The Rufford Foundation
Final Report

Congratulations on the completion of your project that was supported by The Rufford 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	Angelica Menchaca Rodriguez
Project title	Understanding migration with genomics to aid in the conservation of the tequila bat (*Leptonycteris yerbabuenae*)
RSG reference	18287-1
Reporting period	22 March 2016 – 22 March 2017
Amount of grant	£5000
Your email address	am14886@bristol.ac.uk
Date of this report	22 March 2017

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
Sample collection for genomic analysis				I conducted two successful fieldtrips; one to the Sonoran desert in May-June 2016 and another to the lowland forests of Chiapas in November 2016. During these fieldtrips I was able to collect over 200 wing punches for genetic analysis and 80 blood samples to characterize the transcriptome of *L. yerbabuenae*. Other samples, such as droppings, parasites and dead bats, were collected opportunistically and intended to be used for collaborations with other projects and in the future.
DNA and RNA extractions				I successfully extracted genomic DNA and RNA from samples intended to be used in the characterisation of the transcriptome. I tried several protocols to optimise the quality and quantity of genetic material obtained from the samples and developed a good laboratory protocol that increased the yield. These samples were screened thoroughly and proved to be very high quality that will be useful to continue the project.
Geometric morphometrics of wings				I was able to take photographs from the wings and run a pilot analysis of the data. I got significant results and will continue to work on this analysis.

				However, another field trip to the Sonoran desert will be necessary as the photography equipment used the first time was not adequate and could interfere with the interpretation of the data. The photographs I took in field trip to Chiapas followed a more stringent protocol and meet all necessary requirements to run the analysis.
Analysis of patterns of gene expression				After the successful optimisation and extraction of RNA in the laboratory, I was able to choose the best samples that will be used in the gene expression analysis. However, this step has taken longer than expected, as I had no previous knowledge on bioinformatics and will need to spend more time carefully running the analysis before I can determine the patterns of gene expression between and within each target population.
Migratory corridor modelling				The information obtained from the DNA will be useful to understand if the two populations are facing genetic structuring and the levels of gene flow between them. I am still working on analysing every sample to be able to make any sound conclusions. This information will then be used to test if the environment or certain landscape elements are facilitating genetic communication between populations.
Science communication				During the course of the year, and especially while I was conducting the fieldtrips, I communicated my outcomes via social media and through my blog and website. I also had the opportunity to train several

				undergraduate students and field assistants on techniques such as bat identification, handling, and experimental design. Whenever given the opportunity I shared with the public the goals of the project and distributed printed posters with information about bats. My work also featured in the podcast *Ode to evolution*, in a magazine article *Uberisation of Science* in Euroscientist magazine and my work and that of my colleagues featured in NatGeo in Spanish in *Tequila una Historia de Amor.*

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

- Delays in the processing of the importing and exporting permissions made me postpone the laboratory work.

- Conflict with local indigenous communities in the Sonoran desert caused our trip to shorten, having to reduce the number of sampling sites.

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

1. Conduct two successful field expeditions; one to the Sonoran desert and another one to the lowland forests of Chiapas. Both visits were very successful as I was able to collect the data that will be the core of my thesis. I also had the opportunity to share my ideas with colleagues from other universities, including Ulm University, The National Autonomous University of Mexico (UNAM), and Lund University. These experiences expanded my knowledge in field techniques and allowed me to network with other researchers with the potential of continue collaborating with them in the future. I also had the opportunity to train several undergraduate students from Mexico and I have since become their assessor and part of their thesis committee. Furthermore, I had the opportunity to interact with NGO's; for example with Tierra Verde, Naturaleza y Cultura A.C and Amigos de la Red Ambiental, two groups that are based in Chiapas and working to integrate the communities with environmental protection projects. These trips also gave me the opportunity to interact with the local communities and share with them the importance of

conserving bats and the goals of my project. Whenever I had the opportunity, I talked to them and answer any questions related to the environment, conservation and bats as important ecosystem service providers.

