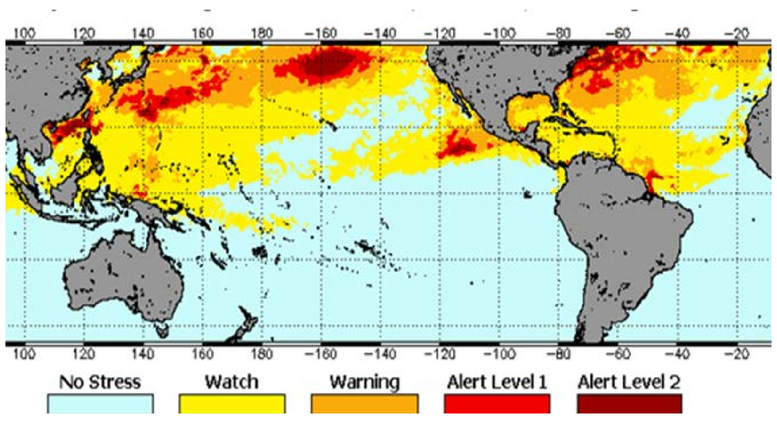
The effect of iron availability on coral bleaching at 30°C : preliminary test

Yueh-Ching Wu (吳玥慶), Zhu-Jia Kuo, Tung-Yuan Ho

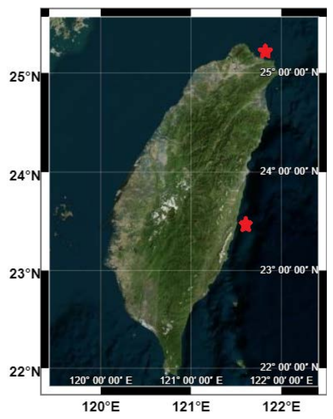
Research Center for Environmental Changes, Academia Sinica, National Chiayi University

Introduction & Motivation

The warming of ocean surface water has caused severe bleaching of global coral reefs. The mutualism between coral and its symbionts is disrupted due to the temperature rise. The latest research in our laboratory found that under coral bleaching threshold (CBT, 30°C), increased Fe availability enhances the growth of *Symbiodinium*[1]. Here, we designed a novel experiment to test whether increased Fe availability affects the extent of bleaching at CBT, 30°C.

