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. The Final Report must be sent in **word format** and not PDF format or any other format. 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. Please note that the information may be edited for clarity. 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	Victor Borda
Project title	Conservation of giant land snails (*Megalobulimus* spp.) from Southeastern Peru
RSG reference	11454-1
Reporting period	1 year
Amount of grant	£3018
Your email address	vicbp1@gmail.com
Date of this report	8th April 2013

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
Sampling		x		This objective was partially achieved. The sampling was proposed for Cusco, Puno, Ayacucho and Apurimac but the last two localities have involved in social problems (terrorism), for this reason it was not possible complete the sampling.
DNA isolation			x	
Phylogenetic approach			x	
Phylogeographic approach			x	
List of species of land snails		x		

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

The most important difficulty was social problems. The study area involves four regions of Peru (Cusco, Puno, Apurimac and Ayacucho) (Fig 1). Some localities in Apurimac and Ayacucho were involved with terrorism, because of that the sampling was not optimal. This problem affected the list of species but not to the phylogenetic and phylogeographic approach although it is possible that these localities have new species of land snails.

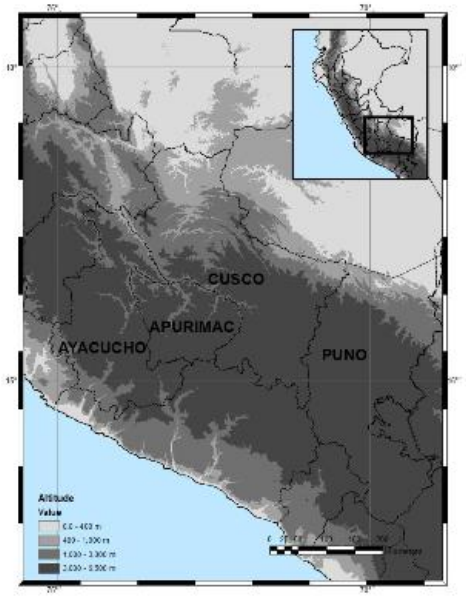

Figure 1. Study Area. South-eastern Peru. This study was carried out in four regions of Peru, mainly Cusco and Puno.

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

The three most important outcomes are:

a) Phylogenetic tree of the *Megalobulimus* species from Peru:
The establishment of evolutionary relationships of the Megalobulimidae family based on a molecular marker (16S RNA) was an important evidence to question the validity of morphological character (mainly shell characters) for taxonomy in these land snails (Figure 2). The tree supports groups with different conchological patterns but that have some similarities on internal anatomy. Also, to determinate that one population with subspecies status should be considered like independent species, this is the case of *Megalobulimus leucostoma lacunosus* which it would be considered like *Megalobulimus lacunosus*, because *M. leucostoma* belong to a different monophyletic group than *M. lacunosus*.

