Crane Lake
Algae Study Report

Prepared for:

Pickerel/Crane Protection and Rehabilitation District

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Chapter 1. Introduction

In 2023, the Pickerel/Crane Lake Protection and Rehabilitation District worked with White Water Associates, Inc. to develop a Crane Lake Limnological Study that addresses broad topics such as algae, aquatic plants, water recreation, and water quality in Crane Lake. Over time aspects of this study have been implemented. In 2024, the algae study component was undertaken. It considered questions such as:

- Why does Crane Lake have algae blooms?
- What types of algae are present and prevalent?
- What environmental are favorable to the algae in Crane Lake?
- Can the conditions favorable to algae in Crane Lake be modified?

Algae sampling took place on Crane Lake on August 11, 2024. This period was selected as it is typically a peak season for algae in the region. The samples were processed, taxa identified, and data analyzed. This report presents the findings in four main sections (Introduction, Methods, Results, and Conclusion).

Chapter 2. Methods

The Crane Lake algal community was sampled by collecting water and biofilm samples throughout the lake. Figure 1 illustrates sample locations. Table 1 provides additional details about the samples. Plankton is algae that is suspended within the water column, and was collected using a plankton net. Epiphyton is algae that grows in biofilms attached to aquatic plant matter, and was collected by sampling biofilms from aquatic plants. Biofilms attached to submerged wood and rocks were scraped to collect periphyton, which is algae that grows attached to hard surfaces. One sample of floating green scum was also collected to sample its algal composition. Samples were collected by Dean Premo assisted by lake steward Brad Kupfer.

Samples were immediately shipped to Davis Fray for identification. In the laboratory, soft algal identification and enumeration occurred within seven days of sample delivery. A minimum of 600 algal cells per sample were identified to genus level using a compound light microscope at 400x magnification. For Diatom identification, samples were boiled in 40% hydrogen peroxide to remove organic debris, and the resulting solution of diatom valves was concentrated and mounted to slides. Diatoms were identified to genus level and enumerated from the resulting slides under a compound light microscope at 1000x magnification.

