

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	Lida Marcela Franco Pérez
Project title	Ecology, behavior and conservation of the endangered arboreal marsupial <i>Dromiciops gliroides</i> “monito de monte
RSG reference	56.09.07
Reporting period	February 2008 – May 2009
Amount of grant	£5000
Your email address	lidamarcelafranco@gmail.com
Date of this report	21 September 2009

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
1. To determine the ecological and behavioural patterns of <i>D. gliroides</i> in a fragmented landscape of southern Chile.			Yes	However, it was possible to establish that the period for the telemetry assay was not sufficient for determining the mating system in <i>D. gliroides</i> and would require further sampling. As an alternative, I am going to use molecular tools to achieve this objective. Nevertheless, the other aspects related to ecological and behavioural patterns (social organization and home range) were fully achieved.
2. To determine the huddling during the hibernation and activity period of <i>D. gliroides</i> .			Yes	Happily, this objective was achieved and I found amazing results on how organisms living in adverse conditions can survive using different physiological and behavioral strategies.
3. To establish the variables of habitat affecting the abundance of <i>D. gliroides</i> .			Yes	It was possible to establish the habitat conditions that determine the maintenance of populations of <i>D. gliroides</i> in an increasingly landscape fragmented in southern Chile.
4. To use the information obtained for implementing conservation strategies and offer scientific support to conservation local initiatives.			Yes	The results obtained in this project were highlighted and integrated into local initiatives and conservation strategies through Environmental Government entities. However, it is necessary to continue raising awareness that guarantees local participation in the conservation of native forest and its associated fauna in southern Chile.

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

In December 2007, at the beginning of the project, there was a heavy fire in the Faculty of Sciences building of the Universidad Austral de Chile, including the Institute of Zoology where I worked. This catastrophic event delayed several activities related to the beginning of fieldwork and the development of the research. The loss of all material by fire required the acquisition of new equipment that was not budgeted at the beginning of the project. However, with the collaboration of various national and international institutions and the support from University Austral de Chile, we were able to overcome this disaster. Finally, most of the objectives proposed in the project were achieved, with some changes due to the said previously.

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

From objective 3: The abundance of *D. gliroides* in the habitat evaluated was higher than expected - that could be related to different factors. First, the places evaluated correspond to fragmented landscape of native forest bordered by exotic plantations and grasslands, with scarce or no connectivity among patches so the populations of this species are isolated and confined to small fragments. Second, *D. gliroides* is resident and has little ability to disperse, which was shown during the captures and the high probability of recapture over the period evaluated. In addition, some captured individuals in the summer were also found in the nest boxes in torpor stage in the winter season, and third, this relict marsupial prefers heterogeneous habitats with presence of even-aged and second-growth forest stands and, a dense bamboo understorey, climbers, epiphytes and the mistletoe *Tristerix corymbosus* as well. These resources provide refuge against predators (Rau et al. 1995), supply materials for nest construction (Jiménez 2005) and harbour a rich insect fauna and fleshy fruits which are the principal food resources in the diet of *D. gliroides* (Amico et al. 2009; Quijano 2008; Rodriguez-Cabal et al. 2008). Therefore, the presence and availability of these variables associated to habitat in the study area could explain its higher abundance. However, it is projected that if the reduction of habitat and fragmentation are maintained (Echeverría et al. 2006), it is likely that the populations of this species are going to suffer local extinction. Hopefully, our work helps to give insight into the future conservation plans of the southernmost temperate rainforest, by knowing the biology of a hidden and underestimated seed disperser, the little mountain monkey (monito del monte).

From objective 1 and 2: The results obtained suggest that huddling is a behavioral strategy very important in the life cycle of *D. gliroides*. This pattern was frequent during summer and early autumn seasons because sometimes I found up to 5 individuals together, including one post-reproductive female and several juveniles, suggesting that this behaviour could be related to benefits from the parental care and kinship selection instead an energy saving mechanism *per se* (Schradin et al. 2006), particularly during the coldest seasons. In this manner, I propose that huddling is a key behavioral strategy affecting the survival of this relict and arboreal Valdivian ecoregion-associated marsupial (Franco et al. 2009). Likewise, *D. gliroides* showed home range patterns ranging from 0.67 and 2.18 ha, but there was no significant difference between sexes with a high intersexual spatial overlapping. Finally, I suggest that huddling during the torpor and activity period should determine spatial and behavioural patterns of *D. gliroides*, which should explain the behavior not territorial and the high gregariousness in wild.

