Survey of the Population of Howler Monkeys (*Alouatta palliata*) at Yumká Park in Tabasco, Mexico

Alejandro Estrada, Yasminda García, David Muñoz & Berenice Franco

Introduction

The state of Tabasco in southern Mexico harbors representatives of the three species of wild primates that exist in Mexico: *Alouatta palliata, A. pigra* and *Ateles geoffroyi* (Smith, 1970, Horwich and Johnson 1986; Rylands *et al.*, 1995). Tabasco is the only state of Mexico, and the only area in the Mesoamerican region, where representatives of these three primate species are found. Tabasco additionally harbors the transitional zone between *A. palliata* and *A. pigra* and in some localities both species are sympatric (Smith, 1970). As a result of human activity in Tabasco, a great proportion of the habitats of these three primates has disappeared or remains in a fragmented condition. About 60% of the total surface area of the state (24,141 km²) was originally covered by evergreen rain forest, but as a result of human activity more than 60% of this rain forest disappeared in the last few decades at a rate of 600 km² per year, particularly in the lowlands (Masera, 1996; México, SEMARNAP, 1999). Published data on population, natural history, ecology, and behavior of these three primate species for this part of the Mesoamerican region is nonexistent. Here we report the results of the first of a series of population surveys of *A. palliata, A. pigra,* and *A. geoffroyi* conducted at several localities in the state of Tabasco. Specifically, we report on population parameters for an isolated population of *A. palliata* existing at Yumká Park in central Tabasco.

Methods

Study site

Yumká park is located at 17°45' y 18°00'N, 92°45' y 93°00'W, at about 12 miles south of the city of Villahermosa. Yumká is a public park encompassing an area of 101 ha, of which 32 ha contain tropical rain forest, 47 ha are savannas and the rest form part of a lake (Fig. 1). Elevation is 15 m above sea level. The weather is hot and humid, and mean annual precipitation is 2,159 mm (average from 10 years). Rainfall is seasonal, and the rainiest period is August-October (average precipitation 383 mm). Mean temperature is 26.9°C (maximum 29.4°C in May-June and minimum 23.8°C in January).

Vegetation

The vegetation at the site is tall evergreen rain forest (Pennington and Sarukhán, 1968). There is a predominance of tree species in the plant families Euphorbiaceae (e.g., *Psychotria viridis, Genipa americana*), Caesalpiniaceae (e.g., *Dialium guianensis, Cynometra retusa*), Palmae (e.g., *Scheelea liebmannii, Sabal yucatanica*), Lauraceae (e.g., *Nectandra ambigens, N. glabrens*), Moraceae (e.g., *Cecropia obtusifolia, Brosimum alicastrum*), Meliaceae (e.g., *Ceiba pentandra, Guarea glabra*), and Sapindaceae (e.g., *Cupania dentata, C. glabra*) (Jiménez, 1987; Pineda, 1988).

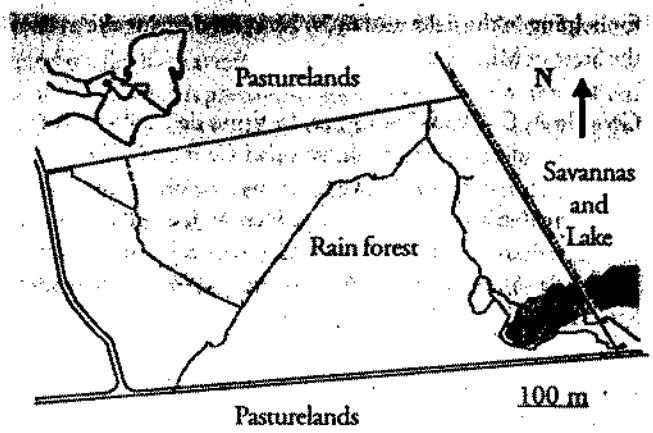

Figure 1. Location of Yumká Park in central Tabasco (black dot in map of southern Mexico). Parallel and solid lines are paved and unpaved roads, respectively. Thin lines within this perimeter are trails. Shaded area at the right bottom is a lake.

