The Acidification of Coral Reefs: Controls on the Carbonate Chemistry of a Coral Reef Lagoon

St. Mary's University

David A. Feagins[1], Anne Cohen[2], Weifu Guo[2], Steven Lentz[3]

[1]*Department of Mathematics, St. Mary's University, San Antonio, TX 78228*

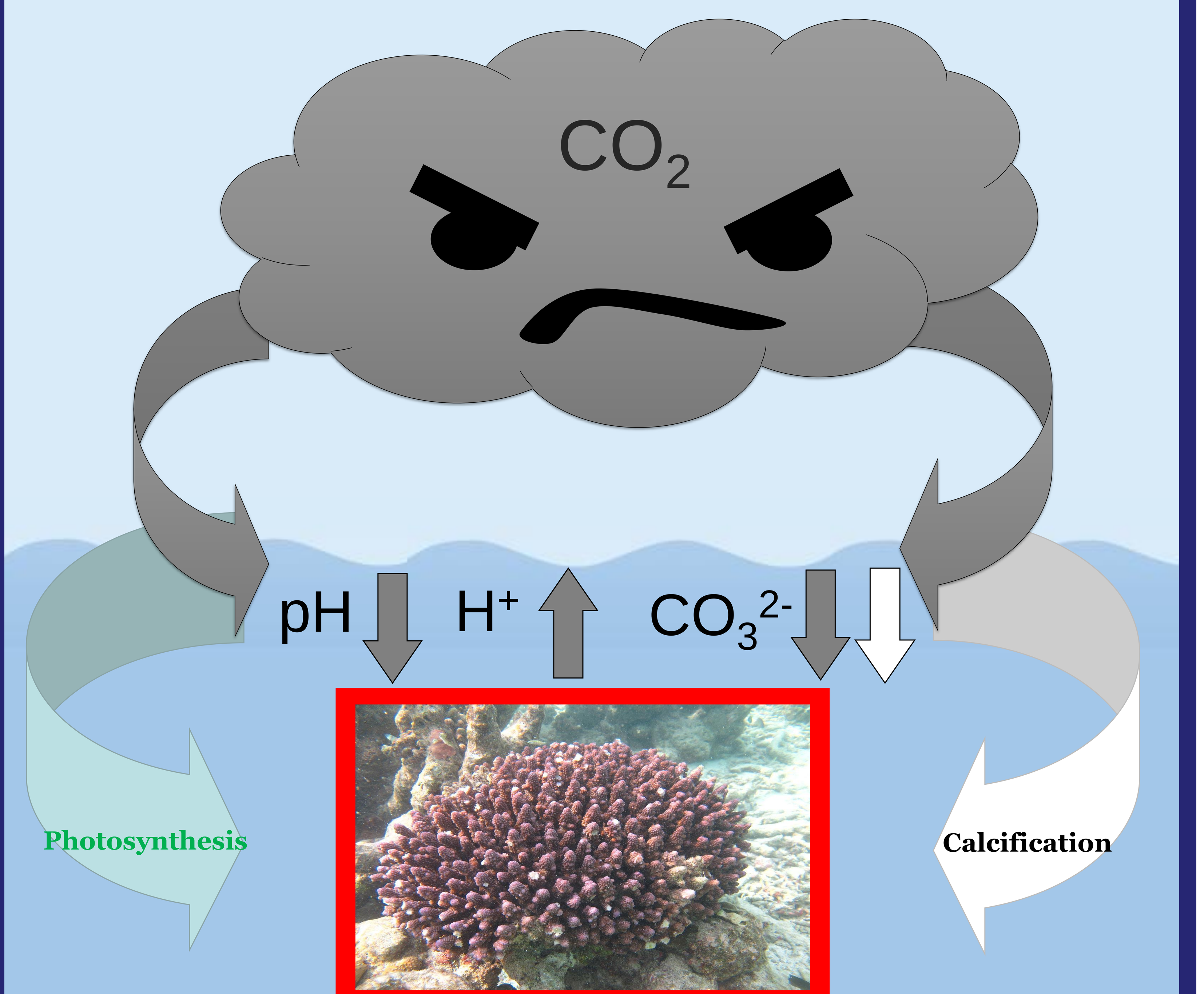
[2]*Department of Geology and Geophysics, Woods Hole Oceanographic Institution, Woods Hole, MA 02543*

