Chilliwack Lake Phytoplankton Summary Report 2021-2022

Overview

Samples were collected from one site on Chilliwack Lake during 2021 and 2022 (Figure 1; Table 1). Algae were identified to the taxonomic level of species and grouped into broad alga types for analysis.

Table 1: Sample sites and dates sampled in 2021 and 2022

Sample Site (EMS#)	Dates
CHILLIWACK LAKE NEAR CENTRE OF THE NORTH 1/2 OF LAKE (E303413)	2021-04-07 2021-08-18 2022-03-29 2022-08-17
Total= 4 samples	

Samples contained low densities of green algae, Desmids, Chrysophyta, Cryptophyta, Dinoflagellates, micro-flagellates, and diatoms. Chilliwack Lake contained very low total agal densities (Figure 2).

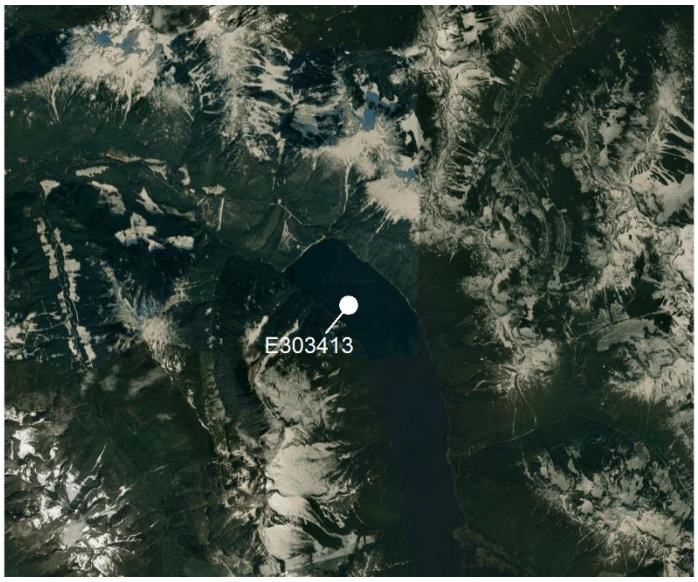

Figure 1: Aerial view of Chilliwack Lake

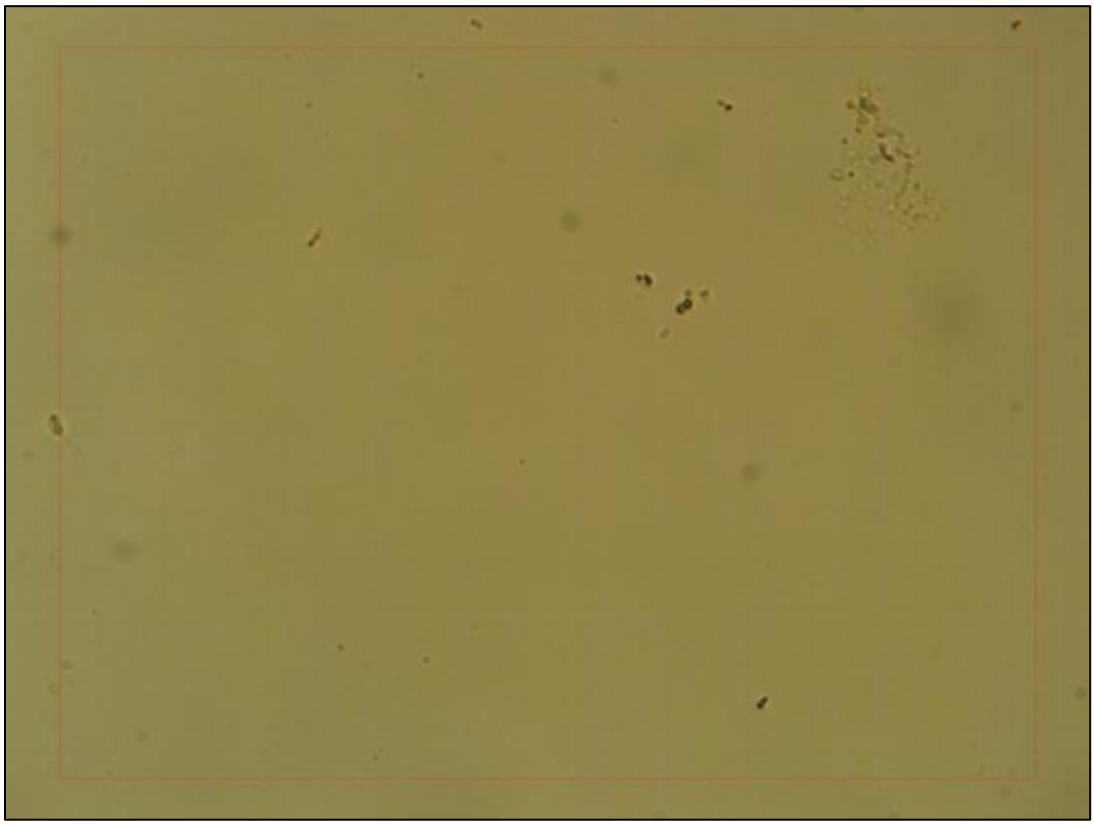

Figure 2: 400x magnification of a typical microscopic frame, note the low levels of detritus, algae, and bacteria

Overview (continued)

