever sakis were observed feeding during either type of data collection, all relevant details were recorded, including the item (flower, fruit, seed), and the species of plant exploited. Feeding sites were marked, and specimens collected for identification at the EMBRAPA herbarium in Belém. The proportion of secondary forest cover in the larger fragments (Table 1) was estimated by recording the forest type observed at 50-m intervals along the respective trail system (2.5-5.2 km total length, depending on the site).

Complementary behavioural data were collected in the Primavera fragment between December 2001 and February 2002, where a study group with 17 members was monitored using a scan-sampling schedule in which one-minute scans were conducted at intervals of five minutes (see Ferrari and Rylands, 1994). Records were assigned to four principal behaviour categories (Feeding, Locomotion, Rest and Miscellaneous, which includes social interactions and alarm vocalisations and postures).

Results

Bearded sakis were observed in all five fragments (Table 2), including Martirinho, where there was a group of at least four individuals. Given the reduced size of this fragment, it seems likely that the sakis may range into surrounding areas, or even visit neighbouring fragments by crossing open ground – although no evidence of such behaviour was collected, either from direct observation or reports from local residents. Sakis were relatively abundant in all but the largest fragment (Esplanada), especially in comparison with *Chiropotes* populations inhabiting continuous forest (for

Table 1. Characteristics of the forest fragments surveyed.

Fragment	Location	Area (ha)	Estimated % of secondary forest
Martirinho	05°00'S, 48°08'W	8	100.0
Primavera	05°09'S, 48°17'W	63	61.1
Coração do Brasil	05°00'S, 48°12'W	306	56.3
Santa Rosa	05°05'S, 48°15'W	653	57.5
Esplanada	04°58'S, 48°08'W	>2000	64.9

Table 2. Known (Martirinho and Primavera) or estimated abundance of bearded sakis at the five study sites.

	Martirinho	Primavera	Coração do Brasil	Santa Rosa	Esplanada
Individuals per km²	62.5	27.0	11.4	10.1	2.5
Total population	4	17	35	66	49

example, Ayres, 1981; Van Roosmalen *et al.*, 1988; Ferrari *et al.*, 1999).

The behavioural data for the study group from the Primavera fragment are limited in terms of both sample size and period, but confirm the general pattern recorded for bearded sakis from other sites as active animals (Table 3). The proportion of time spent feeding was reduced in comparison with some previous studies, such as those of Ayres (1981) and Peetz (2001), although it remains unclear to what extent this represents a real difference in behaviour patterns, as opposed to differences in sampling procedures.

Despite the limited number of records, feeding behaviour was typical of *Chiropotes*, characterised by the exploitation of a wide variety of species, a large proportion of immature seeds (Table 4), and the predominance of the Sapotaceae, Lecythidaceae and Leguminosae (Table 5). The total of 48 different species, belonging to 19 families, was recorded in only 75 feeding events – although of course data were collected over a relatively wide area, which may have contributed (at least in part) to increased diversity in comparison with previous studies. However, no fewer than 37 of these species were recorded at Primavera, which suggests that high diversity is a characteristic of the forest in the study area. A majority of the species were exploited for their immature seeds (Table 4), although the sakis also dispersed the seeds of nine families, all of which have relatively small seeds, varying in length between 1-20 mm. With one exception, the species recorded in the diet at more than one site or on more than two occasions were all exploited for their immature seeds, further reinforcing the importance of this item in the sakis' diet. The ingestion of flowers was recorded only once, and no evidence was found of insectivory. However, we emphasize that while data were collected throughout the year, a majority of the records were collected between December and February, which corresponds with the onset of the wet season at the study site. It is thus possible that there may be a certain degree of seasonal bias (see Norconk, 1996).

Discussion

Two aspects of the results of this study of *Chiropotes s. satanas* are especially relevant to the conservation of this endangered primate. The occurrence of a sizeable metapopulation this far east and south is an extremely important finding, and the possibility of the existence of other isolated populations in the region's fragmented landscape surely demands further investigation. In addition, remnant populations were found in all the fragments surveyed, including those smaller than 100 ha, and all disturbed to a greater or lesser degree (Table 1). This is considerably smaller than the original estimates of home range size for bearded sakis in continuous forest (Ayres, 1981; Van Roosmalen *et al.*, 1988), although recent studies (Peetz, 2001; Santos, 2002; Silva, 2003) have also recorded much smaller ranges in fragmented habitat. Even so, it seems unlikely that the group in the Martirinho fragment will be able to survive over the long term without access to neighbouring habitat (Rylands and Keuroghlian, 1988).

In addition to tolerating extremes of habitat fragmentation, the results indicate that the diet and activity regime of *C. s. satanas* in the study area is similar to that of bearded sakis at other sites. In other words, toleration of fragmented habitat appears not to have been dependent on significant changes in behavioural patterns, such as the exploitation of alternative resources, although it must be remembered that the data presented here are preliminary in nature. The characteristics of the process of habitat fragmentation may also be important, however. Many members of the Sapotaceae, Lecythidaceae and Leguminosae are valued hardwoods (Johns and Ayres, 1987), so shifts in feeding patterns might be expected where fragmentation has been accompanied by selective logging. Silva (2003) did find evidence of such a shift in the feeding ecology of *C. s. satanas* in a fragment similar in size to that of Martirinho but, as mentioned above, data from the latter site are far from comprehensive.

Table 3. Activity budget of the *C. s. satanas* study group between December 2001 and February 2002.

Category	Records	% Total
Locomotion	245	58.5
Feeding	83	19.8
Rest	58	13.8
Miscellaneous	33	7.9
N	419	100.0

Table 4. Composition of the diet of *C. s. satanas* according to the different items ingested.

Item	Number of species (% of total)	Number of events (% of total)
Immature seeds	28 (58.3)	47 (62.7)
Mesocarp or aril (seeds spat out)	10 (20.8)	14 (18.7)
Mesocarp (seeds ingested)	9 (18.8)	13 (17.3)
Flowers	1 (2.1)	1 (1.3)
Total	48 (100.0)	75 (100.0)

Table 5. Food sources exploited by bearded sakis in western Maranhão.

Family	Species	Habitus	Item	Events	Site
Annonaceae	*Xylopia* sp.	Tree – 25 m	Immature seed	1	PRI
Apocynaceae	*Apisdosperma multiflorum*	Tree – 20 m	Mesocarp	1	PRI
	Not identified	Liana	Mesocarp	2	ESP
Arecaceae	*Euterpe oleracea*	Tree – 15 m	Mesocarp	1	MAR
Boraginaceae	*Cordia scrabifolia*	Tree – 15 m	Mesocarp	2	PRI
Burseraceae	*Protium apiculatum*	Tree – 25 m	Mesocarp	1	PRI
	Protium puncticulatum	Tree – 20 m	Mesocarp	2	MAR
	Tetragastris altissima	Tree – 15 m	Mesocarp	3	PRI/MAR
	Tetragastris paraensis	Tree – 30 m	Mesocarp	1	PRI
Caesalpinaceae	*Dialium guianense*	Tree – 25 m	Immature seed	1	CBR
Cecropiaceae	*Cecropia* sp.	Tree – 15 m	Mesocarp	1	PRI
Chrysobalanaceae	*Licania kunthiana*	Tree – 20 m	Mesocarp	2	PRI
Clusiaceae	*Caraipa* sp.	Tree – 25 m	Seed	1	MAR
Combretaceae	*Buchenavia* sp.	Tree – 20 m	Mesocarp	1	PRI
Dilleniaceae	*Tetracera wildnoviana*	Tree – 25 m	Mesocarp	1	CBR
Flacourtiaceae	*Laetia procera*	Tree – 30 m	Mesocarp	1	MAR
	Laetia suaveolonus	Tree – 15 m	Mesocarp	1	PRI
Hippocrateaceae	*Cheiloclinium coguateae*	Liana	Mesocarp	2	PRI
Lecythidaceae	*Cariniana* sp.	Tree – 25 m	Seed	1	MAR
	Eschweilera coriaceae	Tree – 25 m	Immature seed	3	PRI/CBR
	Eschweilera ovata	Tree – 25 m	Immature seed	1	PRI
	Eschweilera pedicillata	Tree – 20 m	Immature seed	1	CBR
	Eschweilera sp.	Tree – 20 m	Immature seed	2	PRI
	Lecythis lurida	Tree – 25 m	Immature seed	2	PRI
Leguminosae	*Hymenaea parvifolia*	Tree – 20 m	Immature seed	1	PRI
	Inga alba	Tree – 25 m	Mesocarp	2	PRI
	Inga nobilis	Tree – 10 m	Mesocarp	1	PRI
	Peltogyne venosa	Tree – 20 m	Immature seed	2	PRI
	Pterocarpus rohrii	Tree – 15 m	Immature seed	1	PRI
Moraceae	*Brosimum guianense*	Tree – 05 m	Immature seed	1	PRI
	Brosimum parinarioides	Tree – 35 m	Immature seed	1	MAR
	Ficus pertusa	Hemiepiphyte	Mesocarp	1	PRI
	Pseudolmedia laevigata	Tree – 15 m	Mesocarp	1	PRI
Myrtaceae	*Eugenia patrisii*	Tree – 15 m	Immature seed	7	PRI
	Eugenia sp.	Tree – 15 m	Flower	1	PRI
Quinaceae	*Lacunaria crenata*	Tree – 15 m	Immature seed	1	PRI
	Lacunaria oppositifolia	Tree – 15 m	Immature seed	1	SRO
Sapotaceae	*Franchetella anibifolia*	Tree – 15 m	Immature seed	1	PRI
	Manilkara amazonica	Tree – 15 m	Immature seed	1	PRI
	Micropholis egensis	Tree – 20 m	Immature seed	1	PRI
	Micropholis guyanensis	Tree – 20 m	Immature seed	1	PRI
	Neoxythece sp.	Tree – 20 m	Immature seed	1	PRI
	Panchonella guianensis	Tree – 20 m	Immature seed	1	PRI
	Pouteria caimito	Tree – 20 m	Immature seed	2	SRO
	Pouteria lasiocarpa	Tree – 25 m	Immature seed	5	PRI
	Pouteria hispida	Tree – 10 m	Immature seed	1	PRI
	Priurella prieuri	Tree – 20 m	Immature seed	1	PRI
Vochysiaceae	*Qualea dinizii*	Tree – 30 m	Immature seed	2	PRI
	Qualea gridonia	Tree – 20 m	Immature seed	3	PRI/CBR

While the similarities with previous studies of bearded sakis have been emphasised here, an alternative interpretation of the results may be relevant to an understanding of the ecology of the genus. Early ecological studies of bearded sakis (Ayres, 1981; Van Roosmalen *et al.*, 1988; Frazão, 1992) were conducted at sites located well within the main body of the genus' distribution, and supported what came to be a "standard" dogma, that these primates were intolerant of habitat disturbance and dependent on large areas of continuous forest (for example, Johns and Ayres, 1987). All recent studies, however, have contradicted this idea (Bobadilla and Ferrari, 1999; Lopes and Ferrari, 2002; Peetz, 2001; Pereira, 2002; Santos, 2002; Silva, 2003; present study). A common aspect of these studies is that they were conducted at relatively marginal sites, close to the transition of the continuous forest with the Venezuelan Llanos to the northwest (Peetz, 2001) and the Brazilian Cerrado to the southeast (all other studies).

This suggests that these sakis may be naturally more tolerant of habitat disturbance than those found at more central sites, although it remains unclear whether this reflects phylogenetic differences, or variation at the local population level. More detailed data will obviously be required before such conclusions can be evaluated definitively. In the meantime, whatever the factors involved, the results presented here, together with those of other recent studies, indicate that *C. s. satanas* is able to survive in the fragmented landscape of eastern Amazonia, although the long-term conservation of this primate will depend on adequate metapopulation management.

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Infección por Larvas de *Alouattamyia baeri* (Diptera: Cuterebridae) en Monos Aulladores, *Alouatta palliata* (Primates: Cebidae) de la Costa Caribe de Costa Rica

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Introducción

Alouattamyia baeri es una especie de cuterébrido cuya larva se asocia con el parasitismo en primates del Nuevo Mundo (Catts, 1982). La descripción de la morfología fue realizada por Shannon y Greene (1926) con ejemplares procedentes de la Guayana Inglesa y de la Región del Darién en Panamá. Zeledón y colaboradores (1957) describieron el caso de una miasis furuncular en un mono aullador procedente de La Hacienda Lombardía en Tilarán (Guanacaste, Costa Rica) en la que el agente etiológico identificado correspondió a *Cuterebra* (=*Alouattamyia*) *baeri*. Este fue el primer informe acerca de la presencia de este díptero en el territorio nacional.

A pesar de que el parasitismo por esta mosca se ha informado en primates como *Aotus trivirgatus* (Guimarães, 1971) y el ser humano (Guimarães y Coimbra, 1982; Fraiha *et al.*, 1984), se ha observado que las relaciones parasitarias más frecuentes se establecen con monos del género *Alouatta* (*A. palliata* y *A. belzebul*) (Catts, 1982), por lo que podrían constituir un importante agente patogénico para estas especies.

En el presente trabajo se analizaron las características de la infestación que presenta este díptero en una muestra de monos aulladores procedentes de la Costa Caribe de Costa Rica.

Métodos

Se estudió la presencia de *A. baeri* en monos aulladores procedentes de la Costa Caribe de Costa Rica. El manejo de los mismos se hizo de acuerdo con los protocolos descritos por Troyo y colaboradores (2002). Brevemente, los animales fueron anestesiados con dardos que contenían los sedantes Telazol o una mezcla de ketamina y xylosin (aproximadamente 0.2 mg/kg). El primate fue capturado en una red y una vez en el suelo, se realizó su inspección física, ubicando la presencia o ausencia de lesiones miásicas. Esta evaluación se realizó en el marco de una investigación multidisciplinaria en la cual se estudian diferentes aspectos de las poblaciones de primates de Costa Rica.

El diagnóstico del agente etiológico fue realizado mediante análisis de las larvas que fueron extraídas mecánicamente de las lesiones. Estas fueron colocadas en alcohol al 70% para su fijación y transporte al laboratorio. Dichas larvas fueron observadas macroscópicamente y posteriormente se aclararon en lactofenol por un período de 20 días, luego del cual

se realizó la disección y montaje de las estructuras diagnósticas (esqueleto cefalofaríngeo, espiráculos posteriores y piel larval). Estas fueron montadas entre porta y crubreobjetos en medio Hoyer para su posterior análisis microscópico y comparadas con las observaciones descritas por Shannon y Greene (1926) y Zeledón y colaboradores (1957).

Las características de la infestación fueron expresadas de acuerdo con las definiciones propuestas por Margolis y colaboradores (1982). Los valores correspondientes a prevalencia y densidad relativa en monos machos y hembras fueron evaluados mediante pruebas de hipótesis para la comparación de proporciones, en tanto que los valores concernientes a la intensidad promedio se analizaron mediante pruebas de *t*-student para comparación de medias (Daniel, 1988).

Resultados

Se capturaron 28 monos aulladores correspondientes a la especie *Alouatta palliata*, en cinco localidades ubicadas en la Costa Caribe de Costa Rica. Ocho de los monos, procedentes de tres localidades diferentes, mostraron lesiones miásicas (Tabla 1), cuyas larvas presentaron las características típicas de *A. baeri* (Figura 1). Las lesiones observadas fueron de tipo furuncular (Figura 2) y se localizaron en las partes superiores del cuerpo, principalmente a nivel de cuello (Figura 2, Tabla 2).

Las diferencias en las características de la infección en monos macho y hembra fueron estadísticamente significativas en lo referente a prevalencia y densidad relativa, en tanto que la intensidad promedio fue similar entre los animales de ambos sexos (Tabla 3).

Discusión

La presencia de *A. baeri* en primates del territorio costarricense fue informado por primera vez durante la década de los años 50 cuando, casi como una curiosidad, se presentó el caso de un mono de la especie *Alouatta palliata palliata* que sufría una miasis en la cual el agente causal fue *A. baeri*. Este mono procedía de la provincia de Guanacaste, ubicada en el Pacífico Seco de Costa Rica (Zeledón *et al.*, 1957). En la presente investigación se evidencia la presencia de *A. baeri* en la Costa Caribe del país (Tabla 1). Al igual que en estudios previos (Shannon y Greene, 1926; Zeledón *et al.*, 1957; Milton, 1996), el tipo de miasis observado fue furuncular, con una localización de preferencia en la periferia del cuello del animal (Figura 2, Tabla 2). La presencia de lesiones en hombro, flanco derecho, pecho y axila fue también evidente (Tabla 2). Estas lesiones podrían obedecer a migraciones endógenas erráticas por parte de las larvas, las cuales han podido completar su ciclo larval exponiéndose a nivel dérmico en sitios anómalos.

La prevalencia total de la infección fue del 28.6%, siendo significativamente mayor en machos que en hembras (Tabla 3). Las diferencias asociadas al sexo del hospedador podrían estar relacionadas con los bajos porcentajes de infección por

Tabla 1. Infestación por larvas de *Alouattamyia baeri* en los primates estudiados. Se presenta el número de monos infectados seguido de diagonal y el número de monos capturados.

Procedencia	Hembras	Machos	Total
Puerto Vargas	2/2	2/2	4/4
Bambú	0/6	0/1	0/7
Albi Lodge	1/6	2/3	3/9
Río Juárez	0/4	1/3	1/7
Cacaotal	0/0	0/1	0/1
Total	**3/18**	**5/10**	**8/28**

Figura 1. Vista macroscópica de larvas de *Alouattamyia baeri* obtenidas en la Costa Caribe de Costa Rica.

