



Distribution Survey and Threat Assessment of the Yellow-tailed Woolly Monkey (*Oreonax flavicauda*; Humboldt 1812), Northeastern Peru

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Abstract Peruvian yellow-tailed woolly monkeys (*Oreonax flavicauda*) are considered Critically Endangered (IUCN Categories A4c). The International Primatological Society also considers them one of the world's 25 most endangered primate species and therefore a conservation priority. However, there is little concerted conservation action, and the existing protected area network may be inadequate to protect this species from extinction. Until recently this species has been the focus of few studies and its distributional limits remain unknown. I present results of a range-wide survey of *Oreonax flavicauda* in northeastern Peru. I conducted 53 presence/absence field surveys at 43 sites between March 2007 and March 2010, with data collected for an additional 7 sites from other researchers. I chose sites where the species was previously reported or following suggestions from predictive GIS modeling. *Oreonax flavicauda* was present at 35 sites, all presence records were in *Ficus* spp.-dominated cloud forests between 1500 and 2650 m above sea level. I give the geographical limits of this species distribution throughout the north, east, and west of its range; the exact extent of its range to the south requires further investigation. *Oreonax flavicauda* continues to be threatened throughout its range. The major threats I identified at the survey locations were the continued conversion of forests to cattle pasture, opening of new access routes into virgin areas, and both commercial and subsistence hunting. My results suggest that existing conservation measures may be inadequate at protecting this species but that substantial opportunities do exist. Further surveys need to be made in the southern distribution of this species to determine more accurately extant habitat.

Keywords Atelidae · Cloud forest · Distribution · *Lagothrix flavicauda* · Peru

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Introduction

Peruvian yellow-tailed woolly monkeys (*Oreonax flavicauda*) are endemic to a small belt of Andean cloud forest in northeastern Peru. This area is considered part of the Tropical Andes Biodiversity Hotspot (Myers *et al.* 2000), noted for its high levels of species endemism and threats faced. This species is listed as Endangered on Appendix I of CITES (2005) and as Critically Endangered (IUCN category A4c) on the *IUCN Red List of Threatened Species*. The International Primatological Society also considers *Oreonax flavicauda* one of the world's 25 most endangered primate species (Cornejo *et al.* 2009), where it has been listed continuously since 2006 (Mittermeier *et al.* 2009). This species is also the subject of a taxonomic dispute (Mathews and Rosenberger 2008); for consistency I follow the taxonomy put forward by Groves (2001) as recommended by the IUCN primate specialist group.

Oreonax flavicauda was thought extinct until its rediscovery in the mid-1970s (Mittermeier *et al.* 1975). Since then, few studies have been conducted because of the rarity of the species and the physical and sociopolitical difficulties of working in the area. This species has a very limited geographical range (Leo Luna 1987; Shanee *et al.* 2007, 2008) in a small area of tropical premontane and montane cloud forest in the departments of Amazonas and San Martín (Butchart *et al.* 1995) and is restricted to elevations of 1500–2700 m above sea level (Leo Luna 1980). *Oreonax flavicauda* has also been recorded in border areas of the neighbouring departments of Huánuco and La Libertad (Graves and O'Neill 1980; Parker and Barkley 1981). The first predictive distribution map for this species (Mittermeier *et al.* 1975) included many areas of lowland Amazonian rain forest outside of its historical distribution (Leo Luna 1980; Shanee *et al.* 2008). Later maps were more detailed, using stricter parameters and more field data; however, few sites were actually surveyed (Leo Luna 1980, 1989), and maps generally included only elevation and predictions of extant forest. Other published data on this species has been limited to sightings and conservation recommendations (Graves and O'Neill 1980; Parker and Barkley 1981; Rios and Ponce del Prado 1983; Shanee *et al.* 2007, 2008).

Deforestation rates in northeast Peru are among the highest in the country (INEI 2008), fueled by high immigration rates and the need for agricultural land and timber extraction (DeLuycker 2007; Shanee *et al.* 2007). The widespread deforestation that has occurred in this region has, in many areas, forced *Oreonax flavicauda* into isolated forest patches (Shanee *et al.* 2007). Previous calculations of this species total range have been 11,240 km² (Leo Luna 1987), 7690 km² (Cornejo *et al.* 2009), and 7240 km² (DeLuycker and Heymann 2007). Recent calculations (Buckingham and Shanee 2009) show habitat loss to be even higher than expected from previous predictions, with only 6302 km² of viable habitat remaining in Amazonas and San Martín. There is almost certainly a downward trend in this species' population size because of habitat loss and hunting (Buckingham and Shanee 2009; Shanee *et al.* 2007, 2008).

Through field surveys I aimed to gather up-to-date information on the actual distribution of *Oreonax flavicauda* throughout its range and to determine accurately distributional barriers and limits. I also aimed to gather relevant information regarding threats to and conservation status of this species to aid in more effective conservation management.

Methods

Study Area

I surveyed sites in the premontane and montane cloud forest belt in the eastern branches of the Andean Cordillera between S05°31' and S09°44'S and W78°39' and W 76°15'W (Fig. 1), at altitudes ranging from 1300 to 2800 m.a.s.l. in the departments of Amazonas, Huanuco, La Libertad, and San Marin located in northeastern Peru. Average daytime temperatures for these areas are between 8°C and 25°C. Average monthly rainfall is between *ca.* 15 mm in the dry season, August–November, and 1500 mm in the wet season, December–May.

Field Surveys

I conducted field surveys between March 2007 and March 2010 at 43 sites. Some sites I visited were those listed in previous studies (DeLuycker 2007; Graves and O'Neill 1980; Leo Luna, 1980, 1989; Mittermeier *et al.* 1975; Parker and Barkley 1981) as areas of this species' occurrence. I also surveyed other areas based on habitat, climatic requirements, and when shown as possible habitat in previous GIS analysis based on extant forest and proximity away from anthropogenic habitat disturbance (Buckingham and Shanee 2009). Sites varied in size from forest patches of *ca.* 90 ha to areas within contiguous forest blocks.

