

# Survey of the gastrointestinal parasites of the primate community at Tambopata National Reserve, Peru

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## Abstract

The main objective of this project was to provide baseline data on faecal parasites of groups of non-human primates from Tambopata Research Center, Tambopata National Reserve, Peru. All primate species found in this area were sampled: red howler monkeys *Alouatta seniculus*, night monkeys *Aotus vociferans*, spider monkeys *Ateles bezlebeth chamek*, brown titi monkeys *Callicebus brunneus*, white-fronted capuchins *Cebus albifrons*, brown capuchins *Cebus apella*, saddleback tamarins *Saguinus fuscicollis* and squirrel monkeys *Saimiri sciureus*. Individuals from four howler monkey troops, three brown titi monkey troops, two squirrel monkey troops and one troop each of night monkeys, spider monkeys, brown capuchins, white-fronted capuchins and saddleback tamarins were sampled. Faecal samples were collected from July to October 2002 from 86 individuals. A concentration test was used to analyse faecal samples. Results indicate the presence of various protozoans, *Ancylostoma* sp., *Ascaris* sp., *Strongyloides stercoralis*, *Trichuris trichiura*, *Prosthenorchis elegans* and *Schistosoma mansoni*.

**Key words:** New World primates, parasites, health, Peru

## INTRODUCTION

The exchange of disease is a concern for wildlife conservation both outside and inside the boundaries of parks and reserves. Land adjacent to parks increasingly includes villages, farming and domesticated animals. In addition, the presence of tourists, researchers and park personnel has created a situation that may facilitate disease transmission between humans, livestock and wildlife (Simonetti, 1995; Butynski & Kalina, 1999). Cross-transmission has been inferred in a number of African species, including gorillas (e.g. Graczyk *et al.*, 2001; Lilly, Mehlman & Doran, 2002; Nizeyi, Cranfield & Graczyk, 2002) and various wild carnivores (e.g. Creel, 1992; Roelke-Parker *et al.*, 1996).

Parasitic infections have been identified as critical components to consider in conservation biology (Scott, 1988), but little information is available concerning intestinal parasites in Neotropical primates (Platyrrhini). Some data are available for a limited number of platyrrhine genera, including *Saimiri*, *Aotus*, *Alouatta* and *Ateles* (Stuart *et al.*, 1990; Tantalean, Gozalo & Montoya, 1990; Stoner, 1996; Karesh *et al.*, 1998). However, little or no population data exist for parasitic infections of wild *Cebus* spp., *Callicebus* and *Saguinus*. This paucity of

data, combined with ever-increasing human encroachment into previously pristine areas of Neotropical forest, underscores the need for this kind of research. The primary objective of the present study was to provide baseline data on the presence of faecal parasites of groups of non-human primates from a relatively isolated research station, the Tambopata Research Center, Tambopata National Reserve, Peru.

## METHODS

### Study site

Research was conducted at the Tambopata Research Center (TRC), Tambopata National Reserve, Peru, located in south-eastern Peru in the Department of Madre de Dios. The research centre is located on the western bank of the Tambopata River (13°8'10''S; 69°36'40''W), 75 km SSW from Puerto Maldonado. No permanent settlements exist within 40 km of the research station. The region is characterized by a dry season lasting from May to October, a mean daily temperature between 25 and 31 °C, and an annual precipitation of 2400 mm. Approximately 8–10 staff and researchers are permanent residents at the site. During the dry season months the number of researchers, staff, and tourists increases to as many as 50 people per day.

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## Subjects

All 8 primate species found in the Tambopata National Reserve were sampled: red howler monkeys *Alouatta seniculus*, night monkeys *Aotus vociferans*, spider monkeys *Ateles bezlebuth chamek*, brown titi monkeys *Callicebus brunneus*, white-fronted capuchins *Cebus albifrons*, brown capuchins *Cebus apella*, saddleback tamarins *Saguinus fuscicollis*, and squirrel monkeys *Saimiri sciureus*. Individuals from multiple groups of *Alouatta*, *Callicebus* and *Saimiri* were sampled from different areas in the reserve; from the other 5 species individuals from only 1 group (of each species) were sampled. While data on ranging behaviour were not collected at the TRC, at other sites the ranges of these species vary from 6 ha (*Callicebus*) to > 250 ha (*Ateles*, *Saimiri*), and the ranges of individual species overlap considerably (Terborgh, 1983; Kinzey, 1997).

The *Aotus* and *Cebus apella* troops were sampled in an area that was within 50 m of the research station. All other troops were sampled further away from the lodge and encountered humans less frequently. However, as there is no history of hunting, logging or other intrusive human activity in this area, all subjects were unafraid of humans and typically did not produce alarm calls or flee when they were encountered.

