MANAGEMENT AND CONSERVATION PLAN FOR THE BROWN SPIDER MONKEY(Ateles hybridus) , IN QUECHUA INDIGENOUS TERRITORY, COLOMBIA.

ABSTRACT

Despite being considered one of the most endangered primates in the world, knowledge about the distribution and population status of the brown spider monkey (Ateles hybridus) is scarce. This work compiles the information that has been obtained on brown spider monkeys in Colombia for the last few years in a document that contains the current state of knowledge of their distribution and that of some of their studied populations. Based on recent records (2010 -2020) we generated a habitat prediction model for Ateles hybridus in Colombia and contrasted it with: historical data, natural protected areas and a habitat loss analysis. Information from population census studies was collected and we discussed some of its most relevant results. In 2010, only 22% of the historical range contained available habitat for the species. The deforestation rate in the last 20 years was more than 27%, suggesting that the process of habitat loss and fragmentation is prevalent. We identified eight priority areas for their conservation in Colombia and the need to create new protected areas, since only 3% of their distribution is legally protected. Finally, we identified that the highest densities of the studied populations are not necessarily the ones in the best condition, since they are restricted to small fragments of forest, usually isolated. The situation of Ateles hybridus populations is critical and coordinated and immediate efforts are required to prevent their prompt extinction.

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INTRODUCTION

The spider monkey, marimonda del Magdalena or choibo (Ateles hybridus) is a neotropical platyrrhine primate resident in Colombia and Venezuela, belonging to the genus Ateles. The species is currently critically endangered. It is characterized by being a not very small primate with a very long prehensile tail, which it uses as support to move from one place to another in the treetops, sometimes it usually goes down to ground level, it is an animal that does not flees into human presence if no aggression is shown. In Colombia there are some individuals in captivity in various zoos, such as the Ocarros Zoo in Villavicencio, the Cali Zoo in Cali, or the Santa Cruz Zoo in San José del Tequendama, all in Colombia. This species is included in CITES Appendix II, and categorized as Critically Endangered (CR) on the IUCN Red List. The spider monkey was listed in the biannual publication The World's 25 Most Endangered Primates, 2008-2010.

Ateles hybridus hybridus is found in several protected areas in Colombia, including: Catatumbo-Bari National Natural Reserve (158,125 ha), Tamá National Natural Park (48,000 ha), El Coco National Natural Park (306,000 ha), and Parque National Sierra Nevada de Santa Marta (383,000 ha). It can also occur in the Hingaza National Natural Park (50,374 ha). In Venezuela, the species occurs in the Guatopo National Park (92,640 ha), which is of particular importance because it is one of the main water reservoirs for the capital city,

Caracas. The Serranía del Perijá National Park (295,288 ha) is the other large protected area with brown spider monkeys. In these national parks, activities against hunting and logging are necessary. There are no organizations actively working with Ateles hybridus hybridus as target species, and government agencies should enhance their conservation efforts. However, there is interest in continuing with the studies on these primates, as well as an awareness program, especially at the local level. It is also essential to increase the number of park rangers and improve their economic condition. The record in the study area (El cerro Bañaderos) of groups of marimondas (Ateles hybridus) make the area its northernmost distribution site, and consequently constitute evidence of its ecological importance, as it houses various population groups within it. of this species, (Forero et al 2012) which, in addition to being endemic to Colombia, has currently been classified as critically endangered, a situation that highlights the importance of the area for CORPOGUAJIRA to formally define the area as a protected natural area.

This species, which requires forests in a good state of conservation, is strongly threatened by the decline in its natural habitat and the hunting pressure to which it is subjected, which is why it is a flagship species and priority conservation object of the DMI. proposed in the study area, giving it great biological importance as a conservation zone for this emblematic taxon of national diversity. Therefore, it is considered of vital importance to conduct research on its ecology and behavior, in such a way that it is possible to obtain the necessary technical support to design and implement effective strategies and mechanisms for its conservation and management. In this sense, the present project is oriented to obtain scientifically supported information on aspects such as land use, state and population density, diet and use of natural resources, role of the species in the dispersal of seeds and forest fruits, habitats used, breeding seasons, local migrations, behavior of the species regarding fragmentation processes, and definition

of connectivity needs through the establishment of corridors between the existing fragments.

