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A Survey of Black Howler (*Alouatta pigra*) and Spider (*Ateles geoffroyi*) Monkeys Along the Río Lacantún, Chiapas, Mexico

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Introduction

One of the major problems in making adequate conservation assessments of primate populations is a lack of data on their location and demographic features—an issue exacerbated by rapid changes in species distribution as a result of forest destruction and fragmentation. Rapid assessment surveys can update such information and set the stage for further studies of population, ecology and conservation. In southern Mexico, large expanses of the native habitat of *Alouatta palliata, A. pigra* and *Ateles geoffroyi*—the three northernmost species of Neotropical primates—have been converted to pasture, and the primates have become extinct in many localities (Estrada and Coates-Estrada, 1996; Estrada and Mandujano, 2003). In other areas, populations of the three species exist in fragmented landscapes under precarious ecological and demographic conditions (Estrada *et al.*, 1999, 2002b). Finally, some populations exist in the protected forests of ecological reserves, national parks and biosphere reserves (Estrada *et al.*, 2002a, 2004). However, such information is still scanty for many regions of southern Mexico. In this paper we report data resulting from a first-time survey of populations of *A. pigra* and *A. geoffroyi* along a 40-km section of the Río Lacantún, Chiapas, one of the remotest regions of southern Mexico.

Methods

Study area and study sites

Fieldwork was conducted in the region of Marqués de Comillas, bordering Guatemala, in two adjacent areas separated by the Río Lacantún (16°05'58"N, 90°52'36"W; elevation 10–50 m. a.s.l., Fig. 1). Colonization of the eastern side of the river (heavily impacted, which we call the "settled" side) began about 30–40 years ago, and cattle ranching resulted in the rapid disappearance and fragmentation of the forest (Mariaca-Méndez, 2002). The western side of the river contains a large protected forest tract of about 300,000 ha—the Montes Azules Biosphere Reserve (MABR). The original vegetation in the area is tall evergreen and semideciduous rain forest, with trees reaching heights of 45 m. Common tree species in these forests include *Pterocarpus hayesii* (Fabaceae), *Nectandra* aff. *globosa* and *N. ambigens* (Lauraceae), *Brosimum lactescens* (Moraceae) and *Pouteria sapota* (Sapotaceae), among others (Mariaca-Méndez, 2002). The climate is hot and humid: mean annual precipitation and temperature are 2874 mm and 25°C, respectively.

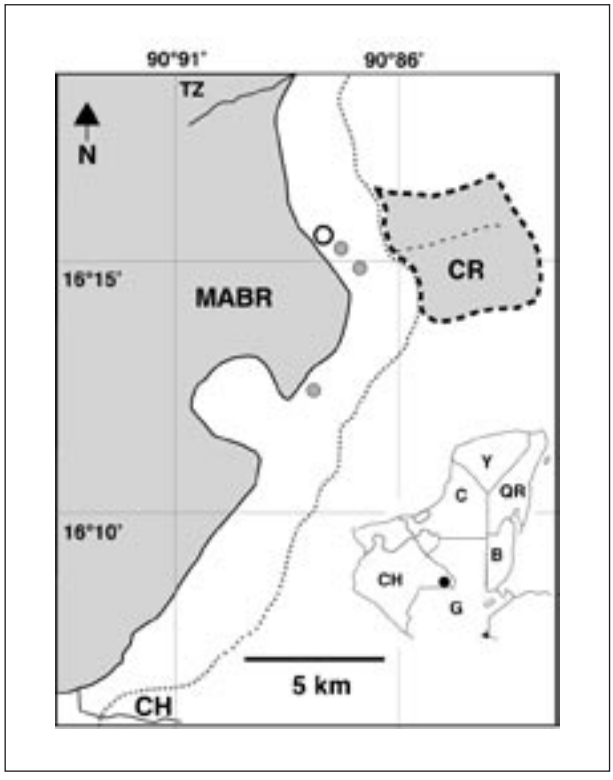

Figure 1. Bottom right corner shows location of study area (black dot) in the state of Chiapas (CH), Mexico. C, Y and QR are the Mexican states of Campeche, Yucatán and Quintana Roo, respectively; B = Belize, G = Guatemala. The main map shows the 40-km section of the Río Lacantún (thick black line) in southern Chiapas, Mexico, where primate surveys were conducted. The shaded area to the left shows part of the 300,000 ha Montes Azules Biosphere Reserve (MABR). The smaller shaded area (1,700 ha) to the right is the Reforma community ecological reserve (CR in text). The dashed line inside CR is a major trail. Open circle is the approximate location of the village of Reforma. The gray dots are three forest fragments (nearest to farthest from the human settlement: 1, 8 and 20 ha) surveyed for primates. The dotted line is a dirt road. CH = Chajulillo River, TZ = Tzendales River. Grid lines are geographic coordinates.

