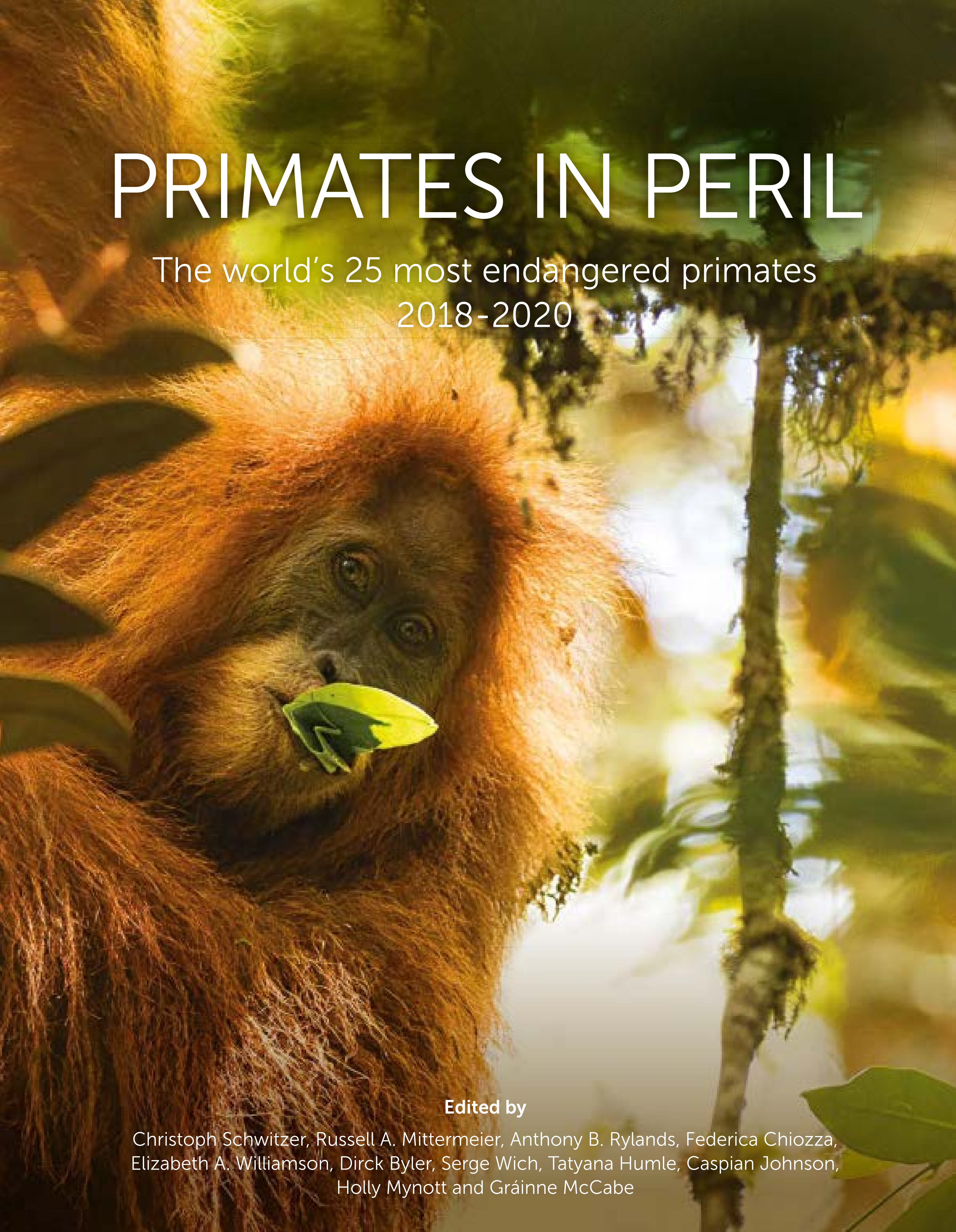
Primates in Peril: The world's most endangered primates 2018-2020



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The world's 25 most endangered primates 2018-2020

Edited by

Christoph Schwitzer, Russell A. Mittermeier, Anthony B. Rylands, Federica Chiozza, Elizabeth A. Williamson, Dirck Byler, Serge Wich, Tatyana Humle, Caspian Johnson, Holly Mynott and Gráinne McCabe

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GLOBAL WILDLIFE CONSERVATION
IPS International Primatological Society

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Illustrations by

Stephen D. Nash

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ACKNOWLEDGEMENTS

Here we present the 2018–2020 iteration of the World's 25 Most Endangered Primates list, drawn up during an open meeting held during the XXVII Congress of the International Primatological Society (IPS), Nairobi, 22 August 2018.

We have updated the species profiles from the 2016–2018 edition (Schwitzer *et al.* 2017) for those species remaining on the list and added additional profiles for newly listed species.

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

We are most grateful to the Margot Marsh Biodiversity Foundation for providing significant support for research and conservation efforts on these endangered primates through the direct provision of grants and through the Primate Action Fund, administered by Ms. Ella Outlaw, of the Chief Conservation Officer's Office at Global Wildlife Conservation. Over the years, the foundation has provided support for the training workshops held before the biennial congresses of the International Primatological Society and helped primatologists to attend the meetings to discuss the composition of the list of the world's 25 most endangered primates.

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References

Schwitzer, C., Mittermeier, R.A., Rylands, A.B., Chiozza, F., Williamson, E.A., Macfie, E.J., Wallis, J. and Cotton, A. (eds.). 2017. *Primates in Peril: The World's 25 Most Endangered Primates 2016–2018.* IUCN SSC Primate Specialist Group (PSG), International Primatological Society (IPS), Conservation International (CI), and Bristol Zoological Society, Arlington, VA. 99 pp.

THE WORLD'S 25 MOST ENDANGERED PRIMATES: 2018–2020

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

The 2018–2020 list of the world's 25 most endangered primates has seven species from Africa, five from Madagascar, seven from Asia, and six from the Neotropics (Appendix: Table 1). Indonesia, Brazil, Ghana and Cote d'Ivoire each have three, Nigeria and Tanzania two, and China, Myanmar, India, Bhutan, Sri Lanka, Vietnam, Argentina, Ecuador, Peru, Mexico, Guatemala, Nicaragua, Honduras, El Salvador, Costa Rica, Panama, Bolivia, Guinea-Bissau, Liberia, Republic of Guinea, Senegal, Sierra Leone, Togo, Benin and Kenya each have one.

Twelve of the primates were not on the previous (2016–2018) list (Appendix: Table 3). Eight of them are listed as among the world's most endangered primates for the first time. The Rondo dwarf galago, kipunji, Tana River red colobus and indri had already been on previous iterations, but were subsequently removed in favour of other highly threatened species. The 2018–2020 list contains two members each of the genera *Piliocolobus* and *Trachypithecus*, thus particularly highlighting the severe threats that large primates are facing in all of the world's primate habitat regions.

The changes made in this list compared to the previous iteration (2016–2018) were not because the situation of the twelve species that were dropped (Appendix: Table 2) has improved. In some cases, the situation has in fact worsened. By making these changes we intend rather to highlight other, closely related species enduring equally bleak prospects for their survival.

During the discussion of the 2018–2020 list at the XXVII Congress of IPS in Nairobi in 2018, a number of other highly threatened primate species were considered for inclusion (page 102). For all of these, the situation in the wild is as precarious as it is for those that finally made it on the list, thus they have been included as '*Other Species Considered*', a new category in the Top 25 Most Endangered Primates' series.

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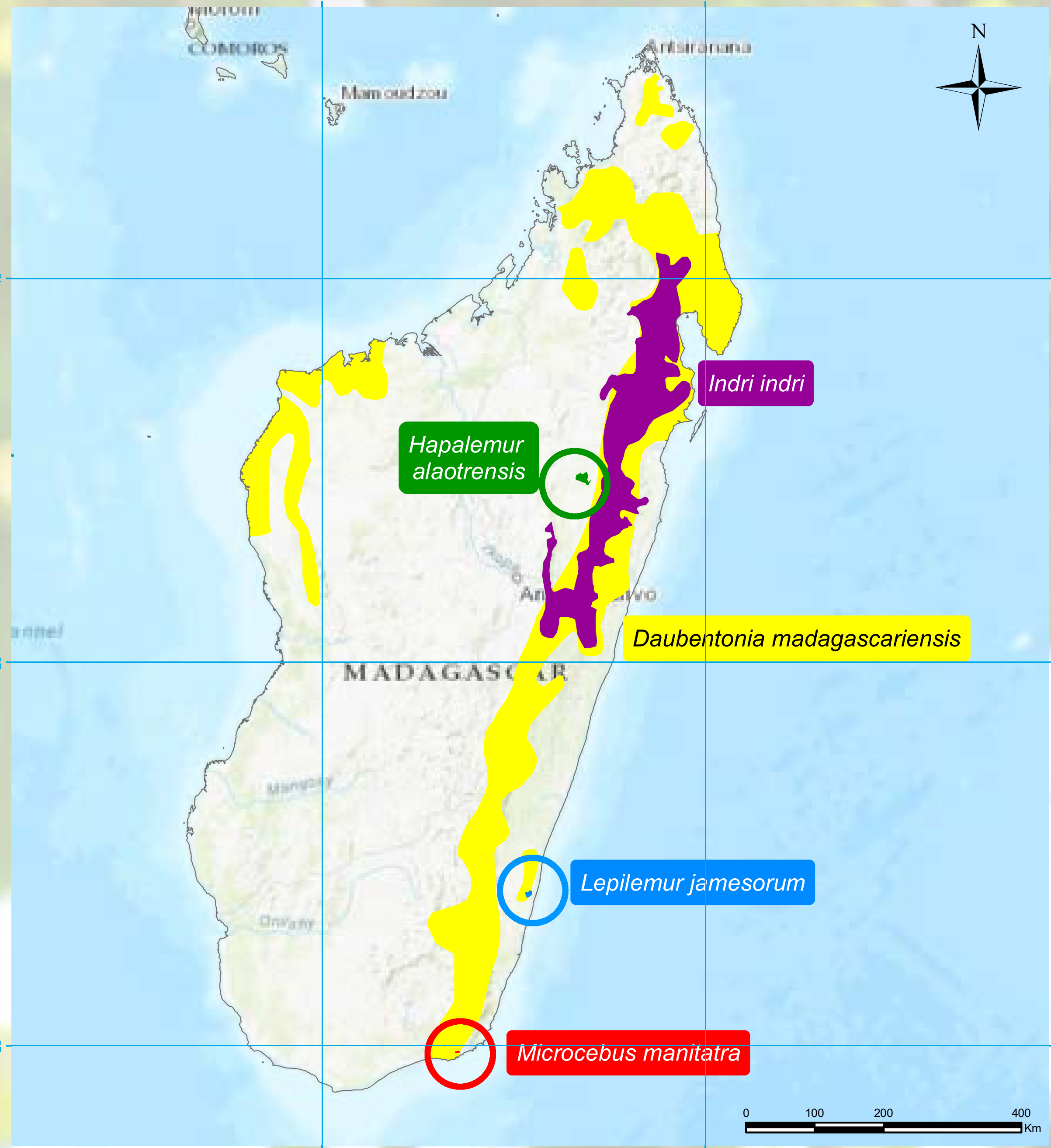

Madagascar Primates

- *Daubentonia madagascariensis*
- *Indri indri*
- *Hapalemur alaotrensis*
- *Microcebus manitatra*
- *Lepilemur jamesorum*

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BEMANASY MOUSE LEMUR

***Microcebus manitatra* Hotaling *et al.*, 2016**

Madagascar
(2018)

Giuseppe Donati, Andrianjaka Rijaniaina Jean Nary & Jean-Baptiste Ramanamanjato

The Bemanasy mouse lemur, *Microcebus manitatra*, was recently described from specimens collected in April 2007 in Bemanasy (also called Petite Lavasoa), one of the forest fragments in the Nouvelle Aire Protégée of Ambatotsirongorongo in the south-eastern corner of Madagascar (Hotaling *et al.* 2016). It was distinguished as a separate species to *M. murinus* using its nuclear and mtDNA, differences in which were diagnosed using species discovery delimitation criteria of mtDNA gene tree monophyly, distinct nuclear population structuring, and validation using coalescent-based Bayesian species delimitation tests (Hotaling *et al.* 2016). This recent description confirmed the findings of previous comprehensive surveys of mtDNA of *M. murinus* from across the south-eastern region, which revealed divergent geographic clades in close geographical proximity with no evidence of haplotype sharing (Weisrock *et al.* 2010; Hapke *et al.* 2012). This species takes its name from the Malagasy 'manitatra,' meaning 'range expansion,' to reflect the divergent distribution of this mouse lemur from the primarily western distribution of *M. murinus*.

Microcebus manitatra is a relatively large mouse lemur characterized by its size (total length of 270–276 mm and body mass of 58 g), long tail, dense, short fur (150 mm), relatively short hind feet (33 mm) and long ears (25–26 mm). The dorsal pelage is uniformly greyish brown on the back and tail and the underside is a greyish beige with dark grey underfur. This contrasts with *M. murinus* which has a variable greyish-brown to brownish-grey back and tail with a dull reddish-brown or cinnamon mid-dorsal stripe, as well as a mixed beige and grey underside (Hotaling *et al.* 2016).

> The greatest threats to the Bemanasy mouse lemur are habitat loss and degradation driven by wood extraction, slash-and-burn cultivation, and fires.

The type locality, a forest called Bemanasy, is a 31.1 ha forest patch averaging 617 m a.s.l. located around 25 km south-west of the town of Tolagnaro (Fort Dauphin). It is one of a complex of three fragments (the other two are named Grand Lavasoa and Ambatotsirongorongo) today formally protected as Special Reserve of Ambatotsirongorongo (since 2015 according to the decree 2015-792). These fragments are remnants of one large forest block in the southern part of the Lavasoa Mountains that was positioned in a steep ecological gradient between spiny bush habitat to the west, the humid lowland forest to the north, and the littoral humid forest to the east (Donque 1972). This is reflected by its mixed floristic composition, which contains both humid forest plants and representatives of drier formations (Ramanamanjato *et al.* 2002; Andrianarimisa *et al*. 2009). Historical land cover maps indicate that these forests have not been directly connected to other forests for more than 40 years (Foiben-Taosarintanin'i Madagasikara 1979). The ecological complexity of the Lavasoa–Ambatotsirongorongo mountains and the close geographical proximity of several mouse lemur species in the area (*M. griseorufus* in the west, *M. tanosi* in the north, and *M. ganzhorni* in the east) is remarkable. According to Hapke *et al.* (2012), this can be regarded as a micromodel of the retreat and expansion of various forest types and their resident mouse lemur species.

Neither population estimates or eco-ethological data are available for *M. manitatra*. Currently its distribution has only been confirmed in the 31.1 ha Bemanasy fragment, thus its population size is assumed to be very small. However, it is likely that

the *M.* cf. *murinus* present in the other two fragments in the Special Reserve of Ambatotsirongorongo is also *manitatra,* which would result in a total area of occupancy of around 136 ha. MtDNA analyses indicate that the population of *M.* cf. *murinus* in Petriky, a 300-ha littoral forest 5 km east of Ambatotsirongorongo, clusters in the same clade of *M. manitatra* (Hapke *et al.* 2012). If confirmed by future analyses, this would increase the population size of this highly threatened mouse lemur species by several times.

The greatest threats to *M. manitatra* are habitat loss and degradation driven by wood extraction, slash-and-burn cultivation, and fires (Hapke *et al.* 2012). Although a recent report indicates that most fields near forest edges are abandoned, the fragments are surrounded by fields and cattle pastures, so slash-and-burn cultivation remains a threat (Ramanamanjato *et al*. 2002; Andrianjaka and Hapke 2015). The largest pressure currently seems to be wood extraction to meet the demand of construction timber (Andrianjaka and Hapke 2015). The forests in the Special Reserve of Ambatotsirongorongo also play a key role as sources of irrigation and drinking water (Andrianjaka and Hapke 2015).

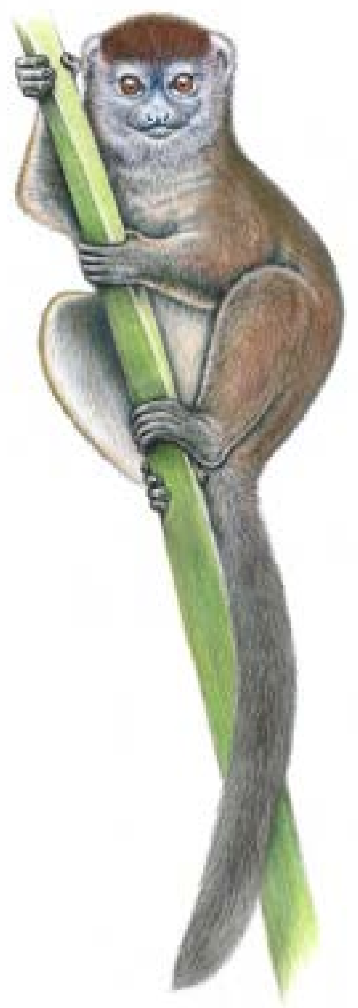
Since 2017, the forest has been co-managed by local communities through an association of neighboring villages, called FIMPIA (Forest Police Association for Ambatotsirongorongo), and by the DREF (Direction Régionale de l'Environnement et des Forêt Anosy). Several aspects of forest management such as land use, sanctions for violations of these rules, and fees for visitors and researchers have now been implemented in the DINA (the community set regulations) as a result (Andrianjaka and Hapke 2015). The conservation value of this area has long been recognized and several conservation projects involving habitat restoration and local livelihood improvement have been conducted over recent years. However, the extremely small size of the remaining forest coupled with the increasing anthropogenic pressures from the town of Fort Dauphin call for further and immediate conservation actions. Because of its location, the Special Reserve of Ambatotsirongorongo contains an unusual and highly diverse mixture of lemurs, including one species of dwarf lemur previously listed (2014-16) in the World's 25 most endangered primates publication, *Cheirogaleus lavasoensis* (see Schwitzer *et al.* 2015). This makes these tiny forest fragments in the south-eastern corner of Madagascar a very high conservation priority.

LAKE ALAOTRA GENTLE LEMUR

Hapalemur alaotrensis **Rumpler, 1975**

Madagascar
(2000, 2014, 2016, 2018)

Lena M. Reibelt, Herizo T. Andrianandrasana, Fidy Ralainasolo, Lucile Mialisoa Raveloarimalala, Richard Lewis, Jonah Ratsimbazafy & Patrick O. Waeber



The Critically Endangered Lake Alaotra gentle lemur, also known as the Lac Alaotra bamboo lemur (*Hapalemur alaotrensis*), is the only primate taxon living constantly in a wetland. While all other bamboo lemurs are forest dwellers occupying a variety of forest habitats across Madagascar, *H. alaotrensis* is confined to the marshlands surrounding Lake Alaotra. It is this limited geographical range and the ever-increasing pressures on its shrinking habitat that have brought this lemur close to extinction.

This lemur is a cathemeral and a highly specialized herbivorous feeder. It targets 11 plant species and 16 distinct plant parts such as shoots, stem, pith, leaves, seeds, buds, and flowers (Mutschler 1999). The species is characterized by an average adult body length of about 30 cm (12 in), with a 30–40 cm (12–16 in) tail and a weight between 1 and 1.4 kg (2–3 lb) (Mutschler 1999). Its home range varies from 2 to 5 ha depending on group size (Nievergelt *et al*. 1998). Reibelt *et al.* (2017a) provide a more detailed account of the lemur's biology.

Its habitat, the marsh of Lake Alaotra, is located in the Alaotra-Mangoro region, where it covers about 20,000 ha and acts as a buffer zone between the lake (~20,000 ha of open water) and the agricultural zone (~120,000 ha of ricefields). Due to the high importance of the wetland for biodiversity and agro-economy, it was designated as a Ramsar site in 2003 (722,500 ha covering the whole watershed). Throughout the 2000s, marsh management was delegated from the state to environmental associations based in the villages adjoining the marshes, and in 2015 this mosaic formed the creation of the Alaotra Protected Area (46,432 ha encompassing the lake and the marshes) under the Regional Forestry Department.

Despite legal protection efforts, the lemur population has been declining continuously since the first published census in the 1990s. From the first estimate (7,500–11,000 individuals; Mutschler and Feistner 1995) it has shrunk to an estimated 2,500 individuals (Ralainasolo *et al.* 2006). Even the high priority conservation zone and tourist focal area, Park Bandro, recorded losses in recent years. While 170 individuals were estimated there in 2013 (Ratsimbazafy *et al.* 2013), only half of the original 85 ha park remained three years later, resulting in a reduced carrying capacity of 40–80 individuals (Raveloarimalala and Reibelt 2016). However, no recent sightings have been confirmed for this northern subpopulation. Subpopulations also exist in the southwestern marsh of Lake Alaotra, which is more protected due to its inaccessibility.

The principal threats to *H. alaotrensis* are habitat loss, habitat degradation, and hunting. While lemurs were regularly hunted for food in the 1990s, this is no longer the case due to long-term conservation public awareness work. Marsh burning to establish irrigated rice fields and to access fishing ponds is the main driver of habitat conversion (Copsey *et al*. 2009a, 2009b; Guillera-Arroita *et al*. 2010; Ralainasolo *et al*. 2006), which caused a nearly 30% loss of total marsh area between 2000 and 2016 (Andrianandrasana 2017). Furthermore, recent declines in rice harvests and fish catches have resulted in counter-season rice (*vary jeby*) production; grown in shallow lake water, or by converting the marshes at the lake-edge. More recently, the establishment of counter-season rice fields has been the main cause of suitable habitat loss in Park Bandro. Fires are also problematic for the lemurs, as marsh vegetation needs three years to regenerate to provide suitable habitat for the lemur again (Andrianandrasana 2002, 2009).

The total population of the Lake Alaotra gentle lemur has shrunk to an estimated 2,500 individuals.

The conservation and management of the Alaotra Protected Area is challenging. Four permanent technical agents from the Ministry of Environment, Ecology and Forests are responsible for more than 50,000 ha of marshes. In close partnership with the authorities, Durrell Wildlife Conservation Trust (Durrell) and Madagascar Wildlife Conservation (MWC) have been collaborating for more than ten years on community-based efforts around the lake, focusing on supporting the local resource-management associations, participatory ecological monitoring, environmental education, and eco-tourism (Andrianandrasana *et al.* 2005; Rendigs *et al.* 2015; Waeber *et al.* 2017a).

Durrell Wildlife Conservation Trust has recently installed more than 200 posts around core biodiversity zones to properly delineate the Protected Area, and local authorities approved a law prohibiting the utilization of the marshes inside this area. Durrell further supports the Regional Ministry of Fisheries in implementing a fishing ban, and works with the Regional Ministries of the Environment, Ecology and Forests, and the National Gendarmerie to ensure law enforcement, i.e. detect and follow-up on illegal activities in the Protected Area. In 26 villages around the lake, 96 CFL (marsh patrollers) monitor the Protected Area and report to Durrell for follow-up actions. Fires are monitored by sight and using the system 'Global Fire' to ensure timely detection and control of fires.

MWC engages in research on human dimensions of lemur conservation for a better understanding of local livelihood strategies as well as values and perceptions to inform conservation actions (Reibelt *et al*. 2017b, 2017c; Stoudmann *et al.* 2017; Waeber *et al.* 2017b; Reibelt and Waeber 2018). MWC also develops alternative income opportunities such as compost from invasive species and ecotourism through Camp & Park Bandro. Environmental education activities include a comic book and poster (Maminirina *et al.* 2006; Richter *et al.* 2015), local restoration events in Park Bandro, and a new educational table-top game that explores ecosystem links and facilitates social learning (cf. Reibelt *et al.* 2018a, 2018b).

The annual Bandro festival (World Lemur Festival) is celebrated to value the lake and its biodiversity. It involves local authorities, MWC, Durrell and GERP (Groupe d'étude et de recherche sur les primates), and is accompanied by restoration events with the community. The festival is held in late October, when the marshes are dry, accessible and easy to burn, hence when protection activities are most critical. The Bandro Festival thus reminds everyone in the Alaotra region of its unique biodiversity and the need to protect it.

MADAGASCAR

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JAMES' SPORTIVE LEMUR

***Lepilemur jamesorum* (Louis et al., *2006*)**

Madagascar
(2016, 2018)

Tsarafilamatra R. Andriamisedra, Jonah Ratsimbazafy, William Dreyer, Colin Peterson & Edward E. Louis, Jr.

James' sportive lemur (*Lepilemur jamesorum*) is a medium-sized nocturnal sportive lemur of Madagascar. It is found only in Manombo Special Reserve and Vevembe Classified Forest in the southeastern coastal region of the island, and is currently listed as Critically Endangered on the IUCN Red List (Andriaholinirina *et al*. 2014).

James' sportive lemur is similar to all other sportive lemurs in being folivorous (Ganzhorn 1993). However, it supplements its diet by feeding on gums. The species weighs approximately 780 g, with a total length of 56 cm, a head-body length of 26 cm, and a tail length of 30 cm. The pelage is short and smooth, primarily brown on the body and lightly grayish-brown on the belly and ventral portion of the extremities. The face is distinguished by the whitish-gray marking along the jaw and throat from the chin to the ears, forming a mask. The upper part of the head is brown with a black midline stripe that is continuous for almost the entire length of the body. The ears are large and cup-shaped, gray dorsally with black borders and a small cream-colored patch on the region beneath (Louis *et al*. 2006; Mittermeier *et al*. 2010). In general, the tail is uniformly brown, but several individuals have been noted to have a whitish tip.

Lepilemur jamesorum is primarily known from the Manombo Special Reserve, although it has been documented, through molecular genetic data, to exist in the Vevembe Classified Forest inland near Vondrozo. Although James' sportive lemur was first described in 2006 (Louis *et al*., 2006), there has been limited field research before or since. Nocturnal surveys were carried out for the species in 2017 and 2018 by the authors. Low population densities were found, with only two individuals occupying an 800 ha survey plot in the special reserve. There were also few signs of their presence, such as tree holes and feeding traces. Sustained detection of the animal through censuses is planned to continue before research starts on behaviour and parasitism.

The primary threats to James' sportive lemur are habitat loss and hunting for bushmeat. Anthropogenic pressure is a significant problem in the Manombo area due to high levels of poverty, limited job opportunities and inflation, which increase dependence of local communities on resources inside protected areas to survive.

> James' sportive lemur is hunted with traditional traps or simply by cutting into trees and taking them from tree holes.

James' sportive lemurs are hunted with traditional traps or simply by cutting into trees and taking them directly from their tree holes. Deforestation in the Manombo Special Reserve is a significant problem not only for the sportive lemurs but also for the local communities which are gradually losing their timber, firewood and charcoal. This utilization of the forest also reduces natural food availability for James' sportive lemur and fragments their habitat. Fires started by humans destroy habitat and food resources. The distribution of James' sportive lemur in coastal littoral forests in southeastern Madagascar makes it especially vulnerable to stochastic events such as cyclones, e.g., cyclone Gretelle in 1997. This powerful cyclone in eastern Madagascar created difficulties for local people, and many animals died including lemurs. A census

is required to quantify the impact on *L. jamesorum* as the population appeared to have declined.

The exact distribution and population numbers for James' sportive lemur are not known. Field surveys and research are required to ascertain population size and to establish baseline population parameters for the species.

Reforestation is important, not only to increase the habitat available and reconnect forest fragments, but also to provide resources for the local communities that they can harvest outside of the two protected areas. Complementary to this will be engaging local communities in alternative livelihoods to encourage sustainable practices and conservation in the Manombo region. In addition, reinforcing environmental education in the school system and local surrounding communities is needed to safeguard the future of James' sportive lemur.

INDRI

Indri indri **Gmelin, 1788**

Madagascar
(2012, 2018)

Valeria Torti, Longondraza Miaretsoa, Daria Valente, Chiara De Gregorio, Giovanna Bonadonna, Rose Marie Randrianarison, Jonah Ratsimbazafy, Marco Gamba & Cristina Giacoma

Variation in pelage colouration has resulted in two indri subspecies being identified (Groves 2001), but results from recent research (Brenneman *et al.* 2016) provide no support for this hypothesis. Molecular analysis of the mitochondrial sequences underline no significant genetic differentiation of the indri populations that would allow a two-subspecies classification system. The two major color forms are merely part of a clinal variation and not indicative of distinct taxa.

This highly distinctive lemur is endemic to the island of Madagascar where it inhabits the eastern rainforests from Anjanaharibe-Sud and Antohaka Lava (15 km SE of Andapa) in the north, south to Anosibe Anala Classified Forest. It has not been found on the Masoala Peninsula or in Marojejy (Mittermeier *et al.* 2008). It usually occurs at low elevations, but ranges up to 1,800 m (Goodman and Ganzhorn 2004).

Few studies on indri population densities are available. Betampona (2228 ha) has an estimated population of 77–147 indris (Glessner and Britt 2005). In Torotorofotsy (9900 ha) and Analamazaotra Special Reserve (700 ha), 21–32 indris have been reported (Junge *et al.* 2011). Population densities are presumably low, typically ranging from 5.2–22.9 per km^2 or 6.9–13.2 per km^2 (C. Golden pers. comm.). A recent survey in the Maromizaha New Protected Area (GERP 2017) suggested an indri population density of 82.32 individuals per km^2. A reasonable total population estimate, based on few studies (Glessner and Britt 2005; Junge *et al.* 2011; Brenneman *et al.* 2016; Nunziata *et al.* 2016; Bonadonna *et al.* 2017), would be 1,000–10,000 individuals. Population figures are in decline due to habitat destruction and hunting.

The indri is a mainly folivorous lemur (Powzyk and Mowry 2003), inhabiting tropical moist lowland

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and montane forests. Their diet consists primarily of immature leaves supplemented by flowers, fruit, seeds and bark, which vary in proportion according to season (Randrianarison *et al.* 2018). They occasionally descend to the ground to eat earth, perhaps to detoxify seeds that have also been eaten (Powzyk 1997; Britt *et al.* 2002; Powzyk and Thalmann 2003; Randrianarison *et al.* 2016).

The indri lives in socially monogamous family groups, composed of one adult pair and their offspring (Pollock 1979). Group size is reported to vary between two to six individuals (Torti *et al.* 2013). The limited number of adult individuals in a group suggests that intrasexual dominance is age-related (Pollock 1977). Females give birth every two years. Reproduction is highly seasonal, with the birth of a single offspring in May or June. Reproductive maturity is reached between seven and nine years of age (Pollock 1977), but individuals may disperse earlier (V. Torti pers. obs). Both males and females disperse (C. Giacoma pers. obs; Torti *et al.* 2018) and the sex ratio at birth is approximately 1:1 (Kappeler 1997). Groups in fragmented landscapes tend to be larger than those in more extensive, undisturbed areas (Pollock 1979; Powzyk 1997; Bonadonna *et al.* 2017). Indri groups occupy relatively small territories, the sizes of which vary according to the study and the site: 17.6 to 25.9 ha in Analamazaotra Reserve (Bonadonna *et al.* 2017), 34 to 40 ha in Mantadia (Powzyk 1997), 27 ha in Betampona (Glessner and Britt 2005) and 5 to 17.47 ha in Maromizaha New Protected Area (Bonadonna *et al.* 2017). Indri movements in the territory are evenly distributed. Mean daily path lengths are 243 m in Maromizaha NPA (Torti, unpublished data) and 350 m per day in Andasibe-Mantadia NP (J. A. Powzyk unpubl. data).

Group encounters are rare; Bonadonna and colleagues (2017) observed only 30 encounters of 16 different indri groups in 36 months. However, when two groups meet, they defend their territory ownership by using long vocal interactions or territorial song (Torti *et al.* 2013), and eventually starting physical fights (Pollock 1979; Powzyk and Mowry 2006). After a dispute resolution, the adult males reunite with their females and resume their normal ranging and feeding activities.

The indri has a rich vocal repertoire (Sorrentino *et al.* 2013) and is the only lemur that communicates through songs. Their songs are long sequences of vocal units that are organized in phrases (Thalmann *et al.* 1993; Gamba *et al.* 2011). They have the form of a chorus in which all the adults and subadults of a group utter their contribution in a precise and coordinated manner (Gamba *et al.* 2016a). Songs have various functions depending on the context in which they are emitted and they are used for both inter- and intra-group communication (Torti *et al.* 2013, 2018). Furthermore, songs are likely to provide information about the group composition and mediate the formation of new groups (Giacoma *et al.* 2010; Gamba *et al.* 2016b; Torti *et al.* 2017).

> The principal threat to the indri is habitat destruction for slash-and-burn agriculture, logging and fuelwood gathering.

The principal threat to the indri is habitat destruction for slash-and-burn agriculture, logging and fuelwood gathering, all of which also take place in protected areas.

Illegal hunting is a major problem for the indri in certain areas (Jenkins *et al.* 2011). Although long thought to be protected by local *fadys* (traditional taboos), these do not appear to be universal and the animals are now hunted even in places where such tribal taboos exist, with observed increases in hunting since the political crisis. In many areas, these taboos are breaking down with cultural erosion and immigration, and local people often find ways to circumvent taboos even if they are still in place. For example, a person for whom eating the indri is forbidden may still hunt the animals to sell to others, while those who may be forbidden to kill indris can purchase them for food. In 2018, in the Commune of Lakato (Alaotra Mangoro Region), nine indris were killed by poachers in the Antavolobe forest (J. Ratsimbazafy pers. obs.). Recent studies of villages in the Makira Forest indicate that indris have been hunted for their skins (which are worn as clothing), and show that indri meat is prized, fetching a premium price, and that current levels of indri hunting are unsustainable (Golden 2009; Jenkins *et al.* 2011; R. Dolch pers. comm.). The indri is listed on Appendix I of CITES.

It occurs in three national parks (Mananara-Nord, Andasibe-Mantadia and Zahamena), two nature reserves (Betampona and Zahamena) and five special reserves (Analamazaotra, Mangerivola, Ambatovaky, Anjanaharibe-Sud, and Marotandrano) (Mittermeier *et al.* 2008). It is also present in several of the 27 new protected areas declared in 2015 (e.g., Anosibe An'Ala, Anjozorobe-Angavo, Makira, Maromizaha). The corridors between Mantadia and Zahamena are an important Conservation Site, where widespread conservation education and capacity building should be implemented to eliminate hunting, with the indri as the flagship species. This species has never been successfully kept in captivity and thus the success of a captive breeding program is difficult to predict. In the next years it will be critical to support local forest management by improving the existing community-based approach (Randrianarison *et al.* 2015). Actions should include expansion of protected habitats to increase population connectivity (e.g., the Ankeniheny-Zahamena corridor) and to decrease lemur disturbance by rural communities.

AYE-AYE

Daubentonia madagascariensis Gmelin, 1788

Madagascar
(2016, 2018)

Doménico R. Randimbiharinirina, Timothy M. Sefczek, Brigitte M. Raharivololona, Yves Rostant Andriamalala, Jonah Ratsimbazafy & Edward E. Louis, Jr.

The aye-aye, *Daubentonia madagascariensis*, is the only surviving representative of the Daubentoniidae, the most anciently diverged family of primates known to date (Martin 1990; Simons 1995; Catlett *et al.* 2010; Perry *et al*. 2012). Aye-ayes have the widest distribution of any extant lemur, ranging from Montagne d'Ambre in the north of Madagascar, to Parc National d'Andohahela in the south, and Parc National Tsingy de Bemaraha in the west (Ganzhorn and Rabesoa 1986; Simons 1993; Schmid and Smolker 1998; Rahajanirina and Dollar 2004). Aye-ayes were also introduced to Nosy Mangabe, an island located off the Masoala Peninsula in northeast Madagascar (Petter 1977; Sterling 1993).

The aye-aye is the largest nocturnal primate, with a body mass of 2.5–2.6 kg and a total length of 74–90 cm, of which 30–37 cm is head-body length and 44–53 cm is tail length (Oxnard 1981; Glander 1994; Feistner and Sterling 1995). Aye-ayes have several unusual, derived traits including an elongated, thin, highly-flexible middle finger with a metacarpophalangeal ball and socket joint, continuously-growing fused canines and incisors, the greatest encephalization quotient of any strepsirrhine or nocturnal primate, a relatively long gestation period for lemurs, and a slow life history, including late weaning and a protracted learning period (Owen 1863; Jouffroy 1975; Martin 1990; Simons 1995; Barrickman and Lin 2010; Catlett *et al.* 2010).

Aye-ayes live in several forest types, from primary rainforest to dry undergrowth forest, and occupy habitats of varying qualities, including disturbed forests and heavily degraded forests near plantations (Pollock *et al*. 1985; Ganzhorn and Rabesoa 1986; Ancrenaz *et al*. 1994; Andriamasimanana 1994). Their distribution across various habitats is partially due to their

dietary adaptability. Though aye-ayes primarily eat insect larvae and *Canarium* seeds, they may expand their diet to include nectar from *Ravenala madagascariensis,* coconut, banana, mango, litchi, breadfruit, sugar cane and cankers (Petter and Petter 1967; Petter 1977; Iwano and Iwakawa 1988; Sterling 1993; Andriamasimanana 1994; Simons and Meyers 2001; Randimbiharinirina *et al*. 2018).

Despite the aye-aye's distribution and dietary flexibility, their huge individual home ranges and long interbirth intervals may translate to low population densities (Perry *et al.* 2012). As aye-ayes are solitary and can have large home ranges upwards of 973.12 ha, reliable population estimates remain elusive (Randimbiharinirina *et al*. 2018). Most locality records are based on feeding traces. However, at any given site, traces may be made by one aye-aye or multiple individuals (Aylward *et al*. 2018).

The greatest threats to aye-ayes are habitat destruction (forest degradation, fragmentation and slash and burn agriculture) and persecution by some local populations who believe aye-ayes to be an evil omen (Petter and Peyrieras 1970; Simons and Meyers 2001). Although there are multiple scientific and popular articles focusing on the aye-aye, Randimbiharinirina and colleagues' (2018) research from the Kianjavato Classified Forest currently represents the only long-term field study conducted on naturally-occurring individuals. Therefore, further long-term studies are needed to understand the aye-aye's ecology across its distribution before accurate population estimates and conservation initiatives can be achieved. Furthermore, novel studies utilizing molecular genomic platforms, such as in Aylward *et al.* (2018), should be further explored as a means to provide accurate population estimates. The reclusive nature of the aye-aye provides a cautionary facet of this species' status, since its extirpation from forest habitat will only be documented long after it has been unknowingly eliminated.

AFRICA

African Primates

- Cercopithecus roloway
- Colobus vellerosus
- Paragalago rondoensis
- Pan troglodytes verus
- Piliocolobus epieni
- Piliocolobus rufomitratus
- Rungwecebus kipunji

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RONDO DWARF GALAGO

Paragalago rondoensis **Honess in Kingdon, 1997**

Tanzania
(2006, 2008, 2010, 2012, 2014, 2018)

Andrew Perkin

Weighing approximately 60 g, the Rondo dwarf galago, *Paragalago rondoensis*, is the smallest of all galago species (Perkin and Honess 2013). It is distinct from other dwarf galagos in its diminutive size, a bottle-brush-shaped tail, its reproductive anatomy, and its distinctive "double unit rolling call" (Perkin and Honess 2013). Current knowledge indicates that *P. rondoensis* is endemic to the coastal forests of Tanzania. There are three spatially distinct sub-populations. One is in southeast Tanzania near the coastal towns of Lindi and Mtwara. The second is approximately 400 km north, in pockets of forest around the capital city of Dar es Salaam. The third sub-population is in Sadaani National Park, approximately 100 km north of Dar es Salaam. However, there is emerging data (vocal and penile morphological) that suggests the northern and southern populations may be phylogenetically distinct.

Rondo dwarf galagos have a mixed diet of insects and fruit. They often feed close to the ground, and move by vertical clinging and leaping in the shrubby understory. They build daytime sleeping nests, usually in the canopy (Bearder *et al*. 2003). As with many small primates, *P. rondoensis* is probably subject to predation from owls and other nocturnal predators, such as genets, palm civets and snakes. The presence of these predators invokes intense episodes of alarm calling (Perkin and Honess 2013).

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

The major threat facing the Rondo dwarf galago is loss of habitat.

P. rondoensis, classed as Critically Endangered, (Perkin *et al.* 2008), has an extremely limited and fragmented range in a number of remnant patches of Eastern African Coastal Dry Forest (Burgess and Clarke 2000) in Tanzania. These are at Zaraninge forest (06º08'S, 38º38'E) in Sadaani National Park (Perkin 2000), Pande GR (06º42'S, 39º05'E), Pugu/Kazimzumbwi (06º54'S, 39º05'E) (Perkin 2003, 2004), Rondo Nature Reserve (NR) (10º08'S, 39º12'E), Litipo (10º02'S, 39º29'E) and Ziwani (10º20'S, 40º18'E) FRs (Honess 1996b; Honess and Bearder 1996). New sub-populations were identified in 2007 near Lindi town in Chitoa FR (09º57'S, 39º27'E) and Ruawa FR (09º44'S, 39º33'E), and in 2011 in Noto Village FR (09º53'S, 39º25'E) (Perkin *et al.* 2011, 2013) and in the northern population at Ruvu South FR (06º58'S, 38º52'E). Specimens of *P. rondoensis*, originally described as *Galagoides demidoffi phasma*, were collected by Ionides from the Rondo Plateau, SE Tanzania in 1955, and by Lumsden from Nambunga, near Kitangari, (approximately 10º40'S, 39º25'E) on the Makonde Plateau, Newala District in 1953. There are doubts as to the persistence of the species on the Makonde Plateau, which has been extensively cleared for agriculture. Surveys there in 1992 failed to detect any extant populations (Honess 1996). Distribution surveys have been conducted in the southern (Honess 1996; Perkin *et al.* in prep.) and northern coastal forests of Tanzania (29 surveyed)

and Kenya (seven surveyed) (Perkin 2000, 2003, 2004; Perkin *et al.* 2013). Absolute population sizes remain undetermined, but recent surveys have provided density estimates of: 3–6/ha at Pande GR (Perkin 2003) and 8/ha at Pugu FR (Perkin 2004). Relative abundance has also been estimated from encounter rates: 3-10/hr at Pande GR and Pugu/Kazimzumbwi FR (Perkin 2003, 2004), and 3.94/hr at Rondo FR (Honess 1996b). There is a clear and urgent need for further surveys to determine population sizes in these dwindling forest patches.

The major threat facing the Rondo dwarf galago is loss of habitat. All sites are subject to some level of agricultural encroachment, charcoal manufacture and/or logging. In 2008, the known area of *P. rondoensis* occurrence was <101.6 km^2, but new data on forest area change indicates this figure has fallen to 87.4 km^2. In Pande GR (2.4 km^2), Chitoa FR (5 km^2) and Rondo FR (25 km^2), forest cover remained the same between 2008 and 2014. However, forest cover between 2008 and 2014 fell in Zaraninge forest from 20 km^2 to 15 km^2, in Pugu/Kazimzumbwi FR from 33.5 km^2 to 8 km^2, in Ruawa FR and Litipo FR from 4 km^2 to 3 km^2, and in Ziwani FR from 7.7 km^2 to 1 km^2. Two newly discovered areas of occupancy are Ruvu S, in which forest cover fell from 20 km^2 to 5 km^2, and Noto, in which forest cover fell from 21 to 20 km^2, in the same time period (Burgess and Clarke 2000; Doggart 2003; Perkin *et al.* in prep).

As habitat availability decreases, the population trend must also be assumed to be declining, the rate varying according to the level of protection of each forest fragment. All sites, except Pande GR, Zaraninge (in Saadani National Park) and Rondo NR forest, are national or local authority forest reserves and as such nominally, but in practice minimally, protected. Since 2008, protection of two forests has increased: the Noto plateau forest, formerly open village land, is part of a newly created village forest reserve, and the Rondo Forest Reserve has now been declared a new nature reserve. Both are important for Rondo dwarf galago conservation given their relatively large size. Given current trends in charcoal production for nearby Dar es Salaam, the forest reserves of Pugu and Kazimzumbwi were predicted to disappear over the next 10–15 years (Ahrends 2005). Recorded forest loss in Pugu/Kazimzumbwe and Ruvu South has been attributed to the rampant charcoal trade. Pande, as a Game Reserve, is relatively secure, and Zareninge forest, being in a national park, is the most protected part of the range of *G. rondoensis*. In the south, the Noto, Chitoa and Rondo populations are the most secure, as they are buffered by tracts of woodland. The type population at Rondo is buffered by woodland and *Pinus* plantations managed by the Rondo Forestry Project, and is now a nature reserve. Litipo and Ruawa FRs are under threat from bordering village lands. Ziwani is now mostly degraded scrub forest, thicket and grassland.