Oreonax flavicauda have a small area of yellow fur on the underside of the prehensile tail tip, and males have a conspicuous large yellow/orange scrotal tuft, measuring up to 15 cm in length. I used both in identification. There is little sexual dimorphism, with females slightly smaller than the males and with smaller genital tufts (Leo Luna 1980; Shanee and Shanee 2009). *Oreonax flavicauda* are the largest-bodied primate present within their range. The similarly sized white-bellied spider monkey (*Ateles belzebuth*) is sympatric with *Oreonax flavicauda* in many areas; however, distinct differences in pelage, locomotion, and vocalizations between the species made correct identification unproblematic. Other known sympatric primate species are the Peruvian night monkey (*Aotus miconax*) and white-throated capuchin (*Cebus albifrons*).

I collected primary data during forest walks along existing trail systems 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 forest disturbance. I visited field sites for 2–7 d, making up to 3 visits to each site. The duration of my field visits depended on whether or not presence of *Oreonax flavicauda* was confirmed or whether there was a good possibility of its being found. Similarly, I returned to sites where I did not encounter this species but where its presence was suggested by secondary evidence. The time and distance I spent walking trails varied depending on site-specific limitations, such as patch size and existing access routes. I recorded the location of all sites with a handheld GPS, as well as points of visual, audio, or incidental, e.g., food residues showing clear bite marks, detection. I never inferred the species' presence from bite marks without additional secondary evidence. I also collected additional data on threats to habitat in areas where this species occurs.

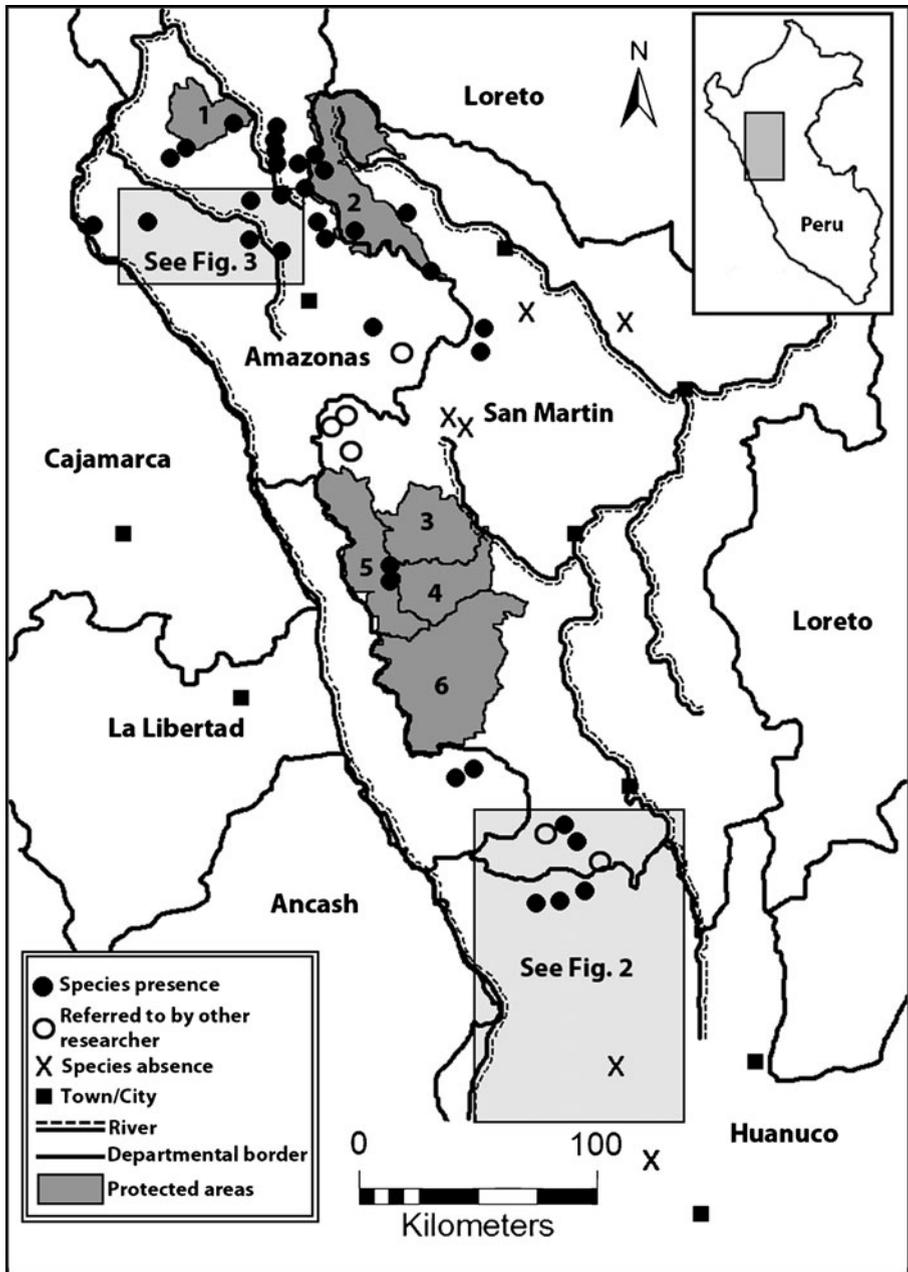


Fig. 1 Map of survey sites showing presence/absence of *Oreonax flavicauda* and protected areas. 1, Santuario Nacional Cordillera Colan and Reserva Comunal Chayu-Naine; 2, Bosque Protección Alto Mayo; 3, Área de Conservación Municipal Ambiental Huicungo; 4, Concesión para Conservación El Breo; 5, Concesión para Conservación Huyabamba; 6, Parque Nacional Río Abiseo. Insets show locations of Figs. 2 and 3 in relation to total survey area.