Tabla 2. Carga parasitaria y localización de las lesiones en los monos infectados por larvas de *Alouattamyia baeri.*

Ejemplar Nº	Sexo*	Localización	Carga parasitaria	Topografía de la lesión
1	M	Puerto Vargas	1	Hombro izquierdo
2	H	Puerto Vargas	3	Cuello/flanco derecho
3	M	Puerto Vargas	3	Cuello/pecho/ abdomen
4	H	Puerto Vargas	1	Cuello
5	M	Albi Lodge	3	Cuello/hombro/ flanco derecho
6	M	Albi Lodge	3	Hombro/axila derecha
7	H	Albi Lodge	7	Cuello
8	M	Río Juárez	1	Cuello
Total			**22**	

M = macho, H = hembra

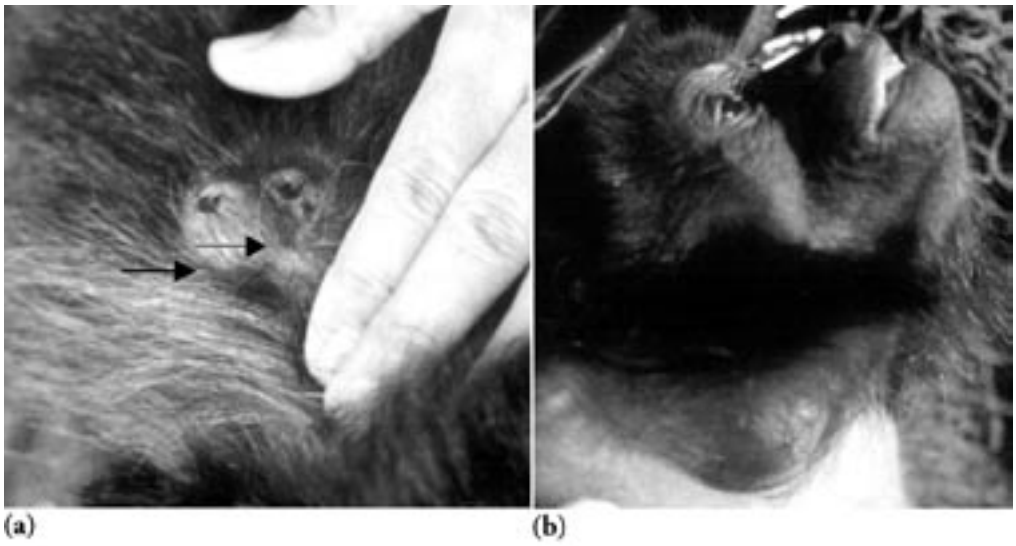

Figura 2. Lesiones furunculares por *Alouattamyia baeri* en monos aulladores de la Costa Caribe de Costa Rica: **a**. Detalle de la lesión furuncular; **b**. Ubicación típica del furúnculo; → = sitio de la lesión.

parte de *A. palliata* en los monos estudiados. En otros estudios, como los realizados por Milton (1996) y Baron y colaboradores (1996) en la Isla de Barro Colorado (Panamá), se observaron prevalencias totales mayores a las evidenciadas en el presente estudio (60.0 y 83.0% respectivamente) y no se observaron diferencias en la prevalencia entre machos y hembras. En el primero de estos estudios (Milton, 1996) se demostró que la incidencia de la parasitosis muestra una clara estacionalidad con picos de incidencia en la mitad y finales de la estación lluviosa. En Costa Rica, la Zona Caribe, no tiene una estacionalidad marcada, por lo que se esperaría que la prevalencia fuera más o menos la misma durante todo el año.

En el presente estudio se pudo evidenciar una distribución asimétrica de la infección observada en las localidades estudiadas cuyas características biológicas y ambientales prácticamente son iguales (Tabla 1), lo que plantea la posibilidad de que la capacidad de dispersión de *A. baeri* sea realmente limitada. Tal y como lo demostraron Colwell y Milton (1998), la tasa de oviposición de las hembras es de alrededor de 262 ± 149.4 huevos, con una oviposición total de 1.399 ± 243 huevos, lo que permitiría suponer la ocurrencia de más o menos cinco oviposiciones a lo largo de la vida del díptero. Si las densidades de moscas no son muy altas, el evento de infección ocurriría de una manera eventual en las poblaciones de monos, afectando solamente a pequeñas fracciones de las tropas. A pesar de lo anterior, se puede observar que la intensidad promedio de la infección (Tabla 3) fue similar en los monos infectados, sin que hubiese diferencia entre machos y hembras. El valor de Intensidad Promedio Total observado en este estudio (2.75) fue similar a los descritos por Milton (1996) en la Isla de Barro Colorado. Lo anterior podría reflejar el ingreso de una carga infectante similar en el momento de la infección. Este comportamiento es compatible con la hipótesis de que los sitios de oviposición podrían estar dados por las hojas de las plantas que sirven de alimento a los monos, por lo que la infección tendría lugar por vía oral. En relación con lo anterior Colwell y Milton (1998), en un modelo animal con conejos, demostraron que la infección por vía dérmica prácticamente no se da, en tanto que la penetración vía mucosas es mucho más permisiva. La intensidad promedio podría ser regulada también por medio de mecanismos inmunes. En este sentido se ha podido evidenciar que en los monos aulladores existe una respuesta tipo IgG específica, dirigida primordialmente contra larvas de primer y tercer estadio de *A. baeri* (Baron *et al.*, 1996).

Tabla 3. Caracterización de la infestación por *Alouattamyia baeri* en los monos estudiados.

Parámetro	Hembras	Machos	Total
Prevalencia[1,†]	16.6	50.0	28.6
Intensidad promedio[2]	3.6 ± 3.05	2.2 ± 1.09	2.75 ± 1.98
Densidad relativa[3,‡]	0.61	1.1	0.78

[1]Monos infectados por sexo/Total de monos analizados (infectados y no infectados) por sexo
[2]No. de larvas/No. de monos infectados por sexo
[3]No. de larvas/No. total de monos analizados por sexo
Diferencias estadísticamente significativas [†]($p < 0.1$), [‡]($p < 0.05$)

El impacto de la infección por *A. baeri* en las poblaciones de monos aulladores puede verse reflejado en la mortalidad de los miembros de las tropas. En este sentido Milton (1996) demostró una correlación entre incidencia de infección y mortalidad. Dicha mortalidad puede estar relacionada con cuadros sépticos secundarios o infestación con otras larvas de dípteros como *Cochliomyia hominivorax* (Diptera: Calliphoridae). El papel que juega el parasitismo errático, donde se da el compromiso de órganos y tejidos vitales, debe ser evaluado posteriormente.

La profundización en el conocimiento biológico sobre *A. baeri* se plantea como una necesidad para el desarrollo de alternativas de control contra este díptero, el cual podría constituir un agente causal de miasis frecuente en las poblaciones de monos aulladores de países tropicales.

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Flora Bacterial Oral y su Perfil de Sensibilidad a Antibióticos en Monos de Costa Rica (*Alouatta palliata* y *Ateles geoffroyi*)

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Introducción

Costa Rica es considerada como la región de mayor diversidad biológica en Centro América; en 51 000 km^2 tiene al menos de 500 000 diferentes especies (Reid *et al.,* 1994) y entre los mamíferos presentes, se identifican cuatro especies de monos distribuidas por todo el país, dos de las cuales son *Alouatta palliata*, conocido como congo, y *Ateles geoffroyi*, o mono colorado. Los *A. palliata* se encuentran distribuidos en todo el país; son arborícolas, aunque en ocasiones se ven obligados a cruzar áreas abiertas sobre suelo para alimentarse de árboles aislados y ocasionalmente, cuando el recurso alimenticio es escaso, migran del parche boscoso hacia los cafetales (Sánchez, 1991). En Costa Rica, *A. geoffroyi* es considerada en peligro de extinción, debido a la deforestación y a la caza para aprovechar su carne. Los individuos de esta especie se encuentran en todo el país y se les conoce por su especialización extrema a la forma de vida arbórea; son principalmente frugívoros, alimentándose muy selectivamente en el bosque maduro, en alturas de moderadas a extremas (Elizondo, 1999).

Con el tiempo los monos han aumentado su contacto con los humanos, ya sea por la siembra de café dentro de zonas boscosas o por la eliminación de árboles (Sánchez, 1991), lo que ha afectado su comportamiento y hábitos alimenticios (Vergeest, 1992) y por ende, posiblemente su flora bacteriana normal. En el ser humano, las bacterias aerobias y anaerobias constituyen los componentes principales de la microflora que coloniza las superficies mucosas y la piel; las bacterias anaerobias superan en número a las bacterias aerobias, pudiéndose encontrar una relación de 10:1 en la cavidad oral (Engelkirk y Duben-Engelkirk, 2000). Se conoce poco acerca de la flora bacteriana normal de los monos, incluyendo la oral, ya que la mayoría de estudios se enfocan principalmente en su biología, comportamiento, hábitat y alimentación. En este trabajo se pretende describir la flora bacteriana (aerobia y anaerobia) de la cavidad oral de monos de las especies *A. palliata* y *A. geoffroyi* y determinar su patrón de sensibilidad a los antibióticos. Esto con el propósito de evaluar el riesgo potencial de contraer alguna enfermedad por la cercanía humana con los monos y tratar de establecer si la interacción del hombre en ambientes pro-

pios de estos animales ha influenciado dicho patrón de sensibilidad antimicrobiana.

Métodos

Se estudiaron 27 muestras de la cavidad oral de monos de las especies *A. palliata* y *A. geoffroyi* en las regiones de Costa Rica de: Chomes (10° 02' 35" N, 84° 54' 50" O), Limón (09° 59' 34" N, 83° 01' 51" O), San Ramón (10° 05' 05" N, 84° 28' 48" O), Cahuita (09° 44' 06" N, 82° 48' 39" O) y Palo Verde (10° 20' 47" N, 85° 20' 44" O); sólo estas dos últimas constituyen hábitat continuo, a partir de los cuales se analizaron 13 muestras.

Con una torunda estéril, se raspó los dientes y la cavidad de la boca del mono (previamente sedado) y se resuspendió en un tubo con 2 ml de solución salina (SS) estéril. Con jeringa y a través del tapón de hule, se inoculó 0.5 ml de la suspensión en un tubo con medio de carne cocida (CC) prerreducido, que se mantuvo a temperatura ambiente antes de ser procesado en el laboratorio; los tubos con el resto de la suspensión en SS se mantuvieron en frío. A cada una de las suspensiones, se les agregó 2 ml de caldo tripticasa soya (CTS) y se incubaron a 35°C por 24 hr; los tubos con medio de CC prerreducidos se incubaron a 35°C por 48 hr. A partir de cada tubo de CTS, se rayaron placas de agar sangre (AS), chocolate, MacConkey y manitol sal, que se incubaron a 35°C por 24 hr para el aislamiento de bacterias aerobias. A partir de cada tubo con medio de CC prerreducido, para el aislamiento de bacterias anaerobias, se rayó una placa de AS que se incubó en anaerobiosis a 35°C por 48 hr. Se seleccionaron los diferentes morfotipos coloniales en cada placa, anotando sus características, se les hizo tinción de Gram y se rayaron en AS para obtener cultivos puros. Se determinó la tolerancia al oxígeno de cada morfotipo colonial (incubación en atmósfera incrementada de CO_2 y en jarra de anaerobiosis) y se seleccionaron como bacterias anaerobias aquellas cuyo crecimiento fue exclusivo o mejor bajo condiciones anaerobias.

A las bacterias aerobias se les realizaron pruebas de Gram, oxidasa y catalasa y con base en ello, se escogió la correspondiente galería miniaturizada de pruebas bioquímicas (API®); las bacterias anaerobias se inocularon en Rapid ID 32A o API 20A. Todas las galerías se incubaron y se leyeron de acuerdo con las recomendaciones de la casa fabricante y se identificaron utilizando el programa API-Plus®. Se realizaron pruebas adicionales, según el caso, cuando la identificación no fue precisa. Para determinar la sensibilidad a los antibióticos se utilizaron galerías comerciales (ATB®), de acuerdo con el tipo de bacteria aerobia: ATB G-5, ATB-Staph y ATB-Strep; para bacterias anaerobias se usó ATB-ANA y se siguieron las recomendaciones de la casa fabricante.

Resultados

A partir de las 27 muestras de la cavidad oral de los monos, se aislaron 109 cepas de bacterias (promedio de cuatro cepas por muestra); 56 eran de monos de hábitat continuo y 53 de monos en fragmentos de bosque, cerca de poblaciones humanas. No se encontraron diferencias en las especies bacterianas aisladas en ambos hábitats ni en los patrones de resistencia antimicrobiana. De las 109 cepas, 70 correspondieron a bacterias aerobias (64%) y 39 a bacterias anaerobias (36%), lo que equivale a 2.6 aerobios y 1.4 anaerobios por muestra. Respecto a las bacterias aerobias, predominaron los bacilos Gram negativos (49 de las 70 cepas), siendo *Enterobacter* el género más frecuente, ya que se aisló en el 67% de las muestras (Cuadro 1) e incluyó las especies de *E. agglomerans*, *E. cloacae* y *E. amnigenus*. Fue posible aislar otros 10 géneros de bacilos Gram negativos aerobios, cuya frecuencia en las muestras varió del 26% (*Escherichia*) al 4% (*Achromobacter* y *Chryseomonas*, Cuadro 1). Se aislaron 21 cepas de cocos Gram positivos aerobios, siendo *Staphylococcus* el género más frecuente (en 67% de las muestras) e incluyó las especies de *S. aureus*, *S. hominis*, *S. lentus*, *S. sciuri* y *S. simulans*; otros géneros aislados fueron *Streptococcus*, *Aerococcus* y *Leuconostoc* con una frecuencia de 4% cada uno.

Referente a las bacterias anaerobias, se aislaron 39 cepas: 17 bacilos Gram positivos, 12 bacilos Gram negativos, 6 cocos Gram negativos y 4 cocos Gram positivos. *Clostridium*, el género más frecuente, se encontró en el 48% de las muestras (Cuadro 2), correspondiendo a las especies de *C. beijerinckii*, *C. bifermentans*, *C. cadaveris*, *C. clostridioforme*, *C. histolyticum*, *C. septicum*, *C. sordellii* y *C. sporogenes*. Otros siete géneros de bacterias anaerobias también estuvieron presentes, con una frecuencia que varió desde un 26% (*Bacteroides*) al 4% (*Actinomyces* y *Peptostreptococcus*, Cuadro 2).

Con respecto a las pruebas de sensibilidad a los antibióticos, el 71% de los bacilos Gram negativos aerobios fue resistente a la amoxicilina y el 45% a la amoxicilina más ácido clavulánico. El 63% fue resistente a cefalotina, cefalosporina de primera generación, pero sólo el 8, 4 y 4% a cefotaxime, ceftriaxone y ceftazidime (8-16 mg/L), respectivamente, cefalosporinas de tercera generación (Figura 1); hubo resistencia moderada a otros antibióticos como ticarcilina, ceftazidime (1 mg/L), cotrimoxazol y aztreonam (Figura 1). Ocho de los 18 antibióticos (44%) evaluados fueron efectivos contra todas las cepas aisladas (piperacilina, piperacilina + tazobactam, imipenem, tobramicina, amikacina, gentamicina, netilmicina y ciprofloxacina). Las cepas de *Staphylococcus* mostraron una menor resistencia, pues 10 de los 15 antibióticos probados (67%) fueron efectivos contra todas las cepas aisladas (cefalotina, gentamicina, netilmicina, clindamicina, ciprofloxacina, tetraciclina, nitrourantoína, rifampicina, vancomicina y teicoplanina). Sin embargo, el 89% de los aislamientos fue resistente a penicilina G y el 28% a ampicilina más sulbactam, 11% a eritromicina y 6% a cotrimoxazol y a pefloxacina. Las únicas cepas de *Streptococcus* y *Aerococcus* aisladas fueron resistentes, entre otros, a ciprofloxacina, quinolona de amplio espectro y de uso relativamente reciente.

En cuanto a las cepas anaerobias, la resistencia a varios antibióticos también fue manifiesta, siendo el mayor porcentaje

Cuadro 1. Bacilos Gram negativos aerobios aislados de la cavidad oral de 27 monos (*Alouatta palliata* y *Ateles geoffroyi*).

Género	Total de cepas n=49	Frecuencia (%) n=27
Enterobacter	18	67
Escherichia	7	26
Klebsiella	5	19
Acinetobacter	5	19
Serratia	3	11
Pseudomonas	3	11
Citrobacter	2	7
Chromobacterium	2	7
Aeromonas	2	7
Achromobacter	1	4
Chryseomonas	1	4

Cuadro 2. Bacterias anaerobias aisladas de la cavidad oral de 27 monos (*Alouatta palliata* y *Ateles geoffroyi*).

Género	Total de cepas n=39	Frecuencia (%) n=27
Clostridium	13	48
Bacteroides	7	26
Veillonella	6	22
Prevotella	5	19
Gemella	3	11
Eubacterium	3	11
Actinomyces	1	4
Peptostreptococcus	1	4

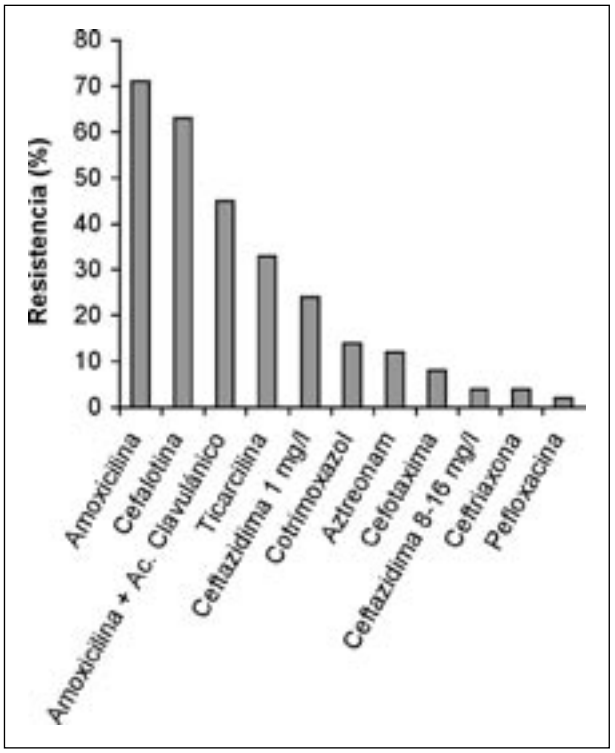

Figura 1. Resistencia a los antimicrobianos de 49 bacilos Gram negativos aerobios aislados de la cavidad oral de 27 monos (*Alouatta palliata* y *Ateles geoffroyi*).

de resistencia hacia el metronidazole, de un 49 a 44% según su concentración, seguido por la penicilina, la clindamicina y cloranfenicol (31, 28 y 26%, respectivamente); hubo un bajo porcentaje de resistencia a antibióticos como amoxicilina, cefotetan, imipenem y ticarcilina (Figura 2). Cinco de los 15 antibióticos evaluados (33%) fueron efectivos contra todas las cepas aisladas (amoxiclina + ácido clavulánico, piperacilina, piperacilina + tazobactam, cefoxitina, ticarcilina + ácido clavulánico).