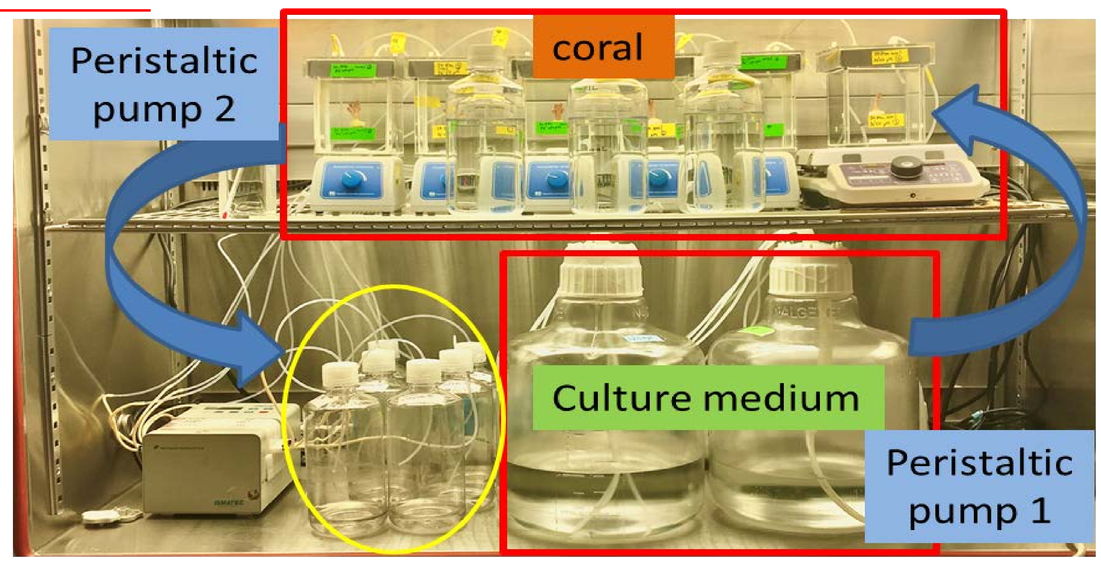


Alert level, based on SST, in August 14, 2020 (NOAA)



Our coral samples were collected from the ocean of Yehliu (25.21° N, 121.69°E) and Shitiping (23.48° N, 121.51° E).

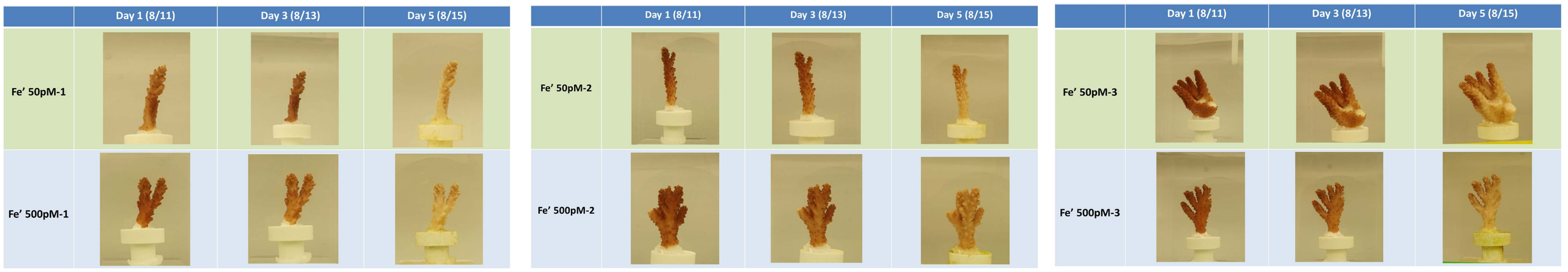
Method



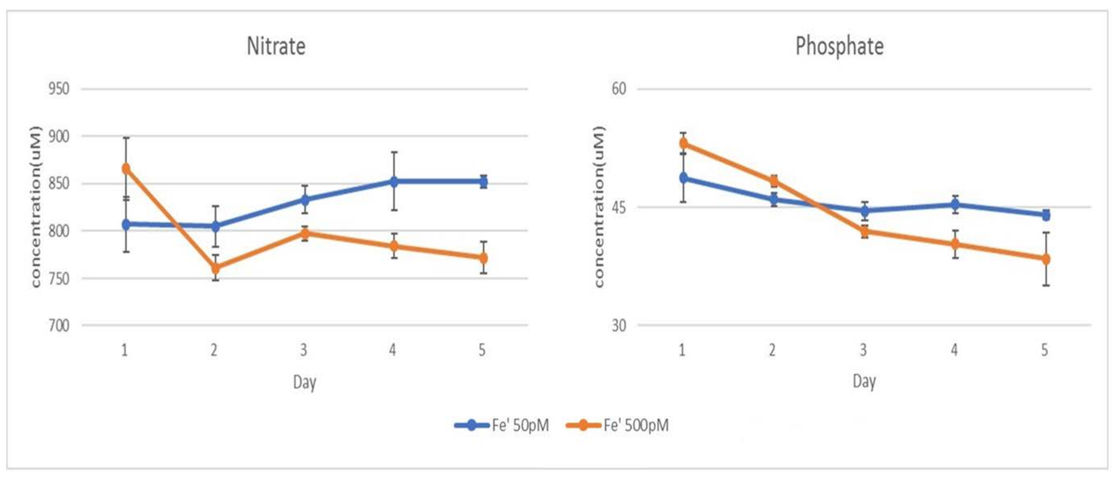
Chemostat system used in this experiment:

