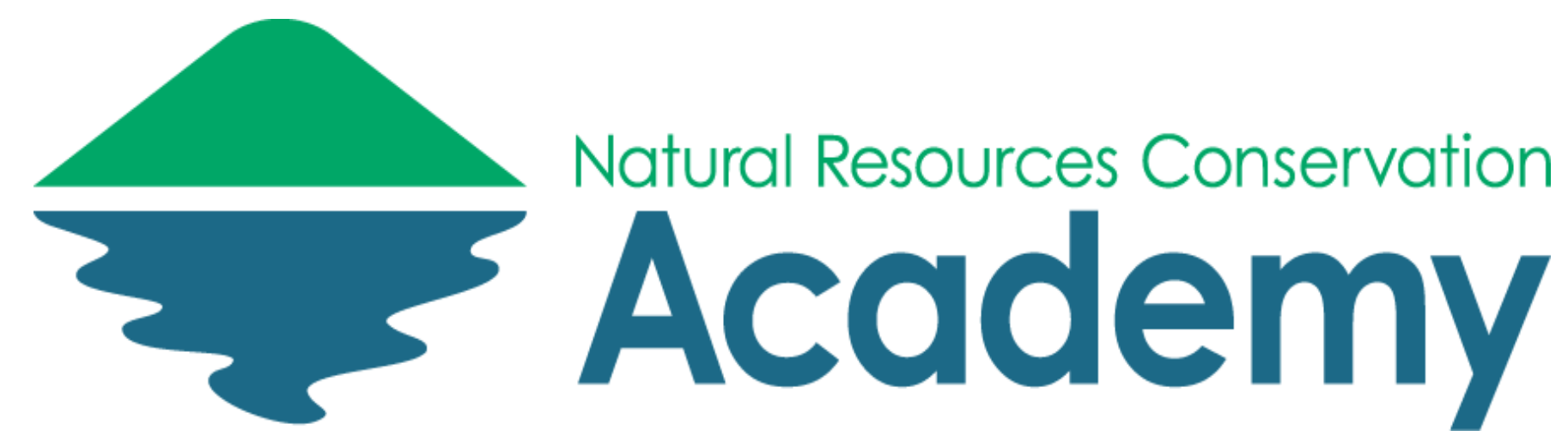# Macroinvertebrates as Bioindicators to Guide Restoration in the Salmon Kill Watershed

Mari Cullerton[1] and Tracy Brown[2]
[1]Housatonic Valley Regional High School, [2]Trout Unlimited

Natural Resources Conservation Academy

TROUT UNLIMITED

UCONN UNIVERSITY OF CONNECTICUT

ABSTRACT

About half of the lakes and rivers in the United States have been severely polluted and deemed unhealthy for human activities or aquatic life. Given limited time, supplies and funding, areas with the most degradation should be identified to guide restoration activities. Consequently, the objective of this project was to use macroinvertebrates as bioindicators to determine which areas of the Salmon Kill Watershed needs the most management and aid.

To guide restoration efforts, macroinvertebrates were sampled from four sites distributed throughout the Salmon Kill Watershed: Wachocastinook Brook, Salmon Kill, Ball Brook and Factory Brook. The Hilsenhoff Biotic Index and the EPT (*Ephemeroptera, Plecoptera, and* Trichoptera) Index were then used to determine which of the brooks were the most degraded.

The major conclusions drawn from this project were that the Salmon Kill had the worst water quality, while the Wachocastinook Brook was the least degraded. These findings will be implemented by focusing resources, such as time and funds, on the sites that need the most management to benefit the entire watershed. Thus, areas that do not require management will be left undisturbed.

INTRODUCTION

Water is one of the most important resources on Earth, but only 2.5% of this is freshwater. Of this freshwater 1.2% comes from surface water (lakes, streams, swamps etc.) and according to Conserve Energy Future, 46% of lakes and 40% of rivers in the United States "are considered unhealthy for swimming, fishing, or aquatic life." In the northwest corner of Connecticut, the Salmon Kill is being monitored for pollution because of its potential habitat for the Brook Trout. Over the past couple of years, Trout Unlimited has been heading this restoration project in attempt to reduce pollution and warm temperatures in this watershed.

