DEEP INCURSION AND USE OF A MINERAL LICK WITHIN A NEIGHBORING TERRITORY BY A GROUP OF WHITE-BELLIED SPIDER MONKEYS (*ATELES BELZEBUTH*) IN EASTERN ECUADOR

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Abstract

One convergent aspect of the societies of chimpanzees and spider monkeys is the fact that members of a social group jointly conduct territorial boundary patrols and raids into home ranges of neighboring groups. Boundary patrols are usually perpetrated by subgroups of adult and subadult males who travel in silence into neighboring territories. Only rarely do females participate in these incursions. Moreover, for spider monkeys living in the western Amazon, mineral licks (or 'salados') seem to be key areas where animals descend to the ground and consume water and soils, most likely to acquire minerals not readily available in their diet. Based on 10 years of behavioral research, here we document a unique case in which most members of one group of white-bellied spider monkeys (*Ateles belzebuth*) collectively made a deep incursion into a neighboring group's territory and used a mineral lick well within a that group´s range. This particular event raises the intriguing questions of what knowledge group members might possess about locations of key resources in adjacent territories, how they acquire this knowledge, and what motivates the use of those resources, especially when groups have other mineral licks they can frequent within their own territories. Although occasional deep incursions into other group's ranges may be part of the repertoire of intergroup interactions engaged in by wild spider monkeys, the underlying explanation behind the decision to visit and consume soil from mineral licks in neighboring territories remains largely unexplained.

Key words: Boundary patrol, inter-group competition, mineral lick, territorial behavior

Resumen

Um aspecto covergente de las sociedades de chimpances y monos araña es el hecho de que miembros de un grupo social conjuntamente llevan a cabo patrullajes en los límietes de sus territorios e incursiones en los territorios de grupos vecinos. Las patrullas limítrofes son usualmente prepetradas por subgrupos de machos adultos y subadultos quienes viajan en silencio hacia los territorios vecinos. Solo raramente participan hembras en estas incursiones. Más auún, para los monos arañas que habitan en la Amazonia occidental, los ¨salados¨ (mineral licks) parecen ser áreas donde los animales descienden al suelo y consumen agua y suelos, muy posiblemente para adquirir minerales no disponibles fácilmente em su dieta. Basados en 10 años de investigación comportamental, aquí documentamos un caso único en el cual la mayoría de los miembros de un grupo de monos araña de barriga blanca (*Ateles belzebuth*) colectivamente hicieron una incursión profunda dentro del territorio de un grupo vecino y utilizaron un salado dentro de su territorio. Este particular evento plantea las intrigantes preguntas de qué conocimiento deben poseer los integrantes de un grupo acerca de la localización de recursos clave en territorios adyacentes, cómo adquieren este conocimiento y, qué motiva el uso de aquellos recursos, especialmente cuando los grupos tienen otros salados que pueden frecuentar dentro de sus propios territorios. Aunque las incursiones profundas dentro de los territorios de otros grupos pueden ser parte del repertorio de las interacciones intergrupales de los monos araña silvestres, las explicaciones subyacentes tras la decisión de visitar y consumir suelo de salados en territorios vecinos son aún ampliamente desconocidas.

Palabras clave: Patrullas limítrofes, competencia intergrupal, salados, comportamiento territorial

Introduction

Boundary territorial patrols and raids into neighboring territories have been documented in several chimpanzee societies that have been subjects of long-term studies (Wilson and Wrangham, 2003 and references therein). In most populations, boundary patrols are relatively rare events (Goodall, 1986; Boesch and Boesch-Achermann, 2000; Watts and Mitani, 2001; Mitani and Watts, 2005) in which chimpanzees move along the boundaries of their territory or make incursions into the territories or neighboring groups. Boundary patrols are primarily executed by adult and subadult males, but sometimes females participate as well, with the extent of female participation in these activities varying across sites (Goodall, 1986; Boesch and Boesch-Achermann, 2000; Watts and Mitani, 2001; Mitani and Watts, 2005). Although this behavior has been described as a distinctive and unique aspect of the behavior of wild chimpanzees, *Pan troglodytes* (Mitani and Watts, 2005), it has also been documented in spider monkeys societies (Symington, 1990; Shimooka, 2005; Aureli *et al.,* 2006; Wallace, 2007, 2008; Link, 2011). During spider monkeys' territorial encounters, aggression has been observed between neighboring groups and parties, primarily by males (Symington, 1990; Shimooka, 2005; Wallace, 2007; Aureli *et al.,* 2006).

