Benthic Macroinvertebrate Report

Codornices Creek 2018 - 2019

Helen Fitanides and Grier Gammon survey for benthic macroinvertebrates in Codornices Creek in June 2019.

Benthic macroinvertebrates (BMI) are small animals living among stones, logs, sediments and aquatic plants on the bottom (benthos) of streams, rivers and lakes. They are large enough to see with the naked eye (macro) and have no backbone (invertebrate). BMI are an example of an indicator species, which serve as a measure of the environmental conditions that exist in a given site. Looking at the BMI assemblage of a water body allows us to make some inferences about watershed health; for example, if we find a healthy population of invertebrates who have a low tolerance to pollution, this signifies that conditions in the creek must have been good enough for long enough for that population to grow and thrive.

On June 9, 2018 Friends of Five Creeks board member Helen Fitanides led groups of volunteers in BMI surveys of three locations along Codornices Creek: 6th St, Kains Ave, and Albina Ave. On April 3, 2019 a city truck's load of cardboard bound for recycling caught fire near California and Rose in Berkeley. Berkeley firefighters extinguished the fire using water and a standard detergent-like surfactant foam, which entered Codornices Creek at Monterey Ave. This foam biodegrades quickly and is unlikely to harm people or mammals, but quickly kills fish and their eggs at very low concentrations, and resulted in a near-complete fish kill in Codornices Creek (fortunately, some survived and there is hope for recovery). The effects of the foam on BMI are less well known, and on June 14, 2019, Helen Fitanides once again

completed BMI surveys at the same three locations, all of which were downstream of the fire foam release.

For all surveys, the crew used methods laid out in *A Rapid Approach to Assessing the Condition of Wadeable Streams in California* (James Harrington, California Department of Fish and Wildlife, 2018), with the modification that reach length was only 60 meters due to urban constraints. At five transects, a D-net was used to collect BMI, and information on physical habitat (including flow type and water depth across the channel) was recorded. The crew also assessed habitat quality for the entire reach. (All field forms can be found in Appendix 1 and 2.) The combined BMI sample was sent to Tom King at BioAssessment Services for analysis to SAFIT level 2 (SAFIT stands for the Southwest Association of Freshwater Invertebrate Taxonomists, and level 2 indicates that the bugs are identified to the genus or species level.)

Data from both the 2018 and 2019 BMI monitoring is graphed below. The sites are graphed from left to right and correspond to their placement in the watershed, with 6th St being the closest to the bay and Albina Ave being the closest to the hills.

Brendan Lum and Grier Gammon measure the width of Codornices Creek at Albina Ave.

Tolerance

One measure of water quality is based on the tolerance level that each BMI taxa has to pollution (such as motor oil in the creek) or low water quality (such as high temperature, low dissolved oxygen, or other non-favorable water chemistry conditions). Finding some taxa that are intolerant to pollution is a good sign for a creek, while finding only taxa tolerant to pollution could indicate a problem. Figures 1 and 2 show that, in general, percent tolerant taxa increased and percent intolerant taxa decreased between 2018 and 2019. At Albina Ave, which was one block from the fire foam entry, tolerant taxa doubled and intolerant taxa decreased by 50%. These results indicate that water quality probably decreased between 2018 and 2019.

