

Fish community assessment in the Harpeth River prior to the removal of the dam at Franklin, TN

Submitted to Dorie Bolze, Harpeth River Watershed Association

By Frank Fiss and Nathan Singer, Tennessee Wildlife Resources Agency

April 4, 2011

The Southeast Aquatic Resource Partnership provided funding to the Harpeth River Watershed Association to help remove a dam on the Harpeth River in Franklin, TN. The project is scheduled for 2011. As a partner on this project, Tennessee Wildlife Resources Agency (TWRA) agreed to monitor fish populations prior to and after the dam removal and habitat alteration project. The objective of this report was to document fish species are currently found in the vicinity of the dam on the Harpeth River. The post-alteration survey will be conducted a few years after the project is completed so that the habitat has time to stabilize. In addition to these pre- and post-alteration surveys, TWRA is funding a graduate student at Middle Tennessee State University (Nathan Singer) who is evaluating fish populations in the Harpeth River and several off the tributaries found in the upper watershed in the vicinity of the dam.

Study Areas

The dam is located adjacent to Lewisburg Pike southeast of Franklin's city center. We selected four sites to characterize the fish community in the vicinity of the dam. The most downstream site was at Pinkerton Park (Pinkerton). The most upstream site was at the confluence with Fivemile Creek (Fivemile). The Fivemile site was selected because it was upstream of the influence of the reservoir created by the dam. Two sites were selected in the immediate area of the dam. One was immediately below the dam (Below Dam). The other site was immediately upstream of the dam in the reservoir (Reservoir).

The Pinkerton, Fivemile, and Below Dam sites were established in locations that would provide several units of all habitat types, but the riffle and run habitat was still quite scarce. Pool habitat was abundant at all sites. The Franklin discharge gage reported the discharge in the Harpeth River to be 120 cfs on June 9 when the project started, which would be considered typical to flow for this time of year. We experienced these flow conditions throughout the surveys.

Table 1. Sample dates, site locations, and conditions on Harpeth River.

Site	Survey Date	Latitude	Longitude	Water	
				Temperature (C)	Conductivity (uS/cm)
Pinkerton	16 June 2010	35.92099	-86.86500	27	480
Below Dam	15 June 2010	35.90954	86.85777	28	500
Reservoir	9 June 2010	35.90930	-86.85569	29	450
Fivemile	23 June 2010	35.88615	-86.83700	28	490

Methods

Pinkerton, Below Dam and Fivemile were surveyed using a seine and backpack electrofishing unit and following IBI techniques for streams described by TVA (1995). All riffle, run, and pool habitats were sampled until no new species were collected on three consecutive efforts, or until that habitat type had

been exhausted. In riffles and runs the electrofishing unit was used to stun fish into a 20-ft seine which was opened to varied widths depending on that specific effort. Pools were seined using a 20-ft seine. A minimum of two, 150-ft shoreline shocking efforts were made at each site. Total survey effort varied by site (Table 2) as is expected using this technique. After each effort each species was counted and notes of any anomalies were recorded. Several fish were kept for voucher specimens and were later identified by ichthyologists at TWRA and Tennessee Valley Authority.

Table 2. IBI survey effort at wadeable sites on the Harpeth River.

Site	Number of riffle efforts	Number of run efforts	Number of pool efforts	Number of shoreline efforts	Total area of all habitats surveyed (sq ft)
Pinkerton	10	7	6	2	3980
Below Dam	6	11	12	3	5250
Fivemile	7	10	13	2	5100

IBI metrics have not been established for the Harpeth River. An IBI expert (C. Saylor) at TVA provided surrogate metrics based on metrics developed for the interior plateau region of Tennessee. The scoring criteria vary with watershed area. Pinkerton and Below Dam sites were close enough within the watershed to share the same criteria, whereas the Fivemile had slightly different (<1 %) scoring criteria for metrics based on percentages (Tables 3- 5). IBI scores can range from 0 to 60, and the descriptions range as follows: No Fish (0-12), Very Poor (12-22), Poor (28-34), Fair (40-44), Good (48-52), Excellent (58-60).

To survey the Reservoir site, we used a 14-ft Jon boat outfitted with an electrofishing pulsator box and hand-held probe to provide about 4 amps of DC current at 60 pulses per second. We shocked all shoreline habitat on both sides of the river from the dam (35.9034, -86.85569) upstream approximately 2215 feet to a point (35.90624, -86.84940) adjacent to the asphalt pull-off on Lewisburg Pike. During eleven 10-minute shocking efforts, one netter collected all fish observed. Fish were identified to species, counted and released. IBI metrics for boat surveys in the Cumberland drainage have not been established nor were suitable surrogate metrics available for this type of habitat and survey methods. An IBI score was not calculated for the Reservoir site.