Several studies have proposed that male spider monkeys are territorial in order to defend access to females rather than other important resources (Symington 1987; Wallace 2007; Link, 2011). In fact, Symington (1987) proposed that males cooperate not to gain immediate access to reproductive opportunities but rather to maintain the integrity of a group territory and thus, indirectly, access to the females who range within that territory. Aureli *et al.* (2006) and Link (2011) have also argued that deep incursions by spider monkeys are driven by factors other than feeding competition and access to key areas of high fruit productivity, because patrolling males spent virtually no time feeding during their incursions into neighboring territories.

Mineral licks are important sites where several species of Neotropical mammals – including spider monkeys – come to the ground to consume soil for mineral supplementation and/or as a detoxification agent (Blake *et al.,* 2010; Link *et al.,* 2011). When spider monkeys visit these sites, they often assemble in larger subgroups than in the rest of their territory and they often invest several hours per visit resting and being vigilant in the area around the lick before descending to the ground to feed on soil (Link and Di Fiore 2013). For many arboreal primates, mineral licks are especially risky because these are the only sites where they go down to the ground, where the risk of predation risk (e.g., from terrestrial felids) is presumed to be greatest (Janson, 1998; Link *et al.,* 2011). In western Amazonia, each group of spider monkeys usually has at least one mineral lick in their territory, and these sites are visited up to several times per week (Link *et al.,* 2011). The long periods of time that spider monkeys remain at mineral licks suggests that they represent an especially valuable resource.

Here, we describe a unique case of a deep incursion performed by most of the adults of both sexes who were resident in of a group of wild white-bellied spider monkeys (*Ateles belzebuth*) that has been the subject of our long-term research in western Amazonia. During the incursion, the monkeys traveled directly towards and subsequently used a mineral lick located deep in the territory of a neighboring group, and we discuss the potential implications of this observation for the cognitive ecology of spider monkeys

Methods

Data were collected at the Tiputini Biodiversity Station, which is located in the Yasuní National Park and Biosphere Reserve in the Ecuadorian Amazon. The study group (MQ-1) of wild white-bellied spider monkeys (*Ateles belzebuth*) was habituated in 2005 and has been followed regularly since that time. All group members can be individually identified on the basis of variation in age, sex, and distinctive pattern of pelage and pigmentation on the face and genitals. Data on the behavior, ranging patterns, and social associations of all adult members of the study group were collected in the context of regular all-day follows of adult individuals using focal animal sampling (Altman, 1974). During follows, researchers used datalogging GPSs (model Garmin 76CSx), programmed to record location points every 20 seconds (i.e., 3 times per minute) from the beginning of each follow. From these GPS data, we extracted a mean location record for 12 sampling points every hour (i.e., at 0, 5, 10, etc., minutes after the hour) by averaging the UTM coordinates for records scored within the 2-minute window centered on those points. Daily range maps were constructed by importing these data into ArcGIS 9.2 and superimposing them on a template of the TBS trail system. Data on the composition of the focal subgroup were also collected for the same 5-minute sampling points throughout the duration of the follow.

Following the incursion described below by MQ-1 into the territory of the adjacent group (MQ-6), we set up a video camera trap for four months equipped with a motion and heat sensor to monitor activity at the mineral lick they visited, which was located deep within MQ-6's territory. This allowed us to evaluate the pattern of use of the lick and to discern whether it was being visited by individuals from our main study group or by other individuals.

