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Rediscovery and Conservation of the Peruvian Yellow-Tailed Woolly Monkey (*Lagothrix flavicauda*)

RUSSELL A. MITTERMEIER, HERNANDO DE MACEDO-RUIZ, B. ANTHONY LUSCOMBE, AND JOHN CASSIDY

I. Introduction

The woolly monkeys of the genus *Lagothrix* are large, robustly built, prehensile-tailed monkeys found primarily in the Upper Amazon region of northwestern South America. The genus consists of two species, *Lagothrix lagothricha* (Fig. 1A), the common woolly monkey, and *Lagothrix flavicauda* (Figs. 1B,2, and 3), the Peruvian yellow-tailed woolly monkey. *Lagothrix lagothricha* is divided into four subspecies and is fairly widespread in the rain forests of Brazil, Colombia, Peru, Ecuador, and Bolivia (Fooden, 1963). It is frequently exhibited

in zoos and, until recently, was commonly sold in the pet trade. *Lagothrix flavicauda*, on the other hand, is known only from a very restricted area in the Andes of northern Peru and is among the rarest and least known of New World monkeys. Although first described more than 160 years ago, *L. flavicauda* was, as of 1974, represented by a total of only five museum specimens, the last of which was collected in 1926.

In this paper, we will briefly describe *L. flavicauda*, discuss its history, report the results of an expedition intended to determine if it still existed, review its conservation status, and discuss measures needed to ensure its survival. In addition, we provide plans which briefly outline the requirements for a captive breeding colony of this rare monkey (Section VIII).

II. Description

Lagothrix flavicauda differs from *L. lagothricha* in several features, including the mahogany-colored pelage, the white or buffy circumbuccal patch, the long yellow tuft of scrotal hair, the yellow band on the posteroventral surface of the tail (which originally gave rise to the specific name *flavicauda*), the texture of the hair, and certain features of the skull. The lower back, dorsal and ventral surfaces of the tail, and adjacent parts of the legs are mahogany brown. This color darkens anteriorly to deep mahogany brown on the upper back, nape, crown, sides of the face and arms, and laterally to the same color on the ventral surface of the body. The arms and especially the legs darken distally, becoming very dark brown or almost black on the hands and feet. In both males and females, a long, conspicious tuft of yellow or straw-colored pubic hair is present and varies in length from 100 to 200 mm. This tuft may be somewhat longer and thicker in males (Thomas, 1927a; Hill, 1962; Fooden, 1963), but on the basis of the small sample of specimens currently available, no definite statement can be made concerning dimorphism in this character. The yellow band on the posteroventral surface of the tail extends about one-third of the way up the tail. It flanks the volar skin at the end of the prehensile tail and extends 50–260 mm past the anterior border of the volar skin. Thomas (1927a) noted that a juvenile he examined lacked both the pubic tuft and the yellow band on the tail. Two juvenile specimens examined by us also lacked the yellow pubic tuft and one (the smaller) lacked the yellow tail band as well. The pubic tuft is probably a secondary sexual characteristic that only appears later in development. The tail

Fig. 1. (A) Juvenile *Lagothrix lagothricha* from Peruvian Amazonia (B) Juvenile male *Lagothrix flavicauda* obtained in Pedro Ruiz Gallo. Note the white circumbuccal facial patch and the texture of the hair and compare with Fig. 1A.

