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Primates in Peril: The World's 25 Most Endangered Primates 2008–2010

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Illustrations by Stephen D. Nash

Introduction

Here we report on the fifth iteration of the biennial listing of a consensus of 25 primate species considered to be amongst the most endangered worldwide and the most in need of urgent conservation measures. The first was drawn up in 2000 by the IUCN/SSC Primate Specialist Group, together with Conservation International (Mittermeier *et al.* 2000). The list was subsequently reviewed and updated in 2002 during an open meeting held during the 19th Congress of the International Primatological Society (IPS) in Beijing, China (Mittermeier *et al*. 2002). That occasion provided for debate among primatologists working in the field who had first-hand knowledge of the causes of threats to primates, both in general and in particular with the species or communities they study. The meeting and the review of the list of the World's 25 Most Endangered Primates resulted in its official endorsement by the IPS, and became as such a combined endeavor of the Primate Specialist Group, the IPS, and Conservation International. A third revision was carried out at a meeting in August 2004, at the 20th Congress of the IPS in Torino, Italy (Mittermeier *et al*. 2006). The fourth, covering the biennium 2006–2008, was the result of a meeting held during the 21st Congress of the International Primatological Society (IPS), in Entebbe, Uganda, 26–30 June 2006 (Mittermeier *et al.* 2007).

The list of the world's 25 most endangered primates for the biennium 2008–2010 was drawn up at an open meeting held during the 22nd Congress of the International Primatological Society, Edinburgh, UK, 3–8 August 2008. Our most sincere thanks to the organizers of the congress: Paul Honess (University of Oxford), Phyllis Lee (Stirling University), Hannah Buchanan-Smith (Stirling University), Ann Maclarnon (Roehampton University), and William Sellers (Manchester University).

As was the case for the 2004–2006 report, the texts for each species — reporting on their conservation status and threats — have counted on the extraordinary collaboration and expertise of those who know most about them; 85 contributors in all. We are most grateful for their time and dedication. Their contributions guarantee the authority of this report in describing the reasons why these primates are

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in such danger, and we hope it will be effective in drawing attention to the plight of each and in garnering support for the appropriate concern and action by those who can contribute to saving them.

Mittermeier, R. A., W. R. Konstant and A. B. Rylands. 2000. The world's top 25 most endangered primates. *Neotropical Primates* 8(1): 49.

Mittermeier, R. A., W. R. Konstant, A. B. Rylands, T. M. Butynski, A. A. Eudey, J. U. Ganzhorn and R. Kormos. 2002. The world's top 25 most endangered primates–2002. *Neotropical Primates* 10(3): 128–131. Reprinted in *Lemur News* (8): 6–9.

Mittermeier, R. A., C. Valladares-Pádua, A. B. Rylands, A. A. Eudey, T. M. Butynski, J. U. Ganzhorn, R. Kormos, J. M. Aguiar and S. Walker (eds.). 2006. Primates in peril: the world's 25 most endangered primates 2004–2006. *Primate Conservation* (20): 1–28.

Mittermeier, R. A., J. Ratsimbazafy, A. B. Rylands, E. A. Williamson, J. F. Oates, D. Mbora, J. U. Ganzhorn, E. Rodríguez-Luna, E. Palacios, E. W. Heymann, M. C. M. Kierulff, Long Yongcheng, J. Supriatna, C. Roos, S. Walker and J. M. Aguiar. 2007. Primates in peril: the world's 25 most endangered primates 2006–2008. *Primate Conservation* (22): 1–40.

The World's 25 Most Endangered Primates: 2008–2010

The 2008–2010 list of the world's 25 most endangered primates has five species from Madagascar, six from Africa, 11 from Asia, and three from the Neotropics—five lemurs, a galago and the recently described kipunji from Tanzania, two red colobus monkeys, the roloway monkey, a tarsier, a slow loris from Java, four langurs (the pig-tailed langur from Indonesia, two so-called karst species from Vietnam, and the purple-faced langur from Sri Lanka), the Tonkin snub-nosed langur and the gray-shanked douc, both from Vietnam, the cotton-top tamarin and the variegated spider monkey from Colombia (the latter also from Venezuela), the Peruvian yellow-tailed woolly monkey, two gibbons (one from China/Vietnam, the other from India, Bangladesh and Myanmar) and two of the great apes (the Sumatran orangutan and the Cross River gorilla from Nigeria and Cameroon).

The changes in the list compared to the previous one of 2006–2008 (see Tables 3 and 4) were not because the situation of the six species dropped has improved; unfortunately, far from it. Most of the changes were made so as to highlight other closely related species, which are also in dire straits regarding prospects for their future survival.

Lepilemur sahamalazensis was replaced by *Lepilemur septentrionalis*. Both are from the northernmost parts of Madagascar, both have minute populations in tiny, tiny geographic ranges, and both suffer from hunting pressure and habitat loss.

Table 1. The World's 25 Most Endangered Primates 2008–2010.

Madagascar		
Prolemur simus	Greater bamboo lemur	Madagascar
Eulemur cinereiceps	Gray-headed lemur	Madagascar
Eulemur flavifrons	Sclater's lemur	Madagascar
Lepilemur septentrionalis	Northern sportive lemur	Madagascar
Propithecus candidus	Silky sifaka	Madagascar
Africa		
Galagoides rondoensis	Rondo dwarf galago	Tanzania
Cercopithecus diana roloway	Roloway monkey	Côte d'Ivoire, Ghana
Procolobus rufomitratus	Tana River red colobus	Kenya
Procolobus epieni	Niger Delta red colobus	Nigeria
Rungwecebus kipunji	Kipunji	Tanzania
Gorilla gorilla diehli	Cross River gorilla	Cameroon, Nigeria
Asia		
Tarsius tumpara	Siau Island tarsier	Indonesia (Siau Is.)
Nycticebus javanicus	Javan slow loris	Indonesia (Java)
Simias concolor	Pig-tailed langur	Indonesia (Mentawai Is.)
Trachypithecus delacouri	Delacour's langur	Vietnam
Trachypithecus p. poliocephalus	Golden-headed or Cat Ba Langur	Vietnam
Semnopithecus vetulus nestor	Western purple-faced langur	Sri Lanka
Pygathrix cinerea	Gray-shanked douc	Vietnam
Rhinopithecus avunculus	Tonkin snub-nosed monkey	Vietnam
Nomascus nasutus	Cao Vit or eastern black-crested gibbon	China, Vietnam
Hoolock hoolock	Western hoolock gibbon	Bangladesh, India, Myanmar
Pongo abelii	Sumatran orangutan	Indonesia (Sumatra)
Neotropics		
Saguinus oedipus	Cotton-top tamarin	Colombia
Ateles hybridus	Variegated spider monkey	Colombia, Venezuela
Oreonax flavicauda	Peruvian yellow-tailed woolly monkey	Peru

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Loris tardigradus nycticeboides from Sri Lanka (2004 and 2006) was replaced by the Javan slow loris, representing a crisis threatening all the Asian lorises. The massive and crushing trade in them for pets and for commerce in traditional medicines, compounded by widepread forest loss, is causing their rapid decline. The Javan slow loris, representing the plight of all, is evidently the hardest hit of any of the lorisiformes in this respect.

The 2008 IUCN Red List of Threatened Species recognizes 19 red colobus monkeys (*Procolobus*). Five were Not Evaluated (NE), two were ranked as Near Threatened (NT), seven were ranked as Endangered (EN), and three were ranked as Critically Endangered (CR). Only one of the red colobus monkeys, *Proclobus rufomitratus oustaleti*, from Central Africa, north of the River Congo, was ranked as of Least Concern (LC). These colobus monkeys are particularly susceptible to hunting—the widespread and insidious bushmeat trade—and also suffer from forest loss and fragmentation. Four red colobus monkeys have been listed over the five iterations of this list since 2000: *Procolobus badius waldroni*, *Procolobus p. pennantii* and *Procolobus epieni*, from the widely destroyed, fragmented and hunted forests of West Africa, and *Procolobus r. rufomitratus* from the few small gallery forest patches remaining along the Tana River in Kenya. The Tana River red colobus has been on the list since 2002. The Niger Delta red colobus, first discovered only in 1993, was placed on the list in this biennium 2008–2010 because its range is very small, it suffers from bushmeat hunting, and there is widespread degradation of the Niger Delta's forests; there is every reason to suspect that its numbers are declining.

The Hainan gibbon, *Nomascus hainanus*, was taken off the list, despite the fact the world population of this species numbers less than 20 individuals. Considerable efforts are now underway to protect this species. The closely related eastern black crested gibbon, however, is also extremely threatened. It occurs in a very small region on the Vietnam/China border and numbers are estimated at around 100 in just 18 groups. The remaining few forest patches where it still survives are being destroyed (charcoal, firewood, and clearance for agriculture and pasture).

Table 2. The world's 25 most endangered primates 2008–2010 are spread through 17 countries. Those which stand out are Madagascar (five species), Vietnam (five species), and Indonesia (four species).

Madagascar	
Madagascar	*Prolemur simus, Eulemur cinereiceps, Eulemur flavifrons, Lepilemur septentrionalis, Propithecus candidus*
Africa	
Cameroon	*Gorilla gorilla diehli*
Côte d'Ivoire	*Cercopithecus diana roloway*
Ghana	*Cercopithecus diana roloway*
Kenya	*Procolobus rufomitratus*
Nigeria	*Procolobus epieni, Gorilla gorilla diehli*
Tanzania	*Galagoides rondoensis, Rungwecebus kipunji*
Asia	
Bangladesh	*Hoolock hoolock*
China	*Nomascus nasutus*
India	*Hoolock hoolock*
Indonesia	*Tarsius tumpara, Nycticebus javanicus, Simias concolor, Pongo abelii*
Myanmar	*Hoolock hoolock*
Sri Lanka	*Semnopithecus vetulus nestor*
Vietnam	*Trachypithecus delacouri, Trachypithecus p. poliocephalus, Pygathrix cinerea, Rhinopithecus avunculus, Nomascus nasutus*
Neotropical Region	
Colombia	*Saguinus oedipus, Ateles hybridus*
Venezuela	*Ateles hybridus*
Peru	*Oreonax flavicauda*

Table 3. The following primates included on the 2006–2008 list were removed from the 2008–2010 list.

Madagascar	
Lepilemur sahamalazensis	Sahamalaza sportive lemur
Africa	
Procolobus pennantii pennantii	Pennant's red colobus
Procolobus badius waldroni	Waldron's red colobus
Asia	
Loris tardigradus nycticeboides	Horton Plains slender loris
Nomascus hainanus	Hainan gibbon
Neotropics	
Ateles fusciceps	Brown-headed spider monkey

Table 4. The following six primates were placed on the list for the first time.

Madagascar	
Eulemur flavifrons	Sclater's lemur
Lepilemur septentrionalis	Northern sportive lemur
Africa	
Procolobus epieni	Niger Delta red colobus
Asia	
Nycticebus javanicus	Javan slow loris
Nomascus nasutus	Cao Vit crested gibbon
Neotropical Region	
Saguinus oedipus	Cotton-top tamarin

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Of the two remaining species on the list for the first time, one was at the expense of one of the three red colobus monkeys, and the other at the expense of the Ecuadorean spider monkey, *Ateles fusciceps*, both on the 2006–2008 list. The loss of *A. fusciceps* of the Chocó region of Ecuador was due to the lack of a spokesperson on its behalf. The addition of the cotton-top tamarin, *Saguinus oedipus*, endemic to northern Colombia, was due to a recent distribution-wide survey of the species that had revealed a highly fragmented and severely diminished population, with even the few small protected areas where it occurs suffering extensive forest loss. Sclater's lemur, *Eulemur flavifrons*, is one of the least-studied of all *Eulemur* species. The single population that occurs on the Sahamalaza Peninsula of Madagascar is undergoing a very rapid decline because of hunting and trapping and the destruction of its forests due to slash-and-burn agriculture and selective logging.

New Species

Five of the world's 25 most endangered primates are species only recently described: the Rondo dwarf galago (*Galagoides rondoensis*) by Paul Honess in Kingdon (1997); the gray-shanked douc (*Pygathrix cinerea*) by Tilo Nadler in 1997; the Niger Delta red colobus (*Procolobus epieni*) by Peter Grubb and C. Bruce Powell in 1999; the kipunji (*Rungwecebus kipunji*) by Carolyn Ehardt and colleagues in Jones *et al.* (2005); and the Siau Island tarsier (*Tarsius tumpara*) that was first described by Myron Shekelle and colleagues in 2008. Eighty-six primates—species and subspecies—have been described since 1990; 47 from Madagascar, 10 from Africa, 11 from Asia, and 17 from the Neotropics (statistic current 25 July 2009). Fifty-four of the primates described since 1990 are prosimians, and 32 are monkeys. Many of these new primates have very restricted distributions (one of the reasons they were not discovered sooner) and some are known only from their type localities. With more information becoming available it is possible to predict that many will be future candidates for this list.

Grubb, P. and C. B. Powell. 1999. Discovery of red colobus monkeys (*Procolobus badius*) in the Niger Delta with the description of a new and geographically isolated subspecies. *Journal of Zoology, London* 248: 67–73.

Jones, T., C. L. Ehardt, T. M. Butynski, T. R. B. Davenport, N. E. Mpunga, S. J. Machaga and D. W. De Luca. 2005. The highland mangabey *Lophocebus kipunji*: A new species of African monkey. *Science* 308: 1161–1164.

Kingdon, J. 1997. *The Kingdon Field Guide to African Mammals*. Academic Press, San Diego.

Nadler, T. von. 1997. A new subspecies of douc langur, *Pygathrix nemaeus cinereus* ssp. nov. *Zool. Garten N. Z.* 67(4): 165–176.

Shekelle, M., C. P. Groves, S. Merker and J. Supriatna. 2008. *Tarsius tumpara*: A new tarsier species from Siau Island, North Sulawesi. *Primate Conservation* (23): 55–64.

Threats

The 2008 IUCN Red List of Threatened Species assessed the status of 634 primate taxa. Of these, 303 (47.8%) were ranked as threatened (Vulnerable, Endangered or Critically Endangered); 37% of the African primates, 43% of the lemurs, 71% of the Asian primates, and 40% of the Neotropical primates.

Nearly half of all the world's primates are threatened; principally due to habitat loss and hunting. In the face of habitat degradation and loss, factors which determine more precisely the status of each primate taxon include the following: the size of the geographic range of the taxon (extent of occurrence), the area actually occupied by the taxon (area of occupancy), the pattern of habitat loss (fragmentation, including fragment size and degree of fragment isolation), the extent and form of habitat degradation (for example, intensive logging, light selective logging, agroforestry, firewood collection, exploitation of non-timber products, understorey damage by cattle, and edge effects depending on fragment size), and the intrinsic resilience of the taxon to fragmentation and degradation. Hunting, of course, can vary in intensity (occasional, subsistence, for local, regional or international commerce [bushmeat]) and purpose (for food, traditional medicine, talismans and potions, for bait, pets or for biomedical research). Susceptibility to hunting pressure will depend on demographic (life history) variables, on overall population size and the geographic patterns of populations (some protected by remoteness, the degree to which populations are connected [sources and sinks]), and the ease with which they can be hunted (group size and habits, and accessibility, for example).

The depredations of hunting and habitat destruction on the populations of each primate taxon are behind the two principal parameters that result in them being placed on this list of the world's 25 most endangered primates—very, very small population sizes and very rapid declines in numbers. Of the 206 primates on the 2008 IUCN Red List that are classified as Critically Endangered or Endangered, fifty-four (26%) have at some time been placed on the world's 25 most endangered list. Seven of them have been on all five of the lists since 2000: the silky sifaka (*Propithecus candidus*), four Asian colobines—Delacour's langur (*Trachypithecus delacouri*), the Cat Ba langur (*T. p. poliocephalus*), the gray-shanked douc (*Pygathrix cinerea*), and the Tonkin snub-nosed monkey (*Rhinopithecus avunculus*)—the Cross River gorilla (*Gorilla gorilla diehli*), and the Sumatran orangutan (*Pongo abelii*) (Table 6).

Table 5 provides a summary of the threats to each of the world's 25 most endangered primates 2008–2010 as identified in the species profiles in this report.

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Table 5. Threats to the world's 25 most endangered primates 2008–2010 as given in the species' profiles in this report.

	Estimated population size	Threats
Madagascar		
Prolemur simus	Not more than 100–160	Small isolated populations, slash-and-burn agriculture, mining, illegal logging, the cutting of bamboo, hunting with slingshots, reduced availability of drinking water due to climatic change. Intrinsic: extreme dietary specialization and dependency on giant bamboo.
Eulemur cinereiceps	7,265 ± 2,268	Very small range (*c.* 700 km²), hybridization with *E. rufifrons*, low population densities, fragmented populations (small population effects, including parasitosis), cyclones, deforestation, hunting.
Eulemur flavifrons	450–2,300	Very small range (*c.* 2,700 km²), forest loss, (slash-and-burn agriculture, selective logging), hunting and trapping and live capture for pet trade.
Lepilemur septentrionalis	Less than 100	Very small range, tree-felling for charcoal, hunting.
Propithecus candidus	100–1,000	Very small range, hunting, forest loss (slash-and-burn agriculture, selective logging, firewood).
Africa		
Galagoides rondoensis	-	Very small and fragmented range in remnant forest patches, loss of habitat (agricultural encroachment, charcoal production, logging).
Cercopithecus diana roloway	-	Hunting (bushmeat trade), forest loss, fragmented populations (numerous documented local extinctions).
Procolobus rufomitratus	Less than 1,000	Very small and fragmented range, forest loss (agricultural encroachment, selective logging for local use [houses, canoes]), exploitation of nontimber products, parasitosis of isolated populations.
Procolobus epieni	-	Very small range (*c.* 1,500 km²), habitat degradation, bushmeat hunting, logging (important food trees for the species), change in hydrological regime of marsh forest due to construction of canals.
Rungwecebus kipunji	*c.* 1,117	Very small and fragmented range (area of occupancy *c.* 12.8 km²), forest loss, hunting.
Gorilla gorilla diehli	200–300	Restricted range, agricultural encroachment, fires to clear forest or improve pasture, development activities (roads), hunting, wire snares set for other wildlife.
Asia		
Tarsius tumpara	Low thousands at best	Island population (active volcano), very small range (area of occupancy *c.* 19.4 km²), high human density, hunting for snack food, habitat degradation.
Nycticebus javanicus	-	Massive trade (traditional medicine and pets), forest loss (agriculture), roads, human disturbance.
Simias concolor	*c.*3,347	Island population, forest loss (human encroachment, product extraction, commercial logging, conversion to cash crops and oil palm plantations), hunting.
Trachypithecus delacouri	Less than 320	Restricted range (400–450 km²), fragmented populations (60% occur in isolated populations of less then 20 animals), hunting (primarily for trade in bones, organs and tissues used in traditional medicine).
Trachypithecus p. poliocephalus	60–70	Island population (karst island of 140 km²), seven isolated subpopulations, hunting (primarily for trade in bones, organs and tissues used in traditional medicine).
Semnopithecus vetulus nestor	-	Forest loss, more than 90% of forest in its range has been lost or fragmented (urbanization and agriculture), dependant on gardens for survival, electrocution (power lines), road kill, dogs, occasional hunting (for pet trade or persecution for crop-raiding).
Pygathrix cinerea	600–700	Restricted range and fragmented population, forest loss (agriculture logging, firewood), hunting, including use of snares.
Rhinopithecus avunculus	No more than 200	Restricted range and fragmented population (five isolated localities), forest loss (logging, shifting cultivation), hunting, dam construction (habitat loss and influx of thousands of people, increasing hunting pressure).
Nomascus nasutus	*c.* 110	Very small range (*c.* 48 km²), habitat loss and disturbance (cultivation, pasture, firewood, charcoal production), fragmented populations (small population effects).
Hoolock hoolock	Less than 5,000	Recent very rapid declines in numbers, very fragmented populations (small population effects), forest loss (human encroachment, tea plantations, slash-and-burn cultivation), hunting for food and medicine, and capture for trade.
Pongo abelii	*c.* 6,600	Recent very rapid declines in numbers, restricted and fragmented range (10 fragmented habitat units), habitat conversion and fragmentation (fires, agriculture and oil palm plantations, roads, logging, encroachment), occasional killing as pests or for food, occasional pets.
Neotropics		
Saguinus oedipus	Less than 6,000	Forest loss and fragmentation (large-scale agricultural production [cattle] and farming, logging, oil palm plantations, hydroelectric projects), pet trade, capture for biomedical research (past).
Ateles hybridus	-	Restricted ranges of two subspecies, low population densities, forest loss and fragmentation (agriculture, cattle-ranching), hunting, pet trade.
Oreonax flavicauda	-	Restricted range, low populaion densities in tall premontane, montane and cloud forest, forest loss (agriculture, logging, roads, colonization), hunting (food, pets, fur).

