Preliminary Primate Survey at the Chucanti Nature Reserve, Darien Province, Republic of Panama

Censo Preliminar de Primates en la Reserva Natural Chucantí, Provincia de Darién, República de Panamá

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Abstract. We carried out a preliminary study of the primate populations surviving in a protected forest of the Chucanti Natural Reserve, Darien Province. The study site is located in the Maje Mountain chain, on the frontier between the Panama and Darien Provinces (08·47´16.5" N, 078·27´01.4"W). With three km² of mature forest surrounded by fragmented forest and farming lands, the study site averages temperatures between 24-27 ºC and annual rainfall of 1,940.5 mm at an elevation of >1,250 m. We utilized line transect and triangulation methods. Three species of non-human primate were identified living in this forest: black-headed spider monkey (*Ateles fusciceps rufiventris*), conforming by subgroups of four individuals (range: 1-13), with complete groups of at least 20 individuals and a total population of 60 individuals, with a population density of 9.3 ind/km²; the Ecuadorian mantled howler monkey (*Alouatta palliata aequatorialis*), with six troops in total, 14 individuals as average per group, 85 total individuals and density of 28.4 ind/km²; and the white-faced capuchin monkey (*Cebus capucinus capucinus*), with only one group of six individuals and density of two ind/km². The results are similar with other primate densities calculated for other species of the same genus living in connected forest. Although the Convention on International Trade in Endangered Species (CITES) classified only the Darien black spider monkey as Critically Endangered, the three monkeys are locally threatened by bush meat hunting and commercial deforestation. This research is the first study for these species in Darien, which is part of a conservation initiative that pretend to minimize the high risk of extinction of those animals in Panama.

Key words: Primates, Panama, Darien, Chucanti, *Ateles*, *Alouatta*, *Cebus*, population.

Resumen. Se realizó un estudio preliminar de primates en un área protegida de bosque maduro en la Reserva Natural Chucantí, Provincia de Darién, Panamá. El área se localiza en el borde fronterizo entre la provincia de Panamá y la provincia del Darién con 08·47´16.5" N, 078·27´01.4"W. Su altura es de 1,259 m.s.n.m., y posee extensión de tres km² de bosque maduro y fragmentos con ganadería en su alrededor. Es el punto más alto de la Serranía Majé, con temperatura de 24-27 ºC, y precipitación anual de 1,940.5 mm. Se utilizaron Transectos de Línea y Triangulación. Se identificaron tres especies de primates: El mono araña negro del Darién (*Ateles fusciceps rufiventris*), con subgrupos de cuatro individuos (1-13), grupos de 20 individuos y una población total de 60 individuos, con densidad poblacional de 9.3 ind/km²; el mono aullador negro (*Alouatta palliata aequatorialis*), con tropas de seis, 14 individuos promedio por grupo, 85 individuos totales, y densidad de 28.4 ind/km²; y el mono cariblanco (*Cebus capucinus capucinus*), de los cuales solo se reportó un grupo con seis individuos y una densidad de dos ind/km². Los grupos presentan similitudes con otras densidades calculadas para primates de estos géneros. Aunque el listado de la Convención en el Comercio Internacional de Especies en Peligro de Extinción (CITES) clasifica solo al mono araña negro como en Peligro Crítico, estos tres primates están siendo amenazados localmente por cacería cultural (araña y cariblanco) y tala indiscriminada a nivel industrial. Esta investigación es el primer estudio para estas especies en Darién, el cual forma parte de una iniciativa de conservación y pretende estudiar otros aspectos de estos primates en peligro de extinción.

Palabras clave: Primates, Panamá, Darién, Chucantí, *Ateles*, *Alouatta*, *Cebus*, población.

