# BEAR CREEK WATERSHED

Fact Sheet 67 Diatoms As Water Quality Indicators
February 2020

The Bear Creek Watershed Association protects and restores water and environmental quality within the Bear Creek Watershed from the effects of land use.

Diatoms in the Bear Creek Watershed can tell us about the health of select aquatic systems. Diatoms are a type of phytoplankton with porous silica cell walls. The bigger diatoms are about the width of a human hair. Diatoms have been around since the Jurassic Period and are found worldwide. The current total number of species is over 20,000. These diverse plankton are easily transported by a variety of mechanisms from different aquatic systems. Species of diatoms found in Colorado waters are also found across the country with some species having European origins. The Association monitors diatoms during the growing in Bear Creek Reservoir (species level 1999 to 2019) and Evergreen Lake (2018-2019).
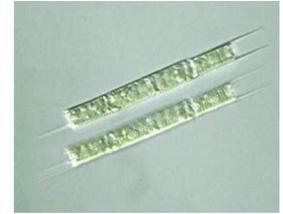
Melosira ambigua

Diatoms produce 50% of the air we breathe. Diatoms remove carbon dioxide from the atmosphere, which is converted to organic carbon in the form of sugar, and oxygen is released. Diatoms are often a major component of phytoplankton communities in nutrient-rich waters, especially during spring blooms. They can flourish year-round with some blooms occurring under ice conditions on reservoirs. Diatoms can divide more rapidly than other groups of phytoplankton with an assemblage of living diatoms doubling in biomass approximately every 24 hours.

Diatoms are sensitive to changes in water quality. Diatoms have ranges and tolerances for numerous environmental variables, including temperature, pH, nutrient concentrations (nitrogen and phosphorus), heavy metals, specific conductance, suspended sediment, flow regime, elevation, and can be sensitive to different types of human disturbances. As a result, diatoms are useful for assessing and monitoring biotic condition of freshwaters. The types of diatom species present and their relative abundances are influenced strongly by the concentration and ratio of nitrogen and phosphorus in the water. Research on eutrophication of lakes and reservoirs has shown that changes in diatom biomass and diversity reflect changes in nitrogen or phosphorus concentrations.

Diatoms can serve as bioindicators of environmental changes in a waterbody. Changes in diatom assemblages both seasonally and over time can be used as predictors of environmental conditions. Populations dominated by select species at high biovolumes indicate worsening eutrophic conditions. Higher species diversity with lower biovolumes can indicate improving water quality.

Climate affects diatoms in complex ways. As the planet warms due to the increase in carbon dioxide, scientists predict diatoms will decrease compared to smaller plankton, like cyanobacteria. A changing climate alters river flow and lake levels. The frequency and severity of droughts and floods can change diatom species community diversity, densities and seasonality. Furthermore, climate controls circulation patterns and thermal stratification of lakes, which alter diatom species composition.

Achnanthes deflexa is found in western shallow western lakes and reservoirs. It first appeared in Bear Creek Reservoir in 2019 with a peak biovolume (um3/mL) >1,499,000. This significant bloom turned the reservoir a brownish color. *Asterionella formosa* first appeared in Evergreen Lake in August 2019 with a biovolume of 7,200 um3/mL and bloomed in September at about 720,000 um3/mL This bloom reduced the Secchi measurement (depth of light penetration) to 1.1 meters.

Bear Creek Reservoir

Seasonal Diatoms	Total Biovolume	Species Diversity
2013	25%	72%
2014	6%	71%
2015	5%	49%
2016	1%	80%
2017	20%	67%
2018	14%	71%
2019	18%	72%

Asterionella formosa

Bear Creek Reservoir

	Total	2013	2014	2015	2016	2017	2018	2019
Species	83	41	44	31	49	12	39	38
Genera	25	19	16	14	17	10	18	14

Bear Creek Reservoir Major Eutrophic Species	Potential Pollution Indicator
Asterionella formosa	Eutrophic
Diatoma vulgare	Eutrophic
Fragilaria crotonensis	Eutrophic
Fragilaria vaucheria	Eutrophic
Melosira ambigua	Eutrophic
Melosira granulata	Eutrophic
M. granulata angustissima	Eutrophic
Stephanodiscus hantzschii	Eutrophic
Stephanodiscus niagarae	Eutrophic
Achnanthes lanceolata	High Nutrients
Achnanthes linearis	High Nutrients
Cocconeis placentula	High Nutrients
Synedra ulna	Eutrophic
Cymbella minuta	Eutrophic
Achnanthes minutissima	Tolerate Metals

Evergreen Lake

	Total	2018	2019
Species	37	11	32
Genera	17	11	17

Major Evergreen Lake Species	Morphology	Maximum Biovolume um3/mL	Potential Pollution Indicator
Asterionella formosa	Araphid	716,589	Eutrophic
Cymbella microcephala	Asymmetric Bi-raphid	26,742	Eutrophic
Melosira ambigua	Centric	285,931	Eutrophic
Melosira granulata	Centric	87,754	Eutrophic
Synedra ulna	Araphid	31,163	Eutrophic
Hannaea arcus	Araphid	50,593	Mesotrophic/Eutrophic