Cercopithecus albogularis – Samango Monkey

Regional Red List status (2016)	
C. a. labiatus	**Vulnerable B2ab(ii,iii,v)***
C. a. erythrarchus	**Near Threatened B2ab(ii,iii,v)***
C. a. schwarzi	**Endangered B2ab(ii,iii,v)***
National Red List status (2004)	
C. a. labiatus	Endangered B1ab(ii,iii,iv,v)
C. a. erythrarchus	Vulnerable B1ab(i,ii,iii)+2ab(i,ii,iii)
C. a. schwarzi	Not Evaluated
Reasons for change	
C. a. labiatus	Non-genuine: New information
C. a. erythrarchus	Non-genuine: New information
C. a. schwarzi	Non-genuine: Taxonomy
Global Red List status (2008)	
C. a. labiatus	Vulnerable A2c
C. a. erythrarchus	Least Concern
C. a. schwarzi	Not assessed
TOPS listing (NEMBA) (2007)	Vulnerable
CITES listing (1977)	Appendix II (species level)
Endemic	
C. a. labiatus	Yes
C. a. erythrarchus	No
C. a. schwarzi	Unknown

*Watch-list Data

The Zulu word for Samango Monkey, *insimango*, means "monkeys in the mist".

Taxonomy

Cercopithecus albogularis labiatus Geoffroy Saint-Hilaire 1842

Cercopithecus albogularis erythrarchus Peters 1852

Cercopithecus albogularis schwarzi Roberts 1931

ANIMALIA - CHORDATA - MAMMALIA - PRIMATES - CERCOPITHECIDAE - *Cercopithecus* - *albogularis*

Synonyms: *Cercopithecus mitis* Geoffroy Saint-Hilaire 1842

Common names: Samango Monkey, Stair's White-collared Monkey, Schwarz's White-collared Monkey (English), Samango-aap (Afrikaans), Insimango (siSwati, Zulu), Ndlandlama (Tsonga), Dulu (Venda), Intsimango (Xhosa)

Taxonomic status: Subspecies

Taxonomic notes: There are taxonomic controversies on both the species and subspecies level. While Groves (2001, 2005) classifies the Samango Monkey as *C. albogularis* (recognising *albogularis* as a separate species within the highly polytypic *Cercopithecus nictitans* group), Grubb et al. (2003) do not recognise *C. albogularis* as a separate taxon and classify it as *C. mitis*. No genetic analysis has been done to date to support one or the other classification. The number of subspecies recognised in South Africa is also inconsistent. Meester et al. (1986) followed by Grubb et al. (2003) recognise two subspecies, namely *C. a. labiatus* and *C. a. erythrarchus*, whereas Roberts (1951) followed by Dandelot (1974) and (Groves 2001) recognise an additional third Samango Monkey subspecies in South Africa, namely *C. a. schwarzi* Roberts 1931. Recently, Dalton et al. (2015) found clear pelage colour polymorphism in South African Samango Monkeys and were able to identify three distinct geographical colour morphs as well as three genetically distinct entities: Hogsback (Eastern Cape Province) corresponding to *C. a. labiatus*, Inland (Soutpansberg, Magoebaskloof) corresponding to *C. a. schwarzi*, and Coast (Cape Vidal, Sodwana Bay) corresponding to *C. a. erythrarchus*. These findings support the presence of three subspecies within the assessment region, as first proposed by Roberts (1951) and as currently accepted by Groves (2001).

Assessment Rationale

Samango Monkeys are restricted to a variety of forest habitats and comprise three subspecies within the assessment region: Samango Monkey (*C. a. labiatus*), Stair's White-collared monkey (*C. a. erythrarchus*), and Schwarz's White-collared Monkey (*C. a. schwarzi*). While *C. a. labiatus* is endemic to the assessment region, *C. a. erythrarchus* occurs throughout southern Africa and it is uncertain whether *C. a. schwarzi* is endemic due to lack of sampling in suitable extra-regional habitats. However, according to current data the latter subspecies is, at this

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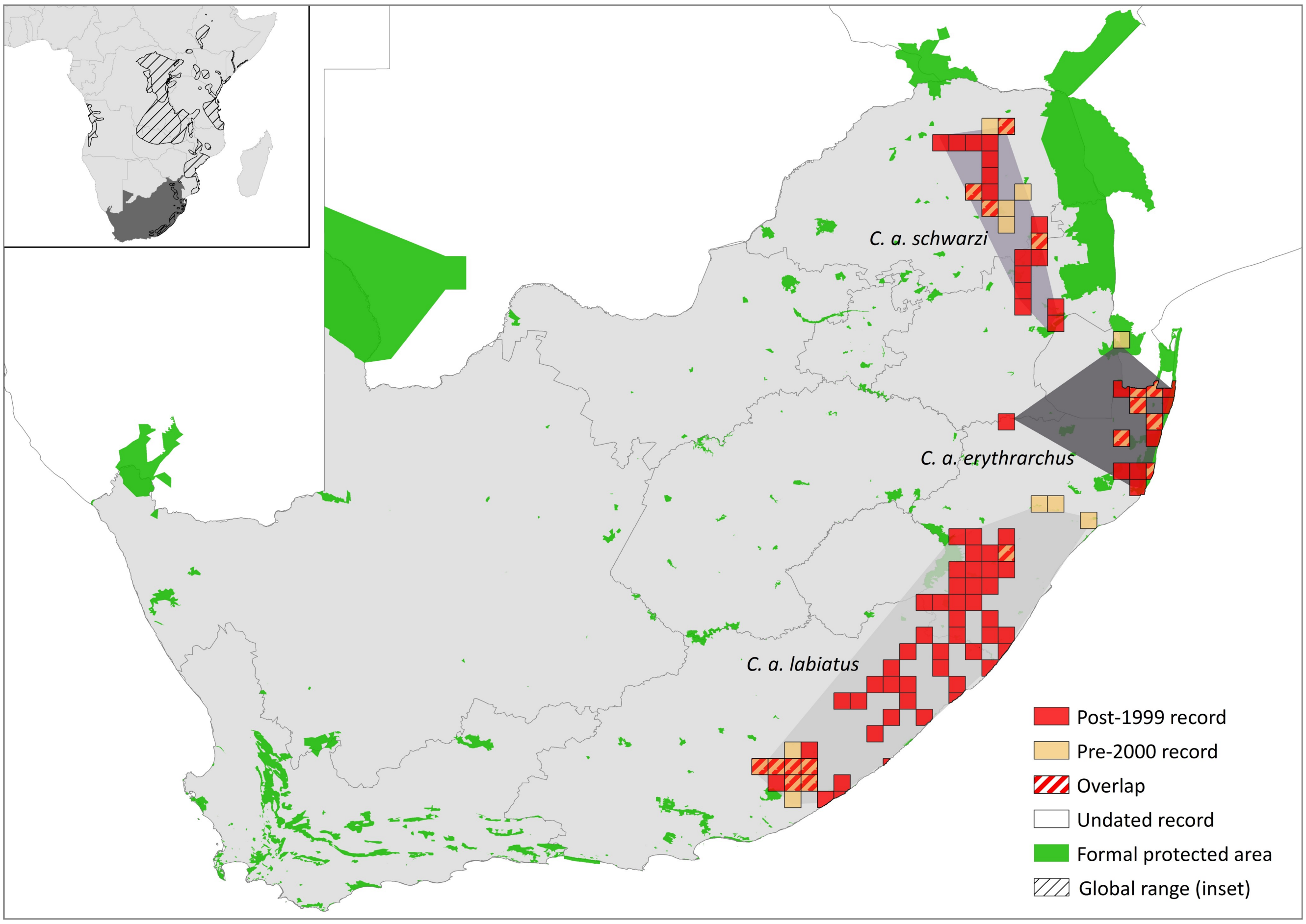

