Using Camera Traps to Determine Group Demography in a Paraguayan Population of *Sapajus cay*.

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Introduction

The hooded capuchin (*Sapajus cay*) is found in south-east Bolivia, northern Argentina, Brazil (states of Goiás, Mato Grosso, Mato Grosso do Sul) and is the only representative of the genus found in Paraguay (Wallace, 2015). In Paraguay, the average group size for the capuchin has been estimated at 7 individuals with a population density of 4 groups/km² or 28 individuals/km² (Stallings, 1985). Across its range, very little is known about the Hooded Capuchin regarding their reproduction, movements and activity patterns, home range, and social organisation (Rylands *et al*., 2013).

Demographic comparisons of wild primate species across forest fragments can be used to monitor the health and life histories of different populations. Rapid and cost effective assessments are necessary to establish baseline demographic information for future spatial and temporal comparisons across populations of a single species. These assessments can be used to compare population densities, reproductive parameters, patterns of natal dispersal, and group fission and fusion events (Alfaro *et al.*, 2014).

Figure 1: Juvenile (Left) & adult male (Right) capuchin in RNLB

Previous studies have highlighted inherent difficulties with the use of spot counts and direct observation as a means of assessing group demography in arboreal primates (Williamson & Fiestner, 2011), especially in areas where troops are not fully habituated to human presence (Strier, 2007).

In order to overcome these issues, alternative methods can be utilised. Motion-activated camera traps are an effective non-invasive method for monitoring primates (Kierulff *et al.,* 2004; Tan *et al.,* 2013; Pebsworth & LaFleur, 2014).

Here, we report how video camera trapping was used to provide the first information on group composition for wild hooded capuchins (*Sapajus cay*) in Paraguay.

Methods

This study was carried out at Reserva Natural Laguna Blanca (RNLB), San Pedro Paraguay (23°49'59"9S 056° 17'68"2W). RNLB is a private nature reserve in Eastern Paraguay and is home to two groups of hooded capuchins. The reserve contains a small fragment of 243ha of young secondary Upper Paraná Atlantic Forest, characterised by deciduous, mesophytic, broadleaf plants (Lowen *et al.*, 1996). This study was carried out with O Group, the larger of the reserve's capuchin groups.

For 24 camera trap days between July 4th and the 4th August 2015, the platforms were baited with between 5 and 10kg of whole ears of corn. A trap day was defined as a full 24-hour period in which the video camera trap was set to record one-minute videos (with a 5 second delay) when movement was detected within 14m of the camera.

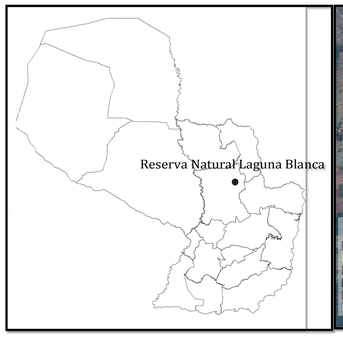

Figure 2: RNLB in Departamento San Pedro, Paraguay. Location of

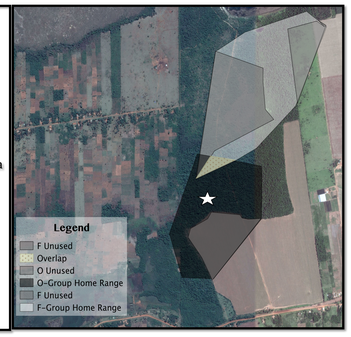

Figure 3: Home ranges of capuchin groups in RNLB and Location of the Feeding Platform (☆) .

Figure 4: Feeding Platform.

- A — Primos Ultra 46HD Truth Cam
- B — Two Tomahawk Traps with bait
- C — *Chrysophyllum gonocarpum*
- D — 2m high, 0.72m² triangular platform

All videos in which a capuchin appeared were reviewed on a frame-by-frame basis. Individual identities were assigned to monkeys on each screenshot based on a variety of physical characteristics including:

1) body size, shape, size, and colour of tufts and shape of the black cap
2) shape and colouration of black and white facial masks and distinctive scars or wounds.

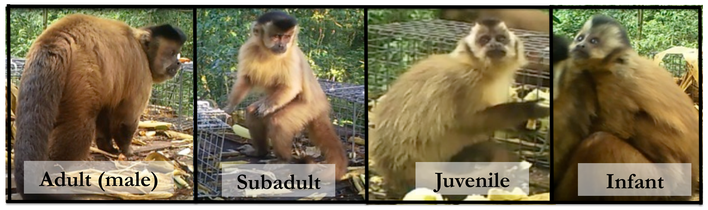

Figure 5: Examples of age classifcation from video screen shots.

A sex was assigned to an individual when a clear image of their genitalia was obtained. Individuals with robust facial features, complete adult dentition, and the largest relative body sizes were scored as "adults" (Fragaszy *et al.,* 2004). "Subadults" were classified as individuals approaching adult body size but lacking the characteristic robust facial features and tufts of the adults. "Juveniles" were classified as individuals that were less than three quarters of the average adult size, not including tail length (Olvieria & Langguth, 2006; Bezerra *et al.,* 2014). "Infants" were classed as individuals only observed being carried by an adult.

