

A rapid assessment survey of the herpetofauna at Befotaka-Midongy National Park, south-eastern Madagascar

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Received 18 October 2006, accepted 5 April 2007

Published 24 September 2007

With 2 figures

Key words: Herpetology, species survey, Madagascar, Befotaka-Midongy National Park, Rozabe, Kilimagnarivo.

Abstract

We report on the results of a herpetological rapid assessment survey in the Befotaka-Midongy National Park in south-eastern Madagascar, carried out between 25 September and 17 October 2005. The survey yielded a total 46 species (30 amphibians and 16 reptiles). Of the two surveyed sites, both characterized by rainforest habitat and situated at elevations of 600–900 m, Kilimagnarivo was richer in species diversity than the second site, Rozabe. Seven species were only recorded from Rozabe whereas 14 species were only recorded from Kilimagnarivo. Among the remarkable discoveries was the frog *Gephyromantis spinifer*, which constitutes a significant range extension for this species. The same is true for *Gephyromantis tschenki* which was hitherto only known from the Ranomafana region. One specimen assigned to the arboreal snake *Stenophis* cf. *carleti* had a number of ventral and subcaudal scales intermediate between *S. gaimardi* and *S. carleti*, indicating that the taxonomic definition of *S. carleti* is insufficient. The reported herpetofaunal diversity appears low if compared to other sites in the same region (e.g., Ranomafana National Park) but considering the unfavourable period of the survey in the austral winter, and taking into account the results of other teams who also have surveyed sites in the Befotaka-Midongy region, we assume a high species diversity in Midongy National Park.

Resume

Un inventaire rapide a été effectué dans le Parc National de Befotaka-Midongy, dans la partie sud-est de Madagascar, pour but de connaître la composition herpétologique de la réserve, du 25 septembre au 17 octobre 2005. Un total de 46 espèces est inventorié dont 30 amphibiens et 16 reptiles. Cet inventaire a permis de constater que le site de Kilimagnarivo est beaucoup plus riche en espèce et plus diversifié que celui du site de Rozabe. En effet, 7 espèces sont propres de Rozabe tandis que 14 autres ne sont trouvées qu'à Kilimagnarivo. Entre les découvertes remarquables, il faut mentionner la grenouille *Gephyromantis spinifer*, sa localisation en Midongy constitue un élargissement important de son aire de répartition. La même est vraie pour *Gephyromantis tschenki*, jusque'à maintenant seulement connue de la région de Ranomafana. Un serpent arboricole attribué à l'espèce *Stenophis* cf. *carleti* à un nombre d'écaillles ventrales intermédiaire entre *S. carleti* et *S. gaimardi*, ceci confirme que *S. carleti* est insuffisamment défini. La diversité herpétofaunique trouvée est faible par rapport aux autres sites dans la même région (par exemple le Parc National de Ranomafana). Mais, elle est élevée si l'on tient compte de la période d'inventaire qui n'est pas favorable aux animaux en particulier les amphibiens et reptiles et les résultats des autres chercheurs qui ont également travaillé dans la zone de Befotaka-Midongy autres que les sites étudiés dans notre travail.

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Introduction

Befotaka-Midongy National Park is a reserve in south-eastern Madagascar, located about 110 km

west of Vagaindrano and consisting of humid mid-altitude rainforest. The area is among the candidates for becoming part of a southern cluster of natural areas in Madagascar which may become a

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World Heritage site. Although several biotic surveys of this reserve have been carried out in the past by various research teams, no published species inventory exists to date. In 2003, a team of Malagasy students led by A. Raselimanana has carried out intensive research on the herpetofaunal diversity of this region, but their results so far remain unpublished. Considering the need for further data, the Madagascar national agency for the management of protected areas (Association Nationale pour la Gestion des Aires Protégées; ANGAP) who recently became responsible of managing this area, initiated a number of rapid assessments of sites in this area.

In this paper we report on the results of one rapid assessment at two sites within the Befotaka-Midongy National Park, carried out by the first two authors in 2005. Our goal is not to provide a comprehensive species list for the reserve but to contribute an annotated list of species as a starting point for a more complete future inventory. We will highlight a number of remarkable herpetofaunal discoveries and point to future needs of research.

