

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	Robert Lamb
Project title	Anthropogenic threats to mollusc populations and their ecological role on the continental coast of Ecuador
RSG reference	9845-1
Reporting period	04/2011-05/2012
Amount of grant	£6,000
Your email address	salvarelmundo1@gmail.com
Date of this report	08/04/2012

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
Description of intertidal communities of Ecuador			X	Study in press in Marine Ecology Progress Series
Correlation between patterns of community structure and coastal region/seasonal phase			X	Study in press in Marine Ecology Progress Series
Qualitative assessment of mollusc collection			X	Study in press in Marine Ecology Progress Series
Temperature manipulation crossed with natural variation in nutrient levels			X	
Observations of natural recruitment and succession, and how this varies along the Ecuadorian coast			X	
Mollusc exclusion from succession plates		X		Application of anti-fouling plates for mollusc exclusions failed
Designation of no-fish zones	X			Insufficient budget, resources, and time for this component
Communication of results to local communities and regulatory organizations		X		Preliminary results have been expressed to local National Marine Reserves and in oral presentation at the Universidad San Francisco de Quito, the rest is pending termination of the data analysis phase

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

One of the first difficulties was finding suitable study sites along the entire coast of Ecuador, and gaining access to them. I had originally thought it would be fairly easy to find sites with flat, rocky benches extending into the surf zone upon which rocky intertidal communities would exist in abundance. However, it took me several months to find 10 suitable sites, and the spacing along the Ecuadorian coastline was not as regular as I had hoped. Even so, I was able to establish 5 sites in what turned out to be a "southern" bioregion, and 5 in the "northern" region. This facilitated comparisons between the two regions in terms of how intertidal communities differ, and how these communities react differently to changes in ocean temperature and nutrient levels. In addition, 5 of the 10 sites that were ultimately used in the project were located within national parks: the Parque Nacional Machililla, and the Reserva Marina Galera-San Francisco. In order to perform experiments in these sites, I was required to obtain permits from both of these entities, which proved to be a

more lengthy and bureaucratic process than I had previously envisioned. However, through persistence and the help of contacts who had some sway in local politics, I was able to procure both permits.

Another difficulty came in the maintenance of the mollusc exclusion experiment. As planned, I placed several small acrylic settlement plates at two sites in the south and two in the north. Half of these plates were black and half were white, with the goal of examining the interaction between differences in temperature and nutrients on intertidal organism settlement and later ecological succession. In addition, half of the plates were designated to be surrounded by anti-fouling paint, such as is applied to the underside of boats in order to prevent the settlement of marine organisms.

It has been shown that this anti-fouling paint provides a fairly definitive barrier across which most molluscs will not cross. Thus, these plates were of mollusc exclusion, the goal of which was to determine how the intertidal community was affected by the high level of mollusc removal by local gatherers. However, my first attempt at lining the plates with the anti-fouling paint was a complete failure. I attempted to apply the paint directly to the rock surface surrounding each plate, but the paint simply ran off down the sides of the rock, soaked into minute holes drilled by marine organisms, or was simply washed away once the tide rose. This presented quite a dilemma, but I decided to use a marine putty that hardens almost to cement to line the experimental plates, and then paint over the putty, so that the paint would have time to dry before the plates were bolted to the rock. This seemed to work quite well: I was able to apply several layers of paint over the putty, and since the putty could be removed once the experiment was over, I was not risking ruining the plates for later use. A few months went by, and while organisms were settling well onto the plates, the paint and putty did not fare so well. On several plates, the putty had been washed away by the corrosive action of salt water and waves. On still others, the paint had been virtually disintegrated from the combined erosive effects of the saltwater and intense tropical sunlight. At this point, however, there was no way of reapplying the paint, since the experiment was already well under way and it would have meant starting over from square one if I had removed the plates in order to paint them again. As such, the mollusc exclusion component of the experiment failed. In order to properly test the effect of mollusc removal from these intertidal plots, I would need to effectively exclude them from large parcels of intertidal space, which would involve materials, funding, and time that extend far beyond the resources allotted for this project. However, I am currently pursuing a research plan that might be able to answer these questions and others, and will soon be applying for a continuation grant in order to continue my research.

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

First ever comprehensive description of intertidal communities on the mainland coast of Ecuador, and how these communities vary in composition over time and space: I surveyed 10 different sites along the entire coast of Ecuador, describing the community structure of the intertidal ecosystem and how it varies between northern and southern regions and between warm and cold phases of the local seasonal cycle.

