

in the area. The possibility that the animal was kept in captivity by the local human population cannot be ruled out, as the collector did not state whether the single collected specimen belonged to a larger group of individuals or was found alone. As more specimens become available, a more comprehensive study about geographical variation in pelage among distinct populations of *M. emiliae* would be important for understanding whether the variation found within the species warrants its division into separate specific taxa or not.

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OBSERVATIONS OF TERRESTRIAL BEHAVIOR IN THE PERUVIAN NIGHT MONKEY (*AOTUS MICONAX*) IN AN ANTHROPOGENIC LANDSCAPE, LA ESPERANZA, PERU

Sam Shanee
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Introduction

The Peruvian night monkey (*Aotus miconax*) is one of the least studied of all Neotropical primate taxa. *A. miconax* is endemic to northeastern Peru (Aquino and Encarnacion 1994) and its entire range lies within the 'tropical Andes biodiversity hotspot', an area characterized by its high levels of species endemism and threats to conservation (Myres et al. 2000). This species has not been the focus of previous behavioral studies and is only known from *ad libitum* observations and collection localities in the departments of Amazonas, Huánuco and San Martín (Thomas 1927a; 1927b; Butchart et al. 1995; Cornejo et al. 2008). These same departments have some of the highest rates of deforestation in Peru (Elgregen 2005; INEI 2007). Deforestation in the area is fuelled by immigration of people from the central and northern highlands looking for land for small scale agriculture, cattle ranching and timber extraction (Garland 1995; Schjellerup 2000; Shanee 2010). In many areas this has caused the complete loss of large areas of forested land (Shanee et al. 2007; Shanee 2010). In other areas patterns of land use and ownership have caused the isolation of many small patches of forest forming an anthropogenic landscape mosaic (Shanee 2010). *A. miconax* is listed as Vulnerable by the IUCN (Red List categories A2c) and Endangered under Peruvian law (Decreto Supremo 34–2004-AG). *A. miconax* lives in small family groups of 2–6 individuals (personal observation). Like other night monkey species these groups generally comprise a heterosexual pair and their off-spring. The diet of night monkeys

is primarily frugivorous although leaves, buds and insects also figure in their diet (Ganzhorn and Wright 1994; Fernandez-Duque 2003). Fruiting figs (*Ficus spp.*) are a preferred food source in all studied *Aotus* species (Fernandez-Duque 2007).

Terrestriality has been recorded in other species of neotropical primates. Most commonly terrestriality has been observed in populations of *Cebus spp.* using stone tools to open hard shelled fruit (Fleagle 1999; Waga et al. 2006) and at dry season waterholes (Freese 1978). Terrestriality has also been observed in populations of *Ateles spp.* (Campbell et al. 2005) at dry season water holes as well as to access salt-licks and other scarce resources. A similarly wide range of terrestrial behaviors has been observed in *Brachyteles spp.* (Mourthe et al. 2007).

We aimed to gather basic ecological data on this little known species. We conducted night follows and *ad libitum* data collection to monitor the behavior of a group of *A. miconax* in a mosaic landscape of forest patches and cultivated land, to better understand the interactions between night monkeys and their habitat in an anthropogenic environment. The work will aid ongoing conservation efforts for *A. miconax* and other endangered primates in the northeast of Peru.

Methods

Study site

Our observations took place in the *Centro Poblado La Esperanza* (S 05°39'46", W 77°54'32"), Amazonas department, Peru. Habitat in the area is comprised of disturbed primary and regenerating secondary montane and pre-montane cloud forests interspersed with pasture and plantations. In areas closer to human settlements this landscape becomes decreasingly forested with isolated forest patches ranging in size from ~ 0.5 ha to ~ 10 ha surrounded by cattle pasture and small cultivated plots of corn, potatoes, beans and other vegetables for local sale or local consumption. The area lies on the eastern slopes of the Andes with elevations between 1800 and 2400 meters above sea level. Terrain is very rugged with steep valleys separated by high mountain ridges. Temperatures fluctuate between approximately 25 °C in the day and can reach as low as 6 °C before dawn. Rainfall is heavy year round with a drier season during June–November. Average monthly rainfall is 1500 mm.

Habituation

We conducted group follows on a habituated group of *A. miconax*. When the group was identified it was already well habituated to the presence of humans due to the proximity of the village of La Esperanza and nearby houses (three houses bordered the patch). Local residents frequently pass through the forest patch on their way to their fields and many use the patch as a source of firewood for their homes. We furthered the habituation process between January 2008 and the start of the study period while testing

methodologies and preparing transects for the study. No dedicated habituation program was implemented as this was deemed unnecessary.

Study group

At the start of the study period the group consisted of 5 individuals (2 adults, 2 sub-adults/juveniles and one infant). One individual was born in April 2010, for a group of 6 individuals (3 adults, 2 sub-adults/juveniles and one infant) at the end of the study period.

Data collection

Observations took place between 18:00–22:00 hours and 03:00–06:30 hours for five nights each month between December 2009 and November 2010. Our night follows were conducted on the days preceding, during and after the full moon. Group follows were made by one to three trained observers using red light LED headlamps (Silva) as well as conventional light flashlights. The focal group lives in a small ~ 1.4 ha isolated forest patch (S 05°42'17", W 77°54'14"). Trails were cut in a 10 × 10 meter grid; all intersections were tagged with high visibility flagging tape. We also recorded *ad libitum* data from observations of *A. miconax* while conducting other research in the same area, since the initiation of the project in October 2007.

