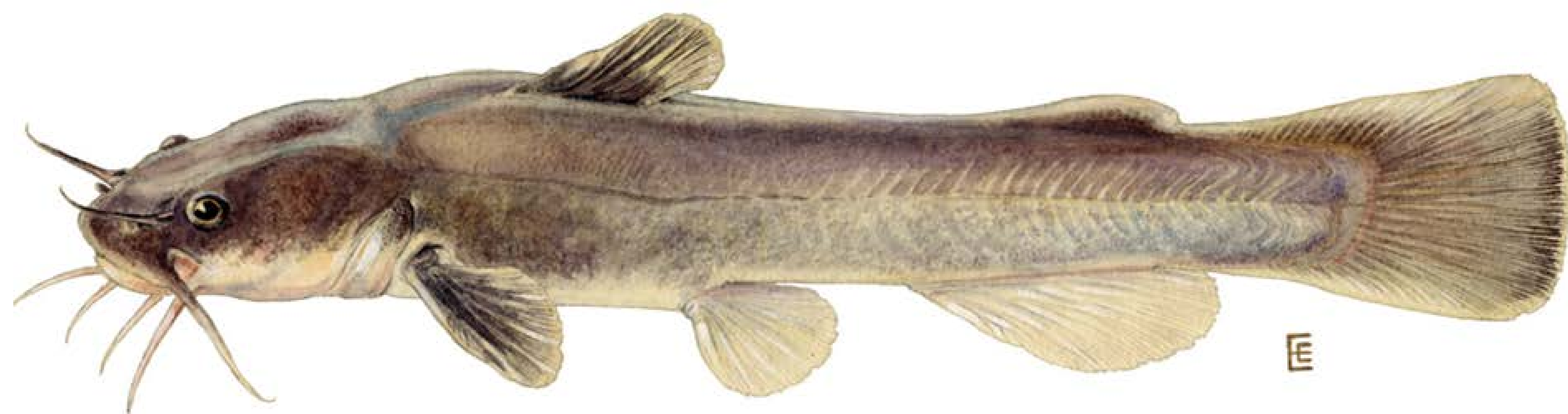


Introduction

There are only two streams in Vermont that have been found to contain the stonecat (*Noturus Flavus*). Because of this observation, we researched the differences between Allen Brook, a stream without stonecats, and Upper LaPlatte, harboring the stonecat. The Allen Brook in Williston, Vermont is a similar stream to Upper LaPlatte in terms of macroinvertebrates species and climate. The two main habitat differences are river substrate and dissolved oxygen. Substrate, organic and inorganic materials, provides habitat for all biological elements. Stonecats have been found to prefer freshwater, temperate climates, riffles and high gradient reaches, and gravel bars. They breed annually in monogamous pairs around 25°C, nesting from April to July. Stonecats are nocturnal invertivores, feeding primarily on mayfly larvae (Ephemeroptera), stoneflies (Plecoptera), and crayfish (Antrologna). Dissolved oxygen is vital to aquatic invertebrates because the percent of oxygen in the stream determines the effectiveness of their respiration. Usual healthy levels of dissolved oxygen for aquatic life are between 6 and 9 ppm. The stonecat is found to prefer higher levels of dissolved oxygen.

Hypothesis - If the dissolved oxygen measures lower at the LaPlatte stream site than the Allen Brook stream site, then the dissolved oxygen is a negligible abiotic factor in determining stonecat habitat.



The Effect of Dissolved Oxygen on Stonecat Habitat

Champlain Valley Union High School: Erika Barth and Alex von Stange

Procedure

The Water Quality Test Kit was used to determine the amount of oxygen in the water at the stream site. Following specific RACC protocol, the sampling bottle was submerged with the cap tightly on the bottle, the cap was removed to allow the bottle to fill with the water from the stream site, the cap was then fastened. The cap was removed and 8 drops of Manganous Sulfate ($MnSO_4$) and 8 drops of Potassium Iodide were immediately added. The solution was then mixed by inverting the bottle several times. The precipitate settled at the bottom of the bottle and 8 drops of sulfuric acid (H_2SO_4) was added. The bottle was then mixed until the precipitate and reagent had dissolved completely. The titration tube was then filled with 20 mL of the solution. The titration solution (Sodium Thiosulfate - $Na_2S_2O_3$) was collected into the titrating plunger and inserted into the cap of the titration tube. The titrant was slowly dispensed until the solution turned light yellow. The titration tube was gently mixed to ensure the reaction had gone to completion. After the titration was removed 8 drops of Starch Indicator solution was added to the sample, which then turned blue. The amount of titrant added to the solution was noted.

