Augustana College
Augustana Digital Commons

Celebration of Learning

May 3rd, 12:00 AM - 12:00 AM

Microspora Competition for Sunlight

Christina Sauer
Augustana College, Rock Island Illinois

Follow this and additional works at: https://digitalcommons.augustana.edu/celebrationoflearning

Part of the Environmental Education Commons

Augustana Digital Commons Citation

Sauer, Christina. "Microspora Competition for Sunlight" (2017). *Celebration of Learning.*
https://digitalcommons.augustana.edu/celebrationoflearning/2017/posters/12

This Poster Presentation is brought to you for free and open access by Augustana Digital Commons. It has been accepted for inclusion in Celebration of Learning by an authorized administrator of Augustana Digital Commons. For more information, please contact digitalcommons@augustana.edu.

Microspora Competition for Sunlight

Christina Sauer and Dr. Kevin Geedey
Augustana College Dept. of Biology Rock Island, IL.

Introduction

Net primary production (NPP) is the amount of oxygen produced by photosynthetic organisms after the costs of respiration are paid. Rates of NPP can help explain the distribution of photosynthetic organisms within a pond or wetland and NPP can be used as a way of measuring the relative success of primary producers in a particular habitat. The distribution of primary producers is influenced by other organisms, chemical or physical factors, microhabitat differences, historical events, and geographical factors (Vesela, 2008). *Microspora* is a common genus of filamentous green algae (Prescott, 1962). Young mats of *Microspora* form carpets at the bottom of ponds, and as these mats produce oxygen, they float up to the surface where they can perform photosynthesis efficiently (Rural Chemical Industries, 2016). This study focused on the impact of light on NPP in *Microspora* within Main Pond at Augustana College's Green Wing Environmental Laboratory (Lee County, Illinois). Do floating mats of *Microspora* self-shade? Is the NPP of *Microspora* affected by the shade produced by rooted aquatic vegetation?

Materials and Methods

Two experiments were conducted exploring how competition for sunlight could explain the distribution of *Microspora*. The first experiment tested if a floating mat of *Microspora* could inhibit NPP through self-shading. The second experiment tested if *Microspora's* NPP could be inhibited by shading from a macrophyte, *Potamogeton crispus*. We hypothesized that the NPP of *Microspora* would be highest in direct sunlight and lowest in shade (by either source) due to the differences in light penetration and the increased competition for sunlight.

For both experiments, *Microspora* from surface mats and fresh surface water was harvested from Main Pond. This water was filtered through a 20µm mesh flat nitex sheet and decanted into twelve 250 ml biological oxygen demand (BOD) bottles. The initial oxygen concentration of each bottle was measured in mg/L using a Hach BOD meter. *Microspora* was separated from other organisms from the pond that were either feeding on or living in the mat, using forceps under a dissecting microscope. 0.2 grams of the isolated *Microspora* was placed in each of eight BOD bottles, while four BOD bottles had pond water only as activity controls. All the bottles were returned to Main Pond and suspended from floatation devices with zip ties. Two flotation devices were used. Each device consisted of two buoys, attached to a 1/2 inch PVC pipe through the center of a pool noodle. The buoys were tied to either end of the noodle for floatation and stabilized by wooden stakes driven into the sediment. For both experiments, one floatation device was set up in an area of direct sunlight as an experimental control (Figure 1). For the first experiment, the other flotation device was placed within a mat of *Mircrospora* and the bottles were completely covered (Figure 2). For the second experiment, the device within the mat was moved to an area of the pond consisting of only curly leaf pond weed, *Potamogeton crispus* (Figure 3). Both devices held 4 bottles with *Microspora* and 2 without and were left *in situ* for 10 hours. Bottles were then retrieved and the final oxygen concentration was measured for each bottle. NPP was defined as the difference between the final and the initial oxygen concentration in each bottle, and then expressed as a rate by dividing by the bottle volume and incubation time.