Scenedesmus cf. bijuga and *Chroomonas acuta* dominated species biovolumes despite being identified only eight and 25 individual times (Figure 3). Low densities of algae present in all samples enabled small quantities of algae to skew biovolume results.

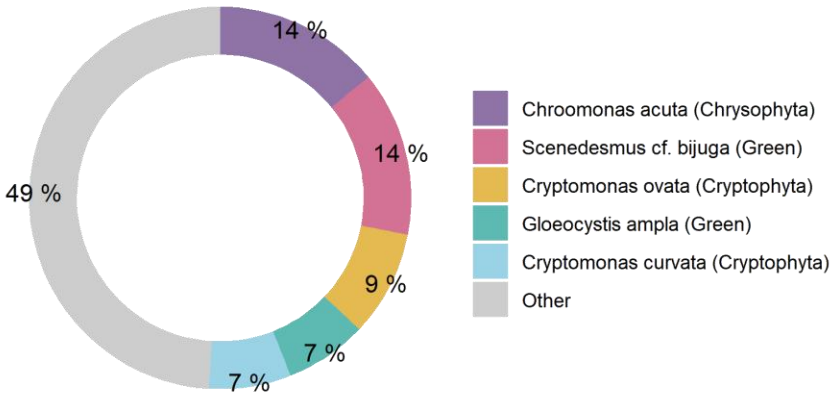

Figure 3: Dominant organisms from Chilliwack Lake (E303413) as percent of total biovolume

Scenedesmus cf. bijuga and Chroomonas acuta were two of thirty-five species identified in Chilliwack Lake (Figure 4). Cyanobacteria, Chrysophyta and green algae groups contained the most species identified in Chilliwack Lake samples.

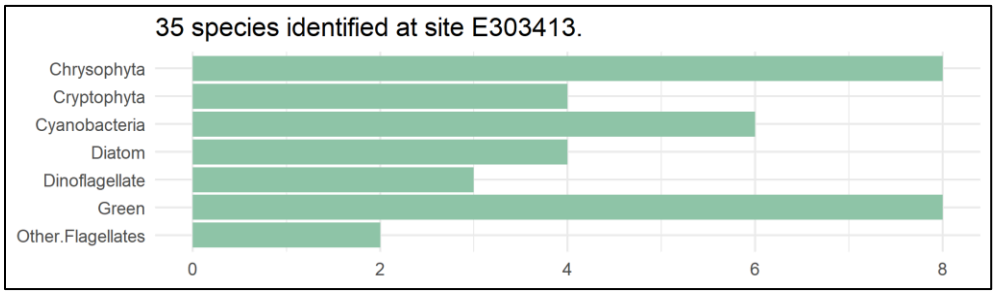

Figure 4: Unique species observed in Chilliwack Lake sorted into higher level taxa

Algae – why should we care?

Algae blooms are becoming more frequent and severe worldwide due to excessive nutrient loading and warming summer lake temperatures. Diatom blooms can cause filter clogging, and odor issues.