Allen Brook

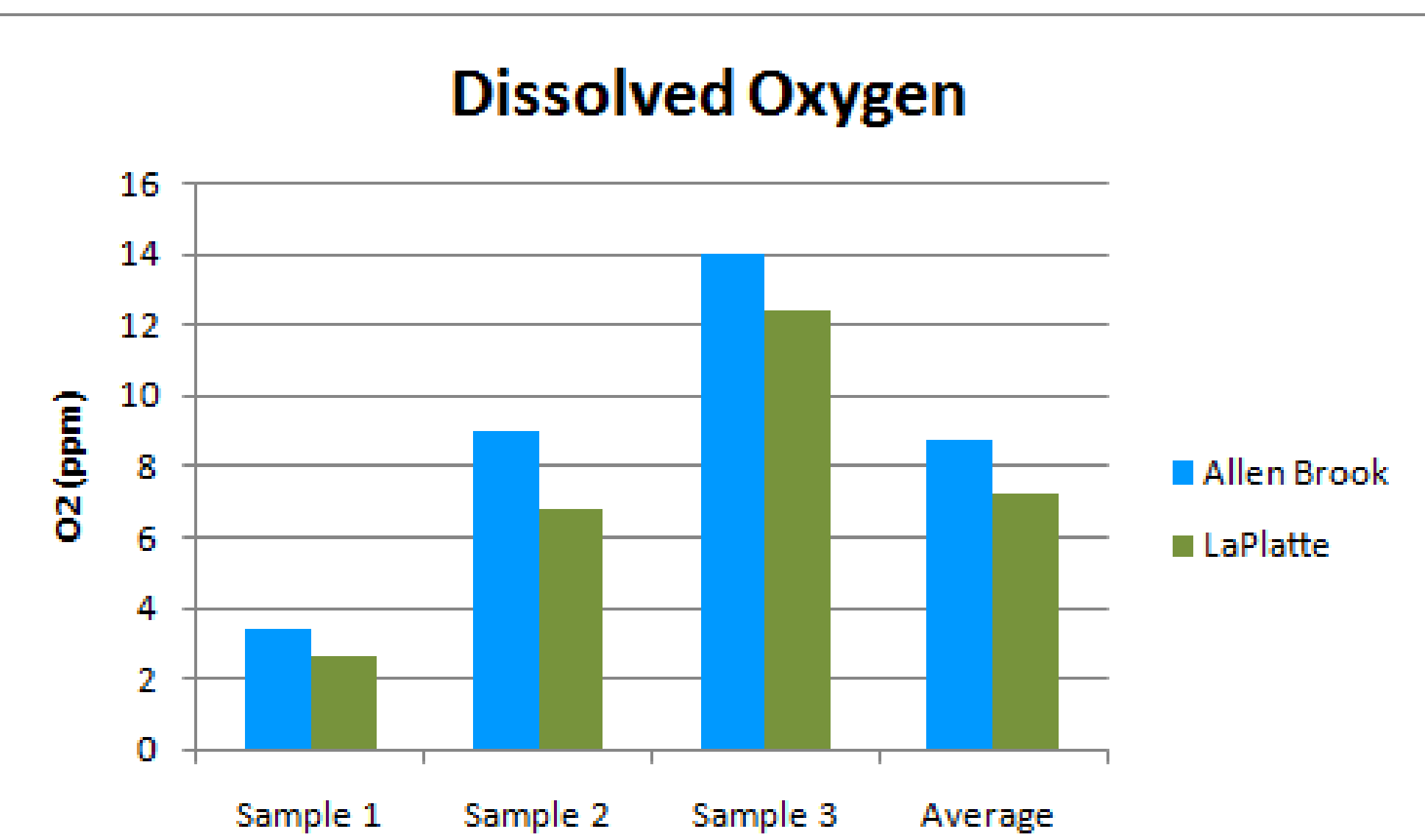


LaPlatte River



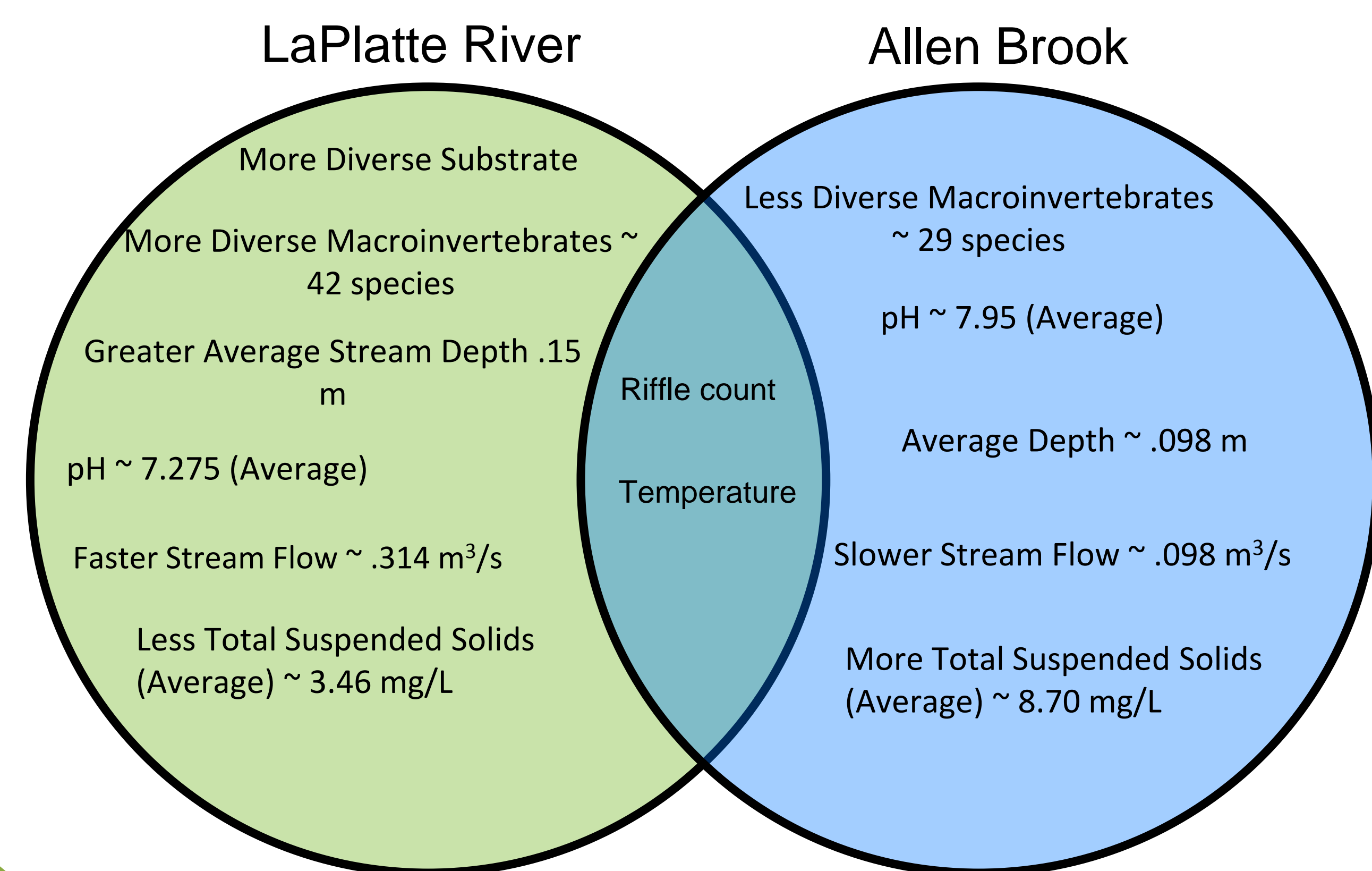
Results and Observations

- Dissolved oxygen levels are dependent upon temperature, riffles and pollution.
 - Allen Brook has significantly decreased stream turbulence, however has higher dissolved oxygen levels.
 - Stream temperatures were moderate and relatively similar; dissolved oxygen levels were significantly different.
 - There was more evidence of pollution/potential for pollution at the Allen Brook
 - Surrounding Land: Commercial and Agricultural uses