Surveys

Surveys of *A. palliata* existing in the forest of Yumká Park were conducted from September to December 2000 and from January to February 2001. In total, 56 field days encompassing 444 man-hours of surveys were completed. Surveys of howlers were conducted in two ways: By triangulation of dawn and dusk choruses and by direct counts of troops. In the first case, we chose a strategic location surrounding the area of forest vegetation using access roads and trails. Monitoring was conducted daily between 0500 and 0700 hrs and between 1700 and 1900 hrs by three teams of two people each. The direction from which howling was heard was determined with the use of a compass. Resulting information was placed on a detailed topographic map. In the second case, the three two-person teams searched for different triangulated troops using existing trails or by walking through the forest.

Contacted troops were followed for several hours and repeatedly counted by each team to confirm identification and age and sex composition. Confirmation was made by examining the consistency in the age and sex composition of each troop and the consistency in the spatial location of the troops in relation to the trail system and to topographical features of the terrain and the relative location of other troops. Troop identification was also helped by recording body markings on certain individuals, such as patches of blonde hair on the hands, feet and tail, as well as varied patterns of skin pigmentation on the palms and soles of the hands and feet. Trees used by howler monkeys as a source of food were marked and measured (DBH and maximum height).

Results

Our surveys detected the presence of 55 howler monkeys forming part of four troops (Table 1). Average troop size was 14 individuals (range 4-28). Adult males comprised 23% of the population surveyed, adult females 36%, juveniles 22%, infants 9%, and young adult individuals for whom sex could not positively be determined accounted for the remaining 9%. Crude density was estimated at 1.67 ind/ha and ecological density was estimated at 167 ind/km² (Table 1). Average adult sex ratio

Table 1. Age and sex composition of howler monkey troops detected at Yumká Park in Tabasco, Mexico.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	4	4	3	1	1	13
2	6	11	5	3	3	28
3	1	3	3	1	1	9
4	2	1	1	0	0	4
Total	13	19	12	5	5	54

(male:female) was 1:1.42 ±0.70. Average adult female-to-non-adult ratio was 1:1 ±0.26. Average adult female-to-infant ratio was 1:1 ±0.26. Average juvenile-to-infant ratio was 1:0.31 ±0.29. Average adult-to-nonadult ratio was 1:0.56 ±0.23.

An examination of the DBH and height of trees used by howlers during our surveys showed that all sightings were in trees with a DBH ranging from 50-100 cm (average 78.6 ± 31.3 cm) and from 18 to 25 m (average 21.5 ±3.1 m) in height (Fig. 2).

Discussion

The *A. palliata* population present in the forest of the Yumká Park exists in a very small habitat-island. Examination of an aerial photo mosaic showed that only about 7% of the original forest remains today in a 300 km² area, and consists of very small, isolated forest fragments. The habitat-island forming part of the Yumká Park is one of the largest forest fragments and is totally isolated from nearby forest. Preliminary surveys in some of the forests in the vicinity of the park showed that they were not inhabited by howler monkeys. Interviews with the local people and the park administrators indicated that the howler population at the site has been there since the foundation of the park in 1960, but was isolated when the land surrounding the park was cleared shortly after.