The following conservation actions are recommended to safeguard the future of this species: 1) continued monitoring of habitat loss rates, 2) surveying new areas for remnant populations, 3) implementation of community-based conservation and awareness, 4) assessment of population status and phylogenetic relationships between the sub-populations and confirmation of suspected phylogenetic distinctions. Until such time that the latter has been carried out, each subpopulation must be considered to be of high conservation value.

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ROLOWAY MONKEY

Cercopithecus roloway **Schreber, 1774**

Ghana, Côte d'Ivoire
(2002, 2006, 2008, 2010, 2012, 2014, 2016, 2018)

Sery Gonedelé Bi, Andrea Dempsey, Inza Koné, W. Scott McGraw & John F. Oates

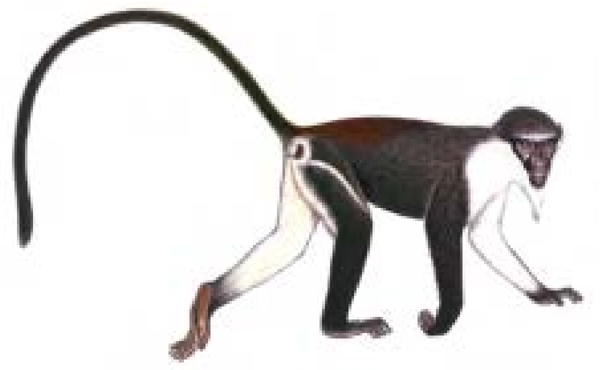
Cercopithecus roloway and its close relative *Cercopithecus diana* are highly attractive, arboreal monkeys that inhabit the Upper Guinean forests of West Africa. The roloway monkey, which once occurred in many of the southern forests of Ghana and central and eastern Côte d'Ivoire, is distinguished from the Diana monkey by its broad white brow line, long white beard and yellow thighs. Because individuals with intermediate coat patterns are known from near the Sassandra River in Côte d'Ivoire, some scientists treat the roloway and Diana as subspecies of one species, *C. diana* (for example, Oates 2011). Of the two forms, the roloway is the more seriously threatened, and it is now rated as Critically Endangered on the IUCN Red List (Koné *et al.* 2019).

Roloway monkeys are upper-canopy specialists that prefer undisturbed forest. Destruction and degradation of their habitat and relentless hunting for the bushmeat trade have reduced their population to small, isolated pockets. Miss Waldron's red colobus (*Piliocolobus waldroni*) once inhabited many of the same forests as the roloway, but is now almost certainly extinct (Oates 2011). Unless much more effective conservation action is taken very quickly, there is a strong possibility that the roloway monkey will also disappear in the near future.

> The captive population of the roloway monkey is now so small that extinction in captivity is also a strong possibility.

Over the last 50 years, roloway monkeys have been steadily extirpated in Ghana. In southwestern Ghana, once a stronghold of *C. roloway*, an ornithological study showed a 600% increase in both legal and illegal logging between 1995 and 2008 (Arcilla *et al.* 2015). Illegal logging, which makes up 80% of timber harvested in Ghana, is particularly devastating; because it is wholly unregulated or monitored, there are no limits on number, size or species of trees taken. One third of illegal logging is by companies that take more than their quota, expand into protected areas, and/or continue to log after their permit has expired. The remaining two thirds are rogue illegal chainsaw operators (Arcilla *et al.* 2015). Additional factors causing the roloway monkey's decline are clearing for agriculture, charcoal production and bushmeat hunting. Hunting has very likely been the major cause in the recent crash in roloway populations; bushmeat is a major food source for Ghanaians, with an estimated 80% of the rural population dependent on it as their main source of protein (Dempsey 2014; Trench 2000).

Several recent surveys have failed to confirm the presence of roloway monkeys in any reserves in western Ghana, including the Ankasa Conservation Area, Bia National Park, Krokosua Hills Forest Reserve, Subri River Forest Reserve and Dadieso Forest Reserve (Oates 2006; Gatti 2010; Buzzard and Parker 2012; Wiafe 2013). Community-owned forests along the Tano River (referred to as the "Kwabre Community Rain Forest") in the far southwestern corner of the country are the only localities in Ghana where any roloways have been recorded by scientists or conservationists in the last decade. Kwabre consists of patches of swamp forest along the lower Tano River, adjacent to the Tanoé forest in Côte d'Ivoire. Surveys of these forests have been conducted under the auspices of the West African Primate Conservation Action organization since 2011, and several sightings of roloway groups have been made, along with mona monkeys,



spot-nosed monkeys, white-naped mangabeys and olive colobus (WAPCA 2014; Dempsey 2014; Osei *et al.* 2015). WAPCA has supported a community-based conservation project with villages around these forests, establishing a Kwabre Community Resource Management Area, which works to protect the forest through the sustainable management of natural resources. Meanwhile, further efforts should be made to ascertain whether any roloway monkeys still survive in Ankasa, because this site has significant conservation potential and roloways have been reported there in the relatively recent past, as well as in the Amazuri Wetlands Area.

In neighbouring Côte d'Ivoire, the roloway monkey's status is dire as well. Less than twelve years ago, roloways were known or strongly suspected to exist in three forests: the Yaya Forest Reserve, the Tanoé forest adjacent to the Ehy Lagoon, and Parc National des Iles Ehotilé (McGraw 1998, 2005; Koné and Akpatou 2005; Gonedelé Bi *et al.* 2013). Surveys of eighteen areas between 2004 and 2008 (Gonedelé Bi *et al.* 2008, 2012) confirmed the presence of roloways only in the Tanoé forest, suggesting that the roloway monkey may have been eliminated from at least two forest areas (Parc National des Îles Ehotilé, Yaya Forest Reserve) in the last dozen years. Subsequent surveys carried out in southern Côte d'Ivoire suggest a handful of roloways may still survive in two forest reserves along the country's coast. In June 2011, Gonedelé Bi observed one roloway individual in the Dassioko Sud Forest Reserve (Gonedelé Bi *et al.* 2014, in review; Bitty *et al.* 2013). In 2012, Gonedelé Bi and A. E. Bitty observed roloways in Port Gauthier Forest Reserve, and in October 2013, Gonedelé Bi obtained photographs of monkeys poached inside this reserve, including an image purported to be a roloway. The beard on this individual appears short for a roloway, raising the possibility that surviving individuals in this portion of the interfluvial region may in fact be hybrids. In any case, no sightings of roloways have been made in the Dassioko Sud or Port Gauthier Forest Reserves since 2012, including during the most recent patrols (February 2017). These reserves are described as coastal evergreen forests, and both are heavily degraded due to a large influx of farmers and hunters from the northern portion of the country (Bitty *et al.* 2013). Gonedelé Bi and colleagues, in cooperation with SODEFOR (Société de Développement des Forêts) and local communities, have organized regular surveys aimed at removing illegal farmers and hunters from both reserves. However, surveys made in August 2015 revealed that a logging company (SIDB) had begun clearing a portion of the Port Gauthier reserve. Efforts are underway to work with SODEFOR to stop logging and other illegal activities in these reserves (Gonedelé Bi 2015).

Thus, the only forest in Côte d'Ivoire where roloways are confirmed to exist is the Tanoé forest adjacent to the Ehy Lagoon, and immediately across the Tano River from the Kwabre forest in Ghana. This wet forest also harbours one of the few remaining populations of white-naped mangabeys in Côte d'Ivoire. Efforts led by I. Koné and involving several organizations (WAPCA, ACB-CI, Mulhouse Zoo) helped stop a large palm oil company from causing further habitat degradation, and a community-based conservation effort has helped slow poaching in this forest (Koné 2015). Unfortunately, hunting still occurs in Tanoé, and the primate populations there are undoubtedly decreasing (Gonedelé Bi *et al.* 2013).

As the potential last refuge for roloways and one of the last refuges for white-naped mangabeys, the protection of the Tanoé Forest in Côte d'Ivoire and the adjacent Kwabre Forest in Ghana should be the highest conservation priority. By any measure, the roloway monkey must be considered one of the most Critically Endangered monkeys in Africa and is evidently on the verge of extinction (Oates 2011). In addition, the captive population is now also so small that extinction in captivity is a strong possibility (Lefaux and Montjardet 2016).

KIPUNJI

Rungwecebus kipunji Ehardt, Butynski, Jones and Davenport in Jones _et al_. 2005

Tanzania
(2006, 2008, 2018)

Tim R. B. Davenport, Noah E. Mpunga, Sophy J. Machaga & Daniela W. De Luca

The discovery of the kipunji (*Rungwecebus kipunji*), a monkey endemic to southern Tanzania, on the forested flanks of Mt Rungwe in 2003, (Davenport 2005), demonstrated how much there was still to learn about Africa's primate fauna. Originally thought to be a mangabey (Jones *et al*. 2005), it was later placed in a new monotypic genus *Rungwecebus* by Davenport *et al.* (2006) on the basis of molecular and morphological data, making it the first new genus of African monkey to be described in 83 years. Subsequent research supported this phylogenetic position and taxonomic status (Olson *et al.* 2008; Roberts *et al.* 2009).

The kipunji is one of the world's most threatened primates. This was first demonstrated by a census that provided the initial systematically-derived data on the animal's abundance and distribution (Davenport *et al.* 2008). Whilst there is growing evidence that a decade of conservation has ameliorated the situation (Davenport and Markes 2018), the kipunji remains Critically Endangered, with the species and genus facing a high risk of extinction in the wild (Davenport & Jones 2008).

> Previous surveys estimated the total population of kipunji to be 1,117 animals.

The kipunji is known from only two populations, separated by approximately 350 km of non-forested, agricultural land. One population is at 1,750–2,450 m in 12.4 km^2 of Rungwe-Kitulo Forest (Davenport *et al.* 2008) in Tanzania's Southern Highlands (09.12°-09.18°S, 33.67°-33.92°E). The Rungwe-Kitulo Forest includes the Mt Rungwe Nature Reserve (150 km^2) and the Livingstone Forest (191 km^2, found in the 412 km^2 Kitulo National Park) (Davenport 2002; Davenport and Bytebier 2004; Davenport *et al*. 2005, 2006, 2008). Mt Rungwe and Livingstone Forest (in Kitulo) are connected by the Bujingijila Corridor, a 2-km-wide degraded forest connection (Davenport 2005, 2006; Mwakilema and Davenport 2005) that is currently being re-wilded. The kipunji inhabits the wetter forest of southern Mt Rungwe, and isolated groups are scattered in the north and south of Livingstone Forest (Davenport *et al*. 2006, 2008; Bracebridge *et al.* 2011), with five groups in Madehani forest a few kilometres further south.

The other population of *R. kipunji* is located at 1,300–1,750 m in the Vikongwa Valley, Ndundulu Forest (07.67°-07.85°S, 35.17°-36.83°E; ca. 180 km^2 of closed forest), in the Kilombero Nature Reserve of the Udzungwa Mountains (Jones *et al.* 2005). The area occupied by the species in Ndundulu is estimated to be approximately 25 km^2 (Davenport pers. obs. in Marshall *et al.* 2015) although its density is low. The kipunji has not been recorded from the contiguous Udzungwa Mountains National Park (Davenport *et al*. 2008; De Luca *et al.* 2010; Marshall *et al.* 2015). The species' extent of occurrence (EOO) is estimated to be 42.4 km^2 in Rungwe-Kitulo (Bracebridge *et al*. 2011) and ~25 km^2 in Ndundulu (Davenport pers. obs. in Marshall *et al*. 2015), with the combined total EOO (species range) at just 67.5 km^2.

The kipunji is sparsely distributed (Davenport *et al*. 2006, 2008; Bracebridge *et al.* 2001, 2012). The small extent of occurrence in Rungwe-Kitulo (42.4 km^2) and even smaller estimate for Ndundulu (~25 km^2) give grounds for conservation concern. The total extent of occurrence is much less than the 100 km^2 required to meet the threshold for listing as Critically Endangered under criterion B of the IUCN Red List.

Surveys totalling 2,864 hours and covering 3,456 km of transect were undertaken by Davenport *et al.* (2008) to determine distribution and group numbers. In addition, 772 hours of simultaneous multi-group observational follows in Rungwe-Kitulo and Ndundulu forests enabled 209 total counts to be carried out. Davenport *et al.* (2008) estimated some 1,042 individuals in Rungwe-Kitulo, ranging from 25 to 39 individuals per group (μ = 30.65; SE = 0.62; n = 34), and 75 individuals in Ndundulu, ranging from 15 to 25 individuals per group (μ = 18.75; SE = 2.39; n = 4). The total kipunji population was thus estimated to be 1,117 animals in 38 groups (μ = 29.39; SE = 0.85; n = 38). The Ndundulu population is restricted and the Rungwe-Kitulo population is fragmented with isolated subpopulations remaining in degraded habitat (Davenport *et al.* 2008, 2010). Kipunji densities appeared to be three times greater in the secondary forests of Rungwe-Kitulo than in the primary forests of the Udzungwas (Davenport *et al.* 2008), possibly because competition with other diurnal primates is not present in Rungwe-Livingstone (Bracebridge *et al.* 2011). There was also a statistically significant difference in mean group size between the Rungwe-Kitulo and the Ndundulu populations (Davenport *et al.* 2008), possibly related to the small total population in Ndundulu. A new census by the Wildlife Conservation Society (WCS) is now underway (Davenport and Markes 2018).

Rungwecebus kipunji occurs entirely within protected areas (PAs); Kitulo National Park, Mt Rungwe Nature Reserve, Kilombero Nature Reserve (Davenport *et al.* 2008) as well as Nkuka and Madehani forests managed under lease by WCS. Of the state-run PAs, however, only Kitulo National Park has ongoing management activities and these remain limited in the forest. Neither Mt Rungwe nor Kilombero Nature Reserves have financial resources, and the management of Mt Rungwe has been dependent on funds from WCS since 2008. Forest loss and degradation has been much reduced over the last decade, especially compared with the situation in 2003 when unmanaged resource extraction was commonplace (Machaga *et al.* 2004; Davenport 2005, 2006). However, challenges remain in some of the more remote areas.

The Bujingijila corridor linking Mt Rungwe Nature Reserve to Livingstone Forest in Kitulo National Park and the areas joining the northern and southern sections of Livingstone are encroached (Davenport 2005; Mwakilema and Davenport 2005). However, a decade of protected area and community conservation work by WCS has meant that solid recovery is underway (Davenport and Markes 2018). Despite this, some subpopulations remain fragmented even within the same protected area. Kipunji are killed by log traps, mainly as retribution for the raiding of maize, beans and potatoes, and mostly from January to April. In Ndundulu Forest the species is present in low numbers (Davenport *et al.* 2008) but the reason for this remains unclear (Marshall *et al.* 2015).

The focus of current kipunji conservation work is the protection and restoration of the montane habitats of Mt Rungwe, especially the forest connections such as the Bujingijila corridor (Davenport 2006; Bracebridge *et al.* 2011). Protecting connections is a high priority for the conservation of this genus/species and restoring Bujingijila could provide habitat for an additional 88 kipunji (8% population increase), using density estimates from the 2008 census (Bracebridge *et al.* 2013). This would also reconnect the Mt Rungwe and Kitulo subpopulations.

The kipunji is being used as a 'flagship species' by WCS's long-term Southern Highlands Conservation Program in and around Rungwe-Kitulo, especially in education and awareness raising activities, and as part of a long-term monitoring program. A section of forest contiguous with Mt Rungwe that contains groups of kipunji is now being leased to and managed by WCS. A habituated group is monitored daily for research, especially on aspects of the kipunji's social and reproductive behaviour, feeding ecology, home range dynamics, predation and demography. A new group is now being habituated for tourism. The focus of applied kipunji conservation work is the protection and restoration of its montane forest habitats, widespread environmental education, and support to both management authorities and local communities across its range.

WHITE-THIGHED COLOBUS

***Colobus vellerosus* I. Geoffroy Saint-Hilaire, 1830**

Côte d'Ivoire, Ghana, Togo, Benin, possibly Nigeria
(2016, 2018)

Reiko Matsuda Goodwin, Sery Gonedelé Bi, Edward D. Wiafe & John F. Oates

The white-thighed colobus (*Colobus vellerosus*) is one of five *Colobus* species that inhabit sub-Saharan Africa. As the name suggests, it has white-silvery thighs and a white ruff around the face. It is a middle-to-upper canopy species, but it sometimes goes down to the forest floor to cross tree gaps, play, and drink water. This colobine feeds mostly on the leaves of trees and lianas (Wong *et al.* 2006). It lives in lowland rainforests, swamp forests, seasonally inundated semi-deciduous forests, savannah-woodlands and gallery forests from the coastal areas to 10˚6' N (Oates 2011). The fact that it occurs in wet, dry, and moderately disturbed habitats and that groups occupy small home ranges (Wong and Sicotte 2007) attests to its ecological flexibility.

This colobus monkey has an extremely fragmented distribution from the area between the Sassandra-Bandama rivers in Côte d'Ivoire to Benin, traversing Ghana and Togo. It is not clear if it still occurs in western Nigeria. The species' broad range may give a false impression that it is not as threatened as some primates with more restricted ranges. In each range country, however, *C. vellerosus* occurs in only a limited number of protected areas and community forests.

Habitat destruction and degradation have significantly reduced *C. vellerosus* populations, but the primary cause of their decline in all range countries is uncontrolled hunting (Oates 2011). Large primates, like the other six colobine species included in this volume, have been particularly decimated by illegal hunting in Africa and Asia.

Our current estimate of the population size of *C. vellerosus* at sites from which there are some data is only about 1,200 (Matsuda Goodwin *et al.* unpublished). Although this number excludes several groups in some forest areas where surveys have not yet been conducted or have been incompletely performed, we estimate that the total population is now less than 1,500. Apart from the Boabeng-Fiema Monkey Sanctuary (BFMS) in Ghana, which has a population of about 370 white-thighed colobus (Kankam *et al.* 2010), the average number of individuals known or inferred to be present at all other sites is 23, and these sites are typically separated from each other by about 60 km. This means that there are considerable impediments to gene flow between the populations and a high risk of inbreeding depression.

> The encounter rate in seven protected areas has declined by 87.2% in the last four decades.

In Côte d'Ivoire, the white-thighed colobus used to be commonly observed in many protected areas, but in the Bandama-Sassandra interfluvial zone, Grébouo 1 sacred forest is the only place where this species still occurs (Gonedelé Bi *et al*. 2014). East of this zone, this species is known to occur at only three sites: Tanoé-Ehy swamp forest, Comoé National Park, and Dinaoudi sacred forest (McGraw *et al*. 1998; Gonedelé Bi *et al*. 2014). The successive periods of civil unrest in Côte d'Ivoire between 1999 and 2012 exacerbated the threats to *C. vellerosus.* Many protected areas suffered from weakened protection and heavy hunting, some were converted into plantations, and the settlement of people inside protected areas was widespread (Campbell *et al*. 2008; Bitty *et al*. 2015).

Dinaoudi and Grébouo 1 sacred forests have only two groups of *C. vellerosus* each (S. Gonedelé Bi pers. obs.). A survey conducted in the Tanoé-Ehy swamp forest in 2007 had an encounter rate of 0.05 groups/km and the observed group size was extremely small (mean = 2) (Gonedelé Bi *et al.* 2010). In the Comoé National Park, camera images and *ad libitum* sightings by J. Lapuente (pers. comm.) in the last four years indicate that several groups still occur there.

Three Critically Endangered taxa are found in the Tanoé-Ehy swamp forest—the roloway monkey and the white-naped mangabey, besides the white-thighed colobus—and the Comoé Monkey Project is now taking an initiative to survey and conserve these species there, alongside local non-governmental organizations (NGOs) from both Côte d'Ivoire and Ghana (RASAP-CI, CEPA, WAPCA). While logging (to create an oil palm plantation) and hunting continue, these NGOs have been engaging with local communities to promote conservation activities (Gonedelé Bi *et al.* 2013; McGraw *et al.* 2017).

The white-thighed colobus used to be widely distributed in Ghana (Grubb 1998). However, it has been extirpated from at least 14 of 26 sites where surveys were conducted between 1976 and 2018. It is still present in two national parks (Kakum, Mole), several forest reserves (Ayum, Bia Tributaries North, Bonsam Bepo, Bonkoni, Cape Three Points, Subin, Mpameso, Krokosua Hills, Atewa Range), Bia Resource Reserve (RR), and at BFMS (Oates 2006; Burton 2010; Gatti 2010; Wiafe 2013, 2016, 2018; Osei *et al.* 2015; Akom 2015). The species also occurs in the Kwabre swamp forest, where a transboundary project linked to the Tanoé-Ehy project in Côte d'Ivoire that focusses on community-based conservation for the roloway monkey has been in place since 2014 (Osei *et al.* 2015; McGraw *et al*. 2017; WAPCA 2018).

Only one to a few groups remain at each of these sites, however, and hunting and logging continue in most of them. The species may still occur in the Digya and Kyabobo national parks, the Yoyo River Forest Reserve, the Kalakpa Resource Reserve, and the Amanzule swamp forest, but it is very unlikely that large populations survive at any of these sites given ongoing high levels of hunting and forest destruction (Owusu-Ansah 2010). Atewa Range Forest Reserve, which is also home to the white-naped mangabey, still harbours the white-thighed colobus, but hunting, snaring, mining, logging and farming threaten their sustained existence there (Kusimi 2015; Wiafe 2018). A campaign against a joint China-Ghana bauxite mining at Atewa Range here is ongoing (Environmental Justice Atlas 2018). The only site in Ghana where there is a stable *C. vellerosus* population is the BFMS, but deforestation and habitat degradation have been increasing there (E. Wiafe pers. obs.). At BFMS, group size varies from 9 to 38 with a mean of 13 in forest fragments and 15 in the larger forest (Wong and Sicotte 2007). Past survey data from seven protected areas indicate that the encounter rate of this species has declined on average by 87.2% in the last four decades, suggesting an equivalent population decline (Matsuda Goodwin *et al*. unpublished).

The white-thighed colobus has probably been extirpated from Burkina Faso (Ginn and Nekaris 2014). In Togo, recent surveys found a few groups of this species at each of Togodo Faunal Reserve, Fazao-Malfakassa National Park and Yikpa Community Forest (Segniagbeto *et al*. 2017, 2018). *Colobus vellerosus* is on the verge of extinction in Benin; only 1–2 groups live in the Lama Forest Reserve and Kikélé sacred forest, and the species appears to have been extirpated from the forest reserves of Pénéssoulou, Mt. Kouffé, Wari-Maro, Ouémé Superieur, and the Lokoli swamp forest where it used to occur (Matsuda Goodwin *et al*. 2016). The chance of this species still being present at Bonou swamp forest and Ouémé Boukou Forest Reserve in Benin is slim. In Nigeria, there is little credible information that this species still occurs in the Old Oyo and Kianji Lake national parks, where it was said to occur more than 30 years ago (Happold 1987).

Urgent measures are required to stop further local extirpations of the white-thighed colobus. We urge range countries to enact tough laws against the hunting of threatened species, similar to the Wildlife Conservation and Management Law (2013) in Kenya, and to strictly enforce the laws against hunting. Moreover, systematic surveys should be conducted in Mole and Digya national parks, and the Atewa Forest Reserve in Ghana, and the Old Oyo and Kainji Lake national parks in Nigeria. We also encourage the European Association of Zoos and Aquaria to consider establishing a captive-breeding programme for this species at Zoo Duisburg (Germany) where such a programme for the closely-related king colobus (*Colobus polykomos*) already exists, or at Zoo Barcelona (Spain) where the white-naped mangabey is housed.

NIGER DELTA RED COLOBUS

***Piliocolobus epieni* Grubb and Powell, 1999**

Nigeria
(2008, 2010, 2016, 2018)

Rachel Ashegbofe Ikemeh & John F. Oates

The Niger Delta red colobus (*Piliocolobus epieni*) is endemic to the marsh forests in the central part of the Niger Delta of Nigeria (Oates 2011). Its species name is derived from its name in the Ijaw language of the people who inhabit the limited area of about 1,500 km^2 in Bayelsa State where it occurs. *Piliocolobus epieni* only became known to science in 1993 in the course of a biodiversity survey co-ordinated by C. Bruce Powell (Powell 1994). Studies of vocalizations and mitochondrial DNA suggest that this population is not closely related to its closest geographic relatives, the Bioko red colobus (*Piliocolobus pennantii*) or Preuss's red colobus (*Piliocolobus preussi*) of eastern Nigeria and western Cameroon, leading Ting (2008) to treat this monkey not as a subspecies of *P. pennantii* (see Groves 2001; Grubb *et al.* 2003) but as a distinct species, *Procolobus epieni*. Groves (2007) regarded almost all the different red colobus monkeys, including *epieni*, *pennantii* and *preussi*, as separate species in the genus *Piliocolobus* – a taxonomy that we follow here. Since 2008, the IUCN Red List of Threatened Species has regarded *P. epieni* as Critically Endangered (Oates and Struhsaker 2016).

The marsh forests where the Niger Delta red colobus is found have a high water table all year round, but do not suffer deep flooding or tidal effects. The most intensive ecological study of this monkey, by Lodjewijk Werre (1994–1996), suggested that the clumped distribution of food species in the marsh forest is a key factor restricting *P. epieni* 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 (Werre 2009). At the time of its discovery in the mid 1990s, this 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 *Fleroya ledermannii*, were being felled at a high rate by artisanal loggers, and the logs were 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. The most recent range-wide assessment of *P. epieni* conducted in 2013 suggests that, as a result of habitat destruction and hunting, the population has declined significantly since the 1990s, and that it may now be around 90% lower than the previous estimate of <10,000 (Ikemeh 2015).

In the 2013 survey, the presence of *P. epieni* was confirmed only in four forest areas, and it was considered extirpated from 11 other forests where it had been reported in the 1990s by Werre (2009). Cumulative survey data indicate that the current number of individuals surviving in the wild may be only a few hundred (Ikemeh 2015). The two most important remaining areas for *P. epieni* conservation are thought to be the Apoi Creek Forests, flanked by the communities of Gbaraun, Apoi and Kokologbene, and forests near Kolotoro. Insecurity in the region and the consequences of corrupt governance, amongst other factors, have exacerbated the major threats of habitat degradation and commercial hunting. Because red colobus monkeys are known to be sensitive to habitat disturbance and hunting in other parts of Africa (Struhsaker 2005), it is feared that the Niger Delta red colobus, with its restricted range, is at risk of extinction.

> It is feared that the Niger Delta red colobus, with its restricted range, is at risk of extinction.

The red colobus monkeys are probably more threatened than any other taxonomic group of primates in Africa (Oates 1996; Struhsaker 2005). *Piliocoobus badius temminckii* (Senegal to Guinea or Sierra Leone) (Galat-Luong *et al.* 2016), *Piliocolobus badius badius* (Sierra Leone to western Côte d'Ivoire) (Oates *et al.* 2016a), *Piliocolobus preussi* (western Cameroon and eastern Nigeria) (Oates *et al.* 2016b), and *Piliocolobus pennantii* (Bioko Island, Equatorial Guinea) (Oates and Struhsaker 2008) are all now Critically Endangered from different combinations of habitat loss and hunting, while *Piliocolobus waldroni* (eastern Côte d'Ivoire and western Ghana) may already be extinct (Oates *et al.* 2019).

At present, no areas in the Niger Delta are formally protected for wildlife, even though the region has great ecological significance and supports many rare, unique and/or threatened taxa (Ikemeh 2015). 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*) (Ikemeh 2015). Also found in these forests are the putty-nosed monkey (*Cercopithecus nictitans*), the mona monkey (*Cercopithecus mona*) and the olive colobus (*Procolobus verus*) (Efenakpo *et al.* 2018). 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 (Ikemeh 2015).

Because security in the Niger Delta continues to be challenging, undertaking effective conservation actions remains difficult. Despite these challenges, and with the urgent need to save this species from extinction, a locally driven research, awareness-raising and conservation initiative is currently underway in Bayelsa State, coordinated by the SW/Niger Delta Forest project (directed by R. Ikemeh). Plans exist to intensify this effort, with concerted focus on ensuring that *P. epieni* is protected by law in Bayelsa State and that one or more protected areas are established for the fragile remaining populations. Two areas in particular have already been suggested for special protected status to conserve red colobus monkeys: the Otolo-Kolotoro-Ongoloba area and the Apoi Creek area (Ikemeh 2015).

Note: To date, photographs of this species have been difficult to obtain. Thus, it is represented here only by the illustration.

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TANA RIVER RED COLOBUS

***Piliocolobus rufomitratus* Peters, 1879**

Kenya
(2002, 2004, 2006, 2008, 2012, 2014, 2018)

Stanislaus Kivai, Laura Loyola, Julie Wieczkowski, Juliet King, Yvonne de Jong, Laura Allen, Nelson Ting & Tom Butynski

The taxonomy of the Tana River red colobus *Piliocolobus rufomitratus* has been disputed (Grubb *et al*. 2013; Oates and Ting 2015); it has been considered a species (Groves 2007; Zinner *et al*. 2013; Groves and Ting 2013, Butynski and Hamerlynck 2015) and a subspecies *P. r. rufomitratus* (Napier 1985; Grubb *et al.* 2003; Ting 2008; Struhsaker and Grubb 2013). The classification used here follows the taxonomy adopted at the IUCN SSC Primate Specialist Group African Primate Red List Assessment Workshop in Rome in April 2016. The species is listed as Endangered on the IUCN Red List of Threatened Species based on its extremely limited and fragmented geographic range, continued habitat fragmentation, and the unsustainable exploitation of forest products (Butynski *et al.* in press). The Tana River red colobus is listed as Class B in the African Convention on the Conservation of Nature and Natural Resources.

The Tana River red colobus, as well as the Endangered Tana River mangabey *Cercocebus galeritus*, are endemic to the riparian forests of the lower Tana River and Tana Delta of the north coast of Kenya. They are broadly sympatric with the Vulnerable *Cercopithecus mitis albotorquatus*, as well as with *Paragalago cocos,* and *Otolemur garnettii lasiotis*, and narrowly sympatric on the forest edge with *Papio cynocephalus ibeanus, Chlorocebus pygerythrus hilgerti*, and *Galago senegalensis braccatus* (De Jong and Butynski 2009, 2012; Butynski and De Jong 2019). The gallery forests are part of the East African Coastal Forests Biodiversity Hotspot. The evergreen riparian forest patches are narrow, often restricted to less than 500 m from the river or water channels. They provide habitat in this, otherwise, expansive arid and semi-arid landscape (Baker *et al.* 2015).

> Continuing deforestation, forest fragmentation and invasive plants challenge the survival of the Tana River red colobus.

The Tana River red colobus occupies about 34 riverine and flood-plain forests that range in size (1-500 ha) along a 60-km stretch of the lower Tana River and in the upper Tana Delta (Butynski and Mwangi 1995; Mbora and Meikle 2004; Hamerlynck *et al*. 2012). The area of occupancy is extremely small (<13 km^2; Butynski and Mwangi 1994; Hamerlynck *et al*. 2012; Butynski and Hamerlynck 2015). Fewer than 1000 individuals remain (Mbora and Butynski 2009). Primate surveys in 2000 found two groups in Onkolde forest (Tana Delta) but a survey in December 2017 recorded only one male and one female (Nature Kenya, unpubl. data).

Population densities of the diurnal, arboreal, and folivorous Tana River red colobus range from 33 to 253 individuals/km^2, varying according to habitat quality (Mbora and Meikle 2004; Loyola 2015). As all remaining forests inhabited by the Tana River red colobus are small, fragmented, degraded, and, therefore, seriously threatened, the long-term survival of this species seems bleak.

With the Tana River red colobus population in a continual state of decline (Marsh 1978, 1986; Butynski and Mwangi 1995), mean group sizes have fallen by about 50% since the 1970s (Marsh 1978; Karere *et al.* 2004). Many factors account for these declines, most (if not all) of which are associated with the rapidly increasing human population, including poverty, insecurity, poor

conservation leadership among local communities and weak governance by government authorities. Seventy-five percent of the population lives below the poverty line (Baker *et al*. 2015). This requires rigorous community awareness and outreach on the importance of human population control strategies, initiation of sustainable livelihood alternatives, and adoption of agricultural technologies that improve food production (Mbora and Allen 2011).

The construction of hydroelectric power dams along the upper Tana River, and several big irrigation projects, have altered the water table, river flow volume, and flood cycle, leading to drastic vegetation changes in the lower catchment (Butynski 1995; Maingi and Marsh 2002). The situation is likely to worsen with the upcoming High Grand Falls Dam, which is expected to be completed in 2031 (Hamerlynck *et al*. 2012; Mwangasha 2018). This will be the second largest dam in Africa. It will be accompanied by large-scale irrigation schemes, and water transfer to the Lamu Port and to the Southern Sudan-Ethiopia Transport Corridor (LAPSSET). Additionally, the High Grand Falls Dam will have negative impacts on the floods and groundwater recharge required for the maintenance of the lower Tana River and Tana Delta forests. It is expected to have a negative impact on flood-dependent livelihoods (crop farmers, pastoralists, and fishermen) and the biodiversity of this biologically-sensitive region (Njiru 2011; Duvail *et al.* 2012; Hamerlynck *et al.* 2012).

Continuing deforestation, habitat degradation, fragmentation, and spread of invasive plant species, further threaten the Tana River red colobus, as do agricultural encroachment and unsustainable forest exploitation (e.g., building materials, palm wine, medicinal plants, wood for canoe-making, firewood collection) (Butynski and Mwangi 1995; Mbora and Meikle 2004; Moinde-Fockler *et al.* 2007; De Jong & Butynski 2009; Duvail *et al*. 2012; Hamerlynck *et al*. 2012; Butynski & De Jong 2019). The invasive mesquite *Propopis juliflora*, facilitated by forest clearing by people and elephants *Loxodonta africana*, is steadily spreading into indigenous forests and inhibiting regeneration of native tree species. Stringent habitat protection, restoration of abandoned farmlands and degraded forests, and research on the control of the invasive species are required.

Proposed and failed irrigation schemes continue to threaten Tana River red colobus habitat. The Tana Delta Irrigation Project (TDIP), a failed rice growing development [financed by the Japan International Cooperation Agency (JICA) and managed by the Tana and Athi Rivers Development Authority (TARDA)] led to the loss of some of the most important forests for the Tana River red colobus and Tana River mangabey (Butynski and Mwangi 1994; Moinde-Fockler *et al.* 2007). Similarly, the Bura Maize and Cotton Irrigation Scheme cleared 350 km^2 and diverted river water through furrows, but failed (Horta 1994; Christensen *et al*. 2012). A proposed 10,000 km^2 irrigation scheme in the lower Tana River has also been initiated by the Kenyan government, which will lead to further habitat loss.

The entire Tana River red colobus population lies in a politically insecure area and much unplanned, unregulated, and unsustainable exploitation of natural resources. Conservation efforts, as well as monitoring, are impeded by insecurity and regional conflicts (Duvail *et al.* 2012). Resettlement of pastoralist communities from the Tana Delta and Tana River Primate National Reserve (TRPNR; Baker *et al.* 2015), by Kenya Wildlife Service (KWS) led to unrest in the region. A court case to degazette the only protected area in the geographic range of the Tana River red colobus (and Tana River mangabey), the TRPNR (171 km^2) was won by the local community. In January 2007, the High Court of Kenya ordered the annulment of the Reserve, citing lack of proper involvement of the local people during its gazettement. In 2012, the Tana Delta became a Ramsar Site, otherwise, the Tana Delta has no protected area or protection status. To secure the long-term survival of the Tana River red colobus, conservation initiatives that aim to enable local people to conserve biodiversity, improve livelihoods, rehabilitate degraded areas, and establish sustainable income generating projects, including ecotourism, are required (Butynski & De Jong 2019).

Despite the many challenges of the lower Tana River and Tana Delta, there is some good news. Various unsustainable commercial developments have aborted their plans, and conservation initiatives have started in the region, including the Ndera Community Conservancy (NCC) (Northern Rangeland Trust; Mbora and Allen 2011; Butynski and De Jong 2019). In addition, plans to form the Ngwano Community Conservancy are on-going and the Tana River County Government is supporting various community conservation efforts.

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WESTERN CHIMPANZEE

***Pan troglodytes verus* Schwarz, 1934**

Côte d'Ivoire, Ghana, Guinea-Bissau, Liberia, Mali, Republic of Guinea, Senegal, Sierra Leone
(2018)

Tenekwetche Sop, Christophe Boesch & Hjalmar Kühl

The western chimpanzee (*Pan troglodytes verus*) is one of the four currently recognised subspecies of chimpanzees. Since 2016, it has been classified as Critically Endangered on the IUCN Red List of Threatened Species (Humle *et al.* 2016).

Historically, the western chimpanzee ranged widely from eastern Senegal to Benin, across 11 countries. Currently, it only occurs in eight countries. It is believed to have disappeared from Benin, Togo, and Burkina Faso (Ginn *et al*. 2013; Campbell and Houngbedji 2015), and is close to extinction in Ghana. It is possible that remnants of its historic geographic range extend into western Nigeria, but genetic evidence is still needed as confirmation (Humle *et al*. 2016).

Twenty years ago, knowledge about the population status of the western chimpanzee was limited (Kormos and Boesch 2003), but extensive large-scale surveys since have increased knowledge (e.g., Brncic *et al.* 2010; WCF 2012; Tweh *et al*. 2014). The most comprehensive estimation suggests a wild population of 35,000–55,000 chimpanzees (Kühl *et al*. 2017; Heinicke *et al*. 2019). Guinea alone has been estimated to host more than 20,000 western chimpanzees, with the largest remaining population – more than 17,000 individuals – found in the Fouta Djallon region (WCF 2012). The other strongholds for this taxon are Liberia with 7,000 individuals (Tweh *et al*. 2014), and Sierra Leone with 5,000 individuals (Brncic *et al*. 2010). Five to six hundred are estimated for Senegal (Wessling and Pruetz, pers. comm.) while in Guinea-Bissau a population of 1,000–1,500 individuals was recently reported in the Boe area (A. Goedmakers pers. comm. 2017). Côte d'Ivoire was once a stronghold for this subspecies, with an estimated population of 8,000–12,000 individuals in the 1990s (Marchesi *et al*. 1995). The number of chimpanzees in Côte d'Ivoire has declined by 80% since 1990 (Kühl *et al*. 2017).

> The western chimpanzee is thought to have been lost from Benin, Togo and Burkina Faso, and is close to extinction in Ghana.

Between 1990 and 2014, the western chimpanzee's geographic range declined by 20% from 657,600 to 524,100 km^2 (Kühl *et al*. 2017). At the same time, populations declined annually by 6.5%, with a total population reduction of 80%. This period corresponds to a single chimpanzee generation (23 years) (Langergraber *et al*. 2012). If this decline continues, 99% of the remaining population will be lost by 2060. This drastic population decline and range reduction provided the quantitative basis for uplisting the western chimpanzee to Critically Endangered (Humle *et al*. 2016).

The major causes of population decline are illegal hunting, habitat loss (Kormos *et al*. 2003; Carvalho *et al*. 2012; Tweh *et al*. 2014; Brncic *et al*. 2015; Humle *et al*. 2016) and infectious disease (Köndgen *et al*. 2008). Throughout its range, the western chimpanzee is losing its natural rainforest and savanna woodland habitat. Even though hunting chimpanzees is illegal, it is widespread, mainly for food, but also in retaliation for crop raiding, and occasionally, infants are captured and sold to wildlife traffickers (e.g., Pruetz and Kante 2010). Large spatial variation, however, exists in the importance and magnitude of threats and their underlying drivers across the subspecies' range.

Several range countries of the western chimpanzee (Liberia, Sierra Leone, and Côte d'Ivoire) have suffered in past decades from civil unrest and acute political

crises that have undermined their capacity to protect their biological resources. This has had direct and indirect impacts on forest resources and wildlife protection, including the occupation of protected areas. In Marahoué National Park in Côte d'Ivoire, for example, the chimpanzee population disappeared within a few years only because of human immigration, and the Mount Peko and Mount Sangbe National Park were occupied by migrants in the 2000s. The influx of humans resulted in unsustainable exploitation of natural resources and the illegal circulation of weapons, exacerbated by the absence of law enforcement in protected areas. Indeed, the dramatic decline of western chimpanzees is a consequence of the combined effect of increasing levels of threats and lack of political, financial and conservation commitments (Kühl *et al*. 2017). In Côte d'Ivoire, where up to 12,000 chimpanzees were estimated to occur in the 1990s, a 90% decline was recorded from 1990 - 2007. This was mostly driven by increasing human population density and the associated pressures of poaching, massive deforestation in classified forests, immigration from the Sahelian belt, and political instability in the country (Campbell *et al*. 2008; Kühl *et al*. 2017). As a consequence, chimpanzees became locally extinct in several protected areas including Marahoué National Park and several classified forests, including Nizoro, Dassikro, Haute Dodo, Niouniourou, Okromodou, Port Gauthier, Monogaga, Mount Kope, Tamin and likely Mount Peko National Park (based on data in the IUCN SSC A.P.E.S. database).

Nowadays, the majority of chimpanzees that remain in Cote d'Ivoire are found in Tai National Park (Tiedoué *et al.* 2018), likely because of the regular anti-poaching patrols, long-term research activities, eco-tourism and awareness-raising activities conducted there by OIPR (Office Ivoirien des Parcs et Reserves), as well as by national and international NGOs over many decades.

Liberia holds the largest remaining rainforest population of western chimpanzees (Tweh *et al*. 2014), but this is threatened by bushmeat hunting that also occurs in protected areas (Greengrass 2016) and rapidly developing mining, forestry and agro-industrial sectors (Junker *et al*. 2015). The 5,000 chimpanzees of Sierra Leone (Brncic *et al*. 2010) are mostly threatened by mining expansion, industrial agriculture and hunting for bushmeat and in retaliation to crop foraging.

In Mali, Senegal and Guinea-Bissau, at the northern limit of the western chimpanzee range, they are particularly susceptible to habitat loss due to mining concessions and unregulated artisanal mining. In Senegal, for example, nearly the entirety of the chimpanzee range has been licensed for gold mining exploration and exploitation. This chimpanzee population is also facing immediate threats of habitat loss as it is vulnerable to aridity and environmental change (Kühl *et al*. 2017). The chimpanzees of Guinea-Bissau occur predominantly in the Boé area which has important Bauxite reserves, and future mining projects will considerably impact this fragile population.

Heinicke *et al*. (2019) report that chimpanzees persist in higher densities under three social-ecological conditions: rainforest habitats with low human impact, rough terrain that is difficult to access, and regions where cultural taboos such as hunting prohibitions prevail and there is a low human footprint. In Guinea, where the largest remaining and most stable population is found, western chimpanzees live predominantly in the unprotected area of the Fouta Djallon, which meets the third category (Boesch *et al*. 2017). The majority of local people belong to the Fulani ethnic group, who neither hunt nor eat chimpanzees for cultural reasons and are mostly pastoralists or practitioners of small-scale traditional agriculture (Ham 1998). Although currently hosting a stable chimpanzee population, Fouta Djallon is rich in bauxite. Anticipated large-scale mining in the future is expected to cause further population decline and threaten the main stronghold of *Pan t. verus.* Furthermore, several large infrastructure projects planned by the Guinean authorities across the country (e.g., dams, roads, and railway construction) are threats to chimpanzees in Guinea at large.

Chimpanzees are protected by national and international laws throughout their range, but enforcement of laws is almost nonexistent. Seventy percent of the current population occurs outside protected areas (IUCN SSC A.P.E.S. database 2016). With exponential human population growth in range countries, global demand for natural and mineral resources, and poor law enforcement in and outside protected areas in most range countries, it is very likely that the western chimpanzee will continue to decline in the future unless conservation efforts are made to effectively protect the remaining populations.

Following the uplisting of *P. t. verus* to Critically Endangered on the IUCN Red List of Threatened Species, a multi-stakeholder meeting was held in Monrovia (December 2017) to discuss necessary conservation measures. A new Regional Action Plan for *P. t. verus*, currently in preparation, has identified 9 conservation strategies. These include improvement of regional law enforcement coordination, improved legal frameworks and landuse planning, capacity for protected area management, disease surveillance and conservation finance mechanisms (IUCN, unpublished).