Figure 1. Distribution records for Samango Monkeys (*Cercopithecus albogularis*) in South Africa and Swaziland. Grouping of records into the three subspecies was done using historical subspecies description records and recent molecular analyses confirming *C. a. labiatus* inland and in the southern part of Eastern Cape, *C. a. erythrarchus* on coastal KwaZulu-Natal and *C. a. schwarzi* in the Soutpansberg, Mariepskop and Woodbush area. Given their fragmented forest habitat, more analysis needs to be done on subpopulations throughout the proposed range of each subspecies and thus this species is on a watch-list. For instance, *C. a. labiatus* subpopulations should be sampled along the coast and northern inland areas as well as in the Umfolozi River area, the proposed border with *C. a. erythrarchus*. *C. a. erythrarchus* subpopulations in the most easterly distribution need to be confirmed, and, for *C. a. schwarzi*, there is a need to verify subpopulations in the area bordering Swaziland up to Mariepskop further north along the escarpment.

Table 1. Countries of occurrence within southern Africa

Country	Presence	Origin
Botswana	Absent	-
Lesotho	Absent	-
Mozambique		
C. a. labiatus	Absent	-
C. a. erythrarchus	Extant	Native
C. a. schwarzi	Presence uncertain	-
Namibia	Absent	-
South Africa	Extant	Native
Swaziland		
C. a. labiatus	Presence uncertain	-
C. a. erythrarchus	Extant	Native
C. a. schwarzi	Presence uncertain	-
Zimbabwe		
C. a. labiatus	Absent	-
C. a. erythrarchus	Extant	Native
C. a. schwarzi	Presence uncertain	-

point in time, most likely completely isolated with no rescue effect from neighbouring countries possible. Furthermore, given historical and ongoing forest habitat loss and fragmentation, all three subspecies exist in isolated or semi-isolated forest fragments with a suspected low rate of dispersal. Although the estimated extent of occurrence for all subspecies is > 20,000 km^2, area of occupancy was calculated as the amount of remaining natural habitat within forest patches greater than 1.5 km^2 in extent (below which, forest patches are generally unoccupied by Samangos), which yielded 870 km^2, 692 km^2 and 340 km^2 for *C. a. labiatus*, *C. a. erythrarchus* and *C. a. schwarzi* respectively.

For all three subspecies, there is an inferred continuing decline in area of occupancy due to ongoing forest habitat loss across the country, a suspected continuing decline in habitat quality from commercial forestry reducing food resources, and a suspected continuing decline in mature individuals from frequent reports of mortality from road collisions, electrocutions, snaring and hunting for traditional medicine. This results in the listings of Vulnerable B2ab(ii,iii,v) for both *C. a. labiatus* and *C. a. erythrarchus*, and Endangered B2ab(ii,iii,v) for *C. a. schwarzi*. Although the extra-regional habitat of *C. a. erythrarchus* is similarly fragmented, and we do not yet understand the dispersal capacity of Samango

Monkeys, its core range is protected by the Lubombo Transfrontier Conservation Area (established in 2000), which has secured corridors between Swaziland, South Africa and Mozambique. Thus, because these northern forests of the South African range of *C. a. erythrarchus* are formally protected and there is at least the potential for dispersal across boundaries, we down-list *C. a. erythrarchus* to Near Threatened B2ab(ii,iii,v). Although the minimum estimated population sizes fall below 10,000 mature individuals, and *C. a. labiatus* and *C. a. schwarzi* have lower estimates for the largest subpopulation size below 1,000 mature individuals, the huge range in possible population sizes was deemed too great to realistically apply the C criterion without more recent density and occupancy estimates from field surveys.

Although preliminary studies suggest that Samango Monkeys adapt to human-modified habitat by being able to eat exotic plant species planted by people, core forest patches are needed by the species for successful reproduction, recruitment and viability. Extinction risk is thus entirely dependent upon effective management of the Forest Biome. Key interventions correspondingly include enforcement of penalties for forest-related transgression, protected area expansion and the establishment and/or maintenance of corridors between forest patches. Critically, distribution data from the literature need to be collated and surveys of all suitable habitats need to be performed to more accurately delineate range boundaries and occupancy in remaining forest patches. This current assessment should therefore be revised once a more complete dataset is available.

Regional population effects: While *C. a. labiatus* is confirmed to be endemic to South Africa, and *C. a. schwarzi* is assumed to be endemic until further research shows otherwise, *C. a. erythrarchus* is presumably connected to extra-regional subpopulations through the Lubombo Transfrontier Conservation Area and thus we assume rescue effects are possible. Future research should, however, confirm dispersal between countries.

Distribution

Cercopithecus albogularis is distributed from Ethiopia to South Africa and also occurs in southern and eastern Democratic Republic of the Congo and northwestern Angola (Groves 2001, 2005). The current South African Samango Monkey populations are relicts of the repeated historical (Pleistocene and Holocene) expansion and contraction of forests. They are naturally fragmented and, as a result, often isolated. This natural fragmentation is exacerbated by human population expansion and development. Where there might have been connections and dispersal corridors between subpopulations in the past (for example, through riverine corridors), these have been increasingly lost to development and agriculture.