Analysis of the impacts of local changes in water temperature and productivity levels on intertidal communities: Although my research was based on changes produced by normal, seasonal variation produced by the El Niño-Southern Oscillation, this phenomenon provided the means for mimicking the probable alterations that will occur with climate change. As such, my work shows how local

intertidal communities might be modified in the coming decades if climate change continues unchecked.

Analysis of natural recruitment and succession in intertidal communities and the impacts of temperature and productivity manipulations on these patterns: The experimental component of my study produced a 6-month description of patterns of recruitment of intertidal organisms, succession among the newly established communities, and how temperature and nutrient levels affected these patterns. I am still in the process of analyzing these data, but I hope that this information will allow me to make inferences on whether the differences in the observational phase of the study are due primarily to ambient conditions that vary by region and/or phase, or more due to differences in the propagules of marine organisms brought by the predominating currents in each region/phase.

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

The first form of involvement of local communities was by bringing along various individuals to work on my project with me, in order to foment experience in science and exposure to the marine life that can be found on the coast of Ecuador. To this end, 7 different Ecuadorians came with me, most on multiple trips, to assist in the field work.

Secondly, during each session of field work, I had interaction with local fishers that were collecting the intertidal molluscs. I asked each of these collectors to show us their catch, and I explained our research and why it was important. I also discussed with each fisher their concepts regarding resource management, how the resource has changed in recent years, and what they expect for the future. This type of basic environmental education is a very important component of community capacitation, as it plants the initial seeds of interest in the natural environment and the concept of caring for resources in order to ensure future sustainability.

Finally, I presented the results of my work at a conference in the Universidad San Francisco de Quito, where the majority of students and professors of the College of Science attended.

5. Are there any plans to continue this work?

I still want to carry out the experiment in which entire sections of the intertidal community are excluded from predatory molluscs, as this will definitively show the impacts that mollusc removal has on the ecosystem. However, it does not seem feasible to do such an experiment on the Ecuadorian coast, since there are too many local inhabitants that continuously peruse the intertidal area for edible molluscs. As such, I am currently planning another study, involving sites that are much more remote in the Galapagos Islands, in which I will be able to directly measure this component, as well as other topics regarding the complex interplay of temperature and nutrients, how these affect marine organisms and their interactions, and how global climate change may locally be impacting these processes.

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

Already, I have presented the primary results of my work at the Universidad San Francisco de Quito, in the form of an oral presentation to the College of Science.

Once the full scope of the project has been completely assessed, analysed, and recorded, I will share my results with the Parque Nacional Machalilla, the Reserva Marina Galera San Francisco, and the Ministerio del Ambiente, all governmental organizations charged with caring for Ecuador's coastal marine resources, so that they may take this information into account when making management decisions.

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

The field work for my study went from October 2010 to January 2012. This is approximately the timescale that I had foreseen for my project, although it did take somewhat longer than I had expected. I am also continuing to monitor water temperature values at several sites along the coast of Ecuador in order to produce a more long-term dataset for at least this one variable.

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
Assorted tools	385.81	420	+35	I had to replace several stainless steel screws that were lost during the experiment
Major equipment and transportation	1313.75	850	-463.75	I was able to use the drying oven at the Laboratorio de Ecologia Acuatica
Food and lodging	3076.09	3500	+425	I had to also pay for several research assistants during each trip
Research supplies	839.52	700	-140	Fewer I-button temperature readers were needed than expected
Permits/didactic materials	384.52	100	-385	Didactic materials were provided for by the Universidad San Francisco de Quito
TOTAL	6,000.00	5570	-430	

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

The first step of importance is to publish the results I have. As I mentioned, I am currently submitting one paper for publication in Marine Ecology Progress Series, with high hopes that they will accept it for publication. In addition, I plan on submitting a comprehensive report to the national authorities responsible for managing marine reserves and resources so that they may take into account the information produced by my study in regulating fishing practices.

Secondly, I plan to pursue further research in this area both on the Ecuadorian coast and in the Galapagos Islands in order to further delve into the question of how intertidal ecosystems in this

region are being affected by nutrients and temperature. For this, I plan on applying for a continuation grant.

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?

Within the university setting where I was supported in doing my research, namely the Universidad San Francisco de Quito, I discussed the Rufford funding I had received with several colleagues, many of which went on to receive Rufford grants themselves, namely: Alexandra Avila, and Maximilian Hirschfeld. I also named the Rufford grant as the primary funder of my research in my publication submitted to Marine Ecology Progress Series.

11. Any other comments?

Just to say thank you again for this wonderful opportunity!