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	Rohan Arthur
Project title	Understanding drivers of coral reef resilience in the face of climate change in the Lakshadweep Archipelago
RSG reference	11691-2
Reporting period	September 2012 to September 2013
Amount of grant	£6000
Your email address	rohan@ncf-india.org
Date of this report	1st October 2013

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
Establishing permanent monitoring sites along a gradient of predictive resilience		✓		The establishment of permanent monitoring sites took a considerable amount of field energy, but we were able to establish sites at almost all locations along the predictive resilience gradient apart from Minicoy where logistic constraints and the absence of diving equipment prevented us from establishing the plot last season. This will be completed in the coming field season.
Benthic composition, structural complexity and recruitment			✓	At all sites, we conducted detailed surveys of benthic composition, collecting information on generic cover of coral as well as other benthic elements. In addition, at every location we measured structural complexity using photographic techniques. Coral recruits were enumerated within the 5 m^2 plots, with information on genus and size class.
Fish counts			✓	Species-level visual transects were conducted at each location to characterize the fish communities at every reef.
Trophic rates		✓		We standardised assays to estimate critical rates of herbivory and microinvertivory and used already standardised methods of bioerosion to measure these rates at each reef. Our measures of piscivory still need further development since we need to evolve non-destructive means of estimating fish predation. We will be doing this over the next season.
Fishing and other human disturbances			✓	At each location, we have measured fishing, boat, and tourism pressure and in addition, have begun a programme of catch monitoring with local fishers to validate some of these measures.

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

We expected to have all the sites established in our gradient of predictive resilience, but this was not possible because of logistic constraints. We decided that we would focus our efforts on the locations we could establish sites at and establish the remaining permanent plots in the coming season.

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

a. Perhaps the most important outcome of this work is the establishment of permanent monitoring locations along the predictive resilience gradient. This will set a critical baseline for this archipelago that will help not merely track the responses of these reefs to local and global pressures but will also help us identify the mechanisms underlying the pathways these reefs take. This will be vital in prioritising areas for management efforts and to determine how to maximise the resilience potential of this reef system.

b. Our initial results indicate that coral post-recruitment processes are heavily influenced by the relative stability of settlement substrate. This appears to be a key factor influencing the recovery potential of these reefs, and in the coming years, we will be focusing much of our attention unpacking this mechanism in much more detail to understand how oceanographic conditions, bioerosional forces and reef topography interact to influence coral recovery in the wake of mass mortality events.

c. Interestingly, the reefs of the Lakshadweep Archipelago, despite their high human density, have thus far been very lightly fished. I have argued that much of the inherent resilience we have documented in these reefs is linked very closely to this relatively low fishing pressure. Our recent work has shown however that fishing practices may be changing here, with more fishers looking once more to the reef as a source of exploitation. This is something that our future work is geared to looking at since it will have a huge bearing on the resilience potential of the Lakshadweep reefs.

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

The local communities of the Lakshadweep have been an important part of our research team and their inputs have been vital to the success of the programme. Our field coordinator has been working with me for the last 15 years, and his enthusiasm and insights on reef processes have helped considerably in developing the work. In addition, we have been working closely with artisanal fishing communities, conducting workshops with fishing cooperatives at each island we visit, in order to communicate our findings with them and to keep track of changes in resource extraction issues and emerging trends. This interaction has been essential in designing our interventions going forward.

5. Are there any plans to continue this work?

This is part of an ongoing research programme that will continue for the next several years in the archipelago. In particular, we will be using the next few years to: 1. Complete establishing the predictive monitoring baseline; 2. Conduct specific studies on reef recruitment and substrate

stability as drivers of coral recovery patterns; and 3. Identify key functional indicators of resilience in terms of herbivory, predation rates, fishing pressure and other anthropogenic stresses.

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

Along with this recent work, we have begun to analyse data from this archipelago collected over the last 16 years for peer-reviewed publications in scientific journals. In addition, we have already submitted reports of our results to concerned Lakshadweep departments including the Department of Science and Technology, the Department of Environment and Forests and the Lakshadweep Administration.

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

The RSG project was used for the entire year for which it was budgeted (2012-2013).

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
Field station rent (12 months)	315	343.36	-28.36	
Other accommodation	233	239.96	-6.96	
Boat fuel, hire and maintenance (12 months)	1,120	1,098.95	21.05	
Air fares (four return trips)	467	565.72	-98.72	
Surface transport (12 months)	105	105.01	-0.01	
Researchers per diem (8 months)	1,870	1,831.25	38.75	
Field coordinator (8 months)	1,400	1,373.44	26.60	
Compressor and dive equipment spares	115	114.99	0.01	
Other field equipment (tape measures, underwater paper, stationary, etc.)	115	114.99	0.01	
Phone, internet, postage (12 months)	70	69.20	0.80	
Reporting, printing, etc.	95	-	95	
Other administrative costs	95	95.00	-	
TOTAL	**6,000**	**5,952**	**48.12**	

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

Our work thus far has identified three qualitatively very different reef responses to major disturbance events. While some reefs appear to **resist** major bleaching events very well, others respond with a dynamic **recovery** of benthic cover and others are **susceptible** and do not show recovery in the short term. Critical to the management of this archipelago is to determine the mechanisms that underlie these responses, and our work in the next few years will be geared towards determining these factors to assist in maximizing the resilience potential of these reefs.

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 was featured in all reports submitted to the Lakshadweep administration and will be duly acknowledged in all future publications, popular and scientific.

11. Any other comments?

As a direct result of the work being conducted through the RSGF, I have been recognised as a Pew Marine Fellow for 2013. This fellowship will assist in taking some of this work forward.