



Mercury assessment in wild primate populations at Brownsberg Nature Park, Suriname.

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Study site: Brownsberg Nature Park (BNP) Suriname

- Established in 1970 and Suriname's only national park.
- Located approximately 130 kilometers south of Paramaribo and northwest of the 1560 km² Brokopondo Reservoir.
- Encompasses some 12,200 hectares of predominantly seasonal evergreen rainforest situated on top of a 500 meter high tabletop range (Fitzgerald et al. 2002).
- The park is managed by the Foundation for Nature Conservation in Suriname (STINASU)

Ecological Significance of BNP

- Home to all eight species of non-human primates in Suriname: the golden-handed tamarin (Saguinus midas), squirrel monkey (Saimiri sciureus), brown capuchin (Cebus apella), wedge-capped capuchin (Cebus olivaceus), white-faced saki (Pithecia pithecia), bearded saki (Chiropotes satanus), red howler (Alouatta macconnelli), and black spider
- In addition there are 109 mammals, 374 bird species, 83 reptile species, 43 amphibian species, and 52 fish species (Fitzgerald et al. 2002).
- Over 900 plant species known to occur at BNP, including 49 species of orchids.
- The BNP forest includes10 different habitat types: high forest, high palm dominated forest, high closed forest, high marsh forest, swamp forest, savanna forest, liana forest, bamboo thicket, moss aspect, and secondary aspect.

Threats to BNP

For the past ten years, the Brownsberg Nature Park in Suriname has been the target of illegal artisanal gold mining that has caused deforestation, destruction of creeks in and around the park, and the release of gaseous mercury into the environment.





Current techniques for assessing levels of organic mercury in primates are limited to captive non-human primates and analysis of hair and blood samples in human populations. Results of these studies have shown a significant correlation between mercury contamination in the environment and bioaccumulation of organic mercury. However, no such studies have been conducted on free-ranging primate populations. As such, the main purpose of this study was

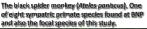
1. Develop a safe, reliable, and simple field method for assessing organic mercury levels in wild primates

In addition to mercury analyses, the following were collected on subgroups of black spider monkeys (Ateles paniscus):

- 2. Feeding and behavioral ecology data
- Daily travel patterns in order to assess how close individuals/subgroups travel in relation to the mining areas. These can also be used to estimate home ranges(s) of groups

Spider monkeys (Ateles spp.) are among the most frugivorous primates known (Link & Di Fiore, 2006) and incorporate a diverse array of fruits into their diets. They need vast expanses of rainforest due to their strictly arboreal habitats, and have the longest birthing intervals (46-50 months) of any New World primate (Robinson & Janson, 1987). These factors combined result in the black spider monkey being the most vulnerable primate species in Suriname, and ultimately serve as a primary indicator of overall forest health. No rious studies had been conducted on the black spider monkey population at BNP.







Virola kwatae (Fam. Myristicaceae), one of the mar fruits eaten by sp ame is derived from the French Guva

MATERIALS AND METHODS

To assess bioaccumulation of mercury in local primate populations, fresh fecal and urine samples were collected from Ateles paniscus (n=7), Alouatta macconnelli (n=1), and Pithecia pithecia (n=3). These samples were analyzed using a heavy metals test kit (Osumex Natural Alternatives Ltd.) and compared to those taken from captive primates of the same species at the Paramaribo Zoo. Fecal matter was dissolved using a 5% HCL solution prior to running the

Different subgroups were followed all day, during which data were collected on species of fruit eaten/ingested, geographic location of feeding trees (tree spp. that produce largeseeded bearing fruits that are ingested by black spider monkeys), geographic locations of defecated seeds from those trees, and general travel patterns throughout the rainforest. When possible, the night was spent in the rainforest with the focal subgroup. Geographic data were collected using a Garmin 60csx mapping global positioning system (GPS) unit. All data were collected from June 01, 2008 until July 28, 2008

Results from the Brownsberg and zoo populations ranged between 0.025 ppm to 0.1 ppm (toxic level > 0.8 ppm) (Table 1). The majority of the samples consisted of fecal material as collecting urine proved to be a difficult task. Across the wild populations, the species with the "highest" levels cam from an individual that ranged far from the mining areas During the study period all subgroups fed on fruit species from ten different plant families (Table 2) that they dispersed further away from the feeding tree.