Troop size of howlers at the Yumká Park ranged from 4 to 28 individuals. The size of the largest troop (#2) is unusual. Population data for *A. palliata*, 500 km north of Yumká Park, at Los Tuxtlas indicate, for troops existing in forest tracts >500 ha in size, an average troop size of 9.12 individuals (range 5-16 individuals) (Estrada, 1982). In a fragmented landscape at Los Tuxtlas, four forest fragments of similar size (30-50 ha) to that of the Yumká Park showed that howler monkey troop size varied from 4 to 16 individuals (Estrada *et al.*, 1999). At Yu-Balcah, located about 50 km west of Yumká in the state of Tabasco, preliminary surveys of *A. palliata* conducted by our research team in a forest tract about 200 ha in size showed that troop size varied from 2 to 12 individuals (Estrada *et al.*, 2000a). Troop size of populations of *A. pigra* at Palenque, Chiapas, 150 km south of Yumká in a forest tract about 600 ha in size, was reported to range from 2 to 11 individuals (Estrada *et al.*, 2000b). The causes for the unusually large troop observed at Yumká are unknown, but it is possible that it could be the original troop residing at the site prior to isolation and that many individuals have remained in the troop as a result of kinship ties and an inability to disperse as a result of the small size of the forest patch and of its isolation. Individuals that may have been expelled from the troop probably gave rise to the smaller troops detected by us at the site.

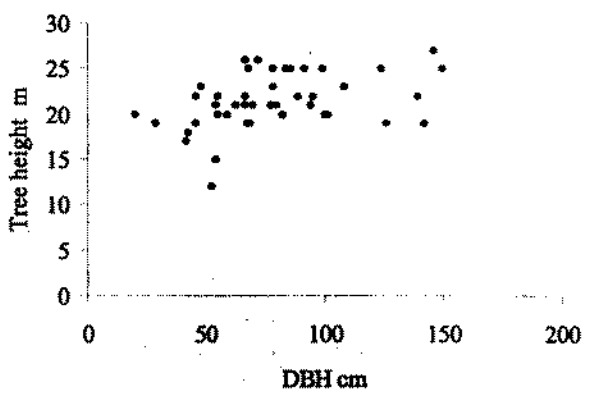

Figure 2. Relations between tree DBH and height for trees used by howlers during our surveys. Note that only trees >10 m in height were used. Average DBH of trees was 78.6 ±31.3 cm.

Adult sex ratios for the relict population of *A. palliata* at Yumká are within the range reported for this species in forest tracts >500 ha in Los Tuxtlas (Estrada, 1982). The 1:1 ratio found for adult females and non-adults suggests that all reproductively active females are breeding. However, the adult-to-non-adult ratio of 1:0.56 and the juvenile to infant ratio of 1:0.31, suggests moderate-to-high mortality in the juvenile and infant groups, respectively.

Causes of such mortality are unknown, but predators such as *Boa constrictor* and small *Felis* spp., exist in the forest. Another feature related to possible juvenile mortality could be the ingestion of toxic plants. The large edge-to-area ratio of the habitat island and the many gaps present in the interior have favored the growth of many second growth trees and vines, the leaves of which may be rich in secondary compounds (Glander, 1982; Garay-Arroyo and Alvarez-Buylla, 1997). For example, during our surveys we encountered, on two different occasions, a juvenile on the ground convulsing and foaming at the mouth. The juvenile died shortly after, suggesting intoxication.

The vegetation at the study site is characterized by the presence of many gaps caused by branch and tree falls, events especially affecting small forest fragments (Laurance *et al.*, 1997). Frequent open spaces in the canopy may complicate travel by young individuals, possibly accounting for some mortality. For example, in one instance we found a stunted juvenile on the ground. Examination of its body showed evidence of a healed fracture in one of the legs.

The densities reported by us of 166 ind/km² for the howlers at Yumká Park are unusually high compared with those reported for populations of the same species at Los Tuxtlas in southern Veracruz, where we detected densities of 23 ind/km² in extensive tracts of forest (>500 ha) (Estrada and Coates-Estrada, 1996). However, such high densities are within the range for troops of *A. palliata* surveyed by us in 21 small (<100 ha) isolated forest fragments in Los Tuxtlas (Estrada *et al.*, 1999a). We estimated howler biomass at Yumká to be approximately 8.75 kg/ha (for average weight of *A. palliata* see Estrada, 1982). This contrasts

with 1.28 kg/ha reported for troops of *A. palliata* existing in undisturbed and contiguous (>500 ha) forests in Los Tuxtlas (Estrada and Coates-Estrada, 1996). Continuous growth of the troops and the high densities for this population at Yumká, coupled with the small size of the habitat-island, suggest significant pressure on food resources and available space (Estrada *et al.*, 199b).

