**Field Data on the Little Known and Endangered *Lepilemur mittermeieri***

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**Abstract:** *Lepilemur mittermeieri* is a very little known sportive lemur of the Ampasindava peninsula of Madagascar, presently regarded as Endangered. It was described in 2006 by Rabarivola *et al.* on the basis of genetic material only, obtained from three individuals collected at the same locality. No observation confidently allocated to the species has been reported since. The objectives of our research were to verify that the sportive lemurs found in forests of the Ampasindava peninsula beyond the type locality of *Lepilemur mittermeieri* belonged to the same species as the type, to provide morphological and behavioral data for populations confidently attributed to *L. mittermeieri* and to obtain for these populations preliminary evaluations of density variations within the peninsula. Our surveys were undertaken in March and April 2014 in remnant forest patches of the western part of the Ampasindava peninsula. Linear transects by night and punctual observations by day were conducted. A total of 54 animals were seen along nine transects situated in four forest patches, two at low altitude and two at high altitude. All animals examined and photographed appeared similar, and the impression was gained that a single taxon was involved. Genetic material collected from one dead specimen proved identical to the type of *L. mittermeieri* which confirmed the identity of the populations we observed. It thus appears that *L. mittermeieri* is indeed the only sportive lemur present on the peninsula and that it occurs in several forest remnants. We endeavored to get evaluations of the density and abundance of the species in the four forest patches we studied. We used KAI (Kilometric Abundance Indices) to evaluate and compare relative densities, and Buckland’s distance sampling method to evaluate absolute densities. The latter suggested a density of 1.9 animals/ha, a result that must, however, be taken with caution.

**Key Words:** *Lepilemur mittermeieri*, Ampasindava peninsula, Madagascar, distance sampling, endangered species

**Introduction**

Sportive lemurs (genus *Lepilemur*) are medium-sized, mostly folivorous, forest-dwelling, mostly nocturnal primates, confined, like the rest of the infraorder Lemuriformes, to Madagascar (Wilmet *et al.* 2014). They are placed by most recent authors in the monotypic family Lepilemuridae (Groves 2005; Schwitzer *et al.* 2013). As a genus, the sportive lemurs are widely distributed, in discrete populations, in low and mid-altitude evergreen and deciduous forests of Madagascar (Andriaholinirina *et al.* 2006; Mittermeier *et al.* 2010; Mittermeier 2013; Drösher and Kappeler 2014). The diversity of the genus has only recently been fully appreciated (Schwitzer *et al.* 2013). Until the 1970s, all populations were included in two or one species. Between 1977 and the 1990s seven species were recognised. Groves (2005) recognised eight species. Recent genetic and cytogenetic studies have identified 26 species, with more likely to be discovered (Schwitzer *et al.* 2013). The cryptic character of the now-recognized species, the long ignorance of their identity and the fact that many of them have only been characterised through genetic analyses mean that very few eco-ethological data can be specifically attributed to most of them. Thus, by 2013, data on behaviour and ecology were only available for six of the 26 species (Schwitzer *et al.* 2013). The genus is very homogenous; species are morphologically similar and are not sexually dimorphic. The reproductive cycle of individual species and the social behaviour of individuals are poorly known but some sportive lemurs at least show a seasonal reproductive cycle and individuals appear to

Figure 1. Representation of the four sites (numbers) studied on the Ampasindava peninsula in northwest Madagascar. (ArcMap 10.1)
be mostly solitary (Andriaholinirina et al. 2006; Drösh and Kappeler 2014; Thalmann 2001; Zinner et al. 2003; Seiler 2012).

Concern for the conservation status of sportive lemurs had long been expressed, in spite of their supposed large range and occasional local abundance, because of the fragmented distributions and severe threats to many isolated populations, risk factors which increase with the current intensification of deforestation and habitat degradation (Ganzhorn et al. 2000; Harper et al. 2007; Schneider et al. 2010). The new understanding of the diversity of the genus has considerably increased this concern as most species are now known to have very small, shrinking and fragmenting ranges and, probably for some of them, small total populations (Schwitzer et al. 2013). A 2012 assessment evaluated five species as Critically Endangered, 17 as Endangered, and four as vulnerable. Effective conservation actions are thus urgently needed to preserve viable populations of each species. To define and guide these actions, a minimum understanding of the limits of the area of distribution, of the habitat requirements, and of the behaviour and population size of the target species are required.