A crucial first step would be to include conservation priorities into development and land use planning (LUP) across sectors. This requires increased commitment by the conservation community and relevant political bodies (ministries for resources and environmental affairs), to conduct cross-disciplinary planning of infrastructure, development, and resource extraction projects that affect chimpanzee habitat. This will also require increased funding of conservation initiatives on the ground, and additional engagement from political authorities to improve the management of ape habitat, including existing protected areas. Protected areas are important in conserving biodiversity (Lovejoy 2006), hence it is also essential that range countries "expand [their] protected area system to at least 17% of land surface (...) by 2020", as agreed upon in the Aichi Biodiversity Targets (CBD 2010), so that a greater number of chimpanzees are protected. There are some promising initiatives in Liberia, with the creation of the new Grebo-Krahn National Park in the chimpanzee range, and in Guinea, where the Moyen Bafing National Park is in the process of being created. If finalized, this new national park would protect ca. 5,000 chimpanzees of the Fouta Djallon. In June 2017, the Government of Guinea Bissau officially created the Boé and Dulombi national parks in the south-east of the country, which if properly governed, should protect several chimpanzees in the area.

Apart from immediate actions, long-term, sustainable protection of the region's biodiversity will likely depend on interventions which address critical problems specific to range countries of the region, such as poverty, regional immigration, poor governance, unsustainable agricultural practices and lack of land-use planning. The Fouta Djallon landscape, the main stronghold of the western chimpanzee, deserves special attention. It is particularly important to understand how chimpanzees and humans co-exist in agricultural landscapes, how factors contributing to this coexistence can be maintained over time, and how they can eventually be transferred to other regions inhabited by great apes.

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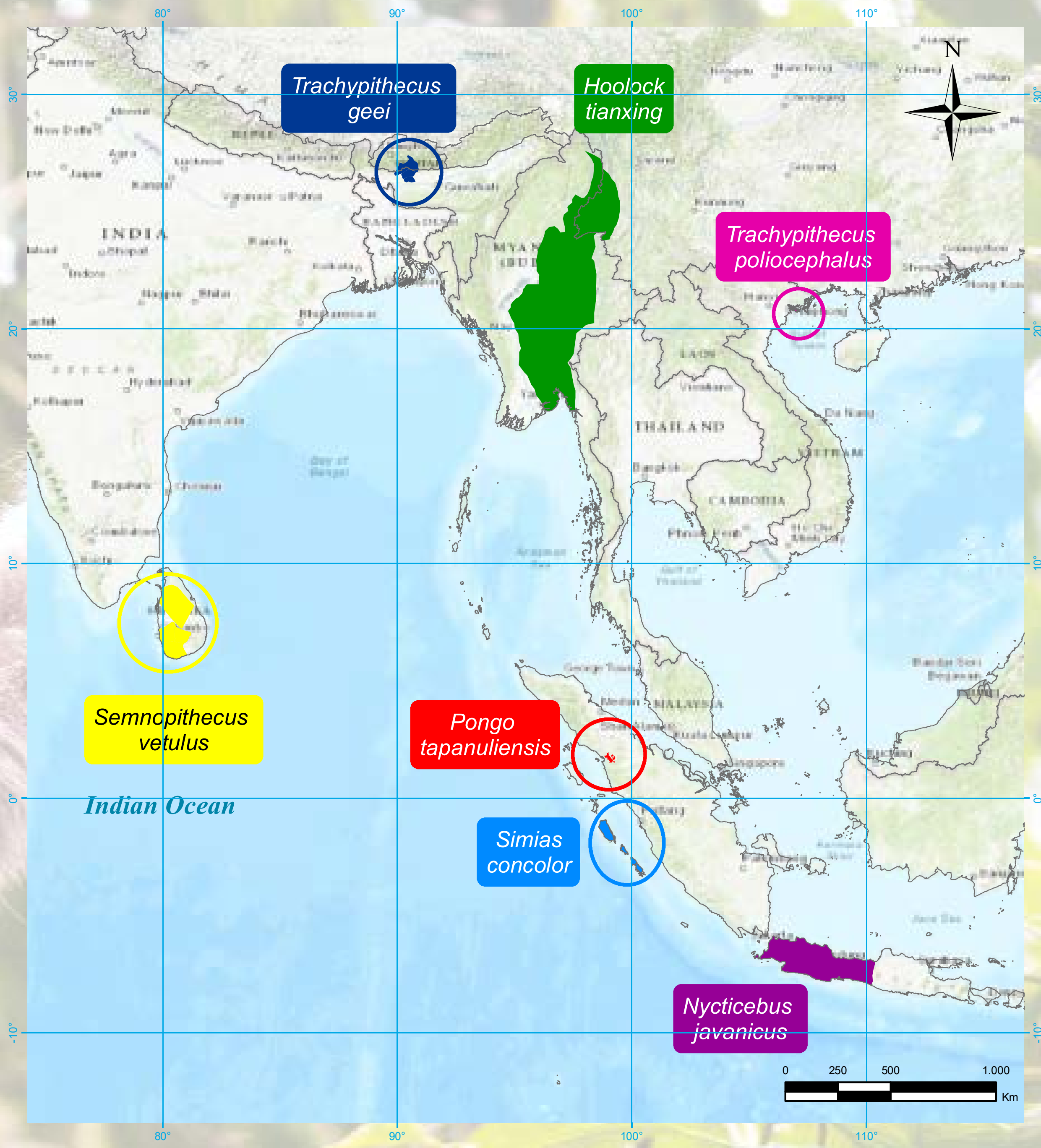
ASIA



Asian Primates

- *Pongo tapanuliensis*
- *Trachypithecus geei*
- *Nycticebus javanicus*
- *Hoolock tianxing*
- *Trachypithecus poliocephalus*
- *Semnopithecus vetulus*
- *Simias concolor*

IUCN SSC PRIMATE Specialist Group

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JAVAN SLOW LORIS

Nycticebus javanicus **É. Geoffroy Saint-Hilaire, 1812**

Indonesia
(2008, 2010, 2012, 2014, 2016, 2018)

K. Anna I. Nekaris & Vincent Nijman

Devastating habitat loss throughout southeast Asia threatens all nine species of slow loris with extinction, i.e. greater *Nycticebus coucang*, pygmy *N. pygmaeus*, Bengal *N. bengalensis*, Philippine *N. menagensis*, Bornean *N. borneanus*, Kayan *N. kayan*, Sody's *N. bancanus*, Sumatran *N. hilleri*, and Javan *N. javanicus* (Munds *et al.* 2013; Pozzi *et al.* 2014; Rowe and Myers 2016). Slow lorises exhibit numerous unique traits including slow life history, locomotion and digestion, the ability to enter torpor and hibernate, and being the only venomous primates (Nekaris 2014). Still, wild slow lorises have seldom been studied for more than a year (Malaysia *N. coucang,* Wiens *et al.* 2006; Cambodia *N. pygmaeus,* Starr *et al.* 2011; India, *N. bengalensis,* Das *et al.* 2014), with only *N. javanicus* being the focus of a long-term study (Rode-Margono *et al.* 2014). Many researchers and conservationists have only ever seen a slow loris in the illegal wildlife trade, either dried on bamboo sticks in preparation for traditional medicine, paraded as a photo prop on a tourist beach, or sold as a pet (Schulze and Groves 2004; Das *et al.* 2009; Nijman *et al.* 2015; Osterberg and Nekaris 2015). The extreme popularity of viral slow loris internet videos is a double-edged sword, to some extent making the public aware of their decline, but also causing the public to perceive that they are not threatened (Nekaris *et al.* 2013a). The extent of trade raised international concern, resulting in the transfer of the genus *Nycticebus* to CITES Appendix I in 2007 (Nekaris and Nijman 2007).

Javan slow lorises are now listed by IUCN as Critically Endangered, thus here we use the Critically Endangered Javan slow loris as the flagship for slow loris conservation (Nekaris *et al.* 2013b). Since being re-recognised as a species by the IUCN in 2006, work on the Javan slow loris has increased and provides a sound example of understanding and mitigating the threats to a highly threatened species. Both morphologically and genetically distinct, the Javan slow loris weighs about 1 kg, and exhibits a 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).

> To avoid being bitten by venomous slow lorises, traders habitually cut or pull out an animal's lower front teeth.

Capturing individuals to meet the demand for pets is the most severe threat to the survival of Javan slow lorises. Despite being legally protected in Indonesia since 1973, with their striking coloration and presence on Java, Indonesia's commercial centre, it is no wonder that Indonesian pet traders in the 1990s targeted Javan slow lorises above other endemic slow loris species. Since 2012, the number of Javan slow lorises openly traded in markets has decreased, with a stark rise in numbers of greater slow lorises from Sumatra, a species with a threat status that must also be carefully monitored. Indeed, over three years of market surveys on Java between 2012 and 2015, four times more greater slow lorises than Javan slow lorises were counted, with traders claiming that Javan slow lorises are increasingly difficult to obtain (Nijman *et al.* 2015). In November 2013, nearly 300 greater slow lorises were confiscated in two raids. Following the smaller of these raids, 31 out of the 76 slow lorises confiscated died in the next few weeks. Death rates of the larger raid are unknown. Successful prosecution of lawbreakers buying or selling slow lorises in Indonesia is a very rare occurrence, so much so that we are not aware of a single slow loris trader having been sentenced in the last

decade, despite hundreds of slow lorises having been confiscated from traders. Wildlife traders in Indonesia have increasingly turned to social media to advertise their illegal stock, including Javan slow lorises. The huge rise in Facebook and WhatsApp means that many are sold via social media without ever being seen in a wildlife market. An ongoing online monitoring programme by the Little Fireface Project suggests that in 2018, an average of 43 Javan slow lorises are offered per month in online forums, an increase of 13 individuals per month since 2017.

To avoid being bitten by venomous slow lorises, traders habitually cut or pull out an animal's lower front teeth prior to selling them (Nekaris *et al.* 2013c). Traders may also cut teeth prior to packing slow lorises tightly into crates, as they often damage each other with their venomous bites during transport. Indeed, Fuller *et al.* (2017) showed that in a single confiscation of 77 slow lorises by Cikananga Wildlife Rescue Centre, nearly 30% died in the first 6 months, with morbidity from wounds, mainly bites, being the main cause of death. Other causes of death due to dental removal include dental abscess or pneumonia (Nekaris and Starr 2015). Those that do survive are no longer able to eat their preferred food (gum) (Das *et al.* 2014), or 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 slow loris. In the major markets in Java, at least four of the other six Indonesian species are traded along with the Javan slow loris, and in the markets in Sumatra at least three species are regularly traded, including ones that do not occur naturally on the island. The similar appearance of slow lorises, to the untrained eye, results in release of slow loris species from Sumatra and Borneo into Java and vice versa, causing potential for hybridization or even displacement of native species by introduced ones (Nekaris and Starr 2015). The ability of slow lorises to persist in human habitat if left undisturbed means that well-meaning people may translocate animals to habitat that is unknown to the animals, exacerbating these problems (Kumar *et al.* 2014).

Moore *et al.* (2014) assessed the success of Javan slow loris reintroductions, finding a death rate of up to 90%. Illness, hypothermia and exhaustion were all implicated in the death of slow lorises. Reintroductions were started before the basics were known about the Javan slow loris' behaviour, ecology or distribution. No habitat suitability assessment could be made, since details were lacking on the type of habitat the species preferred and what it avoided. It has recently been reported by rescue centers that the success rates of Javan slow loris reintroductions are improving, but unfortunately no published data are available to verify these claims. Newspaper reports show that up to 30 slow lorises are released in one site at one time, but the highly territorial and venomous nature of slow lorises means that such releases are destined to have a high failure rate. A related study of pygmy slow lorises in Vietnam found that the season of release and age should be considered to increase the likelihood of survival (Kenyon *et al.* 2014).

To obtain vital information on the Javan slow lorises, in 2011 the Little Fireface Project instigated a study of the species' behavioural ecology in Garut District of West Java, Indonesia (Rode-Margono *et al.* 2014). This multi-disciplinary project has obtained data on home range size, social organisation, infant dispersal and feeding ecology. It was found that both sexes disperse from their natal range at about 20 months old, dispersal distances are 1–3 km from the natal range, home range sizes are large relative to the size of the animal (5–10 ha), the species goes into torpor, and the diet comprises mainly gum, supplemented with nectar and insects (Cabana *et al.* 2017). Several initiatives have been put into place to conserve slow lorises in the area and in other parts of Java. National workshops have been held for law enforcement officers and rescue center employees to provide essential data for a national slow loris action plan. At the local level, slow lorises are often totally dependent on local people for their protection, feeding on human planted tree species and residing in human farmlands. Thus, a major conservation program combining empowerment activities, conservation education and village events has been launched, and it is hoped that it can be used as a model for other key slow loris sites in Indonesia (Nekaris and Starr 2015).

For a long time, slow lorises were thought to be common throughout Indonesia, and the presence of animals in trade was believed to be an indicator of their abundance. We are only beginning to unravel the complexity of their taxonomy and distribution, leading to a bleak overall picture. While Java has an impressive and comprehensive protected area network, encompassing over 120 terrestrial conservation areas and covering 5,000 km^2, enforcement of environmental laws and active protection in most of these parks is lacking. Besides curbing the illegal trade, it is paramount that these conservation areas, and indeed all other remaining forest areas on the island, be effectively protected.

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PIG-TAILED SNUB-NOSE LANGUR

***Simias concolor* G.S. Miller, 1903**

Indonesia
(2002, 2004, 2006, 2008, 2010, 2012, 2014, 2016, 2018)

Lisa M. Paciulli & Anna P. Pannick

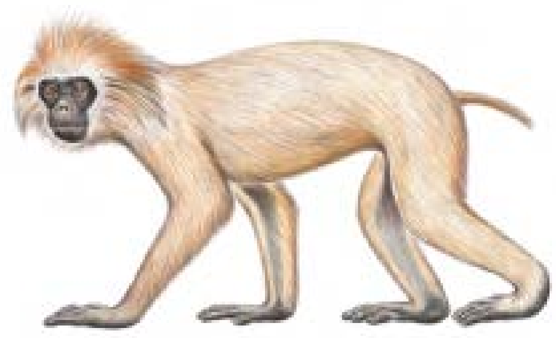
The pig-tailed snub-nose langur (*Simias concolor*) is serving as the representative species for the six threatened and endemic Mentawai Islands primates. The other primates inhabiting this 7,000 km², ~70 island archipelago west of Sumatra are Kloss's gibbon (*Hylobates klossii*), the Pagai surili (*Presbytis potenziani*), the Siberut surili (*Presbytis siberu*), the Pagai macaque (*Macaca pagensis*), and the Siberut macaque (*Macaca siberu*). *Simias* is a monotypic genus with two subspecies: *S. c. concolor* / masepsep (Miller 1903) that inhabits Sipora, North Pagai Island, and South Pagai Island; and *S. c. siberu* / simakobu (Chasen and Kloss 1927), which is restricted to Siberut Island (Zinner *et al.* 2013). Threatened mainly by commercial logging, human encroachment, and hunting (Whittaker 2006), *Simias concolor* is classified as Critically Endangered on the IUCN Red List (Whittaker and Mittermeier 2008).

> Locals consider pig-tailed snub-nose langur meat to be a delicacy, and entire groups can be eliminated in a single hunting event.

The populations of *S. concolor on* Pagai Island are threatened by forest conversion to oil palm plantations, forest clearings, product extractions by local people (Whittaker 2006), and opportunistic hunting (Paciulli 2004). On Siberut Island, a 1,000 km² oil palm plantation development was planned in 2014, and a 200-km² timber plantation for biomass energy production was planned in 2016 (Gaworecki 2016). Although both plans were cancelled as a result of local opposition, protests, and environmental assessments, attempts to exploit the Mentawai Islands' natural resources are likely to continue since the national government has designated these biodiverse tropical islands as production forests (Gaworecki 2016).

Timber removal on a large scale is a concern as *S. concolor* has significantly lower densities in forests logged ~20 years previously – 2.54 individuals/km², compared to 5.17 individuals/km² in unlogged forests (Pagai Islands) (Paciulli 2004). It is estimated that on the Pagai Islands, there are approximately 3,347 pig-tailed snub-nosed langurs, 1,049 Kloss's gibbons, 1,545 Pagai surilis, and 7,984 Pagai macaques (Paciulli and Viola 2009). All of the primate species seem to reach their highest known densities in the Peleonan Forest, an underused research base (Whitten 2009) and site of the Siberut Conservation Project in northern Siberut (Waltert *et al.* 2008). In Peleonan peat-swamp forests, *S. c. siberu* has densities as high as 65.5 individuals/km² (Quinten *et al*. 2010). However, in other Siberut peat swamp forests located in mangroves, the roots of many mangrove trees are cut for the construction of ephemeral kitchen shelters. This human-inflicted soil and tree damage has long-term impacts on the regeneration of plants and the morphology of the area (Guillaud and Burgos 2018), likely making some of the mangroves unsuitable as primate habitat.

Logging facilitates hunting by providing easier access to forested areas, leaving primates more exposed and vulnerable (Febrianti 2015). Where hunting occurs on the Mentawai Islands, it has devastating effects on *S. concolor*, as it is the



preferred game species (Mitchell and Tilson 1986; Fuentes 2002; Paciulli and Sabbi 2017). The locals consider pig-tailed snub-nose langur meat to be a delicacy (Febrianti 2015), and entire groups can be eliminated in a single hunting event (Hadi *et al.* 2009). On the Pagais, few men report actively hunting (Paciulli 2004), but on Siberut, 24% of the men still hunt, with 77% targeting pig-tailed snub-nose langurs (Quinten *et al*. 2014). On Siberut, hunting reduces pig-tailed snub-nose langur group size, significantly impacts adult sex ratios, and affects the number of immature individuals in groups (Erb *et al.* 2012).

The uncertainty of Indonesian government land use means that land function and protection levels on the Mentawai Islands can change at any time with little notice, putting the species further at risk. There is only one large protected area for *S. concolor*: the 190,500 ha Siberut National Park, a UNESCO Biosphere Reserve that covers 47% of Siberut. Although the park serves as the main reserve for ~51,000 primates (Quinten *et al*. 2015), hunting is much more prevalent there than elsewhere, with ~4,800 primates being removed each year (min. 6.4 % of the population) (Quinten *et al*. 2014). Drastic measures need to be taken to ensure that the Peleonan Forest on Siberut is truly protected. The same goes for forests on the southern islands, where the Pagai macaque and Pagai surili are not represented in any protected areas (Supriatna *et al.* 2017).

Whittaker (2006) suggested protecting areas in the Pagai Islands by cooperating with a logging corporation that has practiced sustainable logging there since 1971, as well as increased protection for Siberut National Park, which currently lacks enforcement. The Peleonan Forest in North Siberut, which is home to unusually high primate populations and easily accessible, also needs to be safe-guarded. In addition, the Mentawai people could benefit from conservation education, especially regarding hunting, and the development of alternative economic models to reduce the likelihood that land will be sold to logging companies (Whittaker 2006). Although the World Wildlife Fund, Asian Development Bank (1992-2000 loan project), and Phase I of the World Bank-implemented Critical Ecosystem Partnership Fund have poured over $1 million into Siberut, Whitten (2009) noticed that little has changed on the remote islands in thirty years.

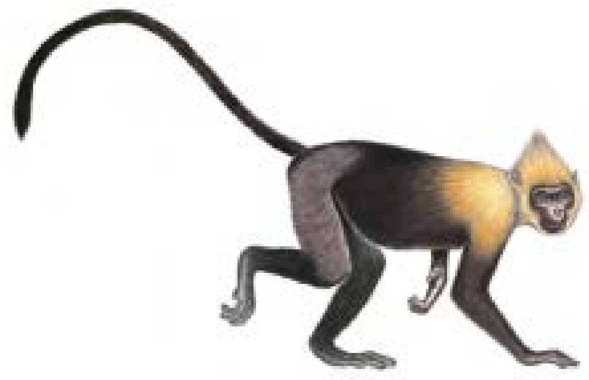
GOLDEN-HEADED LANGUR

or Cat Ba Langur

Trachypithecus poliocephalus **Trouessart, 1911**

Vietnam
(2000, 2002, 2004, 2006, 2008, 2010, 2012, 2014, 2016, 2018)

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



The Cat Ba langur (also known as the golden-headed langur), *Trachypithecus poliocephalus*, is probably the most endangered of the Asian colobines, and is assessed as Critically Endangered (Bleisch *et al.* 2008). This species occurs only on Cat Ba Island in the Gulf of Tonkin off the north-eastern Vietnamese shore (Stenke and Chu 2004). The Cat Ba Archipelago is adjacent to the world-famous Ha Long Bay, a spectacular karst formation that was invaded by the sea following the last major glaciation. The favoured habitat of the Cat Ba langur is tropical moist forest on limestone karst hills, a habitat preference it shares with the other six to seven taxa of the *T. francoisi* group.

While there are no systematic and reliable data available on the historic density of the langur population on Cat Ba Island, reports by indigenous people suggest the entire island of Cat Ba (140 km^2) and some smaller offshore islands were previously densely populated by langurs. Hunting has been identified as the sole cause for the dramatic and rapid population decline from an estimated 2,400–2,700 in the 1960s to approximately 50 individuals by 2000 (Nadler and Ha 2000). The langurs were poached mainly for trade in traditional medicines and for sport. Since the implementation of strict protection measures in 2000, the langur population on Cat Ba Island has stabilized (Nadler *et al.* 2003) and since 2003 has been on the increase (Leonard 2016). In the latter half of 2015 numbers fell from the mid-high 60s to the low 50s and have since been slowly recovering. This has raised concerns that as langur numbers recover, interest in poaching by people from adjacent regions may also revive (Leonard 2016).

Although the growth of the population is encouraging, the overall status of the species

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remains critical and the total population is worryingly small. Habitat fragmentation and hunting has divided the remaining population into several isolated sub-populations, some of which are non-reproducing social units. A surplus of young males is a cause for concern as take-over attempts can lead to infanticide and inadvertent infant deaths, both of which were recorded in early 2018 (N. Leonard pers. comm.).

The total reproductive output of *Trachypithecus poliocephalus* has been low due to the small population and the long inter-birth cycle, but records indicate that the birth rate is increasing, with 49% of the total births recorded between 2000 and 2018 having taken place from 2014–2018. Births occur throughout the year, with a peak in January–April, just prior to the rainy season (Leonard *et al.* 2016, N. Leonard pers. comm.).

In 2012, after many years of planning and preparation, one group of two females was successfully translocated from a small off-shore islet where they had become stranded to the relative safety of the strictly protected core zone of Cat Ba National Park. Here they quickly assimilated into existing groups containing males, thus allowing them the opportunity to reproduce for the first time ever. It is hoped that continued protection efforts and additional population management interventions such as these will enhance the rebound of this species.

> A surplus of young male Cat Ba langurs is a cause for concern as group takeover attempts can lead to infanticide.

The Cat Ba Archipelago and adjacent Ha Long Bay 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. Ha Long Bay was established as a World Heritage site in 1994, and the combined archipelago includes ~1,500–2,000 large and small islands, cliffs and rocks. In 2004, the Cat Ba Archipelago was designated a UNESCO Man and the Biosphere Reserve. Despite the conservation designations and laws to protect the region, nature and wildlife protection on Cat Ba Island is deficient. Environmental awareness and commitment among the local communities is slowly increasing, and hunting/trapping of all animals is illegal on Cat Ba Island. Unfortunately, efforts to effectively conserve the langurs and their habitat continue to face major obstacles from increasing tourism development, increasing human population and severe deficiencies in law enforcement (Stenke 2005; Leonard 2018). As is common elsewhere in the region, poaching by local people is driven by livelihood issues, brought about by low incomes and lack of employment opportunities. Immense local and regional demand for wildlife and animal parts for food and dubious traditional medicines provide a market for poached animals and plants. Although langur hunting ostensibly stopped years ago, the 2015 decline in numbers raises doubts as to the permanence of the hunting cessation. Regardless, hunters continue to poach other animals and plants in langur areas, thus jeopardising langur habitat. Strict enforcement of the established protections is therefore necessary for the survival of all species on Cat Ba Island that are targeted by the illegal Asian wildlife trade.

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

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GOLDEN LANGUR

Trachypithecus geei **Khajuria, 1956**

India, Bhutan
(2018)

Rekha Chetry, Dilip Chetry & P. C. Bhattacharjee

The Golden langur (*Trachypithecus geei*) is an attractive, arboreal and diurnal primate endemic to India and Bhutan in south-east Asia. It was first discovered by E. P. Gee in 1953. As the name suggests, its coat color is golden orange, but only during the breeding season – in the rest of the year it becomes creamy or dirty white. Ventral coat color is comparatively lighter, and the golden orange color is brighter in females than males. The species is predominantly arboreal, spending 99% of its active time in trees, foraging primarily in the top and middle strata of forest canopies (Biswas 2004). However, in degraded habitats, they descend to the ground (Chetry and Chetry 2009).

Golden langurs mature sexually after 5–7 years for males and 4 years for females. The breeding season is between June and January and the birth season is January to June. The gestation period is 168–180 days with one infant being born at a time, and the inter-birth interval is two years (Chetry and Chetry 2009). Sexual harassment is an integral part of the species' reproductive behaviour. Infants and, to some extent, females, have been identified as harassers.

Golden langur deaths are being attributed to electrocution on power lines, road accidents, and attacks by domestic dogs.

The golden langur is highly social and maintains diverse forms of societies: (1) uni-male, multi-female troops/harem troops (3–9 members with 1:2.68 male–female ratio), (2) bi-male, multi female troops (8-15 members with 1:1.94 male–female ratio), (3) multi-male, multi-female troops, (4) all male bands (2–5 individuals) and (5) lone males (Chetry and Chetry 2009). However, uni-male, multi-female troops or societies are the most stable and common form of social structure, followed by bi-male, multi female societies (Biswas 2004). Troops are cohesive and both intra- and inter-troop interactions are mostly peaceful. The annual home range is between 10 and 58 ha for diverse social troops in different habitat conditions (Chetry and Chetry 2009) and day path lengths vary from 200 to 700 m.

The golden langur is diurnal. They spend, on an annual basis, 12.8–33% of time feeding, 40–63.1% resting, 6.3–19% in locomotion, 5–11.5% monitoring, 2–3.7% playing and 0.3–6% grooming (Mukherjee 1996; Chetry 2002; Medhi and Chetry 2003; Biswas 2004; Medhi 2004). At night, golden langurs select tall trees of few selected species to sleep in (Biswas 2004).

Green leaves (both young and mature) form the major constituent of the folivorous golden langur's diet. Other dominant food items include fruits, seeds, flowers, stem cortex and twigs from >200 plant and tree species. Gum, soil, algae, snails and alcoholic effluence are also important supplements in the diet of golden langurs (Medhi 2004; Biswas 2004). Their primary predators are leopard, wild dog and python (Chetry *et al*. 2005; Chetry *et al.* 2018). Their anti-predator response varies according to the predator (Chetry *et al.* 2007).

In India, its distribution extends over an area greater than 2,500 km², bordered by the rivers Manas in the east, Sankosh in the west and the Brahmaputra in the south (Srivasatava 1999). Remarkably, Ram *et al.* (2016) found that the Aie and Champabati rivers are also acting as natural barriers to migration between golden langur populations in Assam. Its distribution in Bhutan is limited between the Sankosh river and Chamkhar-Mangde-Manas river complex and

covers a range of 4,782 km² (Wangchuk 2005, Lhendup *et al.* 2018).

In India, the estimated available habitat for the golden langur is 1,255 km². While it primarily inhabits wet evergreen and tropical semi-evergreen forests, it also thrives in sal (*Shorea robusta*) dominated forests and secondary forests. In Bhutan, available habitat is 3,475 km², out of an estimated 4,782 km² potential habitat (Wangchuk 2005). The preferred habitat here is warm broad-leaved forests between 1,000 m and 2,600 m asl, and subtropical forests between 200 m and 1,000 m asl. The golden langur shares its habitat with three other primate species: Assamese macaque (*Macaca assamensis*), rhesus macaque (*Macaca mulatta*) and slow loris (*Nycticebus bengalensis*).

The estimated population size of the golden langur in Bhutan is 6,637 (Wangchuk 2005). In India, Ghosh (2009) and Biswas *et al.* (2010) observed 5,141 individuals in 566 troops. Thus, the global population of the species is estimated to be >12,000 (Chetry and Chetry 2009; Horwich *et al*. 2013).

The conservation status of the golden langur, according to the IUCN Red List, is Endangered (Das *et al.* 2008). The Wildlife (Protection) Act of India (1972) and the Forest and Nature Conservation Act of Bhutan (1995) have classified the animal as a Schedule-I species, and it is an Appendix-I species in CITES. In India, protected habitat is limited to Manas National Park and the Chakrashila Wildlife Sanctuary. The combination of habitat loss and fragmentation have already taken their toll on golden langur populations in India where it is also threatened by encroachment, illegal tree felling, fuel wood collection and cattle grazing (Chetry *et al*. 2018). Srivastava *et al*. (2001) reported a 50% loss of original habitat of the species in India.

Due to severe shrinkage and fragmentation, eight isolated populations were wiped out from eight forest patches between 1970 and 1990, all in Assam, India (Choudhury 2002). Moreover, at the human-wildlife interface, golden langur deaths are being attributed to electrocution on power lines and road accidents (Chetry and Chetry 2009) and they are increasingly attacked by dogs.

In Bhutan, the species is better protected, with 50% of its habitat situated within the protected area network, including Royal Manas National Park, Black Mountain National Park and Phipsoo Wildlife Sanctuary.

Nevertheless, the species remains under pressure from a myriad of anthropogenic threats including fluctuating land tenure systems, infrastructure development, shifting cultivation and commercial logging (Wangchuk 2005). However, the most severe threat has arisen from the hybridization of the Golden langur with capped langurs as a result of the recently built suspension bridges over the Chamkhar river (Wangchuk *et al*. 2005; Choudhury 2008; Ram *et al*. 2016). Alarmingly, 15% of the golden langur population is now hybridised (Wangchuk 2005).

Conservation challenges are likely to increase despite current conservation initiatives. There is no doubt that the local administration and NGOs are working at different levels to address the threats faced by the golden langur. Yet the current situation calls for more effective and continuous conservation action in order to safeguard the golden langur and prevent it from becoming Critically Endangered.

To secure the future of the species, several actions are recommended. Firstly, we advocate for a reform in the protected area network. Specifically, we propose that Bhumeswar Proposed Reserve Forest (PRF), Bamungaon PRF, Nadangiri Reserve Forest (RF), Kakoiajana RF and the Sankarhola area under the Bhairabchura PRF should be declared as Community Reserves and directly involve the local community in the conservation of the golden langur. In Assam, the proposed Ripu Chirang Wildlife Sanctuary should be instated as early as possible. Finally, Chakrashila Wildlife Sanctuary along with its adjacent reserve forests such as Sreegram, Katrigacha, Buxamara and Nadangiri Hill should be upgraded to a National Park at the earliest opportunity to ensure the preservation of the golden langur's habitats in India.

Secondly, we propose forest corridors to connect these forest fragments. Specifically, forested corridors should be created between (1) Chirang RF to Bengtol RF to Manas RF in the northern range of its population, (2) Chakrashila to Abhaya rubber garden to Naddengri RF, (3) Bamingaon to Khoragaon PRF, and (4) Nakkati to Kakoijana RF in the southern range, to provide larger areas for the long-term survival of these populations. These efforts would be complemented by habitat restoration to reverse habitat loss. In instances where it is not possible to connect fragments by forested corridors, a translocation management plan should be considered, to reinforce remnant populations.

Thirdly, the re-assessment of the current status of the species across its entire distribution is urgently needed. Finally, a recognised and state-sponsored species action plan is needed, which includes the recommendations included here.

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PURPLE-FACED LANGUR

***Semnopithecus vetulus* Erxleben, 1777**

Sri Lanka
(2004, 2006, 2008, 2010, 2012, 2014, 2016, 2018)

Rasanayagam Rudran

After Sri Lanka's twenty-six year civil war ended in 2009, extensive deforestation occurred, which escalated conflicts between humans and monkeys. This conflict undermined the long-term survival of all three Sri Lankan primate species (*Semnopithecus vetulus*, *S. priam thersites* and *Macaca sinica*), which are not only endemic, but also threatened with extinction. As public outcry and political pressure mounted to resolve these conflicts, several government institutions and non-governmental organizations, led by SPEARS Foundation, helped the country's Department of Wildlife Conservation (DWC) to develop an action plan for people to conserve and coexist with all species of monkeys. The plan was submitted to the country's government in March 2016 for cabinet approval.

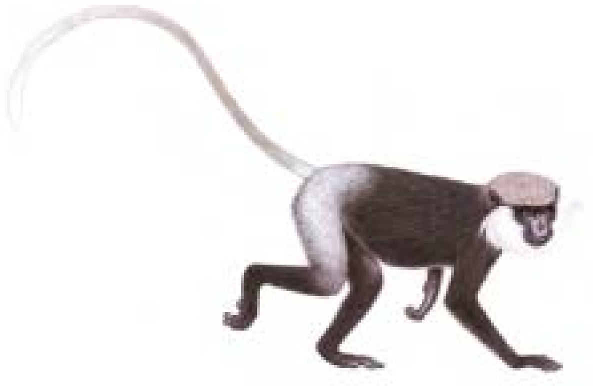
While awaiting approval, SPEARS Foundation used funds from foreign donors to implement some key elements of the plan. One was to develop Community Conservation Areas (CCAs), which, when established, would be administered and managed sustainably by local communities under DWC supervision. To find suitable sites for CCAs, the SPEARS team analysed complaints of human-monkey conflicts received by the DWC between 2007 and 2015. The analysis indicated that conflicts occurred throughout the country, but their frequency varied between localities (Cabral *et al.* 2018). Therefore, thirteen field surveys were conducted from 2016 to 2018 to locate sites best suited for the establishment of CCAs. Information from these surveys and other relevant data on all four purple-faced langur subspecies are presented below.

> Urbanisation poses a serious threat to the long-term survival of the Critically Endangered and endemic subspecies of the western purple-faced langur.

The range of the western purple-faced langur (*Semnopithecus vetulus nestor*) includes the most densely populated region around Colombo, the country's capital. Therefore, urbanisation poses a serious threat to the long-term survival of this Critically Endangered and endemic subspecies (Dittus *et al.* 2008; Rudran *et al.* 2009). A survey conducted in 2007 (Rudran 2007) indicated that 81% of *S. v. nestor*'s historical range (Hill 1934; Phillips 1935) had been deforested and converted to human altered landscapes. Due to this habitat reduction, much of *S. v. nestor's* current population subsists mainly on fruit from home gardens (Dela 2007; Rudran 2007). Nutritional consequences of feeding on a low diversity diet of cultivated fruits are unclear but considered detrimental to the folivorous *S. v. nestor* (Rudran 2015).

Besides depleting natural food sources, deforestation causes habitat fragmentation, forcing animals to travel on the ground and along power lines to move between fragments. These movements increase mortality by exposing them to attacks by dogs, speeding vehicles, and electrocution (Parker *et al.* 2008). In some parts of its range, *S. v. nestor* is occasionally shot and killed as a pest while feeding in home gardens (Dela 2004). Such human-induced fatalities reduce group sizes and appear to lead to local extinctions in *S. v. nestor*'s range (Rudran 2007).

To promote environmental awareness among school children, classroom lectures were presented to 1,360 students, and about 400 of them participated in nature walks. To enhance economic stability and reduce unsustainable dependence on natural resources, 90 adults



were trained to cultivate pepper, a crop with considerable demand in world markets. They also received pepper plants to grow in their home gardens to generate income. Another initiative trained young adults as nature guides to earn income by accompanying visitors to the species-rich lowland rainforest around Thummodara. Some stakeholders were also given loans to produce food, drinks and local handicrafts to sell to visitors. A brochure was prepared to advertise the ecotourism program to hotel visitors, and a website is under construction to promote it via the internet.

The highland purple-faced langur (*S. v. monticola*), also known as the bear monkey, was investigated for two years at Horton Plains by Rudran (1973a, 1973b) nearly fifty years ago. When the area was surveyed again in 2016, Rudran noted appreciable changes to the vegetation. Many species previously recorded as important food plants of the bear monkey were dead or dying. This appeared to be primarily due to debarking of the adult trees and feeding of saplings by the sambar (*Cervus unicolor*) population, which had increased in population because of the invasive soft grass introduced to Horton Plains with the fertilizer used by a now defunct potato farm (Adikaram *et al.* 1999). The death and lack of regeneration of food plants appear to have undermined bear monkey survival. A census was not conducted in 2016, but early morning loud calls of harem males were considerably less frequent than before, indicating a population decline. The area was surveyed again in 2017 to collect data on crop damage and human attitudes towards monkeys.

Three surveys were conducted in the range of the southern purple-faced langur (*S. v. vetulus*) in 2017. Data from these surveys are still being analysed but a long-term study of *S. v. vetulus* (Roscoe *et al.* 2013) reported several threats to the future survival of this subspecies. These threats were the same as those experienced by *S. v. nestor*. Additionally, a major highway constructed through *S. v. vetulus*'s range is expected to create a permanent barrier to gene flow between the populations found along the coast and the interior of the country.

The northern purple-faced langur (*S. v. philbricki*) was investigated for two years in the late 1960s (Rudran 1973a, 1973b) when conflicts with humans were not a serious issue. In the late 1970s, however, the impact of the Accelerated Mahaweli Development Program (AMDP) on wildlife in *S. v. philbricki*'s range became a serious concern. To mitigate this concern, an Environmental Impact Assessment (EIA) of AMDP recommended the establishment of four new National Parks around the development area (Tippetts-Abbett-McCarthy-Stratton 1980). While these areas provided protection to *S. v. philbricki*, serious threats such as habitat fragmentation and hunting for food, medicinal purposes and rituals still remained in other areas (Wickremasinghe *et al.* 2016). Similar findings have also been reported by other investigators (Nahallage and Huffman 2013). Two surveys conducted in 2018 by SPEARS Foundation staff found that populations of the highly arboreal *S. v. philbricki* were fewer than that of the other two subspecies in the area due to habitat fragmentation.

In conclusion, although Sri Lanka's monkeys face a perilous future (Rudran 2013), there is hope that they can be conserved. One reason for hope is that most Sri Lankans follow the Buddhist doctrine of compassion towards all living things. Therefore, promoting this doctrine and Buddha's own reverence of the forest present opportunities to deter deforestation in a country steeped in cultural traditions but ignorant of the detrimental effects of habitat destruction. Another reason for optimism stems from a decision by successive governments to increase Sri Lanka's forest cover from 27% to 36% using native plants, to achieve the country's economic development goals (Yatawara 2011). The political will to increase forest cover augurs well for the future protection of wildlife. It is important that the Sri Lankan government approves the 2016 action plan in order to ensure a steady flow of financial support to conserve Sri Lanka's monkeys.

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GAOLIGONG HOOLOCK GIBBON

or Skywalker hoolock gibbon

***Hoolock tianxing* Fan *et al.*, 2017**

China, Myanmar
(2018)

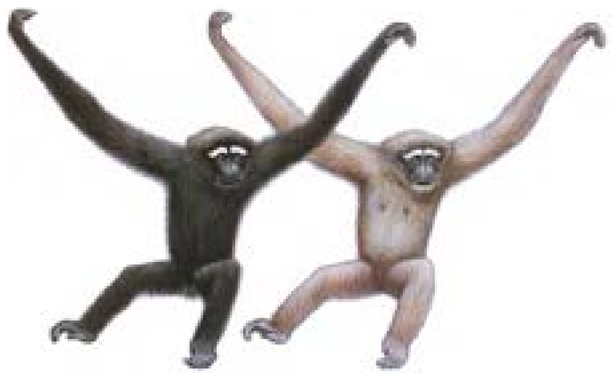
Pengfei Fan, Hanlan Fei, Lu Zhang, Guopeng Ren & Susan M. Cheyne

Hoolock gibbons were first described scientifically by Harlan (1834) under the name *Simia hoolock*. They were subsequently transferred to the genus *Hylobates*, and then assigned to their own distinct subgenus (later elevated to genus), first *Bunopithecus* (later restricted to an extinct Quaternary gibbon from China) (Prouty *et al.* 1983; Groves 2001) and then *Hoolock* Mootnick and Groves 2005. Taxonomic variation between different hoolock populations was first recognized by Groves (1967), who identified a major east-west morphological division and described *Hylobates hoolock leuconedys* to distinguish eastern hoolock populations from those in the west, geographically isolated by the Chindwin River. Both subspecies were latterly elevated to full species: the western (*Hoolock hoolock*) and eastern hoolock (*H. leuconedys*) gibbons. Fan *et al.* (2017) assessed the morphological and genetic characteristics of wild animals and museum specimens to evaluate the taxonomic status of the hoolock population in China. The results suggested that hoolocks distributed to the east of the Irrawaddy and Nmai Hka rivers, which were previously assigned to *H. leuconedys*, are morphologically and genetically distinct from those to the west of the rivers, resulting in them now being recognized as a new species: the Gaoligong hoolock gibbon or skywalker hoolock gibbon, *Hoolock tianxing* Fan *et al.*, 2017.

> In 2009, the Skywalker hoolock gibbon population was estimated to be less than 200 individuals; now, it is less than 150.

Hoolock tianxing was once widely distributed around the west bank of the Salween River, west of Yunnan, China, but >90% of its habitat was lost by 1994 (Fan *et al.* 2017). In 2009, the population was estimated to be <200 individuals (Fan *et al.* 2011). Now, this figure is less than 150 individuals, made up of 34 family groups and 10 solitary individuals across 17 subpopulations. The largest subpopulation has seven groups. Five subpopulations have only one group. The population has remained relatively stable from 2009 to 2017, but is isolated from other populations by distance, villages and roads, and has a low birth rate. For example, between 2008 and 2018 the reproductive rates of three mature females were tracked. One of these females produced two offspring in this time (November 2008 and December 2012), whilst the others produced just one (2008 and2012). *Hoolock tianxing* is listed as Critically Endangered under criterion A4a,c,d.

Agricultural encroachment, commercial logging, habitat fragmentation and isolation, and hunting (for bushmeat and pet trade) are major threats to *H. tianxing*. Additionally, the population is threatened by stochastic loss, in which subpopulations are reduced to 1-2 groups with no opportunity for dispersal or gene-flow. Population linking, protection and habitat restoration are urgently needed, and the translocation of non-viable sub-populations may also be required. There is also a hoolock population in Myanmar. While unstudied, it



is likely that the population faces similar difficulties to those in China, (i.e. habitat loss and poaching) but there is comparatively less conservation action and law enforcement in Myanmar. As the population in China decreases, the importance of the Myanmar population increases. Therefore, although demand for conservation intervention in Myanmar is high, a careful approach is advised to safely navigate the recent political unrest.

The following actions are needed: (1) Raise awareness of this species, especially in China through targeted campaigns, (2) Determine population status in Myanmar through population surveys, (3) Address threats at a local scale through an ethnographic approach, (4) Investigate possibilities for connecting populated forest fragments and/or translocation of isolated groups/individuals.

TAPANULI ORANGUTAN

Pongo tapanuliensis **Nurcahyo, Meijaard, Nowak, Fredriksson & Groves in Nater** ***et al.*****, 2017**

Indonesia (Sumatra)
(2018)

Gabriella Fredriksson, Matthew G. Nowak, Jatna Supriatna & Serge Wich

The Tapanuli orangutan, *Pongo tapanuliensis,* was only formally described in 2017, when it was shown that an isolated orangutan population in the Batang Toru region, which used to be considered the southernmost range of extant Sumatran orangutans (*Pongo abelii*), south of Lake Toba, is distinct from other Sumatran and Bornean populations (Nater *et al*. 2017). Through a comparison of cranio-mandibular and dental characters from an orangutan killed during human-orangutan conflict to a comparative sample of adult male orangutans of similar developmental stage, Nater *et al.* (2017) found consistent differences between the Batang Toru individual and other extant Ponginae. Similarly, comparisons of adult male long calls from two Tapanuli males with those of a large sample of Bornean and Sumatran males also revealed a unique mix of long call characteristics. Model-based approaches based on the analyses of 37 orangutan genomes supported the morphological results, revealing that the deepest split in the evolutionary history of extant orangutans occurred ~3.38 mya between the Batang Toru population and those to the north of Lake Toba. In comparison, the Bornean orangutan and Sumatran orangutan separated much later at about 674 ka. The analyses show that there was some gene flow between the Sumatran and Tapanuli orangutan species until 10–20 ka. Combined, these analyses support a new classification of orangutans into three extant species.

