Assessing the Ecology of the Flint River, Above and Below a Century-Old Dam

Chloe Summers : *summersj@umich.edu*, Arianna Elkins : *arelkins@umich.edu*,

Cason Konzer : *casonk@umich.edu*, Heather Dawson : *hdawson@umich.edu*

repository : *https://github.com/casonk/Flint_River_Ecology* | website : *https://flintriverecostudy.com*

Where is Flint?

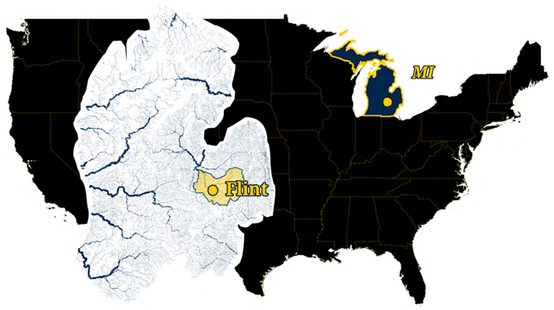


Figure 1. Michigan location in USA and Flint location in MI.

Introduction

- The Hamilton Dam is the terminal dam on the Flint River and was constructed in 1920. The dam is in the urban city of Flint, Michigan and prevents fish passage upstream, but many fish migrate from the Great Lakes to this dam during spawning periods.
- Upstream reaches of the Hamilton dam consist of a wide riparian zone, whereas downstream is composed mainly of cemented structures.

Hypotheses

1. **Because of influences from Great Lakes fishes, contaminant loads of fishes will be higher downstream than upstream.**
2. **Due to habitat availability, water quality scores based on benthic macroinvertebrate communities will be higher upstream than downstream.**
3. **Because many Great Lakes fishes migrate to the dam, fish population diversity indices will be higher downstream of this terminal dam than upstream.**

Methods

- Fish were obtained from four sites near the Hamilton Dam (Figure 2) using cast nets, gillnets, hoop traps, electrofishing (Figure 3), and hook and line and select fish were preserved for contaminant analysis.
- Benthic macroinvertebrates were sampled upstream and downstream of the dam in the spring and fall and water quality scores were assessed.
- Fish species were obtained and measured, weighed, tagged (Figure 3), and released and diversity indices were compared downstream vs. upstream.

Methods

Figure 2. Study site map for the Flint River Ecology Study.

Collect data on the ecology and health of the Flint River above and below the Hamilton Dam before the dam removal and the restoration of the Flint River to gain an understanding of the present ecosystem and provide a baseline for measures of restoration outcomes.

Figure 3. Sampling Methods.
Top-Left:Hoop Trap, Top-Right:Electrofishing, Bottom-Left:Tagging, Bottom-Right:Cast Net.

Contaminant Analysis

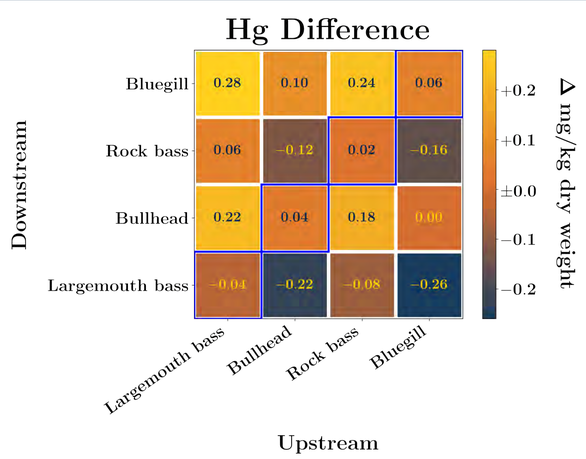
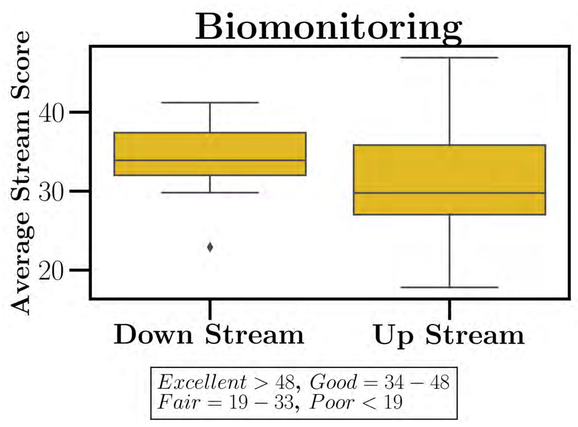


Figure 4. Mercury levels were compared between the same species captured below the dam and above the dam. The values represent the difference in mg/kg of mercury between species from downstream vs upstream (*downstream* − *upstream*).