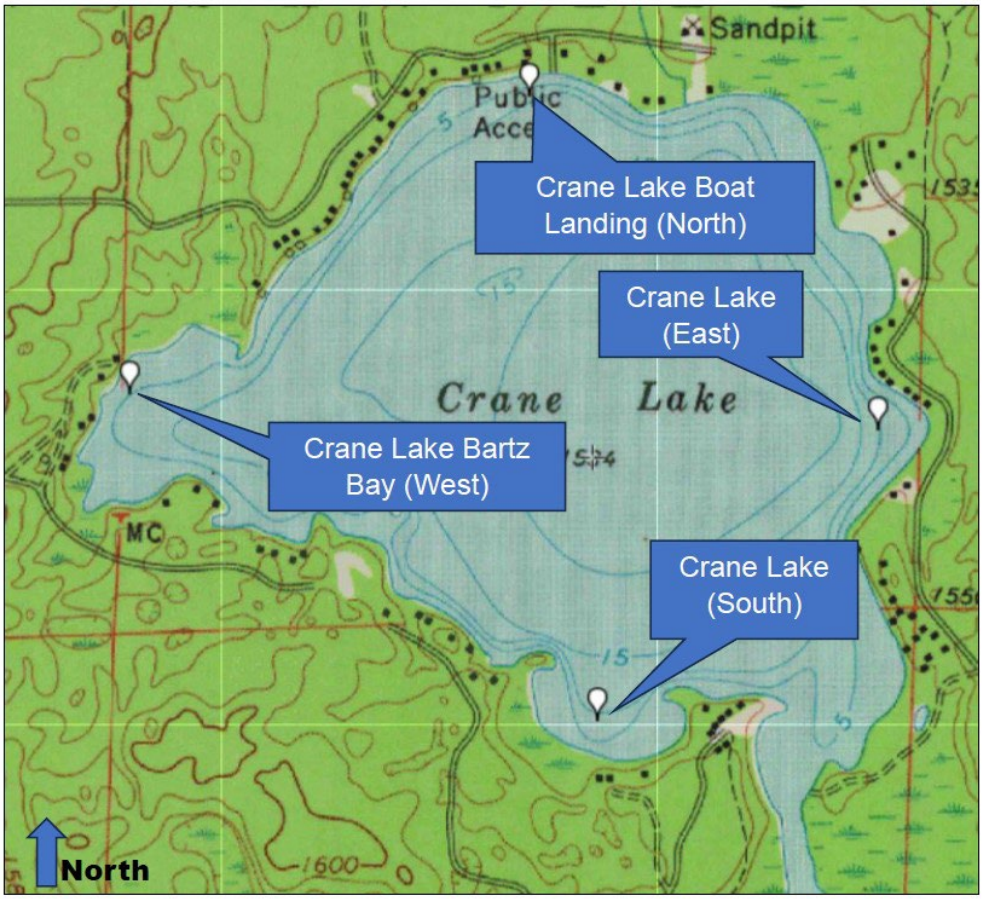

Figure 1. Locations of Algae Samples Taken at Crane Lake on August 11, 2024.

Table 1. Algae Samples Taken at Crane Lake on August 11, 2024

Sample Name and Type	Collection Date & Time	General location
Crane Lake Bartz Bay (West)-Plankton Tow	8/11/2024 – 0930 h CT	45.411996, -88.903664
Crane Lake Bartz Bay (West)-Epiphytic	8/11/2024 – 0930 h CT	
Crane Lake Bartz Bay (West)-Wood/Rock	8/11/2024 – 0930 h CT	
Crane Lake Bartz Bay (West)-Scum	8/11/2024 – 0930 h CT	
Crane Lk Boat Landing (North)-Plankton Tow	8/11/2024 – 1000 h CT	45.417273, -88.893600
Crane Lake Boat Landing (North)-Epiphytic	8/11/2024 – 1000 h CT	
Crane Lake Boat Landing (North)-Wood/Rock	8/11/2024 – 1000 h CT	
Crane Lake (East)-Plankton Tow	8/11/2024 – 1030 h CT	45.411371, -88.884794
Crane Lake (East)-Epiphytic	8/11/2024 – 1030 h CT	
Crane Lake (East)-Wood/Rock	8/11/2024 – 1030 h CT	
Crane Lake (South)-Plankton Tow	8/11/2024 – 1100 h CT	45.406230, -88.891873
Crane Lake (South)-Epiphytic	8/11/2024 – 1100 h CT	
Crane Lake (South)-Wood/Rock	8/11/2024 – 1100 h CT	

Chapter 3. Results

Overall, the Crane Lake algal community is typical of inland lakes in the Great Lakes Region. Five algal divisions were represented by a variety of common taxa. A total of 40 genera were identified in this study (Table 2). Cyanobacteria dominated the algal community composition, but large numbers of diatoms were also present. Further information on the algal divisions and specific taxa found are described below. While Cyanobacteria have the potential to create toxic blooms, their presence in large numbers is not alarming for the algal community. It is typical for healthy lakes to contain Cyanobacteria, and many taxa rarely or never create harmful blooms. The algal community was consistent among habitat types throughout Crane Lake (Figure 2), with both planktonic and attached forms of cyanobacteria being most abundant in all habitats. Diatoms, an ideal food source for driving lake food chains, were also abundant in biofilm samples.

Table 2. Algal Genera found in Crane Lake.

Division	Genus
Cyanophyta	
	Oscillatoria
	Lyngbia
	Planktothrix
	Merismopedia
	Coleosphaerium
	Microcystis
	Aphanocapsa
	Anabaena
	Pseudanabaena
Chlorophyta	
	Euglena
	Scenedesmus
	Chlamydomonas
	Oocystis
	Mougeotia
	Eudorina
	Pediastrum
Chrysophyta	
	Synura
Cryptophyta	
	Rhodomonas

Division	Genus
Bacillariophyta	
	Epithemia
	Navicula
	Rhopalodea
	Cyclotella
	Fragilaria
	Cymbella
	Cocconeis
	Gomphonema
	Achnanthidium
	Melosira
	Stephanodiscus
	Pinnularia
	Synedra
	Rhoicospehnia
	Craticula
	Staurosira
	Tabellaria
	Halamphora
	Nitzschia
	Denticula
	Asterionella
	Encyonema