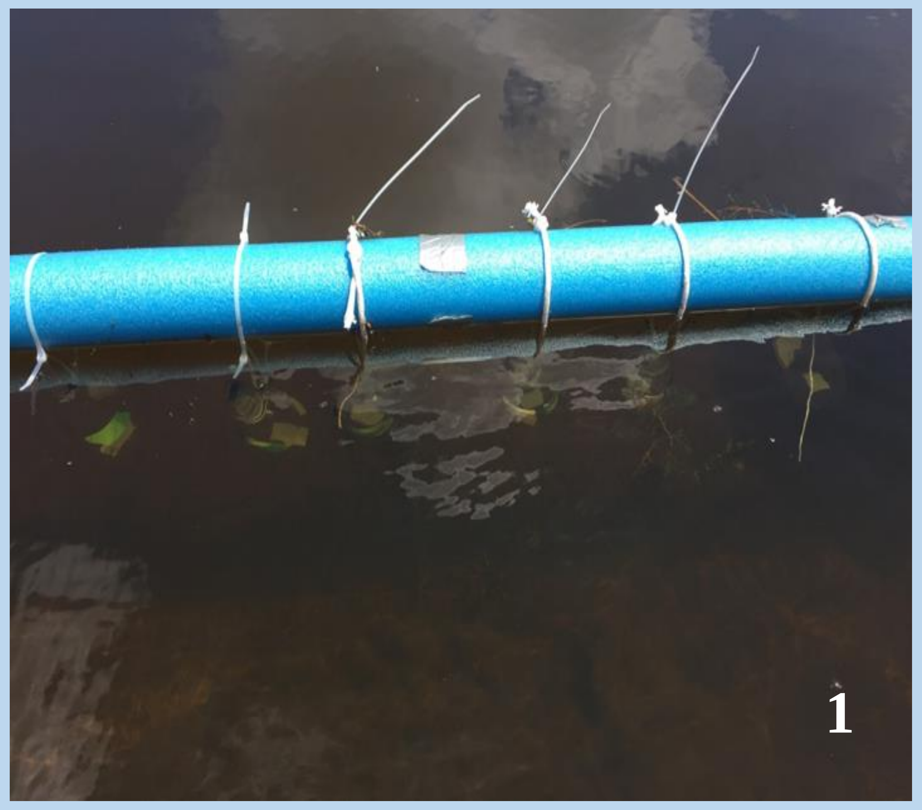

Figure 1: Direct Sunlight Condition

Figure 2: *Microspora* Shade Condition

Figure 3: *Potamogeton crispus* Shade Condition

Results

The results for both experiments were statistically significant and consistent with the hypothesis. *Microspora* had a significantly lower net primary production level when shaded by itself (Figure 4) and by *Potamogeton crispus* (Figure 5) than it did when it was in direct sunlight. In both experiments, NPP is positive in the direct-sunlight condition and negative in the shaded conditions. This means that the cost of respiration was higher than the amount of oxygen produced when *Microspora* was shaded. The percent of light penetration through the mat of *Microspora* was 0.54%. The percent of light penetration through *Potamogeton crispus* was 6.8%. Although the shading caused by the *Microspora* mat (self-shading) was more severe, the degree to which net primary production was reduced in the shade in each experiment was similar (Figures 4 and 5).

