ISSN 1413-4703

NEOTROPICAL PRIMATES

A Journal of the Neotropical Section of the
IUCN/SSC Primate Specialist Group

Volume 12
Number 3
December 2004

Conservation International

Species Survival Commission

Center for Applied Biodiversity Science at Conservation International

Neotropical Primates

A Journal of the Neotropical Section of the IUCN/SSC Primate Specialist Group

IUCN/SSC
PRIMATE
Specialist Group

Center for Applied Biodiversity Science
Conservation International
1919 M St. NW, Suite 600, Washington, DC 20036, USA

ISSN 1413-4703 Abbreviation: *Neotrop. Primates*
DOI: 10.1896/ci.cabs.2004.np.12.3

Editors
Anthony B. Rylands, Center for Applied Biodiversity Science, Conservation International, Washington, DC
Ernesto Rodríguez-Luna, Universidad Veracruzana, Xalapa, México

Assistant Editors
John M. Aguiar, Center for Applied Biodiversity Science, Conservation International, Washington, DC
Liliana Cortés-Ortiz, Universidad Veracruzana, Xalapa, México

Editorial Board
Hannah M. Buchanan-Smith, University of Stirling, Stirling, Scotland, UK
Adelmar F. Coimbra-Filho, Academia Brasileira de Ciências, Rio de Janeiro, Brazil
Liliana Cortés-Ortiz, Universidad Veracruzana, Xalapa, México
Carolyn M. Crockett, Regional Primate Research Center, University of Washington, Seattle, WA, USA
Stephen F. Ferrari, Universidade Federal do Pará, Belém, Brazil
Eckhard W. Heymann, Deutsches Primatenzentrum, Göttingen, Germany
Russell A. Mittermeier, Conservation International, Washington, DC
Marta D. Mudry, Universidad de Buenos Aires, Argentina
Horácio Schneider, Universidade Federal do Pará, Belém, Brazil
Karen B. Strier, University of Wisconsin, Madison, WI, USA
Maria Emília Yamamoto, Universidade Federal do Rio Grande do Norte, Natal, Brazil

Primate Specialist Group
Chairman Russell A. Mittermeier
Deputy Chair Anthony B. Rylands
Co-Vice Chairs for the Neotropical Region Anthony B. Rylands & Ernesto Rodríguez-Luna
Vice Chair for Asia Ardith A. Eudey
Vice Chair for Africa Thomas M. Butynski
Vice Chair for Madagascar Jörg U. Ganzhorn

Design and Layout: Kim Meek, Center for Applied Biodiversity Science,
Conservation International, Washington, DC

Editorial Assistance:
Mariella Superina, University of New Orleans, Department of Biological Sciences, New Orleans, LA

IUCN/SSC Primate Specialist Group logo courtesy of Stephen D. Nash, 2002.

Front Cover: *Callithrix flaviceps* from Minas Gerais, Brazil. Photo by Russell A. Mittermeier.

This issue of *Neotropical Primates* was kindly sponsored by the Margot Marsh Biodiversity Foundation, 432 Walker Road, Great Falls, Virginia 22066, USA, the Houston Zoological Gardens Conservation Program, General Manager Rick Barongi, 1513 North MacGregor, Houston, Texas 77030, USA, and the Los Angeles Zoo, Director John R. Lewis, 5333 Zoo Drive, Los Angeles, California 90027, USA.

MARGOT MARSH
BIODIVERSITY
FOUNDATION

HOUSTON
Zoological
Gardens
A Division of the Houston
Parks and Recreation Department

LOS ANGELES
ZOO

Short Articles

The Mottled-face Tamarin, *Saguinus inustus*, in the Amanã Sustainable Development Reserve, Amazonas, Brazil

Luciane L. de Souza
Helder L. Queiroz
José Márcio Ayres†

The mottled-face tamarin, *Saguinus inustus* (Schwarz, 1951), has never been studied in the wild, and its distribution, ecology and behavior are virtually unknown. It occurs in southeastern Colombia, between the Ríos Caquetá, Yarí, and Guayabero/Guaviare, and extends into adjacent territory in Brazil between the Rios Japurá and Negro (Hernández-Camacho and Cooper, 1976; Hershkovitz, 1977; Hernández-Camacho and Defler, 1991; Defler, 2004). How far its range extends east between the Rios Japurá and Negro is not known. A. B. Rylands (unpubl., reported in Barnett *et al.*, 2002) observed a group on the north bank of the Lago Amanã, north of the mouth of the Rio Japurá in 1980. Surveys by Rylands (1992) and Neri and Borges (1998) resulted in inconclusive reports of the species along the lower Rio Jaú and the Rio Uniní respectively, both in the Jaú National Park (Barnett *et al.*, 2002). Iwanaga (2004) was the first to confirm its presence in the park, on the upper Rio Jaú in the west at the site called Monteiro (02°36'22"S, 63°21'27"W). Iwanaga (2004) also noted that they were reported to be common by local people on the upper Rio Uniní. Here we record the presence of *S. inustus* in the Amanã Sustainable Development Reserve in the southwestern part of the Rios Negro and Japurá interfluvial region.

The Amanã Sustainable Development Reserve (SDR) of 2,350,000 ha is part of one of the largest blocks of continuous protected forests in the world, linking the Mamirauá SDR of 1,124,000 ha to its southwest and the Jaú National Park of 2,378,410 ha to the east, in the north-central part of the state of Amazonas (Fig. 1). The vegetation there is predominantly tall *terra firma* forest interspersed with flooded forests (*várzea* and *igapó*) and some small areas of white sand forest or *campinarana* (Ayres *et al.*, 1997).

In June of 2001, we were participating in the first expedition of a faunal survey in the vicinity of the head of the Lago Amanã, near the village of Comunidade Boa Esperança (CBE) in the municipality of Maraã (02°28'12"S, 64°44'27"W) (Figure 1). There we found a dead adult male mottled-face tamarin, *S. inustus*, killed by local people from the Comunidade (Fig. 2). It was wild (not a pet), one of a group occupying secondary forest scrub behind the village. The skin is preserved in the reference collection of the Instituto de Desenvolvimento Sustentável Mamirauá (IDSM), Tefé. The skin of its face was almost completely unpigmented and the hair melanic, as described by Hershkovitz (1977) features considered typical for this species (Fig. 3). The fur of the rest of the body was entirely black, with the exception of the mantle, which was dark brown. It weighed approximately 500 g and had a total length (head to tail tip) of 700 mm.

During our surveys, we saw groups of *S. inustus* foraging in secondary (around abandoned cultivated plots) and primary forest in the vicinity of the CBE, and also in the *terra firma* forests by the Juá Grande Igarapé (creek) (L. Souza, pers. obs.). Mottled-face tamarins are not hunted due to their small size, but they are occasionally captured by the local people to be raised as pets (Fig. 4). Other primates known in this area and recorded during the survey were the squirrel monkey (*Saimiri sciureus*), capuchin monkeys (*Cebus apella* and *Cebus albifrons*), the collared titi (*Callicebus torquatus*), the red howler monkey (*Alouatta seniculus*) and the black-headed uakari (*Cacajao melanocephalus*). The Amanã SDR is within the geographic range of the noisy night monkey, *Aotus vociferans*, as indicated by Hershkovitz (1983), but none were seen by our survey team. Three other primates

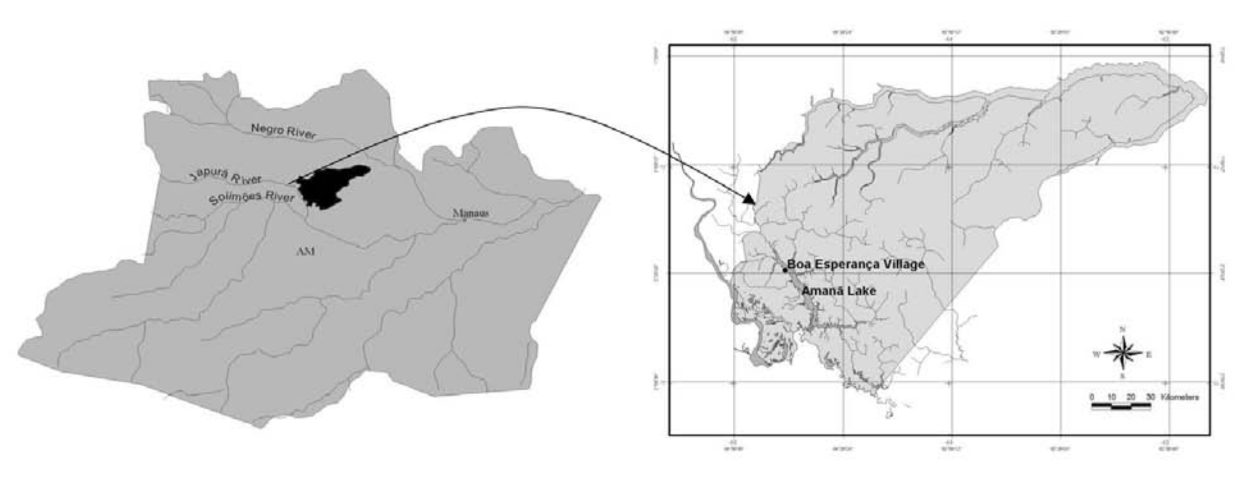

Figure 1. The Amanã State Sustainable Development Reserve in the state of Amazonas (AM), central Amazon.

Figure 2. Adult male of *Saguinus inustus* killed by local inhabitants of the Amanã State Sustainable Development Reserve, Amazonas.

Figure 3. The mottled face of *Saguinus inustus*.

Figure 4. A juvenile pet *S. inustus*.

that may occur in the area but have not been recorded there to date are members of the genera *Pithecia*, *Ateles* and *Lagothrix*.

This note records the presence of groups of *S. inustus* in the Amanã Sustainable Development Reserve on the lower Rio Japurá, more than 300 km west of the locality recorded by Iwanaga (2004) in the Jaú National Park. Additional field surveys are needed to determine the northern limits of its range in Brazil and the more exact delimitation of its range further east towards the lower Rio Negro.

Acknowledgments: It was the late José Márcio Ayres who made this study of the fauna and flora of the Amanã State Sustainable Development Reserve possible. We also thank the inhabitants of the Comunidade Boa Esperança, who provided information regarding this species and others in the reserve, and the Mamirauá Institute for Sustainable Development (IDSM-OS/MCT) for financial and logistical support of the field expeditions, and especially to Josivaldo F. Modesto, coordinator of operations of IDSM.

Luciane L. de Souza, Postgraduate Program in Zoology, Universidade Federal do Pará/ Museu Paraense Emílio Goeldi, Caixa Postal 399, Belém 66040-170, Pará, Brazil, e-mail: <luciane@mamiraua.org.br>, **Helder L. de Queiroz**, Diretor Científico, Instituto de Desenvolvimento Sustentável Mamirauá, Avenida Brasil 195, Juruá, Caixa Postal 38, Tefé 69470-000, Amazonas, Brazil, e-mail: <helder@mamiraua.org.br>, and **José Márcio Ayres**, erstwhile researcher at the Museu Paraense Emiílio Goeldi, Belém, founder of the Instituto de Desenvolvimento Sustentável Mamirauá, Tefé (deceased March, 2003).

References

Ayres, J. M., Silva, V. F. and Nelson, B. 1997. *Proposta de Criação – Reserva de Desenvolvimento Sustentável Amanã.* Report. Instituto de Proteção Ambiental do Estado do Amazonas (IPAAM), Manaus.

Barnett, A. A., Borges, S. H., de Castilho, C. V., Neri, F. M. and Shapley, R. L. 2002. Primates of the Jaú National Park, Amazonas, Brazil. *Neotrop. Primates* 10(2): 65–70.

Defler, T. R. 2004. *Primates of Colombia.* Conservation International Tropical Field Guide Series, Conservation International, Bogotá.

Hernández-Camacho, J. and Cooper, R. W. 1976. The non-human primates of Colombia. In: *Neotropical Primates: Field Studies and Conservation*, R. W. Thorington Jr. and P. G. Heltne (eds.), pp.35–69. National Academy of Sciences, Washington, DC.

Hernández-Camacho, J. and Defler, T. R. 1991. Algunos aspectos de la conservación de primates no-humanos en Colombia. In: *La Primatología en Latinoamérica*, C. J. Saavedra, R. A. Mittermeier and I. B. Santos (eds.), pp.67–100. World Wildlife Fund, Washington, DC.

Hershkovitz, P. 1977. *Living New World Monkeys (Platyrrhini), With an Introduction to Primates.* Vol. I. The University of Chicago Press, Chicago.

Hershkovitz, P. 1983. Two new species of night monkeys, genus *Aotus* (Cebidae, Platyrrhini): A preliminary report on *Aotus* taxonomy. *Am. J. Primatol.* 4: 209–243.

Iwanaga, S. 2004. Levantamento de mamíferos diurnos de médio e grande porte no Parque Nacional do Jaú: Resultados preliminares. In: *Janelas para a Biodiversidade no Parque Nacional do Jaú – Uma Estratégia para o Estudo da Biodiversidade na Amazônia*, S. H. Borges, S. Iwanaga, C. C. Durigan and M. R. Pinheiro (eds.), pp.195–207. Fundação Vitória Amazônica, Manaus.

Preliminary Observations on the Mottled-face Tamarin (*Saguinus inustus*) on the Lower Río Caquetá, Colombian Amazonia

Erwin Palacios
Adriana Rodríguez
Claudia Castillo

Introduction

Saguinus is the most diverse of the Neotropical primate genera, with 13–15 species and 33 recognized forms (Hershkovitz, 1977; Rylands *et al.*, 2000). There have been detailed studies of the feeding ecology, social organization, and behavioral ecology of the majority of the extant *Saguinus* species. *S. leucopus* is notable for the deficiency of information about it (Snowdon and Soini, 1988; Calle, 1992; Vargas and Solano, 1996; Poveda, 2000, and Cuartas-Calle, 2001), and perhaps the least known is *S. inustus.* The latter occurs in southeastern Colombia west of the Andes, between the Río Mesay and the frontier with Brazil, and between the Ríos Guayabero-Guaviare and Caquetá. There is still no accurate delimitation of the eastern and western boundaries of its geographical range in Colombia (Defler, 2003). *S. inustus* also occurs in western Brazil, between the Rios Negro and Japurá and the Colombian border. Here we present preliminary data on some aspects of the ecology of this species on the lower Río Caquetá, Colombian Amazonia and briefly discuss the importance of conducting further research on its ecology in the region.

Subjects, Study Site and Data Collection

Mottled-face tamarins are small: head-body = 208–259 mm (n = 10) with a tail slightly longer, between 330 and 410 mm (n = 10) (Hershkovitz, 1977). On the lower Río Caquetá they are known as "hueviblanco" because the males have naked external genitalia and a white scrotal sac. Otherwise black, they have white patches of skin on each side of the muzzle, which makes them easily recognizable from a distance.

The study was carried out in the interfluvial forests adjacent to the lower Ríos Caquetá and Apaporis, Colombian Amazonia. Observations were made in the vicinity of Comeyafú (1°17'S, 69°34'W), a 19,000-ha indigenous reserve on the left margin of the Río Caquetá in the state of Amazonas (Fig. 1). We first met with the community in order to tell them the purpose of conducting the study and to select people to participate in the fieldwork. With the help of field assistants we found a group of five animals frequently seen near the community. Existing trails in the area were used to search for and follow them, and

Table 1. Fruits eaten by a group of *S. inustus* on the lower Río Caquetá, Colombian Amazonia.

Species	Family	Yucuna name	Part eaten
Mendoncia ovata	Acanthaceae	Pijiture camure	Pulp
Tapirira guianensis	Anacardiaceae	Uayapala or ingna uala	Pulp
Rollinia mucosa	Annonaceae	Cahayú	Pulp
Couma macrocarpa	Apocynaceae	Yuuchi	Pulp
Lacmellea cf. *arborescens*	Apocynaceae	Gemacacu	Pulp
Pourouma cecropiifolia	Cecropiaceae	Caamú	Pulp
Pourouma tomentosa	Cecropiaceae	Cahamulá or Maprimutula	Pulp
Buchenavia cf. *viridiflora*[a]	Combretaceae	Cumela	Pulp
Inga edulis	Leguminosae	Gûiro o Yucurupi	Aril
Inga leptocarpa	Leguminosae	Gûiro "de rastrojo"	Aril
Inga pilosula	Leguminosae	Gûiro	Aril
Inga thibaudiana	Leguminosae	Gûiro de rastrojo	Aril
Inga yasuniana	Leguminosae	Gûiro	Aril
Inga sp.1	Leguminosae	Gûiro	Aril
Inga sp.2	Leguminosae	Gûiro	Aril
Inga sp.3	Leguminosae	Gûiro	Aril
Mouriri cf. *acutiflora*	Melastomataceae	Yukurú or Yauhimapula	Pericarp and pulp
Abuta grandifolia	Menispermaceae	-	Pulp
Pseudolmedia laevis	Moraceae	Amasí	Pulp
Pouteria guianensis	Sapotaceae	Imaá	Pulp
Pouteria sp.1	Sapotaceae	Uiyunumala	Pulp
Pouteria sp.2	Sapotaceae	Jarapila	Pulp
Unknown	Quiinaceae?	Mayé pijulare	Aril

[a] A group of 11 animals were seen eating this fruit near the Lomalinda Indigenous Community (12 km west towards Comeyafú).

additional trails were cut to cover the group's known range. We observed the group from March to June 2003, which included the end of the dry season (early rainy season) and the rainy season. For a period of 18 days we attempted to follow the group for the entire day, but this was achieved on only five days because of the lack of a more extensive trail grid. Daily ranges were drawn on a map scale 1:1000 and were measured using the distances between consecutive group positions recorded during the day. Home range size was calculated using the convex polygon method, which although possibly overestimating the range (Albernaz, 1997), was the most appropriate because the quadrate method requires a comprehensive trail grid. Trees used as feeding sources were marked with colored flagging tape and later revisited to obtain botanic specimens for identification. Information on feeding by *S. inustus* was limited to the animal and plant species we saw them eat.

Results and Discussion

Group size, use of space and daily ranges

Group size varied from three to six (mean 4.4, n = 5, sd = 1.14) at our study site, but larger groups were observed elsewhere. A group of 11 and another of nine were seen 22 km to the west (E. Palacios, pers. obs.). Including these two groups we have a mean group size of 6.0 (n = 7; sd = 2.7). Defler (2003) reported group sizes of three, seven, and eight individuals based on sightings in the same area. These figures are similar to those of other *Saguinus* species (Freese, 1975; Soini, 1987; Sussman and Kinzey, 1984; Janson and Terborgh, 1985; Kostrub, 1997; Peres, 2000). We never observed temporary associations between groups.

Our study group used an area of 35 ha, which included *terra firma* forest and flooded forest. The former included areas of primary and secondary forest (locally called *rastrojo*), and clearings abandoned after being farmed. *Rastrojo alto* was the local name for high secondary forest, and *rastrojo bajo* for low secondary forest. Flooded forest includes areas that suffer occasional flash floods (of one to a few days from overflowing creeks) as well as *várzea* (seasonally flooded for three to five months). A little more than half (54%) of the group's range was secondary forest, and of that mostly (93%) *rastrojo bajo*. Primary forest took up 34% of the home range, but we believe that this forest type would have come to comprise a larger portion of the group's home range if we had observed the group for longer. Only about 1% of the range was flooded forest. Approximately 12% of the area included in the forest matrix used by the mottled-face tamarins was occupied by the Indian's cultivation plots.

Mean daily range length was 961 m (range 750–1100 m; sd = 137; n = 5 complete days). Although the home range size is similar to *S. nigricollis*, *S. fuscicollis*, *S. imperator* and *S. labiatus* (Izawa, 1978; Terborgh, 1983; Kessler, 1995; Veracini, 2000), it is notably smaller than the ranges for *S. mystax* and *S. fuscicollis* reported by Peres (2000). This undoubtedly is a reflection of the short period of study — *S. inustus* range would be larger if recorded over an entire year.

Foods

The mottled-face tamarins were seen to eat the fruits of 23 plant species from 12 families and 13 genera (Table 1). These plant species were spread through *terra firma* (primary and secondary forest) and flooded forest, and all, except for the liana *Mendoncia ovata*, were trees.

Some of these fruits were typically found in the secondary forest. For instance, *Mendoncia ovata* was commonly seen growing in the low and high *rastrojo*, as was *Inga thibaudiana*. Other species, such as the two *Pourouma* spp., grow near large forest gaps and along the borders between the primary and secondary forest and the cultivated plots. *Buchenavia* sp. and two of the *Inga* species, on the other hand, were found only in the flooded forest.

As reported for other tamarins, *S. inustus* was also seen to eat small spiders, orthopterans, and ant larvae. These resources were commonly obtained as the tamarins foraged in the middle and lower levels of the forest, especially in the low *rastrojo*, where they were often seen moving about only 0.5 m above the forest floor.

Inter-specific associations

Twice we saw mottled-face tamarins interacting with groups of *Callicebus torquatus*. They were observed feeding together in a *Pourouma cecropiifolia* tree; titis and tamarins shared different levels of the tree crown, and no agonistic behaviors were seen. No encounters with other primates were recorded; continued hunting in the forests around Comeyafú and the neighboring community has extirpated the larger to middle-sized primate species such as woolly monkeys, *Lagothrix lagothricha*, and the tufted capuchin, *Cebus apella* (E. Palacios, unpubl. data). Although squirrel monkeys, *Saimiri sciureus*, and red howlers, *Alouatta seniculus,* are still present in the area, we never observed them during our time there.

Conservation Aspects

S. inustus is ranked as of Least Concern under the IUCN categorization (2001). It seems to be common around Indian villages along the lower Ríos Caquetá and Apaporis interfluvium. In general, one sees more tamarins in habitats that have been disturbed by human activities. Peres (1999), for example, found that densities of *S. fuscicollis*, *S. mystax*, and *S. imperator* were higher in areas subject to moderate to heavy hunting pressure than in those where hunting was minimal or non-existent. Density comparisons of the same set of species, and including *S. geoffroyi*, in protected and unprotected areas have shown that these species are more abundant and comprise a greater proportion of the total primate density in the latter (Freese *et al.*, 1977; Soini, 1987). Nevertheless, some unprotected sites show densities as low or lower than those in protected sites (Muckenhirn *et al.*, 1975; Freese *et al.*, 1982). Plots cultivated by Indians, peasant crops, and small-scale logging have transformed many areas of the mottled-face tamarin's natural habitat. Slash-and-burn is the prevalent agricultural practice in the region, but can be considered of low impact in forest conversion only when human population densities are very low. Rural populations are growing considerably, concentrating their numbers in certain areas and making increasing demands on forest resources. The interfluvium between the Ríos Caquetá and Apaporis, east to the mouth of the Río Miriti, is a case in point, where a very large proportion of the region's indigenous population is concentrated (1.24 people/km²) and where numbers will continue to increase through immigration.

Much (60-70%) of the range of *S. inustus* in Colombia falls within the boundaries of indigenous reserves (Defler, 2003), along with smaller areas on the lower Río Caquetá settled by peasant families. It will be important to continue studying these tamarins and monitoring their densities along with current trends of forest clearing and other human activities, so that we can attain a better understanding of the ecology and conservation status of the species. These actions will, we hope, both continue our learning about the ecology of this interesting primate, and provide a mechanism to involve local people in joint conservation measures in their lands.

Acknowledgments: Conservation International provided funding through the Primate Action Fund, and we thank particularly Russell A. Mittermeier and William R. Konstant for their support. We also thank Rodolfo Yucuna, chief of the Comeyafú Yucuna Indigenous Community, and field assistants from the community who helped us during the study. Dairon Cárdenas from Instituto Sinchi provided valuable help with the identification of plants.

Erwin Palacios, **Adriana Rodríguez** and **Claudia Castillo**, Conservation International Colombia, Bogotá DC, Colombia, e-mails: <epalacios@conservation.org>, <arodriguez@conservation.org>; <clauscas@hotmail.com>.

References

Albernaz, A. L. K. M. 1997. Home range size and habitat use in the black lion tamarin (*Leontopithecus chrysopygus*). *Int. J. Primatol.* 18: 877–887.

Defler, T. R. 2003. *Primates de Colombia.* Tropical Field Guide Series, Conservación Internacional Colombia, Bogotá, DC.

Calle, Z. 1992. Informe de actividades y resultados: censo preliminar y recomendaciones para el manejo de una población natural de *Saguinus leucopus* en la zona de influencia del Proyecto Hidroeléctrico La Miel II. Unpublished manuscript.

Cuartas-Calle, C. A. 2001. Partial distribution of tamarins (*Saguinus leucopus*, Callitrichidae) in Departamento de Antioquia, Colombia. *Neotrop. Primates* 9: 107–111.

Freese, C. 1975. A census of nonhuman primates in Peru. Report to the National Academy of Sciences, Project AMOR-0719, Washington, DC.

Freese, C. H., Freese, M. A. and Castro, N. 1977. The status of callitrichids in Peru. In: *Biology and Conservation of the Callitrichidae*, D. G. Kleiman (ed.), pp.121–130. Smithsonian Institution Press, Washington, DC.

Freese, C. H., Heltne, P. G., Castro, N. and Whitesides, G. 1982. Patterns and determinants of monkey densities in Peru and Bolivia with notes on distributions. *Int. J. Primatol.* 3: 53–59.

Hershkovitz, P. 1977. *Living New World Monkeys (Platyrrhini): With an Introduction to Primates*, Vol. 1. University of Chicago Press, Chicago.

IUCN. 2001. *IUCN Red List Categories: Version 3.1.* IUCN Species Survival Commission (SSC), Gland, Switzerland, and Cambridge, UK.

Izawa, K. 1978. A field study of the ecology and behavior of the black-mantle tamarin (*Saguinus nigricollis*). *Primates* 19: 241–274.

Janson, C. and Terborgh, J. 1985. Censando primates en el bosque lluvioso, con referencia a la Estación Biológica de Cocha Cashu, Parque Nacional de Manu. Capítulo 15, Centro de Datos para la Conservación, Universidad Nacional Agraria, La Molina, Peru.

Kessler, P. 1995. Revierverhalten, nahrungsstrategie und habitatpraferenzen des Rothändtamarins (*Saguinus midas midas*) in Franzosish-Guayana. Diplomarbeit Anthropologisches Institut und Museum der Universität Zürich, Zürich.

Kostrub, C. E. 1997. Preliminary field observations of golden-mantled tamarins, *Saguinus tripartitus*, in eastern Ecuador. *Neotrop. Primates* 5(4): 102–103.

Muckenhirn, N. A., Mortenson, S., Vessey, S., Fraser, C. E. O. and Singh, B. 1975. Report on a primate survey in Guyana. PanAmerican Health Organization, Washington, DC.

Peres, C. A. 1999. Effects of hunting and habitat quality on Amazonian primate communities. In: *Primate Communities*, J. G. Fleagle, C. Janson and K. E. Reed (eds.), pp. 55–74. Cambridge University Press, Cambridge.

Peres, C. A. 2000. Territorial defense and the ecology of group movements in small-bodied neotropical primates. In: *On the Move: How and Why Animals Travel in Groups.* S. Boinski and P. A. Garber (eds.), pp.100–123. University of Chicago Press. Chicago.

Poveda, K. 2000. Uso de hábitat de dos grupos de tití de pies blancos (*Saguinus leucopus*) en Mariquita, Colombia. Bachelor's thesis, Universidad Nacional de Colombia, Bogotá, DC.

Rylands, A. B., Schneider, H., Langguth, A., Mittermeier, R. A., Groves, C. P. and Rodríguez-Luna, E. 2000. An assessment of the diversity of New World primates. *Neotrop. Primates* 8(2): 61–93.

Snowdon, C. and Soini, P. 1988. The tamarins, genus *Saguinus.* In: *Ecology and Behavior of Neotropical Primates*, Vol. 2, R. A. Mittermeier, A. B. Rylands, A. F. Coimbra-Filho and G. A. B. da Fonseca (eds.), pp.223–298. World Wildlife Fund – US, Washington, DC.

Soini, P. 1987. Ecology of the saddle-back tamarin *Saguinus fuscicollis illigeri* on the Rio Pacaya, northeastern Perú. *Folia Primatol.* 49: 11–32.

Sussman, R. W. and Kinzey, W. G. 1984. The ecological role of the Callitrichidae: A Review. *Am. J. Phys. Anthropol.* 64: 419–449.

Terborgh, J. 1983. *Five New World Primates: A Study in Comparative Ecology*. Princeton University Press, Princeton, NJ.

Vargas, T. N. and Solano, C. I. 1996. Evaluación del estado de dos poblaciones de *Saguinus leucopus* para determinar areas potenciales de conservación en un sector del Valle del Magdalena Medio, Colombia. *Neotrop. Primates* 4(1): 13–15.

Veracini, C. 2000. Dados preliminares sobre a ecología de *Saguinus niger* na Estação Científica Ferreira Penna, Caxiuanã, Pará, Brasil. *Neotrop. Primates* 8(3): 108–113.

MOVEMENTS OF *ALOUATTA PALLIATA* AMONG FOREST FRAGMENTS IN LOS TUXTLAS, MEXICO

Salvador Mandujano
Luis Arturo Escobedo-Morales
Rodolfo Palacios-Silva

Introduction

Individual dispersal is part of a reproductive strategy that balances the costs and benefits for an individual as it chooses to stay with or leave its natal group (Jones, 1995). Dispersal in *Alouatta* has been documented in a number of studies (Agoramoorthy and Rudran, 1993; Clarke and Glander, 2004; Glander, 1992; Moore, 1992). However, habitat fragmentation may significantly limit the options available for an individual to move between social groups (Swart and Lawes, 1996). In many cases, this interference with the ability to disperse forces primates to live in small and isolated fragments, which in turn may cause changes in foraging and activity patterns, social organization, and physiological conditions, leading to inbreeding that can diminish genetic variability (Clarke *et al.*, 2002; Gonçalves *et al.*, 2003). The ability to disperse across fragmented landscapes will depend on the characteristics of each species (Bicca-Marques, 2003; Jones, 1999) as well as the spatial configuration of the landscape in question (Fahrig, 2003). Tischendorf *et al.* (2003) defined a specialist disperser as having a low probability of crossing boundaries from habitat to matrix, a high risk of mortality while in the matrix, and fast movement and high inter-step movement correlation (i.e., small turning angles between consecutive movement steps, in matrix). In contrast, generalist dispersers have a higher probability of leaving habitat, lower dispersal mortality and less directed movement paths while traveling through the matrix (i.e., larger turning angles between consecutive movement steps).

Howler monkeys are arboreal quadrupeds and are observed only occasionally to leave the trees and walk along the ground (Glander, 1992). For example, *A. pigra* individuals walk among the naturally patchy vegetation in the Petenes of Yucatán (A. Estrada, pers. comm.) and Tabascan swamps (J. C. Serio-Silva, pers. comm.). The same is true for red howlers, *A. seniculus*, travelling among clumps of trees in the Venezuelan llanos. Data on travel patterns in continuous forest suggest that *A. palliata* uses routes that minimize travel times from feeding to resting trees (Garber and Jelink, 2004). Fedigan *et al.* (1998) mention that the formation of new *A. palliata* groups in Santa Rosa, Costa Rica, occurred as a result of large groups splitting, and the dispersal of lone individuals in search of females. Glander (1992) reported an average travel distance of 700 m for *A. palliata* at Hacienda La Pacifica, Costa Rica. Individuals had to cross open areas to reach a new group; in some cases, these movements occurred in several stages between "stepping stone" fragments. In particular, dispersal success declines with a decrease in habitat and increased fragmentation of the landscape, but the rate of this decline accelerates once the amount of remaining habitat falls below 10-20% (King and With, 2002). Therefore, one might expect that howler monkeys do not travel among fragments randomly, and that the spatial configuration of habitat patches and the nature of the surrounding matrix is critical to successful dispersal.

The tropical rainforest in Los Tuxtlas in the Mexican state of Veracruz has been largely deforested: 75% of native habitat has been lost, 20% now survives only in isolated fragments, and barely 5% is comprised of widespread contiguous rainforest at high elevations (>800 m) (Estrada and Coates-Estrada, 1996). *Alouatta palliata,* the mantled howler monkey native to Veracruz, now survives in archipelagos of forest fragments that vary in size, age, and degree of isolation. Their existence in these scattered forest remnants is precarious both ecologically and demographically, which compounds the dilemma of dispersal (Estrada and Coates-Estrada, 1996; Mandujano *et al.*, in press). Here we present data on the movements of howler monkeys in this region's highly altered landscape and develop a preliminary model of the probability of interchange between fragments.

Methods

Fieldwork

This research was conducted in the Sierra Santa Marta in the south of Los Tuxtlas, Veracruz, Mexico (18°22'N, 94°45'W). We defined the study area as the landscape between the Ríos Tecuanapa and Pilapa, covering 4,960 ha, of which only 11% is suitable primate habitat (Fig. 1). Elevation ranges from sea level to 900 m. Corn crops and livestock pasture make up the matrix that surrounds the 92 remaining fragments, most of which are located in riparian zones along rivers and streams, often on slopes steeper than 30°. Some fragments are on hilltops, while others lie in permanently flooded areas. Of these fragments, 81% are smaller than 5 ha, and only five (8%) are between 10 and 75 ha. The mean distance between fragments and the higher elevation continuous forest was 3,625 m, while the mean distance from one fragment to the next was 111 m. The mean distance from any fragment to the nearest town was 880 m.