La presencia de cepas multirresistentes (resistencia a dos o más antimicrobianos) se dio tanto en las bacterias aerobias como en las anaerobias. De las bacterias aerobias, el 80% de las cepas mostró resistencia múltiple, desde resistencia a dos (25%) hasta resistencia a nueve antibióticos (4%), aunque la mayoría (41%) fue resistente a tres o cuatro antibióticos y un 10% a cinco o seis. La resistencia múltiple en las cepas de *Staphylococcus* fue menor, pues sólo un bajo porcentaje (6%) fue resistente a tres antibióticos y 33% a dos; la mayoría (61%) mostró resistencia solamente a uno o a ninguno de los antibióticos evaluados. En las cepas anaerobias la resistencia múltiple fue moderada, el 49% mostró multirresistencia: 20% a dos antimicrobianos, 11% a tres o cuatro y 18% a cinco o seis.

Discusión

El conocimiento actual sobre la flora bacteriana oral de monos es muy escaso y este estudio permite señalar resultados interesantes que revelan semejanzas y diferencias con la flora bacteriana humana. Aunque se logró el aislamiento de cuatro cepas diferentes por muestra de cavidad oral de monos, se encontró mayor cantidad de bacterias aerobias (2.6 por muestra) que de anaerobias (1.4 por muestra),

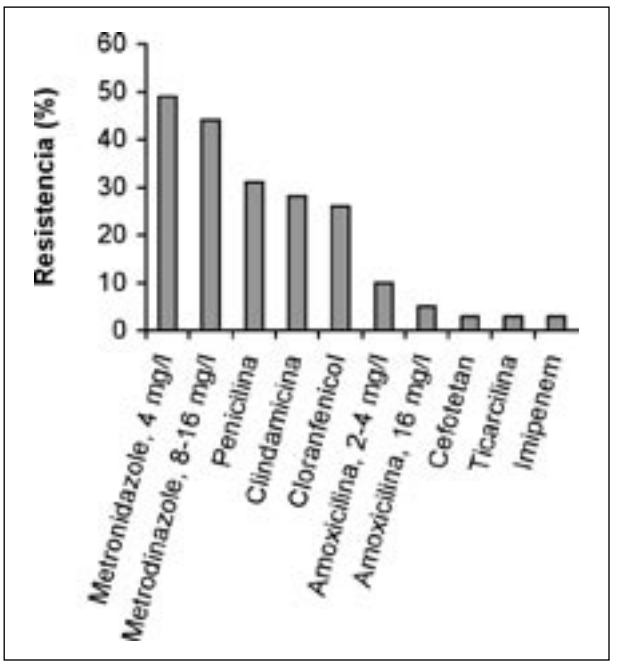

Figura 2. Resistencia a los antimicrobianos de 39 bacterias anaerobias aisladas de la cavidad oral de 27 monos (*Alouatta palliata* y *Ateles geoffroyi*).

contrario a lo que es de esperar en la cavidad oral humana. Esto pudo ser el resultado de varios aspectos, desde problemas metodológicos inevitables a la hora de tomar la muestra para anaerobios en el campo, hasta dificultades para su transporte al laboratorio. En este sentido, para recoger el material, optamos por utilizar una torunda que se resuspendió rápidamente en solución salina y se inoculó con aguja, en un tubo con atmósfera libre de oxígeno; aquellos anaerobios muy sensibles al oxígeno podrían haber muerto antes de ser inoculados en el medio prerreducido. Dado que el muestreo se realizó en zonas alejadas al laboratorio, debió transcurrir entre 24 y 48 hr antes de que las muestras fueran procesadas en el laboratorio. Como la solubilidad del oxígeno aumenta en refrigeración, los tubos se mantuvieron a temperatura ambiente, temperatura que puede haber favorecido sólo a unas pocas especies, perjudicando aquellas cuyo ámbito de temperatura óptima de crecimiento fuera más estrecho y muy cercano a los 37° C. Estos inconvenientes no se presentan con las bacterias aerobias, que se conservaron en la solución salina mantenida en hielo hasta su procesamiento en el laboratorio.

No fue posible demostrar la influencia de poblaciones humanas adyacentes a las áreas de muestreo, dado que los géneros bacterianos que se aislaron de monos provenientes de hábitat continuos y de fragmentos de bosque fueron similares. Lo mismo se observó con los patrones de resistencia y multirresistencia antimicrobiana. Sin embargo, esta observación debería corroborarse ampliando el número de animales estudiados, pues 13 de una zona y 14 de la otra podrían ser insuficientes.

Los géneros de *Enterobacter, Klebsiella* y *Escherichia* están descritos entre los más frecuentes de la cavidad oral humana (Isenberg y D'Amato, 1995) y fueron las bacterias aerobias Gram negativas predominantes en este estudio (Cuadro 1). Los géneros *Staphylococcus* y *Streptococcus* son los Gram positivos más frecuentes en la cavidad oral humana (Isenberg y D'Amato, 1995); en este estudio se encontró un predominio de *Staphylococcus*, quizá debido a condiciones metodológicas que pueden haber permitido su sobrecrecimiento, ya que es un género nutricional y fisiológicamente menos exigente que *Streptococcus.*

Se encontraron algunas especies aerobias que no están descritas como habitantes normales de la flora oral humana, como *Acinetobacter*, quinto género en frecuencia entre los aerobios, y *Serratia*, presente en el 11% de las muestras; sin embargo, están descritos como frecuentes en suelos y aguas (Grimont y Grimont, 1984; Juni, 1984), por lo que fácilmente se explica su aislamiento de la cavidad oral de los monos. El género *Pseudomonas,* también presente en el 11% de las muestras, incluye muchas especies ubicuas, que se han aislado de aguas de ríos, suelos y plantas, entre otros, así como de animales (Palleroni, 1984).

Otros géneros menos frecuentes en este estudio y no descritos como pertenecientes a la cavidad oral humana fueron *Citrobacter*, *Chromobacterium* y *Aeromonas* (7% cada uno) y *Achromobacter* y *Leuconostoc* (4% cada uno). Estos se encuentran presentes en suelos, aguas, plantas, alimentos e incluso algunos se mencionan como habitantes comunes del ambiente en países tropicales (Popoff, 1984; Sakazadi, 1984; Sneath, 1984; Garvie, 1986). La literatura científica no refiere el hábitat natural de *Chryseomonas* y *Aerococcus*, pero señala algunos casos de importancia clínica veterinaria y humana (Evans, 1986; Hall, 2000); su hallazgo en los monos parece indicar que es parte de la flora normal o que se encuentra en suelos, aguas o plantas, tal y como los otros géneros. Debido a que *Aerococcus* requiere de varios factores de crecimiento para su óptimo desarrollo (ácido pantoténico, ácido nicotínico, biotina, purinas y algunos aminoácidos; Evans, 1986) podría ser que su frecuencia en la cavidad oral de los monos fuera mayor que la encontrada en este estudio (4%).

Por otra parte, dentro del grupo de los aerobios, no se aislaron los géneros *Corynebacterium* y *Lactobacillus*, descritos como habitantes de la cavidad oral humana (Isenberg y D'Amato, 1995). Podría ser que estén ausentes en la cavidad oral de monos o bien, que no se hayan aislado por la exigencia nutricional de ambos géneros, ya que requieren aminoácidos específicos, purinas y pirimidinas, vitaminas, entre otros (Collin y Cummins, 1986; Kandler y Weiss, 1986). Aunque *Moraxella* también es habitante usual de la boca de humanos (Isenberg y D'Amato, 1995), desconocemos las razones por las cuales no se aisló en este estudio; sin embargo, en animales sólo se han aislado unas pocas especies (Bovre, 1984).

Los géneros de bacterias anaerobias usuales en la cavidad oral humana incluyen *Bacteroides, Fusobacterium, Peptostreptococcus, Veillonella, Prevotella* y bacilos Gram positivos no esporulados: *Actinomyces* y *Eubacterium* (Isenberg y D'Amato, 1995; Engelkirk y Duben-Engelkirk, 2000). De ellos, en este estudio se aislaron con mayor frecuencia *Bacteroides*, *Veillonella* y *Prevotella* y en menor grado *Eubacterium, Actinomyces* y *Peptostreptococcus* (Cuadro 2). Respecto a *Gemella*, que se aisló en un 11% de las muestras, no está claro su hábitat natural, pero algunos estudios sugieren que se encuentra en la cavidad orofaríngea humana (Engelkirk y Duben-Engelkirk, 2000); el hallazgo en la boca de los monos parece apoyar esta posibilidad. Otro habitante de la cavidad oral humana, *Fusobacterium,* no se aisló en este estudio, aunque es sabido que sólo unas pocas especies (*F. necrophorum* y *F. naviforme;* Moore *et al.*, 1984) se han aislado con frecuencia.

Por otro lado, el género de anaerobios más frecuente en esta investigación fue *Clostridium,* presente en el 48% de las muestras (Cuadro 2). Aunque este género no está descrito como habitante usual de la boca del hombre (Engelkirk y Duben-Engelkirk, 2000), es fácil explicar que una bacteria frecuente en suelos, como lo es *Clostridium*, pueda llegar hasta la boca de los monos, a través de la ingestión de plantas o aguas contaminadas con las esporas de estas bacterias. Todas las especies que se encontraron – *C. beijerinckii, C. bifermentans, C. cadaveris, C. clostridioforme,*

C. histolyticum, C. septicum, C. sordellii y *C. sporogenes* – han sido aisladas de suelos costarricenses en una frecuencia que varió desde un 50 hasta un 5% (Rodríguez *et al.,* 1993; Gamboa *et al*., en prep.).

Muchas de las cepas bacterianas aisladas de los monos presentaron resistencia antimicrobiana y algunos de estos resultados podrían ser alarmantes, principalmente para los bacilos Gram negativos aerobios: 71% de las cepas resistentes a amoxicilina y 63% a cefalotina (Figura 1). Ya ha sido descrito que bacilos Gram negativos aislados de animales salvajes presentan resistencia a antibióticos, a pesar de que no estén en contacto con humanos. Routman *et al.* (1985) encontraron que un 10.7% de las cepas de *Escherichia coli* aisladas de mandriles africanos no asociados con humanos eran resistentes al menos a un antibiótico. Por otra parte, Rolland *et al.* (1985) encontraron que el 47.5% y el 36% de los coliformes aislados de dos poblaciones de mandriles sin contacto frecuente con humanos presentaban resistencia antimicrobiana, mientras que cuando había contacto con el hombre, el 94.1% de las cepas de esos animales eran resistentes. Estudios con roedores silvestres no expuestos a antibióticos han demostrado que la mayoría de los coliformes eran resistentes a varios antibióticos (Gilliver *et al.,* 1999).

Los cocos Gram positivos, que en su mayoría fueron del género *Staphylococcus*, mostraron una menor resistencia, pues 10 de los 15 antibióticos probados (67%) fueron efectivos contra todas las cepas aisladas. Sin embargo, el 89% fue resistente a la penicilina G y el 28% a la ampicilina más sulbactam. El amplio uso de penicilina en el tratamiento de infecciones humanas, además del uso en elevadas concentraciones en ganadería y agricultura, pudo contribuir a generar esta alta resistencia, debida no sólo a la producción de beta lactamasas, sino a otros mecanismos, pues el 28% de las cepas aún continúan comportándose como resistentes con el empleo de sulbactam, inhibidor de dicha enzima.

Numerosos estudios han demostrado que la resistencia antibacteriana en los anaerobios ocurre en diversos géneros (Engelkirk y Duben-Engelkirk, 2000), no sólo por mutación sino además por transmisión horizontal entre microorganismos de suelos y aguas (Shoemaker *et al*., 2001). En este estudio, las cepas anaerobias también mostraron resistencia hacia varios de los antibióticos probados, siendo mayor hacia el metronidazole (49%, Figura 1), medicamento antiprotozoario que además ha demostrado ser efectivo contra infecciones por bacterias anaerobias. Sin embargo, debido a su amplio uso, han surgido cepas resistentes tanto de animales como de humanos (Diniz *et al*., 2000). Un 44% de las bacterias Gram negativas y un 43% de las Gram positivas fueron resistentes, acorde con el patrón que se ha venido observando, pero contrario a Boyanova y colaboradores (2000) quienes encontraron sólo un 3% de cepas Gram negativas resistentes a este agente. En general, la resistencia de todas las cepas anaerobias hacia la penicilina fue de 31% (Figura 2), aunque ésta fue mayor en Gram negativas (39%) que en Gram positivas (24%), lo que es esperable de acuerdo con su mecanismo de acción y su amplio uso. La resistencia a la penicilina en algunos grupos de anaerobios ha ido aumentando, así el 16-26% de *Clostridium* (Engelkirk *et al.,* 1992), el 50% de *Prevotella* (Hecht, 1999) y el 65% de *Bacteroides* (Engelkirk *et al.,* 1992) son resistentes a este antibiótico, especialmente por la producción de beta lactamasas. Otros grupos, como bacilos Gram positivos no esporulados y *Peptostreptococcus,* continúan siendo altamente sensibles (Hecht, 1999).

El 28% de las cepas aisladas fueron resistentes hacia la clindamicina (Figura 2), lo cual es preocupante dado que este antibiótico es ampliamente utilizado para el tratamiento de infecciones clínicas por anaerobios. Aunque Boyanova y colaboradores (2000) informan que ninguna bacteria Gram negativa anaerobia es resistente a clindamicina, Engelkirk y colaboradores (1992) informan que menos del 10% de los Gram negativos y el 19.6% de los Gram positivos son resistentes. Otros estudios confirman esta observación: un 6% de bacilos Gram positivos no esporulados y un 16% de *Peptostreptococcus* son resistentes a la clindamicina (Rodloff *et al*., 1999). En nuestro estudio tres de los bacilos Gram negativos fueron resistentes a este antibiótico, lo que acentúa aún más la preocupación de que cepas difíciles de tratar provenientes de animales silvestres, puedan llegar a causar infecciones clínicas en humanos.

Al analizar los datos de resistencia múltiple, se observó que cepas de todos los grupos bacterianos la presentaron; aún así la mayoría de las bacterias fueron resistentes sólo a dos, tres o cuatro antibióticos y pocas a más de cuatro. Con respecto a los Gram negativos aerobios se pudo notar que el 80% de las cepas mostró resistencia múltiple, que incluyó desde resistencia sólo a dos antibióticos hasta nueve; la mayoría de las cepas (41%) fue resistente sólo a tres o cuatro. Por el contrario, sólo el 39% de los estafilococos mostró resistencia múltiple y además las cepas fueron resistentes a un máximo de tres antibióticos. La multirresistencia en bacterias anaerobias fue intermedia entre estos dos grupos, pues el 49% de las cepas de bacterias anaerobias mostró multirresistencia, encontrándose cepas resistentes hasta seis drogas. Estos resultados son alarmantes, pues tradicionalmente se ha creído que la resistencia múltiple no es un problema común en bacterias anaerobias.

El uso indiscriminado de antibióticos no sólo en medicina humana, sino también en la agricultura y ganadería, facilita el desarrollo de resistencia a los antibióticos (Sosa, 2000; Thompson y Kla, 2000); los aerosoles pueden desplazarse grandes distancias y alcanzar árboles o plantas que sirven de alimento a animales silvestres como los monos. Son bien conocidas las limitaciones de los entes reguladores en América Latina y el Caribe respecto al uso de medicamentos (Fefer, 2000); Costa Rica no es la excepción y no cuenta con legislación que controle el uso no médico de los antibióticos, por lo que suponemos que en nuestro medio las cepas bacterianas de los animales están sometidos a una presión de selección que favorece el desarrollo y persistencia de resistencia. El agua también puede ser un vehículo facilitador de

la resistencia, pues se han encontrado genes bacterianos de resistencia en aguas subterráneas cercanas a sitios donde se usan antibióticos en la crianza de cerdos como promotores de crecimiento. Algunos de los sitios de muestreo de este estudio estuvieron cerca de criaderos de cerdos de este tipo, lo que contribuye a explicar el frecuente aislamiento de cepas resistentes. Además, actualmente en Costa Rica ninguno de los hospitales del sector público cuenta con sistemas de tratamiento de aguas residuales, las cuales son vertidas directamente en el alcantarillado sanitario o en cuerpos de aguas superficiales; en ambos casos, estas aguas llegarán a afluentes mayores sin ningún tratamiento (Tzoc, 2002). Aunque regularmente los monos no bajan a tomar agua a los ríos, otros animales que conviven con ellos sí lo hacen, lo que puede contribuir a extender el fenómeno de la resistencia antimicrobiana; los resultados de esta investigación apoyan esta hipótesis.

Este estudio constituye el primer informe sobre la flora bacteriana oral de monos en Costa Rica y es una contribución importante para el conocimiento y preservación de estos animales. Además, es una evidencia de que el uso indiscriminado de antimicrobianos y el desarrollo de resistencia no se limita a la clínica humana, sino que compromete todo su entorno.

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News

Additional Records of Primates in the Serra dos Órgãos National Park

In early 2003, I reported on the primates of the Serra dos Órgãos National Park (Cunha, 2003). Here I record some further observations I have made in the park on muriquis (*Brachyteles arachnoides*), capuchin monkeys (*Cebus nigritus*), and the buffy-tufted-ear marmoset (*Callithrix aurita*).

At 07:30 on 19 September, 2003, I saw a group of at least 16 adults and subadults of *Brachyteles arachnoides* (not including infants carried by females) crossing the same valley where I observed three individuals in August 2003 (Cunha, 2003). The valley ranges from 1600 m to 1800 m a.s.l., and is thus the highest altitude recorded for the species (see Grelle, 2000). Garcia and Andrade Filho (2002) saw muriquis walking along a rocky outcrop in the park, and indicated that it was in the high-altitude grassland (*campos de altitude*) above 2000 m, although they were unable to be precise. Rocky outcrops as they described are common from 700 m to above 2200 m, and they may have been mistaken. The group I observed would appear to be what Garcia and Andrade Filho (2002) reported as two separate groups of 6 and 9 individuals. When their field team made its survey, the group may have been temporarily divided; it is the only one recorded to date in the park. Researchers from the IPÊ – Instituto de Pesquisas Ecológicas (<http://www.ipe.org.br>) are studying this group. According to local residents, another group of muriquis may exist in the region of Vargem Grande, in or near the recently created Três Picos State Park (see Table 1 in Cunha, 2003). Every effort should be made to locate this group and establish if they are connected with the Serra dos Órgãos group. I suspect they are not, due to the BR-116 highway which runs between these two almost contiguous protected areas.

