

Table 1: Lemur species at Betampona Natural Reserve.

Family	Species	Local name
Cheirogaleidae	<i>Microcebus rufus</i>	Tsidy
	<i>Cheirogaleus major</i>	Tsitsihy
	<i>Phaner f. furcifer</i>	Tantana
Megaladapidae	<i>Lepilemur mustelinus</i>	Trangalavaka
Lemuridae	<i>Hapalemur g. griseus</i>	Bokombolo
	<i>Eulemur fulvus albifrons</i>	Alokosy
	<i>Varecia v. variegata</i>	Varikandana
Indridae	<i>Avahi laniger</i>	Fotsiafaka
	<i>Propithecus d. diadema</i>	Simpona
	<i>Indri indri</i>	Babakoto
Daubentoniidae	<i>Daubentonia madagascariensis</i>	Hay hay

corridor of forest within a highly degraded area, characterised by open secondary forest to the east and recent "Tavy" (slash-and-burn cultivation) plots to the west and south. The group comprised two adults, one juvenile and one infant (carried by mother). Inter-individual variation in pelage was apparent. The adult male was markedly lighter in coloration than the others, with white face and neck, white patches on lower back, flanks, rump and thighs, while shoulders, arms and ears were black. The other individuals had black face, neck, back and arms, grey thighs and only a small v-shaped patch of white on the lower back.

The group was encountered at a height of 10 – 15 m in a Rara tree (Myristicaceae: *Bronchoneura* sp.). The *Indri* at Betampona have been observed to feed on the fruit and leaves of this species. Other tree species present, upon which the *Indri* at Betampona have been observed to feed included: Menahihy (Ochnaceae: *Campylopermum* sp.), Voapaka (Euphorbiaceae: *Uapaca* sp.), Hazinina (Clusiaceae: *Symphonia* sp.), Molopangady (Rubiaceae: *Alberta* sp.) and Zanamalotra (Cesalpiniaceae: *Dialium* sp.). Calls of three groups of *Indri* were heard from this region. A further light-coloured adult was sighted (white face, neck, chest, flanks and lower back; black ears, legs and shoulders) in an area characterised by a low and discontinuous canopy (~ 10 m). Menahihy, Molopangady and Voapaka trees were present in the vicinity and other species upon which *Indri* have been observed to feed included Tarantana (Anacardiaceae: *Rhus tarantana*), Mampay (Cesalpiniaceae: *Cynometra* sp.), Sadodok'ala (Rubiaceae: *Gaertnera* sp.) and Ramy (Burseraceae: *Canarium madagascariensis*). A group of six adult *Varecia* was sighted in a patch of forest bordering a large tavy clearing and calls were heard from two other groups. The pelage of these individuals was identical to those at Betampona—i.e., corresponding to the *variegata* group (Tattersall 1982). A group of three adult *Eulemur f. albifrons* was also sighted.

On 17 January 1999 four lemur species were sighted, the addition being a single adult *Avahi laniger*. Villagers also reported the presence of *Microcebus rufus* and *Phaner furcifer furcifer*. It is also likely that *Hapalemur griseus griseus* and *Cheirogaleus major* occur within the forest. Four adult *Indri* were sighted in the same region as 1998. However no calls were heard from other groups. Four adult *Varecia* (one female, three sex unknown) were sighted in the south of the forest. A local woman working on her tavy claimed to have seen five individuals that morning. This is likely the same group observed in 1998, then numbering six. Calls were heard from a further two groups in the north and west. Two groups of *E. f. albifrons* were sighted: a group of four adults in the north (one male, one female, two sex unknown) and a group of two adults in the south (male and female). Unlike the *E. f. albifrons* at Betampona, the two groups were completely silent and moved very quietly through the canopy. Thirty-eight bird species were recorded in the forest and surrounding area, including 17 species that occur only in primary or secondary forest. Of note is the presence of the Brown Mesite (*Mesitornis unicolor*) and the Red-fronted

Brief surveys of two classified forests in Toamasina Province, eastern Madagascar

Madagascar's classified forests (Forêts classées) are administered by provincial offices of the Ministère des Eaux et Forêts. In theory exploitation of these forests is illegal, with the exception that local people may make use of traditional forest products and apply for permission to cut timber for house construction. In practice protection of these areas is non-existent. The network of classified forests covers an area of 4,000,000 ha (Mittermeier *et al.* 1994), however it is likely that only a fraction of this area still retains forest cover. The status of lemur populations in the classified forests is unknown, but their importance for the continued survival of many lemur species should not be underestimated.