From objective 4: The temperate rainforests of Austral South America located between 35 and 43° S, are catalogued as “hotspot”, a biodiversity world reserve and unique forest ecosystem (Armesto et al. 1998). Inside of the biodiversity that harbour these ecosystems, live the endemic marsupial *Dromiciops gliroides* or so-called “monito del monte” (Saavedra and Simoneti 2001). Its ancestral status demonstrated by phylogenetic studies, suggest that *D. gliroides* is the only living representative of the mammalian order Microbiotheria and shares a greater affinity with the Australian marsupials than with its South American relatives (Himes et al. 2008; Palma and Spotorno 1999; Spotorno et al. 1997). Besides, it contributes amply to the regeneration of the native forest as the only known seed disperser of the parasitic mistletoe *Tristerix corymbosus*, a keystone forest species for both Chilean and Argentinean woodland areas (Amico and Aizen 2000; Amico et al. 2009). This feature makes of *D. gliroides* a key component for conservation in Austral temperate rainforest plans (García et al. 2009). Recently, *D. gliroides* has been classified as a rare species and

Near Threatened by IUCN standards due to a great decrease of its population and loss of its natural habitat (IUCN 2007). Considering the aforementioned, the results obtained in this research provide scientific support and insight into behavioural and ecological features of this species with ecological and behavioural traits very little known. In addition, the result obtained in this project were shared with local people, rural schools and representatives of environmental government entities (CONAMA) guarantying a promissory future for this small mammal at least in the area of study.

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

The results obtained in this research were shown and integrated into proposed conservation strategies through local initiatives of government entities and people of different education level (e.g., rural inhabitants, teachers, gamekeepers, students and researchers). In addition, the results provided scientific information about the importance of monito del monte (*D. gliroides*) as a key species for the conservation of the temperate rainforest ecosystems. Finally, this information was disseminated in some secondary schools for implementation of an environmental and educational programme and initiatives to avoid or minimize the deforestation of the native forest. However, it is necessary to continue working to create consciousness and sustainable management strategies highlighting the importance of the temperate forest as rural model of development for the South region and considering this marsupial as an “umbrella” specie or faunistic symbol for biodiversity. Obviously, this requires amply participation of the local people in the plans for the conservation of habitat and harbouring biodiversity of the temperate rainforest ecosystems.

5. Are there any plans to continue this work?

Yes, the plans are associated with the use de molecular markers for answer key questions, such as: (1) what is the role of the kinship in the huddling and the formation of groups during the activity period in *Dromiciops gliroides*?; and (2) what is the effect of the habitat fragmentation on the gene flow and the structure of populations of this species? All this will provide important guidelines about how the organisms face the current scenario of fragmentation and habitat loss of the temperate forest of South America at different levels (behavioral, genetic and ecological),. In addition, it will permit proposed conservation plans for a threatened species and seed disperser of this south temperate rain forest.

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

The results obtained here were disseminated in different levels. First, through of the delivery of Illustrative posters, triptychs, adhesive pictures and diffusion of conferences to the community and people of different education levels - students of primary and secondary education level, local schools, undergraduates, postgraduates, teachers, gamekeepers, NGOs’ representatives and Environmental Government Entities for encouraging local participation and raising consciousness about consequences of the loss habitat on the biodiversity of Valdivian temperate rainforest. Second, for a worldwide audience, through of scientific papers showing the results obtained in this investigation.

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

The RSG was used from December 2007 to May 2009. In general, the temporal projection of the research was correct and money was used in the period anticipated.

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

Budget. Funding was requested for two seasons of field work during December 2007 to April 2008 and September 2008 to April 2009, and during the hibernation season (May to August 2008). Funding was also requested for radio-telemetry equipment, which was used during summer 2008 and, for field equipment (sleeping bag, tent) and food during the trip days. The budget includes the total cost of travel and subsistence of four persons that were required to successfully complete the proposed habitat and radio-telemetry analyses within the allotted time. Finally, the budget was sufficient and fully utilized without any inconvenience.

Item	Budgeted Amount £	Actual Amount £	Difference	Comments
1. Travel of field work Vehicle rental and gas (8 trips, £142 per trip to the two localities)	1136	1236	100	Increase of price of gas in Chile
Subsistence for 4 people (60 days per two reproductive seasons, £15 per day)	850.68	564.78	285	The budget for subsistence was less than expected
Camping equipment: (1 tent for 4 people £190 and 2 sleeping bags £113.42)	303.42	303.42		
2. Radiotelemetry equipment				
Ten radio-tag "Biotrack" (£136.49 per transmitter)	1364.90	1650	285	Increase of price for costs shipping
Two 3 element folding yagi Antenna "Telonics" (£91.26 per antenna)	182.52	182.50		Increase of price for costs shipping
Receiver TR4 "Telonics" (£595.35)	595.35	595.35		
3. Educational and instructive material				
Illustrative poster (200 poster, £1.90 per poster)	380	280	100	The budget for illustrative poster was less than expected
Triptych (100 triptych, £0.95 per triptych)	95	95		
Adhesive picture (100 adhesives, £0.93 per adhesive)	93	93		
TOTAL	5000.87	5000		

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

Accordingly, we have reasons to believe that huddling is frequently used by *D. gliroides* in the wild and could play a key role in its survival. In fact, our data demonstrate that huddling is most frequent during summer and early autumn, where groups up to 5 individuals formed of one post-reproductive female and four juveniles, were found. This suggests that kinship is an important factor for huddling in this species. In this sense, genetic analyzes would highly valuable in order to determine whether all huddling groups are closely relatives. Moreover, during winter we observed a higher frequency of single hibernating individuals and smaller groups compared with summer. It appears, then, that huddling has more intra-specific than physiological significance in this species. On the other hand, outside of scientific ambit is necessary continue with conservation plans and diffusion of the behavior and ecology of monito del monte.

