

Articles

PRIMATE TRANSLOCATION IN FRENCH GUIANA - A PRELIMINARY REPORT

Introduction - Objectives

Between January 1994 and July 1995, 370 km² of a primary rain forest were flooded by the filling of the Petit Saut hydroelectric dam built on the Sinnamary river in French Guiana (5°4' N - 53°3' W). A wildlife rescue was organized by Electricité de France, the French company building the dam, with the following main objectives: translocate threatened mammals and reptiles, create a biological bank and database on Guianan wildlife, carry out a post release survey including ecological studies, and raise public awareness on Guianan wildlife conservation (Vié, 1996). It was decided to document the consequences of the translocation through the study of several mammal species, including two primates - red howlers (*Alouatta seniculus*) and white-faced sakis (*Pithecia pithecia*). Red howlers were selected because they are one of the most extensively studied of neotropical mammal species giving us, as such, a basis for comparison. The main interest lies in the fact that we could then compare ecoethological aspects with a study conducted on undisturbed animals in a similar habitat in French Guiana (Julliot, 1992). Information on sakis, on the other hand, is scarce and the opportunity of capturing such animals could allow for an extended ecological study.

Methods

Before the start of the operation, a nearby release area had been chosen following several criteria: a) it should guarantee the trophic requirements of all the rainforest animals susceptible to being captured; b) it should be close to the capture area in order to reduce transportation time and stress, disease transmission risk, and genetic pollution and for logistic reasons; c) it should already be disturbed by human activities (hunting, forest logging) in order to avoid disturbing an intact area; d) it should be efficiently protected against hunting, forest logging and tourism in order to avoid jeopardizing the success of the translocation.

The 150 km² selected area fitted these criteria very well. A small part had been subjected to logging, but the entire zone was heavily hunted, as confirmed by our surveys: red howlers and brown capuchin monkeys (*Cebus apella*) were present at low densities and black spider monkeys (*Ateles paniscus*) had been eradicated. Resident populations of golden-handed tamarins (*Saguinus midas*) and white-faced sakis were present. Effective protection measures against human disturbances have been taken since the beginning of the operation.

Up to 40 people worked on the operation, including vet-

erinarians, biologists, technicians, local workers and students. Collaborative programs were also established with public and scientific institutions.

Three primate species were captured in the flooded forest and translocated: red howlers, golden-handed tamarins and white-faced sakis. Most of the primate groups were captured in one go by isolating and then cutting down the shelter tree. Very few animals could be darted and some tamarins were caught using live traps. After capture, the animals were housed in individual cages and brought to the veterinary facility at the dam site. All the animals were anesthetized and immobilization was carefully documented. Capture location, group composition, sex, weight, body dimensions, and the results of a clinical examination were recorded, and biological samples (blood, parasites, skin biopsies) were collected on a large majority of them. Blood smears, exams for trypanosomiasis or filariasis were performed, and serums were kept at -80°C in our laboratory. Other samples were sent to various institutions for identification (parasites), investigation (for example, retrovirus, leishmaniasis, and genetic studies) or analysis (hematological and biochemical parameters).

Each monkey was tattooed and visually identified with collar or radio-tags. For tamarins, we used plastic medals on ball chain collars; sixteen adult females howlers were radio-collared (Telonics MOD-125) and colored collars, colored wrist or ankle bands, ear tags or a combination of all three were used for others; five sakis were radio-collared (Telonics MOD-080) and one female was ear-tagged.

The day following the capture, the animals were released along a 13 km long dirt track penetrating the release area. Howler and saki groups were transferred from individual boxes to a prerelease enclosure built in the forest. After a few hours of rest, the door was opened and animals could leave at their will with a reduced risk of panic and troop fragmentation. Trails were cut every 400 meters through 15 km² for the post-release monitoring which focused mainly on radio-tagged animals. Various methods were used: triangulation from the roads, approaches on foot and aerial tracking in the case of long movements or when the signal was lost. The sakis were habituated to human presence.