I collected secondary data on species occurrence from local informants and other researchers active in the areas that I visited. I identified species during individual and group interviews with informants. I used photographs and drawings of various primate species that may be present in each area to help local people identify the species. I cross referenced positive identifications were between several informants and I asked further details of behavior, diet, and locomotion to ensure correct identification. I also collected additional information on hunting practices, sympatric primate species, forest resource use, and anthropological environmental problems such as deforestation, logging, burning, and contamination to assess better threats and conservation opportunities for the species.

Results

I made a total of 53 field visits to 43 different sites to survey for the presence/absence of *Oreonax flavicauda*; I visited 21 sites in Amazonas, 15 in San Martin, 5 in Huánuco, and 2 in La Libertad (Fig. 1 and Table I). I confirmed presence from visual and audio detections at 15 sites and inferred presence from other evidence and reports from local residents at a further 21 sites: 20 in Amazonas, 11 in San Martin, 3 in Huánuco, and at 2 sites in La Libertad (Fig. 1 and Table I). At 5 sites I obtained extra confirmation of the presence of *Oreonax flavicauda* from other researchers currently active at those sites (Table I). All areas with confirmed and inferred presence were in *Ficus* spp.-dominated forests within the cloud forest belt between 1500 m.a.s.l. and 2650 m.a.s.l. I never encountered the species in areas where local residents did not also confirm its presence.

I found the probable absence of the species at 7 sites: 1 site in Amazonas, 2 in Huánuco, and 4 in San Martin (Fig. 1 and Table I). These sites failed to yield any evidence for the species presence from field surveys, local informants, or historical records. I also gathered additional records from researchers active at a further seven locations: 2 in Amazonas and 5 in San Martin (Fig. 1 and Table II). This information helped me in determining presence in locations I was not able to visit.

Oreonax flavicauda is sympatric with 3 other primate species: white-bellied spider monkeys (*Ateles belzebuth*), encountered at 4 sites during this survey—Peroles, La Esperanza, Copallin, and Rio Blanco in Amazonas—and reported to be present at a further 5 sites; white fronted capuchins (*Cebus albifrons*), encountered at 4 sites—Peroles, El Gato, and Rio Blanco in Amazonas and Shunte in San Martin— and reported to be present at almost all other locations; and Peruvian night monkeys (*Aotus miconax*), encountered at 7 locations—Hierba Buena, Rio Blanco, San Isidro, El Torro, Peroles, El Gato and La Esperanza—all in Amazonas and reported at a further 3 sites.

Approximate Distributional Limits

I recorded *Oreonax flavicauda* in the portions of San Martin and Amazonas expected from previous work (Buckingham and Shane 2009; Leo Luna 1980; Shane *et al.* 2008), as well as in neighboring portions of La Libertad and Huanuco following earlier reports. Its distribution is limited in the north and northwest of Amazonas by the lowland valley of the Marañon River, to the northeast by the lowlands of Loreto

Table 1 Locations visited during the study and presence of *Oreonax flavicauda*

Location	Department	Coordinates	Altitude	Present	Detection type				Additional source
					Direct detection		Secondary detection		
					Visual	Audio	Food residue	Referred to by researcher	
Berlin	Amazonas	S05°55'08.7" W 78°24'45.0"	2500	X			X	X	Leyda Rimarachin <i>pers comm.</i>
Comboca	Amazonas	S05°3'50.4" W78°04'04.2"	2000	X	X			X	
Santo Tomas	Amazonas	S06°20'34.7" W77°31'09.2"	2650	X	X			X	
Guyacil	Amazonas	S05°40'08.4" W78°15'54.1"	1840	X				X	
Hierba Buena	Amazonas	S05°47'43.6" W77°47'12.7"	2530	X			X	X	
San Geronimo	Amazonas	S05°59'38.1" W78°00'01.5"	2200	X				X	
Vilcaniza	Amazonas	S05°48'39.7" W77°52'23.5"	2420	X	X ^a		X	X	
Arenal	Amazonas	S05°58'40.3" W77°43'58.0"	2440	X				X	
Cumba	Amazonas	S05°56'02.3" W78°39'52.1"	–	–					
Shipasbamba	Amazonas	S05°54'35.3" W77°58'50.3"	2300	X	X			X	

Gocta	Amazonas	S06°02'21.5" W77°53'17.8"	1760	X	X	X	X	Eduardo Ormaeche <i>pers comm.</i>
Abra Patricia	Amazonas	S05°41'52.3" W77°48'38.6"	2100	X	X	X	X	Willy Palomino <i>pers comm.</i>
Copallin	Amazonas	S05°38'30.0" W78°15'03.6"	2320	X		X	X	
Rio Blanco	Amazonas	S05°34'32.4" W77°54'00.0"	1830	X	X	X	X	
El Toro	Amazonas	S05°38'13.7" W77°54'32.1"	2110	X	X	X	X	
Agua Dulce	Amazonas	S05°39'54.9" W77°54'07.6"	2270	X	X	X	X	
Peroles	Amazonas	S05°39'56.9" W77°54'36.0"	2140	X	X	X	X	
El Gato	Amazonas	S05°41'27.1" W77°54'00.1"	2230	X	X	X	X	
La Esperanza	Amazonas	S05°41'20.9" W77°54'22.3"	2150	X	X	X	X	
San Isidro	Amazonas	S05°43'41.7" W77°54'45.6"	1830	X	X	X	X	
Wilca	Amazonas	S05°55'26.1" W77°44'23.8"	2480	X			X	
Paujil	San Martín	S06°44'27.6" W77°10'23.6"	1000	-				
La Primavera	San Martín	S06°42'28.4" W77°13'29.6"	1670	-				

Table 1 (continued)