Materials and Methods

Two different sites were surveyed, both within the boundaries of Befotaka-Midongy National Park (BMNP). (1) Rozabe, located at $23^{\circ}44'11.7''$ S/ $47^{\circ}01'22.9''$ E, at elevations between 630–850 m, visited at September 29, 2005 until October 5, 2005. (2) Kilimagnarivo, located at $23^{\circ}47'51''$ S/ $47^{\circ}00'34.6''$ E, at 690–890 m, visited at October 7–13, 2005. Both sites comprised low- to mid-altitude rainforest as well as some more open areas. No rain was recorded during our fieldwork. The location of Befotaka-Midongy National Park, and of other comparative sites mentioned in this paper, is shown in Fig. 1.

Three collecting methods were used: (1) opportunistic, non-systematic diurnal and nocturnal searches along transects (paths) in the forest and in open areas, (2) intensive searches in particular microhabitats known to be used by particular species of amphibians and reptiles, such as the bark of dead trees, logs, and leaf axils of large-leafed plants (*Ravenala* and *Pandanus*). (3) Pitfall trapping using 100 m of a 50 cm high plastic barrier interrupted by 11 15-litres buckets. Three pitfall lines at three different settings (valley, flat area, and crest) were used. Voucher specimens were anesthetized and killed with ether and fixed in 10% formalin (reptiles) or 95% ethanol (amphibians), and subsequently stored in 70% ethanol. They were deposited in the collections of the Université d'Antananarivo, Département de Biologie Animale (UAD-BA), with a few specimens also deposited at the Zoologische Staatssammlung München (ZSM). Four months after capture, tissue samples of the amphibians were taken from the preserved specimens and transferred to vials with 99% ethanol. Morphometric measurements, in particular snout-vent length (SVL) were taken from some specimens using calipers. In addition for the snakes we give information about some diagnostic scale counts, in particular number of ventral (V), subcaudal (SC) and dorsal (at midbody; D) scales. Taxonomy of mantellid amphibians follows Glaw & Vences (2006).

For molecular identification (Vences et al. 2005), muscle tissue samples were taken from the collected specimens and preserved in 98% ethanol. DNA was extracted using different standard protocols and a fragment of the mitochondrial



Fig. 1. Map of Madagascar, showing the approximate location of Befotaka-Midongy du Sud National Park and of other important comparative sites mentioned in the text.

16S rRNA gene amplified using the primers 16Sa-L and 16Sb-H of Palumbi et al. (1991). After purification (Qiagen kits), the fragments were resolved on automated DNA sequencers (ABI 377 and ABI 3100). Sequences were validated and aligned with the software Sequence Navigator (Applied Biosystems), and deposited in Genbank (accession numbers of newly obtained sequences: EF530071-530078).

Results

Altogether in the course of the inventory we have been able to collect 46 species, of which 30 were amphibians and 16 were reptiles. Although the inventory was not carried out during the rainy season, there was a relevant reproductive activity of many of the frog species, as assessed by male call-

ing activity. This regards especially the species of *Boophis* that all were observed calling. The recorded amphibians belonged to four families, Hyperoliidae, Ptychadenidae, Microhylidae, and Mantellidae. Reptiles included lizards (Chamaeleonidae, Gekkonidae, Gerrhosauridae, Scincidae) and snakes (Boidae, Colubridae).

In the following we provide an annotated list of the recorded species, mentioning the respective voucher specimens in the UADBA and ZSM collections, and reporting some observations on the specimens when deemed useful. Some of the specimens were collected in between the two study sites and their collecting locality is therefore indicated as “Rozabe-Kilimagnarivo”.

Amphibians

Hyperoliidae

Heterixalus cf. alboguttatus (Boulenger, 1882)

UADBA 25510 (Kilimagnarivo)

A single juvenile individual was collected along a river. It is tentatively assigned to *Heterixalus alboguttatus* which is known to occur in this area of south-eastern Madagascar.

Mantellidae: Boophinae

Boophis boehmei Glaw & Vences, 1992

UADBA 27858, ZSM 178/2006 (Kilimagnarivo)

Boophis luteus (Boulenger, 1882)

UADBA 25405 (Kilimagnarivo)

A single female of 56 mm SVL was collected at the edge of the forest. Assigned to *B. luteus* based on the presence of a red outer iris area that was still recognizable five months after preservation.

