Temporal and Spatial Variability of Particulate Organic Carbon in Nearshore SW Puerto Rico: An Assessment of Sources, Connectivity, Ecological Implications and Bio-optical Properties

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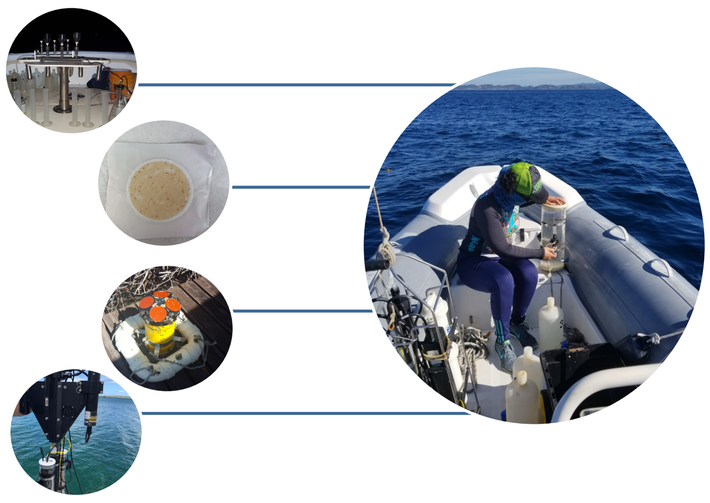
INTRODUCTION

Improved understanding of carbon chemistry in coastal tropical waters demands acknowledging the sources and/or sinks of all reactive species. In La Parguera, Puerto Rico, Rogers (1979) and more recently Meléndez et al. (2018), have reported net heterotrophy in San Cristobal and Enrique's coral reef ecosystems. As in other tropical coastal areas, the presumption has been that highly productive nearshore ecosystems, such as mangroves and seagrasses, are the source of the missing carbon. In general, said contention has not been properly validated. This research proposes to properly assess the spatial and temporal variability of the particulate organic carbon (POC) pool within La Parguera mid and nearshore areas and its transport to coral reefs areas. Rapid changing coastal dynamics represents a significant challenge; therefore, the application of optical techniques will contribute to assess the spatial and temporal dynamics of POC for the selected project area.

Objectives

1. Characterize spatial and temporal variability of POC and nearshore-shelf transport rates
2. Evaluate the potential impact of POC influx rates on metabolic measurements at selected areas
3. Validate regional optical measurements and algorithms for POC quantification

METHODOLOGY



The following sampling scheme was developed to assess the sources of organic material that may be supporting heterotrophy in La Parguera coral reefs:

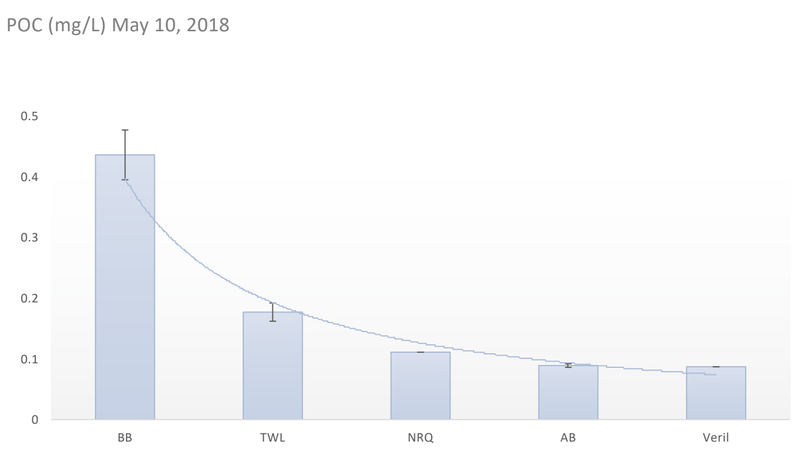
- ✓ 24-hour samplings for diel tidal and wind effects on POC transport/distribution
- ✓ Bi-monthly samplings for POC time-series
- ✓ CHN analysis for POC
- ✓ ADCP deployments for hydrodynamic model validation
- ✓ Optical measurements:
  - Hyperspectral profiles of Lu and Ed.
  - Validate potential proxies (attenuation, remote sensing reflectance, Rs) for long-term POC monitoring
  - Validation of existing optical algorithms for POC quantification from satellite imagery (Stramski et al., 2008):