2. Identified areas that are critical for the survival of the species. In particular, the field trip I conducted to Chiapas allowed me to assess the main threats affecting the cave I visited. The cave is inside a privately own land and is regularly vandalised by local people due to its proximity to Tuxtla Gutierrez City; furthermore, the cave is very close to house developments and a highway. Its protection must be a priority for the local government and conservation groups. I raised this concern with a local NGO and with the landowner to potentially protect the area.
3. Incorporate community members into the conservation process by training them in bat monitoring techniques, species identification and sample collection. Involving local communities, conservation groups and empowering local people is crucial to the protection of the areas that my project covered.

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

The local communities in Sonora include personnel from the Mexican Commission for Natural Protected Areas (CONANP), undergraduate students from the National Autonomous University of Mexico, and students from the University of Sonora (UNISON).

I established a working network with these institutions during my fieldwork and collaborated with them in their own research projects. Personnel from CONANP accompanied us during the visits to the main cave and shared their knowledge of the area and monitoring schemes to improve ours. We were also allowed to use the Biological field station "El Pinacate" to process our samples and we took these opportunities to share the goals of each of the projects we were conducting, answer any questions related to our research, and share with them our most recent outcomes. Several staff members of CONANP were very interested in joining us in future expeditions and expressed interest in collaborating in future research projects.

Undergraduate students from UNAM and UNISON accompanied us and served as field assistants, we trained them in techniques as non-invasive genetic sampling, monitoring, and field techniques. Students that were conducting their research in the area were able to discuss with us their ideas and projects and we provided feedback. I am now part of the thesis committee of two undergraduate students and provide regular feedback and comments during the process of data analysis and writing.

The local communities in Chiapas involved in this project include staff from Tierra Verde, local vigilantes from Amigos de la Red Ambiental, students from the University of Chiapas and two local independent Biologists.

Personnel from Tierra Verde accompanied us during the field trip and helped us locate new bat refuges and areas where we could conduct research in the future. They also introduced us to Amigos de la Red Ambiental with whom we will continue working and aid them in their goal of monitoring their ranches and providing them with resources and information that they can share in their community and with visitors, including photographs, videos, and interviews. Without their help, it would have been impossible to locate new roosting sites for the species I am studying. We have since maintained communication and plan on collaborating next year in other research projects.

Students form the University of Chiapas and two independent Biologists were trained in field techniques as non-invasive genetic sampling and species identification. I invited the students to join us for 1 or 2 nights in the cave and taught them in the techniques I utilise to collect my data. The biologists served as field guides and shared with me their knowledge of the area and local fauna and flora.

5. Are there any plans to continue this work?

Yes, I plan on visiting the Sonoran desert once more in May 2017 to collect additional data for the morphological analysis. If possible, I will also visit Chiapas in November 2017 to continue the collaboration with the local communities. The data collected during 2016 represents 70% of the data needed to conclude my research and I will continue running analysis and interpreting results during the rest of 2017 and beginning of 2018.

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

Research conferences: I plan on presenting my results in three research conferences during 2017. First in April 2017, I will give a talk about my work in the Genetics of Migration conference in Plön, Germany. Then in August 2017 in the 14th European Bat Research Symposium in Donostia, The Basque Country. And in November 2017, at the Rufford Small Grant Conference in Belize. I will also present my work in the student seminar at my university in March 2017.

Social Media: I have been maintaining the Facebook Fan Page "Badass Science" where I update my followers with the latest news about my research and other bat-

related news. I also keep a blog in my personal website www.tequilabatmigration.com

Peer reviewed papers: I expect to publish two manuscripts in high impact journals at the end of 2017 or beginning of 2018. I will also submit my thesis before the end of 2018 and will make it open access via Research Gate and my website.

Science communication: I will continue to seek opportunities to present my work to the general public in talks, interviews, podcasts or magazine articles. I will produce pamphlets with information about local bats, conservation issues and fun facts and distribute them in my next field trip to the Sonoran desert and Chiapas.

