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. The Final Report must be sent in **word format** and not PDF format or any other format. 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. Please note that the information may be edited for clarity. 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	Rucha Karkarey
Project title	Assessing the effects of bleaching-related structural loss on the apex predator guild (piscivores) of the Lakshadweep Islands, India
RSG reference	9016-1
Reporting period	December 2010-December 2011
Amount of grant	£5140
Your email address	rucha@ncf-india.org
Date of this report	30 December 2010

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
Grouper community surveys			■	We managed to conduct extensive species and density surveys of grouper communities at 13 atolls in the Lakshadweep archipelago. This was done by coordinating efforts with Rohan Arthur, another Rufford Small Grants recipient, to get a comprehensive understanding of reef condition across the island group.
Benthic surveys- measuring structural complexity			■	Structural measurements and benthic assessments were carried out at all 13 atolls which will be used as essential predictors of grouper community trends.
Structured interviews with local fishermen	■			We had casual conversations with key informants to understand the islander's preference for various food fish. We found that groupers are not a preferred food fish/ fish trade in the local community and there is no targeted fishing pressure on these fish, apart from a fairly recent fishery on a few islands. Information was derived from another Rufford project which dealt with interviewing the fishing community.

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

A major constraint during the study was the cost of hiring dive equipment for the work. The local dive centre charges for hiring equipment and boat hire were not sustainable for the season as we found ourselves paying significantly larger amounts than we had budgeted for. We tackled this issue by investing in equipment (using the dive gear rental budget from this Rufford project together with the equipment budget from another grant) which now allows us to carry out work in the future with a more sustainable expenditure.

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

1. **Gradient of topographic structure in the islands-** Across the archipelago (13 atolls), we found topographic structure (hard coral structure) to vary highly in response to the 2010 bleaching event (April-May 2010) and the following monsoon season (July-October 2010). We classified sites (total number 43) based on their topographic complexity into low structured (<30%), medium structured (30-70%) and highly structured (70-100 %) locations.
2. **Differential history of topographic structure within atolls**- Local hydrodynamic processes (direction of the monsoon winds during the monsoon season) and the timing of bleaching events (pre-monsoon) together create very different structural environments within atolls. We found that western aspects of atolls are highly dynamic and experience major changes in

topographic structure in response to 6 months of exposure to annual monsoonal currents and storms. Eastern aspects of atolls on the other hand have a relatively more stable topographic structure because they are sheltered from these monsoon storms. Using a 13-year data set on topographic structure we classified sites based on their structural history, with eastern deep reefs with a relatively stable history of structural disturbance, western shallow reefs which show a dynamic structural history, with western deep and eastern shallow reefs intermediate between these two extremes.

3. **Grouper diversity and structural history** - We recorded a total of 33 grouper species across 13 atolls. There were no apparent community differences (abundance, diversity) between atolls and the grouper community (at least in terms of species distributions) appears to be well connected across the archipelago. The structural history of an area plays an important role in shaping communities of long-lived benthic predators like groupers. While the eastern and western sites of all atolls were both equally variable in the amount of topographic structure we found grouper biomass to be almost three times higher on the structurally stable eastern sites as compared to the structurally dynamic western sites.
4. **Potential refuges after catastrophic events-** Groupers are long-lived, structure dependent benthic top predators on coral reefs. The difference in biomass on the eastern and western aspect of atolls for the same level of topographic structure indicates that structurally stable eastern sites may provide refuge (potential migration) to these benthic top predators during catastrophic events like bleaching and monsoonal storms. Further research in resource availability may be useful in identifying eastern sites of atolls as high conservation areas for the Lakshadweep.
5. **Spawning aggregations in the atolls-** A multi-species grouper spawning aggregation was observed at two of the atolls during this study. The spawning aggregations areas can be identified as areas of high conservation priority and therefore we propose to study these aggregation events in more detail in our future studies.

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

The project was carried out along with the reef resilience project of the Nature Conservation Foundation (NCF, Mysore). NCF has established itself as a research institution in the Lakshadweep in the past 12 years. They have built a rapport with various community institutions like the local *Panchayat* (local self governance institutions), tourism department and the Department of Environment and Forests. The results of the study have been discussed and conveyed to these institutions in different capacities.

This project involved the local community in various ways, 1. Hiring local project assistants and boat assistants for the dive-related work. 2. Getting information from key informants (local fishermen) regarding grouper catches, sightings and landings.

5. Are there any plans to continue this work?

Yes. We plan to continue this work over the next few years (including collaborated work), especially for my doctoral study.

This study has helped us lay baselines of top predator diversity and to understand their relationship with the gradient of topographic structure in the islands. Our future plans include understanding the relationship between grouper distribution and the history of benthic structure. In particular we would like to look at:

1. Refuges for fish (eastern sites, structurally stable sites) which can be key sites for conservation and management of fish resources in the islands.
2. Adaptations in fish to structural loss of habitats (switching of predation strategies, diet preferences, physiological adaptations to changing habitat).
3. Monitoring and protecting grouper spawning aggregations in the islands.

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

We plan to share these results via: 1) publication in peer-reviewed international journals; 2) discussions with local village self-governments and fisher groups; and 3) reports that can be shared with policy makers, especially the local 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 was used over the period specified in the original proposal. This project was written to help lay baselines for benthic predator communities and benthic topographic structure for the Lakshadweep and will be used as an initial study to inform and design a more detailed doctoral research.

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
Living Expenses	1050	329	721	The field station expenses were shared with Nature Conservation Foundation (NCF) Mysore. NCF was running two projects funded by the Rufford Small Grants Foundation in the Lakshadweep. Balance amount from all the heads was put towards the purchase of dive equipment.
Field Assistant Salaries	390	90	300	We conducted the dive surveys along with the NCF team and did not have to hire dive assistants for the project. These salaries were instead used to pay boatmen and boat assistants for their efforts and help during the dives and travel between islands.
Travel	500	208	292	Lakshadweep is a fairly difficult area to access and flight seats / fares are often unpredictably high or low. Ship ticket costs also included here, but the bulk of travel for team members had to be by flight. Balance amount was used towards boat hire.
Diving and boat costs	2550	2557	-7	Boat hire charges were higher than we expected. Some of the atolls were logistically difficult to sample with regular

				fishing boats (> 15 hours travel time between atolls) and we had to rent a dive boat with a much faster engine to sample these distant atolls. This boat charge was high and we slightly overshot our budget.
Equipment	600	1904	-1304	Local Dive centre charges for equipment rental were highly unsustainable for the season. The research station had three simultaneous projects in Lakshadweep and resources were pooled from all three projects to purchase dive equipment for the team for this season and future seasons as well. Balance amounts from other budgeted heads in this project were pooled to purchase this dive equipment. (two tanks, regulator set, Buoyancy Control Device, 20% of dive compressor cost)
Miscellaneous contingent expenses	50	41	9	
Total	5140	5156	11	

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

1. **Regular monitoring of benthic topographic structure and fish communities:** A priority is to continue monitoring benthic and fish communities in order to add to the long-term data set collected by NCF Mysore. In order to be able to discern qualitatively different habitats in the atolls, we need to design more detailed studies to get better, more accurate measures of topographic structure.
2. **Filling gaps in the story:** Tracking changes in prey densities in habitats with different structural histories and topographic structure. To understand if benthic predators are tracking changes in food resources across this gradient of structure or if structure itself is a limiting factor in predator efficiency in different habitats.
3. **Detailed ecological studies** of habitat use, foraging strategies, diet preferences, physiology in habitats with different structural histories and topographic structure.
4. **Tracking and monitoring spawning aggregations** as they may be crucial to maintain populations of these top predators across the atolls. Protecting and conservation of these aggregation areas may be necessary.
5. **Understanding effect of fishing pressure on guilds of reef predators**: Tracking changes in fishing practices, from pelagic tuna fishery to reef fishing. Understanding the increasing nature of fishing pressure and its effects on fish communities. Identifying refuge areas for protection.

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 RSG logo was used during presentations made at the Nature Conservation Foundation meetings.

The RSGF funding was acknowledged in:
1) reports provided to the Lakshadweep administration

2) peer-reviewed papers submitted to various journals. In addition, we will be presenting our findings at the upcoming International Coral Reef Symposium in Cairns, where we will be acknowledging the RSGF (with the logo used appropriately) as an important research supporter of this work. Information on the structure of the Rufford Grants was also provided to other researchers working in the islands and we recommended that they submit applications for funding to the Rufford Small Grants Program.

11. Any other comments?

We would really like to thank the RSG for being an extremely supportive grant with the management being very understanding and appreciative of intermittent issues that were dealt with in a flexible and easy manner.