Boophis madagascariensis (Peters, 1874)

UADBA 25403, 25406, 25407, 25482 (Kilimagnarivo); 25408, 25485 (Rozabe)

All six specimens collected were males. Although the collected specimens were not seen calling, they were collected from perches on bamboo and *Pandanus* from where typical *Boophis madagascariensis* calls were heard.

Boophis cf. periegetes Cadle, 1995

UADBA 25500 (Rozabe)

The status of specimens from south-eastern Madagascar assigned to *Boophis goudoti* and *B. periegetes* is problematic since the *Boophis goudoti* populations from this area are morphologically different from those in central Madagascar, mainly characterized by a longer snout and a more granular skin in breeding males, both also features characterizing *B. periegetes*. The specific status of the specimen collected in this survey requires further attention and can only be assessed in the context of a revision of this group of species.

Boophis sibilans Glaw & Thiesmeier, 1993

UADBA 25415, 25419, 25422, 25427 and 25507 (Kilimagnarivo)

Five males were collected along a stream, all males of 26–28 mm SVL. Genetically, one specimen (UADBA 25415) was identified as belonging to *Boophis sibilans*, with some differentiation from specimens from the type locality Andasibe in eastern Madagascar (10 differences in 486 compared nucleotides of the 16S rRNA gene). This record is a significant range extension to the south.

Mantellidae: Laliostominae

Aglyptodactylus madagascariensis (Duméril, 1853)

UADBA 25410 (Kilimagnarivo)

A single female specimen collected. Since recent, unpublished genetic evidence indicates that *A. madagascariensis* is a complex of various species, the identity of the Midongy population requires further study.

Mantellidae: Mantellinae

Gephyromantis cf. boulengeri Methuen, 1920

UADBA 25414, 25421, 25469, 25483, 25514 25516 (Kilimagnarivo); 25431, 25506, 25512 (Rozabe)

5 males and 4 females belonging to the *G. boulengeri* complex were collected. Their identity requires further study since this complex of small diurnal frogs is known to contain many genetically differentiated species of only restricted distribution.

Gephyromantis cf. plicifer (Boulenger, 1882)

UADBA 25399, 25402, 25438, 25463, 25493 and 25504 (Kilimagnarivo)

Of the six specimens only one was a male (UADBA 25504). Its large size (46 mm) agrees with the species defined as *plicifer* by Vences & Glaw (2001).

Gephyromantis spinifer (Blommers-Schlösser & Blanc, 1991)

UADBA 25478 (Kilimagnarivo); 25495 (Rozabe)

The two collected females agree with specimens from the type locality, Chaines Anosyennes, in size (37 mm), large number of dorsal tubercles and spines, and distinct black-white ventral patterning. This species was so far reliably known only from the type locality and from Andohahela National Park at elevations between 440–1250 m (Nussbaum et al. 1999), with a record from the Andringitra Massif requiring confirmation (Vences & Glaw, 2001), and its presence in BMNP is therefore an important range extension. It furthermore indicates that this species is relatively widespread in the south-eastern rainforests at low and mid-altitudes. However, it probably does not reach much further to the north than BMNP, since it has not been found at Andringitra National Park, Ranomafana National Park, or the rainforest corridor linking these two reserves, despite rather intensive surveys in this area (Andreone 1994, Raxworthy & Nussbaum 1996; Raselimanana 1999; Rakotomalala et al. 2001).

Sequences of the 16S rRNA gene differed from those of *G. asper* from Mandraka in central-eastern Madagascar by 33 of 492 nucleotides, corresponding to a differentiation of almost 7% and confirming the separate status of this species.

Gephyromantis tschenki Glaw & Vences, 2001

UADBA 25457 (Kilimagnarivo); 25396, 25468, 25476, 25489, 25490 and 25491 (Rozabe)

Seven individuals were collected, among which there are two males (UADBA 25476 and 25491) of 35–39 mm SVL and two females (UADBA 25489 and 25468) of 45–46 mm.

Molecular data confirmed the assignment of this population to *G. tschenki*; one specimen (UADBA 25457) had a highly repeated insert in the 16S rRNA gene fragment studied here, which is typical also for most other specimens of the species, and also had high sequence similarity to this species in the remainder of this gene fragment. This is

the first reliable record of *G. tschenki* from outside Ranomafana National Park and makes it likely that specimens from the Andringitra region deposited in the Paris museum which have initially been identified as *G. cornutus* (Glaw & Vences 1994) also belong to *G. tschenki*.

