Primates in Peril

The World's 25 Most Endangered Primates 2012-2014

Edited by

Christoph Schwitzer, Russell A. Mittermeier, Anthony B. Rylands, Lucy A. Taylor, Federica Chiozza, Elizabeth A. Williamson, Janette Wallis and Fay E. Clark

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Front cover photo:
Male Tonkin snub-nosed monkey *Rhinopithecus avunculus* © Le Van Dung

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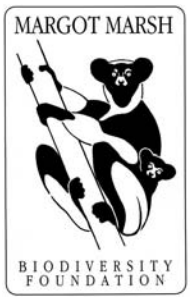

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Contents

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The 2012–2014 iteration of the World's 25 Most Endangered Primates was drawn up during an open meeting held during the XXIV Congress of the International Primatological Society (IPS), Cancún, 14 August 2012, and was published as a series of Species Fact Sheets (Mittermeier *et al*. 2012).

Here, we present an extended version of the 2012–2014 list, with more comprehensive information about the threats facing these primates and with bibliographic references cited in the text. We have updated the species profiles from the 2008–2010 edition for those species remaining on the list, and added additional profiles for newly listed species.

This publication is a joint effort of the IUCN SSC Primate Specialist Group, the International Primatological Society, Conservation International, and the Bristol Zoological Society.

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The World's 25 Most Endangered Primates: 2012-2014

Here we report on the seventh iteration of the biennial listing of a consensus of the 25 primate species considered to be among the most endangered worldwide and the most in need of conservation measures.

The 2012–2014 list of the world's 25 most endangered primates has five species from Africa, six from Madagascar, nine from Asia, and five from the Neotropics (Table 1). Madagascar tops the list with six species. Vietnam has five, Indonesia three, Brazil two, and China, Colombia, Côte d'Ivoire, the Democratic Republic of Congo, Ecuador, Equatorial Guinea, Ghana, Kenya, Peru, Sri Lanka, Tanzania, and Venezuela each have one.

The changes made in this list compared to the previous iteration (2010–2012) were not because the situation of the nine species that were dropped (Table 2) has improved. In some cases, for example, *Varecia variegata*, the situation has in fact worsened. By making these changes we intend rather to highlight other, closely-related species enduring equally bleak prospects for their survival. An exception may be the greater bamboo lemur, *Prolemur simus*, for which recent studies have confirmed a considerably larger distribution range and larger estimated population size than previously assumed. However, severe threats to this species in eastern Madagascar remain.

Nine of the primates were not on the previous (2010–2012) list (Table 3). Seven of them are listed as among the world's most endangered primates for the first time. The Tana River red colobus and the Ecuadorian brown-headed spider monkey had already been included in previous iterations, but were subsequently removed in favour of other highly threatened species of the same genera. The 2012–2014 list now contains two members each of these genera, thus particularly highlighting the severe threats they are facing.

During the discussion of the 2012–2014 list at the XXIV Congress of IPS in Cancún in 2012, a number of other highly threatened primate species were considered for inclusion (Table 4). For all of these, the situation in the wild is as precarious as it is for those that eventually made it on the list.

Table 1. The World's 25 Most Endangered Primates 2012–2014

Africa		
Galagoides rondoensis	Rondo dwarf galago	Tanzania
Cercopithecus roloway	Roloway monkey	Côte d'Ivoire, Ghana
Piliocolobus pennantii pennantii	Bioko red colobus	Equatorial Guinea (Bioko Is.)
Piliocolobus rufomitratus	Tana River red colobus	Kenya
Gorilla beringei graueri	Grauer's gorilla	DRC
Madagascar		
Microcebus berthae	Madame Berthe's mouse lemur	Madagascar
Eulemur flavifrons	Sclater's black lemur	Madagascar
Varecia rubra	Red ruffed lemur	Madagascar
Lepilemur septentrionalis	Northern sportive lemur	Madagascar
Propithecus candidus	Silky sifaka	Madagascar
Indri indri	Indri	Madagascar
Asia		
Tarsius pumilus	Pygmy tarsier	Indonesia (Sulawesi)
Nycticebus javanicus	Javan slow loris	Indonesia (Java)
*Simias concolor**	Pig-tailed snub-nosed langur	Indonesia (Mentawai Is.)
Trachypithecus delacouri	Delacour's langur	Vietnam
Trachypithecus poliocephalus	Golden-headed or Cat Ba langur	Vietnam
Semnopithecus vetulus nestor	Western purple-faced langur	Sri Lanka
Pygathrix cinerea	Grey-shanked douc monkey	Vietnam
Rhinopithecus avunculus	Tonkin snub-nosed monkey	Vietnam
Nomascus nasutus	Cao-Vit or Eastern black-crested gibbon	China, Vietnam
Neotropics		
Ateles hybridus	Variegated spider monkey	Colombia, Venezuela
Ateles fusciceps fusciceps	Ecuadorian brown-headed spider monkey	Ecuador
Cebus kaapori	Ka'apor capuchin	Brazil
Callicebus oenanthe	San Martín titi monkey	Peru
Alouatta guariba guariba	Northern brown howler	Brazil

* The pig-tailed snub-nosed langur *Simias concolor* had previously been classified as *Nasalis concolor* and referred to as such in the 2012–2014 Top 25 Fact sheets.

Table 2. Primate species included on the 2010–2012 list that were removed from the 2012–2014 list.

Africa		
Piliocolobus epieni	Niger Delta red colobus	Nigeria
Madagascar		
Prolemur simus	Greater bamboo lemur	Madagascar
Varecia variegata	Black-and-white ruffed lemur	Madagascar
Asia		
Tarsius tumpara	Siau Island tarsier	Indonesia (Siau Is.)
Macaca silenus	Lion-tailed macaque	India
Pongo pygmaeus pygmaeus	Northwest Bornean orangutan	Indonesia (West Kalimantan, Borneo), Malaysia (Sarawak)
Neotropics		
Cebus flavius	Blond capuchin	Brazil
Callicebus barbarabrownae	Barbara Brown's titi monkey	Brazil
Oreonax flavicauda	Peruvian yellow-tailed woolly monkey	Peru

Table 3. Primate species that were added to the 2012–2014 list. The Tana River red colobus and the Ecuadorian brown-headed spider monkey were added to the list after previously being removed. The other seven species are new to the list.

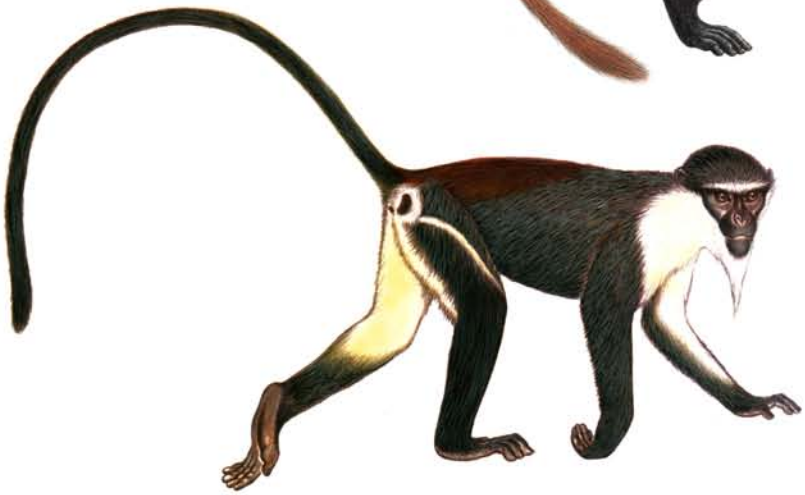
Africa		
Piliocolobus rufomitratus	Tana River red colobus	Kenya
Madagascar		
Microcebus berthae	Madame Berthe's mouse lemur	Madagascar
Varecia rubra	Red ruffed lemur	Madagascar
Indri indri	Indri	Madagascar
Asia		
Tarsius pumilus	Pygmy tarsier	Indonesia (Sulawesi)
Neotropics		
Ateles fusciceps fusciceps	Ecuadorian brown-headed spider monkey	Ecuador
Cebus kaapori	Ka'apor capuchin	Brazil
Callicebus oenanthe	San Martín titi monkey	Peru
Alouatta guariba guariba	Northern brown howler	Brazil

Table 4. Primate species considered during the discussion of the 2012–2014 list at the IPS Congress in Cancún that did not make it onto the list, but are also highly threatened.

Africa		
Piliocolobus preussi	Preuss's red colobus	Cameroon, Nigeria
Gorilla gorilla diehli	Cross River gorilla	Nigeria, Cameroon
Pan troglodytes ellioti	Nigeria-Cameroon chimpanzee	Nigeria, Cameroon
Madagascar		
Cheirogaleus sibreei	Sibree's dwarf lemur	Madagascar
Hapalemur alaotrensis	Lac Alaotra bamboo lemur	Madagascar
Eulemur cinereiceps	White-collared brown lemur	Madagascar
Propithecus perrieri	Perrier's sifaka	Madagascar
Asia		
Nasalis larvatus	Proboscis monkey	Indonesia (Borneo)
Presbytis comata	Grizzled leaf monkey	Indonesia
Rhinopithecus strykeri	Myanmar snub-nosed monkey	Myanmar, China
Nomascus hainanus	Hainan black-crested gibbon	China (Hainan)
Nomascus leucogenys	Northern white-cheeked black-crested gibbon	Laos, Vietnam, China
Neotropics		
Chiropotes satanas	Black bearded saki	Brazil
Leontopithecus caissara	Black-faced lion tamarin	Brazil
Saguinus bicolor	Pied tamarin	Brazil
Callicebus caquetensis	Caquetá titi monkey	Colombia

Photos of some of the Top 25 Most Endangered Primates. From top to bottom, left to right: 1. *Microcebus berthae* (photo by John R. Zaonarivelo); 2. *Nomascus nasutus* (female)(photo by Xu Yongbin); 3. *Nomascus nasutus* (male) (photo by Xu Yongbin); 4. *Alouatta guariba guariba* (photo by Leonardo Gomes Neves); 5. *Cercopithecus roloway* (photo by S. Wolters, WAPCA); 6. *Indri indri* (photo by Russell A. Mittermeier); 7. *Simias concolor* (juvenile)(photo by Richard Tenaza); 8. *Callicebus oenanthe* (photo by Russell A. Mittermeier); 9. *Varecia rubra* (photo by Russell A. Mittermeier); 10. *Lepilemur septentrionalis* (photo by Edward E. Louis, Jr.); 11. *Trachypithecus poliocephalus* (photo by Tilo Nadler); 12. *Gorilla beringei graueri* (photo by Russell A. Mittermeier); 13. *Propithecus candidus* (photo by Iñaki Relanzón); 14. *Galagoides rondoensis* (photo by Andrew Perkin); 15. *Pygathrix cinerea* (photo by Tilo Nadler); 16. *Piliocolobus p. pennantii* (photo by R. A. Bergl).

Bioko red colobus
Piliocolobus pennantii pennantii
Africa



Roloway monkey
Cercopithecus roloway
Africa

Tana River red colobus
Piliocolobus rufomitratus
Africa

Grauer's gorilla
Gorilla beringei graueri
Africa

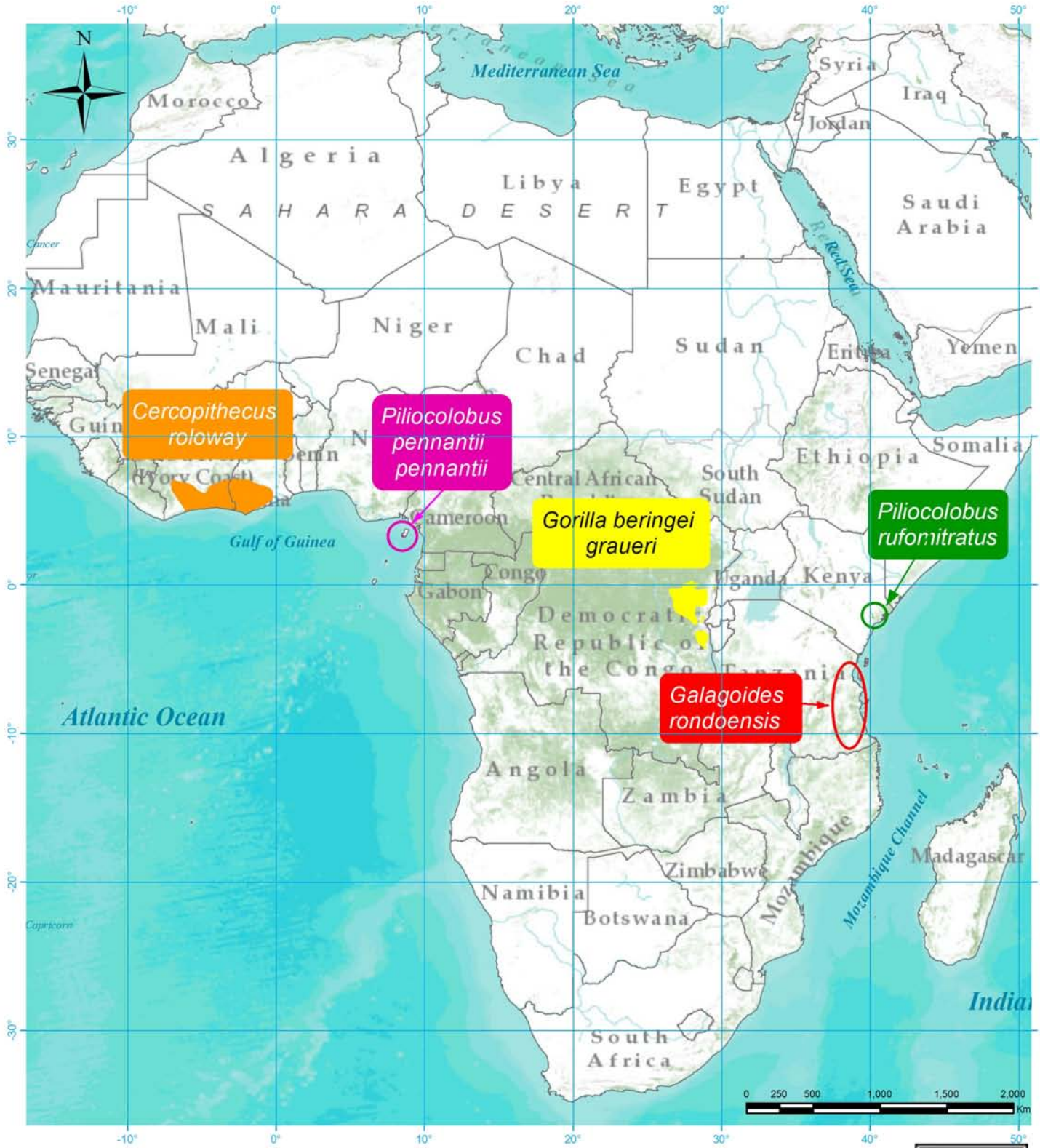
Rondo dwarf galago
Galagoides rondoensis
Africa


Madame Berthe's
mouse lemur
Microcebus berthae
Madagascar
Sclater's black lemur
or Blue-eyed black lemur
Eulemur flavifrons
Madagascar
female
male
Northern sportive lemur
Lepilemur septentrionalis
Madagascar
Silky sifaka
Propithecus candidus
Madagascar
Red ruffed lemur
Varecia rubra
Madagascar
Indri
Indri indri
Madagascar


Pygmy tarsier
Tarsius pumilus
Asia
Pig-tailed
snub-nosed langur
Simias concolor
Asia
Tonkin snub-nosed monkey
Rhinopithecus avunculus
Asia
Grey-shanked
douc langur
Pygathrix cinerea
Asia
Western
purple-faced langur
Semnopithecus vetulus
nestor
Asia
Golden-headed langur
or Cat Ba langur
Trachypithecus
poliocephalus
Asia
Javan
slow loris
Nycticebus
javanicus
Asia
Delacour's Langur
Trachypithecus
delacouri
Asia


male
female
(front view)
female
(rear view)
Cao-Vit or
Eastern black-crested gibbon
Nomascus nasutus
Asia
San Martín titi monkey
Callicebus oenanthe
Neotropics
male
female
dark variant
light
variant
Variegated or
Brown
spider monkey
Ateles hybridus
Neotropics
dark
variant
Ecuadorian brown-headed
spider monkey
Ateles fusciceps fusciceps
Neotropics
Ka'apor capuchin
Cebus kaapori
Neotropics
Northern brown howler
Alouatta guariba guariba
Neotropics

Africa



African Primates

- *Cercopithecus roloway*
- *Galagoides rondoensis*
- *Gorilla beringei graueri*
- *Piliocolobus pennantii pennantii*
- *Piliocolobus rufomitratus*

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Rondo Dwarf Galago

Galagoides rondoensis Honess in Kingdon, 1997

Tanzania

(2012)

Andrew Perkin

Weighing approximately 60 g, this is the smallest of all galago species (Perkin *et al*. 2013). It is distinct from other dwarf galagos in its diminutive size, a bottle-brush-shaped tail, its reproductive anatomy, and its distinctive "double unit rolling call" (Perkin and Honess 2013). Current knowledge indicates that this species occurs in two distinct areas, one in southwest Tanzania near the coastal towns of Lindi and Mtwara, the other approximately 400 km further north, above the Rufiji River, in pockets of forest around Dar es Salaam. One further population occurs in Sadaani National Park, approximately 100 km north of Dar es Salaam. Rondo dwarf galagos have a mixed diet of insects and fruit, often feed close to the ground, and move by vertical clinging and leaping in the shrubby understorey. They build daytime sleeping nests, which are often in the canopy (Bearder *et al*. 2003). As with many small primates, *G. rondoensis* is probably subject to predation by owls and other nocturnal predators. Among these, genets, palm civets and snakes invoke intense episodes of alarm calling (Perkin and Honess 2013).

Rondo dwarf galago (*Galagoides rondoensis*)
(Illustration: Stephen D. Nash)

Over the last decade, the status of *G. rondoensis* has changed from Endangered in 2000 to Critically Endangered in 2008 on the IUCN Red List (Perkin *et al.* 2008). It has an extremely limited and fragmented range in a number of remnant patches of Eastern African Coastal Dry Forest (*sensu* Burgess and Clarke 2000; p.18) in Tanzania, namely those at Zaraninge forest (06°08'S, 38°38'E) in Sadaani National Park (Perkin 2000), Pande Game Reserve (GR) (06°42'S, 39°05'E), Pugu/Kazimzumbwi (06°54'S, 39°05'E) (Perkin 2003, 2004), Rondo (NR) (10°08'S, 39°12'E), Litipo (10°02'S, 39°29'E) and Ziwani (10°20'S, 40°18'E) forest reserves (FR) (Honess 1996; Honess and Bearder 1996). New sub-populations were identified in 2007 near Lindi town in Chitoa FR (09°57'S, 39°27'E) and Ruawa FR (09°44'S, 39°33'E), and in 2011 in Noto Village Forest Reserve (09°53'S, 39°25'E) (Perkin *et al.* 2011, 2013.) and in the northern population at Ruvu South Forest Reserve (06°58'S, 38°52'E). Specimens of *G. rondoensis*, originally described as *Galagoides demidovii phasma*, were collected by Ionides from Rondo Plateau in 1955, and Lumsden from Nambunga, near Kitangari, (approximately 10°40'S, 39°25'E) on the Makonde Plateau in Newala District in 1953. Doubts surround the persistence of this species on the Makonde Plateau, which has been extensively cleared for agriculture. Surveys there in 1992 failed to detect any extant populations (Honess 1996).

No detailed surveys have been conducted to assess population sizes of *G. rondoensis*. Distribution surveys have been conducted, however, in the southern (Honess 1996, Perkin *et al*. in prep.) and northern coastal forests of Tanzania (29 surveyed) and Kenya (seven surveyed) (Perkin 2000, 2003, 2004; Perkin *et al*., 2013). Absolute population sizes remain undetermined but recent surveys have provided estimates of density (3–6/ha at Pande Game Reserve [Perkin 2003] and 8/ha at Pugu Forest Reserve [Perkin 2004]) and relative abundance from encounter rates (3–10/hr at Pande Game Reserve and Pugu/Kazimzumbwi Forest Reserve [Perkin 2003, 2004]) and 3.94/hr at Rondo Forest Reserve (Honess 1996). There is a clear and urgent need for further surveys to determine population sizes in these dwindling forest patches.

In 2008, it was reported that the total area of forest in which *G. rondoensis* is currently known to occur does not exceed 101.6 km² (Pande GR: 2.4 km², Rondo FR: 25 km², Ziwani FR: 7.7 km², Pugu/Kazimzumbwi FR: 33.5 km², Litipo FR: 4 km², Zaraninge forest: 20 km², Chitoa FR: 5 km², and Ruawa FR 4 km²) (Minimum area data source: Burgess and Clarke 2000; Doggart 2003; Perkin *et al*. in prep.). New data on forest area change indicates that while two new sub-populations have been discovered; the overall area of occupancy hovers around 100 km². 2008 and 2014 forest-area estimations are as follows: Zaraninge 2008: 20 km², 2014: 15 km²; Pande 2008: 2.4 km², 2014: 2.4 km²; Pugu/Kazimzumbwe 2008: 33.5 km², 2014: 9 km²; Ruvu South 2008: 20 km², 2014: 10 km²; Ruawa 2008: 4 km², 2014: 4 km²; Litipo 2008: 4 km², 2014: 3 km²; Chitoa 2008: 4 km², 2014: 5 km²; Noto 2008: 21 km², 2014: 20 km²; Rondo 2008: 25 km², 2014: 25 km²; Ziwani 2008: 7.7 km², 2014: 1 km². The total forest area estimates are as follows - 2008: 101.6 km², 2014: 94.4 km².

The major threat facing this species is loss of habitat. All sites are subject to some level of agricultural encroachment, charcoal manufacture and/or logging. All sites, except Pande (Game Reserve), Zaraninge (within Saadani National Park) and Rondo (Nature Reserve), are national or local authority forest reserves and as such nominally, but in practice minimally, protected. Since 2008, there have been changes resulting in the increase in protection of two forests. The Noto plateau forest, formerly open village land, is part of a newly created village forest reserve, and the Rondo Forest Reserve has now been declared a new Nature Reserve, both are important for Rondo galago conservation given their relatively large size. Given current trends in charcoal production for nearby Dar es Salaam, the forest reserves of Pugu and Kazimzumbwi were predicted to disappear over the next 10–15 years (Ahrends 2005). Pugu/Kazimzumbwe as well as Ruvu South have seen continued and predicted losses to the rampant charcoal trade since Ahrends (2005) study. Pande, as a Game Reserve, is perhaps more secure, and Zareninge forest, being in a National Park, is the most protected part of the range of *G. rondoensis*. In the south, the Noto, Chitoa and Rondo populations are the most secure, as they are buffered by tracts of woodland. The type population at Rondo is buffered by woodland and *Pinus* plantations managed by the Rondo Forestry Project, and is now a Nature Reserve. Litipo, and Ruawa FRs are under threat from bordering village lands. Ziwani is now mostly degraded scrub forest, thicket and grassland.

Conservation action is urgently needed by: monitoring rates of habitat loss, surveying new areas for remnant populations, estimating population size, reassessing the phylogenetic relationships of the sub-populations and increasing awareness. There is emerging data (vocal and penile morphological) that the northern and southern populations may be phylogenetically distinct with important taxonomic implications. As such the conservation of all sub-populations is important.

Across its known range, the Rondo galago can be found in sympatry with a number of other galagos, including two much larger species in the genus *Otolemur*: Garnett's galago *O. garnettii* (Least Concern, Butynski *et al*. 2008a), and the thick-tailed galago, *O. crassicaudatus* (Least Concern, Bearder 2008). The Rondo galago is sympatric with the Zanzibar galago, *Galagoides zanzibaricus* (Least Concern, Butynski *et al.* 2008b), in the northern parts of its range (for example, in Zaraninge forest, Pugu/Kazimzumbwi FR and Pande GR). In the southern parts of its range (for example, in Rondo, Litipo and Noto), the Rondo galago is sympatric with Grant's galago, *Galagoides granti* (Least Concern, Honess *et al*. 2008).

A new project to address these conservation and research issues is being implemented this year. Targeted conservation initiatives are taking place in Ruvu South FR, Chitoa FR and Noto VFR.

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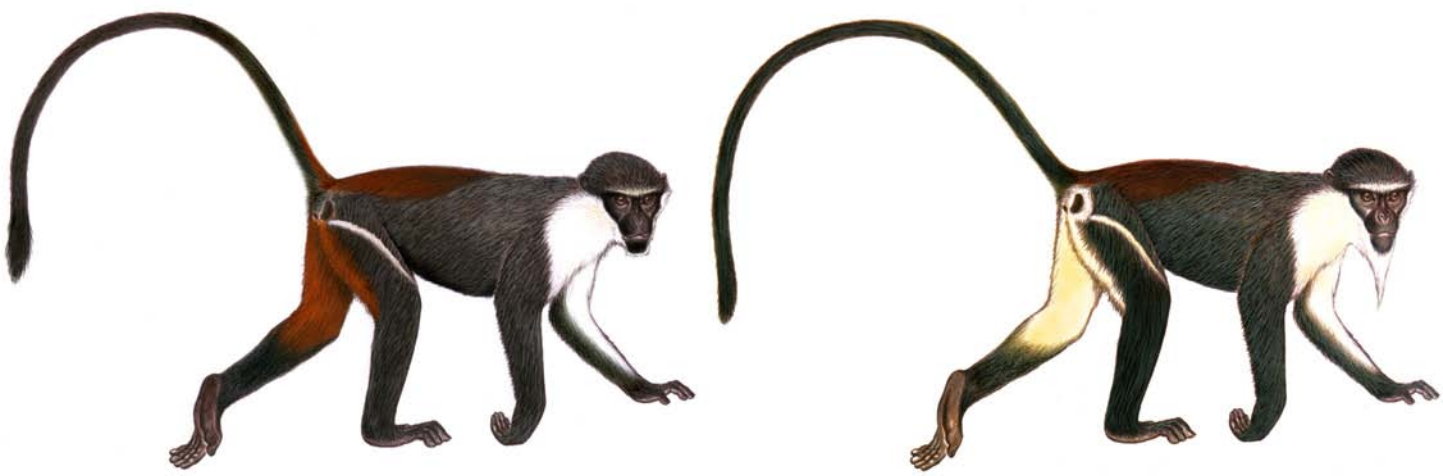
Roloway Monkey

Cercopithecus diana roloway (Schreber, 1774)
Ghana, Côte d'Ivoire
(2002, 2006, 2008, 2010, 2012)

W. Scott McGraw & John F. Oates



Roloway monkey (right) (*Cercopithecus diana roloway*) and Diana monkey (left) (*Cercopithecus diana diana*)
(Illustrations: Stephen D. Nash)

There are two subspecies of *Cercopithecus diana*, both highly attractive, arboreal monkeys that inhabit the upper Guinean forests of West Africa (Grubb *et al.* 2003). Groves (2001) considers the two subspecies to be sufficiently distinct to be regarded as full species. Of the two forms, the Roloway (*C. d. roloway*) which is known from Ghana and central and eastern Côte d'Ivoire, is more seriously threatened with extinction; it is classified as Endangered (Oates *et al*. 2008), but its status should be upgraded to Critically Endangered.

The *roloway* subspecies is distinguished by its broad white brow line, long white beard and yellow thighs. Roloway monkeys are upper-canopy specialists that prefer undisturbed forest. Destruction and degradation of their habitat and relentless hunting for the bushmeat trade have reduced their population to small, isolated pockets. Miss Waldron's red colobus (*Procolobus badius waldroni*) once inhabited many of the same forest areas as the Roloway, but is now almost certainly extinct (Oates 2011). Unless more effective conservation action is taken, there is a strong possibility that the Roloway monkey will also disappear in the near future.

Over the last 40 years Roloway monkeys have been steadily extirpated in Ghana. Several recent surveys have failed to confirm the presence of these monkeys in any reserves in western Ghana, including Bia National Park, Krokosua Hills Forest Reserve, Subri River Forest Reserve and Dadieso Forest Reserve (Oates 2006; Gatti 2010; Buzzard and Parker 2012; Wiafe 2013), although it is possible that the Ankasa Conservation Area still contains a few individuals (Magnuson 2003; Gatti 2010). The Kwabre forest in the far southwestern corner of the country is the only site in Ghana at which any Roloways have been reported as seen by scientists or conservationists in the last decade; surveys at this site were made by West African Primate Conservation Action in 2011 and 2012 (WAPCA 2012). Kwabre consists of fragments of swamp forest along the lower Tano River, adjacent to the Tanoé forest in Côte d'Ivoire; WAPCA has launched a community-based conservation project with villages around Kwabre, and collaboration with conservation efforts in Tanoé. Meanwhile, further efforts should be made to ascertain whether any Roloway monkeys still survive in the Ankasa, because this site has significant conservation potential and Roloways have been reported there in the relatively recent past.

In neighbouring Côte d'Ivoire, the Roloway's status is equally dire. Less than ten years ago Roloways were

known or strongly suspected to exist in three forests: the Yaya Forest Reserve, the Tanoé forest adjacent to the Ehy Lagoon, and Parc National des Iles Ehotilé (McGraw 1998, 2005; Koné and Akpatou 2005). Surveys of eighteen areas between 2004 and 2008 (Gonedelé Bi *et al*. 2008, 2012) confirmed the presence of Roloways only in the Tanoé forest suggesting that the Roloway monkey may have been eliminated from at least two forest areas (Parc National des Iles Ehotilé, Yaya Forest Reserve) within the last decade. Subsequent surveys carried out in southern Côte d'Ivoire suggest a handful of Roloways may still survive in two forest reserves along the country's coast. On 21 June 2012, Gonedelé bi Sery observed one Roloway individual in the Dassioko Sud Forest Reserve; however, Roloways have not been located in this forest reserve since, despite regular patrols there (Bitty *et al*. 2013; Gonedelé Bi *et al*. in review). In 2012, Gonedelé Bi and A. E. Bitty observed Roloways in Port Gauthier Forest Reserve, and in October 2013, Gonedelé Bi obtained photographs of monkeys poached inside this reserve, including an image purported to be a Roloway. The beard on this individual appears short for a Roloway, raising the possibility that surviving individuals in this portion of the interfluvial region may in fact be hybrids. The Dassioko Sud and Port Gauthier Forest Reserves are described as coastal evergreen forests and both are heavily degraded due to a large influx of farmers and hunters from the northern portion of the country (Bitty *et al*. 2013). Gonedelé Bi and colleagues, in cooperation with SODEFOR (Société de Développement des Forêts) and local communities, have organized regular forest patrols aimed at removing illegal farmers and hunters from both reserves. Nevertheless, the most recent surveys have failed to locate living Roloways in either reserve (Gonedelé Bi and Bitty 2013) meaning that the only forest in Côte d'Ivoire where Roloways are confirmed to exist is the Tanoé forest adjacent to the Ehy Lagoon. This wet forest also harbours one of the few remaining populations of white-naped mangabeys in Côte d'Ivoire. Efforts led by I. Koné and involving several organizations (CEPA, WAPCA) helped stop a large palm oil company from further habitat degradation and a community-based conservation effort has helped slow poaching within this forest (Koné 2008). Unfortunately, hunting still occurs in Tanoé and the primate populations within it are undoubtedly decreasing (Gonedelé Bi *et al*. 2013). As the potential last refuge for Roloways and White-naped mangabeys, the protection of the Tanoé forest should be the highest conservation priority. By any measure, the Roloway monkey must be considered one of the most critically endangered monkeys in Africa and appears to be on the verge of extinction (Oates 2011).

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Bioko Red Colobus

Piliocolobus pennantii pennantii (Waterhouse, 1838)
Bioko Island, Equatorial Guinea
(2004, 2006, 2010, 2012)

Drew T. Cronin, Gail W. Hearn & John F. Oates

Bioko red colobus (*Piliocolobus pennantii pennantii*)
(Illustration: Stephen D. Nash)

Pennant's red colobus monkey *Piliocolobus pennantii* is presently regarded by the IUCN Red List as comprising three subspecies: *P. pennantii pennantii* of Bioko, *P. p. epieni* of the Niger Delta, and *P. p. bouvieri* of the Congo Republic. Some accounts give full species status to all three of these monkeys (Groves 2007; Oates 2011; Groves and Ting 2013). *P. p. pennantii* is currently classified as Endangered (Oates and Struhsaker 2008).

Piliocolobus pennantii pennantii may once have occurred over most of Bioko, but it is now probably limited to an area of less than 300 km² within the Gran Caldera and a 510 km² range in the Southern Highlands Scientific Reserve (GCSH) (Cronin *et al*. 2013). Low numbers of *P. p. pennantii* may have persisted through the 1980s in Pico Basile National Park (330 km²) (Gonzalez Kirchner 1994), but there have been no confirmed historical or current sightings in the area. Another isolated population was believed to exist in the southeastern extent of the GCSH; however, recent surveys did not uncover any evidence of this monkey and it is probably extirpated in that area (Cronin 2013).

P. p. pennantii is threatened by bushmeat hunting, most notably since the early 1980s when a commercial bushmeat market appeared in the town of Malabo (Butynski and Koster 1994). Following the discovery of offshore oil in 1996, and the subsequent expansion of Equatorial Guinea's economy, rising urban demand led to increased numbers of primate carcasses in the bushmeat market (Morra *et al*. 2009; Cronin 2013). In November 2007, a primate hunting ban was enacted on Bioko, but it lacked any realistic enforcement and contributed to a spike in the numbers of monkeys in the market. Between October 1997 and September 2010, a total of 1,754 *P. p. pennantii* were observed for sale in the market (Cronin 2013). The rate of occurrence of *P. p. pennantii* carcasses in the market though, has been consistently less than more common primates on Bioko, suggesting that its restricted range is passively protecting the remaining population from significant hunting.

The average price paid in the Malabo market for an adult *P. p. pennantii* in 2008 was about US$50 (D. T.

Cronin, unpubl. data). This is well over twice the cost of the readily available, high quality whole chicken and beef at the same market. Similar high prices are paid on Bioko for all seven species of monkeys and for both species of duikers. Mainland carcasses are now also regularly shipped to Malabo for sale suggesting that transport costs are covered by the high profits relative to those in Nigeria, Cameroon, or Rio Muni (Morra *et al*. 2009). Bushmeat on Bioko is, obviously, now a 'luxury food' (Hearn *et al*. 2006). The continued high flow of primates, duikers and other wildlife into the Malabo bushmeat market indicates that neither of the protected areas is receiving adequate management and that existing hunting laws lack enforcement from the government of Equatorial Guinea.

Of the other two subspecies of *P. pennantii*, Bouvier's red colobus *P. p. bouvieri* of east-central Republic of Congo has not been observed alive by scientists for at least 25 years, raising concerns that it may be extinct (Oates 1996; Struhsaker 2005). The habitat of the Niger Delta red colobus *P. p. epieni* in southern Nigeria has been severely degraded by logging, the surviving monkeys face ever-increasing hunting pressure, and there is no protected area within its range (Oates 2011).

Red colobus monkeys are probably more threatened than any other taxonomic group of primates in Africa (Oates 1996; Struhsaker 2005, 2011), and the status of the western African forms is especially precarious. Preuss's red colobus *P. preussi* of western Cameroon and southeastern Nigeria is Critically Endangered (Oates *et al*. 2008) as a result of relentless hunting, and Miss Waldron's red colobus *P. badius waldroni* of eastern Côte d'Ivoire and western Ghana is now almost certainly extinct (Oates 2011). All remaining West African red colobus populations and their habitats therefore require rigorous protection. Such protection would also greatly assist the conservation of many sympatric threatened primate taxa. On Bioko this would include the Bioko Preuss's monkey *Cercopithecus preussi insularis*, the Bioko red-eared monkey *C. erythrotis erythrotis*, the Golden-bellied crowned monkey *C. pogonias pogonias*, the Bioko greater white-nosed monkey *C. nictitans martini*, the Bioko black colobus *C. satanas satanas,* and the Bioko drill *Mandrillus leucophaeus poensis.* Protection of *P. pennantii epieni* and *P. preussi* and their habitats on the mainland would benefit populations of Nigeria-Cameroon chimpanzees *Pan troglodyes ellioti,* Ebo Forest gorillas *Gorilla gorilla* subsp., Cameroon Preuss's monkey *Cercopithecus preussi preussi*, Nigerian white-throated guenon *Cercopithecus erythrogaster pococki*, Mainland drill *Mandrillus leucophaeus poensis* and Red-capped mangabey *Cercocebus torquatus.*

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Tana River Red Colobus

Piliocolobus rufomitratus (Peters, 1879)
Kenya
(2002, 2004, 2006, 2008, 2012)

David N. M. Mbora & Thomas M. Butynski

Tana River red colobus (*Piliocolobus rufomitratus*)
(Illustration: Stephen D. Nash)

Gallery forests along the lower Tana River, Kenya, are part of the East African Coastal Forests Biodiversity Hotspot. The forests are the only habitat for two endemic primates: the Tana River red colobus, *Piliocolobus rufomitratus*, and the Tana River mangabey, *Cercocebus galeritus* Peters, 1879. *Piliocolobus rufomitratus* is classified as one of four subspecies of *Procolobus rufomitratus* on the IUCN Red List of 2008, which is still current. The other three are *Procolobus r. oustaleti* (Trouessart, 1906), *Procolobus r. tephrosceles* (Elliot, 1907), and *Procolobus r. tholloni* (Milne-Edwards, 1886). Here, we follow Groves (2005, 2007; Groves and Ting 2013) in placing all red colobus monkeys in the genus *Piliocolobus*, and *rufomitratus* and the other subspecies mentioned above as full species. *Piliocolobus rufomitratus* is currently classified as Endangered on the IUCN Red List (Butynski *et al*. 2008). Both the Tana River red colobus and the Tana River mangabey inhabit forest fragments (size range, about 1 ha to 500 ha) along a 60-km stretch from Nkanjonja to Mitapani (01°55'S, 40°05'E) (Butynski and Mwangi 1995; Mbora and Meikle 2004). There are another six sympatric primates in the area, but only the red colobus and mangabey are endemic and entirely forest dependent. The current population of the Tana River red colobus is less than 1,000 individuals and declining, and while the population of the mangabey is a little larger, it too is declining. Indeed, recent genetic analyses have shown that the effective population sizes of the two species are less than 100 individuals (Mbora and McPeek, in revision).

Several factors render the long-term survival of the Tana River red colobus and mangabey bleak and precarious. First, forest is increasingly being cleared for agricultural expansion, and the remaining patches used as a source of building materials and a variety of non-timber forest products. Second, in January 2007, the High Court of Kenya ordered the annulment of the Tana River Primate National Reserve (TRPNR) because, the court

found, that the reserve had not been established in accordance with the law. About half of the remaining forest was legally protected in TRPNR, and therefore no habitat of the Tana River red colobus and mangabey is legally protected at the present time. Third, habitat loss outside the TRPNR was exacerbated by the failure of the Tana Delta Irrigation Project (TDIP). TDIP was a rice-growing scheme managed by the Tana and Athi Rivers Development Authority that had protected forest patches on their land.

Despite the troubles highlighted here, there is reason for hope for the Tana River forests and the endemic monkeys. One of us (Mbora) has maintained a research project in the area over the years. In 2011, Mbora collaborated with Lara Allen to ascertain how and why local people exploited the Tana forests, in order to identify opportunities and constraints for possible conservation action. The study found that the Pokomo people of Tana have a comprehensive traditional system of natural resource use, conservation and management, and a strong desire to preserve the flora and fauna of the forests as part of their heritage. They strongly support community development initiatives related to the conservation of natural resources as these deliver tangible benefits to the people and their environment.

Partly galvanized by the participatory nature of the research, an organization called the Ndera Community Conservancy has now been established in Tana. The sole mission of this formally registered community-based organization is to protect and conserve about half of the forest patches formerly within the TRPNR, and improve the viability of particular forest patches outside the Reserve. The Ndera Community Conservancy is working with government conservation initiatives and is making some progress. However, in order for the community to make significant progress in enhancing the viability of the habitat of the Tana River red colobus, the support of international conservation agencies is needed. With community structures, government, and the international conservation community working together, the prospects for the long-term viability of Tana River primates can be greatly improved.

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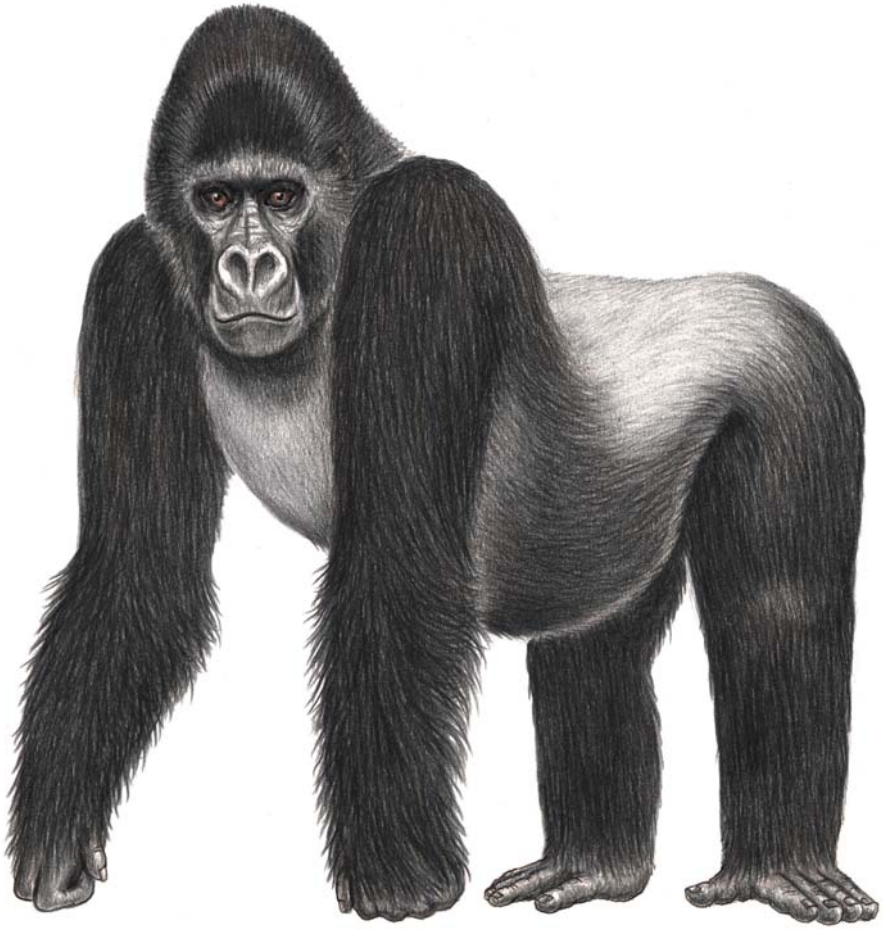
Grauer's Gorilla

Gorilla beringei graueri Matschie, 1914
Democratic Republic of Congo
2010, 2012

Stuart Nixon & Elizabeth A. Williamson



Grauer's gorilla (*Gorilla beringei graueri*) (Illustration: Stephen D. Nash)

The largest of the four subspecies of *Gorilla*, Grauer's gorilla (*Gorilla beringei graueri*), is listed on CITES Appendix I and classified as Endangered on the IUCN Red List (Robbins *et al*. 2008). Grauer's gorillas inhabit mixed lowland forest and the montane forests of the Albertine Rift escarpment in the eastern Democratic Republic of Congo (DRC). Formerly known as the eastern lowland gorilla, the name is misleading as this taxon ranges between approximately 600 m and 2,900 m above sea level. While relatively little is known about the ecology and behaviour of Grauer's gorilla, their diet is rich in herbs, leaves, bark, lianas and vines, seasonally-available fruit, bamboo (at the higher altitudes), and invertebrates (e.g., Schaller 1963; Yamagiwa *et al*. 2005). These gorillas opportunistically raid fields to feed on crops and are often found in regenerating forest associated with abandoned agricultural clearings, mines and villages (e.g., Schaller 1963; Nixon *et al*. 2006).

Since the 1950s, habitat conversion has been widespread, while a proliferation of 12-gauge shotguns has facilitated the hunting of large mammals, resulting in the local extinction of gorillas in many areas (Emlen and Schaller 1960; P. Anderson, pers. comm.). Threats to their survival were exacerbated throughout the 1990s and early 2000s with persistent conflict in the Great Lakes region of Africa. Refugees, internally displaced people and armed groups settled throughout eastern DRC, putting enormous pressure on natural resources, including in the national parks. Destruction of high-altitude forest for timber and charcoal production continue to threaten the isolated gorilla populations

that persist in the North Kivu highlands, while poaching to feed artisanal miners and associated armed groups presents the most serious and immediate threat. Large numbers of military personnel stationed in rural areas and numerous rebel groups active throughout the region have been heavily implicated in illegal mining activities and facilitate access to the firearms and ammunition that fuel the ongoing civil conflict (United Nations 2010). Kahuzi-Biega National Park (KBNP) is a centre of illegal resource extraction, largely under the control of rebel militia. Meanwhile, DRC's protected area authority (the Congolese Institute for Nature Conservation – ICCN) remains chronically underfinanced and its staff poorly equipped. ICCN faces conflicts not only with local communities but also with armed groups, and highly dedicated ICCN personnel have been killed in the line of duty.

NGOs are working with the government authorities to support protected area rehabilitation and develop conservation programmes, and in 2012 IUCN published a conservation strategy with clear priorities for Grauer's gorillas (Maldonado *et al*. 2012). The establishment of accurate baselines on the abundance and distribution of this subspecies and the threats to their survival is urgently needed to guide the future implementation of the action plan. Four, broadly-defined population centres are recognized: Maïko-Tayna-Usala (including Maïko National Park and adjacent forests, Tayna Nature Reserve, Kisimba-Ikoba Nature Reserve and the Usala forest), Kahuzi-Kasese (including the lowland sector of KBNP and adjacent forests), and the Itombwe Massif. Additional isolated populations are found in Masisi, the highland sector of KBNP and Mt. Tshiaberimu in Virunga National Park. In the 1990s, Hall *et al*. (1998) estimated that the total population numbered 8,660–25,500 individuals, despite substantial habitat loss and several localized extinctions. The largest known population, in the lowland sector of KBNP, has since undergone a catastrophic 80% decline (Amsini *et al*. 2008). Elsewhere, 50% reductions have been documented (Wildlife Conservation Society, unpubl. data) and a recent analysis of ape habitat across Africa estimates that suitable environmental conditions for Grauer's gorillas have declined by 52% since the 1990s (Junker *et al*. 2012). Acknowledging gaps in our knowledge, data collated during the past 14 years indicate that Grauer's gorilla numbers are likely to been reduced to 2,000–10,000 individuals (Nixon *et al*. 2012). In collaboration with ICCN and the Max Planck Institute for Evolutionary Anthropology, Leipzig, a consortium of international NGOs has initiated a two-year project to assess the status of Grauer's gorilla across its range.

In the face of ongoing political and economic instability in eastern DRC, the threats are likely to remain intense for the foreseeable future, and concerted action to protect Grauer's gorilla is needed. In its favour, a highly localized distribution in discrete populations enables efficient prioritization of valuable resources, and a recent increase in the KBNP highland population (WCS unpublished data) is evidence that highly-targeted conservation efforts can be successful even in the face of acute pressures.

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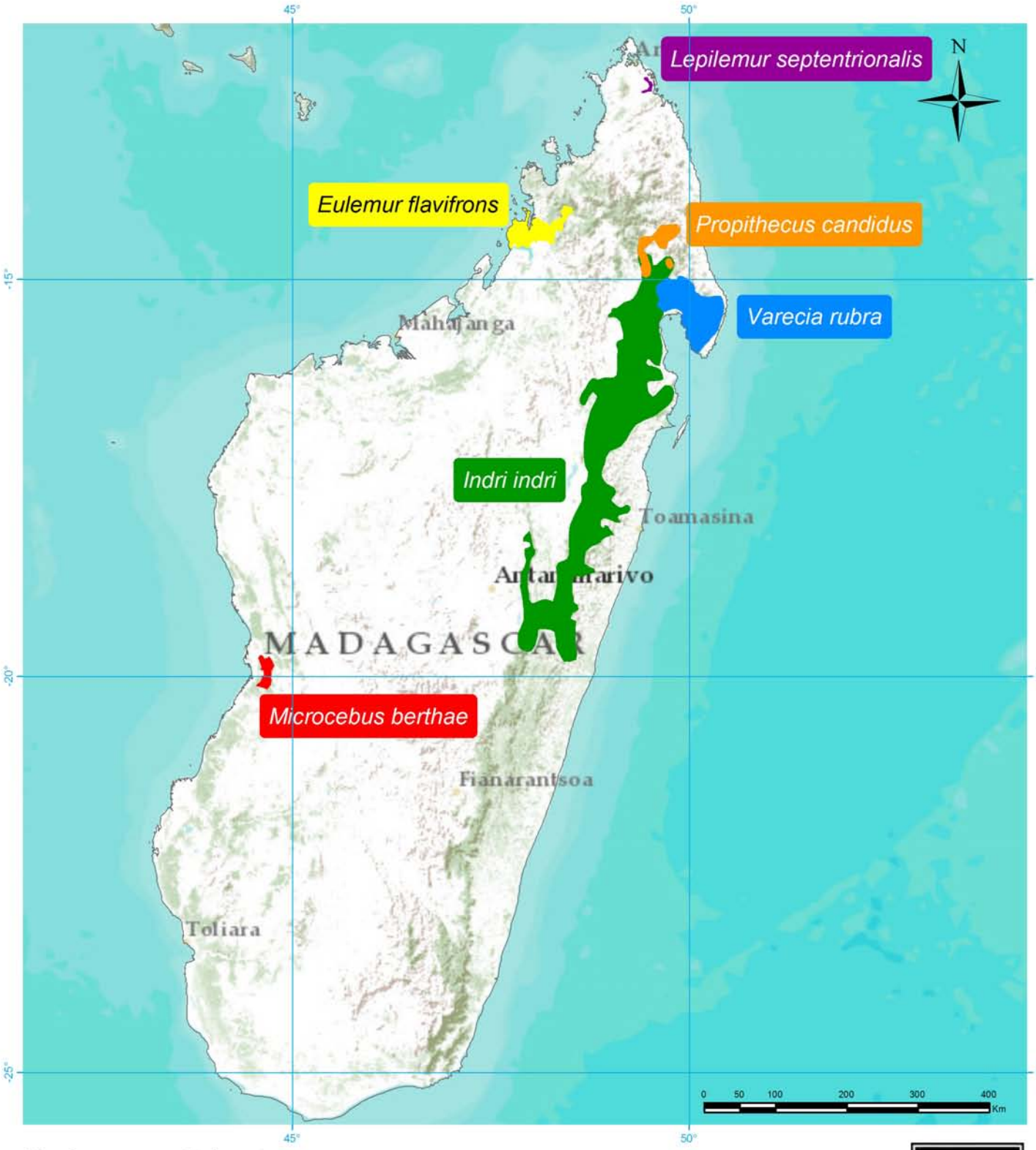
Madagascar



Madagascar Primates

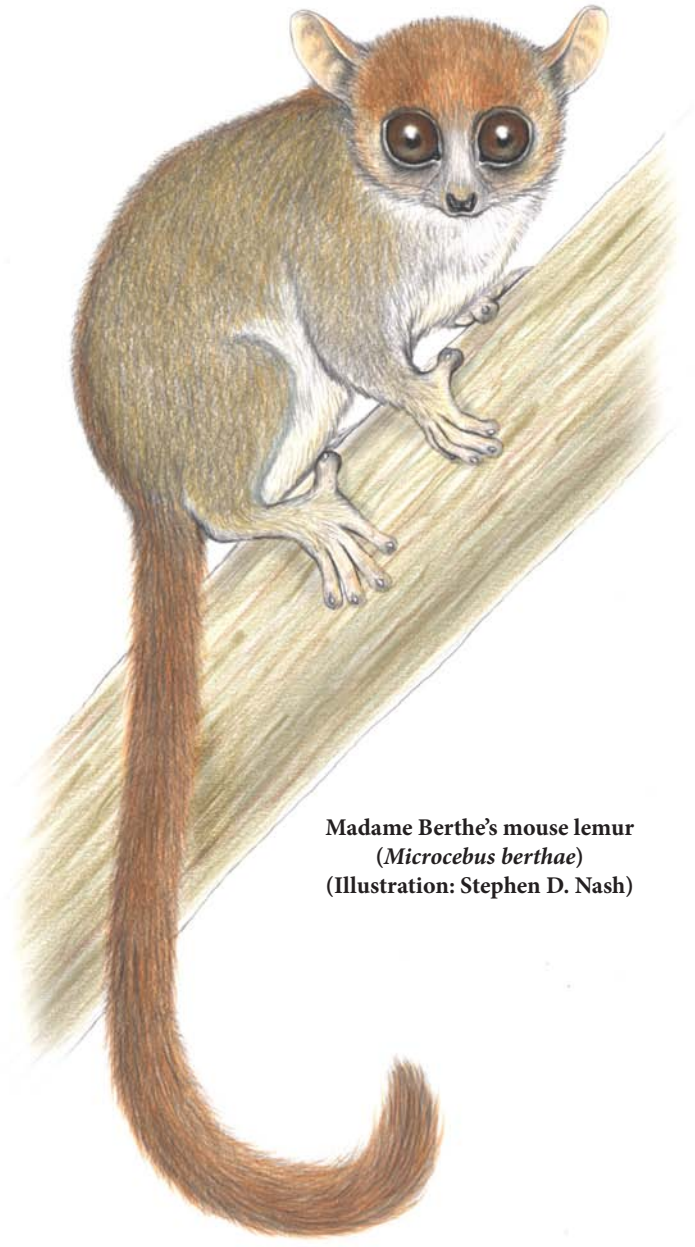
- *Eulemur flavifrons*
- *Indri indri*
- *Lepilemur septentrionalis*
- *Microcebus berthae*
- *Propithecus candidus*
- *Varecia rubra*

IUCN SSC PRIMATE Specialist Group

Madame Berthe's Mouse Lemur

Microcebus berthae Rasoloarison *et al.*, 2000
Madagascar
(2012)

Christoph Schwitzer, Livia Schäffler, Russell A. Mittermeier, Edward E. Louis Jr. & Matthew Richardson



Madame Berthe's mouse lemur (*Microcebus berthae*) (Illustration: Stephen D. Nash)

Microcebus berthae, with a body mass of 31 g and a head-body length of 9.0–9.5 cm, is the smallest of the mouse lemurs (and very likely the world's smallest primate; Rasoloarison *et al.* 2000). It was discovered in the Kirindy Forest in 1992 and was originally thought to be *Microcebus myoxinus* (Mittermeier *et al.* 2010). It is found in the central Menabe region of western Madagascar south of the Tsiribihina and north of the Morondava River (Schmid and Kappeler 1994; Schwab and Ganzhorn 2004). There, it is known to occur in Ambadira Forest and in the Kirindy Classified Forest, as well as in the narrow corridor connecting the two regions (part of the Menabe-Antimena Protected Area). It was formerly found in the Andranomena Special Reserve as well, but has likely been extirpated there.

The species occurs in dry deciduous lowland forest (from sea level to 150 m). It feeds on fruits and gums, and relies heavily on sugary insect excretions and animal matter during the harsh dry season (Dammhahn and Kappeler 2008a). Madame Berthe's mouse lemur has a promiscuous mating system based on testis size, the presence of sperm plugs in females' vaginas, and size dimorphism (Schwab 2000). While both sexes of *M. berthae* engage in daily periods of torpor, decreasing their metabolism and body temperature to reduce energy expenditure, they do not enter prolonged torpor during the dry season (Ortmann *et al.* 1997; Schmid *et al.* 2000). The most common diurnal resting sites of this species are tangles of thin branches surrounded by leaves, but they also use old nests of *Mirza*, tree holes, and rolled bark found in trees. Sleeping sites are located from 2.5 to 12 m above ground. Males seem to distribute their sleeping sites over a larger area than females, and females reuse the same sleeping site more often than males.

Madame Berthe's mouse lemur appears to be entirely solitary. Individuals do not form sleeping groups and, with the exception of females with young, usually sleep alone. During the night, males and females forage separately. Home ranges, however, are extensively overlapping, with those of the males (4.9 ha) being much larger than those of the females (2.5 ha) (Dammhahn and Kappeler 2005). The nightly path averages 4470 m for males and 3190 m for females. *Microcebus berthae* is sympatric with *M. murinus* in the Kirindy Classified Forest; the two seem to avoid interspecific competition by means of spatial segregation, thereby making the distribution of both rather patchy (Schwab and

Ganzhorn 2004; Dammhahn and Kappeler 2008b). In general, *M. berthae* appears to be more localized than *M. murinus*. Population densities have been estimated at 30–180 individuals/km² in forest patches where it occurs (suggesting high localized densities), but the overall generalized density is about 80 individuals/km² (Schäffler 2012; Schäffler and Kappeler, in press). Population densities in Ambadira Forest tend to be higher than in Kirindy Forest, and the population is largely confined to the most suitable core areas in the interior of the range, far from the range boundary (Schäffler 2012; Schäffler and Kappeler, in press).

Microcebus berthae is classified as Endangered (Andrainarivo *et al.* 2011). The extent of occurrence covers less than the remnant forest cover of 710 km² (Zinner *et al.* 2013), and the area of occupancy is considerably smaller than previously assumed based on geographic range borders (Schäffler 2012; Schäffler and Kappeler, in press). The geographic range is severely fragmented, and its extent of occurrence, area of occupancy, and the quality of its habitat are all declining. It is threatened mainly by slash-and-burn agriculture and logging, and is particularly sensitive to anthropogenic disturbances. Sensitivity to fragmentation is evident as the species is only found in core areas of extensive forests, and the regional distribution pattern reveals susceptibility to habitat degradation and spatial avoidance of human environments (Schäffler 2012; Schäffler and Kappeler, in press). In 2005 the total population of this species was estimated at no more than 8000 adult individuals living in a handful of forests (Schwab and Ganzhorn 2004), most of which are at higher risk of destruction and fragmentation now than they were 10 years ago. Schäffler and Kappeler (in press) gave a higher estimate of 40,000 individuals, but did not discriminate between adults and juveniles. Pressure on the forests of the central Menabe is strong, and deforestation continues on a large scale. To quantify recent forest loss, Zinner *et al.* (2013) used a series of satellite images (1973–2010) for estimating annual deforestation rates. The overall rate was 0.67%, but it accelerated to over 1.5% during certain periods, with a maximum of 2.55% per year between 2008 and 2010. Not all areas in the forest block of the central Menabe were affected similarly. Areas surrounding existing clearings showed the highest losses of largely undisturbed forest. If deforestation continues at the same rate as during the last years, 50% of the 1973 forest cover will be gone within the next 11–37 years (Zinner *et al.* 2013). Madame Berthe's mouse lemur is not being kept in captivity (ISIS 2014).

A conservation action plan for Kirindy-Ambadira (Central Menabe) was published recently (Markolf *et al.* 2013) as part of the IUCN Lemur Conservation Strategy 2013–2016 (Schwitzer *et al.* 2013a). The conservation objectives for this area as laid out in the action plan are additional ecological research and threat analyses of the endemic fauna; improved environmental education; and immediate-term threat mitigation actions such as the introduction of short-cycle chicken farming. Madame Berthe's mouse lemur is also a priority species for *ex situ* conservation measures (Schwitzer *et al.* 2013b).

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Sclater's Black Lemur or Blue-eyed Black Lemur

Eulemur flavifrons (Gray, 1867)
Madagascar
(2008, 2010, 2012)

Christoph Schwitzer, Guy H. Randriatahina & Sylviane Volampeno

Sclater's black lemur or Blue-eyed black lemur (male, left and female, right) (*Eulemur flavifrons*)
(Illustrations: Stephen D. Nash)

The Blue-eyed black lemur or Sclater's black lemur was rediscovered by science only in 1983 after more than a century of uncertainty about its existence (Koenders *et al*. 1985; Meier *et al*. 1996). Its taxonomic validity was thereafter confirmed independently by Rabarivola (1998) as well as Pastorini (2000). The species was until recently regarded as a subspecies of *Eulemur macaco*, but was elevated to full species status on the basis of the consistency of the morphological differences between the Black lemur and the Blue-eyed black lemur and the pairwise genetic distances between *macaco* and *flavifrons* of 68–72 bp (which are in the same range as between the former *E. fulvus* subspecies, i.e., 29–90 bp, according to Pastorini 2000). Furthermore, the fact that the hybrid zone between the two taxa is restricted to just the northeastern part of the distribution of *E. flavifrons* (Andrianjakarivelo 2004; Schwitzer *et al*. 2005, 2006; Mittermeier *et al*. 2008) favours this new taxonomy.

Eulemur flavifrons occurs only in northwestern Madagascar in a very small area of about 2,700 km² south of the Andranomalaza, north of the Maevarano, and west of the Sandrakota rivers, where it inhabits primary and secondary forest fragments (Koenders *et al*. 1985; Meyers *et al*. 1989; Rabarivola *et al*. 1991). The area of repartition of *Eulemur flavifrons* lies within a transition zone between the humid Sambirano region in the north and the western dry deciduous forest region in the south, harbouring semi-humid forests with tree heights of up to 30 m on ferruginous alkalescent and alkaline soils based on sandstone, basalt or clay (IRNT 1991a). Average annual precipitation is around 1,600 mm (IRNT 1991b).

There is only a small population of *Eulemur flavifrons* remaining, the majority living in forest fragments on and

adjacent to the Sahamalaza Peninsula (Mouton 1999; Randriatahina and Rabarivola 2004). Rakotondratsima (1999) estimated the population of the Sahamalaza Peninsula to be about 450–2,300 individuals and to have declined by about 35.3% in three years (see also Andriamanandratra 1996). Andrianjakarivelo (2004) found the mean density of *E. flavifrons* in eight inventoried forest fragments to be 24 individuals per km² (range: 4–85 ind./km²). A total count in two fragments of the Ankarafa Forest on the Sahamalaza Peninsula yielded a density of 60 individuals per km² (Schwitzer *et al*. 2005, 2007a). Volampeno *et al*. (2011a) calculated a density of 97 individuals per km² in Ankarafa. However, the density of the species in Ankarafa seems to be higher than in any other forest in the range of *E. flavifrons* (Randriatahina and Rabarivola 2004). Extrapolating the two density estimates of Andrianjakarivelo (2004) and Schwitzer *et al*. (2005, 2007a) to the total surface of the terrestrial core zones of the Sahamalaza–Iles Radama National Park (115.8 km²) yields a remaining, severely fragmented population of 2,780–6,950 Blue-eyed black lemurs. *Eulemur flavifrons* was assessed as Critically Endangered (CR A4cd) at the most recent lemur Red List assessment in July 2012, based on a suspected ongoing decline in the area of occupancy and quality of habitat of at least 80% during a 24-year period spanning the past and future (Andrainarivo *et al*. 2011; Schwitzer *et al*. 2013). The principal threats to its survival are forest destruction and fragmentation due to slash-and-burn agriculture and selective logging, and continued hunting and trapping, especially in the eastern (mainland) part of its distribution (Gerson 1995; Rakotondratsima 1999; Seiler *et al*. 2010, 2011/12, 2013). Andrianjakarivelo (2004) found a density of up to 570 traps/km² in certain areas where *E. flavifrons* occurs.

The Blue-eyed black lemur's home range size and use differs between primary and secondary forest fragments, indicating that it is somewhat able to adapt to different types of habitat. Larger home ranges and lower densities of *E. flavifrons* in secondary forest as compared to primary forest, however, suggest that the former is less suitable habitat for the species (Schwitzer *et al*. 2007a). During a 12-month study, *E. flavifrons* consumed parts of 72 different plant species from 35 families. 52.3% of these were fruits, and 47.7% were leaves. The animals also fed on flowers, insects, insect exudates and fungi (Polowinsky and Schwitzer 2009). *Eulemur flavifrons* exhibits a bimodal activity pattern, which peaks during the morning and evening twilight. It shows activity bouts during the day and night year-round. Nocturnal illumination and the proportion of illuminated lunar disc are positively associated with the amount of nocturnal activity. Total daily activity, as well as nocturnal activity, is higher in secondary forest than in primary forest (Schwitzer *et al*. 2007b).

Blue-eyed black lemur groups are multi-male multi-female, ranging in size from 6 to 11 individuals, including 3 to 7 adults (Randriatahina and Roeder 2013). Both sexes disperse, but only males have been seen moving into a foreign social group. The sex ratio at birth varies strongly between years and could be male-biased (Randriatahina and Roeder 2013). Births occur between late August and October, at the end of the dry season. During two successive birth seasons, infant mortality was 22.7%. Infants start to become independent at around ten weeks of age (Volampeno *et al*. 2011b).

Parts of the range of Sclater's black lemur officially received protected area status in June 2007 (Parc National Sahamalaza – Iles Radama), including the Sahamalaza Peninsula and some mainland forests to the north and east (Moisson *et al*. 1999; Lernould 2002; Schwitzer and Lork 2004; Schwitzer *et al*. 2006). The Sahamalaza Peninsula is also a UNESCO Biosphere Reserve. The Association Européenne pour l'Etude et la Conservation des Lémuriens (AEECL) is a consortium of European zoos that have joined forces to conserve Madagascar's lemurs. AEECL implemented a community-based conservation program in Sahamalaza in December 2000 in order to protect the remaining lemur habitat and to improve the living standards of the local human population. AEECL also maintains a field station in Sahamalaza, which serves as a base for studying the conservation ecology of *E. flavifrons* and of other lemur species in the area. In 2011, AEECL and Madagascar National Parks started a community-based ecotourism program on the periphery of the protected area.

As of 2014, there were 31 Blue-eyed black lemurs living in European and 30 in North American zoos (ISIS, 2014). The European captive population of the species is being managed in a European Endangered Species Programme (EEP) coordinated by Mulhouse Zoo.

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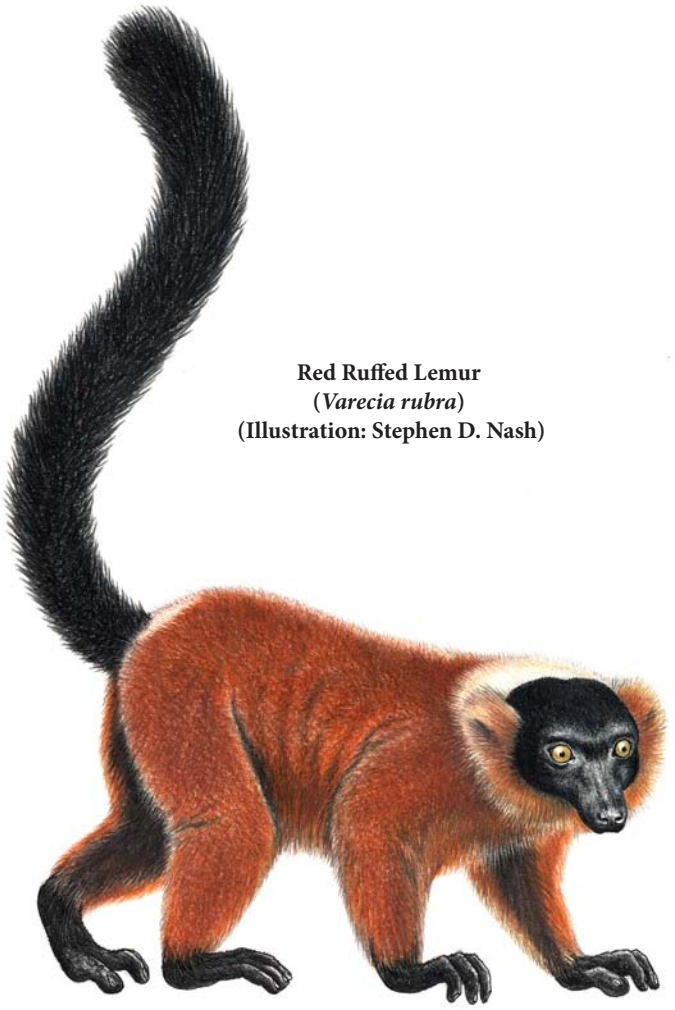
Red Ruffed Lemur

Varecia rubra É. Geoffroy, 1812

Madagascar

(2012)

Christoph Schwitzer, Russell A. Mittermeier, Edward E. Louis Jr. & Matthew Richardson



Red Ruffed Lemur
(*Varecia rubra*)
(Illustration: Stephen D. Nash)

The Red ruffed lemur is confined to the Masoala Peninsula and the region immediately north of the Bay of Antongil in northeastern Madagascar (Petter and Petter-Rousseaux 1979; Tattersall 1982). It may have occurred as far north as Antalaha in the past, but this is not certain (Tattersall 1977). The Antainambalana River appears to separate it from *V. variegata subcincta*, and recent surveys have shown that the westernmost distribution of *V. rubra* is near the confluence of the Antainambalana and Sahantaha rivers (Hekkala *et al.* 2007). Variations in color pattern are well known in this species, but have not been attributed to clear geographic regions. It may intergrade with *V. variegata subcincta*; the confluence of the Vohimara and Antainambalana rivers has been investigated as a possible contact or hybrid zone between the two, but without conclusive results (Tattersall 1982; Lindsay and Simons 1986; Vasey and Tattersall 2002; Hekkala *et al*. 2007).

With a head-body-length of 50–55 cm and a body mass of 3.0–3.6 kg (Vasey 2003), *Varecia rubra* is a large member of the Lemuridae. It inhabits primary and some secondary moist lowland forest (up to 1200 m above sea level) and prefers tall forest, where it is often observed in the crowns of large feeding trees. The species feeds mainly on fruit, supplemented with flowers, nectar, and leaves. In one study conducted between May and November (Rigamonti 1993), Red ruffed lemurs fed on ripe fruits for 73.9% of their feeding time, flowers for 5.3%, and leaves for 20.9% (18.3% of these mature). Only a few plant species were used as food resources: 72.5% of the observed feeding bouts occurred in only seven tree species. The animals fed on 42 plant species altogether, compared to 106 species that would have been available to them in their home range area. The composition of the diet varied from month to month, but fruits were consistently the main item, even when they were hard to find. The core areas used within their territories always correlated with large, fruit-bearing trees. In the cold-wet season, when few fruits are available, the study group split up into subgroups to use different core areas. Females are reported to eat more low-fibre, high-protein items (young leaves and flowers) prior to giving birth and during lactation, presumably to meet the higher energy demands of reproduction (Vasey 2000a, 2002). At Andranobe, 132 different plant species from 36 families were eaten over the course of a year (Vasey 2000b).

This species has been studied in the forests of Ambatonakolahy (Rigamonti 1993) and Andranobe (Vasey 1997a) on the Masoala Peninsula. Social organization is described as fission/fusion, and communities are usually multimale-multifemale and number 5–31 individuals. Home ranges cover 23–58 ha and appear to be defended (Rigamonti 1993; Vasey

2006). In one study at Andranobe, *V. rubra* spent 28% of its time feeding, 53% resting, and 19% traveling. Females fed more and rested less than males (Vasey 2005). The species is most active during the hot rainy season. Mating occurs in early July, and infants are born in October and fully weaned by February (Vasey 2007).

The Red ruffed lemur is classified as Critically Endangered (Andrainarivo *et al*. 2011) based on a suspected population reduction of ≥80% over a 3-generation time period of 24 years in the future. The principal threats to the species are habitat loss and hunting (Simons and Lindsay 1987; Rigamonti 1996; Vasey 1996, 1997b). Because of their large size and evident need for tall primary forest, these animals are particularly susceptible to human encroachment, and hunting and trapping for food still takes place. Furthermore, remaining populations are concentrated on the Masoala Peninsula, and they may be threatened by the frequent cyclones that hit this part of Madagascar. The only protected area where *Varecia rubra* is known to occur is Masoala National Park (Kremen 1998). Masoala was the national park most affected by the very rapid upsurge of illegal logging after the political events of early 2009, and this logging has continued well into 2010. Population density has been variously estimated at 6 individuals/km² (Rakotondratsima and Kremen 2001), 21–23 individuals/km² in Ambatonakolahy (Rigamonti 1993), and 31–54 individuals/km² in Andranobe (Vasey 1997b).

The IUCN lemur conservation strategy 2013–2016 (Schwitzer *et al*. 2013) proposes a suite of conservation measures for Masoala National Park to ensure the conservation of the Red ruffed lemur: further patrols and surveillance; campaigns of environmental education and awareness; and support for small-scale husbandry of domestic animals as a source of protein. As of 2014, there were 590 Red ruffed lemurs reported in captivity worldwide (ISIS 2014). Such populations in American and European zoos represent a safeguard against extinction, but they are unfortunately very limited in their genetic diversity (Schwitzer 2003).

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Northern Sportive Lemur

Lepilemur septentrionalis Rumpler and Albignac, 1975
Madagascar
(2008, 2010, 2012)

Edward E. Louis Jr. & John R. Zaonarivelo

Originally described based on cytogenetic and morphometric characteristics (Rumpler and Albignac 1975), the taxonomic status of the Northern sportive lemur (*Lepilemur septentrionalis*) has since been supported by more detailed cytogenetic, morphogenetic and especially molecular data (Ravoarimanana *et al.* 2004; Andriaholinirina *et al.* 2006; Louis *et al.* 2006), and subsequently accepted in recent taxonomic revisions of primates (Groves 2001, 2005) and lemurs (Mittermeier *et al.* 2008, 2010). With the taxonomic revision confirming *L. septentrionalis* and *L. ankaranensis* as distinct species, the perceived range of the Northern sportive lemur was drastically reduced; limited to a few degraded patches of dry forest in the Sahafary region just south of Antsiranana. The number of animals observed during surveys has decreased dramatically over a six-year period. The first survey was performed in 2001 by I. Ravoarimanana and the second in 2007 by A. Zaramody in the Andrahona, Ankarakataova, and Sahafary regions. The population was estimated at about 120 individuals; mainly in the Sahafary area.

Northern sportive lemur (*Lepilemur septentrionalis*)
(Illustration: Stephen D. Nash)

Expeditions by Omaha's Henry Doorly Zoo and Aquarium (OHDZA) and the Madagascar Biodiversity Partnership (MBP) in 2010 and 2011 verified the continued existence of the Northern sportive lemur but with a tremendous decline in the Sahafary classified forest, and not a single animal was detected in the Analalava forest where it had been seen in 2005. One individual was reported, however, when Analalava was revisited in July 2012 (Ranaivoarisoa *et al.* 2013). Fortunately, Ranaivoarisoa *et al.* (2013) confirmed the presence of the Northern sportive lemur in Montagne des Français (MDF) in 2010, but could only identify 19 individuals across its range based on capture and direct visual observations. Further surveys of the Montagne des Français region in 2012–2013 by OHDZA and MBP that included the previously known habitats of Sahafary and Analalava classified forests through to its northern extent in MDF, documented only 52 *L. septentrionalis* individuals, with 95% of these lemurs located in MDF. The most recent population estimates based on only capture surveys in 2013 in the Montagne des Français area provided the following population estimates: 1) Abatoire - 7 individuals; 2) Andranonakomba - 2 individuals; 3) Ampamakiampafana - 11 individuals; 4) Ambatobe - 2 individuals; and Berambo - 5 individuals for a total of 27 individuals; this species was documented at Anketrakala and Ampitsinjozatsambo in 2012, which were not recently surveyed.

In 2008, the Service d'Appui à la Gestion de l'Environnement promoted the designation of Montagne des Français as a newly protected area, and supported the development of a Vondron'Olona Ifototra (VOI) in Andavakoera, the primary village of this mountain forest. However, sustained human encroachment from the city of Antsiranana continues to finance the production of charcoal and collection of sand, activities that are threatening this last remaining northern sportive lemur population (Ranaivoarisoa *et al*. 2013). Thus, habitat loss from uncontrolled long-term slash-and-burn practices and the conversion of the remaining endemic forest are the primary challenges to overcome. The Northern sportive lemur is nocturnal, spending the day sleeping in tree holes, and very little is known about its ecology and behaviour. However, recent work has shown that its folivorous diet and predilection for new-growth leaves complicates any attempts or plans to maintain it in captivity. Currently, there is no record of any sportive lemur held in any zoological park, as all known attempts to maintain them in captivity have failed; on average within one week of capture. *In situ* conservation programmes and community-based interactions are, therefore, the only viable solutions. The combination of a very small range composed of rapidly deteriorating suitable habitat with high pressure from hunting puts the Critically Endangered Northern sportive lemur (Andrainarivo *et al*. 2011) on the cusp of extinction.

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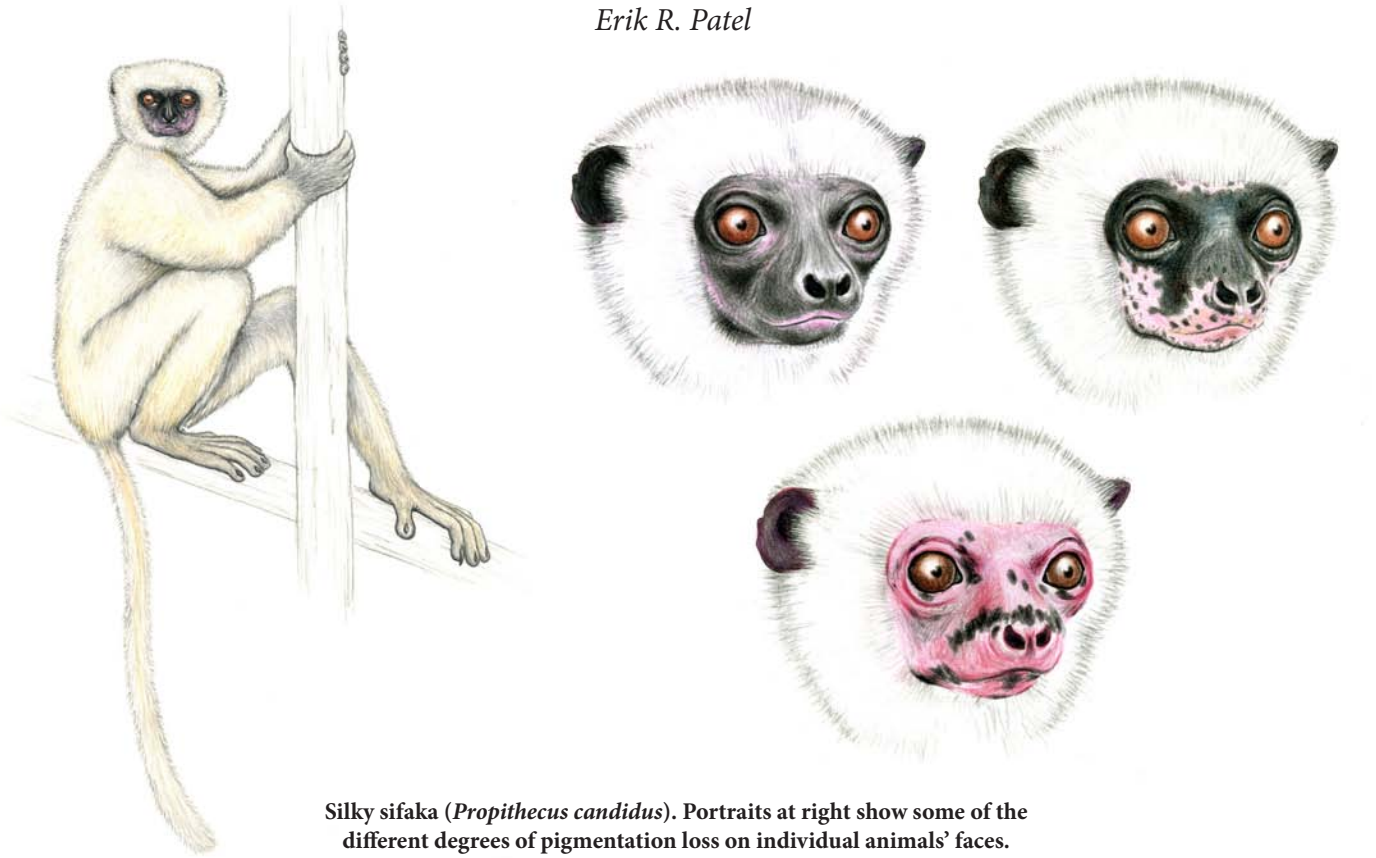
Silky Sifaka

Propithecus candidus Grandidier, 1871

Madagascar

(2000, 2002, 2004, 2006, 2008, 2010, 2012)

Erik R. Patel



Silky sifaka (*Propithecus candidus*). Portraits at right show some of the different degrees of pigmentation loss on individual animals' faces. (Illustrations: Stephen D. Nash)

Propithecus candidus is a large white sifaka from northeastern Madagascar. Silky sifakas were recently raised to full species status (Groves and Helgen 2007; Mayor *et al*. 2002, 2004; Mittermeier *et al*. 2010), although debates remain about the number of sifaka species (reviewed in Tattersall 2007). Head-body length ranges from 48–54 cm, tail length 45–51 cm, total length 93–105 cm, and adult body weight from 5–6.9 kg (Lehman *et al*. 2005; Gordon *et al*. 2013). The pelage is long, silky and white, which gives this species its common name. In some individuals, silver-gray or black tints may appear on the crown, back and limbs, and the pygal region (at the base of the tail) is sometimes yellow. The muzzle and face are bare, and tips of the naked black ears protrude just beyond the white fur of the head and cheeks. Although all infants are born with black skin, all individuals lose pigmentation to varying degrees as they get older, resulting in skin color which is a mix of pink and black, with some individuals having all pink or all black faces. The extent of pigment loss is more extreme than in any other lemur, which led early explorers (e.g., Milne-Edwards and Grandidier 1875) to believe that it was an albino subspecies of *P. diadema*. The lack of red eyes or photophobia and the presence of some black fur, however, confirm that silky sifakas are not albino, but are a leucistic species which may suffer from a heritable vitiligo-like skin disorder (K. Linder, pers. comm.; Cousins 2007).

Unlike *Propithecus perrieri* and *P. edwardsi*, where adult males and females are difficult to distinguish, adult male and female *P. candidus* can be readily distinguished from one another by the pelage coloration of the upper chest. Adult males have a large brown "chest patch" that results from chest scent-marking with the sternal gular gland. As rates of male chest scent marking increase during the mating season, male chest patches become larger and can cover the entire front torso to the abdomen (Patel 2006a).

Propithecus candidus has been classified as Critically Endangered on the IUCN Red List since 1996

(Andrainarivo *et al*. 2011). This is one of the rarest and most endangered lemurs. Global population size is currently estimated to be between 300 and 2000. Line-transect surveys underway in 2014 will provide a more population estimate, even though surveying is challenging because the Silky sifaka is patchily distributed and rare; sightings are few. Encounter rates have been obtained from several sites in Marojejy and are presented below. Silky sifakas are hunted throughout their range as there is no local taboo, or fady, against eating them. Sadly, hunting of lemurs has increased in recent years across Madagascar. Even species once thought to be protected by taboo, such as *Indri*, are frequently hunted in some regions (Jenkins *et al*. 2011; Nielson and Patel 2008). Habitat disturbance, such as slash-and-burn agriculture (*tavy*), logging of precious woods (for example, rosewood) cutting trees for firewood and construction also occurs in and adjacent to the protected areas where they are found (Patel 2007a; Patel *et al*. 2005). Illegal mining of crystal (quartz) and amethyst has increased recently in Anjanaharibe-Sud (primarily) and Marojejy, leading to a two-month closure of Anjanaharibe-Sud to tourism and research in 2012. Of greatest concern is the recent resurgence of illegal rosewood logging (with associated bushmeat hunting) in Marojejy by armed gangs of loggers which, after a several year reprieve, began again in December 2013. Similar park regions that have been impacted in the past are now again being logged, including the Andratamarina, Andrahanjo, and Mandena tourist regions. A new conservation project by the Duke Lemur Center, called 'SAVA Conservation', which began in January 2012, is working to ameliorate some of these conservation threats. Based in Sambava, the project works with Madagascar National Parks, and follows a multi-faceted community-based approach to biodiversity conservation, similar to that used by the Madagascar Fauna Group (MFG).

The Silky sifaka has a restricted range in northeastern Madagascar that includes the humid forest belt extending from Maroantsetra to the Andapa Basin and the Marojejy and Anjanaharibe Massifs, including the Marojejy Anjanaharibe-Sud Tsaratanana corridor (COMATSA). The Marojejy National Park marks the northern limit of its distribution, although remarkably WWF and SAHALA, a Malagasy environmental association, have recently discovered several groups at the Andrakengy site in the Tsaratanana Corridor approximately 25 km northwest (300°) of Doany, just south of the Androranga River (Sandrine Rasarimanana, pers. comm.). There are also unconfirmed reports of silky sifakas in the Anjiabe region (just south of Andrakengy) in the Tsaratanana Corridor and at several sites in the Betaolana Corridor, including Antsahabe, Befamatra, Ambodihasina, Antanambe, Ambodimandresy, and Ambodivohitra (Fara and Andriamarasolo 2010; Andriamarasolo, pers. comm.; BioDev/WWF 2011).

The Antainambalana River, in the Makira Natural Park, is the southern range limit for the species. As of 2014, two small groups of Silky sifakas (a group of two and the other of three) have been found in an unusually low elevation forest (235 m to 565 m above sea level) at the new WCS-managed Silky sifaka site at Andaparaty (Rabeson) just north of the Antainambalana River. Recent infrastructure developments at that site should encourage more tourism and research. Silky sifakas may occur in northeastern Makira (Besariaka, Amparihibe, Bezavona), although they have yet to be observed there (Milne-Edwards and Grandidier 1875; Tattersall 1982; Wilme and Callmander 2006; Rasolofoson *et al*. 2007; Patel and Andrianandrasana 2008). Surveys in recent years by SIMPONA (the main NGO in the Marojejy National Park in charge of conservation, research and social development) have revealed the presence of several groups of Silky sifakas just outside Makira in the disturbed forests of Maherivaratra (near Ambavala town) and about 10 km to the northwest in the Antohakalava forest (near Anivorano village) (pers. obs.) which is a slight enlargement of their known geographic range. Hunting and slash-and-burn agriculture are widespread in Antohakalava and Maherivaratra, placing the remaining silkies there under heavy anthropogenic pressure.

The majority of the remaining population of *P. candidus* is found in just two protected areas managed by Madagascar National Parks (Andapa): Marojejy National Park and Anjanaharibe-Sud Special Reserve. Only perhaps a dozen groups have been found in the (WCS-managed) Makira Natural Park at a few widely separated sites: Andaparaty (noted above), Manandriana (near the western edge of Anjanaharibe-Sud), and Soavera (south of Manandriana) (Rasolofoson *et al*. 2007; Ratelolahy and Raivoarisoa 2007). At least a dozen or more groups are found in the COMATSA forests, managed by WCS, which are expected to be official protected areas soon.

More published results from formal line-transect surveys are clearly needed, particularly in Anjanaharibe-Sud

where there have been no quantitative lemur surveys since 1994 (Schmid and Smolker 1998). Moreover, very little is known about the newly protected western extension of Anjanaharibe-Sud. In Marojejy, recent intensive, line-transect surveys in central-eastern ("tourist zone") and northwestern Marojejy have returned group encounter rates of 0.0357 groups/km and 0.0238 groups/km, respectively (Moore and Patel 2013). A similarly low encounter rate of 0.0137 groups/km was obtained during a three-month line-transect survey in northwestern Marojejy in 2007. At least a dozen groups were found in far western Marojejy near the village of Antsahaberaoka in 2007. The classic and highly cited Marojejy lemur survey by Sterling and McFadden (2000) found Silky sifakas as high as 1875 m above sea level. Only the Andaparaty group in Makira has been found inhabiting forests below 700 m above sea level. The Marojejy expedition undertaken by Duckworth *et al*. (1995) found Silky sifakas in the northwest and southeast sectors of the park, but not in the lower elevation southwest. Goodman and colleagues from WWF have also documented the presence of *P. candidus* in COMATSA (Goodman *et al*. 2003; Fara and Andriamarasolo 2010).

A number of studies have examined the behavioural biology, communication, and feeding ecology of Silky sifakas in Marojejy National Park and the Makira Natural Park. Silky sifakas show the greatest elevational range of any of the sifakas; as low as 235 m above sea level in the Makira (Andaparaty) and as high as 1,875 m in Marojejy. Thus, they inhabit several types of elevation-specific habitats including primary montane rainforest, sclerophyllous forest, and even low ericoid bush at their highest elevations. Their large size (as one of the two largest sifaka species with *P. diadema*) and thick pelage may be adaptations for cold climates at high elevations (Lehman *et al*. 2005).

The social structure of *P. candidus* is variable. They are mostly found in male-female pairs and one-male groups, but occasionally in multi-male/multi-female groups. Groups range in size from 2 to 9 and are cohesive, with inter-individual distances seldom exceeding 25 m. Home ranges vary considerably by site, and are smaller for the Marojejy Camp 2 group inhabiting undisturbed primary forest (100% MCP = 57.2 ha and 95% Kernal = 41.4 ha) than the main group at Andaparaty in Makira in a disturbed forest and unusually low elevation forest (100% MCP = 98.6 ha and 95% Kernal = 67.8 ha). Remarkably, the Camp 2 group ranges from 700 m to 1200 m above sea level, thereby exhibiting a 500-m elevational range within their home range, exceeding that of any other known sifaka group in Madagascar.

Approximately 25% of the day is spent feeding, 44% resting, and the remainder is devoted to social behaviour (16.8%), travelling, and sleeping. Long bouts of terrestrial play involving adults are not uncommon. Rates of aggression are low, and occur mainly during feeding. Females have feeding priority over males. A recent 12-month study at Marojejy Camp 2 documented feeding from more than 100 types of trees, vines, epiphytic ferns, epiphytic hemi-parasitic plants, a few terrestrial parasitic plants, as well as soil. Plant samples were collected, dried, and identified by a botanist. The top ten foods in order of percentage of feeding time were: 10.8% Hazinina (*Symphonia* sp.), 10.1% Lalona (*Weinmannia* sp.), 6.8% Vahindrobanga (*Landolphia* sp.), 6.2% Volomborona (*Albizia polyphylla*), 6.0% Soretry (*Plagioscyphus* sp.), 5.1% Rotro (*Eugenia* sp.), 3.9% Vahivy (*Dichapetalium madagascariense*), 3.8% Taintsitsihy (*Backerella clavata*), 3.3% Fotsidity (*Ficus polita*), 3.3% Nanto (*Mimusops* sp.). Plant part percentages confirm that this species is a folivore/seed predator, with most of their diet comprised of leaves (47.7%) and seeds (31.4%). Fruits (10.6%), flowers (9.8%), and stems (0.5%) were also regularly consumed. By contrast, the most commonly consumed food by the Silky sifakas at the low elevation (235 m to 565m above sea level) Andaparaty (Makira) site was Mampay (Fabaceae, 22.3%), which has never been observed bring eaten by Silky sifakas in Marojejy (Rajaonarison *et al*. 2012).

Mating has been observed and occurs on a single day each year in December or January. Infants are born in June or July. Females generally give birth to a single offspring every two years, although births in consecutive years have been observed (Patel 2006b). Infants initially grasp the fur on their mother's belly, and only about four weeks later begin to ride "jockey style" on their mothers back. As is typical of *Propithecus*, all group members interact affiliatively with infants. Grooming is the most frequent form of non-maternal infant care, followed by playing, occasional carrying, as well as nursing in a few remarkable instances (Patel 2007b). Dispersal is bisexual and has been observed on three occasions.

Other than humans, only the fossa (*Cryptoprocta ferox*) has been documented as a predator of the Silky sifaka (Patel 2005). No aerial predation attempts by raptors have

ever been observed, although these sifakas sometimes stare skyward and emit loud "aerial disturbance" roars in the presence of the large Madagascar buzzard (*Buteo brachypterus*), which does not, however, eat lemurs, only small birds. Loud sneeze-like "zzuss!" vocalizations are their second type of alarm call, and are emitted in response to terrestrial disturbances and to lost calls by other group members, as well as after receiving aggression. A detailed acoustic analysis (160 calls from nine adults in three groups) has revealed sex and individual differences in the acoustic structure of the silky sifaka "zzuss" vocalization. Male and female zzuss calls differed most in F0- and amplitude related features, characteristics that are relatively unconstrained by overall body size. All measures differed among individual callers, with F0-related variables again playing the largest role. Based on usage, these calls most likely function both as generalized alarm and group-coordination signals.

As in all prosimians, olfactory communication is well developed. Eastern sifakas have several specialized scent-marking glands that include a sebaceous chest gland only found in males and mixed apocrine-sebaceous genital glands in both sexes (Schilling 1979). Sifakas do not allomark, as in *Eulemur*, by directly scent-marking conspecifics. Females scent-mark trees by rubbing their genital glands in a rhythmic vertical motion. Males scent-mark trees by rubbing them with their chest gland or genital glands, or a combination of the two. Males routinely bite or gouge trees with their toothcombs just prior to chest-marking, which leaves long-lasting visible marks. Silky sifakas do not eat bark or gum, so such non-nutritive male bark-biting is likely communicative in function. A recent study in Marojejy found that most of the 102 gouged tree, vine, and epiphyte species were food species (61.8%), and many were known to be sleeping trees (38.2%). Multiple regression analysis revealed that the number of gouges per tree species was predicted by the percentile rank of those species as food tree species and sleeping tree species. As first described by Powzyk (1997), bark-biting likely promotes scent longevity, attracts the visual attention of conspecifics, and in some cases remove the scent marks of conspecifics. Male bark-biting may also result in the deposition of saliva cues and may be considered an honest signal of male status (Patel 2012a; Patel and Girard-Buttoz 2008).

A recent six-month scent marking study at Camp 2 of Marojejy examined marking rates and the territorial scent mark function. Mean focal scent mark rate for adult silky sifakas was 1.64 marks/hr, and the mean adult male mark rate (3.6 marks/hr) was more than five times higher than the adult females (0.7 marks/hr). For the adult male, combined chest-genital marking accounted for 40.1% of his scent marks, followed by genital marks at 35.3% and chest marks at 24.6%. Some evidence for territorial scent marking was found. GPS points were recorded for 1549 focal scent marks over six months; although the effect was moderate, more marks were deposited near the periphery of the home range than near the core, particularly for the adult male (Patel 2013). A one-year study of conspecific responsiveness to intragroup scent marks found that only 17% of male *P. candidus* marks are responded to by other group members but 71% of female marks received a response, on average within 61 seconds (Patel 2006a). In both *P. edwardsi* and *P. candidus*, male overmarking of a female's mark is the most common response, followed by males overmarking the scent marks of other males. Male eastern sifakas preferentially use one type of scent marking, combined chest-ano-genital marking, when depositing an overmark (Andrianandrasana *et al*. 2007).

Recent preliminary work has examined Silky sifaka parasites. Over 100 fecal samples from the Silky sifakas in the Marojejy Camp 2 group (mainly) and Andaparaty (Makira) group were examined for endoparasites by several experienced labs. Ectoparasites were also noted during biomedical field exams. One of the Makira sifakas was infected with *Lemurstrongylus* sp. and all harboured the ectoparasite *Listrophriodes* sp. From the larger Marojejy sample, eggs of two species of nematodes were recovered (*Lemurstrongylus* sp. and *Lemuricola* sp.), a tapeworm (*Bertiella* sp.), an unknown oocyst, and two species of ectoparasites (*Gaudalges* and *Listrophriodes* sp.). ELISAs did not detect *Giardia* sp. or *Cryptosporidium* sp. antigens among the Marojejy or Makira sifakas, despite the fact that captive sifaka populations frequently harbour such infections (Loudon *et al*. 2013; Patel 2012b).

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Indri

Indri indri (Gmelin, 1788)

Madagascar

(2012)

Christoph Schwitzer, Russell A. Mittermeier, Edward E. Louis Jr. & Matthew Richardson

Some color forms of Indri (*Indri indri*)(Illustrations: Stephen D. Nash)

The Indri occurs in northeastern and central eastern Madagascar, roughly from the Anosibe an'ala Classified Forest in the south to the Anjanaharibe-Sud Special Reserve in the north (Petter *et al*. 1977; Tattersall 1982; Powzyk and Thalmann 2003). There appears to be a regional trend regarding the amount of white and black fur on the coat, and as a consequence two distinct subspecies were formerly recognized. These are now believed to constitute a cline, with darker individuals to be found in the north of the species' range and lighter ones to the south.

With a head-body length of 64–72 cm and a body mass of 5.8–7.1 kg (and some individuals weighing up to 9 kg), the Indri is the largest of the living lemurs (Glander and Powzyk 1998; Powzyk 1997; E. E. Louis Jr., pers. obs.). In the Analamazaotra Special Reserve and the Anjozorobe-Angavo protected area, males are slightly larger than females, and there is some slight dimorphism in colour pattern. Whether these differences hold true in other parts of the range remains to be determined. The species inhabits primary and secondary moist lowland and montane forest, as well as some disturbed habitats, from sea level to 1800 m (Goodman and Ganzhorn 2004a, 2004b). It is often found in mountainous habitats or steep terrain with numerous ridges and valleys. All levels of the canopy are used, although during October-December the animals tend to stay in the lower levels to avoid biting insects. Population densities typically range from 9 to 16 individuals/km², but are thought to be as low as 5.2 individuals/km² in some areas (Powzyk and Thalmann 2003; Glessner and Britt 2005). The indri is reported to reach quite high densities (22.9 individuals/km²) if not hunted by local people (Powzyk and Thalmann 2003).

Indris feed mainly on immature leaves, although fruits, seeds, flowers, buds and bark are also taken, the latter varying in proportion according to the season (Powzyk and Mowry 2007). Individuals descend to the ground to eat soil as well (Powzyk 1997; Britt *et al*. 2002; Powzyk and Thalmann 2003). The Indri has been studied in the forests of Analamazaotra (Pollock 1975a, 1975b, 1977, 1979a, 1979b) and in nearby Mantadia National Park (Powzyk 1996, 1997; Powzyk and Mowry 2003). There it lives in small groups of 2–6 individuals,

normally consisting of a monogamous adult pair and their offspring (Pollock 1979; Powzyk 1997). Although groups in fragmented habitat tend to be larger than those in more extensive, undisturbed areas (Pollock 1979a, 1979b; Powzyk 1997), this is not always the case (V. Sorrentino, pers. comm.). Changes in the composition of larger groups are quite frequent (V. Sorrentino, pers. comm.). Home ranges average 18 ha in the fragmented forests of Analamazaotra, but can be as large as 40 ha in the more pristine forests of Mantadia, where day ranges of 300–800 m are common. In the low altitude forest of Betampona, home ranges average 27 ha (Glessner and Britt 2005). A large central part of each ranging area constitutes a defended territory, from which other groups are excluded.

Mating takes place between December and March. The female produces a single young about every two or three years—a very slow reproductive rate for a prosimian. Births usually occur in May or June (but can be as late as August), the gestation period being between 135 and 145 days (range 130–150). Females do not reach full sexual maturity until 7–9 years of age (Pollock 1977).

The Indri is Critically Endangered (Andrainarivo *et al*. 2011) based on a predicted population reduction of ≥80% in the future over a 3-generation time period (36 years) due to a continuing and projected decline in area, extent and quality of habitat, in addition to continuing and projected exploitation through unsustainable hunting pressure. The principal threat to this species is habitat destruction for slash-and-burn agriculture, and logging and firewood gathering, even in protected areas. Contrary to what was believed in the past, illegal hunting is also a major problem for the Indri in certain areas (Jenkins *et al*. 2011). Although long thought to be protected by local "fady" (traditional taboos), these do not appear to be universal and the animals are now hunted even in places where such tribal taboos do exist. In many areas these taboos are breaking down with cultural erosion and immigration, and local people often find ways to circumvent taboos even if they are still in place. For example, a person for whom eating the indri is forbidden may still hunt the animals for sale to others, while those who may be forbidden to kill Indris can purchase them for food. Recent studies of villages in the Makira Forest indicate that Indris have also been hunted in the past for their skins (worn as clothing), that Indri meat is prized and fetches a premium price, and that current levels of hunting are unsustainable (Golden 2005, 2009; Jenkins *et al*. 2011; R. Dolch, pers. comm.). This species occurs in three national parks (Mananara-Nord, Mantadia, and Zahamena), two strict nature reserves (Betampona and Zahamena), and five special reserves (Ambatovaky, Analamazaotra, Anjanaharibe-Sud, Mangerivola, and Marotandrano) (Nicoll and Langrand 1989; Powzyk 1997; Schmid and Smolker 1998; Britt *et al*. 1999; CBSG 2002). It is found as well in the Anjozorobe-Angavo Protected Area and in the forests of Makira, which are currently under temporary government protection (though hunting pressure in the latter appears to be especially heavy). The corridor between Mantadia and Zahamena has been proposed as a new conservation site, and the Anosibe an'ala Classified Forest should be considered for the creation of a new park or reserve as well. No population figures are available, but a reasonable estimate would be 1,000–10,000. The Indri does not occur on the Masoala Peninsula or in Marojejy National Park, despite the latter area being connected to forest less than 40 km away where the species is present. Before wholesale deforestation occurred it was much more widely distributed, with a separate group said to occupy almost every ridge of the island's eastern forests. Subfossil evidence indicates that they once occurred well into the interior of Madagascar at least as far west as the Itasy Massif, southwest to Ampoza-Ankazoabo (Tattersall 1982; Godfrey *et al*. 1999) and north to the Ankarana Massif (Jungers *et al*. 1995).

The IUCN lemur conservation strategy 2013–2016 details conservation measures that will benefit the Indri in seven priority sites: Marojejy National Park and Anjanaharibe-Sud Special Reserve; Makira; Mananara Nord National Park; Ankeniheny-Zahamena Corridor (CAZ); Betampona Natural Reserve; Anjozorobe-Angavo and Tsinjoarivo (Schwitzer *et al*. 2013).

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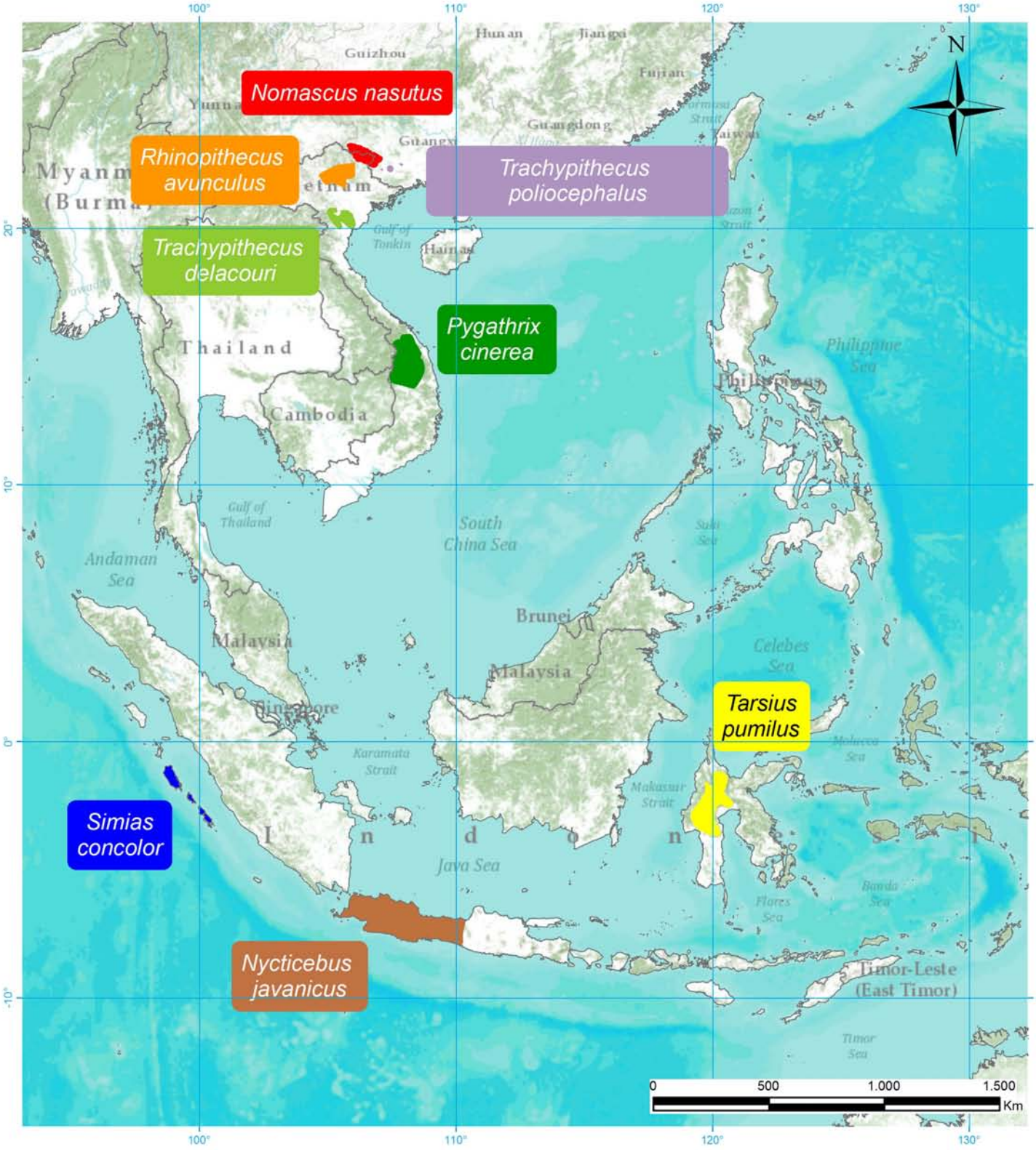
Asia



Asian Primates

- *Nomascus nasutus*
- *Nycticebus javanicus*
- *Pygathrix cinerea*
- *Rhinopithecus avunculus*
- *Simias concolor*
- *Tarsius pumilus*
- *Trachypithecus delacouri*
- *Trachypithecus poliocephalus*

IUCN SSC PRIMATE Specialist Group

Pygmy Tarsier

Tarsius pumilus Miller and Hollister 1921
Central Sulawesi, Indonesia
(2012)

Nanda B. Grow & Sharon Gursky-Doyen

Pygmy Tarsier
(*Tarsius pumilus*)
(Illustration: Stephen D. Nash)

The Pygmy tarsier, *Tarsius pumilus*, was rediscovered in 2008 by Gursky and Grow (2009). It had not been observed for more than 90 years, and was even speculated to be extinct. Pygmy tarsiers are a high-altitude tarsier species endemic to the mountains of central Sulawesi, Indonesia. The species is distinguished from lowland tarsiers by its high-altitude habitat, extremely small size, and unusual behaviours (Shekelle 2008; Grow and Gursky-Doyen 2010). In particular, Pygmy tarsiers weigh an average of 55 g, while lowland tarsier species weigh 108–136 g (Grow 2013a). Further, unlike lowland Sulawesian tarsiers, Pygmy tarsiers have not been observed to produce scent marks or audible duet calls (Grow and Gursky-Doyen 2010), rendering the species extremely cryptic and difficult to locate.

Named by Miller and Hollister in 1921, Pygmy tarsiers were previously known only from two museum specimens. In 1917, the holotype (USNM 219454) was collected by H. C. Raven at 1800 m on Mt. Rano Rano (1°30'S, 120°28'E). The species was first described based on this specimen. Musser and Dagosto (1987) confirmed the species status of *T. pumilus* based on the holotype, and found that G. Heinrich had independently collected an adult female *T. pumilus* specimen at 2200 m on Mt. Latimojong (AMNH 196477; 3°30'S, 120°05'E) in the northern part of the southwestern peninsula of Sulawesi. In the intervening decades, there were numerous attempts to locate a living population of this elusive species, but all were unsuccessful until Gursky and Grow's surveys in 2008, at 2100 m on Mt. Rore Katimbu (01°16.8'S, 120°18.5'E) in Lore Lindu National Park, central Sulawesi (Grow and Gursky-Doyen 2010). These surveys concentrated efforts on the same mountain where a small mammal survey accidentally collected a third specimen in 2000, indicating the species still existed in the wild (Maryanto and Yani 2004).

All of the myriad threats affecting this species are compounded by the extremely limited distribution of

this species. Pygmy tarsiers have only been observed at elevations above 2000 m at Mt. Rore Katimbo, despite surveys at lower altitudes (Grow 2013b). Gursky (unpubl. data 2009) conducted surveys at Latimojong in south Sulawesi but did not observe any Pygmy tarsiers. Surveys by Grow in 2010 and 2012 determined that the population density of *T. pumilus* at Rore Katimbo is approximately 92 individuals per 100 ha, with an estimated 6 groups per 100 ha (Grow *et al*. 2013). The amount of available habitat for Pygmy tarsiers is severely constrained; in Lore Lindu National Park, only 20% of the park consists of elevations higher than 1500 m, and high-altitude Pygmy tarsiers will occupy only a fraction of that area.

Human advancement into higher altitudes is a major threat given the limited distribution and low population densities of Pygmy tarsiers. Although the tarsiers are located in a protected area, there is tremendous deforestation and illegal encroachment of villages into Lore Lindu National Park. Residents of villages located in and near the park continue to extract resources and modify the landscape. Resources regularly collected from the protected forest include resin from Dipterocarpaceae trees, birds and mammals for the wildlife trade, and lumber (N. Grow, pers. obs.). The villages in Lore Lindu National Park are also undergoing massive population growth, creating a higher demand for agricultural land and firewood, increasingly at high altitudes in montane forest where resources are still available. As human populations expand in the future, Pygmy tarsier habitat is at risk of further clearing for agricultural usage. The IUCN Red List notes that this extremely limited population is currently decreasing, and the species is classified as Data Deficient (Shekelle and Salim 2008).

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Javan Slow Loris

Nycticebus javanicus É. Geoffroy Saint-Hilaire, 1812
Indonesia
(2008, 2010, 2012)

K. Anna I. Nekaris, E. Johanna Rode & Vincent Nijman

All Asian lorises are imperilled by the devastating loss of their habitat; indeed, this major threat resulted in Sri Lanka's Critically Endangered Horton Plains slender loris appearing rightfully in the last two incarnations of this list (Nekaris 2006; Nekaris and Perera 2007). An even greater immediate threat to Asian lorises, however, is their high demand in the rampant Asian pet and traditional medicine trades and their use as tourist photo props (Schulze and Groves 2004; Streicher 2004). Easy to catch due to their slow locomotion, numbers of lorises in animal markets far outstretch the ability of these slow-reproducing primates to recover their population numbers in the wild. Indeed, this threat raised international concern, resulting in the transfer of all members of the genus *Nycticebus* to CITES Appendix I in 2007 (Nekaris and Nijman 2007). Eight species of slow loris are now recognized: *N. coucang* (greater), *N. pygmaeus* (pygmy), *N. bengalensis* (Bengal), *N. javanicus* (Javan) and four Bornean: *N. menagensis*, *N. bancanus*, *N. borneanus*, and *N. kayan* (Roos 2003; Chen *et al*. 2007; Munds *et al*. 2013). All slow lorises suffer from trade throughout their range, but when combined with tremendous habitat loss, no other species has been harder hit than the Javan slow loris. There is a general public perception that slow lorises are 'cute' as demonstrated by a recent trend for videos of these animals being used as pets on You Tube and other social media outlets, which exacerbates their demand in the pet trade (Nekaris *et al*. 2013b).

Javan slow loris (*Nycticebus javanicus*)
(Illustration: Stephen D. Nash)

Recognized by the IUCN as a species in 2006, and currently listed as Critically Endangered (Nekaris *et al*. 2013a), the Javan slow loris is distinguished easily from its congeners in several respects. Both morphologically and genetically, it is most similar to, yet still distinct from, the largest slow loris, *N. bengalensis* of mainland Asia (Roos 2003; Groves and Maryanto 2008). Weighing about 1 kg, the most distinctive feature of the Javan slow loris is its facial mask, comprised of bold fork marks leading from the eyes and ears to the crown of the head, revealing a white diamond pattern on the forehead (Nekaris and Jaffe 2007). Despite being legally protected since 1973, with its creamy neck, bold dorsal stripe, and panda-like face, it is no wonder that Indonesian pet traders in the 1990s targeted Javan slow lorises above other endemic loris species. Since 2002, however, the numbers of Javan lorises in trade have decreased,

with a stark rise in numbers of Sumatran greater slow lorises (*N. coucang*), a species whose threat status must also be carefully monitored. Indeed, over one year of market surveys on Java in 2013, quadruple the number of Sumatran than Javan slow lorises were counted, with traders claiming that Javan slow lorises could no longer be found. In November 2013 alone, nearly 300 Sumatran lorises were confiscated in two raids. The smaller raid, yielding 76 individuals, was followed by the almost immediate death toll of 31 individuals, and by 12 infant lorises being born. All of these animals were confiscated before ever making it to markets, but show the dramatic extent of this trade.

Nycticebus javanicus is found only on the Indonesian island of Java. Java has a long history of cultivation and deforestation that already started c.1000 AD, but took off in 1830 when the Dutch colonial government imposed the so-called "cultuurstelsel". To support this agro-economic system, farmers were forced to grow export crops on communal grounds, which were often forest (Whitten *et al*. 1996). By the end of the 19th century the natural forest was severely fragmented, and at the beginning of the last century the remaining forest, especially in West and Central Java, showed a fragmentation pattern very similar to that seen today. Over the last few decades, the decrease in forest area has been slow. At present, less than 10% of the original forest remains, most of it covering the higher slopes of the central mountains.

GIS models made available by Thorn *et al*. in 2009 suggested that historic forest loss and continued degradation mean that less than 20% of habitat suitable for *N. javanicus* remains and that only 17% of the potential distribution of *N. javanicus* is currently within the protected area network of Java. Based largely on Thorn *et al*.'s recommendations, Voskamp *et al*. (2014) investigated eight of these areas along with an additional six unprotected areas. Their results concurred with those conducted by three separate research groups, with animals occurring at 0.02 to 0.20 ind./km^2, when they could be found at all; this means that 5–10 km must be walked to see a single loris (Nekaris and Nijman 2008; Winarti 2008). Roads and human disturbance have been shown to correlate negatively with Javan slow loris abundance (Collins 2007; Winarti 2008). Surprisingly however, during Voskamp *et al*.'s study, numbers of lorises were higher in agro-forest that is, in some cases, extremely disturbed by humans.

Also urgently required are programmes to mitigate trade in all species of slow loris. A number of studies have found that slow lorises are not always a targeted group, but that they do have economic value throughout their range. Rather than seeking a loris, villagers moving through the forest simply pick up a loris when they happen to see it (Starr *et al*. 2008). Similarly, when forests are clear cut (for agriculture or cash crops), villagers pick through the felled trees and collect the lorises; with a defence mechanism to cling to branches rather than to flee, and with their nocturnal senses stunned by bright daylight, lorises are an easy target (Ratjacsek 1998). Nijman and Nekaris (2014) showed that traditional beliefs about slow lorises may hinder people from hunting them, particularly beliefs regarding their being venomous or poisonous.

In Java itself, lorises are often specifically targeted for the trade (K. L. Sanchez, pers. obs.). Local villagers who find a loris take it to a distributor dealer who compiles a stock of lorises. These animals go to middlemen who then distribute them throughout the "bird" markets in the main towns in Java. The traders who ultimately sell the animals are aware that trading lorises is profitable, reaching a price in the market up to ten times or more the purchasing price at the stocker's level.

Once they arrive at a market, lorises face other threats. To avoid being bitten by slow lorises, which are one of the few venomous mammals, traders habitually cut or pull out an animal's lower front teeth. Most of these lorises die due to general infection, dental abscess or pneumonia. Those that do survive are no longer able to eat their preferred food (gum) (Wiens *et al*. 2006), or engage in the important behaviour of social grooming with the toothcomb, meaning that any confiscated animals are unlikely to survive if released to the wild. Reintroduction itself is a threat to the Javan loris; three major trade hubs, markets in Jakarta, Bandar Lampung and Palembang, receive lorises from throughout the region. The similar appearance of lorises to the untrained eye results in release of other loris species into Java, with potential for disastrous effects from hybridization or displacement by invasive species.

Only a single study has assessed the success of reintroduction of Javan slow lorises, finding up to a 90% death rate (Moore 2009). Illness, hypothermia and exhaustion were all implicated in the death of the lorises. Sadly, reintroductions were started before

anything was known about their behaviour, ecology or wild distribution. No habitat assessment could be made since it was not even known in what type of habitat the species occurred.

In 2011, the first long-term study of Javan slow loris behavioural ecology was instigated by the Little Fireface Project in Garut District, West Java, Indonesia (Nekaris *et al*. 2013b; Rode *et al*. 2014). This multi-disciplinary project has obtained the first data about slow loris behaviour in an agro-forest matrix, including home range size, social organization, infant dispersal, and feeding ecology. Some notable discoveries have been that both sexes disperse from their natal range at about 18 months old, dispersal distances are some 1–2 km from the natal range, home range sizes are large (5–10 ha), and the diet of lorises comprises mainly gum, supplemented with nectar and insects. Several initiatives have been put into place to conserve slow lorises in the area and in Java. National workshops have been held for law enforcement officers and rescue center employees to feed essential data into a national loris action plan. At the local level, lorises are totally dependent on local people for their protection, feeding on human planted tree species and residing in human farmlands. Thus a major conservation program, combining empowerment activities, conservation education and village events, has been launched, and it is hoped that it can be used as a model for other key loris sites in Indonesia.

For a long time, slow lorises were thought to be common throughout Indonesia, and the presence of animals in trade was believed to be an indicator of their abundance. We are only beginning to unravel the complexity of their taxonomy and distribution, leading to a bleak picture overall. While Java has an impressive and comprehensive protected area network, encompassing over 120 terrestrial conservation areas covering some 5,000 km², enforcement of environmental laws and active protection of forest is lacking in most of these parks. Besides curbing the illegal trade, it is paramount that these conservation areas, and indeed all other remaining forest areas on the island, be effectively protected.

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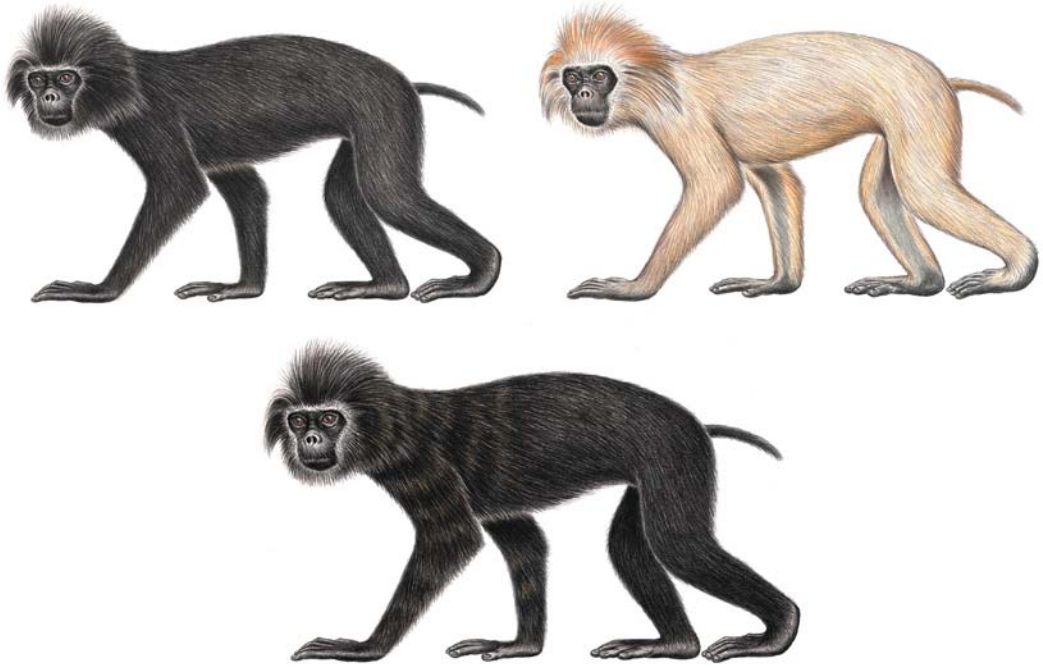
Pig-tailed Snub-nose Langur
Simias concolor Miller, 1903
Indonesia
(2002, 2004, 2006, 2008, 2010, 2012)

Lisa M. Paciulli, Jatna Supriatna & Christian Roos



The two color forms of the Pig-tailed snub-nose langur (*Simias concolor concolor*) above, and the Siberut subspecies (*Simias concolor siberu*), below (Illustrations: Stephen D. Nash)

The Pig-tailed snub-nose langur (*Simias concolor*) is again serving as the flagship species for the six Mentawai Island primates. The other three species inhabiting the 7,000-km² archipelago located west of Sumatra are Kloss's gibbon (*Hylobates klossii*), the Pagai langur (*Presybtis potenziani*), the Siberut langur (*P. siberu*), the Pagai macaque (*Macaca pagensis*), and the Siberut macaque (*M. siberu*). *Simias* is a monotypic genus with two subspecies: *Simias concolor concolor* Miller, 1903 inhabits Sipora, North Pagai, and South Pagai islands and several small islets off of South Pagai; *Simias c. siberu* Chasen and Kloss, 1927 is restricted to Siberut Island (Zinner *et al*. 2013).

The first activity budget of habituated pig-tailed langurs described the activities of two groups living in the Betumonga region of southwestern North Pagai. The data show that they spend almost equal amounts of time resting (46%) and feeding (44%), and less time moving (7%) (Paciulli and Holmes 2008). New estimates of the amount of forest cover remaining on the Pagai Islands (about 826 km²) have been calculated using Google Earth Pro composite satellite imagery (Paciulli and Viola 2009). The forest cover coupled with primate density data (Paciulli 2004) indicate that there are approximately 3,347 pig-tailed langurs, 1,049 Kloss's gibbons, 1,545 Pagai langurs, and 7,984 Pagai macaques on the Pagai Islands. All of the primate species seem to reach their highest known densities in the Peleonan Forest, site of the Siberut Conservation Project in northern Siberut (Waltert *et al*. 2008).

Simias concolor is classified as Critically Endangered on the IUCN Red List (Whittaker and Mittermeier 2008), threatened mainly by heavy hunting and commercial logging (Whittaker 2006). The Pagai island populations are threatened by forest conversion to oil palm plantations, and forest clearing and product extraction by local people (Whittaker 2006). Although hunting appears to be declining and opportunistic in many areas of the Pagais, where it still occurs it has devastating effects on *S. concolor*, the preferred game species (Mitchell and Tilson 1986; Fuentes 2002; Paciulli 2004). Tenaza (1987) estimated that twice as many individuals are killed by hunters each year as are born in the Pagai Islands. In a multi-population study, Erb *et al*. (2012) found that

hunting pressure reduced group size, resulting in the formation of male-female pairs, which is atypical for Asian colobines, which normally form small one-male groups with around five females.

The uncertainty of Indonesian government land-use means that land function and thus protection level on the Mentawai islands can change at any time with little notice, putting the species at further risk. There is only one main protected area for *S. concolor*: the 190,500-ha Siberut National Park, a UNESCO Biosphere Reserve, covers 47% of Siberut Island and serves as the main reserve for the Mentawai primates. The large majority of the other remaining natural habitat lies outside of officially protected areas. *Simias concolor* seems to be particularly sensitive to logging, having 5 individuals/km² in unlogged Pagai forests to half that amount (2.5 individuals/km²) in Pagai forest patches logged 20 years earlier (Paciulli 2004). Drastic measures need to be taken to ensure that the Peleonan Forest on Siberut and areas on the Pagais are truly protected.

Whittaker (2006) suggested the following conservation actions for *S. concolor*: 1) increased protection for Siberut National Park, which currently lacks enforcement; 2) formal protection of the Peleonan forest in North Siberut, which is home to unusually high primate populations and is easily accessible; 3) protection of areas in the Pagai Islands by cooperating with a logging corporation that has practiced sustainable logging technique there since 1971; 4) conservation education, especially regarding hunting; and 5) the development of alternative economic models for the local people to reduce the likelihood of selling off their lands to logging companies.

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Delacour's Langur

Trachypithecus delacouri (Osgood, 1932)
Vietnam
(2000, 2002, 2004, 2006, 2008, 2010, 2012)

Tilo Nadler

Delacour's langur (*Trachypithecus delacouri*)
(Illustration: Stephen D. Nash)

Delacour's langur is endemic to Vietnam, occurring in a very restricted area in the north of the country that comprises about 5,000 km² between 20°–20.30°N and 104.30°–106°E. The distribution is closely related to the limestone mountain ranges in the provinces Ninh Binh, Thanh Hoa, Hoa Binh and Ha Nam. The area of occurrence comprises only about 400 km² (Nadler 1996, 2004).

During the decades following the discovery of Delacour's langur in 1930 there was only scanty information on its existence and distribution. In 1987, the first sightings of live animals were reported from Cuc Phuong National Park (Ratajszczak *et al.* 1990). Intensive surveys by the Frankfurt Zoological Society in the decade before 2000 confirmed 18 isolated populations with a total of 280 to 320 individuals. Five localities were found where local people reported that this species had been extirpated. *Trachypithecus delacouri* is Critically Endangered (Nadler *et al.* 2008), and the most important factor in the decline in numbers is poaching, which is not primarily for meat, but for bones, organs and tissues that are used in the preparation of traditional medicines. The recorded numbers of animals hunted over 10 years (1990–1999) totalled 320, an annual loss of more than 30 individuals, but the real number is undoubtedly higher (Nadler 2004; Nadler *et al.* 2003).

Surveys in 2004 in two protected areas with important subpopulations—Cuc Phuong National Park and Pu Luong Nature Reserve—showed a decline in numbers of 20% in five years (2000 to 2004) (Luong Van Hao and Le Trong Dat 2008). The population in Ngoc Son Nature Reserve was extirpated (Le Trong Dat *et al.* 2008). Monitoring of populations and surveys carried out by the Endangered Primate Rescue Center (EPRC) shows a continuous and dramatic decline of populations. The existence of Delacour's langur could not be confirmed in eight of the formerly known 18 areas. Only four areas where Delacour's langurs now occur are protected: Cuc Phuong National Park, Pu Luong Nature Reserve, Hoa Lu Cultural and Historical Site, and Van Long Nature Reserve. In most protected areas poaching is also common and it is to be expected that populations in unprotected areas will disappear in the foreseeable future. A reasonable estimate of the current population indicates no more than 200 individuals (Nadler 2010). Van Long Nature Reserve harbours the largest remaining

population of Delacour's langurs; these animals are well protected due to close cooperation between the provincial forest protection authorities, and a local guard unit paid and trained by the Frankfurt Zoological Society. Since the establishment of the Nature Reserve in 2001, the population of Delacour's langurs has grown by about 50%, and currently numbers 100 to 120 individuals (Ebenau 2011; Nadler 2010).

Efforts to save this species are one focus of the Vietnam Primate Conservation Program of the EPRC at Cuc Phuong National Park, established in 1993 primarily to safeguard the future of this and other endangered Vietnamese primate species. The EPRC is the only facility which keeps this species. The center started a breeding program with five confiscated animals, and 20 individuals have been born since 1996. The first reintroduction of three captive bred Delacour's langur was carried out in 2011 and continued in 2012 with the release of two individuals. This was the first reintroduction of leaf-eating langurs. It followed the IUCN guidelines for nonhuman primate reintroduction. The animals were equipped with GPS-radio collars and tracked for nearly one year. The reintroduced animals should strengthen the smaller subpopulation in the larger part of Van Long Nature Reserve to support the exchange of individuals of the fragmented area of the nature reserve (Nadler 2012, Elser and Nguyen Hong Chung 2013).

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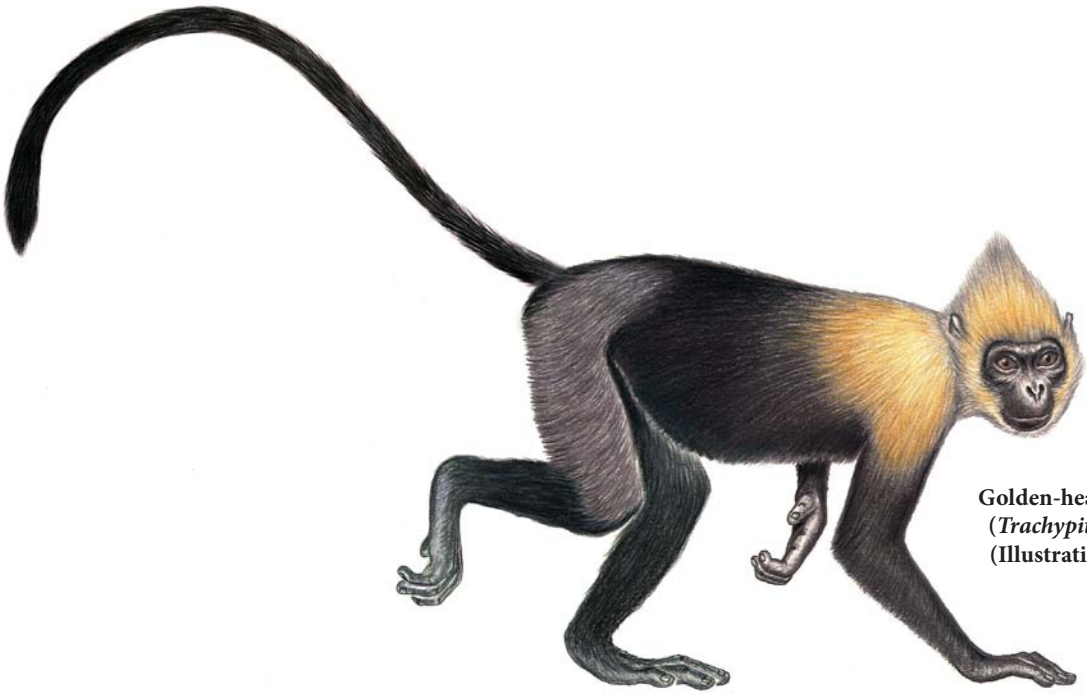
Golden-headed or Cat Ba Langur

Trachypithecus poliocephalus (Trouessart, 1911)

Vietnam

(2000, 2002, 2004, 2006, 2008, 2010, 2012)

Richard J. Passaro, Daniela Schrudde, Roswitha Stenke, Phan Duy Thuc & Martina Raffel



Golden-headed or Cat Ba langur (*Trachypithecus poliocephalus*) (Illustration: Stephen D. Nash)

The Golden-headed or Cat Ba langur, *Trachypithecus poliocephalus*, is probably the most endangered of the Asian colobines, and is assessed as Critically Endangered (Bleisch *et al*. 2008). This species occurs only on the Island of Cat Ba in the Gulf of Tonkin, northeastern Vietnam (Stenke and Chu Xuan Canh 2004). The Cat Ba Archipelago is in the world-famous Ha Long Bay, a spectacular karst formation that was invaded by the sea. The Cat Ba langur inhabits tropical moist forest on limestone karst hills, a habitat preference it shares with the other six to seven taxa of the *T. francoisi* group.

While there are no systematic and reliable data available on the historic density of the langur population on Cat Ba Island reports of indigenous people suggest the entire island of Cat Ba (140 km^2) and some smaller offshore islands were previously densely populated by langurs. Hunting has been identified as the sole cause for the dramatic and rapid population decline from an estimated 2,400–2,700 in the 1960s to approximately 50 individuals by 2000 (Nadler and Long 2000). The langurs were poached mainly for trade in traditional medicines and for sport. Since the implementation of strict protection measures in 2000, the langur population on Cat Ba Island has stabilized and appears to be on the increase (Nadler *et al*. 2003).

Although the growth of the population is encouraging, the overall status of the species remains critical. As a result of habitat fragmentation, the remaining population had been divided into several isolated sub-populations some of which consist of all-female, non-reproducing social units. The total reproductive output of this species over the years has been accordingly low. However, after many years of planning and preparation, one group consisting of two females was successfully translocated from a small off-shore islet where they had become stranded to the relative safety of the strictly protected core zone of Cat Ba National Park. Here they quickly assimilated into existing groups containing males, thus allowing them the opportunity to reproduce for the first time ever. It is hoped that with continued protection efforts and additional population management interventions such as these the species' will soon begin to rebound.

The Cat Ba Archipelago is nationally and internationally recognized for its importance to biodiversity conservation. Cat Ba National Park was established in 1986. It presently covers more than half of the main island. The archipelago (some 1,500–2,000 large and small islands, cliffs and rocks) was designated a UNESCO Man and the Biosphere Reserve in 2004.

Despite this, nature and wildlife protection on Cat Ba Island is deficient, although environmental awareness and commitment among the local communities is slowly on the increase. Efforts to effectively conserve the langurs and their habitat, however, continue to face major obstacles due to the need to better address the local community's aspirations for development, a steadily increasing human population as well as severe deficiencies in law enforcement (Stenke 2005). As elsewhere in the region, poaching is driven by increasingly attractive commercial gains in satisfying the immense local and regional demand for wildlife and animal parts for food and dubious traditional medicines. The strictest protection regime possible is necessary then for the survival of all species on Cat Ba that are, like the langurs, targeted by the Asian wildlife trade.

A conservation program for the Cat Ba langur was initiated on Cat Ba Island in November 2000 by Allwetterzoo Münster and the Zoological Society for the Conservation of Species and Populations (ZGAP), Germany. The aim is to provide for the protection of the langurs and their habitat, conduct research that will help inform future population management decisions and to help contribute to the conservation of the overall biodiversity of the Cat Ba Archipelago in collaboration with Vietnamese authorities.

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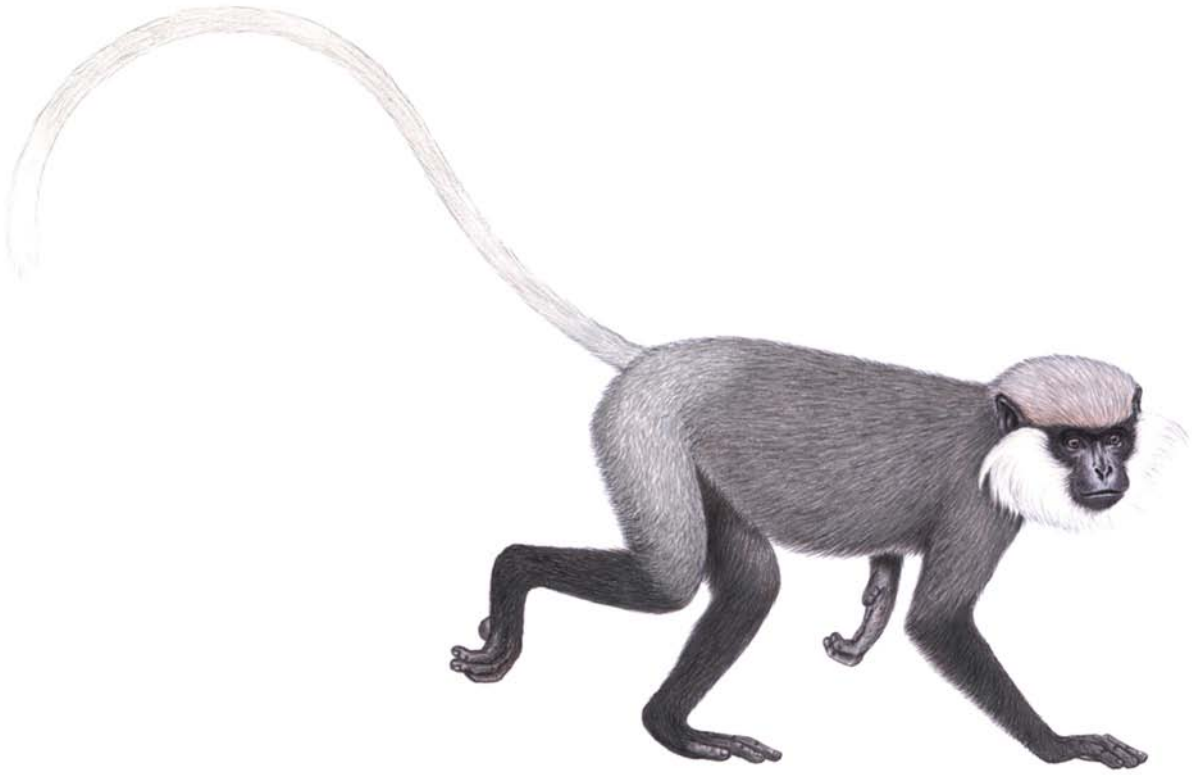
Western Purple-faced Langur
Semnopithecus vetulus nestor Bennett, 1833
Sri Lanka
(2004, 2006, 2008, 2010, 2012)

Rasanayagam Rudran



Western purple-faced langur (*Semnopithecus vetulus nestor*)
(Illustration: Stephen D. Nash)

Sri Lanka's Western purple-faced langur (*Semnopithecus vetulus nestor*) inhabits the most densely populated region around the country's capital, Colombo. As a result, haphazard urbanization severely threatens the long-term survival of this endemic monkey (Molur *et al*. 2003; Rudran *et al*. 2009; Mittermeier *et al*. 2012). Urbanization in its range has been so extensive that it is almost impossible to get a reliable count of its population. However, the size and distribution of its fragmented habitat in the urban landscape reflects the dire predicament this monkey is in. A 1,500-km survey conducted in 2007 through one-third of *S. v. nestor*'s historical range (Hill 1934; Phillips 1935; Hill and Burn 1941) showed that nearly 81% of the areas surveyed consisted of deforested and human-dominated landscapes (Rudran 2007). This situation became even more alarming in 2009, when the country's 26-year civil war ended and the pent-up desire for economic progress unleashed a flurry of development activities. A typical example is the super highway built between Sri Lanka's capital, Colombo, and the Southern city of Galle, which destroyed large areas of *S. v. nestor*'s natural habitat.

Deforestation has fragmented and drastically depleted the preferred habitat and principal food sources of the highly arboreal and folivorous *S. v. nestor.* Within the fragmented urban jungle *S. v. nestor* subsists mainly on fruits from home gardens (Dela 2007; Rudran 2007). The nutritional consequences of feeding on a low diversity diet of cultivated fruits are unclear. However, they are likely to be detrimental over the long term, because *S. v. nestor* is adapted to obtain its nutrients and energy from leaves with the help of a highly specialized stomach containing symbiotic bacteria (Bauchop and Martucci 1968).

Besides affecting *S. v. nestor*'s preferred habitat and diet, deforestation also causes other problems for this monkey's survival. For instance, fragmentation often forces this monkey to move on the ground, for which it is ill adapted, and makes young individuals vulnerable to capture as pets. While on the ground *S. v. nestor* also runs the risk of being killed by village dogs or speeding vehicles. Death by electrocution is another source of mortality when it climbs onto power lines and electricity cables (Parker *et al*. 2008). In some parts of its range *S. v. nestor* is occasionally shot and killed while feeding in home gardens (Dela 2004). Thus deforestation results in a host of human-induced fatalities, which reduce group sizes and undermine social organization.

The long-term effect of extensive deforestation resulting in local extinctions was also evident during the 2007 survey (Rudran 2007). The Western purple-faced langur was seen or recorded as present only in 43% of the sites surveyed in the eastern half of its historical range (N = 23), and 78% of the survey sites in the western half (N = 27). Moreover, the sites where it was seen or recorded as present were interspersed between areas where it was absent or rare, suggesting the occurrence of local extinctions.

Although facing a perilous future, there is hope that *S. v. nestor* can be conserved. One reason for hope is that most people living in the monkey's range follow Buddha's doctrine of compassion towards all living things. Therefore, promoting this doctrine and Buddha's own reverence of the forest could be an effective way of deterring deforestation in a country steeped in cultural traditions. Another reason for optimism stems from a recent decision taken by the Sri Lankan government to increase forest cover from 27% to 36% using native plants, to achieve the country's economic development goals (Yatawara 2011).

Even before the government announced its decision, my field staff and I had launched a research project to help reforest degraded habitats and establish safe havens for *S. v. nestor*. We were therefore delighted with the government's decision and have been continuing our efforts to help conserve *S. v. nestor*. The research on *S. v. nestor* commenced in June 2009 in the largest forest patch it now inhabits (about 21 km^2). This forest became our study site due to its size and also because it surrounded two reservoirs (Kalatuwawa and Labugama) that supply water to 1.2 million inhabitants of Sri Lanka's capital. Because of its importance to people, this forest was a secure safe haven for maintaining a viable population of *S. v. nestor* over the long term. In this safe haven, our field investigations focused on discovering the plants that were important for *S. v. nestor*'s survival, so that they could be used in a reforestation initiative to expand the size of this monkey's habitat. This research ended in December 2010 and the publication that resulted (Rudran *et al*. 2013) will be submitted to the Forest Department of Sri Lanka with a request for permission to initiate a reforestation program. The Forest Department's permission is pending at this time, but other activities that were launched along with field research are described below.

Public education was essential because the most serious threat to *S. v. nestor*'s survival was extensive deforestation to satisfy human needs. Two programs were developed to promote conservation awareness among communities living around the study site. One focused on schoolchildren while the other was oriented towards educating an adult audience. A series of conservation-oriented lectures was presented to children attending primary, secondary and Sunday schools of different religions. Following these presentations, several competitions were organized to test the knowledge that the children had gained from the lectures. These competitions encouraged children to express their environmental knowledge and concerns in the form of essays, drawings, cartoons and poetry. Over 600 schoolchildren participated in these competitions, and a panel of teachers judged their entries. This was followed by a public exhibition where the efforts of all the school children were on display, and well-known local dignitaries and conservationists awarded prizes to the winners of competitions. Details of the exhibition were then publicized via the newspapers to ensure that the project's conservation efforts reached a larger national audience. The above program was initially conducted for schools around the study site. Due to its success however, it has been continued in schools away from the study site.

Nature walks complemented the classroom lectures and brought school children closer to nature. They were conducted along forest trails and around wetlands by the project staff armed with field guides and binoculars. Every time an interesting animal was seen the project staff identified it and explained its life history, habitat preference, and the role it plays in nature. The students also learned about plants of the forest and wetlands, and the role they play in nutrient cycling, soil enrichment,

purifying water, and mitigating soil erosion and climate change. Informal discussions held after nature walks indicated that students learned more during outdoor sessions than in a classroom situation. Hence nature walks have been conducted regularly as part of the children's education program.

Discussions with the community's adults revealed that they were less willing than children to accept the need to conserve natural resources. Their indifference resulted mainly from poverty and anxieties about catering to the basic survival needs of their families. Hence, a program that dealt solely with conserving natural resources did not seem like an effective way to educate the adults. Instead, it had to be built on a platform of activities that focused on people's survival needs. In order to develop this platform, we conducted a community survey and the activities identified by it are discussed below.

A community-needs survey included interviews with residents of 250 homes around the study site. About 48% of the adults felt that their most important need was employment opportunities. This was understandable because the socioeconomic survey conducted in 2009 indicated that nearly half of the adults in this community were unemployed, while another 18% relied on meager pensions or unpredictable daily paid jobs. With over two-thirds of the community leading a hand-to-mouth existence, job opportunities was the community's most important need. Improving health services was ranked the second most important need, and vocational training was ranked third.

A meeting held to discuss employment opportunities showed that most people preferred self-employment to private sector or government employment. During the ensuing discussions the community requested a home-gardening program to help generate additional income, and also address the nutritional requirements of cash-strapped households. In return for the project's support, participants of the home gardening initiative agreed to set aside a plot within their vegetable patch to plant native species exploited by *S. v. nestor* so that these plants could be later used in the reforestation program. Thus a mechanism was developed for the community's adults to be personally involved and take pride in promoting the conservation of an endangered folivore.

The home gardening project was launched during a workshop where outside experts demonstrated techniques for creating plant beds, composting, and organic methods of pest and disease control. After the workshop people who had already established plant beds were given seeds and seedlings of vegetable plants to start their home gardens. The others were given vegetable seeds after they established plant beds. Two of our staff also received training in livestock management, mushroom farming, and bee keeping so that they could promote these income-generating activities in the community.

A healthcare programme began with assistance from HelpAge, a non-governmental organization that is devoted to elder care. HelpAge conducts eye clinics to treat cataracts and provide spectacles free of charge for the elderly. Before commencing this activity the project staff identified about 100 villagers with visual impairments. HelpAge staff then examined these villagers and diagnosed ten of them with cataracts and provided the rest with spectacles to remedy their impaired vision. However, the cataract patients had to be transported to a hospital 50 km away for surgery. The fact that the project staff made all arrangements with doctors, hospital, a transport agency and food suppliers to make the surgery possible was greatly appreciated by the local community.

In order to empower the community's women, two workshops were held to provide training in patchwork-bag making. About ten trainees participated in the workshops, and some of them made and sold bags in the community for a reasonably attractive price. The project staff also contacted a well-known upscale sales outlet in Colombo to sell these bags to foreign tourists with a message explaining that the proceeds will go towards helping a community that is crucial for the conservation of *S. v. nestor*. Such messages were supposed to help expedite the sale of bags but marketing them has posed certain challenges to the community's bag makers.

The goodwill created by addressing community needs had a remarkable effect on the attitude of adults towards the project and its staff. These people finally began to realize that our project was interested in their welfare as much as it was interested in the future of this monkey, currently classified as Endangered (Dittus *et al*. 2008). Thus the people have become more receptive to the project's efforts to help promote the conservation of *S. v. nestor*. We expect this trend to continue as we strive to strengthen our bonds with the local community.

While the project strengthened its ties with local

communities another menace in the form of human-monkey conflicts began to cause serious concern. This problem has continued to intensify (Nahallage *et al.* 2008), and nearly 27% of the complaints (N = 371) received by the Department of Wildlife Conservation were about *S. v. nestor*, mainly from residents living around Colombo, the capital. Thus conserving this highly endangered endemic continues to pose challenges that must be addressed to prevent this animal from disappearing forever.

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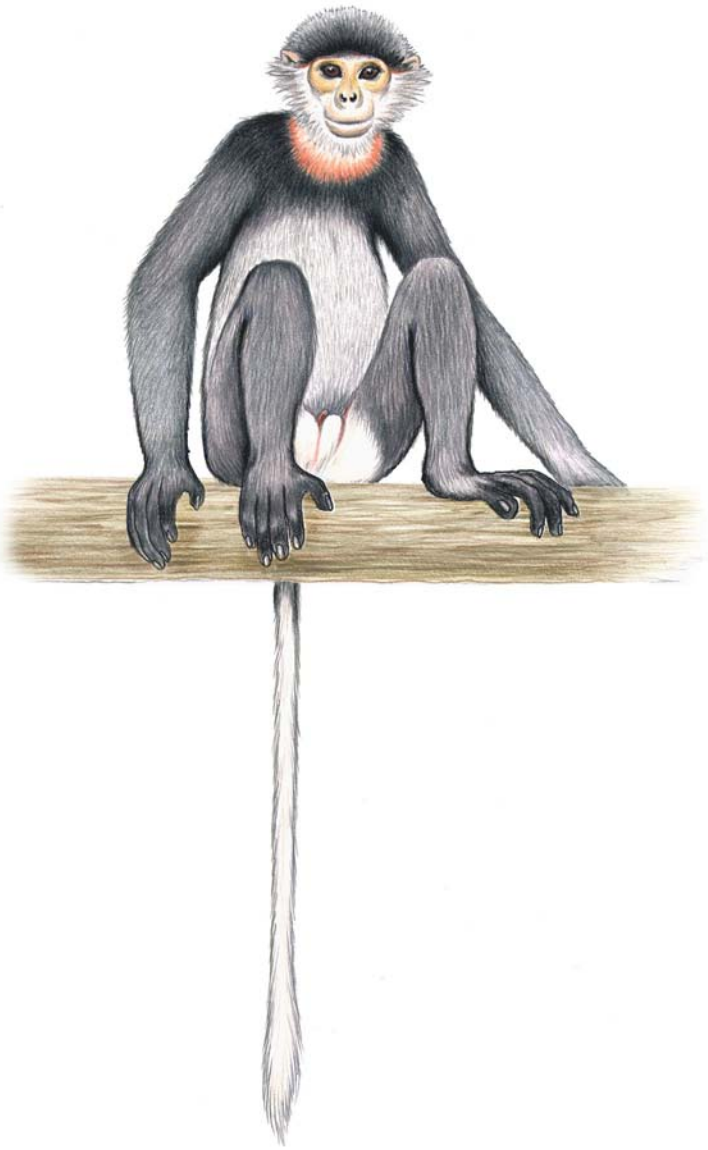
Gray-shanked Douc
Pygathrix cinerea Nadler, 1997
Vietnam
(2000, 2002, 2004, 2006, 2008, 2010, 2012)

Ha Thang Long & Tilo Nadler



Grey-shanked douc (*Pygathrix cinerea*)
(Illustration: Stephen D. Nash)

The colobine monkeys of the genus *Pygathrix* are native to Indochina. The Gray-shanked douc was first described in 1997 as a subspecies of the Red-shanked douc (Nadler 1997), but genetic and morphological studies have since demonstrated a divergence at species level (Roos and Nadler 2001; Roos *et al*. 2007; Stefen and Nadler 2012). It occurs in Central Vietnam between 13°30' and 16°N, and has been recorded in five provinces: Quang Nam, Quang Ngai, Kon Tum, Gia Lai and Binh Dinh (Ha Thang Long 2000, 2004; Nadler *et al*. 2003; Nguyen Thanh Tuan *et al*. 2010). Currently Gray-shanked doucs are known only from Vietnam, but photos of hunted animals from south-east Laos and genetic evidence of a Gray- and Red- shanked douc hybrid from far northeast Cambodia suggest that the species occurs also in very small areas in neighboring countries (Rawson 2010; Rawson and Roos 2008).

Surveys and research on the species in Vietnam have been conducted by the Frankfurt Zoological Society to gather information about its status, distribution and ecology. Gray-shanked douc populations are fragmented and estimated to total 600–700 individuals (Ha Thang Long, pers. obs.; Nadler 2010). Their occurrence has been confirmed in eight protected areas: Song Thanh Nature Reserve, Ngoc Linh Nature Reserve, Ba To Cultural and Historical Site, An Toan Nature Reserve, Kon Cha Rang Nature Reserve, Kon Ka Kinh National Park, Mom Ray National Park and A Yun Pa Nature Reserve. The largest known population occurs in Kon Ka Kinh National Park with 250–300 individuals (Ha Thang Long, pers. obs.).

Pygathrix cinerea is Critically Endangered (Ngoc Thanh 2008). Hunting is the principal threat to the species and is still a problem, particularly inside national parks and nature reserves. Snares are the most commonly used method of hunting, since gun confiscation programs have been carried out in a number of the areas. Often hundreds of traps are installed in trees frequently used by the douc langur groups, as well as on the ground where they are seen crossing between small forest patches. Trapped animals are often severely injured and mutilated. Forest loss in at least part of the species' range is attributable to the expansion of agriculture, illegal logging and firewood collection. Almost 10,000 ha of forest are destroyed every year in the Central Highlands.

Since 1995, the Endangered Primate Rescue Centre (EPRC) at Cuc Phuong National Park has received 68 Gray-shanked doucs confiscated from poachers and the illegal animal trade. The EPRC is the only facility which keeps this species. Despite intensive health care, approximately one-third of animals died during the days after arrival due to heavy injuries, digestion disorders, or extreme dehydration, despite intensive health care. Based on information from villagers and forest protection authorities, less than one-quarter of the hunted animals are confiscated alive. The captive breeding program at EPRC was started with the confiscated animals to provide stock for reintroduction, and 18 individuals have been born at the center. However, reintroduction can only start if hunting is eliminated.

Frankfurt Zoological Society carries out a long-term protection and monitoring project for the species in the Central Highlands of Vietnam to improve the protection of habitats and to identify possible reintroduction areas.

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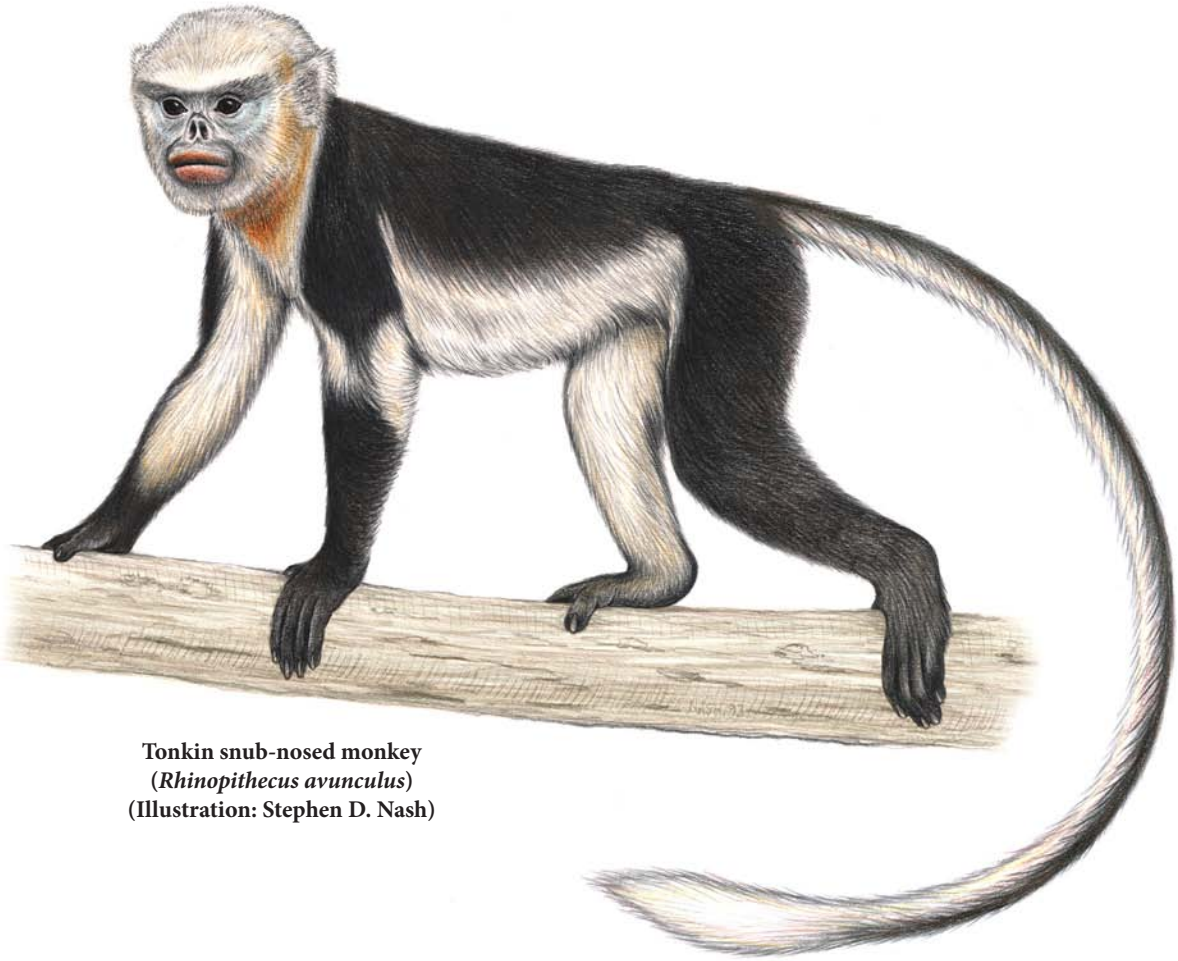
Tonkin Snub-nosed Monkey
Rhinopithecus avunculus Dollman, 1912
Vietnam
(2000, 2002, 2004, 2006, 2008, 2010, 2012)

Le Khac Quyet, Dong Thanh Hai & Tilo Nadler



Tonkin snub-nosed monkey (*Rhinopithecus avunculus*) (Illustration: Stephen D. Nash)

The Tonkin snub-nosed monkey is one of five unusual, large, Asian colobine monkeys of the genus *Rhinopithecus*, all of which have a characteristic turned-up nose. Three species are endemic to China and the newly discovered Burmese snub-nosed monkey, *R. strykeri*, is found in Myanmar and China. The Tonkin snub-nosed monkey is found only in northeastern Vietnam. *Rhinopithecus avunculus* was discovered in 1911, collected on perhaps no more than two occasions over the course of the subsequent 50 to 60 years, and consequently presumed to be extinct by a number of primatologists until it was rediscovered in 1989. Historically the species occurs only east of the Red River between about 21°09'-23°N. Due to widespread deforestation and intensive hunting in recent decades, its distribution has become severely restricted (Nadler *et al*. 2003).

Rhinopithecus avunculus is Critically Endangered (Le Xuan Canh *et al*. 2008). Recent evidence suggests there are only five known locations where Tonkin snub-nosed monkeys occur, and these are completely isolated. In 1992, a population was found in Na Hang-Chim Hoa region, Tuyen Quang Province. As a result of the discovery, Na Hang Nature Reserve was established in 1994 (Thach Mai Hoang 2011). The nature reserve comprises two separate areas: the Ban Bung and Tat Ke sectors. A study in 1993 estimated a population of between 95 and 130 individuals in each sector, respectively, which was probably an overestimation. The most recent field surveys in 2010 found and estimated only 5–10 individuals in the Tat Ke sector, and 13–16 individuals in Ban Bung sector. Hunting is still the main threat to the monkeys in the Na Hang Nature Reserve.

During surveys in 2010, local hunters, hunter shelters and gunshots were recorded commonly in both Tak Ke and Ban Bung Sectors. Conservation activities carried out by several organizations have been unsuccessful, and it has resulted in a reduction of this population (Thach Mai Hoang 2011).

A population of about 70 individuals was estimated for Cham Chu Nature Reserve in 2001, also in Tuyen Quang Province (Dong Thanh Hai *et al*. 2006). Based on interviews of local people during a survey that was reported in 1992, the population was believed to have dropped to only 20–40 individuals. A survey in 2006 provided no sightings and no reliable evidence of the survival of the population. Local reports indicate, however, a small group of 8–12 individuals still in the area. The current threats to the populations of the monkeys are hunting and habitat destruction. Conservation efforts should target reducing human activities inside the reserve.

A population of about 60 Tonkin snub-nosed monkeys was discovered in 2001 and a census in October 2013 confirmed 108–113 individuals in the Tonkin Snub-nosed Monkey Species/Habitat Conservation Area at Khau Ca, Ha Giang Province. This is the only population that is not immediately threatened. There, population and habitat monitoring, conservation education, public awareness and community participatory activities are being linked to increased protection efforts under the supervision of the University of Colorado Boulder, Fauna and Flora International (FFI), and Denver Zoo.

In 2007, a new population of about 20 Tonkin snub-nosed monkeys was discovered in a small forest patch in Tung Vai Commune of Quan Ba District close to the border with China (Le Khac Quyet and Covert 2010). This is the second population of Tonkin snub-nosed monkey discovered in Ha Giang Province. The newly discovered population at Tung Vai appears to be threatened by hunting and habitat loss due to timber exploitation, shifting cultivation and the collection of non-timber forest products for commercial purposes. The immediate conservation measures are likely to be training and establishing patrol groups, awareness-raising, more survey work to locate other groups and assessment of the range of the monkeys, and of the impact of cardamom production on the habitat.

The total population of the Tonkin snub-nosed monkey is believed to be less than 200 individuals.

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Cao Vit or Eastern Black-crested Gibbon

Nomascus nasutus (Kunkel d'Herculais, 1884)

China, Vietnam

(2008, 2010, 2012)

Long Yongcheng & Tilo Nadler

Cao Vit or Eastern black-crested gibbon (*Nomascus nasutus*). Male (left) and front and back views of female (center and right) (Illustrations: Stephen D. Nash)

The Eastern black-crested gibbon or Cao Vit gibbon (*Nomascus nasutus*) was rediscovered in 2002 (La Quang Trung *et al*. 2002; Nadler 2003; La Quang Trung and Trinh Ding Hoang 2004) after being considered extinct in the 1960s (Tan 1985; Geissmann *et al*. 2003). *Nomascus nasutus* was formerly believed to comprise two subspecies (*N. n. nasutus* and *N. n. hainanus*); the first occurring in Vietnam and the second on China's Hainan Island. The subspecies have since been elevated to full species status, based on genetic differences (Roos *et al*. 2007), also supported by vocalizations and fur colouration (Geissmann *et al*. 2000; Mootnick and Fan Pengfei 2011; Van Ngoc Thinh *et al*. 2010, 2011).

Historically, *N. nasutus* was widespread east of the Red River in northern Vietnam and southern China (Geissmann *et al*. 2003; Rawson *et al*. 2011). Early surveys recorded only a few groups along the Vietnamese-Chinese border (Geissmann *et al*. 2002, 2003; Trinh Dinh Hoang 2004; Chan Bosco Pui Lok 2008; Rawson *et al*. 2011). A first simultaneous trans-boundary census of the gibbon population in 2007 recorded 18 groups totalling approximately 110 individuals at the Chinese-Vietnam border at the Bangliang limestone forest in Jingxi County, Guangxi Province, China, and Phong Nam-Ngoc Khe Communes in the northernmost Trung Khanh District, Cao Bang Province, Vietnam (Le Trong Dat and Le Huu Oanh 2007).

Nomascus nasutus inhabits lower montane and limestone forests in a wet tropical monsoon climate at elevations of 500–900 m (Geissmann *et al*. 2000). The species is now known to occur in an extremely restricted area with only one surviving population in a small karst forest patch along the Chinese-Vietnam border. The area comprises only about 48 km², around 22°55'N/106°30'E, including the northern Phong Nam-Ngoc Khe forests (about 30 km²) of Trung Khanh District, Cao Bang Province, Vietnam (Rawson *et al*. 2011), and an immediately adjacent area (about 18 km²) in Jingxi County, Guangxi Zhuang Autonomous Region, China (Chan Bosco Pui Lok *et al*. 2008). A census in 2013 recorded 24 groups and 129 individuals, which represents an increase of the population by 17%

since 2007 (Nguyen The Cuong 2013). A population increase is also estimated for the groups on the Chinese side of the border (Fan Pengfei 2010).

Conservation efforts resulted in the designation of the "Cao Vit Gibbon Conservation Area" in Trung Khanh District, Vietnam, in 2007, and the Bangliang Nature Reserve, Jingxi County, China in 2009. Despite the establishment of protected areas there are still threats to this species through habitat loss and disturbance. The habitat is in danger of being cleared for cultivation, pasture for livestock, logging, firewood collection, and charcoal-production. The species is also Critically Endangered (Bleisch and Geissmann 2008) due to problems intrinsic to small populations such as inbreeding effects, genetic drift, poor mate-choice, and human or natural disasters. The latest study indicates that the gibbon population is approaching the carrying capacity of its current habitat and the carrying capacity has a significant impact on population dynamics (Fan Pengfei *et al.* 2013).

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Neotropics

Neotropical Primates

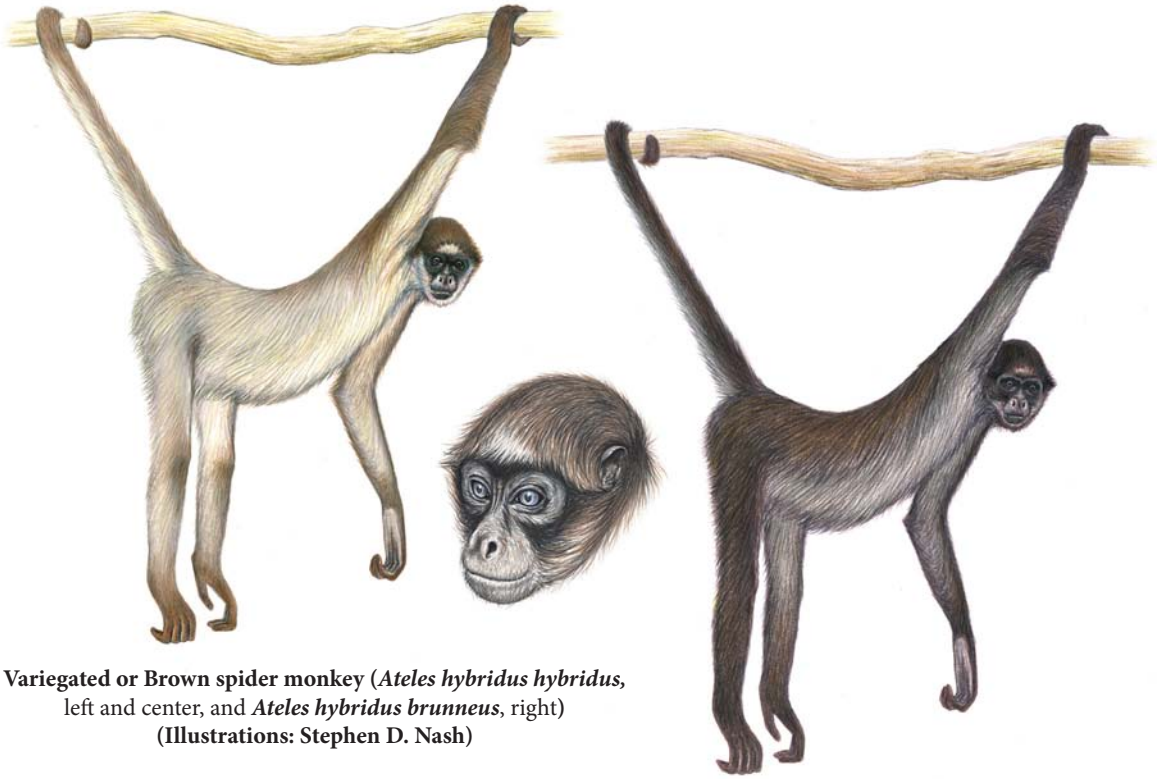
- *Alouatta guariba guariba*
- *Ateles fusciceps*
- *Ateles hybridus*
- *Callicebus oenanthe*
- *Cebus kaapori*

IUCN SSC PRIMATE Specialist Group

Variegated or Brown Spider Monkey

Ateles hybridus (I. Geoffroy Saint Hilaire, 1829)
Colombia, Venezuela
(2004, 2006, 2008, 2010, 2012)

Erwin Palacios, Alba Lucia Morales-Jiménez, Andrés Link & Bernardo Urbani



Variegated or Brown spider monkey (*Ateles hybridus hybridus,* left and center, and ***Ateles hybridus brunneus***, right)
(Illustrations: Stephen D. Nash)

There are two subspecies of the variegated or brown spider monkey. *Ateles hybridus brunneus* Gray, 1870, is restricted to Colombia, occurring between the lower ríos Cauca and Magdalena in the departments of Bolívar, Antioquia and Caldas. *Ateles h. hybridus* occurs east from the right bank of the Río Magdalena extending into western Venezuela. Both subspecies are Critically Endangered because of habitat loss, hunting and the pet trade (Morales-Jiménez *et al*. 2008a, 2008b).

The large size, slow reproductive rate (single offspring at 3-4 year intervals) and generally low population densities of spider monkeys make them especially vulnerable to hunting. Historically, *A. hybridus* has suffered from habitat destruction, and only 0.67% of the current remaining *A. hybridus* distribution is protected. Most of its range has been converted to farms for agriculture and cattle (Portillo-Quintero and Velásquez 2006).

Ateles h. brunneus has a small geographic range in a region where forest loss, degradation and fragmentation is widespread (Defler 2003). The remaining populations are surrounded by human populations, compounding the already high level of threat. Only 9% of their potential range remains as continuous forest, and legal and illegal mining as well as habitat destruction for large scale monoculture (e.g., oil palm) pose an imminent threat for the remaining populations. This subspecies has been seen recently in the lowland forests of eastern Antioquia, Caldas and Bolivar, although there are no protected areas in their current distribution. Potential refuges remain, however. The Serranía San Lucas, southern Bolívar, and some parts of Nechí have been identified as important areas for the creation of national parks. A protected area is highly necessary for this subspecies. It would include besides two other threatened endemic primates, the white-footed tamarin, *Saguinus leucopus*, and the woolly monkey, *Lagothrix lugens*.

Ateles h. hybridus is also extremely endangered due to habitat destruction in both Colombia and Venezuela. Habitat alteration appears to be the most important threat to brown spider monkeys across their current

range (Cordero-Rodríguez and Biord 2001). The forests of Magdalena river valley in Colombia, the Catatumbo area in Colombia, and the lowland forests in the state of Zulia and the piedmont of the Perijá Mountains in Venezuela are heavily destroyed because of expansionist cattle-ranching activities. In the Perijá Mountains only 30% of the forest is relatively well preserved and protected (Portillo-Quintero and Velásquez 2006). The rest is affected by rapid human expansion and land clearing, poor protection and increasing fragmentation, putting potential corridors at risk in most of its extent. Also in the Perijá Mountains, brown spider monkeys seem to be favoured game (Lizarralde 2002). In central Venezuela, some areas that had populations in 2001 were resurveyed in 2007 without any sightings; most of the areas are already covered by secondary vegetation (Cordero-Rodríguez and Biord 2001; Duque 2007). The lowland forest in the eastern part of the Andean Mountains at San Camilo, Ticoporo and Caparo, are extensively logged (Congdon 1996).

Ateles hybridus can be found in at least six zoos in Colombia, presenting problems of surplus animals and consanguinity. This species is suffering also from the pet trade; about 20 confiscated individuals are in residence in four rescue centers and need to be relocated. There is an urgent need for surveys to establish areas with populations of this species and to propose conservation measures. An *ex situ* breeding program is also necessary to maintain healthy and viable captive populations.

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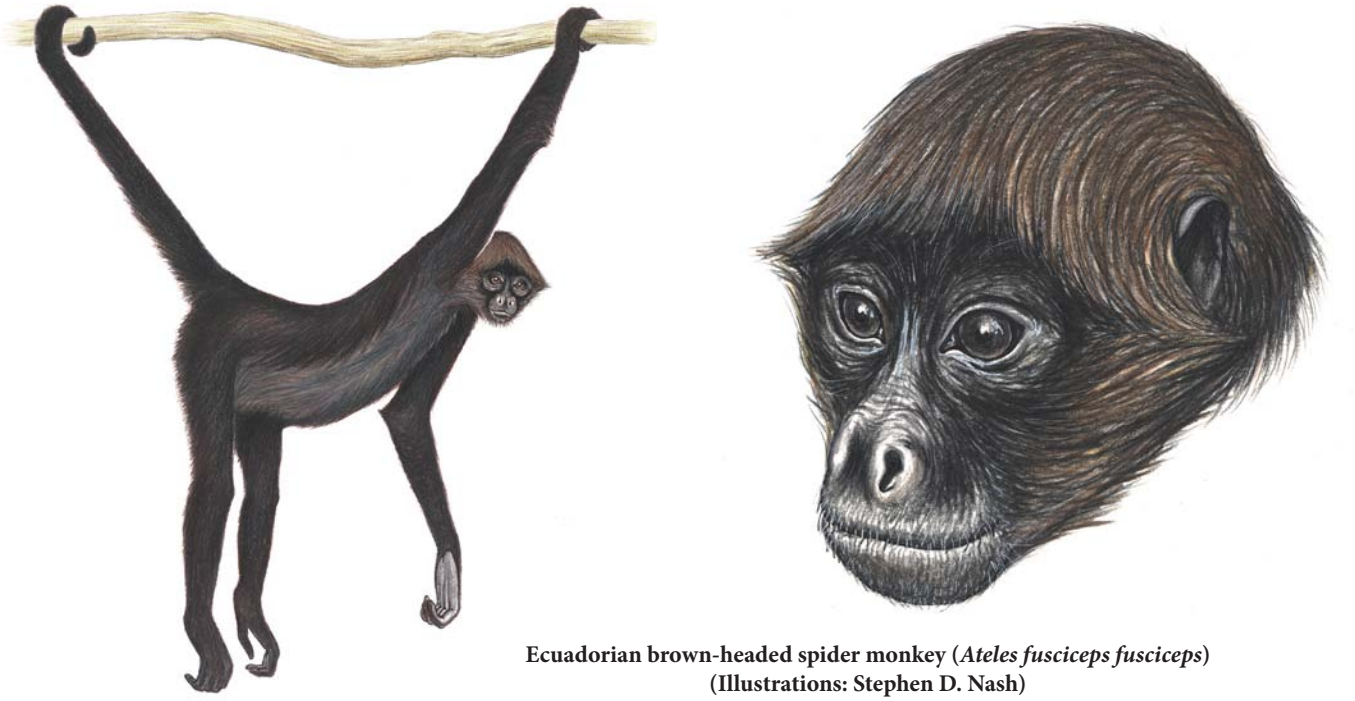
Ecuadorian Brown-headed Spider Monkey

Ateles fusciceps fusciceps Gray, 1866

Ecuador, Colombia

(2012)

Diego G. Tirira, Alba Lucia Morales-Jiménez & Paola Moscoso-R.



Ecuadorian brown-headed spider monkey (*Ateles fusciceps fusciceps*)
(Illustrations: Stephen D. Nash)

Ateles fusciceps lives in Central and South America, from southeast Panama to Ecuador, west of the Andes along the Chocó Eco-region. It is a diurnal species that inhabits mostly evergreen humid tropical and subtropical forests. It mainly inhabits large continuous forest patches in primary or secondary forest and prefers the highest levels of the canopy. The species lives in groups of up to 35 individuals. Its diet comprises mainly ripe fruits, although it supplements its diet with leaves, flowers, seeds, aerial roots, invertebrates, fungi, decaying wood, mud and termitaria. The subspecies *Ateles fusciceps fusciceps* inhabits the Pacific Coast of Ecuador and possibly southern Colombia, in an altitudinal range of 100 to 1,700 m above sea level.

This subspecies is classified as Critically Endangered on the IUCN Red list (Cuarón *et al*. 2008) and in the *Red Book of Mammals of Ecuador* (Peck 2011), because of its restricted distribution range and the small size of the natural populations. Extensive and ongoing deforestation and hunting are the main threats for the species in Ecuador; destruction of the humid tropical and subtropical rainforest in western Ecuador has surpassed 80% of its original area. Tirira (2004) presented information on the historical and current distribution of the subspecies, reporting several localities where it is locally extinct, including the type locality (Hacienda Chinipamba, west of Ibarra, Intag Valley, Imbabura Province), the whole central coast of Ecuador, and the surroundings of the ríos Cayapas, San Miguel, Ónzole and Santiago, in the Esmeraldas Province. Currently, the subspecies is concentrated in the interior part of Esmeraldas Province, and adjacent regions of Imbabura and Carchi Provinces, as well as a small portion of northwest Pichincha Province. Priority areas for its conservation are the Cotacachi-Cayapas Ecological Reserve and its area of influence (mainly within a private protected forest, Los Cedros Biological Reserve), Corredor Awacachi, the Awa Ethnic Forest Reserve, north of the Mira River and close to the Colombian border, and the buffer and surrounding areas of these reserves (Moscoso *et al*. 2011). Population density estimates in the buffer areas of the Cotacachi-Cayapas Ecological Reserve report are 0.2–8.5 individuals/km^2

(Gavilánez-Endara 2006; Cueva 2008, Estévez-Noboa 2009; Moscoso 2010). The presence of *Ateles fusciceps fusciceps* in Colombia is uncertain, but there is a record of *A. fusciceps* in Barbacoas, Nariño, that needs to be confirmed.

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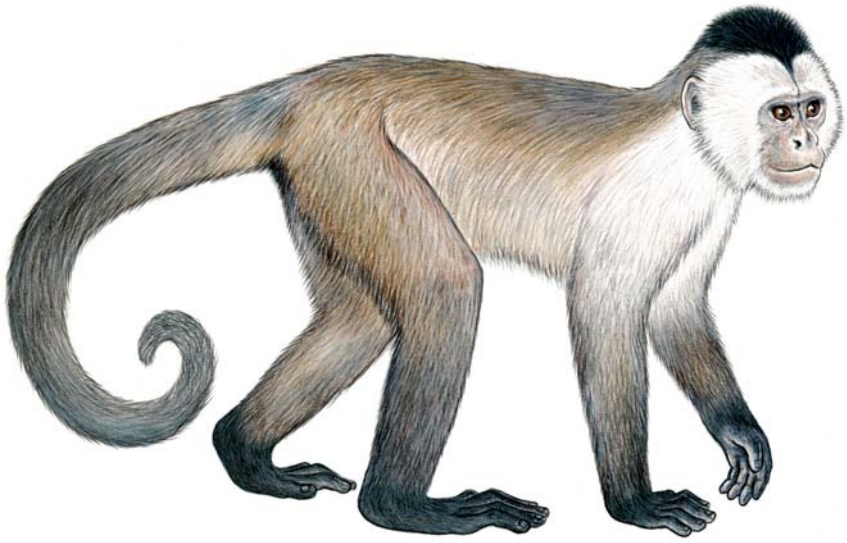
Ka'apor Capuchin
Cebus kaapori Queiroz, 1992
Brazil
(2012)

Fay Clark, Fabiano R. Melo & Maurício Talebi



Ka'apor capuchin (*Cebus kaapori*)
(Illustration: Stephen D. Nash)

The Ka'apor capuchin (*Cebus kaapori*), first described only recently, is found in northeast Brazil, in the state of Maranhão and the south of the state of Pará (Queiroz 1992). Its range extends from the east of the lower Rio Tocantins to the Rio Grajaú where it enters the Zona dos Cocais (Queiroz 1992; Ferrari and Queiroz 1994; Ferrari and Souza 1994; Silva and Cerqueira 1998; Carvalho *et al*. 1999; Cunha *et al*. 2007). It has been observed only in tall lowland terra firma forest, below 200 m above sea level, and has not been recorded in seasonally inundated forest or secondary forest (Rylands and Mittermeier 2013). The birth season is from June to July. This capuchin is generally seen in small groups of up to seven individuals, sometimes accompanying bearded sakis (*Chiropotes satanas*) (Ferrari and Lopes 1996; Carvalho *et al*. 1999; Rylands and Mittermeier 2013).

The precise range of *C. kaapori* is unknown, but is suspected to include an area of around 15,000 km² in the most densely populated region (Carvalho *et al*. 1999), with the highest level of deforestation and habitat degradation, in the entire Brazilian Amazon. More than 50% of the forest has been destroyed in the process of converting land to farmland and pasture (Carvalho *et al*. 1999). Deforestation continues, and most of the remaining forests now comprise isolated, usually hunted and degraded, patches on farmland. *Cebus kaapori* occurs in only two protected areas: the Gurupí Biological Reserve and the Lago de Tucuruí Environmental Protection Area. A large part of the forest of the Gurupí Biological Reserve has been logged and destroyed since its creation in 1988. Ferrari and Lopes (1996) estimated a density of 0.98 individuals/km² in this reserve. Another survey revealed a relative abundance of 0.99 groups/10 km in the Fazenda Cauaxi in Paragominas (Carvalho *et al.*, 1999). Lopes (1993) saw three groups in 480 km walked in the Gurupí Biological Reserve.

Due to the threats of habitat loss and hunting, and a drastic population reduction (more than 80% over the past three generations (48 years), *C. kaapori* is classified as Critically Endangered on the IUCN Red List (Kierulff and Oliveira 2008). Lopes and Ferrari (1993) and Ferrari and Queiroz (1994) concluded that *C. kaapori* is one of the most threatened of all the Amazonian primates. It would seem that the Ka'apor Capuchin is naturally rare; it is hunted and is susceptible to any, even light, disturbance or degradation of its habitat. For example, selective logging of trees providing fruit, which forms a significant part of the diet, is a considerable threat

for this species (Lopes 1993). Why it is so rare may be related to competition with the sympatric Guianan brown capuchin (*Sapajus apella*) and naturally low densities may reflect the need for large home ranges. *Cebus kaapori* is not found in any zoological institutions (M. Richardson, pers. comm.). Guajá Indians, however, keep them as pets (Queiroz 1992).

More recently, researchers from the National Research and Conservation Centre for Brazilian Primates (CPB) of the Chico Mendes Institute for Biodiversity Conservation (ICMBio), Ministry of the Environment, are inventorying primates that inhabit the "arch of deforestation" in the Brazilian Amazon, including *Cebus kaapori*. Partial results show that this species has a healthy population found in the Gurupí Biological Reserve (L. Jerusalinsky, pers. comm.).

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San Martín Titi Monkey
Callicebus oenanthe Thomas, 1924
Peru
(2012)

Jan Vermeer

San Martín titi monkey (*Callicebus oenanthe*)
(Illustrations: Stephen D. Nash)

The San Martín titi monkey was discovered in 1924, but until 2007 was only known from six museum specimens and scarce observations, all from the Alto Mayo Valley in northeastern Peru (Thomas 1924, 1927; Hershkovitz 1990; Mark 2003; Rowe and Martinez 2003; De Luycker 2006). Extensive surveys by the team of Proyecto Mono Tocón have shown that the distribution of the species extends from the Alto Mayo Valley in the south, restricted largely (but not completely) by mountains ranges in the west, south and north, and the Río Huallaga in the east (Boveda-Penalba *et al.* 2009). It inhabits the lowland forest on the eastern foothills of the Andes, rarely occurring at altitudes above 1,000 m above sea level.

Callicebus oenanthe is endemic to the department of San Martín, which has the highest deforestation rates in Peru. Although its original range was estimated to have been approximately 14,000 km², its habitat has been reduced to less than 6,500 km², of which only 1,900 km² is thought to be covered with good habitat (Shanee *et al.* 2013). Considering that the forest cover data used for this study were from 2007/2008 and the high deforestation rate in the lowlands, it is very likely that the situation is even worse today.

The San Martín titi monkey is highly variable in colouration (Boveda-Penalba *et al.* 2009, Vermeer *et al.* 2011). Most animals in the north are brownish with a white mask, while in the south many lack the typical mask and have a darker or more orange color (Proyecto Mono Tocón, unpubl. data).

Only small and isolated populations that are probably not viable have been encountered during extensive surveys in its range (Boveda-Penalba *et al.* 2009). Connecting isolated forest patches is mostly impossible due to human presence. The situation is even more complicated as the San Martín titi monkey seems to have a preference for the edges between primary and secondary forest, where human pressure is often very high (Proyecto Mono Tocón, unpubl. data). The species

can be found on the borders of some protected areas. Although a number of (relatively) small conservation concessions and private conservation areas have been created in the range of the San Martín titi monkey, only two may harbour viable populations. Unfortunately, most of its habitat is still unprotected, and is in danger of being destroyed for agriculture and logging.

The San Martín titi monkey is Critically Endangered (Veiga *et al*. 2011) as it is estimated that a population reduction of ≥80% has occurred over the last 25 years. The isolation of unviable populations in small forest patches increases the risk for the species. More support from national and regional governments and (international) conservation organizations is urgently needed to save this species from extinction.

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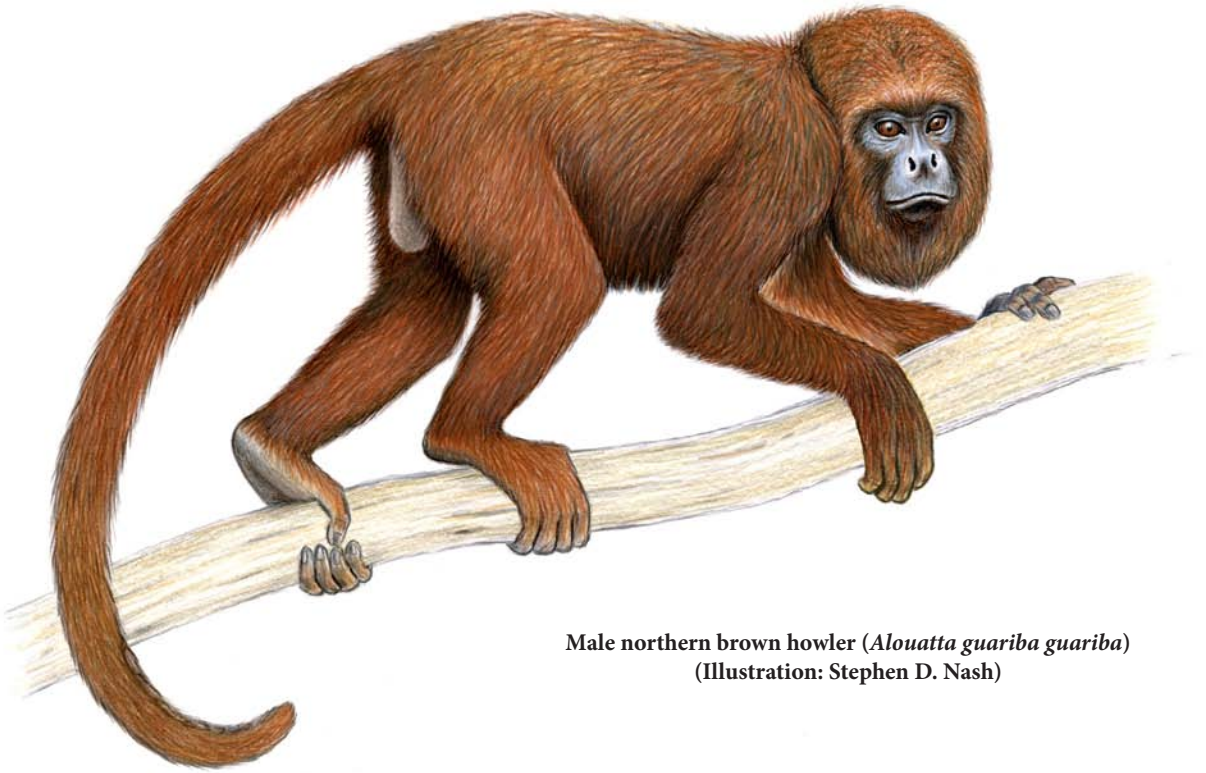
Northern Brown Howler Monkey
Alouatta guariba guariba (Humboldt, 1812)
Brazil
(2012)

Leonardo Gomes Neves, Fay E. Clark, Fabiano R. Melo, Anthony B. Rylands & Maurício Talebi



Male northern brown howler (*Alouatta guariba guariba*)
(Illustration: Stephen D. Nash)

The brown howler is separated into two subspecies, the northern brown howler, *Alouatta guariba guariba*, and southern brown howler, *A. g. clamitans* (Rylands *et al*. 2000; Groves 2001, 2005). Following a study of the morphology of the cranium and hyoid apparatus of the two forms, Gregorin (2006) considered them to be full species, using the name *A. fusca* (É. Geoffroy Saint-Hilaire, 1812) rather than *A. guariba* (Humboldt, 1812) for the northern form, following the recommendation of Hershkovitz (1963). Rylands and Brandon-Jones (1998; p.895) argued that the correct name is in fact *guariba*. Kinzey (1982) concluded that *A. g. guariba* occurred north of the Rio Doce; *clamitans* to the south. Rylands *et al*. (1988) observed what they believed to be *A. g. clamitans* further north, in the middle Jequitinhonha valley, and indicated that the Rio Jequitinhonha basin, not the Rio Doce, divided the two howlers. The extreme rarity of brown howlers north of the Jequitinhonha has confounded attempts to clarify the taxonomy. Only recently have few and minuscule populations been located in southern Bahia. Gregorin (2006) argued that the original range of the northern brown howler in fact extended from Bahia (Rio Paraguaçú) south along the coastal forest to the state of Rio de Janeiro (crossing as such the lower and middle Rio Doce), and that *clamitans*, the southern form, occurs inland north as far as the upper and middle Jequitinhonha. This would be compatible with the findings of Rylands *et al*. (1988) in the Jequitinhonha valley and, in this case, some of the populations surveyed by Chiarello (1999) may have been of the northern subspecies *A. g. guariba*. Here, we maintain the names and subspecific classification as used by Rylands *et al*. (2000), Groves (2001, 2005), and Glander (2013).

Both sexes of *A. g. guariba* are a red-fawn colour, the females being rather duller in colour. *Alouatta g. guariba* inhabits lowland, submontane and montane Brazilian Atlantic forest. It is a folivore-frugivore, including more fruit in its diet according to seasonal availability (Neville *et al*. 1988; Mendes 1989; Chiarello 1994; Glander 2013; Rylands and Mittermeier 2013). As such, brown howler monkeys are important seed dispersers for numerous plant species (Chiarello and Galetti 1994). While the

parent species *Alouatta guariba* is widely distributed and is classified as Least Concern on the IUCN Red List, *A. g. guariba* has a considerably more restricted range and is Critically Endangered (Mendes *et al*. 2008). The primary threats are widespread forest loss and fragmentation throughout its range, due to logging and agriculture (Horwich 1998), hunting (Melo 2005; Canale *et al*. 2012), and disease epidemics such as yellow fever brought from Africa (Holzmann *et al.* 2010).

An action plan for 27 threatened mammals of the Brazilian Atlantic Forest, including *A. g. guariba*, was drawn up in 2010 by the National Research and Conservation Centre for Brazilian Primates (CPB) of the Chico Mendes Institute for Biodiversity Conservation (ICMBio) (Brazil, MMA, ICMBio-CPB 2010). A conservation project for *A. g. guariba* is now ongoing as an immediate effect of this federal conservation public policy. Surveys carried out since 2012, by the Instituto de Estudos Sócioambientais do Sul da Bahia (IESB) and the State University of Santa Cruz (UESC) with the support of Conservation International and the Rainforest Trust, have attempted to locate and count surviving populations, understand better the threats to their survival, and establish the limits to its geographic distribution. To date, eight populations in small and widely separated forest patches have been found: 1) Itajú de Colônia – two groups and one individual seen; 2) Itarantim – two groups heard; 3) Caatiba – three groups totalling nine individuals; 4) Itapetinga – two groups heard; 5) Macarani – one group, one individual seen; 6) Ribeirão Largo – one group heard; 7) Pouso Alegre – one group, two individuals seen; and 8) Itambé – two groups heard (L. G. Neves, unpubl. data). The surveys indicate that most of the surviving populations are those in the valleys of the Rio Pardo and Rio Jequitinhonha. Further north, in the cacao-growing region of southern Bahia, they have been largely hunted out.

There are a number of protected areas in the northern brown howlers range in Bahia and northeastern Minas Gerais, all created since 1980. They have been reported in the Mata Escura Biological Reserve (51.046 ha, created in 2003), just north of the middle Rio Jequitinhonha (Melo 2005). Adding the locations in the lower reaches of Jequitinhonha basin reported by Rylands *et al*. (1988), the known population today is unlikely to number more than 250 mature individuals, and no subpopulation is believed to exceed 50 mature individuals. Howlers have not been seen further north in the Una Biological Reserve (18,500 ha, created in 1980) for more than 60 years. It is not known if they still occur in the submontane and montane forest of the Serra das Lontras National Park (11,336 ha, created in 2010). Future surveys will target protected areas and the limits of their supposed range—the Rio Paraguaçú in the north to the Río Doce in the south, and protected areas in southern Bahia.

Hunting has resulted in the surviving populations being very small and isolated and a metapopulation management plan for the future will need to incorporate translocation of threatened populations. A promising initiative underway at the Serra Bonita Private Reserve, Camacan, Bahia, owned by Vitor Becker, and managed by the NGO Instituto Uiraçú, is the successful release, with the collaboration of ICMBio, of two confiscated pets—an incipient reintroduction of the species that has not been seen or heard there for more than 50 years.

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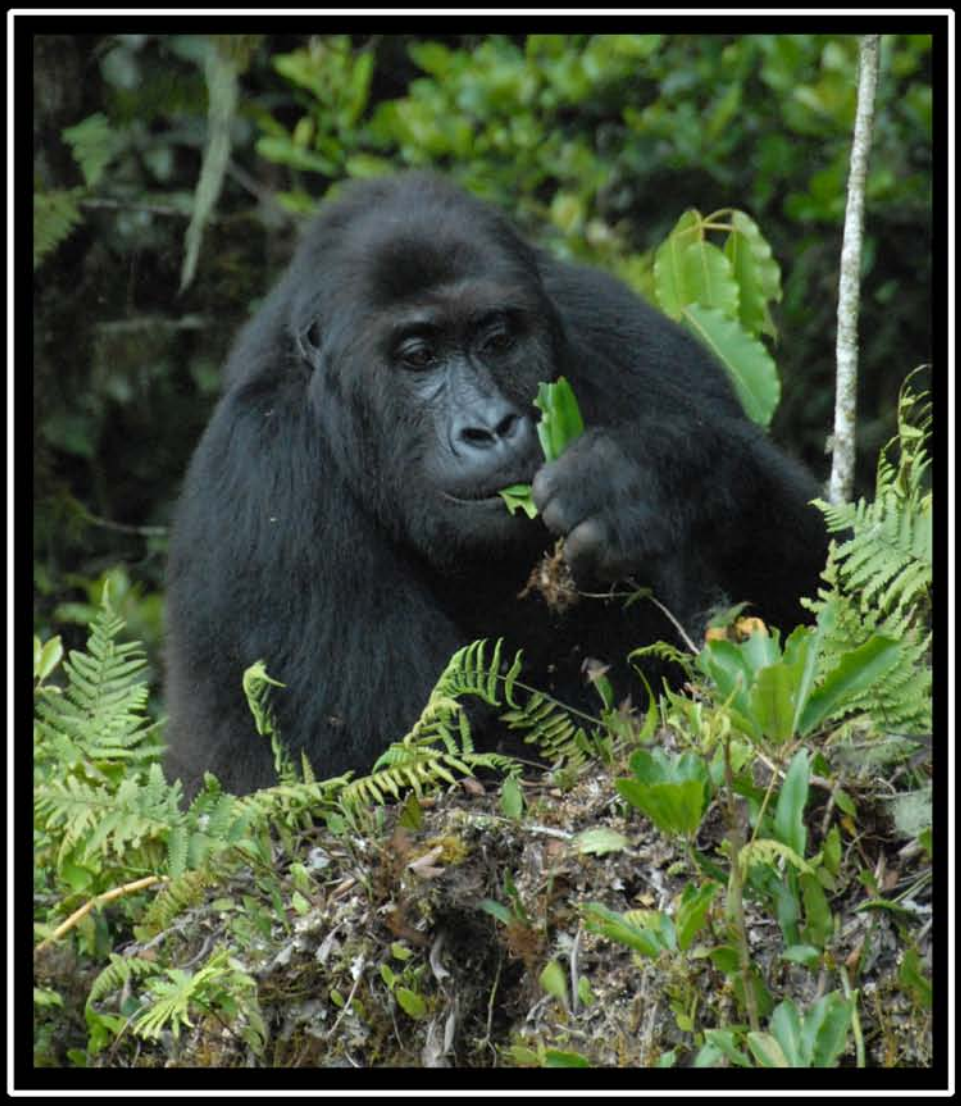

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