Results

A total of 3278 non-flying mammals (47 species), 799 snakes (68 species) and 1386 tortoises were captured. Four primate species were represented: 124 red howlers (*Alouatta seniculus*) from 29 groups, 98 golden-handed tamarins (*Saguinus midas*) from 22 groups, six white-faced sakis (*Pithecia pithecia*) (one group of three and three solitary animals) and one black spider monkey (*Ateles paniscus*). Five of these monkeys were not captured in the flooded forest: two tamarins were found wounded on the access road, the spider monkey was a juvenile probably kept as a pet and two howlers (mother and newborn) were observed falling down from a tree directly onto the ground;

Table 1 - Collected and preserved biological material on primates.

	<i>A. seniculus</i>	<i>S. midas</i>	<i>P. pithecia</i>	<i>A. paniscus</i>
Serum/Plasma	113	90	6	1
Blood smears	114	90	6	1
DNA samples (skin)	108	84	6	0
DNA samples (organ)	4	1	1	0
Hemolysates	109	87	6	0
Endoparasites	9	5	1	0
Cryopreserved cells	8	6	3	0

the female was found dead and the newborn died a few weeks later. Most of our scientific results have not been analyzed and published yet. We give some preliminary results here.

Response of primate populations to the flooding of the forest. The trees began to die and loose their leaves about three months after the flooding of the ground. Most monkeys left the flooded areas and took refuge at the periphery of the lake particularly spider monkeys, brown (*Cebus apella*) and wedge-capped (*C. olivaceus*) capuchins which were never observed in the flooded forest. Howlers, tamarins and sakis were the only species to be observed and captured in the flooded forest and can still be found on small islands. A red howler troop was observed to temporarily survive in a defoliated area by adapting its diet to epiphytes which represented the major available food remaining (De Thoisy and Richard-Hansen, 1997).

Chemical immobilization. For the four species, we successfully used a combination of medetomidine and ketamine at the respective i.m. dosages of 0.15 and 4 mg/kg reversed by atipamezole (Vié and de Thoisy, 1996). We are not aware of a previous use of this association on neotropical primates. The injection induced a 30 minute anesthesia with short induction time and good myorelaxation. This was very useful when we wanted to keep the animals the shortest possible time in captivity.

Biological material collected. Material available for use by the scientific community is listed in Table 1.

Chromosomes of howlers. Forty-two howlers were karyotyped, and comparisons with other chromosomal data found in the literature indicate that howlers from French Guiana are very similar to *Alouatta seniculus* from the Jari river in Brazil (Vassart *et al.*, 1996).

Overview of translocation results. Released animals were very shy and difficult to observe. Moreover, we could not anticipate their future moves in the large release area. So our survey focused on radio-tagged howlers and sakis. However, visually tagged tamarins were observed on only six occasions between one and 11 months after release and between 500 and 1000 metres from their release site, in association with residents. Radio-tracking proved to be efficient and accurate. However, the occurrence of larvae under the collar identified as the New World screwworm fly (*Cochliomyia hominivorax*) (M. Hall, pers. comm.) led to the death of two howlers and one saki. One saki transmitter failed and three howler collars snapped leading to the loss of four animals. One howler was found dead with

evidence of trauma and three additional deaths remained unexplained.

Response of red howlers to translocation (Richard-Hansen and Vié, 1996). 1430 localizations were recorded; they were made daily after release and then weekly on foot for group composition determination. The animals dispersed between 400m and 13,000 m (mean 3,800 m) from the release site. The study focused on seven females for which the study lasted between nine and 18 months. They settled down after a period of one day to three months, and the mean value of their established home ranges was about 50 1-ha quadrats, ranging from 18 to almost 100. Three major tendencies were observed: immediate local settlement, quick but farther dispersal and settlement, or prolonged instability before settling down. Most of the troops split-up after release and the animals were observed merging in new associations with members of the resident population. A twin birth was recorded but the infants probably died. The adult and juvenile males were observed carrying one newborn. The home range size of red howlers under undisturbed conditions was very similar to our results, although somewhat smaller, and we think that most of our monitored females may have formed associations with extra-troop animals as described in other studies in fragmented habitats (Rudran, 1979; Crockett, 1984); this may explain their temporary social and spatial instability.

