

Project Update: December 2021

Fieldwork campaigns

April 6 to 17 2021

Selection of the sites (one at La Ventana Reef, and one at Playa Blanca reef) and colonies (*Pocillopora damicornis* and *Psammocora stellata*) for experiments. After colony selection, some fragments (120 per species) were collected and glued to ceramic tiles as experimental units.

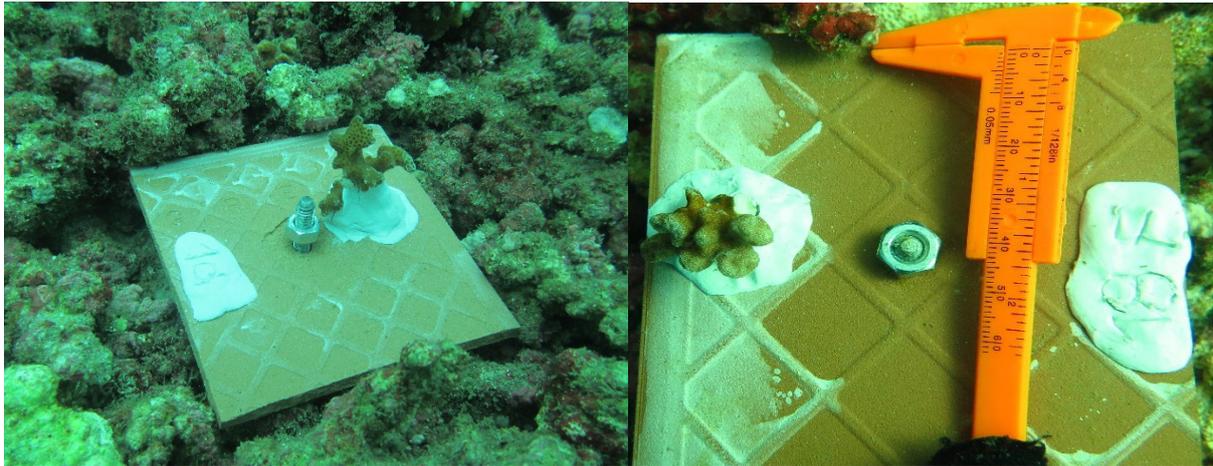


Fig 1. Seeding of coral fragments on ceramic tiles for experiments. Left: *Pocillopora damicornis* fragment. Right: *Psammocora stellata* fragment

July 7 to 12 2021

installation of temperature, light, and salinity data loggers at sites of experiments.