Location	Department	Coordinates	Altitude	Present	Detection type		Secondary detection			Additional source	
					Direct detection		Food residue	Referred to by researcher	Referred to by local		
					Visual	Audio					
Nuevo Bolívar/Alto Huyabamba	San Martín	S07°19'14.3" W77°27'39.5"	2400	X					X	Cesar Flores <i>pers comm.</i>	
Colca	San Martín	S05°53'40.9" W77°23'15.2"	1800	X						X	
Vista Alegre	San Martín	S06°07'28.5" W77°17'22.3"	1610	X						X	
Paitoja	San Martín	S06°21'42.0" W77°04'52.1"	1790	X			X			X	
Nuevo Mendoza	San Martín	S06°27'06.7" W77°05'46.3"	1800	X						X	
Gira—Sisa	San Martín	S06°17'34.3" W76°54'24.7"	1900	–							
Shimbayacu/Yurilamas	San Martín	S06°20'41.9" W76°31'58.4"	1500	–							
Cueva/Alto Huyabamba	San Martín	S07°21'05.5" W77°27'14.9"	1840	X			X			X	Cesar Flores <i>pers comm.</i>
La Victoria	San Martín	S08°22'50.7" W76°45'04.8"	1650	X						X	
Shunte	San Martín	S08°24'40.7" W76°43'07.1"	1560	X				X		X	

Chofersito	San Martín	S05°40'18.5" W77°45'52.3"	1950	X	X	X
El Afluente	San Martín	S05°40'04.8" W77°44'47.5"	1760	X	X	X
Olleros	San Martín	S05°57'43.5 W77°35'38.1	2610	X		X
Monzon	Huanuco	S09°15'29.3" W76°23'36.7	1800	–		
San Pedro de Chontia	Huanuco	S08°39'23.0" W76°52'29.9"	2450	X		X
Ajenco	Huanuco	S08°39'06.4" W76°47'28.0"	2020	X		X
Santa Rosa del Oso	Huanuco	S08°36'48.0" W76°41'45.6"	1570	X		X
Huyllacan	Huanuco	S09°44'26.0" W76°15'57.4"	–	–		
Poroto	La Libertad	S08°07'02.1" W77°08'28.2"	1840	X	X	X
Puerto del Monte	La Libertad	S08°08'30.8 W77°11'05.0	2800	X	X	X

^a Presence confirmed from visual encounter on September 15, 2010 subsequent to this study

Table II Additional records of presence of *Oreonax flavicauda* gathered from other sources

Location	Department	Coordinates	Altitude	Present	Referred to by researcher	Referred to by local	Source
ACM Huicungo	San Martin	–	–	X		X	Rodil Cachique <i>pers comm.</i>
La Grama	San Martin	S06°43'29.7" W77°40'20.5"	–	X	X		Hans Dignum <i>pers comm.</i>
Metal	San Martin	S08°29'31.5" W76°37'32.7"	–	X	X		IIAP 2006
Uchiza	San Martin	S08°22'47.3" W76°50'55.3"	–	X	X		IIAP 2006
Laguna de los Condores	San Martin	S06°50'48.5" W77°36'51.8"		X	X		Kieth Muskett <i>pers comm.</i>
Bosque Javier Tello	Amazonas	S06°42'59.6" W77°39'29.0"	–	X	X		Hans Dignum <i>pers comm.</i>
Leimebamba	Amazonas	S06°26'26.7" W77°24'19.7"	–	X	X	X	Julio Tello <i>pers comm.</i>

on the border with San Martin (*ca.* 77°40'W, 5°25'S), in the east by the lowlands of the Huallaga River Valley from just south of Moyobamba (*ca.* 77°2'W, 6°22'W), San Martin, then extending south almost as far as the Monzon river valley in Huanuco (Fig. 1). The presence of *Oreonax flavicauda*'s was reported by local residents and hunters on both sides of the Chontayacu River Valley (Fig. 2) in Huanuco but no evidence was found, and no reports were given, of its presence further south of this area on the north bank of the Monzon River (Fig. 2); therefore the southern limit of its distribution is probably either the Santa Martha (*ca.* 8°50'S) or Magdalena river valleys (*ca.* 9°00'S) or the intervening highlands, in Huanuco (Fig. 2). To the southwest and west in Huanuco, La Libertad, and San Martin this species is limited by the high cordillera to the east of the Marañon River (between *ca.* 77°10'W, in La Libertad, north to 77°40'W in Amazonas). This limit continues north along this line to the start of the Utcubamba River in Amazonas (*ca.* 6°30'S), where it continues until joining with the Marañon River again in the northwest of Amazonas east of the Cordillera Colan (*ca.* 28°36'W, 5°32'S; see Fig. 1). The continued presence of *Oreonax flavicauda* was also reported by local people and other researchers in remnant forest patches to the west of the Utcubamba River in Amazonas (Fig. 3).

Discussion

As an endemic species limited to high-elevation forest, *Oreonax flavicauda* is expected to have a very limited distribution. The species' original range, estimated at between 12,863 and 11,240 km² (Leo Luna 1984, 1987), is >2 orders of

