

## The Rufford Foundation

### Final Report

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Congratulations on the completion of your project that was supported by The Rufford 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](mailto:jane@rufford.org).

Thank you for your help.

**Josh Cole, Grants Director**

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Grant Recipient Details	
<b>Your name</b>	Shreya Yadav
<b>Project title</b>	Coral Reef Function and Functionality in Warming Waters: Examining the Links between Coral Assemblages, Reef Fish Function, and Fishing in the Maldives Archipelago
<b>RSG reference</b>	24036-2
<b>Reporting period</b>	October 2018 – December 2018
<b>Amount of grant</b>	£4910
<b>Your email address</b>	shreyay@hawaii.edu
<b>Date of this report</b>	11 January 2019

**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
Collect photogrammetry data on reefs in Faafu atoll				
Identify reefs that differ in their coral species compositions and habitat characteristics				
Collect preliminary data on reef fish communities in Faafu				
Create individual-based models of larval dispersal				This project objective changed; details given in the sections below.
Perceptions of people to ecological change				This project objective was also modified in the course of study; details below.

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

The primary objective of this work was to conduct a season of fieldwork in the Maldives and establish strong ecological baselines for future work. This was successfully completed between January and March 2018. Data on coral community composition were collected using photogrammetry techniques, and preliminary assessments of reef fish communities were also done. Two of the proposed objectives changed during the course of this work; the details on these components have been outlined below in the next section. Apart from this, there were no unforeseen difficulties that arose during the grant period and my time in the Maldives was made especially pleasant by the support and encouragement of local networks on the islands.

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

The three most important outcomes of my project were as follows:

**1. Collect photogrammetry data on reefs in Faafu atoll and identify reefs that differ in their structural characteristics:**

I surveyed 17 reefs around six islands in Faafu atoll in the Maldives using photogrammetry techniques to create 100 m<sup>2</sup> large-area mosaics of every reef (see Fig. 1). I processed these data using a visualization software in collaboration with scientists at the Scripps Institute of Oceanography. I then analysed these data to assess differences between reef habitats in their dominant coral morphotypes, their

live coral cover and coral compositions and a few other benthic variables. These data show that reefs in Faafu differ substantially in their habitat characteristics (Fig. 2), which could impact how they recover from disturbances and their overall functioning. Going forward, I would like to test how reefs that are very dissimilar in their structural characteristics differ in the functions they provide to reef fish species. Do reef habitats dominated by submassive and massive coral forms support a set of functions quite different from a branching or corymbose-dominated habitat? Establishing these patterns will help understand how different trajectories of reef decline will impact reef fish community function.

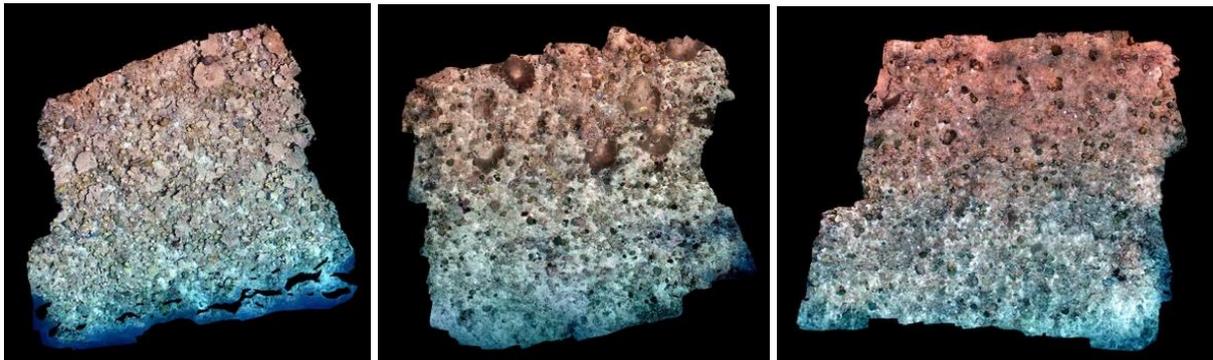


Fig 1: Example of orthophotos (or photomosaics) for 3 mapped reefs (10 m x 10 m each).