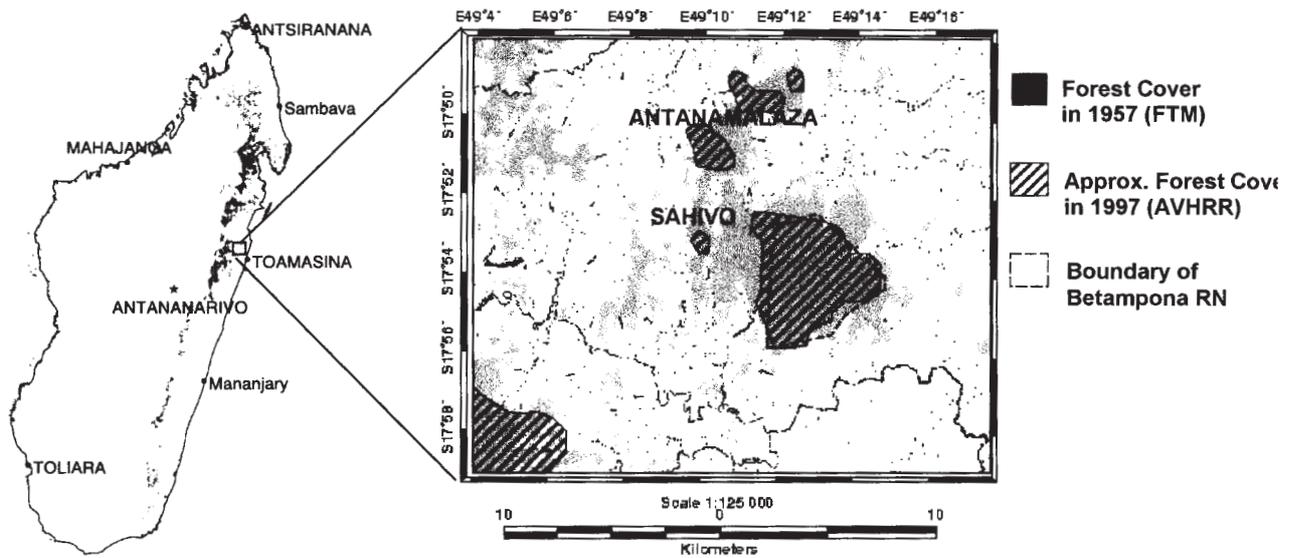
One-day surveys of the Antanamalaza and Sahivo classified forests, in Toamasina province, were carried out in January 1998 to record lemur and bird species present and to assess the state of forest cover. In addition Antanamalaza was re-surveyed in January 1999. Both of these lowland rainforests are situated to the north-west of the 2,228 ha Betampona Natural Reserve (17°15' - 17°55'S, 49°12' - 49°15'E; Fig. 1). It is currently estimated that only 50% of Betampona (i.e., 1,114 ha) is relatively undisturbed primary rain forest. Eleven species of lemur occur at Betampona (see Table 1) and 80 bird species have been recorded in the reserve and its environs.

Antanamalaza

On paper Antanamalaza forest (17°50' S; 49°11' E) covers an area of 231 ha and lies approximately 5 km directly north-west of Betampona. Within the past 20 years the forest was continuous with the Sahivo forest to the south.

On 21 January 1998 three lemur species were sighted: *Indri indri*; *Varecia variegata variegata*; *Eulemur fulvus albifrons*. Local villagers also reported the presence of *Daubentonia madagascariensis*. Four *Indri* were sighted in a thin

Forest Change in the region of Betampona RN, 1957-1997



1997 Eastern Rainforest Map (AVHRR)

Fig. 1: Map of survey areas.

Coua (*Coua reynaudii*). It is likely that further species would be added if a longer period were spent in the forest. It is certain, from discussions with villagers, that the Madagascar Crested Ibis (*Lophotibis cristata*) no longer occurs at Antanamalaza. Similarly it is unlikely that certain rare species present at Betampona, e.g., Pollen's Vanga (*Xenopirostris polleni*) and Dusky Greenbul (*Phyllastrephus tenebrosus*) will exist due to the level of habitat disturbance.

Sahivo

On 18 January 1998 four lemur species were sighted in the 225 ha Sahivo forest (17° 53' S; 49° 10' E): *Indri indri*; *Eulemur fulvus albifrons*; *Hapalemur griseus griseus*; and *Avahi laniger*: One adult, dark-coloured *Indri* was sighted in primary forest at an elevation of 465 m. Arms and upper back were black, face was black with a white band above the eyes, flanks were white, and there was a v-shaped white patch on the lower back. Calls of further *Indri* were heard and estimated to be 2 km from our location. Villagers report two groups of three individuals exist in the forest. A group of seven *E. f. albifrons* was sighted, comprising six adults and one infant being carried by a male. Three *H. g. griseus* were sighted, two adults and one infant, and three *Avahi*, two adults and one infant. *Daubentonia* also occurs in the forest as evidenced by the presence of Ramy nuts bearing the characteristic incisor marks made by this species to obtain the seed inside.