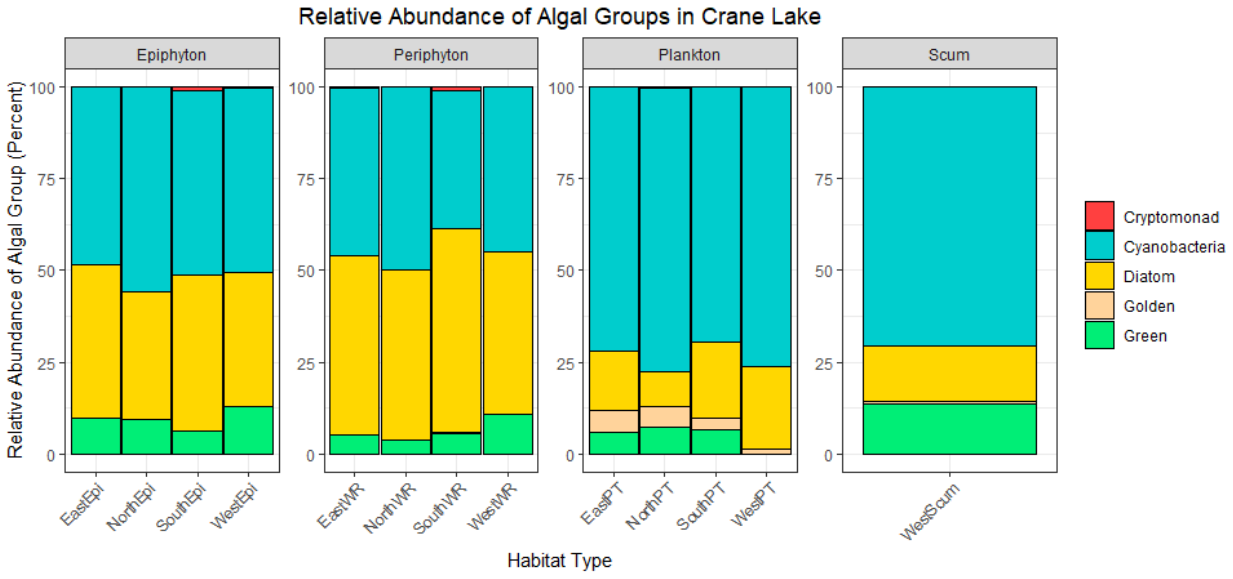

Figure 2. Bar plots showing relative abundance of major algal divisions from each habitat type in Crane Lake.

Cyanobacteria

Cyanobacteria (also known as Cyanophyta) are the so-called blue-green algae) and consist of a wide variety of photosynthetic prokaryotes. The cyanobacteria found in Crane Lake are widespread, and common throughout north temperate lakes (Figure 3). Filamentous forms grow attached to surfaces and provide food for grazing invertebrates and other consumers. The filamentous *Oscillatoria* is the most abundant taxon found in this survey, and was found both as attached filaments and as shorter structures suspended in the plankton (Figure 4). While it is not alarming to find such high numbers of this alga, *Oscillatoria* does form mats on the bottom of lakes, which can float to the surface and become a nuisance. Like most other algae, increases in nutrients can lead to higher *Oscillatoria* growth rates that may reach nuisance levels. While *Oscillatoria* can produce cyanotoxins harmful to mammals, harmful blooms rarely occur and have seldom been reported in small inland lakes. *Oscillatoria* may not present a current problem in Crane Lake, but nutrient inputs to the lake should be limited to avoid nuisance growth in the future.