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Table 6. The following table shows the five lists produced to date. The seven species shaded are those which have remained on the list since 2000.

2000	2002	2004	2006	2008
Madagascar				
Hapalemur aureus				
Hapalemur griseus alaotrensis				
	Hapalemur simus	*Prolemur simus*	*Prolemur simus*	*Prolemur simus*
		Eulemur albocollaris	*Eulemur albocollaris*	*Eulemur cinereiceps*
				Eulemur flavifrons
			Lepilemur sahamalazensis	
				Lepilemur septentrionalis
Propithecus perrieri	*Propithecus perrieri*	*Propithecus perrieri*		
Propithecus candidus	*Propithecus candidus*	*Propithecus candidus*	*Propithecus candidus*	*Propithecus candidus*
Propithecus tattersalli				
Africa				
		Galagoides sp. (Mt. Rungwe galago)		
			Galagoides rondoensis	*Galagoides rondoensis*
	Cercopithecus diana roloway		*Cercopithecus diana roloway*	*Cercopithecus diana roloway*
Cercopithecus sclateri				
Mandrillus leucophaeus				
	Cercocebus galeritus galeritus			
Cercocebus galeritus sanjei	*Cercocebus galeritus sanjei*	*Cercocebus sanjei*		
Cercocebus atys lunulatus	*Cercocebus atys lunulatus*	*Cercocebus atys lunulatus*		
			Rungwecebus kipunji	*Rungwecebus kipunji*
Procolobus badius waldroni	*Procolobus badius waldroni*		*Procolobus badius waldroni*	
		Procolobus p. pennantii	*Procolobus p. pennantii*	
				Procolobus epieni
	Procolobus rufomitratus	*Procolobus rufomitratus*	*Procolobus rufomitratus*	*Procolobus r. rufomitratus*
Gorilla gorilla beringei	*Gorilla b. beringei*	*Gorilla b. beringei*		
Gorilla gorilla diehli	*Gorilla gorilla diehli*	*Gorilla gorilla diehli*	*Gorilla gorilla diehli*	*Gorilla gorilla diehli*
Asia				
			Tarsius tumpara	*Tarsius tumpara*
		Loris tardigradus nycticeboides	*Loris tardigradus nycticeboides*	
				Nycticebus javanicus
	Simias concolor	*Simias concolor*	*Simias concolor*	*Simias concolor*
	Presbytis natunae			
Trachypithecus delacouri	*Trachypithecus delacouri*	*Trachypithecus delacouri*	*Trachypithecus delacouri*	*Trachypithecus delacouri*
Trachypithecus poliocephalus	*Trachypithecus poliocephalus*	*Trachypithecus p. poliocephalus*	*Trachypithecus p. poliocephalus*	*Trachypithecus p. poliocephalus*
	Trachypithecus leucocephalus			
		Presbytis hosei canicrus		
Pygathrix nemaeus cinerea	*Pygathrix nemaeus cinerea*	*Pygathrix nemaeus cinerea*	*Pygathrix cinerea*	*Pygathrix cinerea*
Rhinopithecus avunculus	*Rhinopithecus avunculus*	*Rhinopithecus avunculus*	*Rhinopithecus avunculus*	*Rhinopithecus avunculus*
	Rhinopithecus bieti			
	Rhinopithecus brelichi			
		Semnopithecus vetulus nestor	*Semnopithecus vetulus nestor*	*Semnopithecus vetulus nestor*
Hylobates moloch				
Hylobates concolor hainanus		*Nomascus hainanus*	*Nomascus hainanus*	
	Nomascus nasutus			*Nomascus nasutus*
			Hoolock hoolock	*Hoolock hoolock*
Pongo abelii	*Pongo abelii*	*Pongo abelii*	*Pongo abelii*	*Pongo abelii*
Neotropics				
				Saguinus oedipus
Leontopithecus rosalia				
Leontopithecus chrysopygus				
Leontopithecus caissara	*Leontopithecus caissara*	*Leontopithecus caissara*		
Cebus xanthosternos	*Cebus xanthosternos*	*Cebus xanthosternos*		
			Ateles hybridus	*Ateles hybridus*
		Ateles hybridus brunneus		
			Ateles fusciceps	
Lagothrix flavicauda			*Oreonax flavicauda*	*Oreonax flavicauda*
Brachyteles hypoxanthus	*Brachyteles hypoxanthus*	*Brachyteles hypoxanthus*		

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The World's 25 Most Endangered Primates 2008–2010 Profiles

Madagascar

Greater Bamboo Lemur

Prolemur simus (Gray, 1871)
Madagascar
(2002, 2004, 2006, 2008)

The greater bamboo lemur (*Prolemur simus*) is the largest of Madagascar's bamboo-eating lemurs (Albrecht *et al.* 1990) and the most critically endangered lemur in Madagascar (Ganzhorn *et al.* 1996, 1997; Konstant *et al.* 2006; Mittermeier *et al.* 2006; Ganzhorn and Johnson 2007; Wright *et al.* 2008). Although its placement in *Prolemur* has been questioned (for example, Tattersall 2007), it now represents a monospecific genus, based on a suite of distinctive dental and chromosomal characteristics (Vuillaume-Randriamanantena *et al.* 1985; Macedonia and Stanger 1994) that support its separation from the genus *Hapalemur* (cf. Groves 2001). Genetic studies further suggest that *Hapalemur* may, in fact, be more closely related to the genus *Lemur* (Rumpler *et al*. 1989; Macedonia and Stanger 1994; Stanger-Hall 1997; Fausser *et al.* 2002). *Prolemur simus* also differs from other bamboo lemurs in behavioral and ecological variation.

Greater bamboo lemurs are cathemeral and gregarious, with observed group sizes ranging up to 28 individuals (Santini-Palka 1994; Tan 1999, 2000). Their extensive vocal repertoire of at least seven distinct calls is thought to be linked to their relatively large group size (Bergey and Patel 2008). It is the only male-dominant lemur species known (Tan 1999, 2000). Home ranges are large (60–97 ha; Sterling and Ramaroson 1996; Tan 1999, 2000; Dolch *et al*. 2008) and are primarily influenced by the distribution of bamboo and the availability of drinking water during the dry season (Wright *et al.* 2008). The species' stark reliance on giant bamboo makes it ecologically unique among primates. Throughout its range, *P. simus* has diets consisting almost exclusively of just one species of bamboo; *Cathariostachys madagascariensis* in the north (Tan 1999, 2000; Dolch *et al.* 2008) and a lowland species in the south (Wright *et al.* 2008). *Prolemur simus* is able to manipulate live bamboo culm with specializations in its teeth and jaws (Jernvall *et al.* 2008) that allow it to strip the outside of the live stalk and consume the pith, which is especially crucial for subsistence in drier months, while it relies on its shoots and leaves at other times of the year. *Prolemur simus* supplements its diet with fruits, flowers, soil and fungi (Meier and Rumpler 1987; Tan 1999, 2000; Wright *et al.* 2008; R. Dolch, J. L. Fiely, J. Rafalimandimby, E. E. Louis Jr. unpubl. data).

Historical records (Schwarz 1931) and sub-fossil remains confirm that it was once widespread throughout the island (Godfrey and Vuillaume-Randriamanantena 1986; Wilson *et al*. 1988; Simons 1997; Godfrey *et al*. 1999, 2004). Today, *P. simus* occupies as little as 1–4% of its former range, and remaining populations are very patchily distributed. It has only been confirmed to occur at 12 sites; all of them in the eastern rainforests. Most of them are restricted to SE Madagascar, including those in the national parks of Ranomafana (Miaranony, Talatakely, and Ambatolahy Dimy) and Andringitra (Manambolo, possibly Korokoto, and Camp 2). Five sites are located in unprotected and often degraded forests at Kianjavato, Morafeno, Karianga (near Vondrozo), Mahasoa, and Evendra (near Ivato) (Meier and Rumpler 1987; Wright *et al*. 1987; Sterling and Ramaroson 1996; Goodman *et al*. 2001; Irwin *et al*. 2005; Ratelolahy *et al.* 2006; Wright *et al*. 2008). Recent surveys have confirmed the species' presence in the forests of Torotorofotsy in the region of Andasibe-Mantadia (Dolch *et al*. 2004, 2008).

Wild populations occur in genetically isolated ranges with critically low numbers. Based on available data, the total wild population of *P. simus* is estimated not to exceed 100–160 individuals (Wright *et al.* 2008; R. Dolch unpubl. data). The largest populations are thought to occur in Torotorofotsy (R. Dolch, J. L. Fiely, J. Rafalimandimby, E. E. Louis Jr. unpubl. data) with up to 60 individuals, and in Ranomafana with up to 50 individuals. As of 2007, only 22 individuals of *P. simus* were held in captivity (Wright *et al.* 2008; D. Roullet pers. comm.).

The greater bamboo lemur is threatened by slash-and-burn agriculture, mining, illegal logging, the cutting of bamboo, and hunting with slingshots (Meier 1987; Meier and Rumpler 1987; Arrigo-Nelson and Wright 2004; Dolch *et al.* 2008). Presumed causes of its decline are its extreme dietary specialization and dependency on giant bamboo. Reduced availability of drinking water due to climatic change has also been cited as a limiting factor for the species' distribution (Wright *et al.* 2008).

Prolemur simus occurs mainly outside protected areas. It has been found in two national parks, Ranomafana and Andringitra. Suitable microhabitat within these protected areas is limited, and stochastically elevated mortality has contributed to the recent decline of these groups (Wright *et al.* 2008). The recent discovery of new groups raises hopes for the survival of the species. Yet, declines in known groups have raised new concern. Efforts are underway to declare important *Prolemur* sites as protected areas, and there are plans also for Torotorofotsy, Mahasoa, and Kianjavato. Conservation research projects have been initiated to study additional populations to provide behavioral, ecological, and genetic data necessary to implement an immediate large-scale conservation management plan. Moreover, microhabitat preferences of *P. simus* at known localities should be used to identify suitable habitats within the eastern rainforest, within which it is presumed other greater bamboo lemur populations could be found.

Ranomafana region. The population in and around Ranomafana National Park (RNP) is 26 individuals, with a maximum estimate of 50 individuals, a number of which live outside the park boundaries. Madagascar National Parks (former *Association Nationale pour la Gestion des Aires Protégées–ANGAP*) and Centre ValBio/Institute for the Conservation of Tropical Environments (ICTE) at Stony Brook

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University have achieved long-term behavioral data on the group in Talatakely. Further research initiatives are being conducted to monitor, protect and collect data on the two subpopulations just outside the park, in addition to conducting further surveys throughout the park. The major threats to the RNP population are its small size, genetic isolation, ranging into unprotected areas and opportunistic hunting. Participating institutions active in conservation efforts in this region are Centre ValBio, Madagascar National Parks, and the *Madagascar Institut pour la Conservations des Ecosystèmes Tropicaux* (MICET).

Torotorofotsy region. One of the most recently discovered, this site has one of the largest known contiguous populations with at least 4–5 groups and up to 60 individuals. Its discovery (Dolch *et al.* 2004, 2008) extended the known range of *P. simus* 400 km north of any known populations. The Torotorofotsy groups live almost entirely outside both Torotorofotsy Ramsar site and Andasibe-Mantadia National Park, and are squeezed in between mining concessions. Only one of the known groups occurs entirely within the boundaries of the Torotorofotsy Ramsar site. Mineral exploitation (nickel, cobalt and graphite) is the most prominent threat to the Torotorofotsy population, while it also remains a discrete population, genetically isolated from other known localities by a vast distance. The Torotorofotsy population was discovered by and has since been studied by members of Association Mitsinjo, a local NGO that has subsequently grown to an organization responsible for the management and research-based conservation of the Torotorofotsy Ramsar site. The Torotorofotsy population has been continuously tracked and monitored on a daily basis since July 2007. Data collection on ranging and behavioral ecology and efforts for the formal protection of the unprotected groups are ongoing by members of Association Mitsinjo, with the support of Omaha's Henry Doorly Zoo Madagascar Biodiversity and Biogeography Project (MBP-HDZ). Association Mitsinjo leads efforts to extend the Torotorofotsy Ramsar site to include all *P. simus* groups and to make it a new protected area in its own right.

Ivato and Karianga region. This population occurs in the southeastern part of the species' range in an extremely fragmented landscape that is completely unprotected and severely threatened by habitat disturbance. ICTE and MICET have begun working in Ivato commune, concentrating on one group of *P. simus* in Mahasoa agricultural plantation, just near the village of Ivato. Thus far, this subpopulation consists of one group of 27 individuals that is restricted to a 150-ha forest fragment. While an individual was sighted on a trail between Ivato and Evendra, additional groups between Mahaosa and the corridor remain unknown, but additional surveys are underway. The project is working to protect, monitor and collect behavioral, ecological and genetic data on the known group. This area is threatened mainly by slash-and-burn agriculture and fragmentation. Conservation efforts include working with the local community on more sustainable agricultural practices, and an endemic reforestation program to connect current forest fragments to the corridor *c.*10 km to the west, where other subpopulations have been sighted. ICTE and MICET are trying to implement formal protection of the area extending from Karianga/Morafeno to the corridor. Virtually no forest persists near these sites, with a landscape consisting largely of agricultural land and anthropogenic grasslands, interspersed with small, isolated bamboo patches. Current initiatives will be expanded to Karianga commune, which contains a group of at least three individuals in Morafeno agricultural plantation. Mining concessions and hunting also threaten this population, which subsists in extremely small numbers and in genetically isolated forest fragments that are being actively degraded. Participating institutions in conservation efforts in this region include ICTE, MICET and Stony Brook University.

Kianjavato. Since 1986, individuals have been observed in bamboo patches at the edge of Kianjavato coffee plantation, isolated from the eastern forest escarpment by about 50 km. This area contains at least three groups, with at least 7 individuals each, and an estimated population size of 30 individuals. The MBP-HDZ is researching the behavioral ecology and genetic composition of this population.

Corridor. Surveys within the Vondrozo corridor have been ongoing to try and find additional individuals between Ranomafana (north) and the Manapatrana River (south). Although a recent survey found two individuals between Ivato commune and Andringitra National Park (K. Delmore, unpubl.), further surveys are needed. Meanwhile, Conservation International has been working to protect the biodiversity within the remaining habitat in the corridor. Protection of this tract of intact forest will be crucial to provide a natural link between the remnant populations in south and central-eastern Madagascar. Participating institutions in the surveys in the corridor include ICTE and Centre ValBio.

Patricia C. Wright, Eileen Larney, Edward E. Louis Jr., Rainer Dolch & Radoniana R. Rafaliarison

Gray-headed Lemur

Eulemur cinereiceps (Milne-Edwards and Grandider, 1880)
Madagascar
(2004, 2006, 2008)

The gray-headed lemur (*Eulemur cinereiceps*) has a complicated taxonomic history. It is closely allied with the brown lemurs (*Eulemur* spp.), particularly the neighboring collared lemur (*E. collaris*). This taxon was until recently classed as a subspecies of *Eulemur fulvus* (Tattersall 1982; Mittermeier *et al.* 1994; Pastorini *et al*. 2000). However, cytogenetic and molecular genetic analyses, as well as infertility in crosses with collared lemurs, suggest full species status (Djletati *et al*. 1997; Wyner *et al*. 1999). The name derives from plates in Milne-Edwards and Grandidier (1890) and was applied to museum specimens from the southeastern coast near Farafangana by Schwarz (1931). Groves (1974) also used this name for "white-cheeked" specimens from southeastern Madagascar, distinguishing them from *E. collaris*. Subsequently, Rumpler (1975) made a similar distinction based on karyotypes, but adopted the presumably junior synonym *E. albocollaris*

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(or "white-collared lemur"). The latter nomenclature was supported by Tattersall (1979, 1982) and others, and came to prevail in the literature. It was later suggested that *E. cinereiceps* and *E. albocollaris* might represent separate taxa (Groves 2001; Mittermeier *et al*. 2006); in this scenario, *E. cinereiceps* would likely be found in coastal forests — the localities for specimens discussed by Schwarz (1931) — whereas *E. albocollaris* would be restricted to interior forests (for example, near Vondrozo). This idea was tested with available evidence from genetic sampling and population surveys (Johnson *et al*. 2008). Although not all original localities for *E. cinereiceps* could be sampled due to extensive fragmentation and lemur extirpations in this region during the last century, there is no evidence to date from mtDNA or phenotypes for a coastal-interior division. For now it seems most likely that the region contains just one species and that the name *E. cinereiceps* has priority (Johnson *et al*. 2008). Further ground surveys and genetic sampling should be conducted to confirm these findings.

The gray-headed lemur has one of the most restricted distributions of any *Eulemur* species. It occurs only in southeastern Madagascar from just north of the Manampatrana River to near the Mananara River in the south (Petter and Petter-Rousseaux 1979; Tattersall 1982; Irwin *et al*. 2005). This range includes a continuous forest corridor in the interior escarpment and small forest relicts in the coastal plain. In the north, there is a hybrid zone with *E. rufifrons* centered in Andringitra National Park, extending south to the vicinity of Karianga and north beyond Ankarimbelo (Sterling and Ramarason 1996; Wyner *et al.* 2002; Irwin *et al*. 2005). This encompasses an area of up to 50% of the range of "pure" *E. cinereiceps*. The southern boundary of the species is not well established, and could extend to Vohipaho Forest near Vangaindrano (where *E. cinereiceps* may be sympatric with *E. collaris*; H. Andriamaharoa unpubl. data). Other than Andringitra National Park, *E. cinereiceps* is only found in two protected areas: Manombo Special Reserve and the recently established conservation project at Mahabo Forest, both near Farafangana. The large Andringitra population consists almost entirely of hybrids (Wyner *et al*. 2002), whereas degraded coastal forests at Manombo and Mahabo contain only *c*.750 *E. cinereiceps* individuals (C. Ingraldi in prep.). Population densities across the range tend to be low relative to other *Eulemur* species (Johnson and Overdorff 1999; Johnson and Wyner 2000). Recent analyses combining ground surveys and Landsat imagery indicate that the total habitat remaining within the gray-headed lemur range is approximately 700 km², with an estimated remaining population of 7,265 ± 2,268 individuals (Irwin *et al*. 2005).

Information regarding the natural history of the gray-headed lemur derives largely from recent studies conducted at the interior Vevembe Forest, along with new long-term studies currently underway at Manombo and Mahabo. This species has a highly frugivorous diet, supplemented with flowers, leaves, and fungi. *Pandanus* spp. flowers are an especially important food late in the dry season at Vevembe (Johnson 2002). *Pandanus* fruit also comprises a major component of the diet at Mahabo, along with *Noronhia*, *Pyrostria*, and *Uapaca* (H. Andriamaharoa, C. Birkinshaw, A. Rued unpubl. data). At Manombo, *E. cinereiceps* has been observed eating non-native plants like *Aframomum angustifolium* and a shelf fungus that grows on invasive *Cecropia* (Ralainasolo *et al*. 2008). Feeding on such items may enable *E. cinereiceps* to cope with habitat disturbance, and perhaps in part to avoid competition with other lemurs such as *Varecia* for native plants. The species is cathemeral (active both day and night) throughout the year. It is an adept arboreal quadruped with frequent use of leaping behaviors, and its limb kinematics corresponds closely with those of *Eulemur collaris* (Stevens *et al*. in review). Social groups tend to be multi-male/multi-female and regularly exhibit fission-fusion (Overdorff and Johnson 2003; Johnson 2006). Group size may reach as many as 16 individuals (Johnson 2002). Coastal populations have smaller social groups, with apparently frequent dispersal of individuals among groups (H. Andriamaharoa, S. Martin, C. Ingraldi, A. Rued unpubl. data). Like other lemurs, reproduction is highly seasonal, although extra-seasonal copulations (with at least one birth) have been recorded at Mahabo (A. Rued in prep.).

