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	Ricardo Jessouroun de Miranda
Project title	Invasive Cup Coral in Coral Reef of the Todos os Santos Bay (TSB): effects of interspecific competition in the native coral community and management actions
RSG reference	13119-1
Reporting period	08-03-2013 to 08-03-2014
Amount of grant	£4826
Your email address	ricardojdemiranda@gmail.com
Date of this report	07-03-2014

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
To investigate the effects of the alien species *Tubastraea tagusensis* on native corals and on the structure of reef benthic assemblages.			X	We conducted manipulative experiments of direct contact between invasive and native corals in a recently invaded reef in Brazil (Cascos reef). We also quantified the proportion of competition events between *T. tagusensis* and native corals. Moreover, we compared the benthic community structure of the invaded with others non-invaded areas to estimate potential impacts.
To conduct actions of control the establishment and expansion of *Tubastraea tagusensis* and monitoring the effectiveness of these actions.		X		We removed the invasive coral colonies in about 15 sites but concentrating efforts in Cascos reef. However, we cannot perform effective monitoring of these management actions because did not have the required time to check the growth of new recruits in all these sites.
To raise awareness in the fishermen and recreational diver communities to engage them into management actions programme.		X		We did raise awareness of about 25 fishermen and recreational divers about the importance of management invasive coral in TSB through lecture and training. However as mentioned above, the effectiveness of removal actions (recruitment rates) cannot be monitored and therefore it was not possible give feedback for volunteer divers about the success level of the efforts made by them. If this information had been generated and transmitted during the project, perhaps a greater number of divers had been to engage into programme management actions.

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

Our team had many difficulties in the implementation of the competition manipulative experiment due to the physical conditions of the chosen location (Cascos reef), which has depth of 20 m and is about 10 km from the coast. Because of this, we had to hold more expeditions to establishment of

the experiment than predicted. This affected other steps foreseen in the work, as the beginning of the monitoring of the new recruits in areas where there were removal actions.

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

Our project has contributed to the identification and mapping of invasive coral populations and habitat use in coral reefs and estuarine environments in the TSB, where the invader is currently distributed at 15 sites. We found that four main native coral species in Cascos reefs showed mortality when in direct contact with the invasive coral. Three of these species (*Siderastraea stellata*, *Madracis decatis* and *Mussismilia hispida*) can be susceptible to mortality increase over time and/or reduce abundance in the substrate. However, *Montastraea cavernosa* over time showed the ability to strike back and all of the invasive coral colonies in contact with *M. cavernosa* showed progressive tissue necrosis. In the invaded reef zone, the alien coral dominated vertical habitats (reef walls) and altered the benthic community structure, mainly native hermatypic corals, crustose coralline algae and turf algae. In addition, our project has contributed to the training of volunteer divers and fishermen who worked in control actions and removal of more than 8,000 invasive coral colonies. During the project, information about the threat of invasive coral in TSB was released in regional scope by digital and print media and additionally worked during academic courses for students. Our project has also contributed to identify the main introduction vector of invasive coral in TSB (fouling on oil rigs) and collaborated with the environmental agency to perform supervisory vector actions. Lastly, our work has produced an important baseline that will serve as a starting point for future monitoring.

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

The local community involvement occurred during the control actions of the invasive coral and on the organisation and data processing (cleaning, counting and measuring of removed colonies). The community received training for coral identification and appropriate coral collection techniques.

5. Are there any plans to continue this work?

Yes. We showed that the invasive coral competes and kills native corals and alters the space use of the reef substrate. Simultaneously, we also started the implementation of actions to control populations of the invasive coral in places where it has been identified. Now the next steps of the work will be monitor the effectiveness of these actions performing continuous monitoring of the arrival of invasive coral recruits and evaluate how invader dominance in substrate can alter food availability for native fish predators (grazers), because it is known that cup coral is not palatable to native fishes. Thus, it will be possible to estimate the impacts of invader on reef fishes, one the main marine resources consumed by fishermen in the TSB. Moreover, we plan to create a communication tool to fast share information about possible new invaded sites in TSB through an APP for phones and tablets. This could be done with the collaboration of an expert programmer in computational mathematics partners for other projects in development with our group. Lastly, we intend to implement continuous management actions to control the populations of the invasive coral involving fishermen, recreational divers and technicians from environmental agencies that will have their training improved.

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

We plan to share our results with civil and scientific society and the government. Thus some news in newspapers of regional circulation have been published (Jornal A Tarde 03/11/2013 http://atarde.uol.com.br/bahia/salvador/materias/1545947-coral-invasor-ameaca-biodiversidade-local), and a scientific paper has been submitted for publication in electronic journal Coral Reefs (http://link.springer.com/journal/338). A master thesis was completed and presented to Programa de Pós-Graduação em Ecologia e Biomonitoramento in Federal University of Bahia (www.ecologia.ufba.br). Also partial results had been published in social media page of project (www.facebook.com/projetocoraisdabaia). Other technical reports will be prepared and forwarded to environmental agencies to indicate which management actions must be taken to increase the effectiveness of actions initiated by our project. Furthermore, the results have also been reported in courses conducted at the Federal University of Bahia.

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

The RSG was used along a year fulfilling the expected duration of the project.

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 (£1=R$3,79)	Actual Amount (£1=R$3,79)	Difference	Comments
car fuel	£182	£182		
boat rental	£2364	£2364		
scuba tank rental	£873	£873		
scuba regulator rental	£327	£327		
scuba buoyancy compensator rental	£545	£545		
Fieldwork meals	£535	£535		
TOTAL	£4826	£4826		

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

We believe that the next steps of work should prioritise: i) the implementation of continuous monitoring of invasive new recruits (recruitment) in places where removal actions were started, ii) to test if the dominance of invasive coral in the substrate can change the processes of predation by fish grazers, iii) to develop a tool for rapid dissemination and sharing of information (APP for phones and tablets) on possible new infested sites, and iv) to implement of continuous management actions (control by removal of colonies) involving volunteers.

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?

The RSGF name and/or logo were published in the print and electronic media newspaper of regional circulation (http://atarde.uol.com.br/bahia/salvador/materias/1545947-coral-invasor-ameaca-

biodiversidade-local), and website (http://www.ricardojmiranda.blogspot.com.br/p/palestras.html) and social media page (www.facebook.com/projetocoraisdabaia). Also the RSGF name was cited in master thesis and in submitted scientific paper for electronic journal Coral Reefs.

11. Any other comments?

The RSG granted was crucial for the development of first evaluation of the impacts of the cup coral *Tubastraea* spp. introduction on coral reef substrate in Atlantic Ocean. The continuation of this work is critical to evaluating the effectiveness of invasive coral managements and to understanding the potential impacts environmental and social to long term.