

The lemur diversity of the Fiherenana-Manombo Complex, southwest Madagascar

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ABSTRACT

We conducted the first comprehensive lemur survey of the Fiherenana-Manombo Complex (Atsimo-Andrefana Region), site of PK32-Ranobe, a new protected area within the Madagascar Protected Area System. Our cross-seasonal surveys of three sites revealed the presence of eight lemur species representing seven genera and four families, of which three are diurnal and five are nocturnal species. Six species were only recorded in the riparian and transitional forests of the Fiherenana and Manombo river valleys, while the spiny thicket at Ranobe contains only *Microcebus* (two species), all larger species having been extirpated by hunting in recent years. Two of our records (*Mirza coquereli* and *Cheirogaleus* sp.) represent new locality records or range extensions, but we failed to record one species (*Phaner pallescens*) expected to occur in the area, and question the literature supporting its presence south of the Manombo river. Our findings highlight the importance of the Fiherenana-Manombo Complex for the conservation of lemurs in southwest Madagascar, but also show that PK32-Ranobe fails to protect the full lemur diversity of the Complex. The protected area does not include the riparian forests of the Manombo and Fiherenana rivers, and at least three lemur species are therefore unprotected. We strongly support the proposed extension of the protected area to include these riparian forests as well as other important habitats for locally endemic bird and reptile taxa.

RÉSUMÉ

La zone du Complexe Fiherenana-Manombo (Région d'Atsimo-Andrefana), site de PK32-Ranobe, une nouvelle aire protégée dans le Système des Aires Protégées de Madagascar (SAPM), a fait l'objet d'un premier inventaire de lémuriens. Nos prospections dans trois sites à différentes saisons ont révélé la présence de huit espèces de lémuriens représentés dans sept genres et trois familles, dont trois sont des espèces diurnes et cinq sont des espèces nocturnes. Nous n'avons pas pu identifier l'espèce du genre *Lepilemur* ni celle du genre *Cheirogaleus* à défaut de disposer de spécimens. Six espèces ne se trouvaient que dans les forêts riveraines et les forêts de transition des vallées des fleuves Fiherenana et Manombo. Le fourré épineux de Ranobe n'abrite que des *Microcebus* (deux espèces), toutes les espèces plus grandes ayant déjà été exterminées par la chasse au cours

des dernières années. Nos estimations de densité indiquent que la population des *Microcebus* est deux fois plus importante dans le fourré épineux que dans la forêt riveraine (1,078 individus / km² vs. 546 individus / km²). Nous avons estimé la densité d'*Eulemur rufus* à 40 groupes / km² dans la vallée du Fiherenana, mais nos transects ne nous ont pas permis d'obtenir des estimations fiables pour les densités de *Lemur catta* et de *Propithecus verreauxi*. Deux des espèces répertoriées (*Mirza coquereli* et *Cheirogaleus* sp.) représentent de nouvelles observations pour la zone ou des extensions de leurs aires de répartition connues, mais nous n'avons pas pu trouver l'espèce *Phaner pallescens* qui devait être présente dans la zone et nous émettons des doutes portant sur les références publiées rapportant la présence de l'espèce au sud du fleuve Manombo. Nos résultats mettent en exergue l'importance du Complexe Fiherenana-Manombo pour la conservation des lémuriens dans le sud-ouest de Madagascar, mais ils indiquent que l'aire protégée de PK32-Ranobe ne protège pas la diversité complète des lémuriens du Complexe. Les forêts riveraines des fleuves Fiherenana et Manombo ne sont pas incluses dans l'aire protégée de sorte qu'au moins trois espèces de lémuriens ne bénéficient alors d'aucune protection. Compte tenu des objectifs du SAPM et plus particulièrement de l'Objectif 1, à savoir 'Conserver l'ensemble de la biodiversité unique de Madagascar', nous estimons que la nouvelle aire protégée du PK32-Ranobe n'atteint pas ces objectifs et nous appuyons les efforts des promoteurs afin de re-délimiter l'aire protégée pour inclure les forêts riveraines ainsi que d'autres habitats importants pour la conservation des oiseaux et des reptiles localement endémiques.