Our fieldwork addresses one of the least known, endangered species, *Lepilemur mittermeieri*. *Lepilemur mittermeieri* was described from the Ampasindava peninsula on the basis of tissue samples from three specimens for which karyotypes and mitochondrial cytochrome b DNA sequences were obtained (Rabarivola et al. 2006). At the time of the description no indication of presence of the taxon outside of the type locality was known. No morphological description, and no eco-ethological data accompany the description. Mittermeier et al. (2010) provided some more information on *Lepilemur mittermeieri*. They suggested that the species was limited to the Ampasindava peninsula and was the only *Lepilemur* on the peninsula. They gave indications on the field appearance of the species, basing their description on unpublished observations by Edward Louis. They did not, however, indicate whether and how it had been ascertained that the animals seen by Louis belonged to the same taxon as the type of *L. mittermeieri*. Recently new data on the abundance of “*L. mittermeieri*” were provided by Ralantoharijaona et al. (2014). In this case it is clear that identification rested on geographical probability, not on comparison with the type of the species. No other data appear to have been published on the taxon, which is classified as Endangered (IUCN 2014).

Forest fragmentation proceeds at a fast rate on the Ampasindava peninsula (Ranirison et al. 2014), the presumed area of distribution of the species. Measures to help the species may be found to be a priority in the conservation strategy defined for the area in collaboration with the “Managed Resources Protected Areas” project of the UNDP (United Nations Development Programme) and the GEF (Global Environment Fund) (Ranirison et al. 2014). Rapid surveys are thus essential to immediately improve our knowledge of the species. The objectives of this first field investigation in several forest patches of the northern part of the Ampasindava peninsula were:

1) to confirm that the sportive lemurs found in forests of the Ampasindava peninsula beyond the type locality of *Lepilemur mittermeieri* belonged to the same species as the type;
2) to provide first data on appearance and measurements of individuals of known genetic identity;
3) to assemble eco-ethological data for populations safely attributed to *L. mittermeieri*, with a first emphasis on forest characteristics in area of occupancy, social behaviour and selection of sleeping sites and fidelity to these sites; and
4) to obtain for populations safely attributed to *L. mittermeieri* preliminary evaluations of density variations in the peninsula.

**Methods**

**Study area**

The Ampasindava peninsula is located in northwest Madagascar (Fig. 1), between 13°40'40.0" and 13°40'60.0" latitude and 47°58'40.0" and 47°58'30.0" longitude, in the southwestern part of the Ambanja district, along the Mozambique Channel, and belongs to the Diana region. The peninsula is included in the Sambirano domain, which is characterized by an average yearly precipitation of 2000–2500 mm, most of it (95%) falling during the hot season (Ranirison et al. 2014). Humidity level is always high, and the average annual temperature is near 26°C with low seasonal variation. The mean maximum temperature is about 34°C, the mean minimum temperature about 13°C. Because of the topography of the area, the climate of the Sambirano region is more similar to that of the east coast of Madagascar than to that of other areas of the west coast and can be considered as hot and humid/subhumid (Ranirison et al. 2014). The forest cover of the peninsula is highly fragmented because of human activities and the remaining forest patches are under varying levels of anthropic pressure and disturbance. Four main types of vegetation can be distinguished in the Ampasindava peninsula: 1) secondary formations (grassland or culture), 2) subhumid forests, 3) dense humid forests and 4) mangroves (Ranirison et al. 2014).

We investigated four patches of forest, selected to provide a spectrum of size, location (central or coastal) (Fig. 1) and habitat types. Sites 1 and 2 (Fig. 1) are located on mountains (site 1 on Andranomatyvay mountain, site 2 on Ambohimarahavavy mountain) where vegetation is classified as dense humid forest (Ranirison et al. 2014). Their precise locations are respectively 13°40'26.8"S, 47°58'00.3"E and 13°45'54.5"S, 48°05'40.7"E. They can be considered high-elevation sites as the altitude can reach more than 550 m. Sites 3 and 4 (Sorony forest) are at low elevation (no higher than 300 m), near the coast, in subhumid forest (Fig. 1). Their precise locations are respectively 13°43'53.5"S, 47°52'41.2"E and 13°35'46.7"S, 47°53'42.4"E. The sizes of the four forest patches were estimated at 882 ha (site 1), 1683 ha (site 2), 167 ha (site 3) and 168 ha (site 4).
Field observations