Home ranges of white-faced sakis (Vié and Richard-Hansen, 1996). Sakis are rare and shy animals, impossible to study in a high continuous forest. They do not make any noise when moving, observations are rare and visual contact is lost very quickly. Several studies have been conducted in Brazil and Venezuela, but in fragmented habitats (Oliveira *et al.*, 1981; Setz, 1991; Kinzey and Norconk, 1993) or are based, as in Surinam, on few observations (Buchanan *et al.*, 1981; Mittermeier and van Roosmalen, 1981; Kinzey and Norconk, 1991). Radio-tracking is the only way to study this species at least in a high and non-fragmented forest such as in French Guiana, but they are impossible to capture in their natural habitat; the rescue was a unique opportunity to radio-tag a few individuals. Three animals were habituated and observed during 1013 hours (181 days). Only one group was translocated and split-up after release. We observed that translocated animals formed associations with resident animals. Moreover white-faced sakis have much larger home ranges than previously thought (Buchanan *et al.*, 1981). 150 1-ha quadrats were used by a resident couple with one translocated animal in about three months. Finally they can accomplish long straight moves of up to 10 km within a few days.

Conclusion

Our primate translocation experiment gave encouraging results. As previously demonstrated for other howler species (Horwich *et al.*, 1993; Rodríguez-Luna *et al.*, 1993), this method may be used as a conservation tool for rein-

roduction or population reinforcement, with a fairly good probability of success. The positive results of the translocation, the large amount of original data, and the interest of the international scientific community for our samples, confirm our initial conviction that this operation was worthwhile once the political decision of building the dam had been taken.

Acknowledgments: We thank the "Faune Sauvage" team who made this project possible, the Centre National d'Équipement Hydraulique which provided total support and freedom to conduct this study, and Robin Sinha for checking the English.

Jean-Christophe Vié and Cécile Richard-Hansen, Programme Faune Sauvage, EDF/CNEH, Savoie Technolac, 73373 Le Bourget-du lac Cedex, France.