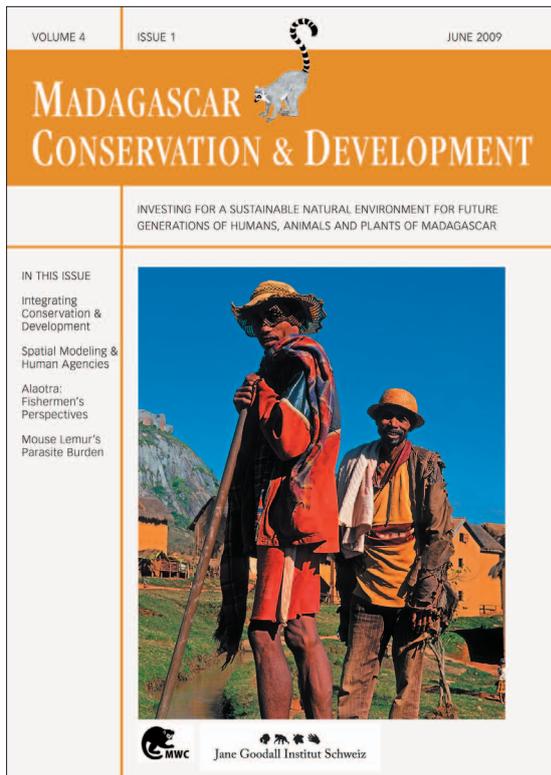
KEYWORDS: Lemurs, PK32-Ranobe, spiny thicket, SAPM, protected area.

MOTSCLEF : forêts riveraines, Manombo, Fiherenana, SAPM, PK32-Ranobe, lémuriens.

INTRODUCTION

The lemurs are the best known of Madagascar's endemic fauna, and as such play an important role as flagships not only for conservation (Durbin 1999, Thalmann 2006), but for the country itself. The level of scientific research on lemurs reflects their flagship status, but despite this many aspects of lemur distribution

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Madagascar Conservation & Development is the journal of Madagascar Wildlife Conservation (MWC) and the Jane Goodall Institute (JGI Switzerland). It is produced in these institutions' own responsibility.

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and taxonomy remain poorly known. This is illustrated by the extraordinary rate of new species description over recent years; while Mittermeier et al. (1994) considered 34 taxa to merit full species status, this number has more than doubled and is still growing (e.g. Thalmann 2006, Craul et al. 2007, Tattersall 2007, Lei et al. 2008, Mittermeier et al. 2008). Three trends have contributed to this growth in species numbers: 1) the discovery and characterisation of new forms, 2) the resurrection of synonyms and 3) the application of new species concepts (Thalmann 2006). The underlying factor is, of course, a huge increase in the level of research effort in lemur taxonomy, distributions and ecology, but despite such effort many areas of the country remain little known or un-surveyed, including many forest areas considered to be national or regional conservation priorities.

The Fiherenana-Manombo Complex, also known as the Southern Mikea/Mikea Sud, Toliara forest and PK32-Ranobe, has long been recognised as a conservation priority area (Domergue 1983, Nicoll and Langrand 1989, Ganzhorn et al. 1997, ZICOMA 1999, Seddon et al. 2000). Forming part of the South Mangoky centre of micro-endemism (Wilmé et al. 2006), the area lies to the north of the regional capital of Toliara (Atsimo Andrefana Region) on Madagascar's southwest coast, stretching between the Fiherenana River to the south and the Manombo River to the north. It is bordered to the west by the Mozambique Channel, and extends to the eastern edge of the Tertiary limestone Mikoboka Plateau (Figure 1). The climate is sub-arid, receiving 100-1,300 mm of rainfall per annum, most of which falls between November and March – the 'rainy season' (Seddon et al. 2000). The site is characterised by its diversity of habitats, influenced by heterogeneous geology (Du Puy and Moat 1996) and north-south and east-west gradients in rainfall (Rakotomalaza and McKnight 2006). The vegetation is broadly classified as 'southwestern dry spiny forest-thicket' (Moat and Smith 2007), and distinct sub-types can be recognised growing on coastal dunes, rufous sands and limestone (Figure 1). There is also a transitional forest between the southwestern dry spiny forest-thicket and the western dry forest that lies to the east of Ranobe (P. J. Rakotomalaza, pers. com.) In addition, riparian forests occur in the Fiherenana and

Manombo river valleys, and wetland complexes exist at Ranobe (freshwater) and Belalanda (brackish).