We carried out fieldwork from January 2001 to July 2003. Three times a year we conducted a census of all fragments identified in the study area noting the presence or absence of *Alouatta* groups in each. Two to five people spent 4-5 hours sampling in small fragments (<10 ha) and 1-2 days in larger fragments (>10 ha). We compiled a catalog of individuals according to their identifying features and facial shapes, plus scars and coloration patterns of the back and tail. Although animal dispersal is broadly defined (see Clobert *et al.*, 2004), for the purpose of this study we consider it be movement between fragments by individuals of any age or sex class. To quantify dispersal, we observed the movement of individuals into adjacent fragments and noted whether or not they later returned to their group of origin. We also recorded the number of solitary individuals inhabiting fragments at the time, plus the number of individuals entering empty fragments. Although we report here all the movements we observed, we recognize that there were other arrivals and departures that we were unable to observe.

Modeling

We divided up all observations of the movements of individuals between adjacent fragments into the following distance classes: 0-100 m, 101-200 m, 201-400 m, and 401-800 m. and then calculated the proportion of the movements in each. We observed no movements greater than 800 m (see Results). We then fitted these data to negative exponential, half-normal, and linear inverse models through the least squares method using the STATISTICA Program (StatSoft, Inc., 1998). These and other dispersal models have been theoretically and empirically used for investigating patterns in a number of animal and plant species (e.g., Urban and Keitt, 2001; Mennechez *et al.*, 2003; Skalski and Gilliam, 2003).

In these three models, the dispersal probability decreased as isolation distance increased between fragments; however, the probability varied among models. For the negative exponential model, the dispersal probability p_{ij} was estimated as

$$p_{ij} = \exp\left(\theta \times \mathrm{d}_{\mathrm{ij}}\right),$$

for the half-normal model, the dispersal probability was

$$p_{ij} = \exp\left(\theta \times \mathrm{d}^2_{\mathrm{ij}}\right),$$

while for the linear inverse model, the dispersal probability was

$$p_{ij} = 1 - \left(\frac{\mathrm{d}_{\mathrm{ij}}}{1000}\right).$$

In all cases, θ is a distance-decay coefficient (θ <0.0) that determines the slope of the relationship (Urban and Keitt,

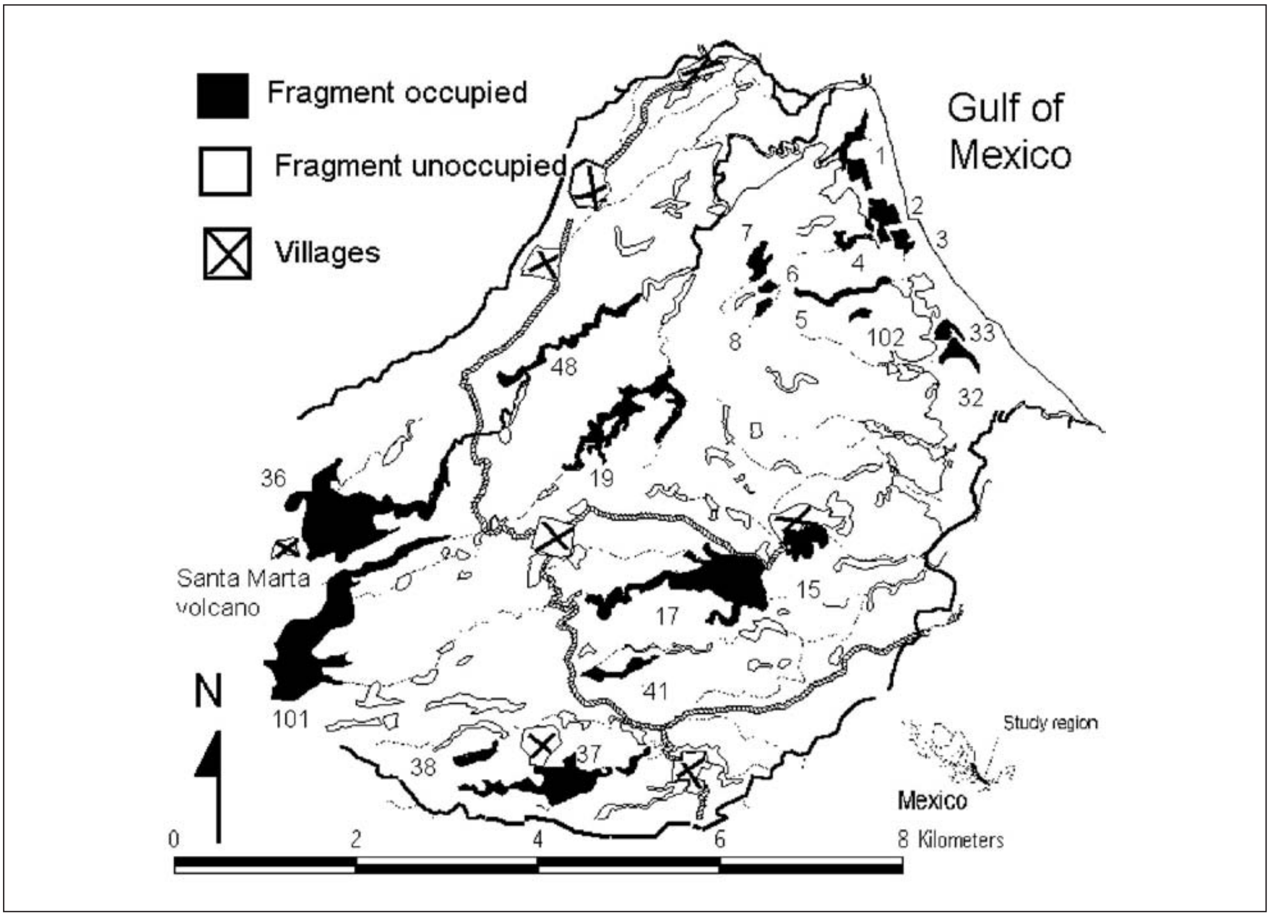

Figure 1. The landscape of the study area in Los Tuxtlas showing the fragments (numbered) occupied by *Alouatta palliata* (in black) and those that were empty (in white). See Table 1 for information on each of the occupied fragments.

2001). To fit the observed data, we made two assumptions. First, if two different primate groups inhabit the same fragment, the probability of dispersal between them is equal to 1.0 because there is no isolation. Second, if two groups inhabit different fragments with an isolation distance equal or greater than 1000 m, the probability of dispersal was equal to 0.0. The 1000 m limit was chosen considering the very few observations of howler monkeys traveling between groups inhabiting fragments at distances of this magnitude (see Glander, 1992).

Results

Overall counts ranged from 71 to 76 howler monkeys inhabiting 19 fragments — 17.5% of the 92 fragments in the study area. Three groups of howlers (of 6, 5 and 3 individuals, respectively) lived in fragment F19 (Fig. 1 and Table 1), while, at the other extreme, one group used four fragments. Eight fragments were each inhabited by a separate group, while five fragments were each inhabited by a separate solitary male. The mean isolation distance of any one occupied fragment to any other was 2.71 ±0.75 km. The mean distance of any one group to the closest fragment was 0.33 ±0.39 km, while the mean distance of the howler groups to continuous forest was 6.18 ±2.31 km.

The following are some examples of movements that we recorded:

1. A male moved from his group in fragment F6 into fragment F8, 78 m away; he remained for almost a year, then returned to F6.
2. Another adult male left fragment F6 to inhabit fragment F7, 79 m away. He remained in this fragment for less than six months before returning to F6.
3. The entire group inhabiting F6 moved to F5, 120 m away, and stayed there for less than one month before returning to their original fragment.
4. At the beginning of the study, a solitary male was found inhabiting F48. According to the field assistant and local landowners, this individual had moved from F19, 656 m away.
5. There were no howlers in F37 when it was first surveyed, but one male who had not been recorded in the next nearest groups, F41 and F17, subsequently took up residence. We suspect that he moved from an unstudied group located 80 m away.
6. Another male appeared in F37, probably from the nearest fragment 80 m away as well.
7. An older male arrived in F37 and then moved on to F38. Again, we suspect that this individual was from an unstudied group located 80 m away. Local people supported this supposition.
8. One group of six individuals initially occupied F32. This group later divided into two, each with three individuals; one group moved out and took up residence in the nearest fragment, F33, 47 m away.
9. Fragment F4 was empty at the beginning of the study; six to eight months later, individuals were continuously observed there. It is probable that they moved from fragments F2 or F3, located 41 m and 92 m away, respectively.
10. An adult male moved 171 m from F5 to F102.

Table 1. Characteristics of the study area. Annual numbers and group composition of howler monkeys and of forest fragments characteristics in the study area. Fragments are labeled in Figure 1.

Fragment	Size (ha)	Isolation distance (m) to nearest			Number of individuals		
		Fragment	Town	Continuous forest	2001	2002	2003
1	11	96	1438	6704	3	4	3
2	9.3	34	2125	6169	5	5	5
3	4.7	34	2542	5900	7	8	7
15	11.8	115	4	3675	10	15	14
17	57.2	18	307	3364	5	5	6
19[1]	29.9	196	562	3197	11	14	11
32	5.3	24	1988	4426	6	5	6
33	3.67	12	2186	4817	6	3	4
36	75.5	75	81	144	1	1	1
38	5	23	192	1184	0	0	1
41	6.5	57	625	2850	5	5	5
48	13	15	557	2660	1	1	1
5, 6, 7, 8[2]	14.6	43	1941	5634	10	7	8
101[3]	71.0	75	438	206	?	?	2
102[3]	1.4	171	1970	6624	?	?	1

[1] Fragment 19 inhabited by 3 groups.
[2] Fragments 5, 6, 7 and 8 were used by one group; therefore the size is the sum of each fragment, and isolation is the mean distance.
[3] Fragments 101 and 102 were sampled only once at the end of 2003; thus there is no precise data for previous years.

Distance of movement ranged from 15 to 656 m, but 70% were under 100 m (Fig. 2). Data fit the negative exponential ($r^2 = 0.90$, $F = 28.6$, df = 1, 3, $P = 0.01$) and half-normal ($r^2 = 0.89$, $F = 24.6$, df = 1, 3, $P = 0.02$) models (Fig. 2). In contrast, data did not fit the linear inverse model ($r^2 = 0.47$, $F = 2.7$, df = 1, 3, $P = 0.20$). The θ coefficients were –0.007 and –0.000035 for the negative exponential and half-normal models, respectively.

Discussion

The landscape of our study area is characterized by considerable destruction and fragmentation of the natural habitats; the remaining forest occurs predominantly in small fragments with a lack of corridors between the fragments (e.g., riparian vegetation, live fences), and a homogeneous matrix consisting mainly of pastures and seasonal agriculture. As a result, *Alouatta palliata* is scarce, and the remaining individuals inhabit only a few fragments (19 of the 92 fragments we investigated), which are isolated from one another and from continuous forest (Rodriguez-Toledo *et al.*, 2003; Mandujano *et al.*, in press). As such, the probability that animals will disperse from one group to another is sharply limited by isolation distances. Considering Tischendorf *et al.*'s (2003) definition of specialist and generalist dispersers, we initially expected that each of the three dispersal models in this study (negative exponential, half-normal, and linear inverse) would represent the hypothetical facility with which the monkeys could disperse from one fragment to another. If a generalist species, the howler monkey would have a greater capacity to move along the ground in the matrix as it disperses from one fragment to other; in this case, the data should be adjusted to a linear inverse model. But if the howler monkey is a habitat specialist and more limited in its dispersal ability, then field data should be adjusted to a negative exponential or half-normal model. The difference between negative exponential and half-normal models is that in the first, the probability of dispersal decreases exponentially with a small increase in isolation distance; in the second model, there is an isolation distance where the dispersal probability is high, and then the probability decreases slowly. The few data obtained during field work showed that the most frequent movements were towards fragments located a very short distance away (<100 m); beyond this distance the frequency of movements dropped. Thus, data fit better into the negative exponential or half-normal models, indicating, therefore, that *A. palliata* may be classified as a specialist disperser.

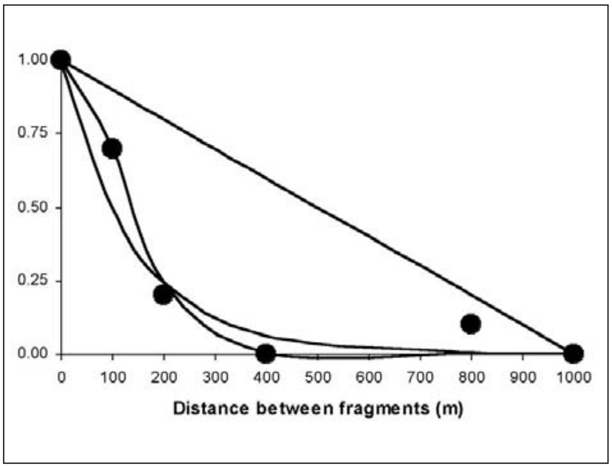

Figure 2. Relationship between dispersal probability and isolation distance. The points represent the proportion of *Alouatta palliata* movements at different isolation distances. Note our assumptions (see methods) that at 0 m the dispersal probability is 1.00; and at 1000 m the probability is 0.00. Lines represent, from left to right, the expected probability of movements in the exponential negative, half-normal, and linear inverse models. Note the field data fit better to the negative exponential and half-normal models.

Our analysis suggests that the degree of structural heterogeneity in the landscape may be an important factor determining the possibility of dispersal by primates across it. In heterogeneous landscapes, primates may use forest fragments as well as tree plantations (for example, shade coffee and cacao agroecoystems) as stepping stones or corridors when moving from one forest patch to another (Estrada *et al.*, in press). In highly homogeneous landscapes (i.e., dominated by pasture or other monocultures, with scant tree cover) exchange of individuals among fragments is more difficult. Using percolation models, it has been found that dispersal success declines with increasing fragmentation of the landscape, with this decline accelerating once the amount of suitable habitat falls below 10–20% (King and With, 2002). The connectivity of habitat patches in a landscape, therefore, depends on the dispersal capacity of the individuals. In the study landscape, connectivity is currently low (<30%) given the high rate of habitat destruction and loss, with only 11% of the original vegetation remaining, and the relatively low dispersal capacity of howler monkeys through the matrix (Palacios-Silva and Mandujano, in press).

Habitat connectivity is a central theme in both metapopulation ecology and conservation biology (Bennett, 2004). As the number of occupied fragments decreases, so too does the probability of persistence on a regional level decline, due to a possible imbalance between the extinction rate of local populations and the colonization rate (Ovaskainen and Hanski, 2004). Therefore, if the dispersal rate proves lower than the deforestation rate, the only conservation alternative on a regional level would involve habitat rehabilitation in an effort to create corridors and stepping stones, plus the translocation of individuals and/or groups to other fragments offering better survival conditions. In particular, the creation of stepping stone fragments could be an alternative management action that increases connectivity and could allow movement among primate groups (Mandujano *et al.*, in press). Basically, a stepping stone can be any landscape element that the animal perceives as a transitional step leading toward a habitat patch (Bennett, 2004). For primates, a stepping stone can be a group of isolated trees, live fences that separate strips of land, riparian zones, corridors, remnants of arboreal vegetation and/or habitat patches that are substantially smaller than an animal's home range. Studies showed that for species with limited dispersal ability and a landscape with isolated habitat, stepping stone habitat patches greatly increase a species' ability to disperse (Bennett, 2004; King and With, 2002).

Evidently, more factors than isolation distance contribute to an individual's dispersal between habitat fragments (Clobert *et al*., 2004). For example, in a 30-year study of *A. palliata* at La Pacifica, Clarke and Glander (2004) found that female migration patterns were primarily associated with environmental variables (habitat, rainfall) and secondarily with social variables (number of females in the group, sex ratio); while male migration patterns were only associated with social variables (i.e., male-female ratio and male age). In contrast, from a census of 333 howlers in a recent study in the northern part of Los Tuxtlas, Cristobal-Azkarate *et al.* (2004) found 16 solitary males and only one solitary female. These authors suggest that females remain in their natal groups, probably reinforced by habitat fragmentation. Thus, the relationships between intrinsic factors (social, demographic, and genetic), habitat factors (quantity, quality, and spatial configuration), and human factors (deforestation, hunting, and others) that influence the decision of an individual monkey to stay or leave its natal group are complex. In consequence, the dispersal models presented here, based only on isolation distance between fragments, are preliminary, and field and experimental data will be required to test their accuracy and general application.

Acknowledgments: The authors thank the Mateo-Gutierrez family for their hospitality and invaluable help during the fieldwork, and also E. M. Rodriguez-Toledo and A. Gonzalez-Zamora for their assistance in the field. A. Estrada and G. Echaverria-Lozano reviewed an early version of this manuscript. The Department of Biodiversity and Animal Ecology of the Instituto de Ecologia A. C. provided the support necessary for the completion of this research. The American Society of Primatologists (ASP) and Primate Conservation, Inc. provided additional support for some aspects of this study through their respective small-grants programs.

Salvador Mandujano, **Luis Arturo Escobedo-Morales,** and **Rodolfo Palacios-Silva**, Instituto de Ecología A. C., km 2.5 Carret. Ant. Coatepec No. 351, Congregación del Haya, Xalapa 91070, Veracruz, México. E-mail: <mandujan@ecologia.edu.mx>.

References

Agoramoorthy, G. and Rudran, R. 1993. Male dispersal among free-ranging red howler monkeys (*Alouatta seniculus*) in Venezuela. *Folia Primatol.* 61: 92–96.

Bennett, A. F. 2004. *Enlazando el Paisaje: El Papel de los Corredores y la Conectividad en la Conservación de la Vida Silvestre.* UICN-Unión Mundial para la Naturaleza. San José, Costa Rica. 278pp.

Bicca-Marques, J. C. 2003. How do howler monkeys cope with habitat fragmentation? In: *Primates in Fragments: Ecology and Conservation*, L. K. Marsh (ed.), pp.283–303. Kluwer Academic/ Plenum Publishers, New York.

Clarke, M. R. and Glander, K. E. 2004. Adult migration patterns of the mantled howlers of La Pacifica. *Am. J. Primatol.* 62 (Suppl. 1): 87.

Clarke, M. R., Collins, D. A. and Zucker, E. L. 2002. Responses to deforestation in a group of mantled howlers (*Alouatta palliata*) in Costa Rica. *Int. J. Primatol.* 23: 365–381.

Clobert, J., Ims, R. A. and Rousset, F. 2004. Causes, mechanisms and consequences of dispersal. In: *Ecology, Genetics and Evolution of Metapopulations*, I. Hanski and O. E. Gaggiotti (eds.), pp.307–335. Elsevier Academic Press, Burlington, MA.

Dietz, J. M., Baker, A. J. and Ballou, J. D. 2000. Demographic evidence of inbreeding depression in wild golden lion tamarins. In: *Genetics, Demography and Viability of Fragmented Populations*, A. G. Young and G. M. Clarke (eds.), pp.203–211. Cambridge University Press, Cambridge, UK.

Estrada, A. and Coates-Estrada, R. 1996. Tropical rain forest fragmentation and wild populations of primates at Los Tuxtlas. *Int. J. Primatol.* 5: 759–783.

Estrada, A., Saenz, J., Harvey, C., Naranjo, E., Muñoz, D. and Rosales-Meda, M. In press. Primates in agroecosystems: Conservation value of some agricultural practices in Mesoamerican landscapes. In: *New Perspectives in Mesoamerican Primatology: Demography and Conservation,* A. Estrada, P. Garber, M. Pavelka and L. Luecke (eds.). Kluwer Academic/ Plenum Publishers, New York.

Fahrig, L. 2003. Effects of habitat fragmentation on biodiversity. *Ann. Rev. Ecol. Syst.* 34: 487–515.

Fedigan, L. M., Rose, L. M. and Morera-Avila, R. 1998. Growth of mantled howler groups in a regenerating Costa Rican dry forest. *Int. J. Primatol.* 19: 405–432.

Garber, P. A. and Jelink, P. E. 2004. Travel patterns and spatial mapping in Nicaraguan mantled howler monkeys (*Alouatta palliata*). *Am. J. Primatol.* 62 (Suppl. 1): 89–90.

Glander, K. E. 1992. Dispersal patterns in Costa Rica mantled howling monkeys. *Int. J. Primatol.* 13: 415–436.

Gonçalves, E. C., Ferrari, S. F., Silva, A., Coutinho, P. E. G., Menezes, E. V. and Schneider, M. P. C. 2003. Effects of habitat fragmentation on the genetic variability of silvery marmosets, *Mico argentatus.* In: *Primates in Fragments: Ecology and Conservation*, L. K. Marsh (ed.), pp.17–28. Kluwer Academic/ Plenum Publishers, New York.

Jones, C. B. 1995. Dispersal in mantled howler monkeys: A threshold model. *Mastozool. Neotropical* 2: 207–211.

Jones, C. B. 1999. Why both sexes leave: Effects of habitat fragmentation on dispersal behavior. *Endangered Species UPDATE* 16: 70–73.

King, A. W. and With, K. A. 2002. Dispersal success on spatially structured landscapes: When do spatial pattern and dispersal behavior really matter? *Ecol. Modelling* 147: 23–39.

Mandujano, S., Escobedo-Morales, L. A., Palacios-Silva, R., Arroyo, V. and Rodriguez-Toledo, E. M. In press. A metapopulation approach to conservation of howler monkeys in highly altered landscape in Mexico. In: *New Perspectives in Mesoamerican Primatology: Demography and Conservation,* A. Estrada, P. Garber, M. Pavelka and L. Luecke (eds.). Kluwer Academic/ Plenum Publishers, New York.

Mennechez, G., Schtickzelle, N. and Baguette, M. 2003. Metapopulation dynamics of the bog fritillary butterfly: comparison of demographic parameters and dispersal between a continuous and a highly fragmented landscape. *Landscape Ecol.* 18: 279–291.

Moore, J. 1992. Dispersal, nepotism, and primate social behavior. *Int. J. Primatol.* 13: 361–378.

Ovaskainen, O. and Hanski, I. 2004. Metapopulation dynamics in highly fragmented landscapes. In: *Ecology, Genetics, and Evolution of Metapopulations*, I. Hanski and O. E. Gaggiotti (eds.), pp.23–44. Elsevier Academic Press, Burlington, MA.

Palacios, R. and Mandujano, S. In press. Conectividad de parches de hábitat para los primates en un paisaje altamente fragmentado en el sureste de México. In: *Evaluación y Conservación de la Biodiversidad en Paisajes Fragmentados en Mesoamérica,* J. Saénz and C. Harvey (eds.), Universidad Nacional, Costa Rica.

Rodriguez-Toledo, E. M., Mandujano, S. and Garcia-Orduña, F. 2003. Relationships between characteristics of forest fragments and howler monkeys (*Alouatta palliata mexicana*) in southern Veracruz, México. In: *Primates in Fragments: Ecology and Conservation*, Marsh, L. K. (ed.), pp.79–97. Kluwer Academic/ Plenum Publishers, New York.

Skalski, G. T. and Gilliam, J. F. 2003. A diffusion-based theory of organism dispersal in heterogeneous populations. *Am. Nat.* 161: 441–458.

Swart, J. and Lawes, M. J. 1996. The effect of habitat patch connectivity on samango monkey (*Cercopithecus mitis*) metapopulation persistence. *Ecol. Model.* 93: 57–74.

Tischendorf, L., Bender, D. J. and Fahrig, L. 2003. Evaluation of patch isolation metrics in mosaic landscapes for specialist vs. generalist dispersers. *Landscape Ecol.* 18: 41–50.

Urban, D. and Keitt, T. 2001. Landscape connectivity: a graph-theoretic perspective. *Ecology* 82: 1205–1218.

ASPECTS OF THE BEHAVIORAL AND ENDOCRINE ONTOGENY OF SIX MOUSTACHED TAMARINS, *SAGUINUS MYSTAX* (CALLITRICHINAE)

Maren Huck, Petra Löttker
Eckhard W. Heymann, Michael Heistermann

Introduction

In order to recognize differences in ontogeny between species and between their life history trajectories, it is necessary to have an understanding of the timing of milestone events in behavior and physiology (Pereira and Leigh, 2003). Assessing when and how individuals become independent from their mother and other caregivers is necessary to evaluate costs of varying parental strategies, which in turn allows broader issues to be addressed, such as the evolution of non-maternal care in anthropoid primates (Ross and Maclarnon, 2000). Patterns of ontogeny may also explain aspects of individual differences in behavior, especially, for example, when same-sexed adults become competitors. Ventura and Buchanan-Smith (2003) have stressed that a good understanding of the species' development and behavior in the wild is essential to assess and ensure the well-being of maturing individuals in captivity. Observations are often anecdotal, but the difficulties and imprecision in obtaining data of this sort under field conditions can be overcome by repeated studies of groups of the same or related species.

The ontogeny of immature primates is tied to endocrinological changes. Typically the gonads are only partially developed at birth. The production of sex hormones such as testosterone increases during puberty until adult levels are reached (Plant, 1988). In adult males, testosterone and other androgens are important in the control of spermatogenesis (Wickings *et al.*, 1986) and seem to play a role in the expression of aggressive behavior and in the achievement of social status, though this latter relationship might be less pronounced in primates (Dixson, 1980; Bouissou, 1983). In three callitrichine species (*Callithrix jacchus*, *Callithrix kuhlii,* and *Saguinus oedipus*), however, newborn males show relatively high testosterone levels that drop after two to six months and rise slowly again thereafter (Abbott, 1984; French and Schaffner, 1995; Ginther *et al.*, 2002). Ginther *et al.* (2002) speculated that this neonatal elevation might be related to the sexual maturation of the gonads, endocrine system, and behavior, but it is not known how representative this pattern may be of other callitrichine species.

During a field study on moustached tamarins (*Saguinus mystax*), we were able to observe some aspects of the development of six immature individuals (five males and one female). For some of them we were able to record, for the first time, the onset and final appearance of a number of behaviors — in particular, the first observations of feeding on solid food, foraging, social play, and marking behavior, and the last days they were carried and successfully begged for food.

We expected that the patterns of testosterone and androgen in the five male immatures would be similar to those of the three callitrichines mentioned above. In addition, the immigration of a new female into one of the groups on 5 December 2001 provided the opportunity to study whether this caused endocrinological changes in the immature males. Given that one subadult male was evicted from the group following the new female's arrival, we also tested whether he and his twin differed in their testosterone levels, and whether their values differed from those of adult males in general. If co-twins differ in their sexual maturation, it might be supposed that the more mature of the two would be forced to leave the group in order to remove a potential competitor. If this is true, it might be expected that the evicted twin had higher testosterone levels than the remaining one. Different testosterone levels due to different aggression levels in the twins are unlikely, since we were able to show previously that adult moustached tamarins do not differ in their testosterone levels despite different breeding and "dominance" status (Huck *et al.*, 2005b; note: aggression occurs too rarely to establish hierarchical relationships). These results should be considered preliminary owing to our small sample size, but they nevertheless present the first data on the behavioral ontogeny of *Saguinus mystax* and the first endocrine data for immature males of any callitrichine in the wild.

Methods

The study took place in 2001 (January to December) at the Estación Biológica Quebrada Blanco, in northeastern Amazonian Peru (for further details of the study site, see Heymann, 1995). We collected fecal samples and behavioral data from two habituated groups of *S. mystax*, each with two sets of offspring, one born in 2000 and the other in 2001. Group W contained one adult female, three adult males, male twins born in February 2000 (WM4 and WM5), and a single male offspring born in February 2001 (WM6). Group E consisted of three adult females and three adult males, a single male born in May 2000 (EM4), and twins — one male (EM6) and one female (EF4) — born in January 2001. Based on physical characteristics, Soini and Soini (1990) classified moustached tamarins as infants from birth until about three months of age, as juveniles between 4–12 months, as subadults between 13–18 months, and as adults thereafter. Following these criteria, three of the immature males (WM4, WM5, EM4) reached adulthood at the end of the study in December 2001. Two males (WM6, EM6) and one female (EF4) were born near the beginning of the investigation, developing from newborns to relatively independent juveniles over the course of the year (see Table 1). In Group W the breeding female WF1, mother of WM6 and (probably) aunt of WM4 and WM5 (relationships were evaluated by microsatellite analysis as described by Huck *et al.*, 2005a), died near the end of the study (3 December, 2001). Two days later an unrelated female (WF3) immigrated to Group W, and one of the male subadults (WM4) was evicted on 5 December 2001. The composition of the groups and major demographic events are described in more detail by Löttker *et al.* (2004).

We followed each group daily from the time they left their sleeping site (about 05:45) until they entered their sleeping site in the afternoon (about 15:45 h). From January to December 2001 we accumulated a total of 3004 and 3257 contact hours over 330 and 351 days for groups W and E, respectively. The average visibility of individuals — measured as the percentage of hourly scans in which each individual could be seen — was 18.0 and 18.6% for adults and immatures in group W, respectively, and 11.3 and 10.9% for adults and immatures in group E. Following the protocols for behavior sampling of Martin and Bateson (1993), we recorded the first observation of an infant independent of a carrier (being "off"), eating solid food (without distinguishing between prey or fruit), engaging in social play, and foraging for prey. We also noted the last observations of an infant being carried and of successfully begging for food. Except for the data on food-begging, the records were taken from the younger litter in the two groups (i.e., WM6 in group W, and EM6 and EF4 in group E). We were unable to distinguish the Group E twins, EM6 and EF4, until they were 81 days old; until then, data of the first occurrences of either one of the two infants are used. Data on food-begging were recorded from the older immatures (WM4 and WM5 in group W, EM4 in group E).

For hormonal analyses, we collected a total of 151 fecal samples from immature males between January and December 2001 (see Table 1 for the number of samples per individual). Immediately after an animal was seen defecating, the feces were collected and immersed in 96% ethanol. (The protocols for treatment and storage of the samples are given in Huck *et al.* [2005b], as are techniques for hormone extraction and measurement of immunoreactive testosterone by enzyme immunoassay.) Hormone concentrations are given in ng/g fecal dry weight and were log-10-transformed for parametric statistics.

In order to examine changes in testosterone excretion over time, we calculated Pearson's correlation coefficient (r) between age and mean monthly testosterone values. As in *Callithrix jacchus*, *Callithrix kuhlii* and *Saguinus oedipus*, testosterone levels in newborns drop only after two to six months and rise slowly again thereafter (cf. Abbott, 1984;

Table 1. Immatures of *Saguinus mystax* study groups W and E, with mean testosterone values of the males and number of fecal samples analyzed (N).

Individual	Sex	Demographic notes	Mean testosterone ±S.D.	N
Group W				
WM4	M	Born 22 February, 2000; Emigrated 5 December, 2001	2720.0 ± 3274.9 (before 18 mo: 3219.3 ±4046.6)	35
WM5	M	Born 22 February, 2000	1918.6 ±3185.1 (before 18 mo: 1435.6.3 ±1160.7)	40
WM6	M	Born 24 February, 2001	470.8 ±549.4	28
Group E				
EM4	M	Born May, 2000	990.3 ±1057.1	34
EM6	M	Born 21 January, 2001	814.1 ±915.0	14
EF4	F	Born 21 January, 2001	-	-

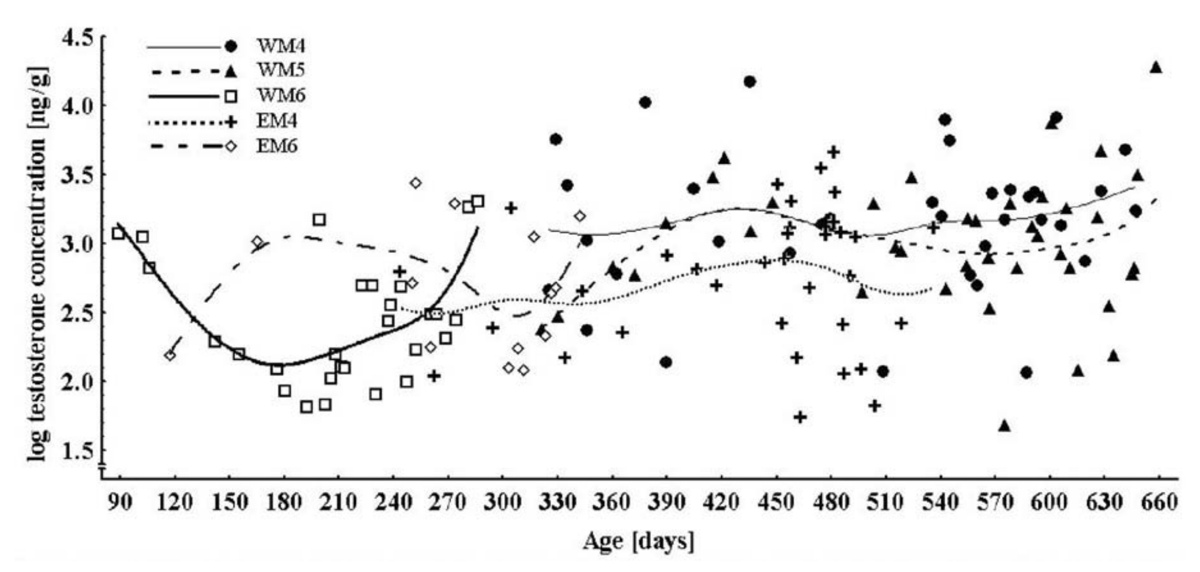

Figure 1. Log-10-transformed fecal hormone concentrations for all individuals related to relative age (in days). Curves give the distance-weighted least-squares fit for each male. Only the month, not the exact date of birth was known for EM4, so it was taken to be 15 May.

