

## SHORT NOTES

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# Non-flying mammalian fauna of Ampijoroa, Ankarafantsika National Park

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## ABSTRACT

There is no list of the mammalian fauna of Ampijoroa Forest Station, a dry deciduous forest within Ankarafantsika National Park. We set Sherman traps and pitfall traps and carried out transect surveys to survey the non-flying mammalian fauna of Ampijoroa. In total, 19 species of mammals were recorded, comprising 10 families. Records include three species of Tenrecidae, two species of Soricidae, one species of Muridae, three species of Nesomyidae, three species of Cheirogaleidae, one species of Lepilemuridae, two species of Lemuridae, two species of Indriidae, one species of Eupleridae, and one species of Suidae.

## RÉSUMÉ

Nous avons procédé à des observations de la faune mammalienne de la station forestière d'Ampijoroa, du Parc National d'Ankarafantsika. Pour compléter les données visuelles, nous avons posé des pièges Sherman, des trous pièges ou *pitfall traps* afin de capturer des animaux vivants qui furent relâchés ultérieurement sur leur lieu de capture. Au total, 19 espèces de mammifères ont été confirmées dans cette forêt, appartenant à 10 familles dont trois espèces de Tenrecidae, deux espèces de Soricidae, une espèce de Muridae, trois espèces de Nesomyidae, trois espèces de Cheirogaleidae, une espèce de Lepilemuridae, deux espèces de Lemuridae, deux espèces d'Indriidae, une espèce d'Eupleridae et une espèce de Suidae.

## INTRODUCTION

In Madagascar, there has been a considerable increase in natural history data for a wide variety of land animals in the last 20 years, as well as the description of numerous new species. However, there is still little information about the mammalian fauna of each region and limited ecological data about small mammals in Madagascar. Furthermore, systematic research has been relatively limited in the western dry deciduous forests compared to research in the eastern rainforests (Goodman et al. 2005), despite the fact that more than one-third of Madagascar's surface was formerly covered in dry forests. Given that the remaining dry forests are suffering from severe fragmentation by fires, illegal logging, and deforestation for agriculture

(Ganzhorn et al. 2001), ecological surveys of animals within the dry regions of the country are urgently needed to obtain baseline data to develop conservation and management strategies.

The Ampijoroa dry deciduous forest is one of the most important forests for both ecological research and ecotourism in Ankarafantsika National Park, located in the northwestern part of Madagascar. Many biologists have conducted ecological surveys in Ampijoroa forest, which is managed for ecotourism by Madagascar National Parks; therefore complete or updated information on the mammalian fauna of Ampijoroa forest can make a contribution to improve both ecological research and ecotourism activities in the National Park.

Although the avifauna and herpetofauna of Ampijoroa forest have already been reported (Mizuta 2005, Mori et al. 2006), there is no complete mammal inventory focused specifically on the forest. Some information on the mammals of Ampijoroa is available from other sources, including Alonso et al. (2002), which assessed the fauna of Ankarafantsika National Park but excluded Ampijoroa forest, Goodman et al. (2005) on the distribution of bats in the dry regions of Madagascar, and Garbutt (2007), which provides a review of mammals for the whole of Madagascar. Although the mammalian fauna of Ampijoroa can be surmised from these sources, a mammalian inventory of the sites is required to serve as a definitive species list and ensure the availability of information on the mammal fauna. Here, we present the results of a mammal survey of Ampijoroa and provide a list of mammal species at the site.

## METHODS

The study was conducted in the forest of Ampijoroa, Ankarafantsika National Park (E46°48', S16°15'). Ampijoroa forest is located in Boeny Region, approximately 110 km from the city of Mahajanga. The vegetation consists of a deciduous canopy 9-12 m high and fairly clear understory (Razafy 1987). Based on meteorological data from 2005 to 2009 at Ampijoroa (Durrell Wildlife Conservation Trust, unpublished data), the annual mean precipitation of the region is 1467.4 mm (range: 1305.1-1528.3 mm). Most rainfall occurs in the rainy season from November to April. Maximum air temperature can reach 34.9 °C

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in the hottest month (October), and minimum temperature can decrease to 17.3°C in the coldest month (July). Jardin Botanique A (JBA) is a research plot of approximately 30 ha (500 × 600 m) is located in the western part of Ampijoroa forest. A brief preliminary survey was also conducted in Jardin Botanique B (JBB; a transect along trails of ca. 3 km length) and around Lake Ravelobe (along National Route 4).