Since 2005 the site has been the focus of a WWF-promoted initiative to establish an IUCN Category V protected area within the *Système des Aires Protégées de Madagascar* (SAPM, Madagascar Protected Area System). A co-management model was proposed for the future Protected Area (PA), and the inter-communal association MITOIMAFI created to regroup the eight rural communes that would be implicated in the proposed PA into a community co-management structure. A *Demande de Protection Temporaire* (request for temporary protection) for a protected area of 287,350 ha was submitted by WWF in 2007, but due to conflicts with three mining concessions or exploration areas, an *Arrêté de Protection Temporaire* (n° 21482-2008/MEFT/MAEP/MEM/MRFDAT) was not granted until 2 December 2008. This decree granted temporary protected status to an area of 77,851 ha centred on the Mikoboka Plateau, composed almost entirely of spiny thicket on limestone habitat. As of January 2009 WWF are seeking to extend the limits of this protected area to include additional habitats not included within the *Arrêté de Protection Temporaire* (Anitry N. Ratsifandrihamanana, pers. com.).

Here we present the results of the first lemur survey of the Fiherenana-Manombo Complex, carried out as part of the Frontier Madagascar Forest Research Programme between August 2002 and December 2004. Inventories were compiled for birds, reptiles, amphibians, mammals and select invertebrate taxa; for a full report of research results for non-lemur taxa, see Thomas et al. (2005). We conducted lemur surveys throughout the year at three sites within the Ranobe Complex and the riparian forests along the Fiherenana and Manombo rivers. Due to logistical constraints, no lemur surveys were carried out on the Mikoboka Plateau. Details of survey locations and survey dates are presented in Table 1.

METHODS

Lemur observations were carried out through both nocturnal and diurnal searches, and incidentally during inventorying of other taxa. In addition, line transects were used to estimate population densities of certain species. Three diurnal transects of 500 m length each were walked in the early morning and late afternoon for seven days each. Six nocturnal lemur transects were walked at least an hour after sunset for three days each. Distance and sighting angle from the transect line were recorded for each sighting of a lemur group (diurnal species) or individual (nocturnal species). Where lemur groups were used, estimates were made to the geometrical centre of the group. Following 'Webb's Method' (Rabinowitz 1997), the mean distance and mean sighting angle of each species to the transect line was calculated to give the mean perpendicular distance, which was considered as half the transect width. Density was estimated by dividing the number of groups or individuals sighted by the transect area (i.e. the total distance walked multiplied by twice the average perpendicular distance). Density estimates for group-living species were therefore calculated in groups/km², whereas non-gregarious species densities are calculated as individuals/km². Effort was recorded in 'transect kilometres'. Due to the logistical constraints of accessing the river valley habitats, diurnal species were only censused in riparian forests. Population densities of nocturnal species were estimated only

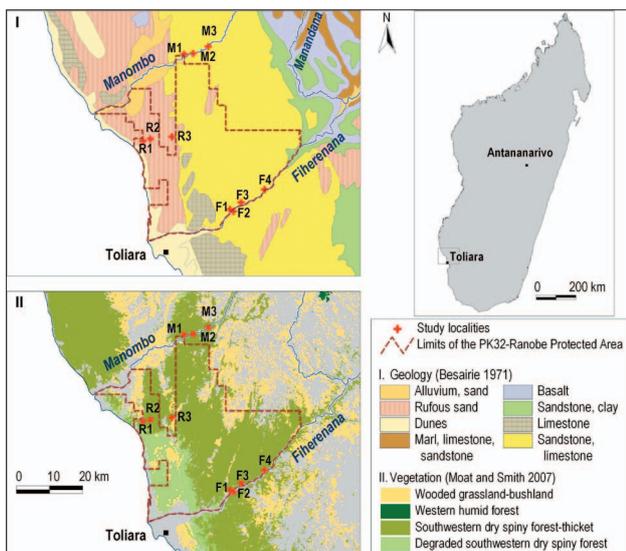


FIGURE 1. Maps of the Fiherenana-Manombo Complex showing vegetation cover and underlying geology, as well as the study locations and the proposed limits of PK32-Ranobe as of February 2009.

