

## Final Evaluation Report

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Your Details	
Full Name	Justin Baumann
Project Title	Implementation and Scaling of science-based approaches to coral restoration in Belize
Application ID	27421-C
Grant Amount	£14,598
Email Address	j.baumann3@gmail.com
Date of this Report	2/10/2022

**1. 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
Complete 14+ month reciprocal transplant experiment			X	We completed an 18-month experiment, published the work in a scientific journal, and presented it at the International Coral Reef Symposium in 2021.
Expand current Fragments of Hope restoration practice by including new species and fragmentation techniques			X	This grant and our research enabled both of these to happen. The grant provided funding for training and compensation of FoH employees and for the purchase and upkeep of the necessary tile saws to implement new fragmentation methods.

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

This project enabled the continuation of a wonderful collaboration between me and Fragments of Hope. Our collaborative research was based on their interests and needs, and we prioritised ways we could work together to both gain knowledge and value from this project. I am proud to say that was very successful and that this funding enabled FoH to sustain their operating budget during our time together at a level that allowed for ambitious work and growth.

The biggest difficulty we had was after we finished the work. I was hoping to return to the field site to help outplant our corals back to the reef. Unfortunately, due to COVID I was unable to do so and most/nearly all of the experimental fragments were lost to coral bleaching events in the summers of 2019-2020.

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

Sustained growth of FoH: Fragments of Hope was able to pay community-based researchers and expand their coral restoration work. They acquired new training and new equipment that allowed them to teach more people their methods and grow their restoration efforts to new sites while also sustaining their current and previous sites.

Research on coral thermal tolerance and acclimation: We completed an 18 month research project that investigated the effects of local adaptation and acclimatisation on coral survival and growth in novel environments. We hypothesised that corals from more turbid and variable nearshore sites may thrive (or

at least survive) in most conditions while corals from pristine clear water sites may struggle to acclimatise to new conditions. Our results demonstrate that the opposite is likely. In fact, corals moved from clear water sites offshore to variable and turbid sites nearshore grew better in the variable nearshore sites than they did at home. Meanwhile, corals moved from variable nearshore sites to pristine offshore sites struggled to grow at all. These results provide evidence that nearshore populations may be locally adapted over many generations to their home reefs (not actively connected via larval transport to other reefs) and that corals of both of these species seem capable of utilising more heterotrophic energy sources than we expected. Thus, perhaps these corals are able to survive (and even thrive) in turbid water. This likely varies tremendously across sites. The take home here is that it may be possible to use targeted nearshore coral nurseries to rear corals for restoration efforts on short (1-2 year) timescales. This could possibly save on time, gas, and energy investments compared with coral nurseries that are 30 km offshore. This is not a blanket statement, but certain sites may be useful and should be considered in future planning.

We published our results and shared our findings at conferences with the scientific and coral restoration communities! A free to download pdf version of the study is available here:

<https://jbaumann3.files.wordpress.com/2021/06/baumann-et-al-2021.-coral-reefs.-two-offshore-coral-species-show-greater-acclimatization-capacity-to-environmental-variation-than-nearshore-counterparts-in-southern-belize.pdf>

#### **4. What do you consider to be the most significant achievement of this work?**

#### **5. Briefly describe the involvement of local communities and how they have benefitted from the project.**

As mentioned above, FoH works closely with the local community in Placencia, Belize to train folks in coral restoration skills. They have a small but growing number of employees and they have trained hundreds of Belizeans in their methods in hopes of converting folks from the fishing and tourism sectors into conservation and to build partnerships with tour guides and tourism companies to monitor their work and help grow their programmes. This has been successful for about a decade and seems to be just growing. For our work, we specifically worked with two experienced FoH employees, the local NGO 'Southern Environmental Association', and the Belize Fisheries Department. We also supported locally owned and operated small business to procure food and lodging, as well as supplies, when possible. We believe our approach was community centric and we aim to continue this model into the future.

#### **6. Are there any plans to continue this work?**

At present, all plans are on hold due to COVID and career transitions (for me). But I am in touch with FoH and fully intend to continue our collaboration into the future. We will likely work together to help them build capacity for data analysis and organisation, as they produce a lot of data!

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

We shared our work with the scientific and restoration communities at the International Coral Reef Symposium in 2021. This work has also been published in the peer-reviewed journal Global Change Biology

An author proof (free to download) is available here:

<https://jbaumann3.files.wordpress.com/2021/06/baumann-et-al-2021.-coral-reefs.-two-offshore-coral-species-show-greater-acclimatization-capacity-to-environmental-variation-than-nearshore-counterparts-in-southern-belize.pdf>

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

This project began in December 2017 and ran for 18 months. A previous RSG was utilised for the 2018 work, but the 2019 (March) work was carried out with this current RSG. Support for FoH expansion and community training was provided by this RSG for 2019.

**9. Budget: 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. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.**

Item	Budgeted Amount	Actual Amount	Difference	Comments
Belize Fisheries permit fee	The Rufford Foundation (Pending)	400		Standard fees were budgeted and paid accordingly
Coral export fee	The Rufford Foundation (Pending)	750		Export fees were slightly higher than anticipated but additional costs were covered by discretionary funds from Baumann
Boat rental and captain fees	The Rufford Foundation (Pending)	5000		FoH works with boat captains and crews on a standard rate. We budgeted for and agreed upon that rate at the time of application.
Community researchers hire, training, salary	The Rufford Foundation (Pending)	6000	+2355	Dive gear for trainees was deemed not required, as the gear we had was

				sufficient. As such, we devoted more of the RSG funding to covering costs for training and hiring folks to work with FOH.
Food for captain, researchers, coral restoration technicians	The Rufford Foundation (Pending)	455	455	Costs for food was budgeted at this amount and thus spent at this amount. Additional food costs were incurred but were covered by Baumann (out of pocket).
Dive Gear for trainees	The Rufford Foundation (Pending)	2355	-2355	We decided to utilize funds for FoH operations (train and hire more people) instead of for gear
<b>TOTAL</b>	<b>14598</b>	<b>14960</b>	<b>+365</b>	

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

Following travel restrictions being lifted and travel being safe, the most important next steps are to convene with FoH to determine what scientific assistance they need to continue to improve their methods and build out their restoration capacity. They have built a number of collaborations in the past few years, so I will attempt to integrate any lessons learned from those into our future collaborative work.

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

I used the RF logo for all public talks and presentations associated with this work. This includes a recorded talk at the remote International Coral Reef Symposium in 2021.

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

**Justin Baumann** – PI/ lead scientist (organize, planned, came up with experiments, analysed data, wrote papers, presented results)

**Colleen Bove** – Dive officer and research tech. Assisted with experimental design, execution, analysis, and writing

**Lisa Carne** – Director, Fragments of Hope – Equal partner in experimental design, logistics expert, made local connections, managed her team (and ours), mentored researchers and employees.

**Mary Lide Parker** – Research photographer – documented the work

**Avelino Franko** – Field technician – Provided shore-based support for this work including instrument maintenance

**Victor Faux** – Field technician and captain – provided expert guidance as captain on occasion and also served as diver/snorkel-based field technician.

**Dale Godfrey** – Boat captain – expert captain of choice, managed relationships with dive shops, ensured safety, and provided transportation

### **13. Any other comments?**

I cannot thank Rufford enough for their continued support over the duration of my scientific career. I've been able to develop a research programme that is centred on relationships and local communities just as much as coral science and I am so grateful for the opportunities you have provided me and my team. We have learned a lot, established connections, trained folks, and had our own small part in helping a very successful coral restoration program grow and thrive. Thank you!