The Rufford Small Grants Foundation

Final Report

Congratulations on the completion of your project that was supported by The Rufford Small Grants Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details	
Your name	Giuseppe Donati
Project title	Coping with degraded habitats: ecological and social flexibility of relocated collared lemurs in the littoral forest of Madagascar
RSG reference	8953-2
Reporting period	February 2011 - July 2011
Amount of grant	£5870
Your email address	gdonati@brookes.ac.uk
Date of this report	March 2012

1. Please indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Identify possible differences in food intake and diet quality among sites, seasons, sexes and ranks.			X	From February to July 2012 more than 1000 observation hours where collected on four groups of *Eulemur collaris*. Two groups were observed in Mandena (degraded habitat) and two in Ste Luce (intact habitat). Overall, the lemurs were mainly frugivorous (ripe fruits $\bar{X}$±SE: 64.9±4.1%; unripe fruits: 6.7±2.3% of total feeding time) at the two sites during our study period, integrating its diet with flowers, leaves, and other items. The percentages of items eaten by the groups in the two study sites were not significantly different, but groups of Ste Luce tended to eat more fruits, more flowers and more young leaves than the animals of Mandena, which ate more unripe fruits and more adult leaves. The nutritional analysis of food samples showed that lemurs of Ste Luce obtained more energy from fruits than Mandena's lemurs, though this difference again is not statistically significant. The main difference in feeding strategies between the two sites seemed to rely mainly on different percentage of use (in terms of feeding time) of the plant species in the diet. In terms of diet, no relevant differences were recorded between sexes and ranks.
Identify possible differences in social structure and hierarchy between sites.			X	Ste Luce groups had a size two times larger than those of Mandena. Group composition did not change during our study period, except in one group of Mandena, in which a subordinated male was mobbed by the other three components until it leaved the group (May). The sex ratio among study groups was similar, with an equal number of males and females per group, except for one group of Mandena, in which only one female was present together with three males. Dominance hierarchy was not always clear and there were differences among all groups in its expression. From the data analysis on affiliative interactions, agonistic interactions, and spatial proximity we found female dominance in one Ste Luce' group and in the groups of Mandena, while male dominance was found in the other Ste Luce'

				group. Thus, some interesting differences seem to emerge in the comparison between the two sites with female dominance (and hierarchical structure) more common in the degraded habitat. This raises the possibility that female dominance can be more advantageous in more "difficult" habitats.
Identify possible differences in frequencies of anti-predator behaviour between sites.			X	The analysis of the data indicated that there were no significant differences in the frequencies of anti-predator behaviours (scanning and alarm callings) between the lemurs at the two sites. No animals were killed by predators during the study period and the individuals did not appear to be particularly vulnerable to predation. In fact, large predators seem to have disappeared from these fragments of forest. The fossa (the largest predator in Madagascar), which was present in 2004-2005 in Mandena, has not been recorded since several years in the two forests. Most alarms were addressed to potential birds of prey though it is not clear to what extent they may represent a significant threat for adult collared lemurs.
Identify possible differences in activity regime and behavioural thermoregulation linked to group size and edge effect of the forest.			X	Resting was the main activity for both groups of Ste Luce and Mandena, followed by moving, feeding and social activities. Mandena' groups showed higher rates of resting and lower rates of feeding and moving throughout the study period. Overall, lemur groups showed seasonal variations in time budget, with significant higher rates of resting in the cool wet season (May-July) respect to those during hot wet season (February-April). The high percentage of moving in the first part of our study (February-April) in Ste Luce seems to have been the result of the abundant fruiting season of trees such as *Sarcolaena multiflora* and *Syzigium* sp. The lower activity observed in groups of Mandena is probably due to a lower availability of resources and the resulting energy savings by animals. There were no significant differences in the 24-hour activity pattern (cathemeral behavior) between the two sites. Postural and social thermoregulation appeared to be influenced mostly by season effect. In fact, thermoregulatory postures and huddling frequencies did not show significant differences between sites, but only between seasons. Prone postures were assumed more frequently during the hot season, in order to dissipate the excess body heat, at both sites.

				Similarly, curled postures that reduce body surface/volume ratio and minimize heat dissipation, increased significantly during the cool season, both in Ste Luce and Mandena.
Compare faecal glucocorticoid content among sites, seasons, sexes and ranks. These data will be used as indicator of stress and related to the ecological/social variables described above.		X		More than 250 faecal samples were collected over the study period, stored in alcohol, and exported to Europe. The samples are ready now for gluco-corticoid analyses in order to evaluate potential stress levels in the individual lemurs at the two sites. This analysis has been delayed for two main reasons. First, we had to apply for additional money to cover the costs of this analysis, since this part was not funded at the beginning of this project. Second, reliable results can be only obtained if a validation tests with fresh faecal material (from captive animals) is performed and we had to wait for this pilot analysis to be completed before processing the set of samples from the field. We plan to have the results from these analyses by September 2012.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).

