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# Clinging To Life: Varecia Variegata Rubra And The Masoala Coastal Forests

Natalie Vasey

*Portland State University, nvasey@pdx.edu*

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## Genetic Research on Differences in *Varecia* underway at the American Museum

Research on the taxonomic status of the ruffed lemur is being conducted in Rob DeSalle's Genetics Laboratory at the American Museum of Natural History (AMNH) in a collaborative project with George Amato and Hilary Simons Morland from the Wildlife Conservation Society (WCS). The project is using DNA obtained from hair and blood samples from wild and captive populations to assess genetic differences between red-ruffed and black-and-white ruffed lemurs, and among the black-and-white coat color varieties. The lab work is expected to be completed by mid-July, 1996. Results of the analysis will be made available to the Madagascar Fauna Group/Duke Primate Center

Ruffed Lemur Release Project, and may be helpful in evaluating the suitability of candidates for release into the Betampona Natural Reserve. The genetics research is being supported by the Madagascar Fauna Group, Conservation International, and the American Museum of Natural History.

Hilary Simons Morland

Assistant Director/Africa Program

Wildlife Conservation Society

185th Street and Southern Blvd.

Bronx, NY 10460

phone (718) 220-5887, Fax (718) 364-4275

email 0002011526@mcimail.com

## Madagascar Conservation Community Mourns the Loss of Nasolo Hubert Neomane Rakotoarison (January 29, 1961–June 20, 1996)

The tragic news of Nasolo's fatal car accident has left his friends and colleagues shocked and deeply saddened. He was very well known and highly respected by his peers, as well as the scientific community in Madagascar. Nasolo was an extraordinary person, who with his intelligence and enjoyable personality gave hope for the future conservation of Madagascar's deteriorating flora and fauna. His big smile, friendly disposition and understanding of the "big picture" made him not only a pleasure to work with but also a treasured friend. His death has created a void in Madagascar which will be impossible to fill.

Urs Thalmann from the Universities of Zurich and Mahajanga, a close friend and colleague of Nasolo's writes: "In recent years Nasolo was probably the most renowned young biologist in Madagascar. His intellectual curiosity and abilities, his understanding and knowledge of animals, and his outstanding field experience were paired with an optimistic and charming character, a gracious integrity and reliable personality that had to be admired. This made Nasolo one of the most desired biologists to work with in Madagascar. Very often, professional relationships turned into personal friendships. His future, professional as well as private, looked extremely promising. Most definitely, he would have played a much more important role in the conservation of Madagascar's environment than he already did. No one who knew Nasolo will ever forget him. He has a lasting home in everyone's hearts".

Nasolo was born in Antanimora, Toliara and later raised in Fort Dauphin (Tolagnaro). He moved to Antananarivo in 1982, to attend science courses at the University of Antananarivo. After graduating in 1988 with a degree in biochemistry, he decided to continue studying for a Masters degree examining the ecophysiology of tenrecs. In 1990, he was hired with financial support from the Madagascar Fauna Group for the position of Curator of Small Mammals at Parc Botanique et Zoologique de Tsimbazaza (PBZT).

While maintaining his position at PBZT, Nasolo not only completed his Masters degree in 1992 but also received the 1992 Conservation Award from the American Society of Primatologists. He persisted in developing his expertise by attending additional Ecology and Biology courses at the International Center for Conservation Education and the University of Aberdeen in the United Kingdom. During the same year, Nasolo successfully completed the "Captive Management and Breeding of Endangered Species" summer program at Jersey Wildlife Preservation Trust and further biology courses at the Durrell Institute of Conservation and Ecology (DICE) at the University of Kent. After witnessing such determination and dedication, it was not at all surprising that he began a Ph.D. project in 1994 with Dr. Elke Zimmermann from the German Primate Center, Deutsches Primatenzentrum (DPZ).

What made Nasolo exceptional amongst his peers was his degree of dedication

and true love for the environment of Madagascar. He was an incredibly hard worker, and there were many days he seemed like he would drop from lack of rest. However, this never stopped him from smiling and joking around, nor did it deter his self-motivation or commitment to the environment.