Results

IBI scores for Pinkerton and Below Dam sites were both 48 or “Good” (Tables 3-4). The IBI scores at the Fivemile site was 40, or “Fair”. This lower score at the Fivemile site, relative to the other sites, is attributed to a lower number of darters, sunfish and species that are intolerant of degraded habitat. All IBI sites had an excessive number of stonerollers (>23 %) which indicates a skewed trophic structure.

Total number of native species collected in the IBI surveys ranged from 30 at Fivemile to 38 at Pinkerton. The most unusual exotic species was a Nile tilapia at the Pinkerton site, which likely escaped from a pond during the May Flood of 2010.

Only 19 native species were collected at the Reservoir site. The sunfish family, Centrarchidae, represented 9 species and 87 % of the fish collected by number. One bigmouth buffalo was collected. We feel that this fish likely migrated up to the reservoir during the May Flood of 2010, as these fish are rarely found so high in a watershed.

Table 3. IBI metrics, scoring criteria, and scores for Pinkerton site on the Harpeth River June 16, 2010.

Metric Description	Scoring Criteria			Observed	Score
	<u>1</u>	<u>3</u>	<u>5</u>		
Total number of native fish species	<18	18-35	>35	31	3
Number of darter species	<4	4-6	>6	8	5
Number of sunfish species, less <i>Micropterus</i>	<3	3-4	>4	6	5
Number of sucker species	<2	2-4	>4	3	3
Number of intolerant species	<3	3-4	>4	6	5
Percent of individuals as tolerant species	>23.3%	11.6%-23.3%	<11.6%	9.2%	5
Percent of individuals as omnivores and stoneroller species	>24.9%	12.4%-24.9%	<12.4%	25.5%	1
Percent of individuals as specialized insectivores	<22.0%	22.0%-44.0%	>44.0%	42.0%	3
Percent of individuals as piscivores	<2.0%	2.0%-4.0%	>4.0%	2.7%	3
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<12	12-24	>24	31	5
Percent of individuals as hybrids	>1%	TR - 1%	0%	0.0%	5
Percent of individuals with disease, tumors, fin damage, and other anomalies	>5%	2% - 5%	<2%	0.7%	5
					48
					Good

Table 4. IBI metrics, scoring criteria, and scores for Below Dam site on the Harpeth River June 15, 2010.

Metric Description	Scoring Criteria			Observed	Score
	<u>1</u>	<u>3</u>	<u>5</u>		
Total number of native fish species	<18	18-35	>35	38	5
Number of darter species	<4	4-6	>6	8	5
Number of sunfish species, less Micropterus	<3	3-4	>4	7	5
Number of sucker species	<2	2-4	>4	3	3
Number of intolerant species	<3	3-4	>4	6	5
Percent of individuals as tolerant species	>23.3%	11.6%-23.3%	<11.6%	8.2%	5
Percent of individuals as omnivores and stoneroller species	>24.9%	12.4%-24.9%	<12.4%	30.8%	1
Percent of individuals as specialized insectivores	<22.0%	22.0%-44.0%	>44.0%	28.7%	3
Percent of individuals as piscivores	<2.0%	2.0%-4.0%	>4.0%	1.6%	1
Catch rate(average number of fish per 300 sq. ft. sampling unit)	<12	12-24	>24	38	5
Percent of individuals as hybrids	>1%	TR - 1%	0%	0.0%	5
Percent of individuals with disease, tumors, fin damage and other anomalies	>5%	2% - 5%	<2%	0.4%	5
					48
					Good

Table 5. IBI metrics, scoring criteria, and scores for Fivemile site on the Harpeth River June 23, 2010.

Metric Description	Scoring Criteria			Observed	Score
	<u>1</u>	<u>3</u>	<u>5</u>		
Total number of native fish species	<18	18-35	>35	30	3
Number of darter species	<4	4-6	>6	6	3
Number of sunfish species, less <i>Micropterus</i>	<3	3-4	>4	4	3
Number of sucker species	<2	2-4	>4	4	3
Number of intolerant species	<3	3-4	>4	4	3
Percent of individuals as tolerant species	23.6%	11.8%-23.6%	<11.8%	11.2%	5
Percent of individuals as omnivores and stoneroller species	>25.3%	12.7%-25.3%	<12.7%	26.1%	1
Percent of individuals as specialized insectivores	<22.0%	22.0%-44.0%	>44.0%	44.4%	5
Percent of individuals as piscivores	<2.0%	2.0%-4.0%	>4.0%	1.1%	1
Catch rate(average number of fish per 300 sq. ft. sampling unit)	<12	12-24	>24	37	5
Percent of individuals as hybrids	>1%	TR - 1%	0%	0.0%	5
Percent of individuals with disease, tumors, fin damage, and other anomalies	>5%	2% - 5%	<2%	2.4%	3
					40
					Fair

Table 6. Fish species and number collected from Harpeth River at Pinkerton site on June 16, 2010.