At 10:20 on 8 February, 2004, I observed a group of at least five *Callithrix aurita*, including one juvenile, around a small cultivated plot near the park's administrative headquarters (22°27'04" S, 42°59'03" W; 950 m a.s.l.). The marmosets had a reddish-chestnut coloration on their backs, as described by Auricchio (1995). I noted the pre-auricular white tufts in only one individual. *C. aurita* is naturally rare throughout its range, as noted even by Schirch (1931) more than 70 years ago. Its occurrence in the park is significant, and implies that it may occur in other protected areas in the Serra dos Órgãos. *C. penicillata* has been seen in the park (Cunha, 2003), and *C. jacchus* also occurs in the region. Given their potential to hybridize (see Coimbra-Filho *et al.*, 1993), more detailed studies should be conducted to know if and how the buffy-tufted-ear marmosets, which are listed as Vulnerable (Bergallo *et al.*, 2000; Rylands and Chiarello, 2003) are ecologically and/or genetically threatened by their introduced congeners.

Cebus nigritus is the most common of the primates in the park; I have encountered them on more than a dozen occasions. Once three of them were in a small shrub (4-6 m high), in the treeline at 1890 m, perhaps the highest recorded altitude for the species. Titi monkeys (*Callicebus nigrifrons*) and howling monkeys (*Alouatta guariba*) also occur in the Serra dos Órgãos, although they are evidently at very low densities; I have never seen them, and have only heard them there.

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Conservation Genetics of the Golden Lion Tamarin

On 9 December, 2003, Adriana Grativol defended her doctoral thesis on ancient DNA and the population genetics of the golden lion tamarin (*Leontopithecus rosalia*), examining genetic structure at two moments in time and its relation to the fragmentation of the Atlantic Forest. The thesis was presented to the Postgraduate Course in Biosciences and Biotechnology (specialization in Environmental Sciences) at the Universidade Estadual do Norte Fluminense (UENF), Rio de Janeiro, Brazil. Her supervisors were Fernando Antônio dos Santos Fernandez (Universidade Federal do Rio de Janeiro – UFRJ) and Alan Cooper (University of Oxford, UK). Adriana Grativol's studies and thesis research were supported by UENF; the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq); the Projeto de Conservação e Utilização Sustentável de Diversidade Biológica Brasileira (PROBIO) of the Programa Nacional da Diversidade Biológica (PRONABIO), Ministério do Meio Ambiente (MMA); the Lion Tamarins of Brazil Fund; the Margot Marsh Biodiversity Foundation; the World Wide Fund for Nature – Brazil (WWF-BR); the Associação Mico-Leão-Dourado – AMLD; the Henry Wellcome Ancient Biomolecules Centre; the Laboratório de Ciências Ambientais (LCA) of the Centro de Biociências e Biotecnologia (CBB), Universidade Estadual do Norte Fluminense (UENF); and the Laboratório de Melhoramento Genético Vegetal (LMGV) of the Centro de Ciências Tecnológicas e Agrárias (CCTA), Universidade Estadual do Norte Fluminense (UENF). The following is an abstract of the thesis.

One of the common characteristics of threatened populations is their low genetic diversity, usually interpreted as the result of a population bottleneck caused by habitat fragmentation. Until recently, the association of habitat fragmentation and loss of genetic diversity was made through indirect comparisons, which are limited, because the unthreatened reference populations do not necessarily reflect the evolutionary history of the threatened populations. With the development of ancient DNA techniques, direct comparisons can now be made by analyzing historical samples that were collected before forest fragmentation. The purpose of this study was to elucidate the effects of the recent fragmentation of the Atlantic Forest on the genetic diversity of golden lion tamarins through ancient DNA techniques and mitochondrial DNA molecular markers. Fifty-seven historical samples (toepads) were compared with 138 modern samples of golden lion tamarins, including wild and captive populations. Eighteen haplotypes were identified among the samples, but only six were present in the extant populations, indicating a 67% loss of genetic diversity. The distribution of haplotypes from the historical samples suggests that this species was panmictic (randomly mating) in the past. The results obtained in this study suggest that the recent fragmentation of the Atlantic Forest has had a strong impact on the gene pool of the species, not only by the loss of genetic diversity, but also by the interruption of gene flow. Conservation strategies for the golden lion tamarin should favor the interchange of individuals among the extant populations, which should be managed as a metapopulation.

Uma das características comuns em populações ameaçadas é a baixa diversidade genética encontrada. Essa baixa diversidade é geralmente interpretada como sendo o resultado do estrangulamento demográfico ocasionado pela fragmentação de hábitats. Entretanto, até recentemente, a associação entre fragmentação de hábitats e perda de diversidade genética era feita a partir de comparações indiretas. Essas comparações

têm limitações, porque as populações não-vulneráveis usadas como referência, nem sempre refletem a história evolutiva das populações ameaçadas. Com o desenvolvimento de técnicas de DNA antigo, as comparações podem ser feitas diretamente, através da análise de amostras históricas obtidas antes da fragmentação. Este estudo teve como objetivo principal elucidar os efeitos da recente fragmentação antrópica da Mata Atlântica na diversidade genética do mico-leão-dourado, através da técnica de DNA antigo e de marcadores de DNA mitocondrial. Cinqüenta e sete amostras (almofada digital) históricas foram comparadas com 138 amostras atuais de mico-leão-dourado, incluindo populações selvagens e de cativeiro. Dezoito haplótipos foram identificados entre todas as amostras. Entretanto, somente seis haplótipos foram encontrados nas populações remanescentes, indicando uma perda de diversidade genética de 67%. A distribuição dos haplótipos das amostras históricas sugere que o mico-leão-dourado distribuia-se panmiticamente. Os resultados obtidos sugerem que a recente fragmentação da Mata Atlântica teve um forte impacto no pool gênico da espécie, não só pela alta perda de diversidade, mas também pela interrupção de seu fluxo gênico. Estratégias de conservação para o mico-leão-dourado devem favorecer o intercâmbio de indivíduos entre as populações remanescentes. Essas populações devem ser manejadas como uma metapopulação.

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Grativol, A. D. 2003. DNA antigo e genética da conservação do Mico-Leão-Dourado (*Leontopithecus rosalia*): Estrutura genética em duas escalas de tempo e sua relação com a fragmentação da Mata Atlântica. Tese de doutorado, Universidade Estadual do Norte Fluminense (UENF), Rio de Janeiro. 64pp.

The Margot Marsh Biodiversity Foundation / Conservation International Primate Action Fund – 2003-2004

The Primate Action Fund (PAF) contributes to global biodiversity conservation by providing strategically targeted, catalytic support for the conservation of endangered nonhuman primates and their natural habitats. In June 2003, William R. Konstant transferred the management of the Primate Action Fund to Anthony Rylands, Center for Applied Biodiversity Science at Conservation International. Ella Outlaw, Executive Assistant to Russell A. Mittermeier, is responsible for drawing up grant agreements, disbursement of funds and the financial accounting.

Thirty-three projects were supported during the period March 2003 – March 2004. Eleven were distribution surveys and population estimates, key aspects for the evaluation of conservation status, and in some cases resulting in taxonomic rearrangements and even the discovery of new species. A further nine projects involved studies emphasizing the ecology and behavioural ecology of primate groups. Other topics included environmental education, conservation workshops, research on specific conservation problems, genetics and the Neotropical database of primate localities. The average grant was $3630 (the maximum award is $5000). Neotropical primates benefited from 13 awards as follows.

- Post-dispersal process of seeds in golden lion tamarin (*Leontopithecus rosalia*) faeces, in União Biological Reserve, Rio das Ostras, Rio de Janeiro – Marina Janzantti Lapenta, Associação Mico-Leão-Dourado, Rio de Janeiro, Brazil.
- A survey of primate populations in northeastern Venezuelan Guayana – Bernardo Urbani, Department of Anthropology, University of Illinois, Urbana, USA.
- Distribution and density of *Callimico goeldii* in northern Bolivia: A survey of the Departamento Pando – Leila Porter, Department of Anthropology, University of Washington, Seattle, USA.
- Spider monkey conservation and reduced impact logging: The potential co-dependence of black spider monkeys (*Ateles chamek*) and timber tree species in a lowland rainforest in Bolivia – Annika Felton, The Australian National University, Centre for Resource Management and Environmental Science, Canberra, Australia.
- Diet and digestive efficiency of southern muriquis (*Brachyteles arachnoides*) in Carlos Botelho State Park, south-eastern Atlantic Forest of Brazil and Curitiba Zoological Park – Mauricio Talebi Gomes, Department of Biological Anthropology, University of Cambridge / NGO PróMuriqui – Carlos Botelho State Park, São Paulo, Brazil.
- Conservation of the yellow-breasted (or buff-headed) capuchin monkey *Cebus xanthosternos* in the state of Bahia, Brazil – Jean-Marc Lernould, CEPA – Conservation des Espèces et des Populations Animales, Schlierbach, France.
- Behavioral ecology of uakari monkeys (*Cacajao calvus*) and woolly monkeys (*Lagothrix lagothricha*) and environmental education in Parque Nacional da Serra do Divisor, Cruzeiro do Sul, Acre, Brazil – Maria Aparecida de Oliveira Azevedo Lopes, Associação SOS Amazônia, Rio Branco, Acre, Brazil.
- Distribution and status of *Callicebus barbarabrownae* in the Brazilian Caatinga – Rodrigo Cambará Printes, Federal University of Minas Gerais, Belo Horizonte, Minas Gerais, Brazil.
- Distribution and conservation of the populations of *Callicebus coimbrai* in the state of Sergipe and northern coastal Bahia – Marcelo Cardoso de Sousa, Laboratório de Zoologia do Instituto de Tecnologia e Pesquisa, Universidade Tiradentes, Aracaju, Sergipe, Brazil.

- Census and distribution of the robust tufted capuchin (*Cebus robustus*) in the Atlantic forest in Minas Gerais, Brazil – Waldney Pereira Martins, Federal University of Minas Gerais, Belo Horizonte, Minas Gerais, Brazil.
- Environmental Education: A tool for the conservation of pygmy marmosets *Cebuella pygmaea* in the Ecuadorian Amazon – Stella de la Torre, Universidad San Francisco de Quito, Ecuador.
- Database of georeferenced occurrence localities of Neotropical primates (BDGEOPRIM) – Phase 2 – André Hirsch, Department of Zoology, Federal University of Minas Gerais, Belo Horizonte, Minas Gerais, Brazil.
- "Ecology of Neotropical Primates" Field Course at the Universidad Nacional de la Amazonia Peruana, Iquitos, in September/October 2003 – Eckhard W. Heymann, Deutsches Primatenzentrum, Göttingen, Germany.

Having been directly involved in this fund for the first time over this year, I have been able to witness at first hand its immense usefulness and the enormous benefits it has in terms of primate conservation and research. Besides their direct impact on conservation and our understanding of conservation issues, small grants such as these enable the maintenance, and I would say the growth, of a conservation competence in the habitat countries, both in terms of expertise as well as active personnel – students, technicians, researchers and administrators. The conservation benefits of these small grants are considerable – in many countries the money goes a very long way – and far beyond the results seen in the final report, in terms of their catalytic effect and the seed effect on the development of larger and longer-term conservation efforts.

The Margot Marsh Biodiversity Foundation has awarded a further grant to Conservation International for a new cycle of Primate Action Fund grants: March 2004 – March 2005. Funding will be available as from June 2004. For application guidelines, please write to Anthony B. Rylands (address below).

Projects submitted to the Foundation are considered if they have one or more of the following characteristics:

- a focus on critically endangered and endangered non-human primates living in their natural habitats;
- location in areas of high overall biodiversity and under great threat (for example, biodiversity hotspots, megadiversity countries) – to ensure maximum multiplier effect for each project;
- direction and management by nationals from the tropical countries, to help increase local capacity for implementing biodiversity conservation;
- the ability to strengthen international networks of field-based primate specialists and enhance their capacity to be successful conservationists; and
- projects that result in publication of information on endangered primate species in a format that is useful both to experts and the general public.

Projects should contribute to at least one, and preferably more, of the following themes:

- enhancement of scientific understanding/knowledge of the target species/ecosystem;
- improved protection of a key species, habitat, or reserved area;
- demonstration of *economic* benefit achieved through conservation of a species and its habitat, as compared to loss thereof;
- increased public awareness or educational impact resulting from the project in question;
- improved local capacity to carry out future conservation efforts through training or practical experience obtained through project participation; and
- modification of inappropriate policies or legislation that previously led to species or habitat decline.

Anthony B. Rylands, MMBF/CI Primate Action Fund, Center for Applied Biodiversity Science, Conservation International, 1919 M Street NW, Suite 600, Washington, DC 20036, USA. E-mail: <a.rylands@conservation.org>.

2003 IUCN Red List – Neotropical Primates

The *IUCN/SSC 2003 Red List of Threatened Species* was released in November 2003. The IUCN Red List now includes 12,259 species threatened with extinction (falling into the Critically Endangered, Endangered or Vulnerable categories). A total of 762 plant and animal species are now recorded as Extinct with a further 58 known only in cultivation or captivity. Of the 4789 mammals assessed, 1,130 or 24% were ranked as threatened. Some notable new additions to the Red List include 1,164 Ecuadorian plants, 125 Hawaiian plants, 303 cycads and 35 Galapagos Islands snails. All known conifer species have now been assessed, including a new discovery in Viet Nam and a rediscovered species in China. See the website for the IUCN Red List at <http://www.redlist.org>.

Of the 295 primate species assessed, more than one-third (114 or 37%) are ranked as threatened (20 Critically Endangered, 47 Endangered and 47 Vulnerable). The threatened New World primates are listed in Table 1. Thirty-four species are threatened (9 Critically Endangered, 10 Endangered, 15 Vulnerable), a further six are Near Threatened and five are Data Deficient. Sixty-four taxa are threatened (21 Critically Endangered, 15 Endangered and 28 Vulnerable). A further 12 taxa are Near Threatened and 13 are Data Deficient. Sixty-nine of the taxa were assessed against the IUCN 2001 Criteria (IUCN, 2001). The remainder are still listed under the assessment using the 1994 criteria (IUCN, 1994).

The following people contributed to the assessment against the 2001 criteria: Maria Iolita Bampi, Julio César Bicca-Marques, Adriano G. Chiarello, Bras Cozenza, Alfredo D. Cuarón, Thomas R. Defler, Gustavo A. B. da Fonseca,

Humberto Giraldo, Marcelo Gordo, Paloma C. de Grammont, Carlos Eduardo Grelle, Marcelo Marcelino, Ana Alice Biedzicki de Marques, Rosana Vera Marques, Fabiano Rodrigues de Melo, Sérgio Lucena Mendes, Russell A. Mittermeier, Raquel Moura, Fábio Olmos, Liliana Cortés-Ortiz, Fernando de Camargo Passos, Rogério Cunha de Paula, Kimberley A. Phillips, Antônio Rossano Mendes Pontes, José Vicente Rodríguez M., Anthony B. Rylands, Anne Savage, Juan Carlos Serio Silva, José de Sousa e Silva Jr., Rosana Subirá, Grace Wong and Diego Tirira, S. The assessment of the Ecuadorian endemics was based on Tirira S. (2001).

Craig Hilton-Taylor, Red List Programme Officer, Species Survival Programme, 219c Huntingdon Road, Cambridge CB3 0DL, UK, **Anthony B. Rylands** and **John M. Aguiar**, Center for Applied Biodiversity Science, Conservation International, 1919 M Street NW, Suite 600, Washington, DC 20036, USA.

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IUCN. 1994. *IUCN Red List Categories*. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland.

Tirira S., D. (ed.). 2001. *Libro Rojo de Los Mamíferos de Ecuador*. Sociedad para la Investigación y Monitoreo de la Biodiversidad Ecuatorania (SIMBIOE) / Ecociencias / Ministerio del Ambiente / UICN. Serie Libros Rojos del Ecuador, Tomo 1. Publicación Especial sobre los Mamíferos del Ecuador, Quito.

Table 1. 2003 IUCN/SSC Red List of Threatened Species – Summary for Neotropical Primates. Numbers indicate assessments of full species.

