LEMUR NEWS

The Newsletter of the Madagascar Section of the I.U.C.N./S.S.C. Primate Specialist Group

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CONSERVATION INTERNATIONAL

WWF

DPZ Deutsches Primatenzentrum

Species Survival Commission

Zoologisches Institut & Zoologisches Museum Hamburg

Cover photos: *On June 7, 2003 nearly a thousand people gathered at Ranomafana National Park near Fianarantsoa to inaugurate a new biodiversity training and research center, Centre ValBio* (*photos by David Haring*).

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EDITORIAL

Have you read the Winter 2003 issue of "*Conservation In Practice*" yet? Therese and John Hart write about the effects of war on biodiversity in the Democratic Republic of Congo. One of their conclusions how to mitigate the effects of war is to "be there during anarchy". While it may be unwise for foreigners and actually counterproductive as a foreigner to be there physically, it is of utmost importance to continue to support our colleagues, friends and staff at the sites, especially when times get tough. The other important conclusion was that it was the training of staff at all levels that made the difference and led to the emergence of leaders for conservation especially while conservation seemed impossible. Fortunately Madagascar is not the Congo. Still, Madagascar has gone through a difficult time of transition. A very fine example of "being there" during difficult times with the goal of promoting research and training has been inaugurated on June 7, 2003. This is the Centre ValBio Training and Research Station in Ranomafana, Fianarantsoa, the first phase which opened despite the national turmoil during the last year of construction.

During the 2003 Madagascar Week of the Environment, a Consortium of International Universities, celebrated with the Minister of the Environment, Water and Forests and the Director General of ANGAP, the inauguration of the Centre ValBio, a biodiversity research and training center near Fianarantsoa. The new Director of this center, Jean Philip Puyvaraud, assumed his role at the end of the festivities. The "Regional Committee against Fire", including the Ranomafana Park Manager, mpanjaka of Ambatalahy, mpanjaka of Ranomafana, the Sous Prefait, the Chef de Cantonnement of Water and Forests, the Deputy, the Delegate with MICET, Antananarivo, ICTE, Stony Brook organized the "two cow" event. Kabaries were given by the the mayor of Ranomafana, the US ambassador's representative, Luke Dollar, the Director of ICTE, the DG of ANGAP, the representative of the President of the Faritany, and the Minister of the Environment.

After the ribbon was cut by the Minister, the tour of the facilities was led by Benjamin Andriamihaja, Director of MICET, and JP Puyvaraud, Director of ValBio. The next events included the cocktail (prepared by Domaine Nature) and the official lunch and traditional dancing at the Centre's Restaurant. The ball began that evening outside in the moonlight at the Centre Valbio, and the festivities and the orchestra continued until dawn.

The three story brick building with a bright green roof overlooks the white water rapids of the River Namorona, is built into the rainforest canopy, and was already visited by wild red-bellied lemurs, a mouse lemur and a chameleon. The top floor is the dining hall which seats 65, a commercial kitchen, and balconies. The lower floors are administrative offices, research offices, a library, database and GIS room and classrooms. The large campus, located between the river and Route 25, now includes a pavilion for more classes, a workshop area and picnic facilities. The future buildings will include laboratories, computer facilities, and a bridge to the Ranomafana National Park. The architect is Peter Ozolins from USA, the contractor is Mr. Lucien Robert from Antananarivo with the bureau d'étude MSAADA.

The funders for this first phase are the National Science Foundation,USA; the University of Helsinki, Finland, the Stony Brook University Research Foundation, USA, United Nations Foundation/UNESCO World Heritage Site Program, USA and France, and The Nando Peretti Foundation, Italy.

The research station offers opportunities for Malagasy students and scientists to use modern technology to study their extraordinary biodiversity. For international researchers, the Centre ValBio will offer an opportunity to teach Malagasies modern techniques, access the databases from 18 years of research by Ranomafana biodiversity scientists, and employ more technology in their field research. The Centre ValBio is honored to serve as the hub of the proposed cluster of UNESCO World Heritage Sites in southeastern Madagascar. After all the political problems of last year, this Center is a breath of fresh air and motivation for researchers!

Jörg U. Ganzhorn

NEWS and ANNOUNCEMENTS

ASP Standing Committee Chairs – 2002-2004

The President of the American Society of Primatologists (2002-2004) is Jeffrey A. French (Department of Psychology, University of Nebraska at Omaha, Omaha, NE 68182, <jfrench@mail.unomaha.edu>), the President-Elect is Steve Schapiro (UTMDACC, Bastrop, Texas, <sschapir@mdanderson.org>), and the Executive Secretary is Toni Zeigler (University of Wisconsin-Madison, Wisconsin, <ziegler@primate.wisc.edu>). The following people have been elected as Chairs of the various ASP Committees. *Program Committee* – Marilyn Norconk, Department of Anthropology, Kent State University, 236 Lowry Hall, Kent, OH 44242, <mnorconk@kent.edu>; *Awards and Recognition Committee* – Gabriele Lubach, Harlow Primate Lab, University of Wisconsin, 22 N. Charter Street, Madison, WI 53715-1239, <grlubach@facstaff.wisc.edu>; *Research and Development Committee* – J. Dee Higley, National Institute on Alcohol Abuse and Alcoholism, NIH Animal Center, P. O. Box 529, Bldg 112, Room 205, Poolesville, MD 20837-0529, <higleyd@1ce.nichd.nih.gov>; *Education Committee* – Susan Howell, Primate Foundation of Arizona, P. O. Box 20027, Mesa, AZ 85277-0027, <suehpfa@qwest.net>; *Conservation Committee* – Janette Wallis, Department of Psychiatry and Behavioral Science, University of Oklahoma Health Sciences Center, P. O. Box 26901, Oklahoma City, OK 73104-5020, <janette-wallis@ouhsc.edu>; *Membership & Finance Committee* – Evan Zucker, Department of Psychology, Loyola University, New Orleans, LA 70118, <zucker@loyno.edu>, <www.asp.org/>.

From: *ASP Bulletin* 26 (2/3), August/September 2002.

ASP Conservation and Education Committee Awards 2002

The Conservation Committee of the American Society of Primatologists, chaired by Randall Kyes, gave their 2002 Conservation Award to Pierre Kakule Vwirasihikya who works with Dian Fossey Gorilla Fund International, in the Democratic Republic of Congo. Conservation Small Grants (up to $1,500) were awarded to 11 people. Projects from the Neotropics included: "The brown howler monkey, *Alouatta guariba clamitans*, in a fragmented landscape in south Brazil" – Soraya Ribeiro; "Habitat fragmentation and genetic variability of populations of *Alouatta pigra* (Primates:

Cebidae) in the Yucatán Peninsula, Mexico: Implications for conservation" – Monica A. Pimenta; "Assessment of primate populations at the Puré River, Colombian Amazon" – Erwin Palacios; and "Forest destruction effects on a population of black-and-gold howler monkeys (*Alouatta caraya*) in northern Argentina"– Gabriel E. Zunino. For information on ASP Conservation Small Grants, contact: Gabriele Lubach, <grlubach@facstaff.wisc.edu>.

A new conservation zone established in the littoral forests of Mandena

In collaboration with the communities of Ampasy-Nahampoana and Mandromodromotra, the Circonscription des Eaux et Forêtss at Tolagnaro and QIT Madagascar Minerals (QMM) established a 230 ha conservation zone in the littoral forest of Mandena. The zone includes the two largest remaining blocs of littoral forest (M15 and M16) which are connected by a swamp created by the Anandrano river. The conservation zone is open for ecotourism. Several nature trails including guided boat trips along the Anandrano river have been established. The revenues are managed by a local committee and are reinvested in community projects and maintenance of the conservation zone. Arrangements to visit the site can be made through Mme. Brigitte Baloa, QMM, BP 225, Tolagnaro 614, phone: (261 20) 92 21 391 or through Mme Fara Razafimaharo, QMM, BP 4003, Antananarivo 101, phone 261 20 22 42559, <qmmtnr@dts.mg>.

Red List of Threatened Species

The 2002 Red List of Threatened Species has been released on 8 October 2002. An information package is available on the SSC website (iucn.org/themes/ssc) in English, French and Spanish, including a news release outlining several significant additions to the Red List and notable shifts in status. From now on, we will be updating the list every year. This, along with continually improving documentation and taxonomic coverage of the Red List, will make it easier for us to identify and highlight species undergoing rapid declines. Species highlighted of 2002 include the Saiga (*Saiga tatarica*), Wild Bactrian Camel (*Camelus bactrianus*), Iberian Lynx (*Lynx pardinus*), and Titicaca Flightless Grebe (*Rollandia microptera*). The updated web site is available at <www.redlist.org>, and also at <www.redlist.net> and <www.iucnredlist.org>.
Caroline Pollock, IUCN/SSC Red List Programme, 219c Huntingdon Road, Cambridge, CB3 0DL, United Kingdom, <caroline.pollock@ssc-uk.org>.

Species Information Service Progress

The Species Information Service (SIS) aims to become a worldwide species information resource (with interlinked databases of species-related information managed by SSC's network of Specialist Groups). The latest in a series of activity reports related to its development is now available. For an update on the progress during 2002, visit: <www.iucn.org/themes/ssc/sis/sis7.html>.

Re-introduction Specialist Group – Deputy Chair

Mike Maunder, Deputy Chair of the IUCN/SSC Re-introduction Specialist Group and Plant Section Chair, took up a new position in November as Director of Horticulture at the Fairchild Tropical Gardens, Miami. His new address is: Dr Mike Maunder, Director of Horticulture, Fairchild Tropical Garden, 10901 Old Cutler Road, Coral Gables, Miami, FL 33156-4296, USA. Tel: 305-667-1651, Fax: 305-667-6930, <mmaunder@fairchildgarden.org>, <www.fairchildgarden.org>.

Free/reduced online access to scientific journals for some developing countries

Free access to the electronic version of the science journal Nature, and many others such as Biodiversity and Conservation, is being made available to the world's poorest countries. The access will be provided through the Health InterNetwork Access to Research Initiative (HINARI), a scheme launched by the World Health Organisation in January to increase access to scientific literature in developing countries, whose research institutions are often unable to afford the subscription fees charged by journal publishers (see WHO initiative gives free electronic access to journals). At present, researchers in countries with a Gross National Product (GNP) below US$1,000 per head can gain free access to almost 1,000 journals through HINARI. From next year, it is intended that the journals will also be available at greatly reduced prices to countries with a GNP between US$1,000 and US$3,000 per head. The link to the journals: <www.healthinternetwork.org/scipub.php?lang=en>.
The link to register for access if you are in a developing country: <www.healthinternetwork.org/src/registration.php>.

Request for information

We are in the process of conducting a detailed analysis of the biogeography of lemurs. Intents of this project are to assess the role of rivers as barriers in the dispersal of lemurs, patterns of elevational distribution, and a broad-scale biogeographic analysis. We would be very grateful to receive unpublished species lists for inventoried sites or isolated observations with associated geographical coordinates, elevation, habitat types, dates, etc. from field researchers. Details associated with the identification of any "unusual" records would be most appreciated. The information will be entered into a database and used in the analysis. All contributors will receive copies of and be acknowledged in any resulting publications. Please send information to Steve Goodman, WWF, B.P. 738, Antananarivo (101), Madagascar, <sgoodman@wwf.mg> or Jörg Ganzhorn, FB Biologie, Ecology and Conservation, Martin Luther King Platz 3, 20146 Hamburg, Germany, <ganzhorn@zoologie.uni-hamburg>.

Demande d'information

Nous sommes en train de procéder à l'analyse détaillée de la biogéographie des lémuriens. Les objectifs du projet sont d'évaluer le rôle des rivières en tant que barrière dans la dispersion des lémuriens, de détecter les différents aspects de la distribution altitudinale et d'effectuer l'analyse biogéographique sur une plus grande échelle. Nous serions très reconnaissants aux chercheurs de nous faire parvenir des listes d'espèces non publiées pour des sites que vous avez inventoriés ou des observations personnelles avec les coordonnées, l'altitude, les types d'habitat, les dates, etc. Par ailleurs, nous apprécierons aussi tous détails relatifs à l'identification d'une observation "inhabituelle". Les informations reçues seront incorporées dans une base de données et utilisées à des fins d'analyse. Tous les contributeurs re-

cevront des copies des publications qui résulteront de cette analyse. Veuillez envoyer les informations à Steve Goodman, WWF, B.P. 738, Antananarivo (101), Madagascar, <sgoodman@wwf.mg> or Jörg Ganzhorn, FB Biologie, Ecology and Conservation, Martin Luther King Platz 3, 20146 Hamburg, Germany, <ganzhorn@zoologie.uni-hamburg>

Studbooks for *Eulemur rubriventer* and *Eulemur coronatus*

Studbooks on the above lemur species have been completed. They are available from:
Dr Vet P. Moisson, Parc Zoologique et Botanique, 51 Rue du Jardin Zoologique, 68100 Mulhouse, France,
<moisson@hrnet.fr>

ARTICLES

Exploitation of the cicada (*Pycna madagascariensis*) for food by black lemurs (*Eulemur macaco macaco*) and brown lemurs (*Eulemur fulvus fulvus*)

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Key words: Lemurs, arthropods, meat eating

The black lemur at Lokobe RNI and the brown lemur at Tsaratanana RNI have both been observed catching and eating the cicada *Pycna madagascariensis* (Cicadidae). This cicada, known locally as *pinjy*, is a large insect with a body (i.e. excluding wings) 4 cm long x 2 cm wide x 1 cm deep. In October each year cicada nymphs emerge from the soil, crawl up vegetation and molt to produce the winged adult. These gather in groups (leks) of up to a few hundred individuals on sunny trunks and branches and stridulate loudly to attract mates. Lemurs seek out these sites where they chase, capture and eat these insects. The lemurs catch the cicadae by energetically leaping on them and grasping them with one or two hands. The cicadae are generally eaten where they are caught, with only the wings being discarded. The cicadae attempt to avoid capture by flying away when they detect the approach of a potential predator but the lemurs seem to have a relatively high capture rate (around one capture every 4 minutes). After mating and laying eggs the adult cicadae die and by mid November none are left alive. During an 18-month study of a black lemur group in the Lokobe Forest, cicadae were the most important food item for October 1992 (accounting for 27 % of total time spent feeding during the day for that month; Birkinshaw 1995) despite the apparent abundance of ripe fruit. In the previous and proceeding months cicadae were not available and this group was almost entirely frugivorous. This illustrates the ability of *E. macaco* to change its diet dramatically in response to changes in food availability (in this case the temporary super abundance of a large relatively slow-moving insect). We also observed this cicada species being eaten by the broad-billed roller (*Eurystomus g. glaucurus*), the crested drongo (*Dicrurus forficatus*), and people (who fry them).

Several other arthropod species have been reported in the diets of *Eulemur* species. The black lemur ate froghoppers at the Lokobe Forest (Birkinshaw 1999), and millipedes at Ambato Massif, Nosy Faly (Colquhoun 1993). During a 15-month study of four black lemur groups at Ambato Massif, this lemur was observed to eat millipedes only in December 1991 (two of the four groups), accounting for 0.6 % of all feeding activity (Colquhoun 1997). *E. coronatus,* the crowned lemur, and *E. fulvus sanfordi*, Sandford's lemur, at Mt. d'Ambre, both infrequently ate millipedes and spiders, although Sandford's lemur ate arthropods more frequently than did crowned lemurs (Freed 1996). Millipedes were eaten exclusively during the wet season when they seemed most abundant. *E. rubriventer*, the red-bellied lemur, and *E. fulvus rufus*, the rufous lemur, at Ranomafana, both ate 3 species of millipedes and a species of pill bug, but in addition, the rufous lemur, on one or two occasions, ate walking sticks, red ants and flies (Overdorff 1993). Once again, feeding on arthropods was restricted to the wet season, with a peak in November when these two species ate this class of food for 12 and 7 % of observed feeding time respectively. *Eulemur fulvus albifrons*, the white-fronted brown lemur, at Andranobe on the Masoala Peninsula, ate millipedes, spiders and insects (taxa unspecified) (Vasey 2000). *Eulemur mongoz,* the mongoose lemur, at Anjamena, ate ants for 1 % of the observation time spent feeding (Curtis 1997).

Acknowledgements
My thanks to Patrice Antilahimena who identified the species of cicada and to Claire Hemingway for her helpful comments on a previous version of this paper. The fieldwork in Tsaratanana was supported by the National Geographic Society Grant Number 41699.

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Hunting of wild animals by Sakalava of the Menabe region: a field report from Kirindy-Mite

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Key words: Lemurs, bushmeat, hunting

Implicit in Madagascar's conservation paradigm is the notion that the major threat to Malagasy terrestrial animals is forest degradation in the form of slash-and-burn agriculture and conversion of natural habitats into cattle pasture. Except for a few cases (Favre 1996; Hawkins 1999; Randriamanalina *et al*. 2000), human hunting has not been cited as a principal pressure on natural animal populations, particularly for primates. However, more recent information indicates that this aspect has been given less attention than it deserves, at least in certain portions of the island.

A recent case has become known amongst Sakalava of the Boina area where collectors of raffia palm fibers while camping over the course of several months per year in the protected area complex of Ankarafantsika hunt wild animals for subsistence (Garcia and Goodman 2003). In this example, of the 49 animals identified from bone remains collected in their camp, 32 were primates and included five *Lepilemur edwardsi*, 12 *Eulemur fulvus*, three *Avahi occidentalis*, and 12 *Propithecus verreauxi*. Herein we present information of another example of extensive wild animal hunting within an existing protected area, in this case amongst the Sakalava-Menabe in the region of Kirindy-Mite, also known as Kirindy-Sud.

Site

During the month of November 2002 we were members of a group that conducted a biological inventory of the Parc National de Kirindy-Mite, south of Morondava and inland from Belo sur Mer (this site should not be confused with Kirindy–CFPF north of Morondava). This recently named park is relatively poorly known and forms a transitional zone between the deciduous forests to the north and the spiny bush to the south (Rakotoarimanana and Roger 1997). Previous work in this zone includes some plant, bird, and primate surveys (Hawkins 1996; Rakotoarimanana and Roger 1997; Projet ZICOMA 1999; Zinner *et al*. 2001).

Over the course of three days in mid-November 2002 we camped near the village of Betakilotse (20° 53.2´ S, 44° 04.8'E), which is within the park and 11 km to the southeast of the village of Marofihitsa. About 9 different Sakalava-Menabe families that colonized this zone several decades ago from the village of Marofihitsa occupy Betakilotse. They are largely pastoralists, but seasonally cultivate certain agricultural crops such as peanuts, corn, and sweet potatoes. They regularly supplement their diet with wild collected animals and plant tubers.

During the few days we were with people from Betakilotse discussions were often directed to their exploitation of forest resources and hunting techniques. Further, we also rummaged through a refuse dump next to one house in the village and obtained physical evidence of different animals these people hunt. These remains included a wide assortment of bird feathers and mammal bones, mostly from wild animals, corncobs, peanut husks, honeycomb, and some other assorted items. In this report we present information on the physical remains found at this site and aspects of our discussions with local people associated with their hunting activities.

Results

Feathers of a wide assortment of birds were found in the refuse debris. It was difficult to quantify the number of individuals involved. In Table 1 is a list of the species identified and their relative abundance amongst these remains. Only one humerus of a *Coua cristata* was recovered from the bone remains.

Table 1: Species of birds identified from feather remains in the refuse dump next to one house in the village of Betakilotse with estimates of the minimum number of individuals represented within the sample.

Species	Minimum number of individuals
Coua cristata	abundant (15-20)
Numida meleagris	abundant (10-15)
Coua ruficeps	common (about 5)
Coracopsis sp.	common (about 5)
Turnix nigricollis	common (about 5)
Gallus gallus (chicken)	present (2-3)
Accipiter cf. *henstii* (large)	present (1-2)
Leptosomus discolor present	present (1-2)
Upupa epops	present (1-2)
Agapornis cana	present (1-2)
Copsychus albospecularis	present (1-2)
other small passerines	present (1-2)

Amongst the bone remains recovered from the site there was a preponderance of lower jaws, particularly of primates and very few long bones. The species identified from the remains are listed in Table 2.

Table 2: Species of mammals identified from bone remains in the refuse dump next to one house in the village of Betakilotse.

Species	Minimum number of individuals
Propithecus verreauxi	6
Lemur catta	3
Eulemur fulvus	2
Lepilemur ruficaudatus	2
Tenrec ecaudatus	1
Bos (zebu)	1*
* Represented by two bone fragments.	

Discussion

A wide variety of wild animals were identified from the garbage debris found next to a single family dwelling in the village of Betakilotse. In most cases, particularly for the mammal species, these are forest dwelling species that do not occur in secondary habitats or outside the forest. The single wild mammal species in this collection that can be found in non-forested zones is *Tenrec ecaudatus*. In contrast, a considerable number of the bird species represented in this sample are species that do not necessarily occur in forested zones or are forest dwelling species that can be found at the forest edge. For example, *Coua cristata*, which is normally considered a forest species, is common in anthropogenic savanna containing scattered trees.