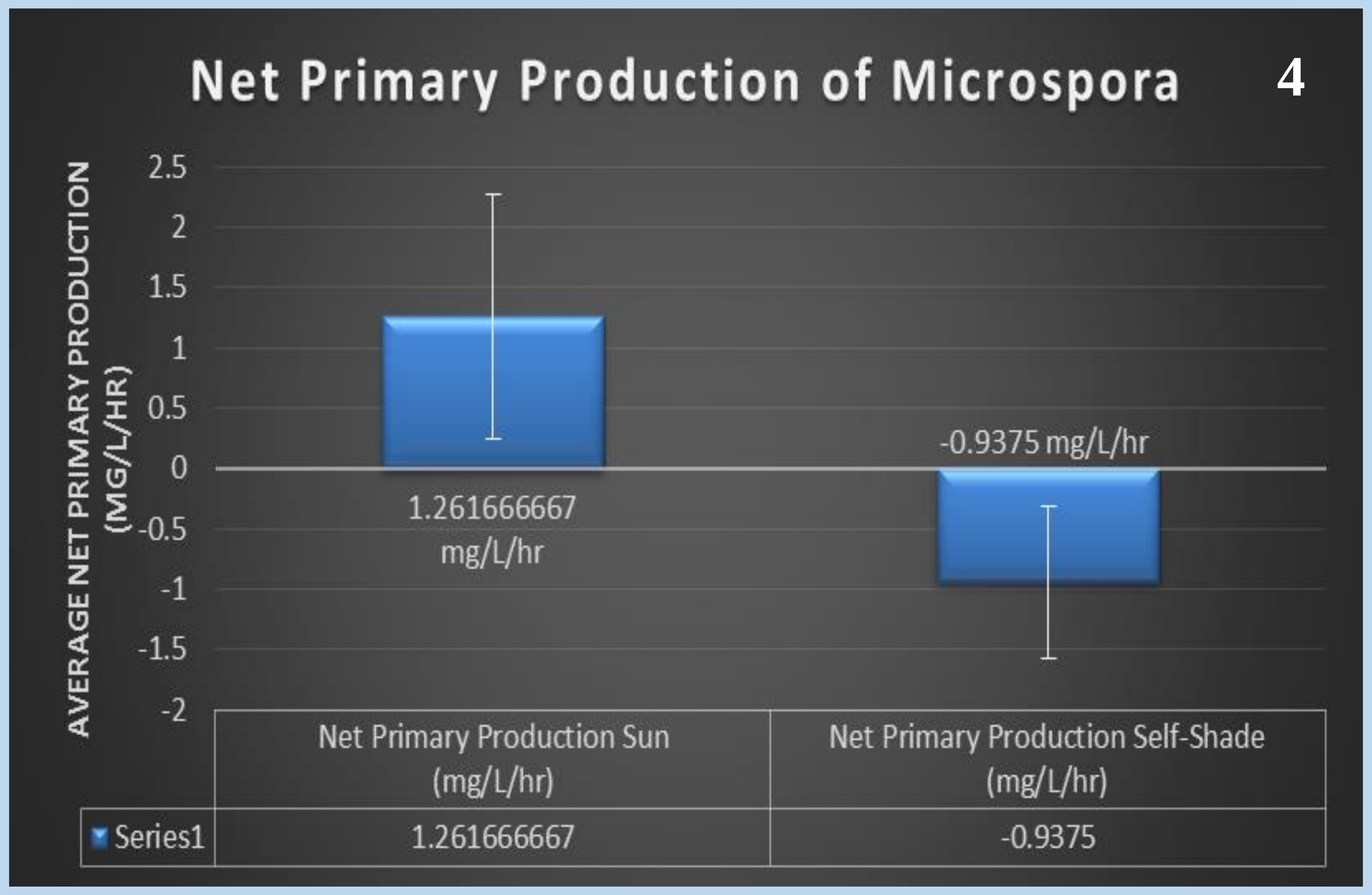

Figure 4: *Microspora* Shade Condition Results: T-test assuming equal variance, $P<0.0015$, df = 6, T = 5.52