French and Schaffner, 1995; Ginther *et al.*, 2002). The data depicted in Figure 1 appear to show a drop in testosterone levels between months 4 and 5 (around day 140). Therefore we also calculated the coefficient r for the younger males WM6 and EM6, excluding the potentially high values before their 140th day of life, which seems to correspond to the turning point in testosterone production described for *Callithrix jacchus*, *Callithrix kuhlii,* and *Saguinus oedipus* at similar ages (Abbott, 1984; French and Schaffner, 1995; Ginther *et al.*, 2002). Three samples were collected from WM6 before he was 140 days old and one for EM6.

Unfortunately we could not obtain enough samples for statistical analysis after WF1's death (3 December 2001) and the subsequent emigration of WM4 (5 December 2001); we collected only one sample each for WM4 and WM6. Instead, we evaluated whether the mean hormone concentration of these samples collected after the new female had immigrated lay above the 95% upper boundary of the group average when WF1 was still alive. In addition, we compared testosterone levels between the twin brothers in group W and in relation to mean testosterone levels of the adult males in the two study groups W and E (values for adult males appear in Huck *et al.*, 2005b).

Results

Our first and last observations of milestone events in behavior are listed in Table 2. Nursing was observed only rarely and was not included. Apart from "last time seen successfully begging", the data report on the second litters only (WM6 in group W, and EM6 and EF4 in group E). Table 1 shows the testosterone concentrations of all samples by individual and the distance-weighted least-squares fit for each. No immature showed a significant increase in testosterone levels during the year, and none of the correlations between age and mean monthly testosterone values were significant (WM4: r = 0.06, p = 0.86; WM5: r = 0.37, p = 0.23; WM6: r = -0.03, p = 0.94; EM4: r = 0.21, p = 0.50; EM6: r = 0.11, p = 0.83).

When we calculated the regressions for WM6 and EM6 after their 140th day of life, only WM6 showed a significant increase in testosterone values over the following six months until December 2001 (r = 0.50, p = 0.012, see Fig. 1); we did not find such a correlation for EM6 for the seven months after his 140th day of life until December 2001 (r = –0.27, p = 0.37; see Fig. 1).

We had no samples from WM4 after the death of the breeding female WF1. The samples of WM5 and WM6, collected after immigration of the new female, both fell above the 95% boundary (Table 3). WM5 had significantly lower testosterone values than the adult males of group W, but the values of WM4 did not differ significantly from adult levels

Table 2. First and last occurrence of behavioral milestone events in two study groups of *S. mystax.*

	Group W	Group E
First day "off" carrier[a,b]	Day 17	Day 21
First day seen eating solid food[a,b]	Day 30	Day 33
First day seen socially playing[a]	Day 57	Both: Day 37
First day seen foraging[a,b]	Day 103	Day 61
Last day carried[a]	Day 106	EM6: Day 104–105 EF4: Day 114
First time seen marking[a]	Day 154	WM6: Day 99 WF4: Day 114
Last day of successful begging[c]	WM4: Day 325 WM5: 1year 8 days	EM4: 1 year 1 month

[a] N = One individual in group W (WM6) and two in group E (EM6 and EF4)

[b] Infants in group E (EM6 and EF4) were too small to be distinguished

[c] N = Two individuals in group W (WM4 & WM5) and one in group E (EM4)

Table 3. Mean (untransformed) testosterone values and the upper 95% boundary of juveniles of Group W during the tenure of WF1, and the value of a sample collected after the immigration of a new female.

Individual	Mean (with WF1)	95% boundary	Mean of last 3 samples with WF1	Sample with new female (N = 1)
WM4	2720.0	10615.6	3017.9	
WM5	1471.3	4740.2	1487.7	19361.4
WM6	413.4	1488.9	782.3	2022.1

(mean and SD for adults: 2782.1 ± 3233.3; for WM4 and WM5: see Table 1. Scheffé *post hoc* tests: adults vs. WM4: p = 0.72; adults vs. WM5: p = 0.014). The testosterone levels of the twin brothers (WM4 and WM5) did not differ significantly but tended to be lower in WM5 (Scheffé *post-hoc* test: p = 0.30; compare fit curve in Fig. 1).

Discussion

In general, the two study groups showed consistent results but differed in two ways. First, WM6 began foraging and showing social play later than his peers from group E. This might have been due to his having been raised as a singleton; his sibling was killed by a raptor at the age of 28 days (Oversluijs Vásquez and Heymann, 2001). Other studies have shown that infants prefer to play with same-aged playmates and that singletons play significantly less than twins (e.g., Cleveland and Snowdon, 1984). This holds true even when older siblings are available as potential playmates (Cleveland and Snowdon, 1984). Without further study we cannot say whether our results are representative and, if they are, whether the reduced play retarded the development of motor skills vital to foraging or whether — with only a single infant to care for — caregivers are more indulgent, resulting in less need for an infant to forage for itself.

The only slight (non-significant) increase of testosterone levels with increasing age in all subjects was unexpected. WM6 showed a testosterone excretion pattern similar to those described for other callitrichines (Abbott, 1984; French and Schaffner, 1995), with high levels very early in life that drop after three months and then rise again after the seventh month. The similar-aged EM6 did not show this pattern, but this might be due to the fact that only one fecal sample was analyzed before his 140th day of life. There was a strong increase in testosterone concentrations in the samples of WM5 and the considerably younger WM6 collected after the death of the related WF1 and the subsequent immigration of the unrelated female WF3.

With only one fecal sample in each case, this finding must be regarded with caution, but we suspect that the elevated levels might be related to the fact that incest avoidance no longer had a role to play (see also Baker *et al.*, 1999, for *Callithrix jacchus*). In addition, WM4, who was later evicted, seems to have been more precocious than his brother. Although the twins in group W showed no differences in time budgets (G-test with William's correction, $G_6 = 11.6$, p = n.s.; unpubl. data), their endocrine levels were different (although non-significantly), and WM4 may have posed more of a threat to the adult males after the arrival of the unrelated female WF3. The testosterone values of WM5 were significantly lower than adult levels, while those of his brother were not. WM4 had apparently reached adult levels before the onset of the study when he was 10.5 months old. In contrast, his twin WM5 reached adult levels only at the end of the study at nearly 23 months old (cf. Ginther *et al.*, 2002, for similar ranges). Age and morphology alone are thus insufficient predictors of sexual maturity, since testosterone levels, which are likely to be related to sperm production and fertility, differ widely during maturation even between twins.

Acknowledgments: We thank our field assistants for their invaluable help in collecting samples. Fieldwork was carried out under a letter of understanding between the Universidad Nacional de la Amazonía Peruana (UNAP), Iquitos, and the Deutsches Primatenzentrum, Göttingen, and complied with Peruvian laws. Financial support was provided by the DFG (HE 1870/10-1,2).

Maren Huck, Department of Biology & Environmental Science, John Maynard Smith Building, University of Sussex, Brighton BN1 9QG, Great Britain, e-mail: <maren_huck@hotmail.com>, **Petra Löttker**, Abteilung Verhaltensökologie & Soziobiologie, Deutsches Primatenzentrum, Kellnerweg 4, 37077 Göttingen, Germany, e-mail: <ploettker@dpz.gwdg.de> and Institut für Neuro- und Verhaltensbiologie, Abteilung Verhaltensbiologie, Westfälische Wilhelms-Universität, Münster, Germany, **Eckhard W. Heymann**, Abteilung Verhaltensökologie & Soziobiologie, Deutsches Primatenzentrum, Kellnerweg 4, 37077 Göttingen, Germany, e-mail: <eheyman@gwdg.de> and **Michael Heistermann**, Abteilung Reproduktionsbiologie, Deutsches Primatenzentrum, Kellnerweg 4, 37077 Göttingen, Germany, e-mail: <mheiste@gwdg.de>.

References

Abbott, D. H. 1984. Behavioral and physiological suppression of fertility in subordinate marmoset monkeys. *Am. J. Primatol.* 6: 169–186.

Baker, J. V., Abbott, D. H. and Saltzman, W. 1999. Social determinants of reproductive failure in male common marmosets housed with their natal family. *Anim. Behav.* 58: 501–513.

Bouissou, M.-F. 1983. Androgens, aggressive behaviour and social relationships in higher mammals. *Hormone Res.* 18: 43–61.

Cleveland, J. and Snowdon, C. T. 1984. Social development during the first twenty weeks in the cotton-top tamarin (*Saguinus o. oedipus*). *Anim. Behav.* 32: 432–444.

Dixson, A. F. 1980. Androgens and aggressive behavior in primates: A review. *Aggressive Behav.* 6: 37–67.

French, J. A. and Schaffner, C. M. 1995. Social and developmental influences on urinary testosterone levels in male black tufted-ear marmosets (*Callithrix kuhli*). *Am. J. Primatol.* 36: 123.

Ginther, A. J., Carlson, A. A., Ziegler, T. E. and Snowdon, C. T. 2002. Neonatal and pubertal development in males of a cooperatively breeding primate, the cotton-top tamarin (*Saguinus oedipus oedipus*). *Biol. Reprod.* 66: 282–290.

Heymann, E. W. 1995. Sleeping habits of tamarins, *Saguinus mystax* and *Saguinus fuscicollis* (Mammalia; Primates; Callitrichidae), in north-eastern Peru. *J. Zool., Lond.* 237: 211–226.

Huck, M., Löttker, P., Böhle, U.-R. and Heymann, E. W. 2005a. Paternity and kinship patterns in polyandrous moustached tamarins (*Saguinus mystax*). *Am. J. Phys. Anthropol.* 127: 449–464.

Huck, M., Löttker, P., Heymann, E. W. and Heistermann, M. 2005b. Characterization and social correlates of fecal testosterone and cortisol excretion in wild *Saguinus mystax. Int. J. Primatol.* 26: 159–179.

Löttker, P., Huck, M. and Heymann, E. W. 2004. Group composition and demographic events in wild moustached tamarins (*Saguinus mystax*). *Am. J. Primatol.* 64: 425–249.

Martin, P. and Bateson, P. 1993. *Measuring Behaviour: An Introductory Guide.* Cambridge University Press, Cambridge.

Oversluijs Vásquez, M. R. and Heymann, E. W. 2001. Crested eagle (*Morphnus guianensis*) predation on infant tamarins (*Saguinus mystax* and *Saguinus fuscicollis*, Callitrichinae). *Folia Primatol.* 72: 301–303.

Pereira, M. E. and Leigh, S. R. 2003. Modes of primate development. In: *Primate Life Histories and Socioecology*, P. M. Kappeler and M. E. Pereira (eds.), pp.149–176. The University of Chicago Press, Chicago.

Plant, T. M. 1988. Puberty in primates. In: *The Physiology of Reproduction*, E. Knobil, J. D. Neill and G. S. Greenwald (eds.), pp.1763–1788. Raven Press, New York.

Ross, C. and MacLarnon, A. 2000. The evolution of non-maternal care in anthropoid primates: A test of the hypotheses. *Folia Primatol.* 71: 93–113.

Soini, P. and Soini, M. 1990. Distribución geográfica y ecológia poblacional de *Saguinus mystax.* In: *La Primatología en el Perú: Investigaciones Primatológicas (1973–1985)*, N. E. Castro-Rodríguez (ed.), pp.272–313. Imprenta Propaceb, Lima.

Ventura, R. and Buchanan-Smith, H. M. 2003. Physical environmental effects on infant care and development in captive *Callithrix jacchus. Int. J. Primatol.* 24: 399–413.

Wickings, E. J., Marshall, G. R. and Nieschlag, E. 1986. Endocrine regulation of male reproduction. In: *Comparative Primate Biology*, W. R. Dukelow and J. Erwin (eds.), pp.149–170. Alan R. Liss, New York.

SOCIAL STRUCTURE OF *ALOUATTA GUARIBA CLAMITANS*: A GROUP WITH A DOMINANT FEMALE

João M. D. Miranda, Itiberê P. Bernardi,
Rodrigo F. Moro-Rios, Lucas M. Aguiar,
Gabriela Ludwig, Fernando C. Passos

Introduction

The social group of the brown howler monkey, *Alouatta guariba clamitans* Cabrera, 1940 is typically small (2–12 individuals), with one or two adult males, and more females than males (Silva Jr., 1981; Neville *et al.*, 1988; Mendes, 1989; Steinmetz, 2000, 2001; Treves, 2001; Miranda and Passos, 2005). In primates where males outnumber females, males compete for both females and food, which normally results in groups with dominant males (Clutton-Brock and Harvey, 1977; Dunbar, 1988; Mittermeier *et al.*, 1999). As in all howler monkeys, *A. g. clamitans* is sexually dimorphic; adult males are larger than females and are dominant to them (von Ihering, 1914; Altmann, 1959; Neville *et al.*, 1988; Bonvicino, 1989; Mendes, 1989; Chiarello, 1995; Mittermeier *et al.*, 1999; Treves, 2001). Although howler monkeys are the most studied of the Neotropical primates, most of the research has been concentrated on a few species, in particular *A. palliata* and *A. seniculus*, and only more recently *A. caraya*, *A. pigra* and *A. guariba* (Neville *et al.*, 1988; Bicca-Marques, 2003). Field studies on the composition, social structure and hierarchy of *A. g. clamitans* are rare (Miranda, 2004; Jardim, 2005; Miranda and Passos, 2005), and long-term investigation will be necessary to obtain more detailed information on their social patterns. Here we describe a particular case of an *A. g. clamitans* group in which the dominant animal was an adult female — in effect, a matriarchal group.

Methods

Study area

The study area is a forest fragment of approximately 700 ha in the Chácara Payquerê, a component of the Área de Proteção Ambiental da Escarpa Devoniana, in the municipality of Balsa Nova, Paraná, Brazil (25°29’52”S, 49°39’24”W). This remnant forest is within the Floresta Ombrófila Mista (*Araucaria* Pine Forest biome) and consists mainly of disturbed primary forest, broken by patches of secondary forest.

Methods

Observations of the behavior and ecology of brown howler monkeys in the study area have been continuous since February 2002 (Miranda, 2004; Miranda and Passos, 2004, 2005; Miranda *et al.*, 2005; Miranda *et al.*, in press). The study group, the Forninho Group, was the best known in the area while its members remained together. Our observations here were recorded *ad libitum* (Altmann, 1974). We used the system of age-sex classification proposed by Mendes (1989) and used by Miranda and Passos (2005).

Results

In February 2002, the Forninho Group included two adult males (AM), three adult females (AF), and a juvenile I (JI). After four births through two years of study (two births in 2003 and two in 2004), the group consisted of two AM, a sub-adult male (SAM), three AF, two juveniles II (JII), one male and one female, and two JI (both males). In January 2004 the dominant adult male (AM1) disappeared, which apparently disrupted the social structure of the group. This resulted in the Forninho Group splitting into two: the Carrano Group with one AM, one AF and one JII (female), and the Vavá Group with one SAM, two AF (AF1 and AF2), one JII (male), two JI (males) and one infant (INF) born one month after the disappearance and presumed death of AM1 (Table 1). Another birth occurred in July of 2004, this time to an AF2 in the Vavá Group. Miranda and Passos (2005) give the details of the dynamics of this group.

AF1 of the Vavá Group was the mother of the SAM, as well as the JII, one of the JI and the older INF. AF1 may also have been the mother of AF2, but we could not confirm this because AF2 was already an adult at the beginning of our study. If AF1 was indeed the mother of AF2, then every member of the Vavá Group would have been the progeny of this single adult female.

In confrontations with neighboring groups, AF1 vocalized the most (bark and howl *sensu* Oliveira, 2002) and challenged the dominant AM of Carrano Group, forcing him away from the confrontation. This female behaved in the same way toward humans when one of the investigators accidentally startled the animals, alarming the group and provoking AF1 to come their defense. On two occasions, AF1 challenged the subadult male over food. The male retreated both times.

Discussion

The breakup of the original Forninho Group may have been prompted by AM2, who was possibly the son of AF1, and, as such, leaving the group to avoid endogamy. Following his departure, AM2 became the nucleus of the new Carrano Group. However, given the occurrence of infanticide in howler monkeys (Clarke, 1983; Zunino *et al.*, 1986; Rumiz, 1990; Clarke *et al.*, 1994; Galetti *et al.*, 1994; Calegaro-Marques and Bicca-Marques, 1996; Palacios, 2000; Aguiar *et al.*, in press), it is also possible that AF1 may have forced AM2 out of the group, since AF1 was pregnant by AM1, who had been the dominant male until his disappearance. AF1, therefore, may have been trying to protect her infant from possible infanticide by AM2. Mendes (1989) observed a similar case in which an AM drove out the dominant male of his study group. Although successful in his ouster of the dominant male, the AM in Mendes' study group was forced out by the two adult females of the group, primarily by the adult female who was pregnant. This behavior on the part of the female ended only when her infant disappeared, and she finally accepted the presence of the new male. Mendes (1989) interpreted these events as an attempt by the pregnant female to avoid infanticide.

Table 1. Composition of rhe Forninho social group and of the resulting (Vavá and Carrano) groups which were formed after it split up, coincident with the disappearance of the adult male AM1.

Before splitting	January 2004	After splitting
Forninho Group 2 AM 3 AF 1 SAM 2 JII 2 JI Total = 10	Disappearance of AM1	**Vavá Group** 2 AF 1 SAM 1 JII 2 JI 1 INF (born Feb 2004) Total = 7
		Carrano Group 1 AM 1 AF 1 JII Total = 3

The AF1 was followed by her offspring with AM1 who had disappeared—INF, JI, JII and SAM, and possibly AF2—which gave rise to a group dominated by a female rather than a male. AF1 remained dominant despite the presence of the subadult male; she was the one who defended the group against neighboring howlers and the researchers who accidentally startled her group. Hirano (2003), studying *A. guariba*, and Calegaro-Marques and Bicca-Marques (1997), studying *A. caraya*, have reported that adult females are dominant to subadult males.

In howler monkeys, individuals of both sexes emigrate, forming new groups or simply integrating with another group (Neville *et al.*, 1988; Mendes, 1989; Bonvicino, 1989; Calegaro-Marques and Bicca-Marques, 1996; Giudice, 1997; Brockett *et al.*, 2000; Ostro *et al.*, 2001; Jardim, 2005). Bonvicino (1989) and Mendes (1989) recorded only subadult males as solitary individuals. We saw solitary adults of both sexes in our study area, showing that females emigrate as well as males (Miranda, 2004; Miranda and Passos, 2005). The subadult male of the Vavá Group could have remained in the group to become the dominant adult, or else moved out to avoid endogamy. Groups without adult males may be more susceptible to predation, as well as to infanticide by strange adult males or to an upset in group hierarchy (Zunino *et al.*, 1986; Dunbar, 1988; Clarke *et al.*, 1994; Galetti *et al.*, 1994; Palacios, 2000). We would expect that sooner or later an adult male, either the resident subadult or an immigrant, would take over as the dominant individual in the group.

Groups of *A. g. clamitans* are usually dominated by males, but they may be adaptable enough to change this pattern in certain cases. We believe that this is evident in the case of our original focal group, the Forninho Group, in which an adult female left in order to avoid imminent infanticide, establishing, at least temporarily, a female-dominated group.

Acknowledgments: We thank Édner L. Rosa for permission to work on his property and Kauê Cachuba Abreu for his help with the fieldwork. We also appreciate the assistance of Dr. Albert Leyva in preparing the manuscript.

João M. D. Miranda, Postgraduate in Zoology – UFPR, Rua Rio Guaporé 1275, Bairro Alto, Curitiba, 82840-320 Paraná, Brazil, e-mail: <guaribajoao@yahoo.com.br>, **Itiberê P. Bernardi**, Graduate in Biology – URI do Alto Uruguai e das Missões, Rua Guerino Cerutti 161, ap. 702, Centro, 98400-000 Frederico Westphalen, Rio Grande do Sul, **Rodrigo F. Moro-Rios**, Graduate in Biology – UFPR, Rua Wilson Valdívia Domingues 203, casa 6, Bairro Jardim das Américas, Curitiba 81540-170, Paraná, **Lucas M. Aguiar** and **Gabriela Ludwig**, Postgraduate in Zoology – UFPR, Rua Bronislau Ostoja Roguski 649, Casa 3, Bairro Jardim das Américas, Curitiba 81540-080, Paraná, and **Fernando C. Passos**, Laboratório de Biodiversidade, Conservação e Ecologia de Animais Silvestres, Departamento de Zoologia – UFPR, Caixa Postal 19020, Curitiba, Paraná, Brazil.

References

Aguiar, L. M., Ludwig, G., Hilst, C. L. S., Malanski, L. S. and Passos, F. C. In press. Tentativa de infanticídio por um macho dominante de *Alouatta caraya* (Humboldt) (Primates, Atelidae) em um infante extra grupo devido a influência do observador. *Rev. Brasil. Zool.* 22(4).

Altmann, J. 1974. Observational study of behavior: Sampling methods. *Behavior* 49: 227–267.

Altmann, S. A. 1959. Field observations on a howling monkey society. *J. Mammal.* 40(3): 317–330.

Bicca-Marques, J. C. 2003. How do howler monkeys cope with habitat fragmentation? In: *Primates in Fragments: Ecology and Conservation*, L. K. Marsh (ed.), 283–303. Kluwer Academic / Plenum Publishers, New York.

Bonvicino, C. R. 1989. Ecologia e comportamento de *Alouatta belzebul* (Primates: Cebidae) na Mata Atlântica. *Rev. Nordestina Biol.* 6(2): 149–179.

Brockett, R. C., Horwich, R. H. and Jones, C. B. 2000. Female dispersal in the Belizean black howling monkey (*Alouatta pigra*). *Neotrop. Primates* 8(1): 32–34.

Calegaro-Marques, C. and Bicca-Marques, J. C. 1996. Emigration in a black howling monkey group. *Int. J. Primatol.* 17(2): 229–237.

Calegaro-Marques, C. and Bicca-Marques, J. C. 1997. Comportamento agressivo em um grupo de bugios-pretos, *Alouatta caraya* (Primates, Cebidae). In: *A Primatologia no Brasil – 5,* H. Schneider and S. F. Ferrari (eds.), pp.29–38. Sociedade Brasileira de Primatologia / Universidade Federal do Pará, Belém.

Chiarello, A. G. 1995. Grooming in the brown howler monkey, *Alouatta fusca. Am. J. Primatol.* 35: 73–81.

Clarke, M. R. 1983. Infant-killing and infant disappearance following a male takeover in a group of howling monkeys (*Alouatta palliata*) in Costa Rica. *Am. J. Primatol.* 5: 241–247.

Clarke, M. R., Zucker, E. L. and Glander, K. E. 1994. Group takeover by a natal male howling monkey (*Alouatta palliata*) and associated disappearance and injuries of immatures. *Primates* 35(4): 435–442.

Clutton-Brock, T. H. and Harvey, P. H. 1977. Primate ecology and social organization. *J. Zool., Lond.* 183: 1–39.

Dunbar, R. I. M. 1988. *Primate Social Systems.* Croom Helm, London.

Galetti, M., Pedroni, F. and Paschoal, M. 1994. Infanticide in the brown howler monkey, *Alouatta fusca. Neotrop. Primates* 2(4): 6–7.

Giudice, A. M. 1997. Comportamiento social em aulladores: El caso de la emigración de una hembra sub-adulta em *Alouatta caraya. Neotrop. Primates* 5(2): 39–43.

Hirano, Z. M. B. 2003. Secreção epidérmica de *Alouatta guariba clamitans* (Primates: Atelidae). Doctoral thesis, Universidade de São Paulo, Ribeirão Preto.

Jardim, M. M. A. 2005. Ecologia populacional de grupos de bugio-ruivo (*Alouatta guariba clamitans*) nos Municípios de Porto Alegre e Viamão, RS, Brasil. Doctoral thesis, Universidade Estadual de Campinas, Campinas.

Mendes, S. L. 1989. Estudo ecológico de *Alouatta fusca* (Primates: Cebidae) na Estação Biológica de Caratinga, MG. *Rev. Nordestina Biol.* 6(2): 71–104.

Miranda, J. M. D. 2004. Ecologia e conservação de *Alouatta guariba clamitans* Cabrera, 1940 em Floresta Ombrófila Mista, no Estado do Paraná, Brasil. Master's thesis, Universidade Federal do Paraná, Curitiba.

Miranda, J. M. D. and Passos, F. C. 2004. Hábito alimentar de *Alouatta guariba* (Humboldt) (Primates, Atelidae) em Floresta de Araucária, Paraná, Brasil. *Rev. Brasil. Zool.* 21(4): 821–826.

Miranda, J. M. D. and Passos, F. C. 2005. Composição e dinâmica de grupos de *Alouatta guariba clamitans* Cabrera (Primates, Atelidae) em Floresta Ombrófila Mista no Estado do Paraná, Brasil. *Rev. Brasil. Zool.* 22(1): 99–106.

Miranda, J. M. D., Bernardi, I. P., Abreu, K. C. and Passos, F. C. 2005. Predation on *Alouatta guariba clamitans* Cabrera (Primates, Atelidae) by *Leopardus pardalis* (Linnaeus) (Carnivora, Felidae). *Rev. Brasil. Zool.* 22(3): 793–795.

Miranda, J. M. D., Bernardi, I. P., Moro-Rios, R. F. and Passos, F. C. In press. Antipredator behavior of brown howlers attacked by black hawk-eagle in southern Brazil. *Int. J. Primatol.* 27.

Mittermeier, R. A., Rylands, A. B. and Konstant, W. R. 1999. Primates of the world: An introduction. In: *Primates of the World*, R. M. Nowak (ed.), pp.1–52. Johns Hopkins University Press, Baltimore.

Neville, M. K., Glander, K. E., Braza, F. and Rylands, A. B. 1988. The howling monkeys, genus *Alouatta.* In: *Ecology and Behavior of Neotropical Primates,* Vol. 2, R. A. Mittermeier, A. B. Rylands, A. F. Coimbra-Filho and G. A. B. da Fonseca (eds.), pp.349–453. World Wildlife Fund, Washington, DC.

Oliveira, D. A. G. 2002. Vocalizações de longo alcance de *Alouatta fusca clamitans* e *Alouatta belzebul belzebul*: Estrutura e contextos. Doctoral thesis, Universidade de São Paulo, São Paulo.

Ostro, L. E. T., Silver, S. C., Koontz, F. W., Horwich, R. H. and Brockett, R. 2001. Shifts in the social structure of black howler (*Alouatta pigra*) groups associated with natural and experimental variation in population density. *Int. J. Primatol.* 22(5): 733–748.

Palacios, E. 2000. Infanticide following immigration of a pregnant red howler, *Alouatta seniculus. Neotrop. Primates* 8(3): 104–107.

Rumiz, D. I. 1990. *Alouatta caraya*: Population density and demography in northern Argentina. *Am. J. Primatol.* 21: 279–294.

Silva Jr., E. C. 1981. A preliminary survey of brown howler monkeys (*Alouatta fusca*) at the Cantareira Reserve (São Paulo, Brazil). *Rev. Brasil. Biol.* 41(4): 897–909.

Steinmetz, S. 2000. Ecologia e comportamento do bugio (*Alouatta fusca clamitans*) no Parque Estadual Intervales. Master's thesis, Universidade de São Paulo, São Paulo.

Steinmetz, S. 2001. Densidade e conservação do bugio (*Alouatta fusca*) no Parque Estadual Intervales. *Neotrop. Primates* 9(2): 69–73.

Treves, A. 2001. Reproductive consequences of variation in the composition of howler monkey (*Alouatta* spp.) groups. *Behav. Ecol. Sociobiol.* 50(1): 61–71.

von Ihering, H. 1914. Os bugios do gênero *Alouatta. Rev. Mus. Paulista* 9: 231–280.

Zunino, G. E., Chalukian, S. C. and Rumiz, D. I. 1986. Infanticídio y disaparición de infantes asociados al reemplazo de machos em grupos de *Alouatta caraya.* In: *A Primatologia no Brasil* – 2, M. T. Mello (ed.), pp.185–190. Sociedade Brasileira de Primatologia, Brasília.

SUBSTRATE MANIPULATION BY *ALOUATTA GUARIBA CLAMITANS* IN SOLVING A LOCOMOTOR PROBLEM

Flávia Koch
Júlio César Bicca-Marques

Primates are distinguished from other groups of animals by having large brains, enhanced manipulative abilities, and more complex cognitive skills (Garber, 2004). These traits allow nonhuman primates to perform complex behaviors such as tool use, a behavior previously considered to be limited to humans (Panger, 1998). Most instances of manipulating objects as tools have been recorded in apes (Beck, 1975; Goodall, 1964). There are some records for Old World monkeys, including baboons (*Papio*) and macaques (*Macaca*) (Van Lawick-Goodall *et al.*, 1973; Tomasello and Call, 1997; Westergaard, 1992); in New World monkeys, tool use has been observed in capuchin monkeys (*Cebus*) (Beck, 1972, 1975; Chevalier-Skolnikoff, 1989; Fragaszy *et al.*, 2004; Ottoni and Mannu, 2001; Phillips, 1998; Struhsaker, 1977; Vauclair and Anderson, 1994; Visalberghi, 1990; Westergaard, 1988).

Beck (1975) defined tool use as "the manipulation of an unattached environmental object, the tool (not part of the user's body), to alter more efficiently the form or position of a separate object, when the user holds or carries the tool *in toto* during or just prior to use and is responsible for the critical connection between tool and incentive" (p.414). Urbani and Garber (2002), however, warned that several reports of tool use cited in the scientific literature are better classified as "proto tool-use or object manipulation." True tool use involves the detachment and manipulation of both the object of change and the agent of change (the tool), whereas in proto tool-use, only the object of change is detached and manipulated (Panger, 1998; Parker and Gibson, 1977).

Here we report a case of substrate manipulation by a brown howler monkey (*Alouatta guariba clamitans* Cabrera, 1940). It was recorded by F. Koch during a study of the ecology and behavior of a group of brown howlers at the Morro da Extrema (30°12'S, 51°04'W), Porto Alegre, Rio Grande do Sul, Brazil. On 16 October 2002, around 15:00 h, the sky became overcast and the wind picked up, signaling an approaching rainstorm. The study group began moving away. At 15:20 h, the group came to a gap in the canopy of about 2 m. All successfully leaped across the gap to the next tree except an infant (in the process of becoming independent from its mother). The branches were blowing about vigorously because of the high winds, and the infant stopped and vocalized (cried) while holding onto the end of the branch. The group members did not return to help the infant, which made no attempt to jump but continued vocalizing loudly, until eventually its mother went back to rescue it. In order to help her infant, the mother manipulated a nearby branch (without detaching it) of the tree she was in until it was positioned close to the infant. The infant immediately used this branch as a bridge to traverse the gap. Once safely across, it quickly climbed onto its mother's back. Given the configuration of the arboreal canopy, the only way for group members to cross the gap was by leaping from one tree to the other. A similar situation involving the same mother-infant pair was observed on a second occasion when there was a strong wind but a clear sky.

This note reports the observation of a complex behavior performed by a howler monkey to solve a problem commonly faced by arboreal primates. This is the first record of the manipulation of an object to help an infant howler monkey travel across a gap in the canopy. Previous reports indicate that adult howler monkeys may use their bodies to form a "bridge" in order to help immatures cross such gaps. According to the definition proposed by Beck (1975), this behavior cannot be considered as true tool use because the animal (mother) did not detach the branch used as a bridge from the tree. This use of the substrate as an object, however, can be classified as proto-tool-use or object substrate manipulation (*sensu* Parker and Gibson, 1977).

Acknowledgments: We thank Paul A. Garber and Anthony B. Rylands for critical comments on an earlier version of this manuscript, Denise Brutto for permission to work at the study site, and the Fundação de Amparo à Pesquisa do Estado do Rio Grande do Sul/FAPERGS for financial support (Research Grant nr. 01/1136.4 to JCB-M, and a Research Fellowship to FK).

Flávia Koch, Instituto de Biociências, Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, and **Júlio César Bicca-Marques**, Laboratório de Primatologia, Faculdade de Biociências, Pontifícia Universidade Católica do Rio Grande do Sul, Av. Ipiranga 6681, Prédio 12A, Porto Alegre 90619-900, Rio Grande do Sul, Brazil, e-mail: <jcbicca@pucrs.br>.

References

Beck, B. B. 1972. Tool use in captive hamadryas baboons. *Primates* 13: 276–296.

Beck, B. B. 1975. Primate tool behavior. In: *Socioecology and Psychology in Primates*, R. Tuttle (ed.), pp.413–447. Mouton, The Hague.

Chevalier-Skolnikoff, S. 1989. Spontaneous tool use and sensorimotor intelligence in *Cebus* compared with other monkeys and apes. *Behav. Brain Sci.* 12: 561–627.

Fragaszy, D. M., Izar, P., Visalberghi, E., Ottoni, E .B. and Oliveira, M. G. 2004. Wild capuchin monkeys (*Cebus libidinosus*) use anvils and stone pounding tools. *Am. J. Primatol.* 64: 359–366.

Garber, P.A. 2004. New perspectives in primate cognitive ecology. *Am. J. Primatol.* 62: 133–137.