TABLE 1. Details of survey locations.

| Study Location | Survey site | Habitat type | Longitude | Latitude | Dates surveyed | Total survey period (days) |
|-------------------------|-------------|--|-----------------|----------------|-------------------------------------|----------------------------|
| Fiherenana River valley | F1 | Riparian forest, spiny thicket on limestone | E043° 52' 14.4" | S23° 14' 10.0" | 11-28 VIII 2002 12 X-10 XII 2002 | 135 |
| | F2 | Spiny thicket on limestone | E043° 51' 36.6" | S23° 13' 51.0" | 5 VII-28 VIII 2003 | |
| | F3 | Riparian forest, transitional forest | E043° 53' 36.1" | S23° 12' 44.2" | | |
| | F4 | Riparian forest, transitional forest | E043° 57' 44.8" | S23° 10' 40.2" | | |
| Ranobe Lake and forests | R1 | Freshwater lake and reed beds, transitional forest | E043° 36' 34.2" | S23° 02' 24.6" | 14 I-28 III 2003 13 IV-4 VI 2003 | 292 |
| | R2 | Transitional forest, spiny thicket on red sand | E043° 37' 52.1" | S23° 02' 05.5" | 14 X-8 XII 2003 16 I-4 III 2004 | |
| | R3 | Anthropogenic grassland, spiny thicket on limestone | E043° 41' 38.2" | S23° 01' 47.9" | 5 VII-29 VIII 2004 | |
| Manombo River valley | M1 | Riparian forest | E043° 44' 02.4" | S22° 48' 21.6" | 17-31 I 2004 | 151 |
| | M2 | Riparian forest, transitional forest | E043° 45' 38.7" | S22° 48' 16.0" | 21 II-5 III 2004 5 IV-31 V 2004 | |
| | M3 | Riparian forest, transitional forest, spiny thicket on limestone | E043° 48' 19.0" | S22° 47' 10.0" | 7-16 VII 2004 11 X-4 XII 2004 | |

at Ranobe, in both spiny thicket and riparian forest surrounding Lake Ranobe. In total we conducted 17.5 km of dry season diurnal transects in the Fiherenana forests and nine kilometres of dry season nocturnal transects at Ranobe. No voucher specimens or DNA samples were taken during our survey, with the result that some taxa are identified only to genus level.

RESULTS

We recorded eight lemur species distributed across seven genera and four families (Table 2). Four of these species are classed as Vulnerable in the IUCN Red List of Threatened Species (IUCN 2008). The Fiherenana (six species) and Manombo (seven species) river valleys harboured greater species diversity than Ranobe (two species), due partly to habitat differences between these sites (but see discussion). Six species were recorded only in riparian and transitional forests, while only two species were recorded in spiny thicket. Two taxa, *Cheirogaleus* sp.

and *Lepilemur* sp. could not be identified without capture of an animal, due to the unclear taxonomy or distributions of the species in question.

Table 3 gives density estimates for diurnal species in degraded riparian forest along the Fiherenana River, and for *Microcebus* spp. in both spiny thicket and degraded riparian forest at Ranobe. Note that data on both *Microcebus* species are pooled in this analysis because although species identity could be established in some cases, this did not yield sufficient data for meaningful inter-site comparisons of the *Microcebus* taxa. Along the Fiherenana River, density estimates for *Eulemur rufus* at 40 groups/km² were high compared with the apparent absence of *Propithecus verreauxi*. These results clearly underestimate the very low densities of *P. verreauxi* and *Lemur catta* that were observed in the small pockets of riparian forest along the Fiherenana. Estimates of mouse lemur (*Microcebus* spp.) populations at Ranobe suggest that spiny

TABLE 2. Lemur species recorded from the Fiherenana-Manombo Complex. Habitat codes: R – Riparian forest, T – Transitional forest between riparian forest and spiny thicket (on valley slopes), S – Spiny thicket; IUCN Status: DD - Data Deficient, LC - Least Concern, VU - Vulnerable; X: confirmed, ?: unconfirmed record of the species.

| Latin name | Common name | Fiherenana | Ranobe | Manombo | Habitat | IUCN Status |
|-------------------------------|------------------------------|------------|--------|---------|---------|-------------|
| Cheirogaleidae | | | | | | |
| <i>Cheirogaleus</i> sp. | dwarf lemur | X | | X | R, T | DD |
| <i>Microcebus murinus</i> | Grey mouse lemur | X | X | X | R, T, S | LC |
| <i>Microcebus griseorufus</i> | Reddish-grey mouse lemur | ? | X | ? | S, R | LC |
| <i>Mirza coquereli</i> | Coquerel's giant mouse lemur | X | | X | R, T | VU |
| Indriidae | | | | | | |
| <i>Propithecus verreauxi</i> | Verreaux's sifaka | X | | X | R, T | VU |
| Lemuridae | | | | | | |
| <i>Eulemur rufus</i> | Red-fronted brown lemur | X | | X | R, T | LC |
| <i>Lemur catta</i> | Ring-tailed lemur | X | | X | R, T | VU |
| Lepilemuridae | | | | | | |
| <i>Lepilemur</i> sp. | sportive lemur | | | X | T | VU |