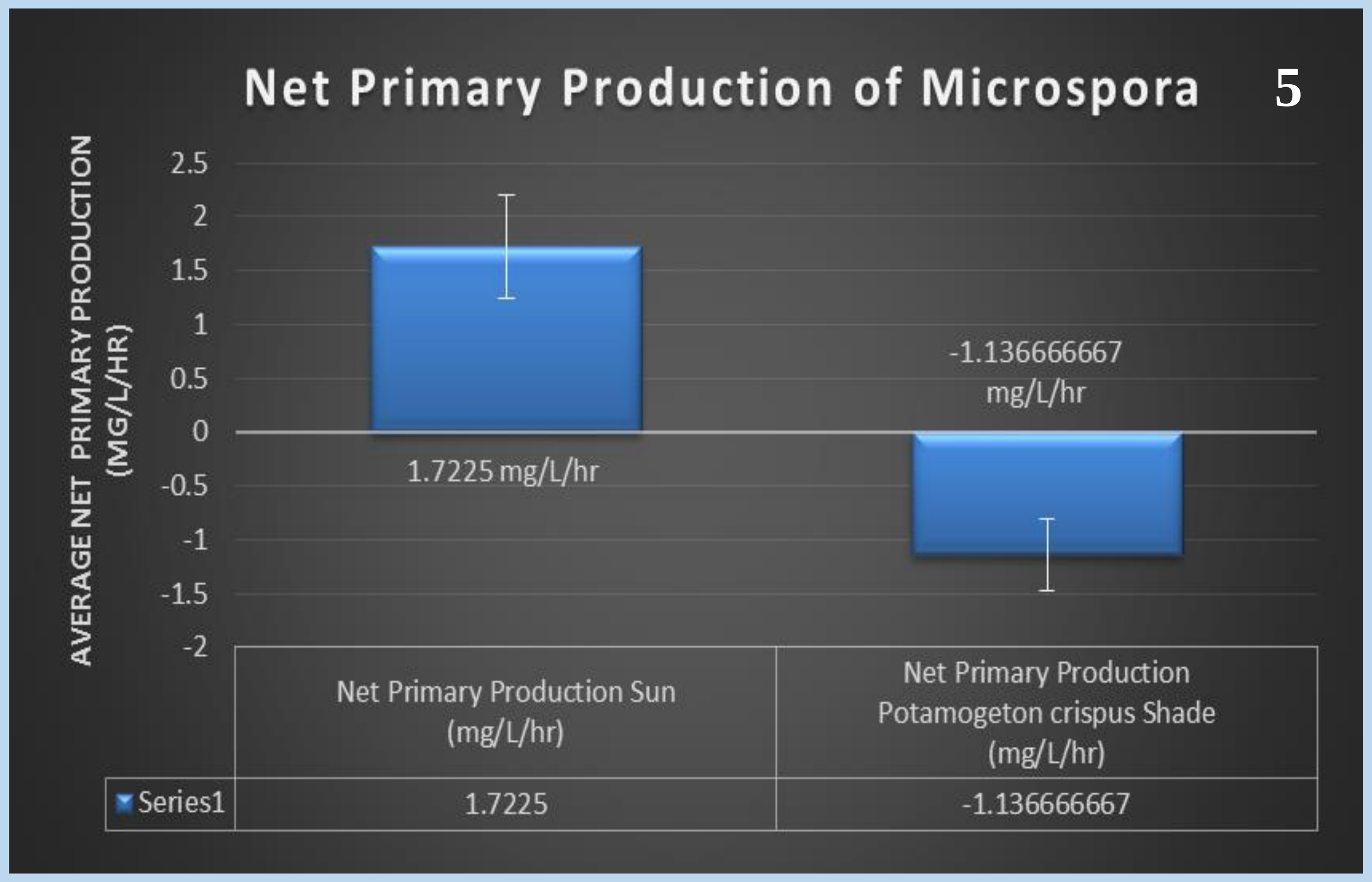

Figure 5: *Potamogeton crispus* Shade Condition Results: T-test assuming equal variance, $p<6.05 \times 10^{-6}$, df = 6, T = 14.78

Discussion

The results of this experiment are consistent with the hypothesis that the NPP of *Microspora* is reduced by self-shading as well as by shading from rooted aquatic plants. The negative NPP measured for *Microspora* in the shade treatment of both experiments suggests that it is expending more energy through respiration than it is gaining through photosynthesis in these habitats. If *Microspora* were confined in those locations, it would not survive, because it is essentially starving from a lack of sufficient sunlight. *Microspora's* ability to produce floating mats may be an adaptation to avoiding competition for light.

This research raises questions about how *Microspora* begins its life in a pond. Specifically, how do new mats begin on the bottom of pond and float up to the surface if NPP is dependent on the amount of sunlight it receives? Do mats begin in areas where the light penetration levels are high, or is there something physiologically different between new mats and mats that have been present for a while? The fact that mats of *Microspora* change position in the water column means that this algae may experience dramatically different light conditions during its life cycle. This, as well as investigating other environmental factors like herbivory, would be interesting next steps in this research program.

References

Microspora. [Internet]. 2010. AP Biology Matrix. [2016 June 3]. Available from: http://apbiologymatrix.weebly.com/microspora.html.
Prescott G. 1962. Algae of the Western Great Lakes Area. Iowa; p. 105.
Tiffany LH. 1938. Algae: The grass of many waters. Springfield, Illinois, United States of America: Charles C. Thomas
What are Algae? [Internet]. Rural Chemical Industries. [2016 June 3]. Available from: https://www.algae.info/Algaecomplete/tabid/1131/Default.aspx.
Vesela Jana. 2008. Spatial heterogeneity and ecology of algal communities in an ephemeral sandstone stream in the Bohemian Switzerland National Park, Czech Republic. Department of Botany, Faculty of Science, Charles University, Czech Republic. [2016 June 2]. Available from: https://botany.natur.cuni.cz/algo/soubory/vesela_spatial%20heterogeneity.pdf.