Available space for growing and newly-formed troops may also become a limited resource. Our observations indicate that the largest troop at Yumká is monopolizing a large proportion of the available habitat, with the smaller troops existing in the periphery of the forested area of the park. We have seen members of some of these smaller troops coming down from the trees and crossing dirt and paved roads surrounding the park to feed on nearby trees. Interviews with the local inhabitants indicate that on some occasions monkeys have been run over. People on foot and dogs may be additional potential dangers for these howler monkeys. The average distance (1.7 km) from the Yumká forest to the nearest forest fragments may be too large for howler monkeys to traverse on foot, and they have never, according to the local people, been seen travelling to some of these forest fragments.

The protection of the Yumká forest by the state government has ensured the conservation of the relict population of *A. palliata* existing there. The successful conservation of the forest and of this small population of *A. palliata* for over four decades by the government of Tabasco is an important proof that, in spite of being located in the vicinity of the state capital (city of Villahermosa) and in an area undergoing rapid development, local conservation efforts can be effective. The term Yumká is a Mayan-Chontal name for a mythical "guardian of rain forest plants and animals".

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Alejandro Estrada, Estación de Biología "Los Tuxtlas", Instituto de Biología - UNAM, Apdo. 176, San Andrés Tuxtla, Veracruz, México, e-mail: <aestrada@primatesmx.com>, **Yasminda García**, e-mail: <monyasmi@primatesmx.com>, **David Muñoz**, e-mail: <aullador@primatesmx.com>, and **Berenice Franco**, División de Ciencias Biológicas, Universidad Juárez Autónoma de Tabasco, Villahermosa, Tabasco, México, e-mail: <berefranco @primatesmx.com>.

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Interações Sociais e Dieta do Bugio-Ruivo, *Alouatta guariba clamitans*, no Parque Estadual de Itapuã, Rio Grande do Sul, Brasil

Rose Mari Martins Silveira
Thaïs Leiroz Codenotti

Os representantes do gênero *Alouatta* são animais gregários, dóceis e pacíficos, que vivem em bandos mistos. Embora considerados como animais sociais, não apresentam altas taxas de interações entre si. O trabalho de Oliveira (1993) demonstrou que apenas 1,5% da freqüência de comportamentos observados em *Alouatta guariba clamitans* foi gasto em atividades sociais: catação, brincadeiras e agressões. Nos conflitos inter-grupais, a agressão física é normalmente substituída pela emissão de vocalizações agressivas. Os indivíduos adultos alimentam-se isolados, sem interação com os membros do grupo. A distâncias mais próxima registrada durante a alimentação foi de 1,50 m (Chitolina e Sander, 1981). As espécies do gênero *Alouatta* são consideradas consumidoras primárias, que alimentam-se, principalmente, de folhas, frutos e flores (Carpenter, 1934; Glander, 1978; Milton *apud* Marques, 1996). Além desses ítens comem pecíolos, brotos, sementes, caules e ramos, em maior ou menor quantidade, dependendo do habitat e das diferenças sazonais de oferta de recursos (Crockett e Eisenberg, 1987). São animais seletivos, tanto com relação à espécie vegetal, quanto com os ítens alimentares preferidos (Glander, 1978; Milton, 1980).