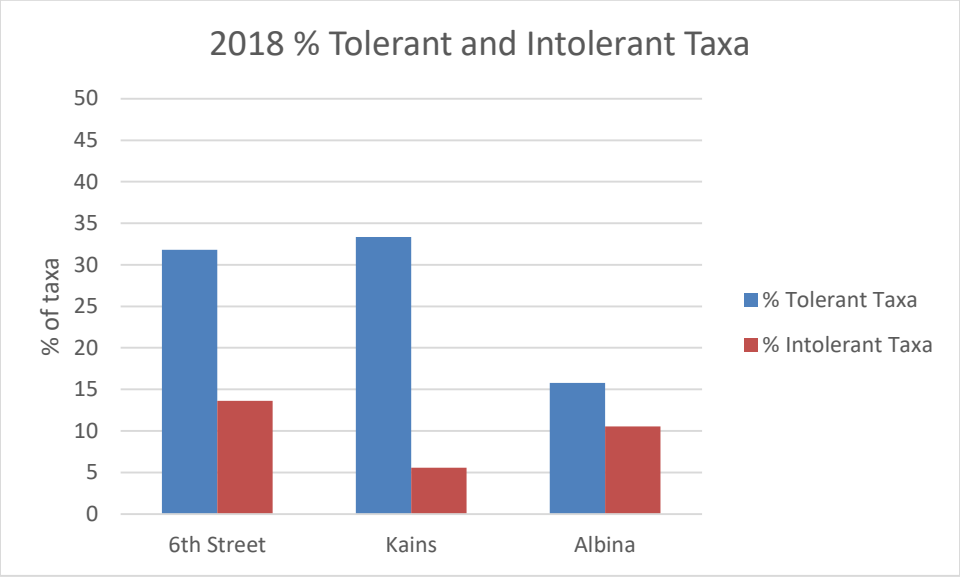

Figure 1: Tolerant vs. intolerant taxa at three sites on Codornices Creek in 2018.

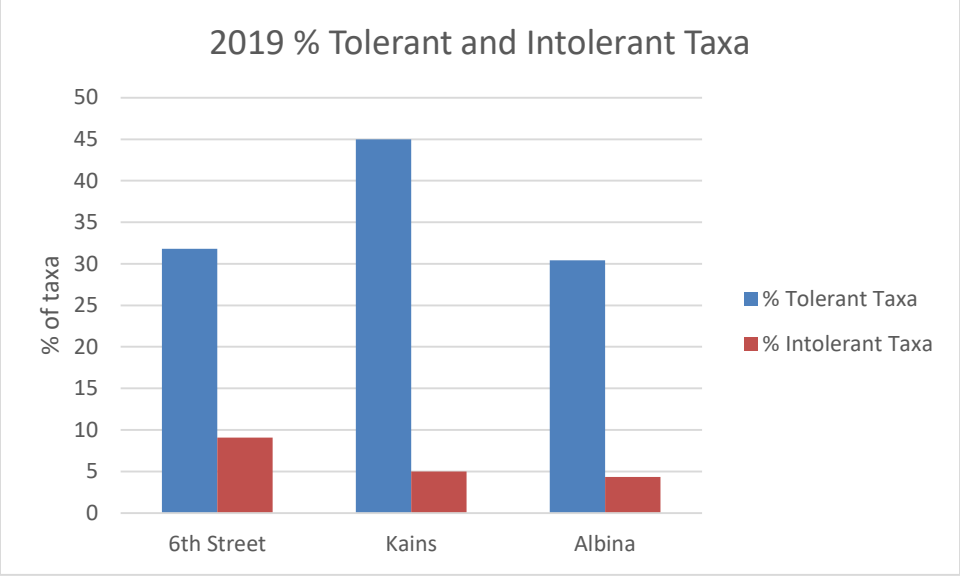

Figure 2: Tolerant vs. intolerant taxa at three sites on Codornices Creek in 2019.

Estimated Abundance

Another measure of water quality is the estimated abundance of BMI at each site. Estimated abundance at 6th St and Kains Ave was higher in 2019 than 2018, while Albina Ave had lower estimated abundance in 2019 than 2018. Taken with the previous graphs, these results support the possibility that something impacted the site between 2018 and 2019.

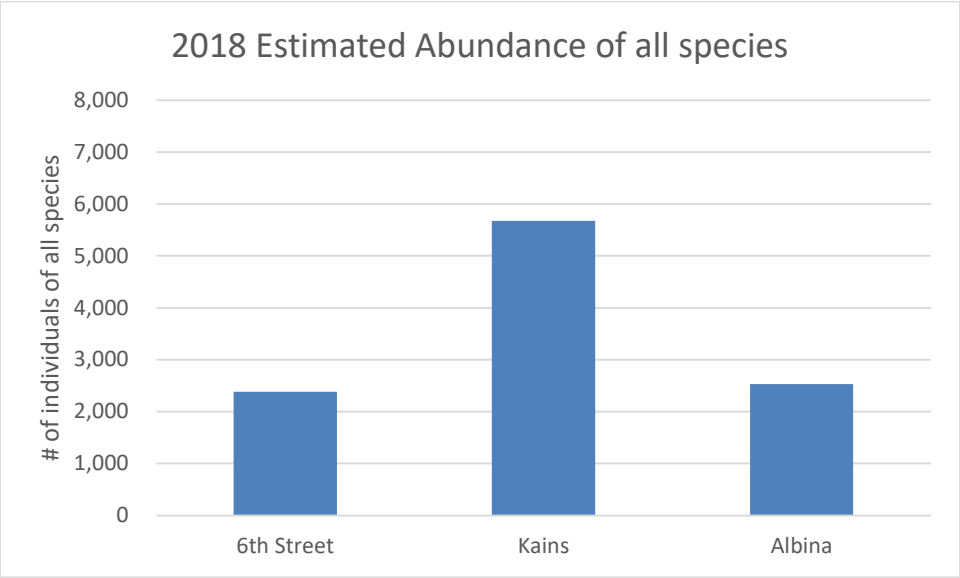

Figure 3: Estimated abundance at three sites on Codornices Creek in 2018.

