

First record of the Peruvian yellow-tailed woolly monkey *Lagothrix flavicauda* in the Región Junín, Peru

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Abstract The Critically Endangered Peruvian yellow-tailed woolly monkey *Lagothrix flavicauda* was presumed to only occur in the tropical montane cloud forests between the Marañón and Huallaga rivers in northern Peru. Here we report the discovery of a population to the south of its previously known range, in the Región Junín. During September–December 2018 we carried out transect surveys to record large mammals present near the village of San Antonio in the district of Pampa Hermosa, at 1,287–2,015 m altitude. We recorded five primate species during transect surveys. *Lagothrix flavicauda* was seen four times, and appeared phenotypically distinct from populations to the north, with notable white patches above each eye and a reduced yellow patch at the end of the tail. The presence of *L. flavicauda* in Junín extends its known geographical range over 200 km southwards from the closest previously known population in the Huánuco region, and presents a unique opportunity for the conservation of this Critically Endangered species.

Keywords Andean montane forest, distribution, *Lagothrix flavicauda*, Neotropical primates, Peru, primate conservation, yellow-tailed woolly monkey

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The Peruvian yellow-tailed woolly monkey *Lagothrix flavicauda* is categorized as Critically Endangered both nationally in Peru (Heymann, 2004; MINAGRI, 2014) and internationally (Cornejo et al., 2008), and is one of the most threatened primates (DeLuycker & Heymann, 2007;

Cornejo et al., 2009). Research on *L. flavicauda* has focused on sparse museum and genetic samples to elucidate its taxonomic placement. Phenetic and morphological analyses had placed it in the monospecific genus *Oreonax* (Thomas, 1927; Groves, 2001), or as a sister species to the other woolly monkeys in the genus *Lagothrix* (Fooden, 1963; Matthews & Rosenberger, 2008; Rosenberger & Matthews, 2008). Recent molecular genetic analyses support the latter (Ruiz-García et al., 2014; Di Fiore et al., 2015). Knowledge of this species comes mainly from long-term study sites in remnant high-elevation tropical Andean forests in the Región Amazonas and Región San Martín in Peru (Graves & O’Neil, 1980; Leo Luna, 1980, 1982; Butchart et al., 1995; DeLuycker, 2007; Cornejo, 2008; Shanee et al., 2008; Shanee, 2011; Shanee et al., 2013a,b; Allgas et al., 2014). The last assessment of viable habitat in this area, in 2009, estimated a reduction by almost 56% since surveys in 1981 (Buckingham & Shanee, 2009), leading to an estimated 93% decline of *L. flavicauda* numbers in this area (Shanee & Shanee, 2014). Early estimates of the geographical range of *L. flavicauda* placed it in the pre-montane and montane forests between the Marañón and Huallaga rivers, but recent research has expanded that range southwards into Región Huánuco and east of the Río Huallaga near the border with Región Pasco (Shanee et al., 2013a; Aquino et al., 2016a,b; Aquino et al., 2019; Fig. 1). There are also reports of *L. flavicauda* in areas of Región La Libertad (Parker & Barkley, 1981; Shanee et al., 2013b) and Región Loreto (Patterson & Wong, 2014), but these potential occurrences have been neither consistently observed nor studied. Neither field surveys nor distribution niche modeling have placed *L. flavicauda* further south than south-east Huánuco (Shanee et al., 2013a; Shanee et al., 2015; Aquino et al., 2017; Aquino et al., 2019), although further field surveys of Pasco and Junín are necessary to assess its presence in these regions (Aquino et al., 2019). Here we report *L. flavicauda* 206 km south-east of previous observations in Huánuco.

Our study area is the upper and lower montane forest adjacent to the Río Pampa Hermosa, near the village of San Antonio in Región Junín (Fig. 2), where accessible forest at lower elevations has been cleared for small-scale cultivation of coffee, coca, corn and yucca. Cattle ranching is also a contributing factor to this deforestation. Because of the steep slopes and terrain, however, most of the forest remains intact, albeit with some selective logging. Our study area has