Deforestation and hunting present the greatest threats to the survival of the gray-headed lemur. Populations in the Manombo lowland rain forest and Mahabo littoral forest are particularly vulnerable to these pressures due to the fragmentation and isolation of the coastal landscape, as well as possible small population effects. They are also susceptible to powerful stochastic climatic events: a cyclone that struck this region in 1997 reduced lemur populations by approximately 50% (Ratsimbazafy *et al*. 2002). These coastal populations have apparently undergone a significant genetic bottleneck, and effective population size (number of breeding individuals) falls well below total population estimates (R. Brenneman, E. E. Louis Jr., S. Johnson in prep.). The extensive hybrid zone with *E. f. rufus* may also pose a risk to the gray-headed lemur; research is presently being conducted to assess the direction and magnitude of gene flow across the contact zone and "pure" populations (K. Delmore in prep.). Current research is also underway to investigate disease ecology in *E. cinereiceps*. Preliminary evidence suggests heavy infestations of some parasites (for example, pinworms) that could reduce fitness, particularly if degraded environmental conditions compromise immune response (S. Martin in prep.).

The Malagasy government, conservation NGOs, and researchers are together taking steps to counter these alarming trends. The Durrell Wildlife Conservation Trust is working in partnership with Madagascar National Parks to strengthen protection at Manombo, including possible expansion of the Special Reserve. Conservation education and tree-planting programs have also been established in the Manombo communities. Missouri Botanical Garden has supported community-based initiatives to preserve Mahabo Forest within the new framework for protected areas in Madagascar; similar programs are underway at Vohipaho, which may also

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maintain a small *E. cinereiceps* population. Conservation International is presently initiating programs for the management of the Fandriana-Vondrozo forest corridor. This will be critical for the long-term survival of the gray-headed lemur, as the vast majority of populations are found within this corridor and few are presently protected. Researchers from Université d'Antananarivo, University of Calgary, Stony Brook University, Henry Doorly Zoo, Ohio University, and other institutions are active in studying gray-headed lemur ecology, social systems, population dynamics, and genetics to better understand the risks and baseline requirements for this still poorly known species.

Steig Johnson, Jonah Ratsimbazafy, Nancy Stevens, Hubert Andriamaharoa, Sara Martin & Fidimalala Ralainasolo

Sclater's Black Lemur, Blue-Eyed Black Lemur
Eulemur flavifrons (Gray, 1867)
Madagascar
(2008)

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) and 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 north-eastern part of the distribution of *E. flavifrons* (Andrianjakarivelo 2004; Schwitzer *et al*. 2005, 2006; Mittermeier *et al.* 2008) is in favour of this new taxonomy.

Eulemur flavifrons is still one of the least-studied of all *Eulemur* species. The species occurs only in northwest 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; Mittermeier *et al.* 1994). 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, harboring 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 largest part of it living in forest fragments on and adjacent to the Sahamalaza peninsula (Mouton 1999). Rakotondratsima (1999) estimates the population of the Sahamalaza peninsula to be about 450–2,300 individuals and to have declined 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 different fragments of the Ankarafa forest on the Sahamalaza Peninsula yielded a density of 60 individuals per km² (Schwitzer *et al.* 2005, 2007a). 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) to the total surface of the terrestrial core zones of the recently created Sahamalaza – Iles Radama National Park (115.8 km²) yields a remaining, severely fragmented population of 2780–6950 blue-eyed black lemurs. *Eulemr flavifrons* was assessed as Critically Endangered (CR A2cd) by the International Union for Conservation of Nature (IUCN) at their most recent Red List Assessment in April 2005, based on an 80% population reduction during the last 25 years. The principal threats to its survival are forest destruction due to slash-and-burn agriculture and selective logging, continued hunting and trapping, especially by the Tsimihety in the eastern part of its distribution, and live capture for the local pet trade (Gerson 1995; Rakotondratsima 1999). 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 in press). *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 10 individuals, including 4 to 7 adults (G. H. Randriatahina and J. J. Roeder in prep.). 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 (G. H. Randriatahina and J. J. Roeder in prep.). 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 eleven weeks of age (S. Volampeno in prep.).

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Parts of the Sclater's black lemur's range 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, with the involvement of representatives of local communities from the Sahamalaza Peninsula and representatives of WCS and several other environmental institutions. AEECL implemented a natural resource management programme 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 basis for studying the conservation ecology of *E. flavifrons* and of other lemur species in the area.

As of 2008, there were 30 blue-eyed black lemurs living in European zoos (Moisson and Prieur 2008). The European captive population of the subspecies is being managed in a European Endangered Species Programme (EEP) coordinated by Mulhouse Zoo.

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Northern Sportive Lemur

Lepilemur septentrionalis Rumpler and Albignac, 1975
Madagascar
(2008)

The northern sportive lemur (*Lepilemur septentrionalis*) was originally described based on cytogenetic and morphometric characteristics (Rumpler and Albignac 1975, see also Rumpler *et al.* 2001). Its taxonomic status has been supported by more detailed cytogenetic, morphogenetic and especially molecular data (Rumpler *et al*. 2001; Ravaorimanana *et al*. 2004; Andriaholinirina *et al.* 2006), and accepted in recent taxonomic revisions of primates (Groves 2001, 2005) and lemurs (Mittermeier *et al*. 2006, 2008). It is believed to be strictly limited to a few small patches of dry forest in the far north of Madagascar, just to the south of Antsiranana on the east coast. Mittermeier *et al.* (2006) list the following localities: very small remnant forest patches near the villages of Madirobe and Ankarongana in the Sahafary region, and in the immediate vicinity of Andrahona, a small mountain about 30 km south of Antsiranana, east of Route Nationale 6 (observations by Yves Rumpler, Russell A. Mittermeier).

It is nocturnal, spending the day sleeping in tree holes, and very little is known about its ecology and behavior. Total numbers are unknown but, taking into account the limited distribution of *L. septentrionalis* in the forests of Sahafary, Andrahona and Andranomadiro, there are probably only about 100–150 individuals remaining. Tree-felling for charcoal continues at an alarming rate and the animals suffer from hunting. Surveys of five areas in 2007 provided the following population estimates: 1) Area of Andrahona (forest patches and gallery forests of Andrahona, Analajanana, and Analanjavavy) — 20 individuals in the entire area; 2) Area of Ankarakataova (forests of Ankarakataova Be and Ankarakataova kely) — none found; and 3) Area of Sahafary (degraded forest patches in Western Sahafary, Sahafary East, Sahafary North, Andravina, Sahandrano, Andranomadiro, and Analalava) — about 100 individuals. None of these areas is protected.

The combination of a very small range containing little and rapidly decreasing suitable habitat with high pressure from hunting makes this species especially threatened. A consortium of the Association Européenne pour l'Etude et la Conservation des Lémuriens (AEECL), the University Louis Pasteur of Strasbourg and the Fondation Nature et Decouverte supported the field work and the genetic study. Socioeconomic studies are under way to determine the anthropogenic effect on the remaining population (Lernould 2006).

Iary Ravaorimanana, Alphonse Zaramody, Clément Rabarivola & Yves Rumpler

Silky Sifaka

Propithecus candidus Grandidier, 1871
Madagascar
(2000, 2002, 2004, 2006, 2008)

Propithecus candidus is a large white sifaka from northeastern Madagascar. Silky sifakas have recently been raised to full species (Mayor *et al*. 2002, 2004; Mittermeier *et al.* 2006), though some still consider this taxon to be a subspecies of *Propithecus diadema* (see Groves 2001; reviewed in Tattersall 2007). It has a head-body length of 48–54 cm, a tail length of 45–51 cm, a total length of 93–105 cm, and a weight of 5–6.5 kg (Lehman *et al*. 2005). The pelage is long, silky and white, which gives this species its common English 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, the skin a mix of pink and black, with some individuals having all pink or all black faces. The tips of the naked black ears protrude just beyond the white fur of the head and cheeks. This species does not occur with any other sifakas and cannot be confused with any lemurs within its range.

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 possess 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).

The most recent IUCN Red List assessment (2008) lists *P. candidus* as Critically Endangered. This is one of the rarest and most critically endangered lemurs. Global population size is estimated between 100 and 1,000. Silky sifakas are

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hunted throughout their range as there is no local taboo, or *fady*, against eating them. Habitat disturbance, such as slash-and-burn agriculture (*tavy*), logging of precious woods (for example, rosewood) and fuel wood, also occurs in and adjacent to the protected areas where they are found (Patel *et al*. 2005b; Patel 2007b; Nielson and Patel 2008).

The silky sifaka has a very restricted range in northeastern Madagascar that includes the humid forest belt extending from Maroantsetra to the Andapa Basin and the Marojejy Massif. Marojejy National Park marks the northern limit of its current distribution, although at one time it occurred as far north as Bemarivo River near Sambava. The Androranga River may represent the northwestern range limit within the Tsaratanana Corridor. The Antainambalana River, within the Makira Conservation Site, is believed to be the southern limit. Silky sifakas may occur in northeastern Makira (Amparihibe, Bezavona), although they have not yet been observed there (Milne-Edwards and Grandidier 1875; Tattersall 1982; Wilme and Callmander 2006; Patel and Rasolofoson *et al.* 2007; Andrianandrasana 2008). Recent unconfirmed reports have identified several groups of silky sifakas just outside of north-eastern Makira in the unprotected Maherivaratra forest (Mosesy, Marojejy National Park Guide Association Chief pers. comm., February 2009) which would represent a slight enlargement of their known geographic range. In Maherivaratra and Andaparaty, silky sifakas may actually be sympatric with *Varecia*, which had never been suggested before 2008.

Surveys have documented the presence of silky sifakas in Marojejy National Park (Humbert 1955; Guillaumet *et al*. 1975; Benson *et al*. 1976, 1977; Duckworth *et al.* 1988; Nicol and Langrand 1989; Sterling and McFadden 2000; Goodman *et al.* 2003), Anjanaharibe-Sud Special Reserve (Nicol and Langrand 1989; Schmid and Smolker 1998; Goodman *et al*. 2003), the Makira Conservation Site (Rasolofoson *et al*. 2007; Ratelolahy and Raivoarisoa 2007; Patel and Andrianandrasana 2008), the Betaolana Corridor (Goodman *et al*. 2003), and the Tsaratanana Corridor (WWF Andapa Projet Simpona pers. comm.).

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. A few groups have recently been found in the Makira Forest Protected Area (managed by the Wildlife Conservation Society) at two sites: Andaparaty (central-east Makira) and Manandriana, 44 km to the north-west, adjacent to the Anjanaharibe-Sud Special Reserve). Silky sifakas are also found in the Betaolana Corridorthat connects Anjanaharibe-Sud and Marojejy, as well as the unprotected Tsaratanana Corridor to the northwest. Further surveys are needed in Makira and in the western part of Anjanaharibe-Sud, which has recently been extended. Approximately 16 groups were found during a recent survey in western Marojejy near Antsahaberoaka (December 2008, pers. obs.).

A 14-month study (Patel 2006a; Patel *et al*. 2006) and two short studies (Kelley and Mayor 2002; Queslin and Patel 2008) have examined the behavioral biology, communication, and feeding ecology of silky sifakas in Marojejy National Park. Silky sifakas show the greatest elevational range of any of the sifakas; as low as 300 m 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 social structure is variable; they can be found in male-female pairs, one-male groups, and multi-male/multi-female groups. Groups range in size from two to nine. Home ranges (95% Kernel) vary by site from 34 to 47 ha (Patel 2006b; Patel and Andrianandrasana 2008).

Approximately 25% of the day is spent feeding, 44% resting, and the remainder is devoted to social behavior (16.8%), traveling, 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. As in other eastern sifakas, *P. candidus* is a folivorous seed predator eating fruits, seeds and leaves from a very large number of plant species. A recent two-month study documented feeding from 76 species across 42 families (mainly trees, but many lianas as well). During this short study, the most important plant families in their diet were Moraceae (20.3%), Fabaceae (12.9%), Myrtaceae (12.6%), Clusiaceae (10.1%) and Apocynaceae (9.5%). The four most preferred foods accounted for 37.1% of total feeding time: fruit from *Pachytrophe dimepate* (16.1%), seeds from *Senna* sp. (8.4%), young leaves from *Plectaneia thouarsii* (6.5%), and fruit from *Eugenia* sp. (6.0%). Fifty-two percent of feeding time was spent eating leaves, 34% fruit, and 11% seeds. Flowers and soil were eaten rarely (Patel 2006b; Queslin and Patel 2008).

Mating is believed to occur 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 they have been seen to give birth in consecutive years (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 mother's 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 *et al.* 2003a; Patel 2007a). Dispersal has been observed only once, when a young adult male immigrated in 2007, aggressively forcing the older resident male out of the group he had been a member of for at least seven years. Although eastern sifakas generally exhibit male and female group transfer, female transfer in *P. candidus* has yet to be observed.

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

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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. Acoustic analyses have revealed sex and individual differences in the acoustic structure of the silky sifaka "zzuss" vocalization (Patel *et al*. 2003b; Patel *et al*. 2006).

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 in a number of ways, by rubbing them with their chest gland, genital glands, or a combination of the two. Males routinely 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 tree-gouging is likely communicative in function (Patel and Girard-Buttoz 2008). Both sexes often urinate while scent-marking. Although males scent-mark two or three times as often as females, female scent-marks are responded to far more often and more quickly than male marks. A one-year study 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-anogenital marking, when depositing an overmark (Andrianandrasana *et al*. 2007). The high rates of overmarking practiced by male eastern sifakas lead to totem-tree marking, in which certain trees are covered with male scent-marks and gouge marks. Extensive scent-marking of the home range border has not been observed in *P. candidus* (Patel 2006a; Ritchie and Patel 2006; Patel and Girard-Buttoz 2008).

Erik R. Patel

Africa

Rondo Dwarf Galago

Galagoides rondoensis (Honess in Kingdon, 1997)
Tanzania
(2006, 2008)

Weighing approximately 60 g, this is one of the smallest of the galagos (Honess 1996b). It is distinct from other dwarf galagos in its bottle-brush-shaped tail, its reproductive anatomy, and its distinctive "double unit rolling call" (Bearder *et al*. 1995; Honess 1996a, 1996b; Perkin 2007). 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 from owls and other nocturnal predators. Among these, genets, palm civets and snakes invoke intense episodes of alarm calling (Honess 1996b).

On the IUCN Red List, the status of *G. rondoensis* has changed from Endangered (IUCN 2006) to Critically Endangered (IUCN 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 (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 1996b; Honess and Bearder 1996). Two 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) (Perkin *et al.* in prep.). 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 1996b).

No detailed surveys have been conducted to assess population sizes of *G. rondoensis*. Limited distribution surveys have been conducted, however, in the southern (Honess 1996b; Perkin *et al.* in prep.) and northern coastal forests (27 surveyed) of Tanzania and coastal Kenya (seven surveyed) (Perkin 2000, 2003, 2004). 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 1996b]). There is a clear and urgent need for further surveys to determine population sizes in these dwindling forest patches. 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 and 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.]). The major threat this species is facing is loss of habitat. All sites are subject to some level of agricultural encroachment, charcoal manufacture and/or logging. All sites,

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except Pande GR and Zaraninge forest, are national or local authority forest reserves and as such nominally, but in practice minimally, protected. Given current trends in charcoal production for nearby Dar es Salaam, the forest reserves of Pugu and Kazimzumbwi will disappear over the next 10–15 years (Ahrends 2005). 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 Chitoa population is the most secure, as it is buffered by tracts of woodland. The type population at Rondo is buffered by woodland and *Pinus* plantations managed by the Rondo Forestry Project. Litipo, Ziwani and Ruawa FRs are under threat from bordering village lands.

Conservation action is urgently needed, and more research is required to determine the continuing rate of habitat loss at these sites and to survey new areas for remnant populations. There is emerging evidence (from vocalizations and penile morphology) that the northern and southern populations may be phylogenetically distinct with important taxonomic implications. As such the conservation of all 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*, and the thick-tailed galago, *O. crassicaudatus*. The Rondo galago is sympatric with the Zanzibar galago, *Galagoides zanzibaricus*, in the northern parts of its range (for example, in Zaraninge forest, Pugu/Kazimzumbwi FR and Pande GR). *Galagoides zanzibaricus* was classified as Lower Risk (Near Threatened) in the 2006 IUCN Red List (IUCN 2006) due to threats to its habitat (in 2008 it was ranked as Least Concern). In the southern parts of its range (for example, at Rondo, Litipo and Ziwani FRs), the Rondo galago is sympatric with Grant's galago, *Galagoides granti*, (listed as Data Deficient in 2006, but Least Concern in 2008). The Mountain dwarf galago, *Galagoides orinus*, ranked as Data Deficient by IUCN in 2006 (considered Near Threatened in 2008), is restricted to areas of sub-montane and montane forest in the Eastern Arc Mountains further inland in Tanzania. As such *G. orinus* also has a very restricted range, although areas of its preferred habitat are believed to be at less risk of degradation because they are relatively inaccessible.

Paul E. Honess, Andrew Perkin & Simon K. Bearder

Roloway Guenon

Cercopithecus diana roloway (Schreber, 1774)
Ghana and Côte d'Ivoire
(2002, 2006)

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). The roloway subspecies is distinguished by its broad white brow line, long white beard and yellow thighs. Groves (2001) considers the two subspecies to be sufficiently distinct to be regarded as full species. Of the two forms, the roloway, which is known from Ghana and eastern Côte d'Ivoire, is more seriously threatened with extinction. In fact, along with the white-naped mangabey (*Cercocebus atys lunulatus*) and Miss Waldron's red colobus (*Procolobus badius waldroni*), it is among the three most endangered monkeys of the Upper Guinea forest block and a target species of the relentless bushmeat trade (Oates 1996).

As primatologists have searched the forests of Ghana and Côte d'Ivoire for evidence of living red colobus, they have also documented the continued decline of both the roloway guenon and white-naped mangabey, which seem to be found in (or absent from) many of the same forests (Struhsaker and Oates 1995; Oates *et al*. 1996/1997; McGraw 1998a; Koné 2004; Oates 2006). In Ghana, roloway guenons have been steadily extirpated from both unprotected and protected areas (for example, Bia National Park) and the monkey is nearing extinction in that country, if it has not disappeared already. Several recent surveys have failed to find roloways in any reserves in western Ghana. It is possible that the Ankasa Conservation Area still contains a few roloway individuals (Magnuson 2003), but in 2006 a wildlife guard reported to J. F. Oates (unpubl.) that he had not seen the monkey for several years. Careful surveys of Ankasa and Bia Conservation Areas and Cape Three Points Forest Reserve in 2007–2008 by West African Primate Conservation Action did not locate any roloways, but unconfirmed reports of their continued survival at Ankasa were received (S. Gatti pers. comm.). A thorough survey of the Dadieso Forest Reserve (where the monkey was also reported in the recent past) should be a high priority.

In neighboring Côte d'Ivoire, the Roloway guenon is not known from any protected areas and the monkey's status is equally dire. Surveys made ten years ago documented roloways in two forests, the Yaya Forest Reserve and the Tanoé forest adjacent to the Ehy Lagoon (McGraw 1998b, 2005; Koné and Akpatou 2005). Hunters had also reported small numbers of roloways in the Parc National des Iles Ehotilé (Koné and Akpatou 2005). Subsequent surveys of eighteen areas made between 2004 and 2006 confirmed the presence of roloways only in the Tanoé forest (Gonedelé Bi *et al.* 2008). This evidence suggests 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 and that the guenon's distribution in Côte d'Ivoire is now restricted to the Tanoé forest (Koné and Akpatou 2005). In 2007, local informants reported the presence of roloways in the Dassioko, Niouniourou, Port Gautier, Mabi and Yaya forest reserves, however surveys of these areas yielded no direct evidence of their presence (G. Campbell pers. comm.). If roloways have been eliminated from Ghana's Ankasa Conservation Area, then the Tanoé forest could be a final refuge for this guenon. This wet forest also harbors one of the few remaining populations of white-naped mangabeys in Côte d'Ivoire and, perhaps, a small number of Miss Waldron's red colobus. The Tanoé forest is under direct threat from a large palm oil company (PALMCI) and several organizations (CEPA, WAPCA) are lobbying against the company and have sponsored local awareness campaigns (Koné 2008). As the

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potential last refuge for roloways, white-naped mangabeys, and Miss Waldron's red colobus, the protection of the Tanoé forest should be the highest conservation priority.