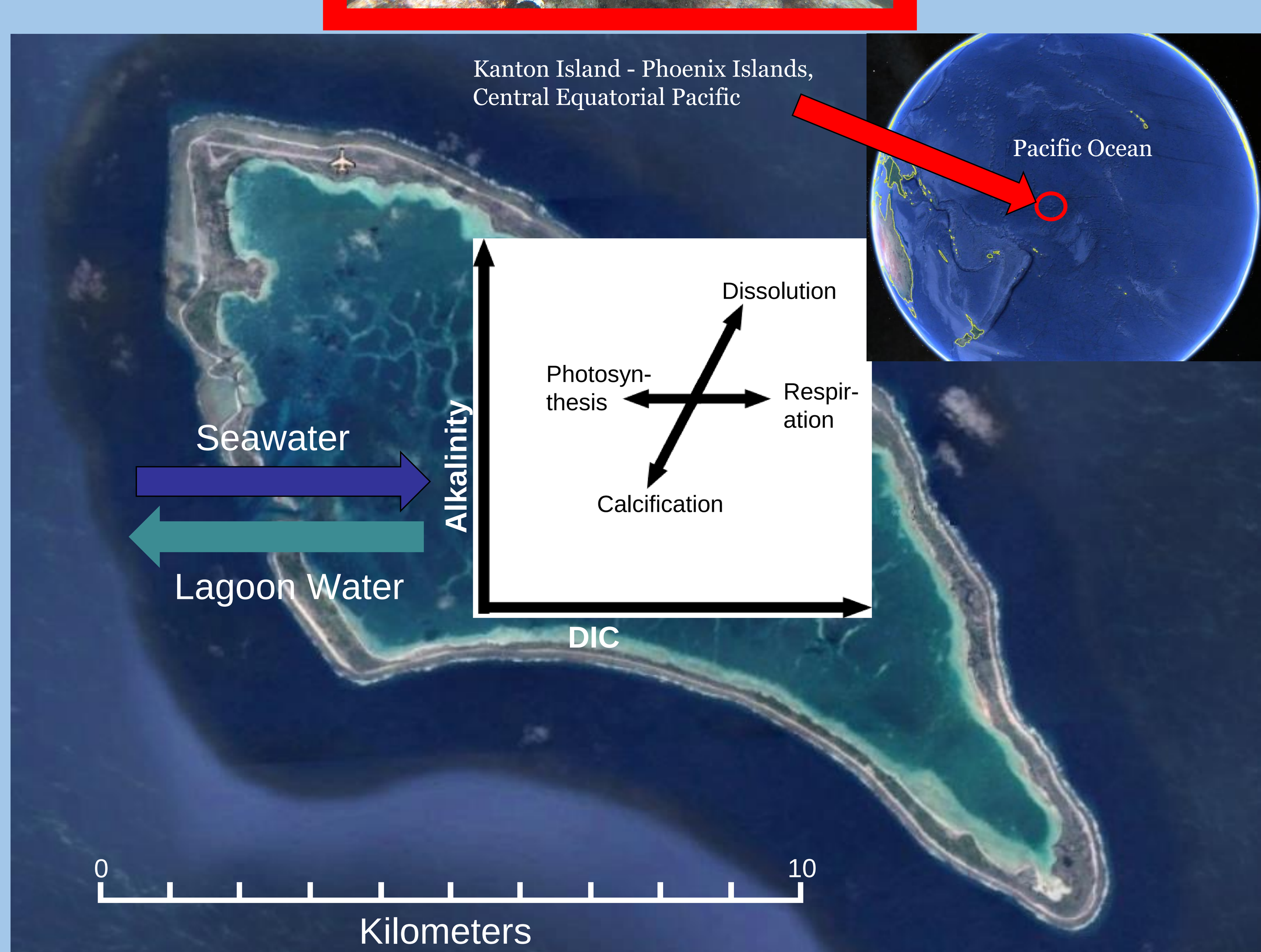
[3]*Department of Physical Oceanography, Woods Hole Oceanographic Institution, Woods Hole, MA 02543*

Woods Hole Oceanographic Institution 1930

INTRODUCTION

We want to understand the impact of ocean acidification and the biological and physical processes in the coral reef that control the carbonate chemistry





METHODS

- Water samples were were taken across the Kanton lagoon, fore-reef, channel and surrounding ocean in the years 2012, 2015, and 2018.
- Temperature, Salinity, Total Alkalinity (TA) and Dissolved inorganic carbon (DIC), and sample depth were measured and recorded.
- TA and DIC were normalized in respect to salinity and are denoted nTA and nDIC, respectively.
- Gnet and NP are defined to be the net calcification rate and the net production rate in the lagoon.