Due to high levels of habitat conversion and fragmentation, along with illegal hunting and poaching, the Tapanuli orangutan is estimated to have experienced a significant population reduction in recent decades (Nowak *et al.* 2017). With a population estimate of 767 (95% confidence intervals 231-1,597) individuals (Wich *et al*. 2019), the Tapanuli orangutan is the least numerous of all great ape species. Its distribution is separated by around 100 km from the closest population of the

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Sumatran orangutan to the north. A combination of small population size and geographic isolation is of particularly high conservation concern, as it may lead to inbreeding depression (Hedrick and Kalinowski 2000) and threaten population persistence (Allendorf *et al*. 2013). Nater *et al*. (2017) recorded extensive runs of homozygosity in the genomes of two Tapanuli orangutan individuals, pointing at the occurrence of recent inbreeding.

The only known population of Tapanuli orangutans occurs in the uplands of the Batang Toru Ecosystem, an area of roughly 1,500 km^2 consisting of three forest blocks, of which 1,023 km^2 is suitable orangutan habitat (Wich *et al*. 2016, 2019). Most of this is upland forest (>500 m asl, up to 1800 m asl), covering the upper watersheds of eight river systems and providing fresh water for over 100,000 people across Tapanuli. Forest loss data indicate that orangutan habitat below 500 m asl was reduced by 60% between 1985 and 2007 for both the Tapanuli and the Sumatran orangutan (Wich *et al*. 2008, 2011). It is thought that more Tapanuli orangutan habitat will be lost as significant areas of forest in its range remain under considerable threat (Wich *et al*. 2016, 2019; Sloan *et al*. 2018) from habitat conversion for small-scale agriculture, mining exploration and exploitation, a large-scale hydroelectric scheme, geothermal development and agricultural plantations. Only about 10% of its geographic range is in an area recognized by the 'World Database of Protected Areas'. Another 76% is in Hutan Lindung (Protection Forest), and 14% does not have any 'forest status' in the spatial plans. The area without any 'forest status' consists of rugged primary forest with the highest densities of Tapanuli orangutans in the Batang Toru Ecosystem (SOCP unpublished data). The protected areas are not immune from the above threats (Wich *et al.* 2008, 2011, 2016) and orangutans in these areas are also hunted (Wich *et al*. 2012). Due to their slow life history, with a generation time of at least 25 years, orangutans on Sumatra are unable to sustain substantial and continual loss of individuals (Wich *et al.* 2004, 2009; Marshall *et al*. 2009).

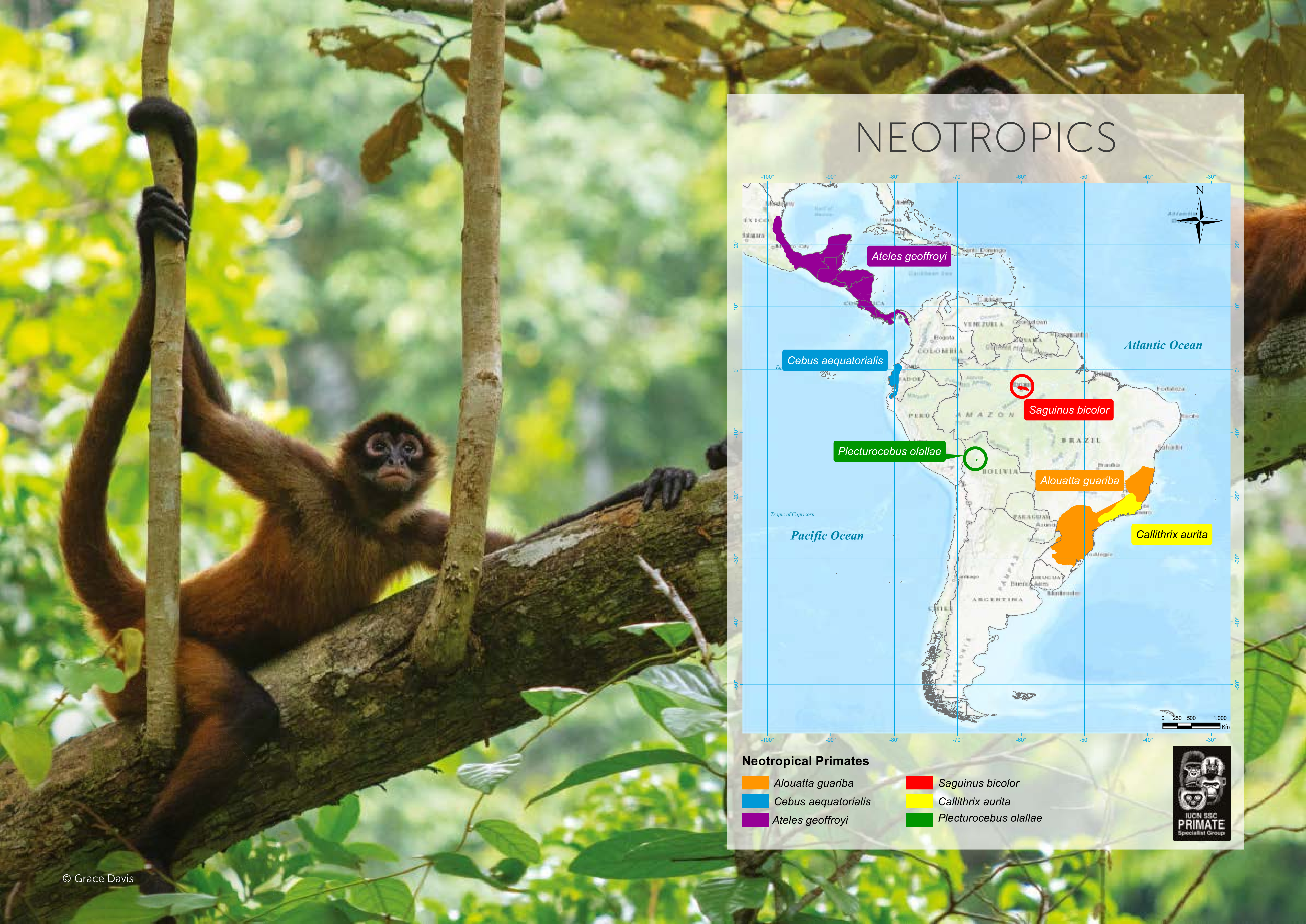
The Tapanuli orangutan was more widespread until relatively recently, with sightings further south in the lowland peat swamp forests in the Lumut area (Wich *et al*. 2003) and several nests encountered during a rapid survey in 2010 (G. Fredriksson pers. obs.). However, the forests in the Lumut area have been almost completely converted to oil-palm plantations in recent years. Observations were also made of a male orangutan in the Adiankoting subdistrict in North Tapanuli, north of the Batang Toru West forest block, during a human conflict situation where the orangutan was shot at with an air rifle when it was found foraging on durian fruits (G. Fredriksson pers. obs.). The persistence of viable subpopulations in these areas is currently not known.

Tapanuli orangutans have been observed feeding on a number of tree species that have not previously been recorded as orangutan food species. These unique species include *Gymnostoma sumatranum* from the Casuarinaceae family, and *Dacrycarpus imbricatus*, *Dacrydium beccarii, Dacrydium comosum*, and *Podocarpus neriifolius* from the Podocarpaceae family. At SOCP's long-term monitoring station in the Batang Toru Ecosystem, 21.9% of all feeding observations recorded between 2011 and 2015 were represented by five conifer species (Araucariaceae and Podocarpaceae) and one non-conifer evergreen species (Casuarinaceae). Seeds of *Agathis borneensis* from the Araucariaceae family have been considered a 'fallback' fruit, frequently consumed when few other fruits are available (Nater *et al*. 2017; SOCP unpublished data). Thus, a significant proportion of the dietary profile of Tapanuli orangutans is markedly different from that of previously studied orangutan populations.

> With a population estimate of fewer than 800 individuals, the Tapanuli orangutan is the least numerous of all great ape species.

Due to the extremely rugged terrain, external threats have been primarily limited to illegal clearing of protected forests, hunting and killing during crop conflict, and trade in young orangutans (Wich *et al.* 2012, 2016). Encroachment and hunting have increased in recent decades, due to an influx of migrants from Nias Island, west of Sumatra, who settle on protected forest land on Batang Toru's forest edge where no land claims exist at present (Wich *et al*. 2012). In addition, despite land status changes from Production Forest to that of Protection Forest in 2014 (Ministry of Forestry of the Republic of Indonesia 2014), one company still maintains a controversial 300 km^2 logging permit located in primary forest in the current range of the Tapanuli orangutan. In the southwest corner of the Batang Toru Ecosystem, a large gold and silver mine has converted key lowland habitat of the Tapanuli orangutan and retains controversial mining permits overlapping parts of the remaining Tapanuli orangutan range. Land speculation related to the company's exploration is further threatening the primary forest. More recently, the development of a hydroelectric project has started in the area of the highest orangutan density, which could impact roughly 100 km^2 of Tapanuli orangutan habitat, or nearly 10% of the entire species' population (Sloan *et al*. 2018). This controversial hydroelectric scheme, located at a hotspot of seismic activity on the Great Sumatran Faultline, also jeopardizes the chances of maintaining and restoring habitat corridors between the western and eastern Tapanuli orangutan ranges and a strict nature reserve with a small population of Tapanuli orangutans (Wich *et al*. 2019). If the connectivity between these populations is not restored, and the last core high-density habitat of the Tapanuli orangutan is bisected by infrastructure development related to the hydro dam (roads, tunnel, high electricity power lines), the long-term survival of the Tapanuli orangutan will be severely threatened (Wich *et al*. 2019).

In order to safeguard the future of the most endangered great ape species in the world, all possible efforts must now be made to prevent any further degradation of Tapanuli orangutan habitat, and to reconnect its three habitat fragments to restore genetic exchange. As it currently stands, two of the three habitat fragments do not contain viable populations, leaving only one viable and highly threatened population as the future of the species. Lastly, field management activities need to be established to prevent further hunting and encroachment, with clear and enforced boundary demarcation, and active human-orangutan conflict mitigation efforts put in place.



NEOTROPICS

Neotropical Primates

- *Alouatta guariba*
- *Cebus aequatorialis*
- *Ateles geoffroyi*
- *Saguinus bicolor*
- *Callithrix aurita*
- *Plecturocebus olallae*

IUCN SSC PRIMATE Specialist Group

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BUFFY-TUFTED-EAR MARMOSET

Callithrix aurita É. Geoffroy Saint-Hilaire, 1812

Brazil
(2018)

Rodrigo S. Carvalho, Sally J. Fransen, Mônica M. Valença-Montenegro, Nicholas J. Dunn, Cláudia A. Igayara-Souza, Márcio Port-Carvalho, Dominic Wormell, Fabiano R. Melo, Alessandro Silva, Wagner R. Lacerda & Leandro Jerusalinsky

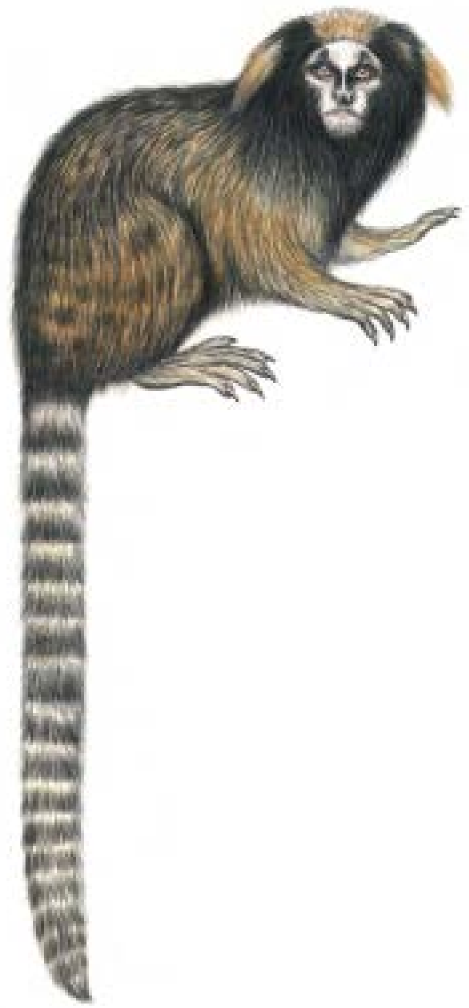
There are six species in the genus *Callithrix*, all endemic to Brazil, but only two, *Callithrix aurita* (VU) and *Callithrix flaviceps* (EN), are listed as Threatened on the IUCN Red List (IUCN 2019). *Callithrix aurita* is under consideration for uplisting from Vulnerable to Endangered in its most recent reassessment (IUCN SSC Primate Specialist Group, in prep.). *Callithrix aurita* is under extreme and increasing threat from habitat loss, habitat fragmentation and competition and hybridization with invasive *Callithrix* species, and the recent outbreak of yellow fever in its range adds significantly to these threats.

Remarkable for its face, which resembles a "little skull", the buffy-tufted-ear marmoset is a small (~420g) primate from the montane region of south-eastern Brazil. *Callithrix aurita*'s habitat is in the mountain chains of the Atlantic Forest of the south-eastern states of Brazil (São Paulo, Rio de Janeiro and Minas Gerais) (Rylands *et al.* 1993). Their presence there has been related to the lower temperatures found in the highlands, with most populations encountered at altitudes between 600 and 1300 m (Norris *et al.* 2011).

Of all Brazilian biomes, the Atlantic Forest is the most heavily populated and a substantial part of it is now an archipelago of small islands of vegetation embedded in a matrix of degraded areas, pasture, agriculture, forestry and urban areas (Joly *et al.* 2014).
Another serious issue is the presence of marmosets introduced from distant and different Brazilian ecosystems into *C. aurita*'s range. Ecological research has shown that *C. aurita* faces significant competition from invasive marmosets, *C. penicillata*, *C. jacchus* and hybrids between them (Pereira 2006, 2010; Rylands *et al.* 2008; Melo and Rylands 2008; Pereira *et al*. 2008, 2014; Port-Carvalho and Kierulff 2009; Nogueira *et al.* 2011; Bechara 2012; Carvalho *et al.* 2013; Carvalho 2015; Melo *et al.* 2015; Nunes 2015; Gonçalves 2016; Silva *et al.* 2018), and genetic research also demonstrates hybridization between *C. aurita* and their introduced congeners (Pereira 2010; Nogueira *et al.* 2011; Carvalho *et al*. 2013; Carvalho 2015). Groups of invasive and hybrid marmosets are replacing native *C. aurita* populations (Pereira 2006, 2010; Bechara 2012; Oliveira 2012; Carvalho *et al.* 2013; Carvalho 2015; Melo *et al*. 2015; Nunes 2015), and hybridization is undoubtedly affecting the genetic integrity of small, pure *C. aurita* populations through genetic introgression.

> Groups of invasive and hybrid marmosets are replacing native buffy-tufted-ear marmoset populations.

The speed and potential consequences of the invasive process that *C. aurita* faces is well exemplified by the situation in the Serra dos Órgãos National Park in Rio de Janeiro State, where five years of observations of two pure *C. aurita* groups in the park found no contact between these native groups and any invasive marmosets. However, field observations in 2015 demonstrated, for the first time, the arrival of invasive marmosets competing



with the native study groups. The replacement of one of the pure *C. aurita* groups by a mixed group of the invasive and native species was observed in the same year. A recent genetic study has also evidenced ongoing hybridization on the edge of the Serra dos Órgãos National Park (Carvalho 2015). This area is emblematic of the invasive processes that are happening in other parts of *C. aurita*'s native range (C. Knogge, W. Lacerda, R. Carvalho, L. Oliveira, D. Pereira, J. Malukiewicz, pers. obs.).

From 2016 to 2017, the yellow fever virus emerged in eastern Brazil, predominantly in the states of Minas Gerais, Espírito Santo, São Paulo and Rio de Janeiro. This was the largest outbreak of yellow fever observed in recent history. The re-emergence of the virus had great impact on the country's non-human primate (NHP) populations, affecting more than 7,000 NHPs, with 1,412 confirmed epizootics, and 777 confirmed human cases with 261 deaths (MinSaude 2017). *Callithrix aurita*'s range contained the highest number of confirmed cases during the 2016-2017 outbreak. In *Callithrix* alone, 257 yellow fever cases have been confirmed so far (2511 reports with final analysis and outcomes still in process), demonstrating the susceptibility of the genus to the disease. Numbers are likely to be far higher than reported as, because of their small size, marmoset cadavers are very difficult to find in the dense forests.

The species' situation has concerned primatologists since 1971 (Coimbra-Filho 1971), but it was only in 2014 that deeper questions were raised and the severity of the threats *C. aurita* faces were widely embraced. These concerns resulted in action being taken to establish an international conservation program to save the species (the Mountain Marmosets Conservation Program - MMCP). *The National Action Plan for the Atlantic Forest Primates and the Maned Sloth* (ICMBIO 2018) was launched in 2018, covering *C. aurita* and 12 other threatened primates.

One of the first actions of the collaborative conservation initiative (MMCP) has focussed on increasing surveys to identify regions with pure *C. aurita* populations, hybrid groups and invasive *Callithrix* spp. (Lacerda *et al.* 2015; Melo *et al.* 2015; Nunes 2015; Carvalho *et al.* 2018). The NGOs PREA and Muriqui Institute of Biodiversity (Minas Gerais), the Environmental Secretariat of São Paulo and the research team and managers of the Serra dos Orgãos National Park began surveys in October 2015. The surveys over the species range show alarming results. In approximately 100 different locations, 85 groups of *C. aurita* and 47 groups of invasive species or hybrids were found (Carvalho and Lacerda, unpubl. data).

Due to the alarming results from the field, the MMCP recognized the urgency of organizing and reinvigorating the captive population of *C. aurita*. In 2017, the MMCP executed a masterplan for movements and pairings for *C. aurita* in captivity. Using SPARKS and PMX software it showed that, with adequate management, the *ex situ* population is expected to reach 60 individuals in 3 years, kept in at least 5 institutions, with the formation and maintenance of at least 12 reproductive pairs. To maintain a genetically healthy population in captivity, the target number for the population was identified to be 350-400 individuals. The program therefore requires more institutions to join, with the appropriate technical capacity and long-term commitment to hold the species.

Recently, an important political initiative was approved by the office of the Environmental Secretary of São Paulo. This was the legislative proposal to establish reproductive restrictions for non-native *Callithrix* legally held in captivity in the state, in order to reduce surplus legally-captive marmosets and reduce undue releases of invasive *Callithrix* into the wild.

Considering that more than 83% of the Atlantic forest comprises fragments smaller than 50 ha (Ribeiro *et al.* 2009), it is suggested that most remaining *C. aurita* sub-populations number less than 1,000 individuals (Rylands 2008), and populations are both fragmented and isolated (Norris *et al.* 2011; Carvalho *et al.* 2018). The minimum viable population size to ensure the long-term survival of a species is thought to be 3,000–5,000 individuals (Traill *et al.* 2007). Based on density estimates and review of the literature, no sub-population of *C. aurita* can be considered viable in the long term (Norris *et al.* 2011).

In this context, the conservation of *C. aurita* will depend on several actions. Firstly, surveys are required to fully comprehend how the species is being affected by invasive congeneric marmosets and yellow fever. Secondly, effective techniques and protocols must be developed to control the invasive *Callithrix* populations. Thirdly, monitoring and management is required within a meta-population framework, with individual movements facilitated by human interventions. Continued legal protection of the species and its habitats must be guaranteed, and finally, the involvement of more institutions and social awareness towards *C. aurita* conservation must be promoted.

In addition to the scientific and environmental communities, the general public will also be indispensable in *C. aurita* conservation. For example, we have received important records of the occurrence of *C. aurita* and invasive marmosets via social media, cell phone applications and birdwatchers. Such information highlights the notion that efficient communication with the general public and the involvement of citizen-science strategies is an important conservation tool. Accordingly, one future priority of the *C. aurita* Conservation Plan will be to amplify the outreach efforts to educate and communicate with the public, and to build upon current achievements, motivating local communities to commit to the conservation of native species.

The first steps of raising awareness for *C. aurita*'s plight and development of a conservation plan have been taken, but future conservation efforts will require partnerships with other researchers and institutions in order to synergise efforts to face the various challenges of saving *C. aurita* as an evolutionarily and ecologically unique Neotropical primate.

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PIED TAMARIN

Saguinus bicolor **Spix, 1823**

Brazil
(2018)

Marcelo Gordo, Diogo Lagroteria, Fábio Röhe, Leandro Jerusalinsky, Renata B. de Azevedo, Marcelo D. Vidal, Tomas Hrbek, Izeni P. Farias & Anthony B. Rylands

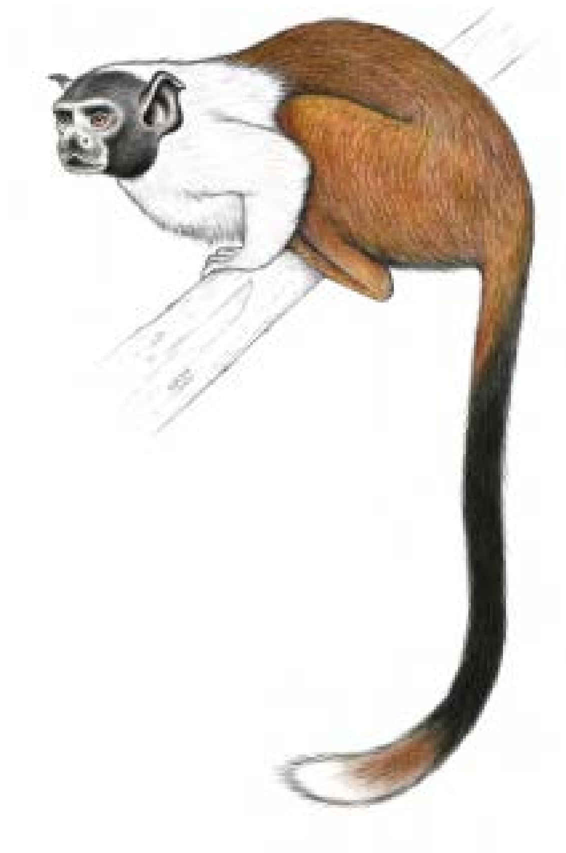
The distinctive pied tamarin, *Saguinus bicolor*, a member of the family Callitrichidae, has a black, hairless face, ears and crown, contrasting with white fur on the back of the head, the mantle, the chest and arms. The back, flanks, abdomen, and legs have pale (sometimes quite dark) greyish brown fur, and the tail and outer surface of the thighs are variably a more reddish brown or have reddish tinges (Hershkovitz 1977; Egler 1986; Gordo *et al.* 2008, 2017). It weighs between 450 and 550 g, occasionally reaching 600 g. The length of the head and body is 28–32 cm, and the long, thin tail is 38–42 cm (Gordo 2008; Gordo et *al.* 2017). With its slim body and claw-like nails, the pied tamarin can move with great agility through thick vegetation, and even climb broad vertical trunks. The sexes are the same in their appearance.

Like other tamarins, *S. bicolor* gives birth to twins once a year, rarely twice (Gordo 2012). Gestation ranges from 180 to 219 days (Hershkovitz 1977; Egler 1992; Baker *et al.* 2009). All group members carry the infants for the few weeks after birth until they become independent. They reach sexual maturity at about two years of age (Gordo 2008). Group sizes range from 2 to 13 (Gordo 2012). *Saguinus bicolor* is diurnal, and groups are extremely territorial. It is found in dense primary forest, secondary forest and *campinarana* (forest on white sand). Its diet includes ripe fruits, small animal prey – invertebrates and small vertebrates – eggs, tree exudates (gums) and nectar (Egler 1986, 1991, 1992; Gordo 2008; Gordo *et al.* 2017).

Pied tamarins are run over, electrocuted when using power lines, attacked by cats and dogs, captured as pets and generally mistreated.

An endemic primate of the Brazilian Amazon, its geographic distribution is approximately 7,500 km², with a large portion of this taken up by the city of Manaus, capital of the state of Amazonas, and its metropolitan region. The adjacent regions suffer strong anthropogenic effects because of urban expansion, roads, colonisation, agriculture and cattle ranching (Emmons 1990; Röhe 2006; Gordo *et al.* 2013; Coelho *et al.* 2017, 2018). Population densities of the pied tamarin are low throughout their range. Gordo (2012; Gordo *et al.* 2017) has recorded densities of 1 group/km² in extensive tracts of mature forest, and slightly higher numbers, about 2 groups/km², in isolated forest patches in and near the city of Manaus. These fragmented areas, despite having higher densities, support small populations that are not viable in the medium to long term (Gordo 2012; Campos *et al.* 2017). In urban areas, pied tamarins are run over, electrocuted when using power lines, attacked by cats and dogs, captured as pets, and generally mistreated (Gordo 2012; Gordo *et al.* 2013, 2017).

Away from urban areas, the pied tamarin is threatened by deforestation, habitat degradation and fragmentation, and displacement by encroaching red-handed (or Midas) tamarins, *Saguinus midas*, a closely related species which otherwise occurs over a large part of the Guiana Shield, in Brazil, French Guiana, Suriname and Guyana (Hershkovitz 1977; Röhe 2006; Gordo *et al.* 2017). Interspecific interactions and competition between *S. bicolor* and *S. midas* were reported by Ayres *et al.* (1980, 1982) and Egler (1983) and studied later in detail by Röhe (2006). The documented, apparent displacement of of the pied tamarin by red-handed tamarins contributed



to its classification as Critically Endangered (CR) (Vidal *et al.* 2018) on the Brazilian List of Threatened Wildlife (Brazil, ICMBio MMA 2018), and, while still pending review and confirmation by the Species Survival Commission (SSC), it has also been ranked as CR by the IUCN SSC Primate Specialist Group.

The rapid demographic expansion of *S. midas* at the expense of *S. bicolor* is very worrying. Genetic studies, however, have demonstrated that in addition to genetic bottlenecks observed in urban fragments, *S. bicolor* has been experiencing population declines for some 10,000 years (Farias *et al.* 2015). Hybrids, which have a predominantly *S. midas* phenotype, have been recorded in the contact zone of the two species (Jeferson Oliveira pers. obs. 2014; Diogo Lagroteria pers. obs. 2016). The southernmost part of the range of *S. bicolor*, which in principle could serve as a natural refuge for the species, encompasses precisely the urban area of Manaus and its zone of expansion.

Another threat is disease. Little is known about the effects of parasites and pathogens in free-living or even captive animals, something that has been of major concern for *in situ* and *ex situ* conservation measures (Baker *et al*. 2009; Brazil, ICMBio, MMA 2011; Jerusalinsky *et al*. 2017; Lagroteria *et al*. 2017a). This concern has stimulated upcoming research (Maia da Silva *et al.* 2008; Solorio *et al.* 2015). Current projects are investigating the relation of this primate to the Zika, Dengue and Chikungunha viruses, filariasis, and digestive tract parasites.

A key initiative for the conservation of the species was the creation of the action plan *Plano de Ação Nacional para a Conservação do Sauim-de-Coleira* (*National Action Plan for the Conservation of the Pied Tamarin*) in 2011 (executive summary) and 2017 (the final document), coordinated by the National Center for Research and Conservation of Brazilian Primates (ICMBio) (Brazil, ICMBio, MMA 2011; Jerusalinsky *et al.* 2017). An environmental education program linked to the action plan was implemented with great success, disseminating an understanding of the threatened status of the species, promoting the adoption of the species as the symbol of Manaus, and also cultivating new allies for conservation and research (Lagroteria *et al.* 2017b). The *ex situ* management program is strongly supported by European zoos and a few North American zoos, and participation from Brazilian institutions is growing (Baker *et al.* 2009; Lagroteria *et al.* 2017b). The financial support provided by the European and US zoos for *in situ* and *ex situ* conservation projects has been, and remains, extremely important for pied tamarin conservation efforts.

Considering that there are currently just two protected areas for the species – one municipal and one state, both located in urban areas, and each smaller than 50 ha – the creation of a reserve that could support a viable population is essential. A concrete output of the action plan was two formalized proposals for protected areas: one an environmental protection area (APA) of the government of the state of Amazonas, the other a federal biological reserve of about 16,000 ha in the east of the pied tamarin's range. The proposal for the APA was accepted, and the APA Sauim-de-Manaus, 1,050 ha, was established in June 2018.

Recent research and conservation measures have also taken a positive turn with the participation of the local population (Santos *et al.* 2017a, 2017b), the scientific community, and diverse institutions including the Federal Public Ministry (Brazil, ICMBio, MMA 2011; Gordo 2012; Barr 2016; Campos *et al.* 2017; Coelho *et al.* 2017, 2018; Jerusalinsky *et al*. 2017) resulting in the reforestation of degraded areas and the creation of ecological corridors vital for the maintenance and connectivity of viable populations in the more urbanized areas.

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ECUADORIAN WHITE-FRONTED CAPUCHIN

***Cebus aequatorialis* J.A. Allen, 1914**

Ecuador, Peru
(2018)

Stella de la Torre, Fanny Cornejo, Laura Cervera & María Fernanda Solórzano

The Ecuadorian white-fronted capuchin *Cebus aequatorialis* is a Critically Endangered (Tirira 2011; Cornejo and de la Torre 2015) primate found in western Ecuador and northwestern Peru from 0 to 2000 m asl (Cornejo and de la Torre 2015; Rylands *et al*. 2013; Tirira 2017). At the north of its range, most records now are south of the Guayllabamba River, and its southernmost distribution appears to be the Cerros de Amotape National Park in Peru (Cornejo and de la Torre 2015; Cervera *et al*. 2018; Tirira *et al*. 2018). The species is included in CITES Appendix 2 and it is illegal to hunt or trade *C. aequatorialis* in both Ecuador (Tirira 2011) and Peru (SERFOR 2015).

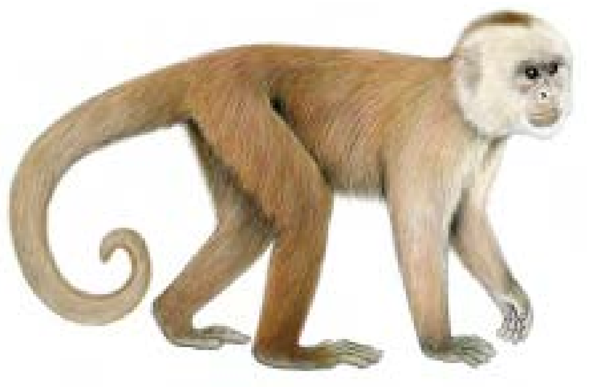
Cebus aequatorialis is a medium-sized monkey (body length: 35-51 cm, tail: 39.5-50 cm) with males slightly larger and heavier than females (Rylands *et al.* 2013). There is considerable individual variation in fur color and length. The upperparts, from the nape to the back, are usually pale cinnamon rufous, darker along the midline of the back. Front and sides of the head are pale, yellowish white, with a narrow black transverse line on the forehead forming the cap, from which a narrow median black line descends to the nose. The outsides of the limbs are similar in color to the body. Hands and feet are more brownish than the arms and legs. The ventral surface is paler than the flanks. The chest is lighter than the belly. The dorsal surface of the tail is dull wood-brown and is darker than the body. The undersurface of the tail is paler (Rylands *et al.* 2013).

> Distribution of the white-fronted capuchin has been reduced to less than 1% of its original range in the last few decades.

The species inhabits tropical and subtropical forests of the Chocó and Tumbes eco-regions (Albuja 2002; Albuja and Arcos 2007). It is diurnal and arboreal, using all forest strata including the ground of primary and secondary forests and orchards (Campos and Jack 2013; Tirira 2017). It feeds mainly on mature fruits, complementing its diet with animal prey (insects, eggs and small vertebrates). In Ecuador, about 30 different plant species are known to be part of its diet (Albuja *et al*. 2018). Groups vary in size from 5 to 20 individuals. The adult sex ratio appears to be 1:1 or mildly skewed towards females 0.8:1 (Albuja 1992; Jack and Campos 2012; Rylands *et al.* 2013). Group home range size appears to be large, at about 500 ha (Jack and Campos 2012; Rylands *et al.* 2013), but more studies are needed to confirm this estimation.

The reproductive biology of *C. aequatorialis* is unknown. In other species of the genus, sexual maturity in females occurs when they are 4-7 years old and one year later in males. However, both sexes only reach adult body size at about 15 years old (Rylands *et al.* 2013). Considering that successful reproduction usually occurs only when animals have attained adult body size, the generation time is estimated to be about 15-16 years (Tirira *et al.* 2018).

The main threats to *C. aequatorialis* are forest loss and fragmentation, which have been particularly severe in western Ecuador, reducing its habitat. About 70% of the original forest cover in this



region has been converted to other uses, mainly agriculture and ranching (Cervera *et al*. 2018; Ecuador 2012; Sierra 2013; Gonzalez-Jaramillo 2016). It is estimated that the species distribution has been reduced to less than 1% of its original range in the last few decades (Albuja and Arcos 2007), and different modelling methods have indicated that only 5,000 km^2 (Campos and Jack 2013) or 8,600 km^2 (Albuja *et al.* 2018) of suitable habitat remains. However, the presence of *C. aequatorialis* in most of this area has yet to be confirmed.

Cebus aequatorialis is considered a pest in plantations of corn (mainly), bananas, plantain and cacao, and hence is persecuted and hunted. In some areas of mangrove, local people see it as a competitor in crab hunting and persecute it. Captive animals have been observed in villages in western Ecuador and in the Huaquillas market on the Ecuador-Perú boundary (Tirira *et al*. 2018).

In Ecuador, *C. aequatorialis* has mainly been reported to occur in public and private protected areas (see below), which are the only sites with sufficient forest to support the species. In disturbed areas, i.e., most localities in Ecuador, the species is elusive, tending to flee upon sighting. In a census of four species of western Ecuadorian primates carried out from October 2016 – March 2017, in 83 localities of 13 provinces, only 13 out of 260 records (5%) were of *C. aequatorialis* (Cervera *et al*. 2018). Surveys from previous years evidenced a relatively wide variability in local abundance (Tirira *et al*. 2018). In central western Ecuador, Jack and Campos (2012) estimated densities of 2–22 ind/km^2 (mean 2.4 ind/km^2). In central and southwestern Ecuador, Albuja and Arcos (2007) estimated densities of 3.5 and 3.9 ind/km^2, while in southwestern Ecuador, De la Torre *et al.* (in prep.) estimated a density of 0.1 ind/km^2.

Some information about the species demography and distribution in the west of Ecuador has been provided (Albuja and Arcos 2007; Jack and Campos 2012; Campos and Jack 2013), and was updated by the most recent census of western Ecuadorian primates (Cervera *et al.* 2018). Other, smaller, short- term studies have provided information about local abundance and conservation threats (Cervera *et al.* 2015; Moscoso-Silva 2013; Solórzano 2014), but the species remains poorly known in most of its potential area of distribution.

In Peru, studies on *C. aequatorialis* are scarce. It is known to occur only in government protected areas that provide a certain degree of protection. However, there is very little information on its status in these protected areas and limited capacity to monitor them. In these areas, Hurtado *et al.* (2016) reported a group size of 3–12 individuals and an encounter rate of 0.3 ind/km (based on 7 sightings during 112 km transects). Previously, group sizes of 3–5 individuals were reported in 1980 (Saavedra and Velarde 1980) and 1994 (Encarnación and Cook 1998). Improving forest connectivity along Ecuador and Peru's border is imperative to maintain the species in both countries (Hurtado *et al.* 2016).

Given the degree of fragmentation across the species' range, targeted efforts are required to better understand its relationship with humans and how the disturbed landscape affects its demography, ecology and behaviour. The Peruvian population in the protected areas can be used as a baseline for comparisons. This information is imperative for conservation planning by decision makers, so that actions such as habitat corridor creation, conservation education, and resolution of human-wildlife conflicts can be undertaken. Additionally, successful conservation efforts must include collaboration between Ecuadorian and Peruvian authorities, stakeholders, and scientists.

The species has been reported to occur in various public and private protected areas. In Ecuador (Tirira *et al*. 2018) these are: Chocó Andino de Pichincha, Parque Nacional Machalilla, Reserva Ecológica Los Ilinizas, Reserva Ecológica Mache-Chindul, Reserva Ecológica Manglares Churute, Refugio de Vida Silvestre Manglares Estuario Río Muisne, Refugio de Vida Silvestre Marino y Costera Pacoche, Área importante para las Aves Tito Santos, Bosque Protector Puyango, Bosque Protector Bellavista, Bosque Protector Buenaventura, Bosque Protector Cambugán, Bosque Protector Cerro de Hayas, Bosque Protector Cerro Blanco, Bosque Protector Jama-Coaque, Bosque Protector Jauneche, Bosque Protector La Hesperia, Bosque Protector La Otonga, Bosque Protector Lalo Loor, Bosque Protector Maquipucuna, Bosque Protector Mashpi, Bosque Protector Mindo-Nambillo, Bosque Protector Río Guajalito. In Peru, it is reported from Cerros de Amotape National Park and Tumbes National Reserve. Finally, it is also reported from Bosques de Paz, a bi-national reserve of Ecuador and Peru.

OLALLA BROTHERS' TITI MONKEY

Plecturocebus olallae **Lönnberg, 1939**

Bolivia
(2018)

Jesus Martinez & Robert Wallace

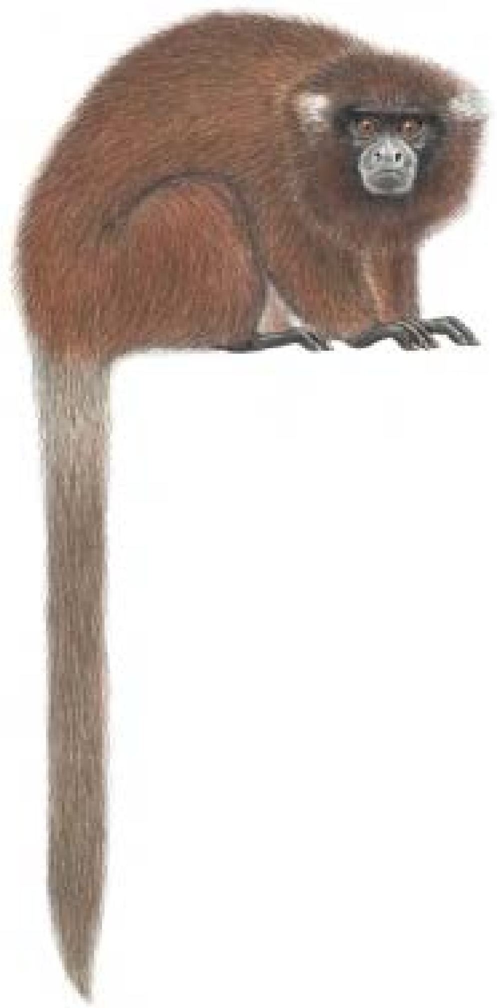
The Olalla brothers' titi monkey was described in 1939 (Lönnberg 1939) and is one of two primates endemic to Bolivia. The original description was made from just one specimen, but it has since been validated as a species by a series of taxonomic assessments (*Callicebus olallae*; Hershkovitz 1990; Kobayashi 1995; van Roosmalen *et al*. 2002). The last review of callicebine taxonomy updated the species name to *Plecturocebus olallae*, maintaining it as a member of the *P. donacophilus* species group (Byrne *et al.* 2016). Its extremely restricted range (267 km^2) in a naturally fragmented forest threatened by deforestation, together with a falling population size (<2,000 individuals remain) make *P. olallae* a Critically Endangered species (Wallace *et al*. 2013; López-Strauss and Wallace 2015; Martinez and Wallace 2016).

No information on wild *P. olallae* populations was available for more than 60 years after its description. It was first observed in 2002 around the Río Yacuma (Felton *et al*. 2006). Subsequent distribution and demography studies showed that the population is small and occurs only in the forests around the upper part of the Río Yacuma in the western part of the Beni Department, confirming its endemism to Bolivia (Martinez and Wallace 2007, 2013; Wallace *et al*. 2013). This area corresponds to the Moxos savannah ecosystem where the landscape, sculpted by flooding regimes, consists of a grassland matrix in which gallery forest and naturally fragmented forest patches are immersed (Martinez and Wallace 2007, 2010).

> No information on wild Olalla Brothers' titi monkey populations was available for more than 60 years after its description.

Plecturocebus olallae is monogamous, living in family groups of up to five individuals (Martinez and Wallace 2007, 2010). Group home range size is around 7 ha and they cover a daily distance of approximately 500 m (Martinez 2014; Martinez and Wallace 2016). Their diet is mainly frugivorous (48.5%), with leaves also being important (38.9%), while flowers, insects, and other foods are consumed in much smaller proportions (Martinez and Wallace 2016). Gestation lasts for around 4 months, but offspring are not produced every year (Martinez and Wallace 2010). The monkeys reach sexual maturity in two years, when they look for opportunities to leave their natal groups (Martinez and Wallace 2010; Bicca-Marques and Heymann 2013).

Habitat loss is the main threat to *P. olallae,* especially considering the fragmented forest coverage that characterizes the region. Habitat loss is linked to cattle ranching, the main economic activity in the region, in which grasslands are burned annually to promote their regeneration as pasture. Unfortunately, this technique often results in uncontrolled fires that can affect forest patches inhabited by titi monkeys. The smoke from nearby fires can result in loss of territory (Martinez and Wallace 2011), showing that alternative methods for grassland management are urgently required. The increasingly fragmented forest promotes unusual ground travel and risky displacements for titi monkeys (Martinez and Wallace 2007, 2010, 2011).



Another important risk for *P. olallae* is the ongoing improvement of the Northern Corridor, a major road that passes around 10 km from the area it inhabits (Martinez and Wallace 2007, 2010). The dirt road is currently being upgraded to an asphalt highway, which could result in more numerous and sizeable human settlements as well as an increase in the intensity of cattle ranching and agricultural activities, both of which would cause forest loss (Martinez and Wallace 2007, 2010; Wallace *et al*. 2013; Porter *et al.* 2013). Although most of the land adjacent to the road belongs to private properties, which reduces the chances of the establishment of new human settlements, encroachment is still a risk due to proximity.

Several measures have been taken for the conservation of *P. olallae*. Initially, outreach activities included talks with local authorities of the Reyes and Santa Rosa municipalities. These authorities were already interested in consolidating tourism, the second largest economic activity in the region. Information on the presence of *P. olallae* and other wildlife was very important in promoting the creation of two municipal protected areas where titi monkeys are a conservation priority (Martinez and Wallace 2010; Wallace 2013). To involve local people in *P. olallae* conservation, posters were designed and distributed to schools and public offices. From 2011 to 2012, an intensive outreach project took place, supported by the municipal authorities, consisting of talks to students in the main towns and several communities, as well as contests and fairs oriented to raise awareness and support the conservation of *P. olallae* as a unique symbol of the local natural patrimony (Martinez *et al*. 2015). These efforts were very successful because they shared information about *P. olallae* and promoted interest in biodiversity conservation.

More recently, efforts have focused on creating management plans for the Santa Rosa and Reyes municipal protected areas, Pampas del Yacuma and Los Santos Reyes, which represent the majority of the distributional range for *P. olallae*. In 2017, a management plan was developed for Pampas del Yacuma (Santa Rosa), in which *P. olallae* conservation is linked to protection of forest and other wildlife in the region (GAMSR 2016). A similar plan is being created for Los Santos Reyes (Reyes), which covers a large portion of the species' range. Currently, conservation action focuses on reinforcing the management of the municipal protected areas and the development of conservation plans that include monitoring and protection actions (MMyA 2009, 2014). Working with the protected areas of Reyes and Santa Rosa represents the best way to work with cattle ranchers towards implementing improved grassland and cattle management to reduce negative effects on *P. olallae* and other wildlife. A second priority is to work with the National Road Authority to implement mitigation measures along the Northern Corridor improvement project, involving both municipalities and local stakeholders. The complete establishment of the municipal protected areas will also enhance protection of *P. olallae* and the areas' wildlife and landscapes, which will also help establish ecotourism as a more sustainable option for local development.

Research is still required to fill the biological and ecological knowledge gaps concerning *P. olallae*. This knowledge will aid in the development of an appropriate monitoring program for *P. olallae* populations to determine how the distinct pressures derived from human activities affect these monkeys and to develop better protection measures.