Given limited time, supplies and funding, it is important to know which areas of the stream need the most aid. The Biotic Index is often used to assess the quality of an aquatic environment, with an index of 0, representing organisms that are very intolerant to pollution, to 10, indicating organisms that are tolerant of pollutants. In this form of assessment, there are three groups or types of macroinvertebrates that are strong indicators of stream or river health. These are the *Ephemeroptera, Plecoptera, and Trichoptera* (mayfly, stonefly, and caddisfly), or EPT for short (Fig. 1). Ultimately, the absence of these species help establish which areas are most degraded, and helps formulate and guide management decisions by looking at both biotic issues as well as abiotic factors, such as temperature and oxygen levels.

This project will evaluate the Biotic Index of macroinvertebrates in certain zones of the Salmon Kill Watershed to assess areas with the worst water quality. Then, rather than managing the entire stream, the areas that require the most help can be assisted. The information will be used to create habitat that is more convivial for native Brook Trout (*Salvelinus fontinalis*).


Figure 1. (a) Mayfly (*Ephemeroptera*), (b) stonefly (*Plecoptera*) and (c) caddisfly (*Trichoptera*) are three macroinvertebrates that are strong indicators river health. Photos taken by David F. Raikow, Aquatic Insects of Central Virginia (also native to Connecticut) and from West-Fly.