TABLE 3. Lemur population density estimates from the Fiherenana-Manombo Complex.
* = Data deficient for density estimate.

| Location | Habitat | Transect | | Length (km) | Species density (number of sightings) | | | |
|--|-------------------|----------|-----------|-------------|---------------------------------------|----------------------|------------------------------|--------------------|
| | | No | Cycle | | <i>Microcebus</i> spp. | <i>Eulemur rufus</i> | <i>Propithecus verreauxi</i> | <i>Lemur catta</i> |
| Fiherenana | | | | | | | | |
| S23° 12' 37.5" E043° 53' 38.5" | Degraded riparian | 1 | diurnal | 7 | - | 62 (16) | 0 (0) | 0 (0) |
| S23° 13' 18.4" E043° 53' 02.6" | Degraded riparian | 2 | diurnal | 3.5 | - | 9 (1) | 0 (0) | (1)* |
| S23° 10' 28.2" E043° 57' 42.2" | Degraded riparian | 3 | diurnal | 7 | - | 50 (12) | 0 (0) | (3)* |
| Riparian forest average density (groups/km ²) | | | | | - | 40 | 0 | 0 |
| Ranobe | | | | | | | | |
| S23° 02' 26.7" E043° 37' 07.1" | Spiny thicket | 1 | nocturnal | 1.5 | 199 (5) | - | - | - |
| S23° 02' 17.8" E043° 37' 01.8" | Spiny thicket | 2 | nocturnal | 1.5 | 1988 (34) | - | - | - |
| S23° 02' 04.9" E043° 37' 04.0" | Spiny thicket | 3 | nocturnal | 1.5 | 1046 (21) | - | - | - |
| Spiny forest average density (individuals/km ²) | | | | | 1078 | - | - | - |
| S23° 02' 35.2" E043° 36' 35.3" | Degraded riparian | 1 | nocturnal | 1.5 | 160 (23) | - | - | - |
| S23° 02' 26.5" E043° 36' 32.0" | Degraded riparian | 2 | nocturnal | 1.5 | 948 (7) | - | - | - |
| S23° 02' 16.1" E043° 36' 38.7" | Degraded riparian | 3 | nocturnal | 1.5 | 531 (21) | - | - | - |
| Riparian forest average density (individuals/km ²) | | | | | 546 | - | - | - |

thicket habitats (1,078 individuals/km²) support mouse lemurs at almost twice the density of riparian forests (546 individuals/km²). We did not calculate the area of suitable habitat at any site, and so are unable to extrapolate from our density estimates to arrive at estimates of population size.

DISCUSSION

Our surveys demonstrate that the lemur diversity of the Fiherenana-Manombo Complex is spatially highly variable, with the number of species present at a survey location ranging from two to eight. This finding has important implications for protected area zoning and management planning. The riparian and transitional forests of the Manombo and Fiherenana river valleys, with seven and six species respectively, not only support a greater diversity of species than the spiny thicket, but are also the only sites where six of the eight species are known to occur. These riparian forests make up a small (but unquantified) proportion of the Fiherenana-Manombo Complex (WWF 2007), which is dominated by spiny thicket on red sand (such as that surveyed at Ranobe) and spiny thicket on limestone (which we did not survey). These forests are therefore disproportionately important for the lemur diversity of the sub-region. Among the species we recorded only at Manombo and/or Fiherenana, some (e.g. *Cheirogaleus* sp., *Mirza coquereli*) may be restricted to gallery forests within the southern part of their range. *Lemur catta*, *Propithecus verreauxi* and *Lepilemur* sp., however, probably range widely across the Mikoboka Plateau that lies between these rivers. Our failure to record these species elsewhere should therefore not be interpreted as implying their absence in other areas of the PA (Goodman et al. 2006). The Manombo and Fiherenana riparian forests probably provide important resources for *L. catta* and, to a lesser extent, *P. verreauxi*, providing refugia and food resources (e.g. *Tamarindus indica* Fabaceae) year-round (see Emmett et al. 2003).