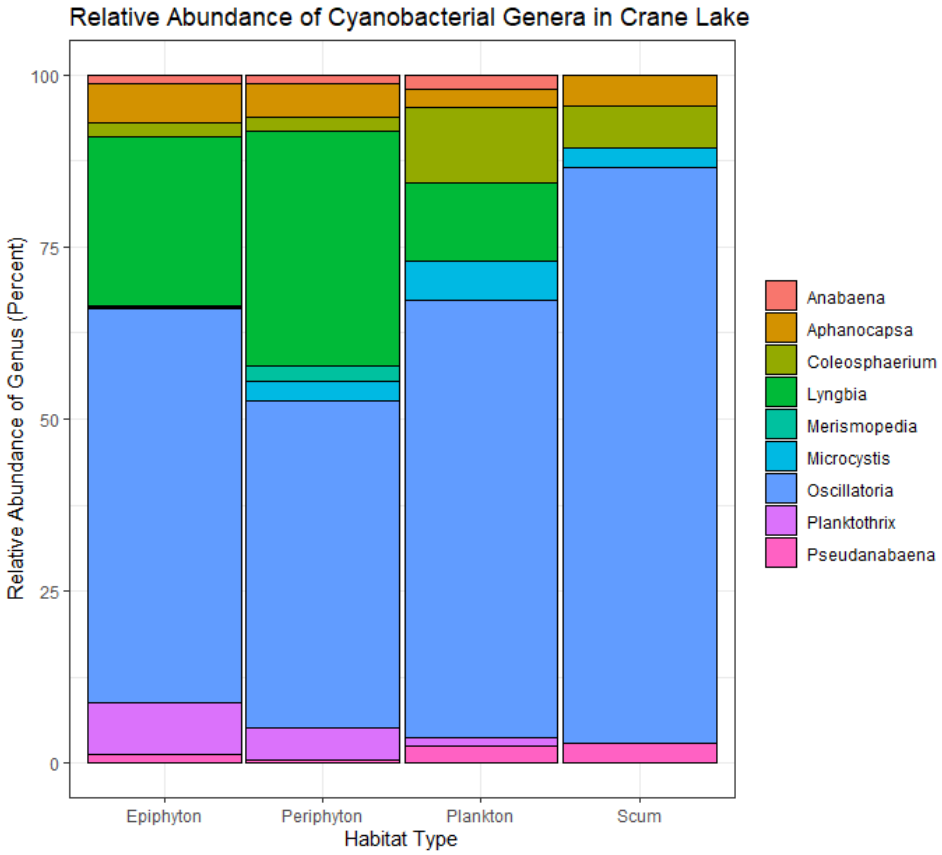

Figure 3. Bar plot showing relative abundance of Cyanobacterial genera from Crane Lake.

Coccoid cyanobacteria are more common in the plankton community, and are represented by various genera in Crane Lake (e.g. *Microcystis, Coleosphaerium, Merismopedia)*. *Microcystis* (Figure 5) is a widespread member of lake algae communities, and its presence in Crane Lake is not cause for concern. However, this genus is responsible for the harmful algal blooms that pose a threat to human safety in inland lakes throughout the world. Low relative abundance of *Microcystis* when Crane Lake was sampled in summer indicates that current nutrient levels and lake conditions are unlikely to lead to a harmful bloom. *Microcystis* blooms are often caused by a combination of increases in nutrients and favorable weather conditions (high temperatures and low wind/current leading to reduced water movement). Limiting nutrient inputs to Crane Lake will help prevent the *Microcystis* in the lake from reaching harmful levels, and the current low abundance is a good sign for the lake's health.