During Nasolo's university time and work at PBZT, he provided organizational and scientific assistance for numerous surveys and field projects throughout Madagascar. Nasolo quickly became a valuable scientist and provided expertise to researchers from Conservation International, World Wildlife Fund, The Smithsonian Institution, and Universities at Aberdeen & Cambridge UK, Osaka Japan, and Zurich Switzerland. Nasolo's field work, professional publications and scientific capabilities helped to bring scientific credibility and recognition to PBZT.

More recently, Nasolo's field work involved collecting behavioral and acoustic communication data for his Ph.D thesis on nocturnal lemurs. He had worked diligently on the physiological ecology of *Cheirogaleus* spp. and later began focusing on researching *Microcebus* and *Lepilemur* spp. To facilitate his field work, Nasolo completed an exchange program in Germany made possible by a scholarship from Deutscher Akademischer Austausch Dienst (DAAD). This trip included a visit to the German Primate Center, DPZ, to develop bioacoustical, behavioral and statistical methods for use in Madagascar.

While in Germany, Nasolo also visited several zoos to gain experience and expertise which could be useful at PBZT. Although he visited many primate collections, Nasolo was very interested in training at Zoo Duisburg, with Achim Winkler, EEP species coordinator for the fossa (*Cryptoprocta ferox*). At the time of Nasolo's death, he was developing a collaboration between PBZT and Zoo Duisburg to successfully exhibit and breed fossa at Parc Tsimbazaza. Through assistance provided by biologist Martina Thelen and Zoo Duisburg, Nasolo was enthusiastic about a future fossa program at PBZT. In memory of Nasolo and in appreciation of his friendship and dedication to Madagascar's environment, we at PBZT with the continued assistance from Martina Thelen will continue Nasolo's work in an attempt to make his fossa project a reality.