References

- Buchanan, D. B., Mittermeier, R. A. and van Roosmalen, M. G. M. 1981. The saki monkeys, genus *Pithecia*. In: *Ecology and Behavior of Neotropical Primates, Vol I*. A. F. Coimbra-Filho and R. A. Mittermeier (eds.), pp.391-417. Academia Brasileira de Ciências, Rio de Janeiro.
- Crockett, C. 1984. Emigration by female red howler monkeys and the case for female competition. In: *Female Primates: Studies by Women Primatologists*, M. Small (ed.), pp. 159-173. Alan R. Liss, Inc., New York.
- De Thoisy, B. and Richard-Hansen, C. 1997. Diet and social changes in a red howler monkey (*Alouatta seniculus*) troop in a highly degraded rainforest. *Folia primatol.* In press.
- Horwich, R. H., Koontz, F., Saqui, E., Saqui, H. and Glander, K. 1993. A reintroduction program for the conservation of the black howler monkey in Belize. *Endangered Species Update* 10(6): 1-6.
- Julliot, C. 1992. Utilisation des ressources alimentaires par le singe hurleur roux, *Alouatta seniculus* (Atelidae, Primates) en Guyane: impact de la dissémination des graines sur la régénération forestière. Thèse de l'Université de Tours, France.
- Kinzey, W. G. and Norconk, M. A. 1993. Physical and chemical properties of fruit and seeds eaten by *Pithecia* and *Chiropotes* in Surinam and Venezuela. *Int. J. Primatol.* 14(2): 207-227.
- Mittermeier, R. A. and van Roosmalen, M. G. M. 1981. Preliminary observations on habitat utilization and diet in eight Surinam monkeys. *Folia Primatol.* 36: 1-39.
- Oliveira, J. M. S., Lima, M. G., Bonvincino, C., Ayres, J. M. and Fleagle, J. G. 1985. Preliminary notes on the ecology and behavior of the Guianan saki (*Pithecia pithecia*, Linnaeus 1766; Cebidae, Primates). *Acta Amazonica* 15(1-2): 249-263.
- Rodríguez-Luna, E., García-Orduña, F. and Canales-Espinosa, D. 1993. Translocación del mono aullador *Alouatta palliata*: una alternativa conservacionista. In: *Estudios Primatológicos en México, Vol I*, A. Estrada, E. Rodríguez-Luna, R. López-Wilchis and R. Coates-Estrada (eds.), pp.129-177. Biblioteca Universidad Veracruzana, Xalapa, Veracruz, Mexico.
- Rudran, R. 1979. The demography and social mobility of a red howler population in Venezuela. In: *Vertebrate Ecology in the Northern Neotropics*, J. F. Eisenberg (ed.), pp.107-126. Smithsonian Institution Press, Washington D.C.
- Setz, E. Z. F. 1991. Comportamentos de alimentação de *Pithecia pithecia* (Cebidae, Primates) em um fragmento florestal. In: *A Primatologia no Brasil - 3*, A. B. Rylands and A. T. Bernardes (eds.), pp.327-330. Sociedade Brasileira de Primatologia, Fundação Biodiversitas, Belo Horizonte.
- Richard-Hansen, C. and Vié, J.-C. 1996. Post translocation behavior of red howler monkeys (*Alouatta seniculus*) in French Guiana. In: *Abstracts from the XVIIth Congress of the International Primatological Society and the XIXth Conference of the American Society of Primatologists*. #213. August 11-16, Madison, Wisconsin, USA.
- Vassart, M., Guédant, A., Vié, J.-C., Kéravec, J., Séguéla, A. and Volobouev, V. T. 1996. Chromosomes of *Alouatta seniculus* (Platyrrhini, Primates) from French Guiana. *J. Heredity* 87(4):331-334.
- Vié, J.-C. 1996. Wildlife rescue in French Guiana: objectives, methodology and preliminary results. In: *Proceedings of the Annual Conference of the American Association of Zoo Veterinarians*. November 3-8, Puerto Vallarta, Mexico.
- Vié, J.-C. and de Thoisy, B. 1996. Anesthesia of red howler monkeys (*Alouatta seniculus*) with medetomidine-ketamine and reversal by atipamezole. In: *Proceedings of the Annual Conference of the American Association of Zoo Veterinarians*. November 3-8, Puerto Vallarta, Mexico.
- Vié, J.-C. and Richard-Hansen, C. 1996. Ecology and behavior of white-faced sakis (*Pithecia pithecia*) in French Guiana - Preliminary results. In: *Abstracts from the XVIIth Congress of the International Primatological Society and the XIXth Conference of the American Society of Primatologists*. #37. August 11-16, Madison, Wisconsin, USA.

AN EASTERN EXTENSION OF THE GEOGRAPHICAL RANGE OF THE PYGMY MARMOSET, *CEBUELLA PYGMAEA*

Cebuella was proposed by Gray (1866) as a subgenus of *Hapale* (later *Callithrix*), and soon after as a distinct genus (Gray, 1870). Generic recognition was reinforced by Cabrera (1917) on account of dental characteristics, and by Thomas (1922) on certain cranial characters. The type specimen of *Cebuella pygmaea* was collected near Tabatinga, on the north bank of the Rio Solimões by Spix and Martius and described in 1823 (Spix, 1823). The ventral surface of the type specimen is ochraceous. In 1940,