Goodall, J. 1964. Tool-using and aimed throwing in a community of free-living chimpanzees. *Nature, Lond.* 201: 1264–1266.

Ottoni, E. B. and Mannu, M. 2001. Semifree-ranging tufted capuchins (*Cebus apella*) spontaneously use tools to crack open nuts. *Int. J. Primatol.* 22: 347–358.

Panger, M. 1998. Object-use in free-ranging white-faced capuchins (*Cebus capucinus*) in Costa Rica. *Am. J. Phys. Anthropol.* 106: 311–321.

Parker, S. T. and Gibson, K. R. 1977. Object manipulation, tool use and sensorimotor intelligence as feeding adaptations in *Cebus* monkeys and great apes. *J. Hum. Evol.* 6: 623–641.

Phillips, K. A. 1998. Tool use in wild capuchin monkeys. *Am. J. Primatol.* 46: 259–261.

Struhsaker, T. T. 1977. Palm-nut smashing by *Cebus a. apella* in Colombia. *Biotropica* 9: 124–126.

Tomasello, M. and Call, J.C. 1997. *Primate Cognition.* Oxford University Press, Oxford.

Urbani, B. and Garber, P. A. 2002. A stone in their hands... Are monkeys tool users? *Anthropologie* 40: 183–191.

van Lawick-Goodall, J., van Lawick, H. and Packer, C. 1973. Tool use in free-living baboons in Gombe National Park, Tanzania. *Nature, Lond.* 241(19): 212–213.

Vauclair, J. and Anderson, J. A. 1994. Object manipulation, tool use, and the social context in human and non-human primates. *Techniques and Culture* 23–24: 121–136.

Visalberghi, E. 1990. Tool use in *Cebus*. *Folia Primatol.* 54: 146–154.

Westergaard, G. C. 1988. Lion-tailed macaques (*Macaca silenus*) manufacture and use tools. *J. Comp. Psychol.* 102: 152–159.

Westergaard, G. C. 1992. Object manipulation and the use of tools by infant baboons (*Papio cynocephalus anubis*). *J. Comp. Psychol.* 106: 398–403.

NOVOS REGISTROS DE MURIQUI-DO-NORTE (*BRACHYTELES HYPOXANTHUS*) NO VALE DO RIO JEQUITINHONHA, MINAS GERAIS E BAHIA

Fabiano R. Melo, Adriano G. Chiarello
Michel B. Faria, Pedro A. Oliveira
Rafael L. A. Freitas, Fernando S. Lima
Daniel S. Ferraz

Introdução

O muriqui-do-norte (*Brachyteles hypoxanthus*) é considerado uma das 25 espécies de primatas mais ameaçadas do planeta. Tem sua ocorrência restrita à Mata Atlântica e suas populações se encontram ameaçadas pela destruição e fragmentação do habitat e também pela atividade de caça (Mittermeier *et al.*, 2005). Essa situação é considerada ainda mais crítica se levarmos em conta que a área de distribuição geográfica original da espécie se encontra localizada na região Leste do Brasil, onde as ações antrópicas foram mais severas (Mittermeier *et al.*, 1989). Como se não bastasse, o muriqui é um dos mamíferos mais caçados nesta região, conforme relatos de caça recentes para o muriqui-do-sul (*Brachyteles arachnoides*, em Mittermeier *et al.*, 1982; 1987; 1989; Mittermeier e Konstant, 1990; Auricchio, 1997) e para o próprio muriqui-do-norte (*B. hypoxanthus*, em Cosenza e Melo, 1998).

Apesar de ter ampla distribuição no leste brasileiro, são conhecidas populações de muriqui-do-norte apenas para Minas Gerais e Espírito Santo (Strier e Fonseca, 1996-1997). No estado da Bahia, os últimos registros feitos por Aguirre (1971) remontam à década de 60. Desde essa data, nenhuma população de muriquis foi confirmada no estado baiano, até o ano de 2004.

Desde 1999, o Instituto Estadual de Florestas de Minas Gerais e a Universidade Federal de Minas Gerais vêm desenvolvendo trabalhos de reconhecimento da fauna de mamíferos, considerando o grupo de primatas como indicador de novas áreas, nos vales do rio Jequitinhonha e Doce, visando preservar essa rica biodiversidade (Hirsch, 2003; Melo *et al.*, 2002; Melo, 2004). Este estudo concentrado trouxe detalhes sobre os principais fragmentos florestais existentes nas referidas bacias e permite, hoje, direcionar recursos e esforços conservacionistas nas áreas apontadas como de importância para a conservação dessa fauna de primatas diagnosticada e, conseqüentemente, dos demais mamíferos e das demais espécies tipicamente florestais.

Concomitante a essas iniciativas, o Ministério do Meio Ambiente abriu um edital, em 2002, convocando instituições de pesquisa e ensino na tentativa de melhorar nosso conhecimento biológico acerca dos principais biomas brasileiros, baseado nos diversos *workshops* nacionais que foram realizados na última década e no início dessa (Brasil, MMA, 2002). A Conservação Internacional do Brasil associou-se às principais instituições de ensino de nível superior do Estado

(Universidades Federais de Minas Gerais e de Viçosa, Universidade do Estado de Minas Gerais, *campus* de Carangola e a Pontifícia Universidade Católica de Minas Gerais – PUC Minas) e teve aprovada sua proposta de inventário da biodiversidade nos vales do Mucuri e Jequitinhonha, Minas Gerais e Bahia, nos domínios da Mata Atlântica e em áreas consideradas prioritárias ou que necessitam de maiores investigações científicas apontadas por Conservation International *et al.* (2000). Este inventário gerou novos dados de ocorrência para o muriqui-do-norte (*Brachyteles hypoxanthus*), que são aqui apresentados e discutidos.

No presente estudo e em trabalho prévio (Melo, 2004), foram enfatizadas amostragens nos fragmentos florestais localizados nas áreas consideradas prioritárias de número 213 (Vitória da Conquista/Jordânia, BA), 217 (Salto da Divisa, MG) e 221 (remanescentes da região de Teófilo Otoni, MG) do mapa "Avaliação e Ações Prioritárias para a Conservação da Biodiversidade da Mata Atlântica e Campos Sulinos" (Conservation International *et al.*, 2000). O número de fragmentos amostrados dependeu de uma análise de viabilidade feita com toda a equipe do projeto, envolvendo os demais grupos temáticos, após análise de imagens de satélite (escala 1:250.000). Aqui, são relatados apenas os resultados dos locais onde a presença do muriqui pode ser confirmada, quais sejam, a Reserva Biológica da Mata Escura, municípios de Jequitinhonha e Almenara (16°20'29.0" Sul e 41°00'42.0" Oeste) e a região da Fazenda Duas Barras, em Santa Maria do Salto (16°24'23.5" Sul e 40°03'15.4" Oeste; Figura 1) (mais detalhes abaixo).

Andrade (2004) caracterizou a região da Mata Escura com clima que corresponde ao tipo Cwa de Köppen, mesotérmico com verões quentes e estação seca no inverno. Nos pontos mais altos (1.100 m de altitude), o clima é mais ameno, tipo Cwb de Köppen, com temperaturas mais brandas (Andrade, 2000a). Já a Fazenda Alto Cariri, nos municípios de Salto da Divisa e Santa Maria do Salto, é caracterizada pelo clima tropical quente úmido com três meses secos. A área encontra-se próxima a isoeta com 1.250 mm de precipitações e as chuvas distribuem-se entre a primavera e o verão, sendo os meses de precipitação máxima entre dezembro e fevereiro (Nimer, 1989; Andrade, 2000b).

O levantamento de primatas que ocorrem nas localidades de estudo foi feito através de três métodos principais: 1) amostragens em transectos lineares ("censos") conduzidas durante o período diurno e noturno para o registro de mamíferos de médio e grande porte; 2) uso de *playback* para a confirmação de presença de primatas; e 3) entrevistas com moradores locais, antigos caçadores e pesquisadores que já atuaram na área.

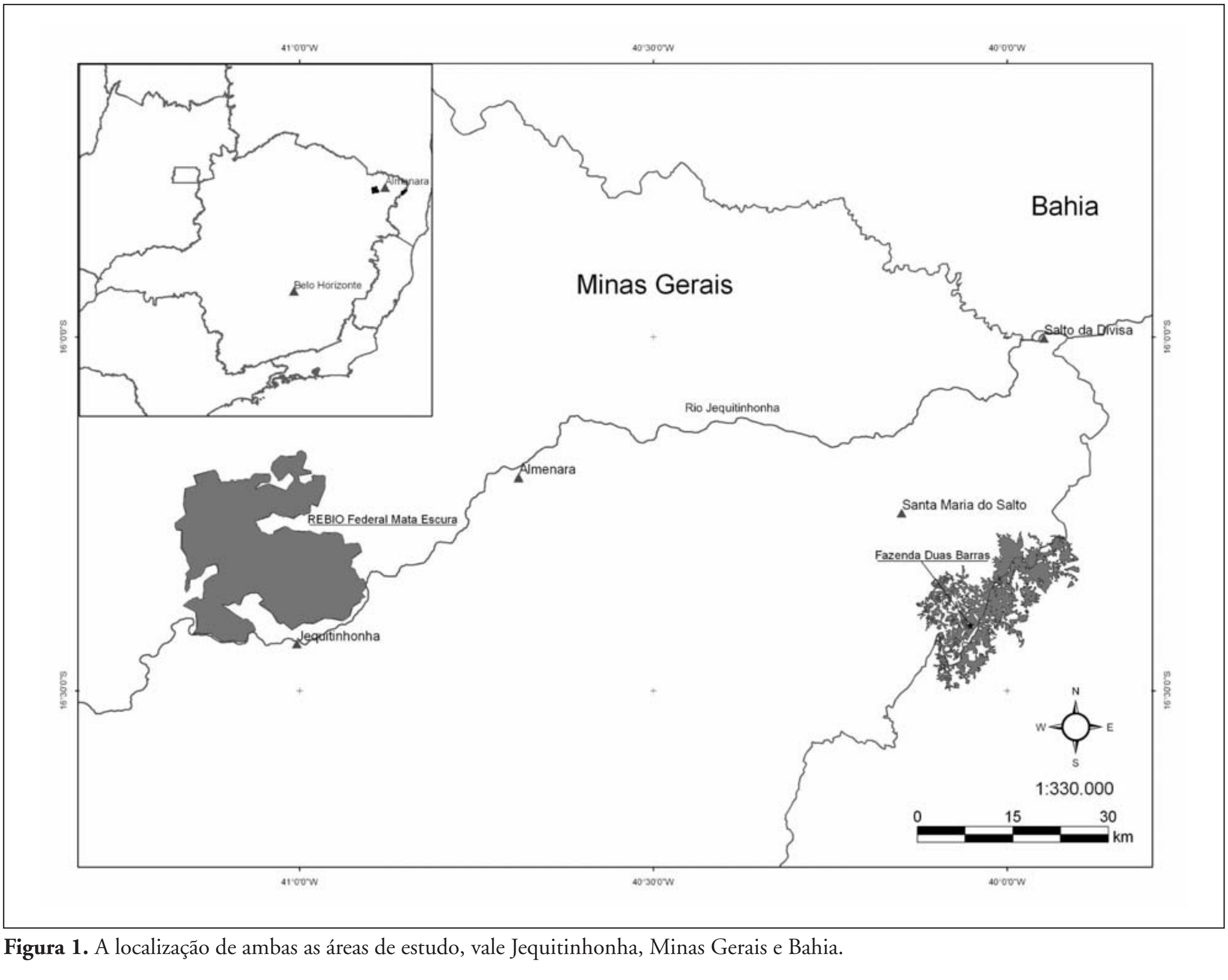

Figura 1. A localização de ambas as áreas de estudo, vale Jequitinhonha, Minas Gerais e Bahia.

Os "censos" (*line-transect sampling*, Buckland *et al.* 2001) foram feitos em trilhas já existentes, bem como em bordas de mata e estradas de terra pelo interior dos fragmentos em dois horários principais, no início da manhã (06:00-10:00h) e no início da noite (18:00-22:00 h). Um mínimo de três censos diurnos e três noturnos foram realizados/fragmento/estação. O registro de mamíferos em geral foi feito através de observações visuais diretas ou através de vocalizações, pegadas, fezes, carcaças, pêlos, espinhos e demais vestígios encontrados. O ritmo da caminhada foi mantido o mais próximo possível de 0,5-1,0 km/h. O início e o término dos censos foram anotados, assim como a distância percorrida. As distâncias foram medidas através de aparelho de GPS. Nos censos noturnos utilizamos uma lanterna Maglite recarregável de 12 watts e Petzl modelo Duo. Todos os registros foram anotados em caderneta de campo previamente preparada, com espaços para hora, local, tipo de floresta, tipo de registro, e número de indivíduos. Adicionalmente, Melo (2004), além de entrevistas com moradores locais, utilizou insistentemente da técnica de *playback*, na tentativa de otimizar os encontros (Melo e Mendes, 2000).

O presente estudo foi realizado em quatro áreas dos 36 fragmentos florestais visitados por Melo (2004). Dos 167 km de censo e mais de 180 km de caminhadas percorridos, obtivemos apenas dois registros de muriqui-do-norte (*Brachyteles hypoxanthus*) num total de 74 avistamentos de primatas.

Melo *et al.* (2002) confirmaram a ocorrência de muriqui para a região da Mata Escura, hoje a Reserva Biológica Federal da Mata Escura, em Jequitinhonha, totalizando 14 indivíduos distribuídos em dois grupos sociais distintos. Mais recentemente, Melo *et al.* (*in prep.*) puderam confirmar o número total de indivíduos de um dos grupos vistos em 1999, que chegou a 25 animais, considerando adultos, jovens e infantes.

Apesar de terem sido raros os relatos referentes à ocorrência de muriquis no vale, esse registro no município de Jequitinhonha (REBIO Mata Escura) é de extrema importância, pois as populações consideradas relictuais de distribuição mais ao norte no estado de Minas Gerais eram as populações do Parque Estadual do Rio Doce, em Marliéria e da Fazenda Córrego de Areia, no município de Peçanha (Mittermeier *et al.*, 1987; 1989; Strier e Fonseca, 1996-1997; Hirsch *et al.*, 2002).

Em Agosto de 2004, durante censo realizado na Fazenda Duas Barras, municípios mineiro de Santa Maria do Salto e baiano de Guaratinga, pudemos confirmar mais uma população de muriquis para o vale. A confirmação dessa população traz um duplo significado para a conservação dessa espécie tão ameaçada, cuja população mundial não ultrapassa a cifra de 1.000 indivíduos de vida livre (Mittermeier *et al.* 2005), já que reforça a existência de mais uma localidade. Somada às demais, aumenta as esperanças de consolidação da luta pela preservação de seu hábitat e de sua sobrevivência em longo prazo. No caso específico dessa região, ambos os governos do estado da Bahia e de Minas Gerais podem somar esforços na tentativa de implantar uma Unidade de Conservação (UC) de proteção integral na área.

A presença do muriqui nessa região, além de ser uma confirmação obtida após cinco anos de busca por Melo (2004), merece destaque, pois pode ser considerada a primeira população de muriquis constatada para o estado da Bahia após as investigações pioneiras feitas por Aguirre (1971). Além desse avistamento feito, computamos diversos relatos fiéis da ocorrência da espécie para toda a região chamada de Alto Cariri. O grupo identificado apresenta pelo menos sete indivíduos e se encontrava em um grande fragmento de mata que abrange ambos os estados. A fazenda Duas Barras possui aproximadamente 1.200 ha de floresta primária e é contínua com os demais fragmentos florestais situados em todo o maciço da serra do Alto Cariri, que pode somar mais de 18 mil ha de mata em bom estado de conservação. Como metade dessa área se encontra em território baiano, temos uma situação singular onde encontramos espécies com suas distribuições alocadas em ambos os estados. Essa condição interessante sugere que podem existir outros grupos de muriquis ao longo deste maciço florestal, que inclui extensos trechos totalmente inseridos em território baiano, pois tivemos muitos relatos da ocorrência de grupos com mais de 30 indivíduos, tanto ao norte quanto nessa região central onde observamos o primeiro grupo de muriquis.

Em outro projeto de pesquisa, Melo *et al.* (*in prep.*) realizaram uma visita à Reserva Particular do Patrimônio Natural (RPPN) Estação Veracruz, em Porto Seguro (BA), de acordo com informações de moradores locais que teriam vistos muriquis na área. Não obtivemos, porém, nenhum indício que pudesse confirmar sua ocorrência durante a visita feita, o que vem ratificar as informações de seu desaparecimento da Estação Veracruz e vizinhanças há pelo menos 40 anos, motivado aparentemente pela forte pressão de caça na região. Aguirre (1971) aponta quatro localidades distintas, mas relativamente próximas à atual RPPN Veracruz, como áreas cujas populações de muriquis foram extintas no passado, incluindo o Parque Nacional (PARNA) Monte Pascoal e a Fazenda Pontal, em Itamaraju.

Um único relato obtido durante o trabalho levanta suspeitas recentes de um muriqui abatido por índios no Parque Nacional Monte Pascoal, há cerca de cinco anos. Embora remota, não se pode descartar totalmente a possibilidade de que uma população remanescente de muriquis ainda ocorra nas áreas deste PARNA.

O muriqui (*Brachyteles* spp.) não teve seu *status* de conservação, em Minas Gerais, avaliado como criticamente ameaçado, pois durante a análise da lista mineira da fauna ameaçada de extinção, esse táxon era considerado um gênero monotípico. A sua taxonomia foi revisada alguns anos depois por Rylands *et al.* (2000), onde houve separação em duas espécies (muriqui-do-sul, *B. arachnoides* e muriqui-do-norte, *B. hypoxanthus*). Tanto a lista nacional quanto a lista da IUCN trazem essa última espécie como criticamente ameaçada de extinção no Brasil e no mundo, respectivamente (Brasil, IBAMA, 1992; IUCN, 2004).

Comparando com o trabalho feito por Rylands *et al.* (1988) na região do médio Jequitinhonha, nenhuma das duas populações citadas nesta região por estes autores pode ser confirmada. Na Fazenda Ramaiana, em Joaíma (MG) (ponto 32 em Rylands *et al.*, 1988), os moradores mais antigos informaram ter ocorrido muriqui na área, mas em tempos remotos. Muitas espécies da avifauna identificadas no vale do Jequitinhonha foram coletadas nessa localidade, sendo que registros históricos importantes, como do macuco (*Tinamus solitarius*), demonstram que a região sofreu intensa pressão de caça ou mesmo teve sua área de floresta tão reduzida que a espécie não subsiste mais (G. T. Mattos, com. pess.). Da mesma forma, *B. hypoxanthus* pode ter chegado a um número reduzido e o seu extermínio por caçadores pode ter selado seu destino, bem como na maioria dos fragmentos de mata primária relativamente grandes que foram detectados, mas que não deixam quaisquer indícios da presença recente da espécie. A segunda localidade, conhecida como Fazenda Nossa Senhora das Graças (ponto 30; Rylands *et al.*, 1988), tem possibilidades remotas ou sequer alguma possibilidade de abrigar populações de muriqui.

Relatos confiáveis da presença de muriquis foram obtidos na Fazenda Alto Cariri (16°18'53.8" Sul e 39°59'42.4" Oeste), situada mais ao norte da Fazenda Duas Barras, porém no município de Salto da Divisa (MG). A presença da espécie nesta localidade deve ser muito provável, já que essa área é contínua com a mata da Faz. Duas Barras onde os muriquis foram vistos.

Há outro fragmento florestal situado na Fazenda Avenida (15°47'44.0" Sul e 40°32'55.0" Oeste) divisa de municípios de Bandeira e Jordânia, em Minas Gerais, com Macarani e Maiquinique, na Bahia, uma área que também possui extensões consideráveis de mata e que se encontra em excelente estado de conservação. Todas as visitas feitas por Melo (2004), este estudo e por Melo *et al.* (*in prep.*) não puderam confirmar a presença de muriqui nessa área, apesar de termos obtido entrevistas relatando a sua ocorrência. Entretanto, consideramos que a localização de novos grupos de *B. hypoxanthus* não deve ser descartada e que estudos futuros sejam priorizados na área.

Uma terceira área visitada e que nos levou a conhecê-la foi exatamente a indicação, pelo seu proprietário, de que a Fazenda Limoeiro (16°02'57.0" Sul e 40°51'02.0" Oeste), em Almenara (MG), abrigava grupos de muriquis. Isso se baseou em relato feito por um morador local que disse ter abatido um indivíduo adulto de muriqui. Porém, em nenhuma das duas visitas realizadas na área foi possível confirmar a ocorrência desse táxon (14 a 18 de novembro de 2003 e 20 a 24 de abril de 2004). A área de mata é grande (mais de 9.000 ha), existem grotas extensas bastante íngremes e de difícil acesso. Mesmo assim, há uma constante retirada de madeira, o que nos leva a crer que a espécie, se de fato ainda subiste no local, está no limiar da extinção.

A redescoberta de grupos de animais de espécies de mamíferos de grande porte, como o muriqui-do-norte, reforça a necessidade urgente de se conhecer melhor as áreas visitadas com relação aos demais elementos da biota regional e exige uma ação imediata dos governos estadual e federal na conservação dessa biodiversidade, já que a caça predatória, o fogo constante e a retirada de madeira são ações de deterioração permanente nessas áreas.

Agradecimentos: Especiais agradecimentos aos financiadores desse trabalho, como o Instituto Estadual de Florestas, a Margot Marsh Biodiversity Foundation, a SEMAD-MG, o PROBIO/MMA, PG-ECMVS/ICB/UFMG, US Fish & Wildlife Service, o CNPq através das bolsas de estudos concedidas e a Conservação Internacional do Brasil. Aos demais parceiros de equipe do PROBIO (Rômulo Ribon, Renato Feio, Luciana Nascimento, Alexandre Salino) e do IEF (Denize F. Nogueira e Priscila M. Andrade). Ao prof. Anthony Rylands pela credibilidade e incentivo durante o doutorado de F. R. Melo. Agradecemos aos alunos da UEMG/FAFILE de Carangola por ter nos ajudado durante a campanha da Faz. Duas Barras, Érica dos Reis Rodes, Marcello Silva Nery e Sílvia Lucília Fonseca de Souza, através do projeto financiado pela Fundação Biodiversitas e CEPAN (028M/012004). À Maria Elisa Castellanos-Solá pela idealização do trabalho original e ao técnico do IEF local, Giovani Alves de Moura, pelo auxílio de todas as horas e apoio às missões empreendidas. Ambos tiveram papéis cruciais no desenvolvimento das pesquisas científicas que vêm ocorrendo no vale Jequitinhonha desde 1999.

Fabiano R. Melo[1,2], **Adriano G. Chiarello**[3], **Michel B. Faria**[1], **Pedro A. Oliveira**[3], **Rafael L. A. Freitas**[3], **Fernando S. Lima**[1,4] e **Daniel S. Ferraz**[1], [1]Ciências Biológicas, FAFILE/UEMG, Campus de Carangola, Praça dos Estudantes 23, Santa Emília, Carangola 36800-000, Minas Gerais, e-mail: <frmelo@carangola.br>; [2]Centro de Estudos Ecológicos e Educação Ambiental, Rua Caparaó 122, Centro, Carangola 36800-000, Minas Gerais; [3]Programa de Pós-graduação em Zoologia dos Vertebrados, PUC-Minas, Av. Dom José Gaspar 500, Coração Eucarístico, Belo Horizonte 30535-610, Minas Gerais; [4]Instituto de Pesquisas Ecológicas – IPÊ, Caixa Postal 47, Nazaré Paulista 12960-000, São Paulo, Brasil.

Referências

Aguirre, A. C. 1971. *O mono* Brachyteles arachnoides *(E. Geoffroy). Situação atual da espécie no Brasil.* Academia Brasileira de Ciências, Rio de Janeiro. 53pp.

Andrade, P. M. 2000a. Caracterização preliminar da vegetação na região da Fazenda Santana, Salto da Divisa, MG e da vegetação da Mata Escura, Município de Jequitinhonha, MG. Relatório Técnico, Instituto Estadual de Florestas, Belo Horizonte. 15pp.

Andrade, P. M. 2000b. Caracterização preliminar da vegetação na região da Fazenda Alto Cariri, Salto da Divisa, MG. Relatório Técnico. Instituto Estadual de Florestas, Belo Horizonte. 18pp.

Andrade, P. M. 2004. Refúgios ecológicos nas matas do Jequitinhonha. *Jornal do Biólogo* 37: 6–8.

Auricchio, P. 1997. A new locality for *Brachyteles arachnoides* and the urgency of finding new directions for muriqui conservation. *Neotrop. Primates* 5(3): 78–80.

Fundação Biodiversitas. 2003. Revisão do Atlas de Áreas Prioritárias para a Conservação da Biodiversidade de Minas Gerais. Web site: <http://www.biodiversitas.org.br/atlas/index.htm>.

Brasil, IBAMA, 1992. *Lista Oficial de Espécies da Fauna Brasileira em Perigo de Extincão.* Portaria No. 45 de 27 de abril de 1992. Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA), Brasilia.

Brasil, MMA. 2002. *Biodiversidade Brasileira: Avaliação e Identificação de Áreas e Ações Prioritárias para Conservação, Utilização Sustentável e Repartição dos Benefícios da Biodiversidade Brasileira.* Ministério do Meio Ambiente (MMA), Secretaria de Biodiversidade e Florestas (SBF), Brasília. 404pp.

Buckland, S. T., Anderson, D. R., Burnham, K. P., Laake, J. L., Borchers, D. L. e Thomas, L. 2001. *Introduction to Distance Sampling: Estimating Abundance of Biological Populations.* Oxford University Press, Oxford.

Chiarello, A. G. 1999. Effects of fragmentation of the Atlantic forest on mammal communities in south-eastern Brazil. *Biol. Conserv.* 89: 71–82.

Conservation International, Fundação SOS Mata Atlântica, Fundação Biodiversitas; Instituto de Pesquisas Ecológicas, Secretaria do Meio Ambiente do Estado de São Paulo, SEMAD/Instituto Estadual de Florestas-MG. 2000. *Avaliação e Ações Prioritárias para a Conservação da Biodiversidade da Mata Atlântica e Campos Sulinos.* Ministério do Meio Ambiente (MMA), Brasília. 40pp.

Cosenza, B. A. P. e Melo, F. R. de. 1998. Primates of the Serra do Brigadeiro State Park, Minas Gerais, Brazil. *Neotrop. Primates* 6(1): 18–20.

Hirsch, A. 2003. Avaliação da fragmentação do habitat e seleção de áreas prioritárias para a conservação dos primatas da bacia do rio Doce, Minas Gerais, através da aplicação de um sistema de informações geográficas. Tese de Doutorado. Universidade Federal de Minas Gerais (UFMG), Belo Horizonte. 227pp. + anexos.

Hirsch, A., Dias, L. G., Martins, W. P. e Porfírio, S. 2002. Rediscovery of *Brachyteles arachnoides hypoxanthus* at the Fazenda Córrego de Areia, Minas Gerais, Brazil. *Neotrop. Primates* 10(3): 119–122.

IUCN. 2004. *2004 IUCN Red List of Threatened Species.* <http://www.redlist.org/>.

Melo, F. R. 2004. Primatas e áreas prioritárias para a conservação da biodiversidade no vale do rio Jequitinhonha, Minas Gerais. Tese de Doutorado, Universidade Federal de Minas Gerais (UFMG), Belo Horizonte. 154pp. + anexos.

Melo, F. R. e Mendes, S. L. 2000. Emissão de gritos longos por grupos de *Callicebus nigrifrons* e suas reações a *playbacks.* In: *A Primatologia no Brasil - 7*, C. Alonso e A. Langguth (eds.), pp.215-222. Universidade Federal da Paraíba, Sociedade Brasileira de Primatologia, João Pessoa.

Melo, F. R., Nogueira, D. F. e Rylands, A. B. 2002. Primatas do vale Jequitinhonha, Minas Gerais. Em: *Livro de Resumos: X Congresso Brasileiro de Primatologia,* pp.56–56. Universidade Federal do Pará, Belém.

Mittermeier, R. e Konstant, W. R. 1990. A hunt for "monos" (*Brachyteles arachnoides*) in the foothills of the Serra da Paranapiacaba, São Paulo, Brazil *Primate Conserv.* (11): 23–25.

Mittermeier, R. A., Coimbra-Filho, A. F., Constable, I. D., Rylands, A. B. e Valle, C. M. C. 1982. Conservation of primates in the Atlantic forest region of Eastern Brazil. *Int. Zoo Yearb.* 22: 2–17.

Mittermeier, R. A., Valle, C. M. C., Alves, M. C., Santos, I. B., Pinto, C. A. M., Strier, K. B., Young, A. L., Veado, E. M., Constable, I. D., Paccagnella, S. G. e Lemos de Sá, R. M. 1987. Current distribution of muriqui in the Atlantic forest region of eastern Brazil. *Primate Conserv.* (8): 143–149.

Mittermeier, R. A., Kinzey, W. G. e Mast, R. 1989. Neotropical primate conservation. *J. Hum. Evol.* 18: 597–610.

Mittermeier, R. A., Valladares-Padua, C., Rylands, A. B., Eudey, A. A., Butynski, T. M., Ganzhorn, J. U., Kormos, R., Aguiar, J. M. e Walker, S. 2005. Primates in Peril: The World's 25 Most Endangered Primates 2004–2006. Technical Report. IUCN/SSC Primate Specialist Group (PSG), Washington, DC. 48pp.

Nimer, E. 1989. *Climatologia do Brasil.* 2ª ed. Instituto Brasileiro de Geografia e Estatística (IBGE), Rio de Janeiro.

Rylands, A. B., Spironelo, W. R., Tornisielo, V. L., Lemos de Sá, R. M., Kierulff M. C. M. e Santos, I. B. 1988. Primates of the Rio Jequitinhonha Valley, Minas Gerais, Brasil. *Primate Conserv.* (9): 100–110.

Rylands, A. B., Schneider, H., Langguth, A., Mittermeier, R. A., Groves, C. P. e Rodríguez-Luna, E, 2000. An assessment of the diversity of New World primates. *Neotrop. Primates* 8(2): 61–93.

Strier, K. B. e Fonseca, G. A. B. da 1996-1997. The endangered muriqui in Brazil's Atlantic Forest. *Primate Conserv.* (17): 131–137.

Strier, K. B., Boubli, J. P., Guimarães, V. O. e Mendes, S. L. 2002. The muriqui population of the Estação Biológica de Caratinga, Minas Gerais, Brazil: Updates. *Neotrop. Primates* 10(3): 115–119.

PLANTED TREES AS CORRIDORS FOR PRIMATES AT EL ZOTA BIOLOGICAL FIELD STATION, COSTA RICA

Jerimiah Luckett, Elizabeth Danforth
Kim Linsenbardt, Jill Pruetz

Introduction

We conducted a study at the privately owned El Zota Biological Field Station in Costa Rica to assess the effects of forest management techniques on primate ecology and behavior. While many conservation-oriented studies note the need for "corridors" to promote dispersal between isolated habitat fragments, few studies provide quantitative information on their use by primates. From July to August 2002, we studied the three primate species that occur at the El Zota Biological Field Station in Costa Rica—*Cebus capucinus, Ateles geoffroyi, Alouatta palliata*—to compare their use of planted versus naturally forested areas. We collected approximately 25 hours of data to quantify the general activities exhibited by primates in these types of habitat.

Methods

Field site

The El Zota Biological Field Station (10°57.6'N, 83°75.9'W) in northeastern Costa Rica (see Pruetz and LaDuke, 2001) is affiliated with the non-profit organization DANTA: Association for Conservation of the Tropics, which, in addition to organizing university-level field courses, seeks to preserve biodiversity in this region of the country. The station is owned by the Hiner Ramirez family of Guapiles and is also affiliated with the Fundación Neotropica in Costa Rica. El Zota has offered field courses in topics such as Primate Behavior and Conservation, and Tropical Herpetology since 2001 and provides an opportunity for students to compare intact forest ecosystems with disturbed and fragmentary habitats. Covering some 1000 ha, much of the site is primary humid and swamp forest (700 ha), but it also includes areas of planted native and non-native trees (~270 ha), as well as pastures formerly used for cattle (30 ha) but now planted with food crops or used for grazing by horses. Emergent trees typical of primary lowland forest in Costa Rica, such as *Dipteryx panamensis*, are widely logged but common at El Zota. Some of the notable fauna there include jaguar (*Panthera onca*), tapir (*Tapirus bairdii*), great green macaw (*Ara ambigua*), king vulture (*Sarcoramphus papa*), brown caiman (*Caiman crocodylus*), the fer-de-lance or terciopelo (*Bothrops asper*), and strawberry poison-dart frog (*Dendrobates pumilio*).

The large-scale plantings at El Zota are part of a reforestation plan in areas previously deforested and used as cattle pasture. Both native and exotic species were originally planted for sustainable tree harvesting, especially *Gmelina arborea* (Meliaceae), *Carapa guianensis* (Meliaceae), and *Hyeronima alchorneoides* (Euphorbiaceae). *Gmelina arborea* is a fast-growing tree indigenous to Asia (Arbonnier, 2000) and is the primary species planted at El Zota. It is planted at a density of approximately 82 trees per ha (Linsenbardt, unpubl. data) and produces fruits edible to humans, which are possibly also eaten by the non-human primates. Other tree plantings appear to be similarly spaced and probably occur at similar densities. *Hyeronima* is a large forest tree native to Costa Rica, characterized by small berry-like drupaceous fruits that are edible for humans (Martin *et al.*, 1987). *Carapa guianensis*, also native, is a medium-sized to emergent tree especially prevalent in rich soils and swamps (Gentry, 1993). The age of the plots at this site for all three species is approximately 8 to 10 years.