Species and Subspecies	Common Name	Threat Category/Criteria	Version
Alouatta belzebul ululata	Red-handed howler	CR C1+2a(i)	2001
1. *Alouatta guariba*	Brown howler	NT	2001
Alouatta guariba clamitans	Southern brown howler	NT	2001
Alouatta guariba guariba	Northern brown howler	CR B2ab(i,ii,iii); C2a(i); D	2001
Alouatta coibensis coibensis	Coiba Island howler	VU D2	2001
Alouatta coibensis trabeata	Azuero howler	CR B1+2abcde, C2a	1994
Alouatta palliata mexicana	Mexican howler	CR A4c; B1ab(i,ii,iii)	2001
2. *Alouatta pigra*	Black howler	EN A4c	2001
Alouatta seniculus insulanus	Trinidad howler	VU B1ab(iii); D1	2001
Alouatta seniculus juara	Juruá red howler	DD	1994
3. *Aotus lemurinus*	Colombian night monkey	VU C2a(i)	2001
Aotus lemurinus brumbacki	Brumback's night monkey	VU B1+2c	1994
Aotus lemurinus griseimembra	Grey-legged night monkey	EN B1+2abcde	1994
Aotus lemurinus lemurinus	Colombian night monkey	VU B1+2c, C2a	1994
Aotus lemurinus zonalis	Panamanian night monkey	DD	1994
4. *Aotus miconax*	Andean night monkey	VU A2cd	2001
5. *Ateles belzebuth*	Long-haired spider monkey	VU A2acd	2001
Ateles geoffroyi azuerensis	Azuero spider monkey	CR B1+2abcde, C2a	1994
Ateles geoffroyi fusciceps	Brown-headed spider monkey	CR B1+2abcde, C2a	1994
Ateles geoffroyi grisescens	Hooded spider monkey	EN B1+2abcde, C2a	1994
Ateles geoffroyi ornatus	Ornate spider monkey	EN A4c	2001
Ateles geoffroyi panamensis	Panama spider monkey	EN B1+2abcde, C2a	1994
Ateles geoffroyi rufiventris	Colombian spider monkey	VU A1c, B1+2c	1994
Ateles geoffroyi vellerosus	Mexican spider monkey	CR A4c	2001
Ateles geoffroyi yucatanensis	Yucatán spider monkey	VU A4c	2001
6. *Ateles hybridus*	Variegated spider monkey	CR A3cd	2001
Ateles hybridus brunneus	Brown spider monkey	CR A3cd	2001
Ateles hybridus hybridus	Hybrid spider monkey	CR A3cd	2001
7. *Ateles marginatus*	White-whiskered spider monkey	EN A4c	2001
8. *Brachyteles arachnoides*	Muriqui	EN C2a(i)	2001
9. *Brachyteles hypoxanthus*	Northern muriqui	CR B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)	2001
10. *Cacajao calvus*	Bald uakari	NT	2001
Cacajao calvus calvus	White bald-headed uakari	VU B1ab(iii); C1	2001
Cacajao calvus novaesi	Novaes' bald-headed uakari	VU B1ab(iii); C1	2001
Cacajao calvus rubicundus	Red bald-headed uakari	VU B1ab(iii); C1	2001
Cacajao calvus ucayalii	Ucayali bald-headed uakari	VU A2cd	2001

continued on next page

Table 1, *continued from previous page*

Species and Subspecies	Common Name	Threat Category/Criteria	Version
11. Callicebus barbarabrownae	Barbara Brown's titi	CR B2ab(i,ii,iii); C2a(i); D	2001
12. Callicebus coimbrai	Coimbra-Filho's titi	CR B1ab(i,ii,iii); C2a(i); D	2001
13. Callicebus melanochir	Southern Bahian masked titi	VU A3c; B1ab(i,ii,iii,iv,v); C2a(i)	2001
14. Callicebus modestus	Bolivian titi	VU B1ab(i,ii)	2001
15. Callicebus nigrifrons	Black-fronted titi	NT	2001
16. Callicebus oenanthe	Andean titi	VU B1ab(iii)+2ab(iii)	2001
17. Callicebus olallae	Beni titi	VU B1ab(i,ii)	2001
18. Callicebus ornatus	Ornate titi	VU B1ab(iii)	2001
19. Callicebus personatus	Northern masked titi	VU A3c; B1ab(i,ii,iii,iv,v); C2a(i); D1	2001
20. Callimico goeldii	Goeldi's monkey	NT	2001
21. Callithrix aurita	Buffy-tufted-ear marmoset	EN B1+2abcde, C2a	1994
22. Callithrix flaviceps	Buffy-headed marmoset	EN C2a(i)	2001
23. Callithrix geoffroyi	Geoffroy's marmoset	VU B1+2b, C2a	1994
Cebus albifrons aequatorialis	Ecuadorian capuchin	NT	2001
Cebus albifrons cesarae	César Valley capuchin	NT	2001
Cebus albifrons malitiosus	Santa Marta capuchin	NT	2001
Cebus albifrons trinitatis	Trinidad white-fronted capuchin	CR B1+2abcde, C2a	1994
Cebus albifrons versicolor	Varied capuchin	DD	1994
Cebus albifrons yuracus	Andean white-fronted capuchin	DD	1994
Cebus apella margaritae	Margarita Island capuchin	CR B1+2abcde, C2a	1994
Cebus capucinus curtus	Gorgona capuchin	VU D2	2001
Cebus olivaceus kaapori	Ka'apor capuchin	VU A1c, B1+2c	1994
24. Cebus robustus	Crested capuchin	VU B2ab(i,ii,iii,iv,v); C2a(i)	2001
25. Cebus xanthosternos	Yellow-breasted or buffy-headed capuchin	CR A2cd; C2a(i)	2001
26. Chiropotes satanas	Bearded saki	EN A2cd; B2ab(i,ii,iii); C2a(i)	2001
27. Chiropotes utahickae	Uta Hick's bearded saki	VU A3cd	2001
28. Lagothrix cana	Geoffroy's woolly monkey	NT	2001
Lagothrix cana cana	Geoffroy's woolly monkey	NT	2001
Lagothrix cana tschudii	Tschud's woolly monkey	NT	2001
29. Lagothrix lugens	Colombian woolly monkey	VU A2acd	2001
30. Lagothrix poeppigii	Poeppig's woolly monkey	NT	2001
31. Leontopithecus caissara	Black-faced lion tamarin	CR C2a(i)	2001
32. Leontopithecus chrysomelas	Golden-headed lion tamarin	EN B2ab(i-v); C2a(i)	2001
33. Leontopithecus chrysopygus	Black lion tamarin	CR C2a(ii)	2001
34. Leontopithecus rosalia	Golden lion tamarin	EN C2a(i)	2001
35. Mico chrysoleucus	Golden-white tassel-eared marmoset	DD	2001
36. Mico leucippe	Golden-white bare-eared marmoset	DD	2001
37. Mico marcai	Marca's marmoset	DD	2001
38. Mico nigriceps	Black-headed marmoset	DD	2001
39. Mico saterei	Sateré marmoset	DD	2001
40. Oreonax flavicauda	Yellow-tailed woolly monkey	CR B1+2abcde, C2a	1994
Pithecia monachus milleri	Miller's monk saki	VU A2c	2001
Pithecia monachus napensis	Napo monk saki	DD	2001
41. Saguinus bicolor	Pied tamarin	CR A2acde	2001
Saguinus fuscicollis crandalli	Crandall's saddle-back tamarin	DD	2001
Saguinus fuscicollis cruzlimai	Cruz Lima's saddle-back tamarin	DD	2001
Saguinus imperator imperator	Black-chinned emperor tamarin	DD	2001
42. Saguinus leucopus	White-footed tamarin	VU A2c	2001
43. Saguinus oedipus	Cotton-top tamarin	EN B1+2abcde, C2a	1994
44. Saimiri oerstedii	Central American squirrel monkey	EN B1ab(i,ii,iii)	2001
Saimiri oerstedii citrinellus	Grey-crowned Central American squirrel monkey	CR B1ab(i,ii,iii)	2001
Saimiri oerstedii oerstedi	Black-crowned Central American squirrel monkey	EN B1ab(i,ii,iii)	2001
45. Saimiri vanzolinii	Black squirrel monkey	VU A3ce; B1ab(i,ii,v)	2001

Capuchin Monkeys in Forest Fragments in São Paulo, Brazil

On 19 May, 2003, Carlos Henrique de Freitas defended his Master's thesis for the Postgraduate Course in Biological Sciences (Zoology) at the Instituto de Biociências of the Universidade Estadual Paulista (UNESP), Rio Claro, São Paulo, Brazil. The thesis was on the feeding ecology and behavior of two groups of tufted capuchins, *Cebus apella nigritus*, in the Maggion and Santa Gemma farms, in the municipality of Franca, in the state of São Paulo. His supervisors were Nivar Gobbi and Eleonore Z. F. Setz. The study was supported by the UNESP. The following is a summary.

Disturbed areas provide information about the ecology and adaptive capacity of species, and as such contribute significantly to plans for management and conservation. The tufted capuchins are highly adaptable species, able to live in a wide variety of habitats throughout Brazil. This study investigated the use of time and space in two groups of the black-horned capuchin, *Cebus apella nigritus*, in a forest fragment spread across two farms in the municipality of Franca, São Paulo, Brazil (20°30'S, 47°18'W). Data on diet, behavior and home range use were obtained on two groups, one of nine individuals (S group) and another of 23 (L group). They were observed for a total of 78 days (58 for S and 20 for L). Behavioral observations were recorded by scan sampling at 10-minute intervals, noting: movement (travel included), no movement, rest, foraging for animal matter, feeding and miscellaneous (such as social behavior, manipulative behavior, scratching, vocalizations, and maintenance activities, including defecation, urination, autogrooming). Of 23,367 records obtained, 37.1% were of movement, 29.1% foraging, 16.8% feeding, 7.6% miscellaneous, 6.8% no movement, and 2.6% for resting. The main items of the diet included fruit (47.5% of the feeding records and accentuated in the wet season), seeds (26%, of which 80% was corn from raiding crops; predominant in the dry season), plant matter (13%; shoots, leaf stems and nectar, eaten more often in the dry season), animal prey (9.5%), unidentified (4%) and drinking water (0.5%). Home range size was 31.75 ha for group S, with a seasonal difference in range use between the dry and wet seasons – the group used the eucalyptus plantation more in the wet season, and the areas near sugar cane and maize crops more often in the dry. The home range size for group L was 67.5 ha, which did not vary between seasons. The home range of group S was entirely within that of group L. Behaviors recorded (n = 1679) included: 48.8% manipulation, 20.5% grooming, 17.6% playing, 4.5% scratching, 2.1% aggression, 3.7% parental care and 2.8% other. A greater proportion of social behaviors, such as playing and grooming, were registered in the wet season. Seasonal variation in the activities, diet, home range size and use, and behaviors show that a fragmented forest strongly affects the lives of the groups. Habitat fragmentation does not represent an obstacle to the survival of these adaptable monkeys, however, and the conservation of forest fragments is vital.

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Reference

Freitas, C. H. 2003. Ecologia alimentar e comportamento de macacos-prego *Cebus apella* (Primates, Cebidae) nas fazendas Maggion e Santa Gemma, município de Franca – SP. Dissertação de mestrado, Instituto de Biociências, UNESP, Rio Claro – São Paulo, Brazil. 97pp.

Call for Contact Addresses of Non-Human Primate Colonies

Franziska Schuerch, a Ph.D. student with Dr. Paul McGreevy at the University of Sydney, is asking to receive contact addresses for non-human primate colonies worldwide. Based in the Faculty of Veterinary Science, their primary project explores the influence which management practices have on social behavior in a research colony of hamadryas baboons (*Papio hamadryas*). In order to provide a broader context for their research, they would like to ask operators of all non-human primate colonies to participate in an anonymous survey of management practices.

If you are involved in the operation of a non-human primate colony – whether as manager, veterinarian or in any other capacity – Ms. Schuerch and Dr. McGreevy would be most grateful if you would contact them to receive their questionnaire. Their principal aim with the survey is to estimate the numbers of primates in research colonies, and to provide an overview of common management techniques.

If you work with a non-human primate colony and would like to help their project, please contact them at the Faculty of Veterinary Science (B19), University of Sydney, NSW 2006, Australia, phone +61 2 9351 7608 (Schuerch) or +61 2 9351 2810 (McGreevy), fax +61 2 9351 3957, e-mail <schuerch@vetsci.usyd.edu.au> or <paulm@vetsci.usyd.edu.au>, website <http://www.vetsci.usyd.edu.au/about/staff/pmcgreevy.shtml>.

The Tahuamanu Biological Station

The Tahuamanu Biological Station of the Amazonian University of Pando (Pando, Bolivia) is sited in an area of primary and secondary *terra firma* forest, typical of Western Amazonia in both flora and fauna, but with a remarkable diversity of primate species (Table 1). River floodplains and bamboo forests provide additional habitat for specialized

Table 1. Primate species observed at the Tahuamanu Biological Station, Pando, Bolivia.

Alouatta sara	*Cebus apella*
Aotus nigriceps	*Lagothrix lagothrica*
Ateles chamek	*Pithecia irrorata*
Callicebus brunneus	*Saguinus fuscicollis*
Callimico goeldii	*Saguinus imperator*
Cebuella pygmaea	*Saguinus labiatus*
Cebus albifrons	*Saimiri boliviensis*

taxa. The fauna is representative of the region and includes endemic species such as the endangered *Callimico goeldii*. Aquatic biodiversity is especially rich in this region, one of the most diverse of the Amazon Basin.

A number of studies have been conducted at the site over the last decade, including long-term field projects on *Callimico goeldii*, *Pithecia irrorata*, *Cebuella pygmaea*, *Saguinus labiatus* and *S. fuscicollis*. Census data have also been collected for large mammals, birds, fish, reptiles and amphibians as well as local flora. The station is well-suited for teaching field courses, and prior topics include primate conservation and ecology, herpetology, field methods, dendrology and more.

The Tahuamanu Biological Station is one kilometer from the north bank of the Río Tahuamanu and 60 km southwest of Cobija, the capital city of Pando; the station is three hours by road from Cobija's international airport. Located within a trinational frontier, the Biological Station is only a short distance from both the Brazilian and Peruvian borders.

Researchers intending to carry out fieldwork and sampling protocols will require permits from the Bolivian Department of National Biodiversity Management (DGB), which also provides CITES permits. To obtain a permit, scientists must sign a research agreement with a local institution, which the Centro de Investigación y Preservación de la Amazonia (CIPA) can easily provide, in addition to assistance with processing permit applications. CIPA also offers academic and logistical assistance to researchers, including the arrangement of transportation to and from the field site.

The Station has shared and private cabins, a partially equipped kitchen, a dining area, and teaching and storage facilities. The presence of local guides and a full-time caretaker ensures safe and comfortable living and working conditions for researchers and the presentation of field courses. Over 25 km of trails in an extensive grid system allows for easy viewing of animals. With advance notice, road and river transportation can also be provided through CIPA at the University of Pando. For more information about the Biological Station, please contact Sandra Suárez at <sqs6596@nyu.edu> or: Centro de Investigación y Preservación de la Amazonia (CIPA), Universidad Amazónica de Pando, Avenida Crnl. Cornejo, Cobija, Depto. de Pando, Bolivia, Tel.: 591-3-842-2135 ext. 112, <cipauap@hotmail.com> or <estacion_tahuamanu@yahoo.com>.

The Tahuamanu Biological Station is operated through the cooperation of the Universidad Amazónica de Pando, CIPA, the Field Museum and the Gordon and Betty Moore Foundation.

10TH EUROPEAN STUDBOOK FOR *SAGUINUS IMPERATOR*

With the help of Orlando Silva and the staff of the Lisbon Zoo, Eric Bairrão Ruivo, Collections Coordinator of the Lisbon Zoo, Portugal, has released the 10th European Studbook for the emperor tamarin, *Saguinus imperator*. The data are current to 31 December, 2003, and record 206 (99.99.8) *S. i. subgrisescens*, and seven (non-breeding) hybrids. As noted by Ruivo in his introduction, 2003 was an excellent breeding year with 60 births. Although only 31 survived, neonatal mortality is gradually improving, and the many births were the principal reason for the population increase over the last three years. Forty-nine institutions participated in the studbook (46 with *S. i. subgrisescens*, two with hybrids, and one with separate colonies of *S. i. subgrisescens* and hybrids): 11 in the UK, 10 in France, 9 in Germany, 3 in Denmark, 3 in the Netherlands, 2 in Australia, 2 in Portugal, and one each in Belgium, Czech Republic, China, Croatia, Finland, Singapore, South Africa, Spain and Switzerland. Three institutions received emperor tamarins for the first time: Blackpool (UK), La Fleche (France), and Induna Park (South Africa). The studbook includes a report on the EEP activities and the status and development of the population for 2003, a full historical listing, the registers of births, deaths and transfers for 2003, a listing of the living population by location, a full studbook analysis, management and husbandry recommendations for 2004, and the addresses of the holding institutions and those waiting to participate in the programme.

Besides the Coordinator, Eric Bairrão Ruivo, as of 2004 the Species Committee for this EEP includes: Bruno van Puijenbroeck (Antwerp), Warner Jens (Apeldoorn), Gary Batters (Banham), Teresa Abelló (Barcelona), Mark Challis (Belfast), Ilona Schappert (Dortmund), Ruediger Dmoch (Frankfurt), Dominic Wormell (Jersey), David Field (London), Pierre Moisson (Mulhouse), John Ray (Twycross) and Samuel Furrer (Zürich).

Eric Bairrão Ruivo, EEP Coordinator for Emperor Tamarin, Jardim Zoológico de Lisboa, Estrada de Benfica 158, 1549-004 Lisboa, Portugal.

Reference

Ruivo, E. B. 2003. *European Studbook for the Emperor Tamarin* Saguinus imperator *ssp.* 10th Edition, 2003. Lisbon Zoological Garden, Lisboa, Portugal. 114pp. (Data current through 31 December, 2003.)

A European Studbook for the Red Titi (*Callicebus cupreus*)

Darren Webster of the Blackpool Zoo, UK, has compiled the first studbook for the red, or coppery, titi, *Callicebus cupreus*. Produced in 2003, the data are current through 31 December, 2002. The stimulus for setting up this studbook was the importation, by several European zoos, of a number of titi monkeys from the California Regional Primate Research Center, Davis, USA. There were some initial complications regarding the exact identity of the titi species. Although coming from the Peruvian Amazon, individual variation led to the suspicion that some might be *C. brunneus* (known from northern Bolivia and the southwestern Brazilian Amazon). The California Regional Primate Research Center confirmed that all the titis originating from them had come from the Río Manití, Peru. Researchers familiar with the species in the wild were consulted and a number of individuals were karyotyped. The results confirmed that all should be classified as *Callicebus cupreus* according to the information we have today regarding its range and pelage coloration, and the fact that all the animals tested had a diploid number of 46 rather than the 48 chromosomes owned by *C. brunneus*. Darren Webster concluded that "although we still need to do more research in the future into the karyotyping and the true pureness of some of the specimens currently held in the population, it is felt that we have established enough information to successfully proceed with this programme." (p.5).

Eighty-nine individuals (41.38.10) are included in the historical listing. On 31 December, 2002, there were 34 (16.17.1) titis living in the following six European collections: Apenheul Primate Park, The Netherlands (1.3); Zoologischer Garten Basel, Switzerland (2.0); Zoologischer Garten Berlin, Germany (2.3.1); Blackpool Zoo Park, UK (7.5); Bristol Zoo Gardens, UK (1.1); La Vallee des Singes, Romagne, France (3.5). All of these except for seven (the six in Berlin and one of the titis in the Vallee des Singes) were from the California Regional Primate Research Center, Davis.

The studbook includes: recommendations for transfers; suggestions regarding karyotyping, and a protocol for the preservation of material (skins, skeleton, etc.) from dead animals; a karyotype summary for *Callicebus*; individual collections inventory; listings of births, deaths and transfers (1 January, 2000 to 31 December, 2002); reports on the age pyramid and inbreeding coefficient (living population); a census graph; historical listing; and a location glossary.

Webster recommends that a photographic record be made of the EEP animals (to be archived at the National Museums of Scotland, Edinburgh), and that dead specimens be given a post-mortem as soon as possible, and preserved (sealed polythene bags with appropriate identification numbers, in 70% ethanol or deep frozen) (methylated ethanol is inappropriate because it prevents the extraction of DNA). A suggested contact regarding the destination and analysis of dead specimens is Dr Andrew Kitchener, Curator of Mammals and Birds, National Museums of Scotland, Chambers Street, Edinburgh EH1 1JF, Scotland, UK, Tel: +44 (0)131 247 4240, Fax: +44 (0)131 220 4819, e-mail: <a.kitchener@nms.ac.uk>.

Darren Webster, Blackpool Zoo, East Park Drive, Blackpool FY3 8PP, England, UK, e-mail: <darren.webster@blackpoolzoo.org.uk>.