On the basis of discussions with local people the following information could be obtained about their wild animal exploitation activities. Hunting takes place throughout the year, but is most intense during the dry season (May to October) when their agricultural plots are not productive and

there is a general lack of food. Hunting parties are almost exclusively made up of family groups (i.e. people living in the same house). The only non-family members of these groups on occasion are three sling-shooting specialists from the village. Virtually all mammals and birds living in the area are amongst the fare local people will hunt and consume. No mention was made of any taboo (*fady*) species with the exception of rodents, specifically the introduced *Rattus rattus*, and owls. Amongst those mammals they named as being hunted and not listed in Table 2 are the Carnivora *Cryptoprocta ferox*, *Mungotictis decemlineata*, and the introduced *Viverricula indica* and the presumably introduced Artiodactyla *Potamochoerus larvatus*. In the case of the latter species, which was rather common in the area and an important pest to agricultural crops, there appeared to be a sort of stigma associated with its hunting or consumption and thus this bush pig may be considered a *fady* animal by some. Another perspective on this point is that lemurs are easier to hunt and their flesh is more esteemed than bush pigs.

Birds are disproportionately represented in the sample by feathers and virtually no bone material was found. In contrast, we found no evidence of any mammal fur in the midden remains and these animals are exclusively represented by bone. What effect scavenging animals such as *Cryptoprocta*, which enter the village during the night, *Viverricula*, and dogs or culinary techniques associated with the human consumption of these animals have on the items remaining in the middens is unknown. In the hypothetical example of this analysis having been conducted based on excavated archeological remains several hundred years in the future, when all or most feathers would have deteriorated and only bone remaining, the number of birds in the sample would have been substantially underestimated.

Several different hunting techniques are used, depending on the type and size of the potential prey. For birds, a type of strap sling or sling shot are employed to subdue these animals. If captured alive the wing feathers are usually removed, the wings tied behind the back, and the bird is brought back alive to the family house to be subsequently consumed. For *Numida* a sort of tree-fall trap baited with corn is often used to capture these birds.

For primates at least two different techniques are used – dogs and slings. For example, one informant mentioned that it was a rather simple matter to obtain up to three *Propithecus* during a morning's hunt. Once the *Propithecus* troop was found dogs were sent to chase these animals. At the same time people moved quickly ahead in the direction they believe the dogs will chase the primates. With the dogs in pursuit the sifakas quickly displaced through the forest between vertical trunks. With each displacement they lose some vertical height, as they did not have the chance to shimmy up the trunks while being chased by the dogs. After some distance they reached the area the hunters were waiting for them, being both physically tired by the pursuit and relatively close to the ground. At this point they are rather easy prey for the hunters to dispatch with their slings. For the other diurnal primates (*Eulemur fulvus* and *Lemur catta*), hunters prefer using a type of noose thin rope trap placed on horizontal limbs. In some cases these traps are baited with items such a fruit that might attract lemurs. It is apparently nearly impossible to capture sifaka with this technique, as they displace vertically and are reputed to use their hands to destroy this type of trap.

Other mammals, such as *Tenrec* or *Setifer* are simply obtained from digging them out of their burrows or being pursued by dogs and then killing them with spears. During the height of the season, presumably during the months of December to March, a single capable hunter can collect up to 20 *Tenrec* per day. For Carnivora an assortment of different traps are used. The details of their configuration were not discussed with our informants, but rather they mentioned that *Tenrec* entrails are excellent bait for these traps.

The forest within a few kilometers of the village of Betakilotse is known as the Forêt d'Ankoadava, one of the more intact and parts of large forest block of the Parc National de Kirindy-Mite. Although with few signs of selective tree extraction or other human perturbations, this forest is remarkable devoid of diurnal primates as compared to other sites visited within the park with presumably less human hunting pressure. During the three days we were in the Forêt d'Ankoadava we had one observation of *Lemur catta* and on another day heard this species calling. The nearly complete lack of diurnal primates in this forest was confirmed by one of our guides. He noted that several years ago the Forêt d'Ankoadava was an excellent place to find *Lemur, Eulemur*, and *Propithecus*, but after extensive hunting pressure these animals are now rare in this zone. Further, the remark was made that it is necessary for the people of Betakilotse to go much further into the forest to have successful hunts. In contrast, virtually all of the birds represented in the midden remains were still relatively common around the village; most notable in this regard are *Coua cristata* and *Numida meleagris.* We were left with the impression that many of the birds consumed by these people may be hunted with sling shots by young men moving on a daily basis with the family cattle herds, while the lemurs are associated with more formal hunting techniques in the forest. One of the other serious problems is the number of village and perhaps feral dogs moving in the forest. One person mentioned that another serious problem over and above animals they hunt, is that dogs produce considerable stress in wild animals, and this in turn might reduce reproductive rates. The example that was cited is that when a sifaka hears a dog barking, even at a considerable distance, they become extremely nervous and tremble.

One informant mentioned that the family members responsible for our midden site were not exceptional hunters and other family groups in the village were as or perhaps even more skilled. We have no idea from what period the bone remains date from, but given that most showed no signs of bleaching from the intensive solar radiation and that many had slight traces of attached tissue, we assume that they represent relatively recent hunted animals. Further, during a portion of the rainy season, presumably the period from January to March, much of the village of Betakilotse floods with close to 1 m of water. We found no evidence amongst the midden remains of such flooding and presume all had been deposited since the end of the last seasonal flood.

The impact of extensive hunting within the reserve seems to be already discernible on diurnal primates and clearly the current level is not sustainable even on the short term. Clear steps need to be taken by the park authorities to ameliorate these problems or certain populations of primates will be locally extirpated.

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Project Betampona Update

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Several exciting developments have occurred during the past year in the Madagascar Fauna Group's (MFG) experimental re-stocking programme for captive-bred *Varecia v. variegata*. First, the female released in January 2001 (Britt *et al.* 2001) mated with a wild male in July last year and produced twin infants in October. This represents a major milestone for the project, being the first recorded successful mating between a released captive-bred *Varecia* and a member of the resident population. The infants appear to be thriving and both the mother and father are sharing the parental duties of guarding them. Second, a male released in November 1997 (Britt *et al.* 1998) who had successfully integrated into a wild group in the north of the reserve (Britt *et al.* 2000), was regularly sighted in the company of a wild female and a single infant earlier this year. He is presumed to be the father, hence there is further evidence that suggests reproduction between the released captive-bred *Varecia* and the resident population has taken place. The project has thus achieved one of its major aims: to reinforce the small, potentially inbred resident population through the introduction of new genetic material from the unrelated captive population. Further news includes the departure of the eldest son of the female released in 2001. His whereabouts are currently unknown due to the failure of his radio-collar, but he is presumed to be somewhere in the reserve and like the male released in 1997 is perhaps attempting to integrate into a wild group. His twin siblings are ranging slightly to the north of their mother, the wild male and their half-siblings. The surviving daughter (one of triplets) of a pair released in 1997 (Britt *et al.* 2000) has moved into an area further north, but is still regularly sighted in the company of a wild male. She remains too young to breed, but hopefully she will be capable of doing so by July 2005. (N.B. Some doubt has been expressed by the MFG field team over the gender of this animal.)
No further losses to predation by Fossa (*Cryptoprocta ferox*) have occurred since November 2000 (Britt *et al.* 2001) and the remaining releasees survived the last winter without the need for supplementary feeding. It is hypothesised that their association with members of the resident *Varecia* population has enabled them to learn by example the appropriate strategies for coping with these periods of cool temperatures and relative fruit scarcity.
In summary, the MFG have released 13 captive-bred *Varecia* since 1997 of which 5 are still surviving - a survival rate of 38.5 %. In addition 6 infants have been born as a result of this re-introduction, with 4 still surviving. Thus 9 *Varecia* survive as a result of the re-introduction, an overall survival rate of 61.5 %. Additionally full integration and reproduction with the resident population has occurred. It is concluded that the reinforcing of small, isolated populations of *Varecia* through the release of individuals from the captive population is a viable, if expensive, conservation strategy for these endangered primates.

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The World's Top 25 Most Endangered Primates – 2002

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In January 2000, Conservation International and the IUCN/SSC Primate Specialist Group released a report - "The World's Top 25 Most Endangered Primates" - a list of threatened prosimians, monkeys and apes whose survival beyond the present century will depend heavily on actions taken now by our own species (Mittermeier *et al*. 2000). The impetus for the original report was two competing realities, one being the lack of any documented primate extinctions during the 20th century – a remarkable record in light of recorded losses among other groups of animals during the same period – and the other being the results of an assessment that identified approximately 120 of the world's estimated 620 types of primate as being in serious danger of extinction within the next few decades. The Top 25 that we named in 2000 were merely the tip of the iceberg.
Two years later, we released a new report based on updated information, especially with regard to Asian primates. Since the original report, the Species Survival Commission (SSC) of IUCN – The World Conservation Union launched a pro-

gram of ongoing conservation status assessments for the world's threatened plant and animal species (Hilton-Taylor 2002), As many experts had feared, the number of species threatened with extinction continues to rise despite our best efforts to ensure their survival. This new report considers preliminary results from primate workshops and assessments that have recently been conducted in Coimbatore, India, for South Asia (IUCN/SSC Conservation Breeding Specialist Group, in prep.), in Indonesia (Supriatna *et al*. 2002), Madagascar (Razanahoera-Rakotomalala *et al*. 2002), and Vietnam (Action Plan in prep.), which recommend listing as many as 195 primate species and subspecies as endangered or critically endangered. New assessments suggest that, from approximately 20 % only a few years ago, we should now consider more than 30 % - close to one in every three – of all primates to be seriously threatened with extinction. The increase from 120 to almost 200 largely reflects new information available from Asian countries. It is not surprising, therefore, that Asia now accounts for almost 45 % - only slightly less than half – of the world's most endangered primates, or not many less than the three other major regions where primates occur – the Neotropics, Africa and Madagascar – combined (Table 1).

Table 1: Numbers of Critically Endangered (CR) and Endangered (EN) primates (Hilton-Taylor 2002).

Region	**CR**	**EN**	**Total**
Neotropics	17	17	34
Africa	10	33	43
Madagascar	10	21	31
Asia	18	69	87
Totals	55	140	195

Within these regions, a total of 49 countries harbor wild populations of the world's most endangered primates: eight countries in the Neotropics, 24 in Africa, 16 in Asia, and Madagascar (a major primate region as well as a country). The top 10 nations, in terms of endangered primates, according to the most recent assessments are shown in Table 2.

Table 2: Top ten countries in terms of numbers of Critically endangered (CR) and Endangered (EN) primates (Hilton-Taylor 2000).

Country	**CR**	**EN**	**Total**
Indonesia	4	31	35
Madagascar	10	21	31
Brazil	10	9	19
China	5	10	15
India	2	13	15
Vietnam	5	10	15
Equatorial Guinea	0	11	11
Nigeria	1	9	10
Sri Lanka	1	8	9
Cameroon	1	7	8

Madagascar and Brazil have long led the list of countries having the most endangered primates, but both have now been overtaken by Indonesia, based on the results of a workshop held by the IUCN/SSC Conservation Breeding Specialist Group (CBSG) in January 2001 (Supriatna *et al*. 2001). Included on the new list of threatened primates are six endangered tarsier species found only in Indonesia. Prior to the Indonesian workshop, none had been considered endangered. However, all six of the newly-added species represent small, isolated, island populations; three of the six are new to science and, as yet, un-named. Firmly in the middle of the pack of nations are China, India and Vietnam, each with 15 endangered primate species and subspecies. Such significant levels of primate endangerment have been recognized for China and Vietnam for a number of years, but India's elevated standing stems from another recent CBSG workshop that focused on South Asian primates, held in Coimbatore in March 2002 (IUCN/SSC Conservation Breeding Specialist Group, in prep.). Workshop results also placed Sri Lanka on the Top 10 list, as the island nation's primates are largely endemic and highly threatened. Four Sri Lankan lorises, in fact, represent the only members of the primate family Loridae that have been categorized as endangered at this time.

The larger primates, especially the colobines and small apes, represent the majority of Asia's most threatened species. Forty-eight members of the Asian colobine genera *Nasalis*, *Presbytis*, *Pygathrix*, *Rhinopithecus*, *Semnopithecus*, *Simias* and *Trachypithecus* are either endangered or critically endangered, representing just over half of their 90 recognized species and subspecies. This situation parallels that of the gibbons, of which 15 of 28 recognized taxa are now considered among the world's most endangered primates.

There are only three Asian great apes, the monotypic orangutan (*Pongo abelii*) found on the Indonesian island of Sumatra, and two subspecies of Bornean orangutan (*Pongo pygmaeus*), but all are endangered. This also holds true for all 10 species and subspecies of African apes – the four subspecies of common chimpanzee, the pygmy chimpanzee (or bonobo) and five recognized types of gorilla. We humans (*Homo sapiens*), by contrast, represent the only species in the family Hominidae that is not considered endangered. With a global distribution and a population exceeding six billion, far from it!

Our activities, in fact, are the principal cause for decline of our closest living relatives. We have long cleared forest land to support agriculture, degraded habitats to collect fuelwood, logged to extract valuable timber, and hunted to provide meat for the table. Wild primate populations – as well as many other species - have suffered as a result. Live capture for the pet trade and export for biomedical research have become lesser concerns in recent decades, but still pose a threat to some species. Today, however, the most insidious threat is that of commercial hunting, which goes far beyond the subsistence needs of rural populations to supply major cities and international markets. In Central and West Africa this is being done largely to supply food, in Asia largely to produce salves, balms and potions. In both cases, overexploitation is creating an "empty forest syndrome" and contributing to the demise of wild primates in a number of countries.

We are not surprised, therefore, in our analysis of the updated list of endangered and critically endangered primates, to find that the overwhelming majority are to be found in the world's 25 biodiversity *hotspots*, that have been identified by Conservation International as covering merely 1.4 % of Earth's land surface but holding within them more than 60 % of all terrestrial plant and animal diversity. Fifteen hotspots harbor native populations of non-human primates, and the 195 most endangered species can be found in a dozen of these (Brooks *et al*. 2002). Also, according to our analysis, 48 (87 %) of the 55 critically endangered primates and 124 (89 %) of the 140 endangered primates are endemic to the hotspots, for a total of 172 (88 %) of the current 195. Of the hotspots, six should be considered the highest priorities for the survival of the world's most endangered primates – Indo-Burma, Madagascar, Sundaland, the Guinean Forests

of West Africa, the Atlantic Forest of Brazil, and the Western Ghats/Sri Lanka.

Between them, these six hotspots cover approximately 500,000 km^2 – just over three-tenths of one percent of Earth's land surface – yet hold 137, or roughly 70 %, of the world's most endangered primates in the tropical forests that remain.

Table 3: Numbers of Critically Endangered (CR) and Endangered (EN) primates (Hilton-Taylor 2002) in six biodiversity hotspots (Myers *et al*. 2000).

Hotspot	CR	EN	Total
Indo-Burma	11	20	31
Madagascar	10	21	31
Sundaland	5	23	28
Guinean Forests	5	20	25
Atlantic Forest	8	3	11
Western Ghats/ Sri Lanka	2	9	11
Totals	41	96	137

Information from this report will help to update the *IUCN Red List of Threatened Species*, though we realize that our assessment efforts to date have not examined all primate habitat regions sufficiently and still probably underestimate the number of endangered species, as well as the extent to which they are threatened. We recognize that new information continues to appear regarding the conservation status of threatened taxa and we do not consider any single document to be the final determinant of such a list. Also, we appreciate that our ability to safeguard primate diversity will depend not only on developing comprehensive lists of those species and subspecies we consider to be threatened, but on drawing attention to those whose situation is most critical, highlighting the kinds of efforts that are being undertaken to save them, acknowledging both our successes and our failures, and continually re-examining the situation on a global scale so that we remain confident in establishing priorities for action.

The World's Top 25 Most Endangered Primates – 2002 is more than a tally of those species with the fewest numbers of individuals remaining. We also recognize the importance of: Primate species recently discovered or rediscovered and known from only a few localities;species whose populations may have been considered stable only a few years ago but are now under severe pressure, in rapid decline and under serious threat of extinction; and varieties of primates that traditionally have not been recognized as distinct but are likely to be so as the result of ongoing genetic and field research.

Table 4: The 25 Most Endangered Primates – 2002 (listed in taxonomic order)

Scientific name	Vernacular name	Location
Hapalemur simus	Greater bamboo lemur	Madagascar
Propithecus perrieri	Perrier's sifaka	Madagascar
Propithecus candidus	Silky sifaka	Madagascar
Leontopithecus caissara	Black-faced lion tamarin	Brazil
Cebus xanthosternos	Buff-headed capuchin	Brazil
Brachyteles hypoxanthus	Northern muriqui	Brazil
Procolobus badius waldroni	Miss Waldron's red colobus	Ghana and Côte d'Ivoire
Cercopithecus diana roloway	Roloway guenon	Ghana and Côte d'Ivoire
Cercocebus atys lunulatus	White-naped mangabey	Ghana and Côte d'Ivoire
Cercocebus galeritus galeritus	Tana River mangabey	Kenya
Procolobus rufomitratus	Tana River red colobus	Kenya
Cercocebus galeritus sanjei	Sanje mangabey	Tanzania
Presbytis natunae	Natuna banded leaf monkey	Indonesia
Simias concolor	Pig-tailed snub-nosed monkey	Indonesia
Trachypithecus delacouri	Delacour's Langur	Vietnam
Trachypithecus poliocephalus	Golden-headed langur	Vietnam
Trachypithecus leucocephalus	White-headed Langur	China
Pygathrix nemaeus cinerea	Gray-shanked douc	Vietnam
Rhinopithecus avunculus	Tonkin Snub-nosed monkey	Vietnam
Rhinopithecus bieti	Yunnan Snub-nosed monkey	China
Rhinopithecus brelichi	Guizhou Snub-nosed monkey	China
Nomascus nasutus	Eastern black crested gibbon	China and Vietnam
Gorilla beringei beringei	Mountain gorilla	Democratic Republic of Congo, Rwanda, Uganda
Gorilla gorilla diehli	Cross River gorilla	Nigeria and Cameroon
Pongo abelii	Sumatran orangutan	Indonesia

In addition, we feel that it is important to remove species from the Top 25 list, at least temporarily, as their situation becomes less urgent or we feel that sufficient efforts and resources are being directed to their survival. While their conservation status and numbers may not change appreciably because of our efforts, we may remove them in favor of other species to which we feel more attention should be given, or whose situations highlight conservation techniques or accomplishments that need to be shared with broader audiences. To arrive at the current list, we decided to drop species such as the golden lion tamarin, black lion tamarin, yellow-tailed woolly monkey and golden-crowned sifaka, since we consider that good progress has been or is being made to ensure the survival of each.

The original World's Top 25 Most Endangered Primates was well received. We have seen cases where a species' presence on the list has been used effectively by conservation organizations to raise funds to put researchers in the field, to train and supply forest guards, to conduct local public awareness campaigns, and to create new parks and reserves. In fact, the Margot Marsh Biodiversity Foundation, which was established in 1995 and has rapidly become one of the world's most important sources of support for primate conservation, actively solicits and supports proposals that focus on species appearing on this list.

The World's Top 25 Most Endangered Primates – 2002 is presented in conjunction with the International Primatological Society, which recently held its 19th Congress in Beijing, China. The list was discussed during a special session at the Congress, and among the participants were many of the dedicated individuals whose work contributes to the continued survival of these species and other threatened primates worldwide. The full report, dated 7 October 2002, with profiles of each of the species, is available as a pdf file at:

<www.conservation.org/xp/CIWEB/newsroom/press_releases/100702>.

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Étude comparative de *Hapalemur simus* (Gray, 1870) de deux sites de la province autonome de Fianarantsoa, Madagascar: forêt dégradée d'Ambolomavo et forêt secondaire du Parc National de Ranomafana

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Key words: *Hapalemur simus*, dermatoglyphes, paternity, social system, genetics, food composition

Introduction

Hapalemur simus ou "Varikovoka ou Varibolo" est un lémurien diurne, vivant dans des zones de bambous très denses de la forêt primaire et de la forêt dégradée de l'Est (Petter *et al.* 1977; Wright *et al.* 1987). Il se nourrit surtout de grosses pousses de bambous de l'espèce *Cathariostachys madagascariensis*, en arrachant l'écorce avec ses incisives pour pouvoir manger la moelle de la tige. De plus, il consomme de jeunes pousses de *Ravenala madagascariensis*, des fruits d'*Artocarpus integrifolius*, de *Ficus* sp., de *Dypsis* sp. et de *Pennisetum clandestinum* (Meier *et al.* 1987; Garbutt 1999). Afin d'étudier l'impact de la dégradation forestière sur l'écoéthologie des *H. simus*, nous avons effectué une étude comparative dans deux sites différents, une forêt dégradée à Ambolomavo et une forêt secondaire dans le parc national (P.N.) de Ranomafana.