Introduction

The Darien forest is one of the oldest and most pristine habitats in Central America. Located in eastern Panama, this region of the Darien Province possesses high endemism despite having been poorly studied due to political strife and the remote and rugged geography. Since the first taxonomic surveys in the 1915s, minimal information about the primate populations in Darien have been formally described (Samudio, 2002). Other than a small study on *Ateles geoffroyi* and *Ateles fusciceps* in 1970 (Porter and Young, 1970), the most recent information on the mammalian community of Darien came from a survey targeting jaguar prey species in Boca de Cupe (Moreno-Ruíz, 2006). Possessing the most extensive forest zone of the Panamanian Isthmus (Velasquez-Runk and Dalling, 2001), the Darien Province is considered one of the most important nexus with the Colombian Choco, an area that is considered one of the most endemically biodiverse zones in the world (Ramírez-Orejuela and Sánchez-Dueñas, 2005). For this reason, Darien maintains an abundant flora and fauna diversity, including large threatened mammals like the white-lipped peccary (*Pecari tajacu*) and jaguar (*Panthera onca*) (Moreno-Ruíz, 2006), as well as one of the few native populations of Harpy eagle (*Harpia harpyja*) found in Panama (Vargas, 2005). Among the primates reported in this area are the Panamanian owl monkey (*Aotus zonalis*), Geoffroy´s tamarin "titi" monkey (*Saguinus geoffroyi*), white-faced capuchin (*Cebus capucinus capucinus*), Ecuadorian mantled howler monkey (*Alouatta palliata aequatorialis*), black-headed spider monkey (*Ateles fusciceps rufiventris*), and red spider monkey (*Ateles geoffroyi panamensis*) (Rodríguez-Luna *et al*., 1996; Groves, 2005).

Due to the lack of information about primate populations and increasing deforestation in the Darien Province, the Chucanti Nature Reserve was created. Located in western Darien Province along the Panama Province frontier, a section of the Chucanti area originally allocated for logging was acquired to protect the remaining fauna and flora (Laurance, 2008). The goals for the creation of the Chucanti Nature Reserve include the protection of the mountains, the old growth forest, and the water sources of four rivers that play an integral role for both the human population and biodiversity of the region. An expedition to this remote location was necessary to carry out preliminary analyses of the primate populations in Chucanti, Darien. This was a vital preliminary objective for this unknown and remote zone in order to establish a long-term project for the future. Primate population studies in large tracts of rainforests (i.e., Chucanti, Darien) are of utmost importance towards our understanding of primate behavior and habitat use within undisturbed continuous forests (Estrada *et al*., 2004).

Materials and Methods

Study Area

The study area was the Chucanti Nature Reserve, Darien Province, Republic of Panama. It is located on the border between the Panama and Darien Provinces (08°47´16.5" N, 078°27´01.4" W) (Laurance, 2008). The highest point rises 1259 meters, with three km², and is the highest point of the "Serranía Maje", which is a mountain chain in the area. Annual temperatures are around 24-27.2 ºC, with a precipitation of 1940.5 mm/year (Navas *et al*., 2001). The habitat is submontane forest with characteristics of cloud forest with many epiphytes and bryophytes (Aizprúa, in prep). The flora could be calculated as involving some 1200 species of trees, with similar diversity with the South American flora and could be considered as a transition zone with the Central American Flora (Aizprúa, in prep). The preliminary study of the flora recognizes 128 species with 99 species of vascular plants, where the most abundant families are Rosaceae, Magnoliaceae, Gentianaceae, and Fabaceae.

Some common species of trees for this area are: *Anacardium excelsum, Bactris gasipaes, Calophyllum longifolium, Cedrela odorata, Genipa americana, Gustavia superba, Pachira quinata, Peltogyne purpurea, Podocarpus guatemalensis, Poulsenia armata, Socratea exorrhiza*, and *Tetragastris panamensis*. Some others species have been found not common for the rest of Panama: *Prunus* spp. (Rosaceae), *Talauma* cf. *sambuensis* (Magnoliaceae), and *Symbolanthus pulcherrimus* (Gentianaceae). Within the herbarium report, at least two species have the possibility to be new report to Panama and one is endemic (Aizprúa, in prep.).

The human population surrounding Chucanti is encroaching from the southwest, specifically from the Azuero Peninsula, which suffers from heavy deforestation and contains the highest number of cattle pastures in Panama (González, 2002). Thus, the Chucanti landscape appears as a large patch of forest surrounded by cattle pastures but still connected with massive vegetation. In addition, the population of Chucanti consists of two indigenous groups: the Wounaan are found along the southwestern side of the mountains (i.e., Cerro Chucanti),

while the Embera have settlements along the southeastern side.