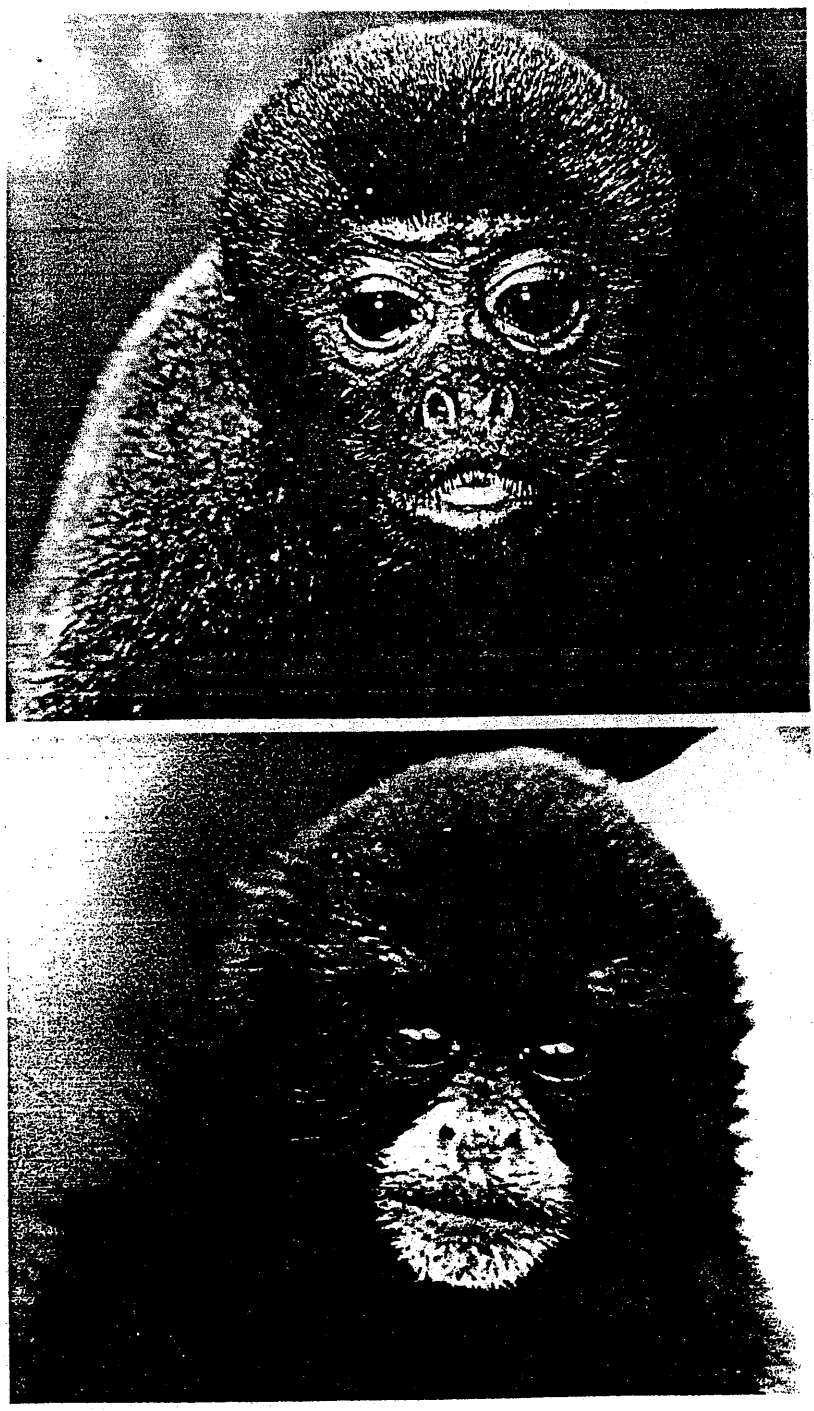

Fig. 2. Juvenile male *Lagothrix flavicauda* obtained in Pedro Ruiz Gallo.

band may also appear late in development in some individuals, or may be considerably reduced or absent in a certain percentage of the population. The white to buffy circumbuccal patch extends from the chin to between the eyes and is the most distinctive external character of *L. flavicauda*. (Indeed, a more appropriate common name for this species would be Peruvian "white-nosed" woolly monkey). The fur of *L. flavicauda* is longer and thicker than in *L. lagothricha* (Fig. 1A,B), perhaps as an adaptation to colder temperatures in the montane

Fig. 3. Juvenile male *Lagothrix flavicauda* and former owners in Pedro Ruiz Gallo.

forests in which *L. flavicauda* lives. Thomas (1927a) describes *L. flavicauda* fur as more "normal" in texture than the hair of other *Lagothrix*. Thomas (1927a, c), Hill (1962), and Fooden (1963) discuss the skull of *L. flavicauda* and point out some ways in which it differs from the skull of *L. lagothricha*. Of particular note are the more narrow braincase of *L. flavicauda* and certain morphological differences in the deciduous dentition. Field measurements are available for five specimens and are given in Table I.

III. History

Lagothrix flavicauda was discovered by Alexander von Humboldt in 1802 and was described by him as *Simia flavicauda*—*"le choro de la Province de Jaen"*—in 1812 (Humboldt and Bonpland, 1812). Humboldt, however, never saw a live specimen of this monkey. His description was based on nothing more than flat, trimmed skins used as saddle covers by Peruvian muleteers in the vicinity of Jaen (Dept. of Cajamarca, Peru). No type specimen was preserved and Humboldt knew so little about the animal that he considered it a new species of howler monkey, rather than a woolly monkey (Fooden, 1963).

For more than 110 years following Humboldt's description of *L. flavicauda*, almost nothing was heard of the animal. Poeppig (1832) mentioned the occurrence of a *rothe choro* ("red choro"—choro being the most frequently used name

TABLE I

Locality Data and Field Measurements of Known Museum Specimens of *Lagothrix flavicauda*

Catalog no.[a]	Sex[b]	Locality, collector, date collected	Field measurements (mm)
AMNH 73222	M	La Lejia (06°07'S, 77°28'W, 2300 m), Dept. of Amazonas, Peru; collected by Watkins, April 8, 1925, skin and skull	Head-body, 515; tail, 605
AMNH 73223	F	Same as AMNH 73222, skin and skull	Head-body, 535; tail, 610
BMNH 1927.1.1.1	M	Pucatambo (06°09', 77°11'W, 1555 m), Dept. of Amazonas, Peru; collected by Hendee, January 27, 1926, skin and skull	Head-body, 520; hind foot, 145; tail, 560; ear, 32.5
BMNH 1927.1.1.2	Juv. M	Same as BMNH 1927.1.1.1, skin and skull	Head-body, 260; hind foot, 86; tail, 286; ear, 30
BMNH 1927.1.1.3	F	Same as BMNH 1927.1.1.1, skin and skull	Head-body, 520; hind foot, 148; tail, 630; ear, 34
MNHJP 41	F	Forest above Alva (05°56'S, 77°56'W, 1000–2000 m), near Pedro Ruiz Gallo, Dept. of Amazonas, Peru; collected by Mittermeier, Macedo–Ruiz, and Luscombe, skin and skull	No field measurements
MNHJP 42	Juv.	Same as MHNJP 41, skin and skull	No field measurements
MNHJP 43	Adult (?)	Same as MHNJP 41, skin and skull	No field measurements
MHNJP 45	Adult (?)	Same as MHNJP 41, skin only	No field measurements
No number	Adult (?)	Same as MHNJP 41, skin only	No field measurements
MVZ 148038	M	Purchased in market of Huamachuco, Dept. of La Libertad, Peru; obtained by Jones, Nov. 21, 1974, skin only	No field measurements

