Macroinvertebrates as an Indicator of Water Quality in Outflow Streams

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Introduction

The evaluation of lake/stream water quality is an important part of the duties of surveyors, researchers, and managers. Over the last three to four decades, the analysis of water quality using bioassessment surveys has grown in popularity. Bioassessment surveys involve evaluating the type and abundance of organisms present in the water body. We can then use what was found in the ecosystem to determine the health of the system. Macroinvertebrates, particularly insects, are especially useful in the case of stream systems. This is because aquatic insects are typically abundant in streams, are sensitive to environmental impacts, and are relatively immobile, leaving them susceptible to environmental perturbations such as pollution or physical alterations to streams. However, some insects are tolerant of poor long-term water quality, so evaluating the composition of the aquatic insect community informs us about the condition of the stream. This bioassessment survey was a piece of a greater management plan being constructed for East Caroga Lake in Fulton County, New York. The resulting community analysis, as well as other collected data, will be used for future lake management planning.

Field & Lab Methods

- Two samples were taken from the outflow of East Caroga Lake
  - Coordinates: 43.1254928, -74.4989850
- Samples collected on October 4th, 2020
- First sample taken from high flow riffle, second sample taken from low flow pool.
- Samples collected using 1ft³ Surber Samplers (Fig. 1)
- Sample collection lasted for five minutes at each habitat
- Stored the contents of the samples in 1L bottles (Fig. 2)
- Samples were later sorted through, and invertebrates were stored in a 70% ethanol solution for preservation
- Individual invertebrates were then identified to genus if possible, family if not, and counted for overall abundance.
- Microsoft Excel was used for data analysis.

Figure 1. Image of 1ft³ Surber sampler used in this experiment

Figure 2. Image of the sample bottle used to preserve and hold samples

Sampling Results

- A total of 73 individuals were processed. 16 were from the pool site, and 57 from the riffle site (Fig. 3).
- Pool habitat contained a greater diversity of Orders, while riffle habitat had the greater abundance of individuals (Table. 1)
- Riffle Habitats were dominated by Caddisflies, specifically members of the genus *Chimarra*, and *Cumadopsyche* (Table. 1)

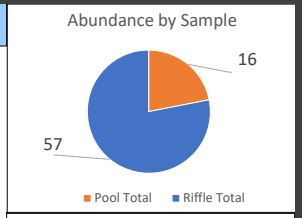

Figure 3. Shows the total number of individuals collected at each sampling site.

Habitat	Order	Family	Genus	Count
Pool	Caddisfly	Hydropsychidae	*Smicridia*	1
Pool	Isopods	Asellidae	*Caecidotea*	1
Pool	Mayfly	Heptageniidae	*Stenacron*	1
Pool	Amphipod	Gammaridae	*Gammarus*	5
Pool	True Flies	Chironomidae	*Ablabesmyia*	2
Pool	True Flies	Empididae	*Hemerodromia*	1
Pool	True Bugs	Belostomatidae	*Belostoma*	1
Pool	Trombidiformes	Hydrachnidia (Water Mites)	x	2
Pool	Cyclopoida (Copepods)	x	x	2
Riffle	Caddisfly	Philopotamidae	*Chimarra*	19
Riffle	Caddisfly	Philopotamidae	*Dolophilodes*	1
Riffle	Caddisfly	Hydropsychidae	*Hydropsyche*	2
Riffle	Caddisfly	Hydropsychidae	*Cheumatopsyche*	16
Riffle	Mayfly	Heptageniidae		2
Riffle	Damselfly (Odonata)	Coenagrionidae	*Argia*	1
Riffle	True Flies	Empididae	*Hemerodromia*	6
Riffle	Beetles	Elmidae	*Stenelmis*	4
Riffle	Flatworms	x	x	6

Table 1. This table shows total number of individuals in each taxonomic group identified within the East Caroga Outflow samples.

Analysis of Data

For this experiment, we used two of the common bioassessment methods, and compared the resulting analyses.

The first method used was the family level Hilsenhoff Biotic Index, or FBI. The FBI works by assigning point values to the different families of invertebrates. The points operate on a scale from 0 – 10. The higher the point value of the family, the greater its ability to survive in poor water quality (Hilsenhoff, 1988). The second method employed was a genus level Hilsenhoff Biotic Index, or GBI. The GBI is similar to the FBI, but it assigns point values to genera of invertebrates as opposed to families. The GBI works on a scale from 0-5 (Hilsenhoff, 1982).

For both methods, a total score is found based on the average score of all invertebrates present. This final score determines the water quality in the stream.

Note that Flatworms, Copepods, and Water Mites were omitted from the analysis, as they were either not identified to family or genus, or there is little known about their biotic index values.
Also note that macroinvertebrates not identified to genera will have their family score used in the genus level biotic index.

Water Quality Scores

Family Level Score: **3.75 [Very Good]**

Genus Level Score: **2.59 [Good]**

Discussion

- Despite having a lower overall score, the GBI results indicate that the stream is of slightly poorer water quality than that suggested by the FBI. This is the result of the differing scales used for scoring invertebrates.
- Both methods have pros and cons. The genus index is a more accurate representation of the stream water quality. However, the family index allows identification of individuals to occur much faster than genus.
- Both of the indices were dominated by the overwhelming amount of caddisflies within the sample. Philopotamidae *Chimarra* and Hydropychidae *Cumadopsyche* represented over half of the individuals included in this bioassessment, therefore playing a major role in the final scores.
- Based on the results of these bioassessments, we know that the water in East Caroga Lake outflow is likely of good quality.
- Other surveying and sampling must be conducted in order to determine the actual state of water quality in East Caroga. However, this bioassessment provides us with a rough estimation.

References

Hilsenhoff, W. L. (1988). Rapid field assessment of organic pollution with a family-level biotic index. *Journal of the North American benthological society*, *7*(1), 65-68.

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Acknowledgements

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