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Callicebus caquetensis: A New and Critically Endangered Titi Monkey from Southern Caquetá, Colombia

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Abstract: We describe a new species of titi monkey *Callicebus* (Primates: Platyrrhini) from the Department of Caquetá, Colombia, that belongs to the *Callicebus cupreus* group. Diagnostic characteristics: it is similar in fur color to *C. ornatus* and *C. discolor*, but has no white band on the forehead as in *C. ornatus* and *C. discolor*, and the hands and feet are not white as they are in *C. ornatus*. The karyotype of this species is 2n=46, and very similar to that published for *C. cupreus.* Comparing it to neighboring species, it is more similar cytologically to *C. discolor* than to *C. ornatus.* It should be classified as Critically Endangered (CR) due to the severe fragmentation of its habitat and very small population.
Key words: Platyrrhini, Pitheciidae, *Callicebus caquetensis*, new species, primate, Colombia.

Resumen: Se describe una nueva especie de *Callicebus* (Primates, Platyrrhini) del departamento de Caquetá, Colombia perteneciente al grupo de *Callicebus cupreus*. Los caracteres diagnósticos para esta especie son una coloración similar a *C. ornatus* y *C. discolor*, pero careciendo de la banda blanca frontal y de pelos blancos en manos y pies. El cariotipo de está especie tiene un 2n=46 muy similar al descrito para *C. cupreus.* Con relación a otras especies colombianas estudiadas, es más similar a los ejemplares de *C. discolor* (2n=46) que a *C. ornatus* (2n=42). Consideramos que esta especie debe ser catalogada como "En Peligro Critico" (CR) por la extensa fragmentación de su hábitat.
Palabras claves: Platyrrhini, Pitheciidae, *Callicebus caquetensis*, nueva especie, primates, Colombia.

Introduction

In his book reviewing the behavior and ecology of the Neotropical primates, Martin Moynihan (1976) mentioned his observations of titi monkeys from the upper Caquetá (the piedmont of Colombia´s Cordillera Oriental), and referred to them as anomalous when compared to the forms *ornatus* Gray, 1866, *discolor* I. Geoffroy and Deville, 1848 and *cupreus* Spix, 1823. In parentheses he described the animals as follows (p.75):

> "The Caquetá animals are anomalous and may deserve special mention. Hershkovitz ignored them, simply because he thought that the species was absent from the area. This is surprising, for *C.* [*Callicebus*] *moloch* is conspicuous around Valparaíso, one of the important towns of the *intendencia* [a political subdivision of national territories in Colombia that has been superseded since 1991 by the subdivision of the country into *departamentos* that are politically equal]. The individuals that I managed to see clearly, close up, in the Caquetá lacked the white stripe above the eyes that is typical of both *ornatus* to the north and *discolor* to the south. They could have been intermediates between one or both of the latter forms and *cupreus*, which occurs downstream, or representatives of an unnamed subspecies."

He went on to describe the forest where he saw them (pp.76–77):

> "I found another pair or family group of *moloch* [Hershkovitz (1963) regarded all Amazonian titis to be subspecies of just two species, *moloch* and *torquatus*] in an even more extreme habitat near Valparaíso (really very near indeed, just outside the town limits). This was a medium-sized expanse of incredibly dense, almost solid, and low forest of small, thin, broadleaved trees and large bushes, hardly 7 meters high at its maximum. During the

> rainy season, the whole ground underneath was a morass of pools, streams, and deep pits of liquid mud. In the dry season, some of the pools and streams disappeared, but the area remained damp and the footing very treacherous. Naturally, the titis of this thicket averaged much lower than those of less stunted vegetation." [His point here was that he believed that "*C. moloch* is the nearest thing to a real swamp monkey in the New World", p.77].

