



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: June 1, 2020 – November 30, 2020

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

- The laboratory analyses and field cruises at UPRM restarted on June 30, 2020, and July 7, 2020, respectively. Operations were on hold since March 16, 2020, due to the COVID-19 pandemic. We completed five cruises to collect surface water samples and CTD profiles throughout La Parguera. A total of 14 pH and 7 TA samples were analyzed at the CARICOOS



laboratory (UPRM), while three pH and 10 TA samples are pending for analysis. Another 24 DIC samples are pending to be analyzed at UNH.

- The MapCO₂ annual refurbishment was completed between September 1 and September 11, 2020.
- García-Troche and Luis Rodríguez replaced the SAMI pH sensor on the MapCO₂ buoy on July 15, 2020.
- García-Troche and Orlando Espinosa replaced another SAMI pH sensor on October 8, 2020.
- The TA titrator and muffle furnace were refurbished in June 2020.

MAJOR OUTCOMES

- The manuscript entitled “Carbonate chemistry seasonality in a tropical mangrove lagoon in La Parguera, Puerto Rico” was accepted for review 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.
- The project titled “*An assessment of Spatial Variability in Jobos Bay waters using surface mapping*” was completed in October 2020. With the results from this project, we provided JBNERR with a better understanding of how the spatial variability changes throughout the year in ocean acidification and hypoxia. Previous efforts had expanded on the temporal variability at selected fixed monitoring stations, but we had no idea what happened between these fixed stations.
- “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
- JBNERR 2019-20: *An Assessment of Spatial Variability in Jobos Bay waters using surface mapping*. **PI:** Julio Morell **Co-PI:** Erick García-Troche



- 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.

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. Carbonate chemistry seasonality in a tropical mangrove lagoon in La Parguera, Puerto Rico. *Plos ONE*, resubmit with revisions.

THESIS

Meléndez, M. 2020. "Effects of Nearshore Processes on Carbonate Chemistry Dynamics and Ocean Acidification". Doctoral Dissertations: UNH, 2532. <https://scholars.unh.edu/dissertation/2532>

García-Troche, E.M. 2020. Carbonate chemistry dynamics in The Bioluminescent Bay: A tropical mangrove lagoon in La Parguera, Puerto Rico. M.Sc. Thesis: University of Puerto Rico at Mayagüez.