Study subjects

The three species of primates at El Zota overlap in range as well as diet. The mantled howling monkey (*Alouatta palliata*) is folivorous and frugivorous, preferring young leaves to mature foliage (Sussman, 2000). Flowers and a small amount of insect material also constitute a significant portion of its diet on a seasonal basis (Burton, 1995). Fruit accounts for approximately 80% of the diet of the black-handed spider monkey (*Ateles geoffroyi*), while leaves make up the remaining 20% (Burton, 1995). It has large day and home ranges due to its widely and patchily distributed food resources (Sussman, 2000). This means that this species in particular needs large contiguous forest remnants or smaller protected islands connected by large travel corridors. The white-faced capuchin (*Cebus capucinus*) has the most varied diet. It is frugivorous and insectivorous. Fruit comprises 65% of its diet, while insects (20%) and leaves (15%) also figure prominently (Burton, 1995). Capuchins have also been known to eat eggs, small vertebrates, buds, and berries (Burton, 1995).

At El Zota, these three primate species use their mutual forest habitat in structurally different ways due in part to their variable dietary requirements. The plantation trees could potentially be used alternately or in combination as food resources, travel corridors, or resting areas between separated parts of the secondary forest. To date, while use of the planted plots has been described anecdotally, no quantification has been made as to the nature of that use or possible species-specific patterns that may exist. This study is one of the first to describe patterns of forest usage exhibited by these three primate species in relation to the plantation stands.

Capuchin groups at El Zota are typical of those reported elsewhere (Sussman, 2000), having a multi-male, multi-female social system. Two groups of capuchins, each of more than 10 individuals, were identified in the main 50-ha study area. The spider monkeys showed the typical fission-fusion social system characteristic of this species (Sussman, 2000), and the largest party was observed to contain 18 individuals. Mantled howling monkeys are the most common species at El Zota. Five multi-male, multi-female groups, each including between four to seven adults in addition to lone individuals, were the focus of behavioral observations at El Zota. Pruetz and LaDuke (2001) estimated that primates at El Zota occur at densities of approximately 35 howling monkeys/km^2, 30 capuchins/km^2, and 28 spider monkeys/km^2.

Observers (KL, JL, JP) followed a systematic observation schedule in which focal group follows were attempted throughout the day to control for temporal bias in primate activity. Over 100 hours in the field yielded approximately 25 hours of systematic data, although contact with primate groups accounted for over 50 hours. A system of trails (3 km) that followed natural ecological contours, such as streambeds, was used in addition to more randomly-oriented transects (1 km) and roads passing through plantations (2 km). Scan-sampling of all group members was used to record general activity patterns, such as rest, travel and feeding, as well as habitat (gallery forest, secondary forest, plantation) and precise location using trail markers placed every 10 meters.

Results

The three species used areas of planted trees for movement/travel and resting, with the proportion of time devoted to moving within plantations greater than for other activities observed in this habitat (see Fig. 1). Howling monkeys spent relatively more time resting in plantation areas (26% of time) than spider monkeys and capuchins (17% and 16%, respectively). Primates were never observed to feed on the non-native *Gmelina*. Although spider monkeys were not seen to feed in *Hyeronima* trees in the plantations during systematic observations, they were observed doing so at other times, and all three species fed in *Hyeronima* trees wherever they occurred in natural forest at El Zota. Like *Ateles*, *Cebus* rested and moved within planted areas, but were never seen to forage there. *Alouatta* fed on *Hyeronima* in planted areas, and moved through these areas, but most of the feeding that we observed there was during a single feeding bout on a lone *Ficus* left standing in a *Gmelina* grove. One group of approximately 10 howlers frequented this particular tree.

Discussion

Various studies have demonstrated that primates are able to adapt to corridor habitats. Lion-tailed macaques (*Macaca silenus*), for example, readily adapt to tea gardens in the Western Ghats of India, where native rainforest fragments are separated by tea and coffee plantings as well as eucalyptus trees, and where non-native plants outnumber native plants (Singh *et al.*, 2001). The macaques fed more often on non-native plants than native ones, and changes observed with the introduction of non-native species to the macaques' habitat included their tendency to forage on the ground for insects and fallen fruits. Birth and survivorship rates at this site increased, possibly in part due to increased food sources in the corridors (Singh *et al.*, 2001). This study demonstrated that corridors can be implemented in degraded natural areas to help the animals adapt to a changing ecosystem.

Other studies have demonstrated that plantation corridors provide new food sources for primates. Brown lemurs (*Lemur fulvus*) near Perinet, Madagascar, have been recorded using old mixed eucalyptus and pine plantations as a new food source (flowers of both pine and eucalyptus) as well as for travel, resting and sleeping, although population densities in these areas were significantly lower than in natural forest, and new eucalyptus plantations were used very little (Ganzhorn, 1985, 1987). Nonetheless, Ganzhorn (1987) concluded that non-native plantation corridors were effective in connecting natural forest areas and extending the natural habitat of primates, as well as in creating a buffer zone between the natural forest and outside disturbances. Similarly, Zanne *et al.* (2001) concluded that introduced pine plantations may attract more indigenous mammals, including primates, than agricultural or fallow land in Uganda. They likened these abandoned plantations to wildlife refuges in an area where the landscape is fragmented. In this case, such habitat could be interpreted as augmenting the associated refuges. Finally, Bicca-Marques and Calegaro-Marques (1994) demonstrated that wild black howlers (*Alouatta caraya*) in southern Brazil relied on introduced plant species during periods of native fruit scarcity. Clearly, although introduced species are viewed as problematic by most wildlife conservationists, non-native or non-indigenous species may prove to be beneficial short-term solutions

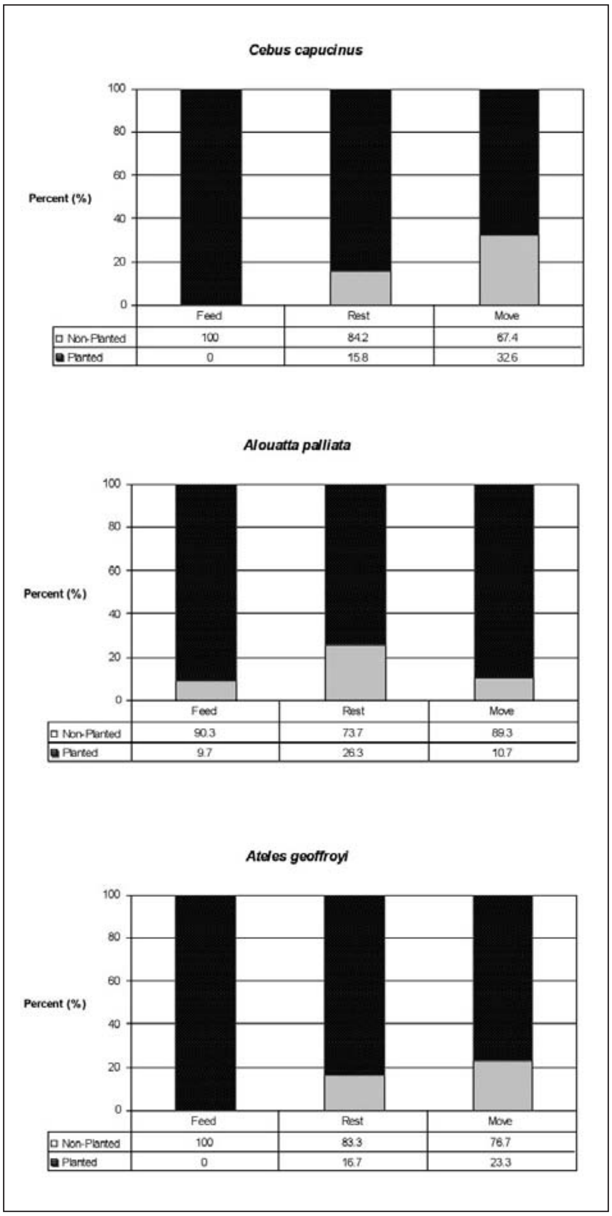

Figure 1. The use of planted versus non-planted (natural) areas by three species of primates at El Zota Biological Station. The graphs show the percentage of time dedicated to feeding, resting and moving in these areas. The numbers in the tables show the proportion of time each species spent feeding, resting and moving in the two different habitats.

for the long-term conservation of primate species in some contexts, especially in isolated forest fragments.

The propagation of non-native trees might be considered in certain cases because fast-growing species could provide travel corridors for primates or access to native food trees, as was observed with primates at El Zota. A narrow corridor of non-native, rapidly growing tree species could be supplemented with slower-growing native species. These plantations could also act as buffers and wildlife refuges in fragmented habitats and would appear to be preferable to fallow or agricultural land (Zanne *et al.*, 2001). At El Zota, trees were originally planted to provide timber for making paper. Research into the ecology of introduced species before implementing such a project is crucial. Although *Gmelina* trees at El Zota provide travel pathways for all three primates, the extensive root network of this introduced species prohibits significant undergrowth where it is thickly planted, stifling succession by native species. For this reason, future management plans at El Zota include intensive clearing of areas after *Gmelina* harvest and the propagation of native tree species, such as *Hyeronima* (J. Ramirez, pers. comm.). Using native trees and allowing succession to occur would provide areas conducive to supporting wildlife, rather than merely providing corridors for wildlife movement (Lindenmayer and Nix, 1993). Although all the plantations were originally part of a sustainable wood-harvesting scheme, the primates' use of these areas for travel has caused the management to change its harvesting plans. Tentative plans are to harvest certain trees while sparing stands that serve as pathways for primates. By cooperating with biologists, the owner and managers of this private reserve allow for a land-use regime that is compatible with the conservation of biodiversity.

Acknowledgments: Thanks to the Hiner Ramirez family and DANTA for contributing to the conservation of Costa Rican biodiversity; the village of El Zota, the Primate Behavior and Ecology class of 2002, Andy Brei, Heather Davis, Tom LaDuke, Maribel Mora, Melissa Remis, Pedro Robles, Jessica Westin, Teresa and William and family, and the Costa Rican government for striving to sustain such diverse flora and fauna.

Jerimiah Luckett, Department of Biology, Franklin College, Franklin, Indiana 46131, USA, **Elizabeth Danforth**, Department of Anthropology, Iowa State University, Ames, Iowa 50011, USA, **Kim Linsenbardt**, Department of Sociology and Anthropology, Purdue University, West Lafayette, Indiana 47907, USA, and **Jill Pruetz**, Department of Anthropology, Iowa State University, Ames, Iowa 50011, USA.

References

Arbonnier, M. 2000. *Arbes, Arbustes et Lianes des Zones Seches d'Afrique de l'Ouest.* Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD) – Museum National d'Histoire Naturelle (MNHN) – The World Conservation Union (IUCN), Paris.

Bicca-Marques, J. C. and Calegaro-Marques, C. 1994. Exotic plant species can serve as staple food sources for wild howler populations. *Folia Primatol.* 63: 209–211.

Burton, Francis. 1995. *Multimedia Guide to Non-Human Primates.* Prentice Hall.

Ganzhorn, J. U. 1985. Utilization of eucalyptus and pine plantations by brown lemurs in the eastern rainforest of Madagascar. *Primate Conserv.* (6): 34–35.

Ganzhorn, J. U. 1987. A possible role of plantations for primate conservation in Madagascar. *Am. J. Primatol.* 12: 205–215.

Gentry, A. H. 1993. *Woody Plants of Northwest South America.* The University of Chicago Press, Chicago.

Lindenmayer, D. B. and Nix, H. A. 1993. Ecological principles for the design of wildlife corridors. *Conserv. Biol.* 7: 627–630.

Martin, F. W., Campbell, C. W. and Ruberte, R. M. 1987. *Perennial Edible Fruits of the Tropics: An Inventory.* Agriculture Handbook No. 642, U. S. Department of Agriculture, Washington, DC.

Pruetz, J. D. and LaDuke, T. C. 2001. New field site: Preliminary census of primates at El Zota Biological Field Station, Costa Rica. *Neotrop. Primates* 9: 22–23.

Singh, M., Kumara, H. N., Kumar, M. A. and Sharma, A. K. 2001. Behavioural responses of lion-tailed macaques (*Macaca silenus*) to a changing habitat in a tropical rain forest fragment in the Western Ghats, India. *Folia Primatol.* 72: 278–291.

Sussman, R. W. 2000. *Primate Ecology and Social Structure. Volume 2: New World Monkeys.* Pearson Custom Publishing, Needham Heights.

Zanne, A. E., Keith, B., Chapman, C. A. and Chapman, L. J. 2001. Protecting terrestrial mammal communities: Potential role of pine plantations. *Afr. J. Ecol.* 39: 399–401.

FURTHER INFORMATION ON NEOTROPICAL MONKEYS REPORTED IN THE XVI CENTURY

Bernardo Urbani

Previously, I reviewed chronicles that reported on or illustrated Neotropical primates in the XVth and XVIth centuries (Urbani, 1999). Recently, I found two new documents that are important for understanding how New World monkeys were initially represented in Europe and Asia.

The first is an Ottoman map of 1513 made by the Turkish Admiral Piri Re'is (1470–1554), a navigator and polyglot who spoke Greek, Arabic, Italian, Spanish, and Portuguese. This work, known as the Piri Re'is *Carte de L'Atlantique* (90 x 65 cm), is housed at the Topkapi Sarayi Museum in Istanbul, Turkey (La Ronciere *et al.*, 1984: plate 28). The polychrome map was lost until 1929 and was part of a larger planisphere. Monkeys were illustrated but not mentioned in the text (Afetinan, 1954; McIntosh, 2000) (Fig. 1). In addition to Portuguese and Arab sources, Piri Re'is may have drawn from a chart by Christopher Columbus, apparently found in a Spanish ship captured by the Turks in the

Figure 1. Two monkeys of the New World in the Piri Re'is' *Carte de L'Atlantique* 1513. One is to the right of a *cynocephalus* (on the left of the map) and the other to the right of an *acephalu*s (on the right of the map) (La Ronciere *et al.*, 1984: plate 28).

Mediterranean Sea around 1501. In fact, Piri Re'is' map may reflect the earlier Columbus map of 1498 (La Ronciere *et al.*, 1984: 218), which coincidentally is the year that Columbus, in his travels, first reported on monkeys in America (Urbani, 1999). In the highly detailed map of Piri Re'is, baboon-like monkeys in the New World were drawn for the first time (Fig. 1). It is possible to infer that these illustrations were made with African primate referents, as were the reports by other travelers in the New World such as Amerigo Vespucci (who referred to Neotropical primates as baboons and macaques; Urbani, 1999) and Arabic chroniclers (Kruk, 1995). On the other hand, Piri Re'is might have obtained another original source on New World monkeys directly from the Europeans. Two primates are represented and associated with mythical animals, one "dancing" with a *cynocephalus* (dog-head) and another with a fruit in its hand together with an *acephalu*s (headless) (Fig. 1). These monkeys were illustrated as inhabiting the area that is currently Colombia, Brazil, and Venezuela.

In February 1595, the English pirate captain Sir Robert Dudley (1574–1649), voyaging in the West Indies, entered the Gulf of Paria (Venezuela) from the southwest at Serpent's Mouth, leaving it by the Dragon's Mouth in order to arrive at the Isle of Trinidad. Of this island, he said, "the country is fertile, and ful of fruits, strange beasts and foules, where of munkeis(3), babions and parats were in great abundance [sic]" (Dudley, 1899: 71). He also indicated that the local name for primates in Trinidad was "howa" (Dudley, 1899: 78). Of interest is that the editor, G. F. Warner, wrote a footnote citing Charles Kingsley (1819–1875): "(3)His 'munkeys' were, of course, the little Sapajous; his 'babions' no true Baboons, for America disdains that degraded and dog-like form, but the great red Howlers (Kingsley, *At last*, p.69)." In principle, it is the first reference that we know of for monkeys from a Caribbean island, and specifically Trinidad. Considering the two primates of this island (Phillips, 1998), the "munkeis" are most likely *Cebus albifrons trinitatis*, whereas the "babions" refer to *Alouatta seniculus insulanus*, both endemic subspecies.

Acknowledgments: To the personnel of the UIUC libraries for their cooperation, and Paul Garber and Anthony B. Rylands for their suggestions. As always to Tania Urquiza-Haas. B. U. is supported by a Fulbright-OAS Scholarship. The author would appreciate comments and references for future updates.

Bernardo Urbani, Department of Anthropology, University of Illinois, 109 Davenport Hall, 607 S. Mathews Ave., Urbana, Illinois 61801, USA, e-mail: <burbani@uiuc.edu>.

References

Afetinan, A. 1954. *Life and Works of the Turkish Admiral: Pirî Reis. The Oldest Map of America Drawn by Pirî Reis.* Türk Tarih Kurumo Basimevi, Ankara. Translated to English by Leman Yolaç.

Dudley, R. 1899. Robert Dudley's voyage to the West Indies, 1594–1595, narrated by Himself. In: *The voyage of Robert Dudley, afterwards styled Earl of Warwick and Leicester and Duke of Northumberland, to the West Indies, 1594–1595, narrated by Capt. Wyatt, by Himself, and by Abram Kendall, master*, G. F. Warner (ed.), pp.67–79. The Hakluyt Society, London.

McIntosh, G. C. 2000. *The Piri Reis Map of 1513.* University of Georgia Press, Athens.

Kingsley, Ch. 1896. *At last: A Christmas in the West Indies.* Macmillan and Co., Ltd., London.

Kruk, R. 1995. Traditional Islamic views of apes and monkeys. In: *Ape, Man, Apeman: Changing Views Since 1600*, R. Corbey and B. Theunissen (eds.), pp.29–42. Leiden University, Leiden.

Phillips, K. A. 1998. Tool use in wild capuchin monkeys (*Cebus albifrons trinitatis*). *Am. J. Primatol.* 46(3): 259–261.

La Ronciere, M., Mollat du Jourdin, M., Azard, M.-M., Raynaud-Nguyen, I. and Vannereau, M.-A. 1984. *Les Portulans, Cartes marines du XIII*^{e} *au XVII*^{e} *siècle*. Office du Libre S. A., Friburg (Switzerland).

Urbani, B. 1999. Nuevo mundo, nuevos monos: Sobre primates neotropicales en los siglos XV y XVI. *Neotrop. Primates* 7(4): 121–125.

THE MEANINGS OF *CACAJAO* AND UACARI: FOLK ETYMOLOGY IN NEOTROPICAL PRIMATE TAXONOMY

Adrian A. Barnett

Introduction

The majority of primate genus names are derived from Latin or Greek roots, typically referring to some aspect of their biology. Among the pitheciines, for example, *Chiropotes* is derived from the Greek "kheír" (hand) and Latin "potare" (to drink). This is a reference to the bearded saki's habit, originally reported by Humboldt (1811: see Hershkovitz,

Table 1. Meanings of the generic names of non-pitheciine Neotropical primates. Fr. = French, Gr. = Greek, L. = Latin.

Name	Derivation
Alouatta	alouette, Fr. 'lark' (i.e., harbinger of dawn)
Aotus	a, Gr. 'not', otus, Gr. 'of the ear' (i.e., 'hidden-eared')
Ateles	a, Gr. 'not' teleios, Gr. 'complete' (referring to thumbless hand)
Brachyteles	brachy, Gr. 'short' teleios, Gr. 'complete' (referring to nearly-thumbless hand, i.e., short thumb)
Callicebus	kalos, Gr. 'beautiful' kébos, Gr. 'a monkey'
Callithrix	kalos, Gr. 'beautiful' thrix, Gr. 'hair'
Cebuella	kébos, Gr. 'a monkey' -ellus, L. diminutive suffix
Cebus	kébos, Gr. 'a monkey'
Lagothrix	lagos, Gr. 'a hare' trikos, Gr. 'hair' (refers to pelage woolliness)
Leontopithecus	leon, L. 'lion' to, L. diminutive pithékos, Gr. 'ape'
Saimiri	"a Brazilian Portuguese name for a small monkey"*
Saguinus	sagouin, Fr. 'a squirrel monkey'* -inus, L. 'like'

* from Gotch (1979)

1985), of drinking by dipping a hand into a bromeliad or water-filled tree hole and then licking the wet fur. The genus *Pithecia* comes from the Greek names for "ape" ("pithékos": see Table 1 for further examples). However, this direct derivation is not the source for the third pitheciine genus, *Cacajao*, a name with no classical roots.

Like the classical derivations of most generic names, common English names for Neotropical primates generally note some obvious feature of the animal that—as is common in folk taxonomies—provides a simple description of the animal (Brown, 1985; Morren, 1989; Cormier, 2000; Mourão *et al.*, 2002). This is seen with "howler," "spider," and "squirrel" monkeys, the common names of *Alouatta*, *Ateles* and *Saimiri*, respectively. *Uacari* does not fit this pattern, for its origins are independent of any European language. This paper, then, seeks to answer the following questions: How did the name *Cacajao* come into use when it has no classical roots, what is the origin of "*uacari,*" and what are the actual meanings of these names? Likewise I discuss what this may tell us about the inclusion of local names into a taxonomic system based on the terminology of classical languages.

Uacaris are medium-sized Amazonian primates (3–5 kg) with short tails and a dentition adapted for a diet of hard fruits (Barnett and Brandon-Jones, 1997). Endemic to the Amazon basin, there are seven recognized forms (Hershkovitz, 1987) in two species: the bald uacari, *Cacajao calvus* (five subspecies), and the black-headed uacari, *C. melanocephalus* (two subspecies). Sousa e Silva Júnior and Martins (1999) recorded the existence of a sixth bald uacari, which might or might not be a new subspecies. Unusual in appearance, uacaris have been described as "one of the most grotesque of all primates" (C. A. Hill, 1965, p.140), and a monkey of "melancholy aspect… emaciated… bedraggled" (W. C. O. Hill, 1960, pp.236-237). Humboldt (1811, p.316; 1812, p.359) provided the first description of a uacari and named it *Simia melanocephala* (in keeping with the time's highly inclusive sense of genus [see Defler and Hernández-Camacho, 2002]), recording the common name of "Le Cacajao." By 1823 the all-embracing category *Simia* was no longer employed, and Johann Baptist von Spix (1823, p.12) named the animal he collected *Brachyurus ouakary*. This genus stood until 1840, when Lesson recognized its preoccupation by *Brachyurus* Fisher 1813 (a genus of rodent, itself later synonymized with *Lemmus*). Deprived of this quite appropriate term (*brachyurus* means "short-tailed"), Lesson proposed—though without explaining why—that the genus be renamed *Cacajao*. Isidore Geoffroy Saint-Hilaire (1847), apparently unaware of Lesson's change, continued the use of *Brachyurus* when describing (as *Brachyurus calvus*) what is now *C. calvus calvus*, and did so again when describing what is now *C. c. rubicundus* (I. Geoffroy Saint-Hilaire and Deville, 1848).

The names *cacajao* and *uacari* are evidently derived from native Amazonian languages: both Humboldt and Spix specifically noted that the names they used for their specimens were those given by the local people at each collection locality. These terms, then, originated from native languages that were once spoken within the geographic range of *Cacajao melanocephalus*. This range covers a large area of northwestern Amazonia (see Hershkovitz, 1987; Barnett and Brandon-Jones, 1997) and overlaps with an area of considerable linguistic diversity (see maps in Dixon and Aikhenvald, 1999). Uacaris occur in large groups, spend much of the year being highly visible in riverside forests, are hunted (Barnett and Brandon-Jones, 1997), and frequently appear in folk taxonomies (e.g., Defler, 2003). The Yanomami name for *C. m. melanocephalus*, for instance, is *hishô-hôshími* (Boubli, 1999). Given that "*hôshími*" means "bad, unpleasant, worthless" and "*hishô*" refers to the area between the nose and upper lip (Gail Goodwin Gomez, pers. comm.), a loose translation could be "ugly snout", a phrase that would certainly be in-line with the slightly pejorative nature of many other local names for members of the genus. However, Gail Goodwin Gomez (pers. comm.) has cautioned that while this is a grammatically possible phrase, it is unknown whether it would be acceptable to a native speaker. Indeed, in his dictionary of the Venezuelan dialect of Yãn̵omãmi, Lizot (2004, p.10) says "ħõsõmi Zool., mono chucuto; *Cacajao melanocephalus* (Cebidae). Es poco frecuente en la región habitada por los Yãn̵omãmi centrales." Gomez points out that the s/sh alternation is found elsewhere in the Yanomami languages, and that it is "linguistically quite normal to find a 'reduplicated' form, [such as] ħõsõmi ħõsõmi," or the variant transcribed by

Boubli as *honsho-honshome* (where "on" refers to the nasalized "o" vowel). So, Boubli's term is a reduplicated variant of the term identified by Lizot (2004) in his dictionary of Yãnomãmɨ. Thus, the name may not be pejorative after all, but simply monomorphemic, which cautions against hasty interpretations of felicitous word combinations under such circumstances.

Hershkovitz (1987) established the type locality for Humboldt's specimen as a Salesian mission on the Río Casiquiare, and the indigenous inhabitants of the mission were said to use *cauiri* for *C. m. melanocephalus* (Humboldt, 1811). The Spanish missionaries called it *chacuto, mono feo* or *mono rabon*; the second literally means "ugly monkey" and so echoes the rather pejorative Yanomami name. The third term refers to its short tail, and parallels *rabicó*, used in Brazilian Amazonia (da Cunha and Barnett, 1989) as does *macaco mal-acabado* ("unfinished monkey") reported by Hershkovitz (1987). "Short tail" is also the direct meaning of several indigenous names for *C. melanocephalus,* including *tschitschi* in the language of the Tariana, who occupy the upper Río Vaupés in Colombia (Alexandra Aikhenvald, pers. comm; Koch-Grunberg, 1911), and *tchitchi* of Baniwa, a language spoken mainly on the Rio Içana and its tributaries on the Brazilian/Colombian frontier and on the upper Río Guainía, Venezuela (Robin Wright, pers. comm.). *Piconturo* or *pitiontouro* is a regional name for the golden-backed uacari, *Cacajao melanocephalus ouakary* and is often heard among settler (*caboclo*) communities on the upper Rio Negro and its tributaries, including the Uapés/Vaupés and the Curicuriarí; it is also used in the town of São Gabriel do Cachoeira (da Cunha and Barnett, 1989). This name appears to be a Europeanized (Spanish or Portuguese colonizers) rendition of *pîko-tuúru*, the name for the animal in Tucano (Ramirez, 1997; Alexandra Aikhenvald, pers. comm.). Ramirez (1997) gives *p(*nasalized i*)ko* as a root for "tail" (p.145), and *turu* (p.198) as "short." These varied names, however, are not often used outside Amazonia and shed no light on the provenance of *cacajao* and *uacari*.

The Origins of *Cacajao* and *Uacari*

Cacajao

According to Humboldt, *cacajao* or *cacahao* is a "Marabitanas" Amerindian name for this monkey. "Marabitanas," however, is not recognized as a linguistic entity today, nor did it exist at the time of Humboldt's visit to northwestern Amazonia (Loukotka, 1968; Tovar and Tovar, 1984; Victor Golla, pers. comm.). More likely, this was the name of a village that was mistaken for an ethnic identity (but see below). In Humboldt's time the Río Casiquare region was probably peopled by speakers of Baré, once the most widespread of Maipurean (or Arawak) languages, originally spoken from the Rio Branco to the upper Orinoco (Alexandra Aikhenvald, pers. comm; Victor Golla, pers. comm.) but now nearly extinct (Aikhenvald, 1995). In Baré, the term *kakáhau* (stressed on the second syllable) has been recorded to stand for the uacari (Alexandra Aikhenvald, pers. comm.). This name does not appear to "mean" anything in the descriptive sense, following the general pattern of North Amazonian languages, in which descriptive names for animals are generally rare (Alexandra Aikhenvald, pers. comm.). Auricchio and Grantsau (1995) believe *cacajao* is onomatopoeic for the uacaris' high-pitched "kah-kah" contact calls. This might have been the origin of the name in Baré, especially since elsewhere in the range of *Cacajao melanocephalus* the common name for the uacari is *bicó*, which almost certainly derives from their plosive "bee-koh!" alarm call (A. Barnett, pers. obs.). The native names of many primate species are often close mimics of their various calls (see Table 2 for Southeast Asian examples).

By the time of von Humboldt's visit, the Marabitanas did not exist as a people, apparently having been exterminated by intertribal warfare in the late 1760s (Robin Wright, unpubl. ms.). The word "Marabitanas" as recorded by Humboldt may have been a place name derived from the people's name or ethnic group (ethnonym) (Alexandra Aikhenvald, pers. comm.), or it may have come from the name of a Baré leader, as a number of prominent individuals seem to have used it. Little is known about the Marabitanas (Robin Wright, unpublished ms.), although one document (Missões Salesianas do Amazonas, 1933, p.25) reports that they were "aliados dos Arihini" or "allies of the Arihini," a subgroup of the Baré. (*Contra* Nimuendajú [1932], they were a cultural rather than a linguistic subgroup: see Aikhenvald [1995]). This reputed alliance implies that the two groups, Baré and Marabitanas, were linked by trade or by language (Wright, 1991; Ramirez, 1997).

While traveling in the region, Karl Martius (1863) recorded *kakayau* as the name used for *C. melanocephalus* in the area of the Braso Casiqiuare/upper Rio Negro. However, the word *kakáhau* does not fit the pronunciation patterns of Baré. Alexandra Aikhenvald (pers. comm.) notes: "I am quite confident that *kakáhau* in Baré is a loan. One reason is

Table 2. Examples of onomatopoeic local names for Asian primates. (Taxonomy follows Groves, 2001).

Local name and language	Latin and English names	Source
Wow-wow (Malay)	*Hylobates lar*	Pocock (1939)
Pio (Bhotia)	*Macaca assamensis pelops*	Pocock (1939), Prater (1965)
Kra (Malay)	*Macaca fascicularis*	Wood (1885), Finn (1929), Payne *et al.* (1985)
Sahu (Lepcha)	*Semnopithecus schistaceus*	Pocock (1939)[1], Brandon-Jones (1999)
Wanga (Marachi)	*Semnopithecus dussumieri*	Pocock (1939) [2], Brandon-Jones (1999)

[1]As *Semnopithecus entellus achilles.* [2]As *Semnopithecus entellus achates.*

that such long roots (three syllables) are atypical for the language. The other reason is that the sound "h" in Baré is very restricted. It is never found in the middle of a morpheme (for example, a root)." The shape and sound of the word also stand out as highly unusual in the language, especially the glottal fricative *h*, which is rarely found in that place in a word and in that juxtaposition to other sounds (see Aikhenvald, 1995).

There are two alternatives for the origin of this word in Baré. First, it may be a very recent loan; the source person for Aikhenvald's dictionary of Baré, the last fluent speaker of the language, was old and used a number of Spanish loan words, such as *playa* for "beach." So *kakáhau* may have entered his vocabulary *via* regional Spanish speakers. Alternatively, it may be a loan from much longer ago, reflecting the status of Baré-speaking people of the upper Rio Negro as comparatively recent arrivals in the Casiquiare/upper Rio Negro area (Derbyshire and Pullman, 1998). When they first entered the region, the Baré may have borrowed names from other tribal groups for the fauna that were new to them, as is often the case (see Pike, 1959; Hunn, 1997; Atran, 1990; Brown, 1984; Berlin, 1992; Cotton, 1996; Minnis, 2000 for other examples). One source of loan words may well have been the Marabitanas, and one of those loaned words may well have referred to a short-tailed primate with a singular vocalization. Before European contact, the upper Rio Negro probably had over a hundred distinct languages, an estimated 70% of which are now extinct (Ramirez, 1997; Aikhenvald and Dixon, 1999; Aikhenvald, pers. comm.). Given this ongoing cultural attrition, what we present there cannot be firmly proven. What appears clear, however, is that the word is not descriptive; it is merely reflective — an onomatopoeic derivative.

Uacari

This word (pronounced wah-KAR-ee) is now the accepted English common name for all monkeys in the genus *Cacajao*. It seems we owe this word to Spix, who wrote of the "ouakary" monkey in his *Simiarum et Vespertilionum Brasiliensium species novae* of 1823, noting it to be the local name where he collected his type specimen. Latinized to *Ouakaria*, this name was briefly used for the genus proper by Gray in 1849, after Lesson (1840) replaced it with *Cacajao*.

While Humboldt´s collection locality is quite precise (San Francisco Solano Mission, Rio Casiquiare, Venezuela), that of Spix is not. "Habitat in sylvis fluminibus Solimöens et Içа interjectis" (Spix, 1823, p.13), the only geographical reference in the original description of the species, does not provide a collection point. Therefore, although Spix acknowledges that "uacary" is a local name ("l´espéce de singe, á quelle le nome Ouakary est applicé par les habitans" [Spix, 1823, p.13]), the linguistic group from which this name originated cannot be determined. Spix's reference to the Rio Içá is a mystery in that the black-headed uacari he illustrates is not known to occur there (restricted to left bank of the Rio Japurá). It may be merely a reference to show the habitat type occupied (riparian forest), rather than an actual locality. The forests of the Rio Içá (the Brazilian stretch of the Río Putumayo) are occupied, at least on the right bank, by *Cacajao calvus rubicundus* (see Hershkovitz, 1987).