Reported localities

Aguas Verdes, near Pedro Ruiz Gallo, Dept. of Amazonas, Peru	Locality reported for live juvenile specimen obtained in Pedro Ruiz Gallo by Mittermeier, Macedo-Ruiz, and Luscombe
Garcia, on the *Marginal de la Selva* road, near km 400 on the Ingénio-Rioja section, Dept. of Amazonas	Information from local people
Laurel, near La Lejía, Dept. of Amazonas	Information from Local people
Region of Upper Río Mayo, along Ingénio-Río Nieva-Rioja road, Depts. of Amazonas and San Martin	Letter in *La Prensa*, June 16, 1974
Forests in vicinity of Moyobamba (very rare), Dept. of San Martin	Freese (1975)
Vicinity of Jaen, Dept. of Cajamarca	Humboldt and Bonpland (1812)

[a]AMNH, American Museum of Natural History, New York; BMNH, British Museum of Natural History, London; MVZ, Museum of Vertebrate Zoology, Berkeley, California; MHNJP, Museo de Historia Natural "Javier Prado," Lima, Peru. Localities reported in the literature or obtainec from local people and listed in the second part of the table.

[b]M, male; F, female; Juv., juvenile.

TABLE II

Vernacular Names for *Lagothrix flavicauda* and Some Other Monkeys in the Department of Amazonas, Peru[a]

Lagothrix flavicauda	Maquisapa[b] (Alva, Pedro Ruiz Gallo Maquisapa chusco (vicinity of Mendoza) Upa (Aguas Verdes, near Pedro Ruiz Gallo) Puca-runtu (= red testicles; Pedro Ruiz Gallo) Choro, Chore (vicinity of Chachapoyas) Quille Corote (= yellow testicles; vicinity of Pucatambo, according to Hendee's 1927 letter)
Ateles belzebuth belzebuth	Choba (Alva) Maquisapa fino (near Mendoza)
Aotus trivirgatus	Mono nocturno (Alva, Pedro Ruiz Gallo)
Cebus albifrons	Mono del día (Pedro Ruiz Gallo)

[a]Areas in which the different names are used are given in parentheses.

[b]"Maquisapa" is the name most frequently used in the Dept. of Amazonas to refer to *L. flavicauda*. However, in the rest of Peru, and especially the Peruvian Amazon, "maquisapa" is used for *Ateles*, whereas "choro" is used for *Lagothrix lagothricha*. To avoid confusion, we use the name "mono choro peruano de cola amarilla," a direct translation of Peruvian yellow-tailed woolly monkey, as the vernacular name of *L. flavicauda* in all Spanish publications on the animal.

for woolly monkeys in Peru; see Table II) from Yurimaguas (Province of Alto Amazonas, Dept. of Loreto, Peru), but the identity of this animal is not clear. In 1925, a professional animal collector named Watkins collected two specimens of *L. flavicauda* at La Lejía (Dept. of Amazonas). These were deposited in the American Museum of Natural History in New York, but were not recognized as *L. flavicauda* until 1963 (Fooden, 1963). In 1926, R. W. Hendee, a collector for the Godman-Thomas Expedition to Peru, collected three more specimens at Pucatambo (a tiny rest stop located at the border between the Depts. of Amazonas and San Martin) for the British Museum of Natural History in London. Unlike Watkins' specimens, these animals were immediately recognized as something unusual and were described by the zoologist Oldfield Thomas (1927a) as *Lagothrix (Oreonax) hendeei*, a new species and new subgenus of wooly monkey. Later the same year, Thomas (1927c) raised the new subgenus to full generic status as *Oreonax hendeei*, basing his decision on several features of the deciduous dentition of one juvenile specimen. Thomas (1972b), incidentally, compared his "new" species with Humboldt's description of *Simia flavicauda*, but concluded that Humboldt's animal was probably nothing more than "a local *Lagothrix*, perhaps *L. lagothricha*." Cabrera (1958) considered Thomas' *Oreonax hendeei* to be no more than specifically distinct from other woolly monkeys, and considered Humboldt's *Simia flavicauda* to be indetermin-

able. Finally, Fooden (1963) carefully checked Humboldt's and Thomas' descriptions, compared them with the two Watkins specimens in the American Museum, and concluded that *Oreonax hendeei* was synonymous with Humboldt's *Simia flavicauda*. He also agreed with Cabrera that the animal was only specifically and not generically distinct from other *Lagothrix*, the correct name thus being *Lagothrix flavicauda* (Humboldt, 1812).