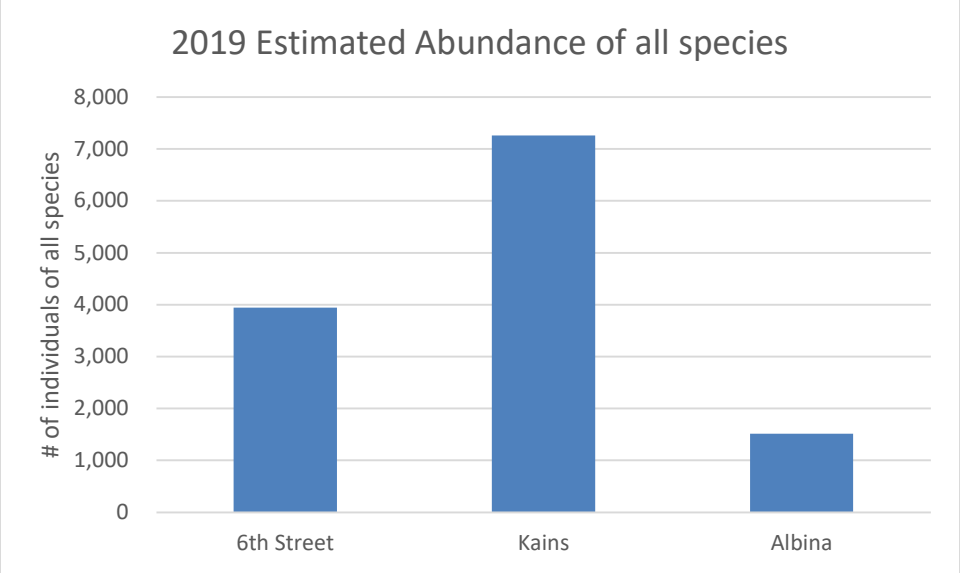

Figure 4: Estimated abundance at three sites on Codornices Creek in 2019.

Feeding Groups

BMI are often grouped into functional feeding groups, based on the feeding behavior of each taxa. In general, a diverse feeding group assemblage would indicate a healthy stream with diverse habitat and food sources. Shredders feed on large pieces of organic matter such as leaves, and their presence in a creek indicates that there is leaf input from the riparian zone. Scrapers feed on algae from rocks and stream plants, and their presence indicates that primary production is occurring. Collectors feed on small particulate matter in the creek, such as bits of algae or leaves that have been processed by shredders or scrapers upstream. Predators feed on other invertebrates in the stream.

In natural creeks, shredders tend to be more prevalent in the upper reaches of a stream, where leaf input is high; scrapers more abundant in the middle reaches, where the creek widens, sun reaches the water, and algae grows on rocks; and collectors are abundant in downstream reaches, where a lot of nutrient-laden detritus is coming down from the upper reaches. Predators tend to maintain a low level in all reaches.

It should be noted that Codornices Creek is a fairly urban stream, and may not have the same distinct reaches described above. Figures 5-10 show the feeding group assemblages present at each site for each year. Overall, collectors dominate at Kains Ave and Albina Ave, while scrapers dominate at 6th St.

Grier Gammon holds the D-net used to collect BMI.

6th St

At 6th St, the composition of collector feeding types changed a little between 2018 and 2019: collector-filterers decreased, while collector-gatherers increased. The dominant feeding group for both years was scrapers.

