

# Conserving the Critically Endangered black-and-white ruffed lemur *Varecia variegata* through integrating *ex situ* and *in situ* efforts

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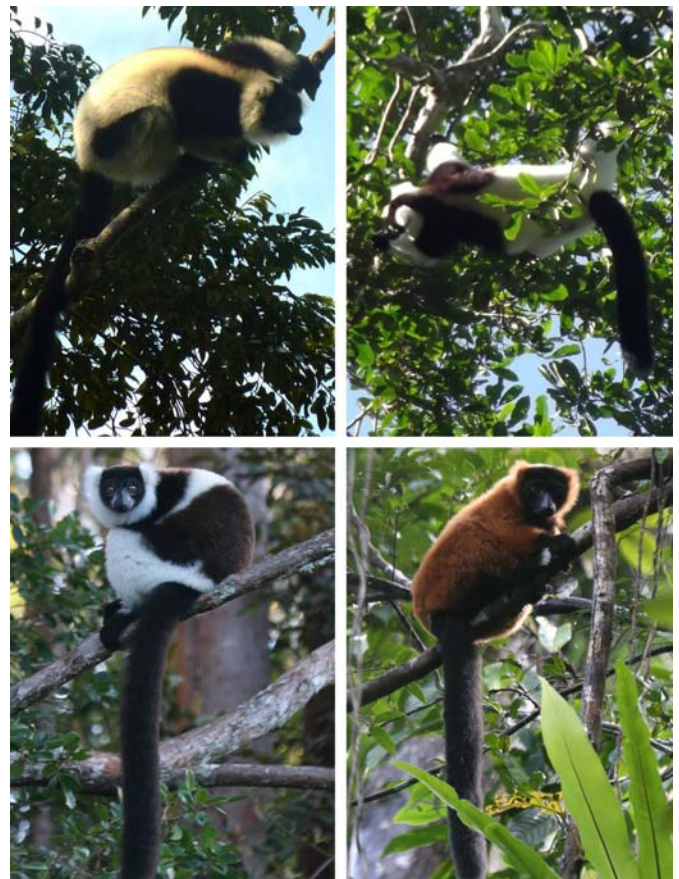
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## Introduction