Matériels et méthodes

Sites: Le P.N. de Ranomafana se situe à 400 km au sud de la ville d'Antananarivo, à 65 km au nord-est de la ville de Fianarantsoa, (21°17' S, 47°25' E). Son altitude se situe entre 400 et 1374 m. Sa végétation climatique est une forêt dense humide. Le Parc a une superficie de 41600 ha (Ramarokoto *et al.* 1999) et est subdivisé en trois parcelles. Notre étude a été menée dans la parcelle n°3. La forêt dégradée d'Ambolomavo se trouve à une cinquantaine de kilomètres à l'Est du P.N. de Ranomafana. entre 21°20' et 21°21' S et 47°47' E. L'altitude est comprise entre 206 et 282 m. Cette forêt d'Ambolomavo est caractérisée par un défrichement ou "Tavy" très accentué, presque inexistant dans le P.N. de Ranomafana. Le défrichement est destiné à faire de la culture sur brûlis (riz et manioc).
À Ambolomavo, nous avons observé deux groupes de *H. simus*. Un groupe de six femelles: un adulte (E7), trois subadultes (E18, E19 et E21), deux juvéniles (E8 et E20) et un groupe de trois mâles: un adulte (E17), un subadulte (E22) et un juvénile non capturé. Au cours de cette étude, nous avons suivi seulement le groupe de six femelles moins sauvages que le groupe des mâles.
À Ranomafana, et plus précisément dans la zone de Talatakely, un groupe de sept animaux a été étudié dont trois mâles: un adulte (E13), deux subadultes (E15 et E16), deux femelles: une adulte (E14) et une subadulte, un juvénile et un petit non capturés. En mars 1998, Tan (comm. pers.) a dénombré dans ce dernier site neuf individus (trois mâles, deux femelles adultes et quatre enfants).

Suivi: Les observations ont été effectuées aux mois de mars, avril et mai 2000 à Ambolomavo et à Ranomafana, puis uniquement à Ambolomavo aux mois de septembre et octobre 2000. Nous avons dû augmenter le volume horaire d'observation des animaux à Ambolomavo car, dans ce site, ces derniers sont sauvages et souvent très difficiles à approcher. Pour le groupe d'Ambolomavo, le total des heures d'observation a été de 693 heures contre 176 pour le groupe de Ranomafana. Pour le suivi journalier, nous avons utilisé la méthode de "Scan sampling" de Altmann (1974) qui consiste à noter dans le groupe les principales activités (déplacement, alimentation et activités sociales). Pour déterminer la superficie du domaine vital, nous avons utilisé la "méthode des grilles" (Ralisoamalala 1996) qui consiste à compter le nombre de carrés (25 x 25 m) traversés par le groupe.

Capture: La capture des animaux a été effectuée par injection de 0,5 ml de solution de kétamine à 50 mg/ml (Kétalar®) à l'aide d'un fusil à air comprimé. Après quelques minutes, lorsque l'animal est complètement endormi sous l'effet de l'anesthésie, on le recueille prudemment dans un sac de jute (Rabarivola 1998).

Prélèvement et conditionnement des échantillons: Pour chaque animal, on a prélevé 2 à 3 ml de sang dans la veine fémorale, puis les tubes étiquetés ont été stockés dans de l'azote liquide. Un petit bout d'oreille a été prélevé à l'aide d'une lame de bistouri stérile après rasage des poils et nettoyage à l'alcool à 90 %, puis mis dans un tube de Nunc® et stocké dans de l'azote liquide. Chaque animal a été marqué au niveau de la queue en coupant les poils d'une façon caractéristique, puis relâché à l'endroit même du lieu de capture.

Prise des empreintes palmo-plantaires: Elle consiste, d'une part, à lire directement les différents dessins de la paume et de la sole, à l'aide d'une loupe, et, d'autre part, à obtenir les empreintes en utilisant de l'encre. Les dermatoglyphes se présentent sous plusieures formes au niveau des coussinets: boucles, tourbillons, arcs, champs ouverts et vestiges de dessins. Les coussinets sont des sortes d'éminences en formes de "coussin" qui garnissent l'extrémité interne des doigts, la face interne des orteils et des pieds. Les coussinets palmaires et plantaires montrent des coussinets bombés et bien individualisés.

Techniques de laboratoire: Extraction de l'ADN: la technique employée est celle décrite par Sambrook *et al.* (1989). La concentration en acides nucléiques des échantillons est mesurée par absorption à 260 nm.

Conditions d'amplification: Recherche de paternité par la technique de RAPD (Random Amplified Polymorphic DNA): Pour les études de recherche de paternité, nous avons employé la technique de RAPD. L'ADN a été amplifié *in vitro* l'ADN par "polymerase chain reaction" (PCR) en employant des amorces oligonucléotidiques aléatoires (Operon Technology, OPA, OPE et OPH). Les segments d'ADN amplifiés correspondent aussi bien à des régions codantes qu'à des régions non codantes (Welsh et Mc Clelland 1990; Clark et Lanigan 1993; Lynch et Milligan 1994). Les conditions de réactions sont celles décrites par Fausser *et al.* (2000). Après amplification, les produits obtenus sont analysés sur gel d'agarose. Les profils sont comparés et les bandes communes entre deux individus notées.

Étude du cytochrome b: nous avons employé une réaction de PCR afin d'amplifier un fragment de 357 paires de bases correspondant à une portion du gène du cytochrome b porté par l'ADN mitochondrial. Nous avons employé la paire de primers suivants:
Pr181: 5'-CCATCCAACATGTCAGCATGATGAAA-3' et Pr182: 5'-CCCTCAGAATGATATTTGTCCTCA-3', dérivée de celle décrite par Kocher *et al.* (1989). Les conditions de réactions ont été décrites précedemment (Fausser *et al.* 2002). Les produits d'amplification sont ensuite soumis à une électrophorèse sur gel d'agarose. Après examen des gels sous lumière UV, la bande majeure est découpée puis sequencée (ABI PRISM sequencer et Taq dye deoxy terminator cycle sequencing kit). Chaque échantillon est séquencé dans le sens 5'-3' et 3'-5', puis les séquences sont alignées et comparées. Les distances génétiques (d) sont calculées par la méthode de Kimura à deux paramètres à l'aide de la formule suivante: d= -1/21n[(1-2P-Q)Xsqr(1-2Q)] avec P: nombre de transitions/nombre de positions et Q: nombre de transversions/nombre de positions; ln: logarithme népérien.Les arbres phylogénétiques sont construits à l'aide du programme "Phylogenetic Analysis Using Parsimony" (PAUP) *4.0 (Swofford 2000).

Statistiques: Le test de chi-2 et le test de student (Schwartz 1963) ont été utilisées pour l'analyse des données.

Résultats et Interprétations

Étude morphologique
Étude des dermatoglyphes et des coussinets: les boucles prédominent sur les coussinets palmaires de *H. simus* tant à Ambolomavo qu'à Ranomafana (50,4 % Ambolomavo et 33,6 % Ranomafana). Pour les coussinets plantaires, on a constaté la prédominance des champs ouverts (55,2 % Ambolomavo et 36,8 % Ranomafana). On note une tendance à la simplification des dermatoglyphes de la sole plantaire par rapport à ceux de la paume. La présence des coussinets palmaires et plantaires aplatis et plus ou moins allongés proxodistalement favorise la remarquable adaptation au saut d'un support à un autre. La locomotion quadrupède sur les branches et le saut de grande amplitude d'une tige verticale à une autre suggère que les hapalemurs pourraient être considérés comme possèdant un mode de locomotion intermédiaire entre les Lemuridae et les Indriidae (Rabarivola 1990). L'hallux est plus allongé chez *H. simus* que chez *H. griseus,* et la fusion de quatre coussinets (deux par deux) montreraient une adaptation plus poussée pour la saisie des différents supports au cours des sauts. Il n'y a pas de différence statistiquement significative ni au niveau des dessins des coussinets palmaires, ni au niveau des dessins des coussinets plantaires entre les *H. simus* d'Ambolomavo et ceux de Ranomafana.
Mensurations: pour pouvoir homogénéiser les différentes mensurations, seuls les animaux adultes et subadultes ont été considérés (Tableau 1). Pour les dix variables étudiées (longueur de l'oreille, longueur de la paume, longueur de la sole plantaire, tour de poitrine, longueur de la symphyse pubienne – gorge, longueur de l'hallux, longueur du pouce, longueur de la queue, longueur de la jambe et longueur totale de l'animal), le test *t* n'a montré aucune différence morphologique entre les *H. simus* d'Ambolomavo et ceux de Ranomafana.

Tableau 1: Tableau récapitulatif des valeurs moyennes des différentes mensurations faites sur *H. simus* d'Ambolomavo et de Ranomafana.

Longeur (en mm)	**Ambolomavo (n = 6)**	**Ranomafana (n = 5)**
Oreille	36,25	35,00
Paume	80,75	77,75
Sole plantaire	115,00	116,25
Tour de poitrine	285,25	278,75
Symphyse pubiennegorge	257,50	232,50
Hallux	68,75	64,75
Pouce	36,50	37,50
Queue	483,75	460,00
Jambe	138,75	167,75
Longueur totale	876,25	835,25

Etude génétique:
La recherche de paternité a été menée sur deux groupes de *H. simus*. Le premier groupe comprend quatre animaux capturés dans la région de Ranomafana (mâles E13, E15, E16, femelle E14). Le second groupe est composé de six animaux provenant de la région d'Ambolomavo (femelles E7, E8, E18, E19, E20, mâle E17). Les recherches de paternité sont basées sur le fait que chaque individu peut être caractérisé par son profil "RAPD" qui permet d'établir des liens de parenté en fonction de la présence de bandes communes entre les individus. La détermination de paternité s'établit selon les lois de l'hérédité mendélienne. Les bandes présentes chez les enfants proviennent soit de la mère, soit du père, soit des deux parents. Les bandes présentes chez l'enfant sont comparées une par une au profil des parents potentiels en utilisant le principe d'exclusion. Les bandes présentes chez les enfants qui ne sont pas présentes chez la mère sont apportées par le père et réciproquement. Lors de ces études, on estime qu'il faut tester au moins trois amorces donnant la même réponse avant de pouvoir conclure à la paternité d'un mâle (Hadrys *et al*. 1993; Takenaka *et al.* 1993; Inoue et Takenaka 1993; Neveu *et al*. 1996).
Pour le groupe de Ranomafana, 16 primers ont été utilisés pour l'étude des quatre *H. simus*. Parmi ces primers, 10 ont été informatifs et ont permis de conclure que le mâle E13 serait le père de E15 (8 bandes communes et absentes chez E14) et de E16 (6 bandes partagées absentes chez E14). La femelle E14 serait la mère de E15 (4 bandes partagées et absentes chez E13) et de E16 (7 bandes partagées et absentes chez E13). Ce groupe de Ranomafana serait donc un groupe familial. Pour le groupe d'Ambolomavo, nous avons également utilisé 16 primers, mais aucun de ces derniers n'a pu démontrer de manière non équivoque une relation unique entre deux individus du groupe. Pour cette population, nous n'avons pas pu déterminer la filiation, ni même trouver un quelconque lien de parenté à partir des primers utilisés.
L´étude de l'homogénéité de la population de *H. simus* a été menée sur 12 animaux de trois provenances différentes: Parc Botanique et Zoologique de Tsimbazaza (Hsi 01 et Hsi 03), Ambolomavo (E7, E8, E17, E18, E19, E20), Ranomafana (E13, E14, E15, E16).

Les séquences obtenues, d'une longueur de 357 nucléotides, ont chacune été vérifiées dans le sens 5'-3' et 3'-5'. L'analyse de ces séquences à l'aide du logiciel PAUP*4.0 par la méthode de "neighbor-joining" permet d'obtenir le phylogramme suivant (Fig. 1):
La séquence LCA1 a été utilisée comme "outgroup". L'analyse des séquences de cytochrome b par la méthode de "neighbor-joining" montre un regroupement des animaux provenant de Ranomafana dans un même "cluster", alors que ceux du groupe d'Ambolomavo sont dispersés dans trois "clusters". Ceci laisse penser que le groupe des *H. simus* de Ranomafana est plus homogène que celui d'Ambolomavo. Il existe également une dispersion des animaux de Tsimbazaza qui pourrait s'expliquer par le fait que la provenance géographique de ces animaux est inconnue.

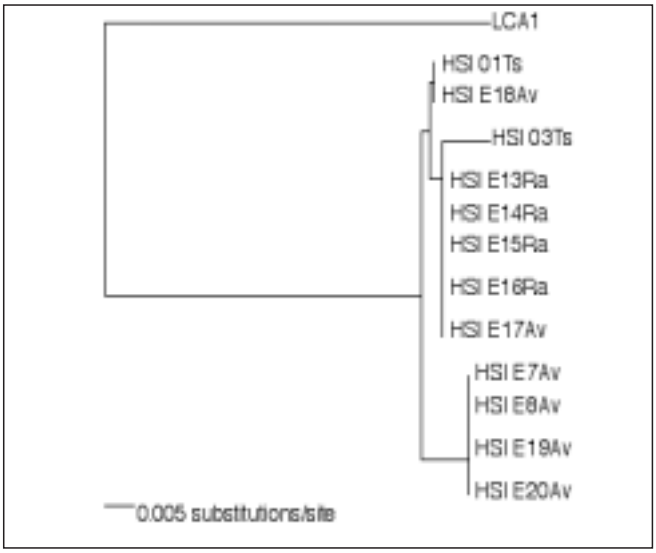

Fig. 1: Phylogramme de *H. simus*. LCA : *Lemur catta*; HSI: *H. simus*, HSI 01 et HSI 03: groupe de Tsimbazaza (Ts), HSI E7, E8, E17, E18, E19, E20: *H. simus* du groupe d'Ambolomavo (Av), HSI E13, E14, E15, E16: *H. simus* du groupe de Ranomafana (Ra).

Compartements:
La surface du domaine vital de *H. simus* à Ambolomavo est de 40 ha. Cette surface est inférieure à celle du domaine vital de *H. simus* de Ranomafana estimée entre 62 et 100 ha (Wright 1989; Tan comm. pers.). A priori, ce résultat paraît un peu surprenant puisqu'on s'attendait à un domaine vital plus grand dans la forêt dégradée d'Ambolomavo que dans celui de la forêt secondaire de Ranomafana. Mais à Ambolomavo, les bambous (*Bambusa barbata* ou Volozatsy) sont très abondants, tandis qu'à Ranomafana les bambous (*Cathariostachys madagascariensis* ou Volohosy) sont beaucoup plus éparpillés et de plus, les grosses pousses ne sont pas aussi abondantes que dans la première localité. Nous pensons que l'extension du domaine vital à Ranomafana résulterait en grande partie de la répartition de la nourriture (Albignac 1981; Warren et Crompton 1997; Alcock 1998).
Les animaux d'Ambolomavo se déplacent beaucoup plus que ceux de Ranomafana (Tableau 2). Ce résultat ne peut pas être correllé à la recherche de nourriture, car les animaux d'Ambolomavo ne sont pas obligés de se déplacer très loin du fait de son abondance. Cette grande différence dans l'activité de déplacement pourrait-être due à la chasse et à la perturbation de l'environnement d'Ambolomavo par la pratique de la culture sur-brûlis ou "tavy". Ces facteurs d'origine anthropique sont en effet reconnus pour intervenir sur la distance parcourue et les différentes activités journalières (Rakotoarisoa 1999).

Tableau 2: Repartition en % des activités principales de *H. simus*.

	Ambolomavo	**Ranomafana**
Nourriture	13,1	30,6
Déplacement	44,5	20,3
Repos	30,6	33,6
Autres	11,8	15,6

L'alimentation de *H. simus* est constituée à 70 % de *Cathariostachys madagascariensis*, de 10 à 30 % de *Poecilostachys festuca* (ou vilon'ala), de 0,5 à 4 % de fruits et d'autres plantes comme *Ravenala madagascariensis*, *Artocarpus* et de 1,5 à 5 % de divers (Meier et Rumpler 1987). À Ambolomavo, les animaux se nourrissent surtout de grosses pousses de bambou (*Bambusa barbata* ou Volozatsy) pendant les mois de février, mars, avril et mai. Pendant les mois de septembre et octobre, quand les bambous sont en quantité insuffisante, ils attaquent la base des feuilles des bambous. À Ranomafana, les animaux se nourrissent également de grosses pousses et de jeunes pousses de bambou mais de *Cathariostachys madagascariensis* et de *Poecilostachys festuca* pendant les mois de février, mars, avril et mai. Durant les mois de septembre, octobre et mi-novembre, les Varibolo attaquent les troncs de bambou pour pouvoir manger les parenchymes médullaires des chaumes de bambou (Tan 1999). Lors de notre étude à Ambolomavo, nous n'avons observé aucune trace d'arrachement de bambou par *H. simus*. Ceci peut être lié à la richesse en bambou de cette zone dégradée.
Les systèmes sociaux peuvent se définir à partir des paramètres démographiques (comme la taille, la composition des groupes et la répartition spatio-temporelle des individus) ou des paramètres sociaux, comme la nature des interactions sociales et leur distribution au sein du groupe (Roeder et Anderson 1990). À Ambolomavo, il existe deux groupes de *H. simus* bien séparés dont l'un est formé de mâles et l'autre de femelles. Bien que la destruction massive et intensive de la forêt d'Ambolomavo ainsi que la chasse rende difficile l'interprétation des observations faites, le système social des animaux d'Ambolomavo semble être de type "multimâles–multifemelles". À l'inverse, la structure sociale à Ranomafana serait de type familial. À Ranomafana, nous avons également pu observer l'existence d'une hiérarchie sociale lors de la prise de nourriture au niveau du groupe étudié (le mâle adulte accapare la plupart du temps la grosse pousse de bambou prise par la femelle adulte, et le juvénile est toujours en bas pour récupérer les restes laissés par les adultes). En 1996 et 1997, Tan (comm. pers.) a trouvé à Ranomafana dans la zone de Talatakely un groupe de *H. simus* composé de neuf animaux (trois mâles adultes, deux femelles adultes et quatre enfants). Ensuite, en 1998, ce même auteur a constaté que deux mâles adultes, descendants probablement du mâle résident et des deux femelles adultes, vivaient alors en périphérie mais qu'ils pouvaient rester avec le groupe d'origine. Or, lors de notre expédition dans ce même site, le groupe de *H. simus* que nous avons suivi est formé seulement de sept animaux dont trois mâles (un adulte et deux subadultes), une femelle adulte, une femelle subadulte, un juvénile et un petit. Les deux mâles marginaux cités par Tan en mai 1997 se seraient détachés du groupe car nous n'avons pas pu les observer lors de notre étude. En 2000, nous avons constaté la présence d'un juvénile et d'un bébé dans ce groupe. Selon Raliva, un guide de recherche travaillant depuis des années sur les Varibolo de Ranomafana, une des femelles adultes et un enfant, qui pourrait être un des quatre enfants cités par Tan en 1996 et 1997, ont disparu du groupe. La diminution des individus constituant le groupe pourrait résulter de la prédation, de la chasse, ou de la fission du groupe (Wright 1995)

Conclusions

La surface du domaine vital des *H. simus* d'Ambolomavo est de 40 ha et celui de Ranomafana est de 62 à 100 ha. Cette différence paraît liée à la répartition et à l'abondance des bambous dans chaque site. *Hapalemur simus* se nourrit surtout de grosses pousses de bambous du genre *Bambusa barbata* à la forêt dégradée d'Ambolomavo et du genre *Cathariostachys madagascariensis* aux mois de février, mars, avril et mai, puis de jeunes feuilles et de jeunes pousses de bambous, d'autres fruits de *Ravenala madagascariensis* et d'*Artocarpus* pendant les autres mois de l'année.

Le système social du groupe de *H. simus* d'Ambolomavo semble être du type "multimâles-multifemelles", et celui du groupe de Ranomafana serait du type familial. En effet, l'étude de paternité confirme qu'à Ranomafana un seul mâle est le père des deux petits étudiés. À Ambolomavo, par contre, aucune filiation n'a pu être déterminée. L'étude des séquences obtenues à partir d'une portion de cytochrome b montre que les animaux issus de Ranomafana sont regroupés dans un même "cluster" à l'inverse de ceux d'Ambolomavo. Toutefois, la taille de l'échantillon ne permet pas de conclure à une plus grande homogénéité de la population de Ranomafana par rapport à celle d'Ambolomavo.

Du fait de la difficulté d'étude et la rareté de cette espèce de Lémuriens suite à la destruction massive et intensive de son habitat d'une part et de l'effet néfaste de la chasse d'autre part, la détermination de l'aire de répartition et l'étude de la variabilité génétique s'avèrent nécessaires pour la conservation de l'espèce. Enfin, il faut protéger les différentes zones où survivent quelques groupes d'individus et étendre l'élevage ex-situ d'animaux dans le cadre de programmes internationaux d'élevage en captivité.