## Sample collection

Samples were collected from all individuals from July to October 2002. When a troop was encountered, the species and the location were identified (so as to differentiate the troop from other troops of the same species) and the total number of individuals in the troop was determined. Individuals were identified by age (adult, sub-adult or juvenile) and sex. Identifiable individuals of a particular age/sex were followed until observed to defecate. Then, another age/sex was chosen and those individuals followed until observed to defecate. In this manner, contact with a troop was maintained until all members were observed to defecate, or until contact was lost. When an identified individual defecated, faeces were collected immediately and placed in a polythene container containing Ecofix fixative (Meridian Bioscience, Inc., Cincinnati, Ohio). Ecofix is a mercury- and formalin-free fixative/preservative, comprising ethyl alcohol (25%), zinc sulphate (7.9%), glacial acetic acid (4.8%), glycerol (1.9%), methyl alcohol (1.4%), isopropyl alcohol (1.4%), and polyvinyl acetate (1.15%). Each sample was marked with date, time, species and subject number. Individuals were only sampled once, and all samples from a given troop were collected in 1 day.

## Faecal analysis

All samples were analysed at Hiram College, Hiram, OH, U.S.A. Samples were processed using a concentration technique that did not require organic solvents (Meridian Bioscience, Inc., Cincinnati, Ohio). Rather, a strong filtration force was used to concentrate eggs, larvae and

protozoa from preserved faecal specimens. Five ml of the preserved stool specimen was pre-filtered and added to an empty conical tube. A cap was placed on the tube, and the tube shaken for 60 s. After adding 2 ml of physiological saline to the tube, it was centrifuged for 10 min at 500× g (2000 rev/min). Two drops of the resulting pellet were placed on a slide and stained using a Trichrome stain. The entire area (18 × 18 mm) was read under the microscope, recording the identification of parasites. Parasites were identified based on size and morphology; however, since not all parasitic life stages were collected, identifications of parasites are tentative.

## RESULTS

A total of 86 individual faecal samples was collected from 15 different primate groups. Forty-four per cent of all individuals sampled were infected with at least one type of gastrointestinal parasite. Protozoans were present in all primate species and were represented by five genera: *Blastocystis hominis*, *Chilomastix mesnili*, *Endolimax nana*, *Entamoeba* sp. and *Iodamoeba buetschii* (Table 1). Helminth parasites were identified in all primate species except *Callicebus*. These parasites included *Ascaris* sp., *Strongyloides*, *Trichuris trichiura*, *Schistosoma mansoni*, *Prosthenochoris elegans*, and an unidentified strongyle (Table 1).

## DISCUSSION

The intestinal parasites identified in the primate community of the Tambopata Research Center are broadly similar to those reported in other New World Primates. With the exception of *Schistosoma mansoni*, which was detected in *Aotus*, all parasites have been identified previously in *Alouatta*, *Ateles*, *Aotus*, *Saimiri* or *Saguinus* individuals (Stuart *et al.*, 1990; Tantalean *et al.*, 1990; Stoner, 1996; Karesh *et al.*, 1998). Additionally, this report provides the first data for parasitic infections of wild *Cebus apella*, *C. albifrons* and *Callicebus brunneus*. Although this study is representative of only a point in time, this research illustrates that several primate species in this community have similar parasitic infections.

The results of this study provide an important baseline for future investigations of gastrointestinal parasites in this primate community. In particular, the presence of *Schistosoma mansoni* (in one *Aotus* individual) and *Ascaris* sp. (in two *Aotus* individuals and one *Cebus apella* individual) may warrant future work as some researchers have suggested that the presence of these parasites in wild non-human primate populations may be indicative of anthroponotic exchange (Stuart *et al.*, 1990; Hahn *et al.*, 2003). The study site, located within the Tambopata National Reserve, Peru, currently has limited human activity. Given that tourism and researcher related impacts on wildlife will probably increase in the future at not only this location but at other field sites, protocols governing human behaviour at field sites, parks and reserves should

Table 1. Prevalence of gastrointestinal parasites in faecal samples from eight primate species at Tambopata Research Center