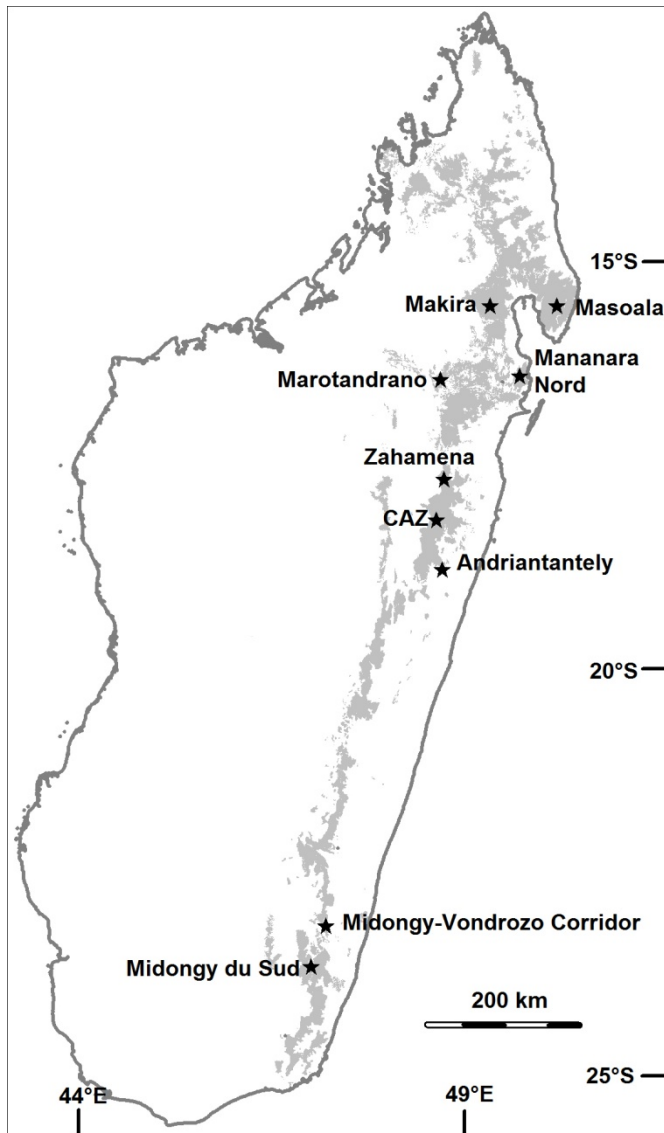
The black-and-white ruffed lemur *Varecia variegata* is listed as Critically Endangered by the IUCN (2012), and is considered to be one of the most endangered primates in the world (Mittermeier *et al.* 2009, 2012). Three subspecies are currently recognised, *V. v. variegata*, *V. v. editorum* and *V. v. subcincta* (Fig. 1), each of which is considered Critically Endangered (IUCN 2012), but there is debate over the validity of these subspecies and their geographic distributions. Black-and-white ruffed lemurs occur only in relatively undisturbed rainforest in the east of Madagascar. There is a zone of hybridisation between the with *V. v. subcincta* form and the red ruffed lemur *Varecia rubra* in the north of the species range, around the Masoala and Makira protected areas (Vasey & Tattersall 2002). The known southern limit of the species distribution has recently been extended south of the Mananara River, to near the Midongy du Sud National Park, by collaborative surveys undertaken by WWF-Madagascar and The Aspinall Foundation (Rakotonirina *et al.* 2013). The species appears to be particularly susceptible to habitat destruction and hunting pressure (Vasey 2003; Beaucent & Fayolle 2008), and is considered a high conservation priority by various organisations. It is listed as number 37 of the most evolutionarily distinct and globally endangered mammals in the world by the EDGE programme of the Zoological Society of London (Collen *et al.* 2011). It is also considered one of the priority lemurs for developing holistic species survival plans integrating both *in situ* and *ex situ* conservation actions (King *et al.* 2012; Schwitzer *et al.* in press).

We therefore present here a proposition for implementing such a plan, identifying priority and complementary *in situ* and *ex situ* conservation actions that The Aspinall Foundation can rapidly realise through its Madagascar Programme, the mission of which is to work with local partners for the conservation of endangered species and their habitats

(King & Chamberlan 2010). The aim of the proposition is to make a significant contribution to the long-term conservation of the critically endangered black-and-white ruffed lemur *Varecia variegata*.



**Figure 1.** The three major colour variants of black-and-white ruffed lemurs, currently considered to represent three subspecies *Varecia variegata variegata* (top left; note white colouration behind neck), *V. v. editorum* (top right; note black colouration behind neck) and *V. v. subcincta* (bottom left; note white belt on predominantly black body), plus the red ruffed lemur *Varecia rubra* (bottom right). (Photos: Andry Rajaonson (top left), Hery Randriaingo (top right) and T. King)



**Figure 2.** Map of Madagascar showing location of sites mentioned in the text, and approximate humid forest cover (light grey).

To achieve this aim, we propose the following objectives, which will be discussed below:

1. To contribute to a collaborative conservation programme for *V. variegata*;
2. To support priority site-protection projects in north, central, and southern parts of the species range, with an emphasis on species-specific threat mitigation activities;
3. To implement high quality long-term population monitoring in priority sites, for *V. variegata* and other priority species such as indri and diademed sifaka, including close monitoring of reproduction rates;
4. To help maintain viable captive and semi-wild populations of each subspecies, and to incorporate Malagasy captive *Varecia* within

global breeding programmes whenever appropriate;

5. To develop the management of captive populations to contribute directly to species conservation goals.

**1. To contribute to a collaborative conservation programme for *Varecia variegata***

Based in both Madagascar and the UK, and as the nominated focal contact for EAZA zoos interested in contributing to *V. variegata* conservation in Madagascar, we will continue to promote improved communication and coordination between Malagasy and international organisations interested in the conservation of *V. variegata*.