IV. The Rediscovery of *Lagothrix flavicauda*

For nearly 50 years following the collection of the Hendee specimens, nothing was heard of *L. flavicauda*, even though at least one expedition went into the area to locate the animal.* In order to determine if *L. flavicauda* indeed still existed and, if it did, to obtain data on its biology and conservation status, we organized a 12-day expedition (April 26—May 7, 1974) to the region in which the Watkins and Hendee specimens had been found. Included in the survey were forested areas in the vicinity of Chachapoyas, Mendoza, and Pedro Ruiz Gallo (near a military engineering base and about 2 hours north of Chachapoyas by bus), all in the Dept. of Amazonas (Fig. 4). While we were still on the road to Chachapoyas, we met a hunter who had with him a stuffed adult specimen (skin and skull) of *L. flavicauda* that he had shot in montane rain forest only 6 days prior to our arrival. We later obtained from this same hunter three additional skins and two skulls of *L. flavicauda* he had shot for food, and traveled with him to the forests from which he had obtained these animals. (The skins and skulls we obtained represent the first *L. flavicauda* specimens for a Peruvian museum and are now deposited in the Museo de Historia Natural "Javier Prado" of the Universidad Nacional Mayor de San Marcos in Lima.)

By questioning local people in the towns we visited, examining the collections of several amateur taxidermists (a popular hobby in Peru), and visiting the forests in which *L. flavicauda* occurs, we obtained a picture of the mammal and bird faunas of the area and learned something of the habitat and status of *L. flavicauda* and other rare and unusual animals sympatric with it.

Finally, on the day before our return to Lima, local children in Pedro Ruiz Gallo directed us to the home of a soldier who had a juvenile *L. flavicauda* as a pet. We managed to obtain this unique find from him and took it back with us. The animal, a young male, is the first living representative of its species to be seen by the scientific world (Figs. 1B, 2, and 3). (It has now been donated to the Museo de Historia Natural "Javier Prado" of the Universidad Nacional Mayor de San Marcos, where it continues to thrive.)

*In 1940, Dr. Oliver P. Pearson (Museum of Vertebrate Zoology, Berkeley, California) went to northern Peru to collect *L. flavicauda*, but was unsuccessful (O. P. Pearson, personal communication, 1974).

V. Habitat and Range of *Lagothrix flavicauda*

On the basis of available data, *L. flavicauda* appears to be restricted to montane rain forest of the broken, intermountain plateau on the eastern slope of the Andes in northern Peru. Its range includes the southern part of the Dept. of Amazonas and the mountainous, western part of the Dept. of San Martin (see Fig. 4). We have been unable to determine if the animal actually occurs in the

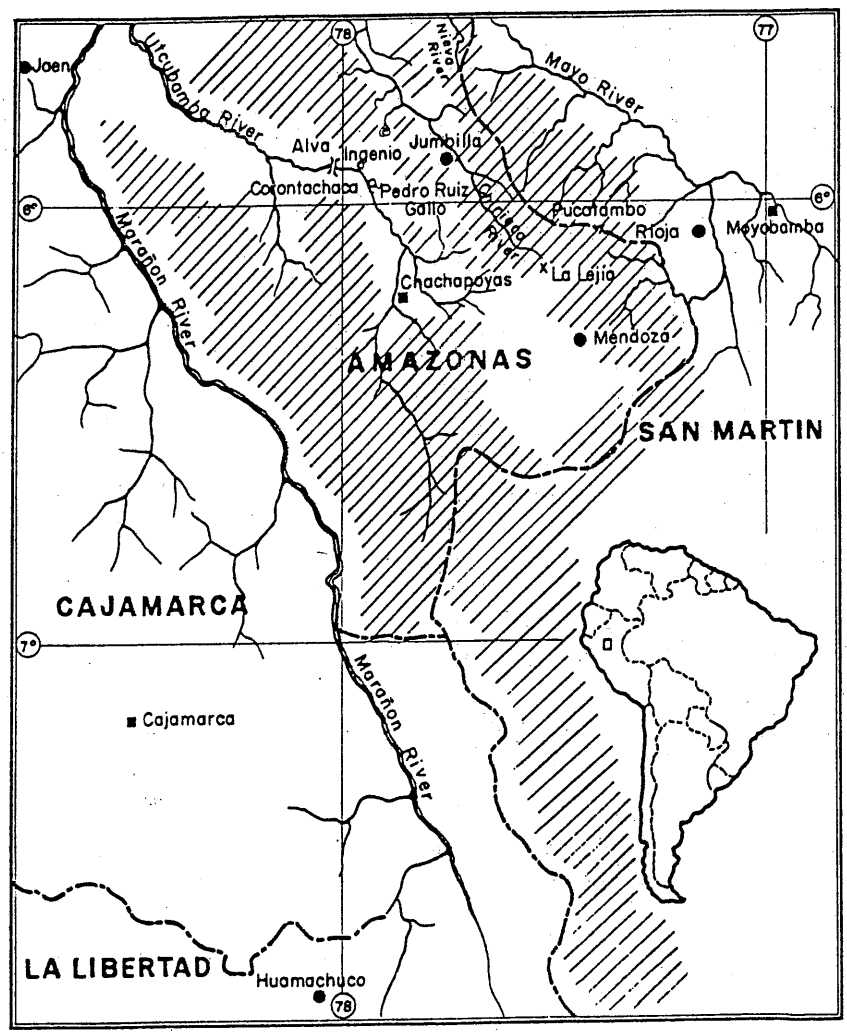

Fig. 4. Map showing the range of *Lagothrix flavicauda* in the Peruvian Departments of Amazonas and San Martin.

immediate vicinity of Jaen, Dept. of Cajamarca. Humboldt observed his skins in Jaen, but the animals could well have come from the Dept. of Amazonas, on the eastern side of the Río Marañon. In November, 1974, R. Jones (University of California, Berkeley, California) obtained a skin of *L. flavicauda* in the market of Huamachuco (Dept. of La Libertad). However, this specimen lacked precise locality data and almost certainly came from forests north or east of Huamachuco. The immediate vicinity of Huamachuco has no forests that could support *L. flavicauda*.

