

Crystal Springs (Helena, MT) as a Potential Fish Refuge for Tenmile Creek Fish Populations

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Introduction:

An increasing human population is putting growing pressure on Earth's ecosystems. This, coupled with climate warming trends and pollution levels mean that some habitats are not able to sustain their historical populations. One habitat of particular concern is the aquatic environment because of its amount of biodiversity and economic significance.

Increasing summer temperatures have been warming waters and decreasing the amount of dissolved oxygen in rivers and streams, making many waterways less hospitable for aquatic populations (Perlman, 2016).

In Lewis and Clark County Montana, Tenmile Creek is a popular recreational area for fishing and outdoor activities for the local community. However, in the summertime, Tenmile Creek can get too hot for fish populations to thrive due to decreasing amounts of dissolved oxygen. This, coupled with Montana's history of mining pollution, results in Tenmile Creek a 303(d) listed creek, which indicates it is an impaired water listing, showing existing habitat impairment (Culpo, 2018).

There are four predominant species of fish in Tenmile Creek: *Salmo trutta* (brown trout) followed by *Oncorhynchus mykiss* (rainbow trout), *Catostomus catostomus* (Longnose sucker), *Salvelinus fontinalis* (brook trout), and *Catostomus commersonii* (white sucker), (MNHP, 2018). Crystal Springs would need to have water quality sufficient to support all four species as well as the vegetation and their prey species, the macroinvertebrates.

Methods:

Data was gathered from Crystal Springs pond on October 26, 2018. Due to the physical geography of the pond, samples were gathered on the east and west sides. The water on both sides is approximately 0.15 meters deep with about 0.2 meters of sediment and is roughly 10 meters wide. Crystal Springs surfaces near the Lewis and Clark Fairgrounds and flows slowly towards Tenmile Creek (Stacey, 2018).

- Three water quality measurements were gathered 1 meter off shore and just above the sediment layer on both sides of the pond using a multiparameter water quality meter and Water Works Nitrate/Nitrite Test Strips.

- Temperature (°C), pH, Dissolved oxygen (mg/L), and nitrate/nitrite (ppm)

- The macroinvertebrate population was collected by dip-netting at 4 sites in different microhabitats around Crystal Springs

- 5 samples were taken at each site

- As macroinvertebrates were counted and identified in the field

- Data was then compared to literature values for the fish populations in Tenmile Creek



Figure 1: View of Crystal Springs



Figure 2: Sampling Crystal Springs



Figure 3: Aerial map of Crystal Springs, provided by Valeria Stacey from Lewis and Clark County.

Table 1: Water quality requirements to support a fish population in Crystal Springs

Variable	<i>Catostomus catostomus</i> (Longnose Sucker)	<i>Salvelinus fontinalis</i> (Brook trout)	<i>Salmo trutta</i> (Brown Trout)	<i>Catostomus commersonii</i> (White Sucker)
Temperature (°C)	10-15	1-22	1-22	13-25
pH	6.6-8.2	4.0-9.5	5.0-9.5	5.8-9.0
Dissolved Oxygen (mg/L)	≥ 5.6	≥ 6	≥ 6	≥ 2.4
Nitrate/Nitrite (ppm)	>10	>10	>10	>10

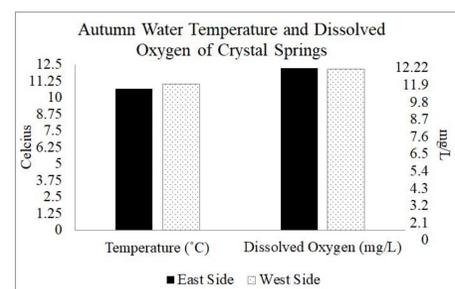


Figure 4: Autumn water temperature and dissolved oxygen in Crystal Springs

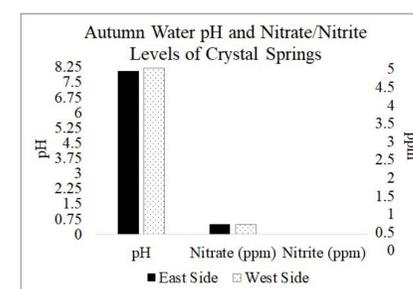


Figure 5: pH and nitrate/nitrite levels in Crystal Springs

Results:

The collected values for Crystal Springs in the fall of 2018

- Water temperature in Crystal Springs was 11.03 (°C) on the west side and the east side was 10.67 (°C)
- Average dissolved oxygen levels of the west side were 12.17 (mg/L) and the east side was 12.22 (mg/L).
- The pH for the west side was an average of 8.22 and 8.06 on the east side, which is slightly above a neutral pH.
- The nitrate and nitrite levels in Crystal Springs were on average 0.5 (ppm) nitrate and 0 (ppm) nitrite on both the east and west sides.

Aquatic life that was sampled from Crystal Springs revealed a dense population of *Spirogyra/Cladophora* (Filamentous Algae) covered approximately 80% of Crystal Springs pond. This provided a home for the two families of macroinvertebrates found.

- 8 *Corixidae* (Water Boatmen)
- Approximately 100 *Hydrachnidia* (Water Mites) were collected and identified

Conclusion:

The abiotic components collected in the fall of 2018 indicates this could be a promising summer refuge for fish populations in Tenmile Creek. The water temperature and dissolved oxygen is within required parameters. The pH is within range and the nitrate/nitrite is below the values the fishes in Tenmile Creek need.

All four species of fish primarily eat available aquatic invertebrates. The Longnose Sucker and White Sucker will feed on some aquatic plants and algae while the brown trout will also eat other small fish. Brook trout have a more specific diet of mainly *Ephemeroptera* (Mayflies) and *Trichoptera* (Caddisflies) (Montana Field Guide, 2018). While the macroinvertebrate population in Crystal Springs is small, a possible connection to Tenmile Creek could be expected to increase diversity and abundance.

A connection of Crystal Spring to Tenmile Creek to provide a refuge for fish populations is worth further study as aquatic ecosystems are put under increasing stress from a changing climate. Next steps for this potential connection effort are that more sampling at different times of year.

Acknowledgements

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Citations:

- Culpo, M. (2018, October 2). Crystal Springs Creek [E-mail to the author].
 Perlman, H. (2016); USGS. Water properties: Temperature. Retrieved from <https://water.usgs.gov/edu/temperature.html> (accessed Dec 2018).
 Montana Field Guide. (2018) <http://fieldguide.mt.gov/displayFamily.aspx?class=Actinopterygii> (accessed Nov 2018).