Species	Unidentified strongyle	Ascaris	Strongyloides	Trichuris	Prosthenorchis	Schistosoma	Chilomastix	Blastocystis	Iodamoeba	Entamoeba	Endolimax
<i>Alouatta seniculus</i> (4 groups; n = 16)	0	0	5/16 (31%)	2/16 (13%)	0	0	1/16 (6%)	1/16 (6%)	1/16 (6%)	0	0
<i>Aotus vociferans</i> (1 group; n = 5)	0	2/5 (40%)	1/5 (20%)	0	0	1/5 (20%)	0	0	2/5 (40%)	0	0
<i>Ateles belzebuth</i> (1 group; n = 11)	0	0	4/11 (36%)	2/11 (18%)	0	0	1/11 (9%)	1/11 (9%)	2/11 (18%)	0	0
<i>Callicebus brunneus</i> (3 groups; n = 12)	0	0	0	0	0	0	2/12 (16%)	0	0	0	0
<i>Cebus albifrons</i> (1 group; n = 11)	0	0	2/11 (18%)	0	0	0	1/11 (9%)	0	0	0	2/11 (18%)
<i>Cebus apella</i> (1 group; n = 10)	0	1/10 (10%)	1/10 (10%)	0	0	0	0	1/10 (10%)	0	2/10 (20%)	1/10 (10%)
<i>Saguinus fuscicollis</i> (1 group; n = 4)	2/4 (50%)	0	0	2/4 (50%)	0	0	0	0	1/4 (25%)	1/4 (25%)	0
<i>Saimiri sciureus</i> (2 groups; n = 18)	0	0	0	0	1/18 (5%)	0	2/18 (11%)	1/18 (5%)	0	1/18 (5%)	0

be established and enforced to prevent exposure of wildlife to human-borne pathogens.

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### REFERENCES

- Butynski, T. M. & Kalina, J. (1998). Gorilla tourism: a critical look. In *Conservation of biological resources*: 280–300. Milner-Gulland, E. J. & Mace, R. (Eds). Blackwell: London.
- Creel, S. (1992). Cause of wild dog deaths. *Nature (Lond.)* **360**: 633.
- Graczyk, T. K., DaSilva, A. J., Cranfield, M. R., Nizeyi, J. B., Kalema, G. R. N. N. & Pieniazek, N. J. (2001). *Cryptosporidium parvum* genotype 2 infections in free-ranging mountain gorillas (*Gorilla gorilla beringei*) of the Bwindi Impenetrable National Park, Uganda. *Parasitol. Res.* **87**: 368–370.
- Hahn, N. E., Proulx, D., Muruthi, P. M., Alberts, S. & Altmann, J. (2003). Gastrointestinal parasites in free-ranging Kenyan baboons (*Papio cynocephalus* and *P. anubis*). *Int. J. Primatol.* **24**: 271–279.
- Karesh, W. B., Wallace, R. B., Painter, R. L. E., Rumiz, D., Braselton, W. E., Dierenfeld, E. S. & Puche, H. (1998). Immobilization and health assessment of free-ranging black spider monkeys (*Ateles paniscus chamek*). *Am. J. Primatol.* **44**: 107–123.
- Kinzey, W. G. (Ed.) (1997). *New World primates: ecology, evolution, and behavior*. New York: Aldine de Gruyter.
- Lilly, A. A., Mehlman, P. T. & Doran, D. (2002). Intestinal parasites in gorillas, chimpanzees, and humans at Mondika Research site, Dzanga-Ndoki National Park, Central African Republic. *Int. J. Primatol.* **23**: 555–573.
- Nizeyi, J. B., Cranfield, M. R. & Graczyk, T. K. (2002). Cattle near Bwindi Impenetrable National Park, Uganda, as a reservoir of *Cryptosporidium parvum* and *Giardia duodenalis* for local community and free-ranging gorillas. *Parasitol. Res.* **88**: 380–385.
- Roelke-Parker, M. E., Munson, L., Packer, C., Kock, R., Cleaveland, S. Carpenter, M. *et al.* (1996). A canine distemper virus epidemic in Serengeti lions (*Panthera leo*). *Nature (Lond.)* **379**: 441–445.
- Scott, M. E. (1988). The impact of infection and disease on animal populations: implications for conservation biology. *Conserv. Biol.* **2**: 40–56.
- Simonetti, J. A. (1995). Wildlife conservation outside parks is a disease-mediated task. *Conserv. Biol.* **9**: 454–456.
- Stoner, K. E. (1996). Prevalence and intensity of intestinal parasites in mantled howling monkeys (*Alouatta palliata*) in northeastern Costa Rica: Implications for conservation biology. *Conserv. Biol.* **10**: 539–546.
- Stuart, M. D., Greenspan, L. L., Glander, K. E. & Clarke, M. R. (1990). A coprological survey of parasites of wild mantled howling monkeys, *Alouatta palliata palliata*. *J. Wildl. Dis.* **26**: 547–549.
- Tantalean, M., Gozalo, A. & Montoya, E. (1990). Notes on some Helminth parasites from Peruvian monkeys. *Lab. Primate Newsl.* **29**(2): 6–8.
- Terborgh, J. (1983). *Five New World primates*. Princeton, NJ: Princeton University Press.