Localities from which *L. flavicauda* has been collected or reported are listed in Table I and shown in Fig. 4. We have been unable to determine the limits of distribution of the species. It may range somewhat more widely than the list of localities presently available indicates and could conceivably extend into Ecuador (but this is unlikely). Thus far no specimens have been collected outside Peru.

The region in which *L. flavicauda* occurs is characterized by steep, grass or forest-covered mountains, cut by valleys and deep ravines (Fig. 5). To the north, south, and east, there is a transition from montane rain forest to low-altitude Amazon rain forest. To the west, the typical "sierra" of the Andes takes over.

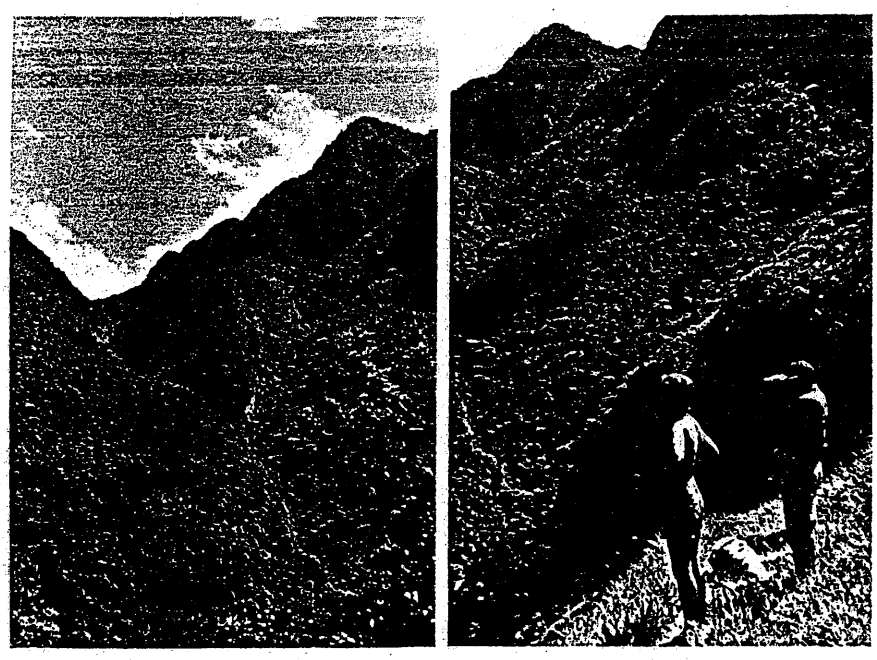

Fig. 5. (A) Montane forest habitat of *L. flavicauda* at Alva, near Pedro Ruiz Gallo, Dept. of Amazonas, Peru. (B) Same as Fig. 5A.

The altitudinal range of *L. flavicauda* is roughly 500–2500 m, and might reach as high as 3000 if adequate forest is available at this altitude. Fooden (1963) estimated that Watkins' specimens came from 3000 m, but Stübel (in Papavero, 1973) gives the altitude of La Lejía as 2300 m.

Few data are available on the behavior and ecology of *L. flavicauda*. Hendee, in a letter written to Oldfield Thomas on February 27, 1927, reported that the group from which he collected the three British Museum specimens was made up of about twenty animals and that they were not particularly timid.

A number of other interesting animals are sympatric with *L. flavicauda*. Among them are at least three other species of monkeys (*Ateles belzebuth belzebuth, Cebus albifrons, Aotus trivirgatus,* and possibly *Alouatta seniculus*), spectacled bear (*Tremarctos ornatus*), possibly mountain tapir (*Tapirus pinchaque*), cock of the rock (*Rupicola peruviana*), marvelous spatule-tail hummingbird (*Loddigesia mirabilis*—another endemic that is apparently even more restricted in range than *L. flavicauda*), and a variety of other birds and mammals (Table III).

VI. Status of *Lagothrix flavicauda*

The information that we gathered during the course of our expedition led us to the conclusion that *L. flavicauda* is an endangered species. It is threatened by habitat destruction and especially by hunting within its restricted range. Prior to 1960, no roads went into the region in which it occurs. However, since that time, the Peruvian army has been constructing the Marginal de la Selva road through the area and has been opening previously isolated localities for colonization and defense purposes. Although a good deal of montane forest still remains, destruction is taking place at an ever-increasing rate. Forests are being cleared to make way for agricultural plots and cattle, although in some places the hillsides are so steep that cattle can barely walk on them.

Hunting, however, is having the most destructive immediate effect on the fauna of the area. Monkeys, bears, and many other mammals and birds are being shot for food and for their skins, some of which are stuffed and sold to townspeople. In the house of the hunter from whom we obtained the four *L. flavicauda*, we also saw skins of a spider monkey (*Ateles belzebuth belzebuth*), a tayra (*Eira barbara*), four coatis (*Nasua nasua*), the skull of a capuchin monkey (*Cebus albifrons*), and a bag of feathers containing the remains of roughly 12 cock of the rock (*Rupicola peruviana*) and a lyre-tailed nightjar (*Uropsalis lyra*). Skins of spectacled bear (*Tremarctos ornatus*) sell for 600 soles (approx. $15.00) each and bear grease is valued at 300 soles per liter. Bear meat is so highly esteemed that it is usually eaten by the family of the hunter and not sold. Monkey meat is also appreciated and *L. flavicauda* is apparently especially sought after because of its size and the quality of its flesh.

