

Field surveys and Environmental Education for Sustainable Protected Area Management for the Yellow-Tailed Woolly Monkey

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INTRODUCTION

Despite recent advances, the yellow-tailed woolly monkey (*Lagothrix flavicauda*) remains one of the least known and most threatened primate species. Previously thought to occur almost exclusively in the northern Peruvian regions of Amazonas and San Martín (Shanee, 2011), populations have recently been documented much farther to the south (McHugh et al., 2019). No field surveys have been undertaken in these southern areas and few conservation initiatives exist. Habitat protection and education are key to the long-term protection of any area or species. Our project aimed to 1) Survey additional field sites in central and southern Peru to confirm the presence of *L. flavicauda* 2) To carry out education and awareness activities in communities 3) To catalyze local conservation initiatives (Horwich et al., 2015).

Together with local conservationists, we carried out continuous education and information campaigns in these areas. In order to update knowledge on the distribution and conservation status of *L. flavicauda*, we visited areas where, based on published studies and our own distribution models, the species may occur. This project builds on our previous successful work in the species' formerly known range.

METHODS

To select areas for surveys we made a simple ecological niche model in Maxent Program (Phillips et al., 2006) to predict where the species may occur outside of its known range. We used all currently published locality records of *L. flavicauda* (62 points) for analysis, and 19, 1km resolution environmental layers from BioClim (Fick & Hijmans, 2017). After each field trip we added any new points to the model, in that way constantly updating predictions to better select which areas to survey next.

Primary data were collected during forest walks along existing trails accompanied by local residents as field guides. Some trails were also cut to enter new areas, but this was kept to a minimum to limit disturbance. The location of all sites was recorded with a GPS. Data collected included date, start and end time of observation, weather, species identity, group size, activity, height in tree, food type (if eating), approximate age and sex of all animals and sighting location. Any mixed-species associations and vegetation features were recorded, as were *ad-lib* behavioural observations.

Secondary data were collected from hunters and other local key informants. Species identification was made using photographs, drawings, and detailed explanations of pelage, size and ecology. Positive identifications were cross-referenced between informants and further details of behaviour, diet and locomotion were requested to ensure identification (Shanee, 2011). During field visits we asked to see any captive animals, skins, skulls or body parts of animals hunted in the area. We were extremely careful that this did not encourage hunting.

Finally, we made qualitative assessments of habitat quality and threats to primates in the areas we visited, based on our direct observations and from key informant interviews. The amount of time spent surveying for the focal species at each site depended on its size and the ease of access to forested areas. Sites were surveyed for 2-5 days, and coupled with key informant interviews to confirm the presence/absence of the species.

Whenever possible we combined field research with environmental education and promotion of community conservation, in towns and villages near to survey sites. In these cases, we visited primary and secondary schools, giving talks and activities to students. We also gave talks to adults and village authorities from the communities. The main issues covered were on the importance of conservation of local biodiversity, particularly primates, and protected areas, the problems these areas face, and possible environmental problems that could be caused by habitat degradation and over-hunting.

PRELIMINARY RESULTS

The updated predicted ecological niche model, including our survey points, highlighted extensive areas of possible habitat further to the south (Figure 1). To date, we have surveyed 34 sites in the regions of Ayacucho, Cerro de Pasco, and Junín. In total, we recorded the presence of primates at 25 sites (Table 1). These came from at least eight

species, the most commonly encountered species were *Lagothrix lagotricha tschudii*, found at 12 sites in Cerro de Pasco, and *Ateles chamek*, found at nine sites across the three regions.

We confirmed the presence of *Lagothrix flavicauda* (Figure 2) at five sites in Junín (Table 1), but were not able to find the species in Cerro de Pasco, where it appears to be replaced by *L. l. tschudii*. These sightings were ~300 km south of the previously known distribution for the species and another ~50 km further south of McHugh et al (2019) records. So far, we have not been able to find the species in Ayacucho either.

At 17 sites we gave talks to the community. Presenting the project and our motives, as well as workshops on general conservation issues, and primates in particular. At these events we spoke of the importance of conservation for the natural environment, forests, species, water and nutrients. We also answered questions from villagers and gave suggestions of what they could do to reduce the impact of their farming and other activities. So far, we have only undertaken one school activity, due to time constraints. This activity was held in Mesapata, where Elvis Charpentier gave talks to 36 students of all grades in the local school. While trying to survey as many sites as possible we have had limited time to undertake these activities. We have coordinated with local people and authorities at all sites visited and have their contact details for future, follow up, visits. We had planned additional activities at schools in the field sites we visited in February/March this year, but schools were on annual holidays until March, and never re-opened due to control measures against COVID. Once we begin surveys again, we will also continue education activities, depending on feasibility.

