

Every year in Sandusky bay there is a harmful algae bloom which is dominated by the cyanobacteria *Planktothrix agardhii*. This past summer this bloom never materialized. Instead, it was replaced by a *Scenedesmus* green algae bloom. What caused this is currently unknown with several possible causes being proposed. One of these hypothesis' is that large numbers of fields going unplanted in 2019 caused there to be lower levels of residual herbicides to be present in Sandusky Bay.

For this project I decided to look into the effects of the herbicide glyphosate on has on *Planktothrix* and *Scenedesmus* competition.

Here is a little bit of background on phytoplankton competition and the effect that herbicides may have on this competition. When different alga are cultured together one species will tend to out compete the others. Which species ends up winning out is affected by both the growth rate of each species and the concentrations at which each species starts. When started at equal concentrations the species with the highest growth rate will win out. But due to the growth rate being exponential when species start at different densities a slower growing strain may be able to gain an advantage.

How herbicides play into this is that depending on the species the effect that a certain concentration has on said species growth rate varies. For *Planktothrix* and *Scenedesmus* a 50% reduction in growth rate has been shown at 250uM and 14.5 uM respectively.

For this project I competition assays both without glyphosate and with glyphosate at concentrations of 1uM and 5uM. Each assay was run in triplicates with a 1mL sample being taken daily. 10uL of glutaraldehyde was added to each sample in order to fix it so that measurements could be run at the end of each week.

Measuring the density of the samples consisted of diluting each sample with 24mL of miliQ water and placing them in a Floroprobe. The Floroprobe then determines cell density of different phytoplankton classes based on the florescence of different algal pigments.

For the competition assays without glyphosate *Scenedesmus* started growing on the bottom of the flask on day 4 and you can see this in the graphs with the concentrations dropping between samples 2 and 3.

Both 1uM and 5uM concentrations had little effect on *Planktothrix* and *Scenedesmus* competition. *Scenedesmus* was able to become the sole alga in the 1uM assays by day 5 and for 5uM *Planktothrix* concentrations were negligible.

Additionally, for the glyphosate cultures there the density of *Scenedesmus* measured at sample point one which was ~30 min after inoculation, was significantly lower that what they were inoculated with. This difference was not present in sample two, so it is likely that *Scenedesmus* was not homogeneously mixed causing the inaccurate reading.

There are may routes that one could go with further research on this topic. One of those routs is simply starting *Scenedesmus* and *Planktothrix* at more extreme starting ratios and at higher glyphosate

concentration. Another route is to redo this experiment with different herbicides to determine the effects that they have on *Planktothrix* and *Scenedesmus* competition.