Cercopithecus a. labiatus is endemic to South Africa and has been separated from populations further north in the assessment region for ~1.7 million years (Dalton et al. 2015). The southern limit of *C. a. labiatus* is the Pirie Forest in the Eastern Cape, it is not found in the evergreen Knysna and Tsitsikamma forests further south (Lawes 1990), and it extends northeastwards to the midlands of the KwaZulu-Natal Province (Figure 1). Its present distribution is closely correlated with the distribution of Afromontane forests within the assessment region (Lawes 1990). It seems to occur in Scarp and Indian Ocean Coastal belt forests, as well as Pondoland forests (Hayward et al. 2005). However, identification of the subspecies there is unknown, and needs to be done via genetic analyses. The boundary between *C. a. labiatus* and *C. a. erythrarchus* is currently suspected to be the St. Lucia and Umfolozi River systems (Lawes 1990; Dalton et al. 2015), where apparently neither subspecies are found in the dune forest south of the St. Lucia estuary (Lawes 1992).

Photo 1. *C. a. erythrarchus*, Cape Vidal, KwaZulu-Natal

Accordingly, *C. a. erythrarchus* occurs from northern KwaZulu-Natal Province, possibly along southern Mpumalanga Province (Figure 1), through Zimbabwe and Mozambique (although the coastal limits are uncertain) up to Malawi. While this subspecies has been described to extend as far as Malawi, their forest habitat is fragmented (both naturally and through human expansion and development), and thus it is unlikely that there is significant immigration from outside the region, especially as not enough is known yet about individuals' (especially male) dispersal abilities. In Swaziland they have been recorded from forest patches in Mlawula and Muti Muti Nature Reserves and in some of the larger forested gorges in the eastern Lubombos (for example, Mnyame Gorge) (Monadjem et al. 2003) (Table 1).

The area bordering Swaziland to the north and the area just north of the Umfolozi River and west to the confirmed *C. a. erythrarchus* range (in the past assigned to *C. a. labiatus*) are both confirmed *C. a. albogularis* distribution records. However, at this stage it is not known to which subspecies these distribution records belong (Dalton et al. 2015). For the purposes of this assessment, we have assigned the record to *C. a. erythrarchus*.

The distribution of *C. a. schwarzi* comprises Mariepskop in the Pilgrims Rest District, north to the Magoebaskloof area including Woodbush (Mpumalanga Province) (Roberts 1951; Groves 2001), as well as the Soutpansberg mountains (Dalton et al. 2015) (Figure 1). It is unknown whether the subspecies is endemic, as possibly suitable locations in the Afromontane forests further north (Eastern Highlands in Zimbabwe and Gorongoza in Mozambique) have not yet been sampled. Consequently, genetic data on subpopulations further north are unavailable for comparison. The Soutpansberg *C. a. schwarzi* subpopulations are currently most likely isolated from the escarpment *C. a. schwarzi* subpopulations further south due to a lack

Table 2. Area of occupancy (AOO) estimates for Samango Monkeys (*Cercopithecus albogularis*) based on remaining forest patches within the extent of occurrence (EOO)

Subspecies	EOO (km^2)	AOO (km^2)	No. forest patches	Average size (km^2)	No. patches > 1.5 km^2	Largest forest patch (km^2)	AOO excluding small patches (> 1.5 km^2)	Natural AOO (km^2)
C.a. labiatus	90,412	1,400	1,124	1.2 ± 3.9	194	91	989	870
C. a. erythrarchus	21,605	665	625	1.1 ± 5.6	66	113	777	692
C. a. schwarzi	25,389	498	445	1.1 ± 4.1	62	71	382	340

of suitable connecting habitat and extensive human-induced landscape change. For this assessment, the area south of Mariepskop along the escarpment to Swaziland has been assigned to *C. a. schwarzi*. However, future sampling of those populations and genetic analysis will need to be undertaken in order to make a definite assignment to which subspecies they belong.

Samango Monkeys are mostly restricted to intact forest habitat although they will traverse other habitats while foraging or moving between forest patches (Skinner & Chimimba 2005; Linden et al. in prep.(a); Wimberger et al. in prep.), such as pine and blue gum plantations and residential gardens, but patch occupancy seems unaffected by land-use type of the surrounding matrix (Lawes et al. 2000). As such, we construe intact forest patches as a measure of core area of occupancy. Estimating extent of occurrence (EOO) and area of occupancy (AOO) is challenging as the precise range delimitations and current forest patch occupancy has not been determined. However, based on available data and information from the literature (for example, Lawes 1990, 1992; Lawes et al. 2000; Dalton et al. 2015), the estimated EOO is between 21,605 and 90,412 km^2 (Table 2). The AOO can be estimated according to all forest patches available (based on the Mucina & Rutherford 2006 vegetation types) within the EOO or from forest patches with current confirmed presence, which, for *C. a. labiatus*, ranges from 1,109–1,400 km^2 (depending on more or less conservative forest patch inclusion) to 702 km^2 respectively. The minimum critical forest patch size has been calculated as 0.44 km^2 and forest patches < 1.5 km^2 were never occupied by Samango Monkeys (Lawes et al 2000). By including only patches above the 1.5 km^2 threshold, AOO is estimated to be between 382 and 989 km^2 (all available patches). Finally, using current (2014) land-cover satellite data (GeoTerraImage 2015), we estimated the effective AOO as the amount of remaining natural habitat within forest patches, which was 88–89% of the habitat (11–12% modified), which yielded revised AOO estimates of 340 km^2, 692 km^2 and 870 km^2 for *C. a. schwarzi*, *C. a. erythrarchus* and *C. a. labiatus* respectively (Table 2).

The effective AOO is likely to be less when dispersal distances (3.7 km) between known occupied forest patches are taken into consideration (Lawes et al. 2000). Indeed, Lawes et al. (2000) found that only 7% of forest patches were occupied in the Balgowan and Karkloof districts of KwaZulu-Natal Province. Similarly, only 11–17% of the forest patches are above the 1.5 km^2 threshold for the various subspecies and thus suspected to be occupied by viable subpopulations (Table 2).