Field surveys were carried out from 16 November 2007 to 12 January 2008 and from 1 November 2008 to 10 February 2009. We attempted to capture small terrestrial mammals by setting 37 Sherman live traps and 60 pitfall traps in JBA, around the southern and western sides of an ephemeral pond for 36 days from 16 to 18 November and 22 November to 24 December 2007. The pitfall traps were plastic buckets (275 mm in depth, 290 mm in top internal diameter, 220 mm in bottom internal diameter) that were buried in the ground and arranged in lines. Sherman traps were put on the ground or on branches near pitfalls. Pitfalls were separated by at least 5 m from each other. We made two pitfall-trapping lines with plastic drift fences (700 mm in height, 50 m in length) to increase capture efficiency. We checked the traps every morning.

Collected animals were brought to the station, where we measured their external morphological characters (head-body length (HB), tail length (TL), body mass (Wt), and hind-foot length (HF)). Identification of the species was based on Carleton (2003), Garbutt (2007) and Mittermeier et al. (2010). We identified rodent species and the genus *Microgale* by morphological size and proportional HB and TL. We painted temporary marks on the backs of several species for visual identification. Except for a few individuals of each species, which were preserved in formalin to confirm the species, collected animals were released at the site of capture as soon as possible. We also recorded mammalian species observed in the field.

## RESULTS

In total we recorded 19 species of mammal comprising 10 families (Table 1). Ecological features and morphological measurements of small species are summarized in Table 1. Mean values of body measurements of each species were calculated without separating sexes. The following is a brief description of each species.

Afrosoricida, Tenrecidae

*Tenrec ecaudatus* (Schreber 1778)

We captured three individuals of this species by hand. This strictly terrestrial species was very abundant in Ampijoroa, and was often observed both in the daytime and at night. Juveniles were often observed foraging in a group with their mother during the day.

*Setifer setosus* (Schreber 1778)

Three individuals were captured, one of which was collected twice in Sherman traps placed on trees. Another individual was collected in a pitfall trap, and the other was captured by hand on the ground. This nocturnal species was common in Ampijoroa.

*Microgale brevicaudata* (G. Grandidier 1899)

Nine live and three dead individuals were collected in pitfall traps. We collected this species only using this method. We captured one individual every three days on average, suggesting that this species is very abundant in Ampijoroa and is terrestrial.

Soricomorpha, Soricidae

*Suncus murinus* (Linnaeus 1766)

Although we did not collect this shrew in traps, we observed it on several occasions.

*Suncus etruscus* (Savi 1822)

We collected only one dead body in a pitfall trap. This shrew is the smallest shrew and the smallest known terrestrial mammal in this forest.

Rodentia, Nesomyidae

*Eliurus myoxinus* (Milne-Edwards 1885)

Five individuals were collected in Sherman traps. Four of them were captured on trees, and the other on the ground. This species was nocturnal and common in the forest.

*Macrotarsomys ingens* (Petter 1959)

Only one individual was captured by hand, but this rat is not uncommon based on our observations. This rat was arboreal, terrestrial and nocturnal.

*Macrotarsomys bastardi* (Milne-Edwards & G. Grandidier 1898)

Only one individual was captured in a pitfall trap, but this rat is probably not uncommon. We observed this rat on several occasions during the night in the survey area.

Rodentia, Muridae

*Rattus rattus* (Linnaeus 1758)

Although three individuals were captured by Sherman traps on the ground, this rat was observed on both the ground and trees. We tentatively identified these individuals as *Rattus rattus*.