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Hormonal Basis of Reproductive Competition in Female *Propithecus v. coquereli*: Mothers and Daughters in Conflict?

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Introduction

Among strepsirrhine primates, seasonality is most marked in the Malagasy lemurs, where mating and births occur for a brief period once per year, coincident with austral summer rains and winter dry periods, respectively (Richard and Dewar 1991). In many seasonally breeding mammals reproduction is tightly entrained to seasonal variations in photoperiod, rainfall, and food abundance (Sadler 1969; Bronson 1989); however, social factors also play a role in regulating reproductive function and behavior within groups. In this regard, the proximate mechanisms mediating reproduction are better understood for captive strepsirrhines and for males in particular, than they are for free-ranging populations and females generally (Izard 1990; Whitten and Brockman 2001).

A few studies suggest that social factors may have a significant impact on the reproduction of strepsirrhine females. For example, serum progesterone (sP) levels in "solitary" nocturnal *Microcebus murinus* show that manipulations of female social group composition result in luteal phase defects and lower sP concentrations in group-housed females (Perret 1982). Results of field endocrinological research (Brockman 1994; Brockman and Whitten 1996; Brockman *et al*. 1995) on *Propithecus verreauxi* at Beza Mahafaly Special Reserve (BMSR) show that socio-demographic factors may be as important as climatic factors in regulating hormonal estrous synchrony and receptivity during the breeding season. Hormonal data indicate that females exhibit age- and rank-related asynchronous receptivity and aggression-related periovulatory synchrony, the latter characterizing larger female groups containing mothers and daughters as well as non-kin. Intensity of reproductive competition in free-ranging sifaka varies with relatedness and reproductive state. Although dominant mothers conceive before subordinate daughters, mating with multiple resident/non-resident males occurs in the absence of intrasexual competition or hormonal evidence of reproductive suppression. In captive sifaka housed at the Duke University Primate Center, NC, *P. v. coquereli* mothers are reported to non-aggressively "suppress" reproduction in adult daughters (Simons, pers. com.), while unrelated *P. tattersalli* females are said to "activate" reproductive function in conspecifics housed nearby (Glander, pers. com.). Coquerel sifaka at DUPC can give birth at 2.5 years of age (n=2), but these early conceptions occur in young females who had been removed from their family groups and paired with novel males, and not in older daughters remaining in their family groups. Gestation in sifaka at DUPC averages 164 ± 10.5 (SD) days (range: 154-191 days, n=10) based on observations of mating and birth (Haring pers. comm.).

The objective of this research was to investigate the factors regulating female ovarian function in related Coquerel's sifaka, particularly periovulatory synchrony, receptivity, and female-female aggression during the breeding season, and the impact of this variation on female mating success, especially among daughters.

Materials and Methods

Subjects: Subjects were Coquerel's sifaka socially housed at DUPC (Table 1). Both social groups experienced a change in composition just prior to the 2000 breeding season; Marcella's death resulted in her eldest daughter, Alex, becoming alpha female (and proxy mother) in her group, and Faustina's eviction (e.g. relentless aggressive attacks by her mother) and subsequent pairing with a male (Constantine) reduced the number of focal daughters in Paulina's group from two to one. These demographic changes, however, allowed us to compare ovarian steroid levels under the maternal vs. paired conditions, thus clarifying the putative effects of mothers on reproductive function in daughters. Resident males were replaced with unrelated males to avoid father-daughter copulations. New adult males were initially housed in an adjoining wire enclosure for seven days prior to physical introduction to the social group.

Table 1: Coquerel's sifaka social group composition 1999-2000.

Mother	New Male	Daughters	Sons
		(age: yrs)	
Paulina 1999 (8.5) 2000 (9.5)	Nero (5.5) Trajan (15)	Faustina 1999 (2.75) 2000 (3.75) Antonia 1999 (1.5) 2000 (2.75)	Philip 1999 (.5) 2000 (1.5) Xeno 2000 (.5)
Marcella 1999 (15) 2000 (died 4/00)	Julian (5.5) Jovian (5.4)	Alex 1999 (2.75) 2000 (3.75) Livia II 1999 (1.5) 2000 (2.75) Pia 1999 (.5)	Marius 2000 (.5)

Data Collection: Behavioral and hormonal data were collected on two mother-daughters pairs (Paulina/Faustina [prior to eviction] and Marcella/Alex) in 1999, and one mother-daughter pair (Paulina/Antonia) and one alpha-subordinate sister pair (Alex/Livia) in 2000. A total of 200 focal animal hours (mean: 33.33 hr/female) and 269 fecal samples were collected from 6 adult females during the September - November 1999/2000 breeding seasons. Early morning fecal samples (1-15 gm) were collected in their entirety, packaged, labeled, and frozen within four hours of voiding using techniques previously described (Brockman et al. 1995). At the end of the project the fecal samples were shipped to the Laboratory of Reproductive Ecology (PLW, Emory University) for extraction and RIA using techniques previously described (Brockman *et al.* 1995). Variation in fecal estradiol (fE_2) and fecal progesterone (fP_4) were used as indices of reproductive function coincident with observations of mating behavior and aggression. In captive sifaka,

mating is typically (but not always) associated with 5-day luteal elevations in fE_2 followed by 24- to 27-day follicular elevations in fP_4 indicative of ovulation (Brockman et al. 1995). Captive and wild sifaka occasionally exhibit situation-dependent receptivity (e.g. non-conceptive copulations and mating during pregnancy; Fig. 3; Brockman and Whitten 1996; Brockman 1999) similar to that observed in catarrhine primates. Fecal steroid assay techniques were previously validated and field-tested for *P. verreauxi* (Brockman 1994; Brockman and Whitten 1996; Brockman *et al*. 1995, 1998), demonstrating that this method accurately reflects gonadal function in this species. Affiliative (e.g. greets, grooms) and agonistic (e.g. chases, cuffs, bites) behaviors were recorded for each focal female using 15-minute focal animal (Altmann 1974) and continuous sampling techniques. Dominance was determined by the consistent direction and outcome of aggressive and submissive behaviors. Behavioral data were analyzed for differences in frequency of behavior over time. These data were checked for normality and equal variance and, depending upon the results of these tests, parametric or nonparametric tests (Mann Whitney U tests) were used to examine differences and trends in the data. Significance was set at $P < 0.05$.

Results

Hormonal data showed evidence of reproductive suppression of daughters/sisters by their dominant relatives. Results showed that mean fE_2 and fP_4 levels of subordinate daughters/sisters were significantly lower than those of their alpha mothers/sisters during the breeding season (Table 2). Daughters removed from the influence of mothers either through eviction or death of the mother, exhibited 2-fold elevations in fP_4 when housed separately with a new male (Table 3). Faustina's 1999 profile (Fig. 1) suggests that a mother's short absence from the group can elicit ovarian responses and sexual behavior in adult daughters. Her post-eviction profile (Fig. 2) shows the onset of ovarian activity five days after being paired with Constantine. With exception of Paulina (2000), alpha females, but not subordinates, responded to the physical proximity and subsequent introduction of new males by significantly elevating fecal E_2/P_4 concentrations above those of subordinates during the first month of exposure to the male (Table 4). Paulina appeared to cycle twice, once in the absence of an adult male in late August and then again in mid-September 4-9 days after Trajan's introduction (Fig. 3).

Table 2: Mean fecal estradiol (fE_2) and fecal progesterone (fP_4) concentrations in mother (M)-daughter (D) pairs and in alpha (AL)-subordinate (SB) sister pairs.

Pairs 1999/2000	fE (ng/gm) ± SEM	N (samples)	fP (ng/gm) ± SEM	N (samples)
M-Paulina-99	75.81 ± 17.10	42	89.43 ± 13.94	42
D-Faustina	1.98 ± .11	41	7.86 ± 2.20	41
P	*< 0.001*		*< 0.001*	
M-Marcella-99	7.05 ± 2.87	22	55.09 ± 7.40	22
D-Alex	1.97 ± .15	22	8.46 ± 2.30	22
P	*< 0.05*		*< 0.001*	
M-Paulina-00	3.32 ± .77	47	16.11 ± 1.80	47
D-Antonia	1.62 ± .05	42	2.96 ± .25	42
P	*< 0.01*		*< 0.001*	
AL-Alex-00	2.81 ± .46	36	4.06 ± .29	36
SB-Livia	1.47 ± .09	17	2.98 ± .47	17
P	*< 0.001*		*< 0.001*	

Daughter Antonia, on the other hand, was anovulatory during this period, although she engaged in sexual activity twice in the *absence* of maternal harassment. Hormonal profiles also show the absence of ovarian cycles in the single alpha/subordinate pair (Alex/ Livia), although Alex's mean fE_2/P_4 concentrations were significantly elevated above those of her subordinate sister, Livia (Table 4). Alex experienced a 6-fold elevation in fE_2 on October 14, but it was unaccompanied by subsequent fP_4 elevations indicative of ovulation. Livia, her subordinate sister, had consistently low E_2 and P_4 levels, averaging 1.47 ± 0.09 (SEM) ng/gm and 2.98 ± .47 (SEM) ng/gm respectively (Table 2). Alex mated for the first time in 2002 at 6 years of age; Livia remains nulliparous and has never been observed mating.

Table 3: Mean fecal estradiol (fE_2) and progesterone (fP_4) concentrations in daughters residing with mothers vs. housed separately with a new resident male.

Daughters	fE (ng/gm) ± SEM	fP (ng/gm) ± SEM	N (samples)	Mating?
Faustina				
With mother	1.98 ± .11	7.86 ± 2.20	41	Mounts
With new male	2.79 ± .22	14.95 ± 3.56	25	Yes
P	*< 0.001*	*< 0.001*		
Alex				
With mother	1.97 ± .15	8.46 ± 2.30	22	No
With new male	2.81 ± .46	4.06 ± .29	36	No
P	*< 0.05*	ns		

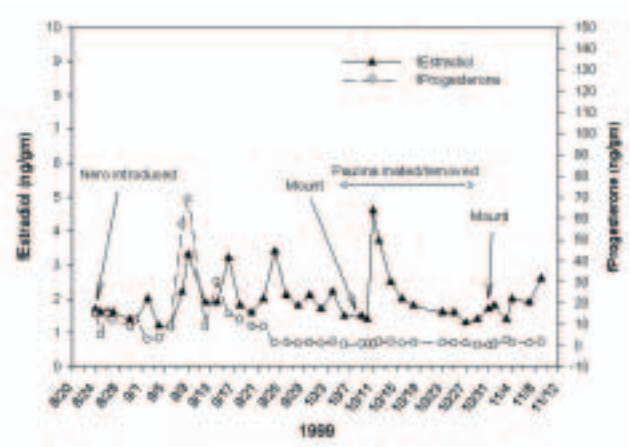

Fig. 1: Faustina's 1999 estradiol and progesterone profiles and associated hormonal responses to the temporary absence of her mother.

Fig. 2: Faustina's 2000 post-eviction estradiol and progesterone profiles and associated behavioral responses when paired with a new male.

Table 4: Mean fecal estradiol (fE_2) and fecal progesterone (fP_4) concentrations in mother (M)-daughter (D) pairs and in alpha (A)-subordinate (S) sister pairs 30 days after the introduction of a new resident male.

Pairs 1999/2000	fE (ng/gm) ± SEM	N (samples)	Mating?	fP (ng/gm) ± SEM	N (samples)	Birth
M-Paulina-99	3.01 ± .29	19	Yes	63.47 ± 8.21	19	Yes
D-Faustina	1.86 ± .14	17	No	17.25 ± 4.46	17	No
P	*< 0.001*			*< 0.001*		
M-Marcella-99	3.28 ± .77	16	Yes	61.31 ± 9.91	16	Yes
D-Alex	1.83 ± .15	16	No	10.41 ± 2.85	16	No
P	*< 0.05*			*< 0.001*		
M-Paulina-00	1.92 ± .33	15	Yes	12.90 ± 3.50	15	Yes
D-Antonia	1.71 ± .09	17	Mounts	3.32 ± .48	17	No
P	ns			*< 0.05*		
A-Alex-00	3.77 ± 1.60	10	No	4.11 ± .51	10	No
S-Livia	1.40 ± .13	7	No	2.53 ± .33	7	No
P	*< 0.01*			*< 0.05*		

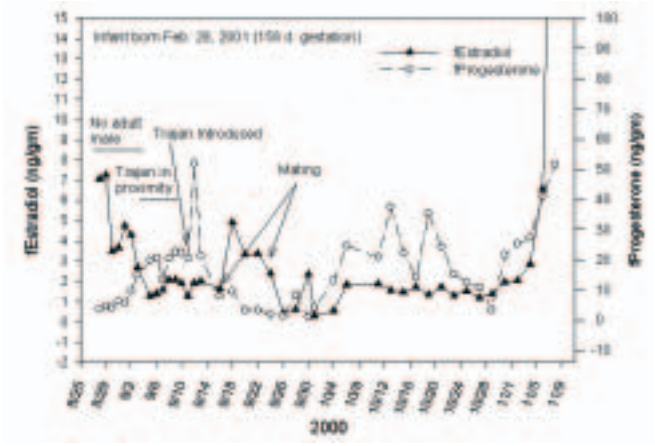

Fig. 3: Paulina's 2000 estradiol and progesterone profiles and associated behavioral responses when paired with a new male and during pregnancy.

Conclusions and Management Implications

Hormonal results suggest that reproduction in Coquerel's sifaka is socially mediated by the proximity/presence of new males and rank among female relatives. The introduction of new adult males appears to stimulate ovarian activity in dominant mothers but not in subordinate daughters, which maintain significantly diminished ovarian steroid levels in the presence of their mothers. Evidence that reproductive failure in daughters is a consequence of maternal suppression rather than age, derives from hormonal data from the Paulina/Faustina pair showing that Faustina experienced significant E_2/P_4 elevations when she was evicted and subsequently removed from her group and paired with a male. Rank-related reproductive suppression also appears to occur in sisters, even when the dominant sister fails to cycle. These results, however, derive from a small sample size of Coquerel's sifaka groups and will need to be confirmed by additional studies. The management implications of these results are far reaching and if substantiated suggest that maternal suppression of daughters may inhibit rapid expansion of this captive population. However, one significant outcome of the management of this species at DUPC is the realization that maintaining larger groups of sifaka provides offspring critical socialization benefits (e.g. acquisition of parenting skills), in spite of the potential short-term reproductive costs. These trade-offs will need to be considered in the development of future management protocols for this species in captivity.

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Inventaires des Communautés Lémuriennes dans la Réserve Spéciale de Bora au Nord-Ouest et la Forêt Domaniale de Mahilaka-Maromandia au Nord de Madagascar

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Introduction

Bien que la faune lémurienne de Madagascar soit hautement diversifiée et entièrement endémique, la biogéographie de certaines populations de lémuriens montre encore des incertitudes. C'est le cas, entre autres, des microcèbes dont le nombre d'espèces découvertes ne cesse d'augmenter (Rasoloarison et *al*. 2000). Jusqu'à présent, peu d'informations ont été recueillies concernant la biodiversité des lémuriens nocturnes du nord-ouest et du nord de Madagascar. Par conséquent, la limite de la distribution de ces lémuriens, et en particulier celle de *Microcebus murinus*, de *M. ravelobensis*, de *Lepilemur edwardsi* et de *L. dorsalis* est encore floue.

A l'aide des connaissances basées sur les espèces de lémuriens nocturnes de la région d'Ankarafantsika, deux sites des régions du Nord-Ouest et du Nord de Madagascar ont été visités. Il s'agit de la Réserve Spéciale (RS) de Bora et la forêt domaniale de Mahilaka. A notre connaissance, aucun biologiste n'avait encore réalisé des recensements de lémuriens dans la forêt de Mahilaka. Par contre, la RS de Bora a déjà fait l'objet de recherches par Mittermeier *et al*. (1994), qui ont signalé la présence de deux espèces (*Eulemur fulvus fulvus* et *Propithecus verreauxi coquereli*).

Le but principal de notre étude était de répertorier les différentes espèces de lémuriens dans ces deux sites, afin de mieux déterminer la distribution des lémuriens nocturnes, en particulier celle des Microcèbes et des Lépilemurs.

Fig. 1: Carte des deux sites d'études, la RS de Bora (Antsohihy) et la forêt de Mahilaka (Maromandia).

Sites d'études

La Réserve spéciale de Bora se trouve dans la province de Mahajanga, à environ 30 km à l'est de la ville d'Antsohihy. Cette réserve est constituée de deux parcelles non contiguës: la parcelle Nord (4370 ha) et la parcelle Sud (3650 ha). Les coordonnées de notre site d'étude (14° 51´ 58 ´´S, 48° 12´ 12´´E, 142 m) ont été prises au campement situé au bord de la rivière Ambodigavo (Fig. 1). Nous avons effectué nos observations (30.05 - 08.06.2002) dans la parcelle Nord qui est accessible par la route goudronnée reliant Antsohihy et Bealanana. La végétation de la réserve est du type forêt dense sèche semi – caducifoliée.

La forêt domaniale de Mahilaka se trouve aussi dans la province de Mahajanga, à environ 20 km à l'est de Maromandia en suivant la rivière Andranomalaza. Ici aussi, les coordonnées de notre site d'étude (14° 17´ 12´´ S, 48° 13´ 38´´ E, 52 m) ont été prises au campement situé au bord de la rivière Mahilaka (Fig. 1). Il faut mentionner que la forêt domaniale de Mahilaka – Maromandia où notre étude a été menée entre15.06-03.07.02 ne correspond pas au site archéologique de Mahilaka qui se trouve dans la baie d'Ampasindava à environ 22 km au Sud de la ville d'Ambanja et à 2 km du village de Djangoa de coordonnées 13° 46´ S – 48° 19´ E (coordonnées du village de Djangoa, source F.T.M. Madagascar; Rakotozafy 1996). La zone d'étude, qui fait partie de la forêt de Mahilaka, est recouverte par une forêt dense humide sempervirente. La forêt de Mahilaka se situe dans la partie sud de la zone du Sambirano. Elle est limitée au sud par la rivière Andranomalaza, laquelle reçoit un affluent (la rivière Manongarivo) au niveau du village de Maromandia. Plus en aval, elle se déverse dans le Canal de Mozambique.

Méthodologie

Recensement par observation directe: L'identification des espèces de lémuriens a été faite par observation visuelle ou par écoute des cris. L'observateur emprunte une piste choisie de 1 km, préalablement mesurée et marquée, à une vitesse moyenne de 1 à 1,5 kmh^{-1}. Les observations nocturnes ont été effectuées entre 18h30 et 20h00 avec une lampe frontale de faible intensité, afin de repérer les lémuriens nocturnes par reflet lumineux de leurs yeux. Une fois un animal repéré, d'autres lampes beaucoup plus puissantes (Maglite) ont été utilisées pour identifier l'espèce. A chaque site, deux pistes de 1 km ont été choisies. Chacune des pistes a été parcourue deux fois en prenant soin de changer le sens entre les deux passages. A chaque observation, les informations suivantes ont été enregistrées: l'espèce, le nombre d'individus, l'heure, et la position de l'observateur; si possible, la hauteur de l'animal par rapport au sol et la distance de l'observateur par rapport à l'animal ont été notées. Nous n'avons pas effectué des recensements diurnes, mais les individus que nous avons cités ont été observés fortuitement pendant le jour ou la nuit. Enfin, pour compléter les informations, nous avons questionné les villageois sur la présence éventuelle de lémuriens à chaque site.

Capture / recapture: Trois nuits de capture ont été effectuées à chaque site pour déterminer la présence / absence des différentes espèces de microcèbes. A chaque nuit, 100 pièges du type Sherman ont été installés 1 à 2 m au-dessus du sol et

distants de 20 m le long de la piste. Nous avons installé les pièges le soir, et avons utilisé des morceaux de bananes comme appâts. Le contrôle de pièges, les différentes mesures morphométriques, et la détermination du sexe des individus capturés ont été effectués le matin suivant.

Résultats et Discussions

RS de Bora : Les études effectuées dans la RS de Bora révèlent la présence d'une espèce strictement diurne, *Propithecus verreauxi coquereli*, d'une espèce cathémérale, *Eulemur f. fulvus* et de deux espèces nocturnes, *Microcebus ravelobensis* et *Avahi occidentalis* (Tableau 1). La présence de *Daubentonia madagascariensis* et *Cheirogaleus medius* dans la forêt de Bora a été signalée par les villageois. Cette dernière espèce était en hibernation pendant la durée de notre passage (saison sèche). Elle demeure difficile à détecter dans cet état (Müller 1999). Par comparaison aux résultats de la forêt sèche d'Ankarafantsika (Radespiel et Raveloson 2001), la forêt de Bora semble être pauvre en faune lémurienne.