W. Scott McGraw and John F. Oates

Tana River Red Colobus

Procolobus rufomitratus (Peters, 1879)
Kenya
(2002, 2004, 2006, 2008)

Gallery forests found in the lower Tana River, Kenya, appear to be remnants of a previously continuous forest that extended from Central Africa to East Africa 25,000–30,000 years ago). The forests are part of the East African Coastal Forests Biodiversity Hotspot and for this, and other reasons, are of great conservation value. In particular, they are the only habitat for two endemic primate species; Tana River red colobus, *Procolobus rufomitratus* (Peters, 1879), and Tana River mangabey, *Cercocebus galeritus* Peters, 1879. These two species inhabit the forests along a 60-km stretch of the lower Tana River from Nkanjonja to Mitapani (01°55'S, 40°05'E). All of these forests are small, ranging in size from <1 ha to *c.*500 ha. Six other species of nonhuman primates are found in this area. However, the Tana River red colobus and Tana River mangabey are forest dependent, and account for the bulk of the primate biomass in these forests.

The Tana River red colobus and the Tana River mangabey are both greatly threatened by forest loss and fragmentation caused by a growing human population. Forest is cleared mainly for agriculture; an estimated 50% of the original forest has been lost in the last 20 years. In addition, people use the remaining forest for materials to build homes and canoes, and for other non-timber forest products. Consequently, the current population of the Tana River red colobus is less than 1,000 individuals and declining, while the population of the Tana River mangabey is not much larger and declining. Furthermore, it has recently been found that the forest loss and fragmentation causes high levels of parasitism in these two primates (Mbora and McPeek 2009). The effect of this on the status of these two populations is currently unknown.

The long-term survival of the two endemic Tana River primates looks very bleak. In January 2007, the High Court of Kenya ruled that the Tana River Primate National Reserve (TRPNR), where 13 km² of forest were protected, was not established in accordance with the law. The TRPNR must, therefore, be degazzetted, which means that none of the habitat of the Tana River red colobus and Tana River mangabey is legally protected. Furthermore, habitat loss outside the TRPNR has been exacerbated by the failure of the Tana Delta Irrigation Project's (TDIP) rice-growing scheme (under the administration of the Tana and Athi Rivers Development Authority [TARDA], with financing from Japan International Cooperation Agency [JICA]) to protect forest patches on their land. Now TARDA is in the process of expanding its activities in the region by establishing a 110 km² sugar cane plantation. In addition, a further 500 km² of land in and around the delta are earmarked for the development of sugarcane plantations by Mat International Sugar Limited. These new plantations will result in a large influx of people and an increase in the demand for forest resources.

Curiously, despite the dire circumstance of Tana River red colobus and the species being on the list of The World's 25 Most Endangered Primates since 2002, not one conservation agency is working in the forests of the lower Tana River. A five-year Kenya Wildlife Service (KWS) and Kenya Forest Department project, funded by the World Bank/GEF, was initiated in 1996 to enhance conservation and protection of the primates and forests. Unfortunately, this potentially important project was terminated prematurely due to poor project management. This left the responsibility for the conservation and protection of the Tana River's forests and primates entirely to the KWS.

Despite the troubles highlighted above, the Tana River situation is not hopeless. One of us (DNMM) has maintained a (relatively poorly funded) research project in the area over the last five years. He has thus been able to monitor developments on the ground. In addition, more than 250 families who farmed within the TRPNR were voluntarily relocated in 2005 to Kipini (about 90 km away) by the KWS. At the moment, there appears to be growing concern for forest and biodiversity conservation among local people. For example, several local leaders have expressed a desire to convert the now degazetted TRPNR into a community wildlife sanctuary. However, there is need for strong support and encouragement from conservation organizations for a community-based conservation effort.

David N. M. Mbora & Thomas M. Butynski

Niger Delta Red Colobus Monkey

Procolobus epieni Grubb and Powell, 1999
Niger Delta, Nigeria
(2008)

This colobus monkey is listed as Critically Endangered on the 2008 IUCN Red List of Threatened Species. It only became known to science in 1993 in the course of a biodiversity survey co-ordinated by C. Bruce Powell (Powell 1994). The monkey's scientific name is based on its name in the Ijaw language of the people who inhabit the limited area (1,500 km²) where it occurs in the central Niger Delta. Studies of vocalizations and mitochondrial DNA suggest that *epieni* is not closely related to its closest geographic relatives, the Bioko red colobus (*Procolobus pennantii pennantii*) or Preuss's red colobus (*Procolobus preussi*), leading Ting (2008) to treat this monkey not as a subspecies of *pennantii* (see Groves 2001, 2005; Grubb *et al.* 2003) but as a distinct species, *Procolobus epieni*. Groves (2007) regarded almost all the different forms of red colobus monkeys, including *epieni*, *pennantii* and *preussi* as separate species, in the genus *Piliocolobus*.

There has been only one field study of this red colobus. Werre (2000) established that *epieni* occurs only in the so-called "marsh forest" zone of the Central Delta, an area that has a year-round high water table, but which does not suffer

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deep flooding or tidal effects. The study suggested that the more clumped distribution of food species in the marsh forest was a key factor restricting the monkey to its limited range, which is demarcated by the Forcados River and Bomadi Creek in the northwest, the Sagbama, Osiama and Apoi Creeks in the east, and the mangrove belt to the south. At the time of its discovery the Niger Delta red colobus was locally common, especially in forests near the town of Gbanraun, but it was beginning to come under intense pressure from degradation of its habitat and commercial hunting. Important colobus food trees — especially *Hallea ledermannii* — were being felled at a high rate by artisanal loggers, and the logs floated out of the Delta on rafts to processing centers in Lagos and elsewhere. In addition, large canals dug as part of oil extraction activities, as well as smaller canals dug by loggers into the interior swamps, were changing local hydrology (Werre and Powell 1997; Grubb and Powell 1999). The Ijaw people are traditionally fishermen but outside influences introduced by the oil industry have encouraged commercial bushmeat hunting and logging throughout the Niger Delta.

As part of his research Werre (2000) formulated a conservation plan that was initially to protect 500 ha of forest near the settlement of Gbanraun through a leasehold arrangement with community landholders. It was hoped that this could eventually be expanded to a full protected area based on the proposed Apoi Creek Forest Reserve. At present there are no formal protected areas in the Niger Delta, even though it has great ecological significance and supports many rare, unique and/or threatened taxa. The Niger Delta red colobus shares its marsh forest habitat with two other threatened primates; the Nigerian white-throated guenon (*Cercopithecus erythrogaster pococki*) and the red-capped mangabey (*Cercocebus torquatus*), each listed as Vulnerable on the Red List. Also found in these forests are the putty-nosed monkey (*Cercopithecus nictitans*), the mona monkey (*Cercopithecus mona*), and possibly the olive colobus (*Procolobus verus*). However, political instability in the Delta, related in the most part to disputes over the allocation of oil revenues, has prevented any progress in biodiversity conservation during the last decade. Because red colobus monkeys have been found to be highly vulnerable to habitat disturbance and hunting in other parts of Africa (Struhsaker 2005), it is feared that the Niger Delta red colobus is being driven to the edge of extinction.

The red colobus monkeys are probably more threatened than any other taxonomic group of primates in Africa (Oates 1996; Struhsaker 2005). Almost all those of western Africa are in a precarious position. *Procolobus badius waldroni* (eastern Côte d'Ivoire and western Ghana), *Procolobus preussi* (western Cameroon and eastern Nigeria), and *P. pennantii bouvieri* (Republic of Congo) are also now Critically Endangered. *Procolobus badius temminckii* (Senegal to Guinea or Sierra Leone), *Procolobus badius badius* (Sierra Leone to western Côte d'Ivoire) and *Procolobus pennantii pennantii* (Bioko Island, Equatorial Guinea) are listed as Endangered. There has been evidence of a few *P. badius waldroni* surviving in swamp forest in the far southeastern corner of Côte d'Ivoire (McGraw and Oates 2002; McGraw 2005), but it is feared that this population may now be extinct. *Procolobus pennantii bouvieri* of the Republic of Congo has not been observed alive by scientists for at least 25 years, raising concerns that they may be extinct (Oates 1996; Struhsaker 2005). *Procolobus pennantii pennantii* is just hanging on in the southwestern corner of Bioko Island, where it has been decimated by bushmeat hunting (Hearn *et al*. 2006) in what is, theoretically, a protected area.

Although the security situation in the Niger Delta is challenging, a pilot survey is planned for early 2009 to gather information on the present status of forest and primates near Gbanraun, and to assess what options may be available for conserving any remaining *P. epieni*. A survey is also urgently needed for Bouvier's red colobus in Congo. In all the protected areas where red colobus monkeys occur, much greater efforts must be made to improve management, especially the enforcement of laws against hunting.

John F. Oates & J. Lodewijk Werre

Kipunji

Rungwecebus kipunji (Ehardt, Butynski, Jones & Davenport in Jones *et al*., 2005)

Tanzania

(2006, 2008)

The discovery of the kipunji (*Rungwecebus kipunji*), a monkey endemic to southern Tanzania (Jones *et al*. 2005; Davenport *et al.* 2006), demonstrated how much there is still to learn about Africa's forests, as well as the continent's primate fauna. Kipunji were first found by teams working in the Southern Highlands and Udzungwa Mountains in 2003 and 2004, respectively (Jones *et al.* 2005; Davenport 2005, 2006; Davenport and Jones 2005; Davenport *et al.* 2005, 2006), sites that are some 350 km apart. Although initially placed in the genus *Lophocebus* (Jones *et al.* 2005), subsequent molecular and morphological analyses led to the monkey's placement in a new monospecific genus *Rungwecebus*, making it the first new genus of African monkey to be described in 83 years (Davenport *et al*. 2006). Further molecular studies have corroborated the validity of the genus (Olson *et al.* 2008) and anatomical investigations are under way.

More importantly, however, the kipunji is one of the world's most threatened primates, as demonstrated by a recent census that provided the first systematically-derived data on the animal's abundance and distribution (Davenport *et al.* 2008). Kipunji are cryptic, rare, primarily arboreal and in urgent need of conservation attention (Davenport *et al.* 2006; Davenport and Jones 2005), and consequently a complete count after a long-term survey was made, ensuring a much more accurate population estimate (Davenport *et al.* 2008). The census demonstrated that the kipunji is probably Africa's rarest monkey, and provided empirical data in support of its official designation as 'Critically Endangered' on the 2008 IUCN Red List, with the genus facing an extremely high risk of extinction in the wild (Davenport *et al.* 2008; Davenport and Jones 2008).

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The kipunji is restricted to a number of discrete portions of the forests of Mt. Rungwe and the adjacent Livingstone (in Kitulo National Park) in the Southern Highlands, and the Vikongwa area of the Ndundulu forest (in the new Kilombero Nature Reserve) in the Udzungwa Mountains. The Mt. Rungwe-Livingstone population occupies degraded submontane and montane forest between 1,750 and 2,450 m above sea level, whereas the Ndundulu population lives between 1,300 and 1,750 m above sea level in submontane forest (Davenport *et al.* 2006, 2008). Kipunji have not been recorded in the Udzungwa Mountains National Park itself, the closest record being 1.9 km outside the park boundary (Jones 2006). Despite extensive surveys, kipunji have not been recorded from other forests in either the Southern Highlands or the Udzungwa Mountains.

During the census, a total of 34 kipunji groups were identified in the Southern Highlands with an estimated total population of 1,042. Of these, 501 individuals in 16 groups were counted in Mt. Rungwe and 541 individuals from 18 groups in the Livingstone forest of Kitulo National Park. In Ndundulu, just four groups were identified with an estimated total of 75 animals. The total global population of the kipunji therefore, is estimated to be just 1,117 animals, living in some 38 groups (Davenport *et al.* 2008). During the same surveys, the Areas of Occupancy (AoO) for Mt. Rungwe, Livingstone Forest and Ndundulu were estimated to be 671 ha, 408 ha and 199 ha, respectively. The total for Rungwe-Kitulo therefore was 1,079 ha, and the total species' AoO was 1,278 ha based on data collected over three years (Davenport *et al.* 2008). Meanwhile the Extents of Occurrence (EoO) for kipunji for Mt. Rungwe, Livingstone and Ndundulu were 815 ha, 425 ha, and 528 ha, respectively. The total for Rungwe-Kitulo was 1,241 ha and the total species EoO was estimated to be 1,769 ha (Davenport *et al.* 2008).

A total population of just 1,117 animals is very small. As reported elsewhere, both the Mt. Rungwe and Livingstone forests are heavily degraded (Davenport 2005, 2006; Davenport and Jones 2005) and remote sensing analysis of forest cover has demonstrated that the extent of habitat connection between the various groups is extremely tenuous. Indeed the Mt. Rungwe-Kitulo portion of the population consists of a number of isolated sub-populations and this is compounded by the poor condition of the narrow Bujingijila Corridor that joins Mt. Rungwe and Livingstone (Davenport 2005). With the loss of this corridor, the Mt. Rungwe-Kitulo population will be further fragmented. Furthermore, and in addition to the continuing loss of habitat, this population continues to be hunted (Davenport 2005, 2006; Davenport *et al.* 2005).

The fragile status of the population in Ndundulu is particularly worrying and its causes remain unknown. However, given current thinking on primate population sizes, it may be that this population is no longer viable (Davenport *et al.* 2008). The recent census also revealed an interesting and statistically significant difference in mean group size between the Rungwe-Kitulo and the Ndundulu populations (Davenport *et al.* 2008). This may be due to the small total population size in Ndundulu, or to fragmentation, reduced resource patches and food availability in Rungwe-Kitulo, as demonstrated in other primate species. Either way, the kipunji is more sparsely distributed than initially thought (Jones *et al.* 2005). The total EoO (species range) is just 17.69 km² giving grounds for much conservation concern, and being considerably less than the 100 km² required to fulfill the 'Critically Endangered' criterion of the IUCN Red List.

An estimated 541 individuals reside in Livingstone, a forest that has been incorporated into Kitulo National Park. This should significantly improve protection for the kipunji groups in this area, although the forest is severely degraded (Davenport 2006), and illegal activities, including logging and hunting of primates, are only now being brought under control. A new management plan for Kitulo National Park has recently been produced, in which the mandate for research and monitoring of the kipunji falls to the Wildlife Conservation Society (WCS). There are no immediate plans for habituation of the animal for tourism until appropriate and thorough research has been carried out on its potential impacts. However, a section of forest contiguous with Mt Rungwe, and containing groups of kipunji, is now being leased to, and managed by, WCS. The kipunji here are being studied and monitored full time by WCS staff as well as national and international students.

More than 51% of the total kipunji population lives in forests with comparatively little management. However, there are grounds for optimism. Ndundulu Forest Reserve was absorbed by the new Kilombero Nature Reserve in 2007 (Marshall *et al*. 2007) under the auspices of the Forestry and Beekeeping Division of the Ministry of Natural Resources and Tourism. Similarly, Mt. Rungwe, so long a neglected Catchment Forest Reserve, is now in the final stages of becoming a nature reserve as well. This will complement the adjacent national park and enable community involvement. A management plan is currently being written, and reserve rangers have recently been hired and trained. It will, however, be some time until illegal activities are brought under control, even with full resources at the authority's disposal.

On Mt. Rungwe, where forest clearance, hunting and fragmentation pose the most serious threats (Machaga *et al.* 2005), the reasons for the animal's discrete distribution are being studied. Moreover, research is being carried out on aspects of the kipunji's social and reproductive behaviour, feeding ecology, home range dynamics, predation and demography. Across Rungwe-Kitulo, the isolated sub-populations may already be subject to a loss of genetic variability due to low effective breeding populations. Some may no longer be viable and this is also under investigation.

Southern Ndundulu, meanwhile, is in excellent condition due chiefly to its remote location (Davenport and Jones 2005). However, the long-term viability of the 7% of the kipunji population must be considered uncertain, at best. It is possible that this population is simply dying out 'naturally', but research into the reasons for, and the viability of, the small Udzungwa population is ongoing. Whether any

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tangible primate conservation measures could or should be applied in a largely undisturbed habitat is debatable. The focus of applied kipunji conservation work is currently the protection and restoration of the montane forest habitats of Mt. Rungwe, widespread environmental education, and support to both management authorities and local communities across the range.

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Cross River Gorilla

Gorilla gorilla diehli Matschie, 1904

Nigeria and Cameroon

(2000, 2002, 2004, 2006, 2008)

The Cross River gorilla (*Gorilla gorilla diehli*) is the most western and northern form of gorilla, and is restricted to the forested hills and mountains of the Cameroon-Nigeria border region at the headwaters of the Cross River. It is separated by about 300 km from the nearest population of western lowland gorillas (*Gorilla gorilla gorilla*), and by around 250 km from the gorilla population in the Ebo Forest of Cameroon. The most recent surveys suggest that between 200 and 300 Cross River gorillas remain. Groups of these gorillas concentrate their activities in 11 localities across a 12,000 km² range, though recent field surveys confirmed the presence of gorillas outside of their known localities suggesting a wider distribution within this range. This distribution is corroborated by genetic research, which has found evidence that many Cross River gorilla localities continue to maintain contact through the occasional dispersal of individuals.

There are many human settlements around the forests where the gorillas occur, including a number of enclaved villages within Okwangwo and Takamanda. The encroachment of farms, dry-season fires set to clear forest or improve pasture, and development activities, such as roads, continue to threaten the integrity of gorilla habitat. However, large tracts of lower elevation forest remain between the localities where the gorillas are presently concentrated, and if these areas can be protected, the animals may be able to expand their range and population size. Genetic evidence suggests that the decline in the population of Cross River gorillas has been recent, and is probably associated with the introduction of hunting with firearms. After several years of awareness-raising by conservationists and researchers, hunting of Cross River gorillas for bushmeat has been reduced to a low level, but it is still a potential threat, as are wire-snare traps set for other animals. A conservation action plan to improve the survival prospects for the Cross River gorilla was published in 2007 (Oates *et al*. 2007), and many of the key recommendations contained in the plan have already been implemented.

Afi Mountain Wildlife Sanctuary (AMWS). AMWS is managed by the Cross River State Forestry Commission with support from a partnership of NGOs. Although levels of hunting have been reduced, the presence of more than 600 illegal farms within the sanctuary remains an unresolved problem. Widespread illegal logging in the contiguous Afi River Forest Reserve (ARFR) and the spread of farms from the intervening Buanchor enclave threaten to sever the habitat corridor linking Afi to the Mbe Mountains in the east. The sanctuary itself has been largely protected from logging due to its steep mountainous slopes, although the forest is frequently damaged by dry-season fires. Habituation of gorillas for the purposes of tourism is proposed, the potential costs and benefits of which are being debated. The sanctuary is also the proposed release site for the reintroduction of captive drills (*Mandrillus leucophaeus*) by the NGO Pandrillus.

The Mbe Mountains. The Mbe Mountains are a critically important corridor linking Afi Mountain to the west with Cross River National Park and the larger block of gorilla habitat to the east. Lacking any formal conservation status, traditional ownership of the Mbe forest is claimed by nine surrounding communities. In 2005, these communities formed the Conservation Association of the Mbe Mountains (CAMM) to manage the area both for conservation and to provide benefits to local communities. Capacity building and

Key sites for the Cross River gorilla and the Ebo gorilla

Country/Site	Status	Altitude (m above sea level)	Area (km²)	Gorilla range (km²)	Estimated numbers
Nigeria					
Afi Mountain	Wildlife Sanctuary	130–1,300	*c.*100	40	25–30
Mbe Mountains	Proposed Community Wildlife Sanctuary	110–900	85	25	25–30
Okwangwo Division of Cross River National Park	National Park	110–1,700	640	65	25–50
Cameroon					
Takamanda	National Park and adjacent area of unclassified forest	80–1,700	676	80	45–59
Mone River	Forest Reserve	110–1,200	538	68	20–30
Mbulu	Unclassified forest	500–2,000	*c.*1,000	54	20–30
Kagwene	Gorilla Sanctuary	1,700–2,000	19	*c.*9	17–19
Bechati-Fossimondi-Besali	Unclassified forest	200–1,700	80–100	*c.*25	20–30
Ebo Forest	Proposed National Park	200–1,200	*c.*2,000	*c.*25	*c.*25

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support for CAMM is currently provided by the local NGO Development in Nigeria, and an effective patrol system by a team of eco-guards has been established by the Wildlife Conservation Society (WCS). A protected area boundary has been provisionally demarcated, and the permanent demarcation and legal gazettement of this boundary is currently in progress. Although the mountains remain under threat from logging, agricultural encroachment and hunting, these threats have diminished somewhat since 2005.