Reference

Webster, D. 2003. *European Studbook for Red Titi Monkeys* (Callicebus cupreus). No. 1, 2003. Blackpool Zoo Park, Blackpool, UK. 32pp.

A Master's Degree in Primate Conservation – Oxford Brookes University

Oxford Brookes University offers the only postgraduate programme in the UK directly linking the study of primates with conservation. Although traditional studies of primate behaviour and ecology are possible, students are also encouraged to undertake less traditional approaches to the realisation of *in situ* and *ex situ* primate conservation.

Several facilities are available for students including the Tess Lemmon Memorial Library of the Primate Society of Great Britain, the Nocturnal Primate Research Group, an equipment lending service for fieldwork, a collection of primate skeletal material, and a developing sound laboratory. There is a seminar series in Primate Conservation each semester, featuring internationally renowned figures as well as several field trips (including attendance at the Primate Society of Great Britain meetings), and there is an in-house newsletter, *Canopy*, with contributions from staff, students and speakers about their research.

Course content. Students develop a broad overview and understanding of the main areas of research on the conservation of primates and their habitats. Each student is encouraged to build on their own strengths and interests through the choice of practical assignment and co-authorship of a relevant chapter of *Canopy*. In addition, there are opportunities to specialize in appropriate research methods by selection from a range of options, backed by training (fieldwork, zoo-based and museum studies).

The course can be taken in full-time, part-time or distance-learning mode. Students take any three taught modules for a postgraduate certificate, all six taught modules for a postgraduate diploma and complete all modules and a final project for the award of an MSc. The modules include:

- *Primate Diversity and Biogeography* (e.g., threats to primates, taxonomy, systematics, speciation, ecology, behaviour, biodiversity, habitat protection);

- *Human-Wildlife Conflict Issues* (e.g., hunting, pest control, eco-tourism, economic pressures on forests, design and management of reserves and parks);
- *Environmental Education* (e.g., philosophy – the relationship of awareness to action, planning and practice);
- *Primate Conservation Genetics* (e.g., DNA sequencing, studbooks, minimal viable populations);
- *Research Methods in Primate Conservation* (e.g., behavioural sampling, surveys, statistics, generating funding, museum studies);
- *Captive Management* (e.g., enclosures design, breeding, display, rehabilitation);
- *Final Project,* in the form of a traditional dissertation or innovative end-product relevant to primate conservation (e.g., video, website).

The course aims to provide a high-quality postgraduate qualification relevant to the careers of anthropologists, conservation biologists, captive care givers, managers, and educators who have a particular interest in primates and their habitats, and practical solutions to their continuing survival. It is also geared towards those wishing to gain more knowledge of primate conservation before pursuing higher-level study. Special arrangements are also made for people from primate-habitat countries wishing to take the course.

Entry requirements. A first or second class honours degree in anthropology, biology or an appropriate related discipline, or an academic equivalent to an honours degree such as a conversion course is required. In extraordinary cases, admission will still be considered if occupational or life experience have provided the applicant with demonstrable graduate-level knowledge, abilities and skills (e.g., strong publication record in a related field). In the case of students whose first language is not English, proof of language skills must be presented (English Language GCSE or O-level, TOEFL, IELTS).

Career prospects. Students completing the MSc in Primate Conservation have gone on to work for a variety of institutions including: the British Sound Archives, the IUCN, the BBC Natural History Unit, and zoos in the UK and North America as keepers or education officers. Others are now working as paid researchers in Vietnam, Indonesia, Congo and the DRC. Others have embarked upon research degrees or are working as research assistants at institutes of higher education.

Teaching staff. Staff expertise is matched to each aspect of the course, with regular input from visiting speakers with firsthand experience in primate conservation. There are five permanent members of staff: Dr. K. A.-I. Nekaris (Course Leader), Prof. S. K. Bearder (Chair, Course Planning Committee), Dr. C. M. Hill (Final Project Leader), and Dr. A. Lack and Dr. D. Thurling (Tutors). In addition there are three visiting lecturers: Dr. M. K. Bayes (Conservation Genetics), Mr. S. Woollard (Environmental Education), and Dr. M. Prescott (Captive Care). The course is supported by a Course Co-ordinator and an Admissions Administrator, together with experienced postgraduate researchers who help with part-time teaching. The external advisors are Dr. C. S. Harcourt (Chester) and Dr. J. Fa (Durrell Wildlife Conservation Trust, Jersey).

Further information: Postgraduate Administrator, School of Sciences and Law, Oxford Brookes University, Headington Campus, Oxford, OX3 0BP, UK, Tel: +44 (0)1865 483750, Fax: +44 (0) 1865 483937, e-mail: <pgsocsci@brookes.ac.uk>. Website: <http://ssl.brookes.ac.uk/departments/anthropology.html>.

Conservation Grants from the Northwest Primate Conservation Society

The Northwest Primate Conservation Society (NWPCS) is proud to announce the start of its conservation grant program. In memory of Daniel E. Fischer, a healer and community leader, the NWPCS will support the primate research and conservation activities of graduate and undergraduate students.

Please visit the website of the NWPCS (<http://www.uoregon.edu/~nwpcs>) and click on "Grant" for further details and complete application guidelines. The deadline for submission is January 15, 2005. Although offered by a regional society, the competition is open to all students currently enrolled in an accredited academic institution.

Nicholas Malone, Founder, Northwest Primate Conservation Society, Department of Anthropology, University of Oregon, Eugene, OR 97403-1218, USA, e-mail <nwpcs@darkwing.uoregon.edu>.

Muriqui Home Page

A "Muriqui Home Page" voltou ao ar (<http://www.promuriqui.org.br>), apos a versão anterior ter sido destruida pelo antigo provedor gratuito. Ainda está em fase experimental, mas uma olhada rapida pelos links ja dá uma idéia inicial. Um click no mapa da Mata Atlântica (<http://www.promuriqui.org.br/ingles/homeing.htm>) mostra na seqüência o mapa do Estado de São Paulo e, posteriormente, a localização das areas de estudo no Parque Estadual Carlos Botelho. O projeto para a página alem de ser o veiculo de informação sobre as atividades da Associação Pro-Muriqui, é ser uma referência em documentos como mapas, e bibliografia com *Brachyteles* inicialmente.

Maurício Talebi Gomes, Associação Pró-Muriqui, Parque Estadual Carlos Botelho, São Paulo, Brasil. *Endereço para correspondência*: Rua Frei Gaspar 88/603, São Vicente 11320-440, São Paulo, Brasil, e-mail: <talebi40@hotmail.com>.

Primate Societies

American Society of Primatologists (ASP) – Grant Application Deadline

The ASP Research and Development and Conservation Committees announce that the application deadline for the 2005 grants (both "Research and Development" and "Conservation") is 16 January, 2005; much earlier than in previous years (April). This is to facilitate getting conservation grant money to the winners in time for the summer months - when many of the projects get underway. We regret any inconvenience this may cause, but we are sure it will help more than hinder most applicants.

Conservation Grants will be awarded by late March, 2005, and Research and Development Grants will be awarded at the 28th Annual Meeting of the American Society of Primatologists, 17-20 August, 2005, in Portland, Oregon (see Meetings, p.51). During November 2004, we will upgrade the web site to provide full details of the revised grant application process. This information will also appear in the December 2004 *ASP Bulletin* and various e-mail announcements. Any questions, please contact the Chairs of the two committees: Research and Development – Karen Bales, Dept. of Psychology, University of California, One Shields Ave, Davis, CA 95616, <klbales@ucdavis.edu> or Lynn Fairbanks at <lfairbanks@mednet.ucla.edu>; and Conservation – Janette Wallis, Dept. of Anthropology, Dale Hall Rm 521, 455 W. Lindsey, University of Oklahoma, Norman, OK 73019-0535, <janettewallis@sbcglobal.net>. For further information on the procedures to apply for these grants (and other awards), please go to the ASP website: <http://www.asp.org>. Although we encourage electronic submission, if necessary grants may be mailed to:

Nancy L. Capitanio, University of California, Davis, California National Primate Research Center, One Shields Avenue, Davis, CA 95616-8686, USA.

IPS Conservation Small Grants Awarded

The IPS Conservation Committee has recently awarded over $6300 in Conservation Small Grants. Seven applications were received from primatologists studying in all of the continents in which primates naturally occur, and four awards were made. The following individuals received grants for their excellent projects:

- Dilip Chetry (India) for a project titled "Non-human primate survey in Nongkhyllem Wildlife Sanctuary, Meghalaya, India".
- Entang Iskandar (Indonesia) for a project titled "Population survey of the Javan gibbon (*Hylobates moloch*) at the Gunung Halimun National Park, West Java, Indonesia".
- Pierre Kakule (Congo) for a project titled "Environmental education for the conservation of primates at the Tayna Centre for Conservation Biology".
- Karenina Morales (El Salvador) for a project titled "Survey and census of spider monkeys in El Salvador".

Congratulations to Dilip, Entang, Pierre, and Karenina for their outstanding proposals and good luck with the projects. These grants were made possible by generous contributions to the IPS Conservation Fund from many IPS members. We are planning on awarding another set of grants over the next year, so keep your eyes open for the announcement and keep those contributions coming. You can make a contribution to the IPS Conservation Fund (or General Fund) at any time at the IPS website: <http://www.asp.org/IPS/MembersOnly/selectloginoptions.cfm>.

Grant applications were evaluated by the members of the IPS Conservation Committee and I would like to thank Tom Struhsaker, Alcides Pissinatti, Anne Savage, Anthony Rylands, Bill Konstant, Russ Mittermeier, David Chivers, John Oates, Ken Glander, and Pat Wright for their work.

Cláudio Valladares-Pádua, IPS VP for Conservation, IPÊ – Instituto de Pesquisas Ecológicas, Caixa Postal 47, 12960-000 Nazaré Paulista, São Paulo, Brazil. E-mail: <cpadua@ipe.org.br>.

Recent Publications

A Map of the Brazilian Amazon

The Instituto Sociambiental (ISA), São Paulo, have published a new map of the Brazilian Amazon (*Amazônia Legal*) covering 500.6 million ha in the states of Amazonas, Pará, Acre, Roraima, Rondônia, Mato Grosso, Tocantins, Amapá, and part of Maranhão. "Amazônia Brasileira 2004", at a scale of 1:4,000,000, is 100 x 70 cm, and maps vegetation types, deforestation and human impacts in the region. There is also a list of the 236 protected areas and 400 Indigenous lands, parks and reserves of the region, part of a database maintained by the Instituto Socioambiental which indicates a total of 60.5 million ha of the Brazilian Amazon in protected areas, corresponding to 12% of the region (excluding c.14 million ha overlapping with Indigenous lands). Indigenous lands cover 104.3 million ha, or about 20% of the region. The list includes the name, category, area and the legal act which created each park and reserve, and the juridical/administrative status of, and names of the tribes in, each of the Indigenous lands. The data come from the Protected Areas Monitoring

Programme (*Programa de Monitoramento de Áreas Protegidas*) of the Instituto Socioambiental, and have been plotted on maps drawn up by the Brazilian Institute for Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* – IBGE), Rio de Janeiro. The database of the "Global Land Cover 2000" of the Joint Research Centre (JRC) of the European Commission was used to identify areas which have been deforested and impacted. The map is available at the Socioambiental website, <http://www.socioambiental.org>, for R$15.00 + postage.

Books

The Atlantic Forest of South America: Biodiversity Status, Threats, and Outlook, edited by Carlos Galindo-Leal and Ibsen de Gusmão Câmara, 2003. Island Press, Washington D.C. 488pp. ISBN 1-55963-988-1. Price: $70.00 (hardback), $35.00 (paperback). This book presents an authoritative account of one of the world's most threatened tropical forests by the biologists and conservationists who know it best. Although the majority of the remaining Atlantic Forest extends across southeastern Brazil, substantial portions still exist in Paraguay and Argentina as well, and the text considers the surviving forests of each nation in turn before examining issues which affect the remnants of the biome as a whole. Chapters specific to primates include an overview of the conservation history of the golden lion tamarin in Rio de Janeiro, Brazil, and an assessment of primate species in Misiones, Argentina. *Contents*: Foreword – Gustavo A. B. da Fonseca, Russell A. Mittermeier & Peter Seligmann, pp. xi-xiii; Preface – Gordon E. Moore, p.xv. Part I. Introduction. 1. Atlantic Forest hotspot status: An overview – C. Galindo-Leal & I. de Gusmão Câmara, pp.3-11; 2. State of the hotspots: The dynamics of biodiversity loss – C. Galindo-Leal, T. R. Jacobsen, P. F. Langhammer & S. Olivieri, pp.12-23. II. Brazil. 3. Dynamics of biodiversity loss in the Brazilian Atlantic Forest: An introduction – L. P. Pinto & M. C. Wey de Brito, pp.27-30; 4. Brief history of conservation in the Atlantic Forest – I. de Gusmão Câmara, pp.31-42; 5. Status of the biodiversity of the Atlantic Forest of Brazil – J. M. Cardoso da Silva & C. H. M. Casteleti, pp.43-59; 6. Monitoring the Brazilian Atlantic Forest cover – M. M. Hirota, pp.60-65; 7. Conservation priorities and main causes of biodiversity loss of marine ecosystems – S. Jablonski, pp.66-85; 8. Endangered species and conservation planning – M. Tabarelli, L. P. Pinto, J. M. Cardoso da Silva & C. M. R. Costa, pp.86-94; 9. Past, present, and future of the golden lion tamarin and its habitat – M. C. M. Kierulff, D. M. Rambaldi & D. G. Kleiman, pp.95-102; 10. Socioeconomic causes of deforestation in the Atlantic Forest of Brazil – C. E. F. Young, pp.103-117; 11. The Central and Serra do Mar corridors in the Brazilian Atlantic Forest – A. P. Aguiar, A. G. Chiarello, S. L. Mendes & E. Neri de Matos, pp.118-132; 12. Policy initiatives for the conservation of the Brazilian Atlantic Forest – J. C. Carvalho, pp.133-136. Part III. Argentina. 13. Dynamics of biodiversity loss in the Argentinean Atlantic Forest: An introduction – A. R. Giraudo, pp. 139-140; 14. Brief history of conservation in the Paraná Forest – J. C. Chebez & N. Hilgert, pp.141-159; 15. Biodiversity status of the interior Atlantic Forest of Argentina – A. R. Giraudo, H. Povedano, M. J. Belgrano, E. Krauczuk, U. Pardiñas, A. Miquelarena, D. Ligier, D. Baldo & M. Castelino, pp.160-180; 16. Threats of extinction to flagship species in the Interior Atlantic Forest – A. R. Giraudo & H. Povedano, pp.181-193; 17. Outlook for primate conservation in Misiones – M. S. Di Bitetti, pp.194-199; 18. The loss of Mbyá wisdom: Disappearance of a legacy of sustainable management – A. Sánchez & A. R. Giraudo, pp.200-206; 19. Socioeconomic roots of biodiversity loss in Misiones – S. Holz & G. Placci, pp.207-226; 20. Conservation capacity in the Paraná Forest – J. P. Cinto & M. P. Bertolini, pp.227-244; 21. Critical analysis of protected areas in the Atlantic Forest of Argentina – A. R. Giraudo, E. Krauczuk, V. Arzamendia & H. Povedano, pp.245-261; 22. Last opportunity for the Atlantic Forest – L. A. Rey, pp.262-264. Part IV. Paraguay. 23. Dynamics of biodiversity loss in the Paraguayan Atlantic Forest: An introduction – J. L. Cartes & A. Yanosky, pp.267-268; 24. Brief history of conservation in the Interior Atlantic Forest – J. L. Cartes, pp.269-287; 25. Biodiversity status of the Interior Atlantic Forest of Paraguay – F. Fragano & R. Clay, pp.288-309; 26. Socioeconomic drivers in the Interior Atlantic Forest – A. M. Macedo & J. L. Cartes, pp.310-324; 27. The Guaraní Aquifer: A regional environmental service – J. F. Facetti, pp.325-327; 28. Conservation capacity in the Interior Atlantic Forest of Paraguay – A. Yanosky & E. Cabrera, pp.328-354. Part V. Trinational Issues. 29. Dynamics of biodiversity loss: An introduction to trinational issues – T. R. Jacobsen, pp.357-359; 30. Species on the brink: Critically Endangered terrestrial vertebrates – T. Brooks & A. B. Rylands, pp.360-371; 31. Putting the pieces back together: Fragmentation and landscape conservation – C. Galindo-Leal, pp.372-380; 32. Endangered forests, vanishing peoples: Biocultural diversity and indigenous knowledge – T. R. Jacobsen, pp.381-391; 33. Unwanted guests: The invasion of nonnative species – J. K. Reaser, C. Galindo-Leal & S. R. Ziller, pp.392-405; 34. Harvesting and conservation of heart palm – S. E. Chediack & M. F. Baqueiro, pp.406-412; 35. The effects of dams on biodiversity in the Atlantic Forest – C. Fahey & P. F. Langhammer, pp.413-425; 36. Populating the environment: Human growth, density and migration in the Atlantic Forest – T. R. Jacobsen, pp. 426-435; 37. Mercosur and the Atlantic Forest: An environmental regulatory framework – M. Leichner, pp.436-443; 38. A challenge for conservation: Atlantic Forest protected areas – A.-V. Lairana, pp.444-457. Part VI. Conclusion. 39. Outlook for the Atlantic Forest – C. Galindo-Leal, I. de Gusmão Câmara & P. J. Benson, pp.461-464. Available from: Publications Department, c/o Neil Lindeman, Center for Applied Biodiversity Science, Conservation International, 1919 M Street NW, Suite 600, Washington, DC 20036, USA.

