

Impact of Physical Reef Characteristics on Calcification Rates of the Kāneʻohe Bay
Barrier Reef

A THESIS SUBMITTED TO
THE GLOBAL ENVIRONMENTAL SCIENCE
UNDERGRADUATE DIVISION IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

BACHELOR OF SCIENCE

IN

GLOBAL ENVIRONMENTAL SCIENCE

AUGUST 2019

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ABSTRACT

This study elucidates the challenge of quantifying environmental parameters that exert control over calcification by providing an *in-situ* analysis of how localized variations in reef characteristics impact calcification rates, in addition to comparing calculated calcification rates with those previously published for the barrier reef of Kāneʻohe Bay and mesocosm experiments. NEC and was compared against wind speed ($R^2=0.08$), seawater temperature ($R^2=0.42$), seawater salinity ($R^2=0.44$), and time of sampling within our midday sampling period ($R^2=0.00$). Furthermore, we compared the results of this study with previously published literature on reef-wide calcification rates both for Kāneʻohe Bay and mesocosm experiments. The NEC value determined herein ($56.9 \pm 32.6 \text{ mmol} \cdot \text{m}^{-2} \cdot \text{hr}^{-1}$) is comparable to a previous bay-wide estimate ($48.3 \pm 13.5 \text{ mmol} \cdot \text{m}^{-2} \cdot \text{hr}^{-1}$), but larger than found in mesocosm work done with a purely coral community composition ($11.2 \pm 4.9 \text{ mmol} \cdot \text{m}^{-2} \cdot \text{hr}^{-1}$). NEP values exhibited greater variability between this study, a previous bay-wide study, and previous mesocosm work at $210.1 \pm 114.6 \text{ mmol} \cdot \text{m}^{-2} \cdot \text{hr}^{-1}$, $-48.3 \pm 16.9 \text{ mmol} \cdot \text{m}^{-2} \cdot \text{hr}^{-1}$, and $27.7 \pm 4.4 \text{ mmol} \cdot \text{m}^{-2} \cdot \text{hr}^{-1}$ respectively. The results of this study highlight the high degree of calcification and production variability seen within Kāneʻohe Bay, the impacts of sub-diel NEC and NEP on the CO_2 system in seawater, and illustrate the need for further characterization of parameters affecting NEC and NEP parameters not examined in this study.

Keywords: Ocean acidification, coral reefs, calcification