Acari is used for *C. m. ouakary* in Língua Geral, a trans-Amazonian trading language (Stradelli, 1929). Língua Geral is based on a creole version of Tupinambá, from the Tupí-Guaraní branch of the Tupí language family, from what is now Maranhão and Pará (Jensen, 1999; Alexandra Aikhenvald, pers. comm.). However, despite the widespread use of *acari* in Língua Geral to refer to uacaris (e.g., Tatevin, 1910; Stradelli, 1929), what the word actually *means* is unknown (Victor Golla, pers. comm.). It may be monomorphemic (i.e., like "cat," but unlike "green woodpecker," it does not *mean* anything *per se* [Denny Moore, pers. comm.]).

Thus, it seems that members of the pitheciine genus *Cacajao* owe both their common and scientific names to words deeply rooted in unrelated Amazonian languages, attached to specimens independently collected and named by two different 19th-century explorers working in widely separated areas of the Rio Negro basin.

Conclusion

So, we have an explanation for the provenance of the names and some understanding of their meanings in the original languages. But why were these strange, non-European names retained? Despite the uacari's obvious and unusual physical characters — such as their odd facial appearance and a tail one-third their body length (unique among Neotropical primates) — it would seem that no European common name for uacaris has ever been widely used. Given that the common name for *Chiropotes*, the bearded saki, helps distinguish it from the genus *Pithecia*, then "brush-tailed saki" or "bob-tailed saki" might be sensible alternatives to uacari; yet old wildlife encyclopedias (e.g., Broderip, 1857; Wood, 1885; Vogt and Specht, 1888; Miles, 1897; Boulenger, 1936) used no common name other than variants of the word *uacari*.

Common names will often describe a new taxon by combining two familiar animals, often unrelated, which seem to encompass elements of the new form — for example, shrew opossums (Caenolestidae), otter shrews (Potamogalidae), and kangaroo rats (*Dipodomys* spp.). But some animals resist all efforts to be described by amalgamation, and so we have common names such as aye-aye (*Daubentonia madagascariensis*), binturong (*Arctictis binturong*), cacomistle (*Bassaricus* spp.), goral (*Naemorhedus* spp.), kangaroo (*Macropus* spp.), kinkajou (*Potus flavus*), llama (*Lama glama*), okapi (*Okapia johnstoni*), peccary (*Tayassu pecari*), serow (*Capricornis* spp.), and tamaraw (*Bubalus mindorensis*). Likewise, a local name for *Cacajao* was adopted as the common name for want of any suitable European term. Such borrowing of words from existing native folk taxonomies in circumstances of zoological uncertainty must have been very common in the 18th and 19th centuries when new mammal species were being described in numbers never seen before or since.

(Baratay and Hardouin-Fugier [2002] note that only 10% of the mammal species known in 1993 were recognized in 1800; by 1890 that figure had risen to 50%.)

In effect, the formal adoption of a native name acknowledges that what has been named is so far outside the standard frame of reference that the entity defines itself; the local name emphasizes the exotic nature of the animal and becomes its own definition. This process is nicely demonstrated by the uncertainty over what to call the recently discovered Asian bovine *Pseudoryx nghetinhensis*. After several unsatisfactory (and less than euphonious) attempts — "Loatian Ox-Antelope," "Vu Quang Ox" — it was a regional name, "Sao La," that was finally adopted (see Nowak, 1999; Macdonald, 2001). For the third genus of pitheciines we must conclude that Europeans, unable to elaborate on a previous common name, defaulted to the local version, implicitly accepting the incomparability of these highly specialized primates. *Uacari* and *cacajao*, above all, seem to be a subliminal codex that conveys the meaning "strange".

Acknowledgments: I thank the following people for kindly sharing their knowledge and time: Alexandra Aikhenvald, La Trobe University, Australia (who was particularly helpful and generous with her time); Dan Everett, Manchester University; Victor Golla, Humboldt State University, USA; Gale Goodwin Gomez, Rhode Island College, USA; Al and Cheryl Jensen, Summer School of Linguistics; Denny Moore, University of Manchester, England; and Robin Wright, State University of Campinas, São Paulo, Brazil. I am also grateful to Marie Monaghan, Michael Palmer and Ann Sylph of the Zoological Society of London Library, Larry Currey and Laura Burkhart at the California Academy of Sciences General Library, and staff of the University of California Berkeley Life Sciences Library. Ann MacLarnon (University of Surrey Roehampton), Rebecca Shapley (Akodon Ecological Consulting), and Alexandra Aikhenvald commented on early drafts of this paper. The editorial comments of John M. Aguiar and Anthony Rylands considerably improved the original manuscript.

Adrian A. Barnett, Centre for Research in Evolutionary Anthropology, School of Life and Sport Sciences, Roehampton University, West Hill, London SW15 3SN, UK and Dept. of Anthropology, California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118, USA (Research Associate). E-mail: <Adrian@Akodon.com>.

References

Aikhenvald, A.1995. Baré. *Languages of the World.* Loncom Europa, Munich.

Aikhenvald, A. Y. and Dixon, R. M. W. 1999. Other small families and isolates. In: *The Amazonian Languages,* R. M. W. Dixon and A. Y. Aikhenvald (eds.), pp.341–384. Cambridge University Press, Cambridge.

Atran, S. 1990. *Cognitive Foundations of Natural History: Towards an Anthropology of Science.* Cambridge University Press, Cambridge.

Auricchio, P. and Grantsau, R. 1995. *Primatas do Brasil.* Terra Brasilis, São Paulo.

Baratay, E. and Hardouin-Fugier, E. 2002. *Zoo: A History of Zoological Gardens in the West.* Reaktion Books, Paris.

Barnett, A. A. and Brandon-Jones, D. 1997. The ecology, biogeography and conservation of the uacaris, *Cacajao* (Pitheciinae). *Folia Primatol.* 68: 223–235.

Berlin, B. 1992. *Ethnobiological Classification: Principles of Categorization of Plants and Animals in Traditional Societies.* Princeton University Press, Princeton, NJ.

Boubli, J. P. 1999. Feeding ecology of black-headed uacaris (*Cacajao melanocephalus melanocephalus*) in the Pico de Neblina National Park, Brazil. *Int. J. Primatol.* 20: 719–749.

Boulenger, E. G. 1936. *World Natural History.* B. T. Batsford, London.

Brandon-Jones, D. 1999. A systematic revision of the genus *Presbytis* Eschscholtz, 1821 (Mammalia: Cercopithecidae). Ph.D.dissertation, University of London, UK.

Broderip, W. J. 1857. *Zoological Recreations.* 3rd Edition. Ward, Lock and Tyler, London.

Brown, C. H. 1984. *Language and Living Things: Uniformities in Folk Classification and Naming.* Rutgers University Press, New Brunswick, NJ.

Brown, C. H. 1985. Mode of subsistence and folk biological taxonomy. *Current Anthropology* 26: 43–53.

Cormier, L. 2000. Cultural practices benefiting primate conservation among the Guajá of Eastern Amazonia. *Neotrop. Primates* 8: 144–146.

Cotton, C. M. 1996. *Ethnobotany: Principles and Applications.* John Wiley & Sons, Chichester.

Cunha, A. da and Barnett, A. 1989. *Project Uakari: First Report: The Preliminary Survey, Part One: Zoology.* Pronatura, Río de Janeiro, Brazil and WWF-Netherlands, Amsterdam.

Defler, T. R. 2003. *Primates de Colombia.* Conservacíon International Colombia, Santa Fe de Bogotá.

Defler, T. R. and Hernández-Camacho, J. I. 2002. The true identity and characteristics of *Simia albifrons* Humboldt, 1812: Description of neotype. *Neotrop. Primates* 10: 49–64.

Derbyshire, D. C. and Pullum, G. K. 1998. *Handbook of Amazonian Languages*, Vol. 4. Mouton de Gruyter, The Hague.

Dixon, R. M. W. and Aikhenvald, A. 1999. *The Amazonian Languages.* Cambridge University Press, Cambridge.

Finn, F. 1929. *Sterndale's Mammals of India.* Thacker, Spink & Co., Calcutta and Simla.

Geoffroy Saint-Hilaire, I. 1847. Note sur un singe américain appartenant au genre Brachyure. *Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, Paris, série D* 23: 576.

Geoffroy Saint-Hilaire, I. and Deville, E. 1848. Note sur un huit espècies nouvelles de singes américaine, faitent parties des collections de M. de Castelnau et Emile Deville. *Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, Paris, série D* 27: 497–499.

Gotch, A. F. 1979. *Mammals: Their Latin Names Explained.* Blandford Press, Poole, UK.

Groves, C. P. 2001. *Primate Taxonomy*. Smithsonian Institution Press, Washington, DC.

Hershkovitz, P. 1985. A preliminary taxonomic review of the South American bearded saki monkeys, genus *Chiropotes* (Cebidae, Platyrrhini), with a description of a new sub-species. *Fieldiana, Zool., n.s.*, 27: 1–23.

Hershkovitz, P. 1987. Uacaris. New World monkeys of the genus *Cacajao* (Cebidae, Platyrrhini): A preliminary taxonomic review with a description of a new sub-species. *Am. J. Primatol.* 12: 1–53.

Hill, C. A. 1965. Maintenance of facial colouration in the red uakari (*Cacajao rubicundus*). *Int. Zoo Yearb.* 5: 140–141.

Hill, W. C. O. 1960. *Primates: Comparative Anatomy and Taxonomy, Volume 4, Cebidae, Part A.* Edinburgh University Press, Edinburgh.

Humboldt, A., de. 1811-1812. *Recueil d'observations de zoologie et d'anatomie comparée, faites dans l'océan Atlantique et dans l'Intériour du nouveau continent et dans la Mer du Sud pendant les années 1799, 1800, 1801, 1802 et 1803.* Humboldt, A. de & Bonpland, A. (eds.). Levrault Schoell, Paris. 2 vols.

Hunn, E. S. 1997. *Tzelzal Folk Zoology: The Classification of the Discontinuities of Nature.* Academic Press, New York.

Jensen, C. 1999. Tupí-Guaraní. In: *The Amazonian Languages*, R. M. W. Dixon and A. Y. Aikhenvald (eds.), pp. 125–164. Cambridge University Press, Cambridge.

Koch-Gruenberg, T. 1911. Aruak-Sprachen Nordwest-brasiliens und der angrenzenden Gebiete. *Mitteilungen der anthropologischen Gesellschaft Wien* 41: 33–153, 203–282.

Lesson, R. P. 1840. *Species de Mammiferes Bimanes et Quadrimanes: Suivi d'un Memoire sur les Orycteropes.* J. B. Balliére, Paris.

Lizot, J. 2004. *Diccionario Enciclopédico de la Lengua Yãnomãmɨ*. El Vicariato Apostólico de Puerto Ayacucho, Ayachucho, Venezuela.

Loukotka, C. 1968. *Classification of South American Indian Languages.* Latin American Center, University of California, Los Angeles.

Macdonald, D. W. (ed.). 2001. *The New Encyclopedia of Mammals.* Oxford University Press, Oxford.

Martius, K. F. P. 1863. *Glossaria Linguarum Brasiliensium.* Munich.

Miles, A. H. (ed.). 1897. *Natural History.* The Concise Knowledge Library, Hutchinson & Co., London.

Minnis, P. E. (ed.). 2000. *Ethnobotany: A Reader.* University of Oklahoma Press, Norman, OK.

Missões Salesianas do Amazonas. 1933. *Pelo Rio Mar.* Missões Salesianas do Amazonas, Rio de Janeiro.

Morren Jr., G. E. B. 1989. Mammals of the east Myanman area, Telefomin district, Papua New Guinea, with notes on folk knowledge and taxonomy. *Science in New Guinea* 15: 119–135.

Mourão, J. da S. and Nordi, N. 2002. Comparison between folk and scientific taxonomy of the fish of the Mamanguape river estuary, Paraíba, Brazil. *Interciência* 27: 664–668.

Nimuendajú, C. 1932. Wortlisten aus Amazonien, *Journal de la Société des Américanistes de Paris*, n.s., 24: 93–119.

Nowak, R. M. 1999. *Walker's Mammals of the World.* 6th Edition. Johns Hopkins University Press, Baltimore. 2 vols.

Payne, J., Francis, C. M. and Phillips, K. 1985. *A Field Guide to the Mammals of Borneo.* The Sabah Society with World Wildlife Fund-Malaysia, Sabah.

Pike, E. V. 1959. A note on language borrowing in action. *Language* 35: 572–73.

Pocock, R. I. 1939. *The Fauna of British India, including Ceylon and Burma (ed. Lt.-Col. (ret'd.) R. B. S. Sewell), Mammalia, Vol. 1 – Primates and Carnivora (part), families Felidae and Viverridae.* Taylor & Francis, London.

Prater, S. H. 1965. *The Book of Indian Animals.* Bombay Natural History Society, Bombay.

Ramirez, H. 1997. *Afala Tucano dos Yep'â-Masa, Tomo II, Dicionário.* Inspetoria Salesiana Missionária da Amazônia, CEDEM.

Sousa e Silva Jr., J. de, and Martins, E. de S. 1999. On a new white bald uakari population in southwestern Brazilian Amazonia. *Neotrop. Primates* 7: 119–121.

Spix, J. B. von. 1823. *Simiarum et Vespertilionum Brasiliensium Species Novae: ou histoire naturelle des espèces nouvelles des singes et de chauve-souris observées et recueillies pendant le voyage dans l'intérieur du Brésil.* F. S. Hübschmann, Monaco.

Stradelli, E. 1929. *Vocabulario de Língua Geral, Portugues–Nheêngatu e Nheêngatu–Portugues.* Revista do Instituto Histórico-Geográfico. Libraria J. Leite, Rio de Janeiro.

Tatevin, P. C. 1910. *La Langue Tapîhîya dite Tupî ou Nheêngatu. Grammaire, Dictionnaire et Textes.* Kaizerliche Akademie der Wissenschaften, Vienna.

Tovar, A. and Tovar, C. L. de. 1984. *Catálogo de las Lenguas de América del Sur.* Editorial Gredos, Madrid.

Vogt, C. and Specht, F. 1888. *The Natural History of Animals, in Words and Pictures. Volume 1: Class Mammalia,* D. Appleton & Co., New York.

Wright, R. 1991. Indian slavery in the northeast Amazon. *Bol. Mus. Paraense Emílio Goeldi, ser. Antropologia* 7: 149–179.

Wood, J. G. 1885. *Animal Creation: A Natural History.* Selmar Hess, New York.

IN MEMORIAM: HARALD SIOLI 1910–2004

Professor Dr. Harald Sioli, founder of Amazonian Limnology and a major influential campaigner for the conservation of the region, died on Thursday, 14 October 2004, aged 94. He was the former Director of the Department of Tropical Ecology of the Max-Planck-Institute for Limnology, Plön. Most of his career was dedicated to research—medical, physiological, and, primarily, limnological—in Brazil. In 1954 he became head of the Department of Limnology of what was then the newly founded Instituto Nacional de Pesquisas da Amazônia (INPA) in Manaus. He returned to Germany in 1956 as Head of the Department and Director of the Hydrobiological Institute in Plön, later the Max-Planck Institute for Limnology (MPIL), which resulted in the long-term collaboration with INPA that continues today.

We owe to Harald Sioli the classification of the Amazonian rivers (black-, white-, and clearwater) and their inundation systems (*igapó* and *várzea),* and the entire basis of our understanding of much of Amazonian ecology and limnology. With his explanations (his warnings) that the deforestation of the Amazon would lead to a major increase in atmospheric carbon, it was Harald Sioli who, unwittingly, gave rise to the widely cited myth of the Amazon as “the lungs of the planet.”

Two issues of *Amazoniana* were dedicated to Prof. Sioli on the occasion of his 90th birthday—Volume 16(3/4) and Volume 17(1/2). In the first of these, Dr Wolfgang Junk (2001) wrote an appraisal of Sioli’s scientific work and published his curriculum vitae, including a full listing of his scientific publications. Pages 169-172 of Volume 18(1/2) of *Amazoniana* provided a series of short memoirs and comments from numerous world-renowned scientists, friends, and colleagues, including such as Sir Ghillean Prance, Dr Jürgen Haffer, Dr Eneas Salati, Dr Herbert Schubart, Prof. Ernesto Medina, Prof. Nigel Smith, Prof. Loki Schmidt, Dr William Rodrigues, and Dr Jorge Arias. Wolfgang Junk, Director of the Working Group for Tropical Ecology of the MPIL, wrote “During his active working period and also thereafter, Professor Sioli exerted a strong influence on the development of tropical ecology at an international level and created an everlasting monument—his pioneering scientific work about Amazonia” (in litt., 18 October 2004).

References

Junk, W. J. 2001. Appraisal of the scientific work of Harald Sioli. *Amazoniana* 16(3/4); 285–297. [Includes a curriculum vitae (pp.287–290) and a list of scientific publications (pp.290–297)].

Schaller, F. 2004. Nachruf/Obituary. Prof. Dr. Harald Felix Ludwig Sioli (1910-2004). *Amazoniana* 18(1/2): 163–168.

NEWS

PRESENT AND PAST PRIMATE COMMUNITY OF THE TIJUCA FOREST, RIO DE JANEIRO, BRAZIL

The Tijuca forest in the municipality of Rio de Janeiro has a long history of disturbance and modification from human activities. It harbored a large indigenous population until the 16th century when, following European colonization, forests throughout the Atlantic coast of Brazil were intensively logged for brazilwood (*Caesalpinia echinata*). Highly valued for its red/purplish dye and its wood, brazilwood became commercially extinct in the Atlantic forest, including Rio de Janeiro. Changes in the landscape of Tijuca were, however, more drastic still in the 18th century, with the destruction of most of its forest for coffee plantations.

In the middle of the 19th century the rivers feeding the city of Rio de Janeiro were drying up, and the Emperor Dom Pedro II, recognizing the link with deforestation in the upper reaches and headwaters of the rivers, ordered that the forest be restored. Both exotic and native trees were used, along with a very large number of slaves to plant them (Dean, 1996). In the first decades of the 20th century, numerous non-native animals were introduced, including primates. The restored forest of Tijuca was made into a national park of 3,466 ha in 1961, and today is one of the largest urban national parks in the world. The forest is now well-established, although it lacks many of the species that originally occurred there (see Coimbra-Filho and Aldrighi, 1971; Coimbra-Filho, 2000).

The original primate community of these forests would predictably have included the southern muriqui (*Brachyteles arachnoides*), the howler monkey (*Alouatta guariba*), the black-horned capuchin monkey (*Cebus nigritus*), the buffy-tufted-ear marmoset (*Callithrix aurita*) and, in lower elevations, the golden lion tamarin (*Leontopithecus rosalia*) (Aguirre, 1971; Coimbra-Filho and Aldrighi, 1971; Coimbra-Filho *et al*., 1973; Rylands *et al*., 1993). Neither the black-fronted titi (*Callicebus nigrifrons*) nor the northern masked titi (*Callicebus personatus*) have been recorded, and it is not known whether they were ever present there (see Cunha, 2003).

None of these species can be found in the Tijuca forest today. Introduced common marmosets (*Callithrix jacchus*) from northeast Brazil and what we believe are hybrid capuchin monkeys (*Cebus*) are the most abundant primates (Cunha, 2005). Marmosets and capuchin monkeys are both highly favored as pets, and over the centuries many of them have undoubtedly been let free or escaped. The capuchins we have seen are very variable in pelage coloration and in the form of their tufts and are certainly not pure-breeding *Cebus nigritus*, but a mixture of different species, likely *C. nigritus*, *C. libidinosus*, and *C. robustus* (José de Sousa e Silva Jr., pers. comm.). The Amazonian squirrel monkey (*Saimiri*), and the black-tufted-ear marmoset (*Callithrix penicillata*) from Central Brazil are also reported to occur in Tijuca, but are evidently scarce as they were not seen during my fieldwork in 2004. A single capuchin monkey was observed together with a group of *Callithrix jacchus*.

The abundance of common marmosets and the hybrid capuchins is, we believe, related to the abundance of certain food resources, some of them non-native such as the jackfruit (*Artocarpus heterophyllus*), particularly appreciated by the capuchin monkeys (Cunha, 2005). Both marmosets and capuchin monkeys adapt well to urban conditions, entering backyards, gardens, and houses around the park to find food. Since 1970, the zoologist and conservationist Adelmar F. Coimbra-Filho has warned of the potential negative effects of these overabundant, non-native monkeys on other species, specifically on bird populations, nestlings, and eggs preyed upon by both *Cebus* and *Callithrix jacchus* (Coimbra-Filho and Aldrighi, 1971). *C. jacchus* also present a potential threat to human health, harboring a variant of the rabies virus (Morais *et al.*, 2000) that has killed at least eight people in the northeastern state of Ceará (Favoretto *et al.*, 2001). It is also a host for the Chagas' disease parasite (*Trypanosoma cruzi*) and with marmosets now spreading throughout the state, a potential source of infection for *Leontopithecus rosalia,* surviving now only in the north (Morais Jr., 2005).

Acknowledgments: This study was part of the MSc. thesis of the first author. Carlos E. Grelle, Rui Cerqueira, and Anthony B. Rylands made helpful comments on an earlier version of this manuscript. The Brazilian Higher Education Authority (CAPES) and Inter-American Development Bank/ Programa de Despoluição da Baía de Guanabara/Fundacão Estadual de Engenharia do Meio Ambiente/Instituto Terra de Preservação Ambiental provided financial support.

André Almeida Cunha and **Marcus Vinícius Vieira**, Programa de Pós-Graduação em Ecologia and Laboratório de Vertebrados, Departamento de Ecologia, Universidade Federal do Rio de Janeiro, Caixa Postal 68020, Rio de Janeiro 21941-590, RJ, Brazil, e-mail: <cunha@biologia.ufrj.br>, <cunha.andre@gmail.com>.

References

Aguirre, A. C. 1971. *O mono* Brachyteles arachnoides *(E. Geoffroy). Situação atual da espécie no Brasil.* Academia Brasileira de Ciências, Rio de Janeiro.

Coimbra-Filho, A. F. 2000. Reintrodução do tucano-de-bico-preto (*Ramphastos vitellinus ariel* Vigors, 1826) no Parque Nacional da Tijuca (Rio de Janeiro-RJ) e notas sobre sua distribuição geográfica. *Bol. Mus. Biol. Mello Leitão (n. série)* 11/12: 189–200.

Coimbra-Filho, A. F. and Aldrighi, A. D. 1971. A restauração da fauna do Parque Nacional da Tijuca, GB, Brasil. *Publ. Avuls. Mus. Nac.* 57: 1–30.

Coimbra-Filho, A. F., Aldrighi, A. D. and Martins, H. F. 1973. Nova contribuição ao restabelecimento da fauna do Parque Nacional da Tijuca, GB, Brasil. *Brasil Florestal* 4: 7–25.

Cunha, A. A. 2003. Primates in the Serra dos Órgãos National Park: New records. *Neotrop. Primates* 11(1): 49–51.

Cunha, A. A. 2005. Estratificação vertical, abundância e tamanho populacional do macaco-prego (*Cebus* sp.) e do mico-estrela (*Callithrix jacchus*) no Maciço da Tijuca, Rio de Janeiro, RJ, Brazil. MSc. thesis, Universidade Federal do Rio de Janeiro, Rio de Janeiro.

Dean, W. 1996. *A Ferro e Fogo: A História e a Devastação da Mata Atlântica Brasileira.* Cia. das Letras, São Paulo.

Favoretto, S. R., Mattos, C. C. de, Morais, N. B., Araújo, F. A. A. and Mattos, C. A. de. 2001. Rabies in marmosets (*Callithrix jacchus*), Ceará, Brazil. *Emerging Infectious Disease* 7: 1–7.

Morais Jr., M. M. 2005. Saguis do gênero *Callithrix*: Espécies invasoras no norte do estado do Rio de Janeiro. In: *Programa e Livro de Resumos. XI Congresso Brasileiro de Primatologia*, p.57. Pontifícia Universidade Catolíca do Brasil, Porto Alegre, RS, 13–18 February, 2005.

Morais, N. B., Rodin, B. N., Chaves, H. H. M., Neto, J. B. de and Silva, L. M. da. 2000. Rabies in tamarins (*Callithrix jacchus*) in the state of Ceará, Brazil, a distinct viral variant? *Mem. Inst. Oswaldo Cruz* 95: 609–610.

Rylands, A. B., Coimbra-Filho, A. F. and Mittermeier, R. A. 1993. Systematics, geographic distribution, and some notes on the conservation status of the Callitrichidae. In: *Marmosets and Tamarins: Systematics, Behaviour, and Ecology*, A. B. Rylands (ed.), pp.95–120. Oxford Science Publications, Oxford.

CONSERVATION CATEGORIES OF PERUVIAN PRIMATES – CATEGORIAS DE CONSERVACIÓN DE LOS PRIMATES PERUANOS

The Peruvian government published the Supreme Decree No. 34-2004-AG in the official journal *El Peruano* on 22 September 2004. This decree approves the categorization of threatened Peruvian wildlife and at the same time prohibits its hunting, capturing, owning, transporting, and exportation for commercial purposes. An appendix to the decree lists 301 vertebrate species in different IUCN categories. The decree will hopefully represent an important tool to implement conservation action for, and stimulate research on, threatened Peruvian wildlife. Table 1 lists the primate species included in this appendix.

El 22 setiembre 2004, el gobierno peruano publicó en el diario official "El Peruano" el Decreto Supremo no. 34-2004-AG, que aprueba la categorización de especies amenazadas de fauna silvestre y al mismo momento prohibe su caza, captura, tenencia, transporte y exportación con fines comerciales. El decreto lleva un anexo, en la cual están listadas 301 especies de vertebrados en diferentes categorias de la UICN. Este decreto representa un instrumento importante para implementar acciones de conservación y al mismo momento estimular investigaciones científicas en las

Table 1. Categorization of Peruvian primate species.
Cuadro 1. Categorización de especies de primates del Perú.

CR – Critically endangered/En peligro crítico		
No primates listed – no incluye especies de primates		
EN – Endangered/En peligro		
Alouatta palliata	Mantled howler monkey	Mono coto de Tumbes
Aotus miconax	Andean night monkey	Mono nocturno, musmuqui
Ateles belzebuth	White-bellied spider monkey	Maquisapa vientre blanco, mono araña
Oreonax flavicauda	Yellow-tailed woolly monkey	Mono choro de cola amarilla
Saguinus labiatus	Red-bellied tamarin	Pichico de barriga anaranjada Pichico pecho anaranjado
VU – Vulnerable/Vulnerable		
Ateles chamek	Black spider monkey	Maquisapa
Cacajao calvus	Red uakari	Huapo colorado, huapo rojo
Callicebus oenanthe	Andean titi monkey	Tocón, tití
Callicebus torquatus	Collared titi monkey Yellow-handed titi monkey	Tocón de collar, tocón negro
Callimico goeldii	Goeldi's monkey	Pichico de Goeldi, supay pichico
Lagothrix cana	Geoffroy's woolly monkey	Mono choro
Lagothrix lagotricha	Humboldt's woolly monkey	Mono choro
NT – Near Threatened/Casi amenazado		
Alouatta seniculus	Red howler monkey	Mono coto
Lagothrix poeppigii	Poeppig's woolly monkey	Mono choro

especies amenazadas. Cuadro 1 presenta las especies de primates incluidas en este anexo según las categorías.

Eckhard W. Heymann, Abteilung Verhaltensökologie & Soziobiologie, Deutsches Primatenzentrum, Kellnerweg 4, D-37077 Göttingen, Germany, e-mail: <eheyman@gwdg.de>.

Reference / Referencia

El Peruano, Lima, 22 de setiembre de 2004, pp.276853–276855.

Seed Dispersal and Red Howlers in Forest Fragments

In September 2004, Marcela Santamaria Gómez of the Wildlife Research Group, Department of Anatomy, University of Cambridge, UK, defended her doctoral thesis, supervised by David J. Chivers and titled, "The effect of home range reduction on the ecology of red howler monkeys in Central Amazonia." It was supported by the Biological Dynamics of Forest Fragments Project (Smithsonian Institution and Instituto Nacional de Pesquisas da Amazônia), the Fundação O Boticário para a Proteção da Natureza, Apiros, British Federation for University Women (BFUW), Instituto de Pesquisa Ambiental da Amazônia (IPAM), the University of Cambridge, Selwyn College, the Department of Anatomy, the American Society of Primatologists, and Idea Wild. The following is a summary of the thesis.

The loss of effective seed dispersers in forest remnants has been stated to disrupt dispersal services that alter the dynamics of tropical forests. Howler monkeys are efficient seed dispersers that prove to be exceptionally tolerant to habitat fragmentation by surviving in very small forest fragments. In this context, the effect of home range reduction caused by habitat fragmentation on the feeding ecology of red howler monkeys (*Alouatta seniculus*) and on their subsequent role as primary seed dispersers in Central Amazonia is examined.

The study was carried out at the Biological Dynamics of Forest Fragments Project (BDFFP) near Manaus, Brazil. Two howler groups living in fragments of 2.5 ha and 12 ha (Groups 1 and 2, respectively) were habituated during a four-month period. Systematic data on the diet, activity budgets, and use of space were collected for each group on a monthly basis between January 2002 and January 2003. Comparisons on seed dispersal were also made from faecal analysis between the two fragments (Co 2.5 ha and Co 12 ha) and continuous forest (Km41).

At the three study sites, a strong seasonality in plant-part production was recorded within the howlers' home ranges, dividing the year into three seasons: fruiting (January–May), leafing (June–September) and flowering (October–December), but low fruit availability was found within the small fragment. Both groups were frugi-folivorous, with drastic seasonal variations based on plant-part availability. Group 1 responded to low fruit supply by eating more flowers and by repeatedly crossing a secondary-vegetation gap (50 m) to obtain fruit from an adjacent continuous forest. Forest fragmentation drastically reduced the howlers' home range from about 20 ha in Km41 to 7.2 ha and 2.5 ha in the fragments (63% and 88% reduction, respectively).

Home range was composed of 60% edge habitat for Group 1 and only 26% for Group 2. A more drastic reduction in the home range of Group 1 resulted in a net decline in food plants, which affected decisions of time allocation in this group: howlers living in the small fragment rested more and fed less throughout the study. Group 1 seemed to live in a more demanding environment and was presumably at its limits of flexibility, whereas Group 2 was well adjusted to a less disturbed habitat.

Although the reduction of the howlers' home range decreased the number of seeds and plant species dispersed, howlers were effective seed dispersers for most of the species they consumed at the three study sites. In fragments, up to 77% of small to large seeds of fruits exploited by Groups 1 and 2 were dispersed by endozoochory; passing through the howlers' digestive systems—lasting about 20 hours—had a positive or neutral effect on germination success. Despite the fact that Group 1 deposited seeds at shorter distances from fruit sources than Group 2, up to 93% of seeds were moved away from the parental crown by both groups.

Although howlers are generally regarded as less effective dispersers because they produce large faecal clumps with seed aggregation, this is not always the case. Five main aspects of deposition patterns emerged from this study, which indicated that the view of categorizing a species as a good or bad disperser is misguided.

1) Howlers defaecated mainly in synchrony (*c.* 80%), but also separately (20%).
2) In both defaecation types, howlers dispersed seeds in latrines and random sites in the forest, but more often in the former (up to 66%).
3) Seed deposition was spatially clumped; this patchiness was associated not only with sleeping areas, but also with latrines located outside them.
4) In latrines, howlers deposited more seeds of more species than in random sites, but at both fragments seed densities were similar between defaecation sites.
5) The fate of seeds delivered in howlers' multispecies seed depositions varied greatly according to seed species at all sites and to seed density at Km41. Nonetheless, after nearly one year 51% of the seedlings had survived in Km41, 50% in Co 12 ha, and 23% in Co 2.5 ha.

In conclusion, howlers living in small and medium fragments are contributing to the maintenance of regeneration processes through seed dispersal; consequently, the species is a key element to consider in management and restoration programmes of fragmented landscapes.

Marcela Santamaria Gómez, Wildlife Research Group, Department of Anatomy, Downing Street, Cambridge CB2 3DY, UK, e-mail: <marcesanta10@hotmail.com>.

Reference

Gómez, M. S. 2004. The effect of home range reduction on the ecology of red howler monkeys in Central Amazonia. PhD thesis, Wildlife Research Group, Department of Anatomy, University of Cambridge, UK.

2004 RED LIST LAUNCH

On 17 November 2004, at the opening of the third IUCN World Conservation Congress, the *2004 IUCN Red List of Threatened Species* was launched alongside the Global Species Assessment: a detailed analysis of the Red List data and the first major assessment of the status of global biodiversity. The *2004 Red List* is now available on the Red List website, <http://www.iucnredlist.org>, as well as on the mirror sites <http://www.redlist.org> and <http://www.redlist.net>.

This year's version includes a new search feature. It is now possible to search for species by their most recent assessment date. If you are looking for a complete list of assessments on the Red List (including a complete list within a particular country or region), you should select "All" from the "Red List Assessment Years" list box on the search page. If you are looking for a list of species reassessed or added to the list in a particular year, you should select that year from the list box (e.g., for a list of species reassessed or added to the list this year, select "2004" from the list box).

