

Phytoremediation of Mantua Reservoir, Phase 1

Tyler Staten, *Utah State University* | Kevin Young, Ph.D, *Utah State University*

I. Introduction

Harmful algal blooms (HABs) have become a major issue regarding water quality worldwide. Our teams goal is to evaluate biological solutions for the problem of HABs. A variety of techniques have been developed and tested on various different scales in order to remove excess nutrients from the water and thus reduce prevalence of HABs. One such method tested on smaller scales is the use of constructed floating wetlands (CFWs), relying on the plants growing on the CFWs to remove excess nutrients from the water, thereby reducing the likelihood of HABs developing. Success of CFWs can vary depending on climate, water temperature, and type of plant used. This project aims to evaluate the effectiveness of CFWs in reducing nutrient levels in Mantua Reservoir, a larger body of water long plagued with HABs. . We first attempted a proof of concept in a smaller body of water adjacent to the local fish hatchery, which drains into Mantua Reservoir.

Tyler Staten
Utah State University
Department of Chemistry and
Biochemistry
tyler@mikeswoodwork.netl

II. Methods

- An initial plan and design for CFWs was made based off of the findings of a literature review.
- CFWs were constructed from foam boards, rope, and aquaponic style net cups
- A crop was selected to plant on the CFWs in accordance with the requirements from Brigham City and the neighboring fish hatchery. *Lactuca sativa var. longifolia* (romaine lettuce) was chosen under these criteria.
- Crops were planted in the wetlands and placed in the water body for a time period of 3 months.
- Results were analyzed and conclusions drawn

III. Results

After the trial period of three months, the crops growing on the CFWs showed stunted growth and little to no root network protruding into the water. As the roots provide the nutrient absorption crucial to reducing available nutrients for the algae, poor root growth resulted in no measurable reduction of pollutants in the water. Different theories were developed as to the failure of the crops.



Image 1: CFWs on site in Brigham City, UT

IV. Conclusions and Future Work

Following evaluation over the summer it was concluded that CFWs failed to produce any measurable results. This could be due in part to the choice of crop as well as water temperature and size of the water body.

Upon further research and consideration, it was concluded that CFWs would not be a viable option in phytoremediation of a reservoir with the size of Mantua. The sheer number of plants and wetlands required to make a significant impact on the nutrient levels would not be feasible.

The research team plans on evaluating other biological treatments such as the use of silica solubilizing bacteria to allow diatom growth to outcompete algae growth. There are a variety of commercially available products of soluble silica (source), but a biological solution may offer a cheaper, simpler alternative to treating larger scale water bodies. Further research is currently underway to asses viability.

V. Sources

- Bi, R., Zhou, C., Jia, Y., Wang, S., Li, P., Reichwaldt, E. S., & Lue, W. (2019). Giving waterbodies the treatment they need: A critical review of the application of constructed floating wetlands | Elsevier Enhanced Reader. *Journal of Environmental Management*, 238, 484–498. <https://doi.org/10.1016/j.jenvman.2019.02.064>
- Mantua Reservoir. (2019, August 15). Utah Department of Environmental Quality. <https://deq.utah.gov/health-advisory-panel/mantua-reservoir>
- Pavlineri, N., Skoulikidis, Ni. Th., & Tsihrintzis, V. A. (2017). Constructed Floating Wetlands: A review of research, design, operation and management aspects, and data meta-analysis | Elsevier Enhanced Reader. *Chemical Engineering Journal*, 308, 1120–1132. <https://doi.org/10.1016/j.cej.2016.09.140>
- Rodman, S., Nguyen, K., & Delaney, J. (2020, August 1). *Aquaritin Australia Lakes Study Final.pdf*. Google Docs. https://drive.google.com/file/u/0/d/12Vg-YR6AIFEKhu88s3gnr4J5wb8PIL/view?usp=sharing&usp=embed_facebook
- Thomas Kiran, M., Bhaskar, M. V., & Twari, A. (2016, August 24). *Phytoremediation of Eutrophic Lakes Using Diatom Algae* | IntechOpen. InTech Open. <https://www.intechopen.com/books/lake-sciences-and-climate-change/phytoremediation-of-eutrophic-lakes-using-diatom-algae>