Field observations on presence, distribution, appearance and behaviour of sportive lemurs in the Ampasindava peninsula took place in April 2013. Reccees were conducted in four patches of forest to confirm the presence of the species. Once presence of sportive lemurs was confirmed in a forest patch, sportive lemur populations were surveyed using a line-transect method (Buckland et al. 2001; Quéméré et al. 2010; Ibouroi et al. 2013; Sabin et al. 2013). We conducted a total of nine line transects: 1 in site 1, 3 in site 2, 2 in site 3, and 3 in site 4. The total of line transects and the number per site varied for logistical reasons. The nine line transects represent a total length of 18.45 km. Individual transect lengths varied from 380 m to 1260 m (Table 1). Some transects were set up along existing trails in the forest and we opened new trails for others. Each transect was marked every 20 m by a biodegradable flag. Censuses were conducted at night by three observers walking together and operating on three consecutive nights (two nights for one of the transects). The entire length of the transect was covered each night. Night observations began around 18:00 and lasted for at least 2 hours. During the survey, team members walked slowly along each transect (around 0.5 km/h) and lemurs were detected by their eyeshine reflecting the headlamp and/or by their vocalizations. Once an animal was visually detected, the use of a powerful hand torch allowed us to confirm generic identification. For each observation we recorded GPS point, time, position of the animal on the tree, as well as its location in relation to the transect (perpendicular distance), as described by Buckland et al. (2001), Randrianambinina et al. (2010) and Meyler et al. (2012). During the survey, we also performed focal observations (Altmann 1974) of 1-minute/animal (when it did not move) to collect data on behaviour (Resting/Vigilance/Feeding/Locomotion/Interaction with other animals). Reccees were also carried out during the day in order to locate sleeping sites of the species. The observers looked for trees with holes and checked for occupation by sportive lemur. Once a sleeping site was found, we recorded GPS point, elevation, tree height, diameter of the tree at breast height (DBH), height of the sleeping site, classification of the canopy (open/half-open/closed). The tree species involved was provisionally indicated by a vernacular name provided by Malagasy guides, completed when possible by a generic allocation obtained by reference to the key of Schatz (2001). We collected herbarium material to confirm our identification at Tsimbazaza Botanical Garden in Antananarivo.

Animals encountered during night surveys or sighted during the day in their sleeping sites were examined at close range. We were able to take high quality pictures of seven individuals. Four animals were photographed at roost sites during the day in natural light (camera Fujifilm FinePixe S2950); two were photographed at night with a flash. The seventh individual was a dead sportive lemur that had been recently killed. On this animal we also collected morphometric data and two tissue samples (hair and ear clip). Eco-ethological data on the Lepilemur seen were recorded both during night transects and in day searches for roosts.

DNA analyses

In order to relate the animals observed to the type of L. mittermeieri, we conducted a DNA analysis on tissue samples obtained from the dead animal found in the study area. We extracted genomic DNA from both tissue samples (the ear clip and hair) using the NucleoSpin Tissue Kit (Macherey-Nagel). A fragment of the 5’-end of the mitochondrial cytochrome b (cytb) marker was amplified using the primers L14723 (Ducroz et al. 2001) and H15149 (Kocher et al. 1989 modified by Carr and Marshall 1991) in a 25 µl PCR reaction containing final concentrations of 0.2 mM dNTPs, 0.4 μM of each primer, 1.5 mM MgCl2, 0.75 U of Taq DNA polymerase (Platinum, Invitrogen), 1X PCR buffer and 1.5 μl DNA template. The thermal cycler program consisted of an initial denaturation step of 4 min at 94°C, followed by 40 cycles of 30 s at 94°C, 30 s at 49°C and 90 PCR Kit (Macherey-Nagel) and sequenced them on an ABI 3130 Genetic Analyzer (Applied Biosystems) using the BigDye Terminator Cycle Sequencing Kit v.3.1. We checked that the DNA sequences obtained for the two samples were identical. Using Mega v.6.06. (Tamura et al. 2013), we calculated genetic pairwise p-distances (proportion of nucleotide sites at which two sequences differ) between our new sequences and each cytochrome b sequence available in GenBank for the genus Lepilemur.