TABLE III

Some Birds and Mammals Recorded from the Range of *Lagothrix flavicauda* in the Peruvian Department of Amazonas[a]

Birds	
Turkey vulture	*Cathartes aura*
Black-and-chestnut eagle	*Oroaetus isidori*
American kestrel	*Falco sparverius*
Andean guan	*Penelope montagnii*
Sun bittern	*Eurypyga helias*
Scarlet-fronted parakeet	*Aratinga wagleri*
Squirrel cuckoo	*Piaya cayana*
Lyre-tailed nightjar	*Uropsalis lyra*
Sparkling violetear	*Colibri coruscans*
Marvelous spatuletail	*Loddigesia mirabilis*
Cock of the rock	*Rupicola peruviana*
Tropical kingbird	*Tyrannus melancholicus*
Green jay	*Cyanocorax ycas*
Violaceous jay	*Cyanocorax violaceus*
Scarlet-rumped cacique	*Cacicus uropygialis*
Carbonated flower-piercer	*Diglossa carbonaria*
Blue-necked tanager	*Tangara cyanicollis*
Silver-beaked tanager	*Ramphocelus carbo*
Hepatic tanager	*Piranga flava*
Black-beaked grosbeak	*Pheucticus aureoventris*
Mammals	
Opossum	*Didelphis marsupialis*
Night monkey	*Aotus trivirgatus*
White-fronted capuchin monkey	*Cebus albifrons*
Spider monkey	*Ateles belzebuth belzebuth*
Spectacled bear	*Tremarctos ornatus*
Coati	*Nasua nasua*
Long-tailed weasel	*Mustela frenata*
Tayra	*Eira barbara*
Jaguarundi	*Felis yagouaroundi*
White-lipped peccary	*Tayassu pecari*
White-tailed deer	*Odocoileus virginianus*
Paca	*Agouti paca*
Prehensile-tailed porcupine	*Coendou bicolor*

[a]Based on the author's field observations, specimens in local taxidermy collections, and information from local inhabitants.

Added to hunting pressure from local people is an even greater threat from the army. The army is reportedly employing professional hunters (called "mateyeros" or "montaraces") to shoot game to feed construction crews working on the road network. This highly wasteful procedure is unnecessary since domestic animals are available (although somewhat more expensive than living off the land).

The army's destructive effect on the fauna has even caused concern among a number of residents of the area. Several weeks after an article announcing our rediscovery of *L. flavicauda* appeared in *La Prensa*, one of Lima's biggest daily newspapers, the following letter was written to the editor of *La Prensa* by a schoolteacher in Pedro Ruiz Gallo:

> Having read your article on *Lagothrix flavicauda* in the May 19 supplement, I I feel that I should inform you that this species of monkey inhabits the region of the Upper Mayo (Fig. 4), where it is being eliminated without compassion by the workers constructing the Ingénio—Río Nieva—Rioja road because it constitutes one of their food resources and is highly appreciated for its size and excellent meat. I ask you to initiate a campaign to make the government take the necessary measures to prevent the extinction of this monkey. It is very easy to hunt since it travels in "herds" and does not try to escape when it sees hunters. When one of the members of a group is injured, the others reunite around it, which facilitates the slaughter of the entire group. This is why one no longer finds *L. flavicauda* in areas where established human communities exist. If protection is not provided very soon, the species *Lagothrix flavicauda* will have been wiped out by the time the *Marginal de la Selva* road is completed. (Translated from letter in Spanish in *La Prensa* Sunday Supplement, Lima, Peru, June 16, 1974, p. 2).

VII. Conservation and Recommendations for the Future

Lagothrix flavicauda is an important part of Peru's faunal heritage since it is the only species of larger mammal that is endemic to Peru. Nonetheless, because of its rarity and the relative isolation of its habitat, it is unknown to the vast majority of Peruvians. In order to publicize the animal, we held a press conference to announce its rediscovery and were aided considerably by an outstanding performance on the part of the juvenile male *L. flavicauda* obtained in Pedro Ruiz Gallo. We obtained coverage from the major Lima dailies and local television, and longer articles also appeared in two Peruvian magazines (Anonymous, 1974; Mittermeier *et al.*, 1974). Articles on *L. flavicauda*, have also been written for several Peruvian and international conservation journals (Mittermeier, *et al.*, 1975a,b; Macedo-Ruiz, *et al.*, 1976; Marcus, 1975) and we have recommended that it be included in a new series of endangered species postage stamps currently being issued by the Peruvian government [other species in this series include the vicuña (*Vicugna vicugna*), the chinchilla (*Chinchilla laniger*), the giant otter (*Pteronura brasiliensis*), the bush dog (*Speothos venaticus*), the spectacled bear (*Tremarctos ornatus*), and the red uakari (*Cacajao calvus rubicundus*)].

In order to provide legal protection for *L. flavicauda*, we have recommended that it be given full protection within Peru and that it be included as a red sheet,

endangered species in the International Union for the Conservation of Nature's "Red Data Book." The latter has already been done (Red Data Book, 1974).