Primata, Cheirogaleidae

*Microcebus murinus* (Miller 1777) and *M. ravelobensis* (Zimmerman et al. 1998)

During night walks we often found solitary mouse lemurs moving on branches in the shrub layer and canopy, and eating fruits, flowers, gum, nectar, arthropods, and insect secretions in the both around JBA and around the Lake Ravelobe. The two species of mouse lemurs were commonly seen around JBA. In the forest around Lake Ravelobe, however, we observed only *Microcebus ravelobensis* but never saw *M. murinus*.

*Cheirogaleus medius* (É. Geoffroy 1812)

*Cheirogaleus medius* was not frequently seen in the Ampijoroa forest. This nocturnal solitary forager moved more slowly on tree branches than the mouse lemurs.

Primata, Lepilemuridae

*Lepilemur edwardsi* (Forbes 1894)

In Ampijoroa forest, we easily found this nocturnal primate during night walks and also recognized the loud vocalizations. Sleeping individuals were also found during the day in tree holes.

Primata, Lemuridae

*Eulemur mongoz* (Linnaeus 1766)

This species occurred in small troops composed of a male-female pair with one to four offspring: two or three troops appeared to be habituated around the station area in Ampijoroa, although we never saw them around JBA. *Eulemur*

TABLE 1. List of mammals observed in Ampijoroa with their morphological measurements and ecological features. (Ar: arboreal, C: cathemeral, D: diurnal, HB: head-body length, HF: hind-foot length, N: sample size, Nc: nocturnal, T: terrestrial, TL: tail length and Wt: body weight)

Family	Species	N	HB in mm (range)	TL in mm (range)	Wt in g (range)	HF in mm (range)	Activity	Habit
Tenrecidae	<i>Tenrec ecaudatus</i>	3	264.7 (239–290)	Non	549.3 (31.5–40.2)	37.3 (31.5–40.2)	C	T
	<i>Setifer setosus</i>	3	133.5 (120–147)	11.35 (9.65–13.0)	153.0 (88.0–196.0)	26.2 (22.2–30.25)	Nc	Ar, T
	<i>Microgale breviceaudata</i>	12	69.4 (62.9–74.6)	31.9 (29.8–33.7)	9.0 (7.3–10.6)	11.6 (11.4–12.0)	?	T
Soricidae	<i>Suncus etruscus</i>	1	39	13.05	-	7.6	Nc	T
	<i>Suncus murinus</i>	2	-	-	-	-	D?	T?
Nesomyidae	<i>Eliurus myoxinus</i>	5	117 (115–121)	132.4 (128–133.9)	47.0 (43.3–50.3)	24.4 (23.7–25.2)	Nc	Ar (T)
	<i>Macrotarsomys ingens</i>	1	128	200	53.6	34	Nc	Ar, Tr
	<i>Macrotarsomys bastardi</i>	1	-	-	-	-	Nc	Ar (T)
Muridae	<i>Rattus rattus</i>	3	143	191	84.2	30.7	Nc	Ar, T
Cheirogaleidae	<i>Microcebus murinus</i>	-	-	-	-	-	Nc	Ar
	<i>Microcebus ravelobensis</i>	-	-	-	-	-	Nc	Ar
	<i>Cheirogaleus medius</i>	-	-	-	-	-	Nc	Ar
Lepilemuridae	<i>Lepilemur edwardsi</i>	-	-	-	-	-	Nc	Ar
Lemuridae	<i>Eulemur mongoz</i>	-	-	-	-	-	C	Ar
	<i>Eulemur fulvus</i>	-	-	-	-	-	C	Ar
Indriidae	<i>Avahi occidentalis</i>	-	-	-	-	-	Nc	Ar
	<i>Propithecus coquereli</i>	-	-	-	-	-	D	Ar
Eupleridae	<i>Cryptoprocta ferox</i>	-	-	-	-	-	Nc	Ar, T
Suidae	<i>Potamochoerus larvatus</i>	-	-	-	-	-	Nc	T

*mongoz* exhibited a cathemeral activity pattern, active during both day and night.

*Eulemur fulvus* (É. Geoffroy 1796)

*Eulemur fulvus* in Ampijoroa formed multi-male/multi-female troops including five to 12 individuals and was commonly seen around JBA and the station area. We frequently encountered troops ranging around JBA and the station area from the morning to evening.

