Preliminary Observations on the Mottled-face Tamarin (*Saguinus inustus*) on the Lower Río Caquetá, Colombian Amazonia

Erwin Palacios
Adriana Rodríguez
Claudia Castillo

Introduction

Saguinus is the most diverse of the Neotropical primate genera, with 13–15 species and 33 recognized forms (Hershkovitz, 1977; Rylands *et al*., 2000). There have been detailed studies of the feeding ecology, social organization, and behavioral ecology of the majority of the extant *Saguinus* species. *S. leucopus* is notable for the deficiency of information about it (Snowdon and Soini, 1988; Calle, 1992; Vargas and Solano, 1996; Poveda, 2000, and Cuartas-Calle, 2001), and perhaps the least known is *S. inustus.* The latter occurs in southeastern Colombia west of the Andes, between the Río Mesay and the frontier with Brazil, and between the Ríos Guayabero-Guaviare and Caquetá. There is still no accurate delimitation of the eastern and western boundaries of its geographical range in Colombia (Defler, 2003). *S. inustus* also occurs in western Brazil, between the Rios Negro and Japurá and the Colombian border. Here we present preliminary data on some aspects of the ecology of this species on the lower Río Caquetá, Colombian Amazonia and briefly discuss the importance of conducting further research on its ecology in the region.

Subjects, Study Site and Data Collection

Mottled-face tamarins are small: head-body = 208–259 mm (n = 10) with a tail slightly longer, between 330 and 410 mm (n = 10) (Hershkovitz, 1977). On the lower Río Caquetá they are known as "hueviblanco" because the males have naked external genitalia and a white scrotal sac. Otherwise black, they have white patches of skin on each side of the muzzle, which makes them easily recognizable from a distance.

The study was carried out in the interfluvial forests adjacent to the lower Ríos Caquetá and Apaporis, Colombian Amazonia. Observations were made in the vicinity of Comeyafú (1°17'S, 69°34'W), a 19,000-ha indigenous reserve on the left margin of the Río Caquetá in the state of Amazonas (Fig. 1). We first met with the community in order to tell them the purpose of conducting the study and to select people to participate in the fieldwork. With the help of field assistants we found a group of five animals frequently seen near the community. Existing trails in the area were used to search for and follow them, and

Table 1. Fruits eaten by a group of *S. inustus* on the lower Río Caquetá, Colombian Amazonia.

Species	Family	Yucuna name	Part eaten
Mendoncia ovata	Acanthaceae	Pijiture camure	Pulp
Tapirira guianensis	Anacardiaceae	Uayapala or ingna uala	Pulp
Rollinia mucosa	Annonaceae	Cahayú	Pulp
Couma macrocarpa	Apocynaceae	Yuuchi	Pulp
Lacmellea cf. *arborescens*	Apocynaceae	Gemacacu	Pulp
Pourouma cecropiifolia	Cecropiaceae	Caamú	Pulp
Pourouma tomentosa	Cecropiaceae	Cahamulá or Maprimutula	Pulp
Buchenavia cf. *viridiflora*[a]	Combretaceae	Cumela	Pulp
Inga edulis	Leguminosae	Gûiro o Yucurupi	Aril
Inga leptocarpa	Leguminosae	Gûiro "de rastrojo"	Aril
Inga pilosula	Leguminosae	Gûiro	Aril
Inga thibaudiana	Leguminosae	Gûiro de rastrojo	Aril
Inga yasuniana	Leguminosae	Gûiro	Aril
Inga sp.1	Leguminosae	Gûiro	Aril
Inga sp.2	Leguminosae	Gûiro	Aril
Inga sp.3	Leguminosae	Gûiro	Aril
Mouriri cf. *acutiflora*	Melastomataceae	Yukurú or Yauhimapula	Pericarp and pulp
Abuta grandifolia	Menispermaceae	-	Pulp
Pseudolmedia laevis	Moraceae	Amasí	Pulp
Pouteria guianensis	Sapotaceae	Imaá	Pulp
Pouteria sp.1	Sapotaceae	Uiyunumala	Pulp
Pouteria sp.2	Sapotaceae	Jarapila	Pulp
Unknown	Quiinaceae?	Mayé pijulare	Aril

[a]A group of 11 animals were seen eating this fruit near the Lomalinda Indigenous Community (12 km west towards Comeyafú).

additional trails were cut to cover the group's known range. We observed the group from March to June 2003, which included the end of the dry season (early rainy season) and the rainy season. For a period of 18 days we attempted to follow the group for the entire day, but this was achieved on only five days because of the lack of a more extensive trail grid. Daily ranges were drawn on a map scale 1:1000 and were measured using the distances between consecutive group positions recorded during the day. Home range size was calculated using the convex polygon method, which although possibly overestimating the range (Albernaz, 1997), was the most appropriate because the quadrate method requires a comprehensive trail grid. Trees used as feeding sources were marked with colored flagging tape and later revisited to obtain botanic specimens for identification. Information on feeding by *S. inustus* was limited to the animal and plant species we saw them eat.