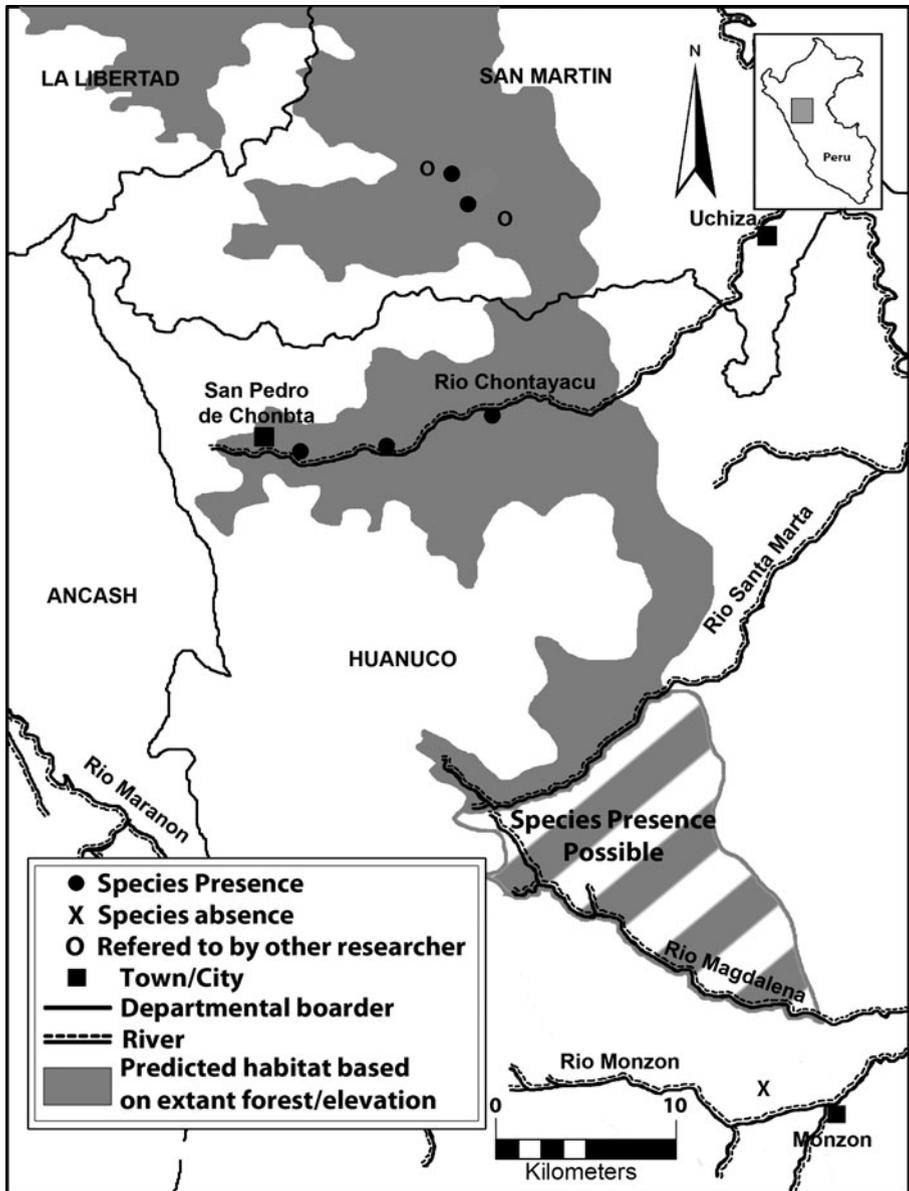


Fig. 2 Southern distribution of *Oreonax flavicauda*, showing possible limit to the species southern range.

magnitude less than that of common woolly monkeys (*Lagothrix lagothricha*), 2,920,000 km², and also *ca.* 2 orders of magnitude smaller than that of the sympatric *Ateles belzebuth*, 1,410,000 km² (Hershkovitz 1949–1988 cited in Ayers and Clutton-Brock 1992). Nearly all other Ateline primates have distributions that include areas in several countries (Groves 2001). This small natural range size and endemism to a restricted habitat type are indicators of a species natural tendency to extinction (Purvis *et al.* 2000). Of Peru's 2 other endemic primates, 1, the

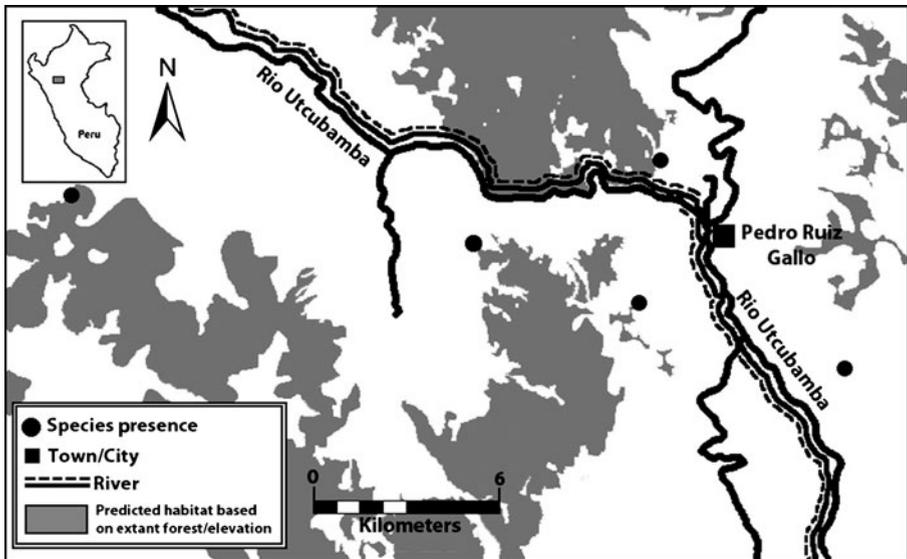


Fig. 3 Northwestern distribution of *Oreonax flavicauda*, showing highly fragmented forest patches to the southeast of the Utcubamba River in Amazonas.

Pithicine *Callicebus oenanthe*, or San Martin titi monkey, has a similarly restricted range of 12,000 km² (Hershkovitz 1949–1988 cited in Ayers and Clutton-Brock 1992) in San Martin; however, smaller-bodied mammals are generally able to live in smaller areas and at higher relative densities (Fa and Purvis 1997; Robinson and Redford 1986). No range size estimates exist for the other Peruvian endemic, Peruvian night monkeys.