Daily travel patterns and behavioral data still need to be analyzed, but preliminary results indicate variation in these data during this period. The study period encompassed the second half of the long rainy season and the very beginning of the long dry season.

| | | | | | _ |
|-----------------------------|-------------|---------|----------|-------|---|
| sample # | sample type | species | sex-age | ppm | I |
| Wild Population Individuals | | | | | |
| 1 | fecal | SM | AF | 0.025 | Į |
| 2 | fecal | RH | UNK | 0.025 | ı |
| 3 | fecal | SM | AF | 0.025 | ı |
| 4 | fecal | SM | Juv male | 0.025 | В |
| 5 | fecal | SM | AF | 0.025 | ı |
| 6 | fecal | SM | AF | 0.05 | ı |
| 7 | fecal | SM | AF | х | ı |
| 8 | fecal | SM | AF | х | ı |
| 9 | fecal | SM | AF | 0.025 | ı |
| 10 | fecal | SM | AF | 0.025 | i |
| 11 | fecal | WFS | AM | 0.05 | Š |
| 12 | fecal | WFS | Unk | 0.025 | ì |
| 13 | urine | WFS | AF | 0.1 | Ė |
| Parbo Zoo individuals | | | | | |
| 14 | fecal | WFS | AF | 0.05 | ě |
| 15 | fecal | BC | AM | 0.025 | ĕ |
| 16 | fecal | BS | Unk | 0.025 | ı |
| 17 | fecal | SqM | Unk | × | |
| 18 | fecal | Tam | Unk | х | |
| 19 | fecal | WC | AM | 0.05 | ļ |
| 20 | fecal | RH | Juv male | 0.1 | |

Table 1: Results of mercury levels from BNP primates and captive primates at the Paramaribo Zoo. Samples 7.8.17, and 18 were unsuccessful.

Species legend: SM = spider monkey, RH = red howler, WFS = white faced saki, BC = brown capuchin, BS = bearded saki, SqM = squirrel monkey, Tam = golden handed tamarin. WC = wedge capped capuchin



Mercury testing kit used in the analyses. Kit is manufactured by Osumex Natural Alternatives Ltd

| genus | species | family |
|---------------|--------------|---------------|
| Pouteria | melanopoda | Sapotaceae |
| Chrysophyllum | eximum | Sapotaceae |
| Rheedia | macrophylia | Clusiaceae |
| Suarea | grandifolia | Meliaceae |
| Apeiba | glabra | Titiaceae |
| Virola | cwatae | Myristicaceae |
| Aniba | riparia | Lauraceae |
| Maquira | sclerophylla | Moraceae |
| Apeiba | petuomo | Tiliaceae |
| Ficus | ıp. | Moraceae |
| Pachira | insignas | Bombacaceae |

Table 2: Fruit species eaten by black spider monkeys during the

CONCLUSIONS

The mercury results from a few individuals suggest that 1) the field test, developed for human urine, appears to be applicable to non-human primates and 2) that it is a safe, reliable, and simple method for testing mercury levels in wild primates. Based on the low levels of mercury detected we can conclude that arboreal primates ingesting fruit and leaves in the vicinity of mines may not be under the same threat as humans that ingest foods with heavy metals directly.

Preliminary results from the ecological data indicate the importance of black spider monkeys as a key component in the seed dispersal of a variety of fruit species and thus indicate how crucial they are, and other frugivorous primates as well, in seedling recruitment of diverse tree species in the neotropics.

cknowledgements

I would like to thank the KSU Graduate Student Senate and the Department of Anthropology for their financial support, without whom this study would not have been possible. Many thanks to friends and fellow graduate students who helped in data collecting and making my research that much more enjoyable.

- Press. p 155-185.
 Fitzgerold, K., De Dijn, B. & Mitro, S. 2002. Brownsberg Nature Park: Ecological and Research Monitoring Program 2001-2006. Paramaribo: STINASU.
 Robinson, J. & Janson, C. 1987. Capuchins, Squirrel Monkeys, and Atelines: Socioecological convergence with Old World Primates: In: Primate Societies (Ed. by Smuts, B., Cheney, D., Seyfarth, R., Wrangham, R. W. & Struhsoker, T.J, pp. 69-82. Chicago: The University of Chicago.