Tableau 1: Moyenne du nombre d'individus recensés par km dans les deux sites (RS de Bora et Forêt de Mahilaka) en comparaison à celui de la RNI d'Ankarafantsika (Schmid et Rasoloarison 2002; Radespiel et Raveloson 2001) et de la RS de Manongarivo (Goodman et Soarimalala 2002). (+/-: présence ou absence des espèces; (+): présence effective selon les villageois).

Species	**RS de Bora**	**FD Mahilaka**	**RNI Ankarafantsika Ankarokaroka***	**RS Manongarivo**
Microcebus ravelobensis	2,75	-	Non identifiée	-
Microcebus murinus	-	-	4,00	-
Microcebus sambiranensis?	-	0,75	-	+
Microcebus spp.	-	-	(21,10)	-
Cheirogaleus sp.	(+)	(+)	2,27 (0,00)	+
Mirza coquereli	-	1,50	-	-
Lepilemur dorsalis	-	4,50	-	+
Lepilemur edwardsi	-	-	0,97 (4,2)	-
Avahi occidentalis	2,50	-	1,93 (0,00)	+
Daubentonia madagascariensis	(+)	0,25	-	+
Propithecus v. coquereli	+	-	0,33 (0,00)	-
Hapalemur occidentalis	-	+	-	+
Eulemur f. fulvus	+	-	0,33 (0,00)	+
Eulemur macaco ssp.	-	+	-	+
Eulemur mongoz	-	-	0,23 (0,00)	-
Phaner furcifer	-	-	-	+
Eulemur rubriventer	-	-	-	+
Nombre d'espèces confirmées	4	6	8	10

* Nous avons pris comme référence le site d'Ankarokaroka tout en prenant la moyenne du nombre d'individus recensés par km sur les trois pistes Ia, Ib et Ic, car toutes les espèces de lémuriens existantes à Ankarafantsika s'y trouvent (Schmid et Rasoloarison 2002). Nous avons mis entre parenthèses les résultats de Radespiel et Raveloson (2001) dans le même site.

Les microcèbes semble être moins abondant car durant la phase de capture, seulement trois individus, deux jeunes mâles et une femelle adulte ont été pris au piège. Chez ces trois individus, le pelage dense de la tête et du dos est de couleur rougeâtre alors que la partie ventrale est jaunâtre.

Le Tableau 2 nous montre que les mesures morphométriques (longueur totale, longueur tête-corps, longueur de la queue) des deux jeunes individus de Bora sont comparables à celles des jeunes *M. ravelobensis* d'Ampijoroa (les "jeunes" ont été définis comme des individus dont les paramètres longueur du corps, longueur de la jambe et la masse corporelle sont inférieurs à ceux des adultes. Ces différences sont évidentes jusqu'à l'âge de 6-8 mois; Zimmermann, observ. pers.). Les mesures morphométriques de la femelle adulte qui avait la queue coupée, sont plus proches de *M. ravelobensis* que de *M. sambiranensis* (Tableau 3). A en croire les caractères morphologiques, les microcèbes de Bora appartiennent à l'espèce *M. ravelobensis*. Toutefois, des études génétiques seront bientôt menées pour confirmer cette hypothèse. Il est probable que l'aire de distribution de *M. ravelobensis* ne soit pas limitée aux alentours de la région d'Ankarafantsika (Zimmermann *et al*. 1998; Radespiel et Raveloson 2001) mais qu'elle s'étende au moins jusqu'à la RS de Bora.

Tableau 2: Statistique descriptive de quelques variables morphométriques (mm) chez *M. ravelobensis* (jeune) (Randrianambinina 2001) en comparaison avec les jeunes mâles de Bora.

	***M. ravelobensis* (jeune) n=8**	**Microcèbe de Bora n=2**
Paramètre statistique	Moyenne(min-max)	min-max
Longueur totale	249,8 (227,4-276,4)	239,6-245,4
Longueur tête-corps	103,7 (97,4-114,4)	99,6-100,4
Longueur queue	146,1 (130,0-162,0)	140,0-145,0
Masse corporelle (g)	39,2 (35,0-42,0)	34,0-40,0

Tableau 3: Statistique descriptive de quelques variables morphométriques (mm) chez *M. ravelobensis* (adulte) (Randrianambinina 2001), chez *M. sambiranensis* (adulte) (Rasoloarison *et al*. 2000), chez *M. sambiranensis*? de Mahilaka (cette étude), et une femelle adulte de Bora.

	***M. ravelobensis* d'Ampijoroa n=55**	**Microcèbe de Bora n=1**	***M. sambiranensis* de Manongarivo n=6**	***M. sambiranensis*? de Mahilaka n=13**
Paramètre statistique	Moyenne (min-max)		Moyenne (min-max)	Moyenne (min-max)
Longueur totale	277,1 (236,6-316,4)	-	258,2 (247,0-271,0)	250,2 (232,0-265,0)
Longueur tête-corps	119,2 (101,6-144,4)	124,3	116,5 (113,0-123,0)	109,9 (102,0-115,0)
Longueur queue	157,9 (135,0-172,0)	-	140,8 (134,0-148,0)	140,3 (130,0-150,0)
Masse corporelle (g)	63,3 (44,0-102,0)	60,0	44,1 (38,0-51,5)	44,9 (36,0-58,0)

L'absence des autres espèces de lémuriens (*M. murinus* et *Lepilemur edwardsi*) dans la forêt de Bora peut s'expliquer soit par la forte pression anthropique entraînant la destruction de l'habitat, et particulièrement les grands arbres à trous, soit par le type de forêt de la réserve qui est considéré comme un domaine de transition entre les forêts pluviales sempervirentes et les forêts sèches caducifoliées (Nicoll et Langrand 1989). Cela nécessite une étude plus approfondie, ce qui est en train d'être effectuée actuellement par notre groupe de recherche.

Forêt de Mahilaka: Sept espèces de lémuriens ont été répertoriées dans la forêt de Mahilaka dont deux sont cathémérales et cinq nocturnes. *Hapalemur occidentalis* est apparemment rare. Un groupe de 7 individus a été observé lorsqu'il passait près de notre campement. La présence de cette espèce dans la zone du Sambirano a déjà été signalée par Mittermeier *et al*. (1994). La présence d'*Eulemur macaco* ssp. a été établie par l'intermédiaire des vocalisations émises par un groupe. Si on se base sur l'aire de distribution de cette espèce, on peut dire que ce sont probablement des hybrides entre *E. m. macaco* et *E. m. flavifrons* (Mittermeier *et al*.

1994; Lernould 2002). *Daubentonia madagascariensis* est apparemment moins abondant car il n'a été recensé qu'une fois. Néanmoins, sa présence dans la forêt de Mahilaka est confirmée. *Lepilemur dorsalis* a été repéré à chaque observation nocturne, et semble être abondant dans la région, de même que *Mirza coquereli*. La présence de ces deux espèces dans la région du Sambirano a déjà été signalée par Mittermeier *et al*. (1994). La présence de *Cheirogaleus* a été annoncée par les villageois, mais faute d'activité, sa détection était impossible.

Enfin, une espèce de microcèbe a été recensée dans la forêt de Mahilaka. Elle semble être plus abondante dans le savoka que dans la forêt de Mahilaka. D'après nos observations (Tableau 3), cette espèce se rapproche de *Microcebus sambiranensis* qui a été capturé et rapporté par Rasoloarison *et al*. (2000) aux environs de la RS de Manongarivo. Etant donné que la forêt de Mahilaka se trouve dans le domaine du Sambirano, nous pensons que le microcèbe que nous avons capturé soit de l'espèce *M. sambiranensis*.

Du point de vue nombre d'espèces de lémuriens, la RS de Manongarivo est plus riche (10 espèces) par rapport à la forêt de Mahilaka. Deux espèces telles que *Phaner furcifer* et *Eulemur rubriventer* ont été observées à Manongarivo (Goodman et Soarimalala 2002) mais pas à Mahilaka. Par contre, *Mirza coquereli* a été recensée à Mahilaka, mais pas à Manongarivo.

Bien que la forêt de Bora ait son statut de Réserve spéciale depuis le 22 avril 1964, l'exploitation forestière et les feux de brousse qui ravagent presque annuellement la forêt, constituent de fortes menaces pour la survie des lémuriens qui y vivent. Néanmoins, la richesse en espèces de lémuriens est plus élevée que celle décrite auparavant par Mittermeier *et al*. (1994). La communauté lémurienne de la RS de Bora est typique des forêts sèches de la région du Nord-Ouest de Madagascar. Cependant, la biodiversité des lémuriens nocturnes et la densité des microcèbes sont moins élevées dans la RS de Bora que dans la RNI d'Ankarafantsika (Radespiel et Raveloson 2001; Schmid et Rasoloarison 2002; Tableau 1). Notre étude est la première qui a montré que la forêt domaniale de Mahilaka abrite six à sept espèces de lémuriens (Tableau 1). La communauté lémurienne est typique de la forêt dense humide sempervirente de cette région. La densité des microcèbes est plus faible qu'à Bora et qu'à Ankarafantsika. Par contre, la densité des lépilemurs y est élevée par rapport à celle d'Ankarafantsika (Tableau 1). Toutefois, la forêt souffre actuellement d'une forte pression anthropique due aux cultures traditionnelles sur brûlis pratiquées par la population riveraine.

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Lémuriens des forêts humides du plateau de Makira, Maroantsetra (Madagascar)

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Key words: Lemurs, survey, biogeography, Makira

Une évaluation biologique rapide des lémuriens a été menée dans la forêt humide du plateau de Makira qui se trouve au nord-est de Madagascar (au nord de la baie d'Antongil) du 11 Janvier au 27 Février 2003. C'est une forêt primaire de moyenne altitude, plus ou moins intacte et avec quelques perturbations selon les sites. La richesse spécifique des lémuriens a été mesurée dans six sites sélectionnés par l'utilisation de la méthode des transects.
Les sites inventoriés sont: Bevontro (S 21°12.201' – E 54° 50.862'), Vohitaly (S 15°26.358' – E 49°32.093'), Ankirindro (S 15°17.440' – E 49°32.847'), Lohanisahantaha (S 15° 13.565' – E 49°31.767'), Anjanaharibe (S 15°11.292' – E 43° 36.858') et Amparihibe (S 15°02.117' – E 49°35.040').
Treize espèces et variétés de lémuriens ont été recensées durant l'inventaire dont six diurnes et sept nocturnes. (Tableau 1). La présence de cette dernière a été signalée d'après les enquêtes menées auprès des assistants et villageois.

Tableau 1: Richesse spécifique des différents sites de la forêt du plateau de Makira.

Sites **Espèces**	**Bevon-tro**	**Vohi-taly**	**Anki-rindro**	**Lohani-sahantaha**	**Anjana-haribe**	**Ampa-rihibe**
Indri indri (Babakoto)	+	+	+	+	-	-
Varecia v. variegata (Varikandana)	+	+	+	+	-	-
Varecia variegata rubra (Varignena)	-	-	-	-	+	+
Eulemur fulvus albifrons (Varikôsy)	+	+	+	+	+	+
Eulemur rubriventer (Tongona)	+	-	-	-	+	+
Hapalemur g. griseus (Bokombolo)	+	-	-	+	+	+
Lepilemur microdon (Tsitsiha)	+	-	-	+	+	+
Avahi laniger (Fotsife)	+	-	+	+	+	-
Phaner ssp. (nom vernaculaire inconnu)	+	-	-	-	-	+
Cheirogaleus major (Tsitsihy)	-	-	-	-	+	+
Microcebus sp_1 (Tsidy)	+	-	+	-	+	+
Microcebus sp_2 (Tsidy)	+	-		+	-	+
Daubentonia madagascariensis (Hay-Hay) *						
Nombre total = 13	**10**	**3**	**5**	**7**	**8**	**9**

+: présence de l'espèce; -: absence de l'espèce; *: présence éventuelle de l'espèce dans la forêt du plateau de Makira d'après les enquêtes menées auprès des assistants et villageois

La richesse spécifique est maximale à Bevontro avec dix espèces, suivi d'Amparihibe et d'Anjanaharibe. Il est aussi important du point de vue abondance des *Indri indri, Varecia variegata variegata* et *Eulemur fulvus albifrons*. Lohanisahantaha possède une densité très élevée de *Eulemur fulvus albifrons*. A Anjanaharibe et Amparihibe, les densité de *Eulemur rubriventer* et *Hapalemur griseus griseus* ont été beaucoup plus notables que dans les autres sites ; mais *Varecia variegata rubra* semble être très rare dans ces deux sites.
Deux espèces de microcèbe sympatriques ont été enregistrées dans la forêt de Makira: *Microcebus* sp_1, qui pourrait être *Microcebus rufus* d'après sa petite taille et la coloration rousse de son pelage et *Microcebus* sp_2, une forme grise et plus grande, qui est probablement une nouvelle espèce.

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Lemurs as the most appropriate and best current didactic tool for teaching

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Key words: Lemurs, teaching

It is undeniable that Madagascar is a very special island with exceptional nature where the unique flora and fauna make it one of the world's foremost nature sanctuaries. The island also has huge natural resources such as gems (saphires, rubies, emeralds, etc.) and other mining products. In other words, Madagascar is a paradise of nature. Unfortunately, its nature is under constant pressures. Every year, thousands of hectares of forest disappear because of deforestation (clearing, slash-and-burn agriculture, etc.). As a result, the soil becomes more and more degraded until it resembles a lunar landscape. Although some national and international organizations do attempt, in a fashion, to remedy the situation by planting trees, it seems that the root of the problem is not addressed, but just its symptoms. We know that most of the endemic fauna of Madagascar is dependent on forests, which means that once the forest becomes degraded and/or vanishes, the fauna also disappears.
Many species of Malagasy endemic reptiles, birds, and mammals are currently on the verge of extinction due mainly to habitat loss and illegal collection. I believe that with the actual situation, there are many who have become aware of the need to step up environmental protection. In reality, this priority has too often been neglected, environmental issues taking second place to economic ones.
In this article, I would like to address the people who have received education from schools and became decision makers and/or have a high responsibility in making programs for schools at different levels (kindergarten, primary, secondary, high school, and university) in this country. To be honest, I doubt that most of the Malagasy children know what exists in their backyards (forests), and obviously when they grow up, they do not have an interest in getting involved in saving the endangered biodiversity. During these last ten years, conservation has become a governmental policy; therefore NGOs have been encouraged to contribute to this field in order to ensure the preservation of species. To be realistic, I do understand that poverty (71 % in 1999) is one of the main causes of the roots of our problems, but if we consider the following questions, we may agree that real conservation will remain a myth, but not reality, unless we involve/use all levels of the country's biodiversity in the education program.

How much do Malagasy children in primary and secondary schools know about lemurs?

How much do the teachers in primary and secondary schools know about endemic plants, reptiles, birds, and lemurs?

How much do farmers, economists, journalists, medical doctors, lawyers, pastors, etc. know and care about endangered species?

How much do the general public know about lemurs?

I would like to underline that I do not say that our children do not have the ability to learn and our teachers the skills to teach or they are careless, but I would say: "Like me, they

are/were not taught about their overwhelming biodiversity".

As a native of Madagascar, I grew up in this island and got my primary education and college degree at the University of Antananarivo, the capital of Madagascar. Remarkably, we were not taught about our native wildlife or about conservation for our island nation's biodiversity. We knew more about giraffes, lions, tigers, and polar bears, i.e., animals that do not exist in Madagascar. It was not until I was a student at the University that I learned about lemurs! Then, I got the opportunity to go to the United States to study more about lemurs. When I was in the US, I often gave talks to young children in primary schools and churches. Every place I did my talk, I was always impressed with the knowledge of these children about Malagasy lemurs. Every week, on my lemur web page I received at least three questions about lemurs from children in the US, Australia, and sometimes Europe. I agree that the children in the US or in Europe have the opportunity to visit zoos where there are lemurs (ring-tailed, black-and-white, and/or mouse lemurs) for recreation, and that they can go to the Internet to learn more about what they are interested. I also agree that they can watch programs on TV about animals such as Zouboumafou from which they can learn about the Sifaka. After my presentation, on the one hand I often felt happy when I realized that these are people who have never been in Madagascar, but they are very interested in our wildlife and very concerned about its conservation. But on the other hand, I also felt a feeling of sadness when I think about the children of my home country who are so far from knowing and loving their biodiversity.

I remember when I was in primary school we learned about the different methods of growing rice and various items (food and non-food) that each province produces. Students were supposed to know these products, because there were asked in the national exams (CEPE and BEPC). Therefore, I am wondering, why we should not use, for example, lemurs as the tool for teaching, because I believe that it is the most complete material for teaching. Lemurs come in various colors, size, morphology, physiology, locomotion, behavior, social organization and structure, diet, activity patterns, vocalizations, geographical distribution, and adaptation. Indeed, hundreds of Masters and PhD degrees are currently available in different languages (Malagasy, French, English, Spanish, German, etc.). For that reason, I would say that lemurs are the best and most up-to-date tool and are appropriate for the Malagasy students at different levels if we really want to teach our citizens to become actors, but not spectators in all conservation actions. Maybe, we are not like British people who are educated to be bird lovers, but it is hard to believe that conservation will be successful if the residents are not encouraged from their young age in that direction.

The *XVII*th Congress of the International Primatological Society was held in Madagascar in 1998. It was not surprising though that Madagascar was selected, because 100 % of the primates of the island are endemic and Madagascar is one of the top hotspots for biodiversity. That Congress was the first international meeting that regrouped Malagasy primatologists. In other words, many of the Malagasy primatologists did not know each other until that Congress. Most of US and non-US anthropologists know each other because of the "annual meeting". The few Malagasy primatologists do not know each other, because our school systems do not encourage faculty from different departments to collaborate for research. Obviously, if such collaboration does not exist for the seniors, how can we can expect juniors, who will be the seniors of tomorrow, to express a desire to work with other students from different departments or from other schools. I am not surprised if the research conducted by Malagasy researchers in general, and primatologists in particular are barely quoted in the references of international scientific journals. It is a shame, but that is the truth! When I studied in the US, we were encouraged to attend seminars in other departments or other schools even occurring in other states than New York. When I took the Biometry and Principles of Ecology courses at the Department of Ecology & Evolution (which was not my department), there were students from Anatomy department, Anthropology Department, Marine Science Department, etc. Even though I study black-and-white ruffed lemurs (*Varecia variegata variegata*) for my PhD research, I had to take courses on Human Evolution and Primate Evolution, which are Paleontology courses. Having such broad views in comparison to ours might be one of the successes of the European and Americans researchers. We all believe that at some point one has to learn different fields (anthropology, botany, economics, psychology, biochemistry, phylogeny, mathematics, physics, paleontology, geography, English, French, Spanish, etc.) if one wishes to go further in research. Just by the name of our department (for example: department of botany), we can say that we are botanist, but if we are interested in the interaction of animals and plants (for example: a botanist who may study the phenology of one lemur species), s/he has to know the movement patterns (behavior) of that species of lemur, otherwise his (or her) research is incomplete and other people cannot use the results for comparisons. Or if someone is a zoologist who is interested in feeding behavior, but s/he does not know how the food-trees of his (or her) lemur species are distributed or function, therefore such study will also be incomplete. Therefore, we will also be far behind other researchers if we limit ourselves or our students to a very limited field.

The Malagasy have a rich culture and we are proud to have such a mixed culture from Asia and Africa. Unfortunately, most of the Malagasy proverbs and/or sayings are mostly inspired by their experiences with domestic animals (cows or chicken) or animals like birds or dogs that people observe in their daily life. In my knowledge, none of our proverbs talks about lemurs and only very few old stories have been recorded on them. Although, lemurs have existed on this island before the first people arrived around 2000 years ago, it is surprising that there is not much recorded on these animals.

Once again, taking account of the Malagasy governmental policy recognizing conservation among the priorities and the richness of biodiversity, I strongly suggest to incorporate lemurs among the didactic tools that the Ministry of Education should apply from now on. They cover several topics and field such as:

Paleoecology: There are subfossils of lemurs found at many sites in Madagascar

Animal Biology and Ecology: Lemurs use different types of habitat, feed on different food categories (leaves, fruits, flowers, nectar, tree barks, insects, etc.), so different species can have different shape of teeth. Some species are leapers, whereas others might be quadrupedalism.

Behavior: Some species are active during the days whereas the others during the night or crepuscular. Different species use different strategies to avoid predators, to find their food, or to defend their territories for example. Lemurs have different ways of communicating (visual, vocalizations, and hormones). Some species live in a small group size with two or three individuals and some in a large group with multimales and multi-females. These latter are often polygamous and polyandrous.

Genetics: I believe that during the last ten years, genetic studies on lemurs have been among the most advanced research areas in comparison to other field studies.

Geography: Different lemur species have clear geographical distribution. Others can be found in each province in Madagascar.
Therefore, I propose that lemurs should be used to teach in school at different levels.

In primary school: Students should learn about the different species of lemurs including subfossils occurring in each province and different habitat types (rainforest, dry forest, spiny desert, marsh) and their conservation.

In secondary school: Students should learn about behavior, diet, locomotion, and social organization of the different lemurs.