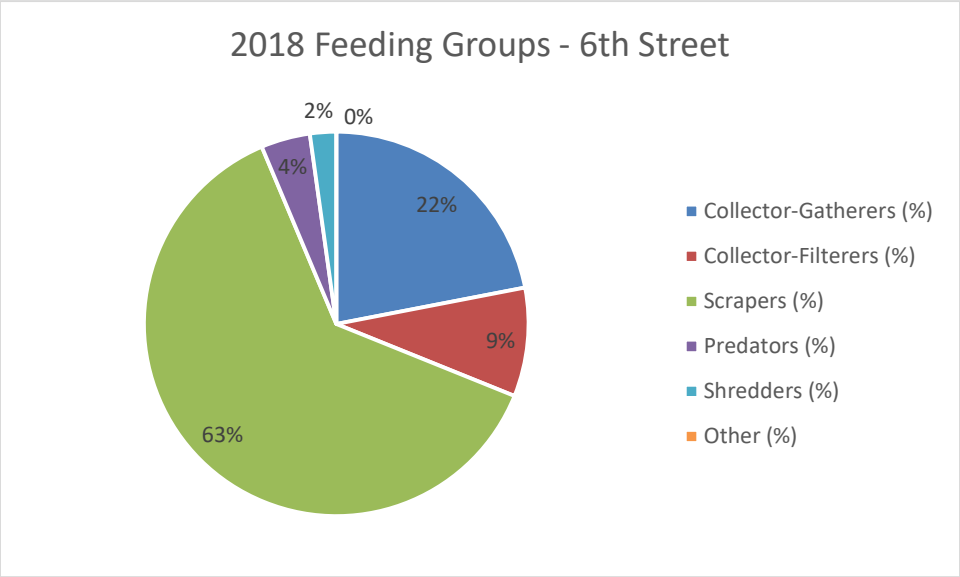

Figure 5: Feeding groups at 6th St in 2018.

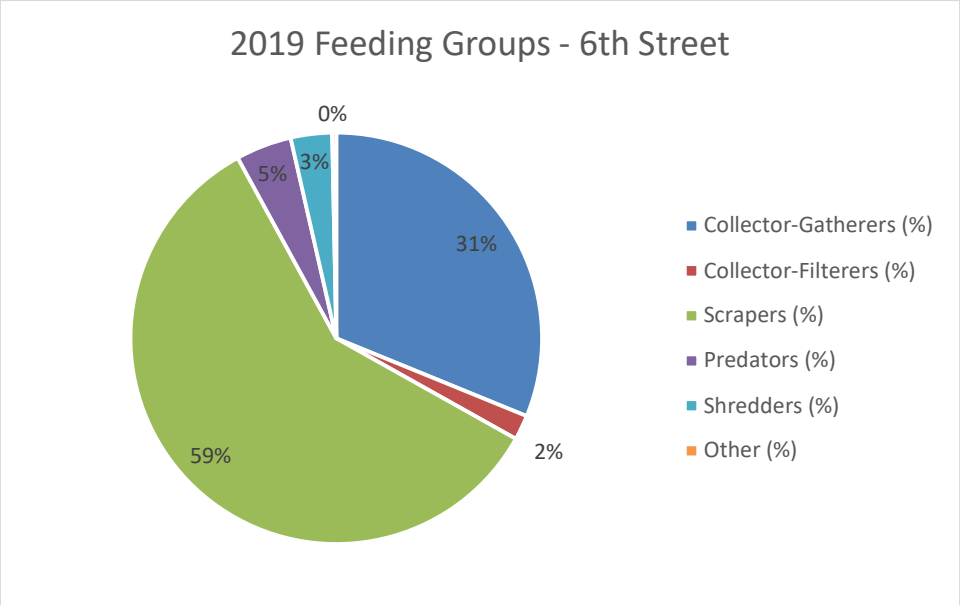

Figure 6: Feeding groups at 6th St in 2019.

Kains Ave

At Kains Ave, the dominant feeding group for both years was collectors, although again there was an increase in collector-gatherers and a decrease in collector-filterers from 2018 to 2019, similar to the shift at 6th St.