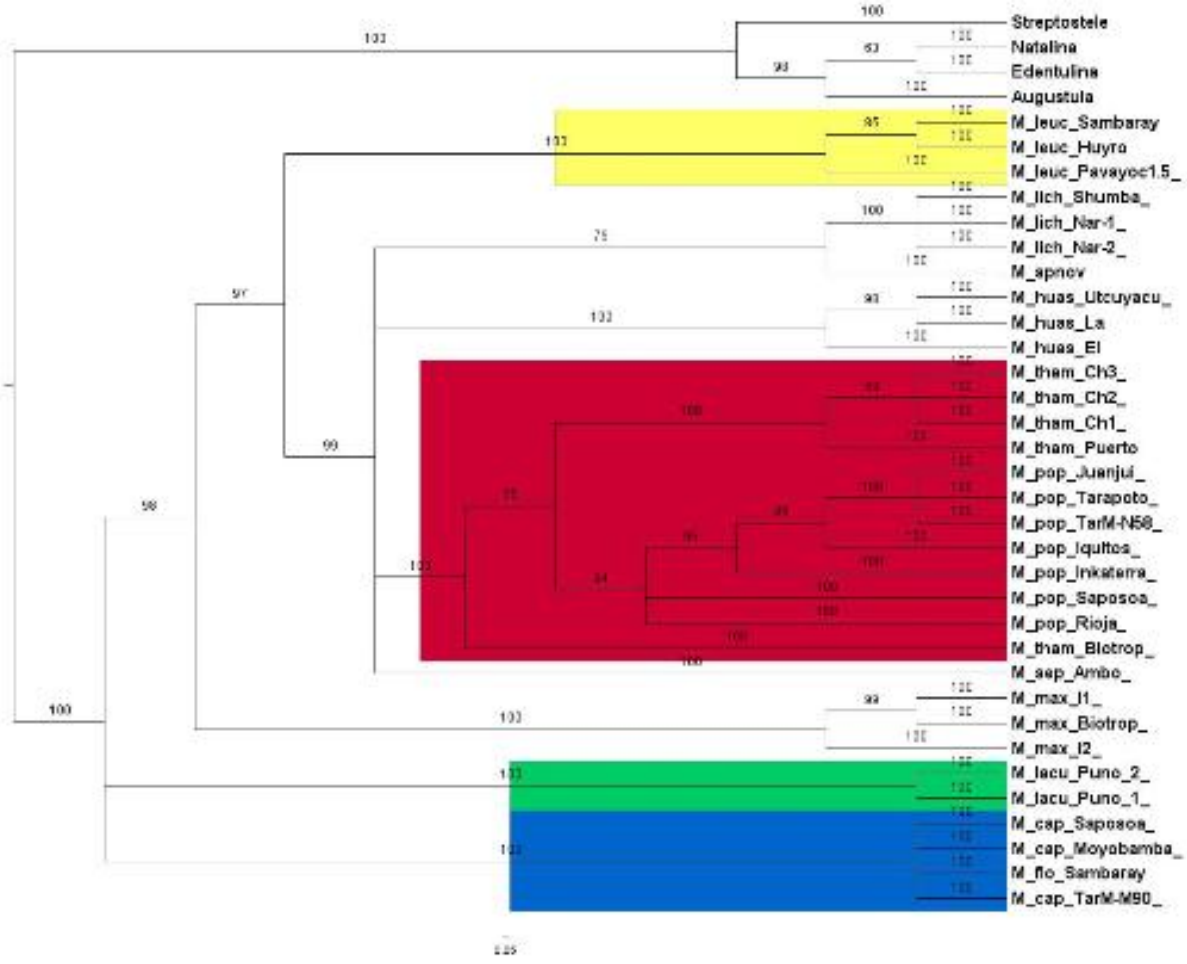

Figure 2. Phylogeny of Megalobulimidae. Bayesian Inference tree of 11 species of *Megalobulimus* reveals the independent status of *M. leucostoma lacunosus* (green) from *M. leucostoma leucostoma* (yellow) that indicate that should be considered like a different species. Red group contain the largest land snails like a monophyletic group. Blue group reveals the close relationship between *M. capillaceus* (San Martin) and *M. florezi* (Cuzco).

b) Phylogeographic pattern of *Megalobulimus leucostoma*:
For the establishment of a phylogeographic patterns in *Megalobulimus*, we consider *Megalobulimus leucostoma* because its populations were abundant. The observed pattern showed an interesting view. The genetic diversity was very high for two mitochondrial markers (COI and 16S RNA), it also shows that its populations have an effective population size that is constant through the time. There is not population structure in its populations of lowlands while the highlands population shows structuration. This pattern was not expected because the presence of rivers and mountains could favour the differentiation between populations in low lands, but this is not the case.