In high school: Students should learn about the phylogeny of lemurs and also the other non-human primates in Asia, Africa, and South America. The initiation of the concept of Anthropology should start at that level.

At the university: The different aspects of primates in general and lemurs in particular listed above should be learned more deeply in the different departments within the University. A Conservation Biology Department should be created. And more importantly, students and faculty should be encouraged to write and publish scientific papers furthermore collaboration between departments must be promoted.

Report on Findings of Subfossils at Ampoza and Ampanihy in Southwestern Madagascar

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Key words: *Archaeolemur,* paleoecology, carbon 14 dating, southwest Madagascar, *Hippopotamus*

Introduction

Sixteen species of large-bodied lemurs have gone extinct within the last 4,000–450 years (Simons 1997; Godfrey *et al.* 1999). These numbers are based on findings from about 40 subfossil lemur sites which range from northern to southern tips of Madagascar, and from the Mozambique Channel east to the central sites of Sambaina, Masinandriana and Andrahomana (Godfrey *et al.* 1997). Excavations in the southwestern Madagascar date back at least to the White/Ramamonjy expedition to Manombo in 1929 (White 1930) and Lamberton's discoveries at Lamboharanana, on the coast north of Tulear (Lamberton 1932). Recent expeditions have provided a more detailed view of the taxonomic composition of the past communities (Simons 1997; Godfrey *et al.* 1997a, b, 1999) and pollen cores have revealed the increased aridity of the area during the past 4 millenia (Burney 1993; Burney *et al.*1998). This condition of relative aridity and periodic drought continues today (Gould *et al.* 1999; Wright 1999). In 1995 our team explored the Ampoza region in order to document the potential for reconstructing the paleoecological setting of the region (Fig. 1).

Fig. 1: Map of the study sites in southeastern Madagascar in context of other subfossil lemur sites.

With the Malagasy Academy records Claude Chanudet (1975) reviewed the documents about early excavations at Ampoza, in southwestern Madagascar. He found that in a 1921 letter from Dr. Razafindramanana to Battistini he describes this site which has a spring that never dries up, and in its course this water exposes bone beds. Mahe took samples in the bone beds at a depth of 200cm which gave radiocarbon dates of 1910 ±120 BP (Mahe and Sourdat 1972). Recently a humerus of a new species of ground roller, a bird with close relatives in the present day Malagasy rain forest, was identified from Ampoza (Goodman 2000). The subfossil lemurs found at Ampoza include inferred forest-dwelling species such as *Hadropithecus stenognathus*, *Paleopropithecus* sp., *Indri* sp. *Archaeolemur edwardsi*, *Megaladapis* sp., and *Archaeolemur majori* (Tattersall 1982; Godfrey *et al.* 1997a,b, 1999).
The objective of this paper is to report preliminary data on the findings at the Ampoza and Ampanihy sites with particular emphasis on their paleoecological context.

Field observations

In November, 1995 an ICTE/ANGAP team from Ranomafana National Park visited the areas around the village of Ampoza (Fig. 2). Today, the region is characterized by open grassland covering gently sloping hills. Trees and bushes are mostly confined adjacent to small rivers running north west. Water levels in the streams were low at the end of November.
The first locality visited was next to the Ampoza river (the river Ampoza is named after a fresh water crab there), a tributary to the Ampanihy river. The site is located at 44° 42.3´ E, 22° 18.9´ S. This site is most likely the classic Ampoza locality and local villagers also recalled earlier ex-

peditions to the site. The river runs through a forty-meter long section of rich bone accumulations. The bone-containing deposits began at the surface and extend down to over one meter and are underlain by sand and sandstone formations that also form the bottom of the river. The bone deposits appear to be slightly more concentrated in the top layer and bottom half of the deposit with finer sediments layered between them. The bones lie predominantly horizontally in the deposits and were not clearly associated. The banks of the bone bed have been continuously eroded by the river and bones can be found in the bottom of the stream.

The second site visited is located about two kilometers south east from the Ampoza locality and is on the Ampanihy river (Fig. 2). The site is located at 44° 42.7´ E, 22° 19.8´ S. Portions of the bone deposits are under the grassland and only a five meter section is exposed by the river. Unlike the Ampoza site, the bone bed of the Ampanihy river is several meters above the present day river bed. We made surface collections of both of the deposits with the only aim of selecting bones with identifiable features.

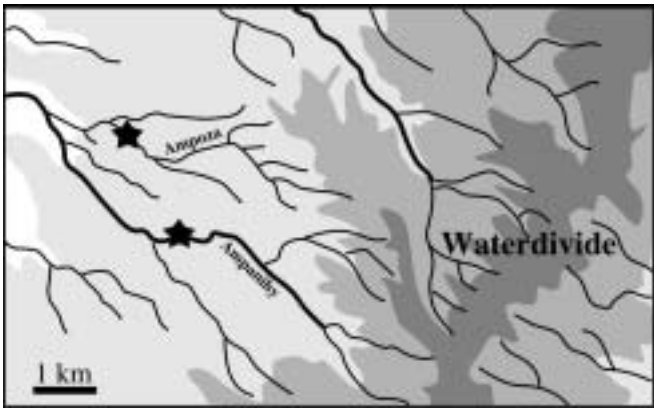

Fig. 2: Closeup schematic map of region of Ampoza and Ampanihy. The patchwork of small streams and hills spans about 40 km along the waterdivide.

Results and Discussion

The majority of bones recovered were from hippopotamuses. Of 269 specimens recovered from Ampoza, 122 were hippos as were also 30 out of 46 specimens from the Ampanihy river site. Several cranial fragments and partial mandibles with teeth were recovered as also fore and hind limb bones including metapodials. Teeth, vertebrae, and femurs made up 58 % of all the hippo bones. The remaining specimens were mostly from medium size crocodilians, large tortoises, and elephant birds. Only one clearly identifiable lemur specimen was recovered. This is a distal humerus of *Archaeolemur sp. from the Ampoza site* (Fig. 3).

The stark contrast between the relatively arid present day conditions of the area and the seemingly wet conditions of the past raises the question of the age and nature of the bone deposits. A 5000 year stratigraphic record containing fossil pollen, charcoal and bones of the extinct Quaternary megafauna from Andolonomby, a hypersaline pond near Ambolisatra in arid southwestern Madagascar shows evidence for climatic desiccation beginning about 3000 years BP. Between 3000 and 2000 yr BP, the site became increasingly arid, with charcoal and pollen evidence indicating increased fire activity beginning ca 1900 yr BP (Burney 1993). Even in the present, years of drought occur each decade (Gould *et al.* 1999; Wright 1999).

We next obtained radiocarbon dates for the Ampoza and Ampanihy river deposits. Samples of unidentifiable bone fragments were collected from the top, from 65 cm, and 110 cm depth of the Ampoza bone bed and dated by the University of Helsinki dating laboratory (Hela). Dates are uncalibrated and reported as ^{14}C yr BP using the international standard half-life of 5568 yr. The top sample date is 1850±55 (Hela-158), the 65 cm sample date is 1705±55 (Hela-157), and the 110 cm sample date is 1810±60 (Hela-156).

Fig. 3: Photo of front and back views of distal humerus (cast) of *Archaeolemur* sp. uncovered at Ampoza.

The roughly 150-year span of these dates suggests that even the thickest bone deposits in Ampoza have accumulated relatively quickly. These three dates do not exclude the possibility that the bones were deposited in a few decades. Only one date was obtained for the Ampanihy river site which gave the age of 2430±100 yr BP (Hela-3854). This suggest that the two localities visited, while separated by only two kilometers, may have been deposited around 600 years apart in time. Interestingly, the Ampanihy site has also a higher elevation (660 m) than Ampoza (570 m) and is located higher above the riverbed, suggesting that the local streams had not yet eroded to the sandstone bedrock as was apparently the case by the time the deposits at Ampoza were formed. Both these sites are located about 6 km west from the local waterdivide which has an elevation of 750 to 780 meters and presumably had already functioned as the waterdivide when the bone deposits were formed (Fig. 2).

The relative vicinity of the waterdivide and the presence of springs that still feed water to the Ampanihy and Ampoza streams is indicative of local origins of the bones. Present day hippos in Africa spend the entire day in the water and typically leave the resting pools and streams only after nightfall (Owen-Smith 1988). The present data do not allow firm conclusions whether the bones were deposited as a result of normal mortality or whether they might represent the death rate during severe drought years. Nevertheless, the slightly different concentrations of bones in different layers in the Ampoza site suggests that droughts may have caused increased hippo mortality. African hippos are well documented to congregate at the last remaining pools during drought and there to suffer heavy mortality (Owen-Smith 1988). The association of Ampoza and Ampanihy with springs may also in part suggest that the locations of the bone beds could have been the last remaining hippo rest sites during drought years. It is noteworthy that these sites are unlikely to represent mass-kills by humans because all body parts of the hippos were collected and also no butchery marks were observed.

It remains to be investigated how long the hippo dominated ecosystem existed in the region. Modern day hippos have

been documented to exert a strong influence on their surroundings. Regular movements of hippos between their rest sites and grazing grounds create channels and paths that cause erosion (Owen-Smith 1988, McCarthy *et al*. 1998). Furthermore, grazing of hippos opens the landscape near the streams, and also changes the species composition of grasses (Owen-Smith 1988). At least *Cyperus* grasses that are found around streams in eastern valleys of Madagascar are also a favored diet of African hippos. If the 600-year separation of Ampoza and Ampanihy river sites is representative of the hippo occupation, this could have been a long enough timespan for the hippos to have had a visible impact on the landscape.

The presence of several kinds of giant subfossil lemurs as well as hippos at Ampoza suggests that these taxa may have existed in the vicinity of the site. However, should the bone beds represent major drought events, animals could have been attracted from broader areas. Hence, the presence of *Archaeolemur* and the other primates may not indicate necessarily that these species shared the same habitat with hippos. The *Archaeolemur* dentition suggests that it fed on foods requiring some preparation with enlarged incisors, such as fruit with tough rinds and seeds with hard outer shells (Godfrey 1988; Simons 1997; Tattersall 1972, 1982). Similar considerations also apply to the other species of large lemurs mentioned above as reported from this site. Also, more intensive efforts to recover microfauna at these sites will likely contribute to a better understanding of the paleo environments from which these subfossils came. Future work is needed to ascertain whether *Archaeolemur*, or some other lemurs, may be more typically associated with putative hippo rest sites and may thus be interpreted to have shared the same habitat.

Acknowledgements

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FUNDING AND TRAINING

New Master's Programme in Primatology – University of Surrey Roehampton

The University of Surrey Roehampton, UK, is offering a one-year Master of Research (MRes) degree programme starting in September 2003. This programme provides a unique opportunity to study primate biology in depth. It will teach original research and place findings into a theoretical context, providing preparation for advanced research (PhD and consultancy work). It will combine theoretical investigation with laboratory and field work on a range of topics. Practical investigations will be carried out in zoos, local habitats, museums and laboratories. After the first semester

the emphasis will be on independent research, with all students carrying out an in-depth piece of original research. This will be written up as a dissertation and a paper in a form suitable for publication in a peer-reviewed scientific journal. Key Areas of Study: *Ecology and behaviour: methods used in surveying and gathering biological information, methods of recording behaviour in the field. *Diet and foraging: observing and investigating behavioural and physical dietary adaptations, field and laboratory techniques for gathering data, analysing nutritional and foraging data from wild and captive primates. *Life-history evolution: allometry, reproductive life history variables, comparative analysis of life-history and brain size evolution. * Reproduction: laboratory techniques for gathering data and analysing reproductive hormone data in wild and captive primates. The evolution of mating strategies. *Zoos and museums as a resource for the study of primates and the ethics of studying captive primates. *Methods of analysing physical and behavioural adaptations (e.g. locomotion, sensory systems). Phylogenetic reconstructions and interpretations of adaptations. For further details, contact: School of Life and Sport Sciences, University of Surrey Roehampton, West Hill, London SW15 3SN, UK, Tel: 020 8392 3524, <life_sciences@roehampton.ac.uk>, <www.roehampton.ac.uk/prospectus/postgraduate.asp?file=primatology>.

Chicago Zoological Society Grants for SSC Specialist Groups

The Chicago Zoological Society makes annual grants to SSC Specialist Groups from its Chicago Board of Trade Endangered Species Fund for small projects identified in Action Plans or other group priority setting exercises. There are two grant cycles a year, the first with awards in May and the second with awards in October. Proposals for the first round are due by E-mail by 22 March, 2003 and should be for work to be conducted in 2003. The Fund supports small projects, usually up to $5,000, and considers proposals on a specific threatened (or nearly threatened) species, or a specific habitat that is of high value or also threatened. Priority is given to projects that are clearly of critical need for the species or habitat that are likely to provide immediate results. Education /communications projects are welcome. Strict biological research projects are not a priority unless there can be a direct application of the results. Projects that have been identified in published or pending Action Plans take priority. The Specialist Group Chair (or other officer of the group) must endorse any proposal submitted on a Group's behalf. Proposals and requests for more detailed guidelines should be submitted by e-mail to: Tim Sullivan at: <tisulliv@brookfieldzoo.org>.

L. S. B. Leakey Foundation

During the budget year 2001-2002, the L. S. B. Leakey Foundation awarded 62 research grants to the tune of $646,830 and ranging from $2,650 to $20,000. Those concerned with Neotropical primates included: Early Miocene primates and other mammals of southern Patagonia – Fabian Marcelo Tejedor; Evolution of brachiation in atelines: A phylogenetic comparative study – Andrea Jones; Golden-backed uacari foraging ecology: Dietary specialists in Amazonian seasonal swamp forests – Adrian Barnett; Socioecology and population genetics of monogamous primates in Eastern Ecuador - Anthony DiFiore; The vexing question of trichromacy in *Brachyteles* and *Lemur catta* – Nathaniel Dominy; Behavioral dimorphism in monogamous owl monkeys of the Gran Chaco – Eduardo Fernandez-Duque. Deadline for grant applications: 5 January 2003. For information on grants and membership of the L. S. B. Leakey Foundation: The Leakey Foundation, P. O. Box 29346, San Francisco, CA 94129-0346, USA, <www.leakeyfoundation.org>.
Source: *AnthroQuest* (14), Fall 2002.

Lincoln Park Zoo Funds

The Lincoln Park Zoo Neotropic and Africa/Asia Funds support field research in conservation biology around the world. The Neotropic fund focuses on projects undertaken in Latin America and the Caribbean. Since 1986, the fund has awarded over 146 grants in 19 countries. The Africa/Asia fund, launched in 1997, focuses on projects throughout Africa, Asia, and the Pacific. The funds emphasize 1) the support of graduate students and other young researchers, 2) direct impact on wildlife conservation and/or conservation biology, 3) involvement by students and/or local field assistants from Latin America, Africa, or Asia at levels that engender appreciation for wildlife conservation, and 4) links to either the Lincoln Park Zoo animal collection or conservation activities of the zoo staff. Each fund typically supports between five and ten projects annually, including project renewals for a second year. Most awards fall into the range of $3,000-$6,000. Initial support is for up to 12 months from the date of award, and the maximum duration of support is two years. The current deadline for receipt of Neotropic and Africa/Asia proposals is October 1st. For additional information and application procedures go to <www.lpzoo.com/conservation>, <conservation@lpzoo.org>, or write to: Lincoln Park Zoo NF/AA Funds, Department of Conservation and Science, Lincoln Park Zoo, 2001 N. Clark St, Chicago, IL 60614, USA.

Sophie Danforth Conservation Biology Fund

Roger Williams Park Zoo accepts proposals for the Sophie Danforth Conservation Biology Fund of the Rhode Island Zoological Society. Annual awards of up to $1000 are granted to conservation programs that protect threatened wildlife and habitats worldwide. Field studies and other projects that demonstrate a multi-disciplinary approach to biodiversity and ecosystem conservation, as well as projects that involve in-country collaborators, receive highest funding priority. Environmental education programs, development of techniques that can be used in a natural environment, and captive propagation programs that stress an integrative approach to conservation are also appropriate. Deadline for submissions is May 31. Grant recipients will be notified by September 3. Proposal guidelines and additional information are available on the Roger Williams Park Zoo at <www.rogerwilliamsparkzoo.org>, in the Conservation section, or may be acquired by contacting Stacia Martin at <smartin@rwpzoo.org>.

MEETINGS

Canopy Biology, Tree Climbing Strategies and Primate Ecology

A mixed Workshop/Symposium "Canopy Biology, Tree Climbing Strategies and Primate Ecologyw" was held during XIXth International Primatological Society Congress in Beijing, China, August 4-9, 2002. It explored the ecology of the canopy from a primate's point of view. The first part of the half-day gathering presented communications for better understanding the primate canopy (field study and modelling). The second part focused on both tree climbing techniques and canopy access strategies. Each tree is now accessible, regardless of its height, size, shape and complexity. Canopy access is safe and provides the exceptional advantage of complete autonomy to the researcher (individual trees can be climbed on a needed basis). The first section of the Workshop was used by experienced climbers to present and exchange ideas on techniques, tricks, gears and strategies. A teaching lesson was provided to interested volunteers. Alain Houle presented a proposal to the Council of the International Primatological Society (IPS) for the production of a guide to techniques and safety precautions for climbing trees. The Symposium he and Emmanuelle Grundmann organized during the IPS Congress included the following themes: habitat and microhabitat description such as physical milieu, light availability, food (color vision, distribution in crowns, biomass, quality, density and defendability), foraging efficiency (the concept of giving-up density), sleeping sites, nest building and nesting behavior of apes, lemurs and galagos (live galagos and nests of galagos were accidentally found within chimpanzees' nests in Kibale), DNA analyses derived from hairs collected in nests, information sharing (visual scan from adjacent and emergent trees), and physical anthropology (branch structures and strength, limited number of paths). Accessing the canopy contributes to our knowledge of primates by bringing original information otherwise unavailable.

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RECENT PUBLICATIONS

Books

Lion Tamarins: Biology and Conservation, edited by Devra G. Kleiman and Anthony B. Rylands, 2002. 422pp. Smithsonian Institution Press, Washington, DC. Zoo and Aquarium Biology and Conservation Series. ISBN 1-58834-072-4. Price: US$45.00, £34.50. Awareness of the plight of the lion tamarins, small primates endemic to the widely decimated tropical forests of eastern Brazil, was incipient in the 1960s, but in the 1970s galvanized multinational efforts to save them - through captive breeding and, later, major programs to protect them and their forests in the wild. Thirty years on, this book records the history of the conservation efforts for the four species; the golden, golden-headed, black and black-faced lion tamarins – the last discovered only in 1990 – and summarizes the main fields of research on their physiology, demography, genetics, diseases, behavior and ecology. Protecting the small fragments of forest remaining in their already diminutive ranges has demanded the commitment of governments as well non-governmental organizations and, not least, local communities which, at the end of the day, hold the key to the fate of these animals. Remarkable over the years has been the collaborative and groundbreaking efforts on the part of zoos, initially supporting research and pioneering an exemplary global breeding program – providing as such the wherewithal for their reintroduction to the wild – and latterly contributing significantly to monitoring and studies of their life in their natural habitats. Saving species demands the application of many disciplines – well illustrated here by the diversity of talents and areas of expertise of the 50 authors who have contributed. The story of the lion tamarins is a case study –- highlighting the conservation role of zoos, the essential element of research for endangered species programs, and above all the need for dedication and endurance in the most difficult task of all – the protection of natural habitats. The book is dedicated to Adelmar F. Coimbra-Filho. *Contents*: Foreword by R. A. Mittermeier; Introduction and Acknowledgments – D.G. Kleiman & A.B. Rylands. Part I. The History and Status of Lion Tamarins. 1. A history of lion tamarin research and conservation – A.B. Rylands, J.J.C. Mallinson, D.G. Kleiman, A.F. Coimbra-Filho, R.A. Mittermeier, I. de G. Câmara, C.B. Valladares-Padua & M.I. Bampi, pp.3-41; 2. Distribution and status of lion tamarins – A.B. Rylands, M.C.M. Kierulff & L.P. de S. Pinto, pp.42-70; 3. The role of non-governmental organizations and the International Committee for the Conservation and Management of *Leontopithecus* in Lion Tamarin Conservation – D.M. Rambaldi, D.G. Kleiman, J.J.C. Mallinson, L.A. Dietz & S.M. Pádua, pp.71-94; 4. History, management and conservation role of the captive lion tamarin populations – J.D. Ballou, D.G. Kleiman, J.J.C. Mallinson, A.B. Rylands, C.B. Valladares-Padua & Kristin Leus, pp.95-114. Part II. The Biology of Lion Tamarins. 5. Genetics and evolution of lion tamarins – H.N. Seuánez, A. DiFiore, M.A.M. Moreira, C.A. da S. Almeida & F.C. Canavez, pp.117-132; 6. Lion tamarin reproductive biology – J.A. French, K. de Vleeschouwer, K. Bales & M. Heistermann, pp.133-156; 7. Behavioral ecology of lion tamarins – M.C.M. Kierulff, B. Raboy, P. Procópio de Oliveira, K. Miller, F.C. Passos & F. Prado, pp.157-187; 8. Mating system and group dynamics in lion tamarins – A.J. Baker, K. Bales & J.M. Dietz, pp.188-212; 9. Infant care in lion tamarins – S.D. Tardif, C.V. Santos, A.J. Baker, L. van Elsacker, A.T.C. Feistner, D.G. Kleiman, C.R. Ruiz-Miranda, A.C. de A. Moura, F.C. Passos, E.C. Price, L. Rapaport & K. de Vleeschouwer, pp.213-232; 10. Conspicuousness and complexity: Themes in lion tamarin communication – C.R. Ruiz-Miranda and D.G. Kleiman, pp.233-254; 11. Diseases of lion tamarins – A. Pissinatti, R.J. Montali & F. Simon, pp.255-268. Part III. Conservation and Management in the Wild. 12. Reintroduction and translocation as conservation tools for golden lion tamarins; M.C.M. Kierulff, P. Procópio de Oliveira, B.B. Beck & A. Martins, pp.271-282; 13. The effects of pre-release environments and post-release management on survivorship in reintroduced golden lion tamarins – B.B. Beck, M.I. Castro, T.S. Stoinski & J.D. Ballou, pp.283-300; 14. Metapopulation management for the conservation of black lion tamarins – C.B. Valladares-Padua, J.D. Ballou, C.S. Martins, L. Cullen Jr., pp.301-314; 15. *In Situ* conservation education and the lion tamarins – S.M. Pádua, L.A. Dietz, D.M. Rambaldi, M. das G. de Souza & G.R. dos Santos, pp.315-335; 16. Lion tamarin

biology and conservation: A synthesis and challenges for the future – D.G. Kleiman & A.B. Rylands, pp. 336-343.
Available from: USA – Smithsonian Institution Press, P. O. Box 960, Herndon, VA 20172-0960, Tel: (800) 782-4612, (703) 661-1599, Fax: 703 661-1501. Asia – East-West Export Books, 2840 Kolowalu St., Honolulu, HI 96822, Tel: (808) 956-8830, Fax: (808) 988-6052,
<www.sipress.si.edu/books/titles_books/1-58834-072-4.html>.