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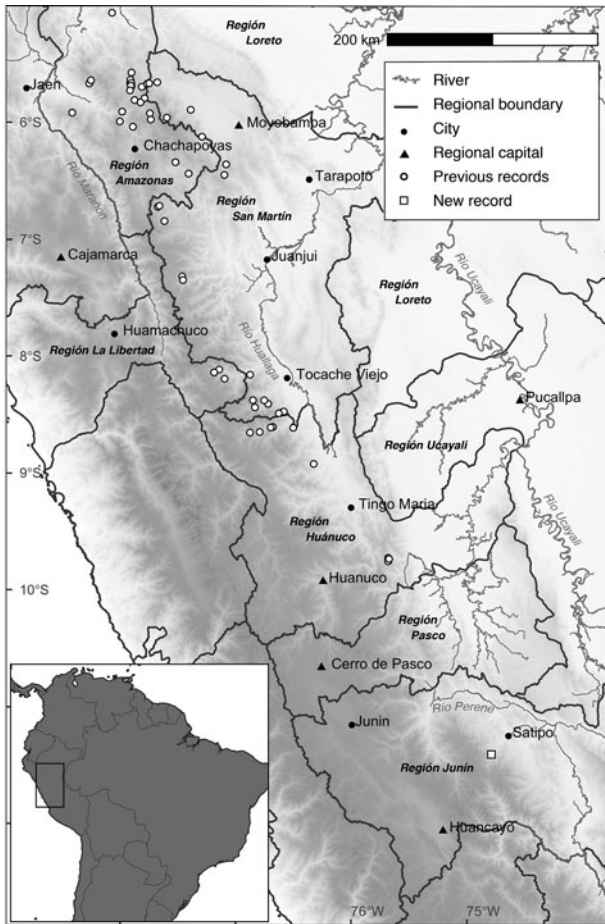


FIG. 1 Known observations of *Lagothrix flavicauda* (Supplementary Table 2), including the newly discovered population in Junín.

a unique primate community (Supplementary Material 1) along with terrestrial mammals such as the Andean bear *Tremarctos ornatus*, red brocket deer *Mazama americana*, collared peccary *Pecari tajacu*, ocelot *Leopardus pardalis* and tayra *Eira barbara*. The University of Central Peru administers a 6,800 ha Área de Concesión de Conservación (Conservation Concession Area) that comprises a portion of our study area (Fig. 2).

During a camera-trap study of terrestrial large mammals, we opportunistically observed the primate community. We surveyed >180 km of cleared logging trails and Andean bear trails over altitudes of 1,287–2,015 m. In addition to *L. flavicauda*, we observed other primate species (Supplementary Material 1).

We encountered *L. flavicauda* four times (Table 1), in primary forest. The monkeys did not flee, but rather approached and descended to observe us more closely, behaviour consistent with unhabituated lowland woolly monkeys *Lagothrix lagotricha* spp. and yellow-tailed woolly monkeys at other sites (FMC & CAS, pers. obs.), allowing us to take photographs (Plate 1). We were able to determine the composition of one of the groups, with 11

individuals, which comprised one adult male, one subadult male, three adult females, three juveniles and three infants. According to people we spoke with in San Antonio, infants and juveniles can be seen with their mothers during December–January. The size of the infants observed in December suggest that one was a newborn and the other two perhaps 3 months old, suggesting births in October–December.

The yellow-tailed woolly monkeys in San Antonio are phenotypically distinct from those further north. All observed individuals had distinct white patches on the brow, one above each eye (Plate 1). This trait has been seen among populations in San Martín and Amazonas, but paler in colour and not in all individuals. The eponymous patch of yellow fur that surrounds the callus friction pad at the ventrodistal end of the prehensile tail is smaller in the Junín individuals than in those further north. All other aspects of appearance (mahogany fur, bright yellow scrotal tuft and pubic hair, white muzzle) seem consistent with other members of the species (Aquino et al., 2015).

Despite being accessible from major towns such as Satipo, via road 24A, the forest in our study area is not heavily fragmented and still has high connectivity, with large tracts of primary forest on the steep slopes. Closer to San Antonio the forest is disturbed, largely by farming. The forest surrounding San Antonio is better preserved and more intact on the northern side of the Río Pampa Hermosa because of the steep terrain, which limits accessibility for farming. From there, the forest is contiguous for 16 km to the border of the Bosque de Protección Pui Pui. The area to the south of the river is more degraded, with widespread farming and cattle ranching contributing to fragmentation, creating a mosaic of habitat types, including pastures and secondary and riparian forests.