**2. To support priority site-protection projects in north, central, and southern parts of the species range, with an emphasis on species-specific threat mitigation activities**

With the subspecific taxonomy of *Varecia* currently being revised, the most pragmatic approach to conserving genetic diversity within the wild population of *V. variegata* would be to ensure viable populations throughout its range are adequately conserved. This would include populations in the north, central and southern parts of the species range (Fig. 2). Identifying priority sites within each region is therefore the first step.

In the north of the species range, ruffed lemurs of the *V. v. subcincta* colouration occur in the Makira and Mananara Nord protected areas, whilst the nearby Marotandrano protected area supports ruffed lemurs of the *V. v. variegata* colour pattern (Mittermeier *et al.* 2010). We propose therefore to help collect and collate density estimates of *V. variegata* from various locations within these three protected areas to help prioritise sites for subsequent species-specific conservation actions.

In the central part of the range, we have identified two sites of high conservation priority for ruffed lemurs of the *V. v. editorum* colour pattern, the Andriantantely lowland rainforest and the community-managed Ranomainty site within the western Ankeniheny-Zahamena Corridor (CAZ). Both sites support high densities of ruffed lemurs (The Aspinnall Foundation, unpubl. data; Figs. 3-4), whilst also supporting other high priority lemur species including greater bamboo lemurs, indri, and diademed sifaka (Figs. 5-6). The Aspinnall Foundation is the lead partner organisation involved in the support of community-based conservation for these two sites (Lantovololona *et al.* 2012; Randrianarimanana *et al.* 2012; King *et al.* 2013), and we propose to increase our technical and financial support of both sites to ensure the survival of



**Figure 3.** A Critically Endangered black-and-white ruffed lemur in the Andriantantely lowland rainforest. (Photo: Hery Randriahaingo / The Aspinall Foundation)



**Figure 4.** Another Critically Endangered black-and-white ruffed lemur in the Andriantantely lowland rainforest. (Photo: Hery Randriahaingo)



**Figure 5.** Critically Endangered indris (*Indri indri*) in the Andriantantely lowland rainforest. (Photo: Tony King)



**Figure 6.** A Critically Endangered diademed sifaka (*Propithecus diadema*) in the Andriantantely lowland rainforest. (Photo: Hery Randriahaingo)

all these species at both sites, including promoting the black-and-white ruffed lemur as a flagship species for Andriantantely (Fig. 7). Located in the Brickaville District 85 km south-west of Toamasina, Andriantantely is one of the few patches of lowland rainforest remaining in Madagascar, and was identified as a high conservation priority during a series of rapid biodiversity assessments undertaken in 1998 and 1999 in and around the CAZ by Conservation International (Schmid & Alonso 2005). It was the only site surveyed for which the surveys of every taxa (plants, lemurs, small mammals, birds, amphibians, reptiles, insects, ants) indicated that the forest remained in good condition. Eight lemur species were recorded of which the black-and-white ruffed lemur “was exceptionally abundant..., indicating that this site contains good habitat for large lemur populations” (Schmid & Alonso 2005, p. 28).

Additionally, the Zahamena National Park is located a little further north than the Ranomainty site, from where we have recently reported the presence of the greater bamboo lemur (Rakotonirina *et al.* 2011), and which contains a population of ruffed lemurs appearing to be of the *V. v. variegata* colour pattern (Mittermeier *et al.* 2010). We therefore propose to collect density estimates of *V. variegata* and other diurnal lemurs in Zahamena to help prioritise the site within the context of a regional lemur conservation action plan.

In 2010 we reported a southern extension to the known range of *V. variegata*, in and around the Midongy-Vondrozo rainforest corridor of south-eastern Madagascar (Rakotonirina *et al.* 2013). We therefore propose to develop and facilitate conservation action plans for these new sites, one at Ambalavero in the corridor itself, the others in the Vohitrambo - Marofiro -



**Figure 7.** Distribution of notebooks promoting the black-and-white ruffed lemur as a flagship species for the conservation of the Ankeniheny-Zahamena rainforest corridor. (Photo: Christelle Chamberlan)

Beroro complex of lowland forest fragments to the east of the Corridor (TAF 2012).