Journals and Book chapters (without abstracts)

Species
Number 38 of *Species*, the newsletter of the Species Survival Commission of IUCN, is available on the web. It has a special feature that will benefit all those working in the field of conservation: lessons learned in fundraising! Several of the IUCN/SSC Specialist Groups offer advice and share their experiences on how to effectively source funding to continue their important work. With an introductory message from SSC Chair David Brackett, news stories from the network, and updates from the Specialist Groups and SSC Programmes, *Species* 38 is well worth a read to stay tuned with the happenings within the Commission. The current issue, along with back issues of *Species*, is available at
<www.iucn.org/themes/ssc/species/spec-int.htm>.

Special issue of the *International Journal of Primatology* – Evolutionary Theory and Primate Behavior
Dario Maestripieri (Committee on Evolutionary Biology, The University of Chicago) and Peter Kappeler (Deutsches Primatenzentrum, Göttingen) were the guest editors for a special issue of the *International Journal of Primatology*, Vol. 23(4), August 2002, dedicated to "Evolutionary Theory and Primate Behavior". According to Maestripieri and Kappeler "the specific goal…is to examine some of the best known evolutionary theories of behavior and discuss critically whether the findings of primate behavioral research are consistent with them." They conclude that not all hypotheses derived from evolutionary theory have been consistently supported by primate data, but that the adaptationist program of Ernst Mayr (*Am. Nat*. 121, 324-333, 1983) has been of enormous heuristic value for primate behavioral research. The contributions of this volume pay tribute to the fact that the evolutionary hypotheses have stimulated a great deal of research and have produced a significant amount of new knowledge on the behavioral biology of nonhuman primates. "Such research and knowledge have often led to formulation of new and more sophisticated evolutionary hypotheses and a better appreciation of the degree to which the behavior of primates is adapted to their ecological and social environment." The editors hope that the articles in the special issue will encourage more primatologists to seriously consider tests of adaptive hypotheses as part of their research, so that the gap with mainstream evolutionary biology will eventually be closed.
The issues includes the following articles. Evolution of primate social systems – P.M. Kappeler & C.P. van Schaick, pp.707-740; Avoiding predators: Expectations and evidence in primate antipredator behavior – C.B. Stanford, pp.741-757; Competition for resources and its behavioral consequences among female primates – A. Koenig, pp.759-783; Modelling primate behavioral ecology – R.I.M. Dunbar, pp.785-819; Primate communication: By nature honest? By experience wise? – H. Gouzoules & S. Gouzoules, pp.821-848; Kin selection in primate groups – J.B. Silk, pp.849-875; Sexual selection and mate choice – A. Paul, pp.877-904; Sex-biased parental investment in primates – F. Bercovitch, pp.905-921; Parent-offspring conflict in primates – D. Maestripieri, pp.923-951.

The Primate Fossil Record
edited by, Walter Carl Hartwig, Cambridge Studies in Biological and Evolutionary Anthropology 33, 2002. Cambridge University Press, Cambridge, UK. 540pp. ISBN: 0-521-66315-6. Price: $175.00, £120.00 (hardback). The Primate Fossil Record is the first comprehensive treatment of primate paleontology in more than 20 years. Profusely illustrated and up to date, it captures the complete history of the discovery and interpretation of primate fossils. The chapters range from primate origins to the advent of anatomically modern humans. Each emphasizes three key components of the record of primate evolution: history of discovery, taxonomy of the fossils, and evolution of the adaptive radiations they represent. *The Primate Fossil Record* summarizes objectively the many intellectual debates surrounding the fossil record and provides a foundation of reference information on the last two decades of astounding discoveries and worldwide field research for physical anthropologists, paleontologists and evolutionary biologists. Includes chapters on: The origin of primates – D.T. Rasmussen, pp.5-9; The origin and diversification of anthropoid primates - M. Dagosto, pp.125-132; Platyrrhine paleontology and systematics: The paradigm shifts – A.L. Rosenberger, pp.151-159; Early platyrrhines of southern South America – J.G. Fleagle & M.F. Tejedor, pp.161-173; Miocene platyrrhines of the northern Neotropics – W.C. Hartwig & D.J. Meldrum, pp. 175-188; Extinct Quaternary platyrrhines of the Greater Antilles and Brazil – R.D.E. MacPhee & I. Horovitz, pp.189-200. Despite the price – evidently indispensable.
Available from: Cambridge University Press, 40 West 20th Street, New York, NY 10011-4211, USA, Tel: 1-800-872-7423, Fax: 914-937-4712,
<directcustserve@cambridge.org>, <www.cambridge.org>.

Infanticide by Males and Its Implications
edited by Carel P. van Schaik and Charles H. Janson, 2002. Cambridge University Press, Cambridge UK. 584pp. ISBN: 0 521 77295 8 (hardback), 0 521 77498 5 (paperback). Price: £80.00 (hardback), £29.95 (paperback). Male primates, carnivores and rodents sometimes kill infants that they did not sire. Is this bizarre behavior a pathological aberration, or does it instead reflect an adaptive strategy for males in certain circumstances? In this unique comparative study of the dark side of social relationships, particularly in primates including humans, the extent to which social organization and reproductive behavior reflect evolved countermeasures against the threat of infanticide is explored. Contents: Foreword – S.B. Hrdy; Preface – C.P. van Schaik & C. Janson; Part I. Introduction: 1. The holy wars against infanticide: which side are you on and why? – V. Sommer; 2. Infanticide by male primates: the sexual selection hypothesis revisited - C.P. van Schaik; 3. Vulnerability to infanticide by males: patterns among mammals – C.P. van Schaik; Part II. Infanticide by Males: Case Studies: 4. Infanticide in red howlers: female group size, male composition and a possible link to folivory – C.M. Crockett & C.H. Janson; 5. Infanticide in Hanuman langurs: social organization, male migration and weaning age – C. Borries & A. Koenig; 6. Male infanticide and defense of infants in Chacma baboons – R. A. Palombit, D.L. Cheney, J. Fischer, S. Johnson, D. Rendall, R.M. Seyfarth & J.B. Silk; 7. Infanticide by males and female choice in wild Thomas's Langurs – R. Steenbeek; 8. The evolution of infanticide in rodents: a comparative analysis – D.T. Blumstein; 9. Infanticide by male birds – J.P. Viega; Part III. Behavioural Consequences of Infanticide by Males: 10. Prevention of infanticide: the perspective of infant primates – A. Treves; 11. Infanticide and the evolution of male-female bonds in animals – R.A. Palombit; 12. The other side of the coin: infanticide and the evolution of affiliative male-infant interactions in Old World primates – A. Paul, S. Preuschoft

& C.P. van Schaik; 13. Female dispersal and infanticide avoidance in primates – E.H.M. Sterck and A.H. Korstjens; 14. Reproductive patterns in eutherian mammals: adaptations against infanticide – M.A. van Noordwijk & C.P. van Schaik; 15. Paternity confusion and the ovarian cycles of female primates – C.P. van Schaik, J.K. Hodges & C.L. Nunn; 16. Social evolution in primates: the relative roles of ecology and intersexual conflict – C.L. Nunn & C.P. van Schaik; Part IV. Infanticide by Females: 17. Infanticide by female mammals: implications for the evolution of social systems – L. Digby; 18. 'The hate that love generated' - sexually selected neglect of one's own offspring in humans – E. Voland & P. Stephan; Part V. Conclusion: 19. The behavioral ecology of infanticide – C.H. Janson and C.P. van Schaik. Available from: Cambridge University Press, 40 West 20th Street, New York, NY 10011-4211, USA, Tel: 1-800-872-7423, Fax: 914-937-4712, <directcustserve@cambridge.org>, <www.cambridge.org>.

Primate Dentition: An Introduction to the Teeth of Non-human Primates

by Daris R. Swindler, 2002. Cambridge University Press, Cambridge, UK. Price: £55.00. ISBN: 0 521 65289 8. 312pp. Primate dentitions vary widely both between genera and between species within a genus. This book is a comparative dental anatomy of the teeth of living non-human primates that brings together information from many disciplines to present the most useful and comprehensive database possible in one consolidated text. The core of the book consists of comparative morphological and metrical descriptions with analyses, reference tables and illustrations of the permanent dentitions of 85 living primate species to establish a baseline for future investigations. The book also includes information on dental microstructure and its importance in understanding taxonomic relationships between species, data on deciduous dentitions, prenatal dental development and ontogenetic processes, and material to aid age estimation and life history studies. Primate Dentition will be an important reference work for researchers in primatology, dental and physical anthropology, comparative anatomy and dentistry as well as vertebrate paleontology and veterinary science. *Contents*: Preface; 1. Introduction; 2. Dental anatomy; 3. Dental development; 4. The deciduous dentition; 5. Superfamily Lemuroidea; 6. Family Cebidae; 7. Family Cercopithecidae; 8. Hylobatidae; 9. Pongidae; Odontometric appendix; Dental eruption appendix; Glossary; References; Taxonomic index. *Available from*: Cambridge University Press, 40 West 20th Street, New York, NY 10011-4211, USA, Tel: 1-800-872-7423, Fax: 914-937-4712, <directcustserve@cambridge.org>,<www.cambridge.org>.

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Andrianjaka, V.E. 2002. Contribution à l'ètude èco-èthologique de *Eulemur albocollaris* (Rumpler, 1975) dans le Parc National d'Andringitra. Mémoire de D.E.A., Dépt. de Biologie Animale. Faculté des Sciences, Université d'Antananarivo. Résumé: L'objectif de ce travail sur l'étude éco-éthologique de *E. albocollaris* du Parc National d'Andringitra est de recenser ces animaux et d'en voir les relations avec leur habitat et ses caractéristiques. Cependant, outre les données écologiques présentées, ce document utilise différentes méthodes de calcul pour évaluer la densité des populations de lémuriens diurnes du site d'étude. La végétation du Parc National d'Andringitra présente, dans sa structure, les caractéristiques du forêt dense humide de l'Est. Ces spécificités se manifestent surtout par la richesse spécifique et par l'abondance des grands arbres. *E. albocollaris*, une espèce de lémurien pesant en moyenne 2,1 kg, y vit en groupe de 3 à 12 individus; sa population étant estimée à 78,1 individus/km^2 ou en terme d'abondance relative, à 3,82 individus/km. Sur le plan activité, le repos s'étale sur les 70,6 % de leur temps; 23,1 % est consacré au déplacement, 0,5 % aux activités sociales et 5,7 % à l'alimentation. A ce propos, les Lémurs à collier blanc, essentiellement frugivores, se nourrissent de 20 espèces végétales. Ces animaux vivent en sympatrie avec d'autres espèces de lèmuriens qui y sont, désormais, moins abondants. Entre autre, les plus nombreux sont les individus de *Eulemur rubriventer* vivant en groupe de 2 à 4 individus et évaluée à 15,4 individu/km^2, soit à 0,61 individu/km.

Craul, M. 2002. Female mate choice in the grey mouse lemur (*Microcebus murinus*). Diploma thesis, Institute of Zoology, School of Veterinary Medicine Hannover. Female mate choice in nocturnal primates has not been tested yet, although it should be relevant, since in many of these species females show a higher investment in their offspring than males. Especially in lemurs female mate choice should be easily detectable, since females in many species are dominant over males. The aim of this study was to check for female mate choice and to reveal some relevant male traits for mate selection in the grey mouse lemur (*Microcebus murinus*). An experimental design was developed, in which females could choose between two males. Mate choice was deduced from the time spent in proximity to the males. The investigated male traits were body weight, testis size, trill frequency, age, relatedness (between males and females) and familiarity (as breeding partners or during socialisation). Seventeen females were tested with two out of sixteen males in each oestrus phase (interoestrus, prooestrus, oestrus and metoestrus) for one hour. Because of the inconsistent choices made by the females over different oestrus phases, only the oestrus data were used to examine the influence of male traits on female mate choice. During oestrus twelve of the seventeen females showed a significant preference for one male. In four cases this spatial choice was accompanied by copulations. The preferences of the twelve choosy females during oestrus were significant for the male with a smaller testes size, and higher trill frequency. The influence of body weight, relatedness, and familiarity could not be statistically confirmed. Relatedness and familiarity, however, were interconnected in the experiments and could therefore not be easily disentangled. Corresponding to theoretical predictions, however, females who did not know the related male from common socialisation (n = 8), chose related and not related males in equal proportions. In the remaining cases (n = 4) the females sometimes chose the related males, but did not copulate (n = 3) or chose the non-related male and copulated (n = 1). The influence of age on the female mate choice was not statistically significant. In the four cases with copulations, however, there was a female preference for the older male. This could indicate a preference for older age as an indicator of experience and fitness.

Marquart, K. 2002. A comparative analysis of population densities of mouse lemurs and other lemur species at two dry deciduous forests in the region of Ankarafantsika, northwestern Madagascar. Diploma thesis, Institute of Zoology, School of Veterinary Medicine Hannover and Institute of Zoology, University Stuttgart-Hohenheim. The occurrence and density of lemur species depends on the ecological conditions in a given habitat, i.e. the distribution and abundance of resources as well as the degree of anthropogenic disturbances like forest fragmentation and habitat alterations, and species-specific levels of tolerance in the face of these changes. The aim of this study was to compare two ecologically different dry deciduous forests in northwestern Madagascar with regard to their lemur communities. The two areas differed drastically in the amount of human disturbance. Data were collected

from July to October 2001. One site (Ampijoroa Forestry Reserve, JBA) is located in a large stretch of primary forest within the limits of the Ankarafantsika Nature Reserve. The other site (Ste. Marie) is an isolated fragment of about 150 ha, surrounded by savannah, farmland and some villages. The two study sites are about 27 km apart. Diurnal and nocturnal census observations and capture-recapture procedures were conducted in both sites. These data were analysed in relation to structural properties of the vegetation (e.g. density of trees and bushes, height of the upper tree layer) and signs of human disturbances in the forest (e.g. cattle droppings, fires, wood exploitation) that were collected systematically along a 2km transect, which was also used for census observations and capturing. Captured mouse lemurs were characterised by 14 morphometric measurements (e.g. body size and weight, measures of the head, snout, ear, face, tail). In both study areas seven lemur species were present, but they differed significantly in population densities and species composition (JBA: *Propithecus verreauxi coquereli, Eulemur fulvus fulvus*, *Avahi occidentalis*, *Lepilemur edwardsii*, *Cheirogaleus medius, M. murinus, M. ravelobensis*, Ste. Marie: *P. verreauxi coquereli*, *E. fulvus fulvus*, *E. mongoz*, *L. edwardsii*, *C. medius*, *M. murinus*, *M. ravelobensis*). The morphologically larger lemur species occurred in about five times lower numbers in Ste. Marie in comparison to JBA. They were more shy towards humans in the degraded forest, which could be due to illegal hunting. In the primary forest, the population density of *A. occidentalis* and *L. edwardsi* was higher than in previous studies. Surprisingly, the population densities of the small nocturnal mouse lemurs were higher in the disturbed forest than in the primary forest. I found no significant morphometric differences between the geographically separated mouse lemur populations. Furthermore, no variation was found concerning body weight and reproductive condition. The analysis of the vegetation composition and density in both forest areas revealed significant differences in habitat structure. The trees in the primary forest had a higher density and crown dominance. In comparison, the degraded forest of Ste. Marie was more transparent resulting in a denser layer of herbs and bushes. The correlation of these ecological parameters with the capture results of the mouse lemurs revealed that *M. ravelobensis* showed a general preference for places with a high density of liana bearing trees. This result coincides with other studies that have shown that *M. ravelobensis* often uses nests in lianas or leaves for sleeping. In conclusion, large lemur species seem to be rare in the disturbed forest fragment of Ste. Marie which might be explained by the intense exploitation of wood, cattle grazing in the forest and fires, which touch the edge of the forest every dry season. Consequently, the habitat of these animals decreases continuously. In contrast, the morphologically small mouse lemurs were encountered in Ste. Marie in relatively high numbers. They used cultivated plants and introduced plantation trees as an additional food source and seem to be more flexible in their behavioural responses to environmental disturbances than other lemur species. With the ever more increasing human alteration of primary and secondary forest habitats, however, the long-term survival of any lemur species is by no means secure.