STATUS OF CONSERVATION

Ateles hybridus is considered Critically Endangered (CR A4cd) due to an anticipated population reduction of 80% or more over a period of 45 years (three generations), including the current generation (2018-2033) and two subsequent generations (2033-2063). This reduction will likely be due, in part, to the loss of suitable habitat, calculated from Global Forest Watch data to be between 20-30% in those regions of Colombia and Venezuela in which this species occurs. In addition, and perhaps more importantly, this species is very heavily hunted for its meat, as well as for the pet trade. According to studies done by Peres and Palacios (2007), population densities of heavily-hunted Ateles species can decline by as much as 80% or more over several generations.

RANGE DESCRIPTION

Brown spider monkeys (Ateles hybridus) are found in the middle Magdalena River basin, in north-eastern Colombia, in the Perijá Mountains, in the south-eastern areas of the Sierra Nevada de Santa Marta and across the Andes into western Venezuela. An isolated population occurs in north-eastern Venezuela in the Parque Nacional Guatopo.

Geographic Range

In Colombia, wild populations are found on the western bank of the Magdalena River in the departments of Bolívar, Antioquia and Caldas, with most populations living in lowland forests (below 1,000 m asl.), but some recent records were reported from higher altitudes (1,780 m asl, Roncancio-Duque 2012). They are also found on the eastern bank of the Magdalena River in the departments of Magdalena and César (north of the southern slopes of the Sierra Nevada de Santa Marta), in the south-western parts of Guajira on the western and eastern slopes of the Serranía de Perijá, and in the middle Río Magdalena valley reaching the departments of

Boyacá and Cundinamarca. West of the eastern Andes they are found in the Río Catatumbo watershed in the department of Norte de Santander and in the north-east piedmont forest of the department of Arauca (Hernández-Camacho and Cooper 1976; Defler 2003, 2004). Brown spider monkeys have a disrupted distribution in Venezuela (Mondolfi and Eisenberg 1979). They are found in the north, along the south-eastern part of the Central Mountain Range (Cordillera de la Costa) in the state of Miranda, and probably in the state of Vargas. They are also located on both sides of the Venezuelan Andean Mountains (states of Zulia, Táchira, Mérida, Trujillo, Portuguesa, Apure and Barinas). In the eastern part of its range, Ateles hybridus occurs in the piedmont forest and in the highly threatened lowland forests of San Camilo and Ticoporo. In the West, it also occurs from the piedmont of the Andes throughout the lowland areas around the southern part of Lake Maracaibo to the Perijá Mountains (Sierra de Perijá) along the border with Colombia (Bodini and Pérez-Hernández 1987; Linares 1998; Cordero-Rodríguez and Biord 2001; Portillo and Velásquez 2006; Duque 2007; B. Urbani, unpubl. data).

Global Forest Watch data show that forest loss rates are between 20-30% in those regions of Colombia and Venezuela in which this species occurs (Global Forest Watch 2020).

POPULATION

In Colombia, the early studies of Bernstein et al. (1976a) estimated a density of 9-14 individuals/km² for Ateles hybridus in the northern range of the San Lucas Mountains. In the same region, specifically at Cerro Bran, Green (1978) estimated densities of 8.2-9.6 groups/km², which, if multiplied by his average group size (3.3 individuals), provide higher population densities. Since 2007 several studies were conducted aiming to estimate population densities of brown spider monkeys in the wild (see Table 1 in the Supplementary Information). Population densities vary from absent to 67 individuals/km².

A population reduction of 80% or more over a period of 45 years or three generations is suspected for the current generation (2018-2033) and two subsequent generations (2033-2063). This reduction will likely be due in part to the loss of suitable habitat, calculated from Global Forest Watch data to be between 20-30% in those regions of Colombia and Venezuela in which this species occurs. In addition, and perhaps more importantly, this species is very heavily hunted for its meat, as well as for the pet trade. According to studies done by Peres and Palacios (2007), population densities of heavily-hunted Ateles species can decline by as much as 80% or more over several generations.

