Using Photosynthesis-Respiration Rate Relationships of Noctiluca to Explain Algae Outbreaks in the Arabian Sea

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Over the past 26 years, massive, harmful algae blooms have flourished in the Northern Arabian sea off the coast of Oman. The appearance of these blooms in the early 2000s prompted researchers to delve deeper into the nature and cause of these blooms, leading to the discovery of the culprit, a planktonic organism known as *Noctiluca Scintillans*. This discovery has since led to new research surrounding the complicated biological underpinnings that allow these plankton to dominate the waters so easily. There are two main types of Noctiluca that exist: red Noctiluca and green Noctiluca. The distinguishing factor between the two types of the species is their modes of energy consumption. Red Noctiluca is a purely heterotrophic organism that feeds on other plankton while green Noctiluca utilizes smaller phytoplankton endosymbionts to photosynthesize within its' cell body. Although many studies have determined the causes of these blooms, understanding the relationship between endosymbiont and host is crucial for identifying the factors that make these Noctiluca proliferate so rapidly and consistently. The bulk of my research will be exploring how we can use photosynthesis-respiration rate relationships of Noctiluca to explain algae outbreaks in the Arabian Sea. This was accomplished by measuring oxygen level traces of different samples of Noctiluca, both red and green, and the endosymbionts found in the green Noctiluca, known as *Protoeuglena Noctilucae*, using an oxygen sensor connected to a probe. These oxygen traces were then used to calculate photosynthetic and respiration rates of the organisms. Through these experiments, I was able to come to two major conclusions: the endosymbionts are regulated by the host cell in green Noctiluca and, secondly, something within the chemical environment of the green Noctiluca confers the ability of red Noctiluca cells to uptake Protoeuglena and become symbiotic. These findings highlight the importance of further research into symbiotic relationships, and more specifically, into identifying what chemical or biological agent is responsible for creating this change in red Noctiluca to become green.