Primate surveys

We conducted surveys of primates by boat along a 40-km stretch of the Río Lacantún, on both the MABR and settled sides, between its confluence with the Ríos Chajulillo and Tzendales to the south and north respectively (16°05'58"N, 90°57'30"W and 16°18'06"N, 90°52'36"W). The width of the river varies from 40–60 m, allowing for surveys on both sides at once. We also conducted terrestrial surveys on the settled side of the river, in a forested ecological reserve of 1,700 ha belonging to Reforma, a local farming and cattle-ranching community. The inhabitants of this community, currently numbering about 600, are immigrants from the state of Oaxaca in western Mexico, who arrived in the area about 30–40 years ago as a result of colonization programs supported by the Mexican government. When the colonists first arrived the landscape was dominated by tropical rainforest, but they rapidly cleared much of the land for farming corn and other staples, as well as for cattle ranching. Interviews with some of the oldest inhabitants indicated that on first arriving, many survived by hunting a variety of terrestrial mammals as well as primates, especially spider monkeys. The settlers no longer hunt these primates in the remaining forest fragments, for three reasons: the establishment of the MABR on the other side of the river; increased supervision by Mexican wildlife officials; and environmental awareness and ecotourism projects in the community which have been supported by the Mexican government.

The community reserve (CR) occupies one portion of the Reforma community's land, which encompasses about 3,500 ha all told. The reserve consists of pristine evergreen rainforest, about 2.5 km from the human settlement. The community (*ejido*) owns titles to this land, and the reserve is part of a network of small forest reserves that, by law, the communities in the area are required to sustain and protect. In the case of the Reforma community, the reserve is part of a larger government-supported project of ecotourism, designed for this particular community and named "Guacamayas" for the large number of macaws in the area. Here camping facilities and rustic cabins have been built at the edge of the Río Lacantún, and all members of the community, especially the women, participate in this project. The men supervise the integrity of the 1,700-ha reserve, and maintain the trails where they guide tourists on walks through the forest (Fig. 1). The rest of the community's land is pasture, with a few smaller forest fragments. According to the residents of Reforma, three of the nearby fragments were inhabited by howler monkeys (Fig. 1).

We carried out primate surveys along the river during three 15-day visits to the study area, in October 2002 and in January and March 2003. Starting at 0400 h, we moved downriver on the current, with the outboard silent, beginning from the confluence of the Ríos Lacantún and Chajulillo. These surveys usually stopped at around 0800

h, when howling had subsided. Whenever we heard howlers, we recorded the time of day and our position with a GPS, estimating the approximate perpendicular distance of the vocalization to the boat and its compass direction. After 0800 h, we continued along the river at higher speed while scanning each side. When monkeys were sighted we moved ashore, following them to obtain repeated counts of individuals, until we reached a consensus on the total number of monkeys in the group. In subsequent days, we began the surveys at the point where we ended the day before.

In the CR forest, we used an existing system of trails running through the reserve to survey the primates, following standard procedures (National Research Council, 1981; Wilson *et al*., 1996). Trails were walked slowly (1 km/h) and when a group of howler or spider monkeys was sighted, we noted its location using a GPS, and recorded its distance to the observer and the perpendicular distance to the trail line. Once a group was located, we followed it for as long as possible to obtain repeated counts of individuals, until we reached a consensus on group size. Each of the three forest fragments (1, 8 and 20 ha in size) reportedly inhabited by howler monkeys was surveyed on foot by our team.

Individuals in the primate groups were classified as infants (clinging ventrally and/or dorsally to the mother), juveniles (independent from the mother and about ¼ to ½ the size of an adult) and adults (all large and robust individuals) (Izawa *et al*., 1979). For both howler and spider monkeys, we expressed population density in terms of the area sampled rather than density of the species' home range (Chapman and Balcomb, 1998).

Results

MABR river survey

Triangulation of early morning howling along the 40-km stretch resulted in 67 locations for troops of howler monkeys. (Some howling may have been produced by solitary animals.) Of these, 72% were heard on the MABR side of the river and the remaining 28% on the settled side. Detection rates were 1.20 troop locations/km of river for the MABR side and 0.48 locations/km for the disturbed side. Average estimated distance (adjusting for the position of the boat in the river) from the river's edge to the source of howling was 208.7 ±171.4 m and 438.2 ±202.0 m on the MABR and settled sides, respectively.