Cross River National Park: Okwangwo Division. Cross River National Park (CRNP) is the most important site for Cross River gorillas in Nigeria and is contiguous with Takamanda in Cameroon. A number of new ranger posts have been constructed, and in 2008 all park rangers received basic training in anti-poaching techniques. Despite the efforts of park authorities, high levels of hunting occur in most areas of the Okwangwo Division (the northern sector of Cross River National Park where gorillas are found), driven by the lucrative bushmeat market. In addition, farmland belonging to three large village enclaves threaten to divide the park in two and thereby isolate the forest and gorillas of the 'Boshi Extension' in the extreme north from the rest of the Okwangwo Division. There have been recent efforts to promote transboundary collaboration between Okwangwo and Takamanda. Unfortunately, should the long-threatened privatization of national parks in Nigeria proceed as planned, the consequences for the remaining gorillas could be catastrophic.

Takamanda National Park. Originally established as a forest reserve in 1934, Takamanda was upgraded to a national park in November 2008. Takamanda's long history of use by local communities poses one of the biggest challenges to conservation in this area. The unsustainable harvesting of wildlife, certain non-timber forest products, and illegal timber extraction (from surrounding areas) must be brought under control. Many of these activities are driven by market forces in Nigeria, and a transboundary approach is essential to success. Despite these challenges, Takamanda and the adjacent Mawambi Hills located outside the southern boundary of the park provide refuge to a significant proportion of Cameroon's Cross River gorillas as well as scattered groups of drills (*Mandrillus leucophaeus*), chimpanzees (*Pan troglodytes ellioti*), Preuss's guenons (*Cercopithecus preussi*) and other large mammals. The area is also known to be of importance in terms of plant diversity, birds, reptiles and other taxa.

Mone River Forest Reserve. Mone was created as a Forest Reserve in the 1950s. Although there are no human settlements within the reserve, local people continue to harvest timber, wildlife, and other forest products. Due to a varied topography and rich vegetation, Mone still provides habitat for a number of large mammals, including Cross River gorilla in the northern half of the reserve (recent studies have confirmed that these gorillas are using an area larger than previously confirmed). In 2003, the government indicated that they might upgrade Mone to a Wildlife Sanctuary, and surveys have confirmed that this is urgently warranted. WCS in partnership with the UNEP/UNESCO Great Ape Survival Programme (GrASP) is to lead a feasibility study into carbon-based marketing for the area.

Mbulu forest. The Mbulu forest is a large block of unclassified forest which cloaks a series of extremely rugged and remote valleys located between the Kagwene Gorilla Sanctuary and northern Takamanda. Human population pressure is relatively low, with human activities being largely restricted to farming in valley bottoms and accessing the forest via ridges or less steep slopes for hunting and the harvesting of other forest products. Because of the relatively low human pressure, Cross River gorillas and other important species have found refuge here, and the forests of Mbulu provide one of the best opportunities to maintain some form of habitat corridor connectivity between various Cross River gorilla sites in the area. WCS is reviewing the possibility of establishing new protected areas and corridors, while at the same time working with villages adjacent to Cross River gorilla sites to establish a community-based gorilla protection and monitoring system known as the 'gorilla guardian network.'

Kagwene Gorilla Sanctuary. Created in 2008, this sanctuary is the only protected area established specifically to conserve the Cross River gorilla. Although of limited size, Kagwene is home to a number of gorillas which are the subject of long-term research, monitoring and protection activities. Due to the daily presence of gorilla monitors, Kagwene is an important site for capacity-building related to gorilla monitoring and awareness-raising. In the near future, the Ministry of Forestry and Wildlife plans to post a warden and eco-guards to the Sanctuary, and will become increasingly involved in the financing of the site. Urgently required management measures include the demarcation of boundaries, recovery of farm-encroached forest, and integration of surrounding communities into management strategies. It is also important that forest corridor links with Mbulu are maintained.

Bechati-Fossimondi-Besali (BFB) Forest (now Lebialem-Mone Forest Landscape). The BFB Forest is about 40 km south of Mone and is the southernmost location of the Cross River gorilla. Though of limited size (*c.*120 km²), the BFB Forest is home to a likely small, but as yet unknown number of gorillas. In 2007, the Environment and Rural Development Foundation (ERuDeF) expanded gorilla research and conservation activities to Ndumbin-Nkandu and the Bechati-Mone Forest Corridor. In 2009, research activities will include the Mak-Betchou Forest, Nkingkwa Hills and Mbanga/Mpongo-Ebensuk Forest. ERuDeF also initiated community-based management activities to secure a future for great apes in the BFB Forest, where the main threats are habitat fragmentation and forest encroachment by small farmers, and hunting.

Ebo Forest. About 250 km south of the Cross River population and 5 km north of the Sanaga River, the Ebo Forest in southwestern Cameroon is home to a small isolated population of gorillas the taxonomic affinities of which are still unclear. The forest, which covers almost 2,000 km² and is adjacent to a large FSC-certified logging concession at its northern perimeter, is characterized by extreme topography

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and a diversity of habitats, and holds a unique assemblage of 11 diurnal primate species. Researchers from the Zoological Society of San Diego's Ebo Forest Research Project have been working in Ebo since 2005, and one of the three research stations is situated in the gorilla's range. Recent field research suggests that fewer than 25 individual gorillas survive in an area of about 25 km². The Ebo forest is also inhabited by important populations of other highly threatened species such as the drill (*Mandrillus leucophaeus leucophaeus*), Preuss's red colobus (*Procolobus preussi*) and the Gulf of Guinea chimpanzee (*Pan troglodytes ellioti*). The forest's primates are under extreme pressure from bushmeat hunting to supply the commercial trade, given the proximity of Ebo to the main urban centers in Cameroon. Over 1,000 km² of the Ebo Forest is currently being gazetted as a national park.

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Asia

Siau Island Tarsier

Tarsius tumpara Shekelle, Groves, Merker & Supriatna, 2008
Indonesia
(2006, 2008)

The Siau Island tarsier, *Tarsius tumpara*, is a newly described species that is Critically Endangered and faces an imminent threat of extinction. Shekelle and Salim (2009) used GIS data and field surveys to list specific threats. They include: a very small geographic range, of 125 km², and an even smaller area of occupancy, perhaps as little as 19.4 km²; a high density of humans (311 people per km²) that habitually hunt and eat tarsiers for snack food; and an extent of occurrence that is entirely volcanic in its geological composition, with Mount Karengetang, a massive and highly active volcano, dominating more than 50% of its geographic range. Furthermore, there are no protected areas within its range (Riley 2002; Shekelle *et al.* 2007; Shekelle and Salim 2009), and all captive breeding programs for tarsiers, including several by leading zoos and primate centers, have been dismal failures, leaving no *ex situ* conservation options for any tarsier species anywhere (Fitch-Snyder 2003).

The most reasonable interpretation of the scant data is that population size is very small, in the low thousands at best, and declining (Shekelle and Salim 2009). Despite the fact that Sangihe Island is renowned for its Critically Endangered avifauna (Whitten *et al.* 1987; Whitten 2006), Shekelle and Salim (2009) found that the conservation threat for *Tarsius tumpara*, on Siau Island, was greater, for every variable measured, than that faced by *T. sangirensis*, which nevertheless is Endangered (Shekelle and Salim 2009). Thus, in spite of the fact that *T. tumpara* was only recently described and remains almost unknown, sufficient evidence indicates that it teeters on the brink of extinction on an island where the entire endemic fauna and flora are at risk (Shekelle *et al.* 2007).

The taxonomic distinctiveness of Siau Island tarsiers was predicted by the Hybrid Biogeographic Hypothesis for Sulawesi (Shekelle and Leksono 2004). Sangihe and Siau Islands are part of a volcanic arc and are separated by approximately 60 km of deep ocean, greater than 1,000 m in depth; far greater than the 180 m depth normally used by biogeographers for the maximum extent of dry land exposed during glacial maxima. There is no feasible means for recurrent gene flow between these islands today, nor is there any historical indication of a land connection between them. Shekelle *et al.* (2008a) reported acoustic and morphological evidence that supported taxonomic separation of the Siau Island population, but a sister-taxon relationship between *T. tumpara* and *T. sangirensis* relative to other known species of tarsier. Shekelle *et al.* (2008b) reported genetic data for *T. sangirensis* along with numerous other tarsiers and comparative primate data. These data revealed that *T. sangirensis* is the sister-taxon of a clade consisting of all other Sulawesian tarsiers in their data set, with an average genetic distance between *T. sangirensis* and other Sulawesian tarsiers being approximately 80%; as great as that found between *Homo* and *Pan*, as measured at the same locus. They infer, therefore, that *T. sangirensis* split from other Sulawesi species several million years ago. Although tissue samples were collected for *T. tumpara*, genetic data are not available at this time owing to the extremely strict control of tarsier tissue for export from Indonesia in recent years, and the comparatively weak capacity for collecting such data within country (M. Shekelle pers. obs. and unpubl. data). Given the isolation between Sangihe and Siau Islands, however, it is reasonable to infer that the taxonomic uniqueness of *T. tumpara* is measured in hundreds of thousands, or even millions of years. Aside from the skull in Dresden, there is no further evidence in the literature of research on this species.

Shekelle's surveys found evidence of tarsiers in only two places, on the shores of a small fresh water pond at the extreme southern end of the island, and on a steep cliff face along the east coast road where it runs next to the ocean. Numerous other sites that looked promising based upon our experience with *T. sangirensis* turned up no evidence of tarsiers. Interviews with several locals indicated that tarsiers had formerly been common at these sites as recently as 10 years ago, but were now rare or non-existent. They also added that tarsiers, and other small endemic mammals such as the dwarf cuscus, were a popular snack food called "*tola-tola*", and that it had formerly been common to eat 5 to 10 animals at a single sitting after hunting them with air rifles. More recently, reports by a colleague (Noldi Kakauhe pers. comm.) indicated that tarsiers are present high on the flanks of Mt. Karengetang, near the edge of the caldera, by the village of Salili. Furthermore, as reports of *Tarsius tumpara* have spread and circled back to Siau Island, it has become apparent that some residents of Siau Island are sensitive to reports that some of the islanders eat tarsiers. Thus a careful line needs to be drawn between accurately reporting genuine threats to this species, and sensationalism that could damage relations between conservationists and island residents. Indeed, the specific name,

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tumpara (the word for tarsier in the local dialect on Siau Island) was given as a means to honor local residents, in the hope that they would actively work to preserve their biological heritage (Shekelle *et al.* 2008a).

Myron Shekelle & Agus Salim

Javan Slow Loris

Nycticebus javanicus É. Geoffroy, 1812
Indonesia
(2008)

All Asian lorises are imperiled 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 (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 (Shepherd *et al.* 2004). 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). Five species of slow loris are now recognized: *N. coucang* (greater), *N. pygmaeus* (pygmy), *N. bengalensis* (Bengal), *N. menagensis* (Bornean), and *N. javanicus* (Javan) (Roos 2003; Chen *et al*. 2007). 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.

Finally recognized by the IUCN as a species in 2006, and currently listed as Endangered, 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, a species whose threat status must also be carefully monitored.

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 really 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 have shown that historic forest loss and continued degradation mean that less than 20% of habitat suitable for *N. javanicus* remains. Species distribution modeling and a Gap Analysis have also revealed that only 17% of the potential distribution of *N. javanicus* is currently within the protected area network of Java. Furthermore, Thorn *et al*. (2008) have highlighted conservation priority areas for the increased protection of *N. javanicus*, based on GIS analysis and ecological niche modeling. These include recommendations for the extension of seven important protected areas across the island, as well as 11 priority survey sites where the current distribution and abundance of this enigmatic primate should be studied. More surveys are vital since the decreased number of Javan lorises in trade seems to correlate with exceedingly low numbers in the wild (Nekaris *et al*. 2008). Indeed, surveys by three research groups all showed animals to occur at 0.02 to 0.20 animals per km, when they could be found at all, meaning 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).

Also urgently required are programs 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 defense 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).

In Java itself, lorises are often specifically targeted for the trade (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 the purportedly toxic lorises, traders habitually cut or pull out an animal's front teeth. Most of these lorises die due to dental abscess or pneumonia. Those that do survive are no longer able to eat their preferred food (gum) (Wiens *et al.* 2006), or to engage in the important behavior 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

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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.

To combat the issue of trade, starting in 2002, a handful of foreign-aid assisted rescue centers were built up in Indonesia. These rescue centers became the haven for many different species of illegally traded wildlife confiscated by the Indonesian forest authorities, including hundreds of slow lorises. Up to 95–100% mortality of slow lorises has been reported by most rescue centers, due to untreated dental infections, improper care and malnutrition, as well as inappropriate releases. This problem is being combated with help from International Animal Rescue Indonesia (IARI), which set up the first facility specialized for the rescue and rehabilitation of lorises in Indonesia in 2006. Working closely with other NGOs, Indonesian Universities, and the Indonesian Ministry of Forestry, a Loris Rescue Unit is being set up to work on market investigations, rescue, rehabilitation and release of lorises, education and awareness, and supporting research work.

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 an overall bleak picture. If trade cannot be halted, Critically Endangered will be a more apt listing for these evolutionarily distinct and beautiful primates. 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.

K. A. I. Nekaris, K. Llano Sanchez, J. S. Thorn, I. Winarti & V. Nijman

Simakobu or Pig-Tailed Snub-Nose Langur

Simias concolor Miller, 1903

Indonesia

(2002, 2004, 2006, 2008)

The simakobu monkey (*Simias concolor*) again is serving as the flagship species for the four Mentawai Island primates. The other three species inhabiting the 7,000 km² archipelago located west of Sumatra are Kloss's gibbon (*Hylobates klossii*), the Mentawai Island leaf monkey (*Presybtis potenziani*), and the Mentawai macaque (*Macaca pagensis*). *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 occurs only on Siberut Island.

Very little has been published on simakobu behavior and ecology. The first activity budget of habituated simakobus described the activities of two groups living in the Betumonga region of southwestern North Pagai. The data show that simakobus spend almost equal amounts of time resting (46%) and feeding (44%), and less time moving (7%) (Paciulli and Holmes 2008). Wendy Erb is in the middle of a year-long study of male simakobu behavior, which should yield more complete data on basic activity patterns (pers. comm.).

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 simakobus, 1,049 Kloss's gibbons, 1,545 leaf monkeys, and 7,984 pig-tailed 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).

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 officially protected areas. Most of these areas are subjected to human encroachment, product extraction, commercial logging, and conversion to cash crops and oil palm plantations (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). In addition, *S. 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.

Lisa M. Paciulli

Delacour's Langur

Trachypithecus delacouri (Osgood, 1932)

Vietnam

(2000, 2002, 2004, 2006, 2008)

Delacour's langur, also known as the white-rumped black leaf monkey, is endemic to Vietnam, occurring in a very restricted area in the north of the country that comprises about 5,000 km² between 20°–21°N and 105°–106°E. The distribution is closely related to the limestone mountain ranges in the provinces Ninh Binh, Thanh Hoa, Hoa Binh, and Ha Nam. Currently there are 18 locations known where Delacour's langurs occur. They are isolated populations, and combined total at most only 400 to 450 km². We know of five localities where local people have reported that it has been extirpated. The northwestern border of the distribution is Mai Chau, between the Da River in the north and the Ma River in the south. The Da River seems to form the northern border of the species' range, but the exact southern boundary is unclear. There are a number of isolated limestone areas south of the Ma River, but the only location where they are known there is the limestone complex between Lang Chan and Ngoc Lan. This population is, however, now most probably extirpated. It seems that this species never occurred south of the Chu River.

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During the decades following the discovery of Delacour's langur in 1930 there was only scanty information on its existence and distribution. The first sightings of live animals were reported in 1987 from Cuc Phuong National Park. The most important and for some subpopulations the only factor for 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 18 isolated wild populations of Delacour's langur have been confirmed over 10 years of surveys and monitoring by the Frankfurt Zoological Society. The total population counted in 1999/2000 was about 280 to 320 individuals. The recorded numbers of animals hunted over the 10 years (1990 to 1999) totaled 320, an annual loss of more than 30 individuals, but the real number is undoubtedly higher. Sixty percent of all existing Delacour's langurs occur in isolated populations with less than twenty animals. The loss of these subpopulations, and consequently 60% of the entire population, is foreseeable without management, strict regulations and law enforcement. 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 5 years (2000 to 2004). Surveys were carried out in 2008 by the Frankfurt Zoological Society in search of possibilities to translocate small isolated populations under severe threat. The results of the surveys show a continuously dramatic decline. The population in Ngoc Son Nature Reserve is most probably extirpated, the population in Pu Luong Nature Reserve reduced by about 25%, and the population in Cuc Phuong National Park reduced to 8 to 11 individuals. It is to be expected that the population in unprotected areas which have yet to be surveyed will show a similar tendency. A reasonable estimate of the current population indicates no higher than 200 individuals. Surveys by the Frankfurt Zoological Society continue, and should provide background information about status of populations and logistics for translocation. The improvement of protection for most of the subpopulations is not a realistic option, and most subpopulations are already too small for recovery without active management.

Four areas where Delacour's langurs occur are protected: Cuc Phuong National Park, Pu Luong Nature Reserve, Hoa Lu Cultural and Historical Site, and Van Long Nature Reserve. Van Long Nature Reserve is believed to harbor the largest remaining population. Delacour's langurs there 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 35%, and currently numbers 80 to 90 individuals. Efforts to save this species are one focus of the Vietnam Primate Conservation Program of the Frankfurt Zoological Society and the Endangered Primate Rescue Center at Cuc Phuong National Park, established in 1993 primarily to safeguard the future of this and other endangered Vietnamese primates. The Endangered Primate Rescue Center is the only facility which keeps this species. The center started a breeding program with five confiscated animals, and 15 individuals have been born since 1996. The aim is to reintroduce these langurs into well-protected areas to establish additional free ranging populations.

Tilo Nadler

Golden-headed Langur or Cat Ba Langur
Trachypithecus p. poliocephalus (Trouessart, 1911)
Vietnam
(2000, 2002, 2004, 2006, 2008)

The golden-headed langur, *Trachypithecus p. poliocephalus*, is probably the most endangered of the Asian colobines. This subspecies occurs only on the Island of Cat Ba in the Gulf of Tonkin, northeastern Vietnam. The Cat Ba Archipelago is in the world-famous Ha Long Bay, a spectacular karst formation that was invaded by the sea. The golden-headed langur inhabits tropical moist forest on limestone karst hills, and shares this habitat preference with the other six to seven taxa of the *T. francoisi* group. These so called karst langurs, including the Cat Ba langur and its closest relatives, the white-headed langur, *T. p. leucocephalus* Tan, 1955, in southern China, display strict behavioral adaptations to their karst habitat.

There are no systematic and reliable data available on the historic density of the langur population on Cat Ba Island. According to reports of indigenous people the entire island of Cat Ba (140 km²) and some smaller offshore islands were previously densely populated by langurs. Hunting has been the sole cause for the dramatic and rapid population decline from an estimated 2,400–2,700 in the 1960s to only 53 individuals by 2000. The langurs were poached mainly for trade in traditional medicines. Since the implementation of strict protection measures towards the end of 2000, the langur population on Cat Ba Island increased to current 60–70 individuals.

Although the growth of the population is encouraging, the overall status of the subspecies is most critical. As a result of habitat fragmentation, the remaining population is now divided into seven isolated sub-populations, probably only four of which include males, while the others are all-female groups and thus non-reproducing social units. The total reproductive output in this species is accordingly low. Since a peak in births in 2003, the reproductive output of the Cat Ba Langur has stagnated at 1–2 offspring per year.

Cat Ba Island and the surrounding area are nationally and internationally recognized for their importance to biodiversity conservation. Cat Ba National Park was established in 1986. It presently covers more than half of the main island. The Cat Ba 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, though awareness as well as partnership and commitment with the local communities are slowly increasing. However, efforts to effectively conserve the langurs and their habitat face major obstacles due to the need to better address the local community's aspirations for development,

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and due to the steadily increasing human population, besides persistent, severe deficiencies in law enforcement. 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. The strictest protection regime possible is necessary for the survival of all the mammals and other species on Cat Ba that are, like the langurs, targeted by the Asian wildlife trade.

A conservation program for the golden-headed langur on Cat Ba was initiated in November 2000 by the Zoologische Gesellschaft für Arten- und Populationsschutz (ZGAP), München, and Allwetterzoo Münster, Germany. The aim is to provide for their protection, reduce population fragmentation, and contribute to the conservation of the biodiversity on Cat Ba Island in collaboration with Vietnamese authorities.