Moynihan (1976) referred to *Callicebus moloch*, but at the time *moloch* included as subspecies the forms *ornatus*, *discolor*, and *cupreus*, and would consequently have included this form from Valparaíso as a distinct (implied) subspecies. At the time that Moynihan published his observations, the Amazonian titi monkeys were considered to belong to just two species: *C. moloch* (Hoffmannsegg, 1807) comprising seven subspecies and *C. torquatus* (Hoffmannsegg, 1807) three, following the revision by Hershkovitz (1963). In his subsequent revision, Hershkovitz (1990) recognized eight species in his *moloch* group, with the forms *discolor* and *ornatus* as subspecies of *C. cupreus*. Groves (2001, 2005) and Van Roosmalen *et al.* (2005) considered *discolor*, *ornatus*, and *cupreus* to be distinct species. Bueno *et al.* (2006) found karyotypic differences in the form of translocations and inversions that clearly distinguished *Callicebus ornatus* from other Colombian titis, and confirmed that it is a distinct species.

For some years it was risky to travel to Valparaíso because of the presence of insurgent groups and the lack of security. In 2008–2009 we were able to travel to the upper Río Caquetá. With a lull in the violence in 2008, Javier García (a native of Caquetá department) went to Valparaíso (13 July to 24 August 2008) to gather observations and obtain live material that would allow for a proper description of the titi monkey there, and the description of its karyotype. Using local transportation, and geo-referencing observations with GPS, García was able to observe 13 groups of this species by searching on foot and listening for early morning calls. He found two animals in captivity, being kept as pets near Valparaíso, Caquetá, and discussions with the owners led to them being donated to the project. They were taken to Florencia where Defler and Bueno met García in order to take immediate blood samples for karyotyping. On 2 September 2008, the youngest animal died of captive trauma, and García took the monkey´s remains and the living holotype to Bogotá by land on 3 September 2008, where the second, living animal was handed over to the care of the Unidad de Rescate y Rehabilitación de Animales Silvestres (URRAS), Department of Veterinary Sciences, Universidad Nacional de Colombia. The remains of the paratype were delivered to Defler for measurements and preparation of material for the mammal collection at the Institute of Natural Sciences at the Universidad Nacional de Colombia.

In 2009 (8–30 April and from 10–30 May, 2009), García returned to the region to study the distribution of the species. The second live specimen died in captivity of a pathology on 27 January 2009 in the URRAS. Both specimens are deposited in the collection of the Instituto de Ciencias Naturales of the Universidad Nacional de Colombia, Bogotá, including skins, skulls, skeletons and soft tissues.

Callicebus caquetensis sp. nov.

Synonyms. *Callicebus moloch* Hoffmannsegg, 1807: 97; Moynihan, 1976: 75–77 (following Hershkovitz 1963).

Holotype. Juvenile female, ICN 19439, skin, skull, tissues in alcohol, complete skeleton; deposited in the Instituto de Ciencias Naturales (ICN) of the Universidad Nacional de Colombia, Bogotá. Died of a pathology at one year of age in captivity 27 January 2008 at URRAS wild animal care facility at the Universidad Nacional de Colombia. It is a one year-old juvenile. *Callicebus* become adults at sexual maturity during the second year (judging by a tame, free-ranging female *Callicebus lugens* that became sexually mature in June–July of her second year at Caparú Biological Station in Vaupés, Colombia) (Defler 2004, 2010).

Paratype. Juvenile female, ICN 19017 1°6'23.10"N, 75°38'32.50"W east of Valparaíso, Caquetá at the farm of Marino Camacho, vereda [subdivisions of municipalities in Colombia, a concentration of houses generally without roads] El Jardín; skull, skeleton; and tissues in alcohol. Deposited in the collection of the Instituto de Ciencias Naturales (ICN) of the Universidad Nacional de Colombia, Bogotá. Died on 2 September 2008 (probably of captive trauma) at about 7 months of age.

Type locality. Vereda El Jardín, east of Valparaíso, municipality of Puerto Milan, Department of Caquetá, Colombia, 1°8'24.61"N, 75°32'34.04"W, 251 m above sea level.