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?

Yes in poster allusive to both monito and representative flowers and trees of the temperate rainforest in southern Chile; and on two different adhesives showing Chile's national flower (*Copihue Lapageria rosea*) and (Quintral *Tristerix corymbosus*).

Yes, I highlighted the support from RSG in all cases.

11. Any other comments?

I am very grateful for your support for my project, which permitted me carry out successfully the proposed objectives. Without these important funds, my investigation will be inconclusive. The monito de monte and the Valdivian temperate rainforest yet want of more key support as that you provide me. I hope that this report will be fully satisfactory for you and your RSG team and hopefully I would like to receive further support to continue my research. My principal interest is follows with field ecological research and to use molecular tools for determining the genetic state of the populations of the endangered monito del monte. Finally, I wish to your every success and congratulate on the great job that do to help conserve species and ecosystems around the world.

REFERENCES

- AMICO, G., AND M. AIZEN. 2000. Mistletoe seed dispersal by a marsupial, *Nature* 408:929-930.
- AMICO, G. C., M. A. RODRIGUEZ-CABAL, AND M. A. AIZEN. 2009. The potential key seed-dispersing role of the arboreal marsupial *Dromiciops gliroides*, *Acta Oecologica* 35:8-13.
- ARMESTO, J. J., R. ROZZI, C. SMITH-RAMIREZ, AND M. T. K. ARROYO. 1998. Conservation Targets in South America Temperate Forest, *Science* 282:1271-1272.
- ECHEVERRÍA, C., D. COOMES, J. SALAS, J. M. REY-BENAYAS, A. LARA, AND A. NEWTON. 2006. Rapid deforestation and fragmentation of Chilean Temperate Forests, *Biological Conservation* 130:481-494.
- FRANCO, L. M., S. A. QUIJANO, AND M. SOTO-GAMBOA. 2009. Activity patterns, huddling behavior and population features in the rare austral marsupial (*Dromiciops gliroides*), submitted to *Journal of Mammalogy*.
- GARCÍA, D., M. A. RODRÍGUEZ-CABAL, AND G. C. AMICO. 2009. Seed dispersal by a frugivorous marsupial shapes the spatial scale of a mistletoe population, *Journal of Ecology* 97:217-229.
- HIMES, C. M. T., M. H. GALLARDO, AND G. J. KENAGY. 2008. Historical biogeography and post-glacial recolonization of South American temperate rain forest by the relictual marsupial *Dromiciops gliroides*, *Journal of Biogeography* 35:1415-1424.
- IUCN. 2007. IUCN red list of threatened species.
- JIMÉNEZ, J. 2005. Monito de monte (*Dromiciops gliroides*), fósil viviente y único marsupial gondwánico del Orden Microbiotheridae, Pp. 541-549 in *Biodiversidad y Ecología de los Bosques Costeros de Chile* (C. Smith-Ramirez, J. J. Armesto and C. Valdovinos, eds.). Editorial Universitaria, Santiago de Chile.
- PALMA, R. E., AND A. E. SPOTORNO. 1999. Molecular Systematics of Marsupials Based on the rRNA 12S Mitochondrial Gene: The Phylogeny of Didelphimorphia and of the Living Fossil Microbiotheriid *Dromiciops gliroides* Thomas, *Molecular Phylogenetics and Evolution* 13:525-535.
- QUIJANO, S. A. 2008. Uso y selección de hábitat del monito del monte, *Dromiciops gliroides* Thomas, 1894, en el Bosque experimental San Martín, Centro Sur de Chile. Doctoral Thesis, Universidad Austral de Chile, Valdivia, Chile.
- RAU, J. R., D. R. MARTINEZ, J. R. LOW, AND M. S. TRILLERAS. 1995. Predation by Gray Foxes (*Pseudalopex griseus*) on cursorial, scansorial, and arboreal small mammals in a protected wildlife area of southern Chile., *Revista Chilena de Historia Natural*. 68:333-340.
- RODRIGUEZ-CABAL, M. A., G. C. AMICO, A. J. NOVARO, AND M. A. AIZEN. 2008. Population characteristics of *Dromiciops gliroides* (Philippi, 1893), an endemic marsupial of the temperate forest of Patagonia, *Mammalian Biology* 73:74-76.
- SAAVEDRA, B., AND J. A. SIMONETTI. 2001. New record of *Dromiciops gliroides* (Microbiotheria: Microbiotheriidae) and *Geoxus valdivianus* (Rodentia: Muridae) in central Chile: their implications for biogeography and conservation, *Mammalia* 65:96-100.
- SCHRADIN, C., M. SCHUBERT, AND N. PILLAY. 2006. Winter huddling groups in the striped mouse, *Canadian Journal of Zoology* 84:693-698.
- SPOTORNO, A. E., ET AL. 1997. Chromosome Divergences Among American Marsupials and the Australian Affinities of the American *Dromiciops*, *Journal of Mammalian Evolution* 4:259- 269.