Scientific name	Common name	Number collected
<i>Etheostoma zonale</i>	banded darter	12
<i>Cottus carolinae</i>	banded sculpin	2
<i>Notropis boops</i>	bigeye shinner	58
<i>Moxostoma duquesneii</i>	black redhorse	1
<i>Lepomis macrochirus</i>	bluegill	41
<i>Pimephales notatus</i>	bluntnose minnow	19
<i>Labidesthes sicculus</i>	brook silverside	3
<i>Etheostoma flabellare</i>	fantail darter	3
<i>Etheostoma crossopterygion</i>	fringed darter	12
<i>Dorosoma cepedianum</i>	gizzard shad	3
<i>Moxostoma erythrurum</i>	golden redhorse	3
<i>Lepomis cyanellus</i>	green sunfish	3
<i>Etheostoma blennioides</i>	greenside darter	4
<i>Micropterus salmoides</i>	largemouth bass	2
<i>Camptostoma oligolepis</i>	largescale stoneroller	79
<i>Percina caprodes</i>	logperch	7
<i>Lepomis megalotis</i>	longear sunfish	29
<i>Lepisosteus osseus</i>	longnose gar	1
<i>Hypentelium nigricans</i>	northern hog sucker	6
<i>Fundulus catenatus</i>	northern studfish	1
<i>Lepomis microlophus</i>	redeer sunfish	7
<i>Etheostoma rufilineatum</i>	redline darter	60
<i>Ambloplites rupestris</i>	rock bass	5
<i>Micropterus dolomieu</i>	smallmouth bass	1
<i>Cyprinella spiloptera</i>	spotfin shiner	18
<i>Erimystax dissimilis</i>	streamline chub	9
<i>Etheostoma virgatum</i>	striped darter	3
<i>Luxilus chrysocephalus</i>	striped shiner	4
<i>Oreochromis niloticus*</i>	nile tilapia	1
<i>Gambusia affinis</i>	western mosquitofish	9
<i>Etheostoma occidentale</i>	Westrim darter	4
<i>Pomoxis annularis</i>	white crappie	2

*Not native

Table 7. Fish species and number collected from Harpeth River at Below Dam site on June 15, 2010.

Scientific name	Common name	Number collected
<i>Etheostoma zonale</i>	banded darter	2
<i>Cottus carolinae</i>	banded sculpin	6
<i>Hybopsis amblops</i>	bigeye chub	31
<i>Notropis boops</i>	bigeye shinner	65
<i>Moxostoma duquesneii</i>	black redhorse	1
<i>Fundulus olivaceus</i>	blackspotted topminnow	1
<i>Lepomis macrochirus</i>	bluegill	85
<i>Pimephales notatus</i>	bluntnose minnow	52
<i>Labidesthes sicculus</i>	brook silverside	2
<i>Etheostoma flabellare</i>	fantail darter	2
<i>Pimephales promelas</i> *	fathead minnow	2
<i>Etheostoma microlepidum</i>	finescale darter	3
<i>Aplodinotus grunniens</i>	freshwater drum	1
<i>Etheostoma crossopterygion</i>	fringed darter	6
<i>Dorosoma cepedianum</i>	gizzard shad	1
<i>Moxostoma erythrurum</i>	golden redhorse	5
<i>Lepomis cyanellus</i>	green sunfish	12
<i>Etheostoma blennioides</i>	greenside darter	2
<i>Micropterus salmoides</i>	largemouth bass	5
<i>Campostoma oligolepis</i>	largescale stoneroller	149
<i>Percina caprodes</i>	logperch	8
<i>Lepomis megalotis</i>	longear sunfish	56
<i>Lepisosteus osseus</i>	longnose gar	1
<i>Hypentelium nigricans</i>	northern hog sucker	14
<i>Fundulus catenatus</i>	northern studfish	5
<i>Lepomis microlophus</i>	reardear sunfish	36
<i>Etheostoma rufilineatum</i>	redline darter	25
<i>Ambloplites rupestris</i>	rock bass	1
<i>Lythrurus fasciolaris</i>	scarlet shiner	7
<i>Noturus exilis</i>	slender madtom	2
<i>Cyprinella spiloptera</i>	spotfin shiner	35
<i>Micropterus punctatus</i>	spotted bass	1
<i>Erimystax dissimilis</i>	streamline chub	24
<i>Luxilus chrysocephalus</i>	striped shiner	1
<i>Lepomis gulosus</i>	warmouth	2
<i>Gambusia affinis</i>	western mosquitofish	4
<i>Etheostoma occidentale</i>	Westrim darter	10
<i>Pomoxis annularis</i>	white crappie	3
<i>Ameiurus natalis</i>	yellow bullhead	1