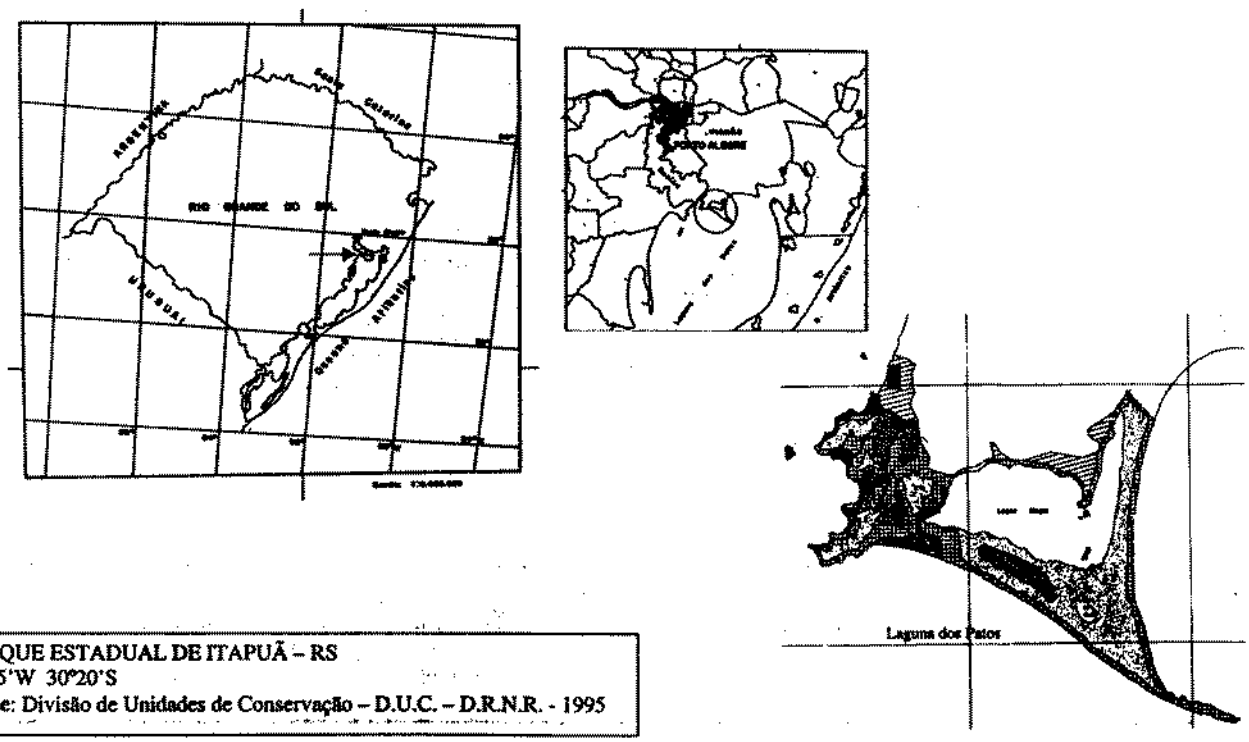
A. guariba clamitans Cabrera, 1940 é um animal pouco ativo, consumindo mais de 50% de seu período diurno em repouso, podendo locomover-se rapidamente mas, em geral, caminha devagar. A economia energética reflete uma estratégia de sobrevivência e decorre de seu hábito folívoro e de um aparelho digestivo pouco adaptado para extrair das folhas todo o potencial energético necessário para o ritmo de vida mais ativo (Marques, 1996).

O objetivo da pesquisa foi estudar o comportamento dos bugios sob dois enfoques: interações sociais e aspectos da dieta alimentar, procurando contribuir com a conservação da espécie e de seu habitat natural.

Métodos

Área de Estudo

A pesquisa foi realizada no Parque Estadual de Itapuã (30°23'S, 50°55'W), localizado ao sul do distrito de Itapuã, no município de Viamão. Tem como limites, ao norte a área remanescente da Fazenda Santa Clara, hoje Hospital Colônia de Itapuã, e o Beco Santa Fé; ao Sul e ao Leste, a Laguna dos Patos e a Oeste o Lago Guaíba (Fig. 1). O Parque abrange uma área de 5.566,50 ha e



PARQUE ESTADUAL DE ITAPUÃ – RS
51°05'W 30°20'S
Fonte: Divisão de Unidades de Conservação – D.U.C. – D.R.N.R. - 1995

Figura 1. Mapa da área de estudo.