Final Evaluation Report

Your Details	
Full Name	Matthew Crane
Project Title	Assessing bat fatalities and application of acoustic deterrents at wind farms in the Philippines
Application ID	29056-1
Grant Amount	5960
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1. 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
Acoustic deterrent testing			■	
Capture surveys		■		Due to limited field time, we were able to conduct only a limited number of surveys. As such very few insectivorous bats were captured.
Acoustic monitoring			■	We were able to inventory the acoustic deterrent testing sites, and identify seven species, from five phonic groups (hipposiderids, rhinolophids, vespertillionids, emballonurids, and molossids).
Fatality monitoring	■			Due to covid travel restrictions the field team was not able to conduct additional monitoring during the project period. However, the data from previous monitoring was made available.

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

Due to the Covid-19 situation I was not able to travel to the site to undertake the fieldwork. Additionally, fieldwork was delayed multiple times and eventually was condensed due to travel restrictions. I remotely coordinated with the local field team to complete the fieldwork and created a digital repository for all the data and information for the project.

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

1) We found that acoustic deterrents work to reduce bat activity with at least some Southeast Asian species at the pond sites.

2) Northern Luzon Renewables (NLR) has decided to move ahead with a implementing an acoustic deterrent on an active wind turbine. While only a small-scale project, there is the potential for upscaling and further reducing bat fatalities at the NLR site.

3) Testing acoustic deterrents with video monitoring at orchard sites did not work. We found that activity levels in these areas were relatively low compared to pond sites, and thus it was difficult to determine changes in activity due to the deterrents. Additionally, vegetation clutter in the orchard

areas limited the effectiveness of video monitoring. To test acoustic deterrents with non-echolocating fruit bats we suggest to instead conduct controlled trials in an in-situ flight tunnel.

4. What do you consider to be the most significant achievement of this work?

5. Briefly describe the involvement of local communities and how they have benefitted from the project.

We used a local team to conduct the fieldwork. They gained training on bat research methodology including mist-netting and acoustic surveys.

6. Are there any plans to continue this work?

The work will continue with the installation of a deterrent unit on a single active wind turbine at the NLR site.

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

First, we have prepared a technical report for NLR covering the results of the project and recommendations. Second, we will prepare a simplified report that can be shared with other interested wind farm companies in Southeast Asia. Finally, we are hoping to publish an academically focused paper in and international journal covering the project.

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

The fieldwork for the project took place in April and July 2021. The anticipated fieldwork was longer than we were able to do, due to Covid-19-related travel restrictions. We were able to roughly follow the initial plan to first survey the area to determine the best sites for testing the acoustic deterrents, although we were not able to do the initial bat capture and acoustic monitoring surveys. These instead occurred concurrently with the acoustic deterrent testing.

9. Budget: 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. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

Item	Budgeted Amount	Actual Amount	Difference	Comments
AA Battery charger (x1) 30 0 30	30		-30	Determined to be unnecessary.

6000 lumen rechargeable head lamp (x3) 45 0 45	45		-45	Determined to be unnecessary.
3000 mAh NIMH AA Batteries (8 pack x 8)	60	60		
Round trip flights Bangkok to Manilla (x2)	300		-300	Due to covid-19 I was unable to travel to the Philippines
NIR security cameras (x2) and HD recorder (x1)	140	220	+80	Purchased higher quality NIR camera to replace the FLIR C2 Thermal Imaging Camera based on expert recommendation
FLIR C2 Thermal Imaging Camera	750		-750	Replaced with high grade NIR security camera after consulting with Brogan Morton.
12-V deep cycle marine batteries (x2)	160		-160	Opted for a gas generator rather than marine batteries for powering the acoustic deterrent set up.
AudioMoth acoustic recorders (15 pack)	470	470		
(2 people @ 240£/month X 12 months)	2880	2880		
Estimated taxes and shipping	100	1165	+1065	Due to travel restrictions all materials had to be shipped directly to the site. Additionally, the Philippine government did not allow the acoustic deterrents to be documented as rentals and thus charged full price for the import fees.
Ecotone 12m mist nets	285		-285	Due to the limited time in the field, we opted for cheaper locally produced mist-nets
Ecotone 9m mist nets	240		-240	Due the limited time in the field, we opted for cheaper locally produced mist-nets
University overhead (10% total budget)	500	455	-45	
Sub-total	**5960**	**5250**	**-710**	
900W Portable Gasoline Generator, and fuel		160	+160	
High-Power IR Illuminators, with extension power cables		420	+420	After consulting with an expert on video monitoring bats, they said we needed additional lighting to accurately detect bats

NW D-LINK SWITCH HUB		35	+35	Replaced HD recorder as it allowed for a computer to record all videos.
Locally produced mist-nets		50	+50	
Micro-SD cards		20	+20	Added expense for acoustic monitoring
HDD extra hard drive		70	+70	Needed to store and manage large audio and video files
TOTAL	**5960**	**6005**	**+45**	

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

There are three important next steps to take with respect to this project.

1) A full test with an acoustic deterrent installed on an active wind turbine to determine how many bat fatalities can be reduced in the long-term. Our initial results suggest that at least the frequently struck insectivorous bats should show reduced fatality rates following full implementation, but this needs to be verified with field testing.

2) Controlled acoustic testing in a flight cage with non-echolocating fruit bat species (Family Pteropidodae). Our in-situ testing did not work due to the limitations in both the activity of bats and with video recording technology. Controlled tests would give a more accurate estimate on how acoustically sensitive these species may be. Fruit bats are easier to capture with mist nets compared to echolocating insectivores and thus this project should be fairly feasible to undertake after designing a mobile flight tunnel setup.

3) Encourage wind farms in Southeast Asia to share data on any carcass monitoring programmes. To determine whether acoustic deterrents will truly decrease the impact of wind turbine fatalities, its necessary to know which species are most at risk.

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

The funding contribution from the Rufford Foundation was recognised in a social media post made by NRG Systems (the provider of the acoustic deterrent). The link for the post can be found here: https://www.nrgsystems.com/blog/a-look-at-the-first-bat-deterrent-system-trial-in-asia/

12. Please provide a full list of all the members of your team and briefly what was their role in the project.

Jayson Ibanez- Dr. Ibanez was the primary contact and field team leader. He organized travel to and from the site. Additionally, he managed all fieldwork and set up.

Gliceria Ibanez – Gliceria was part of the field team running the acoustic deterrent trials, conducting the mist-net surveys, and setting up the acoustic detectors.

Eduardo H. – Eduardo was the NLR contact and primary oversight for the field team. He managed all of the logistical issues with the project in the Philippines such as coordinating shipping and working with Philippine's customs agents.

Brogan Morton – Brogan consulted on the design and set up of the video monitoring program. Additionally, he analysed the video recordings to detect bats within each frame.

George Gale – George provided scientific oversight for the project.

13. Any other comments?