Dean Gibson

Madagascar Fauna Group

Antananarivo, Madagascar

email indri@bow.dts.mg

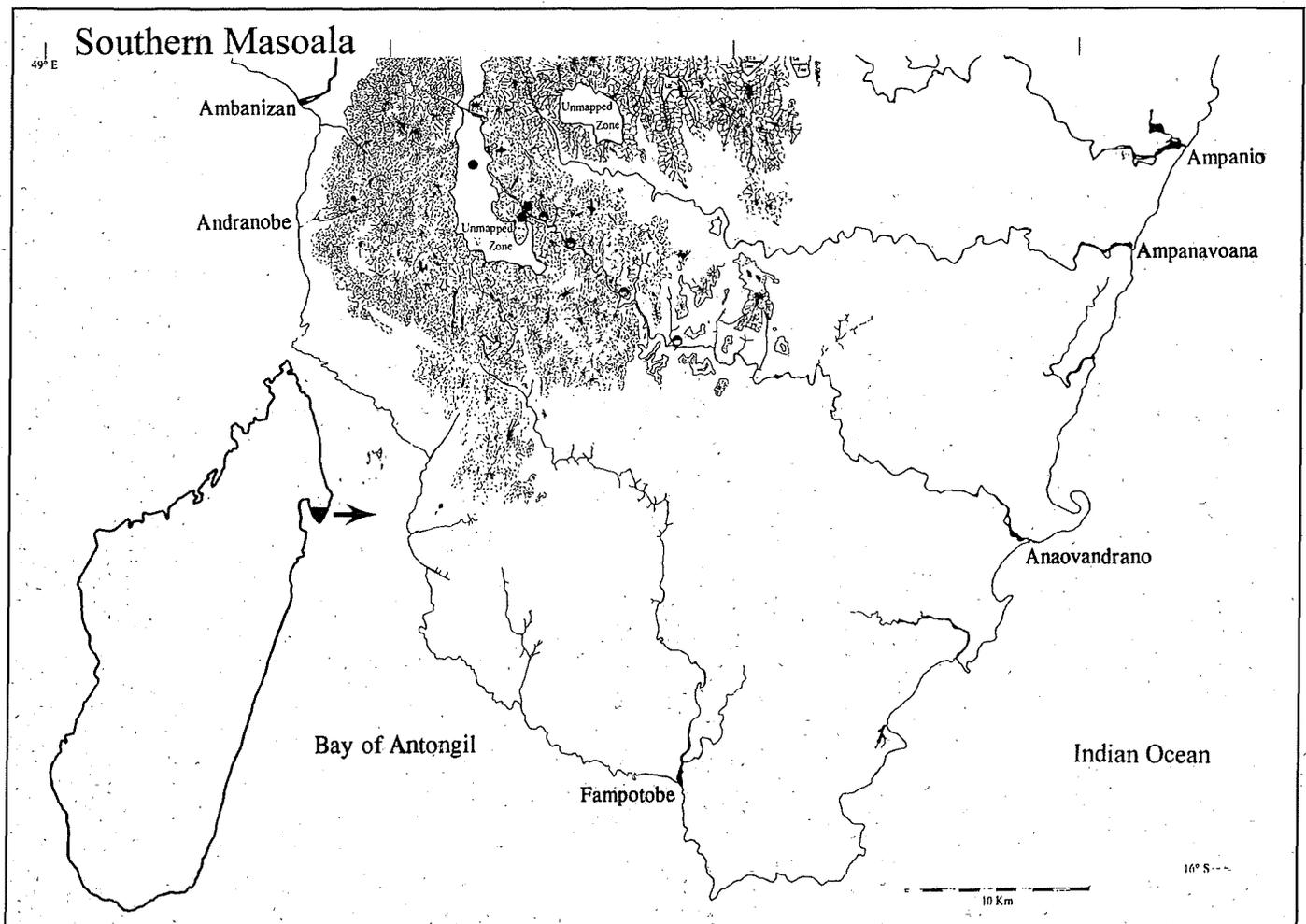
## ARTICLES

### Clinging to Life: *Varecia variegata rubra* and the Masoala Coastal Forests

During my 17 month stay in Madagascar (October 1993 to February 1995) to study the ecology and behavior of *Varecia variegata rubra*, the red ruffed lemur, and *Lemur fulvus albifrons*, the white fronted lemur, I made a series of visits to coastal and riverine forests and villages on both the east and west sides of the Masoala Peninsula. I spent most of my time in the Andranobe Watershed where I conducted my study. I also surveyed the Anaovandrano Watershed, the least accessible region of the southern Masoala Peninsula (Vasey, 1995a). I learned a great deal from my Malagasy friends and acquaintances in the region about their way of life. From my visits to local forests, I learned first hand about human utilization patterns. One thing that naturally interested me was human impact on local lemur populations. Here I provide an informal report on some of my research and on the conservation status of *V.v.rubra*.

Factors that threaten all Masoala lemur species with extinction is habitat loss and hunting. These conditions are the most serious for *V.v.rubra* which is heavily hunted and occurs only on the Masoala Peninsula and just to the north of it. To this species benefit however, is its great population growth potential relative to other lemurs. *V.v.rubra* bear between one and five infants, most commonly twins or triplets. Thus, they have vibrant population growth where adequate habitat exists and where they are not heavily hunted, conditions found at Andranobe. However, the latter conditions are exceedingly rare in the remaining coastal forests of the Masoala Peninsula. Pressures on the land and on the local people are great, and traditions die hard.

On the Masoala Peninsula, new land is converted daily to *tavy* (slash and burn agricultural plots) because of the growing need for new households and village expansion in recent decades. Burning takes place between October and December. Lemurs are hunted annually between June and August, but also in May and September in at least two ways: traditionally, via traps set up across *laly* (narrow swaths of cut forest sometimes up to a kilometer long), and with rifles, usually provided by entrepreneurs in nearby towns who then sell lemurs to local markets, other towns, or other cities. On the Masoala Peninsula, many entrepreneurs are



Map of the southern half of the Masoala Peninsula with selected features illustrated. Watersheds are labeled. Rivers — solid lines; terrain 300 m elevation and higher — broken contour lines; terrain 200-300 m elevation in the Anaovandrano Watershed — solid contour lines; temporary shelters — half-filled circles; cleared forest and shelters — solid circles. Most land less than 300 m in elevation and 20 degrees in slope on the Masoala Peninsula is already highly fragmented, and therefore it is no longer a viable option to conserve it. The Anaovandrano Watershed is exceptional in that it still harbors virgin low elevation rain forest. The Andranobe Watershed is exceptional in that it still harbors virgin coastal low elevation rain forest. Map by Natalia Vasey.

partially of Asian extraction - the locally self-identified "meti-chinois". I ate in their restaurants and bought supplies from their local businesses each month so I knew many of them personally and befriended them. Generally, they are not shy or ashamed of their lemur hunting and utilization practices. They recognize that it is against the laws of the land, but laws against hunting lemur are traditionally un-enforced in the region, and therefore remote and abstract to them. This attitude also prevails in many local villages with which I am familiar. Hunting lemurs with rifles is probably the greatest threat to the survival of *V.v.rubra* since introduction of land management plans could probably reduce selective logging and the amount of land local people convert from forest to *tavy*, thereby permitting protected primary forest to remain standing.