RESULTS

Fig. 1: Sampling locations

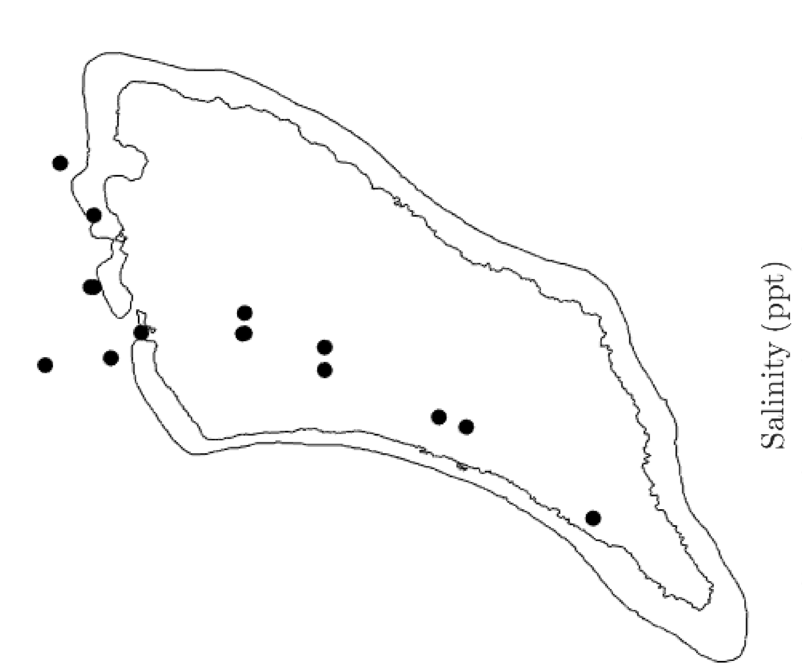


Fig. 2: Salinity increases towards the end of the lagoon due to evaporation

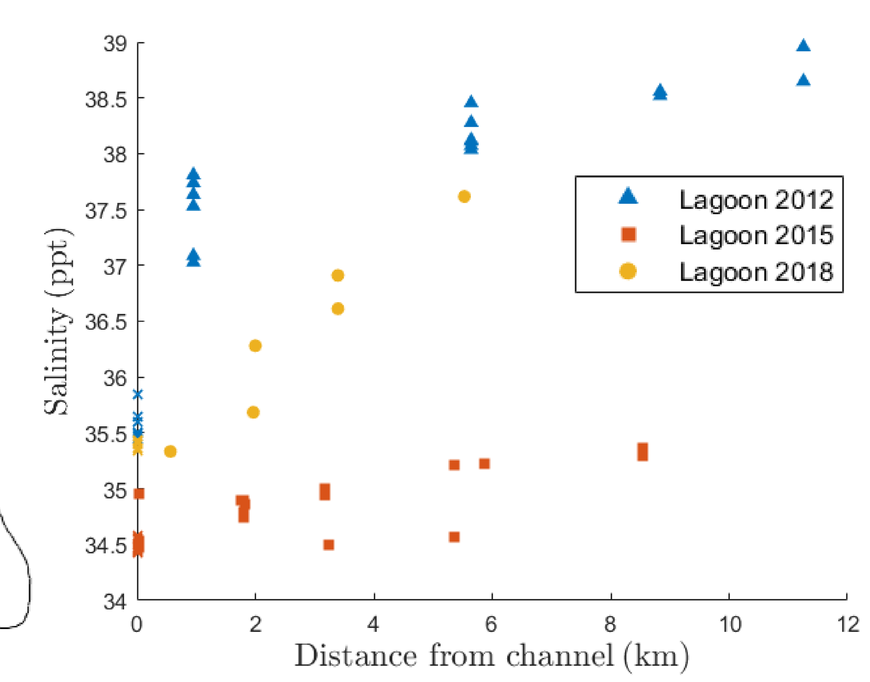
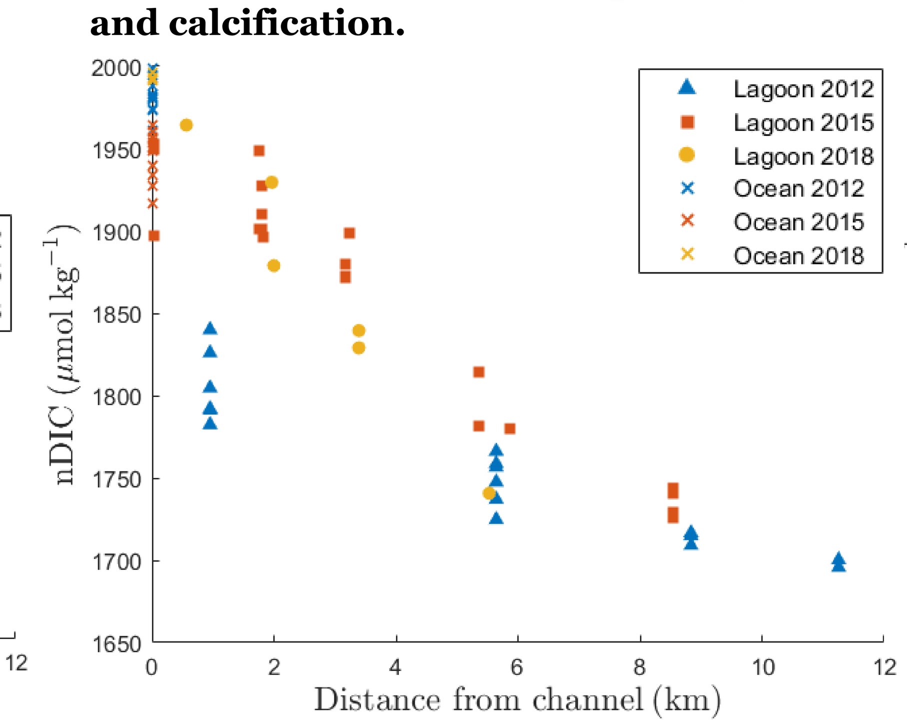