Distribution. Thirteen groups of *Callicebus caquetensis* were observed in 11 locations from 190 to 260 m above sea level, in a broad band south of the Río Orteguaza around Valparaíso, south to the Río Caquetá around La Solita (Fig. 1). The complete geographic distribution cannot be defined on the basis of the information we have at present, but García was unable to find evidence that it extends west to the Cordillera Oriental. Searches east of Florencia to the Río Caguan gave no indication that the species is found north of the Río Orteguaza. The area east of the known distribution towards the mouth of Río Orteguaza where it meets the Río Caquetá has yet to be surveyed.

Diagnostic characters. This species of *Callicebus* is very similar to *C. ornatus* and *C. discolor*, but it does not have a white bar on its forehead (as do *ornatus* and *discolor*), nor does it have white queridia (as does *ornatus*). In place of a white forehead bar (as in *C. ornatus* and *C. discolor*) the hairs are white and grey agouti, the tips of the hair being white. Posterior to this zone (corresponding to a forehead band) the agouti pattern becomes buffy-orange and black, replacing the white tips with buffy-orange.

Description. See Figures 3a–g and 4a–c. Body and skull measurements of the holotype (juvenile female) and the paratype (juvenile female) are shown in Table 1. *Callicebus*

caquetensis is very similar in color and markings to *C. ornatus* and *C. discolor*, though it lacks the white forehead bar of both of those species and the white hands and feet of *C. ornatus*. Crown from above eyes caudally is a light buffy brown; neck, sides, back and tail are mixed grayish-brown and buffy agouti but often with penciled tail tip on terminal third of tail that is dominantly white and black agouti. The specimen is lightly washed in reddish tones that are absent over the grayish agouti tail; the agouti-colored tail has slight banding proximal to the body. Coloration is sparsely-haired chestnut-red on the ventrum, body, arms, legs and face, extending to dorsal parts of lower arms and lower legs up to the elbows and knees. The reddish also extends to the ventral parts of the neck and onto the cheeks up to the basal parts of the ear, giving the appearance of a red beard. The grayish-brown agouti extends from the back onto the dorsal parts of the arms and legs down to the knees and the elbow, also with some slight reddish washing. Facial skin is darker than the skin on the dorsum, arms and legs, which is pinkish. In place of a white forehead bar (as in *C. ornatus* and *C. discolor*) the hairs are white and grey agouti, the tips of the hair being white. Posterior to this zone (corresponding to a forehead band) the agouti pattern becomes buffy-orange and black, replacing the white tips with buffy-orange so that it can be said that there is a very faint band of agouti colored hairs composed of white tips and black bands.

Table 1. Body and skull measurements (mm) of holotype and paratype, *Callicebus caquetensis.*

	Holotype ICN 19439 Juvenile female	**Paratype ICN 19017 Juvenile female**
Tail length	610	
Body length	350	
Hind foot length	70	
Hand length	45 (nail) 42 (no nail)	
Ear length	30	
Basal length	40.9	
Basilar length	37.5	
Condylobasal length	45.25	
Condylocanine length	41	
Greatest length of skull	56.4	50.9
Breadth of braincase	32.85	31.1
Least interorbital breadth	4.65	4.3
Mastoid breadth	33.4	32.2
Postorbital constriction	29.5	27
Mandibular length	34.5	
Bizygomatic breadth	32.6	
Zygomatic breadth	32.6	31.3
Cranial length (braincase)	46.7	
Diastema length	11.8	
Maxillary tooth row	14.9	
Palatal length	19.4	
Palatilar length	15.7	
Nasal length	11.6	
Nasal width	6.1	
Nasal suture length	8	
Postpalatal length	20.4	
Typanic bullae length and width	15.05 × 8.4	
Facial length	18.2	
Mandibular tooth row	18.5	