Primata, Indriidae

*Avahi occidentalis* (Lorenz von Liburnau 1898)

This nocturnal lemur typically lives in small family groups of up to five individuals composed of monogamous pairs with immature offspring. During day walks, we found several sleeping groups under closed canopies but this species was generally uncommon.

*Propithecus coquereli* (A. Grandidier 1867)

*Propithecus coquereli* is the largest lemur species in Ampijoroa forest. This diurnal lemur was commonly seen in the forest in groups of three to ten individuals.

Carnivora, Eupleridae

*Cryptoprocta ferox* (Bennett 1833)

We observed this species twice, at 1100h on 1 November 2008 and at 1820h on 2 February 2009. In both cases the observed individuals were on the ground and ran away immediately after it noticed our presence.

Artiodactyla, Suidae

*Potamochoerus larvatus* (F. Cuvier 1822)

The dung, footprints, and foraging signs of this species were often observed in the forest, but we did not directly observe this species.

## DISCUSSION

In the present survey we recorded 19 species of mammals in Ampijoroa dry forest. Beyond these, some individuals of *Rattus norvegicus* were collected as stomach contents of snakes (Mori, personal communication), and we also observed at least two species of bats (*Taphozous mauritanus* and *Hipposideros comersoni*). More than 10 bat species are noted in Ankarafantsika National Park (Eger and Mitchell 2003, MacKinnon et al. 2003, Goodman et al. 2005, Garbutt 2007). Other authors have recorded a number of species from the area that we did not observe: Alonso et al. (2002) noted that *Geogale aurita*, *Eliurus minor*, and *Mus musculus* are distributed in Ankarafantsika National Park, Hawkins (1994) noted the presence of *Eupleres goudotii* (it was formerly named as *E. major* see also Garbutt 2007), and Goodman et al. (2003) noted the wide distribution of *Viverricula indica* all over the island. Species accumulation curve suggests that our mammal fauna survey was reasonably complete (Figure 1). These data suggest that more than 20 mammalian species inhabit the dry forest of Ampijoroa.

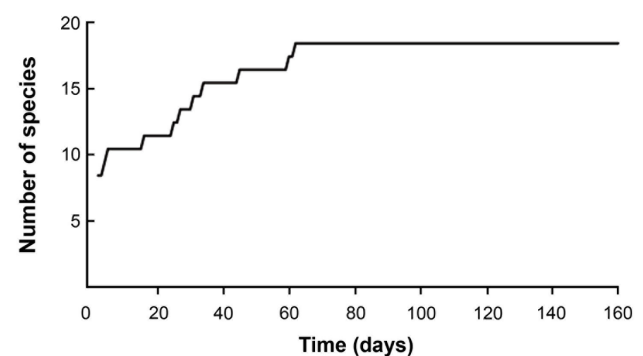


FIGURE 1. Accumulation curve of faunal diversity in mammals in Ampijoroa. The first parts of the curve (58 days) represents the 2007–2008 sampling period, followed by the 2008–2009 period.

We often observed domestic mammals such as cattle, cats and dogs in the forest at Ampijoroa. Although the primary forest in Ampijoroa is managed by Madagascar National Parks, local people leave these domestic animals in the forest. Introduced animals may be a threat to endemic animals. Cattle can be transmitters of common pathogens and are seedling predators, while cats and dogs may be competitors of fosa (*Cryptoprocta ferox*) and predators of small animals: we observed a common tenrec (*Tenrec ecaudatus*) being hunted by a domestic dog in the forest. Therefore, it is necessary for the park managers to consider the management of these domestic animals.

Our results highlight the biological importance of Ampijoroa forest, an important area for ecotourism and biodiversity conservation. However, this forest is suffering from fire-induced fragmentation, illegal logging, and illegal hunting (Ganzhorn et al. 2001). An adequate knowledge of the natural history of species occurring there is essential to ensure appropriate management for both conservation and tourism, such as efficient field guiding. Thus, further research on the biodiversity of Ampijoroa forest should be considered a priority.

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## SUPPLEMENTARY MATERIAL.

AVAILABLE ONLINE ONLY.

Location map and pictures of the animals observed during our survey.