In order to ensure the survival of *L. flavicauda* within its natural habitat, we have recommended that a national park, national reserve, or national sanctuary be established in its range. If properly selected, such a protected area would also include populations of other rare and endangered species of the region. In order to locate a site for a park or reserve, we are planning longer and more detailed surveys, to be conducted under auspices of the *Museo de Historia Natural "Javier Prado"* and the *Servicio Forestal y de Caza* (Wildlife Service) of the Peruvian Ministry of Agriculture. Once a suitable site has been located, a long-term study should also be conducted to provide data on the behavior and ecology of the species.

Finally, we are planning a captive breeding program for *L. flavicauda* in order to ensure the survival of some representatives of the species should it disappear in the wild. (A brief outline of the requirements for a captive colony is given in Sections VIII.)

The letter of the concerned resident of Pedro Ruiz Gallo clearly points out the need for rapid action on behalf of *L. flavicauda*. In recent years, much has been accomplished in Peruvian conservation, thanks both to the efforts and initiative of Peruvian conservationists and to international cooperative endeavors dedicated to saving important parts of Peru's wildlife heritage. We therefore have every hope that it will be possible to direct national and international attention to *L. flavicauda* and that everything feasible will be done to save this unique and attractive monkey from extinction.

VIII. Plans for a *Lagothrix flavicauda* Breeding Colony

With a life expectancy in captivity of only about 15 months, *Lagothrix* was previously considered a very difficult genus to maintain (Crandall, 1964). However, the major problems have now essentially been solved. The first successful colony birth took place in 1966 (Williams, 1967a) and there are now at least four captive breeding colonies in Europe: Murrayton Woolly Monkey, Cornwall, England; Apenheul Woolly Monkey Colony, Apeldoorn, Netherlands; Basel Zoo, Basel, Switzerland; and Banham Zoo, Norfolk, England.

The following plans for a *Lagothrix flavicauda* breeding colony are based on the experiences of the successful European colonies (especially Murrayton and Apenheul, where J. C. spent 2 years studying behavior and designing the physical environment), on several publications by Williams (Williams, 1965, 1967a,b, 1972, 1974), and to a lesser extent on a few recent field studies of *L. lagothricha* (Durham, 1975; Kavanagh and Dresdale, 1975; Nishimura and Izawa, 1975; Hernandez-Camacho and Cooper, 1976; Cassidy, in preparation).

A. Size and Composition of Initial Captive Group

The only information on group size for *L. flavicauda* comes from the 1927 Hendee letter, which mentions about twenty animals. The most recent field studies of *L. lagothricha* indicate a wide group size range of 4 to 35 individuals, with an average of about 13 at an altitude of 600 m and 7 at 1500 m (Kavanagh and Dresdale, 1975; Durham, 1975; J. Cassidy, personal observation). Based on this limited field data and the experience of the European colonies, we feel that a group of 9 to 12 individuals would be optimal for starting a captive colony of *L. flavicauda*. Group composition should be 1 adult male; 1–2 subadult males; 3 adult females; 2–3 subadult females; and 2–3 juveniles. Preferably, the animals should come from a single group or from as small a number of groups as possible.* Ideally one complete group should be captured, thus maximizing group cohesion from the outset. The animals should be captured with tranqulizer darts shot from either a CO_2 rifle or a blowgun (Brockelman and Kobayashi, 1971). The blowgun is preferable since it is safer and its silence facilitates the capture of several individuals from a single group.

B. Physical Features of the Colony

1. Location

Since the colony will be located in Peru, it should, if possible, be situated in a forested area similar to the natural habitat in climate and vegetation. This is not absolutely necessary, since the European colonies are located in areas completely different from *Lagothrix* habitat, but would reduce the need for construction of monkey buildings and planting of food trees.

2. Spatial Requirements

During the initial stages of colony formation, only one compound will be necessary. With increase in numbers, either through reproduction or the introduction of additional wild-caught specimens, two more compounds should be added to form a large complex. The final colony area, excluding research buildings, should be between 12 and 20 hectares, divided into three separate but linked compounds of 4 to 7 hectares each (Fig. 6).

Some trees should be removed from the colony area to facilitate observation, but all trees which can serve as food sources should be left standing.

Compounds should be surrounded by a moat or a wall, or some combination

*Not everyone agrees with this method for starting a colony. Some specialists feel it is too difficult for most adult *Lagothrix* to adjust to captivity and that it is better to start a colony with behaviorally more flexible juveniles and subadults (but not infants or young juveniles) (M.G.M. van Roosmalen, personal communication).