Finally, we also used the location data from one male spider monkey fitted with a GPS collar, to check if this subject visited the newly discovered mineral lick on other occasions, even when not followed by our research team.

Results

On March 11th, 2011, researchers S. Alvarez and L. Abondano were searching for subjects from the MQ-1 study group to sample. At around 06:27, they heard spider monkeys making alarm calls (a.k.a., "repeat barks") and located

a subgroup containing three adult females with their offspring near a mineral lick located at the center of MQ-1's home range. Within a few minutes, three adult males and three additional adult females approached from the eastern part of MQ-1's home range and joined these females. The observers then heard many vocalizations coming from a long distance away from the east and southwest; these vocalizations were not alarm bark but rather were long-distance "loud calls", probably coming from other members of MQ-1 as they were detected from within MQ-1's home range. These nine adult spider monkeys and their offspring then started to move away from the mineral lick area and traveled rapidly towards the northern portion of MQ-1's home range. At around 09:00 the animals were joined by another female from MQ-1 and her two offspring, and they continued moving rapidly to the northwest. Some minutes later three additional adult males from MQ-1 joined them and one of the females left the subgroup. At that point, all six adult male group members of MQ-1 were present in the subgroup. Around 10:00, the animals paused to forage and rest, and they engaged in a lot of social interactions while resting. Several of the juveniles played for a long time, while the adult males rested close to each other for most of the time. During this pause one additional female left the subgroup with her offspring.

At 10:40 the subgroup began moving steadily to the northwest again. Around 12:00 another one of the adult females and her juvenile male offspring fissioned from the subgroup. Half an hour later, the remaining subgroup of six adult males, five adult females, three subadult females, one subadult male, and four juveniles crossed what we considered the "border" of their home range – the northernmost location they had been seen in until this time. Until then the animals' behavior was reminiscent of a "boundary patrol" and their ranging took them towards the territory of a known neighboring group. At 12:40 the animals started to turn towards the west, turning away from the neighboring territory and into an area where we had never followed nor seen spider monkeys previously. The males stayed very close to one another as they moved, keeping a distance of about 5 to 10 meters between them and females were following behind. They kept moving northwest (Fig. 1) and traveled very low in the canopy. They were not vocalizing at all and no other long-distance calls were heard after they started moving northwest.

