HydroGreen Research Labs
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Dear Hugo Hernandez, Director of landscaping:

It has come to our attention that the ponds here at Stan State are filled with algae that are affecting their water quality. Our group has focused on Sequoia Lake at Stan State. This lake is located on the western side of campus and is known for being an aesthetic area for its beautiful views. Additionally, the lake is known for having a relaxing setting, so it is often visited. However, we have recently discovered algae that is starting to turn the pond water into a greenish color with a disturbing order, thus, we are requesting for there to be water maintenance so that the lake remains a pleasant environment. Some of the algae that we have discovered are *Euglena*, *Spirogyra*, *Lepocinclis*, *Planktosphaeria*, *Pediastrum*, *Scendesmus*, and *Stichococcus*. Some of the other ponds have discovered harmful algae such as, *Cyanobacteria*, *Microcystis*, and *Diatoms*. We are concerned with the possibility of these harmful bacteria spreading to the other ponds or our other water systems on campus. According to the article, “Toward a Brighter Future: Enhanced Sustainable Methods for Preventing Algal Blooms and Improving Water Quality” by Su-Ok Huang and other scientific researchers, to improve the water quality of our ponds we can use “physical methods, such as sedimentation, filtration, and dredging” (2). Additionally, we can use “chemical methods, such as activated carbon, ozone, and various coagulants to destabilize or aggregate particles” (2). We believe that if we contribute to the regular maintenance of the Sequoia Lake and the other ponds, we can improve the water quality, control algae growth, and prevent future algae from appearing.

Algae collections at California State University, Stanislaus.

There are a total of six ponds within the Stanislaus State University campus each with prominent algae communities. At each pond, a total of two samples were collected using 80mL plastic sample tubes. Sample 1 was used to collect water from the entry portion of the ponds while sample 2 was used to collect samples at the exit portion of the ponds. Algae samples were collected by filling the sample tube halfway before using a pipette. The pipette was used to collect water 2 to 5 cm below surface water. In order to collect a more diverse sample, the pipette was physically used to create water movement. A second method used for the collection of samples was by repetitive pipetting in order to mix stagnant pond sludge and the water. A total of 12 samples were collected across the ponds.

All 12 algae water samples were left to rest for 30 minutes to allow for settlement of algae and other materials present. After a rest period, the samples were ready to create slides for identification purposes. For the slides, the extraction of the solution was taken in two spots within the sample tubes. The bottom of the sample is expected to contribute the most diversity of algae communities. The middle section of the sample was selected to collect any missing algae that is not dense enough to sink within the 30 minute time frame. From each sample there were two corresponding slides; Slide #1 and Slide #2.

The pond that corresponds to our results is Sequoia Lake. A total of 4 slides were made from the samples taken at Sequoia Lake using the methods stated above. The process of identification of the unknown specimens in the slides was done by identifying a single specimen, taking a picture of the specimen, correctly identifying the specimen by using references, and carefully examining the slide to count the number of specimens. By the end of the examination, the specimens were identified and quantity was known.

Our algae collection identified many different types of algae in the ponds around campus, and our group's algae collection was specifically from the Sequoia lake.