I visited *laly* cut at Andranobe and in adjacent coastal valleys during the 1994 hunting season, I was told the Betsimisaraka wood cutters had made certain ones. The Betsimisaraka are employed in the region by local wood mills. Other *laly* cut within Andranobe forests were accomplished by local men from nearby villages. No effective deterrents to creating *laly* or *tavy* within proposed park lands existed at that time. Because of its rare status as relatively pristine lowland rain forest and its vast species diversity and density, Andranobe is of high conservation priority and is included within the proposed park lands. The inability to protect tracts of forest may all be changing for the better soon. A friend recently sent word that the Masoala National Park was to be inaugurated on the 5th of June, 1996. This friend, Marie Berthine Razafindravao, has worked as a village nurse for the Masoala National Park Project since its inception in 1989 and is representative of how devoted many people working on the park project have been. It is hard to live and work in a remote bush village after growing up and being educated in the capital, just as it is hard to go looking for your study animals during the hunting season not knowing for certain if you will find them all. Some things were so hard

really, if you stopped to think about them. But I did not have much time, as my work load in the forest was enormous and there were fundamental survival issues to distract me. It was a deluge of a year at Andranobe, over 5,000 mm of rain fell from January 1994 to December 1994 (Vasey, in prep). Now I am at work on my thesis and adjusting to life back in the developed world which often puts some issues out of mind. All this while though, I have been certain that red ruffed lemurs need immediate conservation action in order to survive, since sustainable development infrastructure in the region is established at a much slower pace than the rate at which natural habitats are being converted via *tavy*, *laly* and rifles. Red ruffed lemurs are clinging to life, clinging to survival.

The results of my survey of the Masoala interior (Anaovandrano Watershed — see map), are not heartening. *V.v.rubra* do not appear to be that dense there, at least not as dense as in the remaining west coast forests at Andranobe. They may be patchily distributed, as patchily distributed as some of their forest resources perhaps (Vasey, 1995a; in prep). They appear to be reliant on a variety of large trees. These tree species may not necessarily be rare in the forest, but large mature individuals of some species (i.e., *Canarium madagascariensis*) are rare to absent in some forests due probably to geographic floral variation or selective logging. It may be that *V.v.rubra* flourishes best in coastal rain forests where there is lots of natural habitat disturbance and re-growth. Ecologically, *V.v.rubra* appears to be a primordial rain forest beast, highly tuned to seasonal and annual variation in climate (e.g., rainfall, temperature, cyclones) and the distribution of preferred foods, as well as their own reproductive events (Vasey, 1995b, 1996a; in review). They do not have the resiliency to inhabit a wide variety of habitats such as their sympatric relation, *L.fulvus*, species of which form a ring around the entire island and inhabit a wide array of habitats.

In summary, much of the lemur news I have reported here is sobering, but I would say the cup is half full, not half empty. Research and conservation in the region has had humble, and sometimes small scale beginnings, such as my own establishment of a study site for the Masoala lemurs. Much has been learned and advances have been made, both from mistakes and successes. And now, thanks to the efforts of innumerable individuals, the establishment of a National Park seems certain, making the protection of many unique and endangered plants and animals more secure. The coastal study site I established has great potential for long term demographic and ecological study of lemurs and other arboreal animals for a variety of reasons: a number of *V.v.rubra* and *L.f.albifrons* individuals are marked, a trail system has been installed and mapped, *V.v.rubra* and *L.f.albifrons* feeding trees have been permanently marked, and by last word, Andranobe is now officially protected. I encourage anyone contemplating work in the area to make use of the established infrastructure and the baseline data my assistants and I collected.