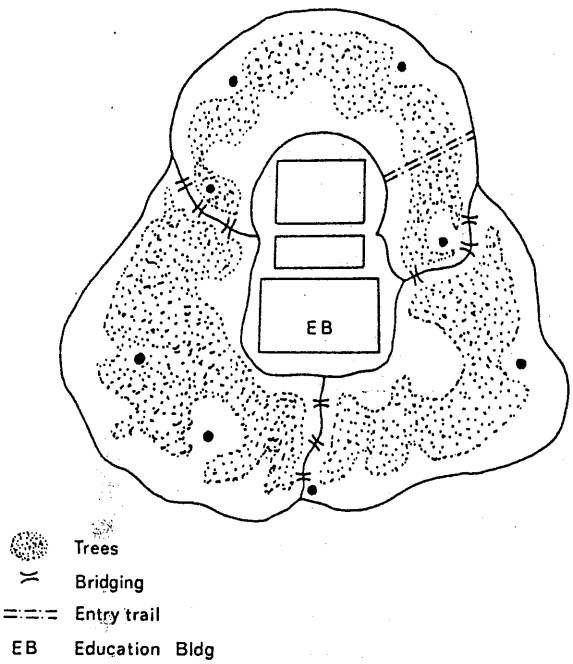

Fig. 6. Plan for a *Lagothrix flavicauda* breeding colony. The education building and monkey buildings are located at the center of the colony area; bridging connects the three compounds. The solid black circles indicate the location of the observation points.

of the two—depending on the physical features of the site, availability of water, and other factors. The moat should be 2–5 m wide, with a minimum depth of 50 cm. The wall should be made of smooth, corrugated, unclimbable, weather-resistant material. Buried at least 30 cm below the surface, it should extend 2.5–3.5 m above the ground and incline inward at an angle of 15 to 20°. All trees and branches should be cleared from an area of at least 5 m on each side of the perimeter, and there should be no vegetation other than grass or very low bushes within 3 m of the wall or moat.

When the second and third compounds are added, "bridges" should be constructed between them in order to study group encounters and possible seasonal changes in group composition (Fig. 6). This observation device is already in use at the University of Puerto Rico Primate Center on La Cueva Island (Neurater and Goodwin, 1972).

3. Building

Three kinds of indoor space are needed in the colony: quarters for monkeys (including hospital area); research facilities (including office space, library,

laboratory facilities, video tape studio); and living quarters for animal keepers and researchers (including sleeping space and kitchen). If the colony is located in an area where protection from adverse weather conditions is necessary, indoor monkey rooms are a must. Two 6 m × 6 m rooms per compound, each well furnished with natural materials like ropes, rope nets, wooden bars, and trimmed trees, are adquate. Indoor enclosures should have sealed concrete floors and walls of some washable, scratch-resistant material. Temperature of these rooms should be maintained at about 17°C, preferably using solar heating.

4. Observation Facilities

The most important function of any breeding colony, aside from its primary purpose of conservation, is to serve as a site for long-term captive studies which provide an invaluable supplement to field studies. Mention has already been made of intercompound bridges. To further facilitate study, several observation towers should be constructed at strategic points within the compounds. The number of towers depends on the site, but a sufficient number should be provided to allow observation of most of the compound from a distance of 50 m or less. Towers 6 m in height should be adequate in most cases, but they can be as high as 8 m if the natural vegetation in the colony makes this necessary. They should include facilities for video tape cameras which serve as a useful aid to behavioral research. (Video tape is recommended since it is economical and easy to use. The tape can be used again and again and instant replay or monitoring is possible.)

5. Nutrition

Captive studies and field observations indicate that *Lagothrix* sp. are frugivores, with a secondary specialization in folivory (Kay, 1973). The diet of wild *Lagothrix* sp. includes the following (Durham, 1976; Kavanagh and Dresdale, 1975; Nishimura and Izawa, 1975; Cassidy in preparation.):

Anacardium excelsum (Anacardiaceae)—leaves, flowers, buds
Attalea regia (Palmae)—fruit
Cecropia sp. (Moraceae)—flowers, buds, fruit
Chrysochlamys sp. (Moraceae)—fruit, pedicels
Ficus sp. (Moraceae)—flowers, buds, fruit
Gustavia sp. (Lecythidaceae)—fruit
Jessenia polycarpa (Palmae)—fruit
Lucuma sp. (Sapotaceae)—fruit, flowers, buds
Mauritia flexuosa (Palmae)—fruit
Protium sp. (Burseraceae)—fruit
Annonaceae, several sp.—leaves
Clusiaceae, several sp.—leaves

Palmae, "palmetto"—fruit, flowers, buds
Sapotaceae, several sp.—fruit

Wild specimens also eat bark, twigs, and some insects (Kavanagh and Dresdale, 1976; Cassidy, in preparation).

Animals in the European colonies are given or browse on the following temperate zone species in their compounds:

Epilobium sp. (Onagraceae)—leaves, common name: willow herb
Rumex sp. (Polygonaceae)—leaves, common name: dock
Taraxacum sp. (Compositae)—leaves, common name: dandelion
Fagus sp. (Fagaceae)—leaves and buds, common name, beech
Ulmus sp. (Ulmaceae)—leaves and buds, common name: elm
Urtica sp. (Urticaceae)—leaves, common name: nettles

In addition to these foods, captive animals are also given a wide range of fruits and green vegetables, onions and garlic, carrots, insects (including mealworms, moths, locusts, stick insects), raw eggs, wheat germ, honey, molasses and brewers' yeast, concentrated fruit juice, vitamin extract, vitamin D drops, and chicken, lightly cooked and eaten with leaves. Occasionally sisal rope or wood is chewed and ingested with chicken. Captive animals also catch insects and occasionally birds in the trees within the colonies.

The following foods, listed in Williams (1967a), are no longer recommended: cooked eggs, cheese and other milk products, condensed or fresh milk, cereals, red meat, coconut, and semolina.

The supplementary foods listed above should be given to colony animals at several feeding platforms. Since provisioning can lead to high intraspecific aggression, foods should be introduced simultaneously at several widely spaced platforms.

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