The status of lemurs in Antanamalaza and Sahivo

The Simpona or Diademed Sifaka (*Propithecus d. diadema*) which still occurs in small numbers at Betampona (estimated 10 - 15 individuals, density: 0.9 - 1.3 animals/km²) is absent from both of these forests. Villagers report that the last Simpona were seen in Antanamalaza during the mid 1970's. Their absence in the two forests is most likely due to a lack of sufficient resources to support a population. Simpona require a significantly richer diet than the sympatric *Indri*. As frugivores, they consume a large diversity of plant species and exhibit seasonal variation in the emphasis of plant parts in their diet (Powzyk 1997). For these reasons they typically maintain large territories and travel long distances to locate resources. Groups at Betampona are estimated to

have territories of 100+ ha. There is probably simply insufficient forest remaining in Antanamalaza and Sahivo to support this species. Simpona are also vulnerable to hunting, being extremely curious and relatively unafraid of humans. It is therefore no great surprise that this species was the first of the current lemur community to disappear from these forests.

Varecia are absent from Sahivo, although they are reported to have occurred there up to about ten years ago. It appears that three groups exist at Antanamalaza and a reasonable estimate would be 10 - 15 individuals. Villagers report that the *Varecia* are mainly observed feeding on leaves. Data from Betampona indicate that the *Varecia* there are highly frugivorous spending 92% of feeding time consuming fruits (Britt 1996). This is supported by studies at other sites (e.g., Morland 1991; White 1991; Rigamonti 1993; Vasey 1996; Balko 1998). If the villager's observation is correct this suggests that the *Varecia* are existing in a sub-optimal environment. This is further supported by the report that infants have not been observed in living memory. The villagers suggested that the *Varecia* population had increased in recent years and inferred that individuals had moved there from Betampona. This would involve an extremely hazardous journey across 10 km of cultivated land. It seems more likely that what the villagers are seeing is the squeezing of the existing population into a smaller and smaller area of primary forest. Estimates of primary forest cover from a September 1997 AVHRR image indicate that less than 121 ha (1 pixel) remained at that time. Green and Sussman (1990) calculated a deforestation rate of 1.4% per year over a 35 year period; preliminary results of current deforestation rates range from 2% to 10% per year depending on the region (Young and Axel, unpublished). Given that those forests most at risk are low elevation, low slope patches in areas of relatively high human population density (Green and Sussman 1990), it is reasonable to assume that less than 100 ha of forest now exists in Sahivo. Thus the density of *Varecia* at Antanamalaza is between 10 - 15 animals/km², considerably higher than the estimate of 2.5 - 3.1 animals/km² at Betampona.

Indri still occur in both forests probably due in large part to the generally observed "fady" (taboo) against eating this

species. At Sahivo 3 - 6 individuals exist in approximately 100 ha of forest (density: 3 - 6 animals/km²). At Antanamalaza 4 - 12 individuals exist also in approximately 100 ha of forest (density: 4 - 12 animals/km²). The population estimate at Betampona is 50 - 75 individuals giving a density estimate of 4.5 - 6.7 animals/km². Pollock (1975) recorded a population density of 8 - 16 animals/km² at Analamazoatra. As in Betampona the *Indri* exhibit inter-individual variation in pelage markings, ranging from very light coloured to very dark individuals.

Eulemur f. albifrons occurs in both forests. It is unlikely that any more than 20 individuals exist in each forest (maximum density: 20 animals/km²). A conservative estimate of the population at Betampona would be within the region of 250 individuals (density: 11.2 animals/km², if one assumes that this species can make use of most of the 2,228 ha of the reserve). This species is likely to be the major target of hunting activities.

Haplemur g. griseus occurs definitely in Sahivo and is likely also to occur at Antanamalaza. It is impossible to provide population estimates at present. However, we have observed this species in highly degraded areas around Betampona. It is probably the least threatened of the diurnal lemurs by the destruction of these two forests.

It is not possible at this time to present population estimates for the nocturnal lemur species.

Conclusion

The future looks bleak for the lemur communities of Antanamalaza and Sahivo. One species has already gone from Antanamalaza and two from Sahivo. Both forests have reduced lemur species diversity compared to the nearby Betampona reserve. The remaining lemurs exist at high densities compared to those recorded at Betampona and are being rapidly squeezed into smaller, fragmented patches of forest. Lemur snares were discovered in Antanamalaza, despite assurances by local villagers that they observed a fady against eating any lemur species. The main threat to these forests is clear-felling for tavy, which is eating away at the edges of the forests and being carried out in the middle, creating a mosaic of small isolated forest patches. Additionally there is evidence of extraction of precious hardwoods such as Ebony and Palissandre. In the surrounding area many rice paddies lie fallow as local people can obtain higher yields from clearing and burning primary forest. There is a real need to discourage this practice. It may already be too late to save these forests and it would certainly require immediate and effective intervention by agents of the Ministère des Eaux et Forêts.

The tragedy is that if well managed, these forests could probably still meet the timber needs of the local community and continue to support the current lemur and bird populations. If felling continues at the present rate it is likely that only a few small patches of forest will remain in 2 - 3 years and the majority of lemur species will disappear. The only remaining forest in the local area will be the Betampona reserve. It is feared that the ever-increasing human population will then turn its attention towards this last refuge for lemurs in the region.

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