HABITAT AND ECOLOGY

Spider monkeys travel and forage in the upper levels of the forest. They spend most of their time in the canopy, sometimes use the middle and lower strata but are rarely seen in the understory. They are highly frugivorous and feed largely on ripe fleshy fruits, which comprise approximately 80% of their diet and that are mainly found in the emergent trees and upper parts of the forest canopy (Van Roosmalen and Klein 1988, Di Fiore et al. 2008, Link et al. 2012). They complement their diet with young leaves and flowers (especially at times of fruit shortage), with immature seeds, floral buds, aerial roots, and decaying wood (Di Fiore et al. 2008). They play a significant role as seed dispersers as they disperse large quantities of seeds from numerous canopy tree and liana species (van Roosmalen 1985, Link and Di Fiore 2006). Studies on brown spider monkeys at Las Quinchas revealed that they largely depend on ripe fruits, spending over 90% of their foraging time feeding on them (Link et al. 2012). Nonetheless, some populations living in fragmented areas include large quantities of young leaves in their diet (app. 40%) all year-round (Link et al. unpubl. data).

Spider monkeys live in multi-male/multi-female groups of approximately 30 individuals (range 15–60) (for review see Shimooka et al. 2008). However, they are rarely seen all together and are most of the time travelling, feeding and resting in small groups of varying size and composition (Symington 1990). Thus, spider monkeys have a high degree of fission fusion dynamic (Aureli et al. 2008). Although, spider monkeys can have home ranges as large as 400 ha (Link and Di Fiore 2013), home ranges of brown spider monkeys, in the heavily fragmented landscape at San Juan de Carare, were estimated to reach only 30-120 ha. Most probably, home ranges of groups living in continuous forests will be larger.

Although some populations of spider monkeys seem to have most of their births in certain months of the year (May–December for white-bellied spider monkeys at TBS, Ecuador), there is no information on birth seasonality for brown spider monkeys. Female spider monkeys disperse from their natal groups (Di Fiore et al. 2009) at approximately 6 years and reach sexual maturity at approximately 8–9 years of age. They give birth to single offspring

after a long gestation period of 226-232 days, with average inter-birth intervals of 32-36 months.

Congdon (1996) provided a brief remark on the behaviour of these monkeys at the Reserva Forestal Caparo, and Duque (2007) provided a list of potential feeding trees for Ateles hybridus hybridus in the El Ávila National Park (however, this primate species was not observed at the time of Duque´s survey). Late maturation and long inter-birth intervals make it difficult for them to recover from hunting and other threats.

Size

Adult male weight: 6.5-8.5 kg (mean 7.5 kg, N=3) (Link unpubl. data)

Adult female weight: not available.

THREATS

In Colombia and Venezuela, Ateles hybridus is subject to pervasive habitat loss and to hunting (Link et al. 2013). In Colombia the habitat of A. hybridus is extremely fragmented, and currently less than 20% of the historical distribution remains (Link et al. 2013). There may be a few populations of adequate size to be viable in the mid- to long-term (Defler et al. 2003). Large and continuous forests only remain at Serranía de San Lucas, Serranía del Perijá, Catatumbo and Serranía de Las Quinchas, but a large proportion of forest fragments within their range is too small to hold viable populations. Also, in areas with large continuous forests, brown spider monkeys are heavily hunted for subsistence and for medicinal use, driving their populations to local extinction.

