Final Project Evaluation Report

Your Details	
Full Name	Valeria Elena Gonzalez Borasca
Project Title	Soundscape analysis on a humpback whale (*Megaptera novaeangliae*) breeding ground in the northern Colombian Pacific.
Application ID	25358-1
Grant Amount	£4690
Email Address	kerri.seger.d@gmail.com
Date of this Report	June 1st, 2019

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
Data Collection: deploy 3 passive Ecological Acoustic Recorders (EARs) at 3 places in the Gulf of Tribuga with anticipated variable soundscapes.				We were able to deploy two of the EARs. The third one that we were intending to borrow was having technical issues and was not available in time. Both EARs, on their first deployment, came back without data due to human programming error. One was very difficult to recover from the sea floor, so we did not perform a second deployment with it. The other site (MorroMico) was a safe location for redeployment, so that EAR was replaced and ultimately collected 35 days of data. Every day, 48 10-min audio files up to 6.5 kHz bandwidth were collected. This is sufficient for establishing diel cycling, a catalogue of sound sources in the area and their baseline acoustic feature distributions, and may be enough to explore lunar cycling.
Data Processing: calculate Power Spectral Densities (PSDs) to determine which sound sources are dominate in the environment and what cycles they operate on.				Data quality is high. Two students at the University of Javeriana are currently processing the data to record all sound sources in each file to assemble a time series of biological acoustic presence. PSD processing is underway with an intern at Applied Ocean Sciences, LLC, to use this exercise to learn MATLAB source code. Preliminary data using some opportunistic over-the-side hydrophone data was presented at the SOLAMAC conference in Peru and illustrated instances when humpback whale song stopped in the presence of a boat passing through, and that snapping shrimp are a prime sound contributor to the environment.

Involving local communities: establish a flow of communication between our research team and the local council.				The original meeting with the local town council was successful. Throughout the season we met with members of this council informally to chat about the project and provide data collection and processing updates.

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

Our first unforeseen difficulty was that we wound up only being loaned two EARs. The company that let us borrow them had technical difficulties with the third one so it wasn't available. We tried to attain another loan last minute from a different company but it did not result in success. Therefore, we only deployed two EARs, placing them in the two sites that we thought would be the most different in terms of sound environments from known boat patterns.

Our second unforeseen difficulty was that the council meeting to gain permission to carry out the project was delayed for approximately a week. This was because of local politics and there was nothing we could do. We responded by preparing all of the cement anchors and meeting with the SCUBA company to plan a safe deployment and recovery schedule. Otherwise we were patient and tried to be respectful of the council's time to reschedule the meeting. Once we were able to hold the meeting, and were granted permission, weather conditions delayed deployment for another few days. This also happened for recovery, but by the time recovery occurred we had a good working relationship with the SCUBA Company so we prepared them to recover the final EAR for us after we all had to leave the field site for other responsibilities. Both EARs are in good working order and no equipment was lost during the season.

Our third unforeseen difficulty was the most stressful. Due to a human error in programming the EARs, no data were recorded on the first attempt. This emotionally was a difficult disappointment to surmount, but it worked out for the better. The batteries were still nearly full, and the EAR manufacturer was comfortable with loaning us the EARs longer. Therefore, we hired the SCUBA Company again to redeploy one of the EARs at Morro Mico. We chose not to redeploy the one at Nuqui because the visibility was low, making conditions potentially unsafe for divers. When recovering the EAR, we managed to do so in less than 5% visibility. We found it by blindly dragging a rope between the boat's anchor line and three divers. It was not even possible to see our hands while removing the EAR from the anchor, so the likelihood of finding it a second time was deemed very low). The second deployment of the EAR at MorroMIco recorded for 35 days and actually was deployed late enough in the humpback whale breeding season to capture their singing activity, and its decline into non-breeding season, when the soundscape would not be dominated by song. In reality, a soundscape has seasons - and recording both the singing season and non-singing season was better for a baseline dataset than recording only the singing season. Despite feeling like this was a failure at the beginning, it turned out that we should have designed the project with a later deployment date in the first place.

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

Scientifically, the most important outcome of the project was obtaining baseline data of the current, relatively undisturbed ecosystem before a large multi-purpose port may be built in the near future. Because so much industrial infrastructure has been built along the coastlines of other continents before soundscape research was a field, and before hydrophones were widely used, this dataset is unique and of immediate interest to the international acoustics community. Therefore we are in a win-win situation. If the port is built we will be able to compare "during" and "after" construction environment states with actual information from a "before" state in lieu of just guessing what the before state was like most soundscape research does. Conversely, if the port is not built then we hold a baseline dataset that can be compared to disturbed environments elsewhere in the world, and we can contribute facts about the biodiversity of the Colombian coastal system that may assist grassroots organizations in lobbying against the port construction so they can conserve an ecosystem that they value.

Another important outcome was that we built strong collaborations with local SCUBA groups and the team ExpTribuga that is filming a documentary series about the Pacific Coast of Colombia ecosystems. These relationships make future work feasible to continue recording a long-term time series of the acoustic environment. They also allow us to feel like we are part of the community and to assist in conservation-based activities lead by the local community members like cleaning up ghost nets and plastics.

