Fall and Rise: Changes in the Fish Community of Triplett Creek Following Restoration of a Channelized Reach

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Introduction

In the early 1970s, Triplett Creek in Morehead, Kentucky, was straightened, deepened, and widened by the Corps of Engineers with the purpose of reducing flooding in Morehead, resulting in a rather homogenous aquatic habitat, varying little in depth, flow, and substrate. In summer of 2018, a section of the stream was "restored" in order to alleviate the bank instability and flooding problems created by the 1970s channelization, restore the health of its aquatic community, and improve recreational opportunities, including fishing. As part of the renovations, riffle and pool habitats were reestablished and the previous substrate (mostly bedrock) was diversified to include more gravel and woody debris. **Our goal was to examine how changes to the extensive channel modification affected the fish populations in that stream reach.**

Methods

Study Location

- Triplett Creek in Rowan County, Kentucky (Figure 1).
- Two sites in the restored area (Figures 2 and 4) and two control sites, unaffected by restoration (Figure 3).

Sampling

- Sampled all four sites five times: June 2018 (just before restoration work), October 2018 (just after restoration work), June 2019, October 2019, and October 2020.
- **Surveyed fishes** in about 120 m at each site, using a backpack electrofisher and seine, following standard protocols (KDOW 2010).
- Fishes captured were identified and counted.
- **Habitat was assessed** in 12, 10 m^2 plots. Specifically we measured variables assessing
  - Stream width and water conductivity
  - Substrate (bottom composition)
  - Flow
  - Depth
  - Vegetation and woody debris

Data Analysis

- Assessed the fish community's health using the Kentucky Index of Biotic Integrity (KIBI) (Compton et al. 2003) and other metrics of fish communities.
- Principal Component Analysis was used to compare differences in habitat among sites and to assess changes in habitat following restoration.
- Data from the restored sites were compared to data from sites unaffected by the restoration.

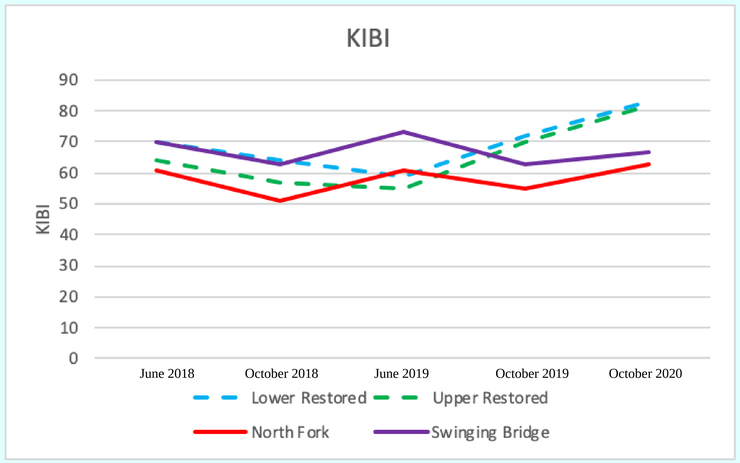

Figure 5. Kentucky Index of Biotic Integrity (KIBI) scores for four sites sampled five times.

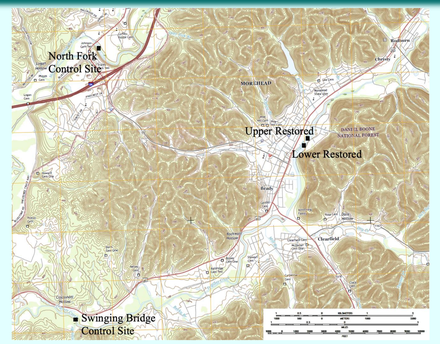

Figure 1. Map of the Morehead area with points of our sampling sites.

Figure 3. Swinging Bridge site, October 2018. This was one of our two control sites.

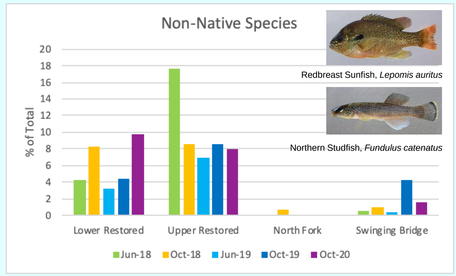

Figure 6. Percentage of non-native species found at the sites.

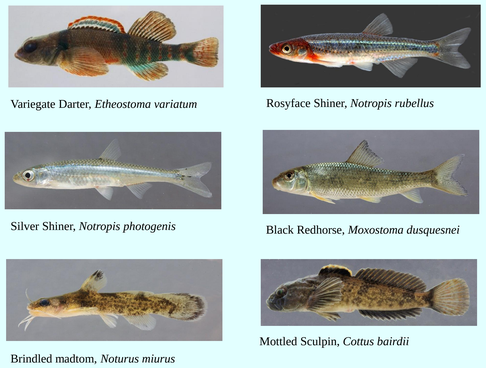

Figure 8. Examples of intolerant species of Triplett Creek.

Figure 2. Upper Restored site, just before restoration, with earth-moving equipment visible in the background.

Figure 4. Upper Restored site after restorations (October 2019).

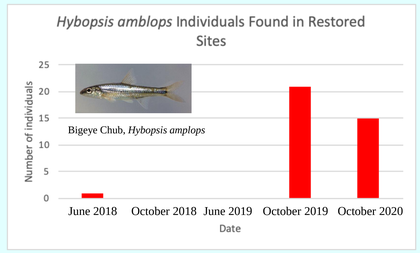

Figure 7. Number of individuals of *H. amblops*, an intolerant minnow species, found in the restored sites.

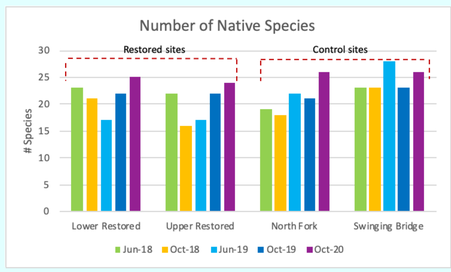

Figure 9. Number of native species found at each site.

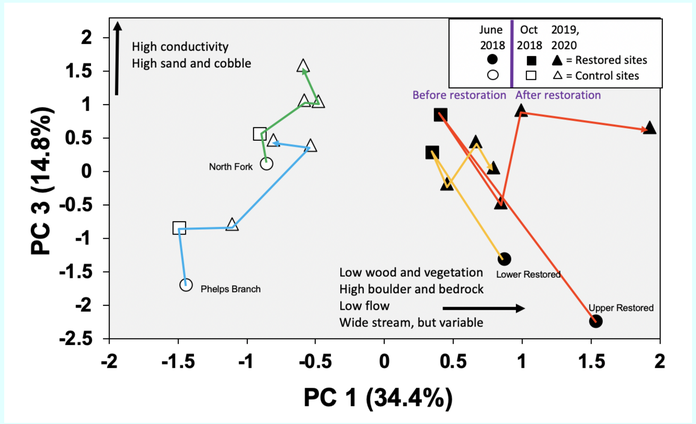

Figure 10. Habitat scores of 16 samples on PC axes 1 and 3. Arrows indicate habitat changes throughout the duration of the project.

Results

Changes in Fish Community.--In June 2018, prior to restoration work, the four sites had KIBI scores between 59 and 70, all of which rated as "good" (Figure 5). However, the two sites in the restored area had a higher proportion of nonnative species (Figure 6), and fewer darters compared to the control sites. In October 2018 and June 2019, after restoration work, the restored sites declined slightly in KIBI scores (Figure 5), had reduced number of species detected (Figure 9), especially species considered "intolerant" by the KIBI (Figure 8), and had reduced number of darter species, while remaining about the same in the control sites. **However, in October 2019 and October 2020, much of these metrics had greatly improved in the restored sites** (Figures 5 and 9). In fact, the October 2020 KIBI scores for both restored sites were considered "excellent." Of particular interest was the change in a highly intolerant species, the Bigeye Chub, in the restored area: formerly of low abundance, it disappeared after restoration, but then reappeared in high numbers recently (Figure 7).

Changes in Habitat.--The habitats of the control vs the restored sites were quite different (Figure 10); the restored sites were wide and shallow, dominated by bedrock, and had little aquatic vegetation and submerged woody debris (Figure 2). After restoration, PCA scores of control sites changed little, while those of the restored sites changed considerably, initially becoming more like the control sites in habitat (Figure 4). Since October 2018, however, the habitats of the restored sites have slowly returned to their original state.

Summary and Discussion

1. In the restored area, high numbers of nonnative species (considered tolerant) and few darter species (considered intolerant) suggest the fish communities of this area were somewhat impaired prior to restoration.
2. The general decline in community metrics in the restored area in the year after restoration work, reflects the extreme habitat modifications of those sites. This is expected because the new habitat had not stabilized (high silt presence) and had not had time for colonization by benthic insects.
3. After the initial disturbance of the restoration, the fish communities in the restored area appear to have markedly improved.
4. The initial habitat changes in the restored area suggest the restoration had made it more like unmodified sites in Triplett Creek, except for the lack of riparian vegetation. The return of the habitat of the restored areas to its original state might be due to added gravel and woody debris being washed downstream without being replaced; a dam just upstream of the restored sites prevents the replacement of gravel and woody debris from upstream.

References

Compton MC, Pond GJ, and Brumley JF. 2003. Development and application of the Kentucky Index of Biotic Integrity (KIBI). Kentucky Department for Environmental Protection, Division of Water, Frankfort, Kentucky.

Kentucky Division of Water (KDOW). 2010. Standard operating procedure collection method for fish in wadeable streams. Kentucky Resources and Environmental Protection Cabinet, Division of Water, Frankfort.

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