In the later phase of the same days, our survey on the MABR side of the river recorded 13 howler monkey troops totaling 72 individuals, plus a couple of solitary adult males and a lone adult male (Table 1). In the troops, adult males accounted for 33% of individuals counted, adult females for 42%, juvenile males 4%, juvenile females 8%, and infants 13%. Mean troop size was 5.5 ±1.5 individuals (range 3–8); the mean number of adult males and adult females in the troops was 1.8 ±0.80 and 2.3 ±0.63, respectively. The sex ratio for adults was 1:1.25; for juveniles, 1:2.0. The ratio of adult females to immatures was 1:0.66. While 38% of the troops had one adult male, 62% had two or more adult males.

We estimated that these surveys sampled a ribbon of vegetation 40 km long by 120 m wide, or about 5.2 km² of forest, yielding a coarse estimate for population density of 14.4 individuals/km². In the same forest area, we detected two subgroups of spider monkeys. One had five individuals (1 adult male, 1 adult female, 1 juvenile, 1 infant and 1 unsexed adult) and the other was composed of 10 adult individuals; in the latter case their rapid movements, combined with the height of the forest, prevented identification of their sexes (Table 1).

CR survey

In the CR, ground surveys along the trail system counted 64 howler monkeys—61 as members of 12 troops, plus a solitary adult male and a pair of solitary males (Table 2). Adult males in the troops accounted for 34.4% of individuals, adult females for 45.9%, juveniles for 13.1% and infants for another 6.5%. Mean troop size was 5.1 ±2.0 individuals (range 2–10). The mean number of adult males and adult females in the troops was 1.8 ±0.75 and 2.3 ±1.23, respectively. The sex ratio of adults (M:F) was 1:1.33 and 1:1.0 in juveniles; the adult female to immature ratio was 1:0.43. While 42% of the troops had one adult male, 58% had two or more adult males (Table 2). The forest area sampled in the CR was estimated to be 4.8 km², resulting in an estimate of population density of 13.3 individuals/km². In the same site, we detected the presence of eight

Table 1. Age and sex composition of black howler monkey troops (*Alouatta pigra*) detected in the protected forest of MABR (Montes Azules Biosphere Reserve) on the western side of the Río Lacantún, Chiapas, Mexico.

Troops	AM	AF	JM	JF	I	Total
1	2	3			2	7
2	1	1			1	3
3	2	2		1		5
4	3	2				5
5	1	2				3
6	1	3	1			3
7	1	2		1	1	5
8	3	3		1		7
9	2	2		2	1	7
10	1	3			1	5
11	3	2	1		2	8
12	2	2	1		1	6
13	2	3		1		6
Total	**24**	**30**	**3**	**6**	**9**	**72**
Mean	1.8	2.3	0.23	0.46	0.69	5.5
±sd	0.80	0.63	0.44	0.66	0.75	1.5
Solitary males	2					2
	1					1
Total howlers						**75**

subgroups of spider monkeys with a total of 45 individuals (Table 2). Forty percent of these individuals were adult males, 36% were adult females, 4% were juvenile males, 9% were juvenile females and 11% were infants. Adult sex ratio was 1:1.13 and 1:2.0 in juveniles; the adult female to infant ratio was 1:0.61. Mean subgroup size was 5.6 ±3.9 individuals, with a mean of 2.3 ±2.1 adult males and 2.3 ±1.4 adult females (Table 2). A gross estimate of population density yielded 9.3 individuals/km².

Forest fragments

There was a single troop of *A. pigra* in each of the three isolated forest fragments, but no spider monkeys were present (Table 3). Troop size in these fragments ranged from 6–11, with 1–3 adult males and 2–4 adult females. Each of the three troops had at least two juveniles, and two had infants (Table 3). Estimated densities for the 20-, 8- and 1-ha forests were 0.55, 0.88 and 6.0 individuals/ha, respectively.

Table 2. Groups of black howler monkeys (*Alouatta pigra*) and subgroups of spider monkeys (*Ateles geoffroyi*) counted in the forest of the community reserve (CR: 1,700 ha) of the farming community Reforma on the eastern side of the Río Lacantún, Chiapas, Mexico. AM = adult male, AF = adult female, JM = juvenile male, JF = juvenile female, I = infant.