The most thorough previous distribution survey of *Oreonax flavicauda* evaluated 17 sites in Amazonas and San Martin (Leo Luna 1980). I visited 2 of these sites and received information on one further site (Hans Dignum *pers. comm.*), all 3 of which continue to contain populations of *Oreonax flavicauda*. The records for this species west of the Utcubamba River and south of the Marañon River in Amazonas seem to be the last remnant population of the species in this area. *Oreonax flavicauda* was reported in a patch of forest 10 km wide and 110 km long west of the Utcubamba River (Leo Luna 1984); during my visit I observed that deforestation in this area has been much greater than in most of its range. Local people reported the presence of only 5 individuals remaining in one of the patches of forest, and there were reports of ≥ 3 different individuals killed by hunters in other forest patches in the weeks leading up to my visit. There is now at least some protection for the species in this area with the proposed creation of a new protected area, the Area de Conservacion Privada Berlin; however, this area covers only 96 ha of forest, connected to another patch of similar size, which is unlikely to ensure the survival of a viable population in this area. If effective protection measures are not implemented, along with extensive habitat restoration and reforestation, I predict the effective local extinction of this species is probable within the next 5–10 yr.

The use of existing trails could have reduced the possibility of my encountering animals (most of these trails are commonly used by local people, including hunters).

However, I did encounter *Oreonax flavicauda* at many sites, and at others secondary evidence and reports from local people allowed me to infer its presence. Similarly, my choice of sites was restricted to areas with existing access routes, although some sites were ≥ 2 d walk from the nearest road. This necessitated nonstratified site selection with differing survey effort between sites; however, it can be assumed that if the species was present in the accessible, e.g., more disturbed, outlying habitat, then the species presence is likely in the intervening areas of less accessible, e.g., less disturbed, habitat.

Most of the sites where I failed to find any evidence of this species' presence were probably outside of its historical range. However, some of these sites, most notably Gira-Sisa and La Primavera in San Martín, were within the predicted habitat for the species. I believe it is unlikely that *Oreonax flavicauda* was extirpated from these areas by recent immigrants, as no local people were able to identify it. However, I found no obvious geographical or man-made barriers separating these areas from contiguous habitat, suggesting some other natural mechanism or barrier is restricting its distribution.

Recent evaluations of *Oreonax flavicauda* (Buckingham and Shanee 2009; Cornejo *et al.* 2009) have focused on the species' distribution solely in Amazonas and San Martín, without including areas in the neighboring departments of Huanuco, La Libertad, and Loreto. This is the first survey to look for this species systematically in Huanuco and the first report of this species in La Libertad since 1974 (Parker and Barkley 1981). These areas have often been overlooked, as most of *Oreonax flavicauda*'s distribution (*ca.* 90%) is within Amazonas and San Martín. The portions of La Libertad and Huánuco with extant populations of *Oreonax flavicauda* have remained largely unsettled because of economic and social unrest. The area around Monzon in Huánuco still contains remnants of the Maoist guerrilla group *Sendero Luminoso* (*pers. obs.*). Similarly, Poroto in La Libertad and neighboring areas of southern San Martín experienced incursions by guerrillas and were centers for production during the 1980's cocaine boom (IIAP 2006). This political unrest and the government's countermeasures not only deterred settlement but also led to the emigration of many of the original residents (*pers. obs.*). With accelerating habitat destruction in more accessible areas, especially those with road access, it seems that these areas now constitute important habitat for this species, as human populations have remained low from lack of development and infrastructure, with consequently little hunting pressure or habitat disturbance.

The major threat to *Oreonax flavicauda* is habitat destruction due to human population increase. In the Peruvian sierra land plots are traditionally inherited among the sons of a family, which leads to ever decreasing plot sizes and has left many farmers without enough land to support themselves. This has led to high levels of immigration, particularly from the mountain sierra of Cajamarca, Piura, La Libertad, and Huánuco (INEI 2008). The majority of villages in the central and northern portions of the species range are <30 yr old (*pers. obs.*). In all areas I visited, settlement began through small-scale timber extraction. When timber supplies diminished, this was replaced by slash and burn agriculture. After a few years of cropping, the land is then left as fallow pasture while new areas are opened up following the same cycle (*pers. obs.*). In some areas this pattern has been disrupted by the planting of coca crops (*Erythroxylum coca*) for cocaine production

(Young 1996). This has led to many other environmental problems because of both coca production and the control measures implemented (Fjeldsa *et al.* 2005). The effect of coca production is particularly important in the central and southern portions of this species' range in Huánuco and San Martín (Young 1996).

Other threats identified included the growth of mining and oil extraction in the cordilleras in the northern and western extremes of this species' distribution. Many of these concessions are located in forested areas or watersheds, threatening forests not only through extractive processes and potentially contamination but also by opening access to new areas for immigration and hunting. Also, the conversion of much of the eastern lowlands to palm oil and rice production is forcing many small farmers to sell their land, moving higher up into new areas of cloud forest, thus accelerating deforestation. Migration and access to areas for mining is being facilitated by the construction of new roads (MTC 2010). No fewer than 6 new roads are under construction connecting the lowlands of San Martín and Huanuco with the sierra and the coast; if all of these are completed it will dissect this species' habitat into 8 parts (1 highway already exists between San Martín and Amazonas), facilitating access to more areas for hunters (Franzen 2006; Peres 1991) and fragmenting habitats, reducing genetic flow between populations (Marsh 2003).

Like common woolly monkeys, *Oreonax flavicauda* are large-bodied diurnal primates. With males weighing up to 15 kg (Helene Colegnues *pers. comm.*), they are the focus of much subsistence and trophy hunting. Despite its prohibition under Peruvian law, hunting still occurs throughout this species' range (DeLuycker 2007; Shanee *et al.* 2007) and is a major threat in some areas, most notably in northern San Martín and central Amazonas, where the Awajun indigenous population is reported to hunt this species in large numbers (Shanee *et al.* 2007). Opportunistic hunting for the illegal pet trade also occurs in many areas; I found infant *Oreonax flavicauda* individuals for sale or kept as pets in 3 locations.