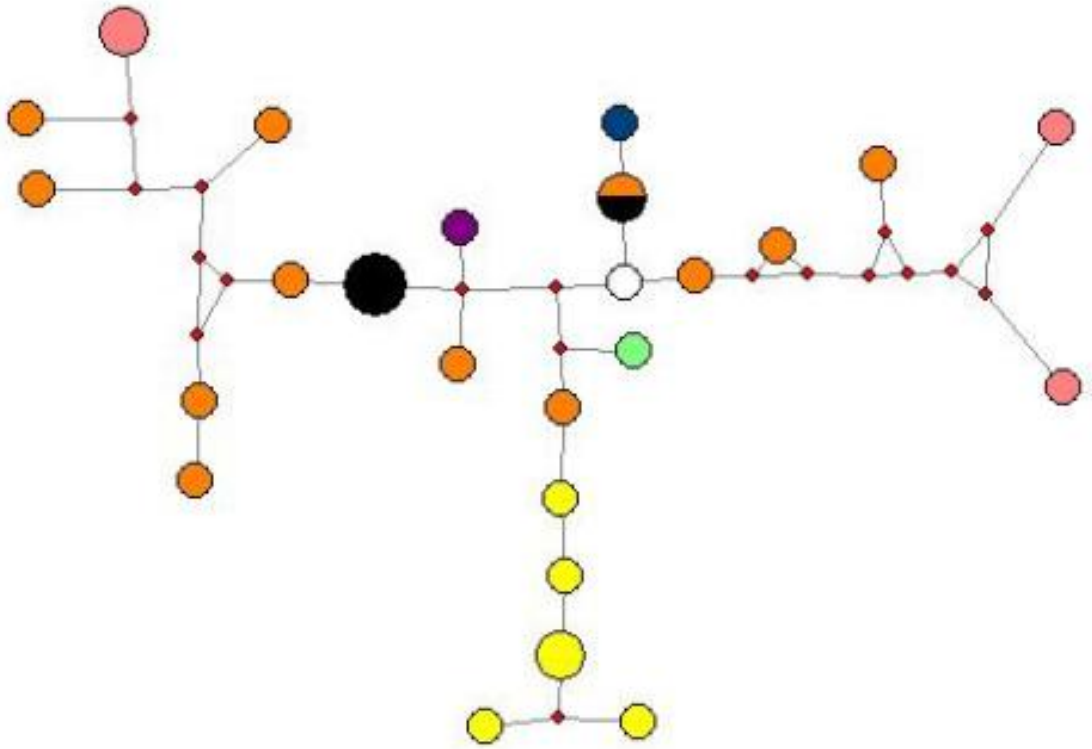

Figure 3. Haplotype network of *Megalobulimus leucostoma* populations. The mitochondrial markers show that there is not population structure in lowlands because the haplotypes do not form independent groups (e.g. Red haplotype is present in both extremes of net) while the highlands population is structured (yellow circles).

c) List of species of land snails and description of a new species
There were previous studies about the diversity of land snails from basin Urubamba (Cusco) carried out by Ramirez *et al.* (1991) and they recorded 49 species for this basin. In this study we had increased this information at a major level by the revision of bibliography, scientific collections and samples collected. We have listed 139 species from 18 families being Orthalicidae the most diverse family with 60 species (Figure 4). It is important to mention that there were another 15 species that could be new species, because they do not had similarity to the descriptions of other species reported. One of this species is now being describing, a new species of *Megalobulimus* from Cusco, *Megalobulimus florezi.*