We have also added an Acknowledgements page this year to recognize and thank all the contributors to the list. Without the enthusiasm, generosity, patience, and hard work of all of our volunteer contributors, the production of the Red List would not be possible.

Caroline Pollock, Research Assistant, IUCN/SSC Red List Programme, 219c Huntingdon Road, Cambridge CB3 0DL, UK, e-mail <caroline.pollock@ssc-uk.org>.

CONSERVATION OF THE ATLANTIC FOREST IN SÃO PAULO – A ROLEX AWARD FOR LAURY CULLEN JR.

Laury Cullen Jr., Research Coordinator at Instituto de Pesquisas Ecológicas (IPÊ) based in Nazaré Paulista, São Paulo, is a recipient of The Rolex Awards for Enterprise, sponsored by Rolex S.A. The award was announced in Paris on 29 September 2004. A key aspect of Cullen's receiving this award was his project "Transforming Farmers into Conservationists to Preserve the Atlantic Forest and its Fauna." Over the last nine years, Cullen has focused on protecting the remaining forest fragments in the west of the state of São Paulo, working with small farmers and landowners and demonstrating techniques and systems in agroforestry that promote the recovery of degraded soils as well as the preservation and recovery of forest fragments and their fauna. He is currently planning to increase the number and extent of forest corridors in the region, while simultaneously helping to promote the economic wellbeing of at least 400 farmers. IPÊ was founded in 1992 specifically to protect the black lion tamarin, *Leontopithecus chrysopygus*, one of the many species that will benefit directly from the forest restoration resulting from Cullen's project. Cullen is currently conducting research for his doctoral thesis at the Durrell Institute for Conservation and Ecology (DICE) of the University of Kent, UK. The deadline to register for "The Rolex Awards for Enterprise 2006" is 31 May 2005. Websites: <http://www.rolexawards.com>, <http://www.ipe.org.br>.

Biodiversidade Ganha Rede

No dia 05 de outubro de 2004, foi lançada oficialmente a rede '*species*Link' criada pelo Centro de Referência em Informação Ambiental (Cria), Estado do São Paulo, Diretor Presidente Vanderlei Perez Canhos. Integrada ao Sistema de Informação Ambiental do Programa Biota/FAPESP (SinBiota), a rede, que deverá permitir a integração dinâmica de dados sobre a biodiversidade paulista, começa além das fronteiras do Estado: a coleção do Jardim Botânico do Rio de Janeiro já está integrada ao sistema.

O sistema permite a integração de diferentes grupos taxonômicos por meio de bancos de dados distribuídos e protocolos de comunicação. Com isso, será possível ligar, no futuro, as coleções biológicas a outras redes de informação do país e do exterior, por meio de "software" livres. A nova estrutura envolve registros de microrganismos, ácaros, insetos, répteis, mamíferos, peixes e tipos de madeira. A rede compartilhará informações de coleções das três universidades paulistas e de nove institutos de pesquisa, além do Jardim Botânico fluminense. O *species*Link deverá ser utilizado como embrião para o desenvolvimento de uma rede brasileira de coleções científicas.

"Com o objetivo de acomodar a biodiversidade tanto sob o ponto de vista geográfico como taxonômico, a expectativa é que o sistema tenha 750 mil registros até 2006", prevê Canhos. A idéia é que esses aplicativos possam ajudar na resolução de problemas como proteção de espécies ameaçadas, mudanças climáticas e planejamento de áreas de conservação.

"Com o avanço das ferramentas de análise, síntese e visualização dos dados, as coleções que ficarem de fora de uma plataforma como o *species*Link tenderão a ficar menos competitivas e menos visíveis para a comunidade científica", disse Canhos.

O mecanismo físico que viabiliza o novo sistema foi estruturado a partir de servidores que permitem a integração de informações por meio da Rede ANSP (Academic Network at São Paulo), a conexão de internet avançada do Estado de São Paulo e também um programa da FAPESP. Mais informações: <http://splink.cria.org.br>.

Fonte: Thiago Romero, Agência de Notícias da Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), 06 de outubro de 2004. Sítio de internet: <http://www.agencia.fapesp.br>.

Field Course in Primate Behavior, Ecology, and Conservation, Department of Pando, Bolivia

Ten students and professors from Bolivia and Peru participated in a field course on primates held in the Department of Pando, Bolivia, during August 2004. Leila Porter (University of Washington) gave lectures on primate behavior, ecology, and conservation at the Universidad Amazonica de Pando (UAP) in the city of Cobija, and students conducted field projects at the UAP's newly established Tahuamanu Biological Field Station. Claudia Coca Mendez, of the Center for the Investigation and Preservation of the Amazon (CIPA), UAP, served as the course coordinator. The goal of the course was to introduce students to concepts concerning primate research and conservation, and to provide participants with the opportunity to conduct research on wild primate groups.

The participants were presented with one week of intensive lectures in Cobija. These courses provided an overview of primate taxonomy, behavioral ecology, the role of primates in their ecosystems, concepts of primate conservation biology, and conservation management strategies. Following these lectures, participants developed team research proposals that they presented to each other for peer review. After due revision, students and professors traveled to the field station to start their research projects. At the field station, local guides helped the teams to complete four projects: 1) a census of primate species' densities at the site; 2) an estimation of niche overlap between *Saguinus fuscicollis* and *S. labiatus*; 3) an examination of the diet of *S. labiatus*; and 4) a study of social behavior in juvenile *S. fuscicollis*. In addition to their research projects, participants were given lessons on how to capture callitrichines using blinds and traps and how to collect fruit phenology data. Following completion of field research, students returned to Cobija to analyze their data, prepare a final report, and present their results to other professors and students from the UAP.

The Field Station is home to 11 species of primates, and a number of primate groups (of four species) have been habituated for field studies. The station therefore serves as an excellent location for teaching about primate behavior and ecology. In addition to learning about concepts related to primate behavior, ecology, and conservation, students became familiar with methods for primate research and developed important contacts across Bolivia and Peru. Due to the success of this first Pandino primate field course, more courses are anticipated for the future.

Special thanks to the Primate Action Fund (Conservation International – Margot Marsh Biodiversity Foundation) for financial support for the course.

Leila Porter, Department of Anthropology, University of Washington, Seattle, WA 98195-3100, USA, e-mail: <lporter@u.washington.edu>.

SECOND EUROPEAN STUDBOOK FOR THE RED TITI (*CALLICEBUS CUPREUS*)

The first studbook for the European zoo collection of *Callicebus cupreus* was produced in 2003, with data current up to 31 December 2002 (Webster, 2004). Darren Webster, of Blackpool Zoo, UK, has produced a second studbook covering another year of births, deaths, and movements current through 31 December 2003. These studbooks were produced due to the large number of individuals taken in by European zoos from the California Regional Primate Research Center, Davis, during the years 2000–2002.

The red titi has a wide range on the upper Amazon, reported to be restricted to the east of the Río Ucayali in Peru to the south of the Rio Amazonas-Solimões in Peru and Brazil, extending east as far the Rio Purus in Brazil (Hershkovitz, 1990; Van Roosmalen *et al.*, 2002). Although quite variable in pelage patterns, its key distinguishing features include the lack of a frontal white blaze across the forehead, reddish-brown cheeks and sideburns, reddish-brown forearms and forelegs and an overall buff-brown agouti crown, back, upper arms, thighs, and tail. The tail can be overall similar to the back (dark brownish) or very much paler to varying extents from the tip to its proximal portion. Andrew Kitchener, Curator of Mammals and Birds of the National Museums of Scotland in Edinburgh, discusses this variability in a short essay in the studbook, "Understanding morphological variation in the red titi, *Callicebus cupreus*" (pp.24-25) and provides a protocol and recommendations for cosmetic postmortems (pp.26-27), requesting that carcasses be submitted to him for registration and preservation.

In 2003, the programme for the red titi monkey was upgraded from a European Studbook (ESB) to a full-blown European Endangered Species Programme (EEP) by the European Association of Zoos and Aquaria (EAZA). The living population registered in the studbook on 31 December 2003 was 36 (18.17.1) in eight institutions. Six individuals (2.4.0) in two institutions were not imported from Davis, are of unknown origin, and are not included in the breeding population. Two institutions (the Edinburgh Zoo and the Skansan Akvarium, Sweden) joined the breeding programme. All collections in a breeding situation produced young in 2002 and 2003. There were seven births (3.2.2) in 2003 with five (3.1.1) surviving. Two adults died and a third individual was transferred to a private breeder and is no longer part of the breeding program. Overall growth for the breeding population was, therefore, two.

The studbook also includes information on the inbreeding coefficient, age pyramid and births, deaths and transfers, and full historical listing. There are contact details for diploid chromosome sampling and a list of *Callicebus* karyotypes (adapted from Hershkovitz, 1990). The eight institutions collaborating in the EEP are Apenheul Nature Park, The Netherlands (0.2.0); Basel Zoo, Switzerland (2.0.0); Berlin, Germany (2.3.0); Blackpool Zoo, Great Britain (5.4.0); Bristol Zoo, Great Britain (1.1.1); Edinburgh Zoo, Great Britain (2.1.0); La Vallée des Singes, Romagne, France (3.5.0); and Skansan Akvarium, Sweden (3.1.0).

Darren Webster, Blackpool Zoo, East Park Drive, Blackpool FY3 8PP, England, UK, e-mail: <darren.webster@blackpoolzoo.org.uk>, and **Andrew Kitchener**, Curator of Mammals and Birds, National Museums of Scotland, Chambers Street, Edinburgh EH1 1JF, Scotland, UK.

References

Hershkovitz, P. 1990. Titis, New World monkeys of the genus *Callicebus* (Cebidae, Platyrrhini): A preliminary taxonomic review. *Fieldiana Zoology, New Series*, (55): 1–109.

Van Roosmalen, M. G. M., Van Roosmalen, T. and Mittermeier, R. A. 2002. A taxonomic description of the titi monkeys, genus *Callicebus* Thomas, 1903, with the description of two new species, *Callicebus bernhardi* and *Callicebus stephennashi*, from Brazilian Amazonia. *Neotrop. Primates* 10(Suppl.): 1–52.

Webster, D. (compiler). 2003. *European Studbook for Red Titi Monkeys (*Callicebus cupreus*).* No 1. Blackpool Zoo Park, Blackpool, UK. 32pp. Data current to 31/12/2002.

Webster, D. 2004a. A European studbook for the red titi (*Callicebus cupreus*). *Neotrop. Primates* 12(1): 38.

Webster, D. (compiler). 2004b. *European Studbook for Red Titi Monkeys (*Callicebus cupreus*).* No 2. Blackpool Zoo, Blackpool, UK. 27pp. Data current to 31/12/2003.

WAZA PRESENTS HEINI HEDIGER AWARD TO SALLY WALKER

On 4 November 2004, Sally Walker received the Heini Hediger Award from Ed McAlister, President of the World Association of Zoos and Aquariums (WAZA). Sally Walker is Coordinator for South Asia for the IUCN/SSC Primate Specialist Group. The following paragraphs are from McAlister's comments describing her life and conservation achievements.

Sally Walker was born in the United States of America. She first travelled to India in the early 1970s as a scholar of Sanskrit, the ancient and sacred language of the Hindus. A heightened awareness of Asian cultures encouraged Sally to become a student of Yoga. This deep cultural immersion also awakened a profound interest in the concept of a "wholeness of nature," increasingly expressed in a concern for the welfare and conservation of the threatened wildlife in India. Sally's first practical commitment to this concern was as a volunteer at Mysore Zoo, where in 1981 she established the Friends of Mysore Zoo Society — an educational, public relations, and scientific support group, the first of its kind in Asia. So began a life-long dedication to Indian, and subsequently, all Asian Zoos and a firm commitment to develop, through education and science, their role and mission in conservation.

Walker's early success resulted in an appointment to the National Zoo Advisory Board of the Department of Environment, Government of India. Government officials encouraged Sally to set up the Zoo Outreach Organisation (ZOO) in 1985. Although based in India, the organisation now extends throughout South Asia, including the nations of Bangladesh, Bhutan, Nepal, Maldive Islands, Pakistan, Sri Lanka, and Afghanistan. This is a region that contains a tremendous amount of biodiversity but is bedevilled by problems such as language differences, political differences, economic, cultural, and social differences, not to mention ongoing conflict. We are all aware of the recent devastation wrought in Afghanistan. The Zoo Outreach Organisation, with Sally's guidance and support, has successfully tackled these problems.

Working both for zoo and field conservation, the zoo organization has become a model for successfully building networks to facilitate or catalyse conservation action. It brings together stakeholders, e.g., scientists, other specialists, and laypeople, to form a consensus on a variety of conservation issues. Two monthly publications, ZOOS' PRINT and ZOO ZEN, founded and edited by Walker, carry the work of the organization far beyond South Asia. A number of other publications have emanated from this organization, one of the most recent being the excellent "Mammals of Afghanistan."

Walker's other work has included lobbying initiatives, provision of educational material, and the development of scientific training programs. In particular, as Convenor of the IUCN/SSC Conservation Breeding Specialist Group – India, she has been instrumental in establishing the now-celebrated CBSG Regional Networks. Walker's early work with zoos led to a six-year membership on the Central Zoo Authority, an autonomous body of the Ministry of Environment, Government of India, and membership on Ministerial committees – rare and unusual honours indeed for those born outside India.

An expert in seeking support for her many initiatives; Walker has become an institution within the Zoo profession, and has demonstrated an extraordinary capacity for achieving successful outcomes, often from extremely limited resources.

Walker is a dedicated conservationist and has achieved a great deal, not only in the region in which she had decided to live and work but all around the world. She is an inspiration to all of us, and I have great pleasure, on behalf of the WAZA Council and you, its members, on handing over the Heini Hediger Award to her today.

Ed McAlister, President, World Association of Zoos and Aquariums, P.O. Box 23, CH-3097, Liebefeld-Bern, Switzerland.

CONTACT ZONES AND THEIR IMPORTANCE FOR SCIENTIFIC PRIMATOLOGY AND THE PRESERVATION OF PRIMATE BIODIVERSITY

We have initiated a project in a contact zone between two species of *Alouatta* in Brazil. Contact zones in this genus have been highlighted in the literature since the early 1970s. We would like to establish a database of research projects focusing on scientific questions related to contact zones, broadly defined including sympatric zones. Although we are particularly interested in contact zones in the Neotropics, other geographical regions are also of interest (for example, the zones of contact among baboon species and subspecies). These studies are of particular importance to primatologists studying behavioral mechanisms of reproductive isolation (vocalizations and others such as reinforcement) as well as the preservation of primate biodiversity due to increasing fragmentation of habitats and other anthropogenic perturbations.

We conducted a search of "speciation" on PrimateLit, which yielded only 123 citations. Most of these references pertained to Paleotropical species and only one paper mentioned bioacoustic character displacement (without any data). Studies such as the one we propose have been conducted with insects, anurans, fish, and birds (see, for example, Loftus-Hills and Littlejohn, 1992; also see Johnstone, 1997), which could provide helpful templates for primate research on these topics. The environmental (abiotic and biotic) changes experienced by numerous taxa provide natural experiments for changes in signaling systems, species integrity, and other important topics for long-term projects involving multidisciplinary input (for example, identification of hybrids with genotyping).

We solicit your interest on these and related topics, including registry of any contact zones of which you may be aware or where you are currently focusing your studies. Please contact one or both of us at the addresses below (preferably via e-mail).

Clara B. Jones, Department of Psychology, Fayetteville State University, 1200 Murchison Road, Fayetteville, NC 28301, USA, Tel: 910-672-1575, e-mail: <cbjones@uncfsu.edu>; <theoreticalprimatology@hotmail.com>. Webpage: <http://clara.jones.socialpsychology.org>. Theoretical Primatology Project (TPP) Website: <www.robertwilliams.org/tpp>.

Júlio César Bicca-Marques, Faculdade de Biociencias/ PUCRS, Av. Ipiranga, 6681 Pd. 12A, Porto Alegre 90619-900, Rio Grande do Sul, Brazil, Tel: +55 (51) 3320-3545, ext. 4742, e-mail:<jcbicca@pucrs.br>.

References

Johnstone, R. A. 1997. The evolution of animal signals. In: *Behavioral Ecology: An Evolutionary Approach*, J. R. Krebs and N. B. Davies (eds.), pp.155–178. Blackwell Science, Oxford, UK.

Loftus-Hills, J. J. and Littlejohn, M. J. 1992. Reinforcement and reproductive character displacement in *Gastrophryne carolinensis* and *G. olivacea* (Anura: Microphylidae): A reexamination. *Evolution* 46: 896–906.

PRIMATE SOCIETIES

IPS RECOGNIZES NEW RECIPIENTS OF JACOBSEN AND SOUTHWICK EDUCATION AWARDS

In honor of Dr. Charles Southwick's longstanding commitment to conservation education, we have developed the Charles Southwick Conservation Education Commitment Award. This award is dedicated to recognizing individuals living in primate habitat countries who have made a significant contribution to formal and informal conservation education in their countries. The amount of the award is $750: $500 is given to the recipient, and $250 will be given in the recipient's name to a project of their choosing in their community.

The IPS Education Committee is pleased to announce the following recipients of the 2004 Charles Southwick Conservation Education Award:

Dr. Surendra Mal Mohnot, Emeritus Professor and Chairman, Primate Research Center, Jodhpur, India, has a long and distinguished career in teaching, research, and public conservation education in India. He is the founding director of the School of Desert Sciences, a teaching and research center devoted to the conservation of wildlife, environments, and people in the Great Thar deserts of western India. He has trained and mentored more than 40 pre- and post-doctoral students and young investigators, many of whom are now working for the conservation of India's natural resources.

Mr. Wilberforce Okeka founded the Kakamega Environmental Education Program (KEEP), a program focused on environmental education for school children living near the Kakamega Forest in Kenya. The educational goal of the KEEP project is to teach local people about the wonder and beauty of the forest and the importance of conserving it. By partnering with local Kenyan organizations, KEEP has also become involved in facilitating lifestyle changes that relieve pressure on the forest, including tree planting, income generation from on-farm cultivation of forest products, and fuel-efficient cooking technology.

The Lawrence Jacobsen Education Development Award supports the initiation and long-term support of primate conservation education programs. This education award supports field conservation programs, work with local communities and/or schools, and programs that provide training in conservation education techniques. The Education Committee is pleased to announce the following recipients of the 2004 Lawrence Jacobsen Education Development Award:

Randy Kyes was awarded $500 to support a conservation education program in the elementary schools around Tangkoko-Batuangus-Duasudara Nature Reserve, North Sulawesi, Indonesia.

Sandra Correa was awarded $500 to support an educational exhibit for *Alouatta seniculus* as part of Fundación Ecolombia's program to reintroduce animals rescued from the pet trade to a restored forested area in Colombia.

Please join us in congratulating these deserving individuals as they develop conservation education programs aimed at preserving primates in their region.

Anne Savage, IPS VP for Education, Disney's Animal Kingdom, P.O. Box 10,000, Lake Buena Vista, FL 32830, USA, e-mail: <anne.savage@disney.com>.

XVIIITH CONGRESS OF THE INTERNATIONAL PRIMATOLOGICAL SOCIETY, ADELAIDE, AUSTRALIA - CD AVAILABLE

The CD of the XVIIIth Congress of the International Primatological Society (IPS) held in Adelaide, South Australia in 2001 is now available. The price is A$35 plus $A3 postage and handling within Australia. Overseas costs will be US$25 plus US$4.00 for postage and handling. If you would like a copy, please contact Graeme Crook, e-mail: <aps_editor@msn.com.au>, with the subject heading "IPS Congress CD."

Graeme Crook, President, Australasian Primate Society, PO Box 500, One Tree Hill, SA 5114, Australia.

ASP CONSERVATION SMALL GRANTS FOR 2006 – EARLY DEADLINE

The ASP Conservation Committee would like to solicit grant proposals for the ASP Conservation Small Grants competition of 2006. These grants, up to $1500, are specifically designed to help fund conservation research or related projects, including conservation education. ASP members working in habitat countries are especially urged to apply or to help someone from a habitat country submit a meaningful project that can be a portion of a larger effort. Guidelines for the grant applications are available on the ASP website, <http://www.asp.org>, and may also be obtained from Dr. Janette Wallis, Chair of the ASP Conservation Committee, ABTI-American University of Nigeria, e-mail <janettewallis@sbcglobal.net> or <jwallis@aaun.edu.ng>.

Please note that the Conservation Small Grants will be awarded early again this year, in order to expedite the delivery of grant money to the winners in time for the summer months when many of these projects begin. The deadline for grant proposals is 16 January 2006. Materials may be submitted online at the ASP website beginning in early December or sent as an e-mail attachment to the Committee Chair at the address above. Successful grants will be announced in late March, 2006.

Recent Publications

Books

A Primatologia no Brasil – 8, edited by Sérgio L. Mendes and Adriano G. Chiarello. 2004. IPEMA – Instituto de Pesquisas da Mata Atlântica and SBPr – Sociedade Brasileira de Primatologia, Vitória, Espírito Santo, Brazil. 340pp. ISBN 8599058010. This volume presents 26 chapters based on presentations at the 9th Brazilian Congress of Primatology held in Santa Teresa, Espírito Santo, Brazil in July 1999. *Contents*: Os primórdios da primatologia no Brasil – A. F. Coimbra-Filho, p.11; Feeding biology of Neotropical primates – D. J. Chivers & M. Santamaría, p.37; Reproductive strategies of New World primates: Interbirth intervals and reproductive rates – K. B. Strier, p.53; Evolutionary trends of neotropical primates according to the AP68 and AP40 microsatellites – M. Ruiz-Garcia, M. I. Castillo and D. Alvarez, p.65; Biogeography of Amazonian primates – S. F. Ferrari, p.101; Interações ecológicas entre mico-leão-dourado (*Leontopithecus rosalia* Linnaeus, 1766) reintroduzido e mico-estrela (*Callithrix jacchus* Linnaeus, 1758) introduzido em fragmentos de Mata Atlântica, RJ – A. G. Affonso, C. R. Ruiz-Miranda and B. Beck, p.123; O mico-leão-dourado (*Leontopithecus rosalia* Linnaeus, 1766) minimiza os custos do comportamento de brincadeira? – C. R. de Oliveira and C. R. Ruiz-Miranda, p.135; Ecologia alimentar de um grupo de mico-leão-da-cara-preta, *Leontopithecus caissara* (Primates: Callitrichidae), no Parque Nacional de Superagui, Guaraqueçaba, PR, Brasil – F. Prado and C. Valladares-Padua, p.145; *Callithrix penicillata* na dieta de *Spizaetus ornatus* (Aves: Accipitridae) em área de cerrado no estado de Minas Gerais – M. V. Greco, M. A. Andrade, G. D. M. Carvalho, E. P. M. Carvalho-Filho and C. E. Carvalho, p.155; Conteúdos estomacais de *Alouatta seniculus* (Primates: Atelidae) no Acre, Brasil – M. B. Diógenes and A. M. Calouro, p.161; Discriminação de cores no sauim-preto (*Saguinus midas niger*) – D. M. A. Pessoa, A. J. Baptista, F. B. F. César, V. F. Pessoa and C. Tomaz, p.169; Evidência comportamental de polimorfismo na visão de cores em mico-de-cheiro (*Saimiri ustus*) – V. F. Pessoa, C. C. Prado, G. B. Mozzer and C. Tomaz, p.181; Discriminação de cores no macaco-prego (*Cebus apella*): Evidência de tricromatismo comportamental – Ú. R. Gomes, M. C. H. Tavares, C. Tomaz and V. F. Pessoa, p.191; Interações agonísticas entre grupos de sagüis (*Callithrix jacchus*): Defesa dos recursos ou localização de parceiros sexuais extra grupo? – C. S. S. de Castro and A. Araújo, p.201; Estudo do padrão de defecação em sagüi-comum, *Callithrix jacchus*, em cativeiro – M. B. C. de Sousa, D. C. Castro, J. L. F. Raminelli, A. V. S. Medeiros, G. H. L. Nobre, P. P. S. Junior and I. C Sousa, p.213; Catação do macho reprodutor em um grupo de sagüis (*Callithrix jacchus*) durante a gestação e pós-parto da fêmea reprodutora: Uma abordagem temporal – C. V M. Azevedo, C. S. Camillo, C. A. Xavier, L. F. Moreira and N. Marques, p.225; Investigando o potencial cognitivo do macaco-prego (*Cebus apella*) – M. C. H. Tavares, M. C. Resende, A. C. M. Barros, M. S. Verburg and C. Tomaz, p.239; Um estudo naturalístico da preferência manual em muriquis (*Brachyteles arachnoides*) – M. Talebi and C. Ades, p.251; Postura e preferência manual em micos-leões-de-cara-dourada e micos-leões-pretos – C. Ades and V. H. Diego, p.263; Uso de fragmentos pequenos de mata Atlântica pelo mico-leão-dourado, *Leontopithecus rosalia* – L. C. Oliveira, F. A. S. Fernandez, G. M. Schittini and M. Passamani, p.279; International committees for the recovery and management of lion tamarins (*Leontopithecus*) – D. G. Kleiman, J. J. C. Mallinson and M. I. Bampi, p.287; Função ovariana e adrenocortical de fêmeas adultas do sagüi (*Callithrix jacchus*) em relação ao comportamento de emigração – A. C. S. R. Albuquerque, M. C. L. Nascimento, H. M. Santos and M. B. C. Sousa, p.301; Parasitismo por ácaro (Trombiculidae, Ewing, 1944) em *Callithrix jacchus* (Linnaeus, 1758), Callitrichidae - Primates – M. M. Valença-Montenegro, J. B. de Oliveira, M. A. O. M. da Cruz, L. B. G. da Silva and M. C. N. Botelho, p.317; Infecção natural por *Trypanosoma* sp. em *Callithrix jacchus* de vida livre – M. M. Valença-Montenegro, J. B. de Oliveira & M. A. O. Monteiro da Cruz, p.321; Levantamento coproparasitológico em muriqui (*Brachyteles arachnoides hypoxanthus*) da Estação Biológica de Caratinga, MG – S. M. C. dos Santos, C. P. Nogueira, A. R. D. Carvalho and K. B. Strier, p.327; Nota sobre helmintos encontrados em primatas da Estação Biológica de Caratinga, MG – S. M. C. Santos, C. P. Nogueira, A. R. D. Carvalho and K. B. Strier, p.333. *Available from*: Sérgio L. Mendes, Departamento de Ciências Biológicas – CCHN, Universidade Federal do Espírito Santo, Av. Mal. Campos 1468, Maruípe, Vitória 29040-090, Espírito Santo, Brasil, e-mail: <slmendes@npd.ufes.br>.

Articles

Alouatta

Martinez-Mota, R., Serio-Silva, J. C. and Rico-Gray, V. 2004. The role of canopy ants in removing *Ficus perforata* seeds from howler monkey (*Alouatta palliata mexicana*) feces at Los Tuxtlas, Mexico. *Biotropica* 36(3): 429–432.

Pinto, L. P. and Setz, E. Z. F. 2004. Diet of *Alouatta belzebul discolor* in an Amazonian rain forest of northern Mato Grosso State, Brazil. *Int. J. Primatol.* 25(6): 1197–1211.

Valle, R. R., Guimarães, M. A. B. V., Muniz, J. A. P. C., Barnabe, R. C. and Vale, W. G. 2004. Collection and evaluation of semen from captive howler monkeys (*Alouatta caraya*). *Theriogenology* 62(1-2): 131–138.

Wehncke, E. V., Valdez, C. N. and Dominguez, C. A. 2004. Seed dispersal and defecation patterns of *Cebus capucinus* and *Alouatta palliata*: Consequences for seed dispersal effectiveness. *J. Trop. Ecol.* 20(5): 535–543.

Zunino, G. E. 2004. Forest disturbance effects on a population of black-and-gold howler monkeys (*Alouatta caraya*) in northern Argentina. *ASP Bulletin* 28(3): 6–7.

Aotus

Pico de Coaña, Y., Barrero, C., Cajiao, I., Mosquera, C., Patarroyo, M. E. and Patarroyo, M. A. 2004. Quantifying *Aotus* monkey cytokines by real-time quantitative RT-PCR. *Cytokine* 27(4-5): 129–133.

Ateles

Muñoz-Delgado, J., Corsi-Cabrera, M., Canales-Espinosa, D., Santillán-Doherty, A. M. and Erkert, H. G. 2004. Astronomical and meteorological parameters and rest-activity rhythm in the spider monkey *Ateles geoffroyi*. *Physiol. Behav.* 83(1): 107–117.

Revol de Mendoza, A., Esquivel Escobedo, D., Martínez Dávila, I. and Saldaña, H. B. 2004. Expansion and divergence of the GH locus between spider monkey and chimpanzee. *Gene* 336(2): 185–193.

Riba-Hernandez, P., Stoner, K. E. and Osorio, D. 2004. Effect of polymorphic colour vision for fruit detection in the spider monkey *Ateles geoffroyi*, and its implications for the maintenance of polymorphic colour vision in platyrrhine monkeys. *J. Exp. Biol.* 207(14): 2465–2470.

Russo, S. E. and Augspurger, C. K. 2004. Aggregated seed dispersal by spider monkeys limits recruitment to clumped patterns in *Virola calophylla*. *Ecol. Letters* 7(11): 1058–1067.

Brachyteles

Martins, W. P. and Strier, K. B. 2004. Age at first reproduction in philopatric female muriquis (*Brachyteles arachnoides hypoxanthus*). *Primates* 45(1): 63–67.

Mendes, F. D. C. and Ades, C. 2004. Vocal sequential exchanges and intragroup spacing in the northern muriqui *Brachyteles arachnoides hypoxanthus*. *An. Acad. Brasil. Ciênc.* 76(2): 399–404.

Callicebus

Tirado Herrera, E. R. and Heymann, E. W. 2004. Does mom need more protein? Preliminary observations on differences in diet composition in a pair of red titi monkeys (*Callicebus cupreus*). *Folia Primatol.* 75(3): 150–153.

Vermeer, J. 2004. Breeding titi monkeys at La Vallee des Singes. *Int. Zoo News* 51(2): 88–93.

Callimico

Porter, L. M. 2004. Forest use and activity patterns of *Callimico goeldii* in comparison to two sympatric tamarins, *Saguinus fuscicollis* and *Saguinus labiatus*. *Am. J. Phys. Anthropol.* 124(2): 139–153.

Porter, L. M. and Garber, P. A. 2004. Goeldi's monkeys: A primate paradox? *Evol. Anthropol.* 13(3): 104–115.

Callithrix

Melo, A. L. de. 2004. Helminth parasites of *Callithrix geoffroyi*. *Lab. Prim. Newsl.* 43(2): 7–9.

Mills, D. A., Windle, C. P., Baker, H. F. and Ridley, R. M. 2004. Analysis of infant carrying in large, well-established family groups of captive marmosets (*Callithrix jacchus*). *Primates* 45(4): 259–265.

Mohr, A., Vermeer, J., Phelan, V., Christensen, K. and Wormell, D. 2004. Callitrichid triplets: A discussion. *Lab. Prim. Newsl.* 43(4): 5–6.

Nascimento Barbosa, M. and da Silva Mota, M. T. 2004. The influence of husbandry on the social interaction between heterosexual pairs of common marmoset, *Callithrix jacchus* (Linnaeus, 1758). *Rev. Brasil. Zoociênc.* 6(1): 29–43. In Portuguese.

de Oliveira, A. L., Malagueno, E., da Silva Telles, A. M., Madruga, M. H. and de Santana, J. V. 2004. Experimental schistosomiasis in the common marmoset *Callithrix jacchus*. *Rev. Soc. Brasil. Med. Trop.* 37(3): 222–228.

Puffer, A. M., Fite, J. E., French, J. A., Rukstalis, M., Hopkins, E. C. and Patera, K. J. 2004. Influence of the mother's reproductive state on the hormonal status of daughters in marmosets (*Callithrix kuhlii*). *Am. J. Primatol.* 64(1): 29–37.

Ramos, T. M. B., de Vasconcelos, A. S., de Carvalho, V. C. O. and Lima, V. L. M. 2004. Alterations in cholesterol, triglyceride and total phospholipid levels in plasma of *Callithrix jacchus* (sagüi) reinfected by *Schistosoma mansoni*. *Rev. Soc. Brasil. Med. Trop.* 37(1): 37–40.

Ross, C. N., French, J. A. and Patera, K. J. 2004. Intensity of aggressive interactions modulates testosterone in male marmosets. *Physiol. Behav.* 83(3): 437–445.

Saltzman, W., Pick, R. R., Salper, O. J., Liedl, K. J. and Abbott, D. H. 2004. Onset of plural cooperative breeding in common marmoset families following replacement of the breeding male. *Anim. Behav.* 68(1): 59–73.

Schaffner, C. M. and French, J. A. 2004. Behavioral and endocrine responses in male marmosets to the establishment of multimale breeding groups: Evidence for non-monopolizing facultative polyandry. *Int. J. Primatol.* 25(3): 709–732.

Schradin, C. and Anzenberger, G. 2004. Development of prolactin levels in marmoset males: From adult son to first-time father. *Horm. Behav.* 46(5): 670–677.

Smucny, D. A. 2004. Effective data management and data sharing in nonhuman primate studies. *Lab. Prim. Newsl.* 43(3): 8–10.