A cyclone and the conditions of the swamps due to the heavy rain did not allow us to work in Mandena during the first month of the study. Thus, it was only possible to work on one of the two groups of collared lemurs ("AB") at this site during the first months of the study. Because of this delay, radio-collars were only attached in June 2011 on the second group of Mandena. Thus, behavioural data at this site are only available for one group for most of the study period. Unfortunately, it was not possible to solve this problem, since the groups in Mandena occur in a habitat which is inundated during most of the wet season (December-March).

Our data on diet and nutritional ecology of the groups living in intact and degraded habitat rely mainly on feeding time rather than actual food intake. Although we tried several times to record data on actual number of feeding bites, the dense lower layers of the littoral forests impeded reliable data and the animals often disappeared from our view. However, feeding time is often used as an approximation of food intake in primatological studies (also because of the difficulties if recording actual food intake). Most important, our interest was mainly on the relative differences between the diet of the lemurs living in different forests and not on the absolute amount of food ingested.

The analysis of the data for this project took longer than expected (we initially planned to finalise it in October 2011) since we had to wait for the nutritional analysis before drawing the full picture on the feeding ecology of these lemurs.

3. Briefly describe the three most important outcomes of your project.

1) Our study confirms the great ecological flexibility of the collared lemurs and they are in line with previous reports. The species is capable to live in degraded and fragmented habitats, such as Mandena, by modifying its ecology and behaviour. Nutritional analyses of food items showed that the collared lemurs in the degraded area were able to maintain a diet as nutritious as the one in the more pristine area. These lemurs seem able to adjust their group size and time budget to compensate the constraints imposed by an impoverished habitat.
2) In terms of social flexibility, groups living in the degraded area were significantly smaller than groups in the more intact area and subordinated individuals were mobbed away from the group during lean period. In Mandena' lemur's female dominance was also evident, while in Ste Luce the dominance hierarchy was less clear. Since Mandena is assumed to be a more difficult habitat (in terms of available resources), these are interesting results which indicate that these lemurs shape their social structure on resource availability.
3) Since the beginning of this long-term project (which actually started with the relocation of the Mandena population in 2000) we have observed an increased awareness of local villagers towards the importance of collared lemur persistence in these forest fragments. Both in Mandena and in Ste Luce there is today a positive attitude towards the presence of researchers and eco-tourists which resulted in halting hunting pressure and reducing tree harvesting within the conservation area boundaries. Of course this result is not just the output of our relatively small project but the achievement of the concerted action of a number of actors in the region. We feel to have contributed to this positive attitude by training assistants, showing our work in the villages (and welcoming villagers to stay with us in forest) and, overall, by associating an additional value to their forest and their animals.

4. Briefly describe the involvement of local communities and how they have benefited from the project (if relevant).

Some members of the local communities were directly involved in the project, since our field assistants both in the site of Sainte Luce and Mandena were people from the surrounding villages. The local Malagasy assistants and their knowledge were essential for us and for our observations in the field. For example, identification of the trees species used by lemurs as food items would have been impossible without the help of local assistants. Our assistants have been involved since 2000 in our long-term study on collared lemurs living in the region and today they have acquired detailed knowledge on how to help students/researchers as well as on how to guide tourists in these forests. Thanks to this project they had the possibility to be updated with some of the more modern techniques for tracking and studying primate behaviour. Given that all our assistants are currently working for local NGOs and private companies, they are variously involved in eco-tourism and research activities and we think that our project was very valuable for them.

In order to involve more widely local communities and to increase their awareness on the importance of lemurs for forest conservation and vice-versa, we also organised four presentations in the surrounding villages. During these activities we explained the status of the remaining populations of collared lemurs and their crucial ecological role for the forest conservation. One of these presentations was shown to the employees of QMM (the local mining company) in Mandena while the other three ones were realised for children and people of the villages. Specifically, one presentation was performed at the school of Ambandrika (Sainte Luce) and the other two at the schools of Mangaiky and Ampasy (Mandena). All the presentations were realised and discussed

using the Malagasy language via the help of our assistants. The technological support used for the realisation of them were Power Point and Windows Movie Maker software. This allowed us to produce an attractive and interactive work by the use of photos, sounds and other special effects that aroused the enthusiasm and the active participation especially of children.

In a long-term perspective, we are convinced that our work is important for the future conservation plans in the region and the benefits for the local communities will be hopefully evident in the near future. Before our team has started to work in the region, in 2000, the collared lemurs and their littoral forests were almost unknown to science while today more and more people arriving in Fort Dauphin aim to see this beautiful area of Madagascar. We hope that demonstrating that the charismatic collared lemurs have a flexibility which allows them to persist in partially degraded fragments will have a positive boost on local conservation plans to protect the remaining fragment of littoral forest and its lemur community.

5. Are there any plans to continue this work?

Two other students from the University of Pisa are currently in the field to continue the data and samples collection on the same groups of collared lemurs that we have studied in this project. This will allow us to have a complete 1-year data set for all the parameters and variables we have measured. In particular, the effect of different seasons on both resources availability and lemur behaviour will be fully considered by having year-round data and by comparing these with data from previous years (2004 and 2007).

