Hypoxia Tolerance of *Acropora cervicornis* through PO_2 Crit Determination

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BACKGROUND

- Low levels of dissolved oxygen (DO) can lead to a range of physiological and behavioral effects on marine organisms, such as mass mortality and reproductive decline. Many responses to hypoxia seem to not affect invertebrates directly but result in a decrease in reproductive output and physiological mechanisms.
- The conventional definition of 2-3 mg O_2/liter to designate waters as hypoxic is below the empirical sublethal and lethal O_2 thresholds for many of the species that have been tested in past studies by researchers, which implies that hypoxia's affects on coastal ecosystems have been underestimated.
- Our results show that *Acropora cervicornis* are affected by hypoxia at 4 mg O_2/liter and start showing signs of decline. This suggests that *A. cervicornis* are very sensitive to hypoxia.

RESULTS

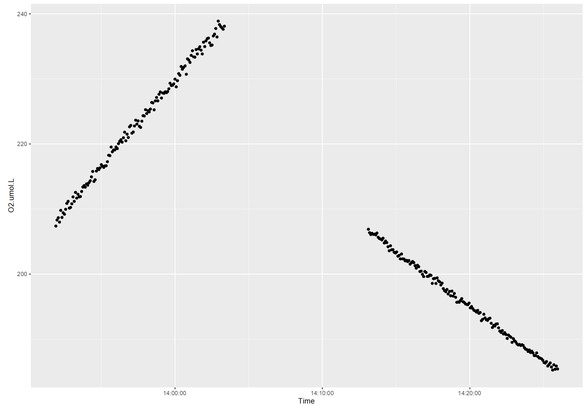
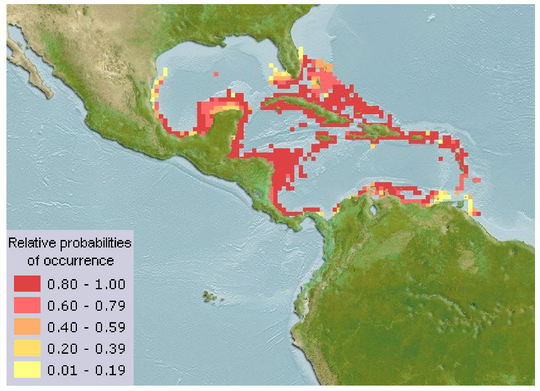


Figure 1: 12 different corals had their photosynthetic and respiration rates measured at 13 different oxygen levels. This figure is representative of Coral 108 at treatment 6.5 mg O_2/liter.



AquaMaps (2019, October). Computer generated distribution maps for *Acropora cervicornis* (staghorn coral), with modelled year 2050 native range map based on IPCC RCP8.5 emissions scenario. Retrieved from https://www.aquamaps.org.

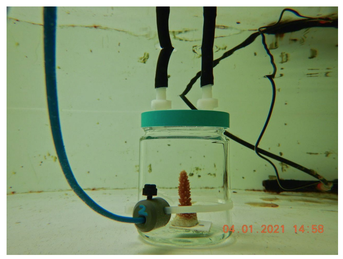
Figure 2: Distribution range of *A. cervicornis*. Colors indicate degree of suitability of habitat which can be interpreted as probabilities of occurrence.

CONCLUSIONS

- For *A. cervicornis,* the results showed that the photosynthetic PO_2 Crit was reached at approximately 3.6 mg O_2/liter, while the respiration PO_2 Crit was reached at approximately 2.4 mg O_2/liter.
- This data shows for the first time that photosynthesis is not only sensitive to oxygen, but also is more sensitive to oxygen than respiration.
- Photosynthesis and respiration are both sensitive to hypoxia. This means that during a mild event of hypoxia, less ATP is produced from their symbiont, zooxanthellae, and the organism itself. This weakens the organism, therefore decreasing their ability to cope with other stressors such as heat and disease.
- During the months of late August – September, coastal waters are the hottest. Reproduction of *A. cervicornis* occurs during these months, as well as hypoxia and bleaching events. Hypoxia amplifies the affects of heat stress and bleaching, which results in lowered reproduction rates and immune responses.

METHODS

- A preliminary study was completed to determine the Critical PO_2 of an *Acropora cervicornis* subset totaling to 14 coral fragments that were gathered from the Lirman Lab Coral Nursery and placed into an indoor tank.
- Corals were exposed to various levels of oxygen in their treatment tank ranging from 6.5 mg/L to 0.5 mg/L for a one-hour exposure phase.
- Oxygen concentrations were achieved by bubbling either air (increase DO) or nitrogen (decrease DO) depending on the desired treatment level.
- After the one-hour exposure phase, photosynthesis and respiration measurements were collected using intermittent flow respirometry in a closed chamber system.



RESULTS

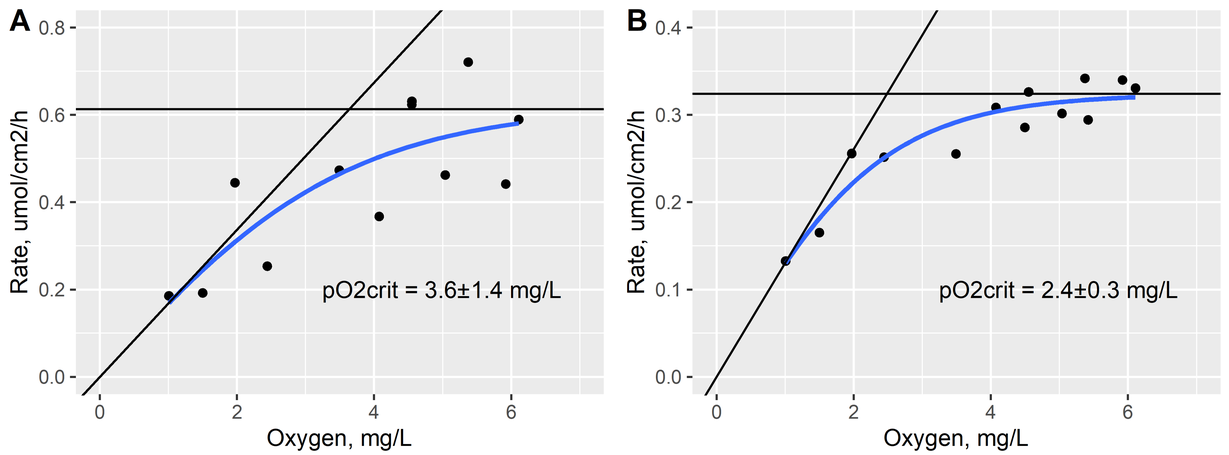


Figure 3: Shows metabolic rates vs O_2 level of *A. cervicornis*. PO_2 Crit serves as the oxygen concentration at which the rate of photosynthesis and respiration fall below 76%.
A) Is a graph of photosynthesis, resulting in a PO_2 Crit at approximately 3.6 mg O_2/liter.
B) Is a graph of respiration resulting in a PO_2 Crit of approximately 2.4 mg O_2/liter.

ACKNOWLEDGMENTS

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