Abundance evaluation 1. Relative density evaluation

We calculated a relative index of abundance which permits a rough comparison between the forest patches we investigated, and which will, with due precautions, enable us to compare the peninsular forests with ones we will sample in other areas. For each transect, we calculated a KIA (Kilometric Index of Abundance) (Ferry and Frochot 1958; Mathot and Doucet 2006; Poilecot 2009), with:

\[
KIA = \frac{n}{l}
\]

where \( n \) is the number of individuals observed along the transect and \( l \) the length of the transect. Each transect was covered three times (twice for one of them). We compared two methods for estimating \( n \). One of them is the classical one, which retains the highest number detected on one passage (Ferry and Frochot 1958). It is the best suited for relatively mobile animals such as temperate forest birds, sampled at relatively long intervals. In our case, however, we tried to exploit the small home range and the site fidelity of sportive lemurs as well as the short intervals between our passages.

We combined the results of the three passages on a transect, using precise location to identify successive records of the same animal. This yields of course a higher value for \( n \).

We further calculated KIAs for whole forest patches, by averaging the KIAs obtained for all transects conducted within the patch. For this exercise we combined the two...
lowland patches (five transects) on the one hand, the two highland patches (four transects) on the other.

**Abundance evaluation 2. Absolute density evaluation**

We analysed surveys from line transects with distance sampling, a widely used technique for estimating the size or density of populations (Thomas et al. 2010; Bouché et al. 2012), including lemurs (Quéméré et al. 2010; Ibouroi et al. 2013; Meyler et al. 2012; Axel and Maurer 2011; Salmona et al. 2014). We used the Buckland method (Buckland et al. 2001) for which the probability of detecting an animal decreases as its distance from the transect increases. This model evaluates the effective strip width (ESW) with a function of detection based on the perpendicular distance of the detected animal to the transect. Several functions can be used, and we tested here four detection models (hazard rate cosine, hazard rate simple polynomial, half-normal cosine and half normal simple polynomial function) and compared them using the Akaike Information Criterion (AIC) and the goodness-of-fit as recommended by Buckland et al. (2001). This method is implemented in the DISTANCE 6.0 program and calculates the final density (D) in function of the ESW, the total number of observations (Nt) and the total length of the transects (Lt).

\[ D = \frac{N_t}{2 \cdot ESW \cdot L_t} \]

The method assumes an even distribution of the target species in the area sampled and an equal probability of detection on each transect. Thus, successive passages on a same transect can be treated in the same way as passages on distinct transects (Buckland et al. 2001). Furthermore, all patches were combined as the patch-specific samples were too small to highlight differences between patches. This research complied with protocols approved and adhered to the legal requirement of Madagascar’s Association Nationale pour la Gestion des Aires Protégées.

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### Table 1a. Transect characteristics, number of *Lepilemur* detected by combination of the three passages, KIA (Kilometric Index of Abundance) per transect, average KIA per site at high and low elevation.

<table>
<thead>
<tr>
<th>Forest patch number</th>
<th>Transect number</th>
<th>Elevation (m) of first and last point</th>
<th>Transect length (km)</th>
<th>Nº of animals detected</th>
<th>KIA per transect</th>
<th>Average KIA per area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.1</td>
<td>315–557</td>
<td>0.38</td>
<td>3</td>
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<td>9.36</td>
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<tr>
<td>2</td>
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<td>194–526</td>
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<td>8</td>
<td>8.99</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.2</td>
<td>449–563</td>
<td>0.635</td>
<td>6</td>
<td>9.45</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.3</td>
<td>289–330</td>
<td>0.45</td>
<td>5</td>
<td>11.11</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3.1</td>
<td>84–102</td>
<td>0.805</td>
<td>5</td>
<td>6.21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.2</td>
<td>79–145</td>
<td>1.26</td>
<td>12</td>
<td>9.52</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4.1</td>
<td>32–161</td>
<td>0.45</td>
<td>5</td>
<td>11.11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.2</td>
<td>181–184</td>
<td>0.6</td>
<td>6</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.3</td>
<td>15–148</td>
<td>0.6</td>
<td>4</td>
<td>6.67</td>
<td></td>
</tr>
</tbody>
</table>

### Table 1b. Transect characteristics, highest number of *Lepilemur* detected in one passage KIA (Kilometric Index of Abundance) per transect, average KIA per site at high and low elevation.