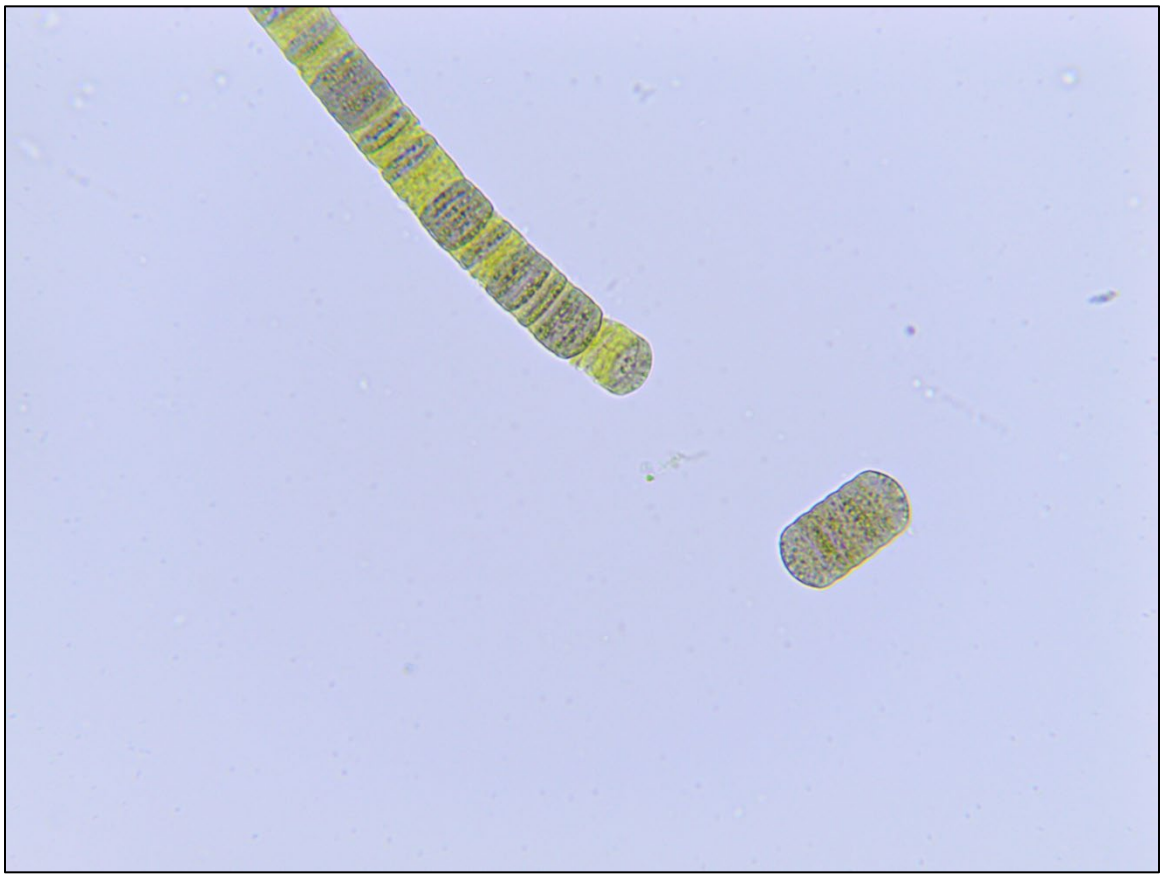

Figure 4. Oscillatoria filaments from Crane Lake.

