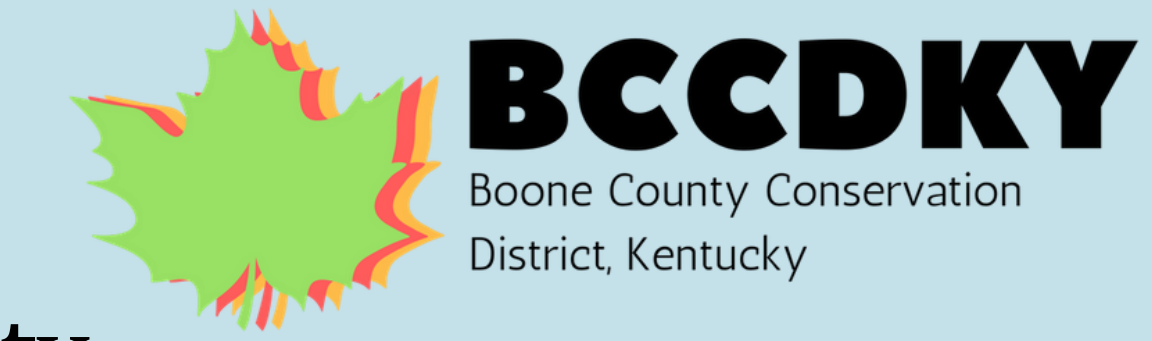


Habitat Characterization of Eastern Hellbender Salamanders (*Cryptobranchus alleganiensis alleganiensis*) for Future Head-Start Program

Jessi Urichich, Kelli Hill and Chris Lorentz, Ph.D.

The Center for Ohio River Research & Education
Thomas More University Biology Field Station,
the Boone County Conservation District, and Ohio Northern University



Introduction

Hellbenders are the largest salamander in Northern America, growing up to two feet long. Hellbender populations have declined by 80% since 1985 (Foster et al. 2009). Several causes to this include destruction and channelization of streams, diseases, pollution, and excess sedimentation (Lipps 2013). Conservation efforts are currently focusing on surveying for these salamanders and reintroduction programs, like head-start programs.

In head-start programs, conservation groups rear hellbenders or hatch them from eggs under managed care to release them back into their natural habitat. Using environmental DNA (eDNA), scientists can locate hellbenders in their region. Another survey method is flipping over rocks throughout the river or stream.

At the Thomas More University Biology Field Station, we plan to create a head-start program with hellbenders. In order to do so, potential reintroduction sites were assessed. Gunpowder Creek at Sperti Park, the Licking River at Visalia Bridge, and Gunpowder Creek at Camp Michael's were three potential release sites in Northern Kentucky.

TMU Future Head-Start Program

Our goals of this project were to create an educational poster for the Thomas More University Biology Field Station to increase conservation efforts, to assess potential sites for future reintroduction, and to investigate other head-start programs.

The poster will be used in field trips to raise awareness of the hellbender's status as a start of the head-start program. The objectives of the head-start program at the field station are to acquire young hellbenders, rear them under managed care until 2-3 years of age, then release them in streams in Northern Kentucky.

Table 1. Results of the Physical characterization/water quality field data sheet

	Site 1	Site 2	Site 3
Habitat Assessment Score	152/200	131/200	167/200
Temperature (°C)	25.3	24.2	24.5
Specific Conductance (µS/cm)	377.2	203.4	490.1
Dissolved Oxygen (mg/L)	-	5.9	6.32
pH	8.31	7.71	8.19
Turbidity	High	High	Slightly Turbid
Boulder	33.30%	-	40%
Cobble	33.30%	-	10%
Gravel	33.30%	-	30%
Sand	-	-	20%
Silt	-	50%	-
Clay	-	50%	-

In order to do so, potential reintroduction sites were evaluated for water quality, stream stability, and habitat availability. Three sites were chosen; Gunpowder Creek at Sperti Park, the Licking River near the Visalia Bridge, and Gunpowder Creek at Camp Michaels.

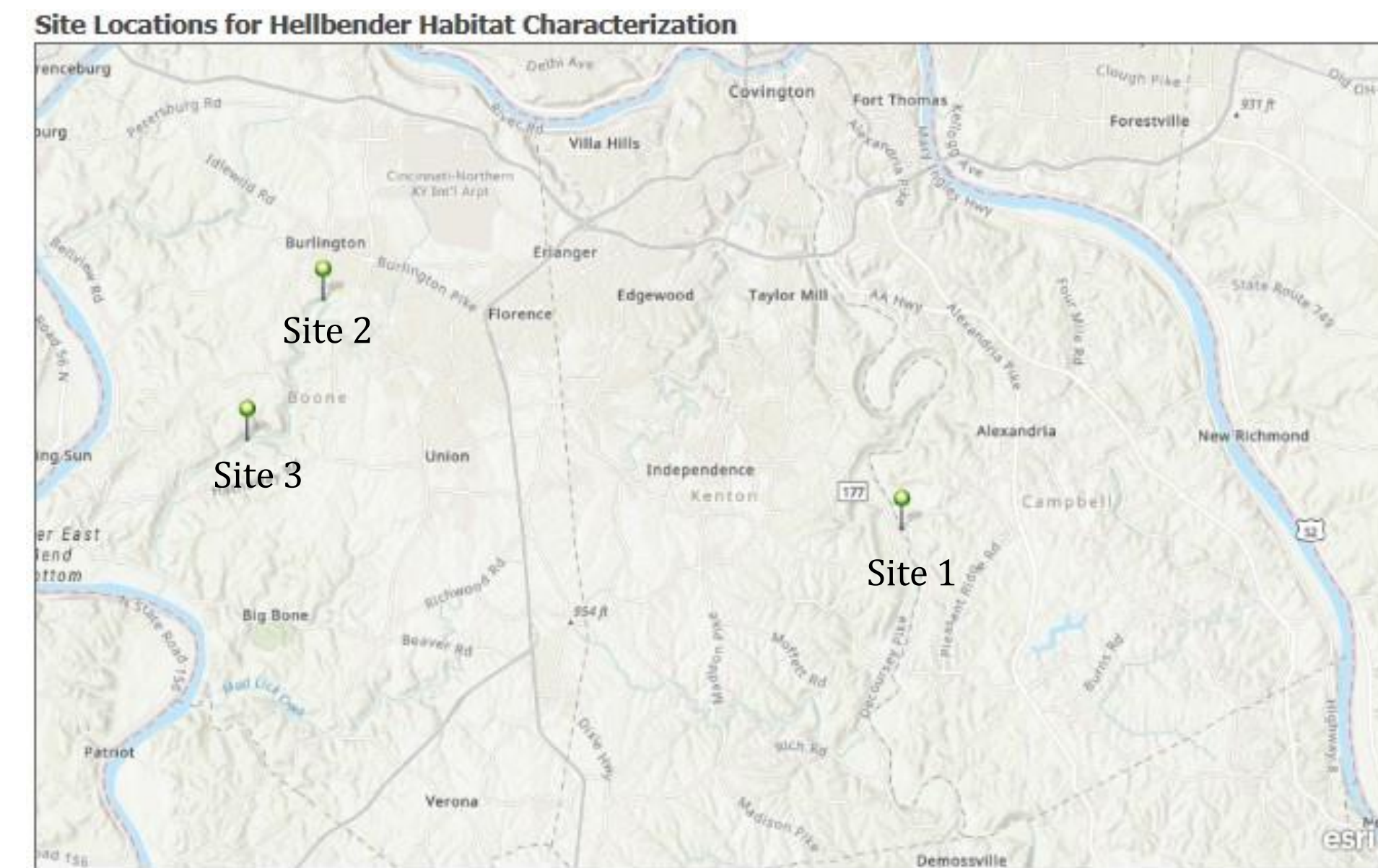


Figure 1. Site distribution for habitat distribution.



Photo 1. Site 1 Gunpowder Creek at Sperti Park.

Site 1 was located at the back of Sperti Park, a public park surrounded by residential areas in Boone County. The site was evaluated shortly after a rain event, slightly skewing the water chemistry data. Despite the surrounding land use, Site 1 scored (high 152/200) on the Habitat Assessment Sheet from Kentucky Division of Water (Table 1). The embeddedness of gravel, cobble and boulders was 0-25%, with 5-30% sediment deposition of sand or point bars. The occurrence of riffles was infrequent with a low score in the suboptimal range. Both the left and right banks were moderately unstable with signs of high erosion from floods. However, about 90% of the streambank and riparian zones had native vegetation with natural growth.

Site 2 was located on the Licking River by the Visalia Bridge. The surrounding area was predominantly agriculture and residential areas. The site was evaluated shortly after a rain event, slightly skewing the water chemistry data. Site 2 scored the lowest of the three sites (131/200) (Table 1). Embeddedness was between 50% and 75%, while sediment deposition was evident being 5-30% affected. There were no riffles as it was a river. The left bank was slightly more stable than the right bank, showing 5-30% bank erosion. Similarly, the left bank had a slightly higher percentage (70-90%) of native vegetation in the riparian zone.

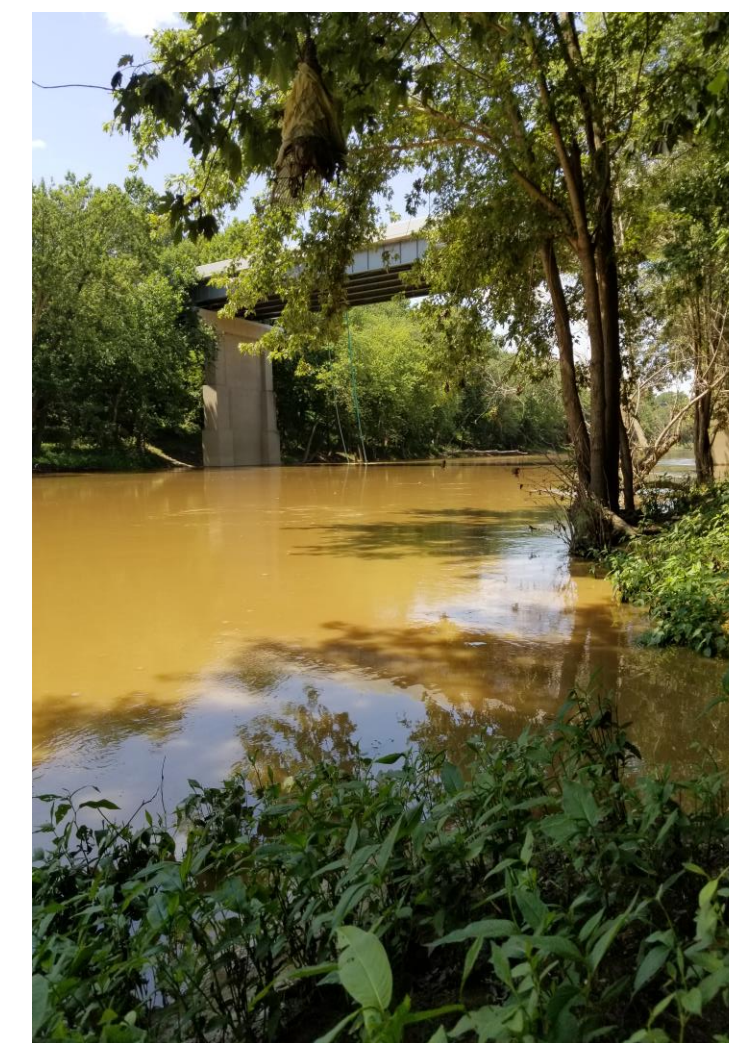


Figure 3. Site 2 Licking River at Visalia Bridge.

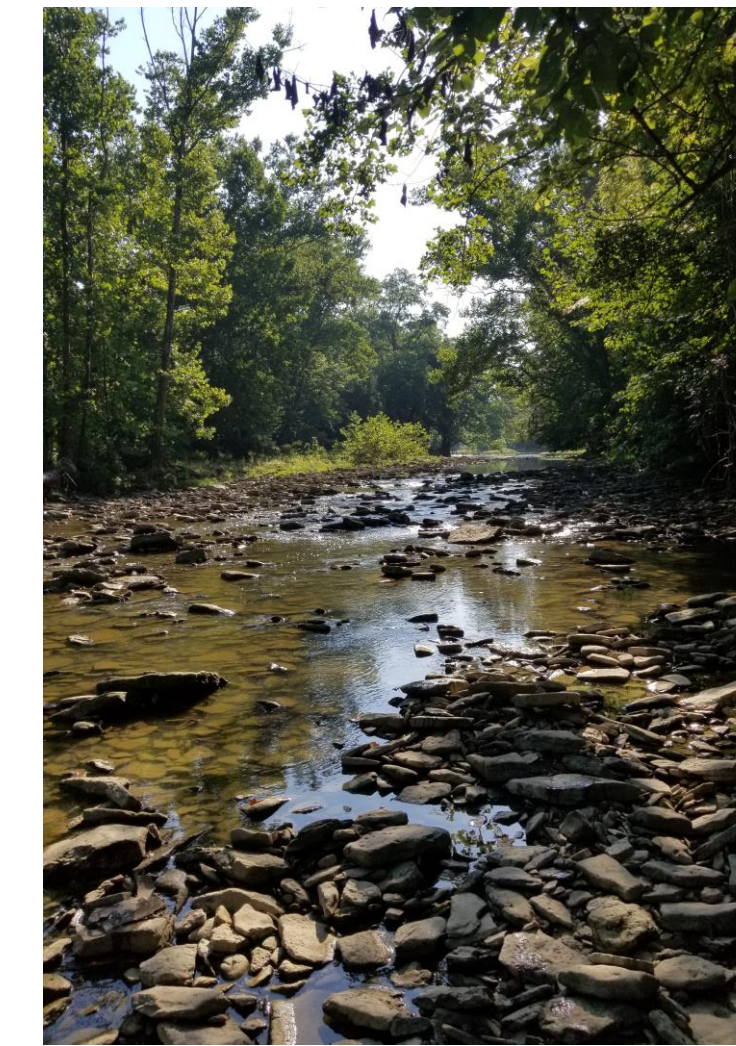


Photo 3. Site 3 Gunpowder Creek at Camp Michael's.

Site 3 was located on Gunpowder Creek at Camp Michael's, a boy scout campground. The surrounding area was forest with little evidence of anthropogenic disturbance. Site 3 scored the highest of the three sites at 167 out of 200. Embeddedness was mid-optimal at 0-25% while sediment deposition was high suboptimal at 5-30%. The frequency of riffles was high marginal. Both the left and right banks were stable with little evidence of erosion. Additionally, both banks had approximately 90% native vegetation in the riparian zone.

Other Head-Start Programs

Columbus Zoo and Aquarium

The Columbus Zoo and Aquarium are aiding in the conservation of the Eastern Hellbender through surveillance, habitat augmentation, head-starting programs and reintroduction.

The head-start program, headed by Pete Johantgen, rears hellbenders from eggs till they are 2-3 years old. Using known sites from eDNA, the staff collects the eggs from the wild and transports them to their facility. Due to the disappearance of larvae populations, this process gives the eggs a greater chance of survival. The hellbender eggs are then separated into individuals. Incubation begins by flowing cold water over the eggs in a parabolic net within a tank.

The juvenile hellbenders were held in large tanks with 100-500 individuals. Placed in the tanks were PVC tubes, large gravel pieces, and terra cotta pots for hiding places. The juveniles were fed black worms, crayfish, and mysis shrimp. All live food was put through a salt treatment to prevent the spread of any diseases. After 2-3 years, at a healthy size, the hellbenders were tagged and then released back into the streams.

Saint Louis Zoo

The Saint Louis Ron Goellner Center for Hellbender Conservation goals is to establish a breeding program and a husbandry protocol for successfully rearing hellbenders to sexual maturity.

The Hellbender conservation center houses the hellbenders in two 40-feet long and 6-feet deep, man-made streams. The stream has rock beds, nesting boxes, and controlled water temperature to aid in the survival of the hellbenders. In 2011, the center announced that the Ozark hellbenders have been bred in captivity for the first time. In 2018, the first generation was successfully bred. The zoo plans to construct a climate-controlled habitat to sustain a group of breeding hellbenders.

Conclusion

The Eastern Hellbender salamander faces many threats. One main threat remains to be stream degradation by sedimentation. Sedimentation buries the large overhanging rocks where hellbenders hide and nest. The stream characteristics of low embeddedness, low sedimentation, high percentage of boulders and cobble, and high-water quality are important parameters for hellbender habitats. These characteristics important indicators of potential hellbender sites for reintroduction and would thus increase survival rates. Based on the stream habitat evaluations, Site 3 (Gunpowder Creek at Camp Michael's) had the greatest viability of supporting hellbenders with a score of 167 of 200. It was the least impacted by anthropogenic activity, having a large tract of forested surroundings. The right bank in Site 3 was steep with many large boulders to feed into the stream over time, providing long-term habitat availability. Additionally, Site 3 had the lowest embeddedness and sedimentation scores. Therefore, Site 3 was the best location for reintroduction of hellbenders for the future head-start program at the TMU Biology Field Station.

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For further information

Kelli Hill (k-hill.5@onu.edu)
Jessi Urichich (jluric34@thomasmore.edu)
Dr. Chris Lorentz (lorentc@thomasmore.edu)