<table>
<thead>
<tr>
<th>Forest patch number</th>
<th>Transect number</th>
<th>Elevation (m) of first and last point</th>
<th>Transect length (km)</th>
<th>Nº of animals detected</th>
<th>KIA per transect</th>
<th>Average KIA per area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>315–557</td>
<td>0.38</td>
<td>2</td>
<td>5.26</td>
<td>6.24</td>
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<tr>
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<td>6.74</td>
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</tr>
<tr>
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<td>6.30</td>
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</tr>
<tr>
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<td>289–330</td>
<td>0.45</td>
<td>3</td>
<td>6.67</td>
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</tr>
<tr>
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<td>84–102</td>
<td>0.805</td>
<td>4</td>
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</tr>
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<td>1.26</td>
<td>7</td>
<td>5.56</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4.1</td>
<td>32–161</td>
<td>0.45</td>
<td>3</td>
<td>6.67</td>
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<tr>
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<td>181–184</td>
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<td>6</td>
<td>10.00</td>
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</tr>
<tr>
<td></td>
<td>4.3</td>
<td>15–148</td>
<td>0.6</td>
<td>4</td>
<td>6.67</td>
<td></td>
</tr>
</tbody>
</table>
Morphological description of sportive lemurs observed

Field descriptions of animals seen and examination of photographs reveal no visible differences between individuals observed within a forest patch nor between those found in the four patches. All animals had a brown back with a dark brown to black midline stripe occasionally present from the head to the lower back, and a lighter grey belly. The tail was usually of the same colour as the back and dark brown to black toward the tips. The face was dark grey and mask-like with a whiter area under the mandible. The spectrum of individual variation did not notably diverge from the description provided by Mittermeier et al. (2010), and was not particularly broad for a sportive lemur so that there is no reason to think that more than a single taxon was involved in all our sightings on the peninsula. The finding of the dead animal (male) allowed us to verify pelage coloration in daylight at close range. Head-body length and tail length measured on this individual were 27.6 cm and 26.5 cm, respectively. These morphometric measures are within the size interval given by Mittermeier et al. (2010) and Mittermeier (2013).

Behaviour of sportive lemurs observed

We observed pairs of sportive lemurs standing peacefully close together or foraging in the same tree several times. We also observed several bouts of agonistic behaviour which could be interpreted as defence of territory and/or mate.

DNA analysis

The two cytb DNA sequences obtained here for two samples of the same animal (GenBank accession number: BankIt2063930 AB42612496 MG551578) are identical to all three cytb sequences of Lepilemur mittermeieri already available in GenBank (Rabarivola et al., 2006). Their interspecific p-distances with the other sequences of Lepilemur range from 3.9 to 16.6% and therefore, the position of Lepilemur mittermeieri is well distinct from the other Lepilemur species in the neighbor-joining tree constructed with the cytb marker (Fig. 2).

Density evaluation 1. Relative density evaluation

Table 1a and Table 1b summarize the relative abundance data obtained for the nine transects, expressed as KIAs calculated by the two methods. Differences between transects are relatively small in both cases. The average KIAs for sites at high elevation (KIA = 9.36 with our method and KIA = 6.24 with the classical method) and sites at low elevation, (KIA = 8.7 with our method and KIA = 6.77 with the classical method) are also quite similar when our method is used and almost equal when the classical method is used. It thus appears that the density of sportive lemurs in the patches investigated is quite uniform.

Density evaluation 2. Absolute density evaluation

The number of observations per transect and per forest patch is too low to apply with any confidence the distance

Figure 2. Unrooted neighbour-joining tree based on pairwise p-distances among all cytochrome b sequences available for the genus Lepilemur in GenBank.