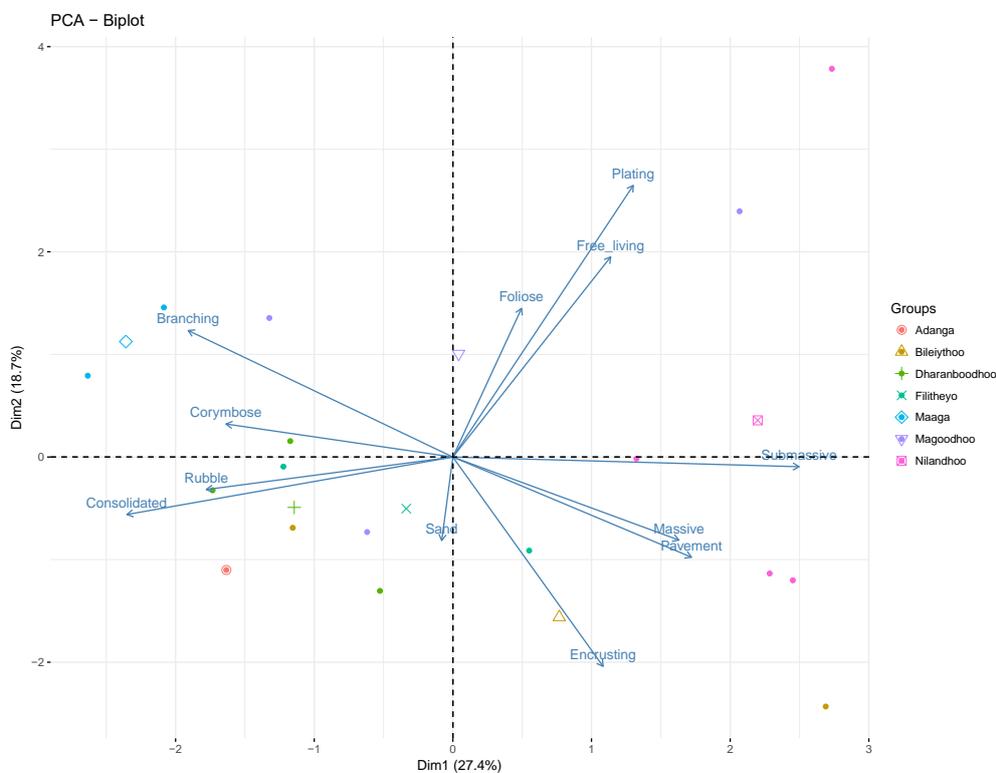


Fig 2: PCA showing how reef sites (n=17) surveyed in 7 islands in Faafu atoll differ in their dominant coral morphotypes (or growth forms; e.g., foliose, plating, branching, etc.)

## **2. Collect preliminary data on reef fish communities in Faafu atoll**

At seven of the 17 reef sites that I surveyed, I collected data on reef fish diversity. This was done by recording 10-15-minute videos using four GoPros at each reef. Video footage was analysed for reef fish diversity but not abundance. These data were intended to provide preliminary information on whether there are potentially significant differences between reefs in their composition of reef fish species. In the future, I want to make longer recordings at specific coral colonies across a range of reefs to assess how the same reef fish species use these colonies across a spatial gradient and how their use differs when the colony dies but retains certain three-dimensional characteristics. These preliminary data on fish diversity helped me to understand the common reef fish species here and the ones to focus study on going forward.

## **3. Perceptions of people to ecological change**

This objective was modified during the course of study as I began a project on the ecological history of the tuna fishery in the Maldives. In attempting to understand how people perceive ecological change on their islands today, I found it necessary to first better understand how people have managed and used their resources historically. This led me to investigating the fascinating 1000-year-old tuna fishery in the Maldives, and I am currently writing this up as a paper for publication. The article raises several questions about the present day governance of fisheries resources in the Maldives, and in the future, I hope to integrate interviews and oral histories into this work for a fuller picture of how Maldivians manage their marine resources today.

The only objective of this proposed study that was completely altered was the creation of individual-based models to assess coral connectivity in the Maldives. The scope of this question was too vast for this project and would have changed my course of study. While this remains a field of research I am very interested in, my efforts right now are aimed at first better understanding the ecological processes that are at play in the Maldives, how small-scale interactions between corals and fish may influence reef function and recover, and in strengthening the role that scientific research plays in education and outreach in these islands.