Fig. 3 &4 :Normalized nDIC and nTA in respect to salinity take in account evaporation, so the drawdown of nDIC is due to photosynthesis and the drawdown of nTA is due to photosynthesis and calcification.



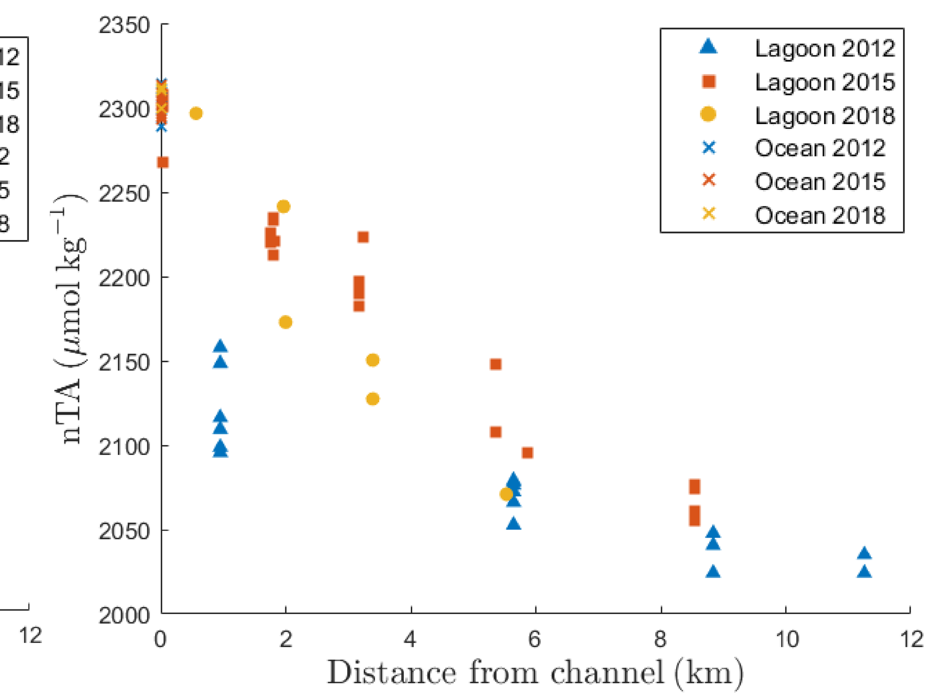


Fig. 5: Dependence of DIC and alkalinity on photosynthesis/respiration and calcification/dissolution