Intense cyanobacteria blooms can threaten human safety and aquatic health through their toxicity. Illness related to cyanotoxins can include liver, kidney, and nerve cell damage, cancer, skin and gut irritation, and neurological issues. Cyanotoxins, including microcystins, are now known to accumulate in the food chain (Lance et al., 2014). Fish from lakes with heavy cyanobacteria blooms can have higher toxin concentrations than the lake water (Greer et al. 2021) and consuming them can increase the risk of liver disease (Zhao et al., 2020).

Cyanobacterial Presence

Samples demonstrated low cyanobacteria densities; *Aphanocapsa* was the dominant genus. *Aphanothece* and *Anacystis* species were also observed (Figure 5).

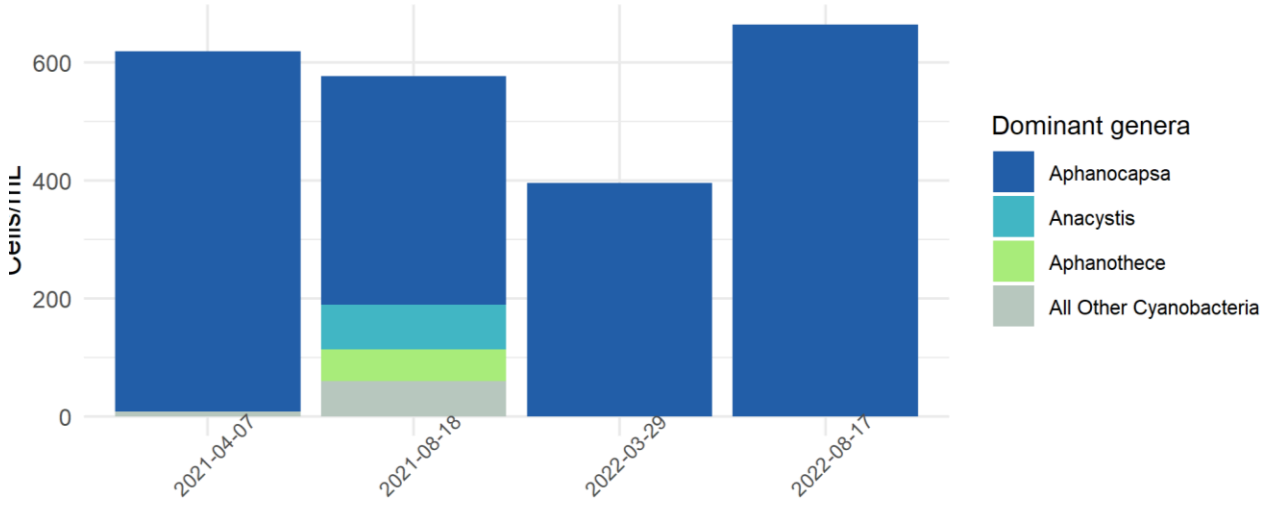

Figure 5: cell abundance for dominant cyanobacteria genera on Chilliwack Lake

When *Aphanocapsa* is present in high concentrations, it is associated with several cyanotoxins that represent risks to public health (Table 2). Other dominant cyanobacteria identified in Chilliwack samples are also associated with several cyanotoxins. Concentration of cyanobacteria observed in Chilliwack Lake were too low to represent risks to human health (Lance et al., 2014).

Table 2: Dominant genera of cyanobacteria on Chilliwack Lake and their associated toxins

Genus	Maximum Abundance* (cells/mL)	Toxins Produced
Aphanocapsa	664	Lyngbyatoxin LYN, Lipopolysaccharide LPS, Microcystin MC, BMAA
Anacystis	76	Lyngbyatoxin LYN, Lipopolysaccharide LPS, Microcystin MC, Nodularins NOD, Anatoxins (-a) ATX, BMAA, Cyanopeptolins CPL, Anabaenopeptins APT
Aphanothece	53	Microcystin MC

Note: * = counted in samples

Cyanobacterial Presence (Continued)

Dominant species of cyanobacteria found in Chilliwack Lake are capable of producing cyanotoxins (Table 2).