DISCUSSION

We have been able to confirm the presence of *L. flavicauda* at additional sites in Junín, even further to the south than previously recorded (McHugh et al., 2019). This, coupled with the results of our ecological niche modelling (Figure 1), suggests the possibility of even more southerly populations in Ayacucho, and possibly beyond. During a literature and database search, while preparing for a previous distribution survey of *L. flavicauda* (Shanee, 2011), we found an online record of *L. flavicauda* in Cusco (CDC Universidad La Molina). This was based on an article in a popular science magazine, *Revista de Lima*. When we were able to locate a copy of the article, the sighting was actually recorded as *L.*

lagotricha, and so we discarded the possibility of the species being found so far south, as had all previous and subsequent researchers, possibly in error.

Our last field trip, to Ayacucho, was in February-March of this year (2020), but due to COVID restrictions we were unable to continue field surveys after the first four sites. At these sites we recorded the presence of several primate species (Table 1). Although *L. flavicauda* was not recorded, we did not record the presence of *L. l. tschudii*, which means that it is not being replaced by this species at these sites. It could be that the habitat is not suitable for woolly monkeys in this area or further surveys may confirm the presence of one or the other woolly monkey. We did record *A. chamek* at all but one site in Ayacucho, so it is unlikely that hunting has extirpated woolly monkeys, as both are large bodied primates and primary targets for local hunters.

Based on the results of our ecological niche model and field surveys we plan to continue our surveys. Completing the survey of planned sites in Ayacucho, and possibly new sites further to south. These areas have several protected areas, both state and communal, which hopefully means that any primate populations will be fairly intact, increasing the chances of finding *L. flavicauda* if it is present. The presence of these protected areas also raises hope for the conservation of primates in these areas.

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Table 1) Primate species' locality records so far during this study.

Region	Locality	Primate species recorded
Cerro de Pasco	Agua fresca - Pusapno	<i>Cebus sp.</i> ; <i>L. l. tschudii</i>
Junín	Condorbamba	<i>A. chamek</i>
Cerro de Pasco	Dos de mayo	<i>Aotus sp.</i>
Junín	Huananay	<i>L. l. tschudii</i>
Junín	La florida de ajos pampa	<i>A. chamek</i> ; <i>Cebus sp.</i> ; <i>L. flavicauda</i>
Cerro de Pasco	Machicura	<i>L. l. tschudii</i>
Cerro de Pasco	Mesapata	<i>Cebus sp.</i> ; <i>S. leucogenys</i> ; <i>L. l. tschudii</i>
Cerro de Pasco	Milagro	<i>Cebus sp.</i>
Junín	Nueva Italia	<i>L. l. tschudii</i>
Ayacucho	Nuevo progreso	<i>A. chamek</i> ; <i>C. cucinus</i>
Cerro de Pasco	Oxapampa - Milagros	<i>L. l. tschudii</i>
Junín	Pacaybamba	<i>A. chamek</i>
Cerro de Pasco	Palcamayo	<i>L. l. tschudii</i>
Junín	Palmapata	<i>A. chamek</i>
Ayacucho	Pichari	<i>A. chamek</i> ; <i>Aotus sp.</i> ; <i>C. cucinus</i> ; <i>S. macrocephalus</i>
Junín	Promisora	<i>L. l. tschudii</i>
Cerro de Pasco	Punchao	<i>Aotus sp.</i> ; <i>Cebus sp.</i> ; <i>L. l. tschudii</i>
Ayacucho	Ramadilla	<i>A. chamek</i> ; <i>C. cucinus</i> ; <i>Aotus sp.</i> ; <i>S. macrocephalus</i> ; <i>S. boliviensis</i>
Junín	San Antonio	<i>L. flavicauda</i>
Junín	San Antonio	<i>A. chamek</i> ; <i>L. flavicauda</i>
Cerro de Pasco	San Francisco	<i>L. l. tschudii</i>
Junín	San Luis	<i>L. flavicauda</i>
Cerro de Pasco	Tingo	<i>L. l. tschudii</i>
Cerro de Pasco	Torrebamba	<i>A. cf. miconax</i> ; <i>Cebus sp.</i> ; <i>L. l. tschudii</i>
Junín	Tupac Amaru	<i>A. chamek</i> ; <i>L. flavicauda</i>
Ayacucho	Triubline alta	<i>S. macrocephalus</i>

Figure 1) Predicted habitat based on ecological niche modelling.