Population

The population density of *C. albogularis* varies greatly with the habitat type occupied, but they can be common in suitable habitat. In South Africa, lowest densities are found in swamp, sand and riverine forests (< 30 individuals / km^2), medium densities in Afromontane forests (44–83 individuals / km^2) and highest densities in coastal forests (200 individuals / km^2) (Lawes 1992). *C. a. labiatus* in general have lower population densities than *C. a. erythrarchus* (Lawes 1992). Home range size varied from 0.46 km^2 for *C. a. schwarzi* in the Soutpansberg (Limpopo Province) (Heikamp 2008) to 0.22 km^2 and 0.27 km^2 for *C. a. labiatus* in Hogsback (K. Wimberger unpubl. data) to 0.15 km^2 for *C. a. erythrarchus* in Cape Vidal (KwaZulu-Natal Province), with densities of between 145 individuals / km^2 and 202 individuals / km^2 (Lawes & Henzi 1995). Table 3 shows the population and largest subpopulation estimates (using the largest forest patch per subspecies as a proxy) for the three subspecies based on maximum and minimum densities using the effective AOO estimates listed in Table 2. The number of mature individuals per troop varies from 40–50% (Friedmann & Daly 2004; Linden et al. 2015). Although the minimum estimates are below 10,000 mature individuals, and two subspecies contain lower estimates of < 1,000 mature individuals in the largest subpopulation, the range in mature individuals is too great to estimate a population size of <10,000 mature individuals for any subspecies. Further surveying will help to refine occupancy of forest patches and subsequently subpopulation sizes.

For the subspecies with the largest AOO, *C. a. labiatus*, Table 4 shows the probable subpopulation sizes in various forest types for currently occupied forest patches above the 1.5 km^2 threshold. The analysis still yields over 10,000 mature individuals within the assessment region. However, this approach should be replicated when new

Table 3. Population size estimates for Samango Monkey subspecies based on maximum (200 individuals / km^2) and minimum (27 individuals / km^2) density estimates. Estimates for the largest subpopulation pertain to the largest forest patch for the subspecies. AOO is area of occupancy.

Subspecies	Natural AOO (km^2)	Maximum population size	Minimum population size	Mature population size	Largest subpopulation
C. a. labiatus	870	173,976	23,487	9,394–69,590	983–7,280
C. a. erythrarchus	455	91,065	12,294	4,917–36,425	1,220–9,040
C. a. schwarzi	340	67,996	9,179	3,671–27,198	767–5,680

Table 4. Summary of subpopulation size estimates for *C. a. labiatus* based on observed densities in different forest types for those forest patches above 1.5 km². Average density per forest type is from Lawes (1992). AOO is area of occupancy.

Forest type	Density (individuals / km²)	Area of occupancy (AOO) in km²	Subpopulation size	Mature subpopulation size (40%)	Mature subpopulation size (50%)
Northern coastal forest	89	2	133	53	66
Mistbelt and Afromontane forest	56	403	22,552	9,021	11,276
Coastal scarp forest	39	201	7,846	3,139	3,923
Total		605	30,531	12,213	15,266

density estimates become available for the various forest types within the subspecies' ranges, especially for the largest forest patches, and when current occupancy of forest patches is more comprehensively mapped.

Small forests are generally unable to support a troop of Samango Monkeys; thus they are generally absent from forests smaller than 1.5 km² (Swart et al. 1993; Lawes 2002) (Table 2). Although it may be simplistic to define a subpopulation as a forest patch, Samango Monkeys are poor dispersers, in comparison to other forest-dwelling mammals, such as Blue Duiker, *Philantomba monticola* and Southern Tree Hyrax, *Dendrohyrax arboreus*, and are reluctant to disperse over open ground (Lawes et al. 2000). As such, most forest patches where they occur can be considered isolated or semi-isolated subpopulations. For example, nearly half (42%, N = 22) of the known (currently occupied) subpopulations of Samango Monkeys (for both *erythrarchus* and *labiatus* subspecies) in KwaZulu-Natal Province are found in forests patches smaller than 4 km² (Lawes 1992; Lawes et al. 2000). Based on estimates of mean density (59 individuals / km², Lawes 1992) this would mean that a large number of subpopulations contain fewer than 250 individuals and thus probably contain fewer than 100 mature individuals (based on 40–50% mature subpopulation structure). Such small subpopulations are vulnerable to demographic and environmental stochasticity facing a high risk of losing genetic diversity and thus adaptability through breeding of closely related individuals and are seldom recolonised (Swart & Lawes 1996). They exist in transient, non-equilibrium or declining metapopulations vulnerable to local extinctions as a result of diminishing forest areas and decline in habitat quality (Lawes 2002). Thus, the long-term viability of these small subpopulations is threatened if further habitat loss or a reduction in their population density occurs. Swart et al. (1993) found that if the density of this species falls below 30–40 individuals / km² they are at risk of local extinctions within 50 years as they are unable to withstand a further 30–35% reduction in size.

Current population trend: Decreasing. We infer that the population is declining within the assessment region, due to ongoing loss and degradation of forests.

Continuing decline in mature individuals: Possibly, due to ongoing snaring for human consumption or indigenous medicine (muthi) trade, road collisions, electrocutions and killing by domestic dogs.

Number of mature individuals in population: See Table 3.

Number of mature individuals in largest subpopulation: See Table 2 "Number of patches > 1.5 km²".

Number of subpopulations: Unknown

Severely fragmented: Yes. Coastal forests are historically contiguous but have become fragmented by human activities in the last 100–150 years. Coastal forests are linear in shape and thus their ecological processes are dominated by those that characterise forest edges. Similarly, natural fragmentation of Afromontane forests (Eeley et al. 1999) has been exacerbated in the last 100 years by logging and harvesting activities, by afforestation (plantations), agriculture (e.g. avocado orchards) and human settlements.