Triangulation Census, Direct Observations, and Presence/Absence Recording

We conducted our survey at the beginning of the rainy season (May 27-31, 2008) using two existing trails as transects of five km bordering the mountain at the top, and one more transect one km long, at the base of the mountain, following Rudran *et al.* (1996), and Ross and Reeve (2003). In conjunction, we also recorded primate vocalizations from the biological station and pre-established transects at the top, middle, and base of the Chucanti Hill (Estrada *et al.*, 2004).

Surveys were conducted at an average pace of one km/hour, repeating this twice between 10:00 to 17:00 h for each transect. The triangulation method consists of noting all primate vocalization data, recording the compass position and estimated perpendicular distance of the vocalization to the biological field station and/or transect. Whenever possible, we attempted to acquire direct observations of each group and collect social data (Milton, 1992; Estrada *et al.*, 2004, Aldrich *et al.*, 2006). These methods were employed every morning at 04:30 to 07:00 h and *ad libitum* thereafter.

We also collected information from the local rangers and the land owner of the Nature Reserve, which was demarcated five years ago, establishing background information for the area (Stoner, 1994). For each observed primate, we recorded the species, group size, and group composition (when possible).

We estimated the population density for each species by: $Dpop = n/A$, when n = sum of all individuals and A = the total surface area of the landscape (Rodríguez-Toledo *et al.*, 2003). For howler monkeys, we estimated the relative total population by multiplying the averages of the total individuals observed by the total number of observed groups, excluding those counted multiple times. For each group we recorded vocalizations and collected film, photos and GPS information, all of which have been donated to the Florida Museum of Natural History and the Vertebrates Museum of the University of Panama.

Results

We detected three species of primates living in the Chucanti Natural Reserve, Darien, Panama: the black-headed spider monkey *A. f. rufiventris,* the Ecuadorian mantled howler monkey *A. p. aequatorialis,* and the white-faced capuchin monkey *C. c. capucinus*. There are some anecdotal reports of Panamanian owl monkeys *Aotus zonalis* and Geoffroy´s tamarin (or titi monkeys) *Saguinus geoffroyi,* but we were unable to confirm their presence during our survey (Table 1).

We estimated six subgroups of black-headed spider monkeys with an average of four individuals per subgroup (range: 1-13) via direct observations, and one large group by the triangulation method with an estimated two groups present in the area. Considering the entire subgroups share the same area within one km, we can predict that each group could be at least between 20-30 individuals, with at least 60 individuals of black-headed spider monkeys present in the area. Due to the valley shape of the nature reserve, we are confident in our vocalization triangulations from the entire landscape. Subgroups consisted of 28% adult male and 28% adult female, while juveniles made up 32% and infants 11% of each subgroup. The relative density of the black-headed spider monkey population was 2.9 groups/km² and 9.3 ind/km² within the Chucanti Natural Reserve.

Ecuadorian mantled howler monkey populations were assessed via vocalization/triangulation, estimating a total of six troops. Group structure was calculated based on the only troop directly observed, consisting of five individuals, calculating an average with other studies for the same subspecies: 19 ind/group at Barro Colorado Island, Panama (Milton, 1992), 11.3 ind/group in the Chorrera Watershed, Panama (Méndez-Carvajal, 2002), and 21.5 ind/group in the Colombian Chocó, Colombia (Ramírez-Orejuela and Sánchez-Dueñas, 2005). When analyses are combined, the result is 14.2 individuals per group. We used this average to estimate the total population of Chucanti, with a total area of three km². We calculated 85 individuals of mantled howler monkey, 28.4 ind/km², with a density of two groups/km². The detection of the howler and spider monkey groups was consistent through the recount every morning in similar locations/angles from the biological field station. These repetitious vocalizations each morning at sunrise and before the heavy rain allowed for ease when confirming their locations.

White-faced capuchin monkeys were observed just once during transects, foraging in the same tree as a group of black-headed spider monkeys and exhibiting no signs of agonism among the polyspecific group. A total of six white-faced capuchins were observed, the group structure

Table 1. Subgroups of black spider monkey *Ateles fusciceps rufiventris*, groups of howler monkey *Alouatta palliata aequatorialis,* and whiteface monkeys *Cebus capucinus capucinus,* reported at Chucanti Natural Reserve, Darien, Panama. Sg = Subgroup, T = Troop, AM = adult male, AF = adult female, J = juvenile, I = infant.