Comparisons. *Callicebus caquetensis* is very similar to *C. cupreus* (*sensu* Groves 2005), although it does not have a blackish band on the forehead over the eyes. It is similar to *C. discolor* (*sensu* Groves, 2005), although it has no white band across the forehead as does *C. discolor*. *Callicebus caquetensis* is phenotypically very similar to *Callicebus ornatus* (*sensu* Groves, 2005), but *C. ornatus* has a white band on the forehead and off-white hands and feet. The crown of the head of *C. caquetensis* is a light agouti brown down to the eyes, while *C. ornatus* has first the white band over the eyes and, posteriorly, the crown is darker and contrasting with the lighter grey agouti of the back and sides. *Callicebus caquetensis* is a darker agouti brown than *C. ornatus*, which is closer to grey agouti. An area over the eyes, corresponding to the white band over the eyes of *C. ornatus*, appears lighter due to the appearance of skin showing through the hairs, and due to the white-tipped agouti hairs (which are buffy or brown-tipped posteriorily).

Karyology. (Fig. 2) Chromosome preparations were obtained by M. L. Bueno using standard methods for lymphocyte culture (Moorhead *et al.*, 1960). Blood samples were taken with heparinized syringes (Liquemine, Roche). Peripheral blood was cultured in Minimal Essential Medium (MEM, Sigma) with 20% bovine fetal serum, 10% of Penicillin-streptomycin, Sigma. As mitogens, 0.35 mls P-Phytohemaglutinin (Difco, at 1:16 dilution) were used. A duplicate culture with a crude extract of *Vicia faba* lectin (the procedure of Arango and Moreno, 1977) gave the best preparations. Optimum culture time was 66 hours. QFQ, GTG and CBG banding were carried out as described by Capersson *et al.* (1970), Seabright (1971) and Summer (1972), respectively. Late DNA replication patterns (RBG) were observed after a 5-bromodeoxyuridine (Budr) terminal pulse (see Camargo and Cervenka, 1980). CBG banding was accomplished using preparations previously analyzed with QFQ banding. Nucleolar organizer regions (NORs) were located by the procedure of Goodpasture and Bloom (1975).

Blood drawn from the holotype in Florencia was taken by airplane to Bogotá for cultivation, but it proved to be contaminated. Blood drawn from the holotype in Bogotá yielded the study material.

This species has a diploid chromosome number of 2n=46, composed of 7 pairs of metacentric chromosomes and 15 pairs of acrocentric chromosomes. The X chromosomes are submetacentric and preserve the characteristic banding pattern typical for this chromosome found in various primates, including humans (Fig. 2).

The karyomorph is very similar to that reported for *Callicebus cupreus* by Bigoni and Stanyon in O´Brien *et al.* (2006). The *C. cupreus* in the *Atlas of Mammalian Chromosomes* was from the *Callicebus* colony housed at Davis, California, USA, and the animals of that colony are said to have been exported to

the United States from Iquitos, Perú (R. Stanyon, pers. comm.; W. A. Mason, pers. comm.). The *C. caquetensis* (2n=46) karyotype has homologies with *C. discolor* (2n=46) in 21 of the 22 chromosome pairs, differing only by the presence of a very small additional metacentric (8 metacentric pairs) in *C. discolor*. Comparing the karyotype of *C. caquetensis* with C. *ornatus* there are more differences, since *C. ornatus* has only five metacentric chromosomes, among which there is a very large metacentric pair that is not found in *C. caquetensis* nor in *C. discolor*. Additionally, in the analysis of G-bands there are only 17 homologies among the 22 chromosome pairs for *C. ornatus* as compared to *C. caquetensis*. A more complete karyotypic description is in preparation.

Etymology. The name *caquetensis* refers to the Department of Caquetá, where the species was found.