Natalia Vasey

Department of Anthropology, Washington University  
St. Louis, Missouri 63130  
phone (314) 726-5524, fax (314) 935-8535  
email nvasey@artsci.wustl.edu

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## Red Ruffed Lemur (*Varecia variegata rubra*): A Rare Species from the Masoala Rain Forests

The Masoala peninsula is isolated: there are no roads or bridges, it has the worst weather of Madagascar (250 days of rain for a total of 4200 mm each year), and the transportation of material is very arduous and unsafe. This explains why only a few, generally short term, studies have been carried out by primatologists on Masoala. On the other hand these very reasons have contributed to keep human population density at relatively low levels when compared to other regions of Madagascar. In the last forty years the forest of the flat eastern side of the peninsula has disappeared (Green and Sussman, 1990). Until recently, restrained human activity and the hilly nature of the central and western parts made possible the survival of a substantial portion of the original forest together with that of many botanical and animal species. At the present rate of clearance, however, this good fortune could not last for long, and rare species like red ruffed lemurs (*Varecia variegata rubra*) could disappear with their unique and restricted habitat very quickly.

The black and white, and the red ruffed lemur are the two subspecies of the monospecific genus *Varecia*. In *Lemurs of Madagascar: An Action Plan For Their Conservation*, the red ruffed lemur (*Varecia variegata rubra*), the rarer of the two subspecies, is listed in the highest priority rating for conservation action. Its habitat is restricted to the Masoala peninsula east of the Antainambalana river and it does not occur in any protected area (see photo). How many red ruffed lemurs live on the Masoala peninsula? Only very few investigations have been carried out, giving only a partial view of the conservation status. Information is too incomplete to attempt an estimate on the population size of this species in its area of distribution.

Between December 1990 and December 1991, I carried out a field study in the

rain forest of the Ambatonakolahy mountain, the sacred rock, that had as its objective the determination of red ruffed lemur home range size, habitat use, and diet. Two groups of these lemurs were followed, and 704 hours of systematic observation were collected. The first group, composed of five individuals, covered a home range of 23.25 ha, the second group of six occupied a home range of 25.75 ha. The population density of red ruffed lemurs calculated from these home range sizes was 46 animals per square kilometer. This is an overestimate since large portions of forest were uninhabited by any group. I have calculated that a realistic estimation of their density in the Ambatonakolahy forest would vary from 20 to 25 individuals per square kilometer. Between the Antainambalana and Andranofotsy



The red ruffed lemur (*Varecia variegata rubra*) from the Masoala Peninsula. Photo by Marco Rigainonti.

rivers local people refer to the presence of red ruffed lemurs. In 1986, Simons and Lindsay spent six days in two localities on the eastern bank of Antainambalana river (see map, page 10) but "could not confirm their presence". If living in this area they probably occur at very low densities (Simons and Lindsay, 1990). In the same year, I inspected the left bank of Antainambalana river but I did not hear a single red ruffed lemur call. I observed these lemurs in six sites all along the western side of the Masoala peninsula, but if 15-20 years ago they were common in the forest near the sea, as local villagers say, today it is necessary to search for them inland. I visited some of these places in 1986 and again in 1991 when I noticed everywhere a growth in human activity and an increased number of tavy plots (slash and burn agriculture). This situation is particularly evident North of Ambanizana. From the top of the Ambatonakolahy mountain on a clear day of December, I counted eleven smoke columns rising from new tavy scattered along the coast. In 1986, in the forest east of the Andranofotsy river valley groups of *V.v.rubra* were seen and heard by Simons and Lindsay. These observations confirm that red ruffed lemurs are still found quite uniformly on the western side of the peninsula. The situation, however, has not been documented for the interior.

For ruffed lemurs habitat destruction, trapping and hunting are the main dangers. The tavy technique, the traditional and difficult way to scrape a living from this inhospitable land, was sustainable when human density was low and families could rotate a dozen tavy plots with a very slow turnover, causing minimal damage to the forest. Today, however, human density is growing very fast. Centers like Maroantsetra, Ambanizana expand with exponential speed and human impact is becoming too intense to be supported by the forest which is rapidly being overcome, especially in river valleys and on the coast. Generally, where new isolated tavy plots are cleared far from villages, the surrounding forest is not heavily damaged as in the case of selective logging. Tavy agriculturists normally cut down *Vontro* sp. and Ravinala (*Ravenala madagascariensis*) for shed construction, or *Bilaly* (sp.) for *betsabetsa* preparation, but large trees are not felled outside the tavy plot. This may account for the information reported by Simons and Lindsay, and also remarked on by local people, that red ruffed lemurs normally come to the borders of tavy plots. Where they are not habitually hunted these