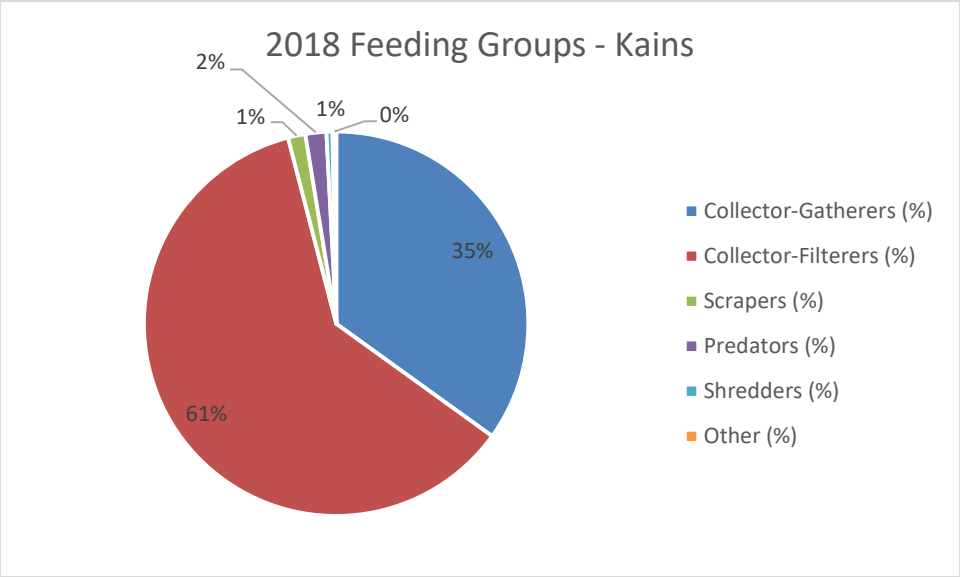

Figure 7: Feeding groups at Kains Ave in 2018.

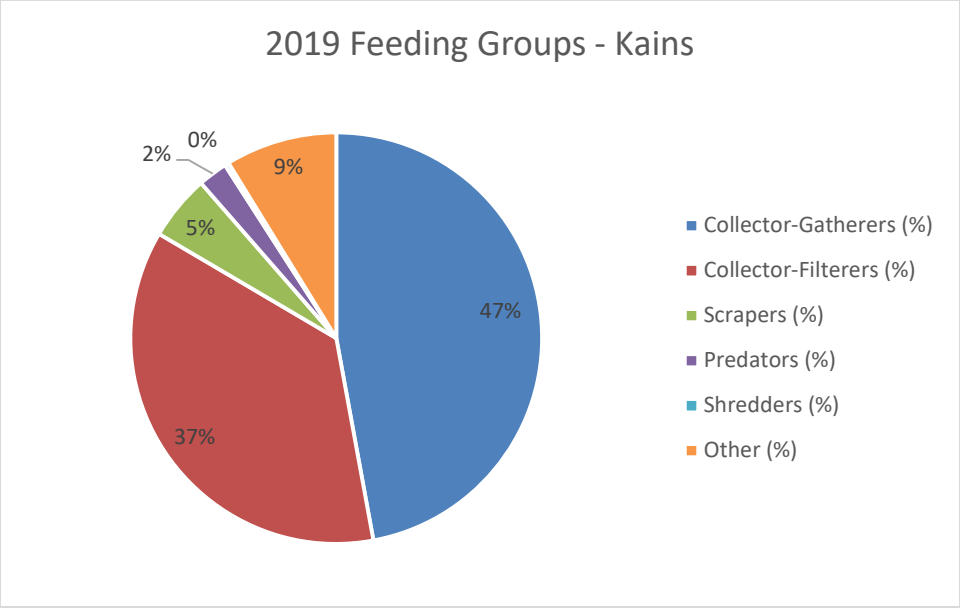

Figure 8: Feeding groups at Kains Ave in 2019.

Albina Ave

At Albina Ave, the dominant feeding group for both years was again collectors, and a similar increase in collector-gatherers and a decrease in collector-filterers was also seen at this site from 2018 to 2019.

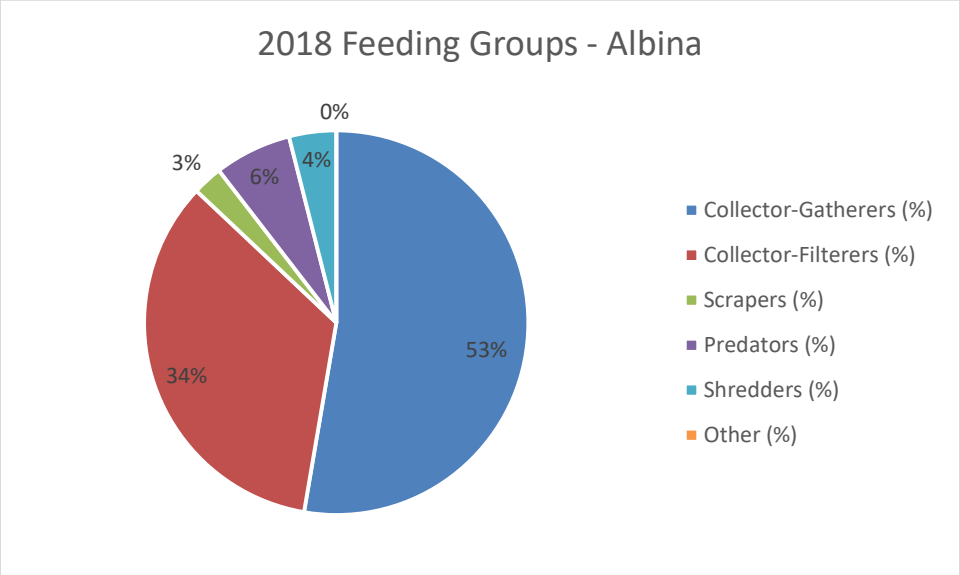

Figure 9: Feeding groups at Albina Ave in 2018.