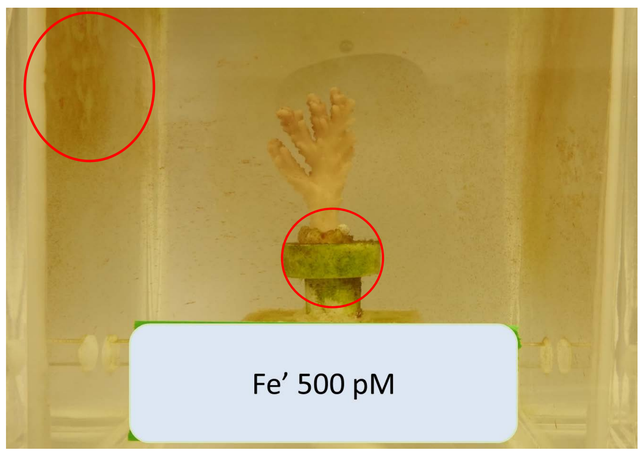
Two Fe availability treatments were prepared in this study. The inorganic Fe concentrations (Fe') were 50 and 500 pM, respectively. All other trace metals, major nutrients, and vitamins were replete in the culture medium. Light intensity was around 850 μE m^{-2} s^{-1}. Individual coral samples were mounted on ceramics bases located in the center of the growth chambers. Pump 1 delivered medium to the 6 coral growth chambers. Pump 2 delivered and collected medium into PC bottles (yellow circle) and also maintained fixed medium volume. The collected seawater was used for the measurement of major nutrients and symbionts expelled out. Pictures were taken every day at 2:30 pm to record the color of the samples and their leaching status.

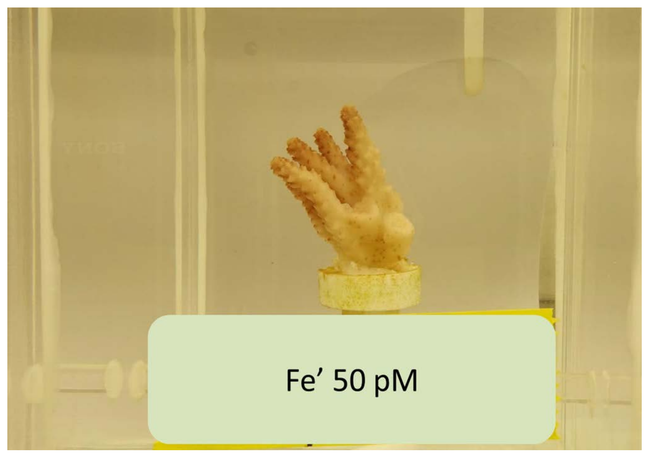
Result & Discussion



The comparison of the bleaching status from day 1 to 5 between high and low Fe treatments







- At day 5, all corals of the two treatments showed significant bleaching (left figure).
- We observed much more microalgae on the chamber walls and mounts of the high Fe treatment than the low Fe ones (upper left).
- The concentrations of nitrate and phosphate of the high Fe were lower than the low Fe treatment after day 3, likely attributed to relatively high consumption of symbiotic or other microalgae observed in the high Fe treatment chambers (upper figure).
- Through time-lapse recording, the coral polyps of high Fe treatment showed higher activities than low Fe treatment.

Conclusion

- The difference of major nutrients concentrations suggests that the high Fe condition enhance microalgal growth. Changes in phytoplankton metabolism can bear positive or negative effects on its symbiotic host that could influence the onset of bleaching.
- The cause of the bleaching probably was not resulted from Fe availability but other growth factors.

Acknowledgement

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Reference

https://coralreefwatch.noaa.gov/satellite/index.php
https://odbgo.oc.ntu.edu.tw/odbargo/