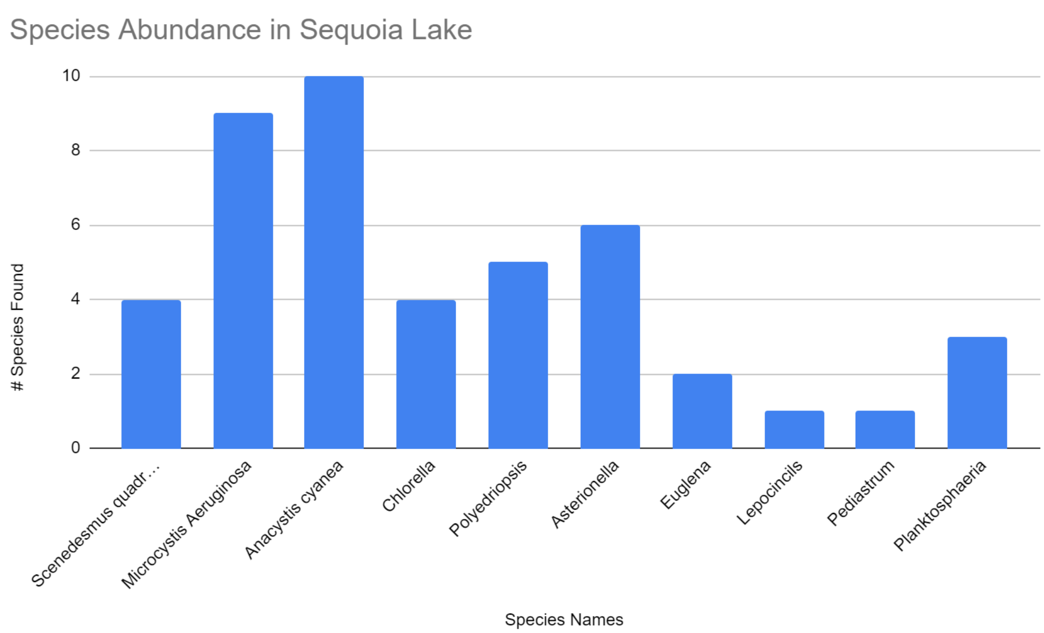

Table 1. The different types of algae collected in Sequoia Lake.

The different algae species identified exhibit various characteristics and environmental implications. *Scenedesmus quadricauda*, a Eukaryotic unicellular microalgae that plays a beneficial role in the ecosystem by photosynthesizing, contributing to oxygen production, serving as a food source for aquatic organisms, aiding in nutrient uptake, and forming colonies for increased survival chances. There is also *Microcystis aeruginosa*, a Cyanobacterium that poses health risks due to its production of potent toxins called microcystins, which can cause liver damage and gastrointestinal issues. This species can also degrade water quality by reducing oxygen levels and contributing to eutrophication. *Anacystis cyanea*, which is another Cyanobacterium that produces cyanotoxins is harmful to humans and animals, leading to skin irritation, gastrointestinal problems, and potential liver or neurological damage. The same as *aeruginosa* which depletes oxygen in water bodies and contributes to eutrophication. However, *Euglena, Spirogyra, Lepocinclis, Planktosphaeria, Pediastrum, Chlorella,* and *Stichococcus* were not found to be harmful, but yet beneficial. These algae are contributing to oxygen production and serving as food sources for aquatic organisms.

There were six groups that collected algae from the six different ponds. Each group collected diverse algae specimens from distinct ponds, resulting in a wide array of algae species being identified.