Chilliwack Lake displayed cyanobacteria levels in the negligible risk category, with a mean cyanobacteria abundance of 564 cells/mL (Figure 6). Figure 6 exhibits the range of cyanobacterial abundance observed in Chilliwack Lake compared to alert levels defined by several authorities including the WHO and EPA.

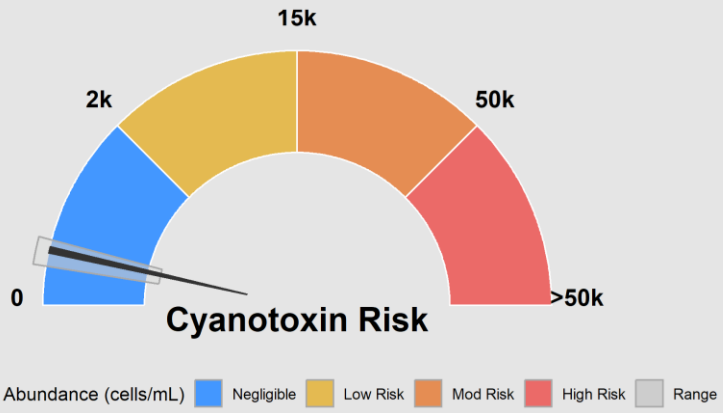

Figure 6: Cyanotoxin risk posed by cyanobacteria blooms in Chilliwack Lake

Cyanobacteria and micro-flagellates frequently dominate algal communities in total cell count. Because of their small cell size, their biovolume is usually low relative to the other types of algae present. This can be seen in Figure 7 where a single *Schroederia indica* (green algae) cell dwarfs the adjacent micro-flagellate.