Guibemantis pulcher (Boulenger, 1882)

UADBA 25416, 25429 and 25511 (Rozabe)

The three individuals were found in forest between altitude 630–950 m.

Mantella cf. baroni Boulenger, 1888

UADBA 27838, 27839, 27844, 27853, 27854, ZSM 172-174/2006 (Kilimagnarivo)

This species was collected at Kilimagnarivo at the forest edge. This species was common along a large stream between 690 and 750 m. The colouration is dorsally largely green without rostral stripe, and the venter is black with many small blue spots. Red colour is present on the ventral side of the tibia. In a sequence of the 16S rRNA gene, specimens were 100% identical to those of *Mantella baroni* and *Mantella nigricans* (and different from *M. haraldmeieri*, the species occurring further south-east), confirming that the complex *baroni-nigricans* also comprises the different and more uniform colour morphs of the south-east of Madagascar.

Mantidactylus aerumnalis (Peracca, 1893)

UADBA 25430, 25436, 25460, 25462, 25464, 25465, 25471, 25492, 25499, ZSM 179/2006 (Kilimagnarivo)

Three males, five females and two juveniles, all found close to a swamp at 630–700 m elevation.

Mantidactylus argenteus Methuen, 1920

UADBA 25454 (Kilimagnarivo); 25466, 25470, 25479, 25481 and 25502 (Rozabe)

This species was common along streams at both study sites. Of the six collected specimens, only one (UADBA 25470) was a male (SVL 36 mm) while the others were females (SVL 36–38 mm). These specimens appear to be larger and more elongated than in specimens from central eastern Madagascar. However, their 16S rDNA sequences (of UADBA 25479 and 25502) were highly similar (6–7 mutations in 497 nucleotides; 1.4% diver-

gence) to those of *M. argenteus* from other specimens, e.g., *Mantadia* in central-eastern Madagascar.

Mantidactylus cf. betsileanus (Boulenger, 1882)

UADBA 25398, 25426, 25508, 25509 (Kilimagnarivo); 25393, 25400, 25417, 25418, 25420, 25423, 25424, 25425, 25428, 25437, 25498, 25505, 25513 (Rozabe)

Five males, six females, and seven juveniles (including one non catalogued specimen) belonging to the *Mantidactylus betsileanus* complex were collected but their identity requires further study, considering the poor taxonomic resolution in the subgenus *Brygoomantis*.

Mantidactylus cf. biporus (Boulenger, 1889)

UADBA 27855 (Kilimagnarivo); 27840, 27847, 27848 (Rozabe); ZSM 176-177/2006

This small species may be related or belong to *Mantidactylus tricinctus*, a species that is in need of revision. Of the four UADBA specimens two were males (SVL 18 mm) and two were females (SVL 20–21 mm).

Mantidactylus cf. charlotteae Vences & Glaw, 2004

UADBA 25453 (Kilimagnarivo)

One female (SVL 29 mm) was collected, demonstrating the possible presence of this species in low- to mid-elevations of south-eastern Madagascar, which so far was only supported by two historical specimens from Andohahela (see Vences & Glaw 2004). However, the identity of these south-eastern populations of this species are in need of revision, because preliminary genetic data (M. Vences, unpublished) are providing evidence for large genetic differences within *M. charlotteae* which may in fact be a species complex.

Mantidactylus cf. femoralis (Boulenger, 1882) – species A

UADBA 25488 (Kilimagnarivo); 25397, 25404 (Rozabe)

The subgenus *Ochthomantis* is, in *Mantidactylus*, one of the groups in major need of revision, with a larger number of undescribed species that partly occur in syntopy (Glaw & Vences 2004, Rabibisoa, pers. comm.). At BMNP we observed individuals belonging to *Ochthomantis*, morphologically close to *Mantidactylus femoralis*, which we here classify tentatively in two species that we name A and B.

Of species A, three specimens were collected, of which one is a male (UADBA 25488) of 44 mm SVL. This species has distinct black horizontal stripes, bordered by yellow, in the inguinal region.

In the male the horizontal tympanum diameter is smaller than the horizontal eye diameter and the upper lip is light coloured.