Habitat alteration appears to be the most important threat to the Venezuelan population of A. hybridus. The lowland forest of the state of Zulia and the piedmont of the Perijá Mountains are heavily destroyed by expanding cattle ranching activities (B. Urbani unpubl. data). Portillo and Velásquez (2006) undertook a gap analysis for this primate species within the Perijá Mountains and found that

the remaining total forest area is still sufficiently large (813,257 ha), but only 30% is relatively well protected. The rest is affected by rapid human expansion and land clearance. Also, in the Perijá Mountains, these monkeys seem to be a favourite game species (Lizarralde 2002). In central Venezuela, some areas that were reported to harbour these primates (Cordero-Rodríguez and Biord 2001) were resurveyed by Duque (2007) without reporting any sightings. This is probably because most of the area is already converted into secondary vegetation. Also in this region, B. Urbani (unpubl. data) found that buffer areas around the protected areas—with confirmed populations of Ateles hybridus hybridus (P. N. Guatopo) and unconfirmed populations (M. N. Cueva Alfredo Jahn, P. N. Henry Pittier, P. N. San Esteban and P. N. El Ávila)—are transformed into cleared areas for slash-and-burn agriculture, human settlements or secondary forests. The lowland forests in the eastern part of the Andean Mountains (San Camilo and Ticoporo) are under severe pressure from logging.


1. METHODOLOGY

A. Population Census

This study will be carried out over a year (August, 2013 – August 2014), a period in which we carry out monthly visits in order to determine: a) the distribution patterns and b) the size of each one of the populations, estimating the number of individuals that make use of the area, expressed in densities, c) ethology of the species and state of the vegetation and forest resources.
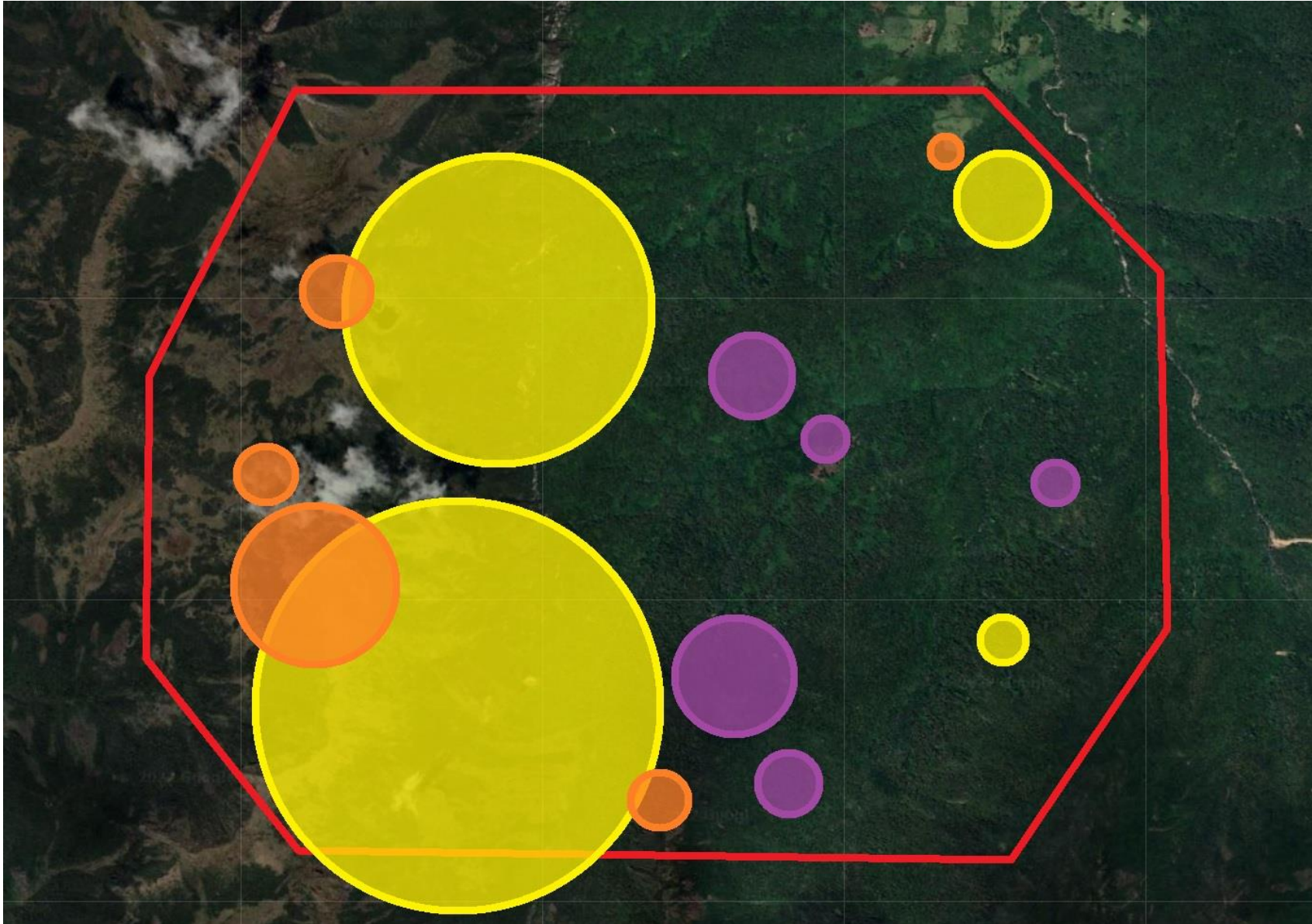
MANAGEMENT AND CONSERVATION PLAN FOR THE BROWN SPIDER MONKEY (Ateles hybridus), IN QUECHUA INDIGENOUS TERRITORY, COLOMBIA.