Habitat differences alone, however, do not explain the depauperate lemur fauna of the spiny thicket at Ranobe. A review of

the literature, supplemented by villager interviews, indicates that several additional species were present in this area until recent times, and that hunting was the primary cause of their extirpation. Domergue (1983) and Nicoll and Langrand (1989) both record *Lemur catta* and *L. fulvus* (= *Eulemur rufus*) from the Site d'Intérêt Biologique du Nord de Tuléar PK32, an area of forest lying several kilometres to the south and contiguous with the Ranobe forests, indicating that these species were present until recent times. These data are confirmed by local ethnoprimate knowledge: We conducted semi-structured interviews with three groups of men in Ranobe which confirm that until the early 1990s *Propithecus verreauxi*, *L. catta* and *Lepilemur* sp. were all present and actively hunted in the Ranobe area. Respondents suggested that hunting was responsible for the disappearance of these animals and stated that *Lepilemur* could still be found on the Mikoboka Plateau approximately eight kilometres to the east. Hunting of lemurs still takes place along the Manombo river: Two groups of men interviewed claimed to trap and hunt *E. rufus* and *P. verreauxi* during the dry season, but not in the rainy season because their diet makes their flesh bitter to taste. Hunting is carried out for personal consumption, but excess animals may be sold at the market of Andoharano-Morafeno.

The role played by lemurs in seed dispersal and therefore forest regeneration has been demonstrated in both humid and dry forests for a range of taxa, including: *Microcebus murinus*, *Cheirogaleus medius* and *C. major* (Lahann 2007); *Varecia variegata*, *Eulemur rubriventer* and *E. rufus* (Dew and Wright 1998); *E. collaris* (Bollen et al. 2004a, 2004b), and *E. macaco* (Birkinshaw 2001). The importance of *E. rufus* for seed dispersal in western dry deciduous forests has also been highlighted (Ganzhorn et al. 1999, Spehn and Ganzhorn 2000) and, given the similarities between these habitats and the transitional forests to the east of Ranobe, we believe that the extirpation of *E. rufus* and other species from this habitat may have negative impacts on the viability of the full species assemblage of these forests. Further research is required to test this hypothesis.

Our findings add greatly to our knowledge of lemur distributions in the southwest of Madagascar, and two of our records represent range extensions or new locality records. The distribution maps published in Mittermeier et al. (2006) show the nearest populations of *Eulemur rufus* in the Mikea Forest (approximately 60 km to the north) and Zombitse-Vohibasia (approximately 90 km to the northeast), despite the species having twice been recorded at PK32 in the literature (Domergue 1983, Nicoll and Langrand 1989). The Fiherenana population of *E. rufus* may therefore represent the most southwestern extant population in Madagascar of this species. The maps in Mittermeier et al. (2006) also show the distributions of *Cheirogaleus* spp. failing to reach the Fiherenana river, where we recorded *Cheirogaleus* sp. The *Cheirogaleus* species we recorded in the Fiherenana and Manombo forests was initially identified as *Cheirogaleus medius*, but following the resurrection from synonymy of *C. adipicaudatus* (Groves 2000), and in the absence of voucher specimens, this identification must be revised to *Cheirogaleus* sp.

The second new locality record is of *Mirza coquereli*, which Mittermeier et al. (2006) record as being present along the Onilahy River to the south of PK32 Ranobe, but which was not recorded in the Mikea Forest to the north of the Manombo by Ganzhorn and Randriamanalina (2004). This species is restricted to riparian forests both on the Manombo and Fiherenana rivers and on the Onilahy to the south (Emmett et al. 2003), giving it several discreet populations isolated along westward draining watercourses. Given the number of new species described as a result of recent revisions of the Lepilemuridae and the Cheirogaleid genera *Microcebus*, *Cheirogaleus* and *Phaner*, we speculate that similar research effort within the southern *Mirza* population complex may also reveal additional taxa. A number of biogeographical models or speciation mechanisms have been proposed (see e.g. Goodman and Ganzhorn 2004, Wilmé et al. 2006, Craul et al. 2007) that may support this suggestion.