Habitats and Ecology

Samango Monkeys are primarily arboreal, utilising the canopy of evergreen forests, and their present distribution is indicative of very broad forest habitat tolerances (Lawes 1990). Within the assessment region, Samango Monkeys are associated with high-canopy, evergreen forests and are South Africa's only forest dwelling guenon. They inhabit a variety of indigenous forest types namely Afromontane Forests (including Mistbelt Forests), Coastal Forests (including Dune Forests), Scarp Forests as well as Riverine Forests (forest types follow von Maltitz et al. 2003). *Cercopithecus a. schwarzi* and *C. a. erythrarchus* have also been observed to utilise acacia woodland and coastal thicket adjacent to high canopy forests (Lawes & Piper 1992; Heikamp 2008). Furthermore, experimental food patches placed in these secondary growth forests with lower canopies were utilised equally to food patches in higher-canopy forests (Emerson & Brown 2013). All three subspecies have been observed in human-modified habitat, including pine plantations, residential gardens and campsites (Lawes 1991; Chapman et al. 1998; B. Linden and K. Wimberger unpubl. data), but more research needs to be conducted to confirm that the species can use modified landscapes to disperse between forest patches. They are able to utilise human infrastructure to traverse their habitat, such as travelling along telephone and power lines, and across roads (B. Linden pers. obs., K.Wimberger pers. obs.). However, Samango Monkeys seem to view human inhabited areas (residential gardens) as "riskier" habitats than their natural habitat, preferring to forage in indigenous forest if given experimental patches in both forest and gardens (K. Nowak et al. unpubl. data). Meanwhile at a site with relatively high density of natural predators, *C. a. schwarzi* seemed to view humans as "shields" against terrestrial predators (for example, Leopards *Panthera pardus*), whereby they exploited experimental food patches at typically high-risk strata (ground level) more intensively in the presence of researchers (Nowak et al. 2014). Being arboreal monkeys, the density of food remaining in an experimental patch when a forager leaves was greatest at ground level relative to higher tree canopy levels, highlighting a strong vertical axis of fear (Emerson et al. 2011; Nowak et al. 2014).

Photo 2. *C. a. schwarzi*, Soutpansberg, Limpopo

Samango Monkeys are predominantly frugivores, with 50–70% of their diet consisting of fruit, but leaves or insects are the main source of protein (Lawes 1991; Skinner & Chimimba 2005; Heikamp 2008; Linden et al. 2015). During periods of low fruit availability, other plant parts such as flowers and leaves/buds were eaten (Linden et al. 2015; K. Wimberger unpubl. data). Using artificial food patch experiments, a population of *C. a. schwarzi* were shown to prefer high-energy foods (peanuts), and were the least likely to choose animal protein (cat food, Emerson & Brown 2012). Low dietary diversity was found in a group of *C. a. erythrarchus* in Cape Vidal, KwaZulu-Natal Province where consumption of plant parts from four of the top 20 plant species (*Isogloassa woodii*, *Mimusops caffra*, *Senegalia* (*Acacia*) *karroo*, and Grewia occidentalis) accounted for 49% of the diet (Lawes 1991). Similarly, in a group of *C. a. schwarzi* one food item, namely figs, accounted for 26% of feeding time, indicating that *Ficus* spp. are perhaps a key resource for this subspecies (Linden et al. 2015). Furthermore, the exotic seeds of invasive black wattle (*Acacia mearnsii*) were the most frequently consumed item (26%, 32% of total diet) for two troops of *C. a. labiatus* (K. Wimberger unpubl. data). All subspecies have been recorded to eat exotic plant species, invasive or planted by people, consume human waste (for example kitchen scraps), and may become a pest in some areas as a result (Lawes et al. 1990; Lawes 1991; Chapman et al. 1998; B. Linden and K. Wimberger unpubl. data). Consumption of exotic plant species, particularly acorns from *Quercus* sp., may have a detrimental impact on teeth as well as other health parameters (A. Tordiffe et al. unpubl. data).

Samango Monkeys typically live in large (up to 45 individuals) multi-female, single-male troops (Skinner & Chimimba 2005). The largest group size of *C. a. schwarzi* observed in the Soutpansberg comprises over 60 individuals (B. Linden pers. obs. 2012). Females are philopatric, while males leave their troops just before sexual maturity, between 6–8 years old (Henzi & Lawes 1987, 1988). These males remain alone or in the company of other lone males before taking over as troop male (Henzi & Lawes 1987, 1988). In some populations, there are seasonal influxes of lone males, which has been documented to occur mainly during May to July in both *C. a. erythrarchus* (Cape Vidal) and *C. a. schwarzi* (Soutpansberg) (Henzi & Lawes 1987, 1988; B. Linden unpubl. data), but from November to March in *C. a. labiatus* (K. Wimberger pers. obs. 2011). These lone males may mate with the females in a troop. The gestation period is around 176 days after which a single young is usually born (Pazol et al. 2002). Samango Monkeys are seasonal breeders, but with birth seasons varying according to locality and subspecies, such as *C. a. erythrarchus* in St Lucia birthing in September/October (Lawes 1990), while *C. a. schwarzi* in the Soutpansberg birthing during the wet season (October to March, B. Linden pers. obs. 2007–2015) and *C. a. labiatus* birthing in Hogsback during the dry season (July to August) (K. Wimberger pers. obs. 2011). Females have been observed carrying their dead infants for several days before eventually leaving them on the ground (K. Wimberger, pers.obs. 2011).

The different subspecies can be visually distinguished according to Dalton et al. (2015) as follows: *C. a. erythrarchus* has an overall lighter appearance when compared to *C. a. labiatus* and *C. a. schwarzi* individuals. A marked difference is the black arms of *C. a. labiatus* and *C. a. schwarzi* individuals compared to the grey arms of *C. a. erythrarchus*. The yellow wash or shine on the back is most visible and most extensive in *C. a. erythrarchus* and near absent in *C. a. labiatus*. The ischial regions also show clear colouration differences, being most prominent and orange in *C. a. erythrarchus*, yellow in *C. a. schwarzi* and white in *C. a. labiatus*. Further colour differences worth mentioning are the very conspicuous white ear tufts and white underside of the tail (about the first quarter) in *C. a. labiatus* compared to the much less obvious white ear tufts and dark tail undersides in *C. a. schwarzi* and *C. a. erythrarchus*. Dalton et al.'s (2015) results are very similar to those of Roberts (1951) and Groves (2001).

Ecosystem and cultural services: Recent research reveals the importance of Samango Monkeys in dispersing the seeds of fruit trees (for example, 52% of fruiting species eaten by *C. a. schwarzi*), especially those occurring in high-canopy forests (Linden et al. 2015). They may be particularly important dispersers for fig trees where these occur in their habitat (Linden et al. 2015). Samango Monkeys can be considered a flagship species for South African forests and they are often a tourist attraction with popular articles on forests, which describe hiking trails and other tourism activities, seldom failing to mention Samangos.