Daniela Schrudde, Roswitha Stenke, Phan Duy Thuc & Martina Raffel

Western Purple-faced Langur

Trachypithecus (Semnopithecus) vetulus nestor Bennett, 1833
Sri Lanka
(2004, 2006, 2008)

One of the most serious problems facing Sri Lanka's western purple-faced langur (*T. v. nestor*) stems from the fact that it inhabits some of the most densely populated regions of the country. As a result, this endemic monkey's long-term survival is severely threatened by unplanned and haphazard urbanization. A recent survey involving nearly 1,900 km of travel through one-third of *T. v. nestor*'s historical range (Hill 1934) showed that nearly 81% of the areas surveyed consisted of deforested and human-dominated landscapes. Another analysis indicated that more than 90% of its entire range has been replaced by houses, home gardens, townships, temples, schools, plantations, commercial operations and other areas of human activity. Deforestation has fragmented and drastically depleted the preferred habitat and principal food sources of the highly arboreal and folivorous *T. v. nestor.*

Within the fragmented and human-dominated landscape, *T. v. nestor* subsists mainly on fruits from home gardens (Dela 2007; Rudran 2007). The nutritional consequences of feeding on a low diversity diet mainly of cultivated fruits are unclear, but likely to be detrimental over the long term, because *T. 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). Given these specializations, relying on a diet of fruits instead of leaves may undermine the functioning of this monkey's gut fauna and thereby compromise its ability to absorb nutrients. Furthermore, fruits tend to occur seasonally, which means that *T. v. nestor* may not be able to fully satisfy its energy requirements outside the fruiting season. When such detrimental effects have the potential to affect this langur through most of its range, its long-term survival becomes an issue of serious concern.

Besides depleting *T. v. nestor*'s primary food source and preferred habitat, deforestation and fragmentation also cause other problems for this monkey's survival. For instance, when fragmentation forces it to move on the ground, for which it is ill-adapted, people will occasionally capture young individuals to raise them as house pets. While on the ground *T. v. nestor* also runs the risk of being killed by domestic 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 *T. v. nestor* is occasionally shot and killed while feeding in home gardens (Dela 2004). Deforestation and fragmentation indirectly lead, therefore, to 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 recent survey. 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). 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, certain facts revealed during the recent survey indicate that it is still possible to save this monkey from disappearing forever. The largest forests it now inhabits (about 21 km² in all) are found around two reservoirs (Kalatuwawa and Labugama) that supply water to 1.2 million inhabitants of Sri Lanka's capital, Colombo. Because of their importance to people and their size, these forests are the last and most secure strongholds for maintaining viable populations over the long term. The Forest Department responsible for these forests has indicated interest in replanting the pine plantations in them with native species that are exploited by *T. v. nestor*. Such an initiative would certainly increase the extent of *T. v. nestor*'s preferred habitat, but it would first require a study of this langur's dietary preferences in the wild, which have yet to be studied.

Another important fact that surfaced during the survey was that the Forest Department has plans to promote forest conservation among communities living around its forests, through environmental education and nature tourism programs. Such programs can help conserve *T. v. nestor*, but to be effective they must be translated into action almost immediately.

Most people living within this langur's range were found to be Buddhists, who have a strong aversion to killing animals. The Buddhist taboo against killing may explain why this monkey has survived for as long as it has in such a densely populated area despite its reputation as an agricultural pest and a nuisance causing damage to roofs of houses and other properties. Sporadic killing does occur, however, as conflict between humans and monkeys intensifies (Nahallage *et al.* 2008), and poverty plagues the lives of the local people. Despite this situation, our survey revealed at least two forested sites around Buddhist monasteries where the incumbents strictly enforced the principles

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of their faith and protected *T. v. nestor* and other wildlife. Hence soliciting the support of the Buddhist clergy and using cultural traditions to protect wildlife is a real possibility in Sri Lanka.

The above mentioned facts indicate that opportunities still exist for conserving *T. v. nestor*, despite the survival problems of this endangered endemic. The survey led to the development of a comprehensive plan for conserving *T. v. nestor* that includes three initiatives; public education, personnel training, and research. Because of the urgent need for conservation action, some elements of these initiatives were launched immediately after the survey despite the paucity of funds.

The public education initiative was launched at two sites that were identified as important for the long-term conservation of *T. v. nestor*, and targeted rural communities, particularly school children and their parents, living close to them. One site was around the Labugama-Kalatuwawa reservoirs where a viable population of *T. v. nestor* could be maintained over the long term, and the other was an area where human-monkey conflict was particularly intense. The educational activities at both sites were conducted with the support and participation of local Buddhist temples and clergy, and culminated in a public exhibition of conservation-oriented children's paintings and essays, at which the country's Minister for Environment and his top bureaucrat awarded prizes to the most talented youngsters. These events were publicized via newspaper articles and radio talk-shows to inform a much larger audience throughout the island that efforts to help conserve *T. v. nestor* were supported by the government and influential officials of the country.

The training initiative was launched with a series of activities designed to help a group of six trainees learn about the biology and identification of Sri Lanka's primates, birds and butterflies. Similar workshops dealing with plants, land snails, reptiles, amphibians and invasive species have been scheduled for the future. The primary objective is to train local youth, particularly those living around the Kalatuwawa-Labugama reservoirs, to become well-informed naturalists, who could work independently as nature guides or with us to help conserve *T. v. nestor*

The research initiative remains dormant for the moment due to a lack of funds, but proposals have been submitted to address this shortcoming. When funds become available, research on *T. v. nestor's* ecology and behavior, particularly its dietary preferences in the wild, will begin, and the work on the public education and training initiatives will be expanded. The battle to win the hearts and minds of people and to help ensure the survival of *T. v. nestor* has only just begun. Much remains to be done, and success can be achieved if this battle is sustained until current trends of deforestation are reversed, and people become more aware of the value of their wildlife.

Rasanayagam Rudran, Kanchana Weerakoon & Ananda Wanasinghe

Gray-shanked Douc Monkey

Pygathrix cinerea Nadler, 1997

Vietnam, Cambodia (?), Laos (?)

(2000, 2002, 2004, 2006, 2008)

The colobine monkeys of the genus *Pygathrix* are native to Indochina. Until only ten years ago, just two distinct taxa were recognized: the red-shanked douc, *Pygathrix nemaeus* (Linnaeus 1771), in the northern part of Central Vietnam and Central Laos; and the black-shanked douc, *P. nigripes* (Milne-Edwards, 1871) from South Vietnam and east Cambodia. The gray-shanked douc was first described as a subspecies of the red-shanked douc, but genetic studies have since demonstrated a divergence at species level (Roos and Nadler 2001). 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. Currently, gray-shanked doucs are known only from Vietnam, but records exist close to the border with Laos, and there are photos of hunted animals from south-east Laos and far north-east Cambodia that suggest that the species occurs in small neighboring areas in both countries. Surveys and research on this recently discovered primate have been conducted by the Vietnam Primate Conservation Program of Frankfurt Zoological Society, and the Endangered Primate Rescue Center at Cuc Phuong National Park.

Gray-shanked douc populations are fragmented, and estimated to total 600–700 individuals. 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. Hunting — the principal threat to the species — is, however, still a problem inside these parks and reserves. Snares are the most commonly-used method since gun confiscation programmes were carried out in a number of the areas. Often hundreds of traps are installed in trees frequently used by the monkey 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 within 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 selectively logging every year in the Central Highlands.

The Endangered Primate Rescue Center has received 37 confiscated gray-shanked douc monkeys since 1995, and has begun a breeding program to provide stock for reintroduction in protected forests. Based on information from villagers and forest protection authorities, less than one-quarter of the hunted animals are confiscated alive. Frankfurt Zoological Society is studying the species in the Central Highlands of Vietnam, specifically to provide recommendations for the establishment of special "Species Protection Areas", which will promote connectivity between the currently-isolated populations in the established parks and reserves.

Ha Thang Long & Tilo Nadler

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

The Tonkin snub-nosed monkey is one of four unusual, large, Asian colobine monkeys of the genus *Rhinopithecus*, all of which possess a characteristic turned-up nose. The three other species are endemic to China, while the Tonkin snub-nosed monkey is found only in northeastern Vietnam. This species 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.

Currently, there are only five known locations with recent evidence where Tonkin snub-nosed monkeys occur, and these are completely isolated. In 1992, a population was found in Na Hang District, Tuyen Quang Province. As a result of the discovery, a nature reserve was established in 1994. The nature reserve comprises two separate areas: the Tat Ke and Ban Bung sectors. A study in 1993 observed 72 individuals and estimated 80 in the Tat Ke sector, and observed 23 individuals and estimated 50 in the Ban Bung sector. A later study, in 2004–2005, found far lower densities, and estimated only 17–22 individuals in the Tat Ke sector; no estimation of numbers was possible for the other subpopulation in Ban Bung sector. The main threat to the monkeys in Tat Ke Sector was hunting. This may result from a hydropower and flood prevention dam project in Na Hang. Construction began in 2002, and some 10,000 workers moved into the area for dam construction. This created a number of access roads and a demand for wildlife products and firewood. Conservation activities carried out by several organizations have been unsuccessful, and it has resulted in a reduction of this population.

A population of about 70 individuals was estimated for Cham Chu Nature Reserve in 2001, also in Tuyen Quang Province. 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 later study (2005–2006) confirmed about 90 animals in Khau Ca, close to Du Gia Nature Reserve, Ha Giang Province. This is the only population which is not immediately threatened. There, public awareness and community participatory activities are being linked to increased protection efforts under the supervision of Fauna and Flora International (FFI).

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. 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 measures are likely to be training and establishing patrol groups, awareness-raising, more survey work to locate other groups and assess the range of the monkeys, and assessment 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.

Le Khac Quyet, Dong Thanh Hai & Tilo Nadler

Eastern Black Crested Gibbon
Nomascus nasutus (Kunkel d'Herculais, 1884)
China, Vietnam
(2008)

The eastern black crested gibbon occurs in a very restricted area along the Sino-Vietnam border, comprising 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, and an immediately adjacent area (about 18 km²) in Jingxi County in South China's Guangxi Zhuang Autonomous Region (La Quang Trung and Trinh Dinh Hoang 2004; Chan Bosco Pui Lok *et al*. 2008).

In the past, the species was believed to comprise two subspecies (*N. nasutus nasutus* and *N. n. hainanus*), the first occurring in Vietnam and the second on China's Hainan Island. Both have now been elevated to full species, based initially on differences in territorial calls and fur coloration (La Quang Trung and Trinh Dinh Hoang 2004), but supported by genetic data (Roos *et al.* 2007). At the 2006 Asian Primate Red List Workshop in Cambodia, both were recognized as distinct species (Geissmann 2007; Chan *et al.* 2008). The historical range of the eastern black-crested gibbon was east of the Red River in China and Vietnam. It was thought to have gone extinct over its historical range in mainland China (Tan 1985), but was rediscovered recently in Bangliang Limestone Forest in Jingxi County; the population was estimated at 19 individuals, living in three groups (Chan Bosco Pui Lok *et al*. 2008). In Vietnam, it was also feared extinct until scientists from Fauna and Flora International (FFI) rediscovered a population in the limestone forest of Phong Nam-Ngoc Khe Communes in the northernmost Trung Khanh District, Cao Bang Province, northeast Vietnam, along the border with Guangxi. The population was estimated to be 26 individuals in at least five groups, based on a survey conducted in August 2002 (Geissmann *et al*. 2002, 2003), and 37 individuals in 8 groups in a survey in September 2004 (Trinh Dinh Hoang 2004). Based on simultaneous surveys in September 2007 on both sides of the border, the total

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population of the gibbon is around 110 individuals living in 18 groups (Le Trong Dat *et al.* 2008). Thus, the species should be listed as Critically Endangered.

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 main threat to this species, given its restricted range, is habitat loss and disturbance. The habitat of *N. nasutus* is in danger of being cleared for cultivation, pasture for livestock, and firewood collection by local Vietnamese, as well as charcoal-production by local Vietnamese and Chinese. The species is also endangered from problems intrinsic to small population size such as inbreeding effects, poor mate-choice, and human or natural disaster (La Quang Trung and Trinh Dinh Hoang 2004).

Conservation efforts on this species have been initiated in China since its rediscovery two years ago. Work on a proposed nature reserve to protect the gibbons, including comprehensive surveys and official document preparation, is now in progress, and the reserve will soon be in place. As for its conservation in Vietnam, Fauna and Flora International (FFI), along with Cao Bang FPD, is spearheading the establishment of a Species Conservation Area and a joint forest protection system that involves communities, a ranger force, and border patrol. FFI is also partnering with the Cao Bang Rural Development Project to encourage sustainability and conservation education and research in the local communities of the region (La Quang Trung and Trinh Dinh Hoang 2004). There is an urgent need to integrate the conservation efforts of both countries if the species is to be saved.

Long Yongcheng & Tilo Nadler

Western Hoolock Gibbon
Hoolock hoolock (Harlan, 1831)
Bangladesh, India, Myanmar
(2009)

Western and eastern hoolock gibbons were formerly in the genus *Bunopithecus* as two subspecies. In 2005, Mootnick and Groves placed them in a new genus, *Hoolock* as two distinct species, the western being *Hoolock hoolock* and the eastern, *Hoolock leuconedys*. The western hoolock gibbon occurs in India, Bangladesh and Myanmar, and the eastern hoolock gibbon in India, Myanmar and China.

The range of western hoolock gibbon is strongly associated with contiguous canopy, broad-leaved, wet evergreen and semi-evergreen forests. Hoolock gibbons are important seed dispersers, their diet including mostly ripe fruits, with some flowers, leaves and shoots.

Western hoolock gibbons face numerous threats, and now may be dependent on human action for their survival. Threats include habitat loss due to human encroachment, forest clearance for tea, slash-and-burn cultivation, hunting as food and medicine, and capture for trade. Additional threats include decline in forest quality which affects fruiting trees, canopy cover and the viability of their home ranges. Isolated populations face additional threats arising from intrinsic effects of small populations. Some populations surviving in a few remaining trees are harassed by locals and dogs while attempting to cross clearings between forest patches in search of food.

Habitat loss over the last 3–4 decades suggests that western hoolock gibbons have declined from more than 100,000 to less than 5,000 individuals (a decline of more than 90%). The contiguous forests have borne the brunt of persistent human impacts. Isolated forest fragments hold a few families of about 1–4 individuals; numbers insufficient for long-term survival. Apart from some border forests between India and Myanmar, the remaining habitat is fragmented, holding minimal populations. The extirpation of western hoolock gibbons from 18 locations between 2001 and 2005 has been documented; ten in India and eight in Bangladesh.

About 100 locations of western hoolock gibbons have been recorded in India. In 2005, 77 of those locations had less than 20 individuals, and 47 of these had less than 10. A Population Viability Analysis (PVA) predicted a 75% decline in the population in India and a 95% decline in the population in Bangladesh over the next two decades, based on the current effects of human impacts.

Earlier estimates of western hoolock gibbons in Bangladesh were about 200 in 22 separate locations. Anwar Islam and his team conducted site visits in additional areas since then, and now estimate a total of about 300 individuals comprising 82 groups in 37 sites. In northeastern Bangladesh there are 12 sites with 102 hoolocks. The rest are in 25 sites in the southeast. There may be populations numbering 50–100 individuals in remote areas of the southeast hill tracts, but this has not been confirmed because of inability to visit these sites due to insurgency. During the last 15 or so years, hoolock gibbons have been extirpated from many sites, including Chunati Wildlife Sanctuary in the southeast. The extent of degradation and fragmentation of hoolock gibbon forests in the country is severe and the available habitats are continuing to decline.

The southernmost population of the western hoolock gibbon in Myanmar has been surveyed by Geissmann *et al.* confirming the presence and identification of western hoolock gibbon (*Hoolock hoolock*) in southern Rakhine Yoma, Myanmar, albeit a very small number. Reports of several other surveys in southern Myanmar are pending (Geissmann *et al.* 2008).

There may be much yet to learn about the distribution of the two species of hoolock gibbons. J. Das *et al.* identified the eastern species from Lohit district of Arunachal Pradesh, India, for the first time in 2005. Also, in a study conducted in the early months of 2009, D. Chetry found a new population of *Hoolock leuconedys* of around 150 groups between the rivers Dibang and Lohit in Lower Dibang Valley District of Arunachal Pradesh, India.

Warren Brockelman has carried out surveys of the eastern hoolock, *Hoolock leuconedys* in two accessible protected areas east of the Chindwin River in Myanmar since 2005. Recent studies in Mahamyaing Wildlife Sanctuary, western Myanmar, using auditory sampling of groups, produced an

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estimate of about 6,000 individuals and a mean density of more than 2 groups/km² in areas of suitable forest. Preliminary analysis of a survey by WCS–Myanmar and Wildlife Department personnel farther north in the Hukaung Valley (Kachin State) suggested that thousands of hoolocks survive there also. The Hukaung Valley Wildlife Sanctuary includes the headwaters of the Chindwin River and is contiguous with areas in India. The area of evergreen forest in the Hukaung Valley Reserve and contiguous PAs is so large (more than 20,000 km²) that the population there is likely to be in the tens of thousands. If so, this represents the largest population of hoolocks anywhere. Nevertheless, these PAs are not well protected and it is hoped that current interest in conservation in this multiple-use area will be sustained.

Eastern hoolock gibbons also occur in China. According to Fan Pengfei, a Chinese field biologist, the Chinese eastern hoolock gibbons survive only in Gaoligongshan Nature Reserve (GNR) in Baoshan,Tengchong, and Yingjiang. Based on field surveys, population size in GNR was estimated to be 20–21 groups. There are about 15 groups living outside Gaoligongshan Nature Reserve (based on interviews). The total population size is estimated to less than 150 individuals and is severely fragmented. The largest subpopulation in Yunnan has 8–10 groups; the second largest subpopulation has four groups, and in several sites there are only single groups. Twenty years ago researchers estimated the population size of hoolock gibbons to be less than 200. This was a low estimate due to failure of research to cover all distribution areas. The hoolock gibbon is threatened by poaching in some places and by habitat degradation and fragmentation outside GNR. There are no records of western hoolock gibbons in China to date.

There has been serious concern about the survival of hoolock gibbons for some decades. The species was listed on Schedule I, the highest schedule, on the Indian Wildlife (Protection) Act in 1972. It is categorized as Endangered on the IUCN Red List. The western hoolock gibbon was designated as one of the top 10 threatened gibbon taxa of the world in a Resolution taken in the gibbon symposium of the Congress of the International Primatological Society at Beijing in 2002.

Hoolock gibbons were assessed along with other South Asian primates at a Conservation Assessment and Management Plan workshop held in Coimbatore in 2002. Participants from northeastern India and Bangladesh assembled detailed locality tables which painted a bleak picture for western hoolock gibbons. Participants recommended that a Population and Habitat Viability Assessment (PHVA) Workshop should be conducted for the species. In 2005, a PHVA workshop was conducted for *Hoolock hoolock* in Dhaka, Bangladesh. Among other recommendations, workshop participants suggested that small, isolated, doomed individuals and groups in degraded areas should be translocated to more supportive habitat within their range.

The level of local knowledge required to conduct successful wild-to-wild translocations needed supplementation, so a collaborative initiative between GOs and NGOs in India and Bangladesh for scoping and training in translocation was organized. Two workshops, held in September 2008 for all stakeholders from India and Bangladesh, and February 2009 for senior foresters or their representatives from India generated a great deal of interest as well as a new awareness of the subtleties of such an exercise. Tentative plans were made for each state at the workshop. Arunachal Pradesh has taken the initiative and engaged the Wildlife Trust of India to assist them with an exercise for several isolated groups in an agricultural field in the state. Other northeastern Indian states and Bangladesh are also considering conducting carefully planned and executed translocations. The CAMP, PHVA and translocation training workshops also generated considerably more public awareness activities on hoolock gibbon that are now taking place very regularly, which will be useful also to the translocations when they occur.

There are hundreds of western hoolock gibbons languishing as single individuals or in minute groups in the northeastern Indian states and in Bangladesh. Successfully translocating these to more viable locations in nearby larger areas with resident, established hoolock populations will not only enrich the gene pool and strengthen populations but also salvage animals and their genetic material that would not otherwise survive even a very few years. Such an exercise will also provide a platform with a remarkable profile for enhancing protection as well as for reclaiming and restoring forest patches to create more contiguous habitat for hoolocks. It should also create good will and interest by the public, whose cooperation is necessary for long-term success. However, such exercises should be undertaken with strict adherence to the IUCN/SSC Reintroduction Specialist Group (RSG) reintroduction guidelines. They should also be a "last resort", after exploring all other means of conserving both habitats and species, working with locals in the current areas.