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NEOTROPICS

BROWN HOWLER MONKEY

Alouatta guariba **Humboldt, 1812**

Brazil, Argentina
(2012, 2014, 2016, 2018)

Gerson Buss, Luciana I. Oklander, Júlio César Bicca-Marques, Zelinda B. Hirano, Óscar M. Chaves, Sérgio L. Mendes, Leonardo G. Neves, Fabiano R. Melo, Anthony B. Rylands & Leandro Jerusalinsky

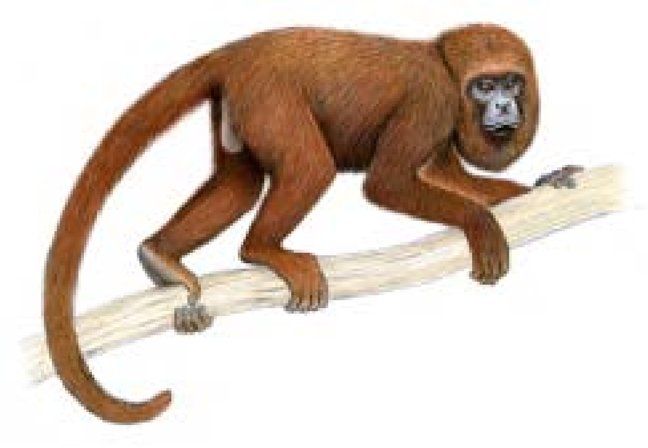
Alouatta guariba is endemic to the Atlantic Forest in eastern Brazil and northeastern Argentina. In the south, its range is limited by the Camaquã river basin in the state of Rio Grande do Sul (Printes *et al*. 2001) and to the north the limit is Boa Nova, southern Bahia, south of the Rio de Contas (Neves *et al.* in prep.), although it occurred north as far as the right (south) bank of the Rio Paraguaçu in the past (Gregorin 2006). The western boundary is marked by the limits of the Atlantic Forest. In Argentina, the species occurs in the province of Misiones (Agostini *et al*. 2014). Although with some uncertainty, two subspecies are recognized: the southern brown howler, *A. guariba clamitans*, and the northern brown howler, *Alouatta g. guariba*, north of the rios Jequitinhonha or Doce (Rylands *et al*. 2000; Glander 2013).

The brown howler is a folivore-frugivore, including more or less fruit in its diet according to seasonal availability (Neville *et al*. 1988; Chaves and Bicca-Marques 2013). As such, brown howlers are important seed dispersers for numerous plant species (Chaves *et al*. 2018). Home range size varies between study sites but averages 13 ha (Fortes *et al*. 2015). Ranges of 15 groups studied varied from 1.8 to 33 ha (Miranda and Passos 2011). Day range varies from 50 m to 1,677 m (Fortes *et al*. 2015). Groups average 4 to 6 individuals, but can be as large as 13 (Jardim 2005; Miranda and Passos 2005; Ingberman *et al.* 2009). Unimale-unifemale and multimale-multifemale groups have been reported (Glander 2013). The size of an adult male is 50–60 cm (head-body) and 52–67 cm (tail), while an adult female is 44–54 cm (head-body) and 48–57 cm (tail). Adult males weigh 5.3–7.2 kg and adult females weigh 4.1–5.0 kg (Glander 2013). Longevity is estimated at 15–20 years (Strier 2004). Females have single offspring, with an interbirth interval of 9–22 months (Strier *et al.* 2001).

As for all the Atlantic Forest primates, the brown howler has suffered extensive habitat loss since European arrival in South America more than five centuries ago. During the colonization process, the forest cover was broadly devastated due to exploitation of natural resources (e.g., Brazil wood, gold), extensive agriculture (e.g., sugar cane, coffee) and cattle ranching. This region today concentrates around 70% of the Brazilian population (~150 million people) and the principal capital cities, with corresponding industrial activity and urbanization (Scarano and Ceotto 2015). In Brazil, the Atlantic Forest has been reduced to 11.7% of its original coverage (Ribeiro *et al*. 2009). The remaining forest is immensely fragmented into hundreds of thousands of patches, of which the great majority are 50 ha or less (Ribeiro *et al*. 2009), hence unsuitable to support viable populations in the long term. Being one of the largest primates in the Atlantic Forest, the species has been extensively hunted, and also suffers to some extent from the pet trade.

> Howlers are highly susceptible to yellow fever, and two recent outbreaks have severely affected their numbers.

Disease epidemics are an additional and very serious threat. Howlers are highly susceptible to yellow fever, and two recent outbreaks (2008/2009, 2016/2018), have severely affected



their numbers throughout the Atlantic Forest (Holzmann *et al.* 2010; Almeida *et al.* 2012; Bicca-Marques *et al*. 2017). Due to misinformation and the dissemination of the fear that humans could be infected directly through contact or proximity with monkeys, howlers were persecuted, with many injured and killed during the outbreaks (Bicca-Marques *et al.* 2017). In the next few decades, pathogen exposure could act synergistically with other threats such as habitat loss, putting populations at high extinction risk.

Southern brown howlers (*Alouatta guariba clamitans*) occur in lowland forests along Brazil's coast, as well as in higher elevation sub-montane and montane forests and seasonal semi-deciduous forests inland (Bicca-Marques *et al*. 2018). In southern Brazil and northeast Argentina, they also occupy a transition of mixed Upper Paraná Atlantic Forest and Araucaria Moist Forest (Miranda and Passos 2005; Agostini *et al.* 2014). Aguiar *et al*. (2007) recorded the species in periodically flooded and semi-deciduous forests in the Paraná river floodplains.

The primary threats are widespread forest loss and fragmentation throughout the subspecies' range due to logging, agriculture and cattle-ranching (Bicca-Marques *et al*. 2018). Attacks by domestic dogs, traffic accidents, and electrocution are serious threats to howlers living close to urban areas (Printes *et al*. 2010; Chaves *et al*. in prep.). The design and implementation of conservation strategies for the southern brown howlers in urban and suburban regions are crucial for the long-term survival of these animals (Jerusalinsky *et al*. 2010).

Although some local population census data are available for Brazil, the total remaining population is unknown, but certainly declining. In Argentina, the situation is even worse; only a few populations persist with no more than 20–50 adult individuals (Agostini *et al.* 2014).

The southern brown howler is listed as Vulnerable on the Brazilian list of threatened fauna (Brazil, MMA 2014) and the IUCN Red List (Buss *et al*. in prep), but may be a candidate for the Endangered category after the 2016–2018 yellow fever outbreak (Bicca-Marques *et al.* 2017). It is considered Critically Endangered in Argentina (Agostini *et al*. 2012).

The northern brown howler monkey (*Alouatta guariba guariba*) inhabits lowland, submontane and montane Brazilian Atlantic forest. It has a considerably more restricted range than *A. g. clamitans* and is classified as Critically Endangered both in the Brazilian list of threatened fauna (Brazil MMA 2014) and the IUCN Red List (Mendes *et al.* 2008). It has been listed as one of the world's 25 most endangered primates since 2012 (Neves *et al*. 2017). Adding the locations in the lower reaches of the Jequitinhonha basin reported by Rylands *et al.* (1988) and the small populations of *A. g. guariba* discovered in the last few years, the total population is unlikely to sum more than 250 mature individuals, and no subpopulation is believed to have more than 50 mature individuals (Neves *et al*. 2018). Overall, the main threats to the wild populations of this subspecies are habitat fragmentation, hunting, and the very small sizes of the scattered populations (Neves *et al.* 2017).

There are protected areas in the northern brown howler's range in the state of Bahia and northeastern Minas Gerais, all created since 1980. Nevertheless, the only strictly protected area where the species has been confirmed is the Mata Escura Biological Reserve (51,046 ha), just north of the middle Rio Jequitinhonha (Melo 2005).

The two subspecies of *Alouatta guariba* are included in the *Brazilian National Action Plan for Conservation of the Atlantic Rainforest Primates and Maned Sloth* (Brazil MMA 2018), and will be part of the Primate Conservation Action Plan of Argentina which will be produced in 2019. These plans provide measures to identify important areas for conservation in order to (a) restore, maintain and increase habitat and its connectivity, (b) mitigate the impact of roads and power lines, and (c) assess and mitigate the impact of epizootics on the species.

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CENTRAL AMERICAN SPIDER MONKEY

***Ateles geoffroyi* Kühl, 1820**

Mexico, Guatemala, Nicaragua, Honduras, El Salvador, Costa Rica, Panama (2016, 2018)

Pedro G. Méndez-Carvajal, Melissa E. Rodríguez, Gilberto Pozo Montuy, Óscar M. Chaves, Gabriela Ponce, Bonarge A. Rodríguez-Beitia & Héctor Portillo-Reyes

Central American spider monkeys *Ateles geoffroyi* are distributed in Mexico, Guatemala, Nicaragua, Honduras, El Salvador, Costa Rica and Panama (Rylands *et al.* 2006). Because of habitat loss and fragmentation, severe hunting pressure, and the pet trade, they are considered Critically Endangered (Smith 2005; Cuarón *et al.* 2008). *Ateles geoffroyi* was subdivided into nine subspecies by Kellogg and Goldman (1944). Since then three have been synonymized (*A. g. pan, A. g. panamensis*, and *A. g. yucatanensis*) (Rylands *et al.* 2006), and Groves (2005) considered *A. g. azuerensis* to be a synonym of *A. g. ornatus*.

Recent taxonomic studies using mitochondrial DNA have validated other subspecies which are mentioned here, but more information on identification and sample locations is needed to corroborate these conclusions (Morales-Jiménez *et al.* 2015; Ruiz-García *et al.* 2016).

> Narco-effect rates (deforestation related to illegal drug trade) are 20-60% per year in parts of the spider monkey range.

The genus *Ateles* has long been considered the most threatened in the Neotropics (Mittermeier *et al.* 1989). *A. geoffroyi* has a long gestation period (226-232 days) compared to other Atelidae, such as *Alouatta*, *Brachyteles* and *Lagothrix* (Campbell 2000). They also spend a larger proportion of their time foraging compared to other Central American primate species (Chapman *et al.* 1989), with a major dietary requirement of 69-91% fruit (Campbell 2000). With their highly frugivorous diet, spider monkeys need large expanses of forest and are less able to adapt to fragmentation than *Alouatta* (Méndez-Carvajal 2013). In addition to its ecological requirements, it is one of the main species hunted in indigenous regions (Smith 2005). This species has a large range compared to other non-human primates in the Mesoamerican region, but it is threatened by high rates of deforestation. Narco-effect rates (deforestation related to illegal drug trade) are 20-60% per year, sometimes also affecting natural parks and reserves (McGrath 2014).

Ateles geoffroyi azuerensis (CR) was initially described as *Ateles azuerensis* Bole, 1937, and was studied for the first time in La Vaca, Coto Region, in the Chiriqui Province (Carpenter 1935). The actual distribution and total population have been assessed by the Fundación Pro-Conservación de los Primates Panameños (FCPP), a Panamanian NGO that has been monitoring this primate since 2001. *Ateles g. azuerensis* has been extirpated in Chiriqui Province, west and north Veraguas and Herrera Province. It is present now only in south-western Veraguas and Los Santos Province, on the Azuero Peninsula, in the southern areas near the Cerro Hoya National Park, and in the fragmented landscape between Punta Duarte, La Barra, Guanico, Quema, La Tronosa Forest Reserve, La Miel and Pedasi. Only 10 subgroups and five complete groups have been detected, with a mean of 3.8 individuals/subgroup, SE ±0.6 (range 2–7) and a mean of 12.5 individuals/

group, SE ±3.7 (range 10–22), with densities of 1.4 individuals/km² (for fragmented habitats), and an approximate total population of <150 individuals (Méndez-Carvajal and Ruiz-Bernard 2009; Méndez-Carvajal 2013). Conservation measures led by FCPP involve community volunteers from Azuero, environmental education and the distribution of an educational *Azuero's Primate Guide*, as well as monitoring biodiversity and surveying the Azuero Peninsula (Méndez-Carvajal *et al*. 2013).

Ateles geoffroyi frontatus (EN) ranges from northern Nicaragua to the northwestern parts of Costa Rica, including the basins of the ríos Princapolca, Tuma and Uluce, and is also found in Metagalpa and the Nicaraguan highlands (Allen 1914; Rylands *et al.* 2006; Cuarón *et al.* 2008).

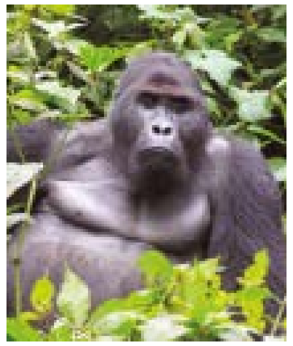
Ateles geoffroyi geoffroyi (CR) inhabits San Juan del Norte, Martina Bay and southeastern Nicaragua, and the population probably extends into northern Costa Rica (Rylands *et al.* 2006).

The subspecies *Ateles geoffroyi grisescens* (DD) was reported by Kellogg and Goldman (1944) from the valley of the Río Tuira, Serrania del Sapo, Pirre, Tucuti in Darien Province, Panama (Elliot 1913; Gray 1865; Sclater 1875). It also occurs in Baudó, northwestern Colombia (Rylands *et al.* 2006). Recent studies have reported that *A. g. grisescens* is no longer in its original area (Tuira River), nor in Chucanti or the Maje Mountain Chain (Méndez-Carvajal 2012). However, the presence/absence of this primate from Panama is still being studied (Méndez-Carvajal *et al.* 2016). A documentary related to the expedition to find *A. g. grisescens* has been filmed for Barbara Réthoré and Julien Chapuis from Conserv-action and NatExplorers, in support of FCPP projects and the re-discovery of this subspecies.

The natural range of *A. g. ornatus* (CR) is in Costa Rica and Panama. In Costa Rica it is known to be in the Osa Peninsula, Carara Biological Reserve, Corcovado National Park (Matamoros and Seal 2001), and Cerro Chirripo, Cantón de Pérez Zeledón, at 1700 m asl, with a density of 0.012 individuals/km² (Rodríguez-Beitia pers. obs.). In Panama, it is present on the northern side of the Caribbean coast, in the lowlands and highlands of Bocas del Toro, the northern coast of Veraguas Province, Coclé (rare in Coclé and Donoso; Méndez-Carvajal, pers. obs.), Portobelo National Park, and San Blas mountain chain (Méndez-Carvajal *et al.* 2016). An isolated population was introduced onto Barro Colorado Island (Campbell 2000). In Panama, FCPP started a long-term monitoring project in 2010 in the San Blas mountain chain to understand the actual distribution and population densities for this subspecies (Méndez-Carvajal 2014).

Ateles geoffroyi vellerosus (CR) is present in Mexico, Belize, Guatemala, Honduras and El Salvador (Cuarón *et al.* 2008). The population density of *A. g. vellerosus* is between 2.9 individuals/km² – 9.3 individuals/km² at Montes Azules Biosphere Reserve in Marqués Comillas ejido, Chiapas, Mexico (Chaves *et al.* 2011). It also occurs in northern Veracruz, Oaxaca, Tamaulipas, Chiapas, Tabasco, Campeche, Quintana Roo and some other regions on the Yucatan Peninsula (Chaves *et al.* 2011). It occurs in densities of 2-12 individuals/km² (Pozo-Montuy *et al.* 2015). In Guatemala, it is reported at Petén, Alta Verapaz, Baja Verapaz, Izabal, Sololá, Huehuetenango and Quiché (Ponce-Santizo *et al.* 2009). It is reported in El Salvador at Chaguantique Natural Protected Area (NPA), El Tercio, El Nacascolo, Normandía NPA (Usulután Department), and a group was recently rediscovered in Olomega lagoon (San Miguel and La Unión Departments) (Pineda-Peraza *et al.* 2017). Some historical records were made in Montecristo, Cerro el Mono y Conchagua (Rodríguez-Menjívar 2007). *A. g. vellerosus* is threatened by forest fires, the pet trade, habitat fragmentation due to farming activities such as palm oil plantations, and road construction (McGrath 2014). Some conservation activities to protect this taxon include environmental education, and setting up canopy bridges to facilitate canopy connection and reduce the number of animals killed on the roads. These activities have been implemented by the Mexican Primates Regional Monitoring System led by the project Conservación de la Biodiversidad del Usumacinta A.C. since 2013 (Pozo-Montuy *et al.* 2015). The Maya Biosphere Reserve (MBR) in the north of Guatemala, with 2.2 million ha, constitutes the largest and most important habitat for the subspecies (68.6% is its original forests). Conservation actions are maintained by several organizations with the aim to preserve this important forest block in Guatemala (Ponce-Santizo *et al.* 2009).

OTHER SPECIES CONSIDERED

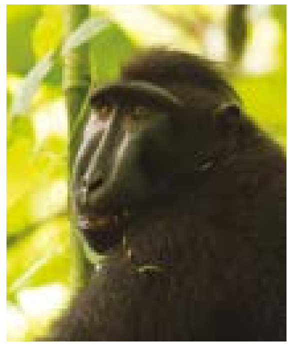


AFRICA GRAUER'S GORILLA

Gorilla beringei graueri Matschie, 1914
(2010, 2012, 2014, 2016)

Stuart Nixon

The Critically Endangered Grauer's gorilla is endemic to the eastern Democratic Republic of Congo (DRC) and distributed discontinuously throughout the forests east of the Lualaba River to the western Albertine Rift escarpment. Long-term insecurity since 1996 has had a devastating effect on their populations. Surveys completed in 2015 identified a catastrophic decline of 77% in just a single generation since the 1990s (Plumptre *et al.* 2016a, 2016b) primarily due to illegal hunting. Today, an estimated 3,800 Grauer's gorillas remain across their 19,700 km^2 range. However, bushmeat hunting remains the single largest threat to Grauer's gorilla, followed by habitat loss, disease such as ebola, and the unmitigated effects of global climate change. Targeted conservation action in priority sites will be vital to slow the further demise of this subspecies.

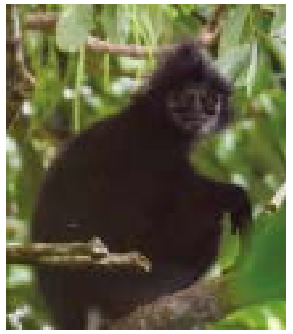


ASIA CRESTED MACAQUE

Macaca nigra Desmarest, 1822
(2016)

Caspian L. Johnson, Rivo Rahasia, Wulan Pusparini, Iwan Hunowu, Alfons Patandung, Andrew E. Bowkett, Harry Hilser & Daphne Kerhoas

Macaca nigra is the only Critically Endangered species of Sulawesi's seven endemic macaques (Fooden 1969). A forest-dwelling macaque, *M. nigra* is endemic to the northern peninsula of Sulawesi from the tip to the Onggak-Dumoga River, where it meets the boundary with *M. nigrescens* (Johnson *et al.* 2019). Dominant threats to the species include hunting and habitat loss, caused by agricultural expansion, human-induced fires (for cattle grazing) and illegal logging. Between 2001 and 2017, 9% of tree cover was lost in the species' range (Hansen *et al.* 2013). Continued habitat loss outside protected areas is therefore expected to have severe implications for the species if left unchecked. Confounding this is the fragmentation of remaining habitat. *Macaca nigra* is being hunted at a potentially unsustainable rate.

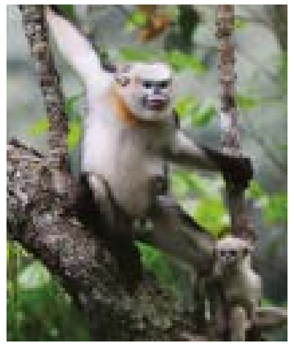


ASIA BORNEAN BANDED LANGUR

Presbytis chrysomelas Müller, 1838
(2018)

Andie Ang, Erik Meijaard, Vincent Nijman & Noel Rowe

The Bornean banded langur (*Presbytis chrysomelas*) is a Critically Endangered primate endemic to the northwestern corner of Borneo (Nijman *et al.* 2008). Two subspecies are recognised: *P. c. chrysomelas* and *P. c. cruciger*. In the past it could be found in protected areas such as Tanjung Datu National Park, Similajau National Park, Maludam National Park, Niah National Park, Lanjak-Entimau Wildlife Sanctuary and Samunsam Wildlife Sanctuary, which are all in Sarawak and Danau Sentarum Wildlife Sanctuary in West Kalimantan (Groves *et al.* 2013; Phillipps and Phillipps 2018). However, the most recent records of their occurrence in several of these parks date back more than a decade. While Nijman *et al.* (2008) conservatively estimated that 200-500 individuals remained, more recent research suggested this might have been an underestimate. However, habitat is declining, partially because of cash crop plantations and forest fires.



ASIA TONKIN SNUB-NOSED MONKEY

Rhinopithecus avunculus Dollman, 1912
(2000, 2002, 2004, 2006, 2008, 2010, 2012, 2014, 2016)

Tilo Nadler

The Tonkin snub-nosed monkey, *Rhinopithecus avunculus,* is a Critically Endangered species endemic to Vietnam, confined to a few areas of the far northwest (Nadler and Brockman 2014). Its distribution has been drastically reduced in recent decades due to massive deforestation and intensive hunting. As a result, the population has become severely fragmented (Nadler *et al.* 2003; Nadler and Brockman 2014). The species was thought to be extinct until its rediscovery near the town of Na Hang, Tuyen Quang Province in 1989. Conservation activities there were unsuccessful and it is likely now extirpated. A population of 20 to 40 individuals was estimated for Cham Chu Nature Reserve, Tuyen Quang Province, but subsequent surveys provided no sightings. In 2001, a population was discovered in Khau Ca, close to Du Gia Nature Reserve, Ha Giang Province. A census in 2015 confirmed 125–130 individuals. Subsequently the area was declared as Tonkin snub-nosed monkey Species/Habitat Conservation Area. It is the only population which is not immediately threatened. In 2007, a population of about 20 Tonkin snub-nosed monkeys was discovered in Tung Vai, Ha Giang Province, close to the border with China. This population is threatened through hunting and habitat loss (Le and Covert 2010). The total population of the Tonkin snub-nosed monkey is currently believed to be fewer than 250 individuals (Xuan *et al.* 2008).

ASIA SIAU ISLAND TARSIER

Tarsius tumpara Shekelle *et al.*, 2008
(2006, 2008, 2010)

Myron Shekelle & Agus Salim

The Siau Island tarsier (*Tarsius tumpara*) is Critically Endangered and first attracted the notice of the scientific community when it was added to the list of the 25 Most Endangered Primates in 2006, on which it remained until 2012 (Shekelle and Salim 2011). The main threats to *T. tumpara* are its very restricted range, limited remaining habitat in its range, and hunting. The species is known only from Siau Island, Sulawesi, Indonesia (116 km^2), on which Mt. Karengetang, a highly active volcano, comprises 55% of the land. Satellite imagery and field surveys indicate that no primary forest remains on the island and that secondary forest might make up as little as 17%. The island lacks protected areas, other than some green areas set aside as water catchments. Most alarmingly, tarsiers are regularly eaten as a snack food, with as many as 10 individuals consumed at one sitting (Shekelle and Salim 2009). It is possible that *T. tumpara* exists on other islands nearby to Siau, which would bring its total extent of occurrence to 125 km^2 (Shekelle and Salim 2009). *Badan Pusat Statistik Kabupaten Kepulauan Sangihe* (2018) reports the total population for the islands of Siao, Tagulandang, and Biaro in 2017 as 65,976. We expect about 66% (or 43,500) to be from Siau.

APPENDIX

Table 1. The World's 25 Most Endangered Primates: 2018–2020.

MADAGASCAR		
Microcebus manitatra	Bemanasy mouse lemur	Madagascar
Hapalemur alaotrensis	Lake Alaotra gentle lemur	Madagascar
Lepilemur jamesorum	James' sportive lemur	Madagascar
Indri indri	Indri	Madagascar
Daubentonia madagascariensis	Aye-aye	Madagascar
AFRICA		
Paragalago rondoensis	Rondo dwarf galago	Tanzania
Cercopithecus roloway	Roloway monkey	Côte d'Ivoire, Ghana
Rungwecebus kipunji	Kipunji	Tanzania
Colobus vellerosus	White-thighed colobus	Côte d'Ivoire, Ghana, Togo, Benin, possibly Nigeria
Piliocolobus epieni	Niger Delta red colobus	Nigeria
Piliocolobus rufomitratus	Tana River red colobus	Kenya
Pan troglodytes verus	Western chimpanzee	Côte d'Ivoire, Ghana, Guinea-Bissau, Liberia, Mali, Republic of Guinea, Senegal, Sierra Leone
ASIA		
Nycticebus javanicus	Javan slow loris	Indonesia
Simias concolor	Pig-tailed snub-nose langur	Indonesia
Trachypithecus poliocephalus	Golden-headed langur or Cat Ba langur	Vietnam
Trachypithecus geei	Golden langur	India, Bhutan
Semnopithecus vetulus	Purple-faced langur	Sri Lanka
Hoolock tianxing	Skywalker hoolock gibbon	China, Myanmar
Pongo tapanuliensis	Tapanuli orangutan	Indonesia
NEOTROPICS		
Callithrix aurita	Buffy-tufted-ear marmoset	Brazil
Saguinus bicolor	Pied tamarin	Brazil
Cebus aequatorialis	Ecuadorian white-fronted capuchin	Ecuador, Peru
Plecturocebus olallae	Olalla Brothers' titi monkey	Bolivia
Alouatta guariba	Brown howler monkey	Brazil, Argentina
Ateles geoffroyi	Central American spider monkey	Mexico, Guatemala, Nicaragua, Honduras, El Salvador, Costa Rica, Panama

Table 2. Primate species included on the 2016–2018 list that were removed from the 2018–2020 list.

MADAGASCAR		
Lemur catta	Ring-tailed lemur	Madagascar
Microcebus gerpi	Gerp's mouse lemur	Madagascar
Propithecus perrieri	Perrier's sifaka	Madagascar
AFRICA		
Paragalago orinus	Mountain galago	Tanzania
Gorilla beringei graueri	Grauer's gorilla	Democratic Republic of Congo
ASIA		
Macaca nigra	Crested macaque	Indonesia
Nomascus hainanus	Hainan gibbon	China
Pongo pygmaeus	Bornean orangutan	Indonesia
Rhinopithecus avunculus	Tonkin snub-nosed monkey	Vietnam
NEOTROPICS		
Ateles fusciceps	Brown-headed spider monkey	Ecuador, Colombia, Panama
Cebus kaapori	Ka'apor capuchin	Brazil
Plecturocebus caquetensis	Caquetá titi monkey	Colombia

Table 3. Primate species that were added to the 2018–2020 list. The Rondo dwarf galago, kipunji, Tana River red colobus and indri were added to the list after previously being removed. The other eight species are new to the list.

MADAGASCAR		
Microcebus manitatra	Bemanasy mouse lemur	Madagascar
Indri indri	Indri	Madagascar
AFRICA		
Paragalago rondoensis	Rondo dwarf galago	Tanzania
Rungwecebus kipunji	Kipunji	Tanzania
Piliocolobus rufomitratus	Tana River red colobus	Kenya
Pan troglodytes verus	Western chimpanzee	Côte d'Ivoire, Ghana, Guinea-Bissau, Liberia, Mali, Republic of Guinea, Senegal, Sierra Leone
ASIA		
Hoolock tianxing	Gaoligong hoolock gibbon	China, Myanmar
Pongo tapanuliensis	Tapanuli orangutan	Indonesia
NEOTROPICS		
Callithrix aurita	Buffy-tufted-ear marmoset	Brazil
Saguinus bicolor	Pied tamarin	Brazil
Cebus aequatorialis	Ecuadorian white-fronted capuchin	Ecuador, Peru
Plecturocebus olallae	Olalla Brothers' titi monkey	Bolivia

REFERENCES

MADAGASCAR

BEMANASY MOUSE LEMUR

Andrianarimisa, A., V. Andrianjakarivelo, Z. Rakotomalala and M. Anjeriniaina. 2009. Vertebres terrestres des fragments forestiers de la Montagne d'Ambatotsirongorongo, site dans le Systeme des Aires Protegees de Madagascar de la Region Anosy, Tolagnaro. *Malagasy Nature* 2: 30–51.

Andrianjaka, R. J. N. and A. Hapke. 2015. Population Size and Distribution of the Lavasoa Dwarf Lemur (*Cheirogaleus lavasoensis*) Within its Entire Range in the Lavasoa-Ambatotsirongorongo Mountains, Southern Madagascar, Region Anosy. Unpublished report for the Primate Action Fund.

Donque, G. 1972. The climatology of Madagascar. In: *Biogeography and Ecology in Madagascar*, R. Battistini and G. Richard-Vindard (eds.), pp. 87–144. Springer, Dordrecht, Netherlands.

Foiben-Taosarintanin'i Madagasikara. 1979. *Ranopiso, Feuille M-62, Carte Topographique au 100000*. Institut National de Geodesie et Cartographie, Antananarivo, Madagascar.

Hapke, A., T. B. Andrianaivo, M. Gligor and E. Razafimahatratra. 2012. Range shifts of mouse lemurs in south-eastern Madagascar: evidence from mitochondrial genetic data. In: *Leaping ahead*, J. Masters, M. Gamba and F. Génin (eds.), pp. 71–77. Springer, New York, USA.

Hotaling, S., M. E. Foley, N. M. Lawrence, J. Bocanegra, M. B. Blanco, R. Rasoloarison, P. M. Kappeler, M. A. Barrett, A. D. Yoder and D. W. Weisrock. 2016. Species discovery and validation in a cryptic radiation of endangered primates: coalescent-based species delimitation in Madagascar's mouse lemurs. *Molecular Ecology* 25 (9): 2029–2045.

Ramanamanjato, J. B., P. B. McIntyre and R. A. Nussbaum. 2002. Reptile, amphibian, and lemur diversity of the Malahelo Forest, a biogeographical transition zone in southeastern Madagascar. *Biodiversity and Conservation* 11: 1791–1807.

Schwitzer, C., R. A. Mittermeier, A. B. Rylands, F. Chiozza, E. A. Williamson, J. Wallis and A. Cotton. 2015. *Primates in Peril: The World's 25 Most Endangered Primates 2014–2016*. IUCN SSC Primate Specialist Group (PSG), International Primatological Society (IPS), Conservation International (CI), and Bristol Zoological Society, Arlington, USA.

Weisrock, D. W., R. M. Rasoloarison, I. Fiorentino, J. M. Ralison, S. M. Goodman, P. M. Kappeler and A. D. Yoder. 2010. Delimiting species without nuclear monophyly in Madagascar's mouse lemurs. *PLoS One* 5 (3): e9883.

LAKE ALAOTRA GENTLE LEMUR

Andrianandrasana, T. H. 2002. Etude de la Régénération du Marais d'Alaotra, Habitat Naturel du Hapalemur Griseus Alaotrensis. Rapport Interne. DWCT Madagascar Programme.

Andrianandrasana,T. H., J. Randriamahefasoa, J. Durbin, R. E. Lewis and J. H. Ratsimbazafy. 2005. Participatory ecological monitoring of the Alaotra wetlands in Madagascar. *Biodiversity and Conservation* 14: 2757–2774.

Andrianandrasana, T. H. 2009. Développement de Systèmes de Télédétection en Vue d'Améliorer le Suivi de l'Habitat et des Feux de Marais au Lac Alaotra. Mémoire de Diplôme d'Etudes Approfondies. ESSA-Forêts, Université d'Antananarivo, Madagascar.

Andrianandrasana, T. H. 2017. Testing the Effectiveness of Community-Based Conservation in Conserving Biodiversity, Protecting Ecosystem Services, and Improving Human Well-Being in Madagascar. PhD Thesis, University of Oxford, Oxford, UK.

Copsey, J. A., J. P. G. Jones, H. Andrianandrasana, L. H. Rajaonarison and J. E. Fa. 2009a. Burning to fish: local explanations for wetland burning in Lac Alaotra, Madagascar. *Oryx* 43: 403–406.

Copsey, J. A., L. H. Rajaonarison, R. Ranriamihamina and L. J. Rakotoniaina. 2009b. Voices from the marsh: livelihood concerns of fishers and rice cultivators in the Alaotra wetland. *Madagascar Conservation & Development* 4: 25–30.

Guillera-Arroita, G., J. J. Lahoz-Monfort, E. J. Milner-Gulland, R. P. Young and E. Nicholson. 2010. Monitoring and conservation of the Critically Endangered Alaotran gentle lemur *Hapalemur alaotrensis*. *Madagascar Conservation and Development* 5: 103–109.

Maminirina, C. P., P. Girod and P. O. Waeber. 2006. Comic strips as environmental educative tools for the Alaotra Region. *Madagascar Conservation and Development* 1 (1): 11–14.

Mutschler, T. 1999. Folivory in a small-bodied lemur. In: *New Directions in Lemur Studies*, B. Rakotosamimanana, H. Rasamimanana, J. Ganzhorn and S. M. Goodman (eds.), pp. 221–239. Kluwer Academic/ Plenum Publishers, New York, USA.

Mutschler, T. and A. T. C. Feistner. 1995. Conservation status and distribution of the Alaotran gentle lemur *Hapalemur griseus alaotrensis*. *Oryx* 29: 267–274.

Nievergelt, C. M., T. Mutschler and A. T. C. Feistner. 1998. Group encounters and territoriality in wild Alaotran gentle lemurs (*Hapalemur griseus alaotrensis*). *American Journal of Primatology* 46: 251–258.

Ralainasolo, F. B., P. O. Waeber, J. Ratsimbazafy, J. Durbin and R. Lewis. 2006. The Alaotra gentle lemur: population estimation and subsequent implications. *Madagascar Conservation and Development* 1: 9–10.

Ratsimbazafy, J. R., F. B. Ralainasolo, A. Rendigs, J. Mantilla Contreras, H. Andrianandrasana, A. R. Mandimbihasina, C. M. Nievergelt, R. Lewis and P. O. Waeber. 2013. Gone in a puff of smoke? *Hapalemur alaotrensis* at great risk of extinction. *Lemur News* 17: 14–18.

Raveloarimalala, L. M. and L. M. Reibelt. 2016. Update on management of Park Bandro and population numbers of *Hapalemur alaotrensis. Lemur News* 20: 2.

Reibelt L. M., Ratsimbazafy J., Waeber P. O. 2017a. Lac Alaotra bamboo lemur *Hapalemur alaotrensis* (Rumpler, 1975). In: *Primates in Peril: The World's 25 Most Endangered Primates 2016–2018*, C. Schwitzer, R. A. Mittermeier, A. B. Rylands, F. Chiozza, E. A. Williamson, E. J. Macfie, J. Wallis and A. Cotton (eds.), pp. 32–34. IUCN SSC PSG, IPS, CI and BZS, Arlington, USA.

Reibelt, L. M., L. Woolaver, G. Moser, I. H. Randriamalala, L. M. Raveloarimalala, F. B. Ralainasolo, J. Ratsimbazafy and P. O. Waeber. 2017b. Contact matters: Local people's perceptions of *Hapalemur alaotrensis* and implications for conservation. *International Journal of Primatology* 38 (3): 588–608.

Reibelt, L. M., G. Moser, A. Dray, I. H. Randriamalala, J. Chamagne, B. Ramamonjisoa, L. G. Barrios, C. Garcia and P. O. Waeber. 2017c. Tool development to understand rural resource users' land use and impacts on land type changes in Madagascar. *Madagascar Conservation and Development* 12 (2): 1–10.

Reibelt, L. M., N. Stoudmann and P. O. Waeber. 2018a. A role-playing game to learn and exchange about real-life issues. In: *Learn2Change – Transforming the world through education*, R. Hembrom, T. Holthoff, G. Janecki, S. Laustroer, M. Rolle, L. Zulu (eds.), pp. 163–171. Verein Niedersächsischer Bildungsinitiativen, Hannover, Germany.

Reibelt, L. M., N. Stoudmann and P. O. Waeber. 2018b. Behandlung realer Problemstellungen mithilfe von Rollenspielen. In: *Learn2Change – Die Welt durch Bildung verändern*, R. Hembrom, T. Holthoff, G. Janecki, S. Laustroer, M. Rolle, L. Zulu (eds.), pp. 173–183. Verein Niedersächsischer Bildungsinitiativen, Hannover, Germany.

Reibelt, L. M. and P. O.Waeber. 2018. Approaching human dimensions in lemur conservation at Lake Alaotra, Madagascar. *InTech Open* 4: 45–66.

Rendigs, A., L. M. Reibelt, F. B. Ralainasolo, J. H. Ratsimbazafy and P. O. Waeber. 2015. Ten years into the marshes – *Hapalemur alaotrensis* conservation, one step forward and two steps back? *Madagascar Conservation and Development* 10: 13–20.

Richter, T., A. Rendigs and C. P. Maminirina. 2015. Conservation messages in speech bubbles – evaluation of an environmental education comic distributed in elementary schools in Madagascar. *Sustainability* 7 (7): 8855–8880.

Stoudmann, N., P. O. Waeber, I. H. Randriamalala and C. Garcia. 2017. Perception of change: narratives and strategies of farmers in Madagascar. *Journal of Rural Studies* 56: 76–86.

Waeber, P. O., J. H. Ratsimbazafy, H. Andrianandrasana, F. B. Ralainasolo and C. M. Nievergelt. 2017a. *Hapalemur alaotrensis*, a conservation case study from the swamps of Alaotra, Madagascar. In: *Primates in Flooded Habitats: Ecology and Conservation*, A. A. Barnett, I. Matsuda and K. Nowak (eds.) in press. Cambridge University.

Waeber, P. O., L. M. Reibelt, I. H. Randriamalala, G. Moser, L. M. Raveloarimalala, F. B. Ralainasolo, J. Ratsimbazafy and L. Woolaver. 2017b. Local awareness and perceptions: consequences for conservation of marsh habitat at Lake Alaotra for one of the world's rarest lemurs. *Oryx* 54 (4): 677–686.

JAMES' SPORTIVE LEMUR

Andriaholinirina, N., A. Baden, M. Blanco, L. Chikhi, A. Cooke, N. Davies, R. Dolch, G. Donati, J. Ganzhorn, C. Golden, L. F. Groeneveld, A. Hapke, M. Irwin, S. Johnson, P. Kappeler, T. King, R. Lewis, E. E. Louis, M. Markolf, V. Mass, R. A. Mittermeier, R. Nichols, E. Patel, C. J. Rabarivola, B. Raharivololona, S. Rajaobelina, G. Rakotoarisoa, B. Rakotomanga, J. Rakotonanahary, H. Rakotondrainibe, G. Rakotondratsimba, M. Rakotondratsimba, L. Rakotonirina, F. B. Ralainasolo, J. Ralison, T. Ramahaleo, J. F. Ranaivoarisoa, S. I. Randrianahaleo, B. Randrianambinina, L. Randrianarimanana, H. Randrianasolo, G. Randriatahina, H. Rasamimananana, T. Rasolofoharivelo, S. Rasoloharijaona, F. Ratelolahy, J. Ratsimbazafy, N. Ratsimbazafy, H. Razafindraibe, J. Razafindramanana, N. Rowe, J. Salmona, M. Seiler, S. Volampeno, P. Wright, J. Youssouf, J. Zaonarivelo and A. Zaramod. 2014. *Lepilemur jamesorum*. The IUCN Red list of Threatened Species 2014. http://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T136491A16123150.en.

Andriaholinirina, N., C. Rabarivola, A. Zaramody, C. Roos, D. Zinner, J-L. Fausser, M. Hauwy, and Y. Rumpler. 2006. Cytogenetic and molecular characterization of the newly described sportive lemur *Lepilemur jamesi* (Louis *et al*. 2006). *Primate Report* 74: 24–33.

Ganzhorn, J. U. 1993. Flexibility and constraints of *Lepilemur* ecology. In: *Lemur social systems and their ecological basis*, P. M. Kappeler and J. U. Ganzhorn (eds.), pp. 153–165. Springer, New York, USA.

Louis Jr., E. E., S. Engberg, R. Lei, H. Geng, J. Sommer, R. Randriamampionona, J. Randriamanana, J. Zaonarivelo, R. Andriantompohavana, G. Randria, B. Prosper, B. Ramaromilanto, G. Rakotoarisoa, A. Rooney and R. Brenneman. 2006. Molecular and morphological analyses of the sportive lemurs (family Megalapidae: genus *Lepilemur*) reveals 11 unrecognised species. *Special Publications of the Museum of Texas Tech University* 49: 1–49.

Mittermeier, R. A., E. E. Louis Jr., M. Richardson, C. Schwitzer, O. Langrand, A. B. Rylands, F. Hawkins, S. Rajaobelina, J. Ratsimbazafy, R. Rasoloarison, C. Roos, P. M. Kappeler and J. Mackinnon. 2010. *Lemurs of Madagascar*, 3rd Edition. Conservation International Tropical Field Guide Series, Washington, USA.

INDRI

Bonadonna, G., V. Torti, R. M. Randrianarison, N. Martinet, M. Gamba and C. Giacoma (2014). Behavioral correlates of extra-pair copulation in *Indri indri*. *Primates* 55 (1): 119–123.

Bonadonna, G., V. Torti, V. Sorrentino, R. M. Randrianarison, M. Zaccagno, M. Gamba, C. L. Tan and C. Giacoma. 2017. Territory exclusivity and intergroup encounters in *Indri indri* upon methodological tuning. *The European Zoological Journal* 84 (1): 238–251.

Brenneman, R., A. McLain, J. Taylor, J. Zaonarivelo, R. Lei, S. McGuire *et al*. 2016. Genetic analysis of the indri reveals no evidence of distinct subspecies. *International Journal of Primatology* 37 (3): 460–477.

Gamba, M., L. Favaro, V. Torti, V. Sorrentino and C. Giacoma. 2011. Vocal tract flexibility and variation in the vocal output in wild indris. *Bioacoustics* 20: 251–266.

Gamba, M., V. Torti, V. Estienne, R. M. Randrianarison, D. Valente, P. Rovara, G. Bonadonna, O. Friard and C. Giacoma. 2016a. The indris have got rhythm! Timing and pitch variation of a primate song examined between sexes and age classes. *Frontiers in Neuroscience* 10: 249.

Gamba, M., V. Torti, G. Bonadonna, R. M. Randrianarison, O. Friard and C. Giacoma. 2016b. Melody in my head, melody in my genes? Acoustic similarity, individuality, and genetic relatedness in the indris of Eastern Madagascar. *The Journal of the Acoustical Society of America* 140 (4): 3017–3018.

GERP. 2017. GERP Annual Report 2017. Unpublished.

Giacoma, C., V. Sorrentino, C. Rabarivola and M. Gamba. 2010. Sex Differences in the Song of *Indri indri*. *International Journal of Primatology* 31 (4): 539–551.

Glessner, K. D. G. and A. Britt. 2005. Population density and home range size of *Indri indri* in a protected low altitude rain forest. *International Journal of Primatology* 26 (4): 855–872.

Golden, C. D. 2009. Bushmeat hunting and use in the Makira Forest, north-eastern Madagascar: a conservation and livelihoods issue. *Oryx* 43 (03): 386.

Goodman, S. M. and J. U. Ganzhorn. 2004. Biogeography of lemurs in the humid forests of Madagascar: the role of elevational distribution and rivers. *Journal of Biogeography* 31 (1): 47–55.

Groves, C. 2001. *Primate Taxonomy*. Smithsonian Institution Press, Washington, DC, USA.

Jenkins, R. K. B., A. Keane, A. R. Rakotoarivelo, V. Rakotomboavonjy, F. H. Randrianandrianina, H J. Razafimanahaka *et al*. 2011. Analysis of patterns of bushmeat consumption reveals extensive exploitation of protected species in eastern Madagascar. *PLoS ONE* 6 (12): e27570.

Junge, R. E., M. A. Barrett and A. D. Yoder. 2011. Effects of anthropogenic disturbance on indri (*Indri indri*) health in Madagascar. *American Journal of Primatology* 73 (7): 632–642.

Kappeler, P. 1997. Determinants of primate social organization: comparative evidence and new insights from Malagasy lemurs. *Biological Reviews of the Cambridge Philosophical Society* 72 (1): 111-151.

Mittermeier, R. A., J. U. Ganzhorn, W. R. Konstant, K. Glander, I. Tattersall, C. P. Groves *et al*. 2008. Lemur Diversity in Madagascar. *International Journal of Primatology* 29 (6): 1607–1656.

Nunziata, S. O., P. Wallenhorst, M. A. Barrett, R. E. Junge, A. D. Yoder, and D. W. Weisrock. 2016. Population and conservation genetics in an Endangered lemur, *Indri indri*, across three forest reserves in Madagascar. *International Journal of Primatology* 37 (6): 688–702.

Pollock, J. I. 1979. Female dominance in *Indri indri*. *Folia Primatologica* 31 (1–2): 143–164.

Powzyk, J. A. and C. B. Mowry. 2003. Dietary and feeding differences between sympatric *Propithecus diadema diadema* and *Indri indri*. *International Journal of Primatology* 24 (6): 1143–1162.

Randrianarison, R., A. Rajaonson, J. Ralison, Z. Rabemananjara, T. Andrianantenaina, J. Rabearison and J. Ratsimbazafy. 2015. Local socio-economic effects of protected area conservation: The case of Maromizaha forest, Madagascar. *Madagascar Conservation & Development* 10 (2): 93-97.