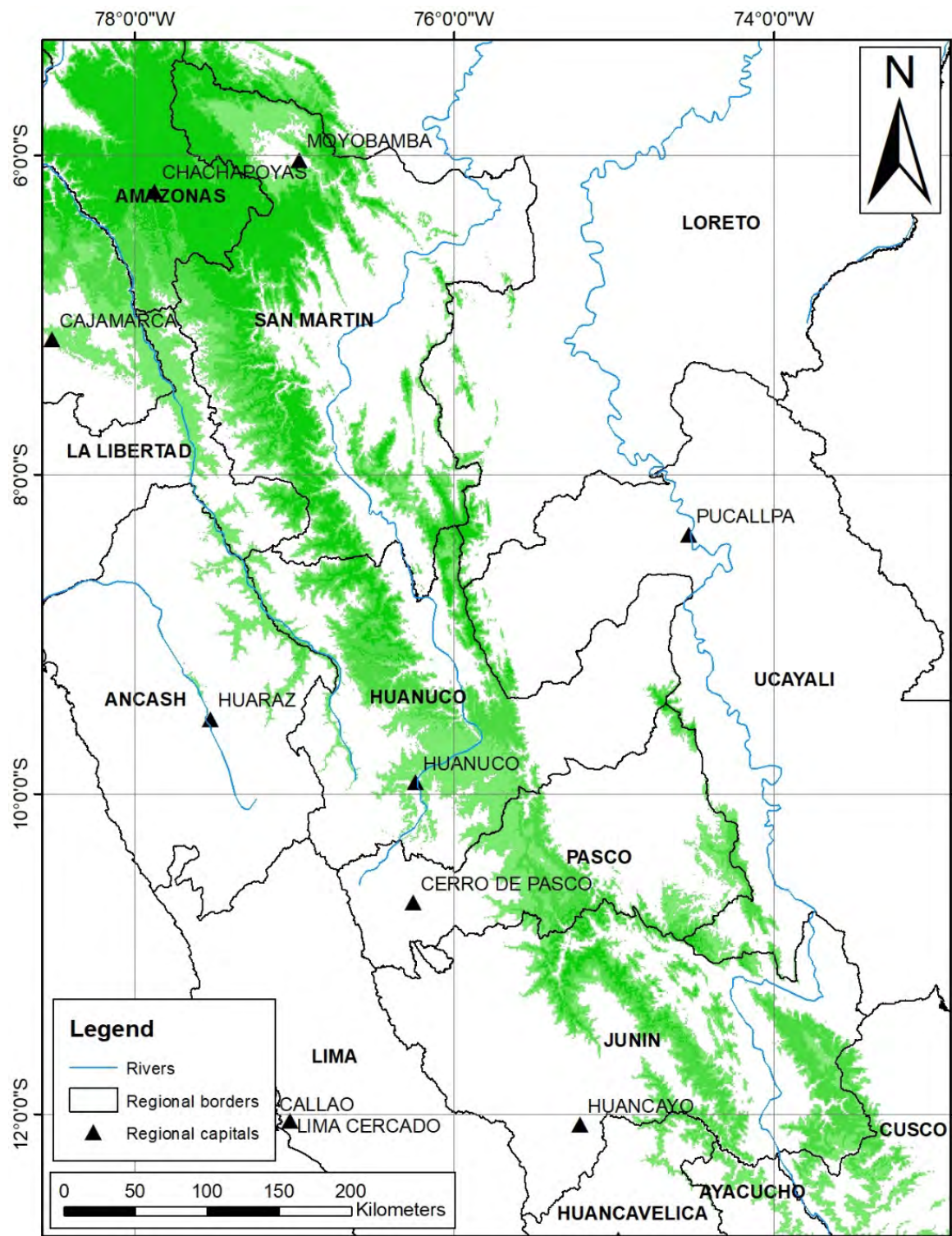


Figure 2) *Lagothrix flavicauda* observed in Junín (Photo: Elvis Charpentier).