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

The grant was approved a few weeks before the field trip to the Sonoran desert and was used to pay for travel expenses, field equipment, sample collection and processing. After this trip, I conducted the pertinent laboratory analysis to store the samples until the next field trip to Chiapas. After my visit to Chiapas I return to the laboratory to continue the sample analysis and I am currently finishing these and will start data interpretation in the summer.

The RSGF covered about 35% of the actual length of the project. Additional funds have been secured via crowdsourcing and through Idea Wild and the Genetics Society, which combined correspond to another 40% of the actual project. Additional funds are necessary to complete the project to a 100%.

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
Airplane fares UK to Sonora, Mexico	£914	£1164	£250	Due to unexpected circumstances with a local indigenous group, I had to return earlier from the field and had to buy a new ticket from Sonora to Mexico City.
Airplane fares UK to	£914	£973	£59	

Chiapas, Mexico				
Lodging and Meals Sonora	£0	£150	£150	Most expenses were covered by UNAM, but their budget was cut and I contributed with this amount
Car rental and Petrol in Chiapas	£0	£250	£250	Not originally in the budget as we counted on collaborators to provide transportation
Lodging and Meals Chiapas	£500	£367	(£133)	
Field equipment (mist nets, hand nets, collection tubes, others)	£0	£350	£350	Mist nets, collection tubes and other sample collection items had to be purchased after the first field trip.
Field Assistant Airplane fare Mexico City to Chiapas	£100	£90	(£10)	Additional luggage space was purchased to transport field equipment.
1 liquid nitrogen tank 3L	£170	£0	(£170)	Airplane regulations did not allow the tank to be transported so we used buffer.
RNA extraction kit (2X)	£0	£600	£600	
RNAlater buffer	£149	£0	(£149)	The RNA kits came with the buffer
Genomic lab services (library building, RNA quantification)	£1944	£2500	£556	This amount only covered the processing of half of the samples. The Genomic Centre increased their price in 2016 as they improved their sequencing machines.
Science communication (Website, printed material and other educational resources)	£250	£200	(£50)	Setting up the website was £150 for 12 months. Some educational material was donated by UNAM.
Total	£4941	£6644	£1703	Additional funding was secured through the Genetics Society and from my own savings.

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

In order to achieve the goals of the project, it is fundamental that I secure more funds to be able to conduct another field trip to the Sonoran desert and process the rest of the samples. It is also important to maintain the collaborations and strengthen the relations built with the local communities and the institutions with which I networked during 2016. To provide continuity and in order to develop new partnerships and projects I would like to establish a solid team of people in the field, local institutions and academics. I would very much like to contribute to the protection of the areas that are crucial for *L. yerbabuenae;* this strategy would have to involve not only the landowners, but also the communities and the government. I would like to continue partnering with Tierra Verde and UNAM to move forward with a project that ensures the protection of the cave near Tuxtla Gutierrez; and continue contributing to capacity building of local environmental vigilantes, such as Amigos de la Red Ambiental, which are doing a massive effort to reduce illegal hunting and protecting their community.

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

The Rufford Foundation logo was used in all the presentations made after March 2016, including student seminars at the University of Bristol, informal talks with local people and a talk at the British Bats Conference held in April 2016. The logo is also included in my website www.tequilabatmigration.com, and the foundation was acknowledge in Youtube videos filmed during fieldwork https://youtu.be/y7g7JcNTiUQ. The logo also features in the educational material that will be distributed in the next fieldtrips such as trifold pamphlets containing general information about bats and the ecosystem services they provide.

11. Any other comments?

I remain extremely grateful to The Rufford Foundation for its generous support. The Small Grant for Nature Conservation made possible the work I needed to carry out during the 2nd year of my PhD and allowed my project to achieve meaningful conservation outcomes. This was the first grant I received for my research and was an important impetus for me to continue my research. I am very proud to have been a recipient of the RSGF and will continue my work to keep honouring the Foundation.