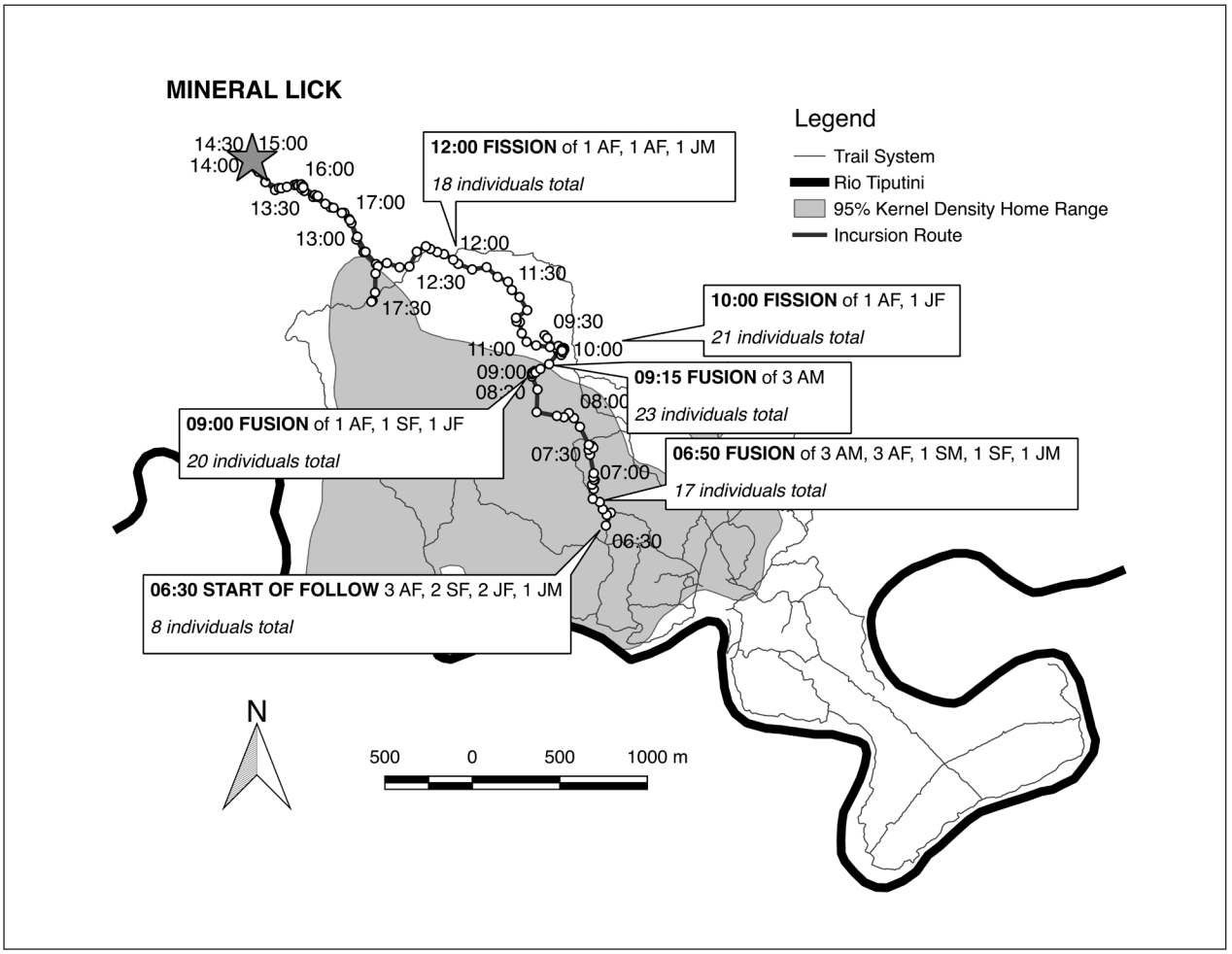

Figure 1. Route taken by a subgroup of MQ-1 during a boundary patrol and deep incursion in another group's territory on March 11th, 2011. Dots are records of the location of the group, taken every 5 minutes, with every 30 minutes point marked with the time. Text boxes indicate subgroup size and changes in subgroup composition throughout the follow. A = adult, S = subadult, J = juvenile, F = female, M = male.

At 13:50, when the group was about 1 km to the north of TBS the trail system (and over 1 km from what we had presumed was the limit of MQ-1's territory based on six years of prior observation), the monkeys stopped and rested for a few minutes. They were vigilant, looking towards the ground, and one of the adult males did some branch-shaking displays towards the observers. They then started cycles of descending partway towards the ground and then retreating up very quickly, similar to behaviors seen when they visit the mineral lick within their home range.

About 15 minutes later one female with her offspring were observed climbing back up from the ground with their faces completely covered with mud, thus confirming that they were indeed consuming soil at the mineral lick. Following this, multiple individuals were then seen going up to the trees with their faces and feet covered with mud. Although the mineral lick was difficult to observe, as it was located in a narrow canyon, it was evident that all of the subgroup members used the lick. The subgroup remained in the area for about an hour, a much shorter time than the ~4 hours animals spend, on average, around the mineral lick within their own territory. At 14:19 a long-distance vocalization was heard at about 400 m away, coming from the north, but the individuals from MQ-1 did not respond and continued going down to the lick.

The subgroup left the mineral lick area at 15:34 and started to head back to their territory backtracking along nearly the same route they used to get there. Nonetheless, they moved much more slowly, resting and eating fruits on their way back. On the return they also vocalized much more, including contact vocalizations ("whinnys") and loud calls. They arrived back at the edge of their territory around 17:45.