Mantidactylus cf. femoralis (Boulenger, 1882) – species B

UADBA 25461, 25486, 25496 and 25503 (Kilimagnarivo)

Four individuals were collected of which three are males (SVL 47–49 mm) and one (UADBA 25503) is a female (SVL 58 mm). In this species the tympanum is of similar size as the eye or slightly larger in the males, and a yellow marking is present in the inguinal region as well. The upper lip is darker than in species A.

Mantidactylus grandidieri Mocquard, 1895

UADBA 25497 (Kilimagnarivo); 25412, 25458 (Rozabe)

This was a common species at the two sites, and only a few representative specimens were collected.

Mantidactylus lugubris (Duméril, 1853)

UADBA 25459, 25472 (Kilimagnarivo); 25433, 25467, 25494 (Rozabe); ZSM 175/2006

Similar to the previous species, *M. lugubris* was a common species at both sites and only a limited number of specimens was collected.

Mantidactylus majori Boulenger, 1896

UADBA 25409, 25413, 25474, 25475 (Kilimagnarivo); 25395, 25411 (Rozabe)

One male and five females from the two sites. The specimens showed a relatively strong genetic differentiation from *majori* specimens from Ranomafana which will require further study.

Mantidactylus melanopleura (Mocquard, 1901)

UADBA 25473, 25477, 25484, 25487 (Kilimagnarivo), 25480 (Rozabe)

Spinomantis cf. aglavei (Methuen & Hewitt, 1913)

UADBA 27845 (Rozabe)

A single subadult specimen was collected which, for morphological characters (numerous dermal

spines laterally on tarsus and foot) can be assigned to this species.

Microhylidae: Cophylinae

Platypelis grandis (Boulenger, 1889)

UADBA 25455 (Kilimagnarivo); 25456 (Rozabe)

One adult female and one juvenile of this species were collected.

Platypelis cf. pollicaris (Boulenger, 1889)

UADBA 27843 (Kilimagnarivo)

A single male was collected on a bush along a stream at night.

Plethodontohyla cf. bipunctata (Guibé, 1974)

UADBA 25394 (Kilimagnarivo)

A single specimen was collected in a swampy area.

Stumpffia cf. tetradactyla Vences & Glaw, 1991

UADBA 25434, 25435 (Kilimagnarivo); 25432, 25515 (Rozabe)

Four specimens were collected in swampy areas.

Ptychadenidae

Ptychadena mascareniensis (Duméril & Bibron, 1841)

UADBA 25501 (Kilimagnarivo); 25401 (Rozabe)

At both localities specimens were observed along rice fields but only single individuals were collected.

Reptiles

Scincidae

Amphiglossus frontoparietalis (Boulenger, 1889)

UADBA 25539 (Kilimagnarivo)

A single specimen was collected in a pitfall line positioned in a valley.

Madascincus melanopleura (Günther, 1877)

UADBA 25541 (Kilimagnarivo); 25540, 25543 (Rozabe)

All three specimens were collected in pitfalls.

Trachylepis gravenhorstii (Duméril & Bibron, 1839)

UADBA 25537 (Kilimagnarivo); 25535 (Rozabe)

Two specimens captured in pitfalls.

Chamaeleonidae

Brookesia superciliaris (Kuhl, 1820)

UADBA 25519, 25525 (Kilimagnarivo); 25517, 25531 (Rozabe)

Gerrhosauridae

Zonosaurus aeneus (Grandidier, 1872)

UADBA 25527 (Kilimagnarivo); 25536 and 25538 (Rozabe)

Three specimens captured by hand in open areas.

Zonosaurus cf. madagascariensis (Gray, 1831)

UADBA 25523 (Kilimagnarivo)

This species was seen at both sites but only one individual was captured by hand in an open savanna-like area at Kilimagnarivo. Relationships of south-eastern specimens assigned to *Z. madagascariensis* (from BMNP as well as from Ranomafana) to the similar species *Z. anelanelany* remain to be clarified.

Gekkonidae

Lygodactylus cf. miops Günther, 1891

UADBA 25544 (Rozabe)

Phelsuma lineata Gray, 1842

UADBA 25530, 25533, 25542 (Kilimagnarivo); 25522, 25534, 25545 (Rozabe)

Six specimens were collected on leaves of *Pandanus* and of agaves.