The greatest threats to the forests around San Antonio are selective logging and clear cutting for agriculture. These activities particularly affect the forest between Mariposa and the settlement of Calabaza, adjacent to road 24A and the Río Pampa Hermosa, with higher rates of deforestation eastwards to Satipo. The selective logging of rare and valuable trees, such as *Cedrela angustifolia* and *Prumnopitys harmsiana*, puts *L. flavicauda* at risk. Increased forest fragmentation could limit the species' access to lower elevation forests and important seasonal fruit resources. As the human population increases, poaching could become a risk, as at other sites (Shanee, 2011; Shanee & Shanee, 2014). Although this does not currently affect *L. flavicauda* or the other primates around San Antonio, it is imperative that intact forests are managed properly, to prevent the degree of forest fragmentation prevalent in San Martín and Amazonas (Buckingham & Shanee, 2009; Shanee, 2011).

Our observations expand the geographical range of *L. flavicauda* to central Junín, well beyond the southernmost limit of the species proposed by Aquino et al. (2016b, 2017).

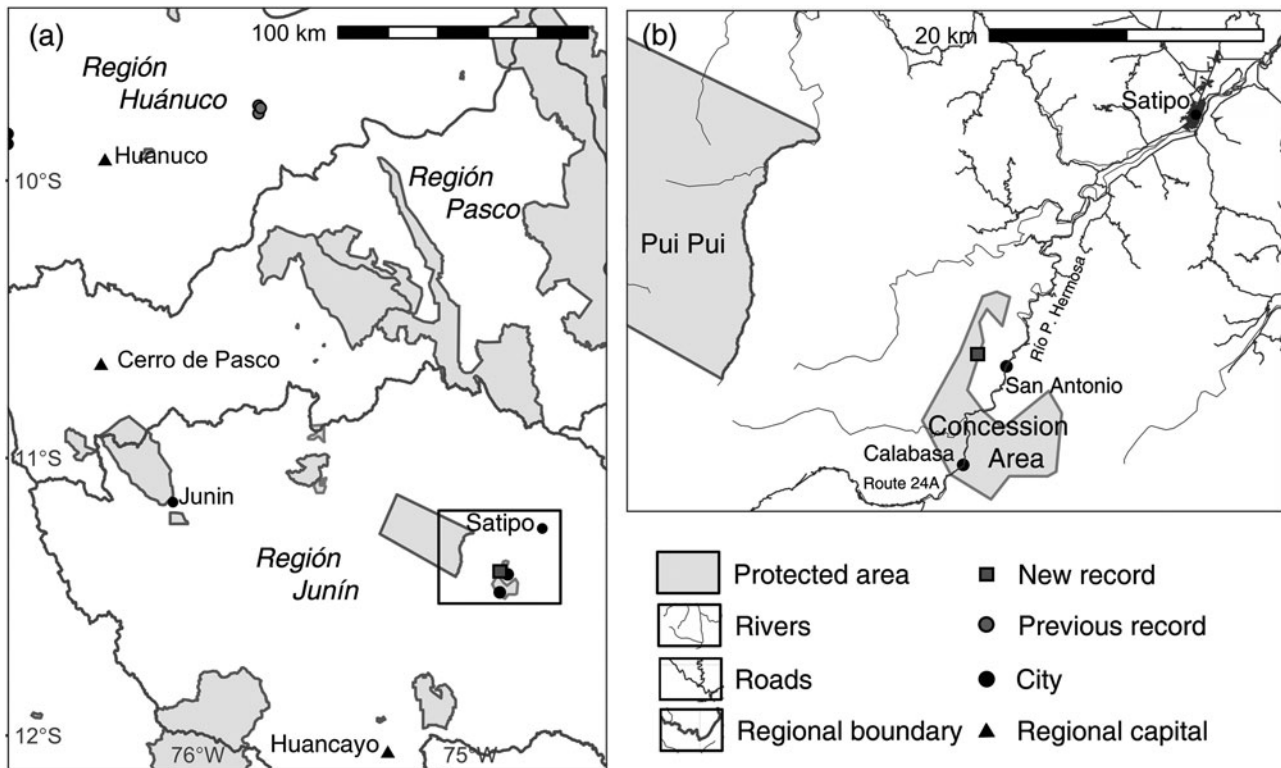


FIG. 2 Location of the new *L. flavicauda* records (a) in relation to the nearest known records in Región Huánuco and protected areas, and (b) the study area, with Bosque de Protección Pui Pui, the University of Central Peru Conservation Concession Area, nearby towns, Río Pampa Hermosa and Road 24A.