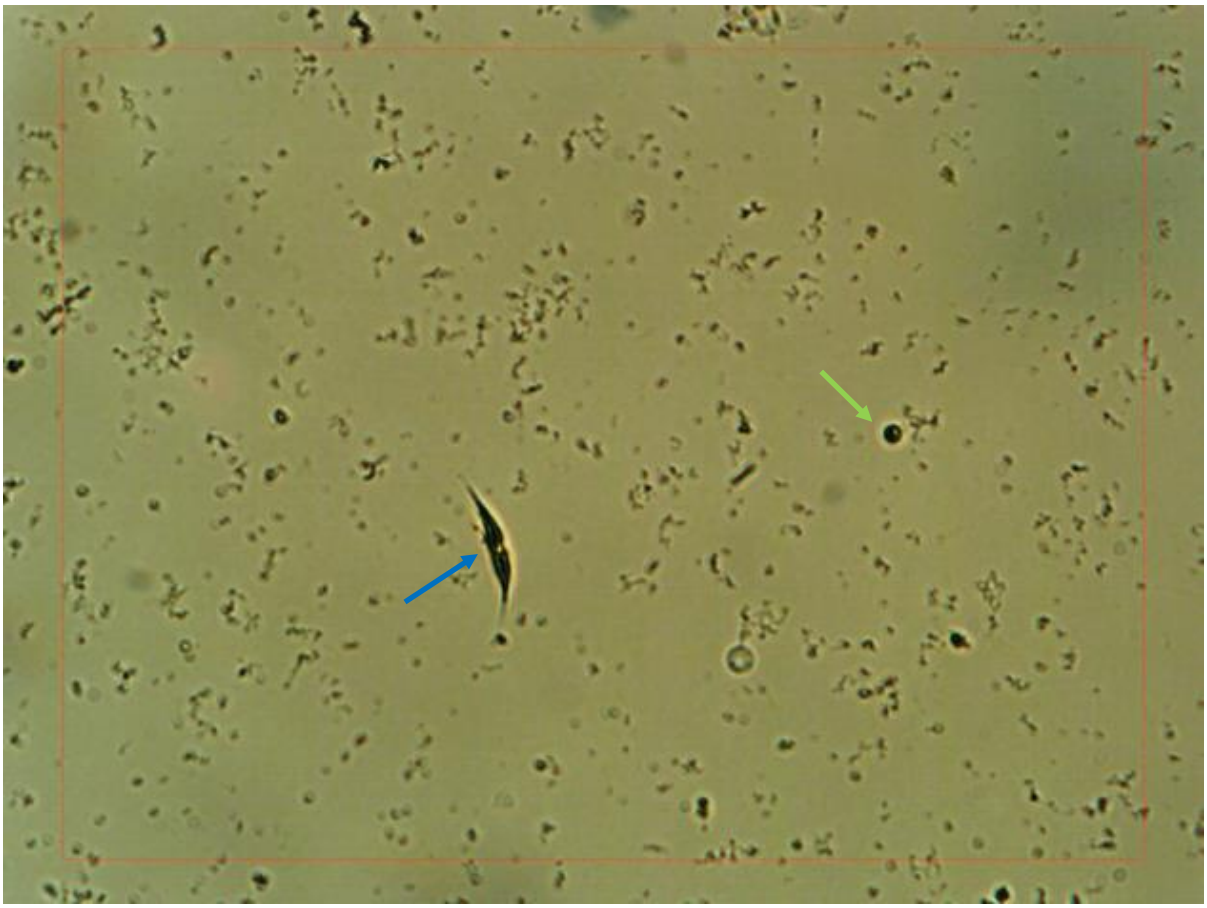

Figure 7: Size comparison of a Schroederia indica (blue arrow) to micro-flagellate (green arrow)

Species Composition

Algae samples were identified to the genus level and grouped into broad alga types for analysis. The figures below display the total cell counts for each broad algae group alongside the biovolume represented by each of these groups. The difference between Figure 8 (cell abundance) and Figure 9 (biovolume) illuminates the difference between cell abundance and biovolume.