MATERIAL AND METHODS

Study Area and Organism

- Project was conducted at four sites (Fig. 2): Wachocastinook Brook, Salmon Kill, Ball Brook, and Factory Brook.
- Both the Salmon Kill and Factory Brook sites are located in direct, or almost direct sunlight; while the Wachocastinook and Ball Brook sites are in forested areas with larger canopy cover.
- Out of all the sites, Wachocastinook Brook is the least degraded.
- All macroinvertebrates were sampled, but the three most significant organisms are Ephemeroptera, Plecoptera and Trichoptera (Fig. 1).
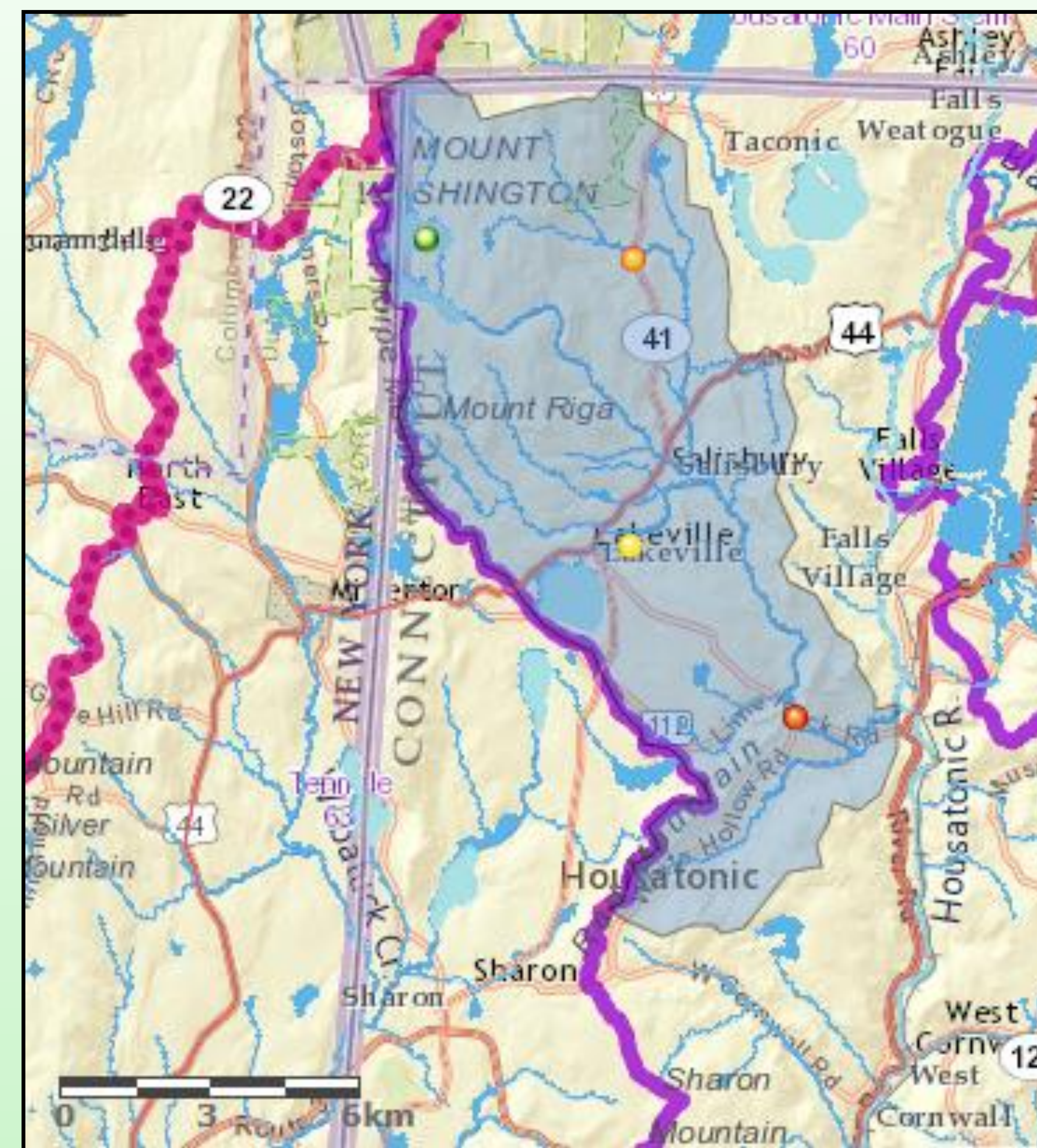
● - Wachocastinook Brook (42.02095, -73.4816)
● - Ball Brook (42.01722, -73.4308)
● - Factory Brook (41.96463, -73.4314)
● - Salmon Creek (41.93374, -73.3908)

Figure 2. Map of the Salmon Kill Watershed. The location of the four study sites are indicated by different colored dots.

Wachocastinook Brook   Ball Brook   Factory Brook   Salmon Kill
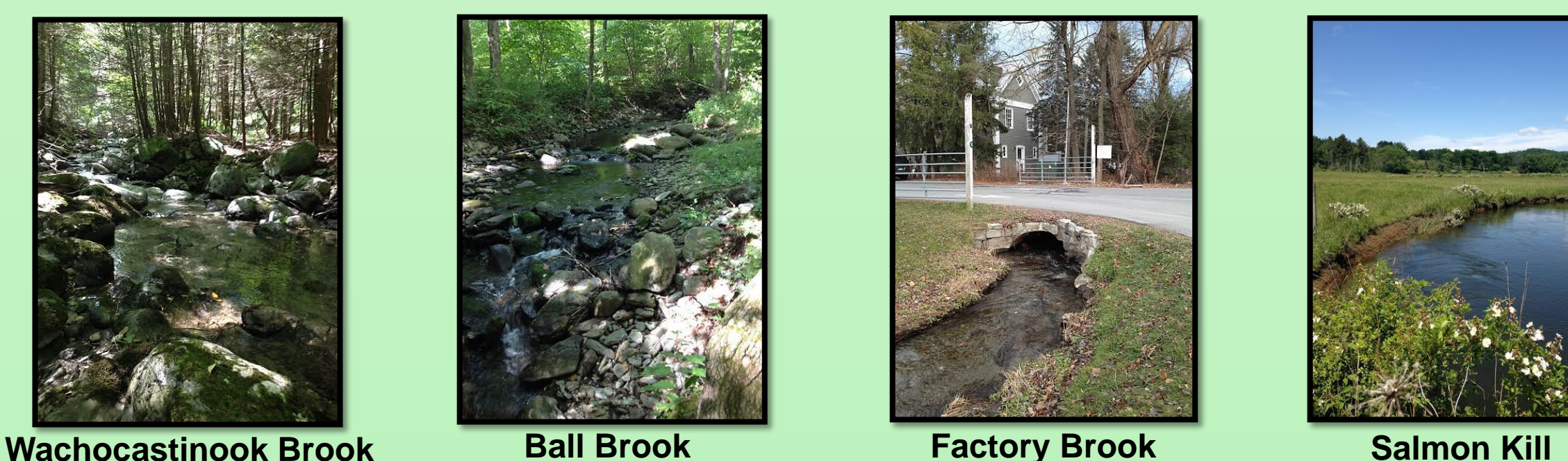
Data Collection Protocol and Analysis