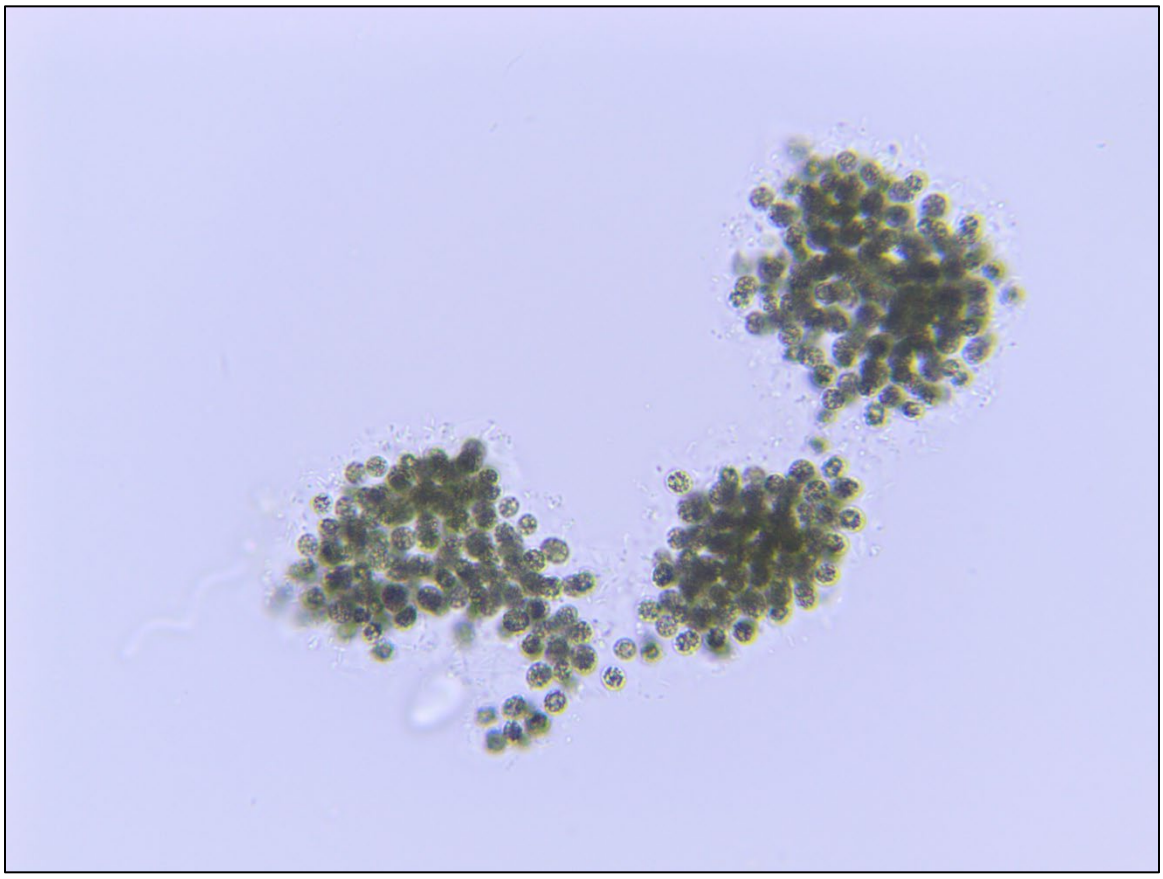

Figure 5. Microcystis colonies from Crane Lake.

Diatoms

Diatoms (Bacillariophyta) are an algal division defined by their silica cell walls, and can grow both attached to structures and suspended in the plankton. Abundant diatoms in Crane Lake are an important component of the lake food chain, and are eaten by zooplankton and macroinvertebrates that are, in turn, eaten by fishes. Several common epiphytic diatoms were found growing on Crane Lake's aquatic plants, such as *Cocconeis, Epithemia, and Gomphonema* (Figure 6). Common periphytic diatoms found growing on wood and rocks in Crane Lake include *Navicula* and *Cymbella* (Figure 7). A relatively diverse diatom community that is not dominated by a few generalist species is indicative of a healthy aquatic ecosystem in Crane Lake, and provides an important forage base (Figure 8).

Figure 6. Common diatoms from Crane Lake include Epithemia (left) and Gomphonema (right) taken from an epiphytic sample.

Figure 7. Common diatoms from Crane Lake include Cymbella taken from a periphyton sample.

