

Final Evaluation Report

Your Details	
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Project Title	Assessment of corals' responses to climate change and local stressors at Gorgona Island, Colombia.
Application ID	31547-1
Date of this Report	July 13, 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
Yearlong record (at hourly intervals) of temperature, salinity, dissolved oxygen, pH, and luminosity for different sites at Playa Blanca reef (Gorgona Island).				Sensors were installed in July 2021 and, after downloading the data, the loggers were re-installed in the reef to continue monitoring the environment. Although it was not possible to import continuous recording sensors for pH, these parameters have been measured only during field trips.
physiological performance of Pocillopora damicornis corals (photosynthesis, respiration and growth rates) under natural conditions				Growth and respiration rate were recorded. Photosynthesis data are not available because it was not possible to send the equipment from Germany to Colombia.
response of P. damicornis to local stress conditions				Changes in respiratory rate and growth were evaluated in response to low and high temperature and hypoxia. The effects of changes in salinity and nutrients were evaluated through a transplant experiment and by measuring changes in growth rate.
the response of corals to climate change (i.e., ocean warming, and acidification expected for the Representative Concentration Pathway 4.5				Measurements were done, and extra experiments of ocean deoxygenation were also performed.

2. Describe the three most important outcomes of your project.

a). We identified that salinity and chlorophyll-a present atypical values that are not registered in other reefs of the Eastern Tropical Pacific. This means that Gorgona Island has exceptionally adapted corals to cope with those harsh conditions.

b). Upwelling was previously thought to only affect the deep areas of the reefs (10 m depth). Here we registered that even shallow corals (3m depth) experienced abrupt changes in temperature due to upwelling (30 - 22°C, in ~3 hrs). We found that corals do not bleach to those abrupt temperature changes, but they modulate their respiratory rate as a strategy to save energy.



c). Dissolved oxygen at Gorgona is relatively low (all year round) compared to other coral reefs in the ETP, and hypoxia is a real threat to benthic organisms. We propose that constant sediments and runoff due to deforestation of mangroves inland decrease water quality at Gorgona Island. Community involvement in the protection of the mangrove will allow reefs at Gorgona Island to remain healthy, as well as the mangrove, and their ecosystem services.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

Due to the pandemic of Covid-19, we started fieldwork in Gorgona island in April 2021 (not in January 2021 as planned). Then due to the national strike and road blockades, we could not return to the island until July 2021.

The pandemic and the national strike generated over costs mainly in fuel/transport. There were also delays in the import of sensors and equipment for the measurements of environmental parameters. The PALM equipment for photosynthesis could not be brought from Germany.

The initial plan was to work on the island during January, July, and November 2021. However, the data register starts after July 2021. Despite the delay, was possible to measure coral responses to environmental changes.

Since February 2022, the students of Guapi returned to on-site classes at school. Previous virtual contacts were not possible, as this is a rural community with very limited internet access, and the main transport is by canoe. We were only able to socialise with some fishermen who frequented Gorgona Island. The first meeting with teachers was carried out in May 2022, and the strategy to socialise the results and transfer the knowledge to students was prepared, the event with students will take place in November 2022.

4. Describe the involvement of local communities and how they have benefitted from the project.

A local fisherman from Guapi was directly involved in the project. We worked with his help to identify sampling sites to evaluate new coral areas and make measurements of coral cover. He was trained as a diver (with the help of the diving center of Gorgona Island), which allowed him to be directly involved in other coral restoration projects on the island. He also was our link with teachers from San Jose school at Guapi.

During each field trip, the working plan and partial results of the project were socialised with local fishermen, environmental managers, and volunteers park rangers of the marine protected area Gorgona.

Recreational divers were trained on fish and coral identification, and on the remarkable ecological features of the coral reefs of Gorgona Island. Also, through the social media of diving centers, the information was disseminated.



5. Are there any plans to continue this work?

Yes, because we characterise unique ambient conditions in which corals live, it is necessary to monitor it at a finer scale and assess in broader the response of the corals.

A cooperation link with The University of Rhode Island was done to identify the microbiome in corals, and how it helps corals to cope whit the extreme environment.

The educational material will be shared in other schools to spread knowledge about the coral reef ecosystem under the climate crisis.

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

- Research group meetings were done with students from the Marine Ecology Department of the University of Bremen (Germany), and the Coral Reef Ecology Research Group from Universidad del Valle (Colombia).
- Educational material delivered with dive centers for species ID.
- Meeting with the environmental authority and reef managers was done at the national natural park of Gorgona.
- Social media publications.
- Virtual presentation at the GSR conference in Nicaragua (<u>https://www.youtube.com/watch?v=DcylSmcKACg</u> minute 1:18:26 al 1:48:06).
- Oral presentation at the II Pan-American conference of coral reefs (Veracruz, Mexico).
- Oral presentation at Senalmar conference (Cartagena, Colombia).
- Three scientific publications are ready to submit to journals: a review-type paper of Gorgona as a natural laboratory, the hypoxic threshold of corals at Gorgona, and the effects of abrupt changes in temperature on the aerobic metabolism of corals.

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

Create a participatory monitoring system where fishermen or young people from Guapi can be trained in the assessment of reef health, in alliance with local researchers. Spread knowledge about the effects of mangrove/forest deterioration on island reefs (as interconnected ecosystems) and its effects on food security (ecosystem protection and ecosystem services).



8. 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?

The logo has been presented during all the socialisation of the project, oral presentations, and in the educational material delivered. The foundation will be mentioned in acknowledgements at any scientific publication.

9. Provide a full list of all the members of your team and their role in the project.

Juan Fernando Rivera: biologist, diver, helped during fieldwork.

Yimmi Caicedo: a local fisherman from Guapi, identify reef areas to install the experiments.

Danna Velasco: Biologist, a master's student, support the measurements of coral response to environmental stress.

Bruce Hoyos: biologist, diver instructor, owner Kraken diver center, helped during fieldwork, and spread knowledge with divers.

Christian Wild: scientific advisor, main supervisor of the PhD.

Fernando Zapata: scientific advisor, co-supervisor of the PhD.

10. Any other comments?

We thank the support from The Rufford Foundation, because after its support this project received credibility, and we were able to acquire other funds (PADI Foundation) to continue with the research.

The space provided on the foundation's web page has allowed other researchers to become interested in the work being done and to contact me to share the project experience.