- Collect macroinvertebrates with a D-net no. 60 or fine sieve (or finer) and sort them by species in ice cube trays with water.
- After separation, count the number of individuals per species and record the data. Then, place one of each species into labeled vials (by species) and send it to the DEEP for further analysis.
- Utilizing the data recorded, use the EPT Index and Biotic Index to determine the water quality of the stream.

Data were provided by the Connecticut Department of Energy & Environmental Protection (DEEP) and were collected between May and September of 1997.

RESULTS

Wachocastinook Brook
- **Hilsenhoff Biotic Index - 2.96**
  Water quality - Excellent

- **EPT index - 64%**
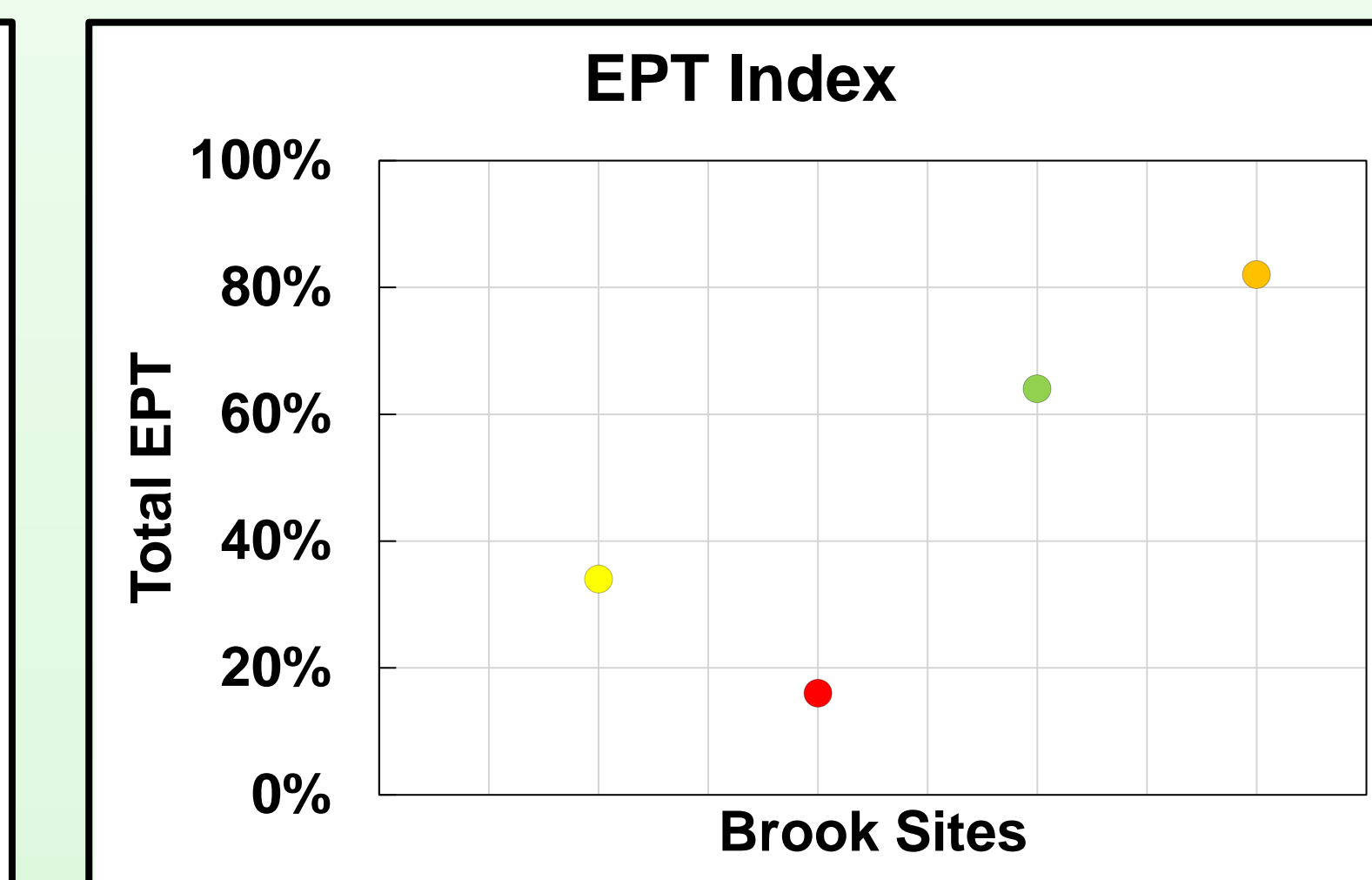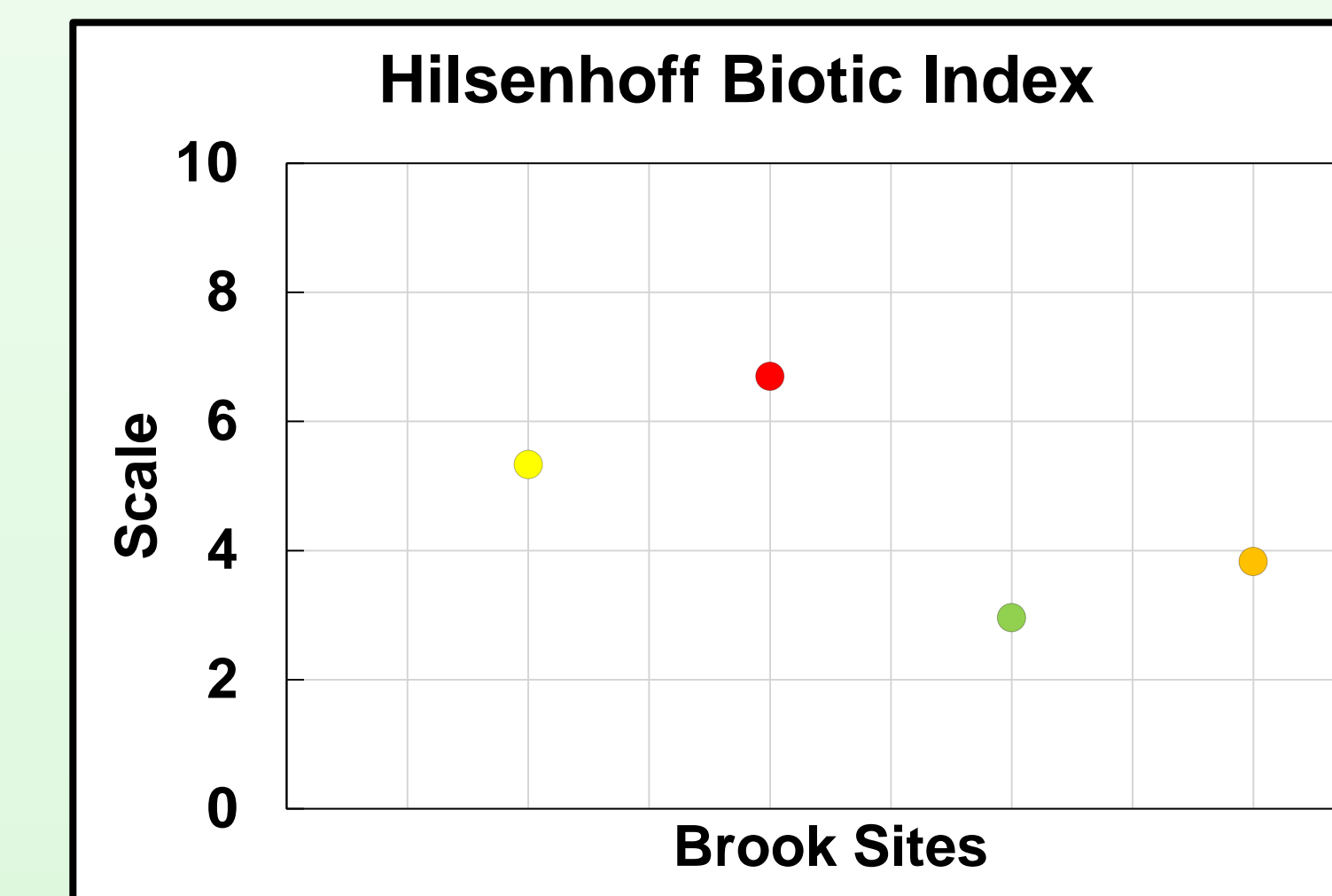 Water quality - Good

Salmon Kill
- **Hilsenhoff Biotic Index - 6.7**
  Water quality - Poor

- **EPT index - 16%**
  Water quality - Poor

Ball Brook
- **Hilsenhoff Biotic Index - 3.83**
  Water quality - Very good

- **EPT index – 82%**
  Water quality - Good

Factory Brook
- **Hilsenhoff Biotic Index - 5.33**
  Water quality - Fair

- **EPT index - 34%**
  Water quality - Fair

CONCLUSIONS

The study determined that the Wachocastinook Brook was the least degraded because the Hilsenhoff Biotic Index (HBI) and the EPT Index concluded that the water quality was "excellent" and "good", respectively. On the contrary, the two indices indicated that the water quality in the Salmon Kill mainstem was "poor". The Ball Brook results were "very good" and "good" and according to our analysis the water quality in Factory Brook was "fair".

Pollution effects whether or not certain macroinvertebrates are able to inhabit an area. This is because these benthic organisms have different tolerances and thus cannot survive in water with certain levels of contamination. Also, both the EPT macroinvertebrates and the Brook Trout require close to the same water conditions: clean and cold. Thus, EPT presence can indicate where Brook Trout are able to survive.

Using macroinvertebrates as a bioindicator will help us plan and prioritize sites in the Salmon Kill Watershed for restoration and management. Then, resources, such as time and funds, can be focused on those sites to benefit the entire watershed and the organism that inhabit it. One such restoration activity that has taken place along the Salmon Kill to help improve water quality are plantings in the riparian zones to prevent erosion and provide shade. This reduces sediment and high water temperatures to allow Brook Trout to survive in the area. After restoration activities, post-macroinvertebrate sampling will be conducted to determine the effectiveness of the overall management efforts.

ACKNOWLEDGEMENTS

REFERENCES

"CT DEEP Tier 2 Volunteer Water Quality Monitoring Network." *Department of Energy and Environmental Protection (DEEP)*. Web. 12 Feb. 2015. <http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325606&deepNav_GID=1654%20>.

"Water Pollution." *Conserve Energy Future*. Web. 12 Feb. 2015. <http://www.conserve-energy-future.com/various-water-pollution-facts.php>.

Personal Communication with Tracy Brown of Trout Unlimited