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

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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 are 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**
	1	**3**	**5**		
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 *Micropterus*	<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**
	1	**3**	**5**		
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
	1	3	5		
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 *Micropterus*	<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
Etheostoma zonale	banded darter	12
Cottus carolinae	banded sculpin	2
Notropis boops	bigeye shinner	58
Moxostoma duquesneii	black redhorse	1
Lepomis macrochirus	bluegill	41
Pimephales notatus	bluntnose minnow	19
Labidesthes sicculus	brook silverside	3
Etheostoma flabellare	fantail darter	3
Etheostoma crossopterum	fringed darter	12
Dorosoma cepedianum	gizzard shad	3
Moxostoma erythrurum	golden redhorse	3
Lepomis cyanellus	green sunfish	3
Etheostoma blennioides	greenside darter	4
Micropterus salmoides	largemouth bass	2
Campostoma oligolepis	largescale stoneroller	79
Percina caprodes	logperch	7
Lepomis megalotis	longear sunfish	29
Lepisosteus osseus	longnose gar	1
Hypentelium nigricans	northern hog sucker	6
Fundulus catenatus	northern studfish	1
Lepomis microlophus	redear sunfish	7
Etheostoma rufilineatum	redline darter	60
Ambloplites rupestris	rock bass	5
Micropterus dolomieu	smallmouth bass	1
Cyprinella spiloptera	spotfin shiner	18
Erimystax dissimilis	streamline chub	9
Etheostoma virgatum	striped darter	3
Luxilus chrysocephalus	striped shiner	4
*Oreochromis niloticus**	nile tilapia	1
Gambusia affinis	western mosquitofish	9
Etheostoma occidentale	Westrim darter	4
Pomoxis annularis	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
Etheostoma zonale	banded darter	2
Cottus carolinae	banded sculpin	6
Hybopsis amblops	bigeye chub	31
Notropis boops	bigeye shinner	65
Moxostoma duquesneii	black redhorse	1
Fundulus olivaceous	blackspotted topminnow	1
Lepomis macrochirus	bluegill	85
Pimephales notatus	bluntnose minnow	52
Labidesthes sicculus	brook silverside	2
Etheostoma flabellare	fantail darter	2
*Pimephales promelas**	fathead minnow	2
Etheostoma microlepidum	finescale darter	3
Aplodinotus grunniens	freshwater drum	1
Etheostoma crossopterum	fringed darter	6
Dorosoma cepedianum	gizzard shad	1
Moxostoma erythrurum	golden redhorse	5
Lepomis cyanellus	green sunfish	12
Etheostoma blennioides	greenside darter	2
Micropterus salmoides	largemouth bass	5
Campostoma oligolepis	largescale stoneroller	149
Percina caprodes	logperch	8
Lepomis megalotis	longear sunfish	56
Lepisosteus osseus	longnose gar	1
Hypentelium nigricans	northern hog sucker	14
Fundulus catenatus	northern studfish	5
Lepomis microlophus	redear sunfish	36
Etheostoma rufilineatum	redline darter	25
Ambloplites rupestris	rock bass	1
Lythrurus fasciolaris	scarlet shiner	7
Noturus exilis	slender madtom	2
Cyprinella spiloptera	spotfin shiner	35
Micropterus punctatus	spotted bass	1
Erimystax dissimilis	streamline chub	24
Luxilus chrysocephalus	striped shiner	1
Lepomis gulosus	warmouth	2
Gambusia affinis	western mosquitofish	4
Etheostoma occidentale	Westrim darter	10
Pomoxis annularis	white crappie	3
Ameiurus natalis	yellow bullhead	1

*Not native

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

Scientific name	Common name	Number collected
Lepisosteus osseus	longnose gar	1
Micropterus salmoides	largemouth bass	14
Lepomis macrochirus	bluegill	101
Lepomis gulosus	warmouth	25
Ambloplites rupestris	rock bass	1
Lepomis cyanellus	green sunfish	44
Moxostoma erythrurum	golden redhorse	5
Pimephales notatus	bluntnose minnow	12
Fundulus notatus	blackstripe topminnow	4
Micropterus punctatus	spotted bass	4
Minytrema melanops	spotted sucker	2
Lepomis microlophus	redear sunfish	2
Dorosoma cepedianum	gizzard shad	3
Ictiobus cyprinellus	bigmouth buffalo	1
Pomoxis annularis	white crappie	3
Gambusia affinis	western mosquitofish	3
sunfish hybrid	sunfish hybrid	1
Ameiurus natalis	yellow bullhead	1
Moxostoma duquesneii	black redhorse	1
Lepomis megalotis	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
Cottus carolinae	banded sculpin	1
Hybopsis amblops	bigeye chub	11
Notropis boops	bigeye shinner	135
Moxostoma duquesneii	black redhorse	1
Fundulus olivaceous	blackspotted topminnow	1
Lepomis macrochirus	bluegill	38
Pimephales notatus	bluntnose minnow	83
Labidesthes sicculus	brook silverside	9
Etheostoma crossopterum	fringed darter	28
Dorosoma cepedianum	gizzard shad	1
Moxostoma erythrurum	golden redhorse	22
Lepomis cyanellus	green sunfish	21
Etheostoma blennioides	greenside darter	5
Micropterus salmoides	largemouth bass	2
Campostoma oligolepis	largescale stoneroller	33
Percina caprodes	logperch	4
Lepomis megalotis	longear sunfish	42
Hypentelium nigricans	northern hog sucker	30
Fundulus catenatus	northern studfish	2
Lepomis microlophus	redear sunfish	14
Etheostoma rufilineatum	redline darter	5
Lythrurus fasciolaris	scarlet shiner	57
Micropterus dolomieu	smallmouth bass	2
Micropterus punctatus	spotted bass	3
Erimystax dissimilis	streamline chub	5
Etheostoma virgatum	striped darter	9
Luxilus chrysocephalus	striped shiner	47
Gambusia affinis	western mosquitofish	1
Etheostoma occidentale	Westrim darter	20
Catostomus commersonii	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.