Handbook of Primate Husbandry and Welfare, by Sarah Wolfenson and Paul Honess. 2005 (forthcoming). 176pp. Blackwell Publishing, Oxford, UK. ISBN 1405111585 (paperback), £34.99. Available in January 2005 (February

2005 in the USA). This book covers all aspects of primate care and management, both in the laboratory environment and in zoos. From the welfare and ethics of primate captivity through housing and husbandry systems, environmental enrichment, nutritional requirements, breeding issues, primate diseases, and additional information on transportation and quarantine proceedings, this book provides a completely comprehensive guide to good husbandry and management of primates. Designed to be a practical field manual, the authors present the material using lists, tables and illustrations to clarify current opinion on best practice. *Contents:* 1. Primates: Their characteristics and relationship with man; What is a primate? Primate characteristics; Why are primates special? Ethical considerations of animals in captivity; Legal considerations; Further reading. 2. The physical environment; Considerations in accommodation design; Indoor/outdoor/combination facilities; Environmental conditions; Waste management; Further research needed; Further reading. 3. Staff, management and health and safety; Selection of staff; Training of staff; Health and safety issues; Lone working; Employee security; Further reading. 4. Nutrition; Natural feeding ecology; Diet formulation and processing; Energy requirements; Carbohydrate, protein and fat; Minerals and vitamins; Water; Supplements; Different life stages; Hand rearing of infants; Further reading. 5. Physical well-being; Assessment of physical health; Quarantine programme; Health-screening programme; Common infectious diseases; Husbandry-related diseases; Sedation of primates; Further reading. 6. Psychological well-being; Strategy for psychological well-being; Environmental enrichment; Assessment of psychological health; Further reading. 7. Training of primates; Why train primates? Sociality and psychological well-being in primates; Primate behaviour; Modification of behaviour; Further reading. 8. Breeding; Group systems and sizes; Primate fertility; Natural suppression of fertility; Reproductive cycles; Artificial control of reproduction; Pregnancy diagnosis; Parturition; Lactation and weaning; Breeding lifespan; Selection of breeding males; Further reading. 9. Sourcing and transporting primates; Background; Transportation; Provision during transport; Post-move monitoring; Further reading. Available from: Blackwell Publishing, c/o Marston Book Services, PO Box 269, Abingdon, Oxford, UK, OX14 4YN, Tel. +44(0) 1235 465 500, Fax +44(0) 1235 465 556, e-mail <direct.order@marston.co.uk>, website <http://www.blackwellpublishing.com/1405111585>.

The Complete Capuchin: The Biology of the Genus Cebus, by Dorothy M. Fragaszy, Elisabetta Visalberghi and Linda M. Fedigan, 2004. 339pp. Cambridge University Press, Cambridge. ISBN 0521661161 (hardback, $100.00), 0521667682 (paperback, $50.00). This book explores our understanding of capuchin monkeys in relation to their lives in nature – their physical, mental and social characteristics in comparison to other monkeys. The first scholarly work devoted entirely to the genus *Cebus*, this book summarizes their taxonomy, distribution, life history, ecology, anatomy, development, perception, cognition, motor skills, and social and sexual behavior. *Contents*: Part I. Capuchins in Nature. 1. Taxonomy, distribution and conservation. Where and what are they and how did they get there? (with Anthony Rylands); 2. Behavioral ecology. How do capuchins make a living?; 3. Community ecology. How do capuchins interact with their local communities and influence their environments?; 4. Life history and demography. Part II. Behavioral Biology. 5. The body; 6. Development; 7. Motor skills. Part III. Behavioral Psychology. 8. Perceiving the world. Memory and perception; 9. Engaging the world. Exploration and problem-solving; 10. Fancy manipulators. Capuchins use objects as tools; 11. Living together. Social interactions, relationships and social structure; 12. Erotic artists. Sexual behavior, forms of courtship and mating; 13. Learning together. Socially biased learning. Epilogue: The (in)complete capuchin. Also includes appendices on plants eaten by capuchins, the sites of long-term field studies on capuchins, biochemical and hematological parameters, and literature resources for the management of captive capuchins. Available from: Cambridge University Press, 40 West 20th Street, New York, NY 10011-4221, USA, Fax: +1 212-691-3239. *General Address* (Orders, Customer Service): Cambridge University Press, 100 Brook Hill Drive, West Nyack, NY 10994-2133, USA, Tel: +1 845-353-7500, Fax: +1 845-353-4141. Website: <http://www.cup.org/>.

Kinship and Behavior in Primates, edited by Bernard Chapais and Carol M. Berman. Oxford University Press, 2004. 520pp. ISBN: 0195148894 (hardcover). Price: $89.50. A fundamental reference for students and professionals interested in primate behavior, ecology, and evolution, this book draws on the emergence of new molecular data in recent years, making possible the direct assessment of degrees of genetic relatedness and kinship relations between individuals. It explores a considerable body of data on intergroup variation, and the experimental studies collected here, on both free-ranging and captive groups, allow for a full and satisfying consideration of this broad area of research. *Contents*: 1. Introduction: The kinship black box – B. Chapais & C. M. Berman. Part I. Who Are Kin? Methodological Advances in Determining Kin Relationships. 2. Determination of genealogical relationships from genetic data: A review of methods and applications – P. A. Morin & T. L. Goldberg; 3. Noninvasive genotyping and field studies of free-ranging nonhuman primates – D. S. Woodruff. Part II. Kin Compositions: Ecological Determinants, Population Genetics, and Demography. 4. Is there no place like home? Ecological bases of female dispersal and philopatry and their consequences for the formation of kin groups – L. A. Isbell; 5. Dispersal and the population genetics of primate species – G. A. Hoelzer, J. C. Morales & D. J. Melnick; 6. The effects of demographic variation on kinship structure and behavior in cercopithecines – D. A. Hill. Part III. Diversity of Effects of Kinship on Behavior. 7. Matrilineal kinship and primate behavior – E. Kapsalis; 8. Patrilineal kinship and primate behavior – K. B. Strier; 9. Kinship and behavior among nongregarious noc-

turnal prosimians: What do we really know? – L. T. Nash; 10. Kinship structure and reproductive skew in cooperatively breeding primates – J. M. Dietz; 11. Kinship structure and its impact on behavior in multilevel societies – F. Colmenares; 12. The impact of kinship on mating and reproduction – A. Paul & J. Kuester. Part IV. Kin Bias: Proximate and Functional Processes. 13. "Recognizing" kin: Mechanisms, media, minds, modules, and muddles – D. Rendall; 14. Developmental aspects of kin bias in behavior – C. M. Berman; 15. The recognition of other individuals' kinship relationships – D. L. Cheney & R. M. Seyfarth; 16. Constraints on kin selection in primate groups – B. Chapais & P. Belisle. Part V. The Evolutionary Origins of Human Kinship. 17. Human kinship: A continuation of politics by other means? – L. Rodseth & R. Wrangham; 18. Residence groups among hunter-gatherers: A view of the claims and evidence for patrilocal bands – H. P. Alvarez; 19. Mating, parenting, and the evolution of human pair bonds – K. Hawkes. Conclusion. 20. Variation in nepotistic regimes and kin recognition: A major area for future research – B. Chapais & C. M. Berman. Available from: Oxford University Press, 2001 Evans Road, Cary, NC 27513, USA, Tel.: (800) 451-7556, e-mail: <orders@oup-usa.org>, <http://www.oup.com/us>.

Primates: Evolución, Cultura y Diversidad, editado por Jorge Martínez Contreras y Joaquín J. Veá. 2002. Centro de Estudios Filosóficos, Políticos y Sociales Vicente Lombardo Toledano, México, D.F. ISBN 968-5721-009. Este libro aborda desde diversas perspectivas científicas el complejo y siempre intrigante mundo de nuestros más cercanos parientes evolutivos. Se han reunido aquí una serie de ensayos que, en tres secciones, ponen en relación las pesquisas cada vez más cercanas entre primatólogos y paleoantropólogos. La primera, *Evolución*, propone artículos metacientíficos (epistemológicos e históricos) y científicos en ambas disciplinas. La segunda, *Conservación y Diversidad,* procura poner de relieve la estrecha relación que la conservación en general y la protección de áreas naturales, así como la conservación del pool genético de una especie, tiene con el sustento de la diversidad, el fenómeno que mejor permite a una especie sobrevivir, eventualmente, al cambio ecosistémico. Finalmente, *Sociabilidad y Cultura*, pone de relieve la importancia de la relación, en los primates, de la sociabilidad con la cultura y la cognición. Introducción – J. M. Contreras y J. J. Veá, p.xi; Jordi Sabater Pí: Un naturalista en África – J. J. Veá y F. Peláez, p. xxv. I. Evolución. Protoculturas materiales e industrias elementales de los chimpancés en la naturaleza – J. S. Pí, p.1; El descubrimiento europeo de los póngidos y sus repercusiones en la filosofía ilustrada – J. M. Contreras, p. 17; Cousins: What the great apes tell us about human origins – C. B. Stanford, p. 35; Chimpanzees on the edge: The implications of chimpanzee ecology in "savanna" landscapes for hominid evolution – J. M. Sept, p. 51; Estrategias alimentarias de los primeros homínidos – J. L. Vera Cortés, p. 69; Recapitulación sobre la importancia adaptativa de la capacidad manipuladora e instrumental en la evolución de los primates – M. E. Aliaga, p. 83; La etología de los póngidos y su interés en el estudio de los hominoideos – J. M. Contreras, p. 101; El adiós a Eva, Adán y la manzana, y la bienvenida a una historia de simios, África y seres humanos (y de cómo Darwin osó teorizar sobre el origen biológico de nuestra especie) – J. Serrallonga, p. 121. II. Conservación y Diversidad. Estrategias para la conservación de primates neotropicales: El caso del mono aullador (*Alouatta palliata*) – E. Rodríguez-Luna y L. E. Domínguez-Domínguez, p. 153; Socioecología de *Alouatta palliata* en hábitat fragmentado: Implicaciones para la conservación – J. J. Veá y J. C. Azkarate, p. 175; Los primates de Eritrea: Una expedición para el estudio de su hábitat, distribución y demografía – F. Peláez y D. Zinner, p. 197; El papel de los parques zoológicos en la conservación de los primates: Un reto para la etología – F. Guillén-Salazar, p. 227. III. Sociabilidad y Cultura. Influencia ambiental en los sistemas sociales de primates – C. G. Burmann, p. 255; Socioecología y relaciones sociales – F. Colmenares, p. 271; A través del espejo: La búsqueda de los orígenes de la autoconciencia – M. C. Mimó, p. 333. *Disponible por:* Centro de Estudios Filosóficos, Políticos y Sociales Vicente Lombardo Toledano, Calle V. Lombardo Toledano num. 51, Exhda. de Guadelupe Chimalistac, México, D.F. c.p. 01050, Tel: 5661 46 79, Fax: 5661 17 87, E-mail <lombardo@servidor.unam.mx>.

Articles

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Abstracts

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Ascunce, M. S., Hasson, E., Zunino, G., Mulligan, C. J. & Mudry, M. D. Pattern of mitochondrial genetic variability of the black howler monkey (*Alouatta caraya*): An example of post-glacial range expansion in South American fauna, pp.54-55.

Bezanson, M. Ontogenetic influences on prehensile-tail use in *Cebus capucinus*, p.63.

Boinski, S. Idiosyncratic social behaviors of brown capuchins in an anthropogenic landscape are consistent with prevalent socioecological theory, p.65.

Byron, C. D., Hamrick, M., Borke, J. & Yu, J. The mechanobiology of primate cranial sutures, p.72.

Clarke, M. R. Group size resurgence in mantled howlers (*Alouatta palliata*), pp.75-76.

Di Fiore, A. & Schwindt, D. M. A preliminary study of social behavior and pair-bonding in wild titi monkeys (*Callicebus discolor*) in Amazonian Ecuador, p.87.

Dirks, W., Ramirez Rozzi, F. V., Reid, D. J. & Anemone, R. L. Thinking small: A comparative study of dental microstructure in *Cantius*, *Otolemur*, *Perodicticus*, and *Saimiri*, p.88.

Ehmke, E., Kauffman, L. & Boinski, S. Adult male relations with juveniles among brown capuchins (*Cebus apella*) in Suriname: Affiliation, antagonism or benign neglect?, p.92.

Field, M. Y. Effect of human cohabitation on activity budgets in white-fronted capuchin monkeys (*Cebus albifrons*) in Ecuador: A pilot study, p.94.

Garber, P. A., Blomquist, G. E. & Anzenberger, G. Kinematic analysis of trunk-to-trunk leaping in Goeldi's monkey (*Callimico goeldii*), p.98.

Gilad, Y., Wiebe, V., Przeworski, M., Lancet, D. & Paabo, S. Loss of olfactory receptor genes is coupled to the acquisition of full trichromatic color vision, p.99.

Jack, K. & Fedigan, L. Resident male replacement in *Cebus capucinus* groups, p.119.

Kauffman, L., Ehmke, E. & Boinski, S. Increased male-male cooperation among brown capuchin monkeys (*Cebus apella*) in Suriname, p.123.

Kay, R. F., Rossie, J. B., Colbert, M. W. & Rowe, T. B. Observations on the olfactory system of *Tremacebus harringtoni* (Platyrrhini, early Miocene, Sacanana, Argentina) based on high resolution X-ray CT scans, pp.123-124.

Kirk, E. C. Effects of activity pattern on eye and orbit morphology in primates, p.126.

Luecke, L. G. Howler monkey (*Alouatta pigra*) populations in five Maya archaeological zones in southern Mexico and northern Guatemala, p.138.

MacKinnon, K. C. Play patterns in small juvenile white-faced capuchin monkeys (*Cebus capucinus*) in Costa Rica, p.139.

McKeon, M. & Winnor, K. Vocal communication within a troop of mantled howling monkeys (*Alouatta palliata*), p.146.

Robinson, A. M., Ford, S. M. & Garber, P. A. Attrition in the dentition of a population of Peruvian tamarins (*Saguinus mystax mystax*), p.168.

Sallenave, A. & Bravo, S. P. Seed dispersal by black howler monkeys (*Alouatta caraya*) in a northeastern Argentinean flooded forest, p.172.

Schwindt, D. M. & Ayres, J. M. Parapatric groups of black and common squirrel monkeys (*Saimiri vanzolinii* and *Saimiri sciureus*) in the central Amazon, p.177.

Shaffer, C. A. Foraging, ranging, and spatial memory in the mantled howler monkey (*Alouatta palliata*), p.179.

Smith, S. J. A preliminary study of seed dispersal by white-faced capuchins (*Cebus capucinus*) and mantled howlers (*Alouatta palliata*) in Costa Rica, p.184.

Spehar, S. Acoustic variation in the long calls of wild spider monkeys (*Ateles belzebuth belzebuth*), p.186.

Taylor, A. B. & Vinyard, C. J. Masseter muscle fiber architecture in tree-gouging (*Callithrix jacchus*) and non-gouging (*Saguinus oedipus*) callitrichids, p.193.

Urbani, B. & Garber, P. A. A stone in their hands...are monkeys tool users?, p.199.

Vinyard, C. J., Lucas, P. W., Valenca-Montenegro, M. M., Melo, L. C. O., Valle, Y. M. & Monteiro da Cruz, M. A. O. Where the wild things are: Linking lab and field work in studying tree gouging in common marmosets (*Callithrix jacchus*), pp.200-201.

Walker, S. E. Intraspecific differences in positional behavior of the white-faced saki, *Pithecia pithecia*, and the influence of habitat characteristics, pp. 202-203.

Wright, B. W. Food mechanical properties and niche partitioning in a community of Neotropical primates, p.212.

Young, N. M. A comparative three-dimensional geometric morphometric study of growth and similarity in the primate scapula, p.214.

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Bales, K. L. Primates, prairie voles, and the physiology of love and fear, pp.83-84.

Bezanson, M. Leap, bridge, or ride? Ontogenetic influences on gap crossing in *Cebus* and *Alouatta*, pp.90-91.

Bolton, I. The veterinarian's role in behavioural management, pp.45-46.

Meetings

2004

Second European Conference on Behavioural Biology, 28-31 August, 2004, Groningen, the Netherlands. The goal of the conference is to provide a bi-annual overview of ongoing European research in behavioural biology, and to stimulate contacts between the different research areas. Plenary topics include Maternal Effects, Genomics Meets Behaviour, Phenotypic Plasticity, Cultural Evolution, Learning, and Aging. Organized by Ton Groothuis, Department of Animal Behaviour, University of Groningen, on behalf of the joint European Societies for Behavioural Biology. For more information contact <info@groningencongresbureau.nl> or see the website at <http://www.biol.rug.nl/ecbb2004>.

II Simposio de Primates: Un Enfoque Multidisciplinario, 26-29 October, 2004, Caracas, Venezuela. Hosted by the Faculty of Economic and Social Sciences at the Central University of Venezuela. The preliminary themes of the congress include: Anatomy and Human Morphology, Prehispanic Osteology, Forensic Anthropology and Human Rights, Population Genetics, Physical Anthropology and Health, Anthropology and Sport, Paleoanthropology and Human Ecology, Biodemography, Epistemological Problems in Physical Anthropology, Professional Formation of the Physical Anthropologists, and Bioethics. For more information contact Braulio Hernández at <macrhesus@hotmail.com> or Elisa Horta at <garota_57@hotmail.com>, or see the announcement at <http://www.primate.wisc.edu/pin/venezuela_congress.doc>.

IUCN Conservation Breeding Specialist Group Annual Meeting, 28 October – 4 November, 2004, Taipei, Taiwan. Hosted by the Taipei Zoo, the theme of this year's meeting will be "The Evolving Role of Reintroduction as a Tool for Conservation." Plenary presentations and working groups will focus on various aspects of reintroduction, including those reflected in the World Zoo and Aquarium Conservation Strategy. Fred Launay, Chair of the IUCN/SSC Reintroduction Specialist Group, will present the keynote address. Other speakers include Hamish Currie of "Back To Africa," who will discuss concepts resulting from their experiences re-introducing Sable and Roan into Southern

Africa; and Mark Stanley Price, Executive Director of Durrell Wildlife Conservation Trust, who will discuss reintroduction as defined by habitat/system restoration. Currently proposed working group topics include: initial work on developing Guidelines on Captive Breeding for Conservation, further work on developing training programs on CBSG processes and zoo biology, and Action Planning as a next step in the World Zoo and Aquarium Conservation Strategy. For more information and registration for the CBSG Annual Meeting, please email <cbsgwaza@zoo.gov.tw> or visit the conference website at <http://www.zoo.gov.tw/cbsg&waza/index.htm>.

Congreso Nacional de Conservación de la Biodiversidad, 16-19 noviembre de 2004, Escobar, Argentina. Organizan: Fundación Temaikèn, Fundación de Historia Natural Félix de Azara, y Departamento de Ciencias Biológicas de la Universidad CAECE. Sede: Temaikèn, Ruta Provincial 25 Km. 0,700 (1625) Escobar, Provincia de Buenos Aires, Argentina. Página web: <http://www.temaiken.com.ar>. Informes e inscripción: <fundacionhn@caece.edu.ar>. El Congreso tendrá cuatro ejes temáticos: 1) Investigación para la conservación de la biodiversidad; 2) Educación ambiental para la conservación de la biodiversidad; 3) Gestión y manejo para la conservación *in situ* de la biodiversidad, y 4) Gestión y manejo para la conservación *ex situ* de la biodiversidad. Los resúmenes deben ser enviados por correo electrónico antes del 10 de setiembre de 2004 a: <fundacionhn@caece.edu.ar>. Inscripción: Profesionales: $70, Estudiantes: $30. Los interesados en participar como asistentes o expositores deberán enviar la ficha de inscripción adjunta antes del 29 de octubre de 2004. Página web: <http://www.caece.edu.ar/fundacionhn>.