Colubridae

Compsophis infralineatus (Günther, 1882)

UADBA 25532 (Kilimagnarivo)

The single specimen was captured close to a stream while it was swallowing a frog, most probably a

specimen of *Boophis sibilans*. The specimen had 167 V and 61 SC.

Liopholidophis cf. rhadinaea Cadle, 1996

UADBA 25529 (Rozabe)

Found on the ground among debris in the forest. The specimen had 166 ventrals.

Liophidium torquatum (Boulenger, 1888)

UADBA 25524 (Rozabe)

Found in similar habitats as *L. cf. rhadinaea*. Observed at both sites but only one individual was captured. Scale counts are: 17 D, 187 V, 63 SC.

Bibilava infrasignatus (Günther, 1882)

UADBA 25546 (Rozabe)

Only found at Rozabe within the forest. Meristic values for the single collected specimen are: 19 D, 158 V, 69 SC.

Liopholidophis cf. sexlineatus (Günther, 1882)

UADBA 25526, 25528 (Rozabe)

Found at both sites but only collected at one site. A common species found both within forest and in the savanna. Meristic values of UADBA 25528 (female) are: 17 D, 154 V, 62 SC.

Madagascarophis colubrinus (Schlegel, 1837)

This species has been observed during the survey in the forest of Rozabe, but no voucher specimen was collected.

Stenophis cf. carleti Domergue, 1995

UADBA 25518 and 25520 (Kilimagnarivo)

One male (25520) and one female (25518) of this arboreal snake were found, one of which at night on a rock in an area of low current of a stream. Meristic data of UADBA 25518 are: 17 D, 253 V, 100 SC. Meristic data of UADBA 25520 are: 17 D, 263 V, 108 SC.

The main meristic difference of *gaimardi* (266–284 V, 105–117 SC) and *carleti* (252–258 V, 97 SC) are apparently the lower counts of ventrals

and subcaudals of *carleti* (Vences et al. 2004). The Midongy specimens lower this gap (263 ventrals and 108 SC in UADBA 25520) and indicate that the taxonomic definition of *S. carleti* is insufficient.

Boidae

Sanzinia madagascariensis (Duméril & Bibron, 1844)

UADBA 25521 (Rozabe)

One specimen was seen at each of the two sites, but only one juvenile specimen was collected as voucher.

Discussion

Altogether 46 species of amphibians and reptiles have been recorded during this inventory, 30 amphibians and 16 reptiles. Of these, seven were only found at Rozabe and 14 were only found at Kilimagnarivo, validating the decision to select two separate survey sites. Both sites were already suffering from some anthropogenic pressure at the time of our survey. Kilimagnarivo had also a much higher amphibian species diversity than Rozabe, namely 26 vs. 19 species at Rozabe, while the recorded reptile species diversity was the same at both sites (12 species). This might be explained by the higher diversity of microhabitats at Kilimagnarivo, where numerous swampy areas and streams, as well as *Pandanus* and *Ravenala* plants, were present.

Altogether the species diversity recorded from both sites together was not particularly high. As points of comparison, at Andohahela in the far south, considering only the results from the rainforest sites at parcel 1 of this reserve, Nussbaum et al. (1999) found a total of 45 amphibians and 32 reptiles at five surveyed sites, with values of 5–29 amphibians and 8–18 reptiles per site. Andreone & Randriamahazo (1997) found 24 amphibians and 18 reptiles at Andohahela, carrying out surveys at two study periods. At Andringitra, Raxworthy & Nussbaum (1996) found a total of 57 amphibians and 35 reptiles at five sites, with values of 5–36 amphibians and 4–17 reptiles per site. At Ranomafana National Park, Rakotomalala et al. (2001) found 53 amphibians and 25 reptiles at three sites, with 16–31 amphibians and 5–16 reptiles per site. Raselimanana (1999) found 56 amphibians and 56 reptiles at Ivohibe Special Reserve and the corridor linking it to Andringitra National Park, after surveying five sites, with 10–22 amphibians and 12–18 reptiles per site. Further north in central-eastern Madagascar, in a rapid assessment inventory of the Zahamena-Mantadia corridor in cen-

tral-eastern Madagascar, 45 amphibians and 42 reptiles were recorded in only a slightly longer survey period (Anonymous, 2001). These data consistently show higher species diversities in areas from south-eastern Madagascar than recorded in our survey.