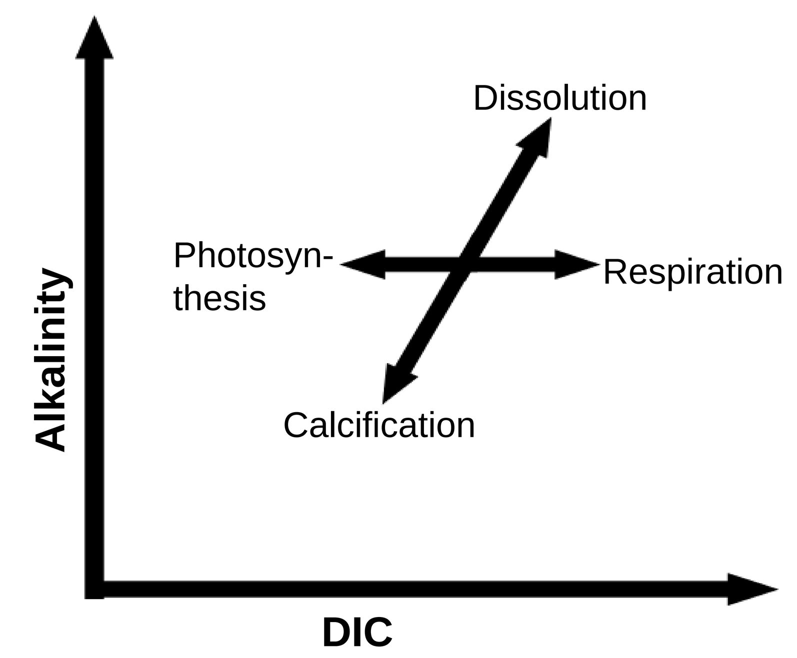


Fig. 6: The nTA and nDIC were drawn down at the same ratio in 2012 and 2018

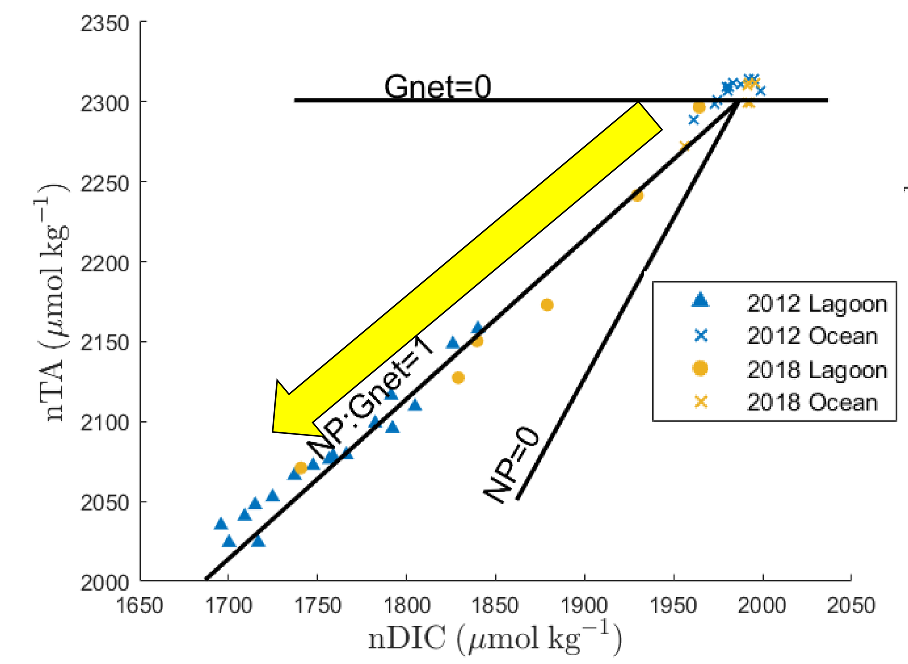


Fig. 7: Ocean DIC in 2015 during El Niño was lower than other years

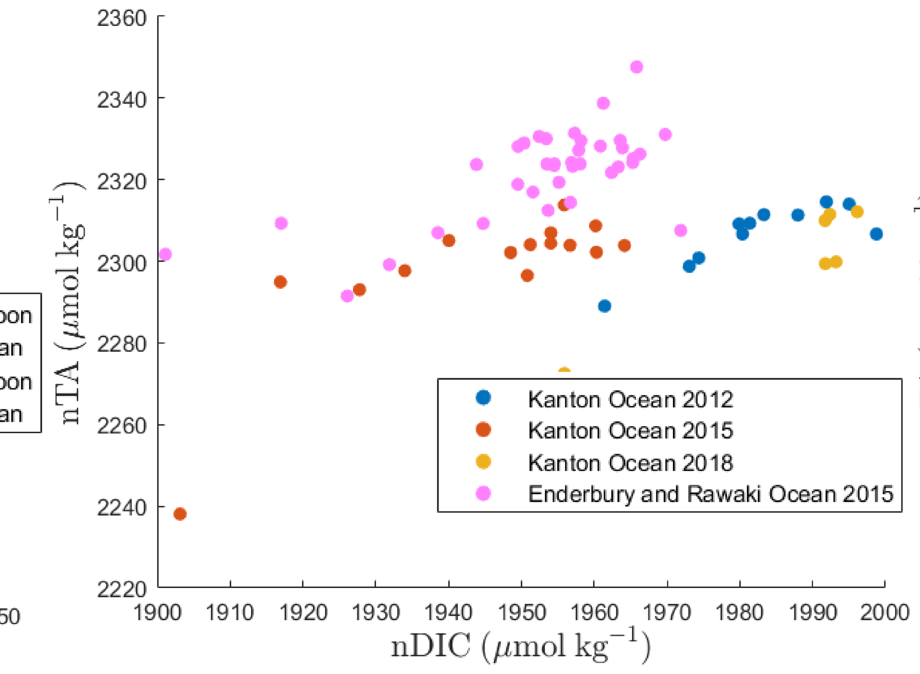
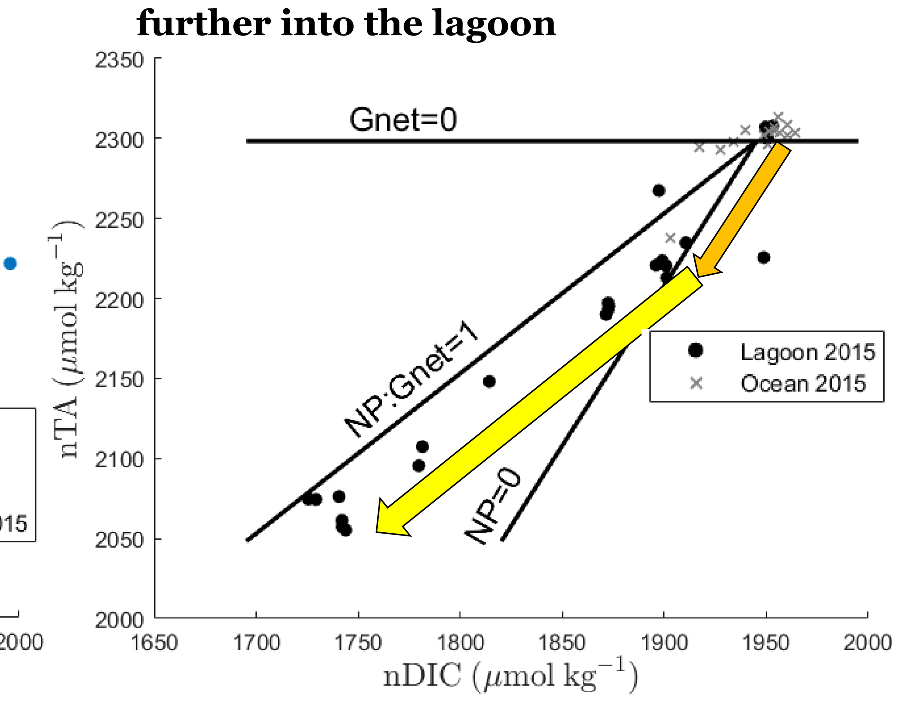


Fig. 8: Reef metabolism in 2015 was different than other years near the channel, but behaved similarly further into the lagoon



CONCLUSION & FUTURE DIRECTIONS

- Reef metabolism and residence time influence the spatial chemical gradient in the lagoon
- Temporal changes caused by El Niño also affect reef chemistry
- Further quantifying these controls is important to be able to predict future chemistry during El Niño events and while ocean acidification is happening

ACKNOWLEDGEMENTS

This research was made possible through the support of the Woods Hole Oceanographic Institution Summer Student Fellowship, the NSF and The Roberson Foundation, and the St. Mary's University MARC U*STAR program. Special thanks to Kathryn Shamberger and Daniel McCorkle for TA/DIC analyses, Dave Wellwood for salinity analyses and Hannah Barkley, George P Lohmann, Jay Andrew, Kathryn Rose, Elizabeth Drenkard, Charles Young, Hanny Rivera, Nathaniel Mollica, Mike Fox and Richard Brooks for collecting the samples.