Results

Habitat

All forest patches investigated on the Ampasindava peninsula are multi-strata forests in which the tallest trees are 23 to 27 m high. The forests of sites 1 and 2 are on slopes, the upper canopy is more closed and darker than in the other patches, and the lower strata are less dense. The forests of sites 3 and 4 have high densities of small trees and, in places, much bamboo (Nastus sp.). Sportive lemurs shared their habitat with other lemur species. Four species, Eulemur macaco, Mirza zaza, Avahi unicolor and Phaner parienti, were seen during the course of the study.

Sportive lemur sightings

We found sportive lemurs in every forest patch visited. Between transects, diurnal recce and the finding of one dead animal (13°45'41.6"S, 048°07'14.1"E"), we saw altogether 60 different individuals of sportive lemurs. Seven sleeping sites of Lepilemur were found. The majority (5 of 7) of those sleeping sites were located in site 1. Four tree species used as sleeping sites belonged to the family Hamamelidaceae (Table 2). Our observations showed that some animals were using the same sleeping site several nights in a row while others, seen one day were not seen the next day.
Field Data on Lepilemur mittermeieri

Sampling method of Buckland et al. (2001). As the relative density is fairly constant over the whole area investigated, however, it appears legitimate to apply the approach to the entire set of data, regarding each passage on a transect as a sample. This yields 69 observations for a total survey effort of 17,010 m. Table 3 summarizes the results obtained with the DISTANCE software. The estimated density is 1.9 animals/ha, with a 95% Confidence Interval situated between 1.5 and 2.5 animals/ha.

Discussion

This preliminary investigation on the Ampasindava peninsula shows sportive lemurs (genus Lepilemur) to be fairly uniformly present in at least some of the remnant forest patches of the peninsula. It also indicates that a single taxon appears to be present on the peninsula. Detailed morphological analysis of seven individuals, and additional observations of about 45 others are consistent with their identification as L. mittermeieri. Genetic analysis of one individual has revealed a DNA sequence that corresponds to the sequence regarded as diagnostic of L. mittermeieri in the original description of the species. There is thus no reason not to accept that the type of L. mittermeieri belongs to the populations we have observed and thus that these can be called L. mittermeieri. Lepilemur mittermeieri is therefore the species present on the Ampasindava peninsula.

Sportive lemurs were sighted in the same habitat as other lemurs. This cohabitation between several species of lemurs is frequent (Mittermeier et al. 2010; Seiler 2012). A notable characteristic of the sportive lemur populations we observed is the relatively low number of sleeping sites discovered compared to the total number of animals observed. This result could be explained by the choice for sleeping sites of high locations or dense tangles of branches instead of tree holes situated at moderate heights, commonly noted for other species (Rasoloharijaona et al. 2008; Seiler et al. 2013). We also saw several pairs of L. mittermeieri. Observation of pairs is rare in L. sahamalazensis but has been reported for L. ruficaudatus (Zinner et al. 2003; Hilgartner 2006) and L. edwardsi (Seiler 2012; Thalmann 1998). Our observations, collected during a relatively short time span, could simply reflect a chance coincidence between the mating season and the time of our survey, or it could represent a specific behavioural trait, longer pair-bond, mother and offspring association, animals of either sex associating in relation to food resource availability.

Our figure of estimation with DISTANCE is fairly similar to, but apparently somewhat higher than, the 1.33 animals/ha published by Ralantoharijaona et al. (2014). Their results were obtained in 2010 in two forest patches situated in the eastern half of the Ampasindava peninsula. They are analysed with the same algorithm as ours but as their number of observations (26) is even lower than ours and well below the 40 required by DISTANCE, not too much reliance can be placed on a comparison of the two estimates. If the area investigated is representative of all forest areas remaining on the peninsula, estimated at 43,702 ha (Ranirison at al. 2014), the density figures we calculated would correspond for the Ampasindava sportive lemur to a total population of the order of ten thousand animals. This estimate needs however to be taken with extreme caution, as only a very small area has been surveyed and as the distance sampling methodology is of limited reliability.

Additional investigations are still needed to improve our knowledge of this understudied species occurring in fragmented and continuously contracting forest patches. In

Table 2. Characteristics of sleeping sites of sportive lemurs, Lepilemur mittermeieri, on the Ampasindava peninsula.

<table>
<thead>
<tr>
<th>Site</th>
<th>Date</th>
<th>Elevation (m)</th>
<th>GPS point</th>
<th>Tree local name</th>
<th>Tree family</th>
<th>Tree genus</th>
<th>DBH (cm)</th>
<th>Tree height (m)</th>
<th>Height of sleeping site (m)</th>
<th>Canopy cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7 April 2014</td>
<td>303</td>
<td>S.13°46’02.3”   E.48°05’40.2”</td>
<td>Piro</td>
<td>Hamamelidaceae</td>
<td>Dicoryphe</td>
<td>75.3</td>
<td>5.5</td>
<td>4</td>
<td>Open</td>
</tr>
<tr>
<td>1</td>
<td>7 April 2014</td>
<td>346</td>
<td>S.13°46’40.8”   E.48°05’40.8”</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>163</td>
<td>19</td>
<td>9</td>
<td>Open</td>
</tr>
<tr>
<td>1</td>
<td>8 April 2014</td>
<td>347</td>
<td>S.13°45’58.7”   E.48°05’41.4”</td>
<td>Piro</td>
<td>Hamamelidaceae</td>
<td>Dicoryphe</td>
<td>214</td>
<td>14</td>
<td>6</td>
<td>Half open</td>
</tr>
<tr>
<td>1</td>
<td>8 April 2014</td>
<td>347</td>
<td>S.13°45’58.7”   E.48°05’41.4”</td>
<td>Piro</td>
<td>Hamamelidaceae</td>
<td>Dicoryphe</td>
<td>214</td>
<td>14</td>
<td>9</td>
<td>Half open</td>
</tr>
<tr>
<td>1</td>
<td>8 April 2014</td>
<td>333</td>
<td>S.13°46’00.7”   E.48°05’38.9”</td>
<td>Piro</td>
<td>Hamamelidaceae</td>
<td>Dicoryphe</td>
<td>94.2</td>
<td>3</td>
<td>3</td>
<td>Closed</td>
</tr>
<tr>
<td>3</td>
<td>19 April 2014</td>
<td>83</td>
<td>S.13°44’35.0”   E.48°53’37.9”</td>
<td>Nato</td>
<td>Sapotaceae</td>
<td>Capurodendron</td>
<td>119</td>
<td>12.5</td>
<td>10</td>
<td>Open</td>
</tr>
<tr>
<td>4</td>
<td>29 April 2014</td>
<td>1’75</td>
<td>S.13°39’21.8”   E.47°53’11.3”</td>
<td>Zahana</td>
<td>Sarcolaenaceae</td>
<td>Leptolaena cuspidala</td>
<td>113</td>
<td>12</td>
<td>5</td>
<td>Closed</td>
</tr>
</tbody>
</table>

Table 3. Results obtained with DISTANCE; the Akaike Information Criterion (AIC), the Effective Strip Width (ESW), the density (D), the density of individuals analytic lower confidence limit and upper confidence limit (D LCL and D UCL), the density of individuals analytic coefficient of variation (D CV), the total number of animals for the area (N), the number of individuals analytic lower confidence limit and upper confidence limit (N LCL and N UCL), the probability of detection (P) and the Goodness-of-fit chi-square test probability (GOF Chi-p) of the analysis with the DISTANCE Software.

<table>
<thead>
<tr>
<th>AIC</th>
<th>ESW</th>
<th>D</th>
<th>D LCL</th>
<th>D UCL</th>
<th>D CV</th>
<th>N</th>
<th>N LCL</th>
<th>N UCL</th>
<th>P</th>
<th>GOF Chi-p</th>
</tr>
</thead>
<tbody>
<tr>
<td>251.36</td>
<td>10.75</td>
<td>1.887</td>
<td>1.449</td>
<td>2.457</td>
<td>0.131</td>
<td>5513</td>
<td>4234</td>
<td>7178</td>
<td>0.83</td>
<td>0.112</td>
</tr>
</tbody>
</table>
particular, it is urgent to assemble data on home ranges, sleeping sites, and feeding behaviour of *L. mittermeieri*. The links between these eco-ethological parameters and forest characteristics need to be investigated to ascertain whether forest quality and maturity affect sportive lemurs. Better understanding of habitat use by this species is necessary in order to design guidelines for a conservation strategy in the area. Our preliminary results do confirm that the Ampasindava peninsula must be considered a priority area for Malagasy conservation.

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