We suppose that the relatively low number of species recorded from BMNP in our survey is due to mainly three reasons: (1) The survey was carried out in the austral winter when accessibility of the BMNP area is better. In fact, no rain was recorded during our fieldwork. (2) The survey period was relatively short and (3) only two sites of similar elevation were visited. (4) In Madagascar, the highest species diversities are recorded in central-eastern Madagascar, probably due to a mid-domain effect of increased overlap of distribution areas (Lees et al., 1999). BMNP is located relatively far south-east and may therefore harbour a lower species diversity than other sites of more central latitude. In fact, the comparative values summarized above clearly indicate that species diversity was lowest at the southernmost locality Andohahela, while Andringitra, Ivohibe and Ranomafana had higher species diversity. BMNP is located further south than these three sites and its species diversity may therefore already be lower, approaching the situation at Andohahela.

The species accumulation curve (Fig. 2) indicates beginning saturation after 6–7 days of survey. However, we suspect that this saturation is artificial because in general, activity of amphibians and reptiles during the survey period is expected to be rather low and several seasonal species may be very difficult to record in this time. The curve and the species recorded may therefore reflect the number of species active in the study period rather than the number of species actually present at the survey sites.

Another survey of BMNP which targeted different sites within the park between 30 October and 14 November 2003 was able to record a higher

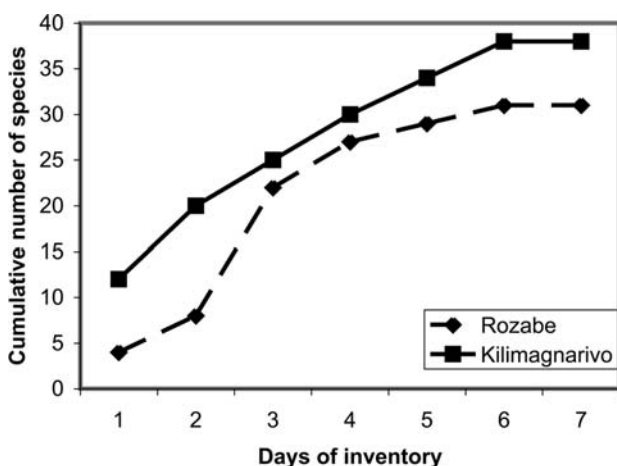


Fig. 2. Species accumulation curve for amphibians and reptiles as collected during 7 days of survey at each of the two sites in Befotaka-Midongy National Park.

number of species of reptiles, but possibly a lower number of frog species. Precise data of this survey by A. P. Raselimana and colleagues are not yet available and will likely be published after completion of data analysis.

Altogether our results indicate links of the herpetofauna of the surveyed sites at BMNP with that found in the extreme south-east (Andohahela). This is mainly supported by the record of *Gephyromantis spinifer*, a species which may not occur much further north since it has not yet been recorded in Andringitra National Park or Ranomafana National Park. *Gephyromantis plicifer* seems to be also restricted to south-eastern Madagascar, but is known to occur over a much wider area, including Ranomafana. Many other species recorded from BMNP are widespread and common over much of Madagascar's rainforests, from at least Andasibe/Mantadia in the center to Andohahela in the south, for example *Boophis luteus*, *B. madagascariensis*, or *Zonosaurus aeneus*, and many others even range into north-eastern Madagascar. Further study is also necessary to assign the *Mantella* population of BMNP, although Rabemananjara et al. (2007) have shown that *Mantella baroni* is a genetically very uniform species, with identical haplotypes distributed over much of its distribution area including specimens from Andringitra that show extended yellow-greenish dorsal colouration. In line with several studies indicating that the south-eastern part of Madagascar is undersampled (Raxworthy et al., 2003) and contains genetically highly divergent phylogeographic lineages (Vieites et al., 2006), our study supports the need of more intensive herpetological survey work in this region, which should be carried out in concert with taxonomic study of the encountered populations.

Acknowledgements

We are grateful to the UNESCO and the Parcs Nationaux de Madagascar/Association Pour la Gestion des Aires Protégées (BMNP/ANGAP), the "Directeur Inter-Régional" of Fianarantsoa, the director and team of the BMNP for their logistic help to reach the study sites at BMNP. Several local guides and the local population were of help during fieldwork. We are grateful to the Association Nationale pour la Gestion des Aires Protégées (ANGAP) for funding and for the permission to proceed with the publication of these data.

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