This brings us to the third important outcome of our project: positive engagement about acoustics across Colombia in rural and urban areas. Carrying out this data collection enabled us to work with labs at local universities to find students who are interested in processing the data and doing thesis projects in bioacoustics. This topic has traditionally not been readily or widely available in Colombia, but now there are a group of students who comprise the beginnings of a Colombian acoustics sector and it only continues to grow as more of this work is processed, published, and shared on our social media sites.

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

Our project contributed to the employment of people in the local community. Because we stayed in a local bed and breakfast, the woman who cooked for us and rented her rooms to us is able to earn her own salary. Her husband is our boat captain and their neighbour serves as our first mate. Therefore, during the course of our fieldwork, two families had stable income. The local woman-owned SCUBA Company that we hired also gained revenue and experience in scientific diving methodology from our project.

We participated in the filming of a documentary at the request of three Colombian film-makers staying at the local eco-hotel. This group witnessed a juvenile whale with us who had lost its entire tail to net entanglement. The press release we wrote with them about this encounter reached several national news outlets and our team was

interviewed about conservation efforts, biology, and the pending port construction. This assisted in publicity for the film series they will release later this year. On a broader journalism scale, we were interviewed for an article in Nature that will be a UK TED talk in July 2019, and are now approached often for comment and/or interviews by journalists throughout Colombia. Colombian interest in their Pacific Coast ecosystem and communities seems to have increased in the past year.

Such information about the port and its potential effects has always been available to anyone who asks, and to anyone who we would strike up a conversation with while living in Coqui. This information can then be used by local residents in Choco Province and at the universities to inform their opinions about the port to help them choose whether to support or oppose it.

The larger academic community has also benefited by having students at Universidad Pontificia Javeriana (Bogota) help process the data, and it is possible that these students will become interested enough to pursue acoustics-based thesis projects. As a result, a small acoustics community continues to grow in Bogota with many students interested in assisting with field work.

5. Are there any plans to continue this work?

Yes, this work will be continuing. We will be redeploying EARs again in 2019. We have also acquired, on loan, acoustic release equipment to do a non-SCUBA based deployment at Nuqui so that the recovery should be less risky. A third loaned EAR is again pending, but two sites are for certain. We have already discussed this with the local council and we are preparing a report for them of last year's project.

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

For the local community, we have messaged them through WhatsApp with some updates of data analysis because that is how they prefer to communicate with the limited cell phone and WiFi coverage in the area. We will give them a full report when we return this year for the 2nd field season.

On a national scale, students who are working on the data analysis are preparing to present posters at conferences. On an international scale, we have presented one poster in Peru, a talk in Kentucky in May, and have submitted an abstract for a December conference in Spain. Peer-reviewed publication preparation will start soon.

Both Colombian and international journalists have approached us for statements and we try to be receptive to their requests as we can, sharing the information as best as we can with science communication skills in both Spanish and English.

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

The grant was approved in July 2018 after we had been in the field for a few weeks. The original payments for flights and the start of field work were made through personal funds or on loan from Dr. Seger's Fulbright account. We were able to use the

Rufford funding between August and October 2018 to reimburse ourselves and continue with fieldwork operations. As mentioned previously, the length of the project lasted longer than expected due not to monetary issues, but to weather, political, and programming ones.

8. 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.

Local exchange rate oscillated between 0.00023 and 0.00025 Colombian Pesos to each pound sterling. The actual amounts we paid in COP were recorded, but conversions were not done every day, but rather every week or two.

Item	Budgeted Amount	Actual Amount	Difference	Comments
RSG amounts requested in application:				
Flight Boston – Medellin (round trip).	470	1,110	+640	Price increased since estimate.
Flight Buenos Aires – Medellin (round trip).	550	390	1-60	Cheaper fare found.
Fuel	540	620	+80	More fuel had to be purchased for the second deployment and retrieval.
Housing	600	600		
Groceries & Food preparation	800	1229	+429	Groceries more costly than expected.
Sponsored Luncheon with locals	350	181	-169	Less costly than expected.
Boat captain & assistant	600	330	-270	Less costly than expected.
SCUBA gear	780	584	-196	Good rapport with SCUBA company provided friends' discount.
TOTALS	**4690**	**5044**	**+354**	Extra costs covered by Fulbright Scholar Award funds.

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

The next steps are to finish analysing data from the first year as soon as we can while also using it as an education opportunity for Colombian students. This way we can accurately communicate updates when we go to the field site again this year. Looking forward, we need to plan for the coming field season to repeat the project and continue to add to the long-term time series we hope to gather from this in the future.

10. 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?

Yes, Rufford's handle was tagged in all of our Facebook, Instagram, and Twitter posts. Our handle is @PHySIColombia. The logo appeared on our poster at the SOLAMAC conference in Peru and in the presentation slides for the ASA conference in Kentucky in May 2019. If our abstract is accepted, it will appear on materials for the SMM conference in Spain in December 2019. It will also appear on any hard copy reports that we make to the local community. We have listed our funders in email correspondence with journalists as much as we could.

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

Valeria Gonzalez*
- Original organizer of team members
- Performed field work in 2019
- Corresponded with journalists in Spanish

Christina Perazio
- Assisted in grant writing and field work in 2019

Kerri Seger
- Led deployment/recovery of EARs
- Leads acoustic data analysis by training students
- Corresponded with journalists in English

*Professional course has taken a detour, so the leadership of project after fieldwork was transferred to other members to meet project goals.

12. Any other comments?

Thank you for helping to create the foundational year of what we hope is a fruitful long-term study site for our careers!