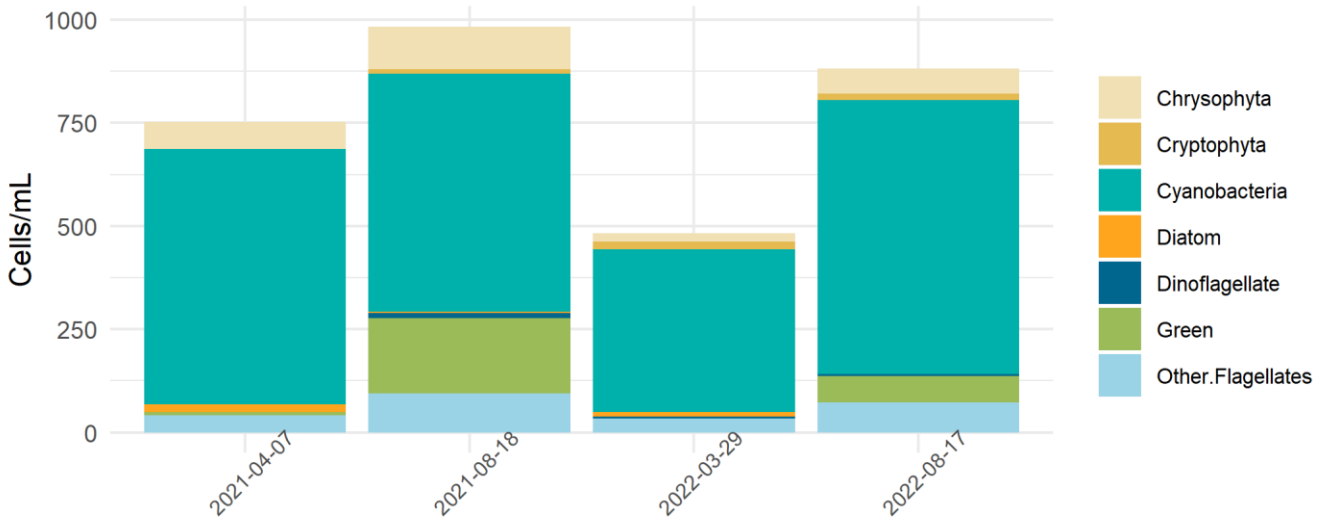

Figure 8: Cell abundance of high-level taxa groups on Chilliwack Lake

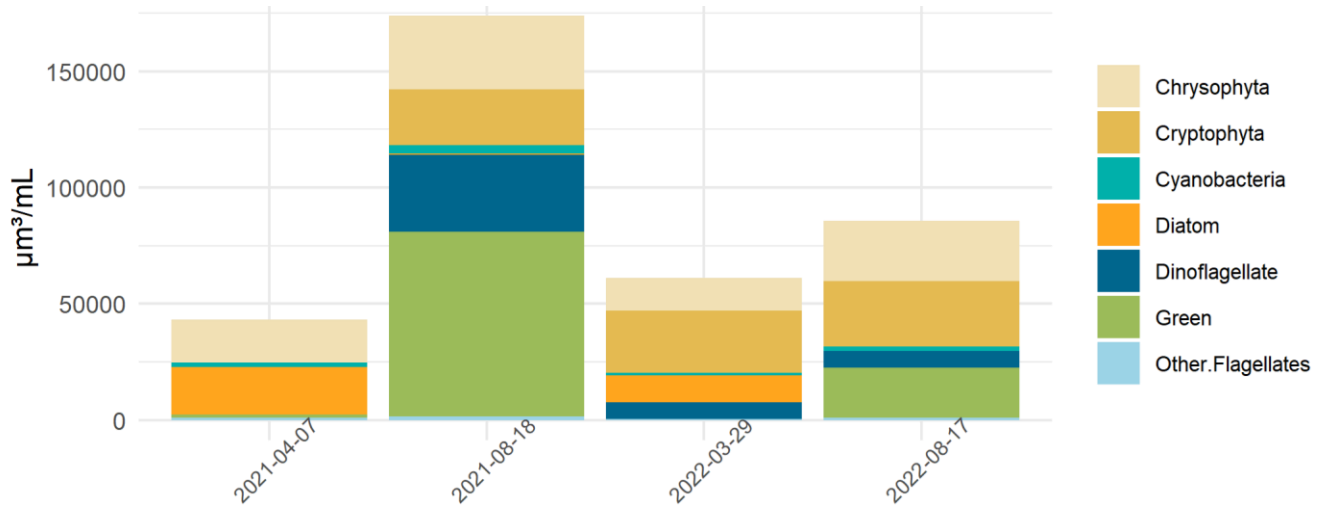

Figure 9: Biovolume of high-level taxa groups on Chilliwack Lake

References

Lance, E., Petit, A., Sanchez, W., Paty, C., Gérard, C., & Bormans, M. (2014). Evidence of trophic transfer of microcystins from the gastropod Lymnaea stagnalis to the fish Gasterosteus aculeatus. *Harmful Algae*, *31*, 9–17. https://doi.org/10.1016/J.HAL.2013.09.006

Zhao, Y., Yan, Y., Xie, L., Wang, L., He, Y., Wan, X., & Xue, Q. (2020). Long-term environmental exposure to microcystins increases the risk of nonalcoholic fatty liver disease in humans: A combined fisher-based investigation and murine model study. *Environment International*, *138*, 105648. https://doi.org/10.1016/J.ENVINT.2020.105648

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Appendix

Additional figures and raw data are listed below:

EMS ID: E303413	**Total Abundance (cells/mL):**	**752**	
Collection Date: 2021-04-07	Total Biovolume (µm³/mL):	43277	
Report.Name	**Abundance (cells/mL)**	**Biovolume (µm³/mL)**	**High.Level.Taxa**
Chroomonas acuta	27	14586	Chrysophyta
Chrysochromulina sp.	23	885	Chrysophyta
Ochromonas sp.	15	3211	Chrysophyta
Synechococcus sp.	8	34	Cyanobacteria
Aphanocapsa elachista	611	1706	Cyanobacteria
Achnanthidium sp.	4	594	Diatom
Ulnaria acus	11	11460	Diatom
Diatoma moniliformis	4	8448	Diatom
Elakatothrix gelatinosa	8	1413	Green
nanoflagellates	30	903	Other.Flagellates
picoflagellates	11	37	Other.Flagellates