Several protected areas exist, both publicly and privately managed, within the range of *Oreonax flavicauda*. The largest and probably best protected of these is the 274,500-ha Parque Nacional Rio Abiseo in San Martín; however, only *ca.* 85,200 ha of this area is suitable habitat for this species (*unpubl. data*), owing to the range of elevations and habitat types present in the area. Other nationally protected areas include the 39,215-ha Santuario Nacional Cordillera Colan and the 182,000-ha Bosque de Protección de Alto Mayo in San Martín (Buckingham and Shanee 2009). Of the privately managed protected areas, the 4 largest are the 143,928-ha Concecion para la Conservacion Alto Huyabamba and the 113,826-ha Concecion para la Conservacion El Breo in San Martín, the 10,000-ha Concecion para la Conservacion Abra Patricia-Alto Nieva, and the 23,597-ha Reserva Comunal Chayu-Naine in Amazonas. Several other smaller private conservation areas also exist in Amazonas and San Martín. There are currently no protected areas in this species' range in Huánuco or La Libertad.

It is estimated that the existing protected area network covers *ca.* 1867 km² of extant habitat in Amazonas and San Martín (Buckingham and Shanee 2009). The largest area of contiguous protected forest is in the central portion of San Martín, including Parque Nacional Rio Abiseo, Concecion para la Conservacion Alto Huayabamba (Buckingham and Shanee 2009), and Concecion para la Conservacion El Breo (AMPA 2009b). With the proposed creation of additional protected areas,

including municipal reserves in Huicungo (AMPA 2009a) and Shunte (PEHCBM 2008), as well as a further conservation concession in Alto Saposoa, all San Martín, this area will finally afford protection to a large contiguous portion of this species' range. Other small reserves are being proposed by several nongovernmental organizations (NGOs): Neotropical Primate Conservation is developing private conservation areas with the communities of Yambasbamba and Corosha in Amazonas and Dos de Mayo in San Martín (Shanee and Shanee 2009); Amazonicos por la Amazonia is working with the municipality of Huicungo and several associations to create new municipal reserves and conservation concessions; Asociacion Peruana para la Conservacion de la Naturaleza is working with the community of Copallin, Amazonas, to create a new private conservation area; and Sociedad Peruana de Derecho Ambiental has aided many communities and private landowners in San Martín and Amazonas with funding and legal aid in registering new conservation areas.

The most urgent need for *Oreonax flavicauda* is more concerted conservation action with coordination between private and public institutions involving both short- and long-term preventative measures to reduce habitat destruction and hunting. This is of particular importance in the central and northern parts of its range, where these threats are greatest. Investment in the current protected area network and help in finalizing proposed reserves will also greatly enhance its chance of survival. This has already begun with the release of the new management plan for the Bosque Proteccion Alto Mayo (INRENA 2008).

The high rate of settlement and immigration throughout the range of *Oreonax flavicauda* also makes community conservation initiatives a good alternative (Horwich 1990; Horwich and Lyon 2007; Shanee and Shanee 2009). Neotropical Primate Conservation, together with national and international partner institutions, is working in many communities with projects including reforestation, environmental education, and sustainable economic development combined with habitat protection (Shanee and Shanee 2009). The Peruvian NGO's Asociacion de Ecosistemas Andinas and the Sociedad Peruana de Derecho Ambiental are also working with many local communities in reforestation and environmental education.

Further investigation is needed to determine the exact extent of remaining habitat in La Libertad and Huánuco, particularly between the Chotayacu and Monzon rivers. A priority for conservation should be environmental education, particularly in isolated areas. I found a surprising willingness toward conservation on the part of local authorities and populations. Many villagers and authorities proposed bans on hunting of *Oreonax flavicauda* to their communities after only a brief explanation of the dangers faced by this species. If implemented properly, these bans could help populations recover and recolonize areas where its numbers have been significantly reduced or extirpated, aiding in the long-term survival of the species.