Following this event we set a video camera trap in the newly identified mineral lick for the next four months, and confirmed that this mineral lick was active (we recorded at least six episodes of clay consumption during that period) and that it was used by monkeys that we were unable to recognize individually. Since this one incursion, after several additional years of sampling we have never again followed animals from the MQ-1 group to this mineral lick. Additionally, after reviewing data for one male from the MQ-1 group who was fitted with a GPS collar from 1.5 months before until nine months after the incursion, we noted that out of 111 days on which the GPS collar – which was programmed to take a fix every half hour – captured at least 10 location records, this was the only occasion where the collared male visited the newly recognized mineral lick.

Discussion

In this brief report we describe a unique case of a deep incursion into a neighboring group's territory and the use of a neighboring group's mineral lick by one group of spider monkeys. Mineral licks, in general, seem to be very important resources for western Amazonian spider monkeys; they are frequently used, and animals invest a large amount of time being vigilant and resting in large subgroups around lick sites (Link and Di Fiore, 2013).

Aureli *et al.* (2006) described seven cases of deep incursions by male Central American spider monkeys into the range of another group; in these cases, animals only fed for a small portion of the time they spent within the neighboring territory, leading Aureli *et al.* (2006) to conclude that these kind of incursions seem not to be motivated by feeding competition. This idea has also received support in chimpanzee studies, where chimpanzees spent only a small portion of their time during raids engaged in feeding behavior (Wilson *et al.,* 2004). However, the deep incursion here described included using the mineral lick of another group, which suggests that such areas not only play a key role in the grouping patterns of spider monkeys, but maybe also in their intergroup relations. This case also constitute an example of animals engaging in a very directed movement towards a specific and far off location, as the focal subgroup, with 18 individuals, moved almost directly towards the target and then back into their own territory using a route that was completely unfamiliar to the observers. Indeed, in six prior years of tracking members of this group, we had never seen the animals range anywhere close to the new mineral lick site, which they approached directly, and in five subsequent years of tracking, we have never seen them revisit the lick. The direct track followed by the animals to arrive at the lick would seem to suggest that they had a very clear notion of the spatial location of this resource.

In contrast to the behavior of the MQ-1 group of spider monkeys around their own mineral lick, where they usually spend, on average, ~ 4 hours resting and being vigilant around the lick prior to coming down to the ground, in this case they spent only around an hour in the neighboring group's mineral lick area. They arrived in silence and did not spend a large amount of time being vigilant before coming down to eat soil. They fed on clay at the lick and did not respond to long distance vocalizations that came from north of the lick while they were at the site.

Nevertheless, the subgroup composition in this case was very different from the male-dominated parties that we and others have usually observed during patrols (Symington, 1990; Shimooka, 2005; Wallace, 2007). In addition to all adult males from the MQ-1 group, five adult females and several subadult animals and juveniles of both sexes were also present, which is not common during incursions or boundary patrols (Link and Di Fiore, unpublished data). Such a subgroup composition would seem to leave some animals vulnerable should they encounter animals from a neighboring group, especially when considering that such encounters are generally aggressive (Symington, 1988; van Roosmalen, 1985; Aureli *et al.,* 2006; Wallace, 2007; this study, data in preparation). This event, we suggest, is thus

best interpreted as a case of an incursion specifically to "use" resources located in another group's territory without the intention to interact with or challenge that group. Here, the subgroup included young animals, the animals did not spend a lot of time in outside of their own territory, they moved fast towards the other group's mineral lick, and, after using those resources, they came straight back into their own territory.

The direct path that the subgroup took towards a mineral lick outside of their territory suggests that one or more subgroup members had spatial knowledge of the area, perhaps due to past experiences, such as prior boundary patrols. It may even be the case that the locations of extra-territory resources are known to one or more of a group's females by virtue of the fact that females are the dispersing sex and may have immigrated in from other groups. However, the reason as to why our main study group (MQ-1) decided to visit and use this mineral lick, when safer mineral licks are frequently used within their own territory, is still unclear; further data on this type of events is needed to better understand this unusual behavior.

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