Results and Discussion

Group size, use of space and daily ranges

Group size varied from three to six (mean 4.4, n = 5, sd = 1.14) at our study site, but larger groups were observed elsewhere. A group of 11 and another of nine were seen 22 km to the west (E. Palacios, pers. obs.). Including these two groups we have a mean group size of 6.0 (n = 7; sd = 2.7). Defler (2003) reported group sizes of three, seven, and eight individuals based on sightings in the same area. These figures are similar to those of other *Saguinus* species (Freese, 1975; Soini, 1987; Sussman and Kinzey, 1984; Janson and Terborgh, 1985; Kostrub, 1997; Peres, 2000). We never observed temporary associations between groups.

Our study group used an area of 35 ha, which included *terra firma* forest and flooded forest. The former included areas of primary and secondary forest (locally called *rastrojo*), and clearings abandoned after being farmed. *Rastrojo alto* was the local name for high secondary forest, and *rastrojo bajo* for low secondary forest. Flooded forest includes areas that suffer occasional flash floods (of one to a few days from overflowing creeks) as well as *várzea* (seasonally flooded for three to five months). A little more than half (54%) of the group's range was secondary forest, and of that mostly (93%) *rastrojo bajo*. Primary forest took up 34% of the home range, but we believe that this forest type would have come to comprise a larger portion of the group's home range if we had observed the group for longer. Only about 1% of the range was flooded forest. Approximately 12% of the area included in the forest matrix used by the mottled-face tamarins was occupied by the Indian's cultivation plots.

Mean daily range length was 961 m (range 750–1100 m; sd = 137; n = 5 complete days). Although the home range size is similar to *S. nigricollis*, *S. fuscicollis*, *S. imperator* and *S. labiatus* (Izawa, 1978; Terborgh, 1983; Kessler, 1995; Veracini, 2000), it is notably smaller than the ranges for *S. mystax* and *S. fuscicollis* reported by Peres (2000). This undoubtedly is a reflection of the short period of study — *S. inustus* range would be larger if recorded over an entire year.

Foods

The mottled-face tamarins were seen to eat the fruits of 23 plant species from 12 families and 13 genera (Table 1). These plant species were spread through *terra firma* (primary and secondary forest) and flooded forest, and all, except for the liana *Mendoncia ovata*, were trees.

Some of these fruits were typically found in the secondary forest. For instance, *Mendoncia ovata* was commonly seen growing in the low and high *rastrojo*, as was *Inga thibaudiana*. Other species, such as the two *Pourouma* spp., grow near large forest gaps and along the borders between the primary and secondary forest and the cultivated plots. *Buchenavia* sp. and two of the *Inga* species, on the other hand, were found only in the flooded forest.

As reported for other tamarins, *S. inustus* was also seen to eat small spiders, orthopterans, and ant larvae. These resources were commonly obtained as the tamarins foraged in the middle and lower levels of the forest, especially in the low *rastrojo*, where they were often seen moving about only 0.5 m above the forest floor.

Inter-specific associations

Twice we saw mottled-face tamarins interacting with groups of *Callicebus torquatus*. They were observed feeding together in a *Pourouma cecropiifolia* tree; titis and tamarins shared different levels of the tree crown, and no agonistic behaviors were seen. No encounters with other primates were recorded; continued hunting in the forests around Comeyafú and the neighboring community has extirpated the larger to middle-sized primate species such as woolly monkeys, *Lagothrix lagothricha*, and the tufted capuchin, *Cebus apella* (E. Palacios, unpubl. data). Although squirrel monkeys, *Saimiri sciureus*, and red howlers, *Alouatta seniculus,* are still present in the area, we never observed them during our time there.

Conservation Aspects

S. inustus is ranked as of Least Concern under the IUCN categorization (2001). It seems to be common around Indian villages along the lower Ríos Caquetá and Apaporis interfluvium. In general, one sees more tamarins in habitats that have been disturbed by human activities. Peres (1999), for example, found that densities of *S. fuscicollis*, *S. mystax*, and *S. imperator* were higher in areas subject to moderate to heavy hunting pressure than in those where hunting was minimal or non-existent. Density comparisons of the same set of species, and including *S. geoffroyi*, in protected and unprotected areas have shown that these species are more abundant and comprise a greater proportion of the total primate density in the latter (Freese *et al.*, 1977; Soini, 1987). Nevertheless, some unprotected sites show densities as low or lower than those in protected sites (Muckenhirn *et al.*, 1975; Freese *et al.*, 1982). Plots cultivated by Indians,

peasant crops, and small-scale logging have transformed many areas of the mottled-face tamarin's natural habitat. Slash-and-burn is the prevalent agricultural practice in the region, but can be considered of low impact in forest conversion only when human population densities are very low. Rural populations are growing considerably, concentrating their numbers in certain areas and making increasing demands on forest resources. The interfluvium between the Ríos Caquetá and Apaporis, east to the mouth of the Río Miriti, is a case in point, where a very large proportion of the region's indigenous population is concentrated (1.24 people/km²) and where numbers will continue to increase through immigration.