Groups	AM	AF	JM	JF	I	Total
Alouatta pigra						
1	2	3	1			6
2	2	2		1		5
3	3	5		1	1	10
4	2	1				3
5	1	4	1			6
6	1	2		1	1	5
7	2	2	1			5
8	2	2				4
9	3	3				6
10	1	2	1	1	1	6
11	1	1			1	3
12	1	1				2
Total	**21**	**28**	**4**	**4**	**4**	**61**
Mean	1.8	2.3	0.33	0.33	0.33	5.1
±sd	0.75	1.23	0.49	0.49	0.49	2.07
Solitary males	1					1
	2					2
Total						**64**
Groups	**AM**	**AF**	**JM**	**J F**	**I**	**Total**
Ateles geoffroyi						
1	2	1		1		4
2	1	3		1	1	6
3	1	2		1		4
4	7	5	1		2	15
5	1	1		1		3
6	2	1			1	4
7		3	1		1	5
8	2	2				4
Total	**16**	**18**	**2**	**4**	**5**	**45**
Mean	2.3	2.3	0.25	0.50	0.63	5.6
±sd	2.1	1.4	0.46	0.53	0.74	3.9

Discussion

Our surveys on the MABR side of the river showed the presence of what seems a large population of howler monkeys, and possibly a smaller population of spider monkeys. While howler monkeys appear to be more common than spider monkeys on this side of the river, it is certainly possible that our surveys underestimated the density of spider monkeys as a result of their rapid movements and lack of long-distance calls, which makes them much more difficult to detect and count. Importantly, our surveys also showed that the protected forest on the settled side of the river also has both primate species, with howler monkeys again apparently more common than *Ateles*.

Interestingly, population density estimates for howlers on both sides of the river were quite similar (14.4 and 13.3 individuals/km², respectively) and they fall within the range reported for the species in other protected forests in Mexico. For example, in Muchukux, Quintana Roo, *A. pigra* occurs at densities of 15.1 individuals/km² (González-Kirchner, 1998), while densities in Palenque and Yaxchilán, Chiapas, are 23.0 individuals/km² and 12.8 individuals/km², respectively (Estrada *et al.*, 2002a, 2004). In contrast, the high densities estimated for *A. pigra* in the three forest fragments on the community land are consistent with values reported for the species from small riparian fragments in Belize (up to 17.8 individuals/ha; Silver *et al.*, 1998; Ostro *et al.*, 1999; Horwich *et al.*, 2001) and in small forest fragments in Palenque, Mexico (mean 1.16 individuals/ha; Estrada *et al.*, 2002b).

Mean troop size values for the black howlers in CR and in MABR (5.1 and 5.5 individuals, respectively) fall within the range of average troop sizes (3.1 to 7.5 individuals) reported for *A. pigra* in other localities in Mexico and in Belize and Guatemala (Coelho *et al.*, 1976; González-Kirchner, 1998; Ostro *et al.*, 1999; Estrada *et al.*, 2002a, 2004).

Table 3. Black howler monkey troops, *Alouatta pigra*, detected in three forest fragments surveyed in the land of the Reforma farming community in Chiapas, Mexico. Sites are listed in descending order by area (ha). AM = adult male, AF = adult female, JM = juvenile male, JF = juvenile female, I = infant.

Site/area ha	AM	AF	JM	JF	I	Total
20	3	4	1	1	2	11
8	1	3		2	1	7
1	2	2		2		6
Total	**6**	**9**	**1**	**5**	**3**	**24**
Mean	2.0	3.0	0.3	1.7	1.0	8.0
±sd	1.0	1.0	0.0	0.6	1.0	2.6

Because of the fission-fusion nature of spider monkey communities, it is rare to see all members of the community in the same location (Van Roosmalen and Klein, 1988; Kinzey, 1997) and it is not easy to make generalizations on density and/or subgroup size (Coelho *et al*., 1976; Klein and Klein, 1977). Bearing this in mind, the mean subgroup size of spider monkeys in the CR (5.6 ±3.9 individuals) falls within the range of values reported for spider monkey populations at other protected forest sites in Mexico and Guatemala (Coelho *et al*., 1976; Cant, 1978, 1990; Estrada *et al*., 2004). In unprotected forests, habitat reduction coupled with hunting pressures can rapidly result in significant population declines, and spider monkeys are one of the most heavily hunted of all Neotropical primates (Raéz-Luna, 1995; Kinzey, 1997). These aspects may explain their absence in the forest fragments we surveyed.