**3. To implement high quality long-term population monitoring in priority sites, for *V. variegata* and other priority species such as indri and diademed sifaka, including close monitoring of reproduction rates**

During 2012 we began implementing participatory monitoring of ruffed lemurs in the Andriantantely lowland forest and the Ranomainty and Sakalava sites of the western Ankeniheny-Zahamena corridor (The Aspinall Foundation, unpubl. data). We propose to continue population monitoring in these sites, and also to implement comparable long-term monitoring of priority populations identified during the collection and analysis of density data as described above.

**4. To help maintain viable captive and semi-wild populations of each subspecies, and to incorporate Malagasy captive *Varecia* within global breeding programmes whenever appropriate**

The two European Endangered Species Breeding Programmes (EEPs) for *V. variegata* face differing management challenges to ensuring their viability. One population (the *V. v. subcincta* EEP) is small and ideally requires new founder genes. The other is large but there are issues with incomplete studbook records and potentially the mixing of distinct taxonomic units. Both will benefit from the clarification of *Varecia* taxonomy that is currently being researched. Once clarified, both can also potentially benefit from the incorporation of captive ruffed lemurs in officially

recognised facilities in Madagascar with the EEP studbook and breeding programme. We therefore propose to support the relevant authorities in their efforts to inventory and regulate captive lemurs in Madagascar, and to promote collaboration with the EEPs for *V. variegata* and other appropriate species (including *Eulemur mongoz*, *Eulemur flavifrons* and *Hapalemur alaotrensis*; King *et al.* 2012; Schwitzer *et al.* in press) in a similar manner to that already implemented for *Prolemur simus* and *Propithecus coronatus* (Roulet 2012, in press).

**5. To develop the management of captive populations to contribute directly to species conservation goals**

In addition to incorporating captive lemurs in Madagascar into appropriate EEPs, we also propose *V. variegata* as an ideal candidate for implementing the proposed new approach to global captive population management as outlined recently by Lacy (2013), combining an open and interactive management of captive, wild, and semi-wild populations within a holistic species conservation programme, which may include reinforcement of small isolated populations or reintroduction projects if appropriate (King *et al.* 2012; Schwitzer *et al.* in press). Several issues need to be addressed before this can become a reality, including the clarification of subspecific taxonomy and the regulation of captive lemurs in Madagascar, but we suggest that the time is right to start considering such programmes as key components for the survival of several species with isolated populations lacking genetic diversity.

**Conclusions**

The proposal we present here is intended to attract support from various sources, so in Table 1 we provide an approximate budget for implementing most of the activities proposed above, each of which can be funded independently of the others within the framework of The Aspinall Foundation's existing Madagascar Programme. We therefore encourage contributions from anyone interested in helping conserve black-and-white ruffed lemurs in the wild and through the integration of *in situ* and *ex situ* conservation activities into a holistic species survival approach.

**Acknowledgements**

We thank the government of Madagascar for their commitment to biodiversity conservation in general, and lemur conservation in particular, numerous organisations who have worked with us over the past

Table 1. Budget in Euros for activities proposed for 2013 to conserve the Critically Endangered black-and-white ruffed lemur *Varecia variegata*.

	Budget (Euros)
Estimating densities in Marotandrano and south-west Makira	3,000
Estimating densities in Mananara Nord and south-east Makira	3,000
Estimating densities in Zahamena	3,000
Community patrol teams for Ranomainty site in CAZ	4,000
Support of community-based management of Ranomainty site	4,000
Community patrol teams for Andriantantely lowland forest	5,000
Reduction of slash-and-burn destruction of Andriantantely	3,000
Support of community-based management of Andriantantely	15,000
Preliminary conservation of sites in or near Midongy-Vondrozo corridor	10,000
Developing captive management strategies	to be discussed
<b>Total</b>	<b>50,000</b>

few years to help conserve black-and-white ruffed lemurs, including the Malagasy Primate Research Group (GERP), WWF-Madagascar, Conservation International, Association Mitsinjo, regional forestry offices, authorities, and local community associations in and around the Ankeniheny-Zahamena and Midongy-Vondrozo Corridors, the staff of The Aspinall Foundation Madagascar Programme, and Jonah Ratsimbazafy, Delphine Rouillet, Eric Robsomanitrondrasana, Christoph Schwitzer and Simon Jeffery for their invaluable discussions, advice and support.

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