

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	Steven M Whitfield
Project title	Is Ranavirus an Emerging Infectious Disease in Costa Rica? Distribution and Characterization of Pathogens from Critically Threatened and Non-Native Amphibians
RSG reference	12199-1
Reporting period	
Amount of grant	£6000
Your email address	sw933@miamidade.gov or steven.m.whitfield@gmail.com
Date of this report	30 October 2015

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. Evaluate prevalence of ranavirus infection at seven sites in Costa Rica			X	We evaluated ranavirus prevalence at all seven sites
2. Examine potential sources of non-native ranaviruses			X	We examined pet trade amphibians and invasive species as potential sources for non-native ranaviruses
3. Isolation and molecular characterization of Costa Rican ranaviruses			X	We isolated two strains of ranavirus from Costa Rica. Molecular sequencing of these isolates is currently under way.
4. Raise public awareness of amphibian conservation			X	We produced 2,000 brochures for public distribution on amphibian conservation, and deposited these brochures at ecotourist destinations throughout Costa Rica

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

We completed all goals for this grant as outlined in the original proposal, though we experienced delays in execution of the project. We completed all fieldwork on timelines of the original grant. We experienced delays in laboratory isolation and sequencing of virus isolates, and in the production of public education materials. These delays were primarily caused by Dr Whitfield assuming a temporary position for 2 years as a full-time lecturer that left little time for research. Dr Whitfield has resumed a full-time, permanent research position and has since been able to attend to this research project.

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

1. We have found that ranavirus - a pathogen of important conservation concern for amphibians - is widespread within Costa Rica, present at five of the eight field sites sampled in this study. This is concerning because ranavirus was only known from a single site within Costa Rica at the onset of this project.

2. We have also determined that illegal importation of animals for the pet trade in Costa Rica is a likely source for ranavirus (and presumably other amphibian pathogens).

3. We have found that critically endangered amphibians often are infected by ranaviruses, increasing the potential conservation concern of ranaviruses and emerging infectious diseases.

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

The most extensive local community involvement was at the town of Turrialba, where our research team sampled an introduced population of Puerto Rican Coquis in suburban habitats. Coquis are notoriously loud frogs, and their calls often interfere with sleep - in particular because they prefer densely populated urban and suburban habitats. Local residents of Turrialba enthusiastically encouraged our research team to collect these invasive species, and clearly wanted to see additional research designed to prevent the spread of this invasive amphibian.

We also expect that the brochures on amphibian conservation we have distributed will create interest by local communities in amphibian conservation. These brochures present a general overview of amphibian biology and amphibian conservation. Further, these brochures indicate specific actions that local people can take if they observe an amphibian mass mortality event or if they detect an invasive species within Costa Rica.

5. Are there any plans to continue this work?

Yes. This research generates a number of future research questions. Given that ranavirus is widespread in Costa Rica, we must now evaluate the virulence of this pathogen to amphibians and the distribution of ranavirus infections among reptiles. We must also determine the distribution of ranaviruses throughout broader geographic regions, and over time-series using preserved specimens. We must also examine imported amphibians for other pathogens of concern (several strains of *Batrachochytrium dendrobatidis* and the newly-described *Batrachochytrium salamandrivorans*).

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

We plan to produce one English language peer reviewed manuscript as a result of this research. We will target a top tier conservation journal (i.e., *Conservation Biology*) as a venue for this research. Zoo Miami's Conservation and Research Department will produce a short video and publicly available webpage that features research sponsored by the Rufford Foundation. Upon the publication of a journal article, the Conservation and Research Department at Zoo Miami will issue a press release in both Spanish and English to be shared via social media (Facebook and Twitter).

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

We completed fieldwork for this project in January 2014. We completed all laboratory work for this permit in October 2015. While the fieldwork was completed within the original timeline of our proposal, there were delays in completing the laboratory research. These delays were primarily caused by Dr Whitfield assuming a temporary position for 2 years as a full-time lecturer that left little time for research. Dr Whitfield has resumed a full-time, permanent research position and has since been able to attend to this research project.

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
Local transportation to field sites	£1479	£802	-£677	Less expensive than budgeted
International Transportation (1 flight US-Costa Rica)	£740	£1238	£498	More expensive than budgeted because of Dr Whitfield's move to the US.
Pathogen assays (qPCR)	£2441	£2441	£0	
Ranavirus isolation materials and sequencing	£740	£739	£0	
Equipment and supplies	£0	£15	-£15	Unanticipated supplies
Materials for informational flyers	£600	£328	£272	At end of project, all unspent funds were devoted to educational materials. This was slightly less than expected.
TOTAL	£6000	£6000	£0	

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

Having firmly established that ranavirus is widespread within Costa Rica, and infects a wide group of amphibians, we have identified several important next steps.

1. Evaluate virulence of native and non-native ranaviruses to Costa Rican amphibians.
2. Evaluate spatial distribution of ranaviruses throughout Central America.
3. Evaluate historic specimens from Central America for ranaviruses to pinpoint the timing of ranavirus emergence in the region.
4. Evaluate infection of ranaviruses in reptiles in Costa Rica, particularly reptiles of conservation concern.
5. Campaign for proactive policies that limit the import or export of amphibians from Costa Rica, or that mandate testing for emerging infectious diseases upon import or export.
6. Examine impacts of pet trade amphibians as a source for additional potentially emergent pathogens of conservation concern (Bd and Bsal).

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. The RSGF logo featured prominently on the 2,000 brochures distributed in Costa Rica. The Rufford Foundation will be mentioned as a funding agency in the publication resulting from this project. Dr Whitfield has presented several research presentations at national scientific conferences that mentioned funding from the Rufford Foundation, and the RSGF logo will be used in similar

presentations that address this work in the future as well. The Rufford Foundation will be mentioned as the funding agency in press releases upon publication of a peer-reviewed manuscript.

11. Any other comments?

In addition to the scientific goals for this program, research conducted with funding from the Rufford Foundation helped to provide training opportunities for several students from Costa Rican universities. Many of these students are now pursuing their own independent research with amphibian conservation, including research on ranaviruses.