Results

We observed terrestrial behavior during a four day period whilst carrying out group follows; we also inferred terrestrial behavior from two *ad libitum* observations. The first *ad libitum* observation was made on the 27th February 2008. A lone adult female was found in a patch of eucalyptus trees (*Eucalyptus globulus*) just outside the village of La Esperanza. The trees, located next to a house on the edge of the main highway (*Carretera Fernando Belaunde Terry*), were over 100 meters from the nearest forest patch and ~20 meters from the next nearest trees. In the morning the patch of trees was surrounded by dogs trapping the individual until we were able to remove her from the tree and release her in a nearby forest patch.

The second *ad libitum* observation was made on the 11th August 2010. Again a lone adult female was found behind a house in the village of La Esperanza. The individual was heard vocalizing continuously for 15 minutes. The trees where this individual was observed were >300 meters from the nearest forest patch. A discontinuous line of trees runs from this forest patch almost to the village but is broken in places, with one gap of >15 meters and one gap of ~6 meters, where the individual had to descend to the ground to cross. Other less substantial gaps also exist in this line but were probably crossed by leaping from one tree to another.

During group follows on the nights of 20th, 21st, 22nd and 23rd of November 2010 we observed a group of 6 individuals leaving the forest patch where they live to gain access to

a fruiting fig tree (*Ficus* spp.). On all occasions the group left the forest in the undergrowth and crossed ~5 meters of open ground before climbing a neighboring tree to gain access to the fig. On each occasion the group stayed in the tree for 15–25 minutes before returning to the forest by leaping from neighboring trees into the undergrowth on the border area of the home patch, thus avoiding crossing open ground again. On one occasion the group returned to the same tree, crossing open ground, twice in the same night.

Discussion

We found no published records of terrestrial behavior in any *Aotus* species although similar behavior has been reported for *A. a. azarai* in Argentina (M. Svensson & E. Fernandez-Duque pers. comm.), and probably exists in other areas where habitat is similarly fragmented. The highly disturbed and fragmented habitat of *A. miconax* at La Esperanza is representative of forests in much of this species range where anthropogenic pressures on remaining forests are increasing. The ability of primates to cope in anthropogenic landscapes is becoming more and more important to their survival as human populations continue to grow, particularly for those with restricted ranges and in areas of high human population density (Marsh 2003). Our first two observations were probably individuals dispersing from their natal groups, although solitary individuals are reported to be common in populations of *A. a. azarai* in Argentina (Fernandez-Duque 2004) and *Aotus* spp. in Colombia (Villavicencio-Galindo 2003).

Our observations on *Aotus* diet at this site show a relatively high reliance on buds and leaves, accounting for 30% of their diet (Shanee and Shanee in prep). This is more than for most other night monkey species (Fernandez-Duque 2007). High consumption of leaves has also been observed in the cathemeral *A. a. azarai* (Fernandez-Duque 2007). Increased leaf consumption could be a strategy developed to cope with reduced availability of fruiting species in smaller patches or less productive forest types. The home patch of the focal group contains other fruiting trees, including figs. However, only two other food species were seen to be fruiting at the time, *Styrax* sp. and one unidentified species. Both of these have smaller, less fleshy fruits than figs and so are probably less desirable to *A. miconax*.

The forests of La Esperanza are home to three other primate species: *Oreonax flavicauda*, *Ateles belzebuth* and *Cebus albifrons* (Shanee and Shanee 2010), however only *Aotus miconax* has been observed so close to villages or in such small forest patches (> 50 ha). In part this is probably because of their smaller body size, nocturnal habits and undesirability to hunters. There are however reports from local people of *O. flavicauda* crossing open ground between forests and in one incident an individual of this species was captured by a local man in a semi-isolated patch of ~30 ha when it

tried to enter a coffee plantation (A. Mego-Rodriguez, pers. comm.).

Terrestrial behavior in primarily arboreal primates' such as *Aotus* may leave individuals at greater risk to predation (Isbell 1994; Mourthe 2007). The risk of attack or predation by domestic animals such as dogs and possible opportunistic capture by hunters will be especially great in areas with relatively high human population densities such as La Esperanza. Even with these increased risks many species of neotropical primate demonstrate occasional terrestriality (Freese 1978; Dib et al. 1997; Fleagle 1999; Campbell et al. 2005; Waga et al. 2006; Mourthe 2007). Several populations of *Cebus* spp. regularly descend to the ground to open dry or hard shelled fruits (Waga et al. 2006), a resource that would be unavailable without access to stone 'tools'. Similarly, *Cebus* spp., *Ateles* spp. and *Brachyteles* spp. have all been observed descending to the ground to access dry season waterholes and otherwise un-available resources (Freese 1978; Port-Carvalho et al. 2004; Campbell et al. 2005; Mourthe et al. 2007). In the 12 months of our study the focal group was only observed descending to the ground during a single four-day period to access an otherwise un-available resource. This occurred during the dry season when fruit is scarce.

In one study Dib et al. (1997) reported that groups of northern muriqui (*Brachyteles hypoxanthus*) descend to the ground to cross areas of pasture between isolated forest patches. Terrestriality in dispersing females has also been observed in *Brachyteles* (Lemos de Sa 1988 cited by Dib et al. 1997). If individuals need to disperse from groups in isolated patches then occasional terrestriality becomes a necessary behavior to avoid inbreeding and intragroup conflicts. The solitary *Aotus* females we observed were probably dispersing from their natal groups. Our observations suggest that conservation of *A. miconax* and other primates in similar landscapes can be aided by the preservation of connectivity between forest patches. Through better planning when converting forest to pasture or plantations, arboreal food sources close to forest habitat could be conserved. Understanding the reasons for, and risks and benefits involved in, terrestrial behaviors in *Aotus* spp. will greatly aid in conservation assessments and planning for this and other species.

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