GROUPS	MA	AF	J	I	TOTAL	HIGH (m)	GLOBAL POSITION
A. f. rufiventris							
Sg.1	1	1	2	1	5	716	08º46'61" N 78º27'61" W
Sg.2	1	1		1	3	986	08º47'528" N 78º27'393" W
Sg.3	1	1	1		3	749	08º47'22" N 78º27'4.5" W
Sg.4	1				1	1,083	08º47'55.0" N 78º27'13.2" W
Sg.5	1	1			2	1,146	08º48'14.5" N 78º27'8.6" W
Sg.6	2	4	6	1	13	716	08º46'61" N 78º27'61" W
Solitary	1				1	1,100	08º48'14.5" N 78º27'8.6" W
Total	8	8	9	3	28		
Mean	1.1	1.6	3.0	1.0	4.0		
±SD	0.3	1.3	2.6	-	4.2		
GROUPS	**MA**	**AF**	**J**	**I**	**TOTAL**	**HIGH (m)**	**GLOBAL POSITION**
A. p. aequatorialis							
T1	2	1	2	0	5	880	08º47'358" N 78º27'84" W
T2							290ºNW 1 km dist.
T3							30ºNE 3 km dist.
T4							315ºNW 3 km dist.
T5							210º SW 3.5 km dist.
T6							0ºN 4 km dist.
GROUPS	**MA**	**AF**	**J**	**I**	**TOTAL**	**HIGH (m)**	**GLOBAL POSITION**
C. c. capucinus							
T1	2	2	1	1	6	850	08º47'528" N 78º27'393" W

consisting of two males, two females, one juvenile and one infant. The calculated density for the capuchins in the Darien forest is two ind/km² (0.3 groups/km²).

Discussion

Our survey showed that black-headed spider monkeys' average subgroup size, four ind/subgroup, is similar to that presented in other species studied: *Ateles hybridus* in north Venezuela with an average of 3.5 ind/subgroup (Cordero-Rodríguez and Biord, 2001), and *Ateles geoffroyi* at the El Tormento Reserve, Mexico with 4.6 ind/subgroup (Barrueta-Rath *et al*., 2003). The subgroup structure was a family type with male, female and offspring. There were more than two occasions when we observed at least two of the identified subgroups in the area outside the transect line, and we made sure to avoid any recounting of a group by careful observation of their group composition. There was another large group at least four kilometers from the biological station that was impossible to count directly, and was only detected by strong vocalizations.

Thus, we consider at least the subgroups detected as part of one group, and the mountain group like the second one present at Chucanti. As has been described, group organization of *Ateles* genus is recognized as fission-fusion (Kinzey, 1997; Sussman, 2000; Di-Fiore and Campbell, 2007), and subgroups can comprise at least five different structural organizations (Carpenter, 1935). *Ateles f. rufiventris* obtained ~20-30 ind/group, average of group size for this species in our study, similar to group size averages obtained for *Ateles belzebuth* in Colombia with 18 ind/group (Klein and Klein, 1975), *Ateles geoffroyi* from Tikal National Park, Guatemala with 28 ind/group (Cant, 1977), *Ateles paniscus* with 18 ind/group in Surinam (van Roosmalen, 1985), *Ateles geoffroyi* with 27.1 ind/group from Quintana Roo, Mexico (Gonzalez-Kirchner, 1998), and *Ateles geoffroyi panamensis* with 23 ind/group counted in Barro Colorado Island, Panama (Méndez-Carvajal, pers. obs.).

We observed a higher density (9.3 ind/km²) than the population of *A. f. rufiventris* at Boca de Cupe, Darien, Panama (3.6 ind/km²) (Moreno-Ruíz, 2006). There is a high risk of group size underestimation due to the difficulties in counting each individual (Rowe, 1996) and the rarity of seeing an entire group at one time (Estrada *et al*., 2004).

Within the general observations of these subgroups of *Ateles*, we can report two remarkable behaviors. First, their vocalizations were almost as frequent as howler monkeys, not only stimulated by human approach, but naturally as part of their communication. Group songs could be repeated for more than four hours, with intervals of resting time; this behavior has not been reported for other species studied or observed in Panama due to the lack of research in extensive forest or high forest disturbance, which may be related with the vocalization frequency (*Ateles geoffroyi panamensis* at Barro Colorado Island, Panamá, and *Ateles geoffroyi azuerensis*, Azuero Peninsula, Panama) (Méndez-Carvajal and Ruiz-Bernard, 2009). Secondly, the territorial display of an adult female was very remarkable: she shook branches and jumped four to five times towards the observer. Both these behaviors have been reported for *Ateles* in forests that have experienced little disturbance and the last could be linked with hunting pressures experiences (Carpenter, 1935; Rowe, 1996; Di-Fiore and Campbell, 2007).