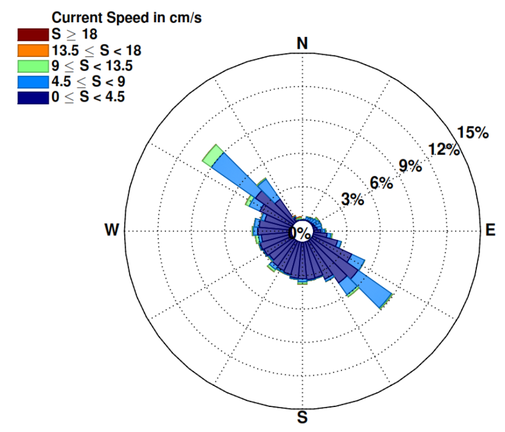
$$POC\ \left({}^{mg}/_{m^3}\right) = 203.2\left[\frac{Rrs\ (443)}{Rrs(555)}\right]^{-1.034}$$

PRELIMINARY RESULTS

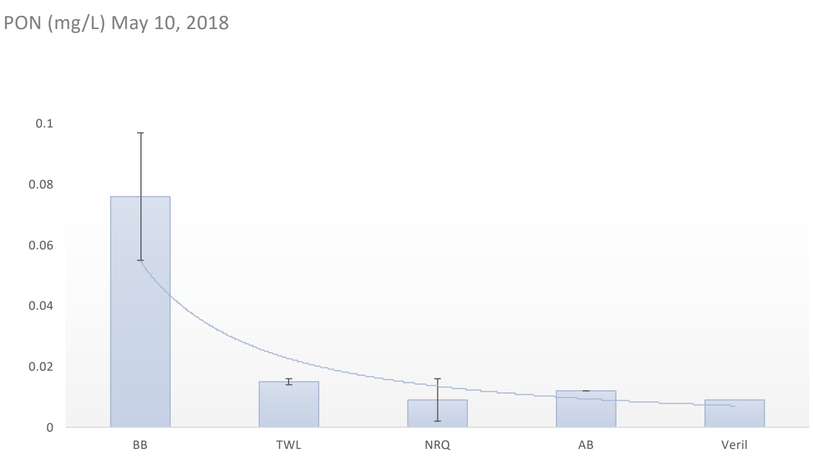
Preliminary results indicate:

- An in-shore, off-shore gradient of POC and PON.
- Greater C:N ratio found in off-shore waters indicative of oligotrophic waters.
- Hydrodynamic observations at Enrique Reef suggest the reef receive offshore and nearshore waters (Figure 3).





Current velocity at Enrique, February 2017.
Data provided by Dr. Sylvia González Abudo, CARICOOS



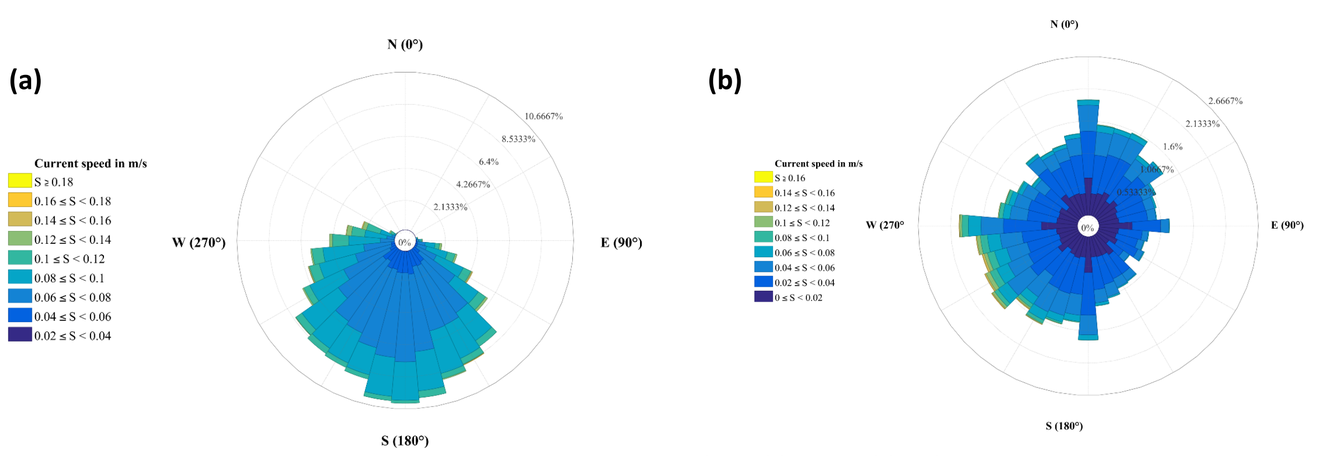


Fig. 3 Current velocity at Enrique's Fore (a) and Back (b) Reef. December 2018-January 2019.

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