Use and Trade

Samango Monkeys are mainly used in the local trade for traditional medicine (Table 5). Samango Monkey skins and carcasses have been found to be traded illegally at South Africa's largest traditional medicine market, the Faraday market in Johannesburg (Whiting et al. 2011). Anecdotal evidence suggests they are used in traditional medicine if caught, as skins and hands were found near human settlements (Soutpansberg: J. Linden pers. obs. 1998; Hogsback: K. Wimberger pers. obs. 2011) and requests to researchers for Samango skulls and hands by traditional healers were also experienced in the Soutpansberg area (B. Linden unpubl. data). They are possibly used on a subsistence level for bushmeat according to anecdotal reports, snares found intact on Samango Monkeys and an infant Samango Monkey being sold (for example, Hogsback K. Wimberger pers. obs. 2011). The effects of this trade are suspected to be minimal because they are infrequently captured and not a targeted species in cultural hunts.

Table 5. Use and trade summary for Samango Monkeys (*Cercopithecus albogularis*)

Category	Applicable?	Rationale	Proportion of total harvest	Trend
Subsistence use	Yes	Used locally and opportunistically as bushmeat.	Minimal	Stable
Commercial use	Yes	Local commercial use in traditional medicine trade.	Majority	Unknown
Harvest from wild population	Yes	Individuals opportunistically harvested for sale as muthi/ bushmeat.	All	Unknown
Harvest from ranched population	No	-	-	-
Harvest from captive population	No	Very few individuals in captivity in zoos. Not much known about how many in rehabilitation centres but we presume it to be low.	Unknown	Unknown

Threats

The major threat to the species is deforestation and resulting habitat fragmentation, especially as Samango Monkeys are poor re-colonisers and are susceptible to local extinction within small forest fragments (Lawes et al. 2000; Lawes 2002). Although forests are currently well-protected in some areas, there is a continuing loss of forest habitat and habitat quality across the assessment region (see current habitat trend below). For instance, loss of habitat and habitat disturbance caused by selective logging of forests for timber and firewood, mainly in the Eastern Cape; and charcoal production and the medicinal plant trade in Maputaland. Coastal development through residential and industrial expansion is a major threat to the coastal forest habitats of both *C. a. labiatus* and *C. a. erythrarchus*, while expanding human settlements on the Pongola Floodplain may have led to the extirpation of the riverine subpopulations of *C. a. erythrarchus* in the area. Further south in the region, strip mining (between St Lucia and Sodwana) is a threat to *C. a. erythrarchus* and possibly *C. a. labiatus*. Extensive commercial afforestation in mistbelt regions of South Africa has resulted in the loss of small forests and reduction in area of some of the larger forests (Armstrong et al. 1998), which may specifically threaten *C. a. schwarzi* (Armstrong & van Hensbergen 1996). Indeed, in Limpopo's Soutpansberg Mountains, ongoing habitat loss and degradation of riverine vegetation, which are possible corridors between forest patches, are the greatest threats to *C. a. schwarzi* (B. Linden pers. obs. 2012).

The effects of forest loss and fragmentation include an increase in edge effects on forest patches and abundance of exotic plant species and availability of "human food" (for example, bread) and bring Samango Monkeys into more frequent contact with human settlements and infrastructure, which may lead to increased rates of morbidity and mortality. These deaths and injuries can be caused by bushmeat hunting, collection for the muthi trade, intentional or incidental snaring and hunting by dogs (which are possibly directed at other forest species; for example, antelope), attacks by residential dogs, direct persecution as pests, road collisions and electrocution when using power lines to cross roads and/or properties (especially in the eastern Soutpansberg, B. Linden et al. unpubl. data; in the Haenertsburg and Magoebaskloof areas, M. Harman pers. comm 2013; in Hogsback, K. Wimberger pers. obs. 2010–2012). It seems that adult males (lone or bachelor males not associated with troops) are particularly vulnerable to being road killed in certain areas in the Soutpansberg where they have been found to move out of forests through highly transformed landscapes (B. Linden et al. unpubl. data). In addition to being persecuted as pests when foraging for food in people's homes (K. Wimberger pers. obs. 2010–2015; B. Linden pers. obs. 2012), and in campsites (Chapman et al. 1998), they may become pests in large-scale and subsistence fruit orchards or pine plantations surrounding natural forest remnants as they sometimes strip the bark to eat the sap (Droomer 1985; von dem Bussche & van der Zee 1985; B. Linden unpubl. data).

Current habitat trend: Most forest types in South Africa have been fragmented throughout much of their history by repeated and severe climate changes, especially in the Quaternary (Eeley et al. 1999). However, selective logging of these forests from 1870 to 1944, the spread of agriculture, and lately the encroachment of commercial plantation forestry have all exacerbated the fragmentation of the natural forested landscape (Lawes et al. 2000). In the Karkloof Forest, KwaZulu-Natal Province, the rate of habitat loss has slowed from an estimated 10–15% between 1880 and 1940, to 5.7% between 1944 and 1996 (Rycroft 1944; Lawes et al. 2004). In KwaZulu-Natal overall, there was a 20.4% loss of natural habitat from 1994 to 2011, with an average loss of 1.2% per annum (Jewitt et al. 2015). In the eastern part of the Soutpansberg range, expansion of forest plantations between 1990 and 2006, wood collection and settlement expansion are significant reasons for an observed reduction of 20% in indigenous forest and woodland cover (Munyati & Kabanda 2009). Recent data confirm an ongoing loss of forest habitat within the assessment region between 2000 and 2014: Afrotemperate, Coastal, Scarp and Lowveld Riverine Forest has declined by between 0.3–3.5% (F. Daniels unpubl. data) between 2000 and 2013; and 1.6 ± 1.9% for forest cover overall between 1990 and 2013 (A. Skowno unpubl. data). Future analyses should incorporate spatially explicit patterns of forest loss into this assessment.

Conservation

We argue for separate conservation management of the three distinct genetic entities defined by Dalton et al. (2015), as subspecies need to be conserved to prevent the loss of genetic diversity in the species, which is an essential part of biodiversity conservation. This needs to apply in the wild as well as in captivity (zoological gardens and primate rehabilitation facilities). In particular, rehabilitation facilities which aim at establishing troops and releasing them in the wild must ensure that different subspecies are not mixed and able to interbreed in

Table 6. Threats to Samango Monkeys (*Cercopithecus albogularis*) ranked in order of severity with corresponding evidence (based on IUCN threat categories, with regional context)

Rank	Threat description	Evidence in the scientific literature	Data quality	Scale of study	Current trend
1	*2.2 Wood & Pulp Plantations*: afforestation from commercial timber operations causes habitat loss and fragmentation and reduction in habitat quality. Also increases human-wildlife conflict. Current stress *1.3 Indirect Ecosystem Effects*: fragmentation of remaining habitat into small patches.	Droomer 1985	Indirect	Regional	Samango Monkeys strip-bark plantations and become problem animals.
		Armstrong & van Hensbergen 1996	Indirect	Regional	Species richness lower in plantations.
		Lawes et al. 2000	Simulation	Regional	Patches < 1.5 km^2 unoccupied.
		Lawes et al. 2004	Indirect	Local	Rate of habitat loss was 5.7% from 1944–1996.
		Munyati & Kabanda 2009	Indirect	Local	20% forest cover lost between 1990–2006.
		Jewitt et al. 2015	Indirect	Regional	Natural habitat loss in KZN 1.2% per annum.
2	*1.1 Housing & Urban Areas*: habitat loss through expanding human settlements. Current stress *1.3 Indirect Ecosystem Effects*: fragmentation of remaining habitat into small patches.	Munyati & Kabanda 2009	Indirect	Local	20% forest cover lost between 1990–2006.
		Lawes et al. 2000	Simulation	Regional	Patches < 1.5 km^2 unoccupied.
3	*5.3 Logging & Wood Harvesting*: selective logging decreases food availability.	Fairgrieve & Muhumuza 2003	Indirect	Local	Food resource quality lower in logged forests.
4	*5.1.1 Hunting & Collecting Terrestrial Animals (Intentional)*: traditional medicine and bushmeat use.	Whiting et al. 2011; K. Wimberger pers. obs.	Empirical, anecdotal	Local	Samango Monkey carcasses present at Faraday market; Hogsback: two carcasses (head and skin only) found and one infant being sold over 2 years.
5	*4.1 Roads & Railroads*: direct mortality from roadkill has been recorded at road crossings. Current stress *1.3 Indirect Ecosystem Effects*: fragmentation of remaining habitat into small patches.	B. Linden unpubl. data; K. Wimberger, pers. obs.	Anecdotal	Regional	15 killed on road between Makhado and Thohoyandou between July 2012 and July 2015. Suspected to be increasing with ongoing infrastructure development and forest fragmentation. Hogsback: one killed in one year.
6	5.1.2 *Hunting & Collecting Terrestrial Animals (Unintentional)*: illegal dog hunting sport.	-	Anecdotal	-	-
7	*8.1.2 Invasive Non-Native/Alien Species/Diseases*: domestic dogs cause direct mortality.	K. Wimberger, pers. obs.	Anecdotal	-	Hogsback: one mortality, one wounded in one year
		B. Linden unpubl. data			Soutpansberg: one mortality in farm yard.
8	*8.1.2 Invasive Non-Native/Alien Species/Diseases*: alien invasive vegetation on forest patch edges reduces food resource quality.	-	Anecdotal	-	-
9	*9.4 Garbage & Solid Waste*: poor refuse management leads to human-wildlife conflict.	K. Wimberger pers. obs.; Chapman et al 1998; B. Linden pers. obs. 2012	Anecdotal, empirical	Local	Hogsback: individuals shot and killed by residents; Individuals have been killed at campsites in Cape Vidal, KwaZulu-Natal. Sodwana Bay: individuals entering tourist accommodation to steal food
10	*4.2 Utility & Service Lines*: electrocutions can occur on power lines when attempting to cross between forest patches.	K. Wimberger, pers.obs.; B. Linden pers. obs. 2006–2015	Anecdotal	Local	Hogsback: 2 deaths in one year Lajuma Research Station: 2 deaths and 1 wounded in 9 years.

captivity and that individuals from any of the three subspecies are not reintroduced into another subspecies range resulting in interbreeding in the wild. Similarly, if wild troops are relocated, such as when provincial conservation authorities conducted relocation programmes for monkeys causing damage to plantations (Droomer 1985; von dem Bussche & van der Zee 1985), they should be translocated to the correct area for the subspecies. Strict guidelines are therefore needed for zoological gardens, rehabilitation centres and provincial conservation authorities in order to conserve the genetic distinctness of the three subspecies and even that within metapopulations of the same subspecies.

Protected area expansion and proper management of indigenous forests are the primary interventions for this species. The various subspecies occur in protected areas across their range. For example, *C. a. labiatus* in Hogsback Forest Reserve; *C. a. schwarzi* in Happy Rest Provincial Nature Reserve, Entabeni and Ratombo parts declared Forest Reserves, and Luvhondo Private Nature Reserve in the Soutpansberg; and *C. a. erythrarchus* in the Lubombo Transfrontier Conservation Area. Protected area expansion could focus on reclaiming and restoring non-viable or cleared commercial forest plantation areas, particularly those that had been planted in areas conducive to indigenous forest growth including riparian forests along streams and rivers (for example, southern mountain slopes). Samango Monkey life-history traits necessitate large forest areas, which means identifying large habitat patches that are close to one another and minimising disturbance in and on the edge of these patches as a key management strategy (Lawes et al. 2000). Conservation planning should thus continue to connect forest fragments to create viable subpopulations and ensure the persistence of metapopulations (Swart & Lawes 1996), especially in Afromontane and Scarp forests (Eeley et al. 1999). For example, in Maputaland, a new transfrontier landscape is being designed that will, amongst other species, presumably benefit *C. a. erythrarchus* immensely by extending the existing Lubombo Transfrontier Conservation Area to the south (Smith et al. 2008). For *C. a. schwarzi*, forest patches in the eastern Soutpansberg (e.g. Entabeni and Thathe Vondo) are key areas to ensure the Samango's long term persistence in the eastern part of the mountain range as they are naturally larger in size than the patches in the western Soutpansberg but are under highest pressure from human development. On the escarpment, Woodbush and Magoebaskloof forests are important sites as they are both large, continuous indigenous forest patches.

Effective forest management is also crucial. Forest guards should be trained to reduce poaching and disturbances within forests. Human-wildlife conflict could be reduced by educating surrounding communities on proper waste and refuse control in residential areas, as well as securing potential attractants such as vegetable gardens, subsistence farming and chicken coops with monkey-proof enclosures or by physically chasing the monkeys away. Intentional feeding of monkeys should be prevented. Communities should also be encouraged to plant indigenous garden trees rather than planting exotic ones to make gardens only as attractive to Samango Monkeys as the surrounding indigenous forest habitat. Indigenous species often have less attractive fruit and

Table 7. Conservation interventions for Samango Monkeys (*Cercopithecus albogularis*) ranked in order of effectiveness with corresponding evidence (based on IUCN action categories, with regional context)

Rank	Intervention description	Evidence in the scientific literature	Data quality	Scale of evidence	Demonstrated impact	Current conservation projects
1	*1.1 Site/Area Protection*: protected area expansion for large forest patches to ensure viable subpopulations.	Lawes et al. 2000	Simulation	Regional	Dispersal between smaller patches inhibited so large "mainland" patches essential.	-
2	*2.3 Habitat & Natural Process Restoration*: creation of forest corridors to connect large forest patches. Old commercial plantations could be targeted to achieve this.	Swart & Lawes 1996	Simulation	Regional	Corridors significantly improve metapopulation persistence in the long-term.	-
3	*2.1 Site/Area Management*: training forest managers and increased prosecution rates of people found with Samango Monkey bodies/parts.	-	Anecdotal	-	-	-
4	*4.3 Awareness & Communications*: increased education of range property owners, local communities and tourists to cease feeding, promote wild living (no exotic plant species), and proper waste management.	-	Anecdotal	Local	-	B. Linden, ongoing in Soutpansberg: several education strategies; K. Wimberger: two information brochures for Hogsback residents
5	*2.1 Site/Area Management*: ensure safe adaptation to living in close contact with humans. For example, monkey bridges to use to cross roads, warning signs on roads to slow down, ensure power lines are safe.	-	Anecdotal	Local	-	B. Linden, ongoing in Soutpansberg: road signs and car stickers, canopy bridges for road crossings

flowers than those offered by exotic plants (for example, protein and fat rich acorns, such as in Hogsback, K. Wimberger et al. unpubl. data).

In general, conservationists should identify road collision hotspots for this species and erect monkey bridges to ensure safe crossing in those areas. Conservationists should also trial other interventions to encourage monkeys to use specific locations to cross over roads. Raising public awareness about Samango Monkeys is also being trialled through bumper stickers ("I brake for Samango Monkeys") and road signs ("Samangos crossing"), in conjunction with local newspaper articles informing people about the problem (B. Linden unpubl. data) Similarly, power line infrastructure should be secured so as to reduce electrocution incidents.

Recommendations for land managers and practitioners:

- Captive breeding programmes are not needed for the species if the long-term persistence of Samangos throughout their current range is ensured through proper management. In situ conservation is the only logical approach for ensuring long-term Samango Monkey persistence in the country. An important part of ensuring the latter is the identification and creation of corridors linking local subpopulations as well as proper management and protection of their forest habitat.
- Managers should develop a Biodiversity Management Plan for this species to sustain a genetically diverse, resilient metapopulation amongst remaining forest patches. Engagement with the private sector will be key in this regard.
- Managers should continue to monitor the cutting down of trees and hunting within or on the edge of forest patches, and enforce penalties.
- Due to the differing landownership types in the range of the Samango Monkey (private, communal, state) different management approaches have to be formulated and areas should ideally be managed by one entity only to ensure the appropriate management strategies.

Research priorities: Research is currently being undertaken in the Soutpansberg on the distribution, population status and conservation of Samangos (University of Venda) which partly falls under the Samango Monkey Working Group (SMWG, http://www.nzg.ac.za/research/samango.html, https://www.facebook.com/groups/samango/) which collaboratively investigates phylogeographic and taxonomic questions about the species. Current research questions include:

- Collection and collation of all Samango Monkey distribution data (including from the literature) and analysis of specimens to delineate boundaries and/or hybrid zones between the subspecies.
- Surveys to determine current distribution and density across forest fragments, including demographic research.
- Further taxonomic resolution of the *Cercopithecus* complex is needed. For example, are the South African Samango Monkeys a different species (*C. albogularis*) to the rest of the African Blue Monkeys (*C. mitis*) or a subspecies? Genetic data are needed. For *C. a. erythrarchus*, further research is needed to identify the extent of occurrence, especially further south along the South African coast (and especially around the Umfolozi area) and also whether they occur in Scarp and Afromontane forests inland (South Africa, Zimbabwe and Mozambique). For *C. a. schwarzi*, further research is needed to identify the extent of occurrence, southern limits in South Africa and northern limits outside of the country, especially further north (Mozambique and Zimbabwe) to clarify endemism.
- Behaviour of lone males (for example, how far they disperse) is important for generating parameters relevant to metapopulation persistence (such as gene flow rates and effects of fragmentation on population stability).
- Reproduction and breeding success of each subspecies in different habitat types
- Development of human-wildlife conflict mitigation measures such as adequate bridge designs for Samango troops to use to cross roads. Starting with erecting these in the Soutpansberg, with possible roll out throughout the country.

Encouraged citizen actions:

- Read the brochures developed by K. Wimberger on how to understand and live with Samango monkeys (http://imfene.org/resources).
- For property owners and tourists, ensure no feeding is done either directly or indirectly (for example, leaving fruit out for birds to eat or badly managed bins and rubbish dumps).
- Plant indigenous garden species so that your garden is only as enticing as the surrounding indigenous forest.
- Report sightings on virtual museum platforms (for example, iSpot and MammalMAP).
- Contact the Samango Monkey Working Group (Bibi Linden at bibi@lajuma.com) if Samango Monkeys are found on private land. Please collect faecal samples for genetic analyses, note any injuries/deaths of individuals and possible causes, and estimate number of individuals in troops and the types of habitat in which they are found.

Data Sources and Quality

Table 8. Information and interpretation qualifiers for the Samango Monkeys (*Cercopithecus albogularis*) assessment

Data sources	Field study (unpublished), Indirect information (literature, unpublished)
Data quality (max)	Inferred
Data quality (min)	Inferred
Uncertainty resolution	Maximum / minimum values
Risk tolerance	Evidentiary

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Details of the methods used to make this assessment can be found in *Mammal Red List 2016: Introduction and Methodology.*