Habitat Restoration of Kickapoo Creek

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Introduction

Agricultural land use and urbanization have caused massive degradation of freshwater ecosystems worldwide. In the Midwestern United States, agricultural practices have impacted as much as 85% of steam ecosystems (Morke and Lamberti 2003). Often, agricultural practices remove riparian (along shore) vegetation, causing increased bank erosion and sedimentation thereby reducing the diversity and productivity of aquatic fauna (Berkman and Rabeni 1987). Although millions of dollars are spent annually on stream restoration and enhancement projects (Roni et al. 2002), few studies have assessed the results of habitat enhancement on aquatic fauna (Berhardt et al. 2005, Baldigo et al. 2008).

In Kickapoo Creek near Charleston IL, massive bank erosion caused by agricultural and urbanization processes has increased sediment deposition in the stream limiting the deep-water pool habitats (Figure 1). A 2000 foot restoration site was identified At the restoration site, two riffle habitats will be created along with expansive bank stabilization. The restoration project will attempt to restore deep-water pool habitats to a stretch of severely impacted stream channel. We are assessing the impact of in-stream habitat enhancement measures on the fish and macroinvertebrate communities in Kickapoo Creek near Charleston, IL.

Methods

Sampling was conducted at four locations: two sites that will be enhanced, one upstream reference site and one downstream reference site. During fall 2009 and spring 2010 Pre-enhancement sampling was completed at each location. We used guidelines set forth in the IDNR-fisheries stream sampling handbook to determine seine operation, crew size, and sampling effort. Researchers set upstream and downstream station limits using blocking seines and sampled fish at each location using an electric seine powered by a 1000 watt generator. All fishes sampled were weighed, measured, and identified. Fish greater than 101 mm were released a the site of collection unharmed. We euthanized all fishes smaller than 101 using a lethal dose of MS-222, these fish were preserved in 5% Formalin and brought to the Eastern Illinois University's (EIU) fisheries lab for species identification and enumeration. Reference individuals for each species were catalogued into the fish collection at EIU.

We quantified catch per unit effort (CPUE) as a measure of relative abundance using both distance of the site and time as the units of effort. We calculated Shannon-Weiner species diversity and evenness for the fish community using a Index. Paired t-tests were used to assess differences in CPUE and Shannon-Weiner diversity between seasons.

Figure 1: Photo of the lower treatment site on Kickapoo Creek pre-restoration.

Table 1: Summary of fishes sampled from Kickapoo creek during fall 2009 and spring 2010

Species	Scientific Name	Total
Silverjaw minnow	*Ericymba buccata*	2492
Sand shiner	*Notropis ludibundus*	2084
Central stoneroller	*Campostoma anomalum*	949
Bluntnose minnow	*Pimephales notatus*	770
Creek chub	*Semotilus atromaculatus*	336
Spotfin shiner	*Cyprinella spiloptera*	335
Orangethroat darter	*Etheostoma spectabile*	207
Brindled madtom	*Noturus miurus*	155
Greenside darter	*Etheostoma blennioides*	150
Suckermouth minnow	*Phenacobius mirabilis*	141
Green sunfish	*Lepomis cyanellus*	109
Longear sunfish	*Lepomis megalotis*	108
Rainbow darter	*Etheostoma caeruleum*	107
Northern hogsucker	*Hypentelium nigricans*	80
Johnny darter	*Etheostoma nigrum*	74
White sucker	*Catostomus commersoni*	72
Steelcolor shiner	*Cyprinella whipplei*	65
Golden redhorse	*Moxostoma erythrurum*	54
Bluegill	*Lepomis macrochirus*	48
Striped shiner	*Luxilus cornutus*	47
Redfin shiner	*Lythurus umbratilis*	36
Blackstriped topminnow	*Fundulus notatus*	35
Largemouth bass	*Micropterus salmoides*	32
Yellow bullhead	*Ameiurus natalis*	19
Quillback carpsucker	*Carpiodes cyprinus*	10
Creek chubsucker	*Erimyzon oblongus*	7
Log perch	*Percina caprodes*	2
Spotted bass	*Micropterus punctulatus*	2
Channel catfish	*Ictalurus punctatus*	1
Dusky darter	*Percina sciera*	1
Highfin carpsucker	*Carpiodes velifer*	1
Longnose gar	*Lepisosteus osseus*	1

Table 2: Summary of fish community data sampled from Kickapoo Creek during fall 2009 and spring 2010. Diversity and Evenness were estimated using Shannon-Weiner indices.

Metric	Downstream control	Lower treatment	Upper treatment	Upstream control	Mean	*S.E.*
Fall 2009						
CPUE (fish/hr)	1310.0	1235.3	1593.7	1639.3	1444.6	*101.0*
CPUE (fish/m)	5.66	6.49	7.08	6.92	6.53*	0.32
Darter CPUE	70.0	74.3	68.0	234.6	111.7	*41.0*
Diversity	2.26	2.16	2.19	2.33	2.24*	*0.04*
Evenness	0.58	0.08	0.08	0.02	0.19	*0.13*
Richness	25	25	24	22	24	*0.70*
Total Catch	1310	1647	1360	1265	1395.5	*86.0*
Spring 2010						
CPUE (fish/hr)	689.0	1634.5	571.4	214.3	777.3	*303.0*
CPUE (fish/m)	2.88	6.23	2.53	0.55	3.05*	1.18
Darter CPUE	33.1	77.5	13.3	25.7	37.4	*14.0*
Diversity	1.69	1.95	2.11	2.06	1.95*	*0.09*
Evenness	0.58	0.08	0.084	0.021	0.19	*0.13*
Richness	18	25	25	14	20.5	*2.72*
Total	666	1580	600	100	736.5	*308.2*

Results

We sampled a total of 32 different species during the spring and fall samples (Table 1). All of the fish came from the families Percidae, Cyprinidae, Centrarchidae, Catostomidae, and Icteluridae with the exception of the one longnose gar. Feeding habits of theses fish were benthic invertivores, insectivores, generalist feeders, and predators. The four most numerically abundant species (silverjaw minnow, sand shiner, central stoneroller, and bluntnose minnow) comprised 74% of the catch (Table 1). Uncommon species observed during the samples were longnose gar, log perch, dusky darter, spotted bass, and channel catfish (Table 1). Relative density fish/m was higher in the fall compared to the spring samples ($P < 0.05$; Table 2). Additionally, the Shannon-Wiener diversity indices indicated higher diversity in the fall (Table 2). Fish species richness was greater in the spring but abundance was lower than the the fall sample (Table 2). Darter CPUE was significantly higher in the spring CPUE in the lower control, upper treatment, and upper control sites, but slightly lower in the lower treatment (Table 2). Evenness was similar in all the sites during the spring and the fall (Table 2). Additionally, richness was similar in the treatment sites but lower in the spring control sites (Table 2).

Discussion

Relative density, diversity, and richness were all higher in the fall samples compared to the spring. This may be the result of above average rainfall in the fall of 2009 leading to increased fish migrations within the drainage. Additionally, fall samples include young of the year individuals which have high overwinter mortality. Finally, water levels in the spring were marginally higher than that of the fall which may have reduced sampling efficiency of the gear. During spring, we did sample a higher richness of large river fishes (carpsuckers, *Percina* darters, and gar) possibly due to spawning movements. The large differences in relative density, diversity and richness suggest managers use caution when comparing streams that have been sampled during different times of the year. We will increase sampling in the upcoming year sampling to include a winter and summer sample, allowing us to determine the most efficient time to sample Midwestern streams. The goal of this project is to determine the impact of habitat restoration on stream fish assemblages. IDNR completed habitat modifications during summer 2010 and EIU will continue to sample this community for an additional two years. In the subsequent samples, we will address the impact of stream restoration on these communities.

Work Cited

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