Randrianarison, R. M., C. L. Tan, J. Randrianasy, M. A. Rakotozafy, N. J. Rarojoson, J. Ratsimbazafy, C. Giacoma, H. Andriamialison, V. Torti and G. Bonadonna. 2016. Geophagy and geochemistry of soil eaten by free-ranging indris in Maromizaha protected area, Madagascar. In: *Abstract Booklets from the 26th International Primatological Society Congress*. Chicago, USA, 21–27 August 2016.

Randrianarison, R. M., C. L. Tan, J. Ratsimbazafy, J. Randrianasy, H. Rabarison, G. Bonadonna, D. Valente, C. De Gregorio, L. Miarestoa, M. Gamba and C. Giacoma. 2018. Phytochemical screening of leaves and fruits consumed by *Indri indri* in Maromizaha Protected Area, Madagascar. In: *Abstract Booklets from the 27th International Primatological Society Congress*. Nairobi, Kenya, 19–25 August 2018.

Schüßler, D., U. Radespiel, J. H. Ratsimbazafy and J. Mantilla-Contreras. 2018. Lemurs in a dying forest: Factors influencing lemur diversity and distribution in forest remnants of north-eastern Madagascar. *Biological Conservation* 228: 17–26.

Thalmann, U., T. Geissmann, A. Simona and T. Mutschler. 1993. The indris of Anjanaharibe-Sud, northeastern Madagascar. *International Journal of Primatology* 14 (3): 357–381.

Torti, V., M. Gamba, Z. H. Rabemananjara and C. Giacoma. 2013. The song of the indris: contextual variation in the long distance calls of a lemur. *Italian Journal of Zoology* 80 (4): 596–607.

Torti, V., G. Bonadonna., C. De Gregorio, D. Valente, R. M. Randrianarison, O. Friard, L. Pozzi, M. Gamba and C. Giacoma. 2017. An intra-population analysis of the indris' song dissimilarity in the light of genetic distance. *Scientific Reports* 7: 10140.

Torti, V., D. Valente, C. De Gregorio, C. Comazzi, L. Miaretsoa, J. Ratsimbazafy, C. Giacoma and M. Gamba. 2018. Call and be counted! Can we reliably estimate the number of callers in the indri's (*Indri indri*) song? *PLoS ONE* 13 (8): e0201664.

AYE-AYE

Ancrenaz, M., I. Lackman-Ancrenaz and N. Mundy. 1994. Field observations of aye-ayes (*Daubentonia madagascariensis*) in Madagascar. *Folia Primatologica* 62: 22–36.

Andriamasimanana, M. 1994. Ecoethological study of free-ranging aye-ayes (*Daubentonia madagascariensis*) in Madagascar. *Folia Primatologica* 62: 37–45.

Aylward, M., S. Johnson, A. Sullivan, G. Perry, and E. Louis. 2018. A novel environmental DNA (eDNA) sampling method for aye-ayes from their feeding traces. *bioRxiv*, 272153.

Barrickman, N. L. and M. J. Lin. 2010. Encephalization, expensive tissues, and energetics: an examination of the relative costs of brain size in strepsirrhines. *American Journal of Physical Anthropology* 143: 579–590.

Catlett, K. K., G. T. Schwartz, L. R. Godfrey and W. L. Jungers. 2010. "Life History Space": a multivariate analysis of life history variation in extant and extinct Malagasy lemurs. *American Journal of Physical Anthropology* 142: 391–404.

Feistner, A. T. C. and E. J. Sterling. 1995. Body mass and sexual dimorphism in the aye-aye *Daubentonia madagascariensis*. *Dodo* 31: 73–76.

Ganzhorn, J. and J. Rabesoa. 1986. The aye-aye (*Daubentonia madagascariensis*) found in the eastern rainforest of Madagascar. *Folia Primatologica* 46 (3): 125–126.

Glander, K. E. 1994. Morphometrics and growth in captive aye-ayes (*Daubentonia madagascariensis*). *Folia Primatologica* 62: 108–114.

Iwano, T. and C. Iwakawa. 1988. Feeding behaviour of the aye-aye (*Daubentonia madagascariensis*) on nuts of *ramy* (*Canarium madagascariensis*). *Folia Primatologica* 50: 136–142.

Jouffroy, F. K. 1975. Osteology and myology of the lemuriform post cranial skeleton. In: *Lemur Biology*, I. Tattersall and R. W. Sussman (eds.), pp. 149–192. Plenum Press, New York, USA.

Martin, R. D. 1990. *Primate origins and evolution: a phylogenetic reconstruction*. Princeton University Press, Princeton, USA.

REFERENCES

Owen, R. 1863. *Monograph on the aye-aye (Chiromys madagascariensis,* Cuvier). Taylor and Francis, London, UK.

Oxnard, C. E. 1981. The uniqueness of *Daubentonia*. *American Journal of Physical Anthropology* 54: 1–21.

Perry, G. H., D. Reeves, P. Melsted, A. Ratan, W. Miller, K. Michelini, E. E. Louis, Jr., J. K. Pritchard, C. E. Mason and Y. Gilad. 2012. A genome sequence resource for the aye-aye (*Daubentonia madagascariensis*), a nocturnal lemur from Madagascar. *Genome Biological Evolution* 4: 126–135.

Petter, J. J. 1977. The aye-aye. In: *Primate Conservation*, P. Rainier III and G. H. Bourne (eds.), pp. 37–57. Academic Press, New York, USA.

Petter, J. J. and A. Petter. 1967. The aye-aye of Madagascar. In: *Social Communication among Primates*, S. A. Altmann (ed.), pp. 195–205. University of Chicago Press, Chicago, USA.

Petter, J. J. and A. Peyrieras. 1970. Nouvelle contribution à l'étude d'un lémurien malagache, le aye-aye (*Daubentonia madagascariensis*, E. Geoffroy). *Mammalia* 34: 167–193.

Pollock, J. I., I. D. Constable, R. A. Mittermeier, J. Ratsirarson and H. Simons. 1985. A note on the diet and feeding behavior of the aye-aye *Daubentonia madagascariensis*. *International Journal of Primatology* 6: 435–448.

Rahajanirina, L. P. and L. Dollar. 2004. Confirmation of aye-aye (*Daubentonia madagascariensis*) in the Tsingy de Bemaraha National Park. *Lemur News* 9: 11–12.

Randimbiharinirina, D. R., B. M. Raharivololona, M .T. R. Hawkins, C. L. Frasier, R. Culligan, T. M. Sefczek, R. Randriamampionona, E. E. Louis Jr. 2018. Behavior and ecology of male aye-ayes (*Daubentonia madagascariensis*) in the Kianjavato classified forest, southeastern Madagascar. *Folia Primatologica* 89: 123–137.

Schmid, J. and R. Smolker. 1998. Lemurs of the Reserve Speiale d'Anjanaharibe-Sud, Madagascar. In: *A Floral and Faunal Inventory of the Reserve Speciale d'Anjanaharibe-Sud, Madagascar: With Special Reference to Elevational Variation*, S. M. Goodman (ed.), pp. 227–238. Field Museum Natural History, Chicago, USA.

Simons, E. L. 1993. Discovery of the western aye-aye. *Lemur News* 1: 6.

Simons, E. L. 1995. History, anatomy, subfossil record and management of *Daubentonia madagascariensis*. In: *Creatures of the dark: The nocturnal prosimians*, L. Alterman, G. A. Doyle and M. K. Izard (eds.), pp. 133–140. Plenum Press, New York, USA.

Simons, E. L. and D. Meyers. 2001. Folklore and beliefs about the aye-aye (*Daubentonia madagascariensis*). *Lemur News* 6: 11–16.

Sterling, E. J. 1993. Behavioral ecology of the aye-aye (*Daubentonia madagascariensis*) on Nosy Mangabe, Madagascar. PhD Thesis, Yale University, Connecticut, USA.

AFRICA

RONDO DWARF GALAGO

Ahrends, A. 2005. Pugu Forest: going, going. *The Arc Journal* 17: 23.

Bearder, S. 2008. *Otolemur crassicaudatus*. *The IUCN Red List of Threatened Species 2008*. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T15643A4943752.en.

Bearder, S. K., L. Ambrose, C. Harcourt, P. Honess, A. Perkin, S. Pullen, E. Pimley and N. Svoboda. 2003. Species-typical patterns of infant care, sleeping site use and social cohesion among nocturnal primates in Africa. *Folia Primatologica* 74: 337–354.

Burgess, N. D. and G. P. Clarke. 2000. *Coastal Forests of Eastern Africa*. Report, IUCN – The World Conservation Union, Gland, Switzerland & Cambridge, UK.

Butynski, T. M., S. Bearder and Y. De Jong. 2008a. *Otolemur garnettii*. *The IUCN Red List of Threatened Species 2008*. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T15644A4945217.en.

Butynski, T. M., Y. De Jong, A. S. Perkin, S. Bearder and P. Honess. 2008b. *Galagoides zanzibaricus ssp. zanzibaricus*. *The IUCN Red List of Threatened Species 2008*. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T136924A4350303.en. Accessed 3 June 2019.

Doggart, N. (ed.). 2003. Pande Game Reserve: A Biodiversity Survey. Tanzania Forest Conservation Group, Technical Paper 7. Dar es Salaam, Tanzania.

Honess, P. E. 1996. Speciation among Galagos (Primates, Galagidae) in Tanzanian Forests. PhD Thesis, Oxford Brookes University, Oxford, UK.

Honess, P. E. and S. K. Bearder. 1996. Descriptions of the dwarf galago species of Tanzania. *African Primates* 2: 75–79.

Honess, P., A. Perkin, S. Bearder, T. M. Butynski and Y. De Jong. 2008. *Galagoides granti*. *The IUCN Red List of Threatened Species 2008*. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T40650A10349875.en.

Honess, P. E., A. Perkin, and S. K. Bearder. 2009. Rondo Dwarf Galago *Galagoides rondoensis* (Honess in Kingdon, 1997) Tanzania. In: *Primates in Peril: The World's 25 Most Endangered Primates 2008–2010,* Mittermeier, R. A., Wallis, J., Rylands, A. B., Ganzhorn, J. U., Oates, J. F., Williamson, E. A., Palacios, E., Heymann, E. W., Kierulff, M. C. M., Long Yongcheng, Supriatna, J., Roos, C., Walker, S., Cortés-Ortiz, L. and Schwitzer, C. (eds.), pp. 84. IUCN/SSC Primate Specialist Group (PSG), International Primatological Society (IPS), and Conservation International (CI), Arlington, USA.

Kingdon, J. 1997. *The Kingdon Field Guide to African Mammals*. Academic Press, London, UK.

Perkin, A. 2000. A Field Study of the Conservation Status and Diversity of Galagos in Zaraninge Forest, Coast Region, Tanzania. Report of WWF-Tanzania, Dar-es-Salaam, Tanzania.

Perkin, A. 2003. Mammals. In: *Pande Game Reserve: A Biodiversity Survey*, N. Doggart (ed.) pp. 95. Tanzania Forest Conservation Group, Technical Paper 7. Dar es Salaam, Tanzania.

Perkin, A. 2004. Galagos of the Coastal Forests and Eastern Arc Mtns. of Tanzania—Notes and Records. Tanzania Forest Conservation Group, Technical Paper 8. Dar es Salaam, Tanzania.

Perkin, A. 2007. Comparative penile morphology of East African galagos of the genus *Galagoides* (Family Galagidae): implications for taxonomy. *International Journal of Primatology* 69: 16–26.

Perkin, A., S. K. Bearder and J. Karlsson. In prep. Galago surveys in Rondo, Litipo, Chitoa, Ruawa, Ndimba and Namatimbili forests, Lindi Region, southeastern Tanzania.

Perkin, A., S. Bearder, P. Honess and T. M. Butynski. 2008. *Galagoides rondoensis*. *IUCN Red List of Threatened Species 2008*. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T40652A10350268.en.

Perkin, A., B. Samwel and J. Gwegime. 2011. Going for Gold in the Noto Plateau, SE Tanzania. *Arc Journal* 26, pp. 14 – 16. http://www.tfcg.org/pdf/Arc%20Journal%2026%20FINAL.pdf

Perkin, A.W., P. E. Honess and T. M. Butynski. 2013. Mountain Dwarf Galago *Galagoides orinus*. In: *Mammals of Africa: Volume II: Primates,* T. Butynski, J. Kingdon and J. Kalin (eds.), pp. 452 – 454. Bloomsbury Publishing, London, UK.

ROLOWAY MONKEY

Arcilla, N., L. Holbech and S. O'Donnell. 2015. Severe declines of understory birds follow illegal logging in Upper Guinea forests of Ghana, West Africa. *Biological Conservation* 188: 41–49.

Bitty E. A., S. Gonedelé Bi and W. S. McGraw. 2013. Accelerating deforestation and hunting in protected reserves jeopardize primates in southern Côte d'Ivoire. *American Journal of Physical Anthropology* Suppl. 56: 81–82.

Buzzard, P. J. and A. J. A. Parker. 2012. Surveys from the Subri River Forest Reserve, Ghana. *African Primates* 7: 175–183.

Dempsey, A. 2014. Save our Forest, Save our Future: A Survey of the Tanoe-Ankasa Community Owned Forest for Primate Presence and Illegal Activity, Introducing SMART Technology. MSc Thesis, Oxford Brookes University, Oxford, England.

Gatti, S. 2010. Status of Primate Populations in Protected Areas Targeted Under the Community Forest Biodiversity Project. CFBP Report, West African Primate Conservation and Ghana Wildlife Division/Forestry Commission, Accra, Ghana.

Gonedelé Bi, S. 2015. Report on Primate Surveys of Dassioko Sud and Port Gauthier Forest Reserves in Southern Côte d'Ivoire. Unpublished report.

Gonedelé Bi, S., I. Koné, J-C. K. Béné, A. E. Bitty, B. K. Akpatou, Z. Goné Bi, K. Ouattara and D. A. Koffi. 2008 Tano forest, south-eastern Côte-d'Ivoire identified as a high priority site for the conservation of critically endangered primates in West Africa. *Tropical Conservation Science* 1: 265–278.

Gonedelé Bi, S., I. Koné, A. E. Bitty, J-C. K. Béné, B. Akptatou and D. Zinner. 2012. Distribution and conservation status of catarrhine primates in Côte d'Ivoire (West Africa). *Folia Primatologica* 2012: 11–23.

Gonedelé Bi, S., J-C. K. Béné, A. E. Bitty, A. N'Guessan, A. D. Koffi, B. Akptatou and I. Koné. 2013. Roloway guenon (*Cercopithecus diana roloway*) and white-naped mangabey (*Cercocebus atys lunulatus*) prefer mangrove habitats in Tano Forest, southeastern Ivory Coast. *Ecosystems and Ecogeography* 3: 126.

Gonedelé Bi, S., E. A. Bitty and W. S. McGraw. 2014. Conservation of threatened primates in Dassioko Sud and Port Gauthier forest reserves: use of field patrols to assess primate abundance and illegal human activities. *American Journal of Physical Anthropology* Suppl. 58: 127.

Koné, I., S. Gonedelé Bi, D. Osei, E. Wiafe, A. Dempsey, W. S. McGraw and J. F. Oates. 2019. Cercopithecus roloway. The IUCN Red List of Threatened Species 2019: e.T4232A92384429. http://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T4232A92384429.en

Koné, I. 2015. Community empowerment for the conservation of Critically Endangered primates and their habitat in south-eastern Côte d'Ivoire. *Twenty-Two Stories of Conservation in Africa: Key Elements for Effective and Well-Governed Protected Areas in Sub-Saharan Africa*. IUCN PAPACO.

Koné, I. and K. B. Akpatou. 2005. Recherche en Côte d'Ivoire de trois singes gravement menaces d'extinction. *CEPA Magazine* 12: 11–13.

Lefaux, B. and L. Montjardet. 2016. 7th European Roloway Monkey Studbook (*Cercopithecus roloway*). Mulhouse Zoo, Mulhouse, France.

McGraw, W. S. 2005. Update on the search for Miss Waldron's red colobus monkey (*Procolobus badius waldroni*). *International Journal of Primatology* 26: 605–619.

McGraw, W. S. 1998. Surveys of endangered primates in the forest reserves of eastern Côte d'Ivoire. *African Primates* 3: 22–25.

Oates, J. F. 2006. Primate Conservation in the Forests of Western Ghana: Field Survey Results, 2005–2006. Report to the Wildlife Division, Forestry Commission, Ghana.

Oates, J.F. 2011. *Primates of West Africa: A Field Guide and Natural History*. Conservation International, Arlington, VA, USA.

Osei, D., R. H. Horwich and J. M. Pittman. 2015. First sightings of the roloway monkey (*Cercopithecus diana roloway*) in Ghana in ten years and the status of other endangered primates in southwestern Ghana. *African Primates* 10: 25–40.

Trench, P. 2000. The many faces of community wildlife management in Central and West Africa. In: *Promoting Partnerships: Managing Wildlife Resources in Central and West Africa*, J. Abbott, F. Ananze, N. Barning, P. Burnham, E. Merode, A. Dunn, E. Fuchi, E. Hakizumwami, C. Hesse, R. Mwinyihali, M. Sani, D. Thomas, P. Trench and R. Tshombe. IIED Publications, UK.

WAPCA. 2014. Annual Report. West African Primate Conservation Action, Accra, Ghana.

Wiafe, E. 2013. Status of the Critically Endangered roloway monkey (*Cercopithecus diana roloway*) in the Dadieso Forest Reserve, Ghana. *African Primates* 8: 9–15.

KIPUNJI

Bracebridge, C. E., T. R. B. Davenport and S. J. Marsden. 2011. Can we extend the area of occupancy of the kipunji, a critically endangered African primate? *Animal Conservation* 14: 687–696.

Bracebridge, C. E., T. R.B. Davenport and S. J. Marsden. 2012. The impact of forest disturbance on the seasonal foraging ecology of a critically endangered African primate. *Biotropica* 44 (4): 560–568.

Bracebridge, C. E., T. R. B. Davenport, V. F. Mbofu and S. J. Marsden. 2013. Is there a role for human-dominated landscapes in the long-term conservation management of the Critically Endangered kipunji (*Rungwecebus kipunji*)? *International Journal of Primatology* 34:1122–1136.

Davenport, T. R. B. 2002. Tanzania's new national park to protect orchids. *Oryx* 36 (3): 224.

Davenport, T. R. B. 2005. Finding kipunji. *Africa Geographic* 13 (7): 56–61.

Davenport, T. R. B. 2006. Plants, primates and people. Conservation in the Southern Highlands of Tanzania. *Miombo* 28: 7–8.

Davenport, T. R. B. 2009. What next for Africa's rarest monkey? *Miombo* 33: 12–13.

Davenport, T. R. B. 2013. *Rungwecebus*. In: *The Mammals of Africa. Volume II: Primates,* T. M. Butynski, J. Kingdon and J. Kalina (eds), pp. 212. Bloomsbury Publishing, London, UK.

Davenport, T.R.B. and Jones, T. 2008. *Rungwecebus kipunji*. The IUCN Red List of Threatened Species 2008: e.T136791A4340286. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T136791A4340286.en

Davenport, T. R. B. and B. Bytebier. 2004. Kitulo Plateau. A first park for orchids. *Orchid Review* 112: 160–165.

Davenport, T. R. B., W. T. Stanley, E. J. Sargis, D. W. De Luca, N. E. Mpunga, S. J. Machaga and L. E. Olson. 2006. A new genus of African monkey, *Rungwecebus*: morphology, ecology, and molecular phylogenetics. *Science* 312: 1378–1381.

Davenport, T. R. B., D. W. De Luca, T. Jones, N. E. Mpunga, S. Machaga and G. Picton-Phillipps. 2008. The kipunji *Rungwecebus kipunji* of southern Tanzania: first census and assessments of distribution and conservation status. *Oryx* 42 (3): 352–359.

Davenport, T.R.B., D.W. De Luca, C.E. Bracebridge, S.J. Machaga, N.E. Mpunga, O. Kibure and Y.S. Abeid. 2010. Diet and feeding patterns in the kipunji (*Rungwecebus kipunji*) in Tanzania's Southern Highlands: a first analysis. *Primates* 51 (3): 213–220.

Davenport, T.R.B. and S. Markes. 2018. *Touchwood – The Beauty and Biodiversity of Tanzania's Southern Highlands*. WCS/CEPF, Arusha, Tanzania.

De Luca, D.W., G. P. Phillipps, S. J. Machaga, T. B. B. Davenport. 2010. Home range, core areas and territoriality in the 'Critically Endangered' kipunji (*Rungwecebus kipunji*) in southwest Tanzania. *African Journal of Ecology* 48: 895–904.

Jones, T. P., 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.

Machaga, S. J., A. A. Massawe. and T. R. B. Davenport. 2004. Medicine, meat and mahogany: understanding natural resource use on Mount Rungwe, southwest Tanzania. *Society for Conservation Biology Abstracts* 48: 20.

Marshall, A. R., R. J. R. Lemos de Figueiredo, R. E. Gereau, Y. Abeid, A. Ahrends, T. Jones, J. C. Lovett, C. J. Marshall, T. R. B. Davenport and C. E. Bracebridge. 2015. Evaluating the habitat of the Critically Endangered kipunji. *Journal of East African Natural History* 104(1&2): 169–193.

Olson, L. E., E. J. Sargis, W. T. Stanley, K. P. B. Hildebrandt and T. R. B. Davenport. 2008. Additional molecular evidence strongly supports the distinction between the recently described African primate *Rungwecebus kipunji* (Cercopithecidae, Papionini) and *Lophocebus*. *Molecular Phylogenetics and Evolution* 48: 789–794.

Roberts, T. E., T. R. B. Davenport, K. B. P. Hildebrandt, T. Jones, W. T. Stanley, E. J. Sargis and L. E. Olson. 2009. The biogeography of introgression in the Critically Endangered African monkey *Rungwecebus kipunji*. *Biology Letters* 11 (9): 1–5.

Mwakilema, W. S. and T. R. B. Davenport. 2005. Managing Kitulo – How to protect Tanzania's newest and most unique National Park. Fifth Annual Scientific Conference, Arusha, Tanzania.

WHITE-THIGHED COLOBUS

Akom, E. 2015. Current Status, Distribution and Abundance of the Western Chimpanzee (*Pan troglodytes verus*) and Other Diurnal Primates in the Bia-Goaso Forest Area, Ghana. PhD Thesis, Kwame Nkrumah University of Science and Technology, Ghana.

Bitty, E. A., S. Gonedelé Bi, K. J. C. Bené, K. P. Kouassi and W. S. McGraw. 2015. Cocoa farming and primate extirpation inside Côte d'Ivoire's protected areas. *Tropical Conservation Science* 8 (1): 95–113.

Burton, A. C. 2010. Wildlife Monitoring and Conservation in a West African Protected Area. PhD Thesis, University of California, Berkeley, USA.

Campbell, G., H. Kuehl, P. N'Goran Kouamé and C. Boesch. 2008. Alarming decline of West African chimpanzees in Côte d'Ivoire. *Current Biology* 18 (19): 903–904.

Environmental Justice Atlas. 2018. Atewa Forest bauxite mining, Ghana. Website: https://ejatlas.org/ conflict/atewa-forest-bauxite-mining.

Gatti, S. 2010. Status of Primate Populations in Protected Areas Targeted under the Community Forest Biodiversity Project. CFBP Report, West African Primate Conservation and Ghana Wildlife Division/Forestry Commission, Accra, Ghana.

Ginn, L. P. and K. A. I. Nekaris. 2014. The first survey of the conservation status of primates in southern Burkina Faso, West Africa. *Primate Conservation* 28: 129–138.

Gonedelé Bi, S., A. Bitty, F. Gnangbé, J. Bené, I. Koné and D. Zinner. 2010. Conservation status of Geoffroy's (or pied) colobus monkey (*Colobus vellerosus*) Geoffroy 1834 has dramatically declined in Côte d'Ivoire. *African Primates* 7: 19–26.

Gonedelé Bi, S., J-C. K. Béné, A. E. Bitty, A. N'Guessan, A. D. Koffi, B. Akptatou and I. Koné. 2013. Roloway guenon (*Cercopithecus diana roloway*) and white-naped mangabey (*Cercocebus atys lunulatus*) prefer mangrove habitats in Tanoé Forest, southeastern Ivory Coast. *Ecosystems and Ecogeography* 3: 126.

Gonedelé Bi, S., A. Bitty, K. Ouatara and W. S. McGraw. 2014. Primate surveys in Côte d'Ivoire's Sassandra–Bandama interfluvial region with notes on a remnant population of black-and-white colobus. *African Journal of Ecology* 52 (4): 491–498.

Grubb, P. 1998. *Mammals of Ghana, Sierra Leone and the Gambia*. Trendrine Press, St. Ives, UK.

Happold, D. C. D. 1987. *Mammals of Nigeria*. Clarendon Press, Oxford, UK.

IUCN Standards and Petitions Subcommittee. 2017. *Guidelines for Using the IUCN Red List Categories and Criteria*. Version 13. Prepared by the Standards and Petitions Subcommittee. Website: http://www.iucnredlist.org/documents/RedListGuidelines.pdf.

Kankam, B. O., T. L. Saj and P. Sicotte. 2010. How to measure "success" in community-based conservation projects: the case of the Boabeng-Fiema Monkey Sanctuary in Ghana. In: *The Public Sphere and Politics of Survival: Voice, Sustainability and Public Policy in Ghana,* K. P. Puplampu and W. J. Tettey (eds.), pp. 115–141. Woeli Publishers, Accra, Ghana.

REFERENCES

Kusimi, J. M. 2015. Characterizing land disturbance in Atewa Range Forest Reserve and buffer zone. *Land Use Policy* 49: 471–482.

Matsuda Goodwin, R., J. O. Orimaye, F. E. Okosodo, B. G. Ogunjemite, M. G. Houngbedji and E. Akpla. 2016. The threatened status of the white-thighed colobus (*Colobus vellerosus*) in West Africa needs to be globally upgraded to Endangered. XXVIth Congress of the ASP/IPS 2016 Chicago, 21 - 27 August 2016, Chicago, Illinois, USA. (Abstract).

Matsuda Goodwin, R., S. E. Gonedelé Bi, J. Lapuente, E. D. Wiafe, G. Nobimè, G. H. Ségniagbeto and R. C. Ota. Unpublished. The white-thighed colobus (*Colobus vellerosus*): current status, distribution, and conservation recommendations. To be submitted to *Primate Conservation*.

McGraw, W. S., I. T. Monah and M. Abedi-Lartey. 1998. Survey of endangered primates in the forest reserves of eastern Côte d'Ivoire. *African Primates* 3: 22–25.

McGraw, W. S., J. F. Oates and A. Dempsey. 2017. Roloway Monkey, *Cercopithecus roloway* (Schreber, 1774). In: *Primates in Peril: World's 25 Most Endangered Primates 2016–2018,* C. Schwitzer, R.A. Mittermeier, A.B. Rylands, F. Chiozza, E. A. Williamson, E. J. Macàe, J. Wallis and A. Cotton (eds.), pp. 14–17. IUCN SSC Primate Specialist Group (PSG), International Primatological Society (IPS), Conservation International (CI), and Bristol Zoological Society, Arlington, USA.

Oates, J. F. 2006. Primate Conservation in the Forests of Western Ghana: Field Survey Results, 2005–2006. Report to the Wildlife Division, Forestry Commission, Ghana.

Oates, J. F. 2011. *Primates of West Africa: A Field Guide and Natural History*. Conservation International, Arlington, VA, USA.

Osei, D., R. H. Horwich and J. M. Pittman. 2015. First sightings of the roloway monkey (*Cercopithecus diana roloway*) in Ghana in ten years and the status of other Endangered primates in Southwestern Ghana. *African Primates* 10: 25–40.

Owusu-Ansah, N. 2010. Evaluation of wildlife hunting restrictions on bushmeat trade in five major markets around Digya National Park. Masters of Arts Thesis, University of Cape Coast, Ghana.

Ségniagbeto, G. H., D. Assou, K. D. Koda, E. K. G. Agbessi, K. H. Atsri, D. Dendi, L. Luiselli, J. Decher and R. A. Mittermeier. 2017. Survey of the status and distribution of primates in Togo (West Africa). *Biodiversity* 18 (4): 137–150.

Ségniagbeto, G. H., K. H. Atsri, A. Delagnon, A. K. Elikplim, A. K. Gbetey, G. Amori, D. Dendi, J. Decher and L. Luiselli. 2018. Local distribution and density estimates of primates in the transboundary reserve of the Mono River, Togo (West Africa). *Revue d'Ecologie (Terre et Vie)* 73 (3): 363–374.

WAPCA. 2018. Community Resource Management Area CREMA. Website : http://www.wapca.org/ crema.

Wiafe, E. D. 2013. Status of the critically endangered roloway monkey (*Cercopithecus diana roloway*) in Dadieso Forest Reserve, Ghana. *African Primates* 8: 9–16.

Wiafe, E. D. 2016. Population studies of Lowe's monkey (*Cercopithecus lowei* Thomas, 1923) in Kakum Conservation Area, Ghana. *Journal of Threatened Taxa* 8: 8434–8442.

Wiafe, E. D. 2018. The fate of endangered primates in three Ghana's forest reserves. Presentation at the 27th Congress of the International Primatologial Society, Nairobi, Kenya, Aug. 20, 2018.

Wong, S. N. and P. Sicotte. 2007. Activity budget and ranging patterns of *Colobus vellerosus* in forest fragments in central Ghana. *Folia Primatologica* 78 (4): 245–254.

Wong, S. N., Saj, T. L. and P. Sicotte. 2006. Comparison of habitat quality and diet of *Colobus vellerosus* in forest fragments in Ghana. *Primates* 47 (4): 365–373.

NIGER DELTA RED COLOBUS

Efenakpo, O., H. Ijeomah, and A. I. Ayodele. 2018. *Threat and Conservation of Wildlife Resources in Niger Delta Region of Nigeria*. Proceedings of 2nd Wildlife Society of Nigeria conference, Akure, Nigeria. Available from: https://www.researchgate.net/publication/328542225_Threat_and_Conservation_of_Wildlife_Resources_in_Niger_Delta_Region_of_Nigeria. Accessed 20 May 2019.

Galat-Luong, A., G. Galat, J. F. Oates, T. Struhsaker, S. McGraw and N. Ting. 2016. *Piliocolobus temminckii. The IUCN Red List of Threatened Species 2016.* http://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T18247A92646945.en.

Groves, C. P. 2001. *Primate Taxonomy*. Smithsonian Institution Press, Washington, DC, USA.

Groves, C. P. 2007. The taxonomic diversity of the Colobinae in Africa. *Journal of Anthropological Sciences* 85: 7–34.

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* 248: 67–73.

Grubb, P., T. M. Butynski, J. F. Oates, S. K. Bearder, T. R. Disotell, C. P. Groves and T. T. Struhsaker. 2003. Assessment of the diversity of African primates. *International Journal of Primatology* 24: 1301–1357.

Ikemeh, R. A. 2015. Assessing the population status of the Critically Endangered Niger Delta Red Colobus (*Piliocolobus epieni*). *Primate Conservation* 29: 1–10.

Oates, J. F. 1996. *African Primates: Status Survey and Conservation Action Plan.* Revised edition. IUCN, Gland, Switzerland.

Oates, J. F. and T. Struhsaker. 2008. *Piliocolobus pennantii. The IUCN Red List of Threatened Species 2008.* http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T41025A92653137.en.

Oates, J. F. and T. Struhsaker, T. 2016. *Piliocolobus epieni*. *The IUCN Red List of Threatened Species 2016*. http://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T41024A92655748.en.

Oates, J. F., T. Struhsaker and S. McGraw. 2016a. *Piliocolobus badius. The IUCN Red List of Threatened Species 2016.* http://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T40009A92635756.en.

Oates, J. F., T. Struhsaker, B. Morgan, J. Linder and N. Ting. 2016b. *Piliocolobus preussi. The IUCN Red List of Threatened Species 2016.* http://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T41026A92632162.en.

Oates, J. F., I. Koné, S. McGraw and D. Osei. 2019. *Piliocolobus waldroni*. *The IUCN Red List of Threatened Species* 2019. http://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T18248A92650711.en.

Powell, C. B. 1994. Niger Delta wildlife and biodiversity survey. *Nigerian Field* 59: 87.

Struhsaker, T. T. 2005. The conservation of red colobus and their habitats. *International Journal of Primatology* 26: 525–538.

Ting, N. 2008. Molecular systematics of red colobus monkeys (*Procolobus* [*Piliocolobus*]): understanding the evolution of an endangered primate. PhD Thesis, City University of New York, New York, USA.

Werre, J. L. R. 2009. *The Niger Delta Red Colobus: Ecology and Behavior*. VDM Verlag, Saarbrucken, Germany.

Werre, J. L. R. and C. B. Powell. 1997. The Niger Delta colobus – discovered in 1993 and now in danger of extinction. *Oryx* 31: 7–9.

TANA RIVER RED COLOBUS

Baker, T., J. Kiptala, L. Olaka, N. Oates, A. *Hussain, and M. McCartney. 2015. Baseline review and ecosystem services assessment of the Tana River Basin, Kenya Vol. 165. International Water Management Institute (IWMI) Working Paper.*

Butynski, T. M. 1995. Report says dam could threaten Kenya's endangered primates. *African Primates* 1: 14–17.

Butynski, T. M., Y. A. de Jong. 2019. Primates of Africa's coastal deltas and their conservation. In: *Primates of Flooded Habitats. Ecology and Conservation*. Nowak, K., A. A. Barnett and I. Matsuda (eds.) pp. 244–258. Cambridge University Press, Cambridge, UK.

Butynski, T. M., Y. A. de Jong and J. King. In Press. *Piliocolobus rufomitratus*. *IUCN Red List of Threatened Species.*

Butynski, T. M. and O. Hamerlynck. 2015. Tana River Red Colobus *Piliocolobus rufomitratus* (Peters, 1879) Kenya. In: *Primates in Peril. The World's 25 Most Endangered Primates 2014-2016*. Schwitzer, C., R. A. Mittermeier, A. B. Rylands, F. Chiozza,E. A. Williamson, J. Wallis and A. Cotton (eds.). pp. 20–22. IUCN SSC Primate

Specialist Group (PSG), International Primatological Society (IPS), Conservation International (CI), and Bristol Zoological Society, Arlington, VA.

Butynski, T. M., J. Kingdon and J. Kalina. 2013. *Mammals of Africa. Volume II: Primates.* Bloomsbury Publishing, London, UK.

Butynski, T.M. & Mwangi, G. 1994. *Conservation status and distribution of the Tana River red colobus and crested mangabey.* Unpublished report. Nairobi: Kenya Wildlife Service and Zoo Atlanta.

Butynski, T. M. and G. Mwangi. 1995. Census of Kenya's endangered red colobus and crested mangabey. *African Primates* 1: 8–10.

Christensen, S. H., C. Mitcham, B. Li, and Y. An. 2012. *Engineering, development and philosophy: American, Chinese and European perspectives Vol. 11.* Springer, Netherlands.

Cronin, D. T., J. M. Linder, N. Ting, E. Abwe, W. S. McGraw, J. A. Hart, K. Detwiler, S. Kivai, S. G. Bi, J. F. Oates and T. T. Struhsaker. In press. *Red Colobus Conservation Action Plan: 2019-2021.* IUCN SSC Primate Specialist Group, Washington DC, USA.

De Jong, Y. A. and T. M. Butynski. 2009. Primate Biogeography, Diversity, Taxonomy and Conservation of the Coastal Forests of Kenya. Unpublished Report to the Critical Ecosystem Partnership Fund.

De Jong, Y. A. and T. M. Butynski. 2012. The primates of East Africa: country lists and conservation priorities. *African Primates* 7: 135–155.

Decker, B. S. 1994. Effects of habitat disturbance on the behavioral ecology and demographics of the Tana River red colobus (*Colobus badius rufomitratus*). *International Journal of Primatology* 15: 703–737.

Duvail, S., C. Médard, O. Hamerlynck and D. W. Nyingi. 2012. Land and water 'grabbing' in an East African coastal wetland: the Tana Delta case study. *Water Alternatives* 5: 322–343.

Groves, C. P. 2007. The taxonomic diversity of the Colobinae of Africa. *Journal of Anthropological Sciences* 85: 7–34.

Groves, C. P. and N. Ting. 2013. Tana River red colobus *Piliocolobus rufomitratus*. In: *Handbook of the Mammals of the World. Volume 3. Primates*, R. A. Mittermeier, A. B. Rylands and D. E. Wilson (eds.), pp. 709. Lynx Edicions, Barcelona, Spain.

Grubb, P., T. M. Butynski, J. F. Oates, S. K. Bearder, T. R. Disotell, C. P. Groves and T. T. Struhsaker. 2003. Assessment of the diversity of African primates. *International Journal of Primatology* 24 (6): 1301–1357.

Grubb, P., T. T. Struhsaker, T. T. and K. Siex. 2013. Subgenus *Piliocolobus* Red Colobus Monkeys. In: *Mammals of Africa. Volume II: Primates.* Butynski, T. M., J. Kingdon and J. Kalina (eds.) pp. 125–128. Bloomsbury Publishing, London, UK.

Hamerlynck, O., Q. Luke, T. M. Nyanger, S. Suvail and C. Leauthaud. 2012. Range extension, imminent threats and conservation options for two Endangered primates: the Tana River red colobus *Procolobus rufomitratus rufomitratus* (Peters, 1879) and the Tana River mangabey *Cercocebus galeritus* (Peters, 1879) in the Lower Tana Floodplain and Delta, Kenya. *African Primates* 7: 211–217.

Horta, K. 1994. Troubled waters: World Bank disasters along Kenya's Tana River. Website: http://multinationalmonitor.org/hyper/issues/1994/08/mm0894_08.html. Accessed November 2018.

Karere, G. M., N. O. Oguge, J. Kirathe, P. K. Muoria, N. N. Moinde and M. A. Suleman. 2004. Population sizes and distribution of primates in the lower Tana River forests, Kenya. *International Journal of Primatology 25* (2): 351–365.

Kivai, S. M. 2010. Are the endemic and endangered Tana River primates culprits of crop raiding? Evaluating human–nonhuman primate conflict status around Tana River Primate Reserve, in Kenya. Technical report, submitted to Rufford Small Grants Foundation.

Kivai, S. M. 2018. Effects of Food Nutritional and Mechanical Properties on Foraging of Juvenile in Wild Tana River Mangabeys, *Cercocebus galeritus*, Kenya. PhD Thesis, Rutgers University, New Brunswick, USA.

Kivai, S. M., C. M. Kivasu, J. W. Mukundi, S. Rhova, S. Komora, and S. Wachiuri. 2018. Application of nutrition ecology in conservation of the Critically Endangered Tana River red colobus (*Piliocolobus rufomitratus*). *Abstract presented in 27th International Primatological Society Congress,* Nairobi, Kenya, 19-24 August 2018.

Loyola, L. C. 2015. A Spatio-Temporal Analysis of the Metabolizable Energy Intake of the Tana River Red Colobus (*Procolobus rufomitratus*). PhD Thesis, University of Southern California, Los Angeles, USA.

Maingi, J. K. and S. E. Marsh. 2002. Quantifying hydrologic impacts following dam construction along the Tana River, Kenya. *Journal of Arid Environments* 50: 53–79.

Marsh, C. W. 1978. Ecology and Social Organisation of the Tana River Red Colobus, *Colobus badius ruformitratus*. PhD Thesis, University of Bristol, Bristol, UK.

Marsh, C. W. 1981. Time budget of Tana River red colobus. *Folia Primatologica* 35 (1): 30–50.

Marsh, C. W. 1986. A resurvey of Tana River primates and their habitat. *Primate Conservation* 7: 72–81.

Mbora, D. N. M. and T. M. Butynski. 2009. Tana River red colobus *Procolobus rufomitratus*. In *Primates in Peril: the World's 25 most endangered primates 2008– 2010.* R.A. Mittermeier, J. Wallis, A.B. Rylands, *et al.* (eds). *Primate Conservation* 24: 1– 57.

Mbora, D. N. M. and L. Allen. 2011. The Tana Forests 'People for Conservation and Conservation for People' Initiative (PCCP): Preserving the Habitat of the Tana River Red Colobus (*Procolobus rufomitratus*) and the Tana River Mangabey (*Cercocebus galeritus*) Through Community Conservation and Development in Tana River District, Kenya. Final Report on Phase 1, Mohamed bin Zayed Species Conservation Fund, Abu Dhabi.

Mbora, D. N. M. and D. B. Meikle. 2004. Forest fragmentation and the distribution, abundance and conservation of the Tana River red colobus (*Procolobus rufomitratus*). *Biological Conservation* 118: 67–77.

Moinde-Fockler, N. N., N.O. Oguge, G. M. Karere, D. Otina and M. A. Suleman. 2007. Human and natural impacts on forests along lower Tana River, Kenya: implications towards conservation and management of endemic primate species and their habitat. *Biodiversity and Conservation* 16: 1161–1173.

Mwangasha, J. 2018. British firm to build Kenya's largest water reservoir. *Construction Kenya*. Website: https://www.constructionkenya.com/933/high-grand-falls-dam-kenya/.

Napier P.H. 1985. *Catalogue of Primates in the British Museum (Natural History) and Elsewhere in the Bristish Isles. Part II: Family Cercopithecidae, Subfamily Colobinae*. British Museum (Natural History), London.

Nature Kenya, 2017. Baseline survey of primates in Shetani Mtwari, Onkolde-East and Onkolde-West forest patches in Tana Delta. Unpublished data.

Oates J. F., A. G. Davies, E. Delson. 1994. The diversity of living colobines. In: *Colobine Monkeys Their Ecology, Behaviour and Evolution*, A. G. Davies and J. F. Oates (eds.), pp. 45–73. Cambridge University Press, Cambridge, UK.

Oates J. F. and N. Ting. 2015. Conservation consequences of unstable taxonomies: the case of the red colobus monkeys. *Taxonomic Tapestries*, 321.

Struhsaker, T. T. and P. Grubb. 2013. *Procolobus rufomitratus* Eastern Red Colobus. In: *Mammals of Africa. Volume II: Primates.* Butynski, T. M., J. Kingdon and J. Kalina (eds.) pp 142-147. Bloomsbury Publishing, London, UK.

Ting, N. 2008. Molecular Systematics of Red Colobus Monkeys (*Procolobus [Piliocolobus]*): Understanding the Evolution of an Endangered Primate. PhD Thesis, City University of New York, New York, USA.

Zinner D., G. H. Fickenscher and C. Roos. 2013. Family Cercopithecidae (Old World monkeys). In: *Handbook of the Mammals of the World, Volume 3 Primates*, R. A. Mittermeier, A. B. Rylands and D. E. Wilson (eds.) pp. 550–627. Lynx Edicions, Barcelona, Spain.

WESTERN CHIMPANZEE

Boesch, C., A. K. Kalan, A. Agbor, M. Arandjelovic, P. Dieguez, V. Lapeyre, and H. S. Kühl. 2017. Chimpanzees routinely fish for algae with tools during the dry season in Bakoun, Guinea. *American Journal of Primatology* 79 (3): e22613.

Boesch, C. and H. Boesch-Acherman. 2000a. Natural cognition in wild chimpanzees. In: *Behind the Dolphin's Smile: Remarkable Accounts of Animal Emotions,* M. Bekoff, A. Colin and G. Burghardt (eds). Random House/ Discovery Books, New York, USA.

Boesch, C. and H. Boesch-Achermann. 2000b. *The Chimpanzees of the Taï Forest*. Oxford University Press, Oxford, UK.

Boesch, L., R. Mundry, H. S. Kühl, and R. Berger. 2017. Wild mammals as economic goods and implications for their conservation. *Ecology and Society* 22 (4): 36.

Brncic, T., B. Amarasekaran, A. McKenna, R. Mundry, and H. S. Kühl. 2015. Large mammal diversity and their conservation in the human dominated land-use mosaic of Sierra Leone. *Biodiversity and Conservation* 24: 2417–2438.

Campbell, G. and M. Houngbedji. 2015. Conservation status of the West African chimpanzee (*Pan troglodytes verus*) in Togo and Benin. Unpublished report to Primate Action Fund.

Carvalho, J. S., T. A. Marques and L. Vicente. 2013. Population status of *Pan troglodytes verus* in Lagoas de Cufada Natural Park, Guinea-Bissau. *PLoS ONE* 8: e71527.

CBD (Convention On Biological Diversity). 2010. COP 10. Decision X/2. The Strategic Plan for Biodiversity 2011–2020 and the Aichi Biodiversity Targets. Website: http://www.cbd.int/decision/cop/default.shtml?id=12268. Accessed 20 November 2018.