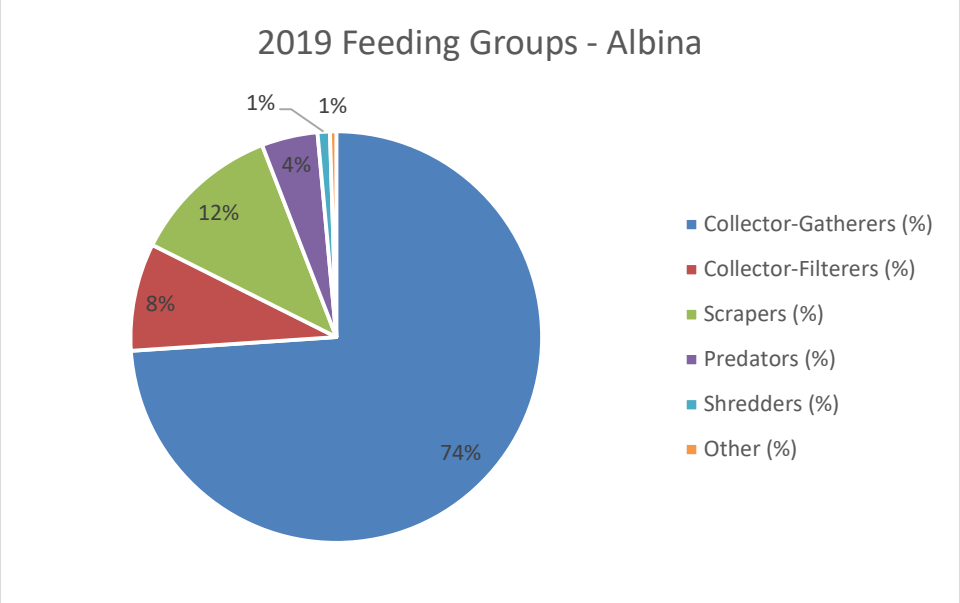

Figure 10: Feeding groups at Albina Ave in 2019.

Discussion

When we surveyed Codornices Creek two months after the fish kill in 2019, we were unsure whether we would find any BMI at all. We were happy to find plenty of BMI, although some changes in BMI composition were seen at the survey sites between the two years. Albina Ave, directly below the site of fire foam entry, may have been affected since we observed a doubling in pollution-tolerant species, a 50% reduction of intolerant taxa, and a 50% reduction in overall abundance of BMI.

When we looked at feeding groups, a general trend of fewer collector-filterers and more collector-gatherers was noted at all sites. Upon closer examination, the decrease in collector-filterer feeding type from 2018 to 2019 was due mainly to the decrease of Simuliidae (black fly larvae) at all sites. The main collector-gatherer increase was due to an increased number of Oligochaeta (aquatic worms) at all sites, although changes in other collector-gatherer taxa also had an impact on this metric. Simuliids have a tolerance value of 6 out of 10, 10 being the most tolerant and 0 being the least tolerant, while Oligochaetes have a tolerance value of 8. These changes to the feeding group assemblage contributed to the increase of pollution-tolerant BMI at all sites.

The terms “pollution intolerant” and “pollution-tolerant” are used to refer to BMI which either need high quality water or do not need high quality water, respectively, and they really speak to more than just the presence of contamination in the water. It is thought that factors such as high temperatures and low levels of dissolved oxygen can be just as prohibitive for the survival of so-called “pollution-intolerant” BMI as is the presence of oil, metals, or pesticides in the water (depending on the levels of pollution, of course).

How do streams recover from events like the entry of fire foam runoff? BMI communities often repopulate from upstream after storms or other population-decreasing events, or from adults laying eggs in the stream. It has been estimated that this repopulation may take between a season and a couple of years to occur, and it is likely that repopulation occurred at these sites between the fire foam incident in 2018 and our sampling date in 2019. Sadly, it is much harder for fish to repopulate a stream, unless there are survivors upstream or downstream, and no barriers to fish migration.

Volunteers at the end of the monitoring day in 2019.