Much (60-70%) of the range of *S. inustus* in Colombia falls within the boundaries of indigenous reserves (Defler, 2003), along with smaller areas on the lower Río Caquetá settled by peasant families. It will be important to continue studying these tamarins and monitoring their densities along with current trends of forest clearing and other human activities, so that we can attain a better understanding of the ecology and conservation status of the species. These actions will, we hope, both continue our learning about the ecology of this interesting primate, and provide a mechanism to involve local people in joint conservation measures in their lands.

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Erwin Palacios, **Adriana Rodríguez** and **Claudia Castillo**, Conservation International Colombia, Bogotá DC, Colombia, e-mails: <epalacios@conservation.org>, <arodriguez@conservation.org>; <clauscas@hotmail.com>.

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Movements of *Alouatta palliata* Among Forest Fragments in Los Tuxtlas, Mexico

Salvador Mandujano
Luis Arturo Escobedo-Morales
Rodolfo Palacios-Silva

Introduction

Individual dispersal is part of a reproductive strategy that balances the costs and benefits for an individual as it chooses to stay with or leave its natal group (Jones, 1995). Dispersal in *Alouatta* has been documented in a number of studies (Agoramoorthy and Rudran, 1993; Clarke and Glander, 2004; Glander, 1992; Moore, 1992). However, habitat fragmentation may significantly limit the options available for an individual to move between social groups (Swart and Lawes, 1996). In many cases, this interference with the ability to disperse forces primates to live in small and isolated fragments, which in turn may cause changes in foraging and activity patterns, social organization, and physiological conditions, leading to inbreeding that can diminish genetic variability (Clarke *et al.*, 2002; Gonçalves *et al.*, 2003). The ability to disperse across fragmented landscapes will depend on the characteristics of each species (Bicca-Marques, 2003; Jones, 1999) as well as the spatial configuration of the landscape in question (Fahrig, 2003). Tischendorf *et al.* (2003) defined a specialist disperser as having a low probability of crossing boundaries from habitat to matrix, a high risk of mortality while in the matrix, and fast movement and high inter-step movement correlation (i.e., small turning angles between consecutive movement steps, in matrix). In contrast, generalist dispersers have a higher probability of leaving habitat, lower dispersal mortality and less directed movement paths while traveling through the matrix (i.e., larger turning angles between consecutive movement steps).

Howler monkeys are arboreal quadrupeds and are observed only occasionally to leave the trees and walk along the ground (Glander, 1992). For example, *A. pigra* individuals walk among the naturally patchy vegetation in the Petenes of Yucatán (A. Estrada, pers. comm.) and Tabascan swamps (J. C. Serio-Silva, pers. comm.). The same is true for red howlers, *A. seniculus*, travelling among clumps of trees in the Venezuelan llanos. Data on travel patterns in continuous forest suggest that *A. palliata* uses routes that minimize travel times from feeding to resting trees (Garber and Jelink, 2004). Fedigan *et al.* (1998) mention that the formation of new *A. palliata* groups in Santa Rosa, Costa Rica, occurred as a result of large groups splitting, and the dispersal of lone individuals in search of females. Glander (1992) reported an average travel distance of 700 m for *A. palliata* at Hacienda La Pacifica, Costa Rica. Individuals had to cross open areas to reach a new group; in some cases, these movements occurred in several stages between "stepping stone" fragments. In particular, dispersal success declines with a decrease in habitat and increased fragmentation of the landscape, but the rate of this decline accelerates once the amount of remaining habitat falls below 10-20% (King and With, 2002). Therefore, one might expect that howler monkeys do not travel among fragments randomly, and that the spatial configuration of habitat patches and the nature of the surrounding matrix is critical to successful dispersal.

The tropical rainforest in Los Tuxtlas in the Mexican state of Veracruz has been largely deforested: 75% of native habitat has been lost, 20% now survives only in isolated fragments, and barely 5% is comprised of widespread contiguous rainforest at high elevations (>800 m) (Estrada and Coates-Estrada, 1996). *Alouatta palliata,* the mantled howler monkey native to Veracruz, now survives in archipelagos of forest fragments that vary in size, age, and degree of isolation. Their existence in these scattered forest remnants is precarious both ecologically and demographically, which compounds the dilemma of dispersal (Estrada and Coates-Estrada, 1996; Mandujano *et al.*, in press). Here we present data on the movements of howler monkeys in this region's highly altered landscape and develop a preliminary model of the probability of interchange between fragments.

Methods

Fieldwork

This research was conducted in the Sierra Santa Marta in the south of Los Tuxtlas, Veracruz, Mexico (18°22'N, 94°45'W). We defined the study area as the landscape between the Ríos Tecuanapa and Pilapa, covering 4,960 ha, of which only 11% is suitable primate habitat (Fig. 1). Elevation ranges from sea level to 900 m. Corn crops and livestock pasture make up the matrix that surrounds the 92 remaining fragments, most of which are located in riparian zones along rivers and streams, often on slopes steeper than 30°. Some fragments are on hilltops, while others lie in permanently flooded areas. Of these fragments, 81% are smaller than 5 ha, and only five (8%) are between 10 and 75 ha. The mean distance between fragments and the higher elevation continuous forest was 3,625 m, while the mean distance from one fragment to the next was 111 m. The mean distance from any fragment to the nearest town was 880 m.