Ostner, J. 2003 Sex-specific reproductive strategies of redfronted lemurs (*Eulemur fulvus rufus*, Primates, Lemuridae). PhD thesis. University of Würzburg. The number of males in animal groups is an essential determinant of male and female reproductive strategies. Females may benefit from living with several males, whereas males generally strive to monopolize a group of females. Due to male intrasexual competition, the sex ratio of groups of anthropoid primates is generally female-biased. Gregarious Malagasy lemurs deviate from theoretical expectations derived from sexual selection theory and from patterns found among anthropoids because they live in relatively small groups with an even or male-biased adult sex ratio and lack sexual dimorphism. The aim of this thesis was to investigate sex-specific reproductive strategies relating to the unusual group composition of redfronted lemurs (*Eulemur fulvus rufus*) by combining behavioral, demographic and endocrinological data. In the first of a set of four studies I investigated the applicability of non-invasive endocrine measurements for monitoring ovarian function in wild redfronted lemur females in order to evaluate the degree of estrus synchrony. Further, I tested the prediction that males living in multi-male groups rely on indirect mechanisms of intrasexual competition, such as physiological suppression of testicular function. Several possible benefits gained from living with many males have been proposed and the hypothesis that additional males improve social thermoregulation was tested in the third study. Finally, I examined the proximate determinants of the unusual sex ratio within groups, the variation in the adult sex ratio as well as possible social benefits of the high number of males for both sexes. The study was conducted in Kirindy Forest, Madagascar, between April 1999 and July 2000. I recorded >3000 hours of focal animal data on social and sexual behavior of all adult members of five groups. Additionally, >2200 fecal samples of males and females were collected for subsequent hormone analysis using enzymeimmunoassay (EIA). Further, I analyzed demographic data from seven *Eulemur fulvus rufus* groups collected between 1996 and 2002. The analyses of fecal estrogen and progestogen excretion in wild and captive females revealed that monitoring ovarian function is principally possible in redfronted lemurs, as demonstrated by the analysis of samples from captive females. Characterization of ovarian cycles in wild females, however, was not possible, because of a high day-to-day variability in excreted hormones. Nevertheless, the study provided reliable information on gestation and cycle length as well as endocrine changes associated with gestation. Additionally, I established a method for prenatal sex determination using maternal fecal samples collected during late gestation. The excretion pattern of androgens in samples of males revealed no differences between dominant and subordinate males, indicating that dominant males did not suppress the endocrine function of subordinate rivals. High frequencies of matings in combination with large testes size suggest that male reproductive competition relies at least partly on sperm competition. Females did not benefit from the high number of males in their groups in terms of improved thermoregulation because surplus males did not participate frequently in huddling groups with females. Analysis of the demographic data revealed that birth and mortality rates were not sex-biased and that males migrated considerably more frequently than females, providing no proximate explanation for the unusual sex ratio. Females in this study may proximately regulate group composition by synchronizing their fertile periods, which were inferred indirectly from the temporal distribution of births within groups. Both males and females benefit from the high number of co-resident males because reduced male group size seemed to be the main predictor of take-over rate, and thus, infanticide risk. The results of these studies suggest that certain life history traits (fast maturation, short inter-birth intervals) may ultimately determine the high number of males and the lack of single-male groups seen in redfronted lemurs. An accelerated male life history may facilitate joint group transfers and take-overs of male coalitions without a transitional time outside bisexual groups. Because males and females both benefit from a high number of males the conflict of interests between the sexes is considerably defused. Thesis available at:
http://opus.bibliothek.uni-wuerzburg.de/opus/volltexte/2003/501/

Rasolofoharivelo, M.T. 2002. Impacts anthropiques sur *Eulemur fulvus collaris* (E. Geoffroy, 1812) et son habitat naturel dans la forêt littorale de Mandena, Fort-Dauphin (Madagascar). Mémoire de D.E.A, Dépt. de Paléontologie et d'Anthropologie Biologique. Faculté des Sciences, Université d'Antananarivo. Résumé: Maintenir l'équilibre écologique de *E. f. c.*, considéré comme "espèce parapluie" à Mandena (Fort-Dauphin), serait un grand pas dans la conservation de l'écosystème forestier littoral qui risque de disparaître dans moins de vingt cinq ans. Ainsi, pour comprendre l'ampleur des pressions anthropiques et statuer sur des implications de stratégie de conservation, nous avons collecté des données socio-économiques et des données sur les activités humaines, la population animale et la forêt avec une combinaison de méthodes variées (observation sur terrain, consultations de documents officiels). Puis, nous avons utilisé des méthodes statistiques inductives pour analyser ces données. Avec une croissance démographique de 2,7 %, l'exploitation des ressources naturelles s'intensifie tous les jours et provoque des impacts négatifs sur la population de *E. f. c.*. La densité varie de 0 à 7 individus/km^2 et la taille d'un groupe ne dépasse pas 5 individus; le sex-ratio reste à priori 1:1 mais la reproduction est estimée à moins de 0,6 petit par femelle adulte par an. Par ailleurs, le déclin des structures forestières engendre des problèmes de ressources alimentaires et de substrats disponibles et cela bouleverse le rythme d'activité de l'animal. Il est alors impératif de renforcer la gestion durable prévue pour cette forêt et d'adopter un plan d'aménagement qui permet de protéger *E. f. c.*, d'assurer les besoins des populations humaines riveraines et de conserver les fonctions écologiques du littoral.

Rahelinirina, M. 2002. Contribution à l'étude du rythme d'activités et de l'alimentation de deux femelles de Microcèbes sympatriques (*Microcebus murinus*, J.F. Miller, 1777 et *Microcebus ravelobensis*, Zimmermann *et al*., 1998) au jardin botanique "A" de la station forestière d'Ampijoroa Ankarafantsika, Mahajanga, Madagascar. Mémoire de D.E.A, Dépt. de Paléontologie et d'Anthropologie Biologique. Faculté des Sciences, Université d'Antananarivo. Résumé: L'étude de la morphométrie et de l'état de la reproduction effectués au cours de cette étude confirme les résultats trouvés par les autres auteurs chez *M. murinus* et *M. ravelobensis*. Les deux femelles étudiées sur ces deux espèces, objet de notre étude, sont actives depuis la sortie de leur gîte, le soir, jusqu'à leur rentrée très tôt le matin. Leur rythme d'activité pendant la saison sèche est constitué en grande partie de la locomotion, du repos et de l'alimentation alors que l'observation, l'interaction, le marquage et la vocalisation sont minimes; il débute par la recherche de la nourriture avec de grands déplacements espacés d'un petit repos et lorsqu'elles ont obtenu une nourriture suffisante, elles se reposent assez longtemps, puis elles reprennent leurs activités jusqu'à la rentrée dans leur gîte; ce rythme varie avec le climat et la disponibilité de la nourriture ainsi qu'avec la période de reproduction. Lorsque la température est fraîche ou le climat mauvais, le déplacement diminue, et l'animal préfère alors se camoufler dans un refuge; la dispersion et la quantité de nourriture règlent aussi le type de son activité. Le niveau choisi fréquenté pendant le déplacement ou pendant l'alimentation ne présente pas une grande différence pour les deux femelles: il se situe du sol jusqu'à 10m de hauteur en général. Leur régime alimentaire est formé par des sécrétions d'Homoptères (*Flatidia coccinea*), des gommes de différentes plantes ainsi que des insectes; la femelle de *M. murinus* préfère davantage la gomme tandis que la femelle de *M. ravelobensis* absorbe beaucoup de sécrétions de *Flatidia coccinea*. Ces deux espèces semblent utiliser les mêmes niches écologiques mais elles n'entrent pas en compétition directe ni alimentaire ni territoriale et leur densité respective garde le même rapport dans ce jardin botanique "A", celle de *M. murinus* est plus grande que celle de *M. ravelobensis*.

Ratelolahy, F.J. 2002. Etude du statut de chef de groupe et impacts de l'écotourisme sur *Hapalemur simus* (Gray, 1870) dans le Parc National de Ranomafana (Madagascar). Mémoire de D.E.A, Dépt. de Paléontologie et d'Anthropologie Biologique. Faculté des Sciences, Université d'Antananarivo. Résumé: Cette étude nous aidera à mieux comprendre le genre *Hapalemur* tout en permettant d'apprécier les différents rôles du chef de groupe que la femelle assume surtout pendant le déplacement, la nourriture, la recherche du dortoir ainsi que pendant le conflit. Les résultats ont montré que sur ces trois espèces, ce sont les grandes femelles qui dirigent le groupe. Pour le cas de *Hapalemur g. griseus*, ces grandes femelles mènent le groupe durant le 69 % de déplacement, chez *H. aureus*, elles tiennent 59 % de déplacement, et chez *H. simus* 51 %. Chez les trois espèces, les perturbations les plus fréquentes sont le flash-photo, la simple approche, et la marche imprudente. Le degré de perturbation va de pair avec le nombre de touristes qui viennent les visiter. Chez *H. simus*, le mâle est dominant. Alors que chez les deux autres espèces, c'est la femelle. Sur ces trois espèces, seule *H. simus* qui est active pendant la nuit. Et dans cet ouvrage, nous mettons donc en relief les menaces que ces lémuriens subissent. En effet, ce fait suscite notre intérêt étant donné que la recherche de la solution adéquate relève de notre domaine en tant que primatologue. Nous espérons que nos résultats feront comprendre les stress subis par les Hapalemurs de la part des touristes et aussi pourront servir aux gestionnaires des Parcs nationaux à réorienter leurs actions de conservation en vue d'un développement durable.

Rasolofoson, R.D.W. 2002. Stratégies anti-prédatrices d'*Eulemur fulvus rufus* (Audebert, 1800) dans la forêt dense sèche de Kirindy, Morondava, Madagascar. Mémoire de D.E.A, Dépt. de Paléontologie et d'Anthropologie Biologique. Faculté des Sciences, Université d'Antananarivo. Résumé: Cette étude a pour but de voir les stratégies anti-prédatrices exercées par *E. f. rufus* face aux différents prédateurs et aux événements qui peuvent survenir. Deux groupes ont été observés dans la forêt de Kirindy/CFPF du mois d'Avril au mois de Juin 2000. Pour cela, nous avons essayé d'analyser les fréquences de vigilance de l'animal par la méthode "Scan Sampling" d'Altmann au cours de ses activités journalières pour connaître ses différents comportements envers les prédateurs. La fréquence de vigilance est distribuée inégalement à l'intérieur du groupe où les mâles adultes sont plus vigilants que les femelles adultes. Ensuite, elle est plus élevée au cours de la locomotion que pendant le repos ou durant l'alimentation. Le Lémur à Front roux est plus vigilant dans la strate inférieure que dans les strates moyenne et supérieure. L'animal ne dort pas toujours dans un même habitat spécifique (normalement dans la strate supérieure). Cette étude montre également que la femelle assure à la fois le rôle de guide et de guetteur au cours de ses activités journalières.

Rakotonirainy, E.O. 2002. Etude de la prédation entre *Mirza coquereli* (A. Grandidier, 1867) et *Microcebus murinus* (J.F. Miller, 1777) dans la forêt de Kirindy, Morondava, Madagascar. Mémoire de D.E.A, Dépt. de Paléontologie et d'Anthropologie Biologique. Faculté des Sciences, Université d'Antananarivo. Résumé: Cette étude a pour but de connaître si *M. coquereli* peut constituer un prédateur de *M. murinus*. Elle se déroule les mois d'avril, mai et juin 2000 et consiste à établir le comportement normal de *M. murinus* en captivité puis de l'examiner en présence de *M. coquereli*. Au total 34 *M. murinus* ont été examinés, 24 durant le premier volet et 10 lors du deuxième volet de l'étude. La méthode d'observation utilisée est la méthode Animal Focus "Focal Animal Sampling". Quatre tests statistiques sont utilisés pour l'analyse des données: le test X^2 de Pearson, test Q de Cochran, test McNemar et McNemar de changement. Les résultats obtenus confir-

ment que: *M. murinus* préfère la distance éloignée de *M. coquereli*, amplifie la fréquentation du niveau haut, et émet fréquemment de vocalisation puis détecte attentivement *M. coquereli*. L'ensemble de comportement reflète la stratégie anti-prédatrice des lémuriens. Ceci n'a aucune relation avec la différence entre les grandeurs du corps ou la compétition alimentaire et la vie en syntopie entre *M. coquereli* et *M. murinus*. De ce fait, *M. coquereli* constitue un danger relatif à la prédation vis-à-vis de *M. murinus.*

Rakotoarisoa, G. 2002. Etude des comportements de soins parentaux et de développement post-natal en captivité chez *Hapalemur aureus* (B. Meier, R. Albignac, A. Peyriéras, Y. Rumpler, P. Wright 1987). Mémoire de D.E.A, Dépt. de Biologie Animale. Faculté des Sciences, Université d'Antananarivo. Résumé: Nos observations sur les comportements de soins parentaux et le développement post-natal ont été faites sur *H. aureus* élevé en captivité au P.B.Z.T. Le couple fondateur étudié est arrivé au Parc le 17 Juin 1987, et provient du Parc Ranomafana. Un enfant est né le 07 Novembre 1994. Son développement a été étudié pendant les trois premiers mois de sa vie. Le couple donne naissance à un enfant chaque année. La mère est la première responsable de l'enfant. Les comportements observés et analysés sont: le déplacement, l'alimentation, la surveillance, le jeu, le grooming et le repos. Dès la naissance jusqu'à la cinquième semaine, la mère a l'habitude de laisser son enfant sur un perchoir ou sur le sol et dans le nichoir alors qu'elle part à la recherche de nourriture ou à la prise de bain de soleil. La surveillance et l'agressivité diminuent d'intensité au fur et à mesure que l'enfant grandit. La mère n'a pas l'habitude de jouer avec l'enfant mais le père le fait constamment. Les deux parents apprennent l'enfant à se déplacer, à se nourrir. L'enfant commence à s'agripper à sa mère et à se déplacer par terre ou sur un perchoir après une semaine. Le mordillement d'un objet non comestible fut observé chez l'enfant de 15 jours. L'ingestion d'aliment solide cependant ne peut avoir lieu qu'à partir de la neuvième semaine. Il y a des différences entre comportement en captivité et dans la nature. Les comportements en captivité sont précoces. A l'âge de 12 semaines, l'enfant est capable d'exploiter son petit environnement. Les résultats de notre étude nous permettent d'améliorer les techniques d'élevage de *H. aureus* au sein du P.B.Z.T.

Rabesandratana, A.Z. 2002. Etudes comparatives des comportements nutritionnels des *Varecia variegata variegata* (Kerr 1792) relâché et sauvage dans la Réserve Naturelle Intégrale de Betampona (N°1). Mémoire de D.E.A, Dépt. de Biologie Animale. Faculté des Sciences, Université d'Antananarivo. Résumé: Pour la première fois à Madagascar et particulièrement dans la Réserve Naturelle Intégrale de Betampona, une expérimentation sur la réintroduction des populations captives de *V. v. variegata* a été effectué sous la coordination du Madagascar Fauna Group (MFG) en 1997 et 1998. Deux groupes de *V.v.variegata* relâchés composés de deux individus chacun sont parmi les survivants dans la forêt de Betampona, faisant l'objet de l'étude. Les comportements (nutritionnel) des individus relâchés sont suivis et comparés à ceux des deux groupes sauvages de Betampona. Ces individus captifs viennent de l'Institution Nord américaine qui est le Duke University Primate Center (DUPC, Caroline du Nord, Etats-Unis). Notre travail qui s'étend de mi-juillet à mi-octobre 2000 consiste à savoir l'origine de la différence de comportement et en particulier nutritionnel montré entre la même espèce *V. v. variegata* résidente et introduite. Le renforcement de stocks permet au *V.v.variegata* l'opportunité de se libérer de l'environnement artificiel, mal adapté et monotone de sa condition de vie. Les animaux captifs pourraient exprimer tous ces répertoires comportementaux dans un milieu naturel, de réaliser des apprentissages grâce aux inestimables ressources (alimentaire, territoriale,…) qui y sont présents. La physionomie complexe tridimensionnelle de la forêt dense humide stimule le réveil de certains traits comportementaux masqués pendant la période de captivité. En effet, le retour à la nature influe sur le dynamisme des groupes relâchés: des apprentissages et amélioration du comportement sont observés (exemple: pendant l'activité nutritionnelle). Ceci, malgré les maladresses observées surtout chez le deuxième groupe relâché pendant la recherche et la consommation des fruits ou feuilles. Il semble qu'il y a une inhibition de certains traits de leur comportement. Ce blocage peut être dû au traumatisme de leur vie en cage. Par contre, le premier groupe relâché présente une nette amélioration de son comportement de nutrition; ce groupe a bénéficié environ 30 mois d'expérience pour exploiter et utiliser leur nouveau environnement. De plus, leur vie antérieure leur permet d'être souple à l'adaptation car ce groupe a été élevé en semi-liberté.

Raharison, F.J.L. 2002. Adaptations stratégiques de *Hapalemur g. griseus* (Link, 1795) selon les conditions du milieu dans le Parc National de Ranomafana (Août - Septembre 1998 et Février - Mars 1999). Mémoire de D.E.A, Dépt. de Biologie Animale. Faculté des Sciences, Université d'Antananarivo. Résumé: Les stratégies utilisées par *H. g. griseus* dans la Parc National de Ranomafana selon les conditions du milieu sont évaluées par la comparaison de l'environnement et les activités de l'animal entre le site de Talatakely et celui de Vatoharanana. *H. g. griseus* vit en sympatrie avec *H. aureus* et *H. simus* dans le site de Talatakely. Ce site est proche de la RN.25 et a été surexploité dans le passé par les villageois. Les données climatiques sont enregistrées à l'aide d'un thermomètre "min-max" et un pluviomètre gradué. Huit quadrats botaniques sont établis pour comparer la composition floristique des deux sites. Le recensement de la communauté de primates est fait par les observations portées sur les transects. Les activités de l'animal sont enregistrées en observant un animal pendant une journée. Les observations portées sur un animal focal pendant une journée permet d'évaluer les activités de l'animal. Les climats des deux sites sont similaires. Les grands arbres sont abondants dans le site de Vatoharanana. Le site de Talatakely est plus diversifié en espèces végétales. *Varecia v. variegata* qui est un indicateur biologique de perturbation est absent dans le site de Talatakely. Dans ce site, *H. g. griseus* élargit la taille de son groupe pour augmenter la faculté de mieux détecter les prédateurs pour une meilleure défense. L'animal change son rythme d'activité pour éviter la compétition par interférence avec les espèces sympatriques. Pendant la saison pluvieuse, l'animal modifie la gestion de ses activités en augmentant le temps de repos pour mieux conserver des énergies. L'animal devient frugivore en cette saison où les fruits sont abondants pour répondre ses exigences énergétiques. Dans le site de Talatakely, l'animal tend à utiliser la monotonie de régime alimentaire tandis qu'à Vatoharanana, son régime est plus diversifié. La quantité de nourriture avalée par unité de temps est plus élevée dans le site de Talatakely. *H. g. griseus* élargit son domaine vital et augmente la longueur de chemin parcouru quotidiennement pour trouver des nourritures. L'élargissement de la taille de groupe qui est favorable en matière de prédation incite la compétition intraspécifique entre les membres du groupe.

Schülke, O. 2003. Living apart together – Patterns, ecological basis, and reproductive consequences of life in dispersed pairs of fork-marked lemurs (*Phaner furcifer*, Primates). PhD thesis, University of Würzburg. Cohesiveness between members of a social unit is a defining characteristic of animal social organization. Dispersed social organizations, where members of a social unit spend the main part of their activity period apart, have only recently been distinguished from cohesive social organizations

and are still poorly understood with respect to their ecological basis and reproductive consequences. The general goal of this dissertation was to study the three components of the social system of fork-marked lemurs (*Phaner furcifer*), a small nocturnal primate from Madagascar living in dispersed pairs. First, I characterise their social organization, focusing on behavioural mechanisms of cohesion between pair partners. Second, through application of van Schaik's ecological model, I investigate predictions about the ecological basis of female intra-sexual avoidance, male-female social relationships and the determinants of differential female reproductive success. Finally, I analyse behavioural and genetic aspects of the mating system to test a recent hypothesis that proposes high extra-pair paternity in dispersed primate pairs resulting from constraints on male mate guarding. The study was conducted in Kirindy Forest in Madagascar between September 1998 and April 2001 during three field seasons for a total of 20 months. During more than 1400 hours of focal animal protocols, I sampled year-round data on space use, feeding ecology, time budgets, and social behaviour of all adults and three subadults of 8 families, complemented by simultaneous focal follows of both pair partners, year-round information on sleeping site use, measures on food abundance in each territory, morphological measurements, and DNA-microsatellite data for seven newly discovered polymorphic loci. Across eight social units and three breeding seasons, pairs were the prevailing grouping pattern (18 of 21 family years). Most pairs were stable for more than three mating seasons and used well defined stable territories. Although both pair partners used the same territory in a fairly similar fashion, average distance between pair partners was 100m, which was far considering that many territories measure only 200m in diameter. Pair partners spent only about 20% of activity time in less than 25m distance of each other and shared a sleeping site on average only every third day. Females were found to be dominant over their partner as well as over neighbouring males in all behavioural contexts. Most important food resources were exudates of a small number of tree species. Major food resources were distributed in small, defendable patches characterized by fast depletion and rapid renewal. In accordance with the ecological model, this led to strong within-group contest and scramble competition and weak between-group contest competition over food, as indicated by a positive dominance effect and a negative group size effect on female physical condition. Female reproductive success was determined mainly by family size. Paternity likelihood and exclusion analyses revealed that four out of seven offspring were most likely sired by an extra-pair male. Behaviour during the mating season implied that females as well as males take an active part in obtaining extra-pair copulations and that males try to guard their mates. Dispersed social organization in itself, i.e. low cohesion between pair partners, cannot explain high extra-pair paternity. I propose instead that several other factors common to most primates living in dispersed pairs constrain mate guarding and lead to high EPP. The ecological settings determine the mode of food competition and have shaped the social system of fork-marked lemurs in several ways. Intense within-group competition for food may have ultimately led to female intra-sexual avoidance and range exclusivity which represents an evolutionary precursor of pair-living. Although it remains elusive why females ultimately associated with single males, patterns of within-group contest competition for food explain why pair partners avoid each other during nocturnal activity. The limited number of food resources that is used in repetitive fashion and incomplete knowledge about the pair partners position explain why pair partners meet relatively often and why most encounters involve agonistic conflict. Rigid feeding itineraries characteristic of exudate feeders are likely to pose high costs to offspring dispersing to unfamiliar areas. Feeding ecology can, therefore, explain why parents tolerate delayed natal dispersal despite a negative effect on actual female reproductive success. In conclusion, the present study successfully applied existing socio-ecological theory to a new area of research, refined a recent evolutionary model and contributed important comparative data to our understanding of dispersed pairs in particular and primate and animal societies in general. Thesis available at:
http://opus.bibliothek.uni-wuerzburg.de/opus/volltexte/2003/501/

Bibliographic sketch

RAMANANTSOA, Efraima Manana was born in Majunga in1981. While still at high school he had been trained as an artist at the Centre Germano-Malgache (C.G.M.) d'Antananarivo. He designed the logo for the XVIIè Congrès de la Société Internationale de Primatologie (I.P.S.) held at Antananarivo in 1998. Efraima Ramanantsoa received numerous awards for his drawings. His address is: 34, Cité des Professeurs, Fort-Duchesne, Antananarivo (101), Madagascar.

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