Smucny, D. A., Abbott, D. H., Mansfield, K. G., Schultz-Darken, N. J., Yamamoto, M. E., Alencar, A. I. and Tardif, S. D. 2004. Reproductive output, maternal age, and survivorship in captive common marmoset females (*Callithrix jacchus*). *Am. J. Primatol.* 64(1): 107–121.

Taylor, A. B. and Vinyard, C. J. 2004. Comparative analysis of masseter fiber architecture in tree-gouging (*Callithrix jacchus*) and nongouging (*Saguinus oedipus*) callitrichids. *J. Morph.* 261(3): 276–285.

Vilela, S. L. and de Faria, D. S. 2004. Seasonality of the activity pattern of *Callithrix penicillata* (Primates, Callitrichidae) in the cerrado (scrub savanna vegetation). *Brazil. J. Biol.* 64(2): 363–370.

Vinyard, C. J. and Schmitt, D. 2004. New technique for studying reaction forces during primate behaviors on vertical substrates. *Am. J. Phys. Anthropol.* 125(4): 343–351.

Vitale, A. and Manciocco, A. 2004. Environmental enrichment techniques in non-human primates: The case of callitrichids. *Annali dell'Istituto Superiore di Sanita* 40(2): 181–186. In Italian.

Yamamoto, M. E., Domeniconi, C. and Box, H. 2004. Sex differences in common marmosets (*Callithrix jacchus*) in response to an unfamiliar food task. *Primates* 45(4): 249–254.

Cebuella

Queralt, A. M. and Vea, J. J. 2004. Evolution in the regulation of space and carrying in the parental rearing of the captive pygmy marmoset (*Cebuella pygmaea*). *Prim. Rep.* 69: 15–27.

Cebus

McDonagh, S. 2004. Monkey business: Do the quirks of capuchins make them creatures with culture? *Science News* 165(14): 218–220.

Moura, A. C. de A. and Lee, P. C. 2004. Capuchin stone tool use in Caatinga dry forest. *Science* 306: 1909.

Phillips, K. A., Schauver Goodchild, L. M., Haas, M. E., Ulyan, M. J. and Petro, S. 2004. Use of visual, acoustic, and olfactory information during embedded invertebrate foraging in brown capuchins (*Cebus apella*). *J. Comp. Psychol.* 118(2): 200–205.

Port-Carvalho, M., Ferrari, S. F. and Magalhães, C. 2004. Predation of crabs by tufted capuchins (*Cebus apella*) in eastern Amazonia. *Folia Primatol.* 75(3): 154–156.

Spinozzi, G., Truppa, V. and Lagana, T. 2004. Grasping behavior in tufted capuchin monkeys (*Cebus apella*): Grip types and manual laterality for picking up a small food item. *Am. J. Phys. Anthropol.* 125(1): 30–41.

Troyo, A., Solano, M. E. and Calderon-Arguedas, O. 2004. Two new species of *Listrocarpus* Fain (Acari: Atopomelidae) from *Cebus capucinus* Linnaeus and *Saimiri oerstedii* Reinhardt (Primates: Cebidae) in Costa Rica. *Systematic and Applied Acarology Special Publications* 18: 1–8.

Wehncke, E. V., Valdez, C. N. and Dominguez, C. A. 2004. Seed dispersal and defecation patterns of *Cebus capucinus* and *Alouatta palliata*: Consequences for seed dispersal effectiveness. *J. Trop. Ecol.* 20(5): 535–543.

Leontopithecus

Moraes, I. A., Stussi, J. S. P., Lilenbaum, W., Pissinatti, A., Luz, F. P. and Ferreira, A. M. R. 2004. Isolation and identification of fungi from vaginal flora in three species of captive *Leontopithecus. Am. J. Primatol.* 64(3): 337–343.

Raboy, B. E. and Dietz, J. M. 2004. Diet, foraging, and use of space in wild golden-headed lion tamarins. *Am. J. Primatol.* 63(1): 1–15.

Selmi, A. L., Mendes, G. M., Figueiredo, J. R., Barbudo-Selmi, G. R. and Lins, B. T. 2004. Comparison of medetomidine-ketamine and dexmedetomidine-ketamine anesthesia in golden-headed lion tamarins. *Canadian Veterinary Journal / Revue Veterinarie Canadienne* 45(6): 481–485.

De Vleeschouwer, K., Leus, K. and Van Elsacker, L. 2004. Re-assessing the reversibility of melengestrol acetate (MGA) implants in golden-headed lion tamarins (*Leontopithecus chrysomelas*): A comparison with golden lion tamarins (*L. rosalia*). *Anim. Welfare* 13(2): 183–191.

Pithecia

Marroig, G. and Cheverud, J. M. 2004. Cranial evolution in sakis (*Pithecia*, Platyrrhini) I: Interspecific differentiation and allometric patterns. *Am. J. Phys. Anthropol.* 125(3): 266–278.

Saimiri

Ribeiro Andrade, M. C., Torres Ribeiro, C., Ferreira da Silva, V., Moraes Molinaro, E., Brueck Goncalves, M. A., Pereira Marques, M. A., Hernan Cabello, P. and Gagliardi Leite, J. P. 2004. Biologic data of *Macaca mulatta*, *Macaca fascicularis*, and *Saimiri sciureus* used for research at the Fiocruz Primate Center. *Mem. Inst. Oswaldo Cruz* 99(6): 581–589.

Saguinus

Miller, L., Savage, A. and Giraldo, H. 2004. Quantifying remaining forested habitat within the historic distribution of the cotton-top tamarin (*Saguinus oedipus*) in Colombia: Implications for long-term conservation. *Am. J. Primatol.* 64(4): 451–457.

Miller, C. T., Scarl, J. and Hauser, M. D. 2004. Sensory biases underlie sex differences in tamarin long call structure. *Anim. Behav.* 68(4): 713–720.

Schroepel, M. 2004. Gerontological observations on two male callitrichids (Callitrichidae). *Zoologische Garten* 74(2): 88–94. In German.

Smith, A. C., Kelez, S. and Buchanan-Smith, H. M. 2004. Factors affecting vigilance within wild mixed-species troops of saddleback (*Saguinus fuscicollis*) and moustached tamarins (*S. mystax*). *Behav. Ecol. Sociobiol.* 56(1): 18–25.

Wormell, D. 2004. Between a rock and a hard place – the plight of the pied tamarin. *On the Edge, Durrell Wildlife Conservation Trust*, April (96): 4–5.

Ziegler, T. E., Jacoris, S. and Snowdon, C. T. 2004. Sexual communication between breeding male and female cotton-top tamarins (*Saguinus oedipus*), and its relationship to infant care. *Am. J. Primatol.* 64(1): 57–69.

General

MacPhee, R. D. E. and Horovitz, I. 2004. New craniodental remains of the quaternary Jamaican monkey *Xenothrix mcgregori* (Xenotrichini, Callicebinae, Pitheciidae), with a reconsideration of the *Aotus* hypothesis. *American Museum Novitates* (3434): 1–51.

Oliveira, D. A. G. and Ades, C. 2004. Long-distance calls in Neotropical primates. *An. Acad. Brasil. Ciênc.* 76(2): 393–398.

Phillips, K. A., Haas, M. E., Grafton, B. W. and Yrivarren, M. 2004. Survey of the gastrointestinal parasites of the primate community at Tambopata National Reserve, Peru. *J. Zool., Lond.* 264(2): 149–151.

Pilbeam, D. 2004. The anthropoid postcranial axial skeleton: Comments on development, variation, and evolution. *J. Exp. Zool.* B302(3): 241–267.

Platek, S. M. and Levin, S. L. 2004. Monkeys, mirrors, mark tests and minds. *Trends Ecol. Evol.* 19(8): 406–407.

Primate Research Institute. 2004. Annual reports. *Reichorui Kenkyusho Nenpo / Annual Reports of the Primate Research Institute, Kyoto University* 34: 1–182.

Righini, N., Serio-Silva, J. C., Rico-Gray, V. and Martinez-Mota, R. 2004. Effect of different primate species on germination of *Ficus* (*Urostigma*) seeds. *Zoo Biol.* 23(3): 273–278.

Rowe, M. P. and Jacobs, G. H. 2004. Cone pigment polymorphism in New World monkeys: Are all pigments created equal? *Visual Neuroscience* 21(3): 217–222.

de Ruiter, J. R. 2004. Genetic markers in primate studies: Elucidating behavior and its evolution. *Int. J. Primatol.* 25(5): 1173–1189.

Satta, Y., Hickerson, M., Watanabe, H., O'hUigin, C. and Klein, J. 2004. Ancestral population sizes and species divergence times in the primate lineage on the basis of intron and BAC end sequences. *J. Molec. Evol.* 59(4): 478–487.

Schino, G. 2004. Birth sex ratio and social rank: Consistency and variability within and between primate groups. *Behav. Ecol.* 15(5): 850–856.

Siren, A., Hamback, P. and Machoa, J. 2004. Including spatial heterogeneity and animal dispersal when evaluating hunting: A model analysis and an empirical assessment in an Amazonian community. *Conserv. Biol.* 18(5): 1315–1329.

Stanyon, R., Bigoni, F., Slaby, T., Muller, S., Stone, G., Bonvicino, C. R., Neusser, M. and Seuánez, H. N. 2004. Multi-directional chromosome painting maps homologies between species belonging to three genera of New World monkeys and humans. *Chromosoma* 113(6): 305–315.

Viveiros de Castro, E. B. and Fernandez, F. A. S. 2004. Determinants of differential extinction vulnerabilities of small mammals in Atlantic forest fragments in Brazil. *Biol. Conserv.* 119(1): 73–80.

Vorobyev, M. 2004. Ecology and evolution of primate colour vision. *Clinical and Experimental Optometry* 87(4-5): 230–238.

White, J. L. and Gebo, D. L. 2004. Unique proximal tibial morphology in strepsirrhine primates. *Am. J. Primatol.* 64(3): 293–308.

Chapters

Marshall, G. R. 2004. Spermatogenesis and its regulation in higher primates. In: *Male Hypogonadism: Basic, Clinical, and Therapeutic Principles*, S. J. Winters (ed.), pp.45–62. Humana Press, Totowa, New Jersey.

Newman, J. D. 2004. The primate isolation call: A comparison with precocial birds and non-primate mammals. In: *Comparative Vertebrate Cognition: Are Primates Superior to Non-Primates?* L. J. Rogers and G. Kaplan (eds.), pp.171–187. Kluwer Academic/Plenum Publishers, New York.

van Noordwijk, M. A. and van Schaik, C. P. 2004. Sexual selection and the careers of primate males: Paternity concentration, dominance-acquisition tactics and transfer decisions. In: *Sexual Selection in Primates: New and Comparative Perspectives*, P. M. Kappeler and C. van Schaik (eds.), pp.208–229. Cambridge University Press, New York.

Plavcan, J. M. 2004. Sexual selection, measures of sexual selection, and sexual dimorphism in primates. In: *Sexual Selection in Primates: New and Comparative Perspectives*, P. M. Kappeler and C. van Schaik (eds.), pp.230–252. Cambridge University Press, New York.

Ravosa, M. J. and Hogue, A. S. 2004. Function and fusion of the mandibular symphysis in mammals: A comparative and experimental perspective. In: *Anthropoid Origins: New Visions*, C. F. Ross and R. F. Kay (eds.), pp.413–462. Kluwer Academic/Plenum Publishers, New York.

Snowdon, C. T. 2004. Social processes in the evolution of complex cognition and communication. In: *Evolution of Communication Systems: A Comparative Approach*, D. K. Oller and U. Griebel (eds.), pp.131–150. MIT Press, Cambridge, Massachusetts.

Snowdon, C. T. 2004. Sexual selection and communication. In: *Sexual Selection in Primates: New and Comparative Perspectives*, P. M. Kappeler and C. van Schaik (eds.), pp.57–70. Cambridge University Press, New York.

Stanyon, R., Stone, G. and Bigoni, F. 2004. The ancestral genomes in primate phylogeny and origins: A molecular cytogenetic perspective. In: *Anthropoid Origins: New Visions*, C. F. Ross and R. F. Kay (eds.), pp.79–90. Kluwer Academic/Plenum Publishers, New York.

Strier, K. B. 2004. Sociality among kin and nonkin in nonhuman primate groups. In: *Origins and Nature of Sociality*, R. W. Sussman and A. R. Chapman (eds.), pp.191–214. Aldine de Gruyter, Hawthorne, New York.

Sussman, R. W. and Garber, P. A. 2004. Rethinking sociality: Cooperation and aggression among primates. In: *Origins and Nature of Sociality*, R. W. Sussman and A. R. Chapman (eds.), pp.161–190. Aldine de Gruyter, Hawthorne, New York.

Wildman, D. E. and Goodman, M. 2004. Humankind's place in a phylogenetic classification of living primates. In: *Evolutionary Theory and Processes: Modern Horizons. Papers in Honour of Eviatar Nevo*, S. P. Wasser (ed.), pp.293–311. Kluwer Academic Publishers, Boston.

de Winter, W. 2004. Convergent evolution in brain "shape" and locomotion in primates. In: *Shaping Primate Evolution: Form, Function and Behavior*, F. Anapol, R. Z. German and N. G. Jablonski (eds.), pp.206–225. Cambridge University Press, New York.

Woodruff, D. S. 2004. Noninvasive genotyping and field studies of free-ranging nonhuman primates. In: *Kinship and Behaviour in Primates*, B. Chapais and C. M. Berman (eds.), pp.46–68. Oxford University Press, Oxford.

ABSTRACTS

Nowak, D. M. 2004. Affiliation patterns in female *Alouatta pigra* in Belize. *Masters Abst.* 42(5): 1513.

Rizzo, K. A. 2004. The socioecology of *Alouatta pigra* at the Calakmul Archeological Zone and Biosphere Reserve, Mexico. *Diss. Abst. Int.* A65(3): 1013.

Saito, A., Mikami, A., Kawamura, S., Ueno, Y. and Hasegawa, T. 2004. Electroretinogram analysis of relative spectral sensitivity in capuchin monkeys (*Cebus apella*). *Reichorui Kenkyu / Primate Research* 20(Suppl.): 21. In Japanese.

Serio-Silva, J. and Rico-Gray, V. 2004. Mexican primates in the Yucatán peninsula: Priority area for conservation in Mesoamerica. *Am. J. Primatol.* 62(Suppl. 1): 79.

Snowdon, C. T. 2004. Social learning in cooperative breeders. *Folia Primatol.* 75(1): 52–53.

Suarez, S. A. 2004. Spatio-temporal foraging skills of white-bellied spider monkeys (*Ateles belzebuth belzebuth*) in the Yasuní National Park, Ecuador. *Diss. Abst. Int.* A64(9): 3360.

Valero, A. and Byrne, R. W. 2004. Do spider monkeys have mental maps? A new procedure to study animal movements in the wild. *Folia Primatol.* 75(1): 58–59.

Van Bergen, Y., Almond, R. and Brown, G. R. 2004. Marmosets go back to school: The role of food sharing in learning about food. *Folia Primatol.* 75(1): 53–54.

Vinyard, P. S. 2004. Postcranial variation in hominoids and monkeys. *Diss. Abst. Int.* A64(9): 3361.

Wanert, F. 2004. Management of reproduction in captive marmosets (*Callithrix jacchus*). *Folia Primatol.* 75(3): 182.

Welker, B. J. 2004. Proximate mechanisms governing feeding behavior and selectivity in mantled howler monkeys, *Alouatta palliata. Diss. Abst. Int.* B64(11): 5396.

Xu, X. M. 2004. Functional organization of visual cortex in bush babies and owl monkeys revealed by optical imaging of intrinsic signals. *Diss. Abst. Int.* B65(3): 1185.

MEETINGS

2005

XXIIIrd 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>.

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. 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>.

Fourth Annual Callitrichid Behavioral Husbandry and Management Workshop, 21–22 May, 2005, Washington, DC, USA. The Callitrichid Behavioral Husbandry and Management Workshop will be presented by the Cotton-top Tamarin SSP and hosted by the US National Zoo in Washington, DC. For more information, see the Workshop's website at: <http://nationalzoo.si.edu/ConservationAndScience/EndangeredSpecies/GLTProgram/CallitrichidWorkshop/default.cfm>.

19th Annual Meeting of the Society for Conservation Biology, 15–19 July, 2005, Universidade de Brasília, Brasília, Brazil. Theme: "Conservation Biology: Capacitation and Practice in a Globalized World." The chair is Miguel Marini, Zoology Department, Universidade de Brasília. 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. 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>.

COHAB 2005: First International Conference on Health and Biodiversity, 23–25 August, 2005, Galway, Ireland. This important global event will provide an international forum for scientists, professionals, policymakers, and stakeholders to address the issues linking environmental health, human health, biological diversity, and international development. Themes to be discussed at the conference include the Millennium Ecosystem Assessment and the U.N. Millennium Development Goals; biodiversity, genetic resources, natural products and drug discovery; nature, culture, sociology and mental health; biodiversity in nutrition, agriculture and food production; pathogen pollution and the ecology of infectious disease; the use of wild species as sentinels of environmental health; functional biodiversity and ecosystem services; and ethnomedicine and traditional knowledge. A special session of COHAB 2005 will discuss policy options for addressing the health and development problems posed by biodiversity loss, with relevance to public health and development planning policies worldwide. COHAB 2005 is being organised by an international consortium led by the United Nations Development Programme, the United Nations Environment Programme, the Global Environment Facility, the World Conservation Union, the Centre for Health and the Global Environment at Harvard Medical School, and other international organisations. Full details of the conference may be found at http://www.cohab2005.com. Enquiries should be directed to Conor Kretsch, COHAB Director, e-mail: <info@cohab2005.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. 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>.

Sixth Meeting of the Asociación Primatológica Española, 27–30 September, 2005, Facultad de Psicología, Universidad Complutense de Madrid, Madrid, Spain. Sponsored by the Asociación Primatológica Española (A.P.E.), this Meeting will focus on the themes of Child Ethology, Conservation, Great Apes and Humans: Similarities and Differences, and Tool Use. For more information please see the website at <http://www.ucm.es/info/ape05> or contact Dr. Fernando Colmenares (<colmenares@psi.ucm.es>) or Dra. María Victoria Hernández-Lloreda (<ape@psi.ucm.es>).

2005 Annual Meeting of the Conservation Breeding Specialist Group, 29 September – 1 October, 2005, Syracuse, New York, USA. Beginning with a late-afternoon ice-breaker on Wednesday, the meeting will run through Saturday, ending with an afternoon and dinner at the Rosamond Gifford Zoo. Regional network meetings will take place on Tuesday, 27 September, and a Steering Committee meeting on Wednesday, 28 September. Accommodations are at the Genesee Grande Hotel (http://www.geneseegrande.com), which offers a variety of rooms and rates. The deadline for registration is 1 August 2005; for more information, email a request to <2005cbsg@cbsg.org> or visit their website at <http://www.cbsg.org>.

New World Primate Workshop (A Focus on Cebids), 30 September – 1 October, 2005, Cleveland, Ohio, USA. The Cleveland Metroparks Zoo announces a workshop on New World Primates that will focus on the captive care of Cebids in U.S. institutions. Informal roundtable discussions will include the following topics: diet and health, social groups and mixed species, enrichment and training behaviors, and population management. The workshop will begin at 10 a.m. on Friday, 30 September, and end at 4 p.m. on Saturday, 1 October. Attendance is limited to 50 people and registrants will be asked to complete a pre-meeting survey regarding their experiences with Cebids. The workshop will be held on the zoo grounds. Some meals will be provided and local lodging suggestions can be provided. Registration fee = $25. For more information and a registration form, contact Tad Schoffner at 216-635-3332 or <tad@clevelandmetroparks.com>.

8th World Wilderness Congress, 30 September – 6 October, 2005, Anchorage, Alaska, USA. Over a thousand delegates from dozens of nations will attend the Eighth WWC, with additional events in Kamchatka and the Russian Far East. Convening every three to four years, the theme of this year's Congress is "Wilderness, Wildlands and People—A Partnership for the Planet." This Congress will generate accurate, up-to-date information on the benefits of wilderness and wildlands to both contemporary and traditional societies, and will examine the best models for balancing wilderness and wildlands conservation with human needs. For more information, see the Congress website at <http://www.8wwc.org>.

60th World Association of Zoos and Aquariums Annual Conference, 2–6 October, 2005, New York, New York, USA. The 60th WAZA Annual Conference will be hosted by the Wildlife Conservation Society and held at the Marriott Marquis hotel. The theme of the meeting will be "Wildlife Conservation: A Global Imperative for Zoos and Aquariums." Additional information will be made available on the conference website at <http://waza2005.org>.

III Congresso Brasileiro de Mastozoologia, 12 a 16 de outubro de 2005, realizado pela Sociedade Brasileira de Mastozoologia (SBMz) e a Universidade Federal do Espírito Santo (UFES), no SESC Praia Formosa em Aracruz, Espírito Santo. O evento reunirá pesquisadores, profissionais e estudantes com o objetivo de apresentar, analisar e discutir trabalhos científicos, descobertas e tendências no estudo dos mamíferos. O tema dessa edição é "Diversidade e Conservação de Mamíferos," que será abordado sob diversos aspectos durante o evento, que contará com a participação de especialistas ligados a instituições de ensino e pesquisa nacionais e estrangeiras, bem como outros profissionais que atuam em órgãos governamentais, na iniciativa privada e em organizações não-governamentais. Somente serão aceitas inscrições pela internet. Poderá ser realizada a inscrição online do congresso até o dia 31 de maio, e o envio dos resumos podem ser feitos até o dia 30 de junho de 2005. Mais informações: <http://www.cbmz.com.br>.

Counting Critters: Estimating Animal Abundance and Distance Sampling, 17–21 October 2005, Disney's Animal Kingdom, Orlando, Florida, USA. This five-day workshop will introduce participants to the most important methods of estimating animal abundance in a rigorous but accessible way. In the first half of the workshop, we cover plot sampling, distance sampling, mark-recapture and removal methods. We explain the common key statistical concepts underlying the methods, use custom-written simulation software to understand how the methods work, and discuss which method to use when. In the second half, we focus on distance sampling in more detail. We discuss practical issues such as use of the Distance software, field methods, and survey design. The workshop is aimed at anyone who needs to estimate wildlife density or abundance and is taught by leading researchers from the Centre for Research into Ecological and Environmental Modelling at the University of St Andrews, Scotland. Registration for this workshop is now open. Since all of our previous workshops in the USA have been oversubscribed, we encourage everyone interested to register as soon as possible. For more details, please see <http://www.ruwpa.st-and.ac.uk/counting.critters/> or contact Rhona Rodger, Workshop Organizer, CREEM, University of St Andrews, The Observatory, St Andrews, Scotland KY16 9LZ, tel: +44 1334 461842, fax: +44 1334 461800, e-mail:<rhona@mcs.st-and.ac.uk>.

Primer Congreso Colombiano de Primatología, Asociación Colombiana de Primatología, del 2 al 4 noviembre de 2005, Bogotá, Colombia. El Primer Congreso Colombiano de Primatología tendrá tres Áreas Temáticas para la presentación de los trabajos: *Biología y Ecología* – estudios en ciencias básicas que incluyen morfología, taxonomía, sistemática, genética, biología molecular, evolución, biodiversidad, comportamiento y ecología; *Medicina* – estudios en anatomía, fisiología, medicina, clínica, patología, epidemiología, nutrición, y restricción de primates; y *Conservación y Manejo* (*in situ / ex situ*) – investigación aplicada y gestión multidisciplinaria, herramientas conceptuales y técnicas dirigidas a la conservación, uso y aprovechamiento, trabajo comunitario, comercio, mantenimiento en cautiverio, reproducción, técnicas de captura, manipulación, registro y marcaje, enriquecimiento ambiental, rehabilitación, disposición de primates decomisados, normatividad y legislación. La ponencia debe incluir información nueva, se pueden enviar resúmenes de temas presentados en reuniones anteriores pero su aporte al Congreso debe ser clave, generar discusión constructiva o representar temas emergentes. Para mayor información del Congreso, puede visitar la siguiente página web: <http://www.geocities.com/primatescolombia>, o en el correo electrónico <ACP_investigacion@yahoo.com>.

Primate Society of Great Britain (PSGB), Winter Meeting 2005, 9 December, 2005. Flett Theatre, The Natural History Museum, London. The theme is "Primate Evolution and the Environment." Guest speakers include R. D. Martin (The Field Museum, Chicago), Erik Seiffert (Oxford University), Peter Andrews (The Natural History Museum), Jussi Eronen and Mikael Fortelius (University of Helsinki), Susan Antón (New York University), Sarah Elton (University of Hull), Christophe Soligo (The Natural History Museum), Jonathan Kingdon (Oxford University), Urs Thalmann (University of Zürich) and Laurie Godfrey (University of Massachusetts). Organised by: Christophe Soligo, The Natural History Museum, e-mail: <C.Soligo@nhm.ac.uk>. See website: <http://www.psgb.org/Meetings/Winter2005.html>.

V Göttinger Freilandtage "Primate Diversity – Past, Present and Future," 13–16 December, 2005. University of Göttingen and German Primate Center, Göttingen, Germany. Organized by Peter M. Kappeler. Confirmed invited speakers: *Diversity in the Past*: Extinct primate communities – John Fleagle (State University of New York, Stony Brook). *Diversity Today*: Diversity of Malagasy primates – Anne Yoder (Yale University); Diversity of American primates – Anthony B. Rylands (Conservation International); Diversity of Asian primates – Jatna Supriatna (Conservation International Indonesia); Diversity of African primates – John F. Oates (Hunter College New York); Primate biogeography – Shawn Lehman (University of Toronto); Speciation and taxonomy – Colin P. Groves (Australian National University); Human diversity – Mark Stoneking (Max Planck Institute, Leipzig). *Preserving Diversity for Tomorrow*: Diversity and conservation hotspots – Russell A. Mittermeier (Conservation International); Extinction biology – Carlos Peres (University of East Anglia); Conservation genetics – George Amato (Wildlife Conservation Society); Conservation genetics – Michael Bruford (Cardiff University); Reintroductions – Carel P. van Schaik (University of Zürich). *Comparative Perspectives*: Speciation in birds – Trevor Price (University of Chicago); Bird taxonomy and conservation – Robert Zink (University of Minnesota). Contact: Prof. Dr. Peter M. Kappeler, Deutsches Primatenzentrum (DPZ), Kellnerweg 4, D-37077 Göttingen, Tel/Fax: +49-551-3851-284/291, e-mail: <pkappel@gwdg.de>, website: <http://www.dpz.gwdg.de/sociobiology/GFT2005/index.htm>.

2006

Ecology in an Era of Globalization: Challenges and Opportunities for Environmental Scientists in the Americas, 8–12 January, 2006, Merida, Mexico. This conference will be held at the Fiesta Americana Hotel in Merida, and is co-hosted by the Universidad Autónoma de Yucatán and the Centro de Investigaciones Científicas de Yucatán. Abstracts should address one of the meeting's three subthemes: invasive species, human migration, and production. The invasive species subtheme includes such topics as dispersal of invasive plant and animal species, emerging diseases, and resistance of local ecosystems to invasive species and disease. The human migration subtheme includes the environmental effects of international and local emigration and immigration on recipient and source areas. Potential topics include infrastructure development needs and impacts, effects on land cover, and land use impacts. The production subtheme focuses on ecosystem transformations, including land-use change, required to produce goods and services for human use. Potential topics include the effects of changes in forest and agricultural policy on economies, biodiversity, and ecosystems throughout the Americas, in terrestrial, marine, and freshwater systems. We particularly welcome reports of projects that are interdisciplinary and that consider the need to communicate with broad audiences. For more information, or to submit an abstract, visit <http://www.esa.org/mexico>. Deadline for abstract submissions: September 16, 2005.

75th Annual Meeting of the American Association for Physical Anthropology, 5–12 March 2006, Anchorage, Alaska, USA. For program information, please contact the Program Chair, Lyle W. Konigsberg, Department of Anthropology, University of Tennessee, Knoxville, TN 37996-0720, USA, Tel: (865) 974-4408, fax: (865) 974-2686, e-mail <aapavp@utk.edu>. Local Arrangements Committee Chair: Christine Hanson, Department of Anthropology, University of Alaska Anchorage, Anchorage, AK 99508, USA, tel: 907-786-6839, fax: 907-786-6850, e-mail <afclh@uaa.alaska.edu>. Website at <http://www.physanth.org/annmeet>.

Primate Society of Great Britain (PSGB), Spring Meeting 2006, 27-28 March, 2006, University of Stirling, Stirling, Scotland. The theme is "Primate Mentality and Wellbeing." On the afternoon of 27 March invited speakers will address the relationship between cognition and welfare in primates. Other topics are welcomed for posters and oral sessions. There will be a prize for the best postgraduate presentation and poster. A provisional programme and instructions for presenters can be found on the meeting web site at: <http://www.psychology.stir.ac.uk/staff/svick/PSGB2006.php>. For more information please contact: Dr Sarah Vick (PSGB), Psychology Department, University of Stirling, FK9 4LA, Scotland. E-mail address for enquiries: <psgbspring@stir.ac.uk>.

21st Congress of the International Primatological Society, 25–30 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>.

29th Annual Meeting of the American Society of Primatologists (ASP), 16–19 August, 2006, San Antonio, Texas. Sponsored by Southwest National Primate Research Center. Tentative deadline dates are: Notify program chair of intent to offer a symposium or workshop by 5 December, 2005; Symposia and Workshop abstracts with confirmed list of participants due to program chair by 9 January, 2006; all final abstracts are due for symposia, oral, and poster presenters by 6 February, 2006. See the ASP website for updates and further information: <http://www.asp.org/meetings/index.html>.

1st European Congress of Conservation Biology, 22–26 August, 2006, Eger, Hungary. The European Section of the Society for Conservation Biology is determined to promote the development and use of science for the conservation of European species and ecosystems, and to make sure that conservation policy is firmly underpinned by the best available scientific evidence. This keystone congress will bring together a wide array of academics, policymakers, students, NGO representatives and biodiversity managers from throughout Europe and beyond. For more information, see the Congress website at <http://www.eccb2006.org> or contact András Báldi, Chair of the Local Organising Committee, at <baldi@nhmus.hu>.

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.

Neotropical Primates is produced in collaboration with Conservation International, Center for Applied Biodiversity Science, 1919 M St. NW, Suite 600, Washington, DC 20036, USA.

Printed on New Leaf Reincarnation Matte 80# cover (100% recycled/50% post-consumer waste, processed chlorine free) and New Leaf Reincarnation Matte 70# text (50% recycled/30% post-consumer waste, elemental chlorine free). By using this environmentally friendly paper, Conservation International saved the following resources:

6	fully-grown trees
621	gallons of water
4	million BTUs of energy
294	pounds of solid waste
357	pounds of greenhouse gases

Calculated based on research done by Environmental Defense and other members of the Paper Task Force. For more information about New Leaf Paper, go to www.newleafpaper.com.

Neotropical Primates
A Journal and Newsletter of the IUCN/SSC Primate Specialist Group
Vol. 12(3), December 2004

Contents

Short Articles

The Mottled-face Tamarin, *Saguinus inustus*, in the Amanã Sustainable Development Reserve, Amazonas, Brazil
Luciane L. de Souza, Helder L. Queiroz and José Márcio Ayres† 121

Preliminary Observations on the Mottled-face Tamarin (*Saguinus inustus*) on the Lower Río Caquetá, Colombian Amazonia
Erwin Palacios, Adriana Rodríguez and Claudia Castillo 123

Movements of *Alouatta palliata* Among Forest Fragments in Los Tuxtlas, Mexico
Salvador Mandujano, Luis Arturo Escobedo-Morales and Rodolfo Palacios-Silva 126

Aspects of the Behavioral and Endocrine Ontogeny of Six Moustached Tamarins, *Saguinus mystax* (Callitrichinae)
Maren Huck, Petra Löttker, Eckhard W. Heymann and Michael Heistermann 131

Social Structure of *Alouatta guariba clamitans*: A Group with a Dominant Female
João M. D. Miranda, Itiberê P. Bernardi, Rodrigo F. Moro-Rios, Lucas M. Aguiar, Gabriela Ludwig and Fernando C. Passos 135

Substrate Manipulation by *Alouatta guariba clamitans* in Solving a Locomotor Problem
Flávia Koch and Júlio César Bicca-Marques 138

Novos Registros de Muriqui-do-Norte (*Brachyteles hypoxanthus*) no Vale do Rio Jequitinhonha, Minas Gerais e Bahia
Fabiano R. Melo, Adriano G. Chiarello, Michel B. Faria, Pedro A. Oliveira, Rafael L. A. Freitas, Fernando S. Lima and Daniel S. Ferraz 139

Planted Trees as Corridors for Primates at El Zota Biological Field Station, Costa Rica
Jerimiah Luckett, Elizabeth Danforth, Kim Linsenbardt and Jill Pruetz 143

Further Information on Neotropical Monkeys Reported in the XVI Century
Bernardo Urbani 146

The Meanings of *Cacajao* and Uacari: Folk Etymology in Neotropical Primate Taxonomy
Adrian A. Barnett 147

In Memoriam: Harald Sioli 153

News 153

Primate Societies 160

Recent Publications 161

Meetings 165

IUCN/SSC
PRIMATE
Specialist Group