We detected a larger number of groups of Ecuadorian howler monkeys compared to similar studies with populations of *Alouatta pigra* and *Ateles groffroyi* in Rio Lacantun, Chiapas, Mexico (Estrada *et al*., 2004), as well as a larger group density per area (28.4 ind/km²), though this appeared to be in the normal range similar to the population of howler monkeys in Barro Colorado Island, Panama (27 ind/km²) (Carpenter, 1934), and Los Tuxtlas, Mexico (23.3 ind/km²) (Estrada, 1982). This relative abundance was greater than other studied populations of howler monkeys in Boca de Cupe, Darien, Panama, with results of 4.8 ind/km² (Moreno-Ruíz, 2006). Howler monkey density could be affected by ecological parameters such as rainfall, high altitude, food availability and quality, but most importantly by their habitat use history (Chapman and Balcomb, 1998).

We found lower densities of *C. c. capucinus*, 0.3 groups/km². Individuals of *C. c. imitator* are reported between 2-30 individuals per group (Oppenheimer, 1992); however, *Cebus* spp. is not restricted by forest type and have been reported to be ecologically opportunistic, in some cases including preferences for regeneration zones (Di-Fiore and Campbell, 2007). The population of *C. c. capucinus* found in Boca de Cupe, Darien, Panama, was larger in terms of relative abundance with 13.5 ind/km² (Moreno-Ruíz, 2006). Vegetation showed broad diversity and plenty potential food resources to support these primates populations, although the rate of deforestation could be increasing in the buffer areas of the reserve.

This survey confirms the presence of three subspecies of the five previously reported for the Darien zone. For example, *A. f. rufiventris* has been catalogued as Critically

Endangered due to a lack of basic information on them prior to this study, deforestation of habitat and hunting pressure (Rowe, 1996; IUCN, 2003; Groves, 2005). This subspecies was previously catalogued by the American Museum of Natural History as *Ateles dariensis*, collected in the Tapalisa zone, Darien Province, Panama (Anthony, 1916). Its endemism distribution ranges between eastern Panama and western Colombia (Groves, 2005). The specimens observed at that time used to be common for the area, but at the moment the black-headed spider monkey has been under increasing pressure from hunting.

Direct interviews with an indigenous guide at Chucanti, coming from the Embera ethnicity, confirmed that these monkeys are one of their favorite dishes served as special food in festivities. It is difficult to estimate how many spider monkeys they kill per event at the indigenous villages. Local preferences concerning the monkey focus on the biceps, triceps, pectorals and the brain (David Menguisama, pers. comm.).

Additionally, there is a lot of logging activity in Darien. Another endemic subspecies shared between Panama, Colombia and Ecuador is *A. p. aequatorialis* which is recognized as of Least Concern by IUCN (2003), but locally Vulnerable in Colombia (Defler, 2003). In Panama, this primate has been the most studied species; however, the majority of these studies are confined to the isolated forest of Barro Colorado Island. Realistically, the situation of this species may be much dire, involving partial extinction to the east of the Panama Canal Watershed. They are sometimes hunted by the indigenous people, and have been hunted by American and Panamanian military in the past, during jungle training activities between 1940 to 1990. Lastly, *C. c. capucinus* is considered at Lower Risk (Groves, 2005). It was considered a typical species found in the Darien by Anthony (1916), however, this is a subspecies that is not well reported and more studies are needed.

Conservation

Among the environmental problems that Darien Province currently faces, we must mention a high and uncontrolled deforestation at industrial levels year-round. Land is then sold to establish cattle pastures or private farms. This is also accompanied by the indiscriminate hunting activities by poachers, and in some areas the situation is critical in terms of bush meat traffic, mostly near the Colombian border and coasts. The Chucanti Nature Reserve is becoming one of the few areas in the Darien Province that is now under protection by the landowner and should be considered a safe place to conduct long-term scientific research.

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