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References

- Amazónicos por la Amazonia (AMPA) (2009a). Expediente técnico justificatorio para el establecimiento del área de conservación ambiental municipal Huicungo.
- Amazónicos por la Amazonia (AMPA) (2009b). Propuesta técnica que sustenta la creación de la Concesión para conservación El Breo.
- Ayers, J. M., & Clutton-Brock, T. H. (1992). River boundaries and species range size in amazonian primates. *The American Naturalist*, *140*, 531–537.
- Buckingham, F., & Shancee, S. (2009). Conservation priorities for the Peruvian yellow-tailed woolly monkey (*Oreonax flavicauda*): a GIS risk assessment and gap analysis. *Primate Conservation*, *24*, 65–71.
- Butchart, S. H. M., Barnes, R., Davies, C. W. N., Fernandez, M., & Seddon, N. (1995). Observations of two threatened primates in the Peruvian Andes. *Primate Conservation*, *16*, 15–19.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (2005). Retrieved November 20, 2009 from <http://www.cites.org/eng/app/appendices.shtml>.
- Cornejo, F. M., DeLuycker, A. M., Quintana, H., Pacheco, V., & Heymann, E. W. (2009). Peruvian yellow tailed woolly monkey *Oreonax flavicauda* (Humboldt, 1812). In R. A. Mittermeier *et al.* (Eds.), *Primates in peril: The world's 25 most endangered primates 2008–2010*. *Primate Conservation*, *24*, 74–76.
- DeLuycker, A. M. (2007). Notes on the yellow-tailed woolly monkey (*Oreonax flavicauda*) and its status in the Protected Forest of Alto Mayo, northern Peru. *Primate Conservation*, *22*, 41–47.
- DeLuycker, A. M., & Heymann, E. W. (2007). Yellow-tailed woolly monkey, *Oreonax flavicauda* Humboldt, 1812. In R. A. Mittermeier *et al.* (Eds.), *Primates in peril: The world's 25 most endangered primates 2006–2008*. *Primate Conservation*, *22*, 1–40.
- Fa, J. E., & Purvis, A. (1997). Body size, diet and population density in Afrotropical forest mammals: a comparison with Neotropical species. *The Journal of Animal Ecology*, *66*, 98–112.
- Fjeldsa, J., Alvarez, M. D., Lazcano, J. M., & Leon, B. (2005). Illicit crops and armed conflict as constraints on biodiversity conservation in the Andes Region. *Ambio*, *34*, 205–211.
- Franzen, M. (2006). Evaluating the sustainability of hunting: a comparison of harvest profiles across three Huaorani communities. *Environmental Conservation*, *33*, 36–45.
- Graves, G. R., & O'Neill, J. P. (1980). Notes on the yellow tailed woolly monkey (*Lagothrix flavicauda*) of Peru. *Journal of Mammalogy*, *61*, 345–347.
- Groves, C. (2001). *Primate taxonomy*. Washington: Smithsonian Institute Press.
- Horwich, R. H. (1990). How to develop a community sanctuary – an experimental approach to the conservation of private lands. *Oryx*, *24*, 95–102.
- Horwich, R. H., & Lyon, J. (2007). Community conservation: practitioners' answer to critics. *Oryx*, *41*, 376–385.
- INRENA (2008). Bosque protección Alto Mayo: Plan maestro 2008–2013. Retrieved February 10, 2010 from <http://www.gtz-rural.org.pe/?apc=Pa-i-j-m-t-w1-andx=1069>.
- Instituto de Investigación de la Amazonia Peruana (IIAP). (2006). *Tocache hacia el desarrollo sostenible: Zonificación ecológica y económica*. Loreto: Instituto de Investigación de la Amazonia Peruana.
- Instituto Nacional de Estadística e Informática (INEI) (2008). Lima, Peru. Retrieved November 20, 2009 from <http://www.inei.gob.pe/>.
- Leo Luna, M. (1980). First field study of the yellow-tailed woolly monkey. *Oryx*, *15*, 386–389.

- Leo Luna, M. (1984). *The effect of hunting, selective logging and clear cutting on the conservation of the yellow-tailed woolly monkey* (*Lagothrix flavicauda*). Master's thesis, University of Florida.
- Leo Luna, M. (1987). Primate conservation in Peru: a case study of the yellow-tailed woolly monkey. *Primate Conservation*, 8, 122–123.
- Leo Luna, M. (1989). Biología y conservación del mono choro de cola amarilla (*Lagothrix flavicauda*), especie en peligro de extinción. In C. J. Saavedra, R. A. Mittermeier, & I. B. Santos (Eds.), *La primatología en Latinoamérica* (pp. 23–30). Washington: World Wildlife Fund-US.
- Marsh, L. K. (2003). *Primates in fragments*. New York: Kluwer Academic/Plenum.
- Mathews, L. J., & Rosenberger, A. L. (2008). *Oreanax*: not a genus. *Neotropical Primates*, 15, 8–12.
- Mittermeier, R. A., de Macedo Ruiz, H., & Luscombe, A. (1975). A woolly monkey rediscovered in Peru. *Oryx*, 13, 41–46.
- Mittermeier, R. A., Wallis, J., Rylands, A. B., Ganzhorn, J. U., Oates, J. F., Williamson, E. A., et al. (2009). Primates in Peril: the world's 25 most endangered primates 2008–2010. *Primate Conservation*, 24, 1–6.
- Ministerio de Transportes y Comunicaciones (MTC) (2010). Proyectos 2009. Retrieved January 1, 2010 from http://www.mtc.gob.pe/portal/logypro/proyectos_depa_2009.htm.
- Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A. B., & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, 403, 853–858.
- Parker, T. A., & Barkley, L. J. (1981). New locality for the yellow-tailed woolly monkey. *Oryx*, 26, 71–72.
- Peres, C. A. (1991). Humboldt's woolly monkeys decimated by hunting in Amazonia. *Oryx*, 25, 89–95.
- Proyecto especial Huallaga Central y Bajo Mayo (PEHCBM) (2008). Propuesta Técnica para el establecimiento del ACAMM Alto Shunte.
- Purvis, A., Gittleman, J. L., Cowlshaw, G., & Mace, G. M. (2000). Predicting extinction risk in declining species. *Proceedings of the Royal Society of London. Series B: Biological Sciences*, 267, 1947–1952.
- Rios, M., & Ponce del Prado, C. F. (1983). El status de las áreas de conservación propuestas para choro de cola amarilla (*Lagothrix flavicauda*): Una investigación sobre la planificación regional de áreas naturales protegidas. In C. J. Saavedra, R. A. Mittermeier, & I. B. Santos (Eds.), *La primatología en Latinoamérica* (pp. 31–65). Washington: World Wildlife Fund-US.
- Robinson, J. G., & Redford, K. H. (1986). Body size, diet, and population density of Neotropical forest mammals. *The American Naturalist*, 128, 665–680.
- Shanee, S., & Shanee, N. (2009). A new conservation NGO, neotropical primate conservation: project experiences in Peru. *International NGO Journal*, 4, 329–332.
- Shanee, N., Shanee, S., & Maldonado, A. M. (2007). Conservation assessment and planning for the yellow-tailed woolly monkey in Peru. *Wildlife Biology in Practice*, 3, 73–82.
- Shanee, S., Shanee, N., & Maldonado, A. M. (2008). Distribution and conservation status of the yellow-tailed woolly monkey (*Oreanax flavicauda* [Humboldt 1812]) in Amazonas and San Martín, Peru. *Neotropical Primates*, 14, 115–119.
- Young, K. R. (1996). Threats to biological diversity caused by coca/cocaine deforestation in Peru. *Environmental Conservation*, 23, 7–15.