



CARICOOS OCEAN ACIDIFICATION MONITORING PROGRAM

Sustained monitoring of near-reef carbonate chemistry at the Atlantic Ocean Acidification NCRMP Class III Station, La Parguera, Puerto Rico

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Performance Period: *December 1, 2020 – May 31, 2021*

LONG-TERM GOALS

A principal CARICOOS mission is to understand and predict changes in our ocean and coasts and inform decision-makers in the US Caribbean region. Ocean acidification (OA) represents one such change unfolding in direct response to increasing atmospheric carbon dioxide (CO₂) concentrations. This project aims to improve our understanding of how OA impacts the coral reef ecosystem and the biogeochemical processes controlling the near-reef and nearshore carbonate dynamics. We can achieve this goal using high-temporal resolution chemical monitoring, which aids NOAA's Coral Reef Monitoring Program efforts to establish baselines and track changes in carbonate chemistry and associated ecological impacts of OA. Furthermore, this effort supports NOAA's progress towards achieving a holistic understanding of the Earth system, identified as a core objective of NOAA's Science and Technology Enterprise.

MILESTONES / OBJECTIVES

1. Provide information about the existing and foreseeable carbon chemistry conditions to help mitigate OA's causes and effects and support adaptation to ecosystem changes.
2. Continue the bimonthly (formerly bi-weekly) discrete sampling for carbonate chemistry at selected sites along the offshore to nearshore gradient in La Parguera Marine Reserve (LPMR). Data is used to validate automated collection by the MapCO₂ buoy and assess the role of nearshore ecosystems in the local carbonate chemistry.
3. Provide operational maintenance to the MapCO₂ buoy and support data management and product dissemination.
4. Quality assurance, synthesis, and reporting of acquired data.
5. Provide yearly maintenance of the MapCO₂ buoy.

WORK COMPLETED

- A total of 9 validation cruises throughout La Parguera were completed. From December to February they were carried out twice a month and switched to a monthly frequency after March.



- A total of 36 pH and 28 TA samples were analyzed at the CARICOOS laboratory (UPRM), while 8 TA samples are pending for analysis. DIC samples are up to date, and a total of 28 were analyzed.
- The SAMI pH on the MapCO₂ buoy was replaced on February 2, 2021 and again in April, 30, 2021.
- The SBE batteries were replaced on April 30, 2021.
- During this period, the MapCO₂ buoy sensors were cleaned every month.

MAJOR OUTCOMES

- The manuscript entitled “Carbonate chemistry seasonality in a tropical mangrove lagoon in La Parguera, Puerto Rico” was published on May 5th, 2021 by the journal *PLOS ONE*. This research describes how The Bioluminescent Bay was unable to consistently buffer declines in pH over five years, contrary to what other research has found in other mangrove sites over diurnal time scales.
- “Tracking Ocean Acidification in Puerto Rico: A Video Journey” was created as part of the NOAA OAP Education Minigrants collaborating with Lisamarie Carrubba (NOAA Fisheries, PI) and Efraín Figueroa. This video aims to educate the Spanish-speaking public of Puerto Rico regarding ocean acidification and its effects on coral habitats, particularly reefs. The impacts of ocean acidification on the local economy through tourism, food security, and coastal protection are expected to have widespread effects on the local coastal communities and other Caribbean islands. The video is in Spanish with English subtitles to make it accessible to the Spanish and English speaking populations of The Island. The video was circled through Facebook, Twitter, and Instagram. It was also highlighted in NOAA’s GOA-ON webpage, the OA Exchange webpage, and added to the October GOA-ON and P2P newsletters. Link: https://youtu.be/nh1EISE_2s4.

RELATED PROJECTS

- Impact of Sargasso Inundation on Coastal Ecosystems. **PI:** Julio Morell
- NOAA Ocean Acidification Program, Education Minigrants - 2019 – 2020: *Tracking Ocean Acidification in Puerto Rico: A Video Journey* (PI: Lisamarie Carrubba; Co-PI: Melissa Meléndez, Ernesto Otero; \$10,000)

WORK PLAN FOR UPCOMING PERFORMANCE PERIOD (December 1, 2020 – May 30, 2021)

- Continue the collaborative effort with UNH to maintain and enhance OA observational capabilities (i.e., provide analytical support for DIC determinations).
- Continue collaborating in data management and product dissemination. Work in progress includes the further improvement of the CARICOOS data portal to provide a seasonal estimate of calcification, production/respiration.



- Continue participation in the Global Ocean Acidification (OA) Observing Network and the OAP Pier2Peer program.
- A series of short-term OA assessments will be carried out in La Parguera, using a recently acquired sensor package capable of measuring temperature, salinity, dissolved oxygen, pH, pCO₂, and chlorophyll-a, turbidity, and colored dissolved organic matter. These assessments will better understand the spatial and temporal variability of coastal OA in La Parguera. The results from this effort will help understand the natural variability of OA and hypoxia and the impact of sargassum inundation events on coastal OA.
- The MapCO₂ buoy annual refurbishment is due for the next period.

PUBLICATIONS & PRODUCTS

PUBLICATIONS

Meléndez, M., Salisbury, J., Gledhill, D., Langdon, C., Morell, J.M., Manzello, D., Musielewicz, S., Rodriguez-Abudo, S., and Sutton, A. 2020. Seasonal variations of carbonate chemistry at two western Atlantic coral reefs, *Journal of Geophysical Research: Oceans*, 125, e2020JC016108. <https://doi.org/10.1029/2020JC016108>

García-Troche, E.M., Morell, J.M., Meléndez, M., Salisbury, J. 2021. Carbonate chemistry seasonality in a tropical mangrove lagoon in La Parguera, Puerto Rico. *PLOS ONE*, 16(5): e0250069. <https://doi.org/10.1371/journal.pone.0250069>