Systematics. This is a species of the *Callicebus moloch* species group as defined by Hershkovitz (1990, p.43) and Groves (2001, pp.172–176). Following Hershkovitz (1990) this group includes *C. cinerascens*, *C. hoffmannsi hoffmannsi*, *C. h. baptista*, *C. moloch*, *C. brunneus*, *C. cupreus cupreus*, *C. c. discolor*, *C. c. ornatus*, *C. caligatus*, *C. dubius*, and *C. personatus* (with four subspecies). Groves' (2001) definition of the *C. moloch* group was similar but he did not accept the validity of the forms *discolor*, *caligatus*, or *dubius* (synonyms of *C. cupreus*), and included *C. coimbrai* described in 1999. Groves (2005) subsequently listed *C. discolor*, *C. caligatus* and *C. dubius* as valid species, following Van Roosmalen *et al.* (2002). Kobayashi (1995) confined *C. cupreus* (*sensu* Hershkovitz, 1990) to a separate *Callicebus cupreus* species group. Following Kobayashi (1995), it is evident that in appearance and in geographic terms, *Callicebus caquetensis* is part of a *Callicebus cupreus* superspecies (*sensu* Mayr 1931; Mayr and Ashlock 1991); "a monophyletic group of closely related and largely or entirely allopatric species" (Mayr and Ashlock 1991, p.53). *Callicebus caquetensis* is clearly related to *C. ornatus* and *C. discolor*, but cytologically it is closer to the latter (see below).

Common name. This monkey is called "macaco" throughout its known distribution, although some use the name "tongo" in the La Solita creek. "Huicoco" is also used, as it is for *Callicebus torquatus* which García found at the headwaters of La Solita creek. We recommend "Caquetá titi monkey" in English.

Conservation status. This species is scarce and its habitat is fragmented. It occurs at very low densities in agricultural land, in fragmented remnants of the former forest. Dispersal is impossible or at best highly dangerous for the animals, since they must cross grassy savanna or barbed wire to reach neighboring forest fragments. The groups seen had an average of 4.1 individuals per group (n=13) (Table 2). The authors strongly recommend the species be classified as Critically Endangered (CR) based on the IUCN criteria (B1a,b, B2a,b) (IUCN, 2001); that is, the geographic range in both the extent of occurrence (estimated to be less than 100 km²) and the area of occupancy (estimated to be less than 10 km²) are severely fragmented and continuing to decline due to agricultural activities. It is possible that the population size is fewer than 250 mature individuals, which would include criterion C as well, but more data on the occurrence of this species needs to be collected and a concerted effort made to calculate population size. Immediate efforts are needed to publicize the presence and the state of this primate species as well as create some small reserves in the region. Further surveys are needed to better delimit its geographic range and to clarify the presence of groups of *Callicebus* in northern parts of Caquetá and southern Meta that have been reported to show some of the characteristics of *Callicebus caquetensis*.

Table 2. Size, composition and locations of groups of *Callicebus caquetensis* observed in 2008–2009.

	Adult male	Adult female	Subadult	Juvenile	Infant	Total	Place	Coordinates	
1	1	1	1	1	0	4	Finca Nilson Barragán	1°08'38.3"N	75°36'00.4"W
2	1	1	0	2	1	5	Finca Nilson Barragán	1°08'40.8"N	75°36'43.0"W
3	1	1	0	1	0	3	Finca Alirio Santanilla	1°08'09.4"N	75°35'51.4"W
4	1	1	0	1	1	4	Finca William Cuartas	1°8'17.9"N	75°34'28.5"W
5	1	1	1	0	1	4	Quebrada El Resbalón	1°06'30.4"N	75°32'42.8"W
6	1	1	2	0	1	5	Finca Moisés Cruz	1°06'54.4"N	75°37'27.3"W
7	1	1	0	1	1	4	Finca Fidelino Peña	1°07'11.0"N	75°38'01.1"W
8	1	1	2	1	1	6	Vereda La Florida	1°10'7.92"N	75°35'43.86"W
9	1	1	1	0	1	4	Quebrada La Solita	0°54'57.42"N	75°39'15.76"W
10	1	1	1	0	0	3	Quebrada La Solita	0°55'05.2"N	75°39'00.6"W
11	1	1	0	0	1	3	Finca Yaneth Soto	0°54'12.6"N	75°35'31.22"W
12	1	1	0	0	1	3	Finca Doña Amparo	0°55'15.4"N	75°33'34.9"W
13	1	1	1	2	1	6	Finca Edilberto Suárez	0°54'47.8"N	75°33'36.3"W
Total						54			
Average group size						4.1			
							Holotype: In captivity	1°8'24.61"N	75°32'34.04"W
							Paratype: In captivity	1°6'23.10"N	75°38'32.5"W

