Future Concentrations of CO_2 and O_2 Threaten the Association of Host *Noctiluca Scintillans* and its Endosymbionts

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Since 2000, the advent of large scale *Noctiluca scintillans* blooms encompassing almost the entire northern Arabian Sea have been an issue of rising concern because of their detrimental effect on the region's food chain, fisheries and water quality. *N. scintillans* blooms are spreading to other tropical bodies of water, including the Gulf of Thailand with similar detrimental consequences. Previous research has shown that *N. scintillans* is able to survive under low O_2 concentrations because it is mixotrophic, combining autotrophy and heterotrophy to sustain itself. *N. scintillans* harbors a photosynthetic symbiont, *Protoeuglena noctilucae* while also having a phototrophic mode of nutrition. Despite the growing concerns surrounding the expansion of the Oxygen Minimum Zone and the spread of hypoxia in the Arabian Sea, there is still no experimental evidence to show how high CO2 associated with low seawater oxygen concentrations work in tandem to impact the growth of *N. scintillans*. We conducted an experiment to address this issue and assessed how *N. scintillans*' mixotrophic capabilities helped it to fare in these conditions. In this controlled experiment, we allowed *N. scintillans* to grow in present-day CO_2 and O_2 concentrations and those projected for the turn of the century, with and without an extraneous food source. We found no significant difference between *N. scintillans*' cell numbers in the present day and future CO_2 and O_2 concentrations. However, under the latter conditions, endosymbionts behaved unusually in that a large portion was released from the cell and had higher photosynthetic rates both as free-living and intracellularly. These findings suggest that much of *N. scintillans*' capability to survive in these hostile conditions is derived from the resilience of their photosynthetic endosymbionts. Surprisingly, *N. scintillans* growth rates decreased when food was (*Peridinium folaiceum)* was available perhaps because it was outcompeted by its food, suggesting that future studies are required using a prey that is not a mixotroph.