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

I stayed on Magoodhoo Island during my time in the Maldives in 2018, a community island with about 700 inhabitants. I was working in collaboration with the Marine Research and Higher Education centre (MaRHE) while I was there – this centre is deeply rooted in the community and employs local staff for almost all their research and education activities. As a result, I was able to engage with several local stakeholders during my stay here and get involved in local education and outreach activities happening at nearby schools. This was immensely useful for me. Photogrammetry also creates visually appealing reef mosaics that easily double as education tools and going forward I would like to use this in my presentations in an interactive format. While my first field season in Magoodhoo was aimed at collecting

data and trying to better understand the kind of educational tools that might appeal to students here, when I go back I would like to make outreach a larger component of my work, with measurable targets and outcomes.

**5. Are there any plans to continue this work?**

Yes, I plan to return to Faafu atoll to follow-up on this work. I would like to re-map some of the reefs I surveyed to assess how different coral morphotypes/growth forms have degraded or consolidated in the past year. This will help me better understand whether reefs with certain structures follow particular trajectories of decline and death. Simultaneously, I plan to conduct experiments on coral degradation/bioerosion at the University of Hawaii to get at more accurate rates of breakdown and consolidation. On my return to Magoodhoo, I also plan to do more extensive interviews with people on community islands to assess the relevance of the tuna fishery to locals today. As mentioned above, I would also like to make outreach a larger part of my work, so that the results of my research are able to feed back into local knowledge more directly.

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

The data that I collected earlier this year in the Maldives will be a part of my first chapter towards my PhD dissertation. I have already presented parts of this research at the University of Hawaii at Tester's Symposium and at the Society for Conservation Biology Conference, in Wellington, New Zealand. Eventually, this work will be written up as peer-reviewed publications. I plan to then share this research at local institutions and schools in the Maldives, both through presentations as well as through more targeted outreach activities.

**7. Timescale: Over what period was The Rufford Foundation grant used? How does this compare to the anticipated or actual length of the project?**

The money that was granted by the Rufford Foundation went into covering my field expenses on Faafu atoll; it was spent over 3 months between January-March 2018 while I was on Magoodhoo. It helped cover the cost of food, diving, accommodation, and other small expenses made on the island. While the actual field component in this project was relatively short, the processing and analysis of data took over 8 months as I had to travel to San Diego (to the Scripps Institute of Oceanography) to learn data processing and analysis techniques. Currently I am writing up the results of this research and I plan to follow-up on the questions it has raised in the coming year.

**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
Diving, food, accommodation	3210	3400	190	Diving and accommodation costs remained the same; I spent ~ 190 more on food than anticipated
Travel (return airfare HNL – Maldives)	1300	1200	100	Flight prices were marginally cheaper than anticipated
Equipment/field supplies	400	400	0	Underwater paper, diving gear (wetsuit, mask, GPS) and transect tapes were bought with the requested amount

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

In the next few months, I would like to complete my analysis of the data I collected in March 2018. I then plan to return to Magoodhoo in the summer of 2019, to follow up on this work, which will likely involve re-surveying some reefs in Faafu, collecting more detailed information on reef fish communities and how they use these reefs, as well as conducting interviews with fisherfolk and locals in the Maldives to assess the value of their tuna fishery today. I also hope to make outreach and education a larger component of my research going forward.

**10. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did The Rufford Foundation receive any publicity during the course of your work?**

I have presented parts of this work at three conferences in the past year; one at the University of Hawaii, the other at the Society for Conservation Biology in Wellington, and at the MS Swaminathan Research Foundation in India. In all these presentations, The Rufford Foundation was acknowledged for providing me with funding support. This involved using the logo in my presentations. The foundation will also be thanked when the papers related to this project are published in peer-reviewed journals.

**11. Please provide a full list of all the members of your team and briefly what was their role in the project.**

I conducted this work with the help and assistance of my PhD committee members, **Dr. Cynthia Hunter, Dr. Ameer Abdulla, Dr. Mark Hixon, Dr. Alex Mawyer and Dr. Josh Madin.** They helped me conceptualize and design this study. Dr. Abdulla joined me for a component of the fieldwork. For the rest of my time in Magoodhoo, I worked with the Marine Research and Higher Education centre and later with the Sandin Lab at the Scripps Institute of Oceanography. They were critical to ensuring my success in the field.

## 12. Any other comments?

I would like to thank the Foundation for supporting this work as a continuation project of my previous work in the Lakshadweep, and for enabling me to carry out this first field season in the Maldives. I am grateful for your belief in this project.