Sample 1		Sample 2		Sample 3	
Allen Brook	LaPlatte	Allen Brook	LaPlatte	Allen Brook	LaPlatte
9/13/2015	8/3/2015	9/29/2015	9/17/2015	11/11/2015	11/4/2015
20.2 °C	26.7 °C	23.6 °C	23.8 °C	13.7 °C	16.5 °C
0.043 m ² /s	0.393 m ² /s	NA m ² /s	0.152 m ² /s	2.45 m ² /s	0.336 m ² /s

Habitat Comparison



Resources & Acknowledgements

- CWDD. "Vermont EPSCoR." *Streams Project Data*. CWDD. 10 Feb. 2016. Web. Feb-Mar. 2016.
- Eaton, Ashley. "LaPlatte River - Tier 2 Report." *LaPlatte River*. University of Vermont, 17 Sept. 2014. Web. 14 Mar. 2016.
- "Learning Center." *Leaf Pack Network*. Stroud Water Research Center, 2015. Web. 14 Mar. 2016.



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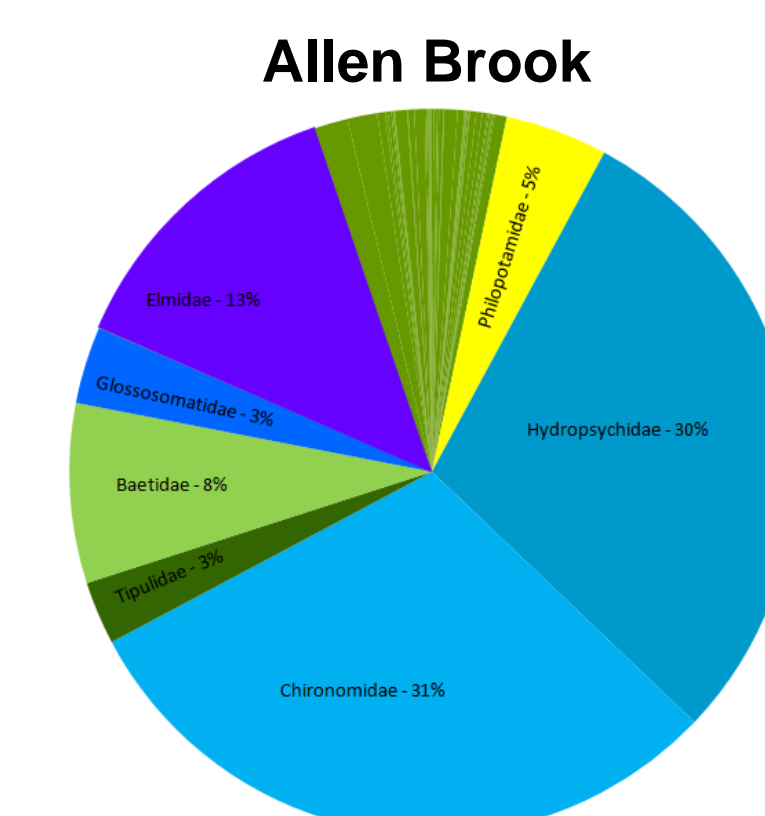
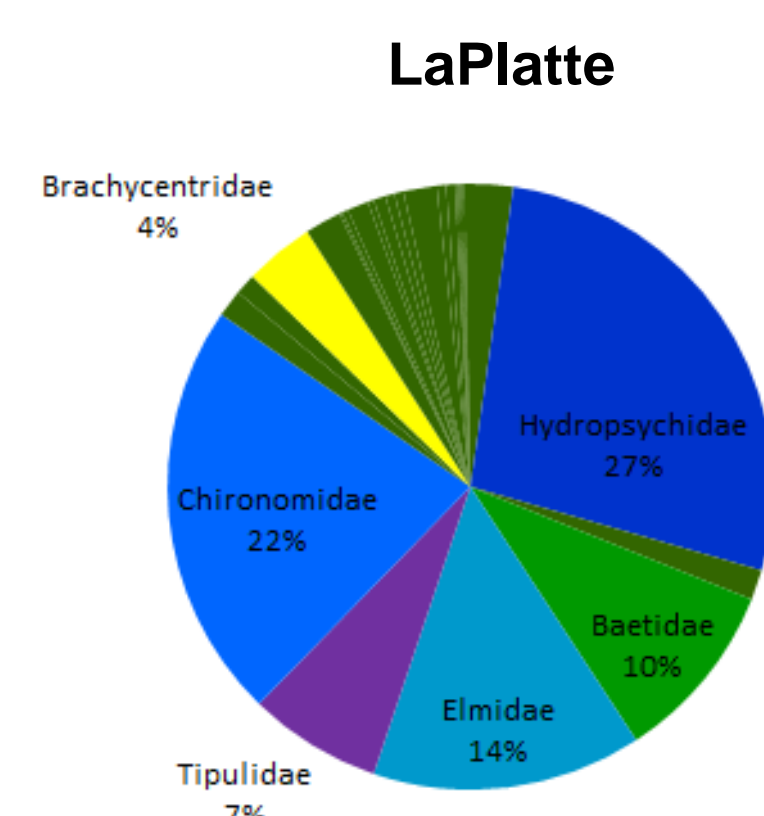
Macroinvertebrate Data