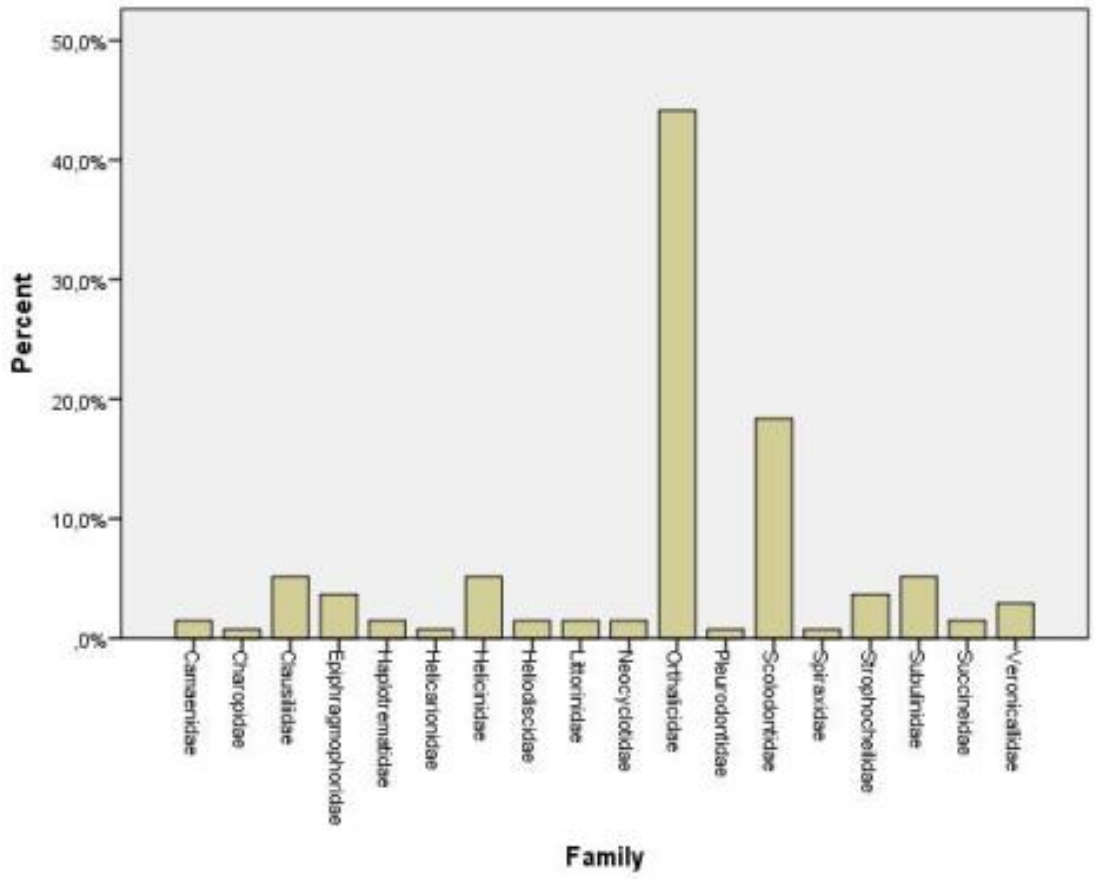

Figure 4. Percentage of the frequency of Families of land snails from South-eastern Peru.

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

Besides the phylogenetic and phylogeographic patterns elucidated in this study, we can highlight that the anatomical evaluation of species of *Megalobulimus*, from this region, showed that these animals have parasites. This discovers would be important in public health because it would note the source of some disease and help to government entities of public health to establish some control that could benefitted to the communities and urban localities.

5. Are there any plans to continue this work?

Yes, our interest is to continue this work because most of the Peruvian invertebrates still unknown for some taxa like molluscs. We are planning to carry out more inventories and characterisation of mollusc species, not only land species but also aquatic molluscs, in other regions of Peru. Also, our studies, like this study in *Megalobulimus*, will involve the estimation of values of genetic diversity and evolutionary relationships of other groups of snails for a better understanding of neotropical biodiversity which may help in decision-making in conservation.

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

To share our results, we have two strategies: academic and social. The academic strategy involves publication of scientific articles now we had submitted the first article that result from this study. The title of this article is "Re-characterization of Red lip Megalobulimus (Gastropoda, Strophocheilidae) from Peru with description of a new species". Nowadays, this manuscript is in review in *Zoología*, a journal from the Sociedade Brasileira de Zoología. Also, a postgraduate thesis of the applicant will be defended in few weeks and this will result in two manuscripts for publication. In the case of the social strategy, we will focus on get collaboration of investigators and authorities involve in public health with the objective of show that our result could help for control strategies of parasites. Also, our final goal is the develop a catalogue of molluscs of Peru which will have both academic and social application showing to the general public the great diversity of these species on Peru. Besides, the obtained information will be useful for implementation of workshops for the local community that could be carried out by the Ministry of Environment or NGO for an optimal integration of the stakeholders in conservation.

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

The period that RSG was used was almost for 12 months (from April 2012 to March 2013). Compared to the anticipated length of the project is the same length of the period for which the project was proposed. This period involves fieldwork, lab work and a workshop to show some results.

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.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Fieldwork	2074	1373.11	-700.89	We only visited two regions instead four because social problems
Field materials	1044	436	-608	We do not buy cabinets because we prefer more priority to molecular approach
Lab materials	155	222.7	67.7	We buy some other materials for a better extraction and amplification of DNA
Extraction kits	237	505.69	268.69	To be able of have the opportunity of extract DNA from more specimens we buy two extraction kits
DNA sequencing	461	666.67	205.67	We decided to sequence more specimens for a better phylogenetic resolution
Total	3971	3204.17	-766.83	The total amount applied for RSGF was £3018, we could not obtain more financial support, because of that we could not be able to buy all necessary materials but this do not affected the results

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

I think that, considered the poor knowledge on invertebrates, the most important next step is publication of the results. In this way other studies can be carried out using our results as basic information for develop ecological or others application studies. Also, another important step is generate more studies with the same approaches of this study (inventory and genetic diversity) in this way will generate more information which it is necessary for taking decision that have an major impact in the conservation of neotropical species.

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, I used the RSGF logo in a poster of this project (Figure 5) presented on a workshop called "Sao Paulo School of Advanced Science" (http://www.ib.usp.br/zoologia/evolution/) which took place from 19 to 31 August, 2012.

11. Any other comments?

I would like to thank the foundation for his financial support, because is one of the few organisations that financed conservation projects that also involve some basic studies, because in regions where the basic knowledge in biodiversity is very poor, like neotropics, it is necessary to development this kind of basic work to obtain result that have a better conservation impact.