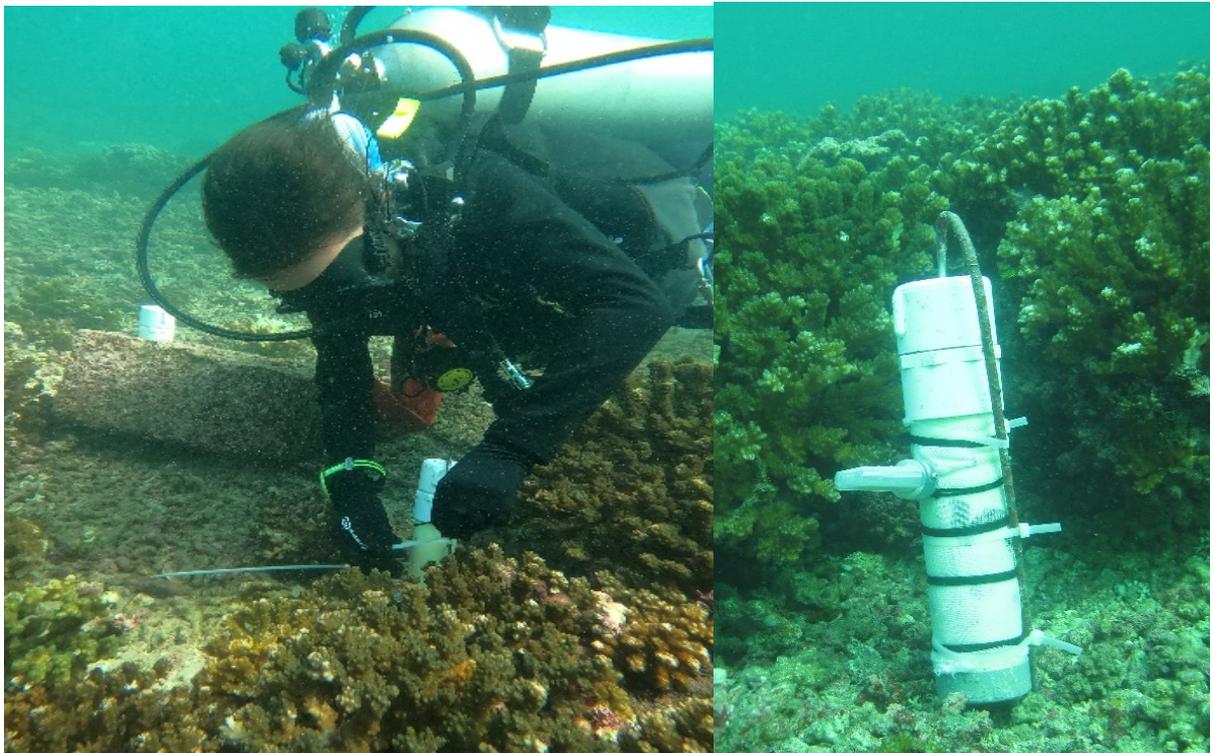


Fig 2. Installation of Hobo® data loggers at reefs near to experimental coral fragments. Benthic and fish community characterisation of reef sites: photo quadrats (50 x 50 cm, along a 10 m transect) were employed to establish % of benthic cover (live coral

cover, algae, crustose coralline algae, and inert substratum). Video transects (1 x 30 m) were recorded to establish the richness and abundance of fish at reefs.

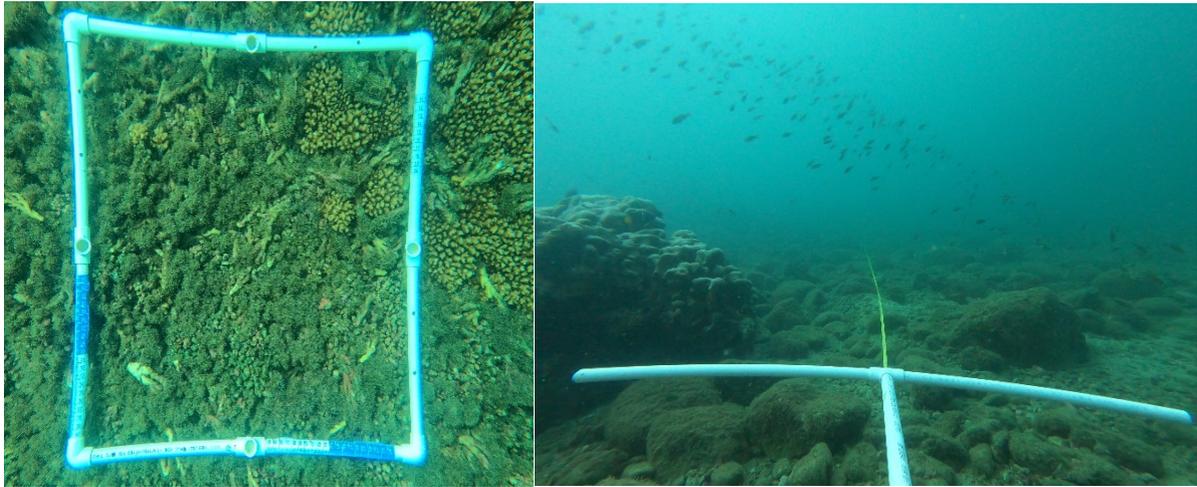


Fig 3. Reef characterization. Left: photo quadrats to establish benthic coverage. Right: video transect to describe the fish community.

Photographic record of experimental fragments to measure growth rates and health status (colour).