The population trends for the western hoolock gibbon observed over recent years in Bangladesh and northeastern India indicate a very rapid decline in numbers for which very little has been done in the way of mitigation. Immediate measures are required by governments, forest departments, local communities and NGOs to limit habitat destruction, initiate or improve habitat restoration and upgrade implementation of protective measures. Although there are indications of increased numbers in this report, it is only because more localities or areas are being visited and found to have hoolock gibbons sometimes in significant numbers. This should not, in any way, lead to complacency but to greater efforts to see that the threats which have plagued the hoolock gibbon in the past 3–4 decades are addressed and contained.

Sally Walker, Sanjay Molur, Warren Y. Brockelman, Jayantha Das, Anwarul Islam, Thomas Geissmann & Fan Peng-Fei

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Sumatran Orangutan
Pongo abelii Lesson, 1827
Indonesia (Sumatra)
(2000, 2002, 2004, 2006, 2008)

Sumatran (*Pongo abelii*) and Bornean (*P. pygmaeus* Linnaeus, 1760) orangutans are now considered to be two distinct species, comprising the genus *Pongo.* Three subspecies are recognized for *P. pygmaeus*, but the Sumatran orangutan is a single taxonomic unit. The long-term viability of the entire genus is in question, but the Sumatran orangutan faces the more immediate threat of extinction and is listed as Critically Endangered on the IUCN Red List of Threatened Species.

The species is endemic to Sumatra, Indonesia. Truly wild populations are restricted to the remaining lowland forests of the two most northerly provinces of the island, Nanggroe Aceh Darussalam (NAD) and North Sumatra. A small reintroduced population is also currently being established in Jambi Province, further to the south.

About 6,600 wild individuals remain (based largely on nest density surveys and 2002 satellite imagery). They survive in just 10 fragmented habitat units stretching from the central regions of NAD, south to the Batang Toru River in North Sumatra, with a notable gap in their distribution immediately west of Lake Toba. The southernmost populations in North Sumatra could be genetically and culturally distinct from their more northern relatives due to isolation. The largest populations occur within Nanggroe Aceh Darussalam, where until 2005 a separatist conflict made monitoring and conservation work problematic. Recent surveys appear to have confirmed the absence of orangutans in the northernmost forests of NAD such that almost all orangutans in Aceh can be found within what is known as the Leuser Ecosystem.

The Leuser Ecosystem is a 26,000 km² conservation area established by presidential decree that encompasses the smaller Gunung Leuser National Park (10,950 km²; itself part of the Sumatran Rainforest World Heritage Site) and the 1,025 km² Singkil Swamps Wildlife Reserve. About 5,800 orangutans are considered to remain in the Leuser Ecosystem. The Leuser Ecosystem, and the smaller National Park and Wildlife Reserve within it, forms the only conservation area where viable wild populations of the Sumatran orangutan, Sumatran tiger, Sumatran rhinoceros and Sumatran elephant, each of which is endangered in itself, still occur side by side. The National Park, however, mostly comprises high mountains, and as the orangutan is predominantly a lowland species, rarely being found above 1,000 m above sea level, the majority of orangutans are found within the larger Leuser Ecosystem but outside of the National Park itself. For example, the Ecosystem harbors *c.*88% of the remaining 6,600 Sumatran orangutans whilst only 30% are found within the National Park and 23% within the Singkil Swamps Wildlife Reserve.

Throughout its range, the primary threat to the Sumatran orangutan is habitat conversion and fragmentation. Logging, both legal and illegal, often leads to total conversion of forests for agriculture or oil palm plantations. Roads are also a constant threat, since they further fragment already declining populations and also give access for additional logging and encroachment. Although precise rates of forest loss are difficult to determine, primary lowland forests in Sumatra have been devastated over the last 30 years. One study of forest cover concludes 301,420 ha, or 13% of the original 2,284,771 ha of forests, were lost in North Sumatra Province alone between 1990 and 2000 (Gaveau *et al.* 2007). A second analysis, more focused on orangutan habitat in Sumatra concluded that habitat supporting around 1,000 orangutans was being lost each year in the Leuser Ecosystem alone during the late 1990s (van Schaik *et al*. 2001). This was largely due to legal logging concessions and conversion of lowland forests to oil palm estates, but also to illegal logging and encroachment in some places.

Fortunately, the rate of habitat loss decreased markedly in many areas during the Aceh civil conflict, as even loggers did not consider it safe to work in the forests. In fact, Gaveau *et al.* (2007) found that satellite data indicated that the rate of loss was five times faster in Aceh between 1990 and 2000 (294 km² or 0.75% per year) than it was between 2000 and 2006 (58 km² or 0.15% per year). Orangutan populations have nevertheless plummeted in those regions that have still been affected by logging. Even small-scale selective logging can reduce local orangutan densities by as much as 60% in Sumatra (Rao and van Schaik 1997).

Encroachment and conversion, especially by settlers fleeing the conflict in NAD and migrants from Nias Island, also accelerated habitat loss in some parts. After the 2004 tsunami many people moved from coastal areas, and the subsequent increase in demand for timber still poses a significant threat. Several new roads (part of a project known as Ladia Galaska) have also begun further fragmenting remaining orangutan habitat. Proposed new roads are a particular concern in the Singkil Swamps Wildlife Reserve, especially as Sumatra's peat swamp forests support the highest densities of orangutans in the world. This is expected to become a major problem in coming years as illegal loggers and settlers gradually move in and open up new agricultural land. Throughout their range, orangutans are sometimes killed as pests at the forest edge as they raid agricultural crops (particularly highly prized fruits such as durian), and in parts of North Sumatra Province they are occasionally still hunted for food. A small yet still significant trade in young Sumatran orangutans as pets also persists.

Key conservation interventions rely heavily on a dramatic and rapid improvement in enforcement of wildlife and forest laws and far greater consideration for environmental issues in spatial planning decisions. Implementing patrols, improving law enforcement (especially the number and frequency of cases actually prosecuted), stopping illegal logging, halting legal logging and forest conversion to plantations, promoting forest restoration, halting road construction, addressing human-orangutan conflict, and providing connectivity in the landscape to allow for genetic exchange are all seen as prerequisites for the species' survival. There is some cause for optimism, however. The Indonesian government has developed a National Strategy and Action Plan for Orangutan

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Conservation 2007–2017 (DitJen PHKA 2007) and the Government of NAD has also imposed a moratorium on all logging in the Province. Nevertheless, as with so many plans and laws, if not strictly followed and enforced, both could result in little or no change from business as usual. Indeed, if pre-civil conflict rates of habitat loss resume in NAD and the protected status of remaining habitat outside of the Leuser Ecosystem is not quickly enhanced, we could see a further 50% of Sumatran orangutans vanish within a decade. Effective long-term solutions to conserve northern Sumatra's remaining lowland primary forests are still urgently needed.

Ian Singleton, Jatna Supriatna & Serge A. Wich

Neotropical Region

Cotton-top Tamarin

Saguinus oedipus (Linnaeus, 1758)
Colombia
(2008)

Cotton-top tamarins are Critically Endangered and found only in northwestern Colombia. They have an extremely limited distribution, occurring in northwestern Colombia between the Río Atrato and the lower Río Cauca (west of the Río Cauca and the Isla de Mompos) and Rio Magdalena, in the departments of Atlántico, Sucre, Córdoba, western Bolívar, northwestern Antioquia (from the Uraba region, west of the Río Cauca), and northeastern Chocó east of the Río Atrato, from sea level up to 1,500 m (Hernández-Camacho and Cooper 1976; Hershkovitz 1977; Mast *et al*. 1993). The southwestern boundary of the cotton-top's range has not been clearly identified. Mast *et al.* (1993) suggested that it may extend to Villa Arteaga on the Río Sucio (Hershkovitz 1977), which included reports of cotton-top tamarins in Los Katios National Park. Barbosa *et al.* (1988), however, were unable to find any evidence of cotton-top tamarins in this area or in Los Katios, where they saw only *Saguinus geoffroyi*. Groups have been seen in the Islas del Rosario and Tayrona National Park in the Sierra Nevada de Santa Marta (Mast *et al.* 1993; A. Savage and L. H. Giraldo pers. obs.). However, these populations were founded by captive animals that were released into the area (Mast *et al*. 1993), and we believe to be outside the historic range of the species.

Colombia is among the top ten countries suffering deforestation, losing more than 4,000 km² annually (Myers 1989; Mast *et al*. 1993). There are just three protected areas in the historic range of the cotton-top tamarin—Parque Nacional Natural Paramillo (460,000 ha), Santuario de Flora y Fauna Los Colorados (1,000 ha) and Montes de María Reserve (7,460 ha). These protected areas have lost 42%, 71%, and 70% of their forests, respectively, since they were created (Miller *et al*. 2004). Cotton-tops can also be found in forest patches on private land, but there they lack the long-term protection of their natural resources. Land use in the region is dominated by large-scale agricultural production (cattle) and farming. Forest remnants can be found only where the land is unfit for agriculture, and their long-term survival, buffering agricultural zones, is constantly threatened.

The extraction and exploitation of natural resources is constant in Colombia's Pacific coastal region. The Plan Pacifico (see Barnes 1993) entails that 160,000 ha (approximately 2.2% of the total forest area) are destroyed each year for wood and paper or to make way for agro-industrial production of African palm. There has been a considerable drop in mangrove coverage with the installation of commercial shrimp farms, and massive sedimentation and mercury contamination in rivers has been caused by deforestation and uncontrolled mining. Riverbanks have also been eroded, which has caused river beds to drop, threatening fish stocks and the ability of communities to transport goods (Barnes 1993).

Further threat lies in the imminent flooding of forests for hydroelectric projects. One of these, the Urra I dam, inundated more than 7,000 ha of primary and secondary forest in the Parque Nacional Natural Paramillo. The environmental impacts of the dam were seriously damaging for local communities and wildlife. The construction of Urra II was proposed in 2008, and if approved by the Colombian government, it will result in the destruction of a further 5,000 ha of forest in the park.

In the late 1960s and early 1970s, 20,000–40,000 cotton-top tamarins were exported to the United States for use in biomedical research (Clapp 1972; Hernández-Camacho and Cooper 1976). Today, cotton-top tamarins continue to be threatened by capture for the illegal pet trade, despite international laws condemning the activity. A recent population census was conducted in the historic distribution of the species that documented a dramatic decline in suitable habitat, and concluded that fewer than 6,000 cotton-top tamarins remain in the wild (Savage *et al*. in review a). Large expanses of forest (500 ha or more) that could support viable cotton-top tamarin populations do not now exist in the departments of Atlántico and Bolívar. What remains are numerous small, isolated forests with tiny remnant populations of cotton-tops. Dispersal opportunities for these animals are limited as the forest patches are surrounded by open land such as cattle pasture. Efforts to protect these forest patches, while creating corridors, are essential to ensure the survival of this Critically Endangered species.

To aid in the conservation of the cotton-top tamarin, we established Proyecto Tití (<www.proyectotiti.com>), a multi-disciplinary, *in situ* conservation program that combines field research, education initiatives and community development for the conservation of natural resources that is economically feasible for local communities in Colombia. The program works with national and international organizations to assist in the long-term preservation of the cotton-top tamarin and to develop local community advocates to promote conservation efforts in Colombia. Early studies (1988 at Colosó in the Montes de Maria reserve) revealed that there were many myths and misconceptions about the forest and the wildlife. More than 90% of the population we surveyed had no idea that cotton-top tamarins were endemic

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to Colombia and not found in other countries (Savage *et al*. 1997). We developed classroom and field activities for elementary and secondary school children that were designed to create an awareness of the plight of the cotton-top tamarin and engage students in a variety of activities in the classroom and field, and in international exchanges that would promote the conservation of Colombia's natural resources (Savage 1993, 1997; Savage *et al*. 2000a, 2000b; Giraldo *et al*. 2003). Our education program continued to expand to include teacher-training programs, the establishment of a rural school dedicated to conservation and sustainable farming practices, and field training for Colombian university students. We developed a strong partnership with the Barranquilla Zoo, and we now reach urban audiences though a series of classroom workbooks (CARTITILLA) aimed at 5–7th grade school children (Guillen 2003). Urban communities were limited in their understanding of wildlife conservation issues and were the primary market for the illegal pet trade of cotton-top tamarins. The workbook focused on the cotton-top tamarin and its tropical ecosystem including knowledge-based activities, interactive games, role-playing scenarios, and inquiry-based questions that would lead students to a conservation-based discovery. It was used in 15 schools with more than 3,000 students. Our evaluations showed an 81% increase in the level of accuracy on correctly identifying a cotton-top tamarin, a 77% increase in understanding that cotton-top tamarins are found only in Colombia, and a 65% increase in the understanding of the pet trade as a threat to the survival of the species. Regional pride was instilled in these students so that they were more interested in exploring opportunities that would help to protect cotton-top tamarins for the future (Guillen 2003). Our extensive education program has created knowledgeable individuals that are concerned for the environment.

However, pressing economic issues created a disconnection between our efforts to educate communities to conserve natural resources and their ability to engage in activities that promoted wildlife conservation. In discussions with local villagers in Colombia we discovered the traditional Colombian "binde", a small cooking stove that was made from a termite mound (Savage *et al*. 1997). Interviews with local villagers indicated that bindes required less firewood than cooking over an open fire. While accepted by local communities in Colombia, bindes were made from termite mounds and they would quickly crack and disintegrate with repeated use and were consequently little favored. Proyecto Titi designed a durable binde made of clay that was readily accepted by the communities and proved to significantly reduce the amount of firewood consumed. A family of five used approximately 15 logs a day to cook their food over an open fire. Using a binde, the number of logs consumed each day was reduced by two-thirds (Savage *et al.* 1997). Food cooked in a binde did not take significantly longer to cook than over open fire, and it retained its flavor better. Since bindes produce less smoke, women reported less eye and lung irritation than when cooking over an open fire (Savage *et al*. 1997). Bindes proved to be a successful tool in reducing the amount of trees harvested for firewood, besides improving the health of the villagers.

Efforts to manage waste are a challenge in local villages, and the situation is worsening, particularly in growing rural communities where disposal is generally by burning or by dumping in rivers or on the roadside. Enormous amounts of plastic appear in the forests; waste which animals tend to investigate or eat, resulting in disease transmission between humans and wildlife. A program was developed to turn the trash into a source of income. The goal was to create an artisan group that would make a product from the numerous plastic bags, so as to provide a stable income that, combined with effective conservation education messaging, would result in a commitment to protect the forests, and reduce the capture of cotton-top tamarins for the illegal pet trade. Proyecto Titi first engaged the village of Los Limites (population of 250) in protecting cotton-top tamarins and their habitat by helping it with the confection of tote bags crocheted with recycled plastic bags and called "eco-mochilas" (Savage *et al*. in review b). Fifteen women—heads of households and well-respected in their community—began the initiative, and were so successful it was necessary to provide business training as they became established entrepreneurs, developing products of a quality that sells in national and international markets. ASOARTESANAS was created in 2004 with 15 founding members and a five-person board of directors.

Proyecto Tití demonstrated a clear economic benefit to individuals that participate in community empowerment programs and produced tangible results that are contributing to the survival of the cotton-top tamarin in Colombia. To date, ASOARTESANAS has trained more than 600 women and recycled nearly 1.5 million plastic bags, and continues to reach out to communities and cities to assist in the collection of plastic bag litter, which has decreased in rural communities and is now rarely seen in the forest. This has had positive implications in reducing human and wildlife health concerns in the region, and has been positive for the cotton-top tamarin in the cessation of their trade as pets and in protecting their habitats through a substantial reduction in the number of trees harvested for firewood.

Anne Savage, Luis Soto, Iader Lamilla & Rosamira Guillen

Variegated or Brown Spider Monkey
Ateles hybridus I. Geoffroy, 1829
Colombia, Venezuela
(2004, 2006, 2008)

There are two recognized 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 due to habitat loss, hunting and the pet trade.

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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 range of *A. hybridus* is protected; most has been converted to farms for agriculture and cattle.

Ateles h. brunneus has a small geographic range in a region where forest loss, degradation and fragmentation is widespread. Currently, 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. This subspecies has been identified in different areas of the Antioquia department, such as: Segovia, Remedios, Maceo, Yondó, Puerto Berrio, and Zaragoza. However, the habitat destruction and hunting pressure over this species has provoked possible local extinctions. Between 2007 and 2008, surveys in this Department yielded some possible areas where this species no longer exists (for example, Vereda El Brazil, Corregimiento La Sierra). Surveys have been conducted to determine the density of this subspecies in the municipality of Maceo. In 2006 one group of eight individuals were found in this area, and by 2008 just four individuals were spotted in the same area, after five months of surveys. A refuge remains, however, in the Serranía San Lucas in southern Bolívar, and in some parts of Nechí, identified as important areas for the establishment of national parks. A protected area is highly necessary for this subspecies that also would include two other threatened endemic primates, the white-footed tamarin, *Saguinus leucopus*, and the woolly monkey, *Lagothrix lugens*.

Ateles h. hybridus is extremely endangered due to habitat destruction in both Colombia and Venezuela. The lowland forest of the state of Zulia and the piedmont of the Perijá Mountains are heavily destroyed from expansionist cattle-ranching activities. Within the Perijá Mountains only 30% of the forest is relatively well preserved and protected. 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 favorite game. In central Venezuela, some areas that had populations in 2001 were resurveyed in 2007 without successful sightings; most of the areas were already covered by secondary vegetation. The lowland forest from the eastern part of the Andean Mountains, San Camilo and Ticoporo, are under severe logging pressure.

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 currently 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.

Erwin Palacios, Alba Lucia Morales-Jiménez & Bernardo Urbani

Peruvian Yellow-tailed Woolly Monkey
Oreonax flavicauda (Humboldt, 1812)
Peru
(2000, 2006, 2008)

The taxonomy of the yellow-tailed woolly monkey has been a matter of some discussion. First described as *Simia flavicauda* by Humboldt in 1812, it was again described by Thomas (1927a) as *Lagothrix (Oreonax) hendeii* a century later. Later in the same year, after receiving a new juvenile specimen, Thomas (1927b) elevated the subgenus *Oreonax* to full generic status. In his revision of the woolly monkeys, Fooden (1963) found that *S. flavicauda* and *O. hendeii* were actually the same species and very closed related to *Lagothrix*, and he thus named it *Lagothrix flavicauda*. Groves (2001) revised some available skulls and found it more closely related to *Ateles*, and consequently separated *flavicauda* from *Lagothrix*, and revived Thomas' old genus *Oreonax*. Most recently, Matthews and Rosenberger (2008a, 2008b) revised Groves' work and found evidence for a "misclassification because a heuristic measure of statistical support has been misconstrued as a biological and phylogenetic characteristic", and therefore argued against the validity of *Oreonax* as a genus. A more comprehensive reassessment of the systematics of *Lagothrix* is still needed, using a wider set of characters and samples, both in morphology and molecular genetics.

The Peruvian yellow-tailed woolly monkey is endemic to Peru, and is found only in a small area in the Tropical Andes. *Oreonax flavicauda* is known to persist only in primary premontane, montane and cloud forest between 1,500 to 2,700 m above sea level (Leo Luna 1982; Butchart *et al.* 1995; DeLuycker 2007; Shanee *et al*. 2008). Historically, the distribution of the species may have included the regions of Amazonas, San Martín, Huánuco, Loreto and La Libertad, as predicted by the species distribution modeled by Pacheco *et al.* (2007). Now the species is restricted to scattered forests in only two regions—Amazonas and San Martín (Heymann and DeLuycker 2007; Shanee *et al*. 2008). There are no current estimates of remaining population numbers. Indiscriminate clear-cutting of primary cloud forest is the principal threat to this species, and its habitat has been largely deforested, resulting in a strongly fragmented landscape.

We estimated the extent of the historical distribution area of *O. flavicauda,* based on a model without taking into account current deforested areas and human settlements, to be 41,446 km². In 1981, it was estimated that the potential forested habitat was at least 11,240 km² and it was predicted that at least 1,600 km² would be deforested for agriculture by 1991 (Leo Luna 1984). With a modeled distribution using known localities and suitable habitat, we estimate the current potential distribution of *O. flavicauda* to be 7,690 km², a number that is rapidly diminishing due to a high rate of human immigration to the area, combined with unregulated land use. In addition, much or most of this forest is now highly fragmented or isolated from other tracts of forest. *Oreonax flavicauda* has likely declined drastically in numbers due to a major reduction in area of occupancy and a decrease in the quality of their habitat.

