Assessing Restoration Need Based on Fish Diversity in the Salmon Kill River

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ABSTRACT

Much of the world's freshwater has been polluted. To help restore freshwater systems, Trout Unlimited (TU) is carrying out a variety of restoration activities along the Salmon Kill in northwest Connecticut (CT). In order to understand and compare species composition in the headwaters of the Salmon Kill watershed and on the mainstem, we used fish data collected by CT Department of Environmental Projection (CT DEEP) for the analysis. In addition to the fish data, habitat condition and stream temperature data was also used to compare sites and guide the restoration planning. Species diversity was greatest at the sites along the upper reaches of the mainstem where both cold and warm water species were present. However, the sites on the mainstem did not contain native Brook Trout (*Salvelinus fontinalis*), a target species for TU's restoration efforts. Brown Trout (*Salmo trutta*) were present at all of the sites except the lower site located just upstream from the confluence with the Housatonic River. This is a priority site for restoration.

INTRODUCTION

Coleridge once said, "Water, water, everywhere, nor any drop to drink." This has become an ever increasing reality to people today. Less than 1% of freshwater in the world is available for humans to drink; however pollution has reduced this percentage significantly[1]. Now, a number of conservation groups are helping to clean and restore our freshwater resources; one of which is making significant contributions in northwestern CT, Trout Unlimited.

Currently, TU is working to restore habitat for Brook Trout (Fig. 1a) living in the Salmon Kill watershed in northwestern CT. The presence of this native species indicates good water quality because it prefers water that is less than 68˚F (warmer water temperatures of 72˚F are lethal to Brook Trout). By improving the river for Brook Trout, restoration will also create a healthier environment that is beneficial to a number of other species, including humans.

But first, the health of various sites along the Salmon Kill must be assessed to determine which areas of the river are the highest priority for restoration. Accordingly, I used fish surveys conducted in the Salmon Kill watershed by the CT DEEP to help understand species composition, diversity and richness in both the headwaters and along the Salmon Kill mainstem. Understanding the fish community will help guide the restoration efforts and will also be used as a baseline. Once restoration is complete fish surveys will be conducted again to evaluate restoration effectiveness.

Fig 1. (Upper left) Photo of Brook Trout, a useful factor in understanding stream health; image provided by Fish Guy Photography.[2] (Lower right) An example of electrofishing, the sampling method used on the Salmon Kill; image provided by Wikipedia.[3]

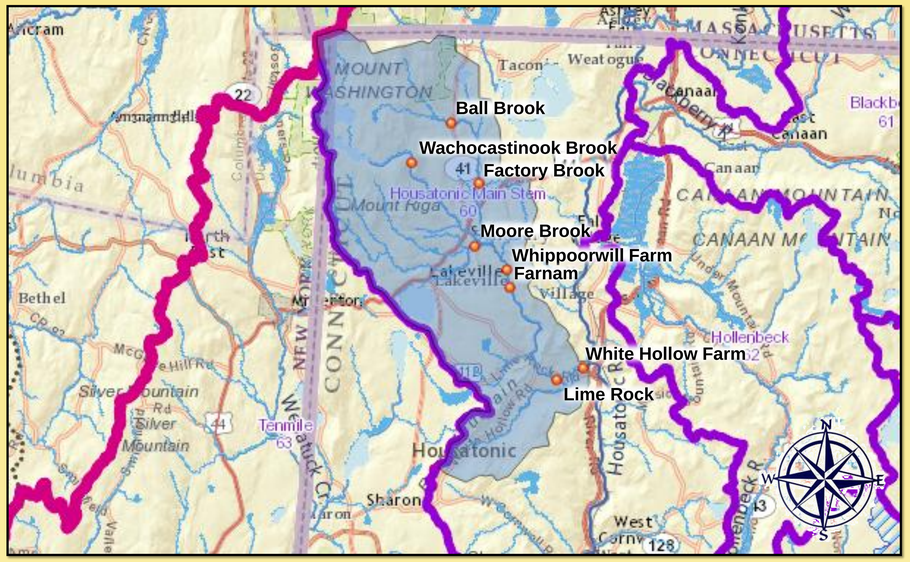


Fig 2. This is the ArcGIS map showing the Salmon Kill watershed and the sample sites used to assess fish diversity.

Fig 3. Salmon Kill mainstem sites: (Left) White Hollow sampling site, (Middle) Whippoorwill Farm sampling site, and (Right) Lime Rock sampling site.

MATERIAL AND METHODS

Study Area and Organism

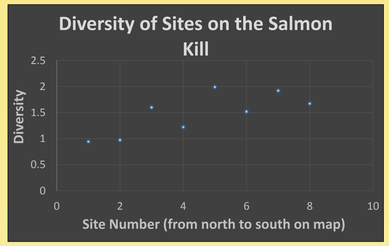
- This project occurred on the Salmon Kill, a tributary to the Housatonic River near the town of Salisbury in northwest Connecticut.
- Fish surveys were conducted at eight sites (Figs. 2 & 3).
- Fish surveys help us understand site conditions along the Salmon Kill. One of the most important species in this is the Brook Trout, which requires certain specifications in its environment.

Data Collection Protocol & Analysis

- DEEP used the electrofishing sampling method to survey fish (Fig. 1b).
- Electrofishing is the process of using electricity to temporarily stun fish so that they can be identified and measured.
- Samples were collected between 2005-2014.
- Sites were mapped using ArcGIS online to help determine the canopy over of certain sites, which could effect the temperature in the creek.
- Shannon Index diversity and richness were calculated at each site.

RESULTS

- Ball Brook and Wachocastinook Brook (Fig. 4, sites 1 & 2) had the lowest diversity and richness values.
- Factory Brook and Moore Brook (Fig. 4, sites 3 & 4) had moderate diversity and moderately-high richness.
- Whippoorwill Farm and White Hollow Farm (Fig. 4, sites 5 & 7; Fig. 3a,b) had the greatest fish diversity. These two sites also had high to moderately-high fish richness.
- Farnam (Fig. 4, site 6) had moderate diversity, but relatively low species richness Lime Rock Raceway (Fig. 4, site 8; Fig 3c) had relatively high diversity and richness.



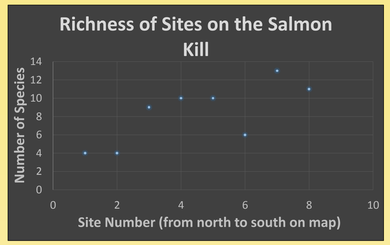


Fig 4. (Left) Shannon Index diversity and (Right) species richness of fish sampled at each of the eight sampling sites along the Salmon Kill. Site numbers from 1 to 8 correspond with sites from north to south in Fig. 2.

CONCLUSIONS

The species diversity and the species present at each site depended upon a number of variables in the surrounding area. The species diversity found at the Ball Brook and Wachocastinook Brook were due to the low richness of the sites. Trout were the main fish found in these areas, which indicates fairly healthy water. The pumpkinseed found at Wachocastinook also indicates healthier water because, like trout, it is intolerant to warmer water. The higher diversity of Factory Brook is a result of warmer water species, since there is a lake that feeds into the Salmon Kill. Although the temperature at the Moore Brook site was warmer than that of Factory and Wachocastinook Brook, the presence of cold water species (e.g. Trout and Slimy Sculpin, *Cottus cognatus)* along with a higher diversity indicates healthier water. The diversity at Whippoorwill Farm is due to more even samples of cold and warm water species. The diversity at Farnam was a result of six species that had fairly even samples. Although there were some Brown Trout found there, the overall number of cold water species decreased. At the time the sample was taken, the stream was low and the spring and summer rain had caused persistent flooding which may have influenced the sampling results. The sample site taken at the Lime Rock site had a riffle, which could have allowed for a higher oxygen content. There were warm and cold water species found here. No cold water species were found at the site near the confluence of the Housatonic River. The high diversity was a result of more fish, and higher counts of the fish. The findings of this study indicate that although some sites may have high fish diversity, the lack of cold water species indicates poor water quality and need for restoration activities. The restoration of the Salmon Kill will be able to improve the quality of the water, and the habitat for the species living there.

ACKNOWLEDGEMENTS

A special thanks to everyone who has helped me throughout this amazing opportunity: Tracy Brown, my mentor, who endlessly provided me with information and help along the way; Laura Cisneros who drove hours to meet with my sister and I, and who provided encouragement throughout this experience; David Moran, one of my agricultural teachers, who recommended the Natural Resources Conservation Academy, and has helped to guide my interests in the environment. The Salisbury Land Trust provided my sister and I with a scholarship to attend the NRCA. CT DEEP provided me with the fish survey data, but the analysis and findings were mine, with the help of my mentor.

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