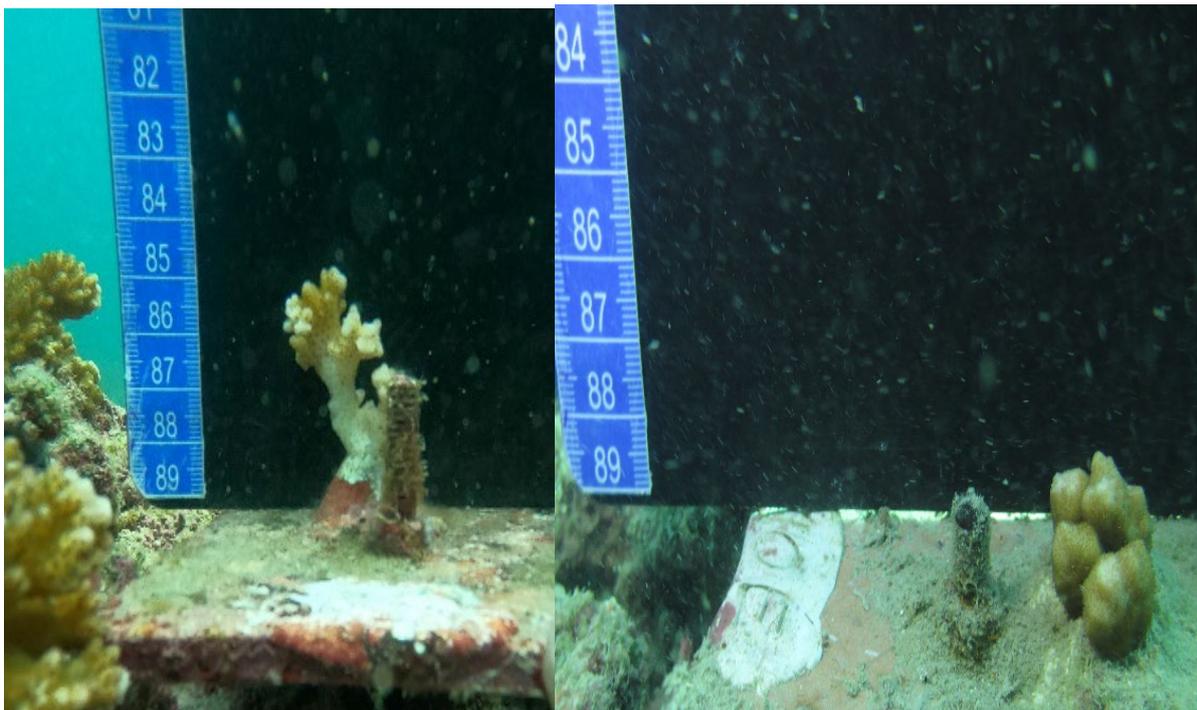


Fig 4. Each experimental coral fragment was photographed with a size reference (in cm) to further establish their growth rates, also changes in coloration and health status. Left: *Pocillopora damicornis*, right: *Psammocora stellata*.

November 9 to 15 2021

Data collection of temperature, light, and salinity from sensors.

Photographic record of experimental fragments to measure growth rates and health status (colour).

Temperature tolerance experiment: colonies of *Pocillopora* were collected and incubated at 27°C (average temperature) and 32°C (thermal stress), their respiration rates, colour, and polyp behavior were recorded as the coral response.

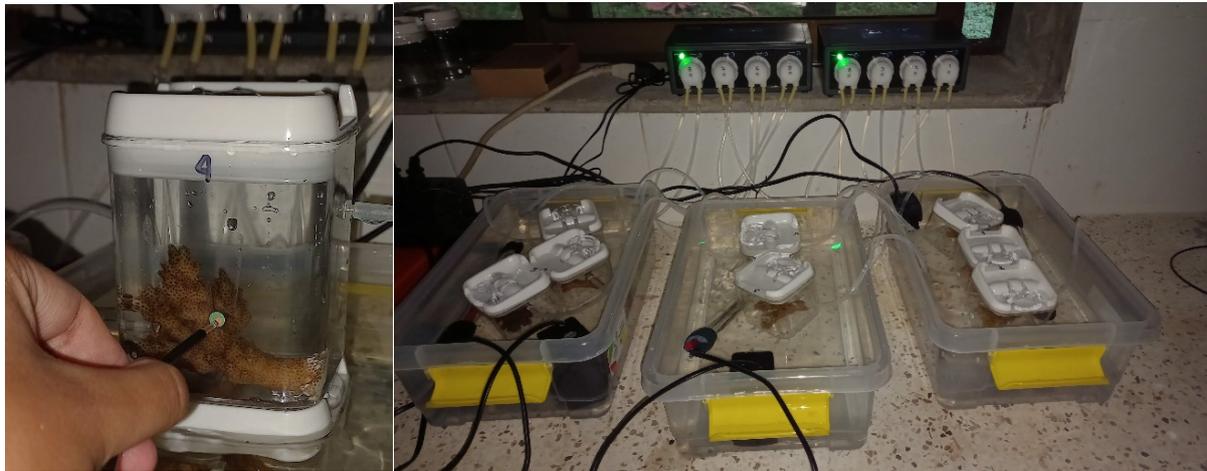


Fig 5. Left: oxygen concentration and temperature measurement in coral fragment. Right: experimental setup where coral fragments were incubated at different temperatures.