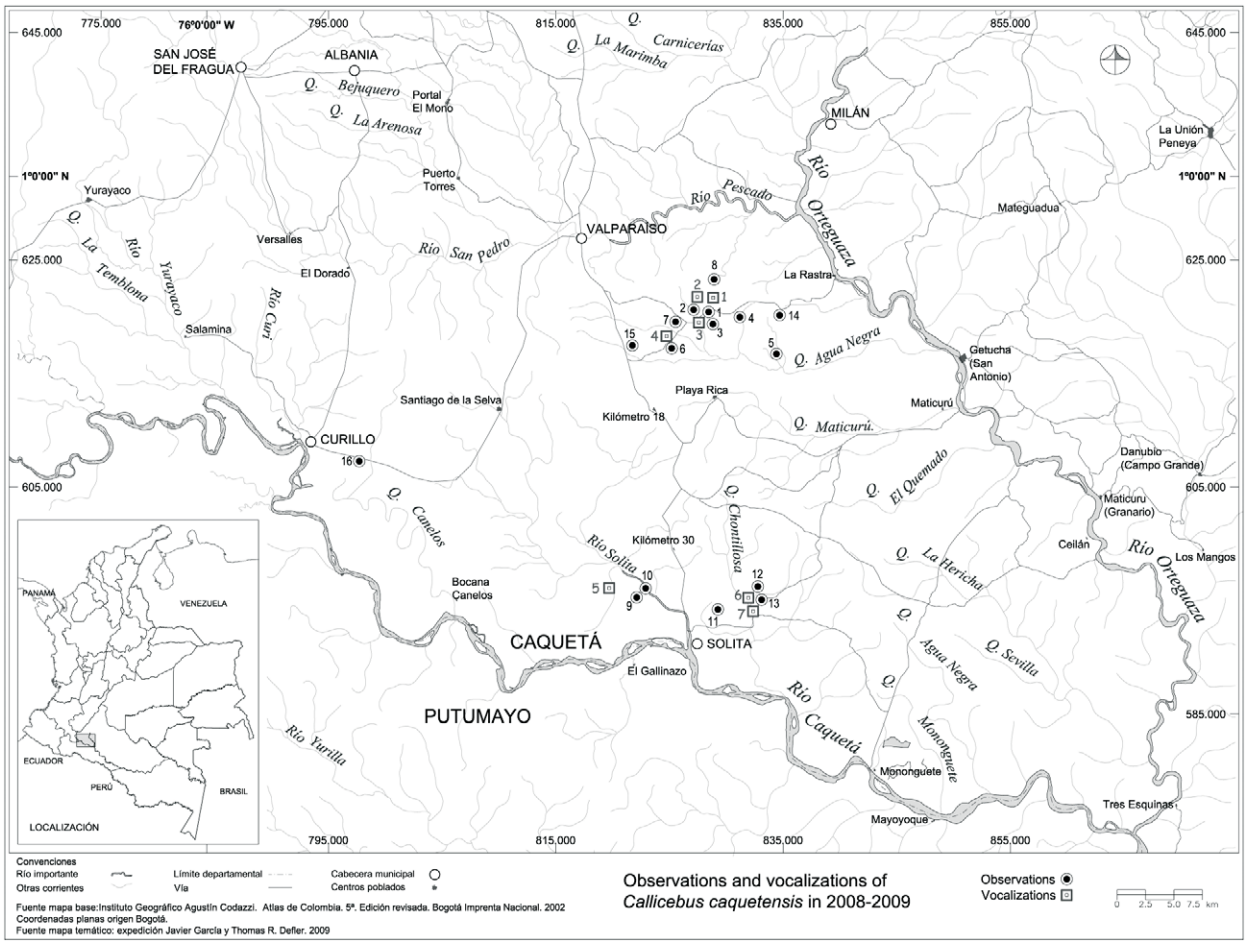

Figure 1. Observations and locations of groups of *Callicebus caquetensis* in the upper basin of the Río Caquetá, Colombia.