TABLE 1 The four troops of yellow-tailed woolly monkeys *Lagothrix flavicauda* observed in the forests around San Antonio (Fig. 1; see Supplementary Table 1 for observations of other primate species in the area).

Date	Time	Individuals	Altitude (m)	Latitude (W)	Longitude (S)
22 Oct. 2018	11.59	3	1,746	74.7854612	11.4113691
12 Nov. 2018	09.59	1	1,711	74.7846628	11.4126528
28 Dec. 2018	14.31	2+	1,437	74.7738746	11.4146831
29 Dec. 2018	08.57	11	1,574	74.7776503	11.4135501

This lends urgency to expand the search for *L. flavicauda* in previously neglected regions of Junín and Pasco (Aquino et al., 2019). Non-invasive genetic analyses of this new population would reveal the extent of its genetic isolation and it is also important that there is further investigation of the viable habitat between Huánuco and the newly discovered population, to examine the degree of isolation between the Marañón–Huallaga and Junín populations.

The Rainforest Partnership and the regional government of Junín are working together to create a regional protected area that would protect remaining *L. flavicauda* habitat in Junín (Buckingham & Shanee, 2009; Aquino et al., 2016a). Rainforest Partnership also works with the community of San Antonio to develop sustainable incomes via ecotourism, which can empower the local community to protect this ecosystem and its rare and threatened species. The economic

incentives provided by ecotourism are an effective conservation model in Peruvian forests (Gordillo Jordan et al., 2008; Stronza & Gordillo, 2008; Stronza & Pegas, 2008), with community-run ecotourism being profitable for local communities and encouraging local conservation (Kirkby et al., 2010, 2011). The community conservation model has been shown to be effective for conservation of the yellow-tailed woolly monkey in north-east Peru, leading to both reduced deforestation and localized population increases (Shanee & Shanee, 2015). Future research on primates in this area will need to be carried out jointly with the community members of San Antonio, to enable them to participate in scientific research and to engage them as conservation stewards (Horwich et al., 2015). This integrated approach will be essential for the conservation of this new-found population of *L. flavicauda*.

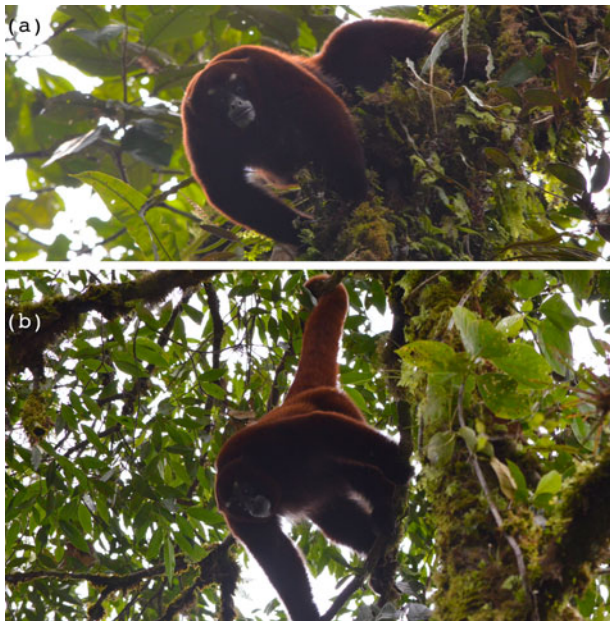


PLATE 1 *Lagothrix flavicauda* adult female (a) and adult male (b) observed in San Antonio (corresponding to the first observation in Table 1). Photos: Jasmina McKibben.

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Author contributions Fieldwork: SMM, FMC, JM, CT, CFJ; writing: SMM, FMC, CT, CAS, JM; editing: all authors; creation of maps: CAS; photographs: JM.

Conflicts of interest None.

Ethical standards This research abided by the *Oryx* guidelines on ethical standards and followed the Code of Best Practices for Field Primatology recommended by the American Society of Primatologists.

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