Our survey not only confirmed the existence of an important population of *A. pigra* and *A. geoffroyi* along a 40-km reach of the Río Lacantún, but also suggests that current land management practices in the area have an important impact upon the persistence of populations of both primates. First, protection by the Mexican government of the MABR forest on the western side of the river has so far conserved populations of *A. pigra* and *A. geoffroyi*. Second, while only howler monkeys seem to survive on the eastern, settled side, owing to the extensive clearing of forest for pasture and agriculture, one community's initiative to preserve the forest on a large section (CR) of their land has sheltered an important population of howler and spider monkeys in this otherwise heavily impacted landscape.

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Primate Species at the Tiputini Biodiversity Station, Ecuador

Laura K. Marsh

Introduction

Many previously untouched regions of the Amazon are now faced with imminent disturbance from oil exploration. Forest cover in Ecuador has been decreasing at a rate of approximately 1.8% per year over the last decade (Wunder, 2000). While this figure might not seem startling, it does not take into account the recent push for oil speculation into unexplored regions of the Amazon. Thus, for all those who work in relatively unspoiled tropical forests, it is mandatory to have as much detailed information as possible about each region's primate fauna, since it may be slated to become another fragmented ecosystem in the greater matrix of rainforest loss (Marsh, 2003). This paper confirms the primates occurring in the Tiputini Biodiversity Station (TBS), as there has been some confusion as to the identity of the species in this part of the Yasuní Biosphere Reserve in Amazonian Ecuador.

Methods

Study area

TBS is located in the 1.7 million-ha Yasuní Biosphere Reserve (00°37'05"S, 76°10'15"W, *c.* 250 m above sea level), 300 km ESE of Quito in the province of Orellana (Salvador-Van Eysenrode *et al.*, 1998). The station was established in 1996 by the Universidad de San Francisco, Quito (Fig. 1). It is maintained primarily for students and researchers but is also open for limited ecotourism. The 650-ha lowland rainforest comprising the Biodiversity Station, extending along the north bank of the Río Tiputini, has 30 km of well-marked trails and two established 100-ha plots (J. Blake and B. Loiselle, pers. comm.). Yearly mean temperatures exceed 24°C and the relative humidity is above 80% (weather station data from 1981–1997 at Coca Airport, 00°27'08"S, 76°59'02"W, Dirección de Aviación Civil); yearly rainfall is around 3250 mm (TBS weather station; J. Guerra, pers. comm.). The topography is flat to gently sloped, with characteristics of *várzea* and *terra firma* forest, swamps, and a small oxbow lake. There is a canopy tower, "Torre II," on the far western side of the trail system.

Census methods

A preliminary census was conducted in February and March of 2002 and 2004 for a total of 205 observation hours. Census methods followed those for one observer as per National Research Council (1981) and Peres (1999). Censuses were carried out along 25 km of the trail system at approximately 1 km per hour to listen to and observe primate species. The trails bisect the site as well as following natural contours that lead through all habitat types in the area, including ridgelines, *várzea*, *terra firma*, and swamp. Positional data were taken with a Geographic Positioning

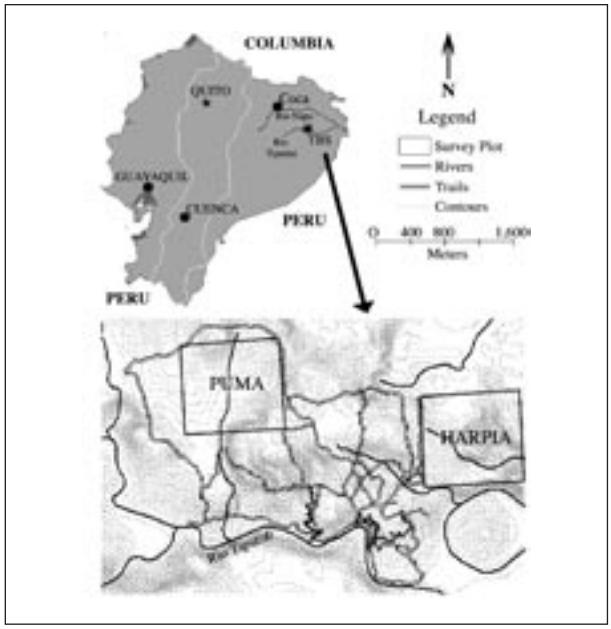

Figure 1. Map of Ecuador showing the location of the Tiputini Biological Station (TBS) and details of the TBS trail system with two 100-ha study plots (Puma and Harpia). Trail system map by B. Loiselle and J. Blake; redrawn by Winters Redstar.