Benthic Macroinvertebrates



Excellent > 48, *Good* = 34 − 48
Fair = 19 − 33, *Poor* < 19

Figure 5. The average stream score assessed through benthic monitoring within the Flint River Watershed. Data was collected from above and below the Hamilton Dam.

Fish Diversity

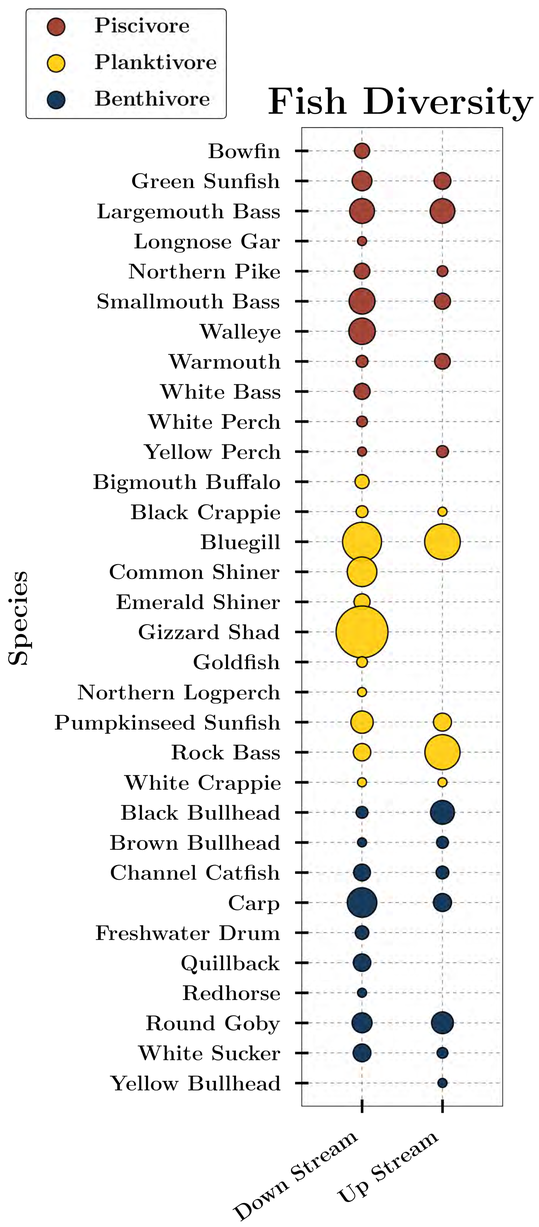


Figure 6. Catches are compared between downstream sites and upstream sites. Notable differences show much higher catches of gizzard shad below the dam and rock bass above the dam.

Discussion

Hypothesis 1 was supported only in non-piscivorous fish.

- Mercury levels were higher in paired species caught downstream vs upstream except in piscivorous fish (Figure 4).
- There were more species downstream with higher levels of mercury likely due to the fact that Great Lakes–influenced fish bring more contaminants downstream.

Hypothesis 2 was supported.

- Water quality scores based on benthic macroinvertebrates were "good" upstream, and downstream we found a lot of zebra mussels rather than benthic macroinvertebrates (Figure 5).
- Water quality scores based on benthic macroinvertebrates in the City of Flint are lower where channelization of the river is common.

Hypothesis 3 was not supported.

- Using Simpson's diversity index fish diversity was found to be lower downstream, 0.67, than upstream, 0.75.
- Even though 31 species were caught downstream vs. 20 upstream, the overall catch was dominated by Gizzard shad downstream, making the species evenness and thus the diversity less than upstream (Figure 6).

Acknowledgements

For funding and support we thank . . .

- The Community Foundation of Greater Flint.
- Saginaw Bay Watershed Initiative Network.
- UM-Flint Office of Research.
- UM-Flint CAS Opportunity Fund.
- UM-Flint Urban Institute for Racial, Economic, & Enviornmental Justice.
- The Gary and Colleen Pace Field Biology Scholarship.
- Those who have worked on or helped with the project including Megan Heyza and many UM-Flint students.
- The Flint River Watershed Coalition.

References

[1] Bankston, N. (2014). Automobile Industry Growth from 1916 to 1989: The Effect on Flint, Michigan Climate.

[2] Bernier, J., Brousseau, P., Krzystyniak, K., Tryphonas, H., & Fournier, M. (1995). Immunotoxicity of heavy metals in relation to Great Lakes. Environmental health perspectives, 103 Suppl 9, 23-34.

[3] McGoldrick, D. J., & Murphy, E. W. (2016). Concentration and distribution of contaminants in lake trout and walleye from the Laurentian Great Lakes (2008–2012). Environmental Pollution, 217, 85-96.