*Not native

Table 8. Fish species and number collected from Harpeth River at Reservoir site.

Scientific name	Common name	Number collected
<i>Lepisosteus osseus</i>	longnose gar	1
<i>Micropterus salmoides</i>	largemouth bass	14
<i>Lepomis macrochirus</i>	bluegill	101
<i>Lepomis gulosus</i>	warmouth	25
<i>Ambloplites rupestris</i>	rock bass	1
<i>Lepomis cyanellus</i>	green sunfish	44
<i>Moxostoma erythrurum</i>	golden redbreast	5
<i>Pimephales notatus</i>	bluntnose minnow	12
<i>Fundulus notatus</i>	blackstripe topminnow	4
<i>Micropterus punctatus</i>	spotted bass	4
<i>Minytrema melanops</i>	spotted sucker	2
<i>Lepomis microlophus</i>	reder sunfish	2
<i>Dorosoma cepedianum</i>	gizzard shad	3
<i>Ictiobus cyprinellus</i>	bigmouth buffalo	1
<i>Pomoxis annularis</i>	white crappie	3
<i>Gambusia affinis</i>	western mosquitofish	3
<i>sunfish hybrid</i>	sunfish hybrid	1
<i>Ameiurus natalis</i>	yellow bullhead	1
<i>Moxostoma duquesneii</i>	black redbreast	1
<i>Lepomis megalotis</i>	longear sunfish	110

Table 9. Fish species and number collected from Harpeth River at Fivemile site on June 23, 2010.

Scientific name	Common name	Number collected
<i>Cottus carolinae</i>	banded sculpin	1
<i>Hybopsis amblops</i>	bigeye chub	11
<i>Notropis boops</i>	bigeye shinner	135
<i>Moxostoma duquesneii</i>	black redhorse	1
<i>Fundulus olivaceus</i>	blackspotted topminnow	1
<i>Lepomis macrochirus</i>	bluegill	38
<i>Pimephales notatus</i>	bluntnose minnow	83
<i>Labidesthes sicculus</i>	brook silverside	9
<i>Etheostoma crossopterygion</i>	fringed darter	28
<i>Dorosoma cepedianum</i>	gizzard shad	1
<i>Moxostoma erythrurum</i>	golden redhorse	22
<i>Lepomis cyanellus</i>	green sunfish	21
<i>Etheostoma blennioides</i>	greenside darter	5
<i>Micropterus salmoides</i>	largemouth bass	2
<i>Camptostoma oligolepis</i>	largescale stoneroller	33
<i>Percina caprodes</i>	logperch	4
<i>Lepomis megalotis</i>	longear sunfish	42
<i>Hypentelium nigricans</i>	northern hog sucker	30
<i>Fundulus catenatus</i>	northern studfish	2
<i>Lepomis microlophus</i>	redeer sunfish	14
<i>Etheostoma rufilineatum</i>	redline darter	5
<i>Lythrurus fasciolaris</i>	scarlet shiner	57
<i>Micropterus dolomieu</i>	smallmouth bass	2
<i>Micropterus punctatus</i>	spotted bass	3
<i>Erimystax dissimilis</i>	streamline chub	5
<i>Etheostoma virgatum</i>	striped darter	9
<i>Luxilus chrysocephalus</i>	striped shiner	47
<i>Gambusia affinis</i>	western mosquitofish	1
<i>Etheostoma occidentale</i>	Westrim darter	20
<i>Catostomus commersonii</i>	white sucker	1

Future Studies

Our goal is to see if the sites downstream of the existing dam will change in response to the dam removal. We plan to survey these sites a few years after the dam is removed. We will also add an IBI site in an area that is presently covered by the reservoir. By this time the engineered habitat should have stabilized and fish populations should have responded to the new habitat.

Literature Cited

Tennessee Valley Authority. 2005. Protocol for conducting an index of biotic integrity biological assessment, updated draft 2005.