Data analysis

Data downloaded from temperature, salinity, and light sensors are under analysis. The size of coral fragments is being recorded to produce data on coral growth rates. Data from the thermotolerance experiment is under analysis to build a manuscript for a peer-reviewed article.

A review-type paper is under construction, its aim is to propose Gorgona Island as a natural laboratory to study corals' physiological thresholds. For this manuscript a historical (2003-2019) analysis of temperature, salinity, pH, water transparency, dissolved oxygen, and chlorophyll-a concentration of Gorgona are compared with other sites of the Eastern Tropical Pacific, letting in evidence that these factors reach extreme values in Gorgona, influencing live coral cover.

Knowledge transference

June 8, 2021

Meeting with diving tourists (previous their visit to Gorgona Island) for the celebration of World Oceans Day. It was a talk about the conservation, biology, and identification of reef species of Gorgona Island. Also was delivered flashcards that allow people to identify fish, corals, and sea urchins during dives. In a PDF is provided the flashcards.



Fig 6. Left: underwater species identification cards. Right: meeting with divers.

July 11, 2021

Meeting with locals of Guapi and members of AMP Gorgona to present the atypical ambient conditions that suffer coral reefs at Gorgona island and the aims and advance of the research project.



Fig 7. Meeting at Gorgona Island with the community of Guapi and members of the AMP (environmental authority).

November 24, 2021: through a virtual meeting, the advance of the research project was presented to the local reef manager of the Henry von Prahls scientific station, the Environmental Authority of Parques Nacionales de Colombia, members of Coral Reef Ecology Research Group of Universidad del Valle, Colombia, and the Marine Ecology Department of Universität Bremen, Germany.

January 3, 2022: abstract submitted for the first Rufford conference organised in Nicaragua under the theme 'SCIENCE WITH A PURPOSE'

Gorgona Island, a natural laboratory to test corals tolerance under natural extreme conditions

Ana Lucia Castrillón-Cifuentes

Doctoral student at Universität Bremen (Germany), and research of the Coral reef ecology research group (Colombia)

Coral reefs of the Eastern Tropical Pacific develop modestly under the harsh conditions of the region. Nonetheless, at Gorgona Island (Colombian) are healthy reefs with great live coral cover (100-60%), even though between 1960 and 1984 strong anthropogenic pressure and El Niño event caused catastrophic bleaching and mortality of corals. These reefs recovered their healthy state in less than a decade, faster than others that also suffered a great decline after the 1982 El Niño. Due to this astonishing reef resilience, the whole project aims to assess the tolerance thresholds of corals under unfavorable local and global conditions (ocean warming and acidification).

The first step of the project was to analyse the historical and current oceanographic conditions of reefs on the island. Finding that Gorgona has the lowest salinity, and dissolved oxygen, and the higher concentration of chlorophyll-a for reef development of the ETP region. Other features that characterise the reef environment of Gorgona are abrupt changes in temperature during the upwelling season, high sedimentation, and sub-aerial exposure during spring low-tides. Globally, few reef areas host healthy coral communities under such atypical ambient. Because of that, we propose this island as a natural laboratory of the ETP to study coral physiological thresholds, i.e., a geographic area that hosts outstanding biological, geological, or climatic features, and where exists an interest to unravel and preserve their underlying processes.

The second step of the project aims to produce knowledge of the physiological performance of corals under those extreme conditions of Gorgona. It is expected that an organism that is exposed to conditions that are constantly changing, is better prepared to deal with local stressors, and ocean warming and acidification. Producing and transferring this physiology knowledge to local reef managers and users of reefs is fundamental to updating policies and management plans adapted to the peculiar conditions of the island. The current ecological and physiological data from coral reefs of Gorgona provides an optimistic scenario about the future of corals because exemplifies that in the absence of additional human-related stressors, a low diverse coral reef can flourish in an atypical and dynamic environment.

Keywords: Coral reef, Dynamic environment, Colombian Pacific, Local management, Tolerance threshold, Scleractinian coral.