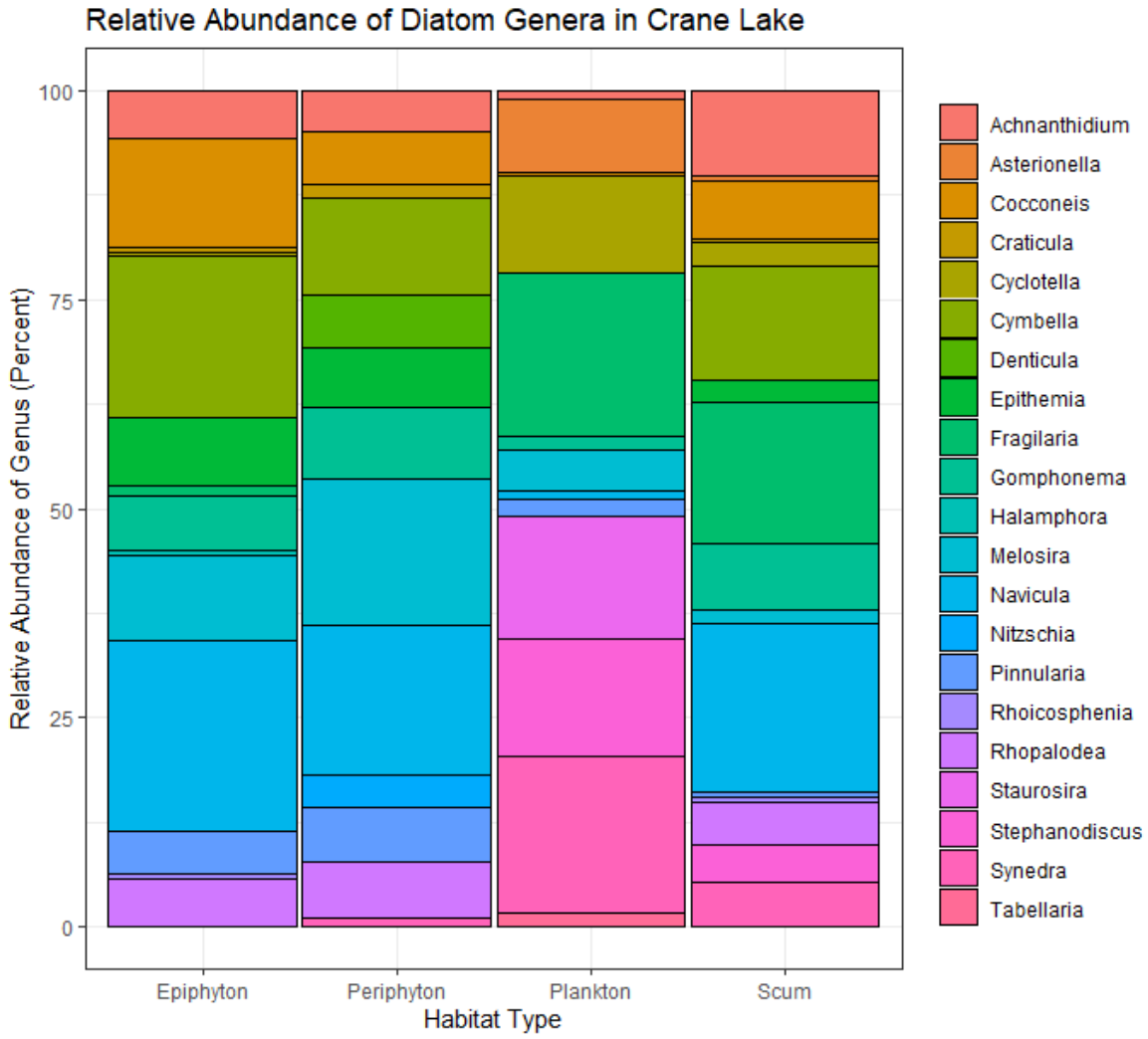

Figure 8. Bar plot showing relative abundance of Diatom genera from Crane Lake.

Green Algae

Only a small number and variety of green algae (Chlorophyta) were sampled from Crane Lake. This lack of abundance and diversity, however, is not a cause for concern. Filamentous green algae are often a cause of nuisance blooms in inland lakes. Our specific sampling methods may have led to a reduced proportion of green algae collected from Crane Lake. Only small numbers of filamentous green algae (*Mougeotia)* were sampled and most green algae documented were the planktonic *Scenedesmus* and *Chlamydomonas,* common food sources for zooplankton.

Golden Algae

The only member of the golden algae division (Chrysophyta) found in Crane Lake was *Synura*, a common member of inland lake plankton communities.

Cryptomonad Algae

The only member of the Cryptomonad algae division (Cryptophyta) found in Crane Lake was *Rhodomonas*, which was found in small numbers and is an uncommon member of freshwater plankton communities.

Chapter 4. Conclusion

Overall, the Crane Lake algal community is healthy, fairly diverse, and comparable to other inland lakes in the region. Many of the algal taxa found contribute to providing a quality base for the lake's food chain. Surface scum consisted mostly of the Cyanobacteria *Oscillatoria*, which likely form mats that become dislodged from the lake bottom. The algal community indicates the lake is currently not in an overly eutrophic state, but future inputs of nutrients to the lake should remain limited to decrease nuisance filamentous algae blooms, and prevent harmful *Microcystis* blooms. This algal sampling effort provides baseline data on the lake's aquatic ecosystem, and allows for future comparisons of the algal community that could provide insights on changes in lake health if needed