



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	Margarita Brandt
Project title	Understanding the functional roles of biodiversity in the Galápagos Marine Reserve, Ecuador
RSG reference	08.09.07
Reporting period	14 December 2007 – 14 December 2008
Amount of grant	£5000
Your email address	m_brandt@brown.edu
Date of this report	14 December 2008

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
Understanding why sea urchins matter			Yes	With the experimental manipulation of sea urchins underwater, I was able to determine that one species, <i>Tripneustes depressus</i> , is the most important urchin grazer in the central archipelago.
Determining the relationship between taxonomic and functional diversity		Yes		408 species have been categorized into marine functional groups (primary producers, herbivores, predators, omnivores). However in order to determine how much redundancy is built in marine ecosystems, recent literature has suggested a finer categorization of the functional groups in addition to the broad categorization described above. For example, a finer categorization of primary producers (algae) will include microalgae, filamentous algae, foliose algae, coralline algae, etc, for which additional trips are needed in order to do feeding observations, field collections and lab identifications.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant). I was not able to measure the concentration of Chlorophyll-a, as algae did not grow on the plates. However, since I conducted the urchin experiment under natural environmental conditions, I documented the change of percent cover of algae before and after urchin grazing. I did so by photographing the substrate within the experimental cages with an underwater camera I borrowed from my advisor.

3. Briefly describe the three most important outcomes of your project. First, I determined that *Tripneustes depressus*, one species of urchin, is the most important grazer between the 3 most common urchin species in the Galápagos Marine Reserve. Kept in relatively small densities, urchins are crucial in removing algae from the substrate, which is an essential process for subordinate algae species or other invertebrate species to colonize and increase the diversity of marine communities. Secondly, my data on attachment forces suggests that the reason of why *Tripneustes depressus* has this overwhelming effect is because its ability to forage under high flow conditions. Thus, having identified how and why this urchin species matters has important implications for the maintenance of diversity in the Galápagos Marine Reserve. And finally, my study underlined the importance of conducting biodiversity and ecosystem functioning (BEF) studies under natural, environmental conditions. Most BEF studies have been performed in

mesocosms under environmental conditions that likely differ from those in natural habitats. Although such studies provide useful insight about potential relationships between biodiversity and ecosystem functioning, *in situ* studies are more representative of the natural world, because additional factors influencing the relationship between biodiversity and ecosystem functioning could be revealed. In my case, the conduction of my experiment under natural conditions uncovered the importance of hydrodynamic forces in influencing urchin grazing.

4. Briefly describe the involvement of local communities and how they have benefitted from the project (if relevant). I recruited a local high school student (Jorge Luis Baque) and trained him in themes of biodiversity and ecosystem functioning. Together, we applied a survey to the tourism and fishing sector of the Galápagos Marine Reserve. By doing this, Jorge Luis learned how to design and administrate questionnaires, as well as what are the current and potential uses of ecosystem services of the Galápagos Marine Reserve. This is of particular importance, as Jorge Luis realized the importance of incorporating sociological into ecological studies.

5. Are there any plans to continue this work? Yes. Thanks to the results from this study, new, important questions arose (see below). I plan to start new experiments during next year that will complement the results found in this study.

6. How do you plan to share the results of your work with others? On April 2008 I gave a talk at the 37th Benthic Ecology Meeting on the preliminary results of this project. Now that I have finished this project and have all the results, I plan to give more talks to international audiences during next year, for example at the 38th Benthic Ecology Meeting or at the 94th ESA (Ecological Society of America) Meeting. In addition, I will share the results of my work with the different stakeholders of the Galápagos Marine Reserve, namely the fishermen, tourism, and conservation sector, as well as with the management authorities (Galápagos National Park).

7. Timescale: Over what period was the RSG used? How does this compare to the anticipated or actual length of the project? The RSG that I got was used almost exactly during the anticipated length of the project. The only exception is that I had to run the experiment one week longer than planned and thus I stayed an extra week in the Galápagos Islands in January of 2008.

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
Boat Time	3434	3535	-101	Since I run the exp 1 week longer, I had to do 2 additional day trips at 50.5 each.
Materials and Supplies	400	300	+100	I didn't have to buy a dynamometer as I borrowed one from a



				colleague.
Travel and Living	1165	1165	0	
TOTAL	4999	5000		

9. Looking ahead, what do you feel are the important next steps? Having identified that *Tripneustes depressus* is the most important urchin grazer under high flow conditions and that it may become a fishing target in the near future, I think that it is important to answer new questions, such as if *Tripneustes depressus* is the grazer with more influence under different flow conditions, or if the other 2 urchin species are going to be able to compensate for the potential loss of *Tripneustes depressus*, or if the overwhelming effect of *Tripneustes depressus* depends on the type of algae available to graze. This new information will help us understand in more depth its functional role and the consequences of losing *Tripneustes depressus* from the system. In addition, it is necessary to do more feeding observations and sample collections of Galápagos biodiversity, as this information is crucial in order to categorize each species into finer functional categories and thus to determine how much redundancy is built in the Galápagos Marine Reserve.

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. I used the logo in the acknowledgments section of a talk I gave (Impacts of urchin diversity on algal abundance in the Galápagos Islands) at the 37th Benthic Ecology Meeting. I am planning to continue using the logo during next year, as I will give more talks and will write manuscripts of this study, where I will acknowledge the RSGF support.

11. Any other comments? I would like to thank the RSGF for having these funds available for projects outside the first world. Thanks to it, I was able to continue doing important research in the Galápagos Islands.

12. I agree to this report being published on the Rufford Small Grants website

Signed (or print name)

Margarita Brandt