Figure 10: Raw data from 2021-04-07 EMS site E303413

EMS ID: E303413	**Total Abundance (cells/mL):**	**983**	
Collection Date: 2021-08-18	Total Biovolume (µm³/mL):	173945	
Report.Name	**Abundance (cells/mL)**	**Biovolume (µm³/mL)**	**High.Level.Taxa**
Chroomonas acuta	42	22689	Chrysophyta
Chrysochromulina sp.	30	1154	Chrysophyta
Chrysococcus sp.	4	1328	Chrysophyta
Dinobryon divergens	4	3448	Chrysophyta
Kephyrion sp.	11	2304	Chrysophyta
Ochromonas sp.	4	856	Chrysophyta
Spumella sp.	8	59	Chrysophyta
Cryptomonas ovata	11	23935	Cryptophyta
Planktosphaeria gelatinosa	30	1833	Cyanobacteria
Anacystis cyanea	76	114	Cyanobacteria
Chroococcus dispersus var. minor	30	424	Cyanobacteria
Aphanocapsa elachista	387	1081	Cyanobacteria
Aphanothece sp.	53	169	Cyanobacteria
Achnanthidium minutissima	4	424	Diatom
Peridinium inconspicuum	4	7326	Dinoflagellate
Gymnodinium ordinatum	4	7800	Dinoflagellate
Peridinium sp.	4	18043	Dinoflagellate
Gloeocystis ampla	30	11875	Green
Scenedesmus brasiliensis	15	5007	Green
Scenedesmus cf. bijuga	30	50800	Green
Schroederia indica	8	2036	Green
Gloeocystis planctonica	99	9611	Green
nanoflagellates	49	1475	Other.Flagellates
picoflagellates	46	154	Other.Flagellates

Figure 11: Raw data from 2021-08-18 EMS site E303413

EMS ID:	E303413			
Collection Date:	2022-03-29			
	Total Abundance (cells/mL):	**482**		
	Total Biovolume (µm³/mL):	**60993**		
Report.Name	**Abundance (cells/mL)**	**Biovolume (µm³/mL)**	**High.Level.Taxa**	**ITIS Genus Number**
Chromulina sp.	4	7069	Chrysophyta	1717
Chroomonas acuta	11	5942	Chrysophyta	10613
Ochromonas sp.	4	856	Chrysophyta	1455
Cryptomonas curvata	4	25200	Cryptophyta	10635
Rhodomonas lacustris	15	1629	Cryptophyta	10663
Aphanocapsa elachista	395	1103	Cyanobacteria	625
Ulnaria acus	11	11460	Diatom	970000
Peridinium inconspicuum	4	7326	Dinoflagellate	10212
nanoflagellates	11	331	Other.Flagellates	
picoflagellates	23	77	Other.Flagellates	

Figure 12: Raw data from 2022-03-29 EMS site E303413

EMS ID:	E303413	**Total Abundance (cells/mL):**	**881**	
Collection Date:	2022-08-17	**Total Biovolume (µm³/mL):**	**85571**	
Report.Name	**Abundance (cells/mL)**	**Biovolume (µm³/mL)**	**High.Level.Taxa**	**ITIS Genus Number**
Chromulina sp.	4	7069	Chrysophyta	1717
Chroomonas acuta	15	8103	Chrysophyta	10613
Chrysochromulina sp.	4	154	Chrysophyta	2160
Dinobryon divergens	11	9481	Chrysophyta	1515
Kephyrion sp.	4	838	Chrysophyta	1764
Spumella sp.	23	169	Chrysophyta	1491
Cryptomonas erosa	11	19490	Cryptophyta	10635
Cryptomonas ovata	4	8704	Cryptophyta	10635
Aphanocapsa elachista	664	1854	Cyanobacteria	625
Peridinium inconspicuum	4	7326	Dinoflagellate	10212
Ankistrodesmus falcatus var. mirabilis	8	3255	Green	5877
Elakatothrix gelatinosa	4	706	Green	9412
Gloeocystis ampla	34	13459	Green	6355
Gloeocystis planctonica	15	1456	Green	6355
Monoraphidium cf. griffithii	4	2650	Green	5990
nanoflagellates	23	693	Other.Flagellates	
picoflagellates	49	164	Other.Flagellates	

Figure 13: Raw data from 2022-08-17 EMS site E303413