Primate Society of Great Britain 2004 Winter Meeting, 1 December 2004, Institute of Zoology, London. Theme: "People, Primates and Conservation." Organized by Kate Hill, Oxford Brookes University, Oxford, UK, and Caroline Ross, University of Surrey Roehampton. The following speakers have been confirmed: John Fa (Durrell Wildlife Conservation Trust), Anna Feistner (AFP Conservation Support), Alison Jolly (University of Sussex), Phyllis Lee (University of Cambridge), France Maddine (Consultant in Human-Wildlife Conflict), Anna Nekaris (Oxford Brookes University), and Nancy Priston (University of Cambrdge). The 2004 Osman Hill Lecture will be given by Carel van Schaik. For more information contact: Kate Hill, e-mail: <cmhill@brookes.ac.uk> or visit the website at <http://www.psgb.org>.

2005

Biodiversity: Science and Governance: Today's Choice for Tomorrow's Life, 24-28 January, 2005, Paris, France. Hosted by the Ministry of Research, with additional coordination by the Institut Français de la Biodiversité, the conference is part of the ongoing global effort to curb the loss of biodiversity by 2010 and ensure the long term conservation and sustainable use of biological diversity. The conference will focus on changes in biodiversity, assessment tools and methodologies; the social impact of change, particularly concerning the exploitation of and trade in renewable resources, agriculture, fisheries, forestry; and biodiversity governance in the context of the 2010 target and the Millennium Development Goals, with an emphasis on legal, economic and political aspects. For a comprehensive overview of the meeting, visit the website at <http://www.recherche.gouv.fr/biodiv2005paris/en/index.htm>.

Zoos & Aquariums: Committing to Conservation, 26-30 January, 2005, Cocoa Beach, Florida. The Brevard Zoo will again be hosting the conference, which will continue to examine and promote the role of zoos and aquaria in supporting *in situ* field research and conservation. Participants will include representatives from zoological institutions, aquaria and most importantly the field. Our intent is to facilitate networking amongst our colleagues and to focus on practical applications that support *in situ* conservation efforts. The registration fee is $185.00, which includes sessions, some meals and social activities. Similar to the last conference in 2001, we would like to encourage zoos and aquaria to sponsor their colleagues from the field. Having such a strong presence of field researchers greatly enhanced the positive interactions and resulted in concrete commitments on the part of several zoos towards field conservation. The conference will be held at the Holiday Inn Beachfront Resort. The room rates are $69.00 (plus tax) per night. The hotel address is 1300 N. Atlantic Avenue, Cocoa Beach, Florida 32931, USA, phone: 1-800-206-2747. ZCC (Zoos Committed to Conservation) is the group code to reference. For those of you looking for roommates, we will compile a list of interested people and will pass on to you at your individual request(s). Please contact Beth Armstrong at <elynn57@aol.com> for further details. For additional ZACC information, please contact: Beth Armstrong, Field Conservation Coordinator, 1-321-454-6285, <elynn57@aol.com> or Cheri Purnell, 1-321-254-9453 ext. 25, <membership@brevardzoo.org>.

XXIII Annual Conference of the Australasian Primate Society, 12-13 March, 2005, South Australian Museum, Adelaide, South Australia. Twenty-minute sessions will be reserved for each paper. Abstracts should be received before 1 February, 2005. Information: Graeme Crook, President, Australasian Primate Society, PO Box 500, One Tree Hill, SA 5114, Australia, e-mail: <aps_editor@msn.com.au>. For further details visit <http://www.primates.on.net/apsconf.htm>.

Primate Society of Great Britain 2005 Spring Meeting, 22-23 March, 2005. Chester College. For more information contact: Paul Honess, PSGB Meeting Officer, Department of Veterinary Services, University of Oxford, Parks Road, Oxford OX1 3PT, UK, e-mail: <meetings@psgb.org> or visit the website at <http://www.psgb.org>.

Student Conference on Conservation Science, 22-24 March 2005, Cambridge, England. The sixth in a series of student-oriented conferences on conservation science will be hosted by the Department of Zoology, University of Cambridge. The conferences are aimed at people actively

engaged in research in conservation science in biological, environmental and geography departments of universities as well as in conservation and resource management agencies. Conservation practitioners from leading UK and international conservation bodies also attend and contribute to discussions. Presentations of work in progress from a broad range of countries, and from economic and social as well as biological aspects of conservation, will all be welcome. Besides the posters and talks, there will also be workshops, presentations by conservation NGOs and agencies and social events designed to give participants the opportunity to make new contacts in their own and related disciplines. Prizes are awarded to posters and talks of outstanding quality and relevance to conservation. There will be plenary lectures by four leading figures in the field: Dr. Mohamed Bakarr (World Agroforestry Centre), Prof. Daniel Pauly (University of British Columbia), Prof. Chris Thomas (University of York), and Graham Wynne (Chief Executive, Royal Society for the Protection of Birds). The conference fee, including registration, tea and coffee and three evening events, is £30. Accommodation and breakfast will be available in a college near the conference venue at a highly subsidised rate of £10 per person per night. However, if you can stay elsewhere, this will help us to keep the prices low. To register, please fill in and return the application form by 10 November 2004. You can get the form from our website <http://www.zoo.cam.ac.uk/sccs/> or from: Conservation Biology Group, Department of Zoology, University of Cambridge, Downing Street, Cambridge CB2 3EJ, UK. You are invited to submit a short abstract of your proposed talk or poster, but it is not essential to present a talk or poster in order to attend.

IX Simposio de Antropología Física, 4-8 April, 2005, Habana, Cuba. El Museo Antropológico "Montané" y la Cátedra de Antropología "Luís Montané" de la Facultad de Biología de la Universidad de La Habana, la Sociedad Cubana de Antropología Biológica, la Sociedad de Estudios Primatológicos Eopithecus de México, convocan al IX Simposio de Antropología Física "Luis Montané", el V Congreso Primates como Patrimonio Nacional, el II Coloquio Primates a través del Caribe y el II Coloquio de Antropología "Manuel Rivero de la Calle", del 4 al 8 de abril del 2005. Esta simultaneidad de eventos permitirá realizar una extensa actividad tanto en el ámbito científico como en el de las relaciones humanas que damos por seguro contribuirá al acercamiento de los profesionales y al intercambio de experiencias. Correspondencia: Dr. Armando Rangel Rivero, Secretario, Museo Antropológico Montané, Calle 25 #455, entre J e I. El Vedado, Facultad de Biología, Universidad de La Habana, Ciudad de La Habana, Cuba, E-mail: <montane05@fbio.uh.cu>, website: <http://www.primate.wisc.edu/pin/IX_SIMPOSIO_DE_ANTROPOLOGMA_FMSICA.doc>.

2005 Meeting of the Mexican Society of Primatologists, 4-7 May, 2005, Instituto de Ecología, Xalapa, Veracruz, México. For information: Juan Carlos Serio Silva, Presidente, Asociación Mexicana de Primatología AC, Departamento de Biodiversidad y Ecología Animal, Instituto de Ecología AC, km 2.5 antigua carretera a Coatepec, No. 351 congregación El Haya, CP 91070, Apartado Postal 63, Xalapa, Veracruz, México, Tel: +52 (228) 8 42 18 00 ext 4109 /4110 (Fax: ext 4111), e-mail: <serioju@ecologia.edu.mx>.

19th Annual Meeting of the Society for Conservation Biology, 15-19 July, 2005, Brasília, Brazil. The meeting will be held at the Universidade de Brasília, Brasília, Brazil, with the central theme of "Conservation Biology: Capacitation and Practice in a Globalized World." The chair of the meeting will be Miguel Marini from the Zoology Department of the Universidade de Brasília. The organizing committee will be composed of professors from the Zoology Department, members of the Austral and Neotropical America Section of SCB, and other researchers, mostly from Brazil and other Latin American countries. Detailed information about the meeting will be available later in 2004; for inquiries, please contact: SCB 2005 Local Organizing Committee, Departamento de Zoologia, IB, Universidade de Brasília, 70910-900 Brasília, DF, Brasil, telefax: + 55 61 307-3366, e-mail: <2005@conbio.org>, website: <http://www.conservationbiology.org/2005>.

Association of Tropical Biology and Conservation – 2005 Annual Meeting, 23-29 July, 2005, Uberlândia, Brazil. The venue will be the Uberlândia Convention Center. For more information write to the Chair of the Organizing Committee, Kleber del-Claro, Laboratório de Ecologia Comportamental e Interações, Universidade Federal de Uberlândia, Caixa Postal 593, Uberlândia 38400-902, Minas Gerais, Brazil, e-mail <delclaro@ufu.br> or <atbc2005@inbio.ufu.br>.

IX International Mammalogical Congress, 31 July - 5 August, 2005, Sapporo, Japan. Organizing Committee: MAMMAL2005, c/o Field Science Center, Hokkaido University, N11 W10, Sapporo 060-0811, Japan, e-mail: <MAMMAL2005@hokkaido-ies.go.jp>. Website: <http://www.imc9.jp>.

1st Congress of the European Federation of Primatology, 9-12 August, 2005, Göttingen, Germany. The Congress will be hosted by the German Society for Primatology (GfP) at the German Primate Centre (DPZ), University of Göttingen. It will coincide with the 9th Congress of the German Society. European students and researchers working on all aspects of primatology are invited to attend. Registration from 1 November 2004 to 30 March 2005. For more information contact Peter M. Kappeler, President EFP, German Primate Center (DPZ), Abteiling Verhaltensforschung & Ökologie, Kellnerweg 4, D-37077 Göttingen, Germany, e-mail: <pkappel@gwdg.de>. Website: <http://www.gf-primatologie.de/EFP2005/index.htm>.

28th Annual Meeting of the American Society of Primatologists, 17-20 August, 2005, Portland, Oregon. The meeting will be held at the Benson Hotel and hosted by the Oregon National Primate Research Center. Call for abstracts and

the meeting announcement will be sent electronically to all ASP members in mid-December 2004. Deadline for proposals for symposia, roundtables or workshops is 17 January, 2005. Deadline for abstracts for contributed papers, symposia speakers, workshops and roundtable discussions is 14 February, 2005. If a paper version of the meeting announcement is preferred, please contact Larry Williams, Program Co-Chair, Tel: +1 251-460-6293, Fax: +1 251-460-6286, e-mail: <lwilliams@usouthal.edu>. For more information, please contact: Dr. Kristine Coleman, Chair of the local organizing committee of the ONPRC, at <colemank@ohsu.edu>.

29th International Ethological Conference, 20-27 August, 2005, Budapest, Hungary. The aim for this conference is to encourage interdisciplinary discussion among representatives of all areas of behavioral biology. The conference will be hosted at the Eötvös University Convention Center on the banks of the Danube. Deadline for early registration and abstract acceptance: 1 March 2005. Final deadline for abstract acceptance: 1 May, 2005. Late registration until 1 June 2005. For more information, write to: IEC2005, Department of Ethology, Eötvös University, 1117 Budapest, Hungary, or subscribe to the e-mail newsletter at <IEC2005-subscribe@yahoogroups.com>.

Measuring Behavior 2005 – 5th International Conference on Methods and Techniques in Behavioral Research, 30 August – 2 September, 2005, Wageningen, The Netherlands. Measuring Behavior will offer an attractive mix of presentations, demonstrations, discussions, meetings and much more (see <http://www.noldus.com/mb2005/program/index.html> for details). Proceedings of the 2002 meeting are available at <http://www.noldus.com/events/mb2002/index.html>. Deadline for proposals of Symposia and SIGs: 1 December 2004. All presentations will deal with innovative methods and techniques in behavioral research. Topics include: behavior recording in the laboratory and field; automatic behavior recognition and pattern classification; sensor technology and biotelemetry; behavior and physiology; vocalizations, speech, gestures and facial expressions; analyzing behavior and movement; new animal models and measurement methodologies; measuring human-system interaction; innovation in teaching behavior research methods. For more information, contact Prof. Dr. Louise E. M. Vet, Program Chair, Measuring Behavior 2005, Conference Secretariat, P. O. Box 268, 6700 AG Wageningen, The Netherlands, Tel: +31-317-497677, Fax: +31-317-424496, e-mail: <mb2005@noldus.nl>. Website: <http://www.noldus.com/mb2005>.

2006

21st Congress of the International Primatological Society, 26-30 June, 2006, Imperial Resort Beach Hotel, Entebbe, Uganda. Theme: "Primate Conservation in Action". Preliminary contact details: Dr. William Olupot, Chair, Organizing Committee, IPS 2006 Congress, P. O. Box 21669, Kampala, Uganda, Tel: 077598134, 077947397, 041501020, e-mail <wolupot@yahoo.com>.

Lion Tamarins: Biology and Conservation

Devra G. Kleiman and Anthony B. Rylands

October 2002
384 pages; 6 x 9 inches; 20 b/w photographs; 42 line illustrations; 33 charts and graphs
Hardcover: $45.00
1-58834-072-4

From the Smithsonian Institution Press: Without the extraordinary efforts of the editors and authors of this book, three of the four lion tamarin species (golden, golden-headed, black-faced, and black) would most likely be extinct. The contributors' hard work set international standards and became the model for the preservation of other endangered species. There is, of course, still much to be done, and this comprehensive assessment of research findings and conservation efforts leads the way.

The first section of the book covers the history and framework of research and conservation for the four species, stressing the importance of both group and individual efforts. Part II examines the principal research fields that have played an important role in contributing to the management of the species in captivity and the wild; the authors maintain that there is no substitute for long-term data and good science when developing recovery and conservation programs. Part III focuses on direct interventions to conserve wild populations and their habitats as guided by scientific and educational principles.

Kleiman and Rylands close the book by noting the remarkable accomplishments of lion tamarin conservation, and look hopefully toward future directions and challenges.

Devra G. Kleiman is a research associate at the Smithsonian's National Zoo and is coeditor of *Wild Mammals in Captivity: Principles and Techniques* (1997). Anthony B. Rylands is senior director for conservation biology at the Center for Applied Biodiversity Science, Conservation International in Washington D.C., and is editor of *Marmosets and Tamarins: Systematics, Behaviour, and Ecology* (1993).

Notes to Contributors

Scope

The journal/newsletter aims to provide a basis for conservation information relating to the primates of the Neotropics. We welcome texts on any aspect of primate conservation, including articles, thesis abstracts, news items, recent events, recent publications, primatological society information and suchlike.

Submissions

Please send all English and Portuguese contributions to: John M. Aguiar, Conservation International, Center for Applied Biodiversity Science, 1919 M St. NW, Suite 600, Washington, DC 20036, Tel: 202 912-1000, Fax: 202 912-0772, e-mail: <j.aguiar@conservation.org>, and all Spanish contributions to: Ernesto Rodríguez-Luna, Instituto de Neuroetología, Universidad Veracruzana, Apartado Postal 566, Xalapa 91000, Veracruz, México, Tel: 281 8-77-30, Fax: 281 8-77-30, 8-63-52, e-mail: <saraguat@speedy.coacade.uv.mx>.

Contributions

Manuscripts may be in English, Spanish or Portuguese, and should be double-spaced and accompanied by the text on diskette for PC compatible text-editors (MS-Word, WordPerfect, Excel, and Access), and/or e-mailed to <j.aguiar@conservation.org> (English, Portuguese) or <saraguat@speedy.coacade.uv.mx> (Spanish). Hard copies should be supplied for all figures (illustrations and maps) and tables. The full name and address for each author should be included. Please avoid abbreviations and acronyms without the name in full. Authors whose first language is not English should please have texts carefully reviewed by a native English speaker.

Articles. Each issue of *Neotropical Primates* will include up to three full articles, limited to the following topics: Taxonomy, Systematics, Genetics (when relevant for systematics), Biogeography, Ecology and Conservation. Texts for full articles should not exceed about 20 pages in length (1.5 spaced, and including the references). Please include an abstract in English, and (optional) one in Portuguese or Spanish. Tables and illustrations should be limited to six, excepting only the cases where they are fundamental for the text (as in species descriptions, for example). Full articles will be sent out for peer-review.

Short articles. These are usually reviewed only by the editors. A broader range of topics is encouraged, including such as behavioral research, in the interests of informing on general research activities which contribute to our understanding of platyrrhines. We encourage reports on projects and conservation and research programs (who, what, where, when, why, etc.) and most particularly information on geographical distributions, locality records, and protected areas and the primates which occur in them. Texts should not exceed 10 pages in length (1.5 spaced, including the references).

Figures and maps. Articles may include small black-and-white photographs, high-quality figures, and high-quality maps and tables. Please keep these to a minimum. We stress the importance of providing maps which are **publishable.**

News items. Please send us information on projects, field sites, courses, recent publications, awards, events, activities of Primate Societies, etc.

References. Examples of house style may be found throughout this journal. Please refer to these examples when listing references:

Journal article
Stallings, J. D. and Mittermeier, R. A. 1983. The black-tailed marmoset (*Callithrix argentata melanura*) recorded from Paraguay. *Am. J. Primatol.* 4: 159–163.

Chapter in book
Brockelman, W. Y. and Ali, R. 1987. Methods of surveying and sampling forest primate populations. In: *Primate Conservation in the Tropical Rain Forest*, C. W. Marsh and R. A. Mittermeier (eds.), pp. 23–62. Alan R. Liss, New York.

Book
Napier, P. H. 1976. *Catalogue of Primates in the British Museum (Natural History). Part 1: Families Callitrichidae and Cebidae.* British Museum (Natural History), London.

Thesis/Dissertation
Wallace, R. B. 1998. The behavioural ecology of black spider monkeys in north-eastern Bolivia. Doctoral thesis, University of Liverpool, Liverpool, UK.

Report
Muckenhirn, N. A., Mortensen, B. K., Vessey, S., Fraser, C. E. O. and Singh, B. 1975. Report on a primate survey in Guyana. Unpublished report, Pan American Health Organization, Washington, DC.

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6	fully-grown trees
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Vol. 12(1), April 2004

Contents

Short Articles

IUCN/SSC
PRIMATE
Specialist Group