Danquah, E., S. K. Oppong, E. Akom, and M. Sam. 2012. Preliminary survey of chimpanzees and threatened monkeys in the Bia-Goaso forest block in southwestern Ghana. *African Primates* 7: 163–174.

Ginn, L. P., J. Robison, I. Redmond, and K. A. I. Nekaris. 2013. Strong evidence that the West African chimpanzee is extirpated from Burkina Faso. *Oryx* 47: 325–326.

Granier, N., A. Hambuckers, T. Matsuzawa, and M. C. Huynen. 2014. Density estimates and nesting-site selection in chimpanzees of the Nimba Mountains, Côte d'Ivoire, and Guinea. *American Journal of Primatology* 76: 999–1010.

Greengrass, E. 2016. Commercial hunting to supply urban markets threatens mammalian biodiversity in Sapo National Park, Liberia. *Oryx* 50: 397–404.

Ham, R. 1998. Nationwide chimpanzee census and large mammal survey: Republic of Guinea. Unpublished report to the European Union, Conakry, Guinea.

Heinicke, S., R. Mundry, C. Boesch, B. Amarasekaran, A. Barrie, T. Brncic, D. Brugière, G. Campbell, J. Carvalho, E. Danquah and D. Dowd. 2019. Characteristics of positive deviants in western chimpanzee populations. *Frontiers in Ecology and Evolution* 7: 16.

REFERENCES

Humle, T., C. Boesch, G. Campbell, J. Junker, K. Koops, H. Kuehl, and T. Sop. 2016. *Pan troglodytes ssp. verus*. The IUCN Red List of Threatened Species 2016. http://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T15935A17989872.en.

IUCN SSC A.P.E.S. database. 2016. *Ape Populations, Environments and Surveys database*. Website: http://apesportal.eva.mpg.de/database/ archiveTable

Junker, J., C. Boesch, T. Freeman, R. Mundry, C. Stephens, and H. S. Kühl. 2015. Integrating wildlife conservation with conflicting economic land-use goals in a West African biodiversity hotspot. *Basic and Applied Ecology* 16: 690–702.

Köndgen, S., H. Kühl, P. K. N'Goran, P. D. Walsh, S. Schenk, N. Ernst, and F. H. Leendertz. 2008. Pandemic human viruses cause decline of Endangered great apes. *Current Biology* 18: 260–264.

Kormos, R., and C. Boesch (eds.). 2003. *Regional Action Plan for the conservation of chimpanzees in West Africa*. IUCN/SSC Primate Specialist Group and Conservation International, Washington DC, USA.

Kormos, R., C. Boesch, M. I. Bakarr, and T. M. Butynski. 2003. West African Chimpanzees: Status Survey and Conservation Action Plan. IUCN/SSC Primate Specialist Group, Gland, Switzerland and Cambridge, UK.

Kühl, H. S., T. Sop, E. A. Williamson, R. Mundry, D. Brugière, G. Campbell and S. Jones. 2017. The Critically Endangered western chimpanzee declines by 80%. *American Journal of Primatology* 79 (9): e22681.

Langergraber, K. E., K. Prüfer, C. Rowney, C. Boesch, C. Crockford, K. Fawcett and M. M. Robbins. 2012. Generation times in wild chimpanzees and gorillas suggest earlier divergence times in great ape and human evolution. *Proceedings of the National Academy of Sciences* 109: 15716–15721.

Lovejoy, T. E. 2006. Protected areas: a prism for a changing world. *Trends in Ecology and Evolution* 21: 329–333.

Marchesi, P., N. Marchesi, B. Fruth, and C. Boesch. 1995. Census and distribution of chimpanzees in Côte d'Ivoire. *Primates* 36: 591–607.

Pruetz, J. D. and D. Kante. 2010. Successful return of a wild infant chimpanzee (*Pan troglodytes verus*) to its natal group after capture by poachers. *African Primates* 7 (1) : 35–41.

Tiedoue, M. R., S. S. Kone, A. Diarrassouba and A. Tondossama. 2018. Etat de Conservation du Parc national de Taï: Résultats du Suivi Écologique, Phase 12. Office Ivoirien des Parcs et Réserves/Direction de Zone Sud-ouest, Soubré, Côte d'Ivoire.

Tweh, C. G., M. M. Lormie, C. Y. Kouakou, A. Hillers, H. S. Kühl, and Junker, J. 2014. Conservation status of chimpanzees *Pan troglodytes verus* and other large mammals in Liberia: A nationwide survey. *Oryx* 49: 710–718.

WCF 2012. Etat de la Faune et des Menaces dans les Aires Protégées Terrestres et Principales Zones de Forte Biodiversité de République de Guinée. Unpublished report, Wild Chimpanzee Foundation, Conakry, Guinea.

ASIA

JAVAN SLOW LORIS

Cabana, F., E. Dierenfeld, W. Wirdateti, G. Donati and K. A. I. Nekaris. 2017. The seasonal feeding ecology of the Javan slow loris (*Nycticebus javanicus*). *American Journal of Physical Anthropology* 162: 768–781.

Das, N., J. Biswas, J. Das, P. C. Ray, A. Sangma and P. C. Bhattacharjee. 2009. Status of Bengal slow loris *Nycticebus bengalensis* (Primates: Lorisidae) in Gibbon Wildlife Sanctuary, Assam, India. *Journal of Threatened Taxa* 1: 558–561.

Das, N., K. A. I. Nekaris and P. C. Bhattacharjee. 2014. Medicinal plant exudativory by the Bengal slow loris *Nycticebus bengalensis*. *Endangered Species Research* 23: 149–157.

Fuller, G., W. Eggen, I. Iryantoro, W. Widateti and K. A. I. Nekaris. 2017. Welfare impacts of the illegal wildlife trade in a cohort of confiscated greater slow lorises, *Nycticebus coucang. Journal of Applied Animal Welfare Science.* In press.

Kenyon, M., U. Streicher, H. Loung, T. Tran, M. Tran, B. Vo and A. Cronin. 2014. Survival of reintroduced pygmy slow loris *Nycticebus pygmaeus* in South Vietnam. *Endangered Species Research* 25: 185–195.

Kumar, A., K. Sarma, J. Panvor, K. Mazumdar, A. Devi, M. Krishna and P. C. Ray. 2014. Threats to the Bengal slow loris *Nycticebus bengalensis* in and around Itanagar Wildlife Sanctuary, Arunachal Pradesh, India: impediments to conservation. *Endangered Species Research* 23: 99–106.

Moore, R., S. Wihermanto and K. A. I. Nekaris. 2014. Compassionate conservation, rehabilitation and translocation of Indonesian slow lorises. *Endangered Species Research* 26: 93–102.

Munds, R. A., K. A. I. Nekaris and S. M. Ford. 2013. Taxonomy of the Bornean slow loris, with new species *Nycticebus kayan* (Primates, Lorisidae). *American Journal of Primatology* 75: 46–56.

Nekaris, K. A. I. 2014. Extreme primates: ecology and evolution of Asian lorises. *Evolutionary Anthropology: Issues, News, and Reviews* 23: 177–187.

Nekaris, K. A. I. and S. Jaffe. 2007. Unexpected diversity within the Javan slow loris trade: implications for slow loris taxonomy. *Contributions to Zoology* 76: 187–196.

Nekaris, K. A. I. and V. Nijman. 2007. CITES proposal highlights rarity of Asian nocturnal primates (Lorisidae: *Nycticebus*). *Folia Primatologica* 78: 211–214.

Nekaris, K. A. I. and C. R. Starr. 2015. Conservation and ecology of the neglected slow loris: priorities and prospects. *Endangered Species Research* 28: 87–95.

Nekaris, K. A. I., N. Campbell, T. G. Coggins, E. J. Rode and V. Nijman. 2013a. Tickled to death: analysing public perceptions of 'cute' videos of threatened species (slow lorises–*Nycticebus* spp.) on web 2.0 sites. *PloS One* 8: e69215.

Nekaris, K. A. I., M. Shekelle, W. Wirdateti, E. J. Rode and V. Nijman. 2013b. *Nycticebus javanicus*. *The IUCN Red List of Threatened Species 2013.* http://dx.doi.org/10.2305/IUCN.UK.2013-2.RLTS.T39761A17971158.en.

Nijman, V., K. A. I. Nekaris, N. Das and M. Zhang. 2015. Slow loris arm key-rings. *Oryx* 49 (3): 391.

Nijman, V., D. Spaan, E. J. Rode-Margono, W. Wirdateti and K. A. I. Nekaris. 2015. Changes in the primate trade in Indonesian wildlife markets over a 25-year period: fewer Apes and langurs, more macaques and slow lorises. *American Journal of Primatology* 79 (11): e22517.

Nekaris, K. A. I., R. S. Moore, E. J. Rode and B. G. Fry. 2013c. Mad, bad, and dangerous to know: the only venomous primates, slow lorises. *BMC Journal of Venomous Animals and Toxins Including Tropical Diseases* 19: 21.

Osterberg, P. and K. A. I. Nekaris. 2015. The conservation implications of the use of photo prop animals for tourists in Thailand: a slow loris case study (*Nycticebus* spp.). *TRAFFIC Bulletin* 27: 13–18.

Pozzi, L., J. A. Hodgson, A. S. Burrell, K. N. Sterner, R. L. Raaum and T. R. Disotell. 2014. Primate phylogenetic relationships and divergence dates inferred from complete mitochondrial genomes. *Molecular Phylogenetics and Evolution* 75: 165–183.

Rode-Margono, E. J., V. Nijman, W. Wirdateti and K. A. I Nekaris. 2014. Ethology of the Critically Endangered Javan slow loris *Nycticebus javanicus* É. Geoffroy Saint-Hilaire in West Java. *Asian Primates* 4: 27–41.

Rowe, N. and M. Myers. 2016. *All the World's Primates*. Primate Conservation, Inc., Charlestown RI, USA.

Schulze, H. and C. P. Groves. 2004. Asian lorises: taxonomic problems caused by illegal trade. In: *Conservation of Primates in Vietnam,* T. Nadler, U. Streicher and Ha Thang Long (eds.), pp. 33–36. Frankfurt Zoological Society, Frankfurt, Germany.

Starr, C., K. A. I. Nekaris, U. Streicher and L. K. P. Leung. 2011. Field surveys of the vulnerable pygmy slow loris *Nycticebus pygmaeus* using local knowledge in Mondulkiri Province, Cambodia. *Oryx* 45: 135–142.

Wiens, F, A. Zitzmann and N. A. Hussein. 2006. Fast food for slow lorises: is low metabolism related to secondary compounds in high-energy plant diet? *Journal of Mammalogy* 87: 790–798.

PIG-TAILED SNUB-NOSE LANGUR

Chasen, F. N. and C. B. Kloss. 1927. Spolia Mentawiensia – Mammals. *Proceedings of the Zoological Society of London* 53: 797–840.

Erb, W. M., C. Borries, N. S. Lestari and T. Ziegler. 2012. Demography of simakobu (*Simias concolor*) and the impact of human disturbance. *American Journal of Primatology* 74: 580–590.

Febrianti. 2015. Hunting threatens population of Mentawai endemic primates. Website: https://en.tempo.co/read/news/2015/06/30/206679544/Hunting-Threatens-Population-of-Mentawai-Endemic-Primates.

Fuentes, A. 2002. Monkeys, humans and politics in the Mentawai Islands: no simple solutions in a complex world. In: *Primates Face to Face: Conservation Implications of Human-Nonhuman Primate Interactions*, A. Fuentes and L. D. Wolfe (eds.), pp.187–207. Cambridge University Press, Cambridge, UK.

Gaworecki, M. 2016. Timber plantation licenses canceled as Mentawai fight off another threat to their traditional lands. Website: https://news.mongabay.com/2016/07/timber-plantation-licenses-canceled-as-mentawai-fight-off-another-threat-to-their-traditional-lands/

Guillaud, D. and A. Burgos. 2018. The senses of the forest. Uses and developments of the Siberut and Nias wetland and mangrove forest, Sumatra, Indonesia. *The News of Archeology* 152: 41–47.

Hadi, S., T. Ziegler and J. K. Hodges. 2009. Group structure and physical characteristics of simakobu monkeys (*Simias concolor*) on the Mentawai Island of Siberut, Indonesia. *Folia Primatologica* 80: 74-82.

Miller, G. S. 1903. Seventy new Malayan mammals. *Smithsonionan Miscellaneous Collections* 45: 1–73.

Mitchell, A. H. and R. L. Tilson. 1986. Restoring the balance: traditional hunting and primate conservation in the Mentawai Islands, Indonesia. In: *Primate Ecology and Conservation*, J. G. Else and P. C. Lee (eds.), pp. 249–260. Cambridge University Press, Cambridge, UK.

Paciulli, L. M. 2004. The Effects of Logging, Hunting, and Vegetation on the Densities of the Pagai, Mentawai Island Primates. PhD Thesis, State University of New York at Stony Brook, New York, USA.

Paciulli, L. M. and J. Viola. 2009. Population estimates of Mentawai primates on the Pagai Islands, Mentawai, West Sumatra, Indonesia. *American Journal of Physical Anthropology* 48: 204.

Paciulli, L. M. and K. Sabbi. 2017. How do Pagai, Mentawai Island (Sumatra, Indonesia) nonhuman primate characteristics affect hunters' prey selection? In: *Ethnoprimatology: A Practical Guide to Research on the Human-Nonhuman Primate Interface,* K. Dore, E. Riley and A. Fuentes (eds.), pp. 122–135. Cambridge University Press, Cambridge, UK.

Quinten, M., F. Nopiansyah and K. Hodges. 2015. First estimates of primate density and abundance in Siberut National Park, Mentawai Islands, Indonesia. *Oryx* 50 (2): 364–367.

Quinten, M., F. Stirling, S. Schwarze, Y. Dinata and K. Hodges. 2014. Knowledge, attitudes and practices of local people on Siberut Island (West Sumatra, Indonesia) towards primates. *Journal of Threatened Taxa* 6: 6389–6398.

Quinten, M., M. Waltert, F. Syamsuri and K. Hodges. 2010. Peat swamp forest supports high primate densities on Siberut Island, Sumatra, Indonesia. *Oryx* 44: 147–151.

Supriatna, J., A. A. Dwiyahreni, N. Winarni, S. Mariati and C. Margules. 2017. Deforestation of primate habitat on Sumatra and adjacent islands, Indonesia. *Primate Conservation* 31: 71–82.

Tenaza, R. 1987. The status of primates and their habitats in the Pagai Islands, Indonesia. *Primate Conservation* 8: 104–110.

Waltert, M., C. Abegg, T. Ziegler, S. Hadi, D. Priata and K. Hodges. 2008. Abundance and community structure of Mentawai primates in the Peleonan Forest, North Siberut, Indonesia. *Oryx* 42: 375–379.

Whittaker, D. J. 2006. A conservation action plan for the Mentawai primates. *Primate Conservation* 20: 95–105.

Whittaker, D. J. and R. A. Mittermeier. 2008. *Simias concolor*. *The IUCN Red List of Threatened Species 2013.* http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T20229A9181121.en.

Whitten, T. 2009. *Returning to Siberut: 30 years later, little has changed on remote Indonesian island.* Website: http://blogs.worldbank.org/eastasiapacific/returning-to-siberut-30-years-later-little-has-changed-on-remote-indonesian-island. Accessed November 2018.

Zinner, D., G. H. Fickenscher and C. Roos. 2013. Family Cercopithecidae (Old World monkeys). In: *Handbook of the Mammals of the World: Volume 3 Primates*, R. A. Mittermeier, A. B. Rylands and D. E. Wilson (eds.), pp. 550–627. Lynx Edicions, Barcelona, Spain.

GOLDEN-HEADED LANGUR

Bleisch, B., L. X. Canh, H. H. Covert and L. Yongcheng. 2008. *Trachypithecus poliocephalus* ssp. *poliocephalus*. *The IUCN Red List of Threatened Species 2013.*Http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T39871A10278002.en.

Leonard, N., L. S. Mai, M. Raffel, J. Adler, R. Passaro, D. Schrudde, and R. Stenke. 2016. Current Status of the Cat Ba Langur Population: Numbers, Population Trend, and Birth Rates. Presentation, IPS Conference, Chicago, USA.

Leonard, N. 2018. Is Primate Tourism a Practical Protection Tool? The Case of Cat Ba Island, Vietnam. Presentation, IPS Conference, Nairobi, Kenya.

Nadler, T. and T. L. Ha. 2000. The Cat Ba Langur: Past, Present and Future. The Definitive Report on *Trachypithecus poliocephalus* - the World's Rarest Primate. Frankfurt Zoological Society, Hanoi, Vietnam.

Nadler, T., F. Momberg, X. D. Nguyen and N. Lormee. 2003. Vietnam Primate Conservation Status Review 2002. Part 2: Leaf Monkeys. Fauna and Flora International and Frankfurt Zoological Society, Hanoi, Vietnam.

Stenke, R. 2005. Conservation of the Golden-headed Langur (*Trachypithecus poliocephalus poliocephalus*) on Cat Ba Island, Vietnam: Status of the Golden-headed Langur and of Human Impact in Langur Areas. Report, People's Committee of Hai Phong (Provincial Government), Cat Ba, Hai Phong, Vietnam.

Stenke, R. and C. X. Chu. 2004. The golden-headed langur (*Trachypithecus poliocephalus poliocephalus*) on Cat Ba Island – status, threat factors, and recovery options. In: *Conservation of Primates in Vietnam*, T. Nadler, U. Streicher and T. L. Ha (eds.), pp. 72–77. Frankfurt Zoological Society, Hanoi, Vietnam.

GOLDEN LANGUR

Biswas, J. 2004. Ecology and Social Behaviour of Golden Langur (*Trachypithecus geei*) Khajuria, 1956. PhD Thesis, Gauhati University, Assam, India.

Chetry, D., M. Phukan, R. Chetry, R. N. Boro and P. C. Bhattacharjee. 2018. Conservation of Golden Langur *Trachypithecus geei* in Chakrashila Wildlife Sanctuary, Assam, India. Event #665, Abstract volume in International Primatological Congress, Nairobi, Kenya.

Chetry, R. and D. Chetry. 2009. The Golden Langur. Gibbon Conservation Centre, Assam, India.

Chetry, D., R. Medhi and P. C. Bhattacharjee. 2005. Domestic dog (*Canis familiaris*): threat for the Golden langur *Trachypithecus geei*. *Journal of the Bombay Natural History Society* 102 (2): 220–221.

Chetry, D. 2002. Socioecology of Golden Langur (*Trachypithecus geei*) in Chakrashila Wildlife Sanctuary, Assam, India. Report, Primate Conservation Inc., Charlestown, USA.

Choudhury, A. 2008. Primates of Bhutan and observations of hybrid langurs. *Primate Conservation* 23: 65–73.

Choudhury, A. 2002. Golden langur *Trachypithecus geei* threatened by habitat fragmentation. *Zoo's Print Journal* 17 (2): 699–703.

Choudhury, A. U. 1990. Primates in Bhutan. *Oryx* 24: 125.

Das, J., R. Medhi and S. Molur. 2008. *Trachypithecus geei*. *The IUCN Red List of Threatened Species 2008*. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T22037A9348940.en. Downloaded on 24 January 2019.

Gee, E. P. 1955. A new species of langur from Assam. *Journal of the Bombay Natural History Society* 53: 252–254.

Ghosh, S. 2009. Report on the distribution and population status of Golden langur (*Trachypithecus geei*) in Bodoland Territorial Council, Assam, India.

Horwich, R. H., R. Das and A. Bose. 2013. Conservation and the current status of the Golden langur in Assam, India, with reference to Bhutan primate conservation. *Primate Conservation* 27: 77–83.

Lhendup, S., T. Ugyen and J. Tenzin. 2018 Population structure and habitat use of golden langur (*Trachypithecus geei*) in Royal Manas National Park, Bhutan. *International Journal of Fauna and Biological Studies* 5 (2): 97–101

Medhi, R. and D. Chetry. 2003. Behavioural Response of Golden Langur (*Trachypithecus geei*) in Fragmented Forests and its Conservation Perspective. A project report submitted to People's Trust for Endangered species, pp. 1–23.

Medhi, R. 2004. Behaviour of Golden langur, *Trachypithecus geei* (Khajuria, 1956) in a Riverine Island. PhD Thesis, Gauhati University, Assam, India.

Mukherjee, R. P. 1996. Studies on the Status and Ecology of Golden Langur, *Presbytis geei* Khajuria in India. Project report submitted to National Geographical Society.

Ram, M. S., S. M. Kittur, J. Biswas, S. Nag, J. Shil and G. Umapathy. 2016. Genetic diversity and structure among isolated populations of the Endangered Gee›s golden langur in Assam, India. *PLoS ONE* 11 (8): e016186.

Srivastava, A., J. Biswas, J. Das and P. Bezbarua. 2001. Status and distribution of golden langurs (*Trachypithecus geei*) in Assam, India. *American Journal of Primatology* 55: 15–23.

Wangchuk, T., D. Inouye and M. Hare. 2003. A new subspecies of golden langur (*Trachypithecus geei*) from Bhutan. *Folia Primatologica* 74 (2): 104–108.

Wangchuk, T. 2005. The Evolution, Phylogeography and Conservation of the Golden Langur (*Trachypithecus geei*) in Bhutan. PhD Thesis, University of Maryland, Maryland, MD, USA.

PURPLE-FACED LANGUR

Adikaram, N. K. B., K. B. Ranawana, C. B. Dissanayake and P. N. Ranasinghe. 1999. Forest dieback in Horton Plains National Park. Project Terminal Report. Global Environmental Facility Project of the Department of Wildlife Conservation.

Cabral, S. J., T. Prasad, T. P. Deeyagoda, S. N. Weerakkody, A. Nadarajah, and R. Rudran. 2018. Investigating Sri Lanka's human-monkey conflict and developing a strategy to mitigate the problem. *Journal of Threatened Taxa* 10 (3): 11391–11398.

Dela, J. D. S. 2004. Protecting the endemic purple-faced langur. *Loris* 23: 14–22.

Dela, J. D. S. 2007. Seasonal food use strategies of *Semnopithecus vetulus nestor* at Panadura and Piliyandala, Sri Lanka. *International Journal of Primatology* 28: 607–626.

Dittus, W., S. Molur and K. A. I. Nekaris. 2008. *Trachypithecus vetulus* ssp. *nestor. The IUCN Red List of Threatened Species* 2013. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T39844A10276249.en.

REFERENCES

Hill, W. C. O. 1934. A monograph on the purple-faced leaf monkeys (*Pithecus vetulus*). *Ceylon Journal of Science* 29 (1): 23–88.

Nahallage, C. A. D. and M. A. Huffman. 2013. Macaque-human interactions in past and present day Sri Lanka. In: *The Macaque Connection: Cooperation and Conflict between Humans and Macaques*, S. Radhakrishna. M. A. Huffman and A. Sinha (eds.), pp. 135-147. Springer-Verlag, New York, USA.

Parker, L., V. Nijman and K. A. I. Nekaris. 2008. When there is no forest left: fragmentation, local extinction, and small population sizes in the Sri Lankan western purple-faced langur. *Endangered Species Research* 5: 29–36.

Roscoe, C. J., M. A. De Silva, N. C. Hapuarachchi and P. A. Rohan Krishantha. 2013. A new color morph of the southern purple-faced langur (*Semnopithecus vetulus vetulus*) from the rainforests of southwestern Sri Lanka. *Primate Conservation* 26: 115–124.

Rudran, R. 1973a. The reproductive cycles of two subspecies of purple-faced langurs (*Presbytis senex)* with relation to environmental factors. *Folia Primatologica* 19: 41–60.

Rudran, R. 1973b. Adult male replacement in one-male troops of purple-faced langurs (*Presbytis senex*) and its effect on population structure. *Folia Primatologica* 19: 166–192.

Rudran, R. 2007. A survey of Sri Lanka's endangered and endemic western purple-faced langur (*Trachypithecus vetulus nestor*). *Primate Conservation* 22: 139–144.

Rudran, R., K. Weerakoon and A. Wanasinghe. 2009. Western purple-faced langur *Trachypithecus (Semnopithecus) vetulus nestor* (Bennett, 1833). In: *The world's 25 most endangered primates 2008–2010*, R. A. Mittermeier *et al.* (eds.), pp. 24–25. IUCN SSC Primate Specialist Group (PSG), International Primatological Society (IPS), Conservation International (CI) and Bristol Zoological Society, Arlington, USA.

Rudran, R. 2013. Purple-faced langur, *Trachypithecus vetulus*. In: *Mammals of South Asia*, J. C. Daniel and N. Manjrekar (eds.), pp. 317–331. Universities Press, Hyderabad, India.

Rudran, R. 2015. Western purple-faced langur *Semnopithecus vetulus nestor* (Bennett, 1833) In: *Primates in Peril: The world's 25 most endangered primates 2014-2016*, C. Schwitzer, R. A. Mittermeier, A. B. Rylands, F. Chiozza, E. A. Williamson, J. Wallis and A. Cotton (eds.), pp. 63–66. IUCN SSC Primate Specialist Group (PSG), International Primatological Society (IPS), Conservation International (CI) and Bristol Zoological Society, Arlington, USA.

Tippetts-Abbett-McCarthy-Stratton (TAMS). 1980. Environmental Impact Assessment, Accelerated Mahaweli Development Program. Volume II Terrestrial Environment.

Wickremasinghe, S., J. R. K. W. Unantenna and D. S. B. Dissanayake. 2016. Distribution of *Trachypithecus vetulus philbricki* in Selected Forest Patches in the Anuradhapura District, Sri Lanka. 5th Asian Primate Symposium 18-22 October 2016. Sri Jayawardeepura University, Sri Lanka.

Yatawara, S. B. 2011. Let's preserve trees, before the last tree vanishes. Website: www.sundayobserver.lk/2011/11/06/fea05.asp. Accessed 27 February 2014.

GAOLIGONG HOOLOCK GIBBON

Fan, P. F. 2017. The past, present, and future of gibbons in China. *Biological Conservation*. 210: 29–39.

Fan, P. F., W. Xiao, S. Huo, H. S. Ai, T. C. Wang and R. T. Lin. 2011. Distribution and conservation status of *Hoolock leuconedys* in China. *Oryx* 45 (1): 129–134.

Fan, P. F., H. S. Ai, H. L. Fei, D. Zhang and S. D. Yuan. 2013. Seasonal variation of diet and time budget of eastern hoolock gibbons (*Hoolock leuconedys*) living in a northern montane forest. *Primates* 54: 137–146.

Fan, P. F., H. L. Fei, S. D. Yuan, D. Zhang and S. Turvey. 2017. Cardamom (*Amomun tsaoko*) agroforest is an important habitat for skywalker hoolock gibbons (*Hoolock tianxing*) in Mt. Gaoligong, Yunnan, China. *Primates*, under review.

Fan, P. F., K. He, X. Chen, A. Ortiz, B. Zhang, C. Zhao, Y. Q. Li, H. B. Zhang, C. Kimock, W. Z. Wang, C. Groves, S. T. Turvey, C. Roos, K. M. Helgen and X. L. Jiang. 2017. Description of a new species of Hoolock gibbon (Primates: Hylobatidae) based on integrative taxonomy. *American Journal of Primatology*. 79: e22631.

Fei, H. L., D. Zhang, S. D. Yuan, L. Zhang and P. F. Fan. 2017. Anti-predation sleeping behavior of skywalker hoolock gibbons (*Hoolock tianxing*) in Mt. Gaoligong, Yunnan, China. *International Journal of Primatology* 38 (4): 629–641.

Mootnick, A. and C. Groves. 2005. A new generic name for the hoolock gibbon (Hylobatidae). *International Journal of Primatology* 26 (4): 971–976.

Yin, L. Y., H. L. Fei, G S. Chen, J. H. Li, L. W. Cui and P. F. Fan. 2016. Effects of group density, hunting and temperature on the singing patterns of eastern hoolock gibbons (*Hoolock leuconedys*) in Gaoliongshan, southwest China. *American Journal of Primatology* 76: 861–871.

Yuan, S. D., H. L. Fei, S. H. Zhu, L. W. Cui, H. S. Ai and P. F. Fan. 2014. Effects of tsaoko (*fructus tsaoko*) cultivating on tree diversity and canopy structure in the habitats of eastern hoolock gibbon (*Hoolock leuconedys*). *Zoological Research* 35 (3): 231–239.

Zhang D., H. L. Fei, S. D. Yuan, W. M. Sun, Q. Y. Ni, L. W. Cui and P. F. Fan. 2014. Ranging behavior of eastern hoolock gibbon *(Hoolock leuconedys*) in a northern montane forest in Gaoligongshan, Yunnan, China. *Primates* 55: 239–247

TAPANULI ORANGUTAN

Allendorf, F. W., G. H. Luikart and S. N. Aitken. 2013. *Conservation and the Genetics of Populations*, 2nd Edition. Blackwell Publishing, New York, USA.

Hedrick, P. W. and S. T. Kalinowski. 2000. Inbreeding depression in conservation biology. *Annual Review of Ecology and Systematics* 31 (1): 139–62.

Marshall, A. J., R. Lacy, M. Ancrenaz, O. Byers, S. J. Husson, M. Leighton, E. Meijaard, N. Rosen, I. Singleton, S. Stephens, K. Traylor-Holzer, S. S. Utami Atmoko, C. P. van Schaik and S. A. Wich. 2009. Orangutan population biology, life history, and conservation. Perspectives from population viability analysis models. In: *Orangutans: Geographic Variation in Behavioral Ecology and Conservation*, Wich, S. A., Utami Atmoko, S. S., Mitra Setia, T. and van Schaik, C. P. (eds.), pp. 311–326. Oxford University Press, Oxford, UK.

Ministry of Forestry of the Republic of Indonesia. 2014. Surat Keputusan Menteri Kehutanan Republik Indonesia, Nomor: SK.579/MENHUT-II/2014, Tentang kawasan hutan Provinsi Sumatera Utara.

Nater, A., M. P. Mattle-Greminger, A. Nurcahyo, M. G. Nowak, M. de Manuel, T. Desai, C. Groves, M. Pybus, T. B. Sonay, C. Roos, A. R. Lameira, S. A. Wich, J. Askew, M. Davila-Ross, G. Fredriksson, G. de Valles, F. Casals, J. Prado-Martinez, B. Goossens, E. J. Verschoor, K. S. Warren, I. Singleton, D. A. Marques, J. Pamungkas, D. Perwitasari-Farajallah, P. Rianti, A. Tuuga, I. G. Gut, M. Gut, P. Orozco-ter Wenge, C. P. van Schaik, J. Bertranpetit, M. Anisimova, A. Scally, T. Marques-Bonet, E. Meijaard and M. Krützen. 2017. Morphometric, behavioral, and genomic evidence for a new orangutan species. *Current Biology* 27 (22): 3487–3498.

Nowak, M.G., P. Rianti, S. A. Wich, E. Meijaard and G. Fredriksson. 2017. *Pongo tapanuliensis*. The IUCN Red List of Threatened Species 2017. http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T120588639A120588662.en.

Sloan, S., J. Supriatna, M. J. Campbell, M. Alamgir and W. F. Laurance. 2018. Newly discovered orangutan species requires urgent habitat protection. *Current Biology* 28 (11): 650–651.

Wich, S. A., I. Singleton, S. S. Utami-Atmoko, M. L. Geurts, H. D. Rijksen and C. P. Van Schaik. 2003. The status of the Sumatran orang-utan *Pongo abelii*: an update. *Oryx* 37 (1): 49–54.

Wich, S. A., S. S. Utami-Atmoko, T. M. Setia, H. D. Rijksen, C. Schürmann, J. A. Van Hooff and C. P. van Schaik. 2004. Life history of wild Sumatran orangutans (*Pongo abelii*). *Journal of Human Evolution* 47 (6): 385–398.

Wich, S. A., E. Meijaard, A. J. Marshall, S. Husson, M. Ancrenaz, R. C. Lacy, C. P. van Schaik, J. Sugardjito, T. Simorangkir, K. Traylor-Holzer and M. Doughty. 2008. Distribution and conservation status of the orang-utan (*Pongo* spp.) on Borneo and Sumatra: how many remain? *Oryx* 42 (3): 329–39.

Wich, S. A., H. de Vries, M. Ancrenaz, L. Perkins, R. W. Shumaker, A. Suzuki and C. P. van Schaik. 2009. Orangutans life history variation. In: *Orangutans: Geographic Variation in Behavioral Ecology and Conservation,* S. A. Wich, S. S. Utami-Atmoko, T. M. Setia and C. P. van Schaik (eds.), pp. 65–75. Oxford University Press, New York, USA.

Wich, S. A., J. J. Riswan, J. Jenson, J. Refisch, and C. Nellemann. 2011. Orangutans and the Economics of Sustainable Forest Management in Sumatra. UNEP/GRASP/PanEco/ YEL/ICRAF/GRID-Arendal, Norway.

Wich, S. A., G. M. Fredriksson, G. Usher, H. H. Peters, D. Priatna, F. Basalamah, W. Susanto and H. Kühl. 2012. Hunting of Sumatran orang-utans and its importance in determining distribution and density. *Biological Conservation* 146 (1): 163–169.

Wich, S. A., I. Singleton, M. G. Nowak, S. S. Utami Atmoko, G. Nisam, S. Mhd Arif, R. H. Putra, R. Ardi, G. Fredriksson, G. Usher, D. L. A. Gaveau and H. S. Kühl. 2016. Land-cover changes predict steep declines for the Sumatran orang-utan (*Pongo abelii*). *Science Advances* 2: e1500789.

Wich, S. A., G. Fredriksson, G. Usher, H. S. Kühl and M. G. Nowak. 2019. The Tapanuli orangutan: Status, threats, and steps for improved conservation. *Conservation Science and Practice* 1: e33.

NEOTROPICS

BUFFY-TUFTED-EAR MARMOSET

Bechara, I. M. 2012. Abordagens Metodológicas em Biogeografia da Conservação para Avaliar Risco de Extinção de Espécies: um Estudo de Caso com *Callithrix aurita* (Primates: Callitrichidae). PhD Thesis, Federal University of Rio de Janeiro, Brazil.

Brazil/MMA. 2014. Portaria n° 444, de 17 de Dezembro de 2014 – Ministério do Meio Ambiente. *Diário Oficial da União – Seção 1* 245: 121–126.

Carvalho, R. S., D. A. Silva, S. Loiola, D. G. Pereira, E. F. and H. G. Bergallo. 2013. Molecular identification of a buffy-tufted-ear marmoset (*Callithrix aurita*) incorporated in a group of invasive marmosets in the Serra dos Orgãos National Park, Rio de Janeiro - Brazil. *Forensic Science International: Genetics Supplement Series* 4 (1): 10–11.

Carvalho, R. S. 2015. Conservação do Sagui-da Serra Escuro (*Callithrix aurita* (Primates)). Analise Molecular e Colormétrica de Populações do Gênero Callithrix e seus Híbridos. PhD Thesis, Rio de Janeiro State University, Brazil.

Carvalho, R. S., H. G. Bergallo, C. Cronemberger, T. Guimaraes-Luiz, C. A. Igayara-Souza, L. Jerusalinsky, C. Knogge, W. R. Lacerda, J. Malukiewicz, F. R. de Melo, S. B. Moreira, D. G. Pereira, A. Pissinatti; M. Port-Carvalho, C. R. Ruiz-Miranda and D. Wormell. 2018. *Callithrix aurita*: a marmoset species in its way to extinction in the Brazilian Atlantic Forest. *Neotropical Primates* 24 (1): 1–8.

Coimbra-Filho, A. F. 1971. Os saguis do gênero Callithrix da região oriental brasileira e um caso de duplo hibridismo entre três de suas formas (Callitrichidae – Primates). *Revista Brasileira de Biologia* 31: 377–388.

Gonçalves, A. E. C. 2016. Características Seminais do Sagui-da-Serra-Escuro (*Callithrix aurita*, Geoffroy in Humboldt, 1812) (Primates, Callitrichidae). Masters Thesis, Fluminense Federal University, Niterói, Brazil.

ICMBio. 2018. *Plano de Ação Nacional para a Conservação dos Primatas da Mata Atlântica e da Preguiça-de-coleira*. Instituto Chico Mendes de Conservação da Biodiversidade, Ministério do Meio Ambiente. Website: http://www.icmbio.gov.br/portal/atendimentoaocidadao-2/29-fauna-brasileira/plano-de-acao-nacional-lista/8330-plano-de-acao-nacional-para-a-conservacao-dos-primatas-e-preguica-mata-atlantica. Accessed 15 December 2018.

Joly, C. A., J. P. Metzger and M. Tabarelli. 2014. Experiences from the Brazilian Atlantic Forest: ecological findings and conservation initiatives. *New Phytologist* 204: 459–473.

Lacerda, W. R., R. P. Barbosa, R. V. Pyramo, V. F. Augusto and G. C. T. Magina. 2015. Levantamento populacional de *Callithrix aurita* em pequenos fragmentos florestais na Bacia do Rio Paraiba do Sul, Estado de São Paulo. XVI Congresso Brasileiro de Primatologia, 9-13 November 2015. Abstract, Sociedade Brasileira de Primatologia. Manaus, Brazil.

Melo, F. R. and A. B. Rylands. 2008. *Callithrix aurita*. In: *Livro Vermelho da Fauna Brasileira Ameaçada de Extinção Machado*, A. B. M. Machado, G. M. Drummond and A. P. Paglia (eds.), pp. 735–737. Ministério do Meio Ambiente, Brazil.

Melo, F. R., D. S. Ferraz, M. M. Valença-Montenegro, L. C. Oliveira, D. G. Pereira and M. Port-Carvalho. 2015. Avaliação do risco de extinção de *Callithrix aurita* (É. Geoffroy, 1812) no Brasil. Processo de avaliação do risco de extinção da fauna Brasileira. ICMBio. Brazil. Website: http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/estado-de-conservacao/7198- mamiferos-callithrix-aurita-sagui-da-serra-escuro.html. Accessed 15 December 2018.

Ministério da Saúde (BR). 2017. Secretaria de Vigilância em Saúde. Departamento de Vigilância das Doenças Transmissíveis. Emergência epidemiológica de febre amarela no Brasil, no período de dezembro de 2016 a julho de 2017. *Boletim Epidemiológico* 48 (28) ISN2358–9450.

Nogueira, D. M., A. M. R. Fereira, B. Goldschmidt, A. Pissinatti, J. B. Carelli and C. E. Verona. 2011. Cytogenetic study in natural hybrids of *Callithrix* (Callitrichidae: Primates) in the Atlantic Forest of the state of Rio de Janeiro, Brazil. *Iheringia, Série Zoologia* 101 (3): 156–160.

Norris, D., F. Rocha-Mendes, R. Marques, R. de Almeida Nobre and M. Galetti. 2011. Density and spatial distribution of Buffy-tufted-ear marmosets (*Callithrix aurita*) in a continuous Atlantic Forest. *International Journal of Primatology* 32: 811–829.

Nunes, N. D. 2015. O Sagui-da-Serra-Escuro (*Callithrix aurita*) e os Saguis Invasores no Parque Nacional da Serra dos Órgãos, RJ, Brasil: Distribuição Espacial e Estratégias de Conservação. Masters Thesis, State University of Rio de Janeiro, Brazil.

Oliveira, A. B. L. 2012. Presença ou ausência do *Callithrix aurita* em Fragmentos de Mata Atlântica: Formando uma Estratégia de Conservação da Biodiversidade para o Município de Sapucaia – RJ. Masters Thesis, Technical University of Lisbon, Lisbon, Portugal.

Pereira, D. G. 2006. Calitriquídeos no Parque Nacional da Serra dos Órgãos, RJ: Interações entre Espécies Exóticas Invasoras e Espécies Nativas. Masters Dissertation, Fluminense Federal University, Niterói, Brazil.

Pereira, D. G., M. E. A. de Oliveira and C. R. Ruiz-Miranda. 2008. Interações entre calitriquídeos exóticos e nativos no Parque Nacional da Serra dos Órgãos - RJ. *Revista Espaço e Geografia* 11 (1): 87–114.

Pereira, D. G. 2010. Densidade, genética e Saúde Populacional como Ferramentas para Propor um Plano de Controle e Erradicação de Invasão Biológica: O Caso de *Callithrix aurita* (Primates) no Parque Nacional da Serra dos Órgãos, RJ, Brasil. PhD Thesis, State University of Rio de Janeiro, Brazil.

Port-Carvalho, M. and M. C. M. Kierulff. 2009. *Callithrix aurita* (É. Geoffroy, 1812) Primates, Callitrichidae. In: *Fauna Ameaçada de Extinção no Estado de São Paulo: Vertebrados Volume 1*, P. M. Bressan, M. C. M. Kierulff and A. M. Sugieda (eds.), pp. 46. Fundação Parque Zoológico de São Paulo e Secretaria do Meio Ambiente, São Paulo, Brazil.

Ribeiro, M. C., J. P. Metzger, A. C. Martensen, F. J. Ponzoni and M. M. Hirota. 2009. The Brazilian Atlantic Forest: how much is left, and how is the remaining forest distributed? Implications for conservation. *Biological Conservation* 142: 1141–1153.

Rylands, A. B. and D. S. Faria. 1993. Habitats, feeding ecology, and home range size in the genus *Callithrix*. In: *Marmosets and tamarins: Systematics, behaviour, and ecology,* A. B. Rylands (ed.), pp. 262–272. Oxford University Press, Oxford, UK.

Rylands, A. B., M. C. M. Kierulff, S. L. Mendes and M. M. de Oliveira. 2008. *Callithrix aurita*. The IUCN Red List of Threatened Species 2008. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T3570A9949843.en. Accessed 15 December 2018.

Silva, F. F. R., J. Malukiewicz, L. C. Silva, R. S. Carvalho , C. R. Ruiz-Miranda , F. A. S. Coelho, M. P. Figueira, V. Boere and I. O. Silva. 2018. A survey of wild and introduced marmosets (*Callithrix*: Callitrichidae) in the southern and eastern portions of the state of Minas Gerais, Brazil. *Primate Conservation* 32: 1–18.

Traill, L. W., C. J. A. Bradshaw and B. W. Brook. 2007. Minimum viable population size: a meta-analysis of 30 years of published estimates. *Biological Conservation* 139: 159–166.

Vivo, M. 1991. Taxonomia de *Callithrix* Erxleben, 1777 (Callitrichidae, Primates). Fundação Biodiversitas, Belo Horizonte, MG, Brazil.

PIED TAMARIN

Ayres, J. M. R., R. A. Mittermeier and I. D. Constable. 1980. A distribuição geográfica e situação atual dos saguis-de-cara-nua (*Saguinus bicolor*). *Bol. FBCN, Rio de Janeiro* 16: 62–68.

Ayres, J. M. R., R. A. Mittermeier and I. D. Constance. 1982. Brazilian tamarins on the way to extinction? *Oryx* 16: 329–333.

Baker, A. J., A. Egen, D. Wormell and A. Pissinatti. 2009. *Pied Tamarin Saguinus bicolor*. *International Studbook*. Philadelphia Zoo, Philadelphia, USA.

Barr, S. 2016. Conservation Efforts for Pied Tamarins (*Saguinus bicolor*): Evaluating Ecological Corridors for Restoring the Forest Fragments of Urban Manaus, Brazil. Master's Thesis, Lund University, Lund, Sweden.

Brazil, ICMBio, MMA. 2011. Sumário Executivo do Plano de Ação Nacional para a Conservação do Sauim-de-Coleira. Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), Ministério do Meio Ambiente (MMA), Brazil.

Brazil, ICMBio, MMA. 2018. Livro Vermelho da Fauna Brasileira Ameaçada de Extinção. Volume 1. Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), Ministério de Meio Ambiente (MMA), Brazil.

Campos, I. B., M. Gordo and M. D. Vidal. 2017. Análise de Viabilidade Populacional (AVP) de *Saguinus bicolor*. In: *Plano de Ação Nacional para a Conservação do Sauim-de-Coleira*, L. Jerusalinsky, R. B. Azevedo and M. Gordo (eds.), *Série Espécies Ameaçadas* (29), pp.45–58. Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), Ministério de Meio Ambiente (MMA), Brazil.

Coelho L. F. M., M. Gordo, R. J. Subirá and F. Röhe. 2017. Análise da estrutura da paisagem, conectividade de habitat e indicação de áreas prioritárias para ações conservacionistas para *Saguinus bicolor*. In: *Plano de Ação Nacional para a Conservação do Sauim-de-Coleira*, L. Jerusalinsky, R. B. Azevedo and M. Gordo (eds.), *Série Espécies Ameaçadas* (29), pp.157–176. Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), Ministério de Meio Ambiente (MMA), Brazil.