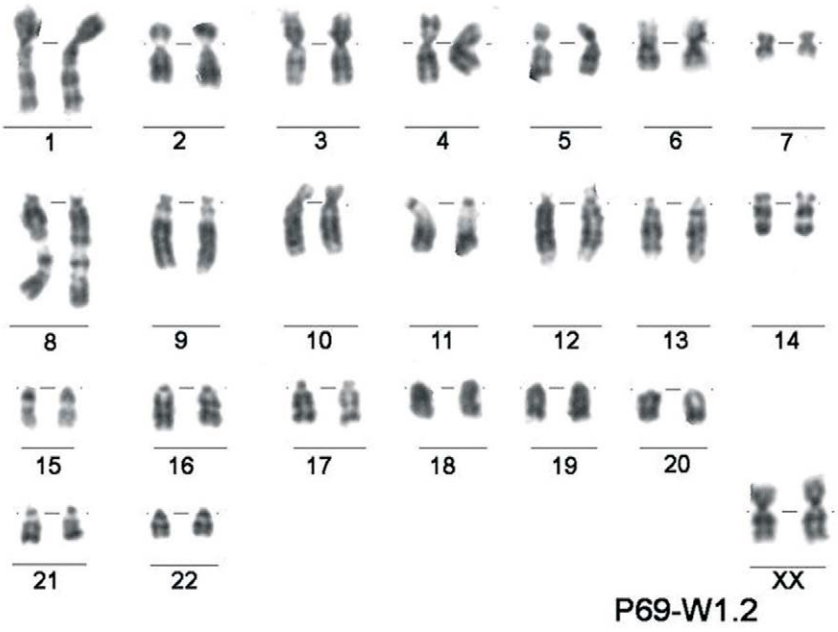

Figure. 2. Karyotype of holotype: *Callicebus caquetensis*.

Figure 3a. Adult *Callicebus caquetensis* temporarily captured.

Figure 3b. Adult *Callicebus caquetensis* temporarily captured.

Figure 3c. Adult *Callicebus caquetensis* temporarily captured.

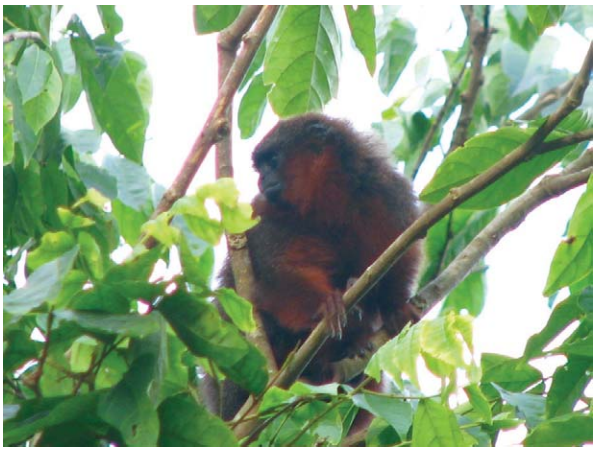

Figure 3d. Adult *Callicebus caquetensis* in low tree.

Figure 3e. Holotype of *Callicebus caquetensis*. Young female.

Figure 3f. Holotype of *Callicebus caquetensis*. Young female.

Figure 3g. Holotype of *Callicebus caquetensis*. Young female.

Figure 4a. Lateral view of holotype skull: *Callicebus caquetensis.*

Figure 4b. Superior view of holotype skull: *Callicebus caquetensis*.

Figure 4c. Inferior view of holotype skull: *Callicebus caquetensis*.

Figure 4d. Lateral view of holotype inferior mandible: *Callicebus caquetensis*.

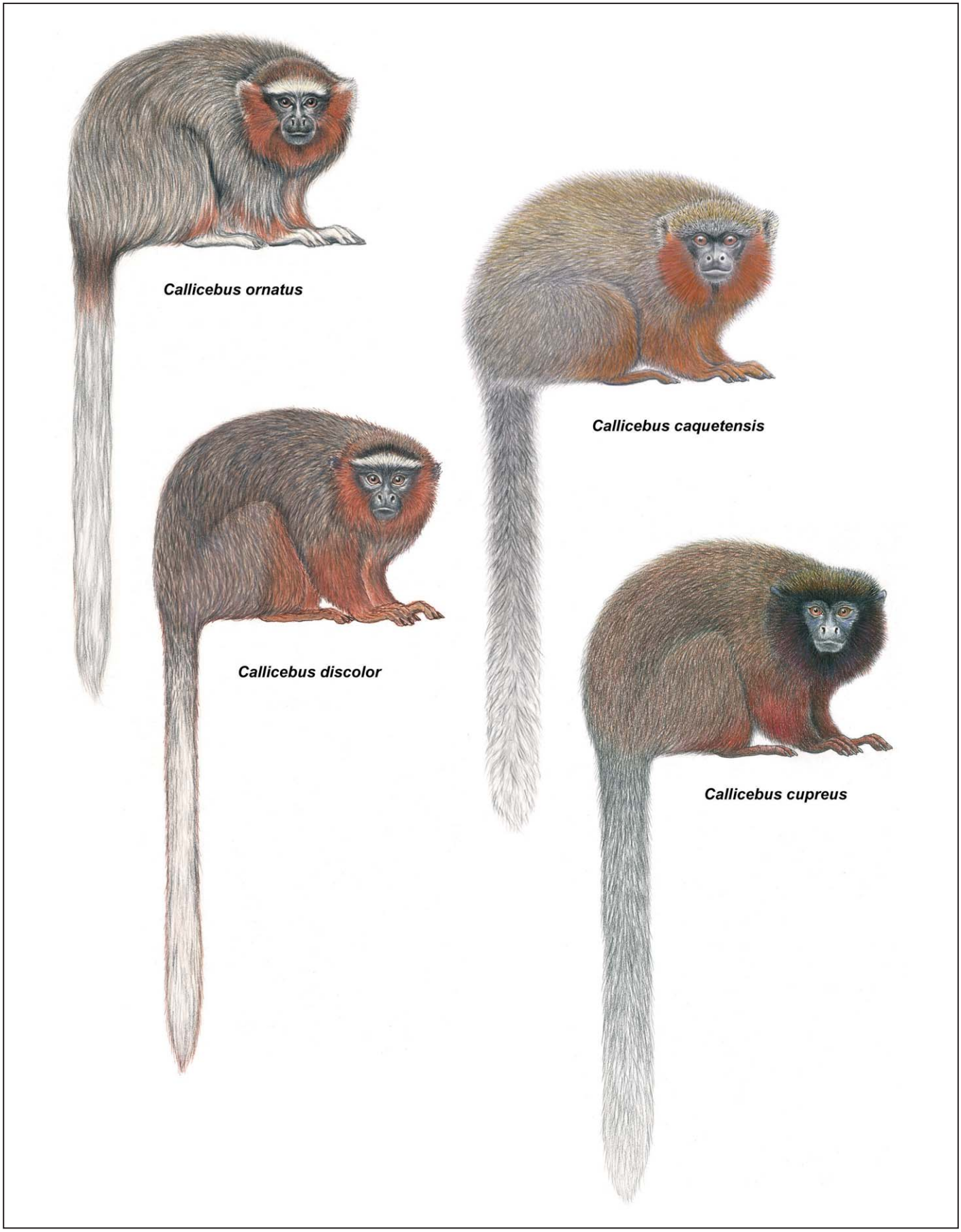

Figure 5. Four titi monkeys of southern Colombia, Amazonian Ecuador, and northern Peru. *Callicebus ornatus*, *Callicebus discolor*, *Callicebus cupreus*, and the new species described here, *Callicebus caquetensis*. Illustrations © Stephen D. Nash / Conservation International.

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