LaPlatte -

- Macroinvertebrates in the LaPlatte River were divided among 42 unique species.
- Chironomidae and Hydropsychidae composed only 49% of the total species count.

Allen Brook -

- Over 61% of the available macroinvertebrates in the Allen Brook are comprised of only two species, Chironomidae and Hydropsychidae.
- The total amount of unique macroinvertebrate species in the Allen Brook were 29



Discussion and Analysis

Lower levels of dissolved oxygen increase the presence of biotic organisms investigated, creating a more suitable habitat for particular species. Specifically, dissolved oxygen levels at the LaPlatte were more than suitable to host aquatic life.

- Dissolved Oxygen
 - Dissolved oxygen levels at LaPlatte in chronological progression, were observed to be 2.5, 7, and 12 parts per million. As reported in the introduction, the average of these levels (7 ppm) supports growth and development.
 - Dissolved oxygen levels at the Allen Brook were higher than those at the LaPlatte; in chronological progression, observed levels of dissolved oxygen were 3, 9, and 14 parts per million, respectively. As seen in the introduction, the average of these levels (9 ppm) supports abundant growth, ensuring that dissolved oxygen levels will not be the constraining factor in life development within the river.
 - Allen Brook is, on average, colder than the LaPlatte.
 - Allen Brook consistently has a lower water depth, .1 meters compared to .216 meters at the LaPlatte: Low water depth allows for a more thorough penetration of the oxygen throughout the water. The deeper the water is, the more time it takes for oxygen to reach maximum dissolution within the water.
 - Allen Brook has an increased amount of riffles in relation to the depth when compared to the LaPlatte.
- Biotic Factors
 - Diverse aquatic insect species eaten by the stonecat are found in the LaPlatte:
 - The available macroinvertebrates in the LaPlatte River were divided among 42 unique species.
 - Chironomidae and Hydropsychidae composed only 49% of the total species count.
 - The Allen Brook was less diverse in terms of consumable macroinvertebrate species:
 - Over 61% of the available macroinvertebrates in the Allen Brook are comprised of only two species, Chironomidae and Hydropsychidae.
 - The total amount of macroinvertebrate species in the Allen Brook were 29.
 - Decreased substrate variability could be a factor leading to decreased biotic diversity in the Allen Brook vs. the LaPlatte.
 - LaPlatte Substrate - 37% >256 mm, 17% 16 - 64 mm, 23% <2.0 mm
 - Allen Brook Substrate - 52% 16-64 mm
 This decreased variability in substrate at the Allen Brook may explain why there is less biotic presence, due to decreased shelter for macroinvertebrates and the stonecat.

Conclusion

The dissolved oxygen levels at the LaPlatte stream were lower than at the Allen Brook, refuting the hypothesis that the LaPlatte provides more suitable DO levels for the stonecat. Thus, there are other determining factors contributing to the stonecat's success at the LaPlatte River.