Coelho, L., S. Barr, L. Santos, F. Röhe, B. Monteiro, M. Raseira, D. Lagroteria and M. Gordo. 2018. Conservação de *Saguinus bicolor* (Callitrichidae) em paisagens fragmentadas na Amazônia Central, Brasil. In: *La Primatologia en America Latina 2 / A Primatologia na América Latina 2, Tomo I, Argentina-Colombia*, B. Urbani, M. Kowalewski, R. G. T. Cunha, S. de la Torre and L. Cortéz-Ortiz (eds.), pp.187–197. Ediciones IVIC, Instituto Venezolano de Investigaciones Científicas (IVIC), Caracas, Venezuela.

REFERENCES

Egler, S. G. 1983. Current status of the pied tamarin in Brazilian Amazonia. *IUCN/SSC Primate Specialist Group Newsletter* 3: 20.

Egler, S. G. 1986. Estudos Bionômicos de *Saguinus bicolor* (Spix, 1823) (Callitrichidae: Primates), em Mata Tropical Alterada. Master's Thesis, Universidade Estadual de Campinas, São Paulo, Brazil.

Egler, S. G. 1991. Hábitos alimentares de *Saguinus bicolor bicolor* (Primates, Callitrichidae) na região de Manaus, Amazonas. In: *A Primatologia no Brasil - 3*, A. B. Rylands and A. T. Bernardes (eds.), pp.213–214. Sociedade Brasileira de Primatologia, Belo Horizonte, Brazil.

Egler, S. G. 1992. Feeding ecology of *Saguinus bicolor bicolor* (Primates: Callitrichidae) in a forest relict in Manaus, Brazilian Amazonia. *Folia Primatologica* 59: 61–76.

Emmons, L. H. 1990. *Neotropical Rainforest Mammals: A Field Guide*. University of Chicago Press, Chicago, USA.

Farias, I. P., W. G. Santos, M. Gordo and T. Hrbek. 2015. Effects of forest fragmentation on genetic diversity of the Critically Endangered primate, the pied tamarin (*Saguinus bicolor*): implications for conservation. *Journal of Heredity* 106: 512–521.

Gordo, M. 2008. *Saguinus bicolor.* In: *Livro Vermelho da Fauna Brasileira Ameaçada de Extinção Volume 2*, Â. B. M. Machado, G. M. Drummond and A. P. Paglia (eds.), pp.750–751. Ministério de Meio Ambiente (MMA), Brasilia, Brazil.

Gordo, M. 2012. Ecologia e Conservação do Sauim-de-coleira, *Saguinus bicolor* (Primates; Callitrichidae). PhD Thesis, Museu Paraense Emílio Goeldi/ UFPA, Belém, Brazil.

Gordo, M., L. Figueiredo, M. D. Vidal and W. R. Spironello. 2008. Primatas. In: *Reserva Ducke, a Biodiversidade Amazônica Através de uma Grade*, M. L. Oliveira, F. B. R. Baccaro, R. Braga-Neto and W. E. Magnusson (eds.), pp. 39–49. Attema Design Editorial, Manaus, Brazil.

Gordo, M., F. O. Calleia, S. A. Vasconcelos, J. J. F. Leite and S. F. Ferrari. 2013. The challenges of survival in a concrete jungle: conservation of the pied tamarin (*Saguinus bicolor*) in the urban landscape of Manaus, Brazil. In: *Primates in Fragments: Complexity and Resilience*, L. K. Marsh and C. A. Chapman (eds.), pp.357–370. Springer, New York, USA.

Gordo, M., R. J. Subirá, M. D. Vidal, F. Röhe, W. R. Spironello, L. M. Valente, J. B. Oliveira, A. Pissinatti, D. Wormell and L. Jerusalinsky. 2017. Contextualização do sauim-de-coleira. In: *Plano de Ação Nacional para a Conservação do Sauim-de-Coleira*, L. Jerusalinsky, R. B. Azevedo and M. Gordo (eds), *Série Espécies Ameaçadas* (29), pp.25–44. Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), Ministério de Meio Ambiente (MMA), Brazil.

Hershkovitz, P. 1977. *Living New World Monkeys (Platyrrhini) With an Introduction to Primates*, Volume 1. Chicago University Press, Chicago, USA.

IUCN SSC Primate Specialist Group. 2015. Red Listing Workshop for Neotropical Primates 26–30 January 2015. Houston Zoo, Houston, Texas. IUCN Species Survival Commission (SSC), Primate Specialist Group (PSG).

Jerusalinsky, L., R. B. Azevedo and M. Gordo (eds.). 2017. *Plano de Ação Nacional para a Conservação do Sauim-de-Coleira*, *Série Espécies Ameaçadas* (29). Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), Ministério de Meio Ambiente (MMA), Brazil.

Lagroteria. D., A. Pissinatti, M. R. Solorio, D. Wormell and M. Gordo. 2017a. Protocolos de cativeiro. In: *Plano de Ação Nacional para a Conservação do Sauim-de-Coleira*, L. Jerusalinsky, R. B. Azevedo and M. Gordo (eds.), *Série Espécies Ameaçadas* (29), pp.79–129. Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), Ministério de Meio Ambiente (MMA), Brazil.

Lagroteria. D., D. Campista and N. A. S. Lima. 2017b. Programa de educação para a conservação do *Saguinus bicolor*. In: *Plano de Ação Nacional para a Conservação do Sauim-de-Coleira*, L. Jerusalinsky, R. B. Azevedo and M. Gordo (eds.), Série Espécies Ameaçadas (29), pp.130–145. Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), Ministério de Meio Ambiente (MMA), Brazil.

Maia da Silva, F., R. D. Naiff, A. Marcili, M. Gordo, J. A. D'Affonseca Neto, M. F. Naiff, A. M. R. Franco, M. Campaner, V. Valente, S. A. Valente, E. P. Camargo, M. M. G. Teixeira and M. A. Miles. 2008. Infection rates and genotypes of *Trypanosoma rangeli* and *T. cruzi* infecting free-ranging *Saguinus bicolor* (Callitrichidae), a Critically Endangered primate of the Amazon Rainforest. *Acta Tropica* 107: 168–173.

Oliveira, J. B. 2014. Filogeografia e Demografia Histórica de *Saguinus bicolor* (Callitrichidae: Primates). Master's thesis, Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Brazil.

Röhe, F. 2006. Área de Contato entre as Distribuições Geográficas de *Saguinus midas* e *Saguinus bicolor*: a Importância de Interações e Fatores Ecológicos. Master's Thesis, Instituto Nacional de Pesquisas da Amazônia (INPA), Universidade Federal do Amazonas (UFAM), Manaus, Brazil.

Santos. L. S., H. S. Pereira and M. Gordo. 2017a. Interações entre populações humanas e de sauim-de-coleira (*Saguinus bicolor*) em fragmentos florestais urbanos de Manaus, Amazonas, Brasil. In: *Olhares Cruzados sobre as Relações entre Seres Humanos e Animais Silvestres na Amazônia (Brasil, Guiana Francesa)*, G. Marchand and F. Vander Velden (eds.), pp.85–102. EDUA, Manaus, Brazil.

Santos. L. S., H. S. Pereira and M. Gordo. 2017b. Simpatria entre populações humanas e de sauim-de-coleira (*Saguinus bicolor*) em fragmentos florestais de Manaus, Amazonas. *Neotropical Primates* 23: 25–30.

Solorio, M., M. Gordo, W. R. Spironello, L. E. Durigan, A. Campos, L. G. Goes, S. Anthony, K. Kirchgatter, L. Guimarães, P. Brandão and F. Ferreira. 2015. Infectious agents survey in pied tamarin subpopulations in Manaus, Amazonas State, Brazil. In: *Proceedings of the 27th International Congress for Conservation Biology and 4th European Congress for Conservation Biology*, P. Visconti, E. Game, R. Mathevet and M. Wilkerson (eds.), pp. 660. Montpellier, France.

Vidal. M. D., M. Gordo and F. Röhe. 2018. *Saguinus bicolor* (Spix, 1823). In: *Livro Vermelho da Fauna Brasileira Ameaçada de Extinção, Volume 2 – Mamíferos*, pp.244–249. Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), Ministério de Meio Ambiente (MMA), Brazil.

ECUADORIAN WHITE-FRONTED CAPUCHIN

Albuja, L. 2002. Mamíferos del Ecuador. In: *Diversidad y Conservación de los Mamíferos Neotropicales*, G. Ceballos and J. A. Simonetti (eds.), pp. 271–327. CONABIO, Universidad Nacional Autónoma de México, Mexico City, Mexico.

Albuja, L. and R. Arcos. 2007. Evaluación de las poblaciones de *Cebus albifrons cf. aequatorialis* en los bosques suroccidentales ecuatorianos. *Politécnica* 27 (4) / *Biología* 7: 59–69.

Albuja, L., P. Moreno-Cárdenas and M. F. Solórzano. 2018. Aspectos taxonómicos y ecológicos del capuchino ecuatoriano, *Cebus albifrons aequatorialis* (Primates: Cebidae) en el Ecuador. In: *La Primatología en Latinoamérica 2 - A Primatologia na America Latina 2. Tomo II Costa Rica-Venezuela*, B. Urbani, M. Kowalewski, R. G. T. Cunha, S. de la Torre and L. Cortés-Ortiz (eds.), pp. 411–426. Instituto Venezolano de Investigaciones Científicas, Caracas, Venezuela.

Campos, F. A. and K. M. Jack. 2013. A potential distribution model and conservation plan for the Critically Endangered Ecuadorian Capuchin, *Cebus albifrons aequatorialis*. *International Journal of Primatology* 34 (5): 899–916.

Cervera, L., D. J. Lizcano, D. G. Tirira, and G. Donati. 2015. Surveying two Endangered primate species (*Alouatta palliata aequatorialis* and *Cebus aequatorialis*) in the Pacoche Marine and Coastal Wildlife Refuge, West Ecuador. *International Journal of Primatology* 36 (5): 933–947.

Cervera, L., S. de la Torre, G. Zapata-Ríos, F. Alfonso-Cortés, S. Alvarez-Solas, O. Crowe, R. Cueva, A de la Torre, I. Duch-Latorre, M. Fernanda-Solórzano, N. Fuentes, D. Larriva, D. Maila, D. Mantilla, A. Mariscal, C. Mariscal, E. Molina, M. Morales, C. Morelos-Juárez, V. Narváez-Ruano, A. Naveda-Rodríguez, J. Palacios, L. Ramis, E. Rivera, A. Rubio, J. Salas, D. Sulca, A. Tapia, M. Toapanta, E. Troya, S. Urbina, V. Utreras, D. A. Velarde-Garcêz and O. A. Eloz. 2018. Working together towards one goal: results of the first primate census in Western Ecuador. *Primate Conservation* 32: 8.

Cornejo, F. and S. de la Torre. 2015. *Cebus aequatorialis*. *The IUCN Red List of Threatened Species 2015.* http://dx.doi.org/10.2305/IUCN.UK.2015.RLTS.T4081A81232052.en.

Encarnacion, F. and G. Cook. 1998. Primates of the tropical forest of the Pacific coast of Peru: the Tumbes Reserved Zone. *Primate Conservation* 18: 15–20.

Gonzalez-Jaramillo, V., A. Fries, R. Rollenbeck, J. Paladines, F. Onate-Valdivieso, and J. Bendix. 2016. Assessment of deforestation during the last decades in Ecuador using NOAA-AVHRR satellite data. *Erdkunde* 70 (3): 217–235.

Jack, K. M. and F. A. Campos. 2012. Distribution, abundance, and spatial ecology of the Critically Endangered Ecuadorian Capuchin (*Cebus albifrons aequatorialis*). *Tropical Conservation Science* 5 (2): 173–191.

Hurtado, C. M., J. S. Serrano-Villavicencio and V. Pacheco. 2016. Population density and primate conservation in the Noreste Biosphere Reserve, Tumbes, Peru. *Revista Peruana de Biología* 23 (2): 151–158.

Ministerio del Ambiente del Equador. 2012. Línea Base de Deforestación del Ecuador Continental. Ministerio del Ambiente, Quito, Ecuador.

Moscoso-Silva, F. J. 2013. Estado de Conservación del Hábitat del Mono Machín *(Cebus albifrons aequatorialis)* en la Localidad de Las Tolas, Noroccidente del Distrito Metropolitano de Quito, Provincia de Pichincha. Licentiate Thesis, Pontifica Universidad Católica del Ecuador, Quito, Ecuador.

Rylands, A. B., R. A. Mittermerier, B. M. Bezerra, F. P. Paim, and H. L. Queiroz. 2013. Family Cebidae (Squirrel monkeys and Capuchins). In: *Handbook of the Mammals of the World. Volume 3: Primates.* R. A. Mittermeier, A. B. Rylands, and D. E. Wilson (eds.), pp. 348–413. Lynx Edicions, Barcelona, Spain.

Saavedra, C. J., and D. Velarde. 1980. Evaluación Preliminar de la Distribución y el Estatus del Coto de Tumbes (*Alouatta palliata*) en el Bosque Nacional de Tumbes. Unpublished report. Dirección General Forestal y de Fauna, Ministerio de Agricultura, Lima, Peru.

SERFOR (Servicio Nacional Forestal y de Fauna Silvestre). 2015. *Ley Forestal y de Fauna Silvestre Ley Nº 29763 y sus Reglamentos*. Depósito Legal en la Biblioteca Nacional del Perú Nº 2015-17751.

Sierra, R. 2013. Patrones y Factores de Deforestación en el Ecuador Continental, 1990-2010, y un Acercamiento a los Próximos 10 años. Conservación Internacional Ecuador y Forest Trends, Quito, Ecuador.

Solórzano, M. F. 2014. Estado de Conservación de las Poblaciones del Capuchino Ecuatoriano *(Cebus aequatorialis),* al Noroccidente del Distrito Metropolitano de Quito (DMQ), Localidad de Las Tolas, Provincia de Pichincha. Licentiate Thesis, Universidad Central del Ecuador, Quito, Ecuador.

Tirira, D. G. 2011. *Libro Rojo de los mamíferos del Ecuador*. 2nd ed. Publicación especial sobre los mamíferos del Ecuador 8. Fundación Mamíferos y Conservación / Pontificia Universidad Católica del Ecuador / Ministerio del Ambiente del Ecuador, Quito, Ecuador.

Tirira, D. G. 2017. *Guía de campo de los mamíferos del Ecuador*. 2nd ed. Publicación especial sobre los mamíferos del Ecuador 11. Asociación Ecuatoriana de Mastozoología / Editorial Murciélago Blanco, Quito, Ecuador.

Tirira, D. G., S. de la Torre and G. Zapata Ríos (eds.). 2018. Estado de conservación de los primates del Ecuador. *Publicación especial sobre los mamíferos del Ecuador 12*, Grupo de Estudio de Primates del Ecuador / Asociación Ecuatoriana de Mastozoología, Quito, Ecuador.

OLALLA BROTHERS' TITI MONKEY

Bicca-Marques, J. C. and E. W. Heymann. 2013. Ecology and behavior of titi monkeys (genus *Callicebus*). In: *Evolutionary Biology and Conservation of Titis, Sakis and Uacaris*, L. M. Veiga, A. A. Barnett, S. F. Ferrari, and M. A. Norconk (eds.), pp. 196-207. Cambridge University Press, Cambridge, UK.

Byrne, H., A. B. Rylands, J. C. Carneiro, J. W. Lynch-Alfaro, F. Bertuol, M. N. F. Da Silva, M. Messias, C. P. Groves, R. A. Mittermeier, I. Farias, T. Hrbek, H. Schneider, I. Sampaio and J. P. Boubli. 2016. Phylogenetic relationships of the New World titi monkeys (*Callicebus*): first appraisal of taxonomy based on molecular evidence. *Frontiers in Zoology* 13: 10.

Felton, A., A. M. Felton, R. B. Wallace and H. Gómez. 2006. Identification, distribution and behavioral observations of the titi monkeys *Callicebus modestus* Lönnberg, 1939 and *Callicebus olallae* Lönnberg, 1939. *Primate Conservation* 20: 41–46.

GAMSR (Gobierno Autónomo Municipal de Santa Rosa del Yacuma). 2016. Plan de Manejo del Área Protegida Municipal Pampas del Yacuma, Beni, Bolivia. Report, GAM Santa Rosa del Yacuma y WCS-Bolivia, La Paz, Bolivia.

Hershkovitz, P. 1990. Titis, New World monkeys of the genus *Callicebus* (Cebidae, Platyrrhini): a preliminary taxonomic review. *Fieldiana Zoology* 55: 1–109.

Kobayashi, S. 1995. A phylogenetic study of titi monkeys, genus *Callicebus*, based on cranial measurements: I. Phyletic groups of *Callicebus*. *Primates* 36: 101–120.

Lönnberg, E. 1939. Notes on some members of the genus *Callicebus*. *Arkiv för Zoologi* 31: 1–18.

López-Strauss, H. and R. B. Wallace. 2015. Estimación de densidad de dos primates endémicos bolivianos, *Callicebus olallae* y *Callicebus modestus*. *Mastozoologia Neotropical* 22: 23–34.

Martinez, J. 2014. Behaviour and Ranging Patterns of the Endangered and Endemic Bolivian Titi Monkeys *Callicebus olallae* and *Callicebus modestus*. MSc Thesis, Oxford Brookes University, Oxford, UK.

Martinez, J. and R. B. Wallace. 2007. Further notes on the distribution of endemic Bolivian titi monkeys, *Callicebus modestus* and *Callicebus olallae*. *Neotropical Primates* 14: 47–54.

Martinez, J. and R. B. Wallace. 2010. Pitheciidae. In: *Distribución, Ecología y Conservación de los Mamíferos Medianos y Grandes de Bolivia*, R. B. Wallace, H. Gómez, Z. R. Porcel, and D. I. Rumiz (eds.), pp. 305–330. Centro de Ecología Difusión Simón I. Patiño, Santa Cruz de la Sierra, Bolivia.

Martinez, J. and R. B. Wallace. 2011. First observations of terrestrial travel for Olalla's titi monkey (*Callicebus olallae*). *Neotropical Primates* 18: 49–52.

Martinez, J. and R. B. Wallace. 2013. New information about the distribution of *Callicebus* (Pitheciidae, Primates) in northern Beni Department, Bolivia. *Ecologia en Bolivia* 48: 57–62.

Martinez, J. and R. B. Wallace. 2016. *Plecturocebus olallae*. In: *All the World's Primates*, N. Rowe and M. Myers (eds.), pp. 201. Pogonias Press Inc., Charlestown, USA.

Martinez, J., R. B. Wallace, A. Arnez, A. J. Barreta, P. Carvaja, E. Domic, C. Flores-Turdera, C. Jurado, L. López, H. López-Strauss, L. Morrison, Z. Porcel, A. Reinaga and T. Siles. 2015. Línea base para la conservación de los monos lucachi endémicos de Bolivia: *Callicebus olallae* y *C. modestus*. *Agrociencias Amazonía* 5: 1–11.

MMAyA (Ministerio de Medio Ambiente y Agua). 2009. Libro Rojo de la Fauna Silvestre de Vertebrados de Bolivia. Report, Ministerio de Medio Ambiente y Agua, La Paz, Bolivia.

MMAyA (Ministerio de Medio Ambiente y Agua). 2014. Plan de Acción Para la Conservación de Mamíferos Amenazados. PGD Impresiones, La Paz, Bolivia.

Porter, L., J. Chisj, T. R. Defler, L. Marsh, J. Martinez, H. Matthews, W. McBride, D. G. Tirira, M. Velilla and R. Wallace. 2013. Pitheciid conservation in Ecuador, Colombia, Peru, Bolivia and Paraguay. In: *Evolutionary Biology and Conservation of Titis, Sakis and Uacaris*, L. M. Veiga, A. A. Barnett, S. F. Ferrari, and M. A. Norconk (eds.), pp. 320–333. Cambridge University Press, Cambridge, UK.

Van Roosmalen, M. G. M., T. Van Roosmalen and R. A. Mittermeier. 2002. A taxonomic review of the titi monkeys, genus *Callicebus* Thomas, 1903, with the description of two new species, *Callicebus bernhardi* and *Callicebus stephennashi*, from Brazilian Amazonia. *Neotropical Primates* 10: 1–52.

Veiga, L. M., R. B. Wallace and J. Martinez. 2008. *Plecturocebus olallae*. *The IUCN Red List of Threatened Species 2008.* http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T3554A9939925.en.

Wallace R. B., J. Martinez, H. López-Strauss, J. Barreta, A. Reinaga and L. López. 2013. Conservation challenges facing two threatened endemic titi monkeys in a naturally fragmented Bolivian forest. In: *Primates in fragments: complexity and resilience. Development in primatology: progress and prospects*, L. K. Marsh and C. A. Chapman (eds.), pp. 493-501. Springer Science, New York, USA.

BROWN HOWLER MONKEY

Agostini, I., G. Aprile, M. C. Baldovino, M. Brividoro, M. Di Bitetti, L. Fantini, V. A. Fernández, E. Fernández-Duque, I. Holzmann, C. P. Juárez, M. Kowalewski, M. D. Mudry, M Nieves, L. I. Oklander, S. M. Peker, R. Pfoh, M. Raño, E. R. Steinberg, M. P. Tujague and G. E. Zunino. 2012. Orden Primates. In: *Libro Rojo de Mamíferos Amenazados de la Argentina,* R. A. Ojeda, V. Chillo and G. B. Diaz Isenrath (eds.), pp. 81–86. Sociedad Argentina para el Estudio de los Mamíferos (SAREM), Mendoza, Argentina.

Agostini, I., I. Holzmann, M. S. Di Bitetti, L. I. Oklander, M. M. Kowalewski, P. M. Beldomenico, S. Goenaga, M. Martínez, E. S. Moreno, E. Lestani, A. L. J. Desbiez and P. Miller. 2014. Building a species conservation strategy for the brown howler monkey (*Alouatta guariba clamitans*) in Argentina in the context of yellow fever outbreaks. *Tropical Conservation Science* 7: 26–34.

Aguiar, L. M., D. M. Mellek, K. C. Abreu, T. G. Boscarato, I. P. Bernadi, J. M. D. Miranda and F. C. Passos. 2007. Sympatry between *Alouatta caraya* and *Alouatta clamitans* and the rediscovery of free-ranging potential hybrids in southern Brazil. *Primates* 48: 245–248.

Almeida, M. A. B., E. Santos, J. C. Cardoso, D. F. Fonseca, C. A. Noll, V. R. Silveira, A. Y. Maeda, R. P. Souza, C. Kanamura and R. A. Brasil. 2012. Yellow fever outbreak affecting *Alouatta* populations in southern Brazil (Rio Grande do Sul State) 2008–2009. *American Journal of Primatology* 74: 68–76.

Bicca-Marques, J. C., C. Calegaro-Marques, A. B. Rylands, K. B. Strier, R. A. Mittermeier, M. A. B. Almeida, P. H. G. Castro, Ó. M. Chaves, L. P. Ferraz, V. B. Fortes, Z. M. B. Hirano, L. Jerusalinsky, M. Kowalewski, W. P. Martins, F. R. Melo, S. L. Mendes, L. G. Neves, F. C. Passos, M. Port-Carvalho, S. Ribeiro, A. P. M. Romano, C. R. Ruiz-Miranda, E. O. Santos, J. C. Souza Jr and D. S. Teixeira. 2017. Yellow fever threatens Atlantic Forest primates. *Science Advances* 3 (1): e1600946.

Bicca-Marques, J. C., S. L. Alves, B. Ingberman, G. Buss, B. G. Fries, A. C. Alonso, R. G. T. Cunha and J. M. D. Miranda. 2018. *Alouatta guariba clamitans* Cabrera, 1940. In: *Livro Vermelho da Fauna Brasileira Ameaçada de Extinção: Volume II – Mamíferos*, A. B. M. Machado, G. M. Drummond and A. P. Paglia (eds.), pp.55–161. Instituto Chico Mendes de Conservação da Biodiversidade, Brazil.

Brazil, MMA. 2014. Lista Nacional Oficial de Espécies da Fauna Ameaçadas de Extinção. Portaria n° 444, de 17 de dezembro de 2014 – Ministério do Meio Ambiente. *Diário Oficial da União – Seção 1*, 245: 121–126.

Brazil, MMA. 2018. Aprova o Plano de Ação Nacional para a Conservação dos Primatas da Mata Atlântica e da Preguiça-de-Coleira. Portaria n° 702, de 07 de agosto de 2018 – Ministério do Meio Ambiente. *Diário Oficial da União – Seção 1* 153: 57.

Buss, G., J. C. Bicca-Marques, S. L. Alves, B. Ingberman, B. G. Fries, A. C. Alonso, R. G. Teixeira da Cunha, J. M. D. Miranda, F. R. Melo, L. Jerusalinsky, R. A. Mittermeier, L. Cortés-Ortiz and M. Talebi. In prep.

REFERENCES

Chaves, Ó. M. and J. C. Bicca-Marques. 2013. Dietary flexibility of the brown howler monkey throughout its geographic distribution. *American Journal of Primatology* 75: 16–29.

Chaves, Ó. M., J. C. Bicca-Marques and C. A. Chapman. 2018. Quantity and quality of seed dispersal by a large arboreal frugivore in small and large Atlantic forest fragments. *PLoS ONE* 13: e0193660.

Chaves, Ó. M., J. C. Souza, G. Buss, J. C. Bicca-Marques, Z. M. B. Hirano, E. L. S. Amaral, J. C. Godoy, M. M. A. Jardim, A. R. Peruchi and T. Michel. In prep. *Threats for wildlife in the anthropogenic urban matrix in southern Brazil: The case of the brown howler monkeys.*

Fortes, V. B., J. C. Bicca-Marques, B. Urbani, V. A. Fernandéz and T. S. Pereira. 2015. Ranging behavior and spatial cognition in howler monkeys. In: *Howler Monkeys: Behavior, Ecology, and Conservation*, M. M. Kowalewski, P. A. Garber, L. Cortés-Ortiz, B. Urbani and D. Youlatos (eds.), pp. 219–255. Springer, New York, USA.

Glander, K. E. 2013. Brown howler *Alouatta guariba*. In: *Handbook of the Mammals of the World. Volume 3. Primates*, R. A. Mittermeier, A. B. Rylands and D. E. Wilson (eds.), pp. 531. Lynx Edicions, Barcelona, Spain.

Gregorin, R. 2006. Taxonomy and geographic variation of species of the genus *Alouatta* Lacépède (Primates, Atelidae) in Brazil. *Revista Brasileira de Zoologia* 23: 64–144.

Holzmann, I., I. Agostini, J. I. Areta, H. Ferreyra, P. Beldomenico and M. S. Di Bitetti. 2010. Impact of yellow fever outbreaks on two howler monkey species (*Alouatta guariba clamitans* and *A. caraya*) in Misiones, Argentina. *American Journal of Primatology* 72: 475–480.

Ingberman, I., R. Fusco-Costa and E. L. A. Monteiro-Filho. 2009. Population survey and demographic features of a coastal island population of *Alouatta clamitans* in Atlantic Forest, southeastern Brazil. *International Journal of Primatology* 30: 1–14.

Jardim, M. M. A. 2005. Ecologia Populacional de Bugios-ruivos (*Alouatta guariba*) nos Municípios de Porto Alegre e Viamão. PhD Thesis, University of Campinas, São Paulo, Brazil.

Jerusalinsky, L., F. Z. Teixeira, L. X. Lokschin, A. Alonso, M. M. A. Jardim, J. N. H. Cabral, R. C. Printes and G. Buss. 2010. Primatology in southern Brazil: a transdisciplinary approach to the conservation of the brown howler monkey *Alouatta guariba clamitans* (Primates, Atelidae). *Iheringia, Série Zoologia* 100: 403–412.

Melo, F. R. 2005. A Reserva Biológica Federal da Mata Escura e sua importância como unidade de conservação para os primatas do médio rio Jequitinhonha, Minas Gerais. *Neotropical Primates* 13: 26–29.

Mendes, S. L., A. B. Rylands, M. C. M. Kierulff and M. M. de Oliveira. 2008. *Alouatta guariba*. *The IUCN Red List of Threatened Species 2008*. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T39916A10284881.en.

Miranda, J. M. D. and F. C. Passos. 2005. Composição e dinâmica de grupos de *Alouatta guariba clamitans* Cabrera (Primates, Atelidae) em Floresta Ombrófila Mista no estado do Paraná, Brasil. *Revista Brasileira de Zoologia* 22: 99–106.

Miranda, J. M. D. and F. C. Passos. 2011. Home range and space use by *Alouatta clamitans* Cabrera, 1940 in Araucaria pine Forest in Southern Brazil. In: *A Primatologia no Brasil Vol 12*, J. M. D. Miranda and Z. M. B. Hirano (eds.), pp. 114–125. Sociedade Brasileira de Primatologia, Curitiba, Brazil.

Neves, L. G., L. Jerusalinsky, M. Talebi, R. A. Mittermeier, L. Cortés-Ortiz and F. R. Melo, In press. *Alouatta guariba ssp. guariba*. *The IUCN Red List of Threatened Species.*

Neves, L. G., L. Jerusalinsky, F. R. Melo, A. B. Rylands and M. Talebi. 2017. Northern brown howler *Alouatta guariba guariba* (Humboldt, 1812). In: *Primates in Peril: The World's 25 Most Endangered Primates 2016–2018*, C. Schwitzer, R. A. Mittermeier, A. B. Rylands, F. Chiozza, E. A. Williamson, E. J. Macfie, J. Wallis and A. Cotton (eds.), pp. 96–99. IUCN SSC Primate Specialist Group (PSG), International Primatological Society (IPS), Conservation International (CI), and Bristol Zoological Society, Arlington, USA.

Neves, L.G., L. Jerusalinsky and F. R. Melo. 2018. *Alouatta guariba guariba* (Humboldt, 1812). In: *Livro Vermelho da Fauna Brasileira Ameaçada de Extinção: Volume II – Mamíferos*, A. B. M. Machado, G. M. Drummond and A. P. Paglia (eds.), pp. 162–166. Instituto Chico Mendes de Conservação da Biodiversidade, Brazil.

Neville, M. K., K. Glander, F. Braza and A. B. Rylands. 1988. The howling monkeys, genus *Alouatta*. In: *Ecology and Behavior of Neotropical Primates Vol. 2*, R. A. Mittermeier, A. B. Rylands, A. F. Coimbra-Filho and G. A. B. da Fonseca (eds.), pp. 349–453. World Wildlife Fund, Washington, USA.

Printes, R. C., M. V. A. Liesenfeld and L. Jerusalinsky. 2001. *Alouatta guariba clamitans* Cabrera, 1940: a new southern limit for the species and for Neotropical primates. *Neotropical Primates* 9: 118–121.

Printes, R. C., G. Buss, M. M. A. Jardim, M. S. Fialho, S. S. Dornelles, M. Perotto, L.F.G. Brutto, E. Girardi, L. Jerusalinsky, M. V. A. Liesenfeld, L.X Lokschin. and H.P. Romanowski 2010. The Urban Monkeys Program: A survey of *Alouatta clamitans* in the South of Porto Alegre and Its influence on land use policy between 1997 and 2007. *Primate Conservation* (25): 11–19.

Ribeiro, M. C., J. P. Metzger, A. C. Martensen, F. J. Ponzoni and M. M. Hirota. 2009. The Brazilian Atlantic Forest: how much is left, and how is the remaining forest distributed? Implications for conservation. *Biological Conservation* 142: 1141–1153.

Rylands, A. B., W. R. Spironello, V. L. Tornisielo, R. M. Lemos de Sá, M. C. M. Kierulff, and I. B. Santos. 1988. Primates of the Rio Jequitinhonha valley, Minas Gerais, Brazil. *Primate Conservation* 9: 100–109.

Rylands, A. B., H. Schneider, A. Langguth, R. A. Mittermeier, C. P. Groves and E. Rodriguez-Luna. 2000. An assessment of the diversity of New World primates. *Neotropical Primates* 8: 61–93.

Scarano, F. R. and O. Ceotto. 2015. Brazilian Atlantic forest: impact, vulnerability, and adaptation to climate change. *Biodiversity and Conservation* 24: 2319–2331.

Strier, K. B. 2004. Patrilineal kinship and primate behaviour. In: *Kinship and Behaviour in Primates*, B. Chapais and C. Berman (eds.), pp.177–199. Oxford University Press, New York, USA.

Strier, K. B., S. L. Mendes and R. R. Santos. 2001. Timing of births in sympatric brown howler monkeys (*Alouatta fusca clamitans*) and northern muriquis (*Brachyteles arachnoides hypoxanthus*). *American Journal of Primatology* 55: 87–100.

CENTRAL AMERICAN SPIDER MONKEY

Allen, J. A. 1914. New South American monkeys. *Bulletin of the American Museum of Natural History* 33: 647–655.

Bole, B. P. 1937. Cleveland Museum of Natural History. *Science Publications: Ateles azuerensis* 7: 149.

Campbell, C. J. 2000. Fur rubbing behavior in free-ranging black-handed spider monkeys (*Ateles geoffroyi*) in Panama. *American Journal of Primatology* 51: 205–208.

Carpenter, C. R. 1935. Behaviour of red spider monkeys in Panama. *Journal of Mammalogy* 16: 171–180.

Chaves, Ó. M., K. E. Stoner and V. Arroyo-Rodríguez. 2011. Seasonal differences in activity patterns of Geoffroyi's Spider Monkeys (*Ateles geoffroyi*) living in continuous and fragmented forests in Southern Mexico. *International Journal of Primatology* 32 (4): 960–973.

Cuarón, A.D., A. Morales, A. Shedden, E. Rodriguez-Luna, P. C. de Grammont and L. Cortés-Ortiz. 2008. *Ateles geoffroyi*. *The IUCN Red List of Threatened Species 2008*. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T2279A9387270.en.

Elliot, D. G. 1913. *A Review of the Primates*. American Museum of Natural History. Monograph Series 1, 2, New York, USA.

Gray, J. E. 1865. Notice of some new species of spider monkeys (*Ateles*) in the collection of the British Museum. In: *Proceedings of the Zoological Society of London for 1865*, J. E. Gray (ed.), pp. 732–733. Zoological Society of London, London, UK.

Goldman, E. A. 1914. Descriptions of five new mammals from Panama. In: *Smithsonian Miscellaneous Collections Vol. 63*. Smithsonian Institution, Washington DC, USA.

Goldman, E. A. 1920. Mammals of Panama (with Thirty-nine Plates). In: *Smithsonian Miscellaneous Collections Vol. 69 No. 2*. Smithsonian institution, Washington DC, USA.

Groves, C. 2005. Order Primates. In: *Mammal Species of the World*, D. E. Wilson and D. M. Reeder (eds.), pp. 111–184. Johns Hopkins University Press, Baltimore, USA.

Kellogg, R. and E. A. Goldman. 1944. Review of the spider monkeys. *Proceedings of the United States National Museum, Smithsonian Institution* 96: 1–45.

McGrath, M. 2014. Drug trafficking is speeding deforestation in Central America. BBC Science & Environment. Website: https://www.bbc.co.uk/news/science-environment-25960481. Accessed 9 December 2015.

Méndez-Carvajal, P. G. and I. Ruiz-Bernard. 2009. Estudio Poblacional del mono araña de Azuero (*Ateles geoffroyi azuerensis*), Península de Azuero, Panamá. *Tecnociencia* 11 (1): 24–44.

Méndez-Carvajal, P. G. 2012. Preliminary primate survey at the Chucanti Nature Reserve, Darien Province, Republic of Panama. *Mesoamericana* 16 (3): 22–29.

Méndez-Carvajal, P. G. 2013. Population size, distribution and conservation status of howler monkeys (*Alouatta coibensis trabeata*) and spider monkeys (*Ateles geoffroyi azuerensis*) on the Azuero Peninsula, Panama. *Primate Conservation* 26 (1): 3–15.

Méndez-Carvajal, P. G., I. Ruiz-Bernard, Y. González, K. Sánchez, V. Franco, S. Silva and G. De León. 2013. Strategies for the conservation of two Critically Endangered, endemic primates in Panama. *Primate Conservation* 27: 13–21.

Méndez-Carvajal, P. G. 2014. The Orion camera system, a new method for deploying camera traps in tree canopy to study arboreal primates and other mammals: a case study in Panama. *Mesoamericana* 18 (1): 9–23.

Méndez-Carvajal, P. G., J. M. Setchell and R. Hill. 2016. Factors Limiting the Distribution of Panamanian Primates: an Ecological Niche Modelling Approach. Conference. International Primatological Society, and American Society of Primatologists, Chicago, USA.

Mittermeier, R. A., W. G. Kinzey and R. B. Mast. 1989. Neotropical primate conservation. *Journal of Human Evolution* 18 (7): 597–610.

Morales-Jimenez A. L., L. Cortés-Ortiz and A. Di Fiore. 2015. Phylogenetic relationships of Mesoamerican spider monkeys (*Ateles geoffroyi*): Molecular evidence suggests the need for a revised taxonomy. *Molecular Phylogenetics and Evolution* 82: 484–494.

Pineda-Peraza, L. A., J. H. Segura-Yanes, K. E. Medina-Zeledón, J. I. Flores-Márquez and M. A. López. 2017. Redescubrimiento de una población de mono araña (*Ateles geoffroyi*) en la Laguna de Olomega, El Salvador. *Acta Zoológica Mexicana* 33 (3): 532–537.

Ponce-Santizo, G., R. García, J. Moreira, R. Balas, G. Ruano, M. Mérida, F. Córdova, V. Méndez, Y. López, E. Castellanos, M. Burgos and R. Lima. 2009. Abundancia y Densidad de Primates en la Concesión Forestal Yaloch, Reserva de Biosfera Maya, Guatemala. Estudio Piloto. Reporte interno Wildlife Conservation Society- Programa para Guatemala.

Pozo-Montuy G., B. P. Guendulain, A. B. Alcacer, L. F. M. Jiménez, L. A. D. Martínez and G. R. Fernández. 2015. Reporte Técnico del Proyecto Fortalecimiento de Acciones de Conservación de Primates y su Hábitat en el Complejo Selva Zoque. Conservación de la Biodiversidad del Usumacinta A.C., Comisión Nacional de Áreas Naturales Protegidas - Programa de Conservación de Especies en Riesgo 2015. Tuxtla Gutiérrez, Chiapas, Mexico, 134pp.

Rodríguez-Menjívar, M. 2007. Monitoreo Poblacional de Mono Araña (Ateles geoffroyi) en el Área Natural Protegida Normandia, Usulután, El Salvador. Centro de Cooperación Integral sobre Tecnologías Alternativas, El Salvador

Ruiz-García, M., N. Lichilín, P. Escobar-Armel, G. Rodríguez and G. Gutierrez-Espeleta. 2016. Historical genetic demography and some insights into the systematics of *Ateles* (Atelidae, Primates) by means of diverse mitochondrial genes. In: *Phylogeny, Molecular Genetics, Evolutiionary Biology and Conservation of the Neotropical Primates*, M. Ruiz-García and J. M. Shostell (eds.), Nova Science Publisher Inc., New York, USA.

Rylands, A. B., R. A. Mittermeier and E. Rodríguez-Luna. 1997. Conservation of neotropical primates: threatened species and an analysis of primate diversity by country and region. *Folia Primatologica* 68 (3-5): 134–160.

Rylands, A. B., C. P. Groves, R. A. Mittermeier, L. Cortés-Ortiz and J. J. Hines. 2006. Taxonomy and distributions of Mesoamerican primates. In: *New perspectives in the study of Mesoamerican primates*, A. Estrada, P. A. Garber, M. M. Pavelka and L. Luecke (eds.), pp. 29–79. Springer, New York, USA.

Sclater, P. 1875. *Ateles melanochir*. *Proceedings of the Zoological Society of London for 1875*, pp. 419. Academic Press, London, UK.

Smith, D. A. 2005. Garden game: shifting cultivation, indigenous hunting and wildlife ecology in western Panama. *Human Ecology* 33 (4): 505–537.

OTHER SPECIES CONSIDERED

GRAUER'S GORILLA

Plumptre, A., S. Nixon, D. Caillaud, J. S. Hall, J. A. Hart, R. Nishuli and E. A. Williamson. 2016a. *Gorilla beringei ssp. graueri*. (errata version published in 2016) *The IUCN Red List of Threatened Species 2016*. http://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T39995A17989838.en.

Plumptre, A. J., S. Nixon, D. K. Kujirakwinja, G. Vieilledent, R. Critchlow and E. A. Williamson. 2016b. Catastrophic decline of world's largest primate: 80% loss of Grauer's gorilla (*Gorilla beringei graueri)* population justifies Critically Endangered status. *PLoS ONE* 11 (10): e0162697.

Plumptre, A. J., S. Nixon, R. Critchlow, G. Vieilledent, R. Nishuli, A. Kirkby, E. A. Spira, C., G. Mitamba, A. Kirkby, T. Kalikunguba, R. Nishuli and A. Plumptre. 2016c. Grauer's Gorilla Numbers Increasing in Kahuzi-Biega National Park Highlands: 2015 Census in Tshivanga Sector. Unpublished report by the Wildlife Conservation Society.

CRESTED MACAQUE

Fooden, J. 1969. Taxonomy and Evolution of the Monkeys of Celebes. Karger, Basel, Switzerland.

Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova and A. Tyukavina. 2013. High-resolution global maps of 21st-century forest cover change. *Science* 342: 850–853.

Johnson, C. L., H. Hilser., N. Andayani., I. Honowu., M. Linkie., A. Patandung., W. Pusparini., R. Rahasia., A. E. Bowkett. 2019. Camera traps clarify the distribution boundary between the crested black macaque *Macaca nigra* and Gorontalo macaque *Macaca nigrescens* in North Sulawesi. *International Journal of Primatology* 40 (2): 162–166.

BORNEO BANDED LANGUR

Ampeng, A. and B. M. Md.-Zain. 2012. Ranging patterns of Critically Endangered colobine, *Presbytis chrysomelas chrysomelas*. *The Scientific World Journal* ID 5943.

Groves, C., M. Richardson and C. Roos. 2013. Cross-marked langur (*Presbytis chrysomelas*). In: *Handbook of the Mammals of the World Vol. 3, Primates*, R. A. Mittermeier, A. B. Rylands and D. E. Wilson (eds.), pp. 716. Lynx Edicions, Barcelona, Spain.

Meijaard, E., K. Mengersen, D. Buchori, A. Nurcahyo, M. Ancrenaz, S. Wich, S. S. U. Atmoko, A. Tjiu, D. Prasetyo, Nardiyono, Y. Hadiprakarsa, L. Christy, J. Wells, G. Albar and A. J. Marshall. 2011. Why don't we ask? A complementary method for assessing the status of great apes. *PLoS ONE* 6 (3): e18008.

Nijman, V., J. Hon and M. Richardson. 2008. *Presbytis chrysomelas*. *The IUCN Red List of Threatened Species 2008*. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T39803A10268236.en.

Phillipps, Q. and K. Phillipps. 2018. *Phillipps' Field Guide to the Mammals of Borneo and Their Ecology, Sabah, Sarawak, Brunei and Kalimantan* (2nd ed.). John Beaufoy Publishing Ltd, Oxford, UK.

TONKIN SNUB-NOSED MONKEY

Le, Q. K. and H. H. Covert. 2010. Another population of the Tonkin snub-nosed monkey (*Rhinopithecus avunculus*) discovered in Ha Giang Province, Vietnam. *Vietnamese Journal of Primatology* 4: 19–25.

Nadler, T., F. Momberg, D. X. Nguyen and N. Lormee. 2003. Vietnam Primate Conservation Status Review Part 2: Leaf Monkeys. Fauna and Flora International and Frankfurt Zoological Society, Hanoi, Vietnam.

Nadler, T. and D. Brockman. 2014. Primates of Vietnam. Endangered Primate Rescue Center, Cuc Phuong National Park, Vietnam.

SIAU ISLAND TARSIER

Badan Pusat Statistik Kabupaten Kepulauan Sangihe. 2018. Kabupaten Kepulauan Sangihe Dalam Angka (Kepulauan Sangihe Regency in Figures).

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

Shekelle M. and A. Salim. 2009. An acute conservation threat to two tarsier species in the Sangihe Island chain [North Sulawesi, Indonesia] *Oryx* 43 (3): 419–426.

Shekelle, M. and A. Salim. 2011. *Tarsius tumpara*. *The IUCN Red List of Threatened Species 2011*. http://dx.doi.org/10.2305/IUCN.UK.2011-1.RLTS.T179234A7636582.en.

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