Results and Discussion

Species	Group Size	-	No .of Adult Males	No. of Adult Females	No. of Subadults	No. of Juveniles	No. of Infants	Source
S. cay	**18**	**-**	**3**	**5**	**5**	**4**	**1**	**This study**
Species	**Mean Group Size**	**Group Size Range**	**Mean No. Males**	**Mean No. Females**	**Mean No. Subadults**	**Mean No. Juveniles**	**Mean No. Infants**	
S. cay (Paraguay)	12.5	7-18	-	-	-	-	-	Stallings, 1985; This Study
S. cay (Brazil)	20.5	20-21	6	6	2	7.5	-	Pinto, 2006; Fernandes Jr., 2013;
S. macrocephalus	8.3	2-21	1.8	2.1	0.65	2.8	0.8	Klein & Klein, 1976; Izawa, 1980; Defler, 1982; Soini, 1986; Rylands *et al.*, 2013
S. libidinosus	21.8	6-45	3.4	7	1.25	5	2.5	Freitas *et al.*, 2008; Izar *et al.*, 2011; Massaro *et al.*, 2012; Carretero-Pinzón, 2013; Falótico & Ottoni, 2013
S. nigritus	20.6	7-44	2.4	5.6	2.6	6.8	2.5	Lynch & Rímoli, 2000; Di Bitetti & Janson, 2001; Lynch-Alfaro, 2007; Izar *et al.*, 2011; Garber *et al.*, 2012; Janson *et al.*, 2012; Liebsch & Mikich, 2015
S. xanthosternos	14	9-27	2	3	4	4	1	Canale *et al.*, 2013
S. robustus	15.7	8-23	2	4	1	-	-	Martins, 2010; Mittermeier *et al.* 2015
S. flavius	40.2	7-77	10	15	-	37	7	Pontes *et al*, 2013; Rodrigues, 2013; Bastos *et al.*, 2015; Mittermeier *et al.* 2015

Table 1: Study Results and Mean Group Size and Composition Across the Genus *Sapajus*.

The group size in Reserva Natural Laguna Blanca is higher than the only previous estimate for *Sapajus cay* in Paraguay (average group size: 7 (Stallings, 1985)), though the total group size is more comparable to the average across the genus. Group sizes and compositions of the eight *Sapajus* species can vary within and across different habitat locations. The variability of group sizes may be indicative of site-specific factors such as variable predation rates, access to supplemental food sources, and anthropogenic disturbances such as hunting and agricultural encroachment (Cullen *et al.* 2000; Fragszy *et al*., 2004; Hankerson & Dietz, 2014).

With less than 13% of the Upper Paraná Atlantic Forest remaining (Figure 6: WWF, 2015), continued habitat fragmentation surrounding RNLB and across Paraguay has the potential to further isolate remaining populations of *Sapajus cay*. Habitat fragmentation can have significant impacts on group demographic structure. Initially, habitat fragmentation can lead to unnaturally high densities of primates, increasing feeding competition within and between groups (Strier, 2007). The higher number of individuals in the group compared to Stallings (1985) average group size of 7 may be a result of the isolated nature of the forest fragment. However, as the forest at RNLB only became cut off from surrounding fragments within the last 10 -15 years future monitoring will be required to establish long term effects of habitat fragmentation.

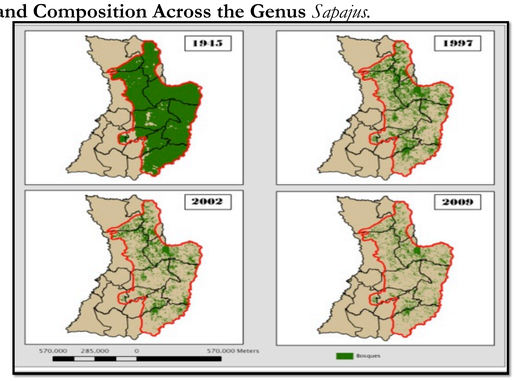

Figure 6: Map of deforestation of the Upper Paraná Atlantic Forest in Paraguay, 1913-2009 (WWF, Sophia Delphin).

This novel information on the group composition of wild *Sapajus cay* population in Paraguay, provides a baseline from which changes in group structure can be monitored, facilitating future studies on the effects of living in such small forest fragments, a topic of increasing importance to the conservation of wild primates (Alfaro *et al*., 2014).

Acknowledgements

We thank all the people that helped with this project:

- Jorge Ayala for building the platform and his continued support.
- Secretaria del Ambiente and Malvina Duarte for their continued and unwavering support of Fundación Para La Tierra's projects.
- Fundación Para La Tierra volunteers and interns.
- Everyone who supported our YouCaring Fundraising Campaign that facilitated the purchase of the two camera traps.

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