6. How do you plan to share the results of your work with others?

The results of this project will form the core of two MSc thesis in "Biodiversity and Conservation" at the University of Pisa. As for our previous RSG granted project, these results will be also the object of future publications in international scientific journals such as *PLoS ONE*, *Oryx*, and *Biological Conservation*. Additionally, all the results of this work will be sent to QIT Madagascar Minerals, which has guaranteed the logistic support for the realisation of this work, and several local NGO. This will hopefully allow our data to be immediately available to the main actors of conservation management in the Mandena and Sainte Luce area.

7. Timescale: Over what period was the RSG used? How does this compare to the anticipated or actual length of the project?

This second grant from RSG has been used from January to July 2011 as planned in our proposal.

8. Budget: please provide a breakdown of budget versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used.

Item **Exchange rate:** **£1 = 3258 MGA**	**Budgeted Amount**	**Actual Amount**	**Difference**	**Comments**
One round-trip to the field (principal investigator): (London-Antananarivo-London) and (Antananarivo-Fort Dauphin-	£990	£1011	- £21	

Antananarivo)				
Two round-trips to the field for two Master's students from Europe: (Rome-Antananarivo-Rome) and (Antananarivo-Fort Dauphin-Antananarivo)	£1980	£2285	- £305	
Subsistence payments and accommodation facilities for two Malagasy Master's students at the Mandena research station (following the collaboration agreement with QMM): including logistics for food, help from local assistants, jeep renting, 24h radio communication on site and medical assistance. Around £3.50 per day (around 100 days per student)	£700	£0	+ £700	The substance cost of the Malagasy MSc student (only one instead of two) in the forest was kindly supported by QIT Madagascar Minerals
Malagasy student accommodation and food in Fort Dauphin around £10 per day (around 15 days per student):	£300	£150	+ £150	Only one Malagasy student (rather than 2) has worked with us during the study period.
Anaesthetics and capture equipment (for 10-15 animals)	£200	£70	- £140	
Activity sensing collars (for about 4 animals, one per group): One antenna for radio-tracking receivers: One radio-tracking receiver:	£1450	£2616	- £1166	The expense for the radio-tracking turned out to be much higher than planned. This was mainly due to the higher price of the new receivers compared to the figures we initially provided (we went for a new, lighter model) and for the VAT costs which were not in the initial budget.
Research permission fees	£250	£750	- £500	This expense was also much higher than expected since fees to get research permissions are now per person and not per project. So we had to pay individual fees for the PI and the 2 MSc European students.
TOTAL	**£5870**	**£ 7152**	**- £1282**	

9. Looking ahead, what do you feel are the important next steps?

The next steps for this research are:
Carrying out the hormonal analyses on the collected faecal samples in order to estimate glucocorticoid levels and then to correlate them with the other social and ecological variables we collected in this project. The samples are now ready for the analysis and the protocol is finally ready to properly evaluate these aspects. We aim to have these results ready by September 2012.

Completing the 1-year data collection and using all the results of the analyses to evaluate the interactive effects of seasons and habitat degradation.

Continuing the long-term monitoring of the two populations of collared lemurs in Mandena and Ste Luce and implementing appropriate conservation measures. This is especially true for the lemurs in the degraded forest of Mandena. Despite the socio-ecological flexibility demonstrated in this study, the collared lemur population in Mandena is extremely small. The possibility of growing forest corridors to re-establish the genetic flux or/and of re-stocking individuals from surrounding, larger populations should be considered if we want this charismatic lemur species to persist in the long term in littoral forests.

10. Did you use the RSGF logo in any materials produced in relation to this project? Did the RSGF receive any publicity during the course of your work?

We used the RSGF logo in our preliminary presentations of the two MSc thesis related to this conservation project, both at the University of Pisa and in Fort Dauphin. During these presentations we explained the goals of our work, the methods, and the outcomes of this project. The RSGF logo will be used in all our future presentations which will include data from this project and the Rufford foundation will be acknowledged in all the resulting publications.

11. Any other comments?

We want to stress here that the Rufford Small Grant Foundation was crucial in supporting the long-term nature of this conservation project by funding us both in 2004 and in 2011. We have appreciated in particular the fast decision-making time and the willing of RSG to support small-scale projects which otherwise would hardly survive. In the field of conservation time is often more important than money and in many countries, like Madagascar, even a relatively small grant is able to make a difference. Unfortunately, the situation for the Malagasy fauna and flora is dramatic and the recent political instability has made all more complicated. But projects performed on animals already living in difficult situations, like this one, can be a great lesson to learn how to preserve endangered species, not only on this island. The message from this work is positive and full of hope: lemurs can tolerate a certain degree of habitat degradation and we can still do a lot for isolated populations. Thanks to Rufford for trusting us a second time.