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Very little is known about the ecology and behavior of the yellow-tailed woolly monkey. Results from studies in the early 1980s indicated that the sizes of its multi-male/multi-female groups range from 5 to 18 individuals. *Oreonax flavicauda* eats a variety of fruits, flowers, leaves, lichens, leaf bases of bromeliads, epiphyte roots and bulbs, and possibly insects (Leo Luna 1982; DeLuycker 2007). Surveys in the Amazonas region found groups ranging from 7 to 10 individuals (Cornejo *et al.* 2007), but DeLuycker (2007) reported an unusually large group (17–20 individuals) in an area relatively close to agricultural plots. The species appears to be very sensitive to habitat disturbance (Leo Luna 1987; DeLuycker 2007). Where the forest is disturbed by logging, *O. flavicauda* decreases its use of the area (Leo Luna 1984), often retreating further into high-altitude forests far away from human settlement, where it is able to use larger tracts of forest. In 1981, it was estimated that *O. flavicauda* occurred in low densities, from 0.25 to 1 group per km² (Leo Luna 1987). Recently, a survey conducted in a forest fragment provided an estimate of 1–2 groups per km² (Cornejo 2007). Based on the difficulty of locating groups of *O. flavicauda* during an intensive three-month survey, DeLuycker (2007) suspected this species to have large home ranges (as do other atelins), but Cornejo (2008) estimated the home range of a single group as only 69 ha.

The species is known to be present in the Río Abiseo National Park (PNRA) (2,745 km²), the Alto Mayo Protected Forest (BPAM) (1,820 km²), and the Reserved Zone Cordillera de Colán (ZRCC) (641 km²), all of which were established with assistance from the Asociación Peruana para la Conservación de la Naturaleza (APECO). Between 1996 and 2001, more than 6,000 ha of primary forest were cleared inside the BPAM (Peru, INRENA 2008). The forest of the BPAM is now considerably fragmented, a result of lack of enforcement and a substantial human population living in the protected forest itself. The "Reserved Zone" Cordillera de Colán (ZRCC) is finally being categorized as a National Sanctuary and a Community Reserve of Awajun Natives, after many years of being without a formal categorization and a management plan. BPAM and ZRCC also suffer from illegal selective logging—ZRCC has two operative mining concessions near its borders, and both areas have the constant threat of human unregulated migration. *Oreonax flavicauda* has been extirpated from all but the most distant and isolated forests on the eastern side of the Río Alto Mayo. Illegal hunting still occurs within and outside protected areas, and if monkeys are encountered, they are likely to be shot, because of their size, conspicuousness, and trustful behavior toward humans. The species' velvety, thick, long fur, its skin and skull, and yellow genital hair-tuft are sought after as trophy items, and make this species a target for hunters even when they do not hunt it for subsistence. Infants taken when their mothers are shot are sold in markets as pets. PNRA is the only governmental protected area that, because of its inaccessibility, is actually protecting the yellow-tailed woolly monkey. Unfortunately, PNRA is only protecting 852 km² of suitable habitat for the species (M. Leo Luna unpubl. data).

There is very little information on the biology and natural history of this species, resulting mainly from the difficulties imposed by the mountainous and precipitous terrain where it lives. A complete, range-wide survey of its cloud forest habitat is urgently needed to develop plans to protect the remaining populations of *Oreonax flavicauda*. These surveys should also include population genetic studies, to examine genetic variability and the viability of existing populations.

Currently, a number of institutions are investing efforts and resources in northeastern Peru's cloud forests. Some community-based conservation projects are underway (Ucumari, Apenheul, Neotropical Primate Conservation [Shanee *et al.* 2007, 2008] and the Museo de Historia Natural–UNMSM in Amazonas), protected area policies and management plans are being enforced (APECO and Deutsche Gesellschaft für Technische Zusammenarbeit–GTZ), private reserves are being established (Asociación Ecosistemas Andinos, Sociedad Peruana de Derecho Ambiental), and conservation education campaigns are being held (Yunkawasi). While these conservation efforts have already produced some positive results, they are not enough. The regions of Amazonas and San Martín have the highest rates of deforestation of Peru (Reategui and Martínez 2007)—the product of very deep social conflicts in the area, with illegal logging and illegal land traffic being the main problems.

Urgent conservation initiatives necessary for the yellow-tailed woolly monkey's survival should continue and include: increased protection within designated parks, reserves, and protected forests, which currently lack enforcement; the establishment of a contiguous area of protected forest, to create a biological corridor; control of illegal logging; purchase of land; the provision of alternative economic models for local communities living along buffer zones, in order to prevent further migration into the primary cloud forests; and the implementation of a strong conservation education plan.

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Madagascar

Greater Bamboo Lemur

Prolemur simus

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Sclater's Black Lemur, Blue-Eyed Black Lemur

Eulemur flavifrons

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Northern Sportive Lemur

Lepilemur septentrionalis

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Silky Sifaka

Propithecus candidus

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Asia

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Javan Slow Loris

Nycticebus javanicus

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Golden-headed Langur or Cat Ba Langur

Trachypithecus poliocephalus poliocephalus

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Rhinopithecus avunculus

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Nomascus nasutus

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Western Hoolock Gibbon

Hoolock hoolock (Harlan, 1831)

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Pongo abelii

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Neotropical Region

Cotton-top Tamarin

Saguinus oedipus

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Lagothrix flavicauda

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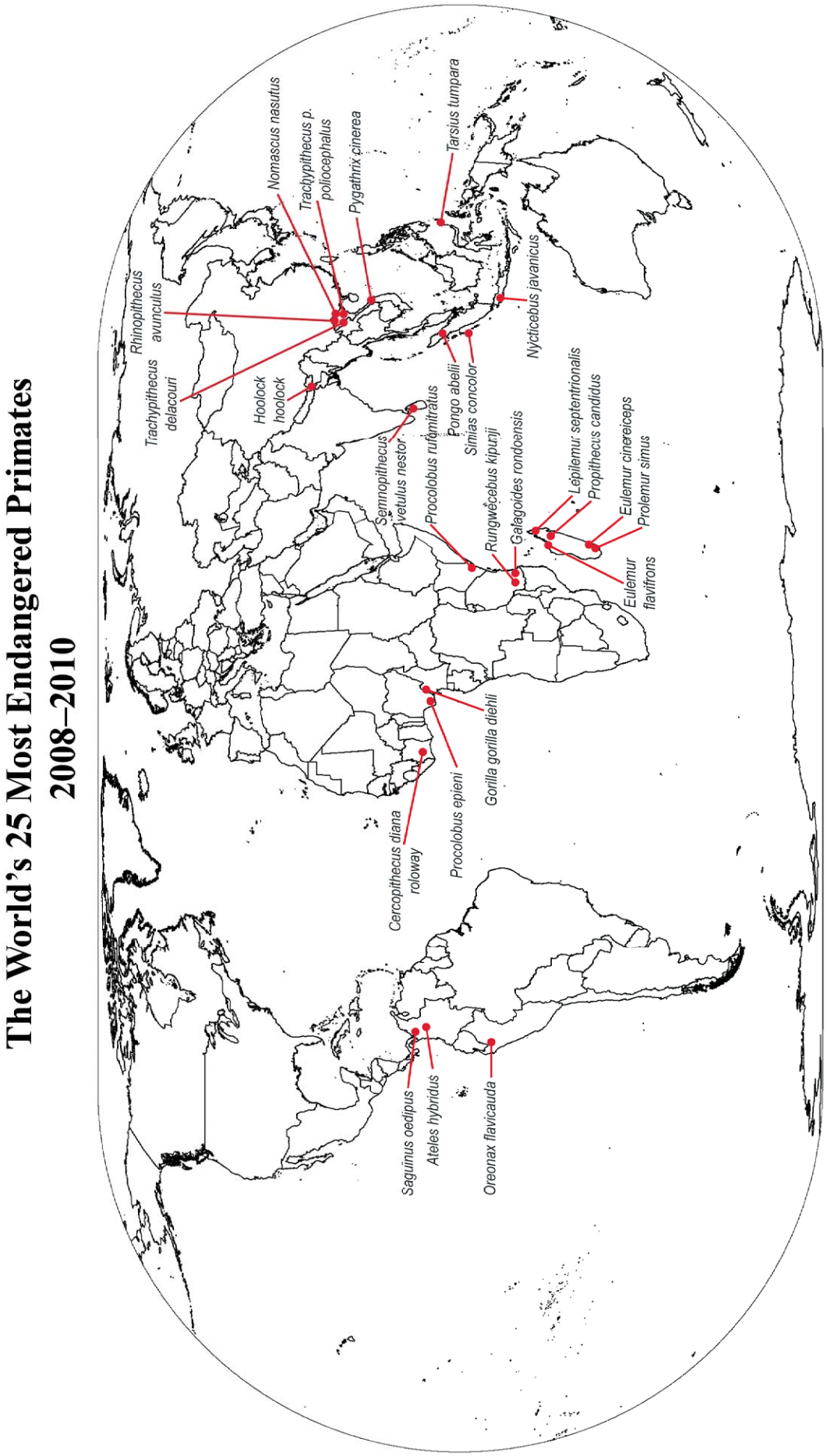
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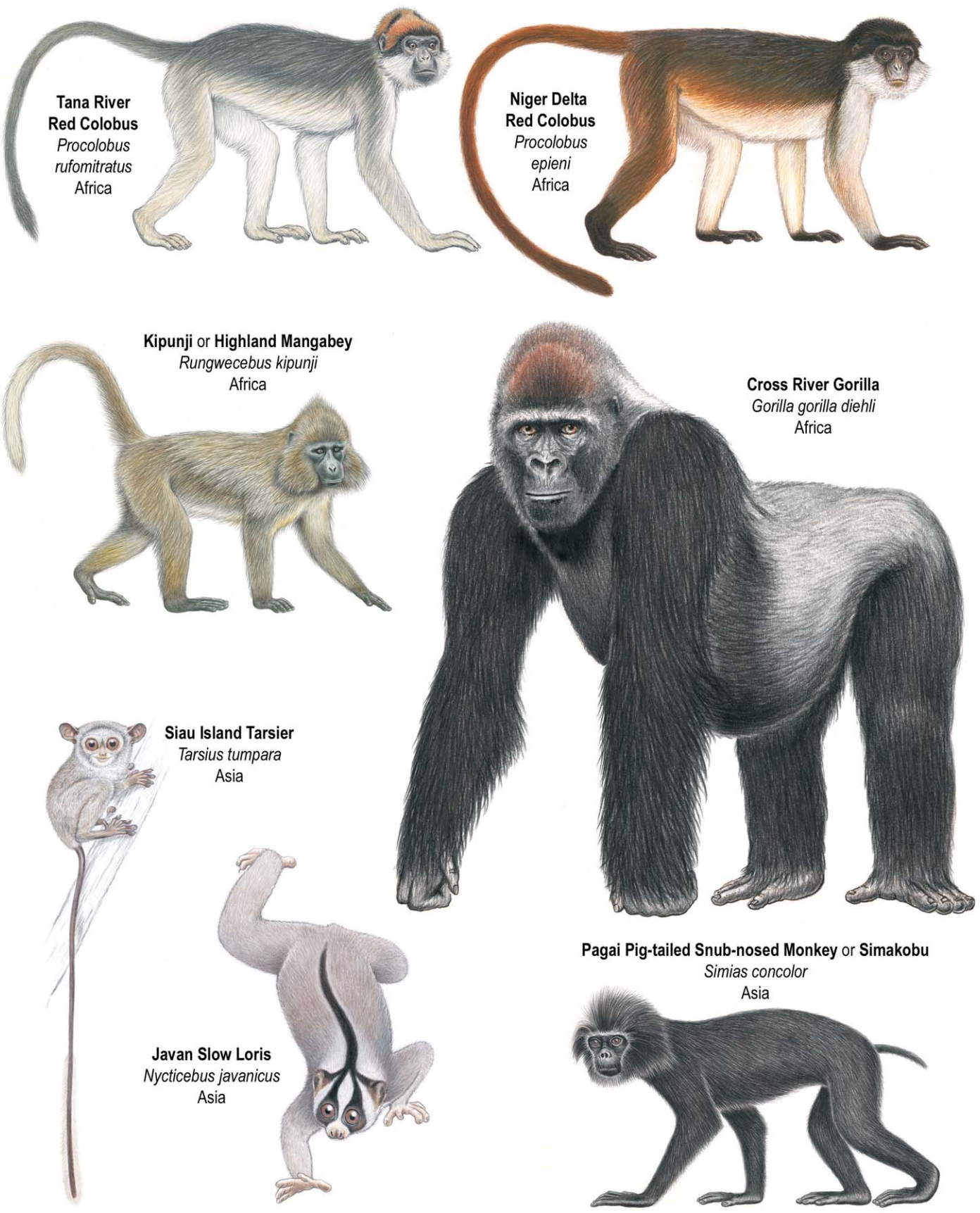


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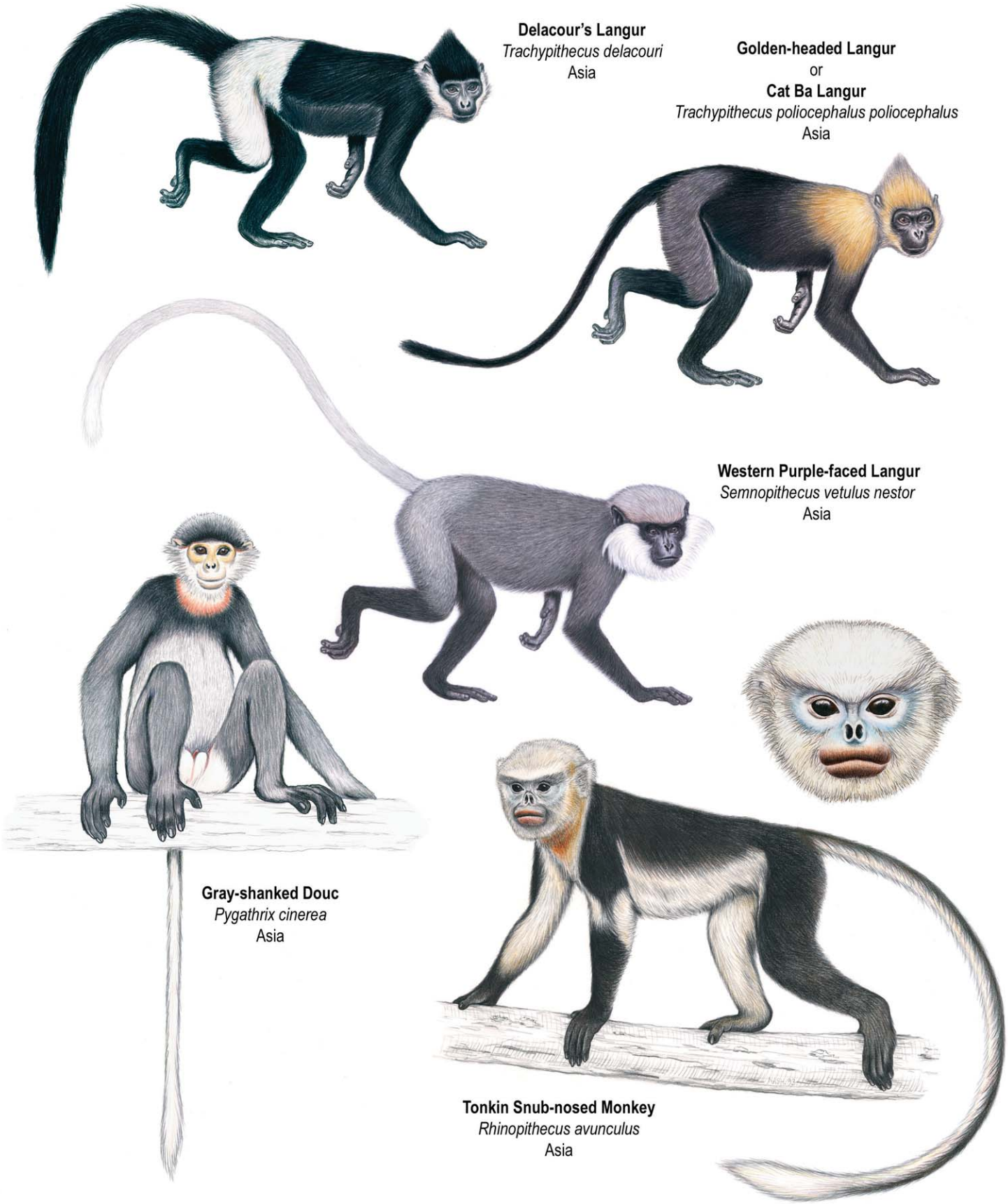
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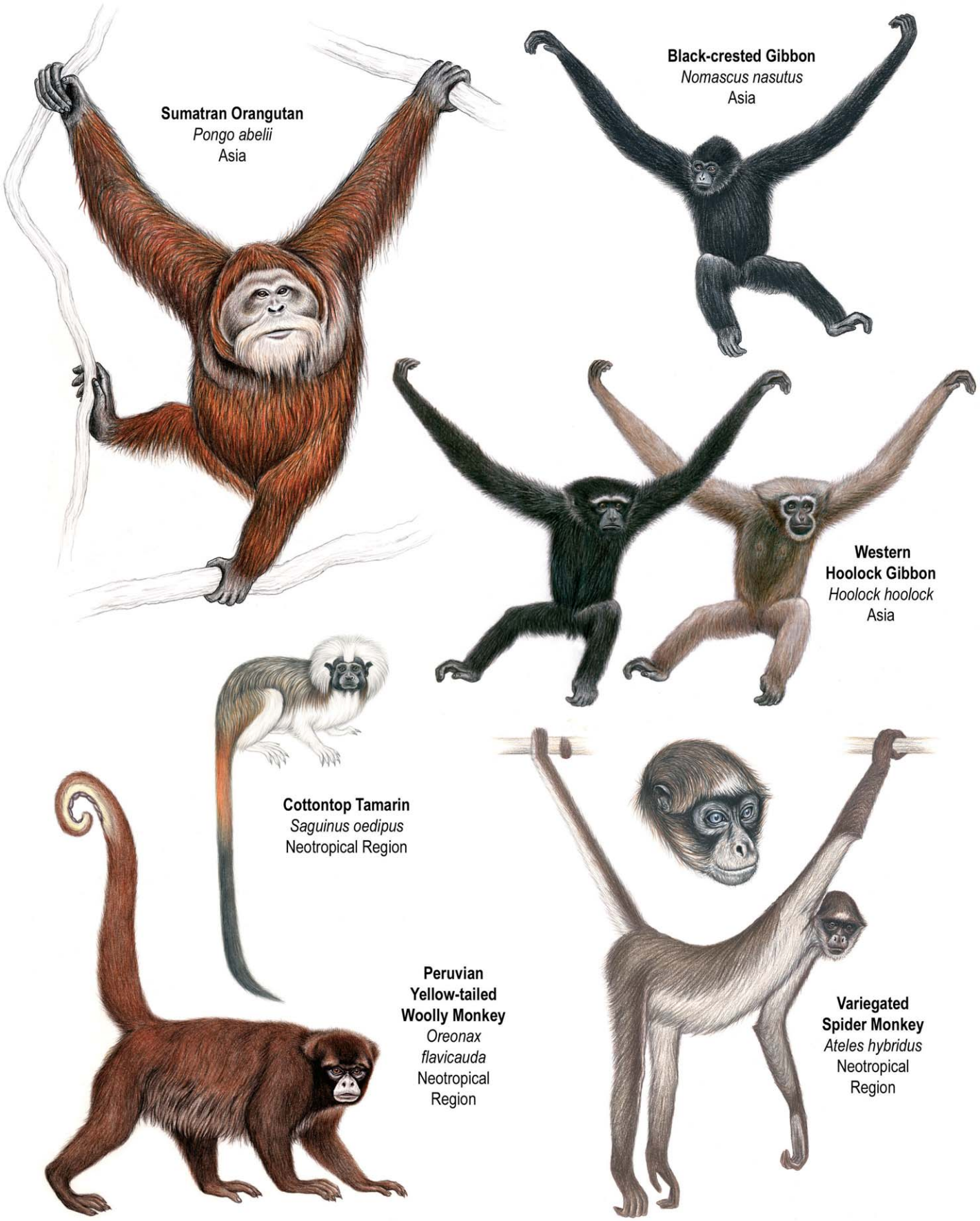
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