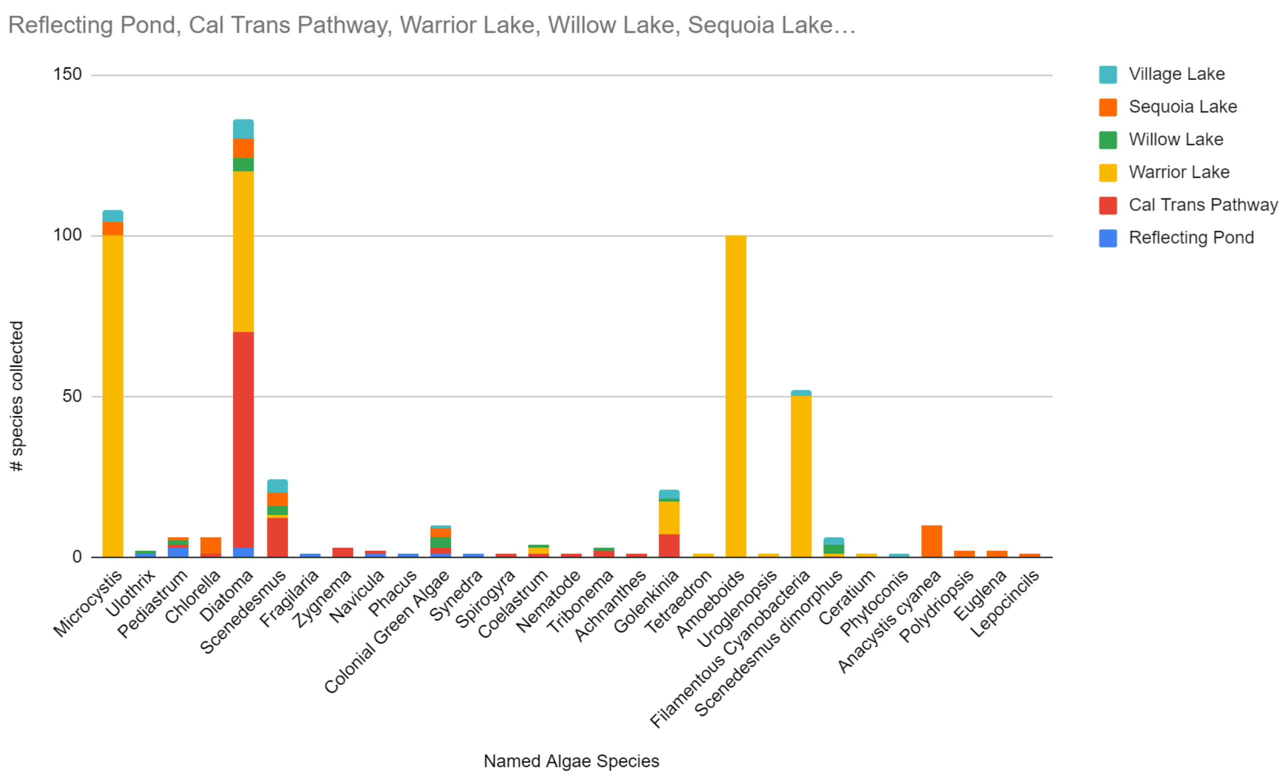

Table 2. Species of algae across six different ponds.

The graph shows the different amounts of algae collected across six different ponds. The highest amount of algae collected from the six ponds was *Diatoma* with a total of 136 Diatoms among the different ponds. The California Trans Pathway pond had the most abundance of *Diatoma* with an amount of 67 *Diatoma*, followed by Warrior Lake with 50 *Diatoma.* The next highest abundance of algae was *Microcystis* with a total amount of around 108 *Microcystis*. Warrior Lake has the highest amount of *Microcystis* with 100 *Microcystis* in the sample collected. The rest was collected from Sequoia Lake and Village Lake. The following highest amount of algae collected was *Amoeboids* from Warrior Lake with the amount of 100 *Amoeboids.* Warrior Lake also had the highest amount of *Filamentous Cyanobacteria* with an amount of 50 *Filamentous Cyanobacteria.* These algae had the highest abundance in the six different ponds while the rest of the algae collected was not as much in abundance.

The *Diatoma* that was observed and collected play many roles in the environment as they are essential in aquatic ecosystems as they form the base of the food chain providing the nutrients to different animals. The *Diatoma* can also contribute to the oxygen production through photosynthesis aiding the ecosystem. The presence of *Diatoma* indicates good water quality because they are sensitive to pollution levels. On the other hand, *Microcystis* produces toxins known as microcystins which are harmful if ingested. An algal bloom of *Microcystis* can lead to oxygen depletion in water bodies which can affect aquatic life. *Amoeboids* can contribute to nutrient cycling, but it can also cause toxins leading to liver damage if ingested, skin irritation, and even gastrointestinal problems. *Filamentous Cyanobacteria* are the same as *Microcystis* as they can produce toxins leading to health risks when exposed to contaminated water sources. Each type of algae in the environment has its own unique benefits and harmful effects. Balancing the positive and negative impacts of algae is crucial for maintaining healthy ecosystems and ensuring water quality. By understanding the diverse roles of algae, we can manage their presence in the environment effectively.

Having the presence of *Cyanobacteria* and *Microcystis* in the lakes, as has been observed, can lead to the production of toxins which can have a negative effect on the health of the organisms that inhabit the lakes. *Cyanobacteria*, alongside diatoms, are known to cause some of the algal blooms that make people sick. In moderation, diatoms can be good given their photosynthetic properties but in excessive amounts they do contribute to the presence of algal blooms. Two ways of limiting the growth of these bacteria would be aeration and introducing algae-eating fish into the lake. Aeration would help because it would allow bubbles of air into the water that would then expel gasses from the water into the surrounding air. By introducing algae-eating fish, the general quality of the lakes could be improved. Additionally, since *Microcystis* is one of the more abundant toxic algae found in the lakes, introducing a Microcystin-degrading enzymatic agent is also an option.

Thank you for your time,

Evelyn Valdovinos, Kimberly Martinez Ascencio, Yusuf Alburati, Jessica Preciado

Works Cited:

Hwang, S.O., Cho, I.H., Kim, H.K., Hwang, E.A., Han, B.H. and Kim, B.H., 2024. Toward a Brighter Future: Enhanced Sustainable Methods for Preventing Algal Blooms and Improving Water Quality. *Hydrobiology*, *3*(2), pp.100-118.