In addition to the new locality records, we failed to record one species, *Phaner pallescens*, said to occur within the study area by Mittermeier et al. (2006), and question the literature indicating the presence of the species south of the Manombo River. Mittermeier et al. (2006) cite an observation of this species south of the Fiherenana River attributed to Ganzhorn and Randriamanalina (2004), but the only record in the cited publication is, according to the geo-coordinates given, actually north of the Manombo, near the *layon pétrolier* linking Ankililoaka and Tsifota. Although Domergue (1983) hesitantly records *P. furcifer* (the southern population of which is now *P. pallescens*) from PK32, stating that in the brief cacophony following sunset "I think I have distinguished the yelping of *P. furcifer* mixed with the cries of *Coua pyropyga*" [= *C. cristata pyropyga*], we are unaware of any confirmed records south of the Manombo.

We were unable to identify the *Lepilemur* we observed near the Manombo River to species level without capturing a specimen. The known distributions of the genus suggest that all populations north of the Onilahy River belong to *L. ruficaudatus* and *L. hubbardi*, but Seddon et al. (2000) report an observation from an unknown location north of the Fiherenana that they provisionally ascribe to *L. leucopus*. Further research is required to confirm the identity of the *Lepilemur* species present within the PA.

CONSERVATION IMPLICATIONS. Our findings highlight the importance of the Fiherenana-Manombo Complex for conserving the lemur diversity of southwest Madagascar, but also show that the new protected area of PK32-Ranobe fails to conserve important elements of the lemur diversity of the zone. We did not survey the limestone Mikoboka Plateau however, and are unaware of any historical records from this area, and so are only able to speculate on the lemur fauna of this new protected area. The riparian forests of the Fiherenana and Manombo rivers, with six and seven species respectively, showed high lemur diversity but are not included in the protected area, and as a result we believe that at least three of the lemur species we recorded still receive no formal protection within this sub-region. These species are *Eulemur rufus*, *Mirza coquereli* and *Cheirogaleus* sp., which we believe to be restricted to or heavily dependent upon gallery forests within the region. The riparian forests of the Manombo River are particularly important given that they are also the only known sites for *Mungotictis decemlineata lineata*, a subspecies of the Narrow-striped mongoose known only from two specimens (Goodman et al. 2005).

The first objective of the Madagascar Protected Area System is to conserve all of Madagascar's unique biodiversity (ecosystems, species, genetic diversity) (Groupe Vision Durban 2006). We suggest that the new protected area of PK32-Ranobe fails to fulfil this objective and conserve the full biodiversity of the Fiherenana-Manombo Complex, because it does not include all the habitats of the area; spiny thicket formations on red sand and white sand, transitional forests, riparian forests and wetlands are not represented (see Figure 1). The spiny thicket on red sand in particular is considered very important for biodiversity (Domergue 1983, Nicoll and Langrand 1989, ZICOMA 1999, Seddon et al. 2000), and is the only habitat of the vulnerable *Monias benschi* and *Uratelornis chimaera*, two locally endemic, monotypic bird genera of endemic families (Seddon et al. 2000). A number of locally and regionally endemic reptile taxa also occur in these forests (Raxworthy 1995, Thomas et al. 2005), and *Furcifer belalandaensis*, probably the world's rarest chameleon (C. Raxworthy, pers. com.), is restricted to the northern banks of the Fiherenana. We believe that the successful resolution of spatial conflicts between conservation and mining areas is essential and strongly support the promoter's efforts to apply for the expansion and redelimitation of the protected area to include the full range of habitats occurring within the Fiherenana-Manombo Complex. The creation of such a protected area is essential if the full range of species, ecosystems and genetic diversity of the area is to be conserved in line with SAPM objectives.

ACKNOWLEDGEMENTS

We thank all staff and volunteers of Frontier-Madagascar, a collaboration between the Society for Environmental Exploration and the Institut Halieutique et des Sciences Marines (I.H.S.M.), Université de Toliara, whose work made this research possible. We are grateful to the Ministère de l'Environnement et des Eaux et Forêts for permitting us to carry out our research, and to WWF's Ala Maiky Programme (in particular Pierre-Jules Rakotomalaza and Mark Fenn) for technical support and advice on study sites. Martin Nicoll, Lucienne Wilmé, Louise Jasper and two anonymous reviewers provided useful commentary on the manuscript. Ralisa Andriamahavita kindly produced Figure 1. Special thanks also to the villagers of Behompy, Ampihalia,

Ranofoty, Anjamala, Belalanda, Ranobe and Andoharano, and to our guides and camp staff Enanatsé Alfred, Mbotiana Clement, Razafindrakoto Fernando and Tovo.

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