CONVENTIONS

🟥	**Project área**
🟨	**Poaching outbreaks**
🟧	**Populations of primate**
🟪	**Quechua indigenous cities**

Elevations

	0m – 1,000m
	1,000m – 2,500m
	2,500m – 3,500
	+3,500m

SCALE

1cm = 2,500m
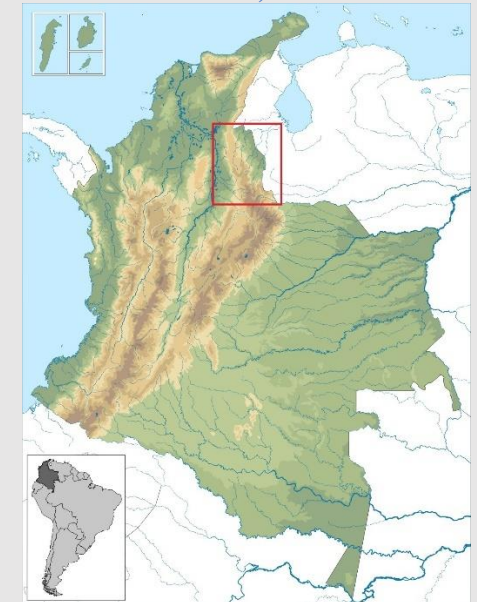
Distribution

To estimate the distribution of the population of this primate, we used the grid method, recommended for the elaboration of primate distribution maps (Barnett, 1995), and widely used for the elaboration of national and regional atlases of European fauna and flora. (Delibes et al, 1983; Campo and García-Gaona, 1983; Rivas-Martínez, 1987, González-Kirchner, 1994). To do this, we divided the study area into grids of 100 m per side, based on existing cartography. In each of the squares covered during the study period, we recorded the presence or absence of Ateles hybridus. For the case of distribution only, "presence" means direct observation of monkeys or unmistakable signs of their presence in a given location, such as feces or bitten fruit. With the data obtained for each of the grids, we elaborated a graphical representation of its distribution.

Population size

The size of the populations is estimated in density measures, expressed in number of individuals per km2. For this, we will randomly choose X transects of variable length, along which we make direct observations through walking tours. The length of each one of the transects mentioned above is estimated by means of a GPS in each one of the routes, to later obtain the average length of each one of the transects. We walk slowly according to the walking method proposed by Telleria (1986), widely used in primatological research (NRC, 1981; Burnham et al., 1979; Brockelman and Ali, 1987; Skorupa, 1987; García and Braza, 1988; Whitesides, et al. al, 1988; Barnett, 1995). The estimation of the size of an animal population using the linear transect method assumes that the following assumptions are met (NRC, 1981; Mandujano, 1994): 1. Animals found at zero meters distance perpendicular to the transect are always observed, that is, the probability of observation is equal to 1 (avoids an underestimation). 2. The data of the observed animals should be recorded in the initial position in which they were observed for the

first time, and avoid individuals being counted two or more times (avoid overestimation). To comply with this assumption, the tree where the group is located is marked, thus recording the initial position of observation. In addition, we will spend as little time as possible on the site to avoid a new contact with the same group later. 3. Distances must be measured with some accuracy. We use a digital pedometer or tape measure, with which we ensure that the distances were always measured in the same way; In addition, we verify in the field the location of points already represented on the maps, such as lagoons and savannahs.

4. Observations must be independent events. Whenever we find separate groups on the same tour, that is, we are sure that they are two different groups of monkeys, we take them as independent observations. Likewise, the routes within the area will be made alternately in each transect, in order to minimize overlaps from one day to another and with this, the probability of observing the same individual and/or group more than once on consecutive days or in different the same place. In addition to the previous assumptions, we consider the minimum lengths that the transects require to be valid sampling units. In each traverse of the transects, we count the total number of individuals observed, recording, for the first animal observed:

1. The radial distance of the observer: distance between the observer located at a point of the transect and the point where the animal is detected.

2. The approximate angle of observation: angle formed between the transect line and the radial distance line.

3. The perpendicular distance of each animal: distance from the point where the animal was observed to the point closest to the transect.

The distances are estimated using the digital pedometer or tape and the angle of vision using a conventional compass. Likewise, we collected data on the number of individuals that made up the registered groups, the sex when it was possible to observe it, and the number of offspring. The densities recorded for each of the primate populations will be estimated with the Hayne model (Mandujano, 1994), based on the data obtained for each of the individuals observed during the tours in each of the transects. The basic assumption of this model is based on the animal detection function or curve, which describes the probability of detecting an animal depending on its distance perpendicular to the center of the transect (ri). The basic idea is that the probability of detecting individuals decreases as they move away from the center of the transect, which is why it is necessary to estimate the effective detection distance, that is, the distance at which the risk of not detecting an individual is minimal. This effective distance is estimated from the data, taking the harmonic mean of the distance at which all individuals were detected.

By means of this procedure, the average density can be estimated for each traversed transect, as well as the 95% confidence interval for the same average.

B. Vegetation The objective was to estimate the relative abundance of different tree species in the prevailing types of vegetation that would allow us to estimate the importance of each of them for the spider monkey. Coupled with larger-scale analyses, using aerial photographs and maps, these results constitute an assessment of the degree of disturbance to spider monkey habitat in the area. The identification of the trees will be done by the forestry engineer (Manuel Manjarres). Subsequently, identification will be made with his scientific name and his family using the existing literature on dry forest vegetation or consulting the samples with other professionals.

C. Habitat

Use The primary objective is to investigate different aspects of the spider monkey's social, reproductive, and feeding behavior, which in the case of this work, will serve to define area requirements, as well as to obtain stability indicators. of the population. Every twenty minutes after visual contact, we recorded the following data in the form of maps or sketches on graph paper: a) Number of adult, subadult and juvenile monkeys, identity and activity of each (eating, resting or moving); b) Distance between each one and with respect to trees or known paths; c) In the case of eating, the species and the vegetable part (fruit, leaf or flower) of which it deals. The definition of a subgroup requires particular attention: due to visibility conditions, it is possible not to include all individuals that are together and therefore underestimate the size of subgroups that do not depend on our ability to find them or visibility conditions. On the other hand, staying in the same place with the same subgroup could cause the virtual size of the subgroup to increase over time as more individuals are discovered. Whereas in the population census this objective measure is provided by the constant speed at which the observer moves, so that he always counts the monkeys in the same way, in the case of the habitat use study, we develop an objective measure.

D. Ethology.

Through preliminary observations of individuals in other studies on spider monkeys, a list of behaviors (ethogram) was drawn up, describing each one of them objectively, and a record sheet is prepared for their daily monitoring. ethogram. It includes the following behaviors: 1. Locomotion: the individual moves from one point to another in space, using front and rear members or only hind limbs (quadri or bipedalism, respectively), quickly or slowly, on the ground or on the trunks of trees. It includes walking, running, brachying, and climbing. 2. Rest: individual at rest, absence of activity for 20 seconds or more. It may or may not be asleep, but it is not alert (see next). 3. Alert state: attentive individual looking at a fixed point, inside or outside the island. It can be sitting, standing on two or four legs, or moving or hanging in the trees. The body may look stiff or tense. 4. Vocalizations: the two sounds that were most striking during the study were considered. These were "oh-oh-oh-oh", opening their mouths in an "O" shape in moments of excitement, especially during some of the enrichment experiments, or "i-i-i-i-i" when something seemed to upset them. 5. Facial expressions: showing teeth, opening the mouth. 6. Foraging or searching for food and water: exploratory movements or movements in order to find food or water. It includes the handling of these resources as well as their ingestion. 7. Scratching: rapid movement of any of the extremities (hind or front) at a point, on the individual himself. Also included in this category are slower, more deliberate movements, using both hands, sometimes called self-grooming. 8. Others: very infrequent behaviors such as washing the body with water from the drinking fountain were included in this category; be hanging (stay suspended in the air, holding on to a branch with the tail.

F. Training of local people and biology students from the University of La Guajira.

It is in the interest of the foundation to link and train local people in all research processes. In this way,

their knowledge about the biology of the spider monkey will not only change their attitude towards the conservation of the spider monkey habitat, but will also pass it on to other local people. Some of these, particularly those who work as guides, also benefit from the presence of the person in charge of this project. In the foundation, many students from the biology faculty of the University of La Guajira are linked, who show a desire to continue in the study of mammals. These students and members of the community will be advised by the Mamma-zoologist of the Marlon Gonzales Vargas Foundation and their participation in the project would be as field assistants in the census activities and study of the behavior of the different groups of marimondas in the Bañaderos hill.

CONSERVATION ACTIONS

Although Ateles hybridus is found in several protected areas in Colombia, there is no information on the status of these protected populations. It is found at: [1] Catatumbo-Bari National Natural Reserve (158,125 ha): there might be a large population (given the forest cover and habitat types protected within the National Park), but there is almost no information on their population size. [2] Tamá National Natural Park (48,000 ha): no recent records. [3] El Cocuy National Natural Park (306,000 ha) and Parque Nacional Sierra Nevada de Santa Marta (383,000 ha): only small areas of these two parks may still harbor populations of brown spider monkeys, however this needs to be confirmed. [4] Selva de Florencia: there are some recent records of browns spider monkeys

(Roncancio et al. 2012), but population densities seem to be extremely low.In summary, there is a complete lack of information on the current status and potential viability of wild brown spider monkeys that live within the National Parks of Colombia. In Venezuela, the species occurs in the Guatopo National Park (92,640 ha), which is of particular importance because it is one of the major water reservoirs for the capital city, Caracas. The Sierra de Perijá National Park (295,288 ha) is the other major protected area with brown spider monkeys in Venezuela. In these national parks, enforcing hunting law and regulations for wood extraction are needed. There are no NGOs working actively with Ateles hybridus hybridus as target species, and governmental agencies should improve their conservation efforts. However, there is interest to continue surveys of these primates, especially in central Venezuela, and to implement an awareness programme at a local level. It is also fundamental to increase the number of park rangers and to improve their economic livelihood. Brown spider monkeys also occur in Caparo Forest Reserve (Venezuela) (Duque unpubl. data).

Bernstein et al. (1976a) showed the effect of forest disturbance, especially on A. h. brunneus (and Lagothrix lagothricha lugens), and (1976b) made a plea for the establishment of reserves for this and other threatened primate taxa. Fortunately, the Serranía de San Lucas in southern Bolívar still contains extensive forest which has been identified as a possible national park site. The establishment of a San Lucas National Park ought to have high priority in Colombia, since it would preserve many elements of the Nechí refuge, including Saguinus leucopus, Cebus versicolor and L. l. lugens. However